Approved American Standards

Published here for your information are nine American Standards approved in October, by the American Standards Association.

PH22.10-1964, Specifications for Projector Usage of 16mm Motion-Picture Film Perforated Two Edges, is basically a reaffirmation of the technical content of the earlier issue differing only in minor editorial points which were made to improve clarity and facilitate use of the standard.

PH22.21-1964, Specifications for Camera Usage of Double Width 8mm Motion-Picture Film Perforated Two Edges, and PH22.22-1964, Specifications for Projection Usage of 8mm Motion-Picture Film Perforated One Edge, have been editorially modified to conform to other recently approved standards. Note should be taken of the fact that the film travel rate has been changed from 16 frames per second to 18 and 24 to agree with current practices.

Six of the standards are dimension standards for 35mm motion-picture films. Five of these are revisions of existing standards differing from their previous versions only in an editorial manner:

PH22.1-1964, Dimensions for 35mm Motion-Picture Film, DB-1870

PH22.34-1964, Dimensions for 35mm Motion-Picture Film, BH-1870

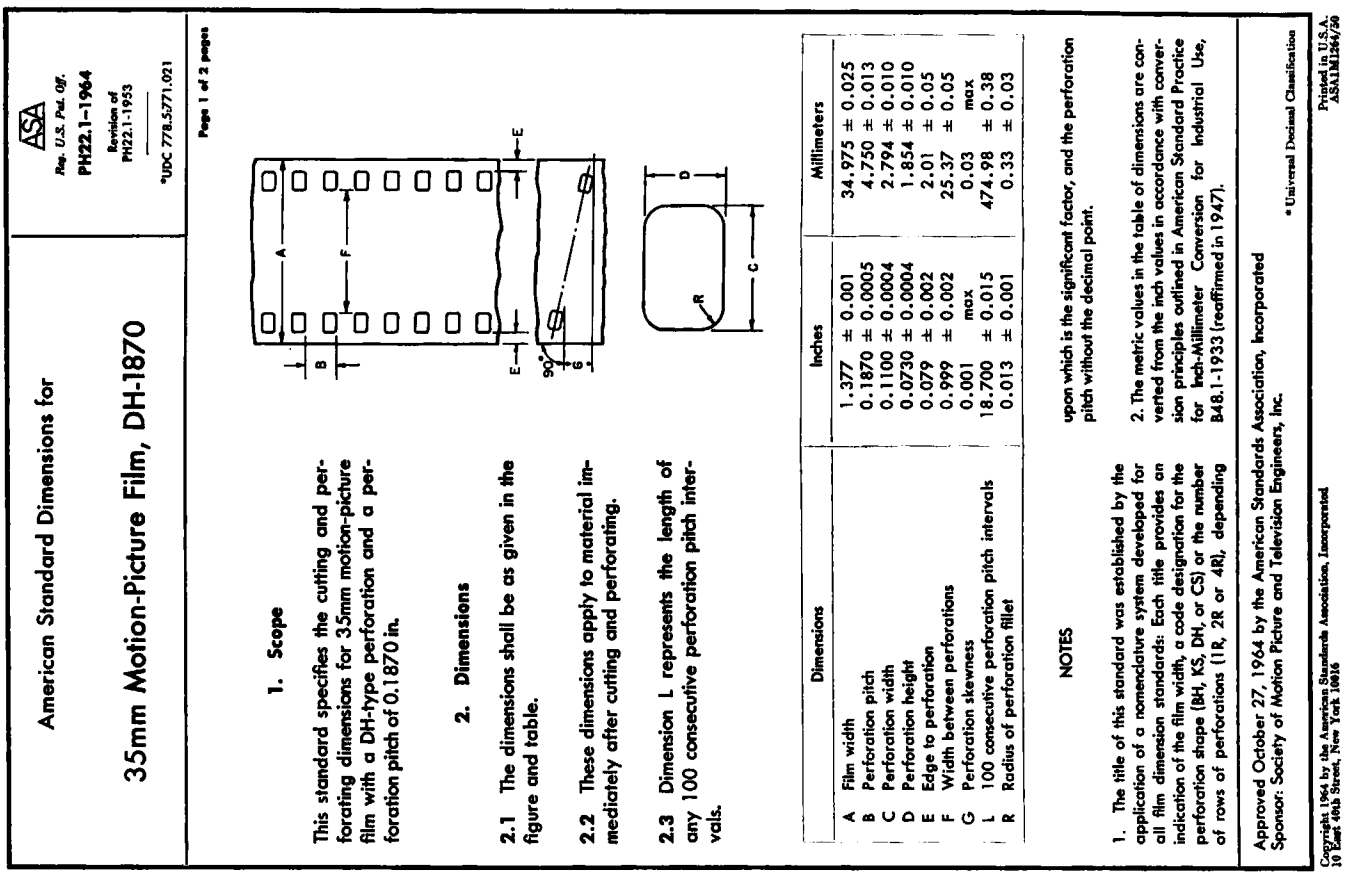
PH22.36-1964, Dimensions for 35mm Motion-Picture Film, KS-1870

PH22.93-1964, Dimensions for 35mm Motion-Picture Film, BH-1866

PH22.102-1964, Dimensions for 35mm Motion-Picture Film, CS-1870

The sixth standard, PH22.139-1964, Dimensions for 35mm Motion-Picture Film, KS-1866, is a new standard.

Inasmuch as compliance with American Standards is purely voluntary, these standards will become truly effective if very broad publicity is given to their existence. The ASA 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 American Standards Association, 10 East 40th Street, New York City, 10016.—*A.E.A.*



American Standard Dimensions for

35mm Motion-Picture Film, DH-1870

ASA Rev. U.S. Pat. Off. PH22.1-1964 Revision of PH22.1-1953

*UDC 778.5:771.021

Page 1 of 2 pages

1. Scope

This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a DH-type perforation and a perforation pitch of 0.1870 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 perforation pitch intervals.

Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Perforation pitch	0.1870 ± 0.0005	4.750 ± 0.013
C	Perforation width	0.1100 ± 0.0004	2.794 ± 0.010
D	Perforation height	0.0730 ± 0.0004	1.854 ± 0.010
E	Edge to perforation	0.079 ± 0.002	2.01 ± 0.05
F	Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitch intervals	18.700 ± 0.015	474.98 ± 0.38
R	Radius of perforation fillet	0.013 ± 0.001	0.33 ± 0.03

NOTES

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.

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).

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* Universal Decimal Classification

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APPENDIX

(This Appendix is not a part of American Standard Dimensions for 35mm Motion-Picture Film, DH-1870, PH22.1-1964, 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 which 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, (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 35mm 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. Perforations of this size and shape were first described in the Journal of the SMPE in 1932 by Dubray and Howell. In 1937, a subcommittee report reviewed the work to date. The main interest in the perforation at that time was in its use as a universal perforation for both positive and negative film. The perforation has been adopted as a standard largely because it has a projection life comparable to that of the perforation used for ordinary cine positive film (American Standard Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36-1964) and the same overall dimensions as the perforations used in the negative film (American Standard Dimensions for 35mm Motion-Picture Film, BH-1870, PH22.34-1964). It should be particularly noted that, although the present standard has the same overall dimensions as the older cine negative perforation, positioning pins or sprocket teeth made to fit this perforation exactly will damage the corners of the cine negative perforation.

American Standard Specifications for

Projector Usage of 16mm Motion-Picture Film Perforated Two Edges

ASA
Reg. U.S. Pat. Off.
PH22.10–1964
Revision of PH22.10-1956
* UDC 778.534:771.5313

1. Scope

This standard specifies the position of the emulsion and the rate of projection for 16mm motion-picture film perforated two edges not used for sound.

2. Position of Emulsion

For original camera reversal-type film, the emulsion shall be toward the projection lens. With other types of prints, or for special purposes, the emulsion position will be dependent upon the process of preparation or use.

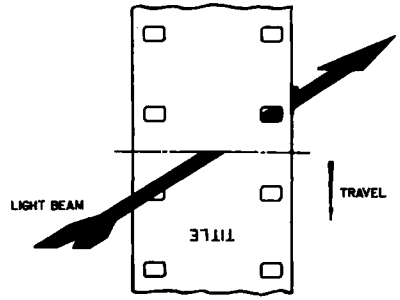

Figure shows film as seen from the light-source in the projector

3. Rate of Projection

The rate of projection shall be 18 frames per second.

Note: In projectors having a fixed rate of projection, the projection rate shall be 18 frames per second with a tolerance appropriate for the use to which the projection at this rate is to be put. Projectors having manually-adjustable speed shall be capable of reaching a projection rate of at least 18 frames per second.

APPENDIX

(This Appendix is not a part of American Standard Specifications for Projector Usage of 16mm Motion-Picture Film Perforated Two Edges, PH22.10-1964, but is included to facilitate its use.)

In modern 16mm projection practice, the use of film perforated along two edges is primarily confined to the amateur field. The equipment is usually portable and the available screen sizes are frequently limited to screens of small size and high gain. Many of the projectors also have a high light output. Under these conditions, it has been observed that very high screen brightnesses are often obtained, and audiences are usually aware of flicker before they are aware of changes in the pictorial quality of the projected pictures. For this reason, it has been industry practice to extend the flicker threshold by choosing as high a projection rate (and, therefore, as high a flicker frequency) as is practicable. A projection rate of 18 frames per second and a corresponding flicker frequency of 54 cycles per second (obtained with a three-blade shutter) has been found by experience to be an acceptable compromise.

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American Standard Specifications for

Camera Usage of Double Width 8mm Motion-Picture Film, Perforated Two Edges

ASA
Reg. U.S. Pat. Off.
PH22.21–1964
Revision of PH22.21-1953
*UDC 778.53

1. Scope

This standard specifies the position of the emulsion, the rate of exposure, and the orientation of the area being exposed for 8mm film as used in a motion-picture camera.

2. Position of the Emulsion

Except for special processes, the emulsion shall be toward the camera lens as shown in the figure.

3. Rate of Exposure

The normal rate of exposure shall be 18 frames per second for silent film and 24 frames per second for sound film.

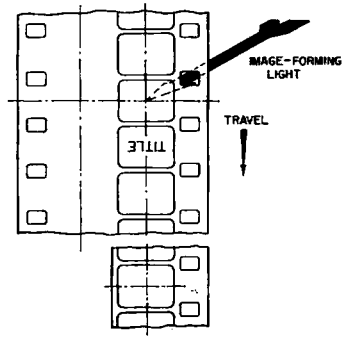

Figure shows film as seen from inside the camera, looking toward the camera lens

APPENDIX

(This Appendix is not a part of American Standard Specifications for Camera Usage of Double Width 8mm Motion-Picture Film, Perforated Two Edges, PH22.21-1964, but is included to facilitate its use.)

American Standard Specifications for Projector Usage of 8mm Motion-Picture Film, Perforated One Edge, PH22.22-1964, indicates a normal projection rate of 18 frames per second for silent films. This projection rate has been in use for some time and is recognized by the current standard. In order that action may be reproduced at normal speed, the camera frame rate should be the same as that of the projector. Accordingly, this revision of PH22.21 raises the silent frame rate from 16 frames per second to the 18 frames per second rate in actual use at the time of this revision.

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American Standard Specifications for

Projector Usage of 8mm Motion-Picture Film Perforated One Edge

ASA
Reg. U.S. Pat. Off.
PH22.22–1964
Revision of PH22.22-1953
*UDC 778.55

1. Scope

This standard specifies the position of the emulsion, the rate of projection, and the orientation of the image area for 8mm film as used in an 8mm motion-picture projector.

2. Position of the Emulsion

The majority of 8mm films are projected with the emulsion toward the screen. There are, however, some systems which produce prints that are projected with the base toward the screen.

3. Rate of Projection

The normal rate of projection shall be 18 frames per second for silent film and 24 frames per second for sound film.

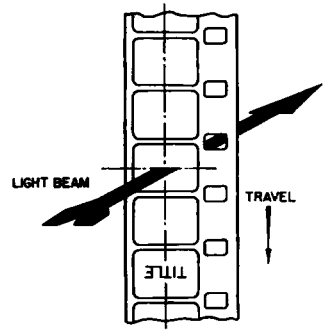

Figure shows film as seen from the light source in the projector

APPENDIX

(This Appendix is not a part of American Standard Specifications for Projector Usage of 8mm Motion-Picture Film Perforated One Edge, PH22.22-1964, but is included to facilitate its use.)

Because of the increased intensity of illumination available in modern 8mm projection systems, the industry has found it desirable to extend the flicker threshold by choosing as high a projection rate (and, therefore, as high a flicker frequency) as practicable. A projection rate of 18 frames per second and a corresponding flicker frequency of 54 cycles per second (obtained with a three-blade shutter) has been found by experience to be an acceptable compromise.

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American Standard Dimensions for

35mm Motion-Picture Film, BH-1870

ASA
Reg. U.S. Pat. Off.
PH22.34-1964
Revision of PH22.34-1956
*UDC 778.534:771.531.3

1. Scope

This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a BH-type perforation and a perforation pitch of 0.1870 in.

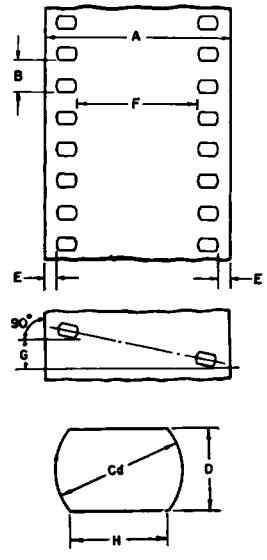
2. Dimensions

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 H is a calculated value.

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



Dimensions	Inches	Millimeters
A Film width	1.377 ± 0.001	34.975 ± 0.025
B Perforation pitch	0.1870 ± 0.0005	4.750 ± 0.013
C_d Perforation width (diameter)	0.1100 ± 0.0004	2.794 ± 0.010
D Perforation height	0.0730 ± 0.0004	1.854 ± 0.010
E Edge to perforation	0.079 ± 0.002	2.01 ± 0.05
F Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G Perforation skewness	0.001 max	0.03 max
H Perforation chord width (BH perforation)	0.082 calculated	2.08 calculated
L 100 consecutive perforation pitch intervals	18.700 ± 0.015	474.98 ± 0.38

NOTES

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.

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).

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ASA1M1264/68

APPENDIX

(This Appendix is not a part of American Standard Dimensions for 35mm Motion-Picture Film, BH-1870, PH22.34-1964, 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, (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 35mm sprocket (circumference of about 12 in.) with film 0.0055 in. 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.

American Standard Dimensions for

35mm Motion-Picture Film, KS-1870

ASA
Reg. U.S. Pat. Off.
PH22.36-1964
Revision of PH22.36-1954
*UDC 778.5:771.5

1. Scope

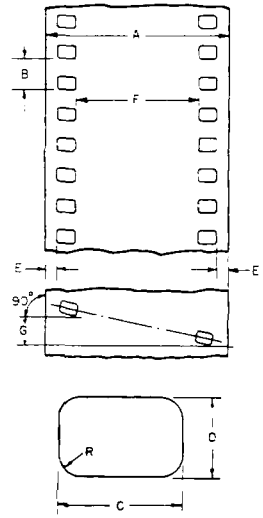
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a KS-type perforation and a perforation pitch of 0.1870 in.

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 perforation pitch intervals.



	Dimensions	Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Perforation pitch	0.1870 ± 0.0005	4.750 ± 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	0.079 ± 0.002	2.01 ± 0.05
F	Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitch intervals	18.700 ± 0.015	474.98 ± 0.38
R	Radius of perforation fillet	0.020 ± 0.001	0.51 ± 0.03

NOTES

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.

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).

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APPENDIX

(This Appendix is not a part of American Standard Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36-1964, 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 which 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,* (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 35mm 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.)

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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.

American Standard Dimensions for

35mm Motion-Picture Film, BH-1866

ASA
Reg. U.S. Pat. Off.
PH22.93–1964
Revision of
PH22.93-1953

*UDC 778.5

1. Scope

This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a BH-type perforation and a perforation pitch of 0.1866 in.

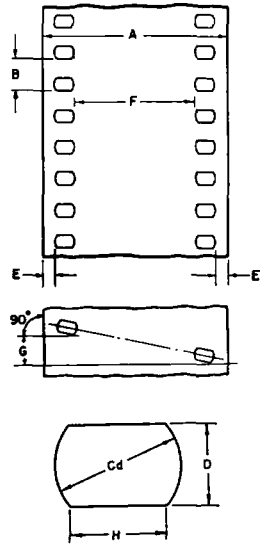
2. Dimensions

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 H is a calculated value.

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



	Dimensions	Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Perforation pitch	0.1866 ± 0.0005	4.740 ± 0.013
C_d	Perforation width (diameter)	0.1100 ± 0.0004	2.794 ± 0.010
D	Perforation height	0.0730 ± 0.0004	1.854 ± 0.010
E	Edge to perforation	0.079 ± 0.002	2.01 ± 0.05
F	Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G	Perforation skewness	0.001 max	0.03 max
H	Perforation chord width (BH perforation)	0.082 calculated	2.08 calculated
L	100 consecutive perforation pitch intervals	18.660 ± 0.015	474.00 ± 0.38

NOTES

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.

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).

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APPENDIX

(This Appendix is not a part of American Standard Dimensions for 35mm Motion-Picture Film, BH-1866, PH22.93-1964, 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 which 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, (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 35mm 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.

American Standard Dimensions for

35mm Motion-Picture Film, CS-1870

ASA
Reg. U.S. Pat. Off.
PH22.102–1964
Revision of PH22.102-1956
* UDC 778.534:771.531.3

1. Scope

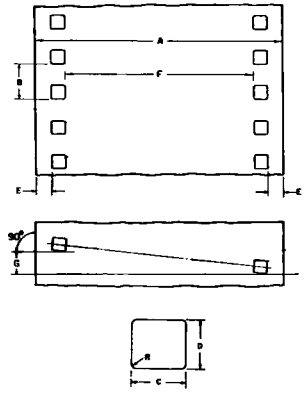
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a CS-type perforation and a perforation pitch of 0.1870 in.

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 perforation pitch intervals.



Dimensions	Inches	Millimeters
A Film width	1.377 ± 0.001	34.975 ± 0.025
B Perforation pitch	0.1870 ± 0.0005	4.750 ± 0.013
C Perforation width	0.0780 ± 0.0004	1.981 ± 0.010
D Perforation height	0.0730 ± 0.0004	1.854 ± 0.010
E Edge to perforation	0.086 ± 0.002	2.18 ± 0.05
F Width between perforations	1.049 ± 0.002	26.64 ± 0.05
G Perforation skewness	0.001 max	0.03 max
L 100 consecutive perforation pitch intervals	18.700 ± 0.015	474.98 ± 0.38
R Radius of perforation fillet	0.013 ± 0.001	0.33 ± 0.03

NOTES

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.

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 American Standard Dimensions for 35mm Motion-Picture Film, CS-1870, PH22.102-1964, 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, (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 35mm sprocket (circumference of about 12 in.) with film 0.0055 in. 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.

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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. Most 35mm motion-picture films produced prior to 1954 were perforated with two rows of perforations, each perforation being 0.110 x 0.078 in. for positive film or 0.110 x 0.073 in. for negative film or both. Such film, in addition to carrying the picture, accommodates a single sound record between one row of perforations and the picture frame. The desire to reproduce multichannel sound on the same film that carries the picture image, and yet not reduce the image size, led to the use of smaller perforations on positive film. Films perforated to this smaller perforation standard have wider margins (Dimension E) and wider usable film areas between the rows of perforations than positive films perforated to American Standard Dimensions for 35mm Motion-Picture Film, DH-1870, PH22.1-1964 and American Standard Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36-1964. This permits the placement of a magnetic coating for the multi-channel sound record along both edges just outside the perforations and along both sides of the picture just inside the perforations.

A5. It should be particularly noted that film made to this standard will not fit over pins and sprocket teeth designed to fit film perforated to the following American Standards: Dimensions for 35mm Motion-Picture Film, DH-1870, PH22.1-1964; Dimensions for 35mm Motion-Picture Film, BH-1870, PH22.34-1964; Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36-1964; Dimensions for 35mm Motion-Picture Film, BH-1866, PH22.93-1964.

The perforation hole size shown in the American Standards listed above is 0.073 x 0.110 in. except for PH22.36 which has 0.078 x 0.110 in. holes. This standard, PH22.102, has a hole size of 0.073 x 0.078 in. Films with holes of this size would be damaged at the perforation edges when run on sprockets or pins of equipment designed for the larger holes. American Standard Dimensions for 16-Tooth 35mm Motion-Picture Projector Sprockets, PH22.35-1962, describes projector sprockets suitable for any of the perforations listed regardless of the perforation size.

American Standard Dimensions for

35mm Motion-Picture Film, KS-1866

ASA

Reg. U.S. Pat. Off.

PH22.139–1964

* UDC 778.5:771.5

1. Scope

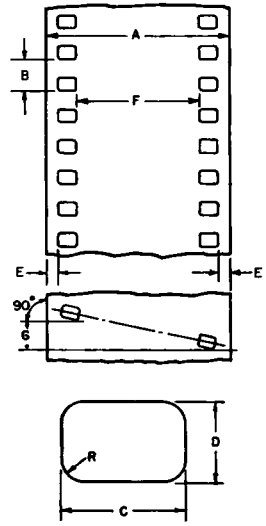
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a KS-type perforation and a perforation pitch of 0.1866 in.

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 perforation pitch intervals.



Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Perforation 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	0.079 ± 0.002	2.01 ± 0.05
F	Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G	Perforation skewness	0.03 max	0.03 max
L	100 consecutive perforation pitch intervals	18.660 ± 0.015	474.00 ± 0.38
R	Radius of perforation fillet	0.020 ± 0.001	0.51 ± 0.03

NOTES

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.

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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 film stock described in this standard is used largely for sound recording purposes. It has a pitch 0.2 percent shorter than release positive film stock because it is used to prepare sound negatives from which release prints will be made on sprocket-type continuous printers having 64 teeth.