standards and recommended practices

Approved USA Standards

On December 2, 1968, the United States of America Standards Institute approved two new USA Standards and the revision of an existing USA Standard. PH22.170, Dimensions for 35mm Motion-Picture Film Perforated 16mm, 3R-3000 (1-3-0), and PH22.171, Dimensions for 35mm Motion-Picture Film Perforated 16mm, 3R-2994, specify 35mm motion-picture stock generally used in the printing of 16mm material. PH22.117, Spectral Diffuse Density of Photographic Sound Record on Three-Component Subtractive Color Films, is primarily an editorial revision of the earlier issue, however it now specifies the transmission density as measured with an instrument having a band width peaking at 800nm instead of 768nm, and applies only to sound records composed of dye images plus silver on a metallic salt.

Inasmuch as compliance with USA Standards is purely voluntary, these standards will become truly effective only when broad publicity is given to their existence. USASI and the SMPTE would appreciate any personal influence to promote the use of these standards 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 E. 40th Street, New York City, 10016.

Proposed Recommended Practices

Two proposed Recommended Practices are published here for a trial period and public review. Proposed Recommended Practice RP 10, Video Alignment Signal Specifications for Quadruplex Video Magnetic Tape Recording, has been editorially modified for clarity. However, it should be noted that the test signal is not felt to be suitable for such characteristics as video transient response, program and cue track audio levels or control track levels and phase. Proposed Recommended Practice RP 36, Specifications for Positioning Tape Neutral Plane and Adjacent Tape Guides for Quadruplex Video Magnetic Tape Recorders Operating at 15 In/s and 7.5 In/s, specifies the video recording head geometry necessary to minimize velocity error which has become associated with hue error in video tape recording.

Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to April 15, 1969. If no adverse criticism is received by this date, the Proposed Recommended Practices will be submitted to the SMPTE Board of Governors for final approval.

USA standard

Approved December 2, 1968

USAS

PH22.170–1968

Sponsor
Society of Motion Picture
and Television Engineers, Inc.

Dimensions for

35mm Motion-Picture Film Perforated 16mm, 3R-3000 (1-3-0)

1. Scope

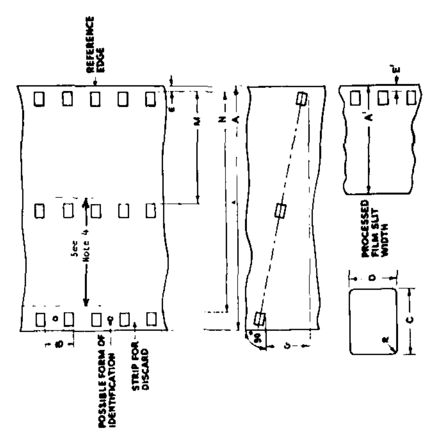
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with 16mm perforations in positions 1-3-0 and a perforation pitch of 0.3000 in. The width of the 16mm strip after processing and slitting is also specified.

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, PH22.31-1967.

2.3 Except for Dimensions A′ and E′, the dimensions apply to the 35mm film immediately after cutting and perforating. Dimensions A′ and E′ apply to the 16mm strips immediately after processing and 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	0.3000 ± 0.0005	7.620 ± 0.013
C	Perforation width	0.0720 ± 0.0004	1.829 ± 0.010
D	Perforation height	0.0500 ± 0.0004	1.270 ± 0.010
E	Reference Edge to first perforation row	0.0355 ± 0.0020	0.902 ± 0.051
E′	Edge to perforation after processing and slitting	0.0355 ± 0.0020	0.902 ± 0.051
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitch intervals	30.00 ± 0.03	762.0 ± 0.8
M	Reference edge side of first perforation row to second perforation row	0.628 ± 0.001	15.95 ± 0.03
N	Reference edge side of first perforation row to third perforation row	1.234 ± 0.001	31.34 ± 0.03
R	Radius of perforation fillet	0.010 ± 0.001	0.25 ± 0.03

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.

The numerals (1-3-0) have been added to the title of this standard to specify how the rows of perforations are placed on the film. This 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 16mm-type perforations on 35mm-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 16mm strips that may be generated by appropriate slitting of the parent 35mm 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 non-symmetrical perforation rows, there could be two different windings for the same numbered rows of perforations. Film perforated 1-0 would be 1-0 regardless of winding, but depending on the location of the reference edge, the winding could be A or B, according to USA Standard A and B Windings of 16mm Film, Perforated One Edge, PH22.75-1953 (Reaffirmed 1961), which has been expanded to include all non-symmetrically perforated film.

NOTE 2: The perforations in the 0-numbered discard row are provided with a visible means of identification.

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

NOTE 4: The dotted lines in the figure indicate the edge of the 16mm cuts after slitting.

NOTE 5: 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). The metric conversion of Dimension A is purposely shown in three figures to prevent the maximum width dimension from exceeding 35mm.

Appendix

(This Appendix is not a part of this USA Standard, 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 0.2994 in. or 0.3000 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 40-tooth 16mm 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 nonuniformity 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 0.2994 in.

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.

USA standard

Approved December 2, 1968

USAS

PH22.171–1968

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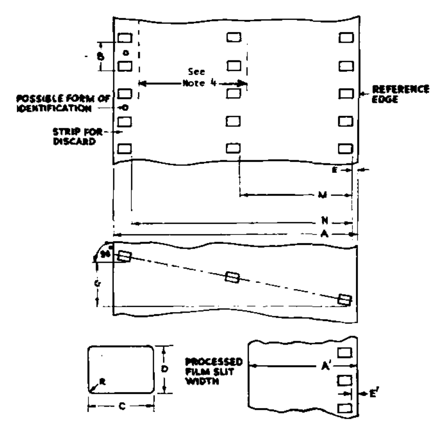
Dimensions for

35mm Motion-Picture Film Perforated 16mm, 3R-2994 (1-3-0)

1. Scope

This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with 16mm perforations in positions 1-3-0 and a perforation pitch of 0.2994 in. The width of the 16mm 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, PH22.31-1967.*

2.3 Except for Dimensions A' and E', the dimensions apply to the 35mm film immediately after cutting and perforating. Dimensions A' and E' apply to the 16mm strips immediately after processing and 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	0.2994 ± 0.0005	7.605 ± 0.013
C	Perforation width	0.0720 ± 0.0004	1.829 ± 0.010
D	Perforation height	0.0500 ± 0.0004	1.270 ± 0.010
E	Reference edge to first perforation row	0.0355 ± 0.0020	0.902 ± 0.051
E	Edge to perforation after processing and slitting	0.0355 ± 0.0020	0.902 ± 0.051
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitch intervals	29.94 ± 0.03	760.5 ± 0.8
M	Reference edge side of first perforation row to second perforation row	0.628 ± 0.001	15.95 ± 0.03
N	Reference edge side of first perforation row to *third perforation row*	1.234 ± 0.001	31.34 ± 0.03
R	Radius of perforation fillet	0.010 ± 0.001	0.25 ± 0.03

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.

The numerals (1-3-0) have been added to the title of this standard to specify how the rows of perforations are placed on the film. This 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 16mm-type perforations on 35mm-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 16mm strips that may be generated by appropriate slitting of the parent 35mm 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 non-symmetrical perforation rows, there could be two different windings for the same numbered rows of perforations. Film perforated 1-0 would be 1-0 regardless of winding, but depending on the location of the reference edge, the winding could be A or B, according to USA Standard A and B Windings of 16mm Film, Perforated One Edge, PH22.75-1953 (Reaffirmed 1961), which has been expanded to include all non-symmetrically perforated film.

NOTE 2: The perforations in the 0-numbered discard row are provided with a visible means of identification.

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

NOTE 4: The dotted lines in the figure indicate the edge of the 16mm cuts after slitting.

NOTE 5: 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*). The metric conversion of Dimension A is purposely shown in three figures to prevent the maximum width dimension from exceeding 35mm.

Appendix

(This Appendix is not a part of this USA Standard, 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 0.3000 in. or 0.2994 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 40-tooth 16mm 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 nonuniformity 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.

PH22.171–1968

USA standard

Approved December 2, 1968

USAS
PH22.117–1968
Revision of
PH22.117-1960

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Spectral Diffuse Density of Photographic Sound Record on Three-Component Subtractive Color Films

Introduction

The purpose of this standard is to supplement USA Standard Spectral Diffuse Densities of Three-Component Subtractive Color Films, PH2.1-1952, by specifying spectral conditions suitable for determining the sensitometric characteristics of photographic sound record on three-component subtractive color films having records made up of dye images plus silver or a metallic salt. It does not apply to the density measurement of records composed of dyes only. The conditions of this standard are intended for, and are applicable to, systems of sound reproduction using the S-1 photosurface, since this photosurface is in common use at the present time. It is recognized that there are other types of photosurfaces sometimes used for photographic sound reproduction that do not fall within the scope of this standard. This standard defines a practical condition by means of which it is expected that most density measurements will be made.

1. Purpose and Scope

1.1 The principal purpose of this standard is to supplement USA Standard Diffuse Transmission Density, PH2.19-1959, and USA Standard Spectral Diffuse Densities of Three-Component Subtractive Color Films, PH2.1-1952.

1.2 This standard defines conditions suitable for integral spectral density measurement of a photographic sound record on three-component subtractive color films composed of dyes plus silver or some metallic salt.

1.3 It is recognized that there are other useful types of photographic sound-record density measurements that do not fall within the scope of this standard.

2. USA Standard Diffuse Transmission Density

The following sections of USA Standard Diffuse Transmission Density, PH2.19-1959, are part of this standard:

2. General Definition of Density
3. Totally Diffuse Density
4. USA Standard Diffuse Density

3. USA Standard Spectral Diffuse Densities of Three-Component Subtractive Color Films

The following section of USA Standard Spectral Diffuse Densities of Three-Component Subtractive Color Films, PH2.1-1952, is part of this standard:

2. Terminology Used in the Densitometry of Color Film

4. Terminology Used in the Densitometry of Photographic Color Sound Records

4.1 Peak Response. The peak response of a densitometer is the wavelength to which the densitometer has the greatest response, including such factors as the spectral emission of the light source, the combined spectral transmission of all optical filters in the light path, and the spectral sensitivity of the photosensitive receptor.

4.2 Bandwidth. The bandwidth of a densitometer is the range of wavelengths to which the densitometer is sensitive. In a practical densitometer this range of wavelengths is not sharply defined; but for the purposes of this standard, the bandwidth shall be considered to lie between

those wavelengths which excite, in the photosensitive receptor, one-half the current which is excited at the wavelength of peak response. These limiting wavelengths are to be measured or computed using the light source, all operating optical filters, and the photosensitive receptor of the densitometer.

4.3 Overall Response. The overall response of a densitometer is the integrated response of the densitometer to all wavelengths, including such factors as the spectral emission of the light source, the combined spectral transmission of all optical filters in the light path, and the spectral sensitivity of the photosensitive receptor.

5. USA Standard Spectral Density of Photographic Sound Record on Three-Component Subtractive Color Films

USA Standard spectral diffuse density of photographic sound record on three-component subtractive color films is USA Standard diffuse transmission density as measured with an instrument having a response of 20 nm bandwidth peaking at 800 nm ± 5 nm, with at least 80 percent of the overall response of the instrument falling within the 20 nm bandwidth.

Appendix

(This Appendix is not a part of this USA Standard, but is included to facilitate its use.)

In three-component subtractive color films, dyes or color couplers are used to form the photographic image. These color materials are designed primarily for the visual region, but sound-record reproduction via the S-1 photosurfaces uses the infrared region of approximately 700 to 900 nm, which is far enough away from the visual region so that the color materials cannot be used efficiently, but close enough so that they produce a measurable effect. The spectral characteristics of this effect depend on the type of light-absorbing material used for the sound record, and on the manner in which the sound record is processed. Therefore, in order to obtain uniformity of sound record densitometry among different films, and among the different density-measuring instruments, it is necessary to specify the spectral conditions under which these density measurements are made. It is the aim of this standard to define these conditions sufficiently to ensure reasonable uniformity of density measurements, yet not so rigidly as to make impractical the obtaining of such measurements.

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 0.2994 in.

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.

PROPOSED

SMPTE RECOMMENDED PRACTICE — RP 36

Specifications for Positioning Tape Neutral Plane and Adjacent Tape Guides for Quadruplex Video Magnetic Tape Recorders Operating at 15 In./s and 7.5 In./s

1. *Scope*

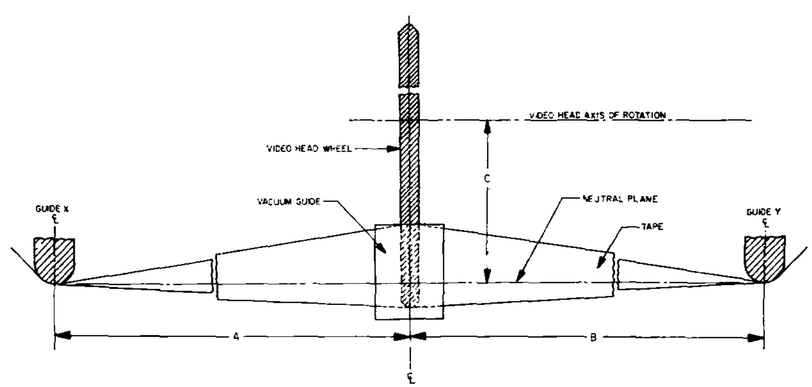
This Recommended Practice defines the position of the tape neutral plane and the guides which determine the tape neutral plane, with respect to the plane of rotation of the pole tips and the axis of rotation of the video head wheel.

2. *Definitions*

2.1 Tape Input Guide. The last guiding element encountered by the tape as it approaches the vacuum guide. The tape input guide, identified as Guide X in the figure, combines with the tape output guide to define the tape neutral plane.

2.2 Tape Output Guide. The first guiding element encountered by the tape after it leaves the vacuum guide. The tape output guide, identified as Guide Y in the figure, combines with the tape input guide to define the tape neutral plane.

2.3 Tape Neutral Plane. A plane, located between and defined by Guide X and Guide Y, in which the tape would lie if it were undeflected by the vacuum guide.



3. *Dimensions*

3.1 References. The plane of rotation of the pole tips and the axis of rotation of the video head wheel shall be the primary positioning references in defining the location of the elements described in this practice.

3.2 Position of Tape Neutral Plane. The tape neutral plane shall be parallel to the axis of rotation of the video head wheel, and 0.905 ± 0.020 in. (22.99 ± 0.51mm) from this axis, as measured in a direction perpendicular to the tape neutral plane (Dimension C in the figure).

3.3 Position of Tape Output Guide. The tape output guide shall be located 7.50 ± 0.25 in. (19.0 ± 6.3mm) from the plane of rotation of the pole tips (Dimension B in the figure).

3.4 Position of Tape Input Guide. The tape input guide shall be located symmetrically with respect to the plane of rotation of the pole tips and the tape output guide (Dimension A in the figure).

3.5 Tolerances on Parallelism of the Tape Neutral Plane and Symmetry of Input and Output Guides. Any lack of parallelism between the tape neutral plane and the axis of rotation of video head wheel and/or any lack of symmetry between input and output guides with respect to the plane of rotation of the pole tips will cause a recorded track curvature which must not exceed 0.001 in. (0.03mm). See Appendix 4.

Appendix

(This Appendix is not a part of this Recommended Practice, but is included to facilitate its use.)

1. A tape recorded at the minimum dimension for C and played back on a reproducer having the maximum dimension for C will have, during one horizontal television line interval, a residual velocity error which will result in a color subcarrier phase error of less than 2½° peak to peak.

2. A tape recorded with maximum allowable track curvature caused by lack of parallelism and/or lack of symmetry, as described in Section 3.5, and played back on a reproducer having no dimensional errors, will have during *one horizontal* television line interval a residual velocity error which will result in a color subcarrier phase error of less than ½° peak to peak.

3. For Appendix 1 and 2 to be valid, all other factors (such as vacuum guide radius, vacuum level, tape tension, ambient temperature and humidity), should be the same as they were when the tape was recorded.

4. See USA Standard Dimensions of Video, Audio and Tracking Control Records on 2-In. Video Magnetic Tape, C98.6-1965 (Section 4).

PROPOSED

SMPTE RECOMMENDED PRACTICE RP 10

Revision of RP 10-1962

Video Alignment Signal Specifications for Quadruplex Video Magnetic Tape Recording

1. *Scope*

1.1 This recommended practice specifies the video signals to be recorded on a magnetic video tape for use in evaluating and adjusting the performance of video tape recording and reproducing equipment on a routine operational basis.

1.2 Specifically, the recorded signals provide the means for checking the following characteristics or adjustments:

(a) video head quadrature
(b) tape vacuum guide position
(c) video levels
(d) video amplitude versus frequency response
(e) video low-frequency tilt
(f) video amplitude linearity
(g) relative noise banding
(h) r.f. carrier deviation frequencies

2. *Recorded Signal Characteristics*

2.1 The video signals shall be recorded so that they will occupy sequential bands from top to bottom in the reproduced picture. Each band shall correspond to the single traverse of one video head tip in a 2-in. quadruplex recording system. For the purpose of identification, these bands shall be designated as one through sixteen. The first band after that containing the vertical synchronizing pulse interval shall be designated as band one. (Band one will contain fewer active lines than the other bands because it contains a portion of vertical blanking.) The active picture portion of the horizontal scan shall be divided into eleven equal sections. For the purpose of identification, these sections are designated as zero through ten. Information shall be recorded as follows:

Information	*Bands*
2.1.1 A stairstep signal consisting of a ten-step linear gray scale extending from blanking level to 100 IRE units respectively, as shown in Fig. 1.	1 through 4
2.1.2 A stairstep signal consisting of a five-step linear gray scale extending from black level to 50 IRE units respectively, as shown in Fig. 2.	5 through 8
2.1.3 A series of five sine-wave bursts, as shown in Fig. 2, and described as follows: The time sequence of the burst frequencies shall be 4.2, 3.6, 3.0, 2.0 and 1.5 MHz. The axis of the multiburst shall be at 30 IRE units, and the peak-to-peak amplitude shall be 40 IRE units. Each burst duration will be at least 75 percent of the section width.	5 through 8
2.1.4 A window signal at reference white level (100 IRE units) three sections wide and six bands high to be positioned horizontally in sections six, seven and eight, as shown in Fig. 3, and vertically between the centers of the ninth and fifteenth bands. The remaining section shall be at blanking level (0 IRE units).	9 through 15
2.1.5 Vertical synchronizing pulse interval and a portion of vertical blanking.	Band 16 Only
2.1.6 Sine-squared T pulses of 0.125 microsecond width (measured at half level) and 50 IRE units in height at horizontal positions corresponding to the center of each of the first six sections. The base level of each sine-squared pulse shall be as follows: (a) Bands 1 through 8, the same as the accompanying stairstep section level, as shown in Figs. 1 and 2. (b) Bands 9 through 15, at blanking level, as shown in Fig. 3.	1 through 15

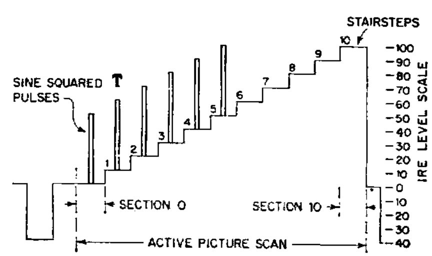


Fig. 1. Bands 1 through 4.

2.2 The waveform of the composite signal shall appear as shown in Fig. 4.

2.3 All synchronizing waveforms and signal amplitudes shall conform with EIA Standard RS-170, Electrical Performance Standards—Monochrome Television Studio Facilities, and Sections 73.682 and 73.687 of the FCC Rules and Regulations dated February 1, 1967.

2.4 All video signals shall be within ± 1 IRE unit of specified amplitudes.

2.5 Rise and decay time of the stairstep signal shall not exceed 0.003 H (0.3 percent of the horizontal scanning period). The leading and trailing edges of the window signal shall correspond approximately in shape and rise time to the sine-squared pulses specified in paragraph 2.1.6, such as may result from the use of the same pulse shaping network for both sine-squared pulse and window signals.

2.6 Overshoot of the stairstep signal shall not exceed 5 percent of the amplitude of transition. An exception is the trailing edge of stairstep (leading edge of horizontal blanking) which is limited to 2 percent in accordance with EIA Standard RS-170.

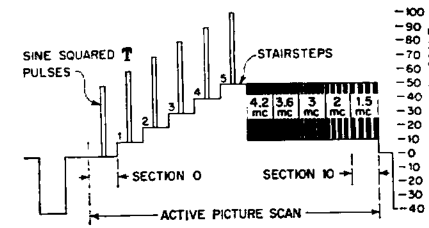


Fig. 2. Bands 5 through 8.

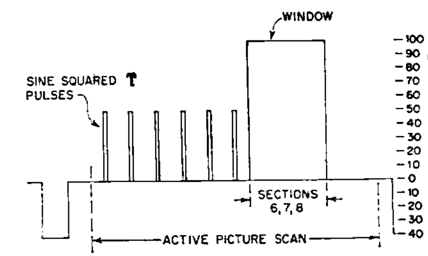


Fig. 3. Bands 9 through 15.

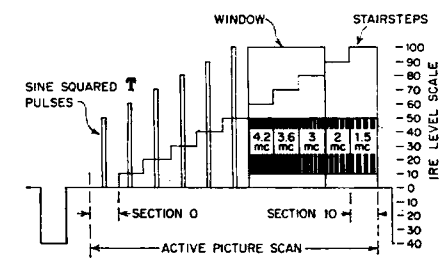


Fig. 4. Composite waveform. Waveforms shown at the line rate.

2.7 Multiburst frequencies shall conform with specified values within 1 percent. Total harmonic distortion content of the multiburst frequencies shall not exceed 2 percent.

2.8 In the event that a color burst is included, it shall conform to Section 2.3.

Note: In paragraph 2.1.6, an 0.125 μs sine-squared T pulse is specified. During the next year, it is intended to review this specification. An alternative would be specification of a 2T pulse for measurement of reproducer transient response characteristics. The T pulse now specified is useful for evaluation of head quadrature and vacuum guide position only.