Approved USA Standards and SMPTE Recommended Practice

Published here for your information are two USA Standards approved on September 30, 1966, by the United States of America Standards Institute and an SMPTE Recommended Practice approved by the Society's Board of Governors on September 12, 1966.

USA Standard PH22.11-1966, Dimensions for 16mm Motion-Picture Projection Reels (200- to 2,000-Ft Capacity), has been revised to specify reels with a capacity up to 2,000 ft and to include specifications for the configuration of the spindle hole position, which was not in the 1953 issue. Several dimensions have also been modified. It is recommended that careful attention be given to this document.

USA Standard PH22.59-1966, Dimensions of 35mm Motion-Picture Camera Aperture Images, originally was concerned only with the aperture used with photographic-sound records, but it has now been expanded to include the image sizes used with anamorphic sound motion pictures and instrumentation photography and special processes.

SMPTE Recommended Practice RP 22-1966, Specifying Graph Paper Used in Inter-Laboratory Exchange of Plotted Sensitometric Data, has been written to help promote among laboratories the urgently needed adoption of a standard plotting paper to facilitate rapid and accurate comparisons of sensitometric results.

Inasmuch as compliance with standards and recommended practices is purely voluntary, these documents will become truly effective only when broad publicity is given to their existence. The USASI and the SMPTE would appreciate any personal influence used for their promotion where such action is appropriate and proper.

Copies of the Standards may be obtained for a nominal fee from the United States of America Standards Institute, 10 East 40th St., New York, N. Y. 10016, and copies of the Recommended Practice may be acquired from Society Headquarters upon request.

Proposed SMPTE Recommended Practices

Three Proposed Recommended Practices 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 January 30, 1967. If no adverse criticism is received by that date, they will be submitted to the SMPTE Board of Governors for final approval.

Proposed SMPTE Recommended Practice RP 6, Reference Carrier Frequencies and De-Emphasis Characteristics for 2-In. Quadruplex Video Magnetic Tape Recording, is an expansion of the 1960 issue. It now specifies the reference frequencies to which the carrier is deviated and the associated video de-emphasis for each of the three modulation practices used in 2-in. video magnetic tape recording of color and monochrome television signals.

Proposed SMPTE Recommended Practice RP 23, Reinforcement of 70mm Positive Splices, is a new document reflecting the Society's recommendation that splices on these larger prints be reinforced to prevent failure during projection.

Proposed SMPTE Recommended Practice RP 24, Dimensions for 16mm Motion-Picture Camera Spindles, is also a new document. *-A.E.A.*

USA standard

Approved September 30, 1966

USAS PH22.59–1966
Revision of PH22.59-1954
UDC 778.53

Sponsor
Society of Motion Picture and Television Engineers, Inc.

Dimensions of

35mm Motion-Picture Camera Aperture Images

1. Scope

1.1 This standard specifies the dimensions of the camera aperture images and the relative positions of their vertical and horizontal centerlines with respect to the reference edge and the perforations of the camera negative film for 35mm motion-picture cameras.

1.2 Motion-picture cameras used for different purposes require different aperture sizes. This standard specifies the image dimensions resulting from three styles of apertures used for the following purposes:

Style A: Nonanamorphic sound motion pictures

Style B: Anamorphic sound motion pictures

Style C: Instrumentation photography and special processes

2. Dimensions

The dimensions shall be as specified in the figure and tables. They shall apply to measurements of the images formed on freshly exposed and processed film.

Table 1. Style A

Dimensions	Inches		Millimeters	
A	0.868	nom	22.05	nom
B	0.631	± 0.002	16.03	± 0.05
C	0.738	± 0.002	18.75	± 0.05
D	0.302	min	7.67	min
E	1.170	min	29.72	min
F	0.115	nom	2.92	nom
G	0.050	nom	1.27	nom
H	0.093	± 0.002	2.36	± 0.05
R	0.030	max	0.76	max

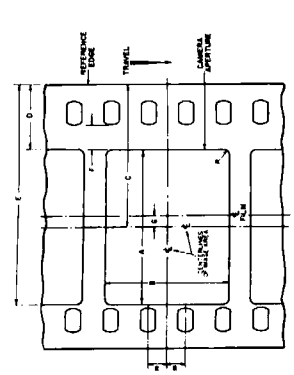
Table 2. Style B

Dimensions	Inches		Millimeters	
A	0.870	nom	22.10	nom
B	0.735	± 0.002	18.67	± 0.05
C	0.738	± 0.002	18.75	± 0.05
D	0.301	min	7.65	min
E	1.171	min	29.74	min
F	0.114	nom	2.90	nom
G	0.050	nom	1.27	nom
H	0.093	± 0.002	2.36	± 0.05
R	0.030	max	0.76	max

Table 3. Style C

Dimensions	Inches		Millimeters	
A	0.980	nom	24.89	nom
B	0.735	± 0.002	18.67	± 0.05
C	0.688	± 0.002	17.48	± 0.05
D	0.196	min	4.98	min
E	1.174	min	29.82	min
F	0.009	nom	0.23	nom
G	0.000		0.00	
H	0.093	± 0.002	2.36	± 0.05
R	0.030	max	0.76	max

NOTE: The displacement of 0.050 in. (Dimension G) of the vertical centerline of the image area for Styles A and B is in accord with current usage of low-shrinkage film base. However, there are in use many cameras in which the vertical centerline is displaced by 0.055 in. (1.40mm), which is the dimension used prior to development of low-shrinkage film base.



Film as Seen from Inside the Camera Looking Toward Camera Lens

USA standard

Approved September 30, 1966

USAS
PH22.11–1966
Revision of
PH22.11-1953
UDC 778.55

Sponsor
Society of Motion Picture
and Television Engineers, Inc.

Dimensions for

16mm Motion-Picture Projection Reels (200- to 2,000-Ft Capacity)

1. Scope

1.1 This standard specifies the dimensions for 16mm motion-picture projection reels having capacities from 200 to 2,000 ft of film inclusive.

1.2 This standard further specifies the configuration of the positioning of the spindle holes in the two flanges. These shall be identified as Type A (square/round) and Type B (square/square).

2. Dimensions

The dimensions shall be as specified in Fig. 1 and Tables 1, 2, and 3.

3. Spindle Hole Alignment

In the Type B configuration (square/square), the two spindle holes shall be oriented so that their respective sides are parallel. The alignment of the sides of the squares in the two flanges shall be such that a test bar 0.316 in. square may be passed completely through the spool. The corner keyways in the two flanges shall be aligned to each other. (See Appendix A1.)

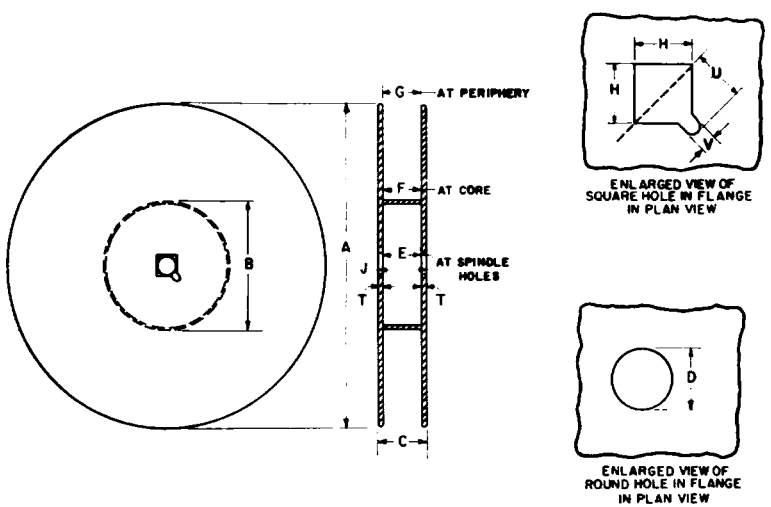


Fig. 1. Figure shows plan view and cross section of reel.

Table 1

"400 Series"

Capacity	Dimensions	Inches	Millimeters
200 ft (60 m)	A	5.000 + 0.031 − 0.000	127.00 + 0.79 − 0.00
	B	1.750 ± 0.250	44.45 ± 6.35
	Lateral runout	0.057 max	1.45 max
400 ft (120 m)	A	7.000 + 0.031 − 0.000	177.80 + 0.79 − 0.00
	B	2.500 + 0.000 − 0.075	63.50 + 0.00 − 1.90
	Lateral runout	0.080 max	2.03 max

Table 2

"2000 Series"

Capacity	Dimensions	Inches	Millimeters
800 ft (240 m)	A	10.500 + 0.031 − 0.000	266.70 + 0.79 − 0.00
	B	4.875 + 0.000 − 0.375	123.83 + 0.00 − 9.53
	Lateral runout	0.120 max	3.05 max
1200 ft (360 m)	A	12.500 + 0.000 − 0.125	311.15 + 0.00 − 3.17
	B	4.875 + 0.000 − 0.250	123.83 + 0.00 − 6.35
	Lateral runout	0.140 max	3.56 max
1600 ft (480 m)	A	13.750 + 0.250 − 0.000	355.60 + 6.35 − 0.00
	B	4.875 + 0.000 − 0.250	123.83 + 0.00 − 6.35
	Lateral runout	0.160 max	4.06 max
2000 ft (600 m)	A	15.000 + 0.031 − 0.000	381.79 + 0.79 − 0.00
	B	4.875 + 0.000 − 0.250	123.83 + 0.00 − 6.35
	Lateral runout	0.171 max	4.34 max

Table 3

Dimensions Common to Both Series

	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 core	0.660 ± 0.010	16.76 ± 0.25
G	At periphery	0.660 $^{+\ 0.045}_{-\ 0.025}$	16.76 $^{+\ 1.14}_{-\ 0.64}$
H	Side of square spindle hole	0.319 $^{+\ 0.000}_{-\ 0.003}$	8.10 $^{+\ 0.00}_{-\ 0.08}$
J	Over-all thickness at spindle holes	0.790 max	20.07 max
T	Flange thickness (adjacent to spindle holes)	0.066 max 0.027 min	1.68 max 0.69 min
U	Keyway depth	0.312 ± 0.016	7.92 ± 0.41
V	Keyway width	0.125 $^{+\ 0.005}_{-\ 0.000}$	3.18 $^{+\ 0.13}_{-\ 0.00}$
	Flange and core concentricity	± 0.031	± 0.79

NOTES:

1. The metric values in the tables 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).

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

3. Rivets or other fastening members shall not extend beyond the outside surfaces of the flanges more than 1/32 in. (0.79mm) and shall not extend beyond the over-all thickness indicated by Dimension C.

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

5. 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.

6. Eccentricity of the flanges and core with respect to the spindle hole axis shall not exceed the total radius variation (total indicator reading) shown in Table 3.

7. 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 1/8 in. radially. Apply a load of 1/2 pound over a central area not greater than 1 1/4 in. in diameter. Measure the vertical location of this area with a dial indicator. Add 1 pound and measure again. Repeat the process on the other flange. The additional deflection caused by the 1 pound weight over that given by the 1/2 pound weight should be less than 0.035 in.

Appendix

(This Appendix is not a part of USA Standard Dimensions for 16mm Motion-Picture Projection Reels (200- to 2,000-Ft Capacity), PH22.11-1966, but is included to facilitate its use.)

A1. 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.

However, if both flanges have square holes (Type B), the reel will 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.

A2. 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. 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 core, 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 set somewhat larger to allow for slight buckling of the flanges between the core and the holes. At the periphery, the tolerances are still greater because it is difficult to maintain the distance with accuracy.

A3. The opening in the corner of the square hole, to which Dimensions U and V apply, is provided to fit the spindles of 35mm rewinds, which are used in some laboratories.

A4. Minimum and maximum values for Dimension T, the thickness of the flanges, were chosen to permit the use of various materials.

A5. 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.

A6. 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 ratio of core diameter (Dimension B) to flange diameter (Dimension A) as large as possible. Rather widely separated limits for core diameter are allowed in the values given in the tables in some cases. While these are not intended to be manufacturing tolerances, they describe currently available reels that give satisfactory performance. In the design of new large reels, it is recommended that the paper listed as Reference 2 below be consulted.

REFERENCES:

1. C. F. Vilbrandt, "The projection life of 16mm film," *Jour. SMPE*, 48:521-542, June 1947.

2. J. S. Chandler, "Projecting 16mm film with large reels," *Jour. SMPTE*, 65:320-327, May 1956.

SMPTE RECOMMENDED PRACTICE — RP 22–1966

Specifying Graph Paper Used in Inter-Laboratory Exchange of Plotted Sensitometric Data

1. *Scope*

1.1 The purpose of this recommended practice is to specify a standard graph paper which could be used for the purpose of inter-laboratory exchange of sensitometric data. It is not to suggest that the use of other graph papers be discontinued but merely to specify one general kind where the size of the sheet, quality of paper, the color of ink, the density and log exposure scale sizes, and length and rulings are appropriate so that quick, easy, and accurate comparisons can be made among laboratories.

2. *Size of Sheet and Quality of Paper*

2.1 The overall size of the graph paper sheet shall be 8½ in. (215mm) nominal horizontally by 11 in. (279mm) nominal vertically.

2.2 The paper shall be of a thin enough quality with black reference lines for ease of comparison by overlay.

3. *Density Scale*

3.1 The density scale shall run vertically from 0.00 to 3.80 and the density figures shall be printed in the left and right margins of the sheet starting at density 0.20 and thereafter at intervals of 0.20.

3.2 Heavy horizontal lines shall be printed at density 0.00, 1.0, 2.0 and 3.0. These shall bear short vertical lines pointed toward the top of the sheet, 1/16 in. (1.6mm) nominal in height, except for every fifth line (starting from left density scale) which shall be ⅛ in. (3.2mm) nominal in height. These vertical lines shall be on a spacing of 0.053 in. (1.4mm) and any 100 lines shall fall within a distance of 5.34 in. (135.5mm). Each line shall represent an increment of 0.02 log exposure.

3.3 Starting at density 0.20, light horizontal lines shall be printed at intervals of 0.20 density on a spacing of 0.53 in. (13.5mm) nominal.

4. *Log Exposure Increment Scale*

4.1 Exposure "step number" scales shall be printed across the lower extremity of the sheet at right angles to the density scales. The "step number" scale shall carry reference numbers from 1 to 21, starting from the right density scale.

4.2 A vertical line shall run from the center of each "step number" on a horizontal spacing of 0.40 in. (10.2mm) nominal to the horizontal line at density 3.80. Each line shall represent log exposure increments of 0.15. These vertical lines shall carry 1/16 in. (1.6mm) nominal horizontal lines pointing toward the left density scale (except on the right side of the left density scale where the horizontal lines shall point toward the right) and shall represent 0.02 density except for each fifth line which shall be ⅛ in. (3.2mm) nominal long and represent 0.10 density starting at density 0.10.

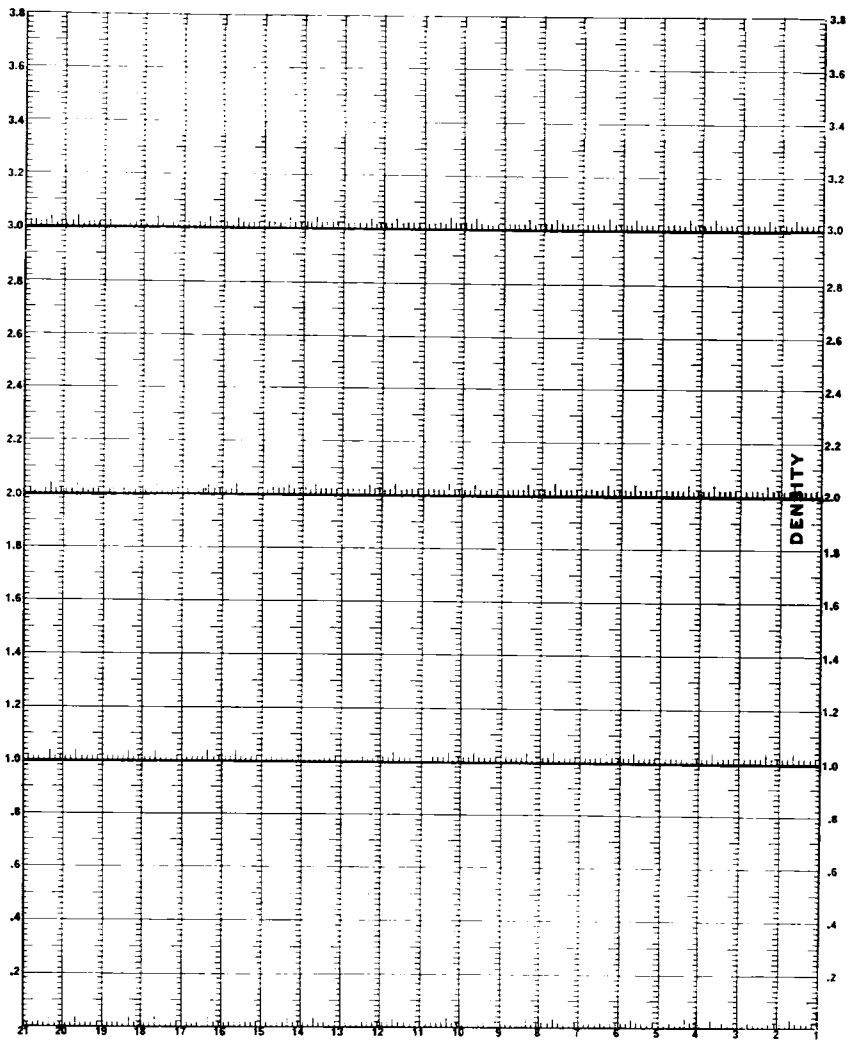
Note: Where step tablets are used as exposure modulators in Type Ib (intensity scale) sensitometers, the steps may not have the required 0.15 density increments. In this instance, the actual densities of the steps should be marked off along the density scale of a sheet described herein. This density scale is then cut off and located along the log exposure scale. The reference points may be then transferred to the log exposure scale and used as an accurate "step number" scale.

5. *Technical and Other Information*

5.1 Technical information such as emulsion, processing time, date, etc., may be surprinted across the top of the sheet at the discretion of the user.

5.2 The name and address of the user company may likewise be surprinted.

Approved September 1966



Illustrative: Not at size specified

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 6

Revision of RP 6–1960

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. (See Note 1.)

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.

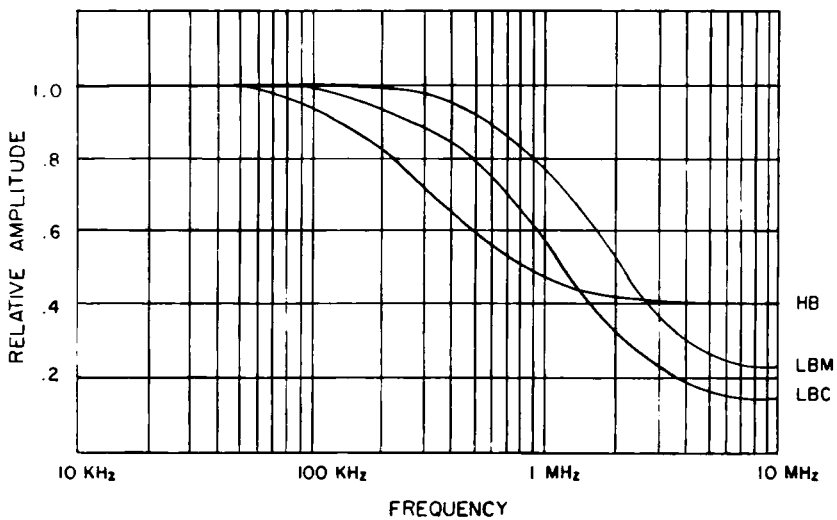
4.2 Recorded carrier frequencies:

(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*

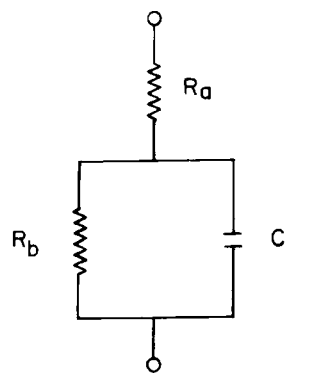
5.1 The video de-emphasis characteristic curves are described in Graph A.

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

$R_b = XR_a$
$T = R_bC$

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.



Note 1: 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.

Note 2: 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 Proposed SMPTE Recommended Practice RP 6, 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.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 23

Reinforcement of 70mm Positive Splices

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.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 24

Dimensions for 16mm Motion-Picture Camera Spindles

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	2.54	min
	0.610	max	15.49	max
B	0.010	max	0.25	max
C	0.63	min	16.0	min
	0.97	max	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	7.87	min
	0.315	max	8.00	max

*See Notes 1 and 2.

Notes

1. 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 for those areas to help prevent loose fit and resultant noise or tilt of spools or reels.

2. Dimension K represents the diameter of the 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.

3. 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.