Proposed American National Standard

Dimensions for 35- and 70-mm Motion-Picture Projection Lenses and Mounts

PH22.28

Revision of
PH22.28-1976

1. Scope

1.1 This standard specifies for lenses used in 35- and 70-mm motion-picture projectors the lens markings, focal length tolerances, mounting diameters, mechanical factors in mounting additional lens adapters to lenses, and the preferred value steps in focal lengths. (Focal length referred to in this standard is the equivalent focal length, commonly known as EFL.)

1.2 This standard also specifies the limiting or maximum available space for projector lens mounts where lenses of varying focal lengths and designs and attachments thereto are used.

2. Marking of Prime Lenses

The focal length of the lens shall be marked on the exterior of the lens barrel in a permanent manner in both English and metric values.

3. Focal Length of Prime Lenses

3.1 The actual focal length shall not differ from the value marked on the lens by more than ± 1 percent.

3.2 Preferred values of focal lengths shall be integral multiples of ¼ in (6 mm) nominal, over the range from 2 to 7 in (50 to 178 mm) inclusive for lenses designed to English units.

3.3 Preferred values of focal lengths shall be integral multiples of 5 mm (0.2 in) nominal, over the range of 50 to 150 mm (2 to 6 in) for lenses designed to metric units.

4. Lens Barrel Diameter

The barrel diameter (Dimension A) shall be as specified in the figure and Table 1. It is expected that in most projectors the lens mount will either clamp onto the lens barrel or provide a mechanical lens holder which will clamp onto the lens barrel at the specified diameter.

5. Limiting Space Dimensions

The limiting volume within which the lens, set at infinity, shall mount and perform its function, as intended, shall be as specified in Table 1. These are not necessarily the dimensions of any lens but specify the limits beyond which there may be physical interference with the projector mechanism.

6. Optical Conversion Lenses

Anamorphic attachments and other optical converters to be mounted to the objective lens specified or to be mounted in turret, swing-away or other separate mounting, must fit within the limiting space dimensions (see Dimension D).

7. Lens Thread

The internal threads for holding attachments, such as anamorphic units, shall be located at Dimension P within Dimension A and shall have dimensions as specified in Table 2.

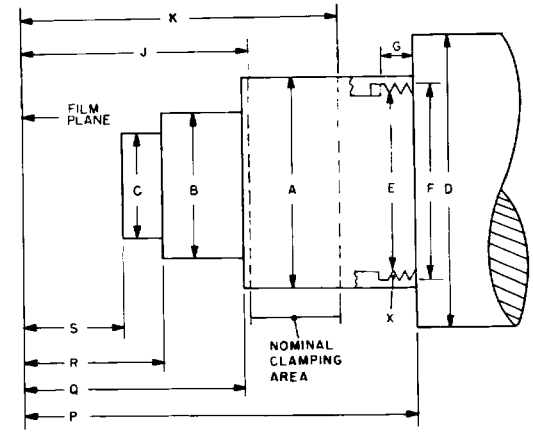


Table 1

Dimensions	Small Lenses Inches	Small Lenses Millimeters	Large Lenses[1] Inches	Large Lenses[1] Millimeters
Barrel Diameter				
A	2.782 $^{+\ 0.000}_{-\ 0.005}$	70.66 $^{+\ 0.00}_{-\ 0.13}$	3.990 ± 0.005	101.35 ± 0.13
Limiting Space				
B[2]	2.25 max	57.2 max	2.25 max	57.2 max
C	1.90 max	48.3 max	1.90 max	48.3 max
D[3]				
P[3,4]	7.50 min	190.5 min	7.50 min	190.5 min
Q	3.75 min	95.2 min	3.75 min	95.2 min
	4.25 max	108.0 max	4.25 max	108.0 max
R	1.50 min	38.1 min	1.50 min	38.1 min
S	1.20 min	30.5 min	1.20 min	30.5 min
Nominal Clamping Area				
J	4.00 min	101.6 min	4.00 min	101.6 min
K	6.00 max	152.4 max	6.00 max	152.4 max

[1]All large-lens dimensions apply to 70-mm projection units.

[2]Dimension B may be as large as 3.25 in (82.6 mm) for projectors manufactured since 1960. For 70-mm projection units, Dimension B is 3.25 in. Some European projectors have a lens mount diameter of 2.46 in (62.5 mm) in which case Dimension B is equal to 2.46 in.

[3]There is no restriction on the limiting space beyond distance P from the film plane; however, because of the practice of clamping lenses and/or their attachments by the section identified by Dimension D, it is recommended that this dimension be held to 3.125 ± 0.002 in (79.38 ± 0.05 mm).

[4]Projectors with small (2.782 in [70.66 mm]) lens mounts, including clamps outside the projector case, are 10.00 in (254.0 mm) minimum.

Table 2
Small Diameter Lenses

	Dimensions	Inches	Millimeters
E	Minor diameter	2.630 max	66.80 max
F	Major diameter	2.668 min	67.77 min
G	Thread length	0.219 ± 0.010	5.56 ± 0.25
X	Thread size	36 tpi	0.706 pitch

Proposed American National Standard

Dimensions of Universal Intermittent Sprockets for 35-mm Motion-Picture Projectors

PH22.35

Revision of PH22.35-1962

1. Scope

1.1 This standard specifies film advancement dimensions of two types of 16-tooth intermittent sprockets for 35-mm motion-picture projectors. Other dimensions and definitions are given in the Appendix.

1.2 This standard is applicable to sprockets used in conjunction with film perforated in accordance with American National Standard Dimensions for 35-mm Motion-Picture Film Perforated KS, ANSI PH22.139-1974 (0.1870 in pitch), or American National Standard Dimensions for 35-mm Motion-Picture Film, CS-1870, ANSI PH22.102-1974.

2. Sprocket Tooth Types

2.1 Type S is the standard square tooth that is used internationally and known as the CS sprocket tooth.

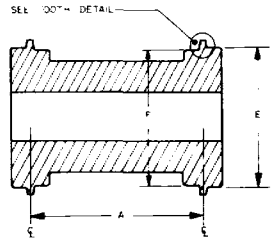
2.2 Type R is the round tooth that eliminates sharp corners on film contacting surfaces.

3. Dimensions

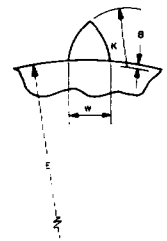
3.1 The dimensions shall be as specified in the figures and table.

3.2 The sprocket tooth pitch is measured at the midpoint of 0.006 in (0.15 mm) film thickness:

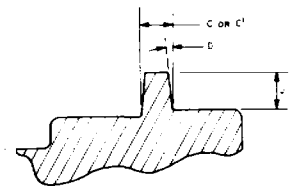
$$\frac{(\text{Diameter E} + 0.006\text{ in})\,\pi}{\text{Number of Teeth}}$$



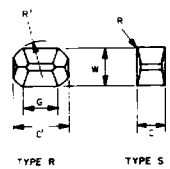
CROSS SECTION OF SPROCKET



TOOTH PROFILE



CROSS SECTION OF TOOTH



TOP VIEW OF TOOTH

	Dimensions	Inches	Millimeters
A	Tooth centerline to centerline	1.125 ± 0.001	28.58 ± 0.03
B	Center point of tooth arc	0.004 — 0.001	0.10 — 0.03
C	Square tooth lateral width	0.040 + 0.001 — 0.002	1.02 + 0.03 — 0.05
C'	Round tooth lateral width	0.072 — 0.002	1.83 — 0.05
D	Lead angle at tooth sides	7°30' max	
E	Root (film supporting) diameter	0.950 ± 0.001	24.13 ± 0.03
F	Inner diameter	0.010 less than E	0.25 less than E
G	Bearing surface	0.046 — 0.002	1.17 — 0.05
J	Tooth height above E	0.050	1.27
K	Tooth arc	0.077 + 0.002	1.96 + 0.05
R	Square tooth corner radius	0.005 max	0.13 max
R'	Round tooth corner radius	0.043 ± 0.001	1.09 ± 0.03
W	Horizontal tooth width	0.055 — 0.002	1.40 — 0.05

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. The figures describe the tooth shapes which recognize the following factors: (1) smooth disengagement of sprocket teeth and transfer of driving forces from perforation to perforation; (2) shrinkage and dimensional changes in motion-picture film; and (3) elastic deformation of the perforation edge induced by the drive forces on the perforation edge.

A2. In current practice, the upper sprocket is usually a feed sprocket while the lower sprocket may function as a holdback sprocket or simply as an idler. These sprockets have dimensional values identical to those shown in the table except for root diameter E. Diameter E is nominally 0.943 in (23.95 mm) on a 16-tooth feed sprocket or 0.940 in (23.88 mm) on those serving as holdback sprockets. 24-tooth feed sprockets have E diameters ranging from 1.413 to 1.424 in (35.89 to 36.17 mm) and holdback sprockets are nominally 1.413 in (35.89 mm) with some variation from manufacturer to manufacturer.

A3. As stated in Sec. 1.2, this standard specifies sprockets designed to accommodate films with either KS or CS perforations which have different specifications insofar as perforation size and positioning are concerned. This requirement affects the centerline-to-centerline dimension (A) and the tooth width (C). The tooth width specified in the table as Dimension C (square tooth) is the dimension covered by the former standard, PH22.35-1962. The value specified for C' (round tooth) is an alternative design permitting a greater tooth width and a relatively large break at each tooth corner which avoids contact of the tooth corner with the fillet radii in the perforation corners, thus limiting the possibility of the tooth damaging the film. Elimination of square tooth corners also minimizes abrasion of the perforation edge. In special instances where a projector is to be used only with films having one type of perforation, it may be advantageous to use sprockets made specifically for that type of perforation. For example, projectors to be used only with films having CS perforations might have a tooth centerline-to-centerline dimension (A) at 1.125 in (28.58 mm) and a tooth width dimension (C) of 0.048 in (1.22 mm) maximum driving face. A projector intended only for use with films having KS perforations might have sprockets with a tooth centerline-to-centerline at 1.109 in (28.17 mm) and a tooth width of 0.065 in (1.65 mm) maximum driving face.

A4. Definitions:

Feed Sprocket. A feed sprocket is used to advance the film against a restraining force. The force is applied to the leading edge of the film perforation (viewed in the direction of film motion). The sprocket rotates at a nominally constant velocity and tends to keep the film in motion. It is also called an advancing or drive sprocket and is usually lightly loaded.

Intermittent Sprocket. An intermittent sprocket is a feed sprocket used to advance the film periodically (frame by frame). The sprocket is usually completely at rest during the intervals between advances. It is normally heavily loaded during a portion of its motion since it must accelerate the film from zero velocity and achieve an average rate of film advance. The root diameter is usually larger than that of a feed sprocket because of greater perforation distortion.

Holdback Sprocket. The holdback sprocket is used to restrain the film against a tension force. The force is applied to the trailing edge of the film perforation (viewed in the direction of film motion) and the sprocket rotates at a nominally constant velocity. It is also called a retarding or restraining sprocket.