ANSI V98.6-1981
Revision of ANSI C98.6-1973

American National Standard

dimensions of video, audio and tracking control records on 2-in video magnetic tape quadruplex recorded at 15 and 7.5 in/s

Approved March 30, 1981

Secretariat: Society of Motion Picture and Television Engineers

1. Scope

This standard specifies both the locations for the edges of the video, audio and tracking control records, and the mechanical separation of the simultaneously-recorded information of the video and audio records, as recorded on 2-in quadruplex video magnetic tape.

2. Definitions

2.1 Transverse: Pertaining to dimensions or motions perpendicular to the tape travel.

2.2 Longitudinal: Pertaining to dimensions or motions parallel to the tape travel.

2.3 Downstream: Pertaining to locations on the tape longitudinally displaced from a given reference point, in the direction of tape travel.

2.4 Upstream: Pertaining to locations on the tape longitudinally displaced from a given reference point, in a direction opposite to tape travel.

2.5 Reference Edge: On a video tape containing quadruplex-recorded information, that longitudinal tape edge nearest the tracking control record.

2.6 Trailing Edge, Video Track: The upstream edge of the video track.

2.7 Transverse Reference Line: A line perpendicular to the reference edge and passing through a video track trailing edge at its lowest end (point T_0) as in Fig. 1.

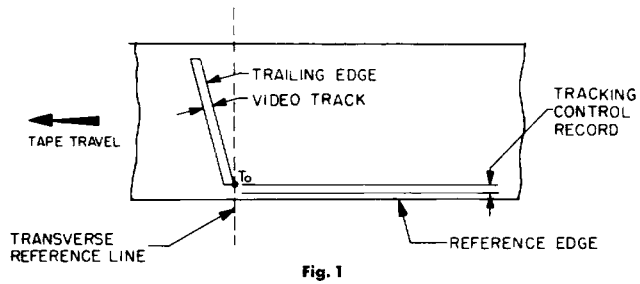

Fig. 1
Definitions

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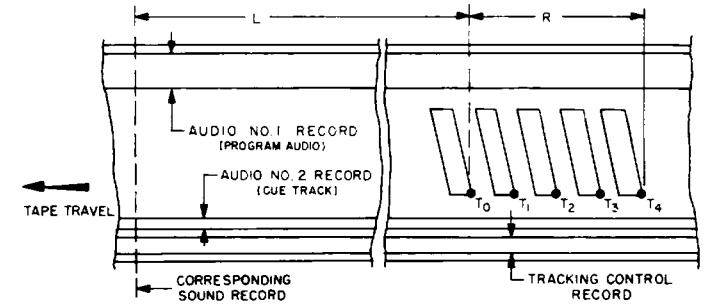


Fig. 2
Longitudinal Dimensions

3. General

3.1 References. The transverse reference line and reference edge shall be the references for all dimensions in this standard.

3.2 Measurement Conditions. The dimensions specified in this standard are measured with no transverse or longitudinal tension applied to the tape. (See Appendix A4.)

3.3 Magnetic Coating. With the direction of tape travel as shown in all figures in this standard, the magnetic coating is on the surface facing the observer.

4. Longitudinal Dimensions

4.1 Average Video Track Pitch. For a tape recorded at 15 in/s (381 mm/s), the longitudinal distance, R, from a transverse reference line to a point, T_4, four tracks away (See Fig. 2), shall be greater than 0.062438 in (1.58593 mm) and less than 0.062562 in (1.58907 mm). (An acceptable method for obtaining the accuracy required by the above dimensions is to measure the span occupied by 3072 tracks, which should be greater than 47.952 in (1217.98 mm) and less than 48.048 in (1220.42 mm).) See Appendixes A2 and A3.

For a tape recorded at 7.5 in/s (190.5 mm/s), the longitudinal distance from a transverse reference line to a point, T_4, four tracks away shall be greater than 0.031219 in (0.79296 mm) and less than 0.031281 in (0.79454 mm). (An acceptable method for obtaining the accuracy required by the above dimensions is to measure the span occupied by 3072 tracks, which should be greater than 23.976 in (608.99 mm) and less than 24.024 in (610.21 mm).) See Appendixes A2 and A3.

4.2 Video Track Spacing. The longitudinal distance from any transverse reference line to Points T_1, T_2, and T_3 shall be R/4, R/2, and 3R/4, respectively, with a tolerance of ± 0.00015 in (0.0038 mm), where R is the average video track pitch as determined in Section 4.1 for the tape being measured (See Fig. 2). (The tolerances indicated cannot be readily measured on a pre-recorded tape by methods presently available. At the present state of the art, these dimensions are controlled by the head wheel manufacturer's ability to achieve coplanarity of the recording pole tips.) See Appendixes A2 and A3.

4.3 Video Track Curvature and Angle. The trailing edge of any video track shall fall between two parallel lines spaced apart by 0.001 in (0.03 mm).

For a tape recorded at 15 in/s, the two parallel lines shall make, with the reference edge, a positive angle no greater than 90° 36′ and no less than 90° 30′, when positioned so as to enclose the entire length of the video track trailing edge.

For a tape recorded at 7.5 in/s, the two parallel lines shall make, with the reference edge, a positive angle no greater than 90° 19′ 30″ and no less than 90° 13′ 30″, when positioned so as to enclose the entire length of the video track trailing edge.

4.4 Video Track Width. For a tape recorded at 15 in/s, the longitudinal width of any video track shall lie between 0.0095 in (0.241 mm) and 0.0105 in (0.267 mm), measured at any and all points along its transverse direction. For a tape recorded at 7.5 in/s, the video track width shall lie between 0.0050 in (0.127 mm) and 0.0060 in (0.152 mm).

4.5 Audio Record Displacement. Audio or other information which is time-coincident with video information recorded at a point, T, of any video track shall be recorded in Audio Record No. 1 (Program Audio) or Audio Record No. 2 (Cue Track), at a distance, L, downstream from that point, T, where L shall be at least 9.200 in (233.68 mm) and no more than 9.300 in (236.22 mm).

5. Transverse Dimensions

The transverse dimensions shall be as specified in Fig. 3 and the table.

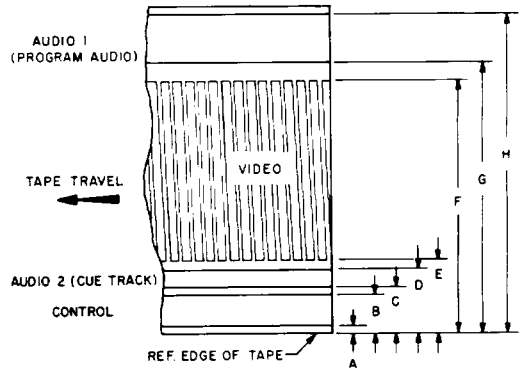


Fig. 3
Tranverse Dimensions

Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.000	0.004	0.00	0.10
B	0.040	0.049	1.02	1.24
C	0.058	0.062	1.47	1.57
D	0.078	0.085	1.98	2.16
E	0.087	0.094	2.21	2.39
F	1.902	1.914	48.31	48.62
G	1.921	1.930	48.79	49.02
H	1.988	1.996	50.50	50.70

Appendix

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

A1. A magnetic record is that area in which magnetization conveying the intended signal exists. A common technique for measurement of record locations and dimensions is the use of carbonyl iron to make them visible.

A2. Since all recorded tapes exhibit wow and flutter to some degree, the span of measured tracks should be long enough to average out variations in video track pitch arising from wow or flutter. If other measuring methods are employed, appropriate averaging must be included in the measurement.

A3. The track pattern specified by Sections 4.1 and 4.2 results when the tape speed in inches per second and the head wheel rotational rate in revolutions per second are in the ratio of 0.0625:1 for 15 in/s recording practice, and in the ratio of 0.03125:1 for 7.5 in/s recording practice. Since both the head wheel rotational speed and the capstan metering rate are locked to the television frame rate, the speed of the tape will vary with the television frame rate. This speed variation will not alter the pattern placed on the tape. Replay rate of any recording, as well as the replay rate of the information contained in the record, will be determined solely by the reference frequency to which the replay capstan and head wheel are synchronized.

Primary causes of departures from the video track pitch specified by Section 4.1 are incorrect capstan diameter, capstan slippage, or incorrect longitudinal tape stretch.

The tolerances specified in Section 4.1 reflect the magnitude of allowable changes in the ratio of tape speed to head wheel rotational speed. Variations in excess of those specified will not only result in improper video track pitch but will also result in an incorrectly placed control track on tapes recorded on machines having the control track head displaced from the plane of rotation of the video pole tips by approximately 0.7 in (18 mm), as is common practice in present-day transports. (See SMPTE Recommended Practice RP 16-1977, Specifications of Tracking Control Record for 2-in Quadruplex Video Magnetic Tape Recordings, for a description of the tracking control record.)

A4. Although, with sufficient care, measurements of track dimensions may be made with no transverse or longitudinal tension applied to the tape, tape-handling problems during measurements may be lessened by making two sets of measurements at two different longitudinal tensions and extrapolating data thus obtained to the zero-tension condition.

ANSI V98.13-1981
Revision of ANSI C98.13-1975

American National Standard
dimensions of cartridge spools for 2-in quadruplex video magnetic tape

Approved March 30, 1981

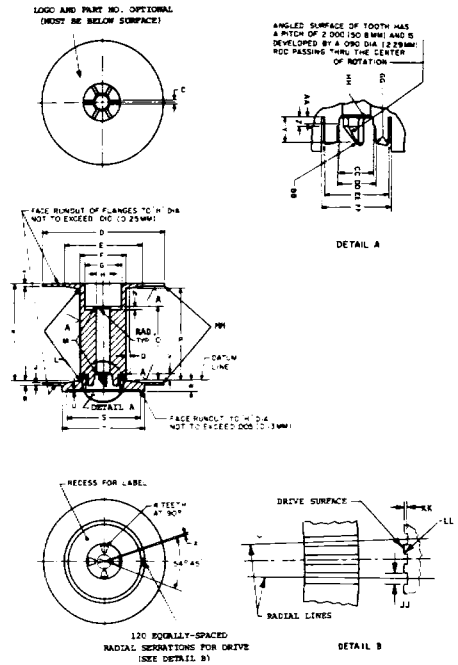
Secretariat: Society of Motion Picture and Television Engineers

1. Scope

This standard specifies the dimensions of a 2.7-in (68.58-mm) diameter supply spool for quadruplex equipment designed to utilize a reloadable cartridge or cassette.

2. Dimensions

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



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DIMENSIONS		INCHES	MILLIMETERS
A		See Note 2	
C		0.060 (6 equal spaces)	1.52 (6 equal spaces)
D	(diameter)*	2.70 ± 0.010	68.58 ± 0.25
E	(diameter)	1.700 ± 0.030	43.18 ± 0.76
F	(diameter)†	1.000 +0.005 −0.010	25.40 +0.13 −0.25
G	(diameter)	0.812 ± 0.010	20.62 ± 0.25
H	(diameter)	0.313 +0.001 −0.000	7.95 +0.03 −0.00
J		0.055 ± 0.005	1.40 ± 0.13
K		2.120 ± 0.010	53.85 ± 0.25
L	(radius)	0.004 max	0.10 max
M		0.015 × 45° (chamfer)	0.38 × 45° (chamfer)
N		0.060	1.52
O		1.611 ± 0.010	40.92 ± 0.25
P		2.030 ± 0.005	51.56 ± 0.13
Q		0.070 ± 0.040	1.78 ± 1.02
R		0.090 ± 0.005	2.29 ± 0.13
S	(diameter)‡	1.625 ± 0.005	41.28 ± 0.13
T	(diameter)‡	1.820 ± 0.005	46.23 ± 0.13
U		0.020 min	0.51 min
		0.070 max	1.78 max
V		0.137 ± 0.005	3.48 ± 0.13
W		0.230 ± 0.005	5.84 ± 0.13
X		0.045 typ	1.14 typ
Y		0.227 ref	5.77 ref
Z		0.100	2.54
AA		0.090	2.29
BB	(radius)	0.01 typ	0.3 typ
CC	(diameter)	0.375 ± 0.010	9.52 ± 0.25
DD	(diameter)	0.410 ± 0.010	10.41 ± 0.25
EE	(diameter)	0.710 +0.040 −0.010	18.03 +1.02 −0.25
FF	(diameter)	0.750	19.05
GG	(radius)	0.031 max	0.79 max
HH	(radius)	0.031	0.79
JJ		0.017 min	0.43 min
		0.020 max	0.51 max
KK		0.005 min	0.13 min
		0.008 max	0.20 max
LL	(radius)	0.003 max typ	0.08 max typ
MM	(radius)	0.010 ± 0.005	0.25 ± 0.13

* D shall be concentric to H within 0.006 inch (0.15 mm).

† F shall be concentric with H within 0.002 inch (0.05 mm). Maximum taper in 2.030-inch (51.56 mm) dimension shall not exceed 0.002 inch (0.05 mm).

‡ S and T shall be concentric to H within 0.010 inch (0.25 mm).

NOTE 1: The teeth described in Detail A and the serrations described in Detail B are intended as alternate methods for driving the spools.

NOTE 2: Surfaces indicated by the letter A should contain surface finish designated as No. 63 (microinch measurement of surface polish), as defined in American National Standard Surface Texture, ANSI B46.1-1978.

ANSI PH22.73-1981
Revision of ANSI PH22.73-1974

American National Standard dimensions for 35-mm motion-picture film perforated 32-mm, 2R

Approved March 30, 1981 Secretariat: Society of Motion Picture and Television Engineers

1. Scope

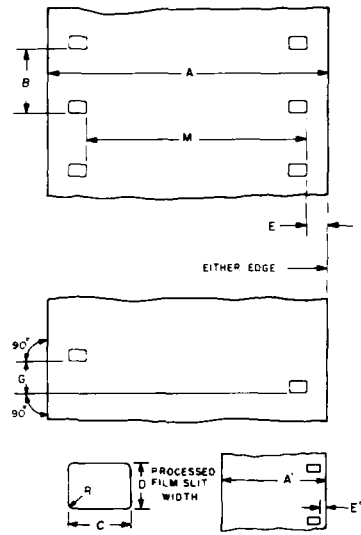
This standard specifies the cutting and perforating dimensions for 35-mm motion-picture film having two rows of 16-mm type perforations, one row near each edge of the 35-mm film, and a perforation pitch of either 0.2994 or 0.3000 in (7.605 or 7.620 mm). The width of the 16-mm strip after processing and slitting is also specified.

2. Dimensions

2.1 The dimensions shall be as given in the figure and table.

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31M-1980.

2.3 Except for Dimensions A' and E', the dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2 F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal temperature and humidity conditions under which the dimensions apply. Dimensions A' and E' apply immediately after slitting.



	Dimensions	Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
A'	Film width after processing and slitting	0.627 ± 0.002	15.93 ± 0.05
B	Perforation pitch (long)	0.3000 ± 0.0004	7.620 ± 0.010
B'	Perforation pitch (short)	0.2994 ± 0.0004	7.605 ± 0.010
C	Perforation width	0.0720 ± 0.0004	1.829 ± 0.010
D	Perforation height	0.0500 ± 0.0004	1.270 ± 0.010
E	Edge to perforation	0.096 ± 0.002	2.44 ± 0.05
E'	Edge to perforation after processing and slitting	0.0355 ± 0.0020	0.902 ± 0.051
G	Perforation misalignment	0.001 max	0.03 max
L	100 consecutive perforation pitches (long)	30.00 ± 0.03	762.0 ± 0.8
L'	100 consecutive perforation pitches (short)	29.94 ± 0.03	760.5 ± 0.8
M	Lateral perforation displacement	1.113 ± 0.001	28.27 ± 0.03
R	Radius of perforation fillet	0.010 ± 0.001	0.25 ± 0.03

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NOTE 1: The title of this standard was established by the application of a nomenclature system developed for all film dimension standards. Each title provides an indication of the film width, a code designation for the perforation shape (BH, KS, DH, or CS) or the number of rows of perforations (1R, 2R, etc.), depending upon which is the significant factor, or the perforation pitch without the decimal point.

NOTE 2: The metric conversion of Dimension A is purposely chosen and shown to three decimal places to prevent the maximum width dimension from exceeding 35 mm.

NOTE 3: Dimension A' represents the film width and Dimension E' the edge-to-perforation distance after slitting a nominal 16-mm strip from the exposed and processed parent 35-mm width film. In deriving the dimension of 0.627 in (15.93 mm), the specified film shrinkage characteristics described in Appendix A2 have been taken into account.

Appendix

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

A1. The user is reminded that, as a plastic, film can change dimensions temporarily due to moisture or temperature, or permanently due to solvent loss or strain effect.

A2. Film for positive use has a longitudinal pitch 0.2 percent longer than its companion negative. Shrinkage of the negative during aging and processing prior to printing will generally not exceed 0.2 percent. Thus, the negative stock is expected to be 0.3 ± 0.1 percent shorter than the positive. This difference will minimize slippage between the two on the 12-inch (305-mm) circumference sprocket of the printer, assuming a film thickness of 0.0055 to 0.0065 in (0.140 to 0.165 mm).

A3. The uniformity of pitch, hole size, and margin (Dimensions B, C, D, and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next within any small group of consecutive perforations. As an example, the uniformity of the margin is uniquely critical for optical printing. During the printing process, the placement of the image on the film is usually with respect to successive lateral pairs of perforations at one-frame intervals. During subsequent projection, however, the portion of the image projected is usually located, not by these perforations, but by the edge of the film. The lateral steadiness of the projected image is, therefore, directly related to the frame-to-frame uniformity of the margin.

ANSI PH22.165-1981
Revision of ANSI PH22.165-1973

American National Standard
dimensions for 35-mm motion-picture film perforated 8-mm type S, 5R (1-3-5-7-0)

Approved March 30, 1981

Secretariat: Society of Motion Picture and Television Engineers

1. Scope

This standard specifies the cutting and perforating dimensions for 35-mm motion-picture film with four rows of 8-mm Type S perforations and one row of special perforations having a perforation pitch of either 0.1664 or 0.1667 in (4.227 or 4.234 mm). The film stock described in this standard is intended for the production of prints. The width of the 8-mm strip after processing and slitting is also specified.

NOTE 1: The title of this standard was established by the application of a nomenclature system developed for all film dimension standards: Each title provides an indication of the film width, a code designation for the perforation shape (BH, KS, DH, or CS) or the number of rows of perforations (1R, 2R, etc.), depending upon which is the significant factor, and the perforation pitch without the decimal point.

The numerals (1-3-5-7-0) have been added to the title of this standard to specify how the rows of perforations are placed on the film. The designation is necessary only when the film stock is wider than its end use and more than one combination of perforation rows is possible. For 8-mm Type S perforations on 35 mm-width film, a maximum of four usable rows of perforations is possible. The perforation rows shall be numbered starting at the reference edge. The reference edge is the edge nearest to that row of perforations which is retained in one of the 8-mm strips that may be generated by appropriate slitting of the parent 35-mm film. A row of perforations which is discarded will always be given the number 0. Negative or intermediate films which are not slit may contain a 0-numbered row of perforations if that perforated row corresponds to the discard row of perforations on the subsequent print stock. For all films with nonsymmetrical perforation rows, there can be two different windings for the same numbered rows of perforations. Film perforated 1-0 would be 1-0 regardless of winding, but depending upon the location of the reference edge, the winding could be A or B, according to American National Standard Designation of A and B Windings for Motion-Picture Raw Stock, ANSI PH22.75-1975.

NOTE 2: The metric conversion of Dimension A is purposely chosen and shown to three decimal places to prevent the maximum width dimension from exceeding 35 mm.

2. Dimensions

2.1 The dimensions shall be as given in the figure and table.

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, ANSI PH22.31M-1980.

2.3 Except for Dimensions A′ and E′, the dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2 F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.

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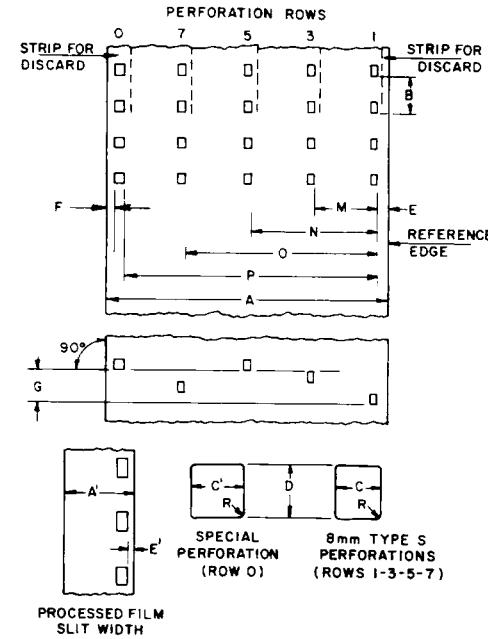

	Dimensions	Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
A′	Film width after processing and slitting	0.314 ± 0.002	7.98 ± 0.05
B	Perforation pitch (long)	0.1667 ± 0.0004	4.234 ± 0.010
B′	Perforation pitch (short)	0.1664 ± 0.0004	4.227 ± 0.010
C	Perforation width	0.0360 ± 0.0004	0.914 ± 0.010
C′	Special perforation width	0.0450 ± 0.0004	1.143 ± 0.010
D	Perforation height	0.0450 ± 0.0004	1.143 ± 0.010
E	Edge to perforation	0.050 ± 0.002	1.27 ± 0.05
E′	Edge to perforation after processing and slitting	0.020 ± 0.002	0.51 ± 0.05
F	Edge to perforation	0.031 nom	0.79 nom
G	Perforation skewness	0.0015 max	0.038 max
L	100 consecutive perforation pitches (long)	16.670 ± 0.016	423.42 ± 0.41
L′	100 consecutive perforation pitches (short)	16.640 ± 0.016	422.66 ± 0.41
M	Lateral perforation displacement	0.314 ± 0.001	7.98 ± 0.03
N	Lateral perforation displacement	0.628 ± 0.001	15.95 ± 0.03
N-M	Functional tolerance	0.314 ± 0.001	7.98 ± 0.03
O	Lateral perforation displacement	0.942 ± 0.001	23.93 ± 0.03
O-N	Functional tolerance	0.314 ± 0.001	7.98 ± 0.03
P	Lateral perforation displacement	1.251 ± 0.001	31.78 ± 0.03
P-O	Functional tolerance	0.309 ± 0.001	7.85 ± 0.03
R	Radius of perforation fillet	0.005 ± 0.001	0.13 ± 0.03