
STANDARDS AND RECOMMENDED PRACTICES

Approved American National Standards

The American National Standards Institute approved two American National Standards on October 21, 1983: ANSI PH22.4-1983, Motion-Picture Equipment — 35- and 70-mm Projection Reels; and ANSI PH22.160-1983, Motion-Picture Equipment — 8-mm Type S Projection Reels — 100- to 312-mm Diameter. Copies of the standards are available for a nominal fee from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Approved SMPTE Recommended Practices

Two revised SMPTE Recommended Practices were approved by the Society's Executive Committee for Standards Approval on September 28, 1983: RP 12-1983, Screen Luminance for Drive-In Theaters; and RP 53-1983, Scene-Change Methods for Printing 35-mm, 16-mm and 8-mm Type S Motion-Picture Film. These and other SMPTE Recommended Practices are available from Society Headquarters for \$1.50 each.

Proposed American National Standards

Published here for a trial period and public review are two Proposed American National Standards: PH22.216, Motion-Picture Film (35-mm) — Recorded Characteristic of Magnetic Audio Records — Four-Track Striped Release Prints; and PH22.217, Motion-Picture Film (70-mm) — Recorded Characteristic of Magnetic Audio Records — Striped Release Prints. Copies of the proposals are available from Society Headquarters for \$1.00 each. The proposals have been submitted to American National Standards Committee PH22. Consequently, all comments received from *Journal* publication will be reviewed prior to conclusion of action by the committee. Comments should be addressed to Stanislav Vesely-Dickinson prior to June 1, 1984.

Approved International Standard

The International Organization for Standardization (ISO) recently approved an International Standard, the technical content of which is published here for your information. ISO 7739-1983, Cinematography — Two-Track Photographic Sound Records on 16-mm Motion-Picture Prints — Positions and Width Dimensions, is in agreement with American National Standard ANSI PH22.204-1981, Dimensions of Two-Track Photographic Sound Records on 16-mm Motion-Picture Prints. This material is reproduced with permission from the ISO and is copyrighted by the American National Standards Institute, 1430 Broadway, New York, NY 10018, from which copies are available.

Editorially Revised SMPTE Recommended Practices

Two proposed SMPTE Recommended Practices are subject to a trial period and public review. The technical content of the proposals is unaffected because the modifications are editorial in nature. The changes are being published for your review and comment.

RP 68, Specifications for Buzz-Track Test Film for 35-mm Motion-Picture Audio Reproducers, Photographic Type (revision of RP 68-1976 published in the March 1977 *Journal*): Dimensions A and B have been reduced by 0.001 inch to ensure that the centerline of the scanned area will conform to American National Standard ANSI PH22.40-1978, the basic sound record standard.

RP 81, Specifications for Scanning-Beam Uniformity Test Film for 16-mm Motion-Picture Photographic Audio Reproducers (revision of RP 81-1978 published in the February 1979 *Journal*): The practice has been modified to conform to established test film documents. A minimum diffuse density of 1.20 including base density is specified for the exposed track area.

Copies of the proposals are available from Society Headquarters for \$1.00 each. They will be submitted to the Executive Committee for Standards Approval if no adverse comments are received from publication. Comments should be addressed to Stanislav Vesely-Dickinson prior to June 1, 1984.

— Alex E. Alden, Manager of Engineering

SMPTE Standards Subscription Service

The Society provides a Standards Subscription Service to assist firms, libraries, and individuals in establishing and maintaining a complete and current file of approved American National Standards and SMPTE Recommended Practices in the motion picture, television, and video magnetic recording fields. Through this service, the Society makes automatic distribution to Standards Subscribers of all new and revised American National Standards and SMPTE Recommended Practices that are approved during the calendar year in these fields.

For further information, write to: Standards Subscription Service, Engineering Department, Society of Motion Picture and Television Engineers, 862 Scarsdale Avenue, Scarsdale, NY 10583.

American National Standard for motion-picture equipment— 35- and 70-mm projection reels

Approved October 21, 1983

Secretariat: Society of Motion Picture and Television Engineers

Page 1 of 4 pages

1. Scope

1.1 This standard specifies the dimensions of 35-mm projection reels for motion-picture and television applications and 35- and 70-mm projection reels intended for use on combination 70/35-mm projectors and rewinds.

1.2 This standard does not apply to shipping reels as specified in American National Standard Dimensions of Shipping Reels for 35-mm Motion-Picture Prints, ANSI PH22.192-1976.

2. Applications

2.1 For conventional application, the 2000-ft (610-m) capacity reel shall be preferred, except in applications where the practice is to combine reels.

2.2 For television application, the 3000-ft (914-m) capacity reel shall be preferred.

2.3 The 1000-ft (305-m) capacity reel is in general use for laboratory and television applications. It should not be used in theatrical projection because the tension on the 2-in (50.8-mm) core may be excessive.

3. Dimensions

3.1 The dimensions of the reels shall be as given in the figures and table.

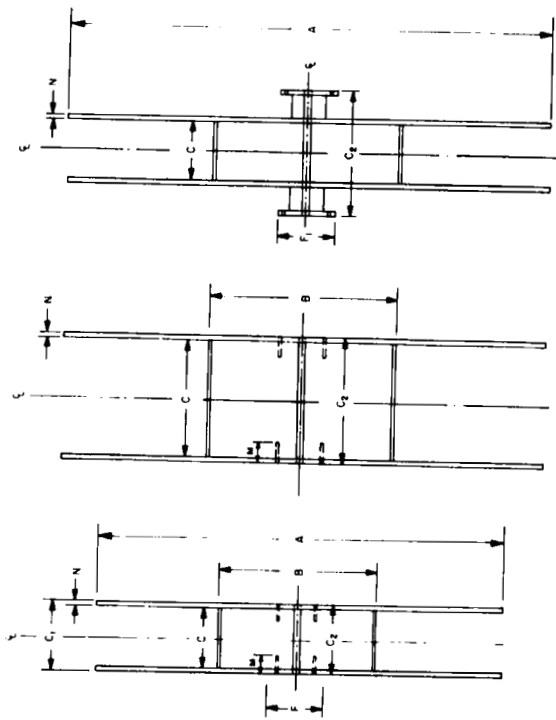
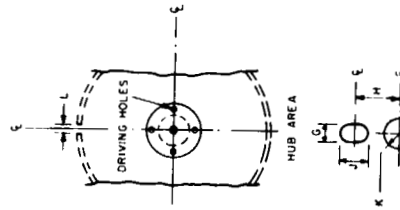
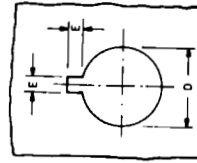
3.2 Dimension F defines the area over which the reel thickness, specified by Dimension C, applies.

3.3 Dimension M in Fig. 2 indicates a clearance for the driving pin in the reel hub.

3.4 Fig. 4 illustrates an optional spindle hole for reel capacities of 3000 ft and less, but mandatory for large-capacity, 70-mm, and 35-mm combination reels. The four driving holes are intended for use on spindles whose diameter is 0.500 ± 0.000 — 0.005 in (12.70 ± 0.00 — 0.13 mm) and driven by a pin of 0.250-in (6.35-mm) nominal diameter, engaging in one of the driving holes.


3.5 Fig. 5 illustrates the standard spindle hole for use with $\frac{3}{16}$ -in spindles. This hole is preferred for reel capacities of 3000 ft and less.

3.6 The centerlines indicated for all figures are coincident.

FIG. 1
35-MM REELFIG. 2
70-MM REELFIG. 3
35-MM REEL FOR
COMBINATION PROJECTORSFIG. 4
ENLARGED VIEW
OF SPINDLE
AND DRIVING HOLEFIG. 5
ENLARGED VIEW
OF HOLE IN BOTH FLANGES

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Optional System
(See 3.4)

Preferred System
(See 3.5)

ANSI PH22.4-1983

Appendix

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

hole to facilitate placing the reel on the spindle. The degree of chamfer should be in accordance with good engineering practice, and should not reduce the bearing surface of the spindle hole on the spindle to the point of endangering reel stability.

A3. Although this standard does not preclude reels of other diameters or design, the rim-to-hub ratio referred to in A1 remains a factor of consideration for any projector with an uncompensated constant-torque clutch in the feed or take-up mechanism.

A4. To minimize perforation damage, projector operators using large-capacity reels are cautioned against allowing film slack to accumulate. Film wound too loosely may slip on itself causing scratches and cinch marks.

A1. Specifications for the reels are based on good engineering design of film winding equipment and on minimum tension variation between hub and rim. Film tension in a projector feed and take-up mechanism should be kept low to avoid perforation damage. In order to maintain low tension where a constant-torque clutch device is used, it is necessary to keep the quotient B/A (hub diameter B divided by flange diameter A) as large as possible. In this standard, the quotient is 0.333, which maintains the initial film tension to final film tension within the 3:1 ratio. Complete interchangeability may require some adjustment in the take-up and hold-back tensions of the projector, maintaining the lowest film tension possible and still wind a full reel.

A2. In designing reels of the size and weight described in this standard, it is the practice to chamfer the spindle

Dimensions	Inches	Millimeters
A (1000 ft, 305 m)	9.90 + 0.00 - 0.20	251.5 + 0.0 - 5.1
A (2000 ft, 610 m)	15.00 + 0.00 - 0.05	381.0 + 0.0 - 1.3
A (3000 ft, 914 m)	16.90 + 0.00 - 0.05	429.3 + 0.0 - 1.3
A (4000 ft, 1219 m)	21.75 ± 0.03	552.4 ± 0.8
A (4300 ft, 1300 m)	21.00 ± 0.06	533.4 ± 1.5
A (5600 ft, 1700 m)	23.70 ± 0.06	602.0 ± 1.5
A (5800 ft, 1775 m)	24.50 ± 0.06	622.3 ± 1.5
B (1000 ft)	1.95 ± 0.10	49.5 ± 2.5
B (2000 ft)	5.00 ± 0.10	127.0 ± 2.5
B (3000 ft)	5.00 ± 0.10	127.0 ± 2.5
B (4000 ft)	8.00 ± 0.03	203.2 ± 0.8
B (4300 ft)	7.00 ± 0.03	177.8 ± 0.8
B (5600 ft)	8.00 ± 0.03	203.2 ± 0.8
B (5800 ft)	8.00 ± 0.03	203.2 ± 0.8
C (35-mm)	1.530 + 0.075 - 0.030	38.86 + 1.90 - 0.76
C (70-mm)	2.87 ± 0.03	72.9 ± 0.8
C (35-mm combination)	1.530 + 0.00 - 0.03	38.86 ± 0.0
C ₁ (35-mm)	1.885 + 0.075 - 0.030	47.88 + 1.90 - 0.76
C ₂ (35-mm up to 3000 ft)	1.625 + 0.075 - 0.030	41.28 + 1.90 - 0.76
C ₃ (35-mm above 4000 ft)	1.625 + 0.175 - 0.030	41.28 + 4.44 - 0.76
C ₄ (70-mm and 35-mm combination)	3.41 ± 0.03	86.6 ± 0.8
D	0.317 + 0.002 - 0.000	8.05 + 0.05 - 0.00
E	0.150 ± 0.010	3.81 ± 0.25
F	2.25 min	57.2 min
F ₁	2.50 min	63.5 min
G	0.265 ± 0.002	6.73 ± 0.05
H	0.782 nom	19.86 nom
J	0.375 nom	9.52 nom
K (diameter)	0.505 + 0.003 - 0.000	12.83 + 0.08 - 0.00
L (threading slot, 35-mm)	0.035 nom	0.89 nom
L (threading slot, 70-mm and 35-mm combination)	0.060 nom	1.52 nom
M	0.75 min	19.0 min
N (flange thickness)	0.27 nom	6.9 nom

Table 1

Reel Size Number*	Nominal Reel Capacity m ft	Dimensions	Millimeters	Inches
10	30 100	M	100.0 ± 1.0	3.94 ± 0.04
		E	46.0 max 32.0 min	1.81 max 1.26 min
		V	100.5	3.96
13	60 200	P _m †	1.9 max	0.07 max
		M	128.0 ± 1.0	5.04 ± 0.04
		E	50.8 max 45.0 min	2.00 max 1.77 min
16	90 300	V	128.5	5.06
		P _m	2.0 max	0.08 max
		M	159.0 ± 1.0	6.26 ± 0.04
18	120 400	E	62.0 ± 1.5	2.44 ± 0.06
		V	159.5	6.28
		P _m	2.3 max	0.09 max
21	180 600	M	180.0 ± 2.0	7.09 ± 0.08
		E	62.0 ± 1.5	2.44 ± 0.06
		V	180.8	7.12
24	180 600	P _m	2.3 max	0.09 max
		M	209.0 ± 2.0	8.23 ± 0.08
		E	62.0 ± 1.5	2.44 ± 0.06
25‡	240 800	V	209.8	8.26
		P _m	2.6 max	0.10 max
		M	237.0 ± 2.0	9.33 ± 0.08
27	240 800	E	124.0 ± 2.0	4.88 ± 0.08
		V	237.8	9.36
		P _m	2.6 max	0.10 max
29	300 1000	M	252.0 ± 2.0	9.92 ± 0.08
		E	80.0 ± 1.5	3.15 ± 0.06
		V	252.8	9.95
31	360 1200	P _m	2.6 max	0.10 max
		M	268.0 ± 2.0	10.55 ± 0.08
		E	124.0 ± 2.0	4.88 ± 0.08
31	360 1200	V	268.8	10.58
		P _m	2.8 max	0.11 max
		M	292.0 ± 2.0	11.50 ± 0.08
31	360 1200	E	124.0 ± 2.0	4.88 ± 0.08
		V	292.8	11.53
		P _m	3.0 max	0.12 max
31	360 1200	M	312.0 ± 2.0	12.28 ± 0.08
		E	124.0 ± 2.0	4.88 ± 0.08
		V	312.8	12.31
31	360 1200	P _m	3.0 max	0.12 max

*The nominal reel capacities in Table 1 are based on a film thickness of 0.16 mm (0.006 in). For an evaluation of capacities for various film thicknesses, see A6. The reel size is the nominal flange diameter in centimeters. Only the centimeter size is shown and is preferred. Corresponding inch sizes are recognized and are Nos. 4, 5, 6, 7, 8, 9, 9.5, 10, 11, and 12, respectively.
 †See 2.8.
 ‡The No. 27 reel with the higher hub-to-flange ratio is preferred because film damage is minimized.

Table 2

Dimensions	Millimeters	Inches
B	1.5 ± 0.3	0.06 ± 0.01
C	12.75 ± 0.15	0.502 ± 0.006
D	20.50 ± 0.50	0.807 ± 0.020
H	8.4 ± 1.5	0.33 ± 0.06
J	11.4 ± 1.2	0.45 ± 0.05
K	25.5 min	1.00 min
P	See 2.6 and 2.6.1	
P _a *	1.5 max	0.06 max
R	1/2 Dimension B	
R ₁	1/2 Dimension B	
R ₂	1.5 max	0.06 max
S	12.0 min	0.47 min
T	6.0 min	0.24 min
U	0.8 max	0.03 max

*See 2.8.

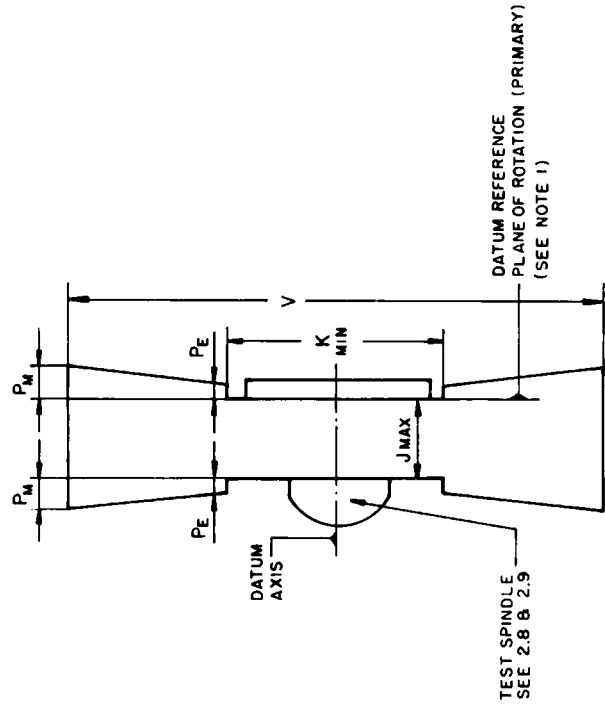


Fig. 2
Maximum Volume of Rotation

Notes

1. A datum reference plane of rotation is defined for each flange of a reel by a plane coincident with the surface of a flat 25.00-mm (0.984-in) diameter support which is centered on the spindle hole datum axis of the flanges. The reference surface makes contact with the reel in the minimum K diameter area. The datum axis, which is perpendicular to the datum reference plane of rotation, does not necessarily coincide with the axis from the center of the spindle holes. (See Fig. 2.)
2. The flanges of the reel should have three radial driving slots placed at $120^\circ \pm 2^\circ$ and conforming to Dimensions B and D. The drive slots of both flanges are aligned if properly aligned, the reel will fit on a test spindle (gauge) of 12.7-mm (0.50-in) diameter with a radial spindle drive key having an axial length from the spindle shoulder greater than width J of the reel, a thickness of 1.47 mm (0.058 in); and H height, measured as a radius from the spindle axis, of 9.1 mm (0.36 in).
3. It is recommended that No. 10 reels be designed with one solid flange with the exception of the hub area. The solid flange of the reel shall be opposite the film attachment opening.
4. Means should be provided for securing the end of the film to the reel. Such provision should accept the full width of the film and freely release the film at the end of the run, except when used on automatic rewind equipment. (If film attachment is provided by a slot in the hub, see 2.7.)
5. If the reel hub is made from plastic or other dimensionally unstable material, the spindle hole diameter, C, should be adjusted so that at least the minimum dimension, 12.75 mm (0.502 in), is maintained through the normal use range of temperature and relative humidity.

Appendix

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

- A1. Three drive slots are specified for the spindle hole of each flange to facilitate easy loading of the reel on the drive spindle, even though only one is normally used to drive the reel. However, spindles may have two or three drive keys.
- A2. A test spindle shoulder of 25.00-mm (0.984-in) diameter is required for the measurement of Dimension P. Loose fit between a projector spindle and reel spindle hole can contribute to flange excursion not measured when determining Dimension P. This can be minimized on a 25.5-mm (1.00-in) shoulder also is incorporated on the projector spindle and a device for locking the K diameter area of the reel against the support is provided. In any case, it is expected that projector manufacturers will incorporate a spindle shoulder of at least 16.0-mm (0.63-in) diameter on their equipment.
- A3. Take-up reels, which are uniquely a part of the manufacturer's projection equipment, may deviate from the provisions of this standard. As an example, it may be desirable to taper the flanges from the hub to the periphery or to provide for special film attachment mechanisms.
- A4. The usual winding of film on a reel with a solid flange is such that the film perforations are closest to the threading slot (i.e., opposite the solid flange).
- A5. The spindle hole may be formed by a sleeve or there may be an air space between the spindle holes in the flanges, depending upon the type of construction. Because of this, the means of retaining the reel on the projector spindle should be designed to act against the full K dimension of the reel adjacent to the spindle hole.
- A6. The variety of needs for motion-picture films has resulted in products with a wide range of thicknesses.
- A7. Caution must be exercised when film is stored on reels intended for archival storage. It is strongly recommended that the reels used not be finished with paints or coatings that have a tendency to evaporate over a long period of time inasmuch as this will affect the stored material.

Table 3
Film Capacities in Meters

Reel Size	Flange Diameter	Hub Diameter E _{max}	Maximum Film Coil D	Length L Calculated for Each Value of Thickness, t, in Millimeters*										
				0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	
10 min	99.0	46.0	92.0	55.4	49.9	45.3	41.5	38.4	35.6	33.2	31.2	29.3	27.7	
10 max	100.0	32.0	93.0	66.5	59.9	54.4	49.9	46.1	42.8	39.9	37.4	35.2	33.3	
13 min	127.0	50.8	117.0	96.9	87.2	79.3	72.7	67.1	62.3	58.2	54.5	51.3	48.5	
13 max	128.0	45.0	118.0	103.8	93.5	85.0	77.9	71.9	66.8	62.3	58.4	55.0	51.9	
16	158.0	63.5	148.0	156.0	140.4	127.6	117.0	108.0	100.3	93.6	87.7	82.6	78.0	
18	178.0	63.5	168.0	211.1	190.0	172.7	158.3	146.2	135.7	126.7	118.8	111.8	105.6	
21	207.0	63.5	194.0	293.2	263.9	239.9	219.9	203.0	188.5	175.9	165.0	155.2	146.6	
24	235.0	126.0	222.0	291.5	262.4	238.5	218.7	201.8	187.4	174.9	164.0	154.3	145.8	
25	250.0	81.5	237.0	422.2	389.0	353.6	324.2	299.2	277.8	259.3	243.1	228.8	216.1	
27	266.0	126.0	253.0	420.0	378.0	343.7	315.0	290.8	270.0	252.0	233.3	222.4	210.0	
29	290.0	126.0	277.0	531.0	477.9	434.5	398.3	367.6	341.4	318.6	298.7	281.1	265.5	
31	310.0	126.0	297.0	631.2	568.1	516.5	473.4	437.0	405.8	378.7	355.1	334.2	315.6	

*The formula used for the calculation of film capacity is:

$$L = \frac{\pi (D^2 - E_{max}^2)}{4000 t}$$

Table 4
Film Capacities in Feet
1 in inches

Reel Size	0.0035	0.0040	0.0043	0.0047	0.0051	0.0055	0.0059	0.0063	0.0067	0.0071
10 min	182	164	149	136	126	117	109	102	96	91
10 max	218	197	179	164	152	140	131	123	116	109
13 min	318	286	260	239	220	204	191	179	168	159
13 max	341	307	279	256	236	219	204	192	180	170
16	512	461	419	384	354	329	307	288	271	256
18	693	623	567	519	480	445	416	390	367	347
21	962	866	787	721	666	618	577	541	509	481
24	956	861	783	718	662	615	574	538	506	478
25	1418	1276	1160	1064	982	911	851	798	751	709
27	1378	1240	1128	1034	954	886	827	775	730	689
29	1742	1568	1426	1307	1206	1120	1045	980	922	871
31	2071	1864	1695	1553	1434	1331	1242	1165	1096	1035