

SMPTE STANDARD

**for Motion-Picture Film (35-mm) —
Motion-Picture Prints —
Projectable Image Area**

Table 1 — Dimensions

Dimensions	Inches	Millimeters
A	0.825 nom	20.96 nom
B (style A)	0.446 min 0.500 max	11.33 min 12.70 max
B (style B)	0.690 max	17.53 max
B (style C)	0.602 nom	15.29 nom
C*	0.738 ref	18.75 ref
D	0.324 min	8.23 min
E	1.151 max	29.24 max
F = H	within 0.012	within 0.30
J = K	nominally equal	nominally equal
*See A.1		



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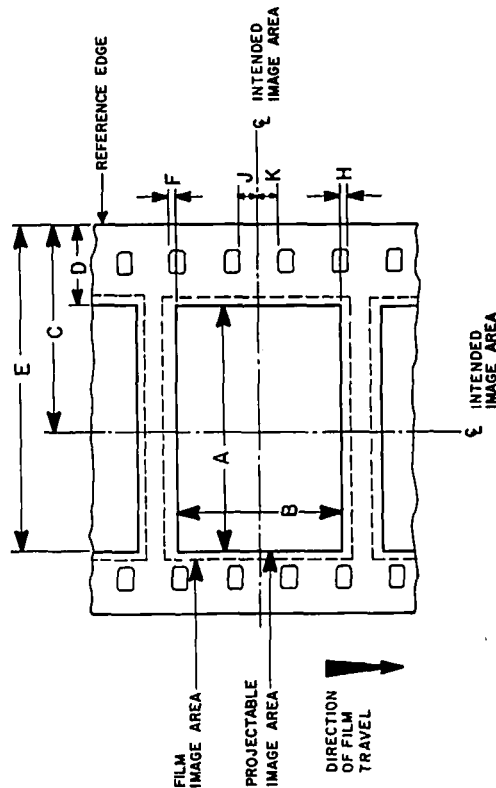
- Style A: General theatrical release prints commonly referred to as nonanamorphic or wide screen;
- Style B: Theatrical release prints with an anamorphic image;
- Style C: Classic theatrical prints.

1 Scope

1.1 This standard specifies the maximum dimensions of the film image area intended for projection from a 35-mm motion-picture film and the placement of this area relative to the perforations and the reference edge of the film.

2 Dimensions

1.2 This standard specifies three types of image areas intended for theatrical projection (see A.4):

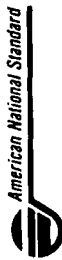


View as seen through film toward lens

Figure 1 — Projectable image area

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Approved
March 22, 1993

NOTES

1 Projector aperture

Dimensions B, D, and E define the image area on the film that is available for projection. They do not define the opening in the projection aperture plate. The size of this opening may differ from dimensions A and B, for example, because of the physical separation necessary between the aperture plate and the film to avoid scratching the film, the slant of the marginal rays accepted by the projection lens, etc.

2 Actual projected area

It is recognized that, in many cases, the actual film image

area that is projected may be smaller than the projectable maximum and, in some cases, may be nonrectangular (for example, an irregular four-sided figure bound by either straight or curved lines). Such departures may result from equipment considerations, such as slight inconsistencies among lenses, screen sizes, etc.; from geometric limitations such as the screen surface being at an angle other than 90° from the projection axis, or being nonplanar or both; and from aesthetic considerations such as pictorial composition within more restrictive image limits. In the absence of specific instructions to the contrary, it is intended that the actual projected film image area be the largest appropriately-shaped figure that can be inscribed within the specified dimensions.

**Annex A (informative)
General Information**

A.1 Centerlines

The centerlines of the image area are given for convenience in interpreting the standard, facilitating such applications as the optical design of equipment, and assisting in the understanding of suitable mechanical embodiments related to projectable image area. Note that the centerline of the projectable image area is displaced from the centerline of the film by 0.050 in (1.27 mm) nominal.

A.3 Image area for television

It is recognized that home television receivers are adjusted to show a distribution of picture sizes ranging downward from the maximum. Guides to picture composition, based upon a statistical survey of receivers in use, are presented in SMPTE RP 27.3. Note that some portion of the audience will see the entire transmitted area, but for certainty in presentation of critical information over broadcast television, such information should be confined to a smaller, central area.

A.4 Related standards

ANSI/SMPTE 59 and ANSI/SMPTE 111 define image areas for other important phases of motion-picture operations and are consistent with this standard and with one another under currently acceptable commercial practices.

A.4 Typical aspect ratios for nonanamorphic theatrical projection

For aesthetic and practical reasons, theatrical projection may present 35-mm images in such a manner that the full

width of the projectable area is shown but the projected height is less than maximum. Photography designed primarily for theatrical exhibition recognizes this and is composed for the more elongated rectangles. Several aspect ratios for the final projected picture are recognized through usage:

Table A.1 - Nonanamorphic aspect ratios

Style	Aspect ratio	Projectable image height Inches	Projectable image height Millimeters
A	1.85:1	0.446 min	11.33 min
A	1.66:1	0.497 ref	12.62 ref
C	1.37:1	0.602 nom	15.29 nom

To help ensure correct vertical centering (framing) of the projected image, hard-matte printing may be used in producing the duplicate negative used for release printing of theatrical prints. A hard matte with an image height of at least 0.505 in (12.83 mm) may be used for all style A aspect ratios (1.66:1 or greater). Note that prints intended for a style C aspect ratio (1.37:1) will normally have an image height of at least 0.630 in (16.00 mm) as specified in

Annex B (informative)
Bibliography

- ANSI/SMPTE 55-1992, Motion-Picture Film --- 35- and 16-mm Audio Release Prints --- Leaders and Cue Marks
- ANSI/SMPTE 59-1991, Motion-Picture Film (35-mm) --- Camera Aperture Images and Usage

ANSI/SMPTE 59. In all cases, the framelines on the print shall essentially be opaque.

It is recommended that pictures designed to be shown at aspect ratios other than those specified in this standard be so marked in a conspicuous manner. The Universal Leader (described in ANSI/SMPTE 55) provides for aspect ratio identification on frames 6-10.

A.5 Image area on original negative

Use of camera aperture dimensions other than those stated in ANSI/SMPTE 59 is discouraged. Film users are reminded that many features composed for wide-screen aspect ratio will be shown later on television. Use of a hard matte in the camera will require substantial cropping of the film horizontally when the film is transferred to television, and severely limits the use of a print made from the negative.

Good practice dictates using the 1.37:1 style A camera aperture of ANSI/SMPTE 59, while composing for the desired theatrical projection aspect ratio. Care should be taken to exclude extraneous items or action from the photographed image area which may show in the television scanned area.

ANSI/SMPTE 111-1988, Motion-Picture Film (35-mm) --- Exposed Areas for Picture and Audio --- Prints Made on Continuous Contact Printers

SMPTE RP 27.3-1989, Specifications for Safe Action and Safe Title Areas Test Pattern for Television Systems

SMPTE STANDARD

**for Motion-Picture Equipment ---
35- and 70-mm Projection
Lenses and Mounts**

ANSI/SMPTE 243M-1993
Revision of
ANSI/SMPTE 243-1989



1 Scope

1.1 This standard specifies the lens markings, focal length, tolerances, mounting diameters, mechanical factors in mounting additional lens adaptors to lenses, and the preferred value steps in focal lengths for lenses used in 35- and 70-mm motion-picture projectors. (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 a nondetachable part of the lens barrel in a permanent manner in metric values on a surface other than that identified by dimension A. (English units are optional.)

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 $\pm 1\%$.

3.2 Preferred values of focal lengths shall be integral multiples of 5 mm (0.2 in) nominal, over the range 45 mm to 150 mm (1.75 in to 6 in). If English units are also shown, they shall be in decimals. Other values over 150 mm shall be in 10-mm steps, and those less than 45 mm can be as is practical for the lens maker. Multicoated lenses shall be so marked or indicated with the abbreviation MC. Lenses made for 70-mm film use shall be so marked in a permanent manner.

4 Lens barrel diameter

The barrel diameter shall be 70.66 mm (2.782 in) (see dimension A and figure 1) for standard projectors. Some European projectors require lenses of 62.5 mm (2.46 in) which can be provided by lens makers at their discretion. Older large lenses have been made at 101.35 mm (3.990 in). It is expected that in most projectors the lens mount will either clamp directly 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 the turret, swing away, or other separate mountings, 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 within dimension A, and shall have dimensions as specified in table 2.

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Approved
March 22, 1993

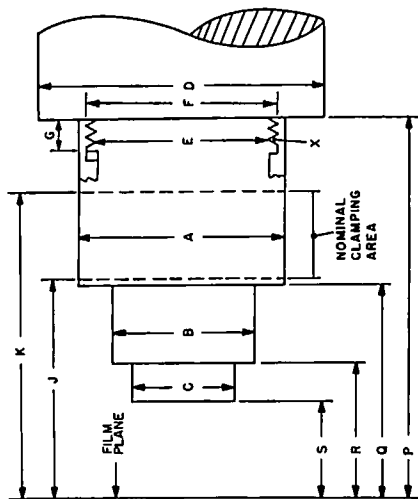


Figure 1 - Lens barrel

Table 1 - Dimensions

	Standard lenses		Large lenses	
	Millimeters	Inches	Millimeters	Inches
Barrel diameter				
A	70.66 + 0.00 - 0.13	2.782 + 0.000 - 0.005	101.35 ± 0.13	3.990 ± 0.005
Limiting space				
B ¹⁾	70.66 max	2.782 max	82.6 max	3.25 max
C	48.3 max	1.90 max	48.3 max	1.90 max
D ²⁾	check with projector manufacturer			
P ³⁾	190.5 min	7.50 min	190.5 min	7.50 min
Q	95.2 min	3.75 min	95.2 min	3.75 min
	108.0 max	4.25 max	108.0 max	4.25 max
R	38.1 min	1.50 min	38.1 min	1.50 min
S	30.5 min	1.20 min	30.5 min	1.20 min
Nominal clamping area				
J	101.6 min	4.00 min	101.6 min	4.00 min
K	152.4 max	6.00 max	152.4 max	6.00 max

NOTES

1) Historically, dimension B was held to 57.2 mm max (2.25 in max) for projectors manufactured before 1960. In addition, some European projectors have a lens mount of 62.5 mm (2.46 in), in which case dimension B is 62.5 mm (2.46 in).

2) The space of dimension D is beyond the lens barrel and outside the front of the projector face to accommodate enlarged wide-angle lenses and anamorphic and magnifying attachment lenses.

3) Historically, dimension P for certain projectors made before 1960 was 254.0 mm (10.00 in).

Table 2 - Standard diameter lenses

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

Annex A (informative)
General Information

Because of types of glass and tolerances of anti-reflection coatings, lenses can cause a shift in color temperature. Using a reliable color temperature meter, the light through the lens as compared to the raw light without the lens should

shift less than 400 K. Matched lenses are those which shift the color temperature, one as compared to another, by less than 200 K. (Light readings should be taken with the shutter stopped.)