ing the electron lens much larger than the diameter of the electron beam as it enters the lens.

The gun uses crossed cylindrical electrostatic electron lenses constructed as shown schematically in Fig. 9. This type of lens has several advantages. The same electrodes can be used for focus and deflection, which allows a longer deflection distance with a short focal length lens. Since the spot is deflected only in one direction it can be focused after deflection in the other direction. This results in a smaller spot height than width because of greater demagnification. This is a very desirable condition since in thermoplastic recording the raster lines must be clearly resolved to produce modulation.

Centering of the electron beam in the lens is accomplished entirely with electrostatic deflection plates upon installation of the tungsten hairpin cathode. The cathode structure is stable enough to require little or no adjustment throughout the life of the cathode.

The film is heated for developing the image before it is charged by infrared radiation from a small Nichrome filament.

Audio can be recorded along with the video either as an optical track beside the video image, or the back of the film can be coated with iron oxide for a magnetic audio track.

Although a visible image appears on the film, which can be used for monitoring or editing, this recorder was designed for applications where an electrical video signal is the primary output. Consequently the reading equipment consists of a transport similar to the one used in the recorder with a line-scan vidicon as the detector. A synchronizing track is recorded on the tape during the horizontal and vertical retrace interval which is used to control the transport drive motor and vidicon scanning position, so that the reading beam will track the recorded horizontal lines in synchronism with an external "house" synchronizing source.

References

1. W. E. Glenn, "Thermoplastic recording," *J. Appl. Phys., 30:* No. 12, 1870, Dec. 1959.
2. W. E. Glenn, "Thermoplastic recording," *Jour. SMPTE, 69:* 577–580, Sept. 1960
3. W. E. Glenn, "New color projection system," *J. Opt. Soc. Am., 48:* 841–843, Nov. 1958.

Business Meeting, October 22, Re: Society Membership Dues

MR. J. W. SERVIES, *President*, has announced that the Board of Governors has approved the calling of a business meeting of the voting members of the Society to be held on Monday, October 22, 1962, at The Drake, Chicago, Ill. This membership meeting will be held immediately following the completion of the Get-Together Luncheon at the 92nd Semi-annual Convention.

The principle item to be considered at this meeting will be a proposed amendment to the Bylaws changing the annual membership dues. This proposed amendment was recommended by the Financial Advisory Committee and was approved by the Executive Committee on July 6. In meeting on July 20, the Board of Governors approved the following:

> (19) RESOLVED, that a regular membership meeting of the Society be called for October 22, 1962, at the Drake Hotel, Chicago, Illinois, and that the following proposed amendment to Sec. 1, Subsec. A, Article VII of the Bylaws be approved for consideration for adoption at that meeting of the Society: "The annual dues shall be twenty dollars ($20) for Fellow and Active members, fifteen dollars ($15) for Associate members, payable on or before January 1 of each year, and five dollars ($5) for Student members, payable on or before October 1 of each year."

In the Board's discussion of this proposal it was indicated that the last increase in dues was in 1955 when Active and Fellow dues were raised from $15 to $18 annually, Associate dues from $10 to $12 annually, while Student dues remained at $5. The purpose of the dues increase which if approved will go into effect beginning with the year 1963, is to raise revenue and to keep a reasonable relationship between the various items that produce revenue and our total budget. Since 1955, our total budget has increased by more than 50%, the rates for printing our Journal have gone up 20%, and other expenses have increased more or less accordingly.

Individual membership revenue in 1955 represented about 30% of our total budget, whereas it will represent less than 25% for the year 1962. Over the years, the individual membership revenue has varied around a 25% figure and, with the additional revenue expected from the increased membership rates, we should come close to realizing this 25% figure.

Contingent upon adoption of the above resolution, the Executive Committee has approved an increase in annual subscription rates to the *Journal* from $12.50 per year to $16.00 per year. This increase maintains a differential between Associate member dues and the cost of an annual *Journal* subscription which favors an individual becoming a member rather than a subscriber.—*C. S. Stodter*, Executive Secretary.

Proposed American Standards

Four proposed film dimensions standards, developed by the SMPTE Film Dimensions Committee and approved by the Standards Committee, are published here for a trial period. Comments should be addressed to Alex E. Alden at Society Headquarters prior to (six weeks from release date). If no adverse criticism is received by that date, the proposals will be submitted to ASA Sectional Committee PH22 for further processing.

Three proposed revisions, PH22.1, American Standard Dimensions for 35mm Motion-Picture Film, DH-1870; PH22.36, American Standard Dimensions for 35mm Motion-Picture Film, KS-1970; and PH22.93, American Standard Dimensions for 35mm Motion-Picture Film, BH-1866, are technically the same as the previous issues. The appendix has been enlarged to incorporate tutorial data concerning perforation and shrinkage problems. PH22.139, American Standard Dimensions for 35mm Motion-Picture Film, KS-1866, is a new proposed standard for 35mm film stock having short pitch and a positive-type perforation.—*A.E.A.*

Proposed American Standard Dimensions for

35mm Motion-Picture Film, DH-1870

PH22.1

Revision of PH22.1-1953

1. Scope

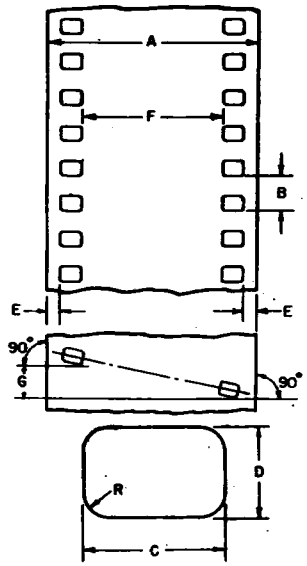
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a DH-type perforation and a perforation length pitch of 0.1870 in.

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 pitch intervals.



Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Length 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	0.025 max
L	Length pitch (100 consecutive 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, 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 dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947, providing a conversion factor of 1 inch = 25.4 millimeters.

APPENDIX

(This Appendix is not a part of Proposed American Standard Dimensions for 35mm Motion-Picture Film, DH-1870, PH22.1, 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 stock is a plastic material, the dimensions of the slit and perforated film 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 sometimes 0.1870 in. (or 0.3000 in.) and sometimes 0.1866 in. (or 0.2994 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. In the case where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. In the case 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 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 or a 40-tooth 16mm sprocket (both of which have a circumference of about 12 in.) and 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 that otherwise can take place. (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 of a pitch which is 0.3 percent shorter than the positive stock without the 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 set the aim for the pitch at a 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 brings 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. or 0.2994 in. depending on whether the film width is 35mm or 16mm.

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, margin, and hole size (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 at this time 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 Positive Raw Stock, PH22.36-1954, or the latest revision thereof approved by the American Standards Association, Incorporated), and the same overall dimensions as the perforations used in the negative film (American Standard Dimensions for 35mm Motion-Picture Film, BH-1870, PH22.34-1956, or the latest revision thereof approved by the American Standards Association, Incorporated). 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 injure the corners of the cine negative perforation.

Proposed American Standard Dimensions for

35mm Motion-Picture Film, KS-1870

PH22.36

Revision of
PH22.36-1954

1. Scope

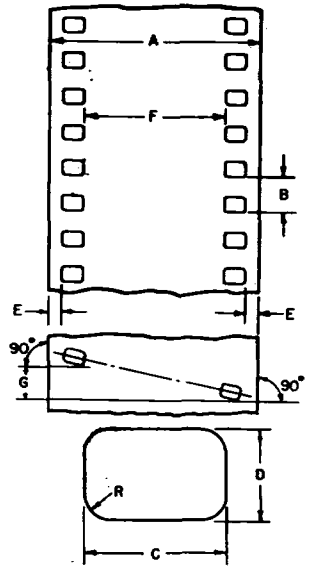
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a KS-type perforation and a perforation length pitch of 0.1870 in.

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 pitch intervals.



Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 0.025
B	Length 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	0.025 max
L	Length pitch (100 consecutive 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, 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 dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947, providing a conversion factor of 1 inch = 25.4 millimeters.

APPENDIX

(This Appendix is not a part of Proposed American Standard Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36, 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 stock is a plastic material, the dimensions of the slit and perforated film 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 sometimes 0.1870 in. (or 0.3000 in.) and sometimes 0.1866 in. (or 0.2994 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. In the case where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. In the case 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 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 or a 40-tooth 16mm sprocket (both of which have a circumference of about 12 in.) and 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 that otherwise can take place. (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 of a pitch which is 0.3 percent shorter than the positive stock without the 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 set the aim for the pitch at a 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 brings 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. or 0.2994 in. depending on whether the film width is 35mm or 16mm. 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, margin, and hole size (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.

Proposed American Standard Dimensions for

35mm Motion-Picture Film, BH-1866

PH22.93

Revision of PH22.93-1953

1. Scope

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

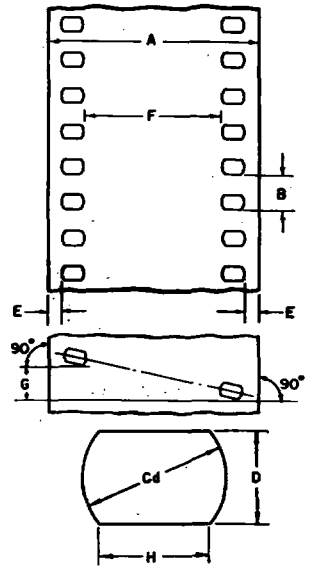
2. Dimensions

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 H is a calculated value.

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



Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Length 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	0.025 max
H	Perforation chord width (BH perforation)	0.082 calc	2.08 calc
L	Length pitch (100 consecutive 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, 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 dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947, providing a conversion factor of 1 inch = 25.4 millimeters.

APPENDIX

(This Appendix is not a part of Proposed American Standard Dimensions for 35mm Motion-Picture Film, BH-1866, PH22.93, 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 stock is a plastic material, the dimensions of the slit and perforated film 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 sometimes 0.1870 in. (or 0.3000 in.) and sometimes 0.1866 in. (or 0.2994 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. In the case where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. In the case 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 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 or a 40-tooth 16mm sprocket (both of which have a circumference of about 12 in.) and 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 that otherwise can take place. (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 of a pitch which is 0.3 percent shorter than the positive stock without the 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 set the aim for the pitch at a 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 brings 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. or 0.2994 in. depending on whether the film width is 35mm or 16mm.

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, margin, and hole size (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.

Proposed American Standard Dimensions for

35mm Motion-Picture Film, KS-1866

PH22.139

1. Scope

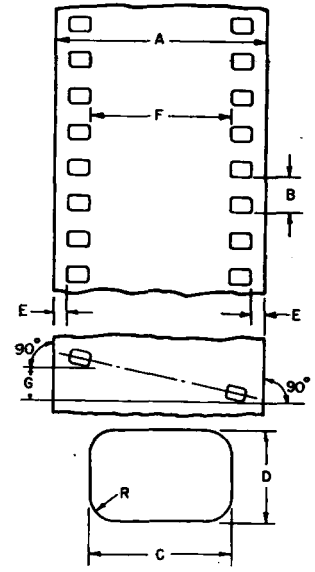
This standard specifies the cutting and perforating dimensions for 35mm motion-picture film with a KS-type perforation and a perforation length pitch of 0.1866 in.

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	1.377 ± 0.001	34.975 ± 0.025
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	0.079 ± 0.002	2.01 ± 0.05
F	Width between perforations	0.999 ± 0.002	25.37 ± 0.05
G	Perforation skewness	0.001 max	0.025 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

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, 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 dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947, providing a conversion factor of 1 inch = 25.4 millimeters.

APPENDIX

(This Appendix is not a part of Proposed American Standard Dimensions for 35mm Motion-Picture Film, KS-1866, PH22.139, 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 stock is a plastic material, the dimensions of the slit and perforated film 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 sometimes 0.1870 in. (or 0.3000 in.) and sometimes 0.1866 in. (or 0.2994 in.). In general, the longer pitch is for print stock and the shorter pitch is for negative stock.

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Maximum steadiness and definition are secured on a sprocket-type printer when the negative 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 or a 40-tooth 16mm sprocket (both of which have a circumference of about 12 in.) and 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 that otherwise can take place. (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 of a pitch which is 0.3 percent shorter than the positive stock without the 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 set the aim for the pitch at a 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 brings 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. or 0.2994 in. depending on whether the film width is 35mm or 16mm.

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, margin, and hole size (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.