

# Standards and Recommended Practices

## Approved American National Standards

The American National Standards Institute approved three American National Standards on August 31, 1988: ANSI/SMPTE 7-1988, Motion-Picture Film (16-mm) — Camera Aperture Image and Usage; ANSI/SMPTE 111-1988, Motion-Picture Film (35-mm) — Exposed Areas for Picture and Audio — Prints Made on Continuous Contact Printers; and ANSI/SMPTE 205-1988, Motion Picture Equipment (8-mm Type S) — Model 1 Camera Cartridge — Interface and Take-up Core Drive (200-Ft Capacity). Copies of the standards are avail-

able for a nominal fee from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

## Reaffirmed SMPTE Recommended Practices

The Society's Executive Committee for Standards Approval approved reaffirmation of two SMPTE Recommended Practices: RP 73-1977, 8-mm Type R (Regular 8) Sprocket Design; and RP 74-1977, 16-mm Sprocket Design. These and other SMPTE Recommended Practices may be purchased from Society Headquarters for \$3.00 each.

—*Sherwin H. Becker, Director of Engineering*

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# American National Standard for motion-picture film (16-mm) — camera aperture image and usage

Approved August 31, 1988

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## 1. Scope

1.1 This standard specifies the dimensions of the camera aperture image and its relative position to the reference edge and the perforations of 16-mm motion-picture film. The location of the perforations is based on dimensions given in ANSI/SMPTE 109-1986 and ANSI/SMPTE 110-1986.

1.2 This standard also specifies the position of the emulsion and the frame rate for 16-mm motion-picture film perforated one or two edges.

## 2. Referenced American National Standards

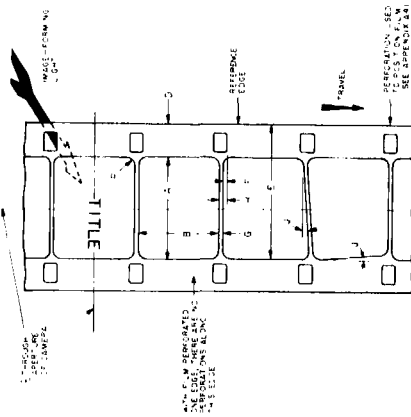
This standard is intended for use in conjunction with the following American National Standards:  
ANSI/SMPTE 109-1986, Motion-Picture Film (16-mm)—Perforated 1R  
ANSI/SMPTE 110-1986, Motion-Picture Film (16-mm)—Perforated 2R

## 3. Film Position

Except for special processes, the emulsion shall be toward the camera lens.

## 4. Dimensions

4.1 The dimensions shall be as given in the figure and table and shall apply to measurements of the aperture image as formed on freshly exposed and processed film.



Film as Seen from Inside Camera Looking toward Camera Lens; Emulsion Away from Observer

Dimensions*	Inches	Millimeters
A	0.404	nom 10.26
B	0.295 + 0.004	7.49 + 0.10
D	0.116 max	2.95 max
E	0.512 min	13.00 min
F	0.018 min	0.46 min
G	0.001 min	0.03 min
H	0.008 max	0.20 max
J	0.032 max	0.81 max
R	± 1/2°	± 1/2°
	0.015 max	0.38 max

\*See Notes.

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4.2 The angle between the vertical and horizontal edges of the aperture image shall be  $90 \pm 1/2^\circ$  to each other.

## 5. Frame Rate

5.1 The frame rate for film perforated two edges not used for audio shall normally be 18 or 24 frames per second, depending upon its intended use. Amateur films are usually photographed at 16 or 18 frames per second and should be projected at that rate. Professional films not used with an audio record may be photographed at any rate from time lapse to high speed, but are generally intended for projection at 24 frames per second, except when special study is desired.

5.2 The frame rate for film containing an audio record or to be used in conjunction with a separate audio record shall be 24 frames per second for both photographic and magnetic audio. However, films which will have post-process recorded magnetic audio and are to be projected at 18 frames per second should be exposed at the rate of 18 frames per second.

## Appendix

(This Appendix is not part of the American National Standard, but is included for information only.)

A1. If the aperture plate is not in the plane of the emulsion, the physical dimensions of the aperture in the camera will be slightly different from the dimensions given in the figure. The exact amount of this difference will depend upon the f-number and focal length of the camera lenses used and upon the distance between the emulsion and the physical aperture. This separation should be no greater than is necessary to prevent scratching of the film.

A2. It is the intent of this standard to provide a camera image such that the exposed area will always be larger than the area of the projector aperture. This standard meets this objective without causing double exposure of the area between frames.

NOTE 1: Dimension B, vertical height of aperture, must be maintained in order to ensure a real (unexposed) frame in the projector. Close control of the tolerances given for dimension B is necessary to enable dimensions F and H to be held within satisfactory limits. These are the distances from the lower edge of the perforation to the horizontal edges of the framelines. Dimensions F and H represent the maximum conditions which can be tolerated due to misalignment of the horizontal centerline of the aperture opening and the optical centerline of the photographic lens. Dimensions B, F, G, and H shall be measured to lines that are at right angles to the reference edge of the film and through a point where the radius (dimension R) is tangent to the horizontal framelines (see figure).

NOTE 2: The centerlines of the aperture image are normally on the optical center of the camera. The optical axis of the camera is defined as the mechanical axis or centerline of the sleeve or other device for holding the camera lens. Except for manufacturing tolerances, it coincides with the optical axis of the lens.

NOTE 3: Dimension J shows the limits by which the frame-line may be out of square with the reference edge of the film but, at all times, this should be confined within the area designated by dimension G.

A3. Dimension G, the distance between adjacent framelines, has been limited carefully so as to make it possible to keep both framelines masked simultaneously by the projector aperture. In addition, dimensions F and H have been established to limit the distance that any part of the frameline can depart from the bottom edge of the perforations. This is to minimize the necessity for frequent adjustment of the framing device on the projector.

A4. The pull-down claw is located at the plus-3 perforation (see figure) with respect to the projector or camera aperture. The reason for selecting the plus-3 perforation for positioning is to obtain the positioning perforation as close as possible to the image being photographed, yet not so close as to interfere with the optical system and gate structure.

# American National Standard

## for motion-picture film (35-mm)— exposed areas for picture and audio— prints made on continuous contact printers

Approved August 31, 1988

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### 1. Scope

**1.1** This standard specifies the location and width dimensions of the exposed areas for picture and photographic audio on 35-mm motion-picture prints made on continuous contact printers.

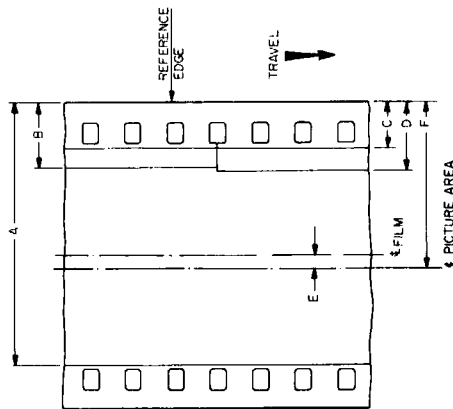
**1.2** This standard is applicable to the printing of motion-picture raw stock which is cut and perforated in accordance with ANSI/SMPTE 139-1986 or ANSI/SMPTE 237-1988.

**1.3** This standard refers to the adjustment of the printer, and is in accordance with ANSI PH22.40-1984.

### 2. Referenced American National Standards

This standard is intended for use in conjunction with the following American National Standards:

- ANSI PH22.40-1984, Motion-Picture Film (35-mm)—Photographic Audio Records—Release Prints
- ANSI/SMPTE 139-1986, Motion-Picture Film (35-mm)—Perforated KS



As Seen from Emulsion Side of Print

Dimensions	Inches	Millimeters
A	1.184 ± 0.002	30.07 ± 0.05
B	0.304 ± 0.002	7.72 ± 0.05
C	0.192 ± 0.001	4.88 ± 0.03
D	0.308 ± 0.002	7.82 ± 0.05
E	0.050 nom	1.27 nom
F	0.738 nom	18.75 nom

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ANSI PH22.195-1984, Motion-Picture Film (35-mm)—Projectable Image Area—Motion-Picture Prints

ANSI/SMPTE 237-1988, Motion-Picture Film (35-mm)—Perforated DH-1870

### 3. Dimensions

The dimensions shall be as specified in the figure and table.

**NOTE 1:** Dimension A minus B defines the width of the picture area exposed in accord with this standard and dimension D minus C that of the sound track area. Thus, an overlap area ranging from 0.000 to 0.008 in (0.00 to 0.20 mm) will receive exposure from both picture and sound printing apertures.

**NOTE 2:** The centerline information (dimensions E and F) given in the table is provided as a convenient reference. These two dimensions are specified in ANSI PH22.195-1984.

# American National Standard

## for motion-picture equipment (8-mm type S) — model 1 camera cartridge — interface and take-up core drive (200-ft capacity)

Approved August 31, 1988

Sponsor: Society of Motion Picture and Television Engineers

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### 1. Scope

This standard specifies the dimensions of the 8-mm type S 200-ft (60-m) capacity motion-picture camera cartridge and cartridge-camera interface. Also specified are the dimensions of the take-up core drive opening and critical dimensions of the take-up core as well as the driving force, direction of drive, and recommended drive ratio. An optional means of retaining the film supply until the cartridge is placed in the camera is described.

### 2. Dimensions

- 2.1** The dimensions shall be as given in the figures and table.
- 2.2** The dimensions apply to an assembled cartridge with a film load at the time of manufacture.
- 2.3** Datum planes B, C, and A are referred to as first, second, and third, respectively. The planes, which are used for dimensioning, are mutually perpendicular and are jointly called a datum reference frame.
- 2.3.1** Datum plane A is coincident with the center of a circle located by basic dimension T. The circle is in contact with the edges of the locating slot defined by dimensions A, O, P, and Q. The diameter of this circle is such that it applies regardless of feature size (RFS) of the locating slot. (See Fig. 2 and Appendix A3.)

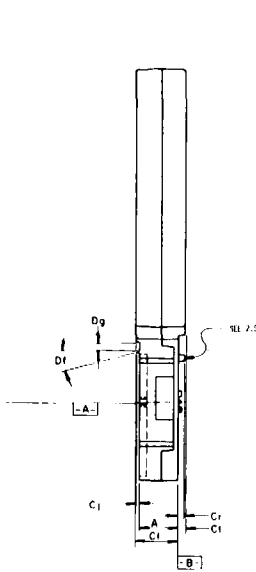
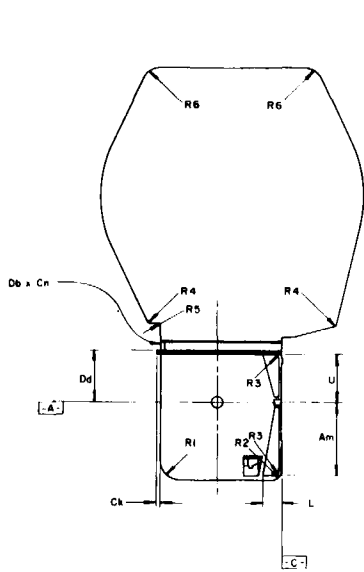
- 2.4** Datum features B, C, and A are primary, secondary, and tertiary, respectively.

**2.4.1** Datum feature B is the unnotched, unlabeled surface of the cartridge, extending 2.00 in (50.8 mm) basic below and 1.635 in (41.53 mm) basic above datum plane A (cartridge surface between dimensions Av and Cs in Fig. 1). It is the primary datum feature and contacts datum plane B (of a gauging fixture [see Appendix A3]) at a minimum of three points.

**2.4.2** Datum feature C is the front seating surface of the cartridge, extending 2.00 in (50.8 mm) basic below and 1.635 in (41.53 mm) basic above datum plane A. It is the secondary datum feature and contacts datum plane C (of a gauging fixture [see Appendix A3]) at a minimum of two points.

**2.5** Dimensions L, N, U, Am, V, M, W, and R3, measured from datum planes A and C to the depth of dimension E, describe the extent of both triangular recessed areas. The inboard wall of the recessed area, defined by dimensions L and N, shall be a smooth surface and may be tilted sufficiently from the perpendicular to datum plane B to allow proper release from a mold, when the cartridge is manufactured in a molding process.

**2.6** The thickness of the wall of the cartridge used for notching, dimension W, shall be sufficient to withstand a force of at least 2.2 lbf (10 N), while



Dimensions	Inches	Millimeters
A	0.954 ± 0.010	24.23 ± 0.25
B	2.99 ± 0.01	75.9 ± 0.3
C	1.390 ± 0.010	35.31 ± 0.25
E	0.780 max	19.81 max
F	0.090 ± 0.010	2.29 ± 0.25
G	0.06 ± 0.01	1.5 ± 0.3
H	0.88 ± 0.03	22.4 ± 0.8
J	0.61 ± 0.03	15.5 ± 0.8
K	0.015 ± 0.010	0.38 ± 0.25
L	0.470 min	11.94 min
M	0.007 ± 0.005	0.18 ± 0.13
N	0.177 min	4.50 min
O	0.154 ± 0.004	3.91 ± 0.10
P	0.142 ± 0.004	3.61 ± 0.10
Q	0.770 ± 0.010	19.56 ± 0.25
R1	0.50 ± 0.10	12.7 ± 2.5
R2	0.25 ± 0.05	6.4 ± 1.3
R3	0.160 max	4.06 max
R4	0.050 min	1.27 min
R5	0.040 max	1.02 max
R6	0.25 min	6.4 min
S	1.02 ± 0.01	25.9 ± 0.3
T	0.870 basic	22.10 basic
U	1.225 min	31.12 min
V	0.125 max	3.18 max
W	See 2.6	
Y	0.151 ± 0.012	3.84 ± 0.30
Af	1.608 basic	40.84 basic
Am	1.835 min	46.61 min
An	2.340 min	59.44 min
Ap	1.032 max	26.21 max
Aq	0.733 ± 0.008	18.62 ± 0.20
As	1.710 ± 0.012	43.43 ± 0.30
At	1.730 min	43.94 min
Au	1.890 min	48.01 min
Av	2.000 ± 0.010	50.80 ± 0.25
Aw	30° ± 5°	30° ± 5°
Ay	0.620 min	15.75 min
Az	0.502 min	12.75 min
Ba	0.040 ± 0.008	1.02 ± 0.20
Bb	0.319 ± 0.008	8.10 ± 0.20
Bc	1.152 min	29.26 min
Bd	0.660 max	16.76 max
Be	0.533 max	13.54 max
Bf	45° nom	45° nom

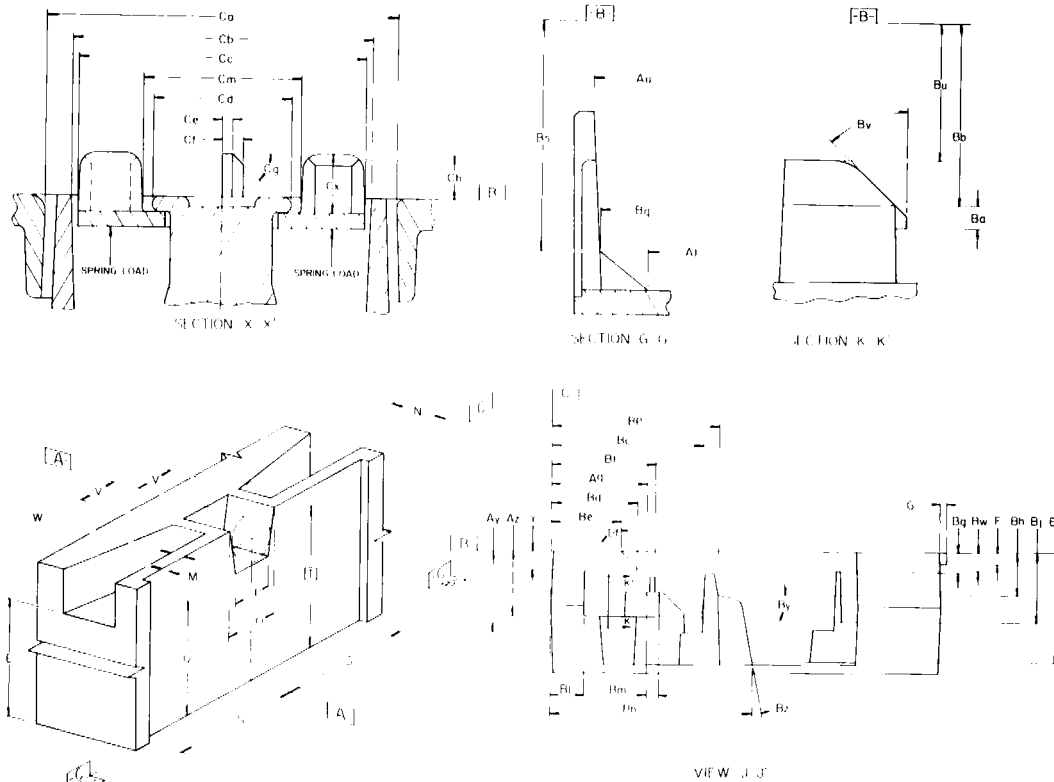


Fig. 2  
Camera Locating Slot

Dimensions	Inches		Millimeters	
	min	max	min	max
Bg	0.162	± 0.015	4.11	± 0.38
Bh	0.347	min	8.81	min
Bi	0.502	min	12.75	min
Bk	0.840	min	21.34	min
Bl	0.260	max	6.60	max
Bm	0.093	± 0.015	2.36	± 0.38
Bn	1.550	max	39.37	max
Bp	1.280	max	32.51	max
Bq	1.888	min	47.96	min
Bs	0.658	min	16.71	min
Bt	0.787	max	19.99	max
Bu	0.200	min	5.08	min
Bv	45°	± 5°	45°	± 5°
Bw	0.151	± 0.012	3.84	± 0.30
Bx	15°	± 2°	15°	± 2°
Bz	15°	± 2°	15°	± 2°
Ca	0.690	max	17.53	max
Cb	0.555	min	14.10	min
Cc	0.500	min	12.70	min
Cd	0.264	max	6.71	max
Ce	0.020	max	0.51	max
Cf	0.040	± 0.015	1.02	± 0.38
Cg	45°	nom	45°	nom
Ch	0.090	± 0.050	2.29	± 1.27
Ci	0.080	± 0.010	2.03	± 0.25
Ck	0.065	± 0.015	1.65	± 0.38
Cl	1.074	max	27.28	max
Cm	0.310	max	7.87	max
Cn	45°	nom	45°	nom
Cp	1.692	± 0.015	42.98	± 0.38
Cq	1.985	± 0.030	50.42	± 0.76
Cr	0.185	max	4.70	max
Cs	1.655	± 0.020	42.04	± 0.51
Ct	0.165	± 0.020	4.19	± 0.51
Cu	15°	± 5°	15°	± 5°
Cv	13°	± 5°	13°	± 5°
Cw	25°	± 5°	25°	± 5°
Cx	0.100	min	2.54	min
Cy	0.310	± 0.020	7.87	± 0.51
Cz	6.500	dia max	165.10	dia max
Da	3.275	max	83.18	max
Db	0.094	± 0.020	2.39	± 0.51
Dc	1.246	basic	31.65	basic
Dd	1.300	± 0.015	33.02	± 0.38
De	5.237	basic	133.02	basic
Df	15°	± 2°	15°	± 2°
Dg	0.215	± 0.008	5.46	± 0.20

deflecting no more than 0.04 in (1.0 mm). (For purposes of measurement, the force is applied by a solid round pin of nominal 0.05-in (1.3-mm) diameter, centered 0.03 in (0.8 mm) nominally above or below the film speed or filter notch coincident with basic dimension T on datum feature C.)

**2.7** Dimension A specifies the normal overall thickness of the cartridge, extending from the bottom edge of the cartridge to the light lock rib (dimension U) and within the light lock channel (dimension Dg).

**2.8** Some cartridge manufacturers may desire to provide a means of retaining the film supply and take-up spools until the cartridge is placed in the camera. One method employs a spool locking device which is activated by a lock pin extending through datum feature B. The device should be designed to unlock the spools when the lock pin is depressed by seating the cartridge on datum plane B (camera mechanism plate). The lock pin should be located within a zone from 0.50 in (12.7 mm) basic from datum plane A within dimension B. The force required to hold the lock pin coincident with datum plane B shall not exceed 20 oz (5.4 N). The initial force to depress the lock pin may be significantly higher than the force required to hold the lock pin coincident with datum plane B.

**2.9** Dimension M is measured from datum plane C.

**2.10** The sprocket axis shall be located within 0.010 in (0.25 mm) of the true center formed by datum plane A and basic dimension Af.

**2.11** Dimensions Ca, Cb, Cc, Cd, and Cm are diameters.

**Appendix**

(This Appendix is not part of the American National Standard, but is included for information only.)

**A1.** In designing the core driver, consideration should be given to the fact that tooth-on-tooth engagement of the core lug on the driver pin is a possibility.

**A2.** It is recommended that the core be tendency driven (by some form of slip-drive mechanism) with a drive ratio of at least one turn of the core driver for every fourteen strokes of the pull-down claw when no slippage occurs.

**2.12** Dimensions Bt, Bu, and Bv define an optional guide provided to facilitate film loading at the time of cartridge manufacture.

**3. Take-Up Core Drive**

**3.1** The direction of rotation for the core shall be clockwise when viewed from the core side of the cartridge.

**3.2** After disengagement of any film locking device, the cartridge shall operate with a nominal torque of 1.3 ozf-in (9.2 x 10<sup>-3</sup> N·m) with a permissible range of 1.0 to 1.5 ozf-in (7.1 x 10<sup>-3</sup> to 10.6 x 10<sup>-3</sup> N·m). (See Appendix A2.)

To enable cameras to distinguish automatically between the 8-mm type S 200-ft (60-m) capacity cartridge and the 50-ft (15-m) capacity sound and silent cartridge, a spring-loaded drive plate is incorporated in the core drive of the 8-mm type S 200-ft (60-m) capacity cartridge. The spring-loaded drive plate will react axially against the core drive mechanism of the camera with a nominal force of 1.4 oz (3.9 N) with a permissible range of 1.0 to 1.8 oz (2.8 to 5.0 N) when the spring-loaded drive plate is depressed to within 0.020 in (0.51 mm) from datum plane B. (Four driving lugs are shown in the core, and it is recommended that the camera core driver be designed in such a way as to present a plane surface for the four lugs to bear against.)

**3.3** When operating the 200-ft (60-m) capacity cartridge loaded with film without a magnetic sound stripe, proper film transport requires that all camera film transport mechanisms, including those for recording sound, be activated. (This may not be required when using the 8-mm type S 50-ft (15-m) capacity silent cartridge.)

**A3.** To provide a consistent method of measurement, it is recommended that a cartridge gauging fixture be used which incorporates datum surfaces, a locating pin, and means of exerting locating forces on appropriate surfaces of the cartridge.