Variables to Be Considered	Effects	Tests and/or Corrective Measures
Uniformity of motion	Frequency distortion (flutter and wow)	Reproduce a 3-kc negative on calibrated equipment wow and flutter meter, full-aperture projection o track; inspection of recorder with stroboscopic light
Skewing	Variation in azimuth	Reproduce a high-frequency negative on calibrated equipment, observing output; inspection with stroboscopic light
Pressure sensitization	Variation in density	Visual examination of film equipment, including magazines
Scratches on negative	Noise	Examination of all parts in contact with track
D. Electronic		
Each basic element in entire chain, including: microphone, preamplifiers, equalizers, voltage and power amplifiers, mixing consoles, magnetic recorders and reproducers, optical recording amplifiers, noise reduction units, filters, compressors, modulators	Variations in: frequency response, distortion, signal-to-noise ratio, dynamic range	Transmission tests (individual and overall): frequency response, distortion, signal-to-noise, compression, listening tests utilizing the following equipment: gain set, oscillator, distortion and noise meter, oscilloscope, vacuum-tube voltmeter

standards and recommended practices

Proposed American Standards

Five Proposed American 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 December 15. If no adverse criticism is received by that date the proposed standards will be submitted to ASA Sectional Committee PH22 for further processing.

PH22.103, Specifications for Projector Usage of 35mm Release Prints with Four-Track Magnetic Sound Records and PH22.111, Dimensions of Exposed Areas for Picture and Photographic Sound on 35mm Motion-Picture Prints Made on Continuous Contact Printers are both reaffirmations of the previous issues modified only in an editorial manner to improve the documents in clarity and usefulness.

PH22.109, Dimensions for 16mm Motion Picture Film 1R-2994, and PH22.110, Dimensions for 16mm Motion Picture Film 2R-2994, are proposed revisions of existing standards. Actually, they are complete reaffirmations of the technical information differing only in an editorial manner to facilitate their use.

PH22.145, Dimensions for 65mm Motion-Picture Film, KS-1866, is a new standard specifying the short pitch used for continuous contact printing of 70mm motion-picture release prints.—*A.E.A.*

Proposed American Standard Specifications for

Projector Usage of 35mm Release Prints with Four-Track Magnetic Sound Records

PH22.103

Revision of PH22.103-1957

1. Scope

This standard specifies the location of the photographic emulsion and magnetic striping relative to the projector light source and lens, the rate of projection and the relationship between sound and picture of 35mm sound motion-picture film having a 0.073 x 0.078-in. perforation (as specified in American Standard Dimensions for 35mm Motion-Picture Film, CS-1870, PH22.102-1956).

2. Position of Photographic Emulsion and Magnetic Striping

2.1 The photographic emulsion shall be on the side of the film which faces toward the light source of the projector.

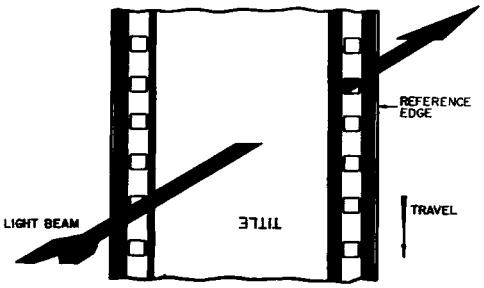
2.2 The magnetic striping shall be on the side of the film which faces toward the lens of the projector.

3. Rate of Projection

The rate of projection shall be 24 frames/sec.

4. Relationship Between Sound and Picture

When the sound records are reproduced, the distance from the sound-scanning point to the center of the projector aperture shall be adjusted to bring the picture and sound into synchronism for the average observer. Usually this separation will be 28 frames and this will provide synchronism for an observer at a distance of approximately 50 ft from the speaker. (The location and dimensions of the magnetic sound records shall be as specified in American Standard Dimensions of Four-Track Magnetic Sound Records for 35mm Release Prints, PH22.137-1963.)



Film as seen from the light-source in the projector

Proposed American Standard Dimensions of

Exposed Areas for Picture and Photographic Sound on 35mm Motion-Picture Prints Made on Continuous Contact Printers

PH22.111

Revision of PH22.111-1958

1. Scope

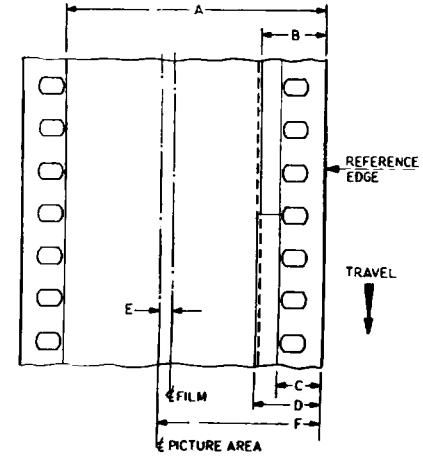
1.1 This standard specifies the location and width dimensions of the exposed areas for picture and photographic sound on 35mm motion-picture prints made on continuous contact printers.

1.2 This standard is applicable to the printing of motion-picture raw stock film which is cut and perforated in accordance with American Standard Dimensions for 35mm Motion-Picture Positive Raw Stock, PH22.36-1954.

1.3 This standard refers to the adjustment of the printer, and is in accordance with American Standard Photographic Sound Record on 35mm Prints, PH22.40-1957.

2. Dimensions

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



As seen from the emulsion side of print

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

NOTE: The centerline information (Dimensions E and F) given in the table is provided as a convenient reference. These two dimensions are specified in Proposed American Standard Dimensions of 35mm Motion-Picture Non-anamorphic Projected Image Area (revision of PH22.58-1954).

Proposed American Standard Dimensions for

16mm Motion-Picture Film, 1R-2994

PH22.109

Revision of
PH22.109-1958

1. Scope

This standard specifies the cutting and perforating dimensions of 16mm motion-picture film with perforations along one edge and a perforation length pitch of 0.2994 in.

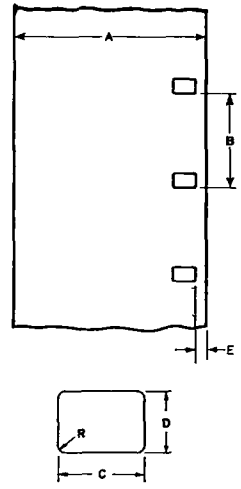
2. Dimensions

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

2.2 These dimensions pertain to a safety film as defined in Appendix A5.

2.3 These dimensions apply to material immediately after cutting and perforating.

2.4 Dimension L represents the length of any 100 consecutive pitch intervals.



	Dimensions	Inches	Millimeters
A	Film width	0.628 ± 0.001	15.95 ± 0.03
B	Length 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	Edge to perforation	0.0355 ± 0.0020	0.902 ± 0.051
L	Length pitch (100 consecutive pitch intervals)	29.94 ± 0.03	760.5 ± 0.8
R	Radius of perforation fillet	0.010 ± 0.001	0.25 ± 0.03

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 or 4R), depending upon which is the significant factor, and the perforation pitch without the decimal point.

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

Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 16mm Motion-Picture Film, IR-2994, PH22.109, but is included to facilitate its use.)

A1. The dimensions given in this standard 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. In general, the longer pitch is for print stock and the shorter pitch is for negative stock.

The choice of pitch for negative motion-picture films depends, within certain limits, on the type of printer to be used. Where 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 printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (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 of horizontal lines in 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, Dimension L, of the negative 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 stock is 0.2994 in.

Low-shrink 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 sprocket hole to the next. Actually it is the maximum variation from one sprocket hole to the next within any small group of consecutive perforations that is important.

A4. The optimum width for 16mm film (which often goes through channels of fixed size) is controlled by the shrinkage characteristics of the films involved. Thus in times past there have been standards for the width of 16mm stock of the "usual" shrinkage and for stock of "low-shrinkage" characteristics. The purpose was to obtain films of approximately the same width regardless of the type of film base during their useful life. This standard is based on the values adapted to "low-shrink" film base since nearly all films now manufactured in the U.S. meet the definition noted below.

For the purpose of choice of width, low-shrinkage film base is film base which when coated with emulsion and any other normal coating treatment, perforated, kept in the manufacturer's normal commercial packings for six months at 65 to 75 F, exposed, processed and stored exposed to air for a period not to exceed 30 days at 65 to 75 F and 50 to 60 percent relative humidity, and measured under like conditions of temperature and humidity, shall have shrunk not more than 0.2 percent from its original dimension at the time of perforating.

This definition of low-shrinkage film stock has been found by experience to be useful as a guide to film manufacturers in slitting their stock. Departure from this definition shall not be cause for rejection of the stock. Note that this definition of shrinkage differs from the criterion applying to the choice of longitudinal pitch, where greater periods of time are involved and where short-time tests can be deceptive.

Allowance has been made in arriving at these values for the common tendency of film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design and in no case should the 16mm equipment fail to accommodate a film of 0.630-in. width.

A5. This film is to be made on safety base complying with American Standard Specifications for Safety Photographic Film, PH1.25-1956 (Reaffirmed 1962).

Proposed American Standard Dimensions for

16mm Motion-Picture Film, 2R-2994

PH22.110

Revision of
PH22.110-1958

1. Scope

This standard specifies the cutting and perforating dimensions for 16mm motion-picture film with perforations along both edges and a perforation length pitch of 0.2994 in.

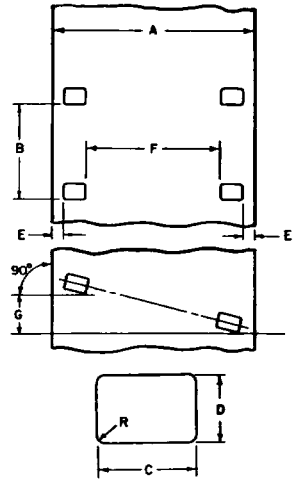
2. Dimensions

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

2.2 These dimensions pertain to a safety film as defined in Appendix A5.

2.3 These dimensions apply to material immediately after cutting and perforating.

2.4 Dimension L represents the length of any 100 consecutive pitch intervals.



	Dimensions	Inches	Millimeters
A	Film width	0.628 ± 0.001	15.95 ± 0.03
B	Length 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	Edge to perforation	0.0355 ± 0.0020	0.902 ± 0.051
F	Width between perforations	0.413 ± 0.001	10.49 ± 0.03
G	Perforation skewness	0.001 max	0.03 max
L	Length pitch (100 consecutive pitch intervals)	29.94 ± 0.03	760.5 ± 0.8
R	Radius of perforation fillet	0.010 ± 0.001	0.25 ± 0.03

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 or 4R), depending upon which is the significant factor, and the perforation pitch without the decimal point.

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

Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 16mm Motion-Picture Film, 2R-2994, PH22.110, but is included to facilitate its use.)

A1. The dimensions given in this standard 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. In general, the longer pitch is for print stock and the shorter pitch is for negative stock.

The choice of pitch for negative motion-picture films depends, within certain limits, on the type of printer to be used. Where 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 printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (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 of horizontal lines in 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, Dimension L, of the negative 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 stock is 0.2994 in.

Low-shrink 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 sprocket hole to the next. Actually it is the maximum variation from one sprocket hole to the next within any small group of consecutive perforations that is important.

A4. The optimum width for 16mm film (which often goes through channels of fixed size) is controlled by the shrinkage characteristics of the films involved. Thus in times past there have been standards for the width of 16mm stock of the "usual" shrinkage and for stock of "low-shrinkage" characteristics. The purpose was to obtain films of approximately the same width regardless of the type of film base during their useful life. This standard is based on the values adapted to "low-shrink" film base since nearly all films now manufactured in the U.S. meet the definition noted below.

For the purpose of choice of width, low-shrinkage film base is film base which when coated with emulsion and any other normal coating treatment, perforated, kept in the manufacturer's normal commercial packings for six months at 65 to 75 F, exposed, processed and stored exposed to air for a period not to exceed 30 days at 65 to 75 F and 50 to 60 percent relative humidity, and measured under like conditions of temperature and humidity, shall have shrunk not more than 0.2 percent from its original dimension at the time of perforating.

This definition of low-shrinkage film stock has been found by experience to be useful as a guide to film manufacturers in slitting their stock. Departure from this definition shall not be cause for rejection of the stock. Note that this definition of shrinkage differs from the criterion applying to the choice of longitudinal pitch, where greater periods of time are involved and where short-time tests can be deceptive.

Allowance has been made in arriving at these values for the common tendency of film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design and in no case should the 16mm equipment fail to accommodate a film of 0.630-in. width.

A5. This film is to be made on safety base complying with American Standard Specifications for Safety Photographic Film, PH1.25-1956 (Reaffirmed 1962).

Proposed American Standard Dimensions for

65mm Motion-Picture Film, KS-1866

PH22.145

1. Scope

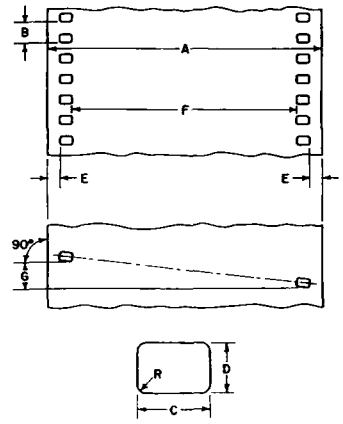
This standard specifies the cutting and perforating dimensions for 65mm motion-picture film with a KS-type perforation, and a perforation length pitch of 0.1866 in.

2. Dimensions

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

2.2 These dimensions apply to material immediately after cutting and perforating.

2.3 Dimension L represents the length of any 100 consecutive pitch intervals.



	Dimensions	Inches	Millimeters
A	Film width	2.558 ± 0.002	64.97 ± 0.05
B	Length pitch	0.1866 ± 0.0005	4.740 ± 0.013
C	Perforation width	0.1100 ± 0.0004	2.794 ± 0.010
D	Perforation height	0.0780 ± 0.0004	1.981 ± 0.010
E	Edge to perforation	0.117 ± 0.003	2.97 ± 0.08
F	Width between perforations	2.104 ± 0.003	53.44 ± 0.08
G	Perforation skewness	0.002 max	0.05 max
L	Length pitch (100 consecutive pitch intervals)	18.660 ± 0.015	474.00 ± 0.38
R	Radius of perforation fillet	0.020 ± 0.001	0.51 ± 0.03

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, or 4R), depending upon which is the significant factor, and the perforation pitch without the decimal point.

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

Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 65mm Motion-Picture Film, KS-1866, PH22.145, but is included to facilitate its use.)

A1. The dimensions given in this standard 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 0.1870 in. or 0.1866 in. In general, the longer pitch is for print stock and the shorter pitch is for negative stock.

The choice of pitch for negative motion-picture films depends, within certain limits, on the type of printer to be used. Where 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 printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (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 64-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 of horizontal lines in 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, Dimension L, of the negative 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 stock is 0.1866 in.

Low-shrink 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 sprocket hole to the next. Actually it is the maximum variation from one sprocket hole to the next within any small group of consecutive perforations that is important.

A4. Film of this size is generally used as a camera negative. There are two advantages in using this larger size. One is the possibility of producing large prints by contact printing for exhibition in special theaters designed to provide the audience with a large viewing angle. The other purpose is to serve as an original from which 35mm prints can be produced by reduction with less grain and better definition than can be obtained by making contact prints from 35mm negatives.

Prints may be made on 70mm film. The appropriate film is described in American Standard Dimensions for 70mm Motion-Picture Film, Perforated 65mm, KS-1870, PH22.119-1961. Note that the 70mm film used with 65mm negative differs in its dimensions from the two earlier films described by American Standard Dimensions for 70mm Unperforated and Perforated Film for Cameras Other Than Motion-Picture Cameras, PH1.20-1963, Type I and Type II. The perforations of the related 70mm film have the same size and pitch as those described by PH1.20-1963, Type II, but the margin and distance between perforations are different. Consequently Dimension F is the same in both 65mm KS-1870 and KS-1866 films and also for 70mm film, perforated 65mm, KS-1870. The increased space provided by a larger margin E is used to make room for magnetic sound records.

Note that the image usually placed on this film is five pitches high. The manufacture of the film is based on this idea and best results accrue from using this format.