

standards and recommended practices

Approved SMPTE Recommended Practices

On March 31, 1967 the Society's Board of Governors approved three Recommended Practices, which are printed here for your information.

SMPTE Recommended Practice, RP 6, Reference Carrier Frequencies and De-Emphasis Characteristics for 2-In. Quadruplex Video Magnetic Tape Recording, is a revision of RP 6-1961 and now describes the modulation practices used in 2-inch video magnetic tape recording of color and monochrome television signals.

SMPTE Recommended Practice, RP 23, Reinforcement of 70mm Splices, and SMPTE Recommended Practice, RP 24, Dimensions for 16mm Motion-Picture Camera Spindles, are new documents and should be brought to the attention of anyone concerned with the subject matter.

Copies of these documents and all SMPTE Recommended Practices may be acquired from Society Headquarters upon request.

Proposed USA Standards

Five Proposed USA Standards are published here for a trial period and public review. Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to August 21.

The Proposals are all new documents dealing with the super 8 system. Four of them specify various aspects of the magnetic sound record: Proposed USA Standard Dimensions of Magnetic Striping of Super 8 Motion-Picture Film Perforated 1R-1667, PH22.161; Proposed USA Standard Dimensions of

Magnetic Striping of 16mm Motion-Picture Film Perforated Super 8, 2R-1667 (1-4), PH22.162; Proposed USA Standard Dimensions of Magnetic Striping of 35mm Motion-Picture Film Perforated Super 8, 5R-1667, PH22.163; Proposed USA Standard Dimensions for Magnetic Sound Record of Super 8 Motion-Picture Film Perforated 1R-1667, PH22.164. The fifth one, Proposed USA Standard Dimensions for 35mm Motion-Picture Film Perforated Super 8, 5R-1667, PH22.165, specifies the cutting and perforating dimensions for 35mm motion-picture film with four rows of super 8 perforations and one row of special perforations.

The documents will be submitted to USA Standards Committee PH22 of the USA Standards Institute. Any comments received from *Journal* publication will be reviewed prior to conclusion of action by that Committee. If no adverse criticism is forthcoming, the Proposals will be submitted to the Standards Institute for approval as USA Standards.

Proposed Withdrawal of USA Standard

The Television Committee and the SMPTE Standards Committee have proposed the withdrawal of USA Standard 16mm Motion Picture Projector for Use with Monochrome Television Film Chains Operating on Full-Storage Basis, PH22.91-1955, inasmuch as the practices described are no longer being used. The Standard was published in the April, 1955, issue of the *Journal*.

The recommendation will be submitted to USA Standards Committee PH22 of the USA Standards Institute. Any comments received from *Journal* publication will be reviewed prior to conclusion of action by that Committee.—A.E.A.



Reference Carrier Frequencies and De-Emphasis Characteristics for 2-In. Quadruplex Video Magnetic Tape Recording

Introduction

In quadruplex television magnetic recording systems, the level of the reproduced signal is controlled by three factors, viz., (a) adjustment of the playback video amplifier gain setting, (b) the reference frequencies to which the video signal deviates the carrier (at frequencies not affected by pre-emphasis), and (c) the combination of the video pre-emphasis used in recording and the video de-emphasis used in reproduction. In order to achieve uniformity in playback, it is essential that video tape recordings be made in accordance with the practices defined herein. It is also essential that all signals contained in a composite recording made by electronic editing or physical splicing of the recorded tape be recorded in accordance with the same one of the practices defined herein.

1. Scope

1.1 This recommended practice specifies the reference frequencies to which the carrier is deviated and the associated video de-emphasis, for each of the recommended modulation practices used in 2-in. quadruplex video magnetic tape recording of U.S. standard color and monochrome television signals. (The video pre-emphasis to be used in recording is specified indirectly by requiring a flat input-to-output video response along with a specified de-emphasis in reproduction.)

2. Practice HB

2.1 This practice is suitable for color and monochrome signals.

2.2 Recorded carrier frequencies:

- (a) Reference white level 10.0 ± 0.05 MHz
- (b) Blanking level 7.9 ± 0.05 MHz
- (c) Sync tip level 7.06 ± 0.05 MHz

2.3 The general de-emphasis characteristic is defined in Section 5 below.

2.3.1 Values:

- (a) T = 0.600 microsecond
- (b) X = 1.5

3. Practice LBM

3.1 This practice is suitable only for monochrome signals.

3.2 Recorded carrier frequencies:

- (a) Reference white level 6.8 ± 0.05 MHz
- (b) Blanking level 5.0 ± 0.05 MHz
- (c) Sync tip level 4.28 ± 0.05 MHz

3.3 The general de-emphasis characteristic is defined in Section 5 below.

3.3.1 Values:

- (a) T = 0.132 microsecond
- (b) X = 4.0

4. Practice LBC

4.1 This practice is used for color signals.

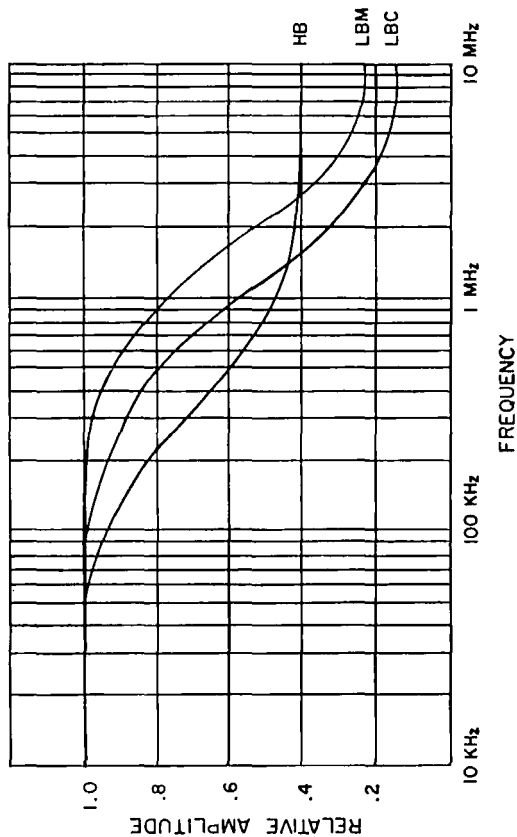
4.2 Recorded carrier frequencies:

- (a) Reference white level 6.5 ± 0.05 MHz
- (b) Blanking level 5.79 ± 0.05 MHz
- (c) Sync tip level 5.5 ± 0.05 MHz

4.3 The general de-emphasis characteristic is defined in Section 5 below.

4.3.1 Values:

- (a) T = 0.240 microsecond
- (b) X = 6.56



Graph A. Video De-emphasis Curves.

5. De-emphasis Characteristic

5.1 The video de-emphasis characteristic curves are described in Graph A.

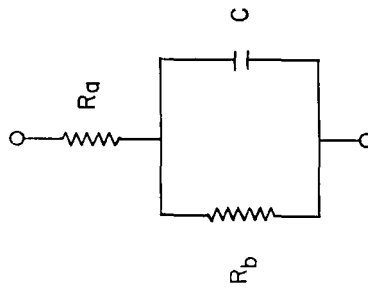
5.2 The video de-emphasis curves are defined as the normalized impedance of the following two-terminal network:

$$R_b = XR_b C$$

$$T = R_b C$$

where T is time constant, R is resistance in ohms, and C the capacitance in microfarads.

5.3 The de-emphasis characteristic is introduced following the demodulator in the signal playback circuitry. (To obtain a flat input-to-output video response over the passband of interest, a complementary video pre-emphasis characteristic is introduced ahead of the frequency modulator stage during recording.)



Appendix

(This Appendix is not a part of SMPTE Recommended Practice RP 6-1967, Reference Carrier Frequencies and De-Emphasis Characteristics for 2-In. Quadruplex Video Magnetic Tape Recording, but is included to facilitate its use.)

This recommended practice assumes that all pre-emphasis and de-emphasis is placed in the video portion of the signal path and that the response of the RF portion of the signal path is flat over the passband of interest. Ideally, the magnitude of the remanent flux on a recorded tape should be independent of frequency over the passband of interest, but since there is no practical way of measuring it, the most practical approach is to ensure that record current in the video heads is independent of frequency over the passband of interest.

SMPTE RECOMMENDED PRACTICE

RP 23-1967

Reinforcement of 70mm Positive Splices



SMPTE RECOMMENDED PRACTICE

RP 24-1967

Dimensions for 16mm Motion-Picture Camera Spindles



Introduction

Cement splices on 70mm projection prints have, in certain instances, failed during projection. To prevent costly damage to the print, projectionists and others involved in distribution and exhibition have suggested that cement splices be reinforced.

1. Scope

1.1 This Recommended Practice specifies that a transparent material shall be employed to reinforce cement splices on 70mm projection prints.

2. Materials

2.1 Pre- or post-perforated transparent polyester tape with pressure-sensitive adhesive is preferred. Total tape thickness, including adhesive, shall not exceed 0.0015 in.

3. Application

3.1 The tape shall be applied to the emulsion side of the film to avoid masking the magnetic soundtracks. For optimum results, the reinforcement should extend to both edges, or just short of both edges, of the film to include the perforation area. Although tape width is not critical, it has been determined that tape 0.750 in. wide, which includes two perforations on each side of the cement splice, will adequately reinforce the splice and yet not be objectionable during projection.

4. General

4.1 Proprietary items are available that fulfill the requirements of this Recommended Practice.

1. Scope

1.1 This recommended practice specifies the dimensions for 16mm motion-picture camera spindles.

2. Dimensions

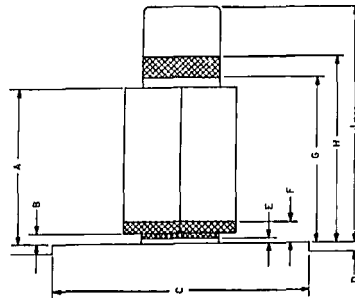
2.1 The dimensions shall be as given in the figure and table.

Dimensions	Inches	Millimeters
A	0.100 min 0.610 max	2.54 min 15.49 max
B	0.010 max	0.25 max
C	0.63 min 0.97 max	16.0 min 24.6 max
D	0.025 min	0.64 min
E*	0.005 max	0.13 max
F*	0.080 min	2.03 min
G*	0.630 max	16.00 max
H*	0.750 min	19.05 min
J	0.800 min	20.32 min
K*	0.310 min 0.315 max	7.87 min 8.00 max

*See Notes 1 and 2.

Notes

- Dimensions E, F, G, and H, illustrated by cross-hatching in the figure, represent the spindle shaft areas (with safety factor) on which the spool flanges rest. A minimum shaft diameter (in addition to a maximum) has been fixed to help prevent loose fit and resultant noise or tilt of spools or reels.
 - Dimension K represents the diameter of the square round portion or length of a side of the square drive portion of the spindle "shaft," excluding locking means.
- Although the figure illustrates a four-sided square drive portion of the spindle, a two-sided (or one side and two half sides) arrangement is also acceptable.
- The shape or action of the device for locking spools on spindles is optional, but the device should work against the full thickness of spools in the vicinity of the spindle hole.



Magnetic Striping of Super 8 Motion-Picture Film Perforated 1R-1667

PH22.161

1. Scope

This standard specifies the location and dimensions of the magnetic recording stripe and the balance stripe applied to 8mm motion-picture film with one row of super 8 perforations.

2. Dimensions

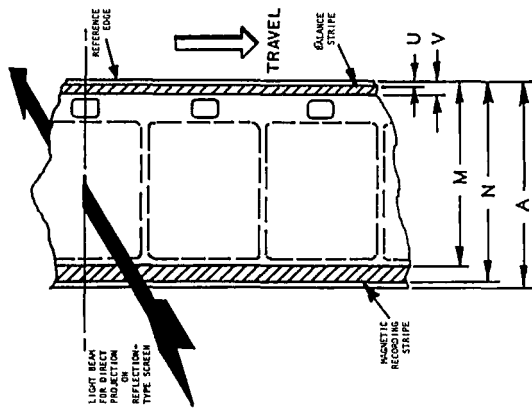
2.1 The location and dimensions of the magnetic recording stripe and the balance stripe shall be as given in the figure and table.

2.2 The magnetic stripe shall be on the side of the film which will be toward the light source when used on a projector arranged for direct front projection on a reflection-type screen.

2.3 The magnetic stripe shall be adjacent to the unperforated edge and is intended for the sound record. The narrow stripe adjacent to the perforated edge is a balance stripe. The balance stripe may be a stripe of magnetic or non-magnetic material of such thickness that the balance and recording stripes project above the surface of the film to substantially the same degree.

3. Film Stock

The film stock used shall be safety type, cut and perforated in accordance with Proposed USA Standard Dimensions for 8mm Motion-Picture Film, Perforated Super 8, 1R-1667, PH22.149.



Film As Seen Looking Toward Lens

Dimensions	Inches	Millimeters
A	0.314	nom 7.98
M	0.285 ± 0.003	7.24 ± 0.08
N	0.312 ± 0.003	7.92 ± 0.08
U	0.003 ± 0.003	0.08 ± 0.08
V	0.015 ± 0.003	0.38 ± 0.08

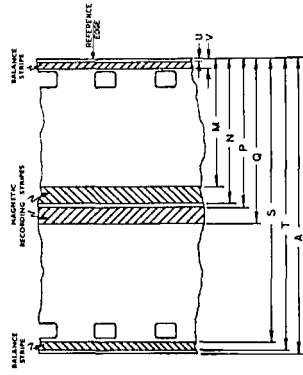
NOT APPROVED

Magnetic Striping of 16mm Motion-Picture Film Perforated Super 8, 2R-1667 (1-4)

PH22.162

1. Scope

This standard specifies the location and dimensions of the magnetic recording stripes and the balance stripes applied to 16mm motion-picture film with two rows of super 8 perforations in positions 1 and 4.



Dimensions	Inches	Millimeters
A	0.628	nom 15.95
M	0.285 ± 0.002	7.24 ± 0.05
N	0.312 ± 0.002	7.92 ± 0.05
P*	0.316 ± 0.002	8.02 ± 0.05
Q	0.343 ± 0.002	8.71 ± 0.05
S	0.613 ± 0.003	15.57 ± 0.08
T	0.625 ± 0.003	15.88 ± 0.08
U	0.003 ± 0.003	0.08 ± 0.08
V	0.015 ± 0.003	0.38 ± 0.08

* The millimeter conversion is approximate so that Dimension P minimum equals Dimension N maximum.

2. Dimensions

2.1 The location and dimensions of the magnetic recording stripes and balance stripes shall be as given in the figure and table.

2.2 The magnetic striping material shall be applied to the surface of the film away from a camera or projector lens; for example, toward the light source of a projector arranged for direct front projection on a reflection-type screen.

2.3 The stripes designated as "recording" are made of a magnetic material and are intended for the sound record. The stripes between the edge of the film and the perforations are the balance stripes. The balance stripes may be stripes of magnetic or nonmagnetic material of such thickness that the balance and recording stripes project above the surface of the film to substantially the same degree.

NOTE: Tolerances for the recording stripes are specified to permit usage of a single wide stripe or two separate stripes. If two stripes are used, the amount of separation between the stripes should be sufficient to permit slitting within the requisites of the standard without obtaining undesirable feather edges of magnetic material. The separation required is determined by laboratory practice.

NOT APPROVED

Proposed USA Standard Dimensions of
**Magnetic Striping of 35mm Motion-Picture
 Film Perforated Super 8, 5R-1667**

PH22.163

Page 1 of 2 pages

1. Scope

This standard specifies the location and dimensions of the magnetic recording stripes and the balance stripes applied to 35mm motion-picture film with four rows of super 8 perforations and one row of special perforations.

3. Film Stock

The film stock used shall be safety type, cut and perforated in accordance with Proposed USA Standard Dimensions for 35mm Motion-Picture Film Perforated Super 8, 5R-1667, PH22.165.

2. Dimensions

2.1 The location and dimensions of the magnetic recording stripes and balance stripes shall be as given in the figure and table.

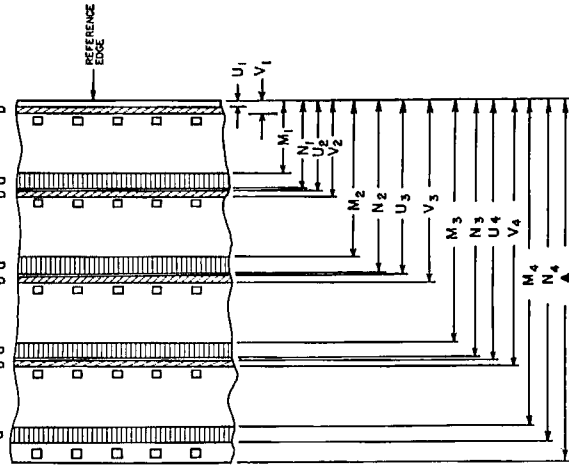
2.2 The magnetic striping material shall be applied to the surface of the film away from a camera or projector lens; for example, toward the light source of a projector arranged for direct front projection on a reflection-type screen.

2.3 The stripes designated as "recording" are made of a magnetic material and are intended for the sound record. The balance stripes may be stripes of magnetic or nonmagnetic material of such thickness that the balance and recording stripes project above the surface of the film to substantially the same degree.

NOTE 1: The width and edge-to-perforation distance of the 8mm slit strip shall be in accordance with Proposed USA Standard Dimensions for 35mm Motion-Picture Film Perforated Super 8, 5R-1667, PH22.165. The location of the magnetic recording and balance stripes shall be in accordance with Proposed USA Standard Dimensions of Magnetic Striping of Super 8 Motion-Picture Film Perforated 5R-1667, PH22.161. Consequently, it is not possible to take full advantage of the tolerances of both the slit width and the location of the magnetic recording and balance stripes.

NOTE 2: Tolerances for the recording stripes and balance stripes are specified to permit usage of a single wide stripe or two separate stripes where they are adjacent. If two stripes are used, the amount of separation between the stripes should be sufficient to permit slitting within the requisites of the standard without obtaining undesirable feather edges of magnetic material. The separation required is determined by laboratory practice.

(b) BALANCE STRIPES



Dimensions	Inches		Millimeters	
	nom	tol	nom	tol
A	1.377	± 0.002	34.98	± 0.05
M ₁	0.315	± 0.002	8.00	± 0.05
M ₂	0.629	± 0.002	15.98	± 0.05
M ₃	0.943	± 0.002	23.95	± 0.05
M ₄	1.257	± 0.002	31.93	± 0.05
N ₁	0.342	± 0.002	8.69	± 0.05
N ₂	0.656	± 0.002	16.66	± 0.05
N ₃	0.970	± 0.002	24.64	± 0.05
N ₄	1.284	± 0.002	32.61	± 0.05
U ₁	0.033	± 0.003	0.84	± 0.08
U ₂	0.347	± 0.003	8.81	± 0.08
U ₃	0.661	± 0.003	16.79	± 0.08
U ₄	0.975	± 0.003	24.76	± 0.08
V ₁	0.045	± 0.003	1.14	± 0.08
V ₂	0.359	± 0.003	9.12	± 0.08
V ₃	0.673	± 0.003	17.09	± 0.08
V ₄	0.987	± 0.003	25.07	± 0.08

1.2 This standard also specifies the picture-sound separation of super 8 motion-picture film with a magnetic sound record.

2. Dimensions

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

3. Picture-Sound Separation
The magnetic sound record on the film shall precede the center of the corresponding picture by a distance of 18 frames \pm 1 frame.

4. Magnetic Striping

The magnetic striping shall be as specified in Proposed USA Standard Dimensions of Magnetic Striping of Super 8 Motion-Picture Film Perforated 1R-1667, PH22-161.

NOTE: Dimension A applies to records produced in equipment using the same head for recording and reproducing. In commercially-produced prints intended for use on a variety of reproducers, it is recommended that a recording head be used capable of producing a 0.025-in. minimum width record having the same centerline.

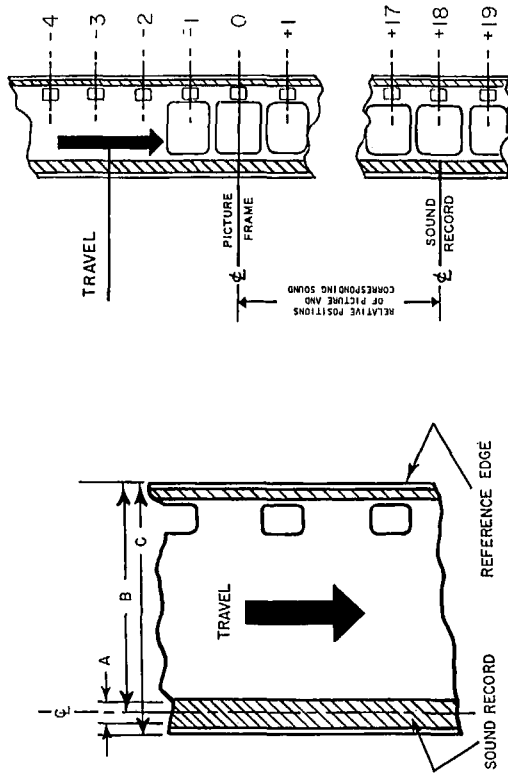
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Dimensions	Inches	Millimeters
A*	0.019 min	0.48 min
B	0.298 \pm 0.001	7.58 \pm 0.03
C	0.314 nom	7.98 nom

* See Note.

1. Scope

1.1 This standard specifies the lateral location and dimensions of the magnetic sound record on super 8 motion-picture film.



Film As Seen Looking Toward the Lens

Proposed USA Standard Dimensions for
**Magnetic Sound Record on Super 8
Motion-Picture Film Perforated 1R-1667**

PH22.164

Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.98 ± 0.03
A'	Film width after processing and slitting	0.314 ± 0.002	7.98 ± 0.05
B	Perforation pitch	0.1667 ± 0.0004	4.234 ± 0.010
C	Perforation width	0.0360 ± 0.0004	0.914 ± 0.010
C'	Identification 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
G	Perforation skewness	0.0015 max	0.038 max
M	Lateral perforation displacement	0.314 ± 0.001	7.98 ± 0.03
N	Lateral perforation displacement	0.628 ± 0.001	15.95 ± 0.03
O	Lateral perforation displacement	0.942 ± 0.001	23.93 ± 0.03
P	Lateral perforation displacement	1.251 ± 0.001	31.78 ± 0.03
L	100 consecutive perforation pitch intervals	16.670 ± 0.017	423.42 ± 0.43
R	Radius of perforation fillet	0.005 ± 0.001	0.13 ± 0.03

Appendix

(This Appendix is not a part of Proposed USA Standard Dimensions for 35mm Motion-Picture Film Perforated Super 8, SR-1667, PH22.165, but is included to facilitate its use.)

A1. The dimensions given in this standard excluding Dimensions A' and E' represent the practice of film manufacturers in that the dimensions and tolerances are for film stock immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but since film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in changes in the dimensions during the life of the film. The change is generally uniform throughout a roll.

A2. It will be noted that among the various standards for slitting and perforating film stock there are often two standards that seem much alike in wording. The difference lies in the longitudinal pitch which is either 0.1664 in. or 0.1667 in. for this standard. In general, the longer pitch is for print stock and the shorter pitch is for negative or intermediate stock.

The choice of pitch for negative or intermediate motion-picture film depends, within certain limits, on the type of printer to be used. Where release step-printers are used and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at time of printing (sprocket-type contact printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter and tooth engagement, (2) the film thickness, and (3) the film shrinkage and the rate at which shrinkage occurs.

Maximum steadiness and definition are secured on a sprocket-type printer when the negative stock is somewhat shorter in pitch than the positive stock in the approximate proportion of the thickness of the film to the radius of curvature. For printing on a 72-tooth sprocket (circumference of about 12 in.) with film 0.0055 to 0.0065 in. thick, the optimum pitch differential is 0.3 percent. The use of the ideal pitch differential for the negative would minimize slippage between the positive stock and negative during the printing operation, thus reducing the amount of blurring and jumping in the vertical axis of the picture or sound image. (This error is to be differentiated from the jump caused by non-uniformity of successive pitches, Dimension B.)

Experience has shown that the average pitch derived from Dimension L of the intermediate can vary ± 0.1 percent from the ideal pitch, which is 0.3 percent shorter than the positive stock, without blurring of picture and sound image being easily detected.

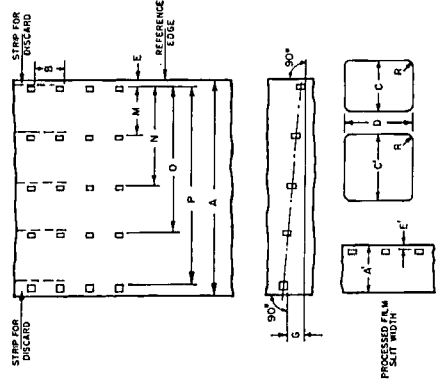
For many years this desired difference in pitch was caused by the shrinkage of the negative film during processing and aging. Current film bases shrink less than the earlier ones and hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing and the aging that takes place before the release prints are made then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative or intermediate stock is 0.1664 in.

Proposed USA Standard Dimensions for
35mm Motion-Picture Film
Perforated Super 8, SR-1667

PH22.165

NOTE 2: The metric values in the table of dimensions are converted from the inch values in accordance with conversion principles outlined in USA Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1933 (Reaffirmed 1947.)

NOTE 3: The perforations in the fifth row are discarded after slitting four strips of nominal 8mm width from the processed film. The "discard row" of perforations will be provided with a means of identification which is visible on the raw film.



1. Scope

This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with four rows of super 8 perforations and one row of special perforations having a perforation pitch of 0.1667 in. The film stock described in this standard is intended for the production of prints. The width of the 8mm 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 USA Standard Specifications for Motion-Picture Safety Film, PH22.31-1958.
- 2.3** Except for Dimensions A' and E', the dimensions apply to material immediately after cutting and perforating.
- 2.4** Dimension L represents the length of any 100 consecutive perforation pitch intervals.

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.

NOT APPROVED

PH22.165—NOT APPROVED

Low-shrinkage negative film perforated to these dimensions should not thereafter shrink appreciably more than 0.2 percent under normal use conditions, and for a reasonable life span, so that the optimum pitch differential from the positive stock of 0.3 ± 0.1 percent is maintained. (The film should be measured after equilibration with air at 70 F and 55 percent relative humidity or at the conditions prevailing at the time of perforating.)

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.