ANSI/SMPTE 235-1998
Revision of
ANSI/SMPTE 235-1987

SMPTE STANDARD

for Motion-Picture Equipment (16-mm) — Projection Reels — 200- to 2300-Ft Capacity

1 Scope

This standard specifies the dimensions for 16-mm motion-picture projection reels having capacities from 200- to 2300 ft (60- to 700 m) of film inclusive.

2 Dimensions

The dimensions shall be as specified in figure 1 and tables 1 and 2.

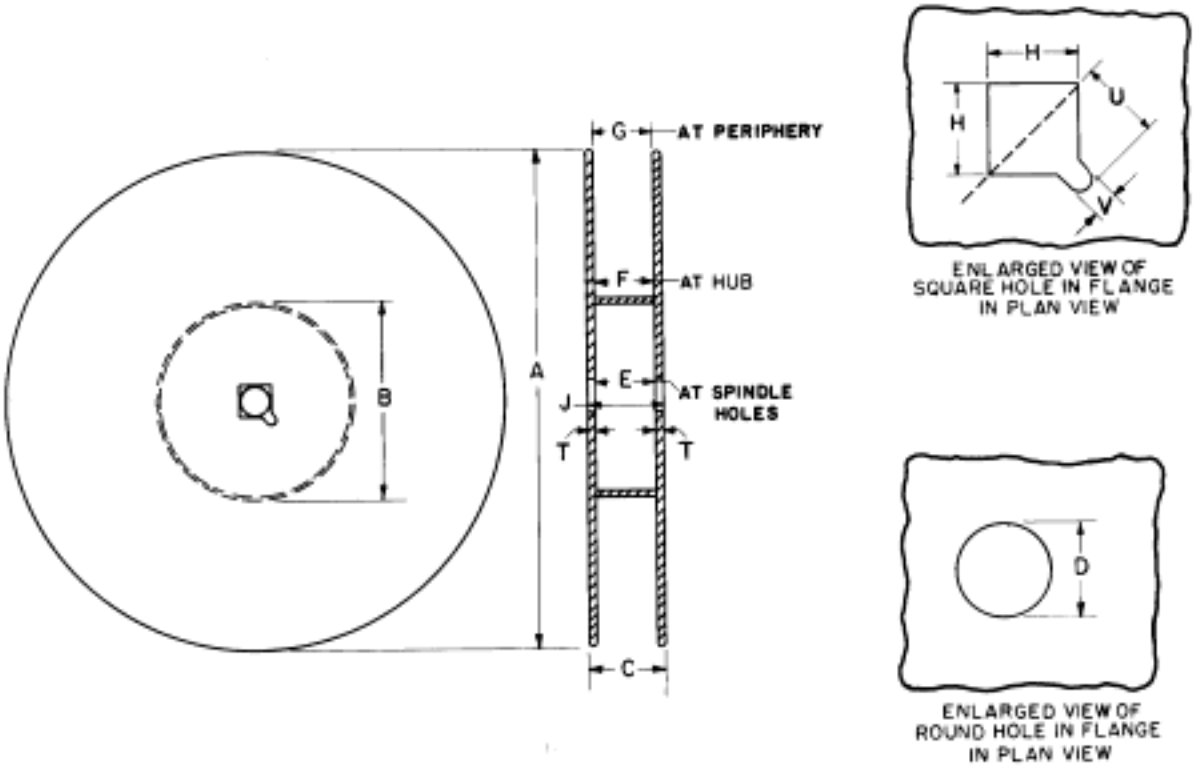

Figure 1 – Plan view and cross section of reel

American National Standard

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Table 1 – Capacity dimensions

Nominal capacity	Dimension A		Dimension B		Lateral runout	
	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
200 ft (60 m)	5.031 $^{+ 0.000}_{- 0.031}$	127.79 $^{+ 0.00}_{- 0.79}$	1.750 ± 0.250	44.45 ± 6.35	0.057 max	1.45 max
400 ft (120 m)	7.000 $^{+ 0.000}_{- 0.031}$	177.80 $^{+ 0.00}_{- 0.79}$	2.500 $^{+ 0.000}_{- 0.075}$	63.50 $^{+ 0.00}_{- 1.90}$	0.080 max	2.03 max
600 ft (180 m)	9.225 $^{+ 0.000}_{- 0.010}$	234.32 $^{+ 0.00}_{- 0.25}$	4.875 $^{+ 0.000}_{- 0.250}$	123.82 $^{+ 0.00}_{- 6.35}$	0.080 max	2.03 max
800 ft (240 m)	10.500 $^{+ 0.000}_{- 0.031}$	266.70 $^{+ 0.00}_{- 0.79}$	4.875 $^{+ 0.000}_{- 0.375}$	123.82 $^{+ 0.00}_{- 9.52}$	0.120 max	3.05 max
1200 ft 370 m)	12.250 $^{+ 0.000}_{- 0.125}$	311.15 $^{+ 0.00}_{- 3.18}$	4.875 $^{+ 0.000}_{- 0.250}$	123.82 $^{+ 0.00}_{- 6.35}$	0.140 max	3.56 max
1600 ft (490 m)	14.000 $^{+ 0.000}_{- 0.275}$	355.60 $^{+ 0.00}_{- 6.98}$	4.875 $^{+ 0.000}_{- 0.250}$	123.82 $^{+ 0.00}_{- 6.35}$	0.160 max	4.06 max
2000 ft (610 m)	15.000 $^{+ 0.000}_{- 0.031}$	381.00 $^{+ 0.00}_{- 0.79}$	4.875 $^{+ 0.000}_{- 0.250}$	123.82 $^{+ 0.00}_{- 6.35}$	0.171 max	4.34 max
2300 ft (700 m)	14.975 $^{+ 0.000}_{- 0.025}$	380.36 $^{+ 0.00}_{- 0.64}$	3.550 $^{+ 0.000}_{- 0.015}$	90.17 $^{+ 0.00}_{- 0.38}$	0.175 max	4.44 max

Table 2 – Other dimensions

	Dimensions	Inches	Millimeters
C	Total thickness (including flared, rolled, or beveled edges, if any)	0.962 max	24.43 max
D	Spindle hole diameter	0.319 $^{+ 0.000}_{- 0.003}$	8.10 $^{+ 0.00}_{- 0.08}$
E	Distance between flanges at spindle holes	0.660 ± 0.015	16.76 ± 0.38
F	At hub	0.660 ± 0.010	16.76 ± 0.25
G	At periphery	0.660 $^{+ 0.075}_{- 0.000}$	16.76 $^{+ 1.90}_{- 0.00}$
H	Side of square spindle hole	0.319 $^{+ 0.000}_{- 0.003}$	8.10 $^{+ 0.00}_{- 0.08}$
J	Overall thickness at spindle holes	0.790 max	20.07 max
T	Flange thickness (adjacent to spindle holes)	0.105 max 0.027 min	2.67 max 0.69 min
U	Keyway depth	0.330 $^{+ 0.000}_{- 0.020}$	8.38 $^{+ 0.00}_{- 0.51}$
V	Keyway width	0.125 $^{+ 0.005}_{- 0.000}$	3.18 $^{+ 0.13}_{- 0.00}$
	Flange and hub eccentricity	0.031 max	0.79 max

NOTES

1 The outer surfaces of the flanges shall be flat out to a diameter of at least 1.250 in (31.75 mm). Dimension J is the thickness of the reel over the area described by this diameter.

2 Rivets or other fastening members shall not extend beyond the outside surfaces of the flanges more than 0.03 in (0.8 mm) and shall not extend beyond the overall thickness indicated by dimension C.

3 Except at embossings, rolled edges, and rounded corners, the limits shown shall not be exceeded at the periphery of the flanges, nor at any other distance from the center of the reel.

4 If spring fingers are used to engage the edges of the film, dimension F shall be measured between the fingers when they are pressed outward to the limit of their operating range.

5 Eccentricity of the flanges and hub with respect to the spindle hole axis shall not exceed the total variation shown in table 2.

6 A good projection reel must meet certain minimal physical strength requirements, particularly with respect to the flanges. A reel that meets this standard must pass the following test for flange rigidity:

Make three posts that are placed 120° apart and constructed so they support a short length of the rim of the reel for a distance of 0.12 in (3.0 mm) radially. Apply a load of 1/2 pound (2.2 N) over a central area not greater than 1.25 in (31.8 mm) in diameter. Measure the vertical location of this area with a dial indicator. Add 1 pound (4.4 N) and measure again. Repeat the process on the other-flange. The additional deflection caused by the 1-pound load over that given by the 1/2-pound load should be less than 0.035 in (0.89 mm).

7 Lateral runout shall be measured with respect to the common axis established by the round and square holes.

Annex A (informative)
Additional data

A.1 For regular projection, a reel with a round hole in one flange is generally preferred. When this hole is present, the projectionist can tell at a glance whether or not the film needs rewinding. Furthermore, this type of reel helps the projectionist place the film correctly on the projector and thread it so that the picture is properly oriented with respect to the right and left sides.

It is common practice to use reels with square holes on both flanges. In such a case, the alignment of the square holes must be such that a test bar 0.316 in (8.02 mm) in diameter shall pass completely through the reel.

However, if both flanges have square holes, they and the opening in the corner should be aligned so that the reel will fit on a square spindle and rewinds with a long key. Such reels may not be suitable for use on some projector spindles. This is true if the spindle has a shoulder that a flange must touch in order to supply lateral positioning for the reel.

A.2 Nominal values for dimensions E, F, and G were chosen to provide lateral clearance for the film, which has a maximum width of 0.630 in (16.00 mm). However, a channel of the indicated width is narrow enough so that the film cannot wander laterally too much as it is wound. If the channel is too wide, it is likely to cause loose winding of the film with resultant excessively large rolls.

At the hub, the tolerances applied to dimension F are least because it is possible to control the separation fairly easily in that zone. At the region near the holes for the spindles, these tolerances are somewhat larger to allow for slight buckling of the flanges between the hub and the holes. At the periphery, the tolerances are still greater because it is difficult to maintain the distance with accuracy.

A.3 The opening in the corner of the square hole, to which dimensions U and V apply, is provided to fit the spindles of 35-mm rewinds, which are used in some laboratories.

A.4 Minimum and maximum values for dimension T, the thickness of the flanges, were chosen to permit the use of various materials.

A.5 The outside diameter of the flanges was made as large as permitted by past practice in the design of projectors, containers for reels, rewinds, and similar equipment. This was done so that the values of B could be made as great as possible. As a result, there is less variation throughout the projection of a roll in the tension to which the film is subjected by the take-up mechanism. This is especially true if a constant-torque device is used.

A.6 Film tension in a projector should be kept low to avoid perforation damage. In order to maintain low tension, it is necessary to keep the quotient B/A (hub diameter B divided by flange diameter A) as large as possible. Rather widely separated limits for hub diameter are allowed in the values given in the tables in some cases. They are not intended to be manufacturing tolerances, only to describe ently available reels that give satisfactory performance. In the design of new large reels, it is recommended that the Chandler paper listed in annex B be consulted.

Annex B (informative)
Bibliography

Vilbrandt, C.F. The projection life of 16mm film. *Jour. SMPTE 48(6): 521-542; June 1947.*

Chandler, J.S. Projecting 16mm film with large reels. *Jour. SMPTE 65(6): 320-327; June 1956.*