they might have for possible modifications to increase its usefulness, to the originator of the instrument, to the Chairman of the committee and to the SMPTE Staff Engineer.

A review of the Universal Leader, PH22.55, has been made, and the Chairman of the subcommittee presented briefly the study of the committee. This study indicated a lack of acceptance of this Leader, as well as conflict in the format needs for motion-picture and television uses. It was pointed out that there is a need to complete this investigation because it parallels international programs. The EBU is planning to submit its Leader to the CCIR and, if it is approved, it will become a de facto international standard and the ISO would find it difficult to change.

The Chairman of the Publicizing Committee urged the membership to consider writing articles and preparing material for publication in various trade journals. Appropriate arrangements have been made with *Boxoffice*, IATSE, *Greater Amusements* and NATO for publishing such articles. It was further stated that the SMPTE should be publicized to the exhibition branch as being the technical arm of our industry. After considerable discussion, it was decided that two types of articles should be prepared; first, technical articles for projectionists and related theater technicians, and second, articles intended for non-technical people, such as the theater manager or theater owner. It was suggested that each member assist the Chairman by forwarding his ideas to him.

Conference guidelines were discussed at some lengths, and it was pointed out that the Standards Committee had recommended that the section on the audio requirements as submitted should be augmented. A subcommittee chairman was asked to study these comments and it was requested that his committee act as a liaison committee between the Film Projection Practice Committee and the Sound Committee. Items to be included in a conference guidelines document were discussed and the Chairman of the subcommittee indicated that a report would be prepared in the very near future.

Under New Business, it was stated that a new aspect ratio of approximately 2:1 for theatrical projection had been inadvertently omitted from consideration. No record of this item is in evidence, and it will appear on the agenda for the next meeting. The Association of Motion Picture & Television Producers Research Center Bulletin No. B-084/01 relates to this subject, and the Chair asked the members of the committee to review this bulletin and to be prepared for discussion of the topic at the next meeting.

J. G. BAER
Chairman Pro Tem
of the April 1973 Meeting

Video Tape Recording Committee Report

The Video Tape Recording Committee met on 23 March 1973 in Washington, D.C. and considered these items:

The proposed standard for a 2-in quadruplex cassette/cartridge spool has been approved by the VTR Committee and has gone to the SMPTE Standards Committee. A second draft of a general purpose Video Magnetic Tape Reel for Quadruplex Recorders has been circulated for vote by the committee.

A proposed revision of RP 16, Specifications of Tracking Control Record for Two-Inch Quadruplex Video Magnetic Tape Recordings, to more clearly and accurately define the frame pulse has been circulated for voting by the committee.

A third, and hopefully final, draft of the Time and Control Code proposal has been circulated for voting.

The Tape Transport Geometry Subcommittee has prepared a third draft of a proposed revision to RP 36, and a second draft of a proposed revision to RP 11.

No progress was reported in the program to standardize the cue tones on tapes used in quadruplex cassettes/cartridges.

Some ideas for possible changes to the quadruplex format to improve performance were introduced, and a subcommittee was formed for the exchange of ideas.

The next meeting of the committee is scheduled for 5 September 1973 in New York.

CHARLES E. ANDERSON
Chairman

standards and recommended practices

Approved American National Standards

On 29 May 1973, the American National Standards Institute approved three new standards: *PH22.146-1973*, Method for Determining Speed of 16mm, 8mm and Super 8 Reversal Color Camera Films Intended for Direct Projection in Motion-Picture Photography; *PH22.165-1973*, Dimensions for 35mm Motion-Picture Film Perforated Super 8, 5R-1667 (1-3-5-7-0); and *PH22.168-1973*, Dimensions for 16mm Motion-Picture Film Perforated Super 8 (1-4).

Inasmuch as compliance with American National Standards is purely voluntary, these standards will become truly effective when broad publicity is given to their existence. ANSI and SMPTE would appreciate any personal influence to promote the use of these standards where such action is appropriate. Copies of the standards may be obtained for a nominal fee from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Draft American National Standards

Three Draft American National Standards, which are revisions of previous issues, are published here for a trial period and public review:

PH22.73, Dimensions for 35mm Motion-Picture Film Perforated 32mm, 2R, PH22.109, Dimensions for 16mm Motion-Picture Film Perforated IR, and PH22.110, Dimensions for 16 mm Motion-Picture Film Perforated 2R, implement agreement by the Society's Film Dimensions Committee to consolidate standards that are similar in format and dimensioning. PH22.73 a revision of PH22.73-1966 and PH22.138-1964, combines the specifications applicable to 35mm film perforated 32mm, having two rows of perforations and a perforation pitch of either 0.2994 or 0.3000 inch. PH22.109 consolidates the revision of PH22.109-1965 and PH22.12-1964, and PH22.110 consolidates the revision of PH22.110-1965 and PH22.5-1964 for the same reasons. The proposed revisions do not reflect a change in specifications.

Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to 1 October 1973. The proposals have been submitted to American National Standards Committee PH22. All comments received through *Journal* publication will be reviewed before conclusion of action by that Committee.

Approved International Standards

The International Organization for Standardization (ISO) approved during March 1973 International Standard ISO 1781-1973, Cinematography- Projector Usage of 8mm Type S Motion-Picture Film for Direct Front Projection, the technical content of which is published here. The standard is in complete agreement with the comparable American National Standard, PH22.155. Copies of all International Standards are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

ISO is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. The International Standard published here was developed by Technical Committee 36 on Cinematography. The work of this committee is administered by the Engineering Department of the SMPTE which functions as the Secretariat in ANSI's name. The report of the last meeting of the Committee was published in the October 1971 *Journal of the SMPTE*. The next meeting is scheduled for 10–17 December 1973 at Williamsburg, Va.—Alex E. Alden, *Staff Engineer*.

American National Standard
method for determining speed of 16 mm, 8 mm and super 8 reversal color camera films intended for direct projection in motion-picture photography

Approved May 29, 1973 Secretariat: Society of Motion Picture and Television Engineers, Inc.

1. Scope

1.1 Specifications. This standard specifies a method for the determination of American National Standard speed of 16 mm, 8 mm and super 8 reversal color camera films intended for direct projection in motion-picture photography.

1.2 Reference Standard. American National Standard Sensitometric Exposure and Evaluation Method for Determining Speed of Color Reversal Films for Still Photography, PH2.21-1972, constitutes the basis for this standard. All sections of PH2.21-1972, except Section 4.3.2.2, are to be considered part of this standard.

2. Exposure Time

Exposure time shall be between 1/25 and 1/50 second.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

Experience has shown that a density level selected as optimum for a transparency is influenced by screen brightness. A less dense transparency is selected if the screen brightness is reduced. Because of the difference in screen brightness typical of 35 mm slide projection, approximately 40 footlamberts (137 candelas per square meter), and that typical of 16 mm motion-picture film projection, assumed to range from approximately 14 to 18 fL (48 to 62 cd/m²), a variation in preferred picture density may lead to a desire for approximately one-third camera stop increase in exposure for the latter. This difference is not considered sufficient to warrant a change in the sensitometric test method for motion-picture use. However, many 8 mm projection conditions are different enough in brightness from 16 fL (55 cd/m²) to require lighter or darker pictures. American National Standard Automatic Exposure Controls for Cameras, PH2.15-1970 (R-1964), suggests that an adjustment which permits ⅓ stop more exposure for 8 mm films is permissible. This is standard practice by camera manufacturers. However, since there is no standard for 8 mm projection, it is not practical to write a separate standard for determining speed of 8 mm films.

American National Standard
dimensions for 35 mm motion-picture film perforated super 8, 5R-1667 (1-3-5-7-0)

Approved May 29, 1973 Secretariat: Society of Motion Picture and Television Engineers, Inc.

1. Scope

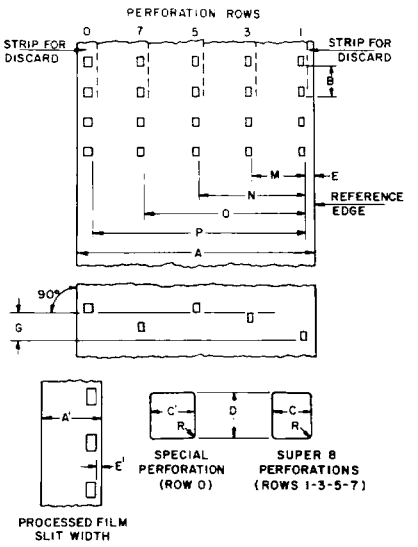
This standard specifies the cutting and perforating dimensions for 35 mm motion-picture film with four rows of super 8 perforations and one row of special perforations having a perforation pitch of 0.1667 in. The film stock described in this standard is intended for the production of prints. The width of the 8 mm strip after processing and slitting is also specified.

2. Dimensions

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

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1973 (R-1967).

2.3 Except for Dimensions A′ and E′, the dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2°F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.



	Dimensions	Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
A'	Film width after processing and slitting	0.314 ± 0.002	7.98 ± 0.05
B	Perforation pitch	0.1667 ± 0.0004	4.234 ± 0.010
C	Perforation width	0.0360 ± 0.0004	0.914 ± 0.010
C'	Special perforation width	0.0450 ± 0.0004	1.143 ± 0.010
D	Perforation height	0.0450 ± 0.0004	1.143 ± 0.010
E	Edge to perforation	0.050 ± 0.002	1.27 ± 0.05
E'	Edge to perforation after processing and slitting	0.020 ± 0.002	0.51 ± 0.05
G	Perforation skewness	0.0015 max	0.038 max
L	100 consecutive perforation pitches	16.670 ± 0.017	423.42 ± 0.43
M	Lateral perforation displacement	0.314 ± 0.001	7.98 ± 0.03
N	Lateral perforation displacement	0.628 ± 0.001	15.95 ± 0.03
N-M	Functional tolerance	0.314 ± 0.001	7.98 ± 0.03
O	Lateral perforation displacement	0.942 ± 0.001	23.93 ± 0.03
O-N	Functional tolerance	0.314 ± 0.001	7.98 ± 0.03
P	Lateral perforation displacement	1.251 ± 0.001	31.78 ± 0.03
P-O	Functional tolerance	0.309 ± 0.001	7.87 ± 0.03
R	Radius of perforation fillet	0.005 ± 0.001	0.13 ± 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, etc.), depending upon which is the significant factor, and the perforation pitch without the decimal point.

The numerals (1-3-5-7-0) have been added to the title of this standard to specify how the rows of perforations are placed on the film. The designation is necessary only when the film stock is wider than its end use and more than one combination of perforation rows is possible. For super 8-type perforations on 35 mm-width film, a maximum of four usable rows of perforations is possible. The perforation rows shall be numbered starting at the reference edge. The reference edge is the edge nearest to that row of perforations which is retained in one of the 8 mm strips that may be generated by appropriate slitting of the parent 35 mm film. A row of perforations which is discarded will always be given the number 0. Negative or intermediate films which are not slit may contain a 0-numbered row of perforations if that perforated row corresponds to the discard row of perforations on the subsequent print stock. For all films with nonsymmetrical perforation rows, there can be two different windings for the same numbered rows of perforations. Film perforated 1-0 would be 1-0 regardless of winding, but depending upon the location of the reference edge, the winding could be A or B, according to American National Standard Designation of A and B Windings for Motion-Picture Raw Stock, PH22.75-1969.

NOTE 2: The metric values in the table of dimensions are converted from the inch values in accordance with conversion principles outlined in American National Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1947 (R-1933). The metric conversion of Dimension A *is purposely chosen and shown to* three decimal places to prevent the maximum width dimension from exceeding 35 mm.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. The dimensions given in this standard, excluding *Dimensions A' and E', represent the practice* of film manufacturers in that the dimensions and tolerances are for film stock immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but since film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in changes in the dimensions during the life of the film. The change is generally uniform throughout a roll.

A2. It will be noted that among the various standards for slitting and perforating film stock there are often two standards that seem much alike in wording. The difference lies in the longitudinal pitch which is either 0.1664 or 0.1667 in (4.227 or 4.234 mm). In general, the longer pitch is for print stock and the shorter pitch is for negative or intermediate stock.

The choice of pitch for negative or intermediate motion-picture film depends, within certain limits, on the type of printer to be used. Where release step-printers are used and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at the time of printing (sprocket-type contact printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter and tooth engagement, (2) the film thickness, and (3) the film shrinkage *and the rate at which shrinkage occurs.*

Maximum steadiness and definition are secured on a sprocket-type printer when the negative stock is somewhat shorter in pitch than the positive stock in the approximate proportion of the thickness of the film to the radius of curvature. For printing on a 72-tooth sprocket (circumference of about 12 in) with film 0.0055 to 0.0065 in (0.140 to 0.165 mm) thick, the optimum pitch differential is 0.3 percent. The use of the ideal pitch differential for the negative would minimize slippage between the positive stock and negative during the printing operation, thus reducing the amount of blurring and jumping in the vertical axis of the picture or sound image. (This error is to be differentiated from the jump caused by nonuniformity of successive pitches, Dimension B.)

Experience has shown that the average pitch derived from Dimension L of the intermediate can vary ± 0.1 percent from the ideal pitch, which is 0.3 percent shorter than the positive stock, without blurring of picture and sound image being easily detected.

For many years this desired difference in pitch was caused by the shrinkage of the negative film during processing and aging. Current film bases shrink less than the earlier ones and hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture or sound negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing and the aging that takes place before the release prints are made then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative or intermediate stock is 0.1664 in (4.227 mm).

Low-shrinkage negative film perforated to these dimensions should not thereafter shrink appreciably more than 0.2 percent under normal use conditions, and for a reasonable life span, so that the optimum pitch differential from the positive stock of 0.3 ± 0.1 percent is maintained. (The film should be measured after equilibration with air at 70°F and 55 percent relative humidity or at the conditions prevailing at the time of perforating.)

A3. The uniformity of pitch, hole size and margin (Dimensions B, C, D and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next within any small group of consecutive perforations. As an example, the uniformity of the margin is uniquely critical for optical printing. During the printing process, the placement of the image on the film is usually with respect to successive lateral pairs of perforations at one-frame intervals. During subsequent projection, however, the portion of the image projected is usually located, not by these perforations, but by the edge of the film. The lateral steadiness of the projected image is therefore directly related to the frame-to-frame uniformity of the margin.

A4. The tolerance for the slit width after processing was established to provide the laboratory with the maximum flexibility for the least critical application of commercial super 8 prints. For some commercial applications, such as photographic sound use, it will be necessary for the laboratory to consider much tighter tolerances. For these more critical uses, film shrinkage characteristics must be taken into account, and the film slit within ± 0.001 in (0.03 mm) variability.

American National Standard
dimensions for 16 mm motion-picture film perforated super 8, (1-4)

Approved May 29, 1973 Secretariat: Society of Motion Picture and Television Engineers, Inc.

1. Scope

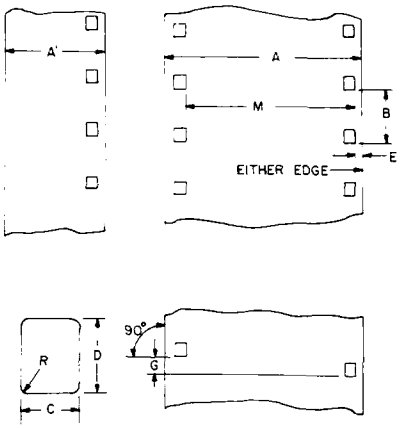
This standard specifies the cutting and perforating dimensions for 16 mm motion-picture film with super 8 perforations in positions 1 and 4 and a perforation pitch of either 0.1664 or 0.1667 in. The width of the 8 mm strip after processing and slitting is also specified.

2. Dimensions

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

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1973 (R-1967).

2.3 Except for Dimension A', the dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2°F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.



	Dimensions	Inches	Millimeters
A	Film width	0.628 ± 0.001	15.95 ± 0.03
A'	Film width after processing and slitting	0.314 ± 0.002	7.98 ± 0.05
B	Perforation pitch (long)	0.1667 ± 0.0004	4.234 ± 0.010
B'	Perforation pitch (short)	0.1664 ± 0.0004	4.227 ± 0.010
C	Perforation width	0.0360 ± 0.0004	0.914 ± 0.010
D	Perforation height	0.0450 ± 0.0004	1.143 ± 0.010
E	Edge to perforation	0.020 ± 0.002	0.51 ± 0.05
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitches	16.670 ± 0.017	423.42 ± 0.43
L'	100 consecutive perforation pitches	16.640 ± 0.017	422.70 ± 0.43
M	Lateral perforation displacement	0.552 ± 0.001	14.02 ± 0.03
R	Radius of perforation fillet	0.005 ± 0.001	0.13 ± 0.03

2.4 Some equipment may be used to slit super 8 film that originally had been designed for the slitting of less critical conventional 8 mm film from 16 mm 2R-1500 camera originals or prints. With this procedure, a larger tolerance for Dimension A' of 0.314 — 0.002 — 0.003 inch may be used for film that has not been prestriped with magnetic material. New slitting equipment should be designed to function within the prescribed tolerances.

NOTE 1: Although film stock with a perforation pitch of 0.1667 inch (4.234 mm) may be used as a reversal camera original film, its principal use is for the production of prints. The principal use of the stock perforated 0.1664 inch (4.227 mm) is as an intermediate film in the production of prints. If this film is used in a camera and slit after processing, the width of the strips so slit shall be 0.314 ± 0.002 inch (7.98 ± 0.05 mm).

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

NOTE 3: The title of this standard was established by the application of a nomenclature system developed for all film dimension standards: Each title provides an indication of the film width, a code designation for the perforation shape (BH, KS, DH or CS) or the number of rows of perforations (1R, 2R, etc.), depending upon which is the significant factor, and the perforation pitch without the decimal point.

The numerals (1-4) have been added to the title of this standard to specify how the rows of perforations are placed on the film. This designation is necessary only when the film stock is wider than its end use and more than one combinaition of perforation rows is possible. The perforation rows shall be numbered starting at the reference edge. The reference edge is that edge of the strip nearest to the perforations which is retained on one of the slit prints that is not discarded in any subsequent slitting. The designation 1 through 4 of 16 mm films indicates that the perforations are in row

1 — adjacent to the reference edge
2 — on the reference side of center
3 — on the non-reference side of center
4 — adjacent to the non-reference edge

when the film end is observed from the base side with the wound roll above and away from the point of observation.

There can be two different windings for the same numbered rows of perforations. This applies, however, only when the film is perforated in the 1-3 position and the designation of the film would be 1-3, regardless of winding. Winding could be A or B, depending upon the location of the reference edge. (Refer to American National Standard Designation of A and B Windings for Motion-Picture Raw Stock, PH22.75-1969.)

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

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 0.1664 or 0.1667 in (4.227 or 4.234 mm). In general, the longer pitch is for print stock and the shorter pitch is for negative or intermediate stock.

The choice of pitch for negative or intermediate motion-picture film depends, within certain limits, on the type of printer to be used. Where release step-printers are used and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at the time of printing (sprocket-type contact printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter and tooth engagement, (2) the film thickness, and (3) the film shrinkage and the rate at which shrinkage occurs.

Maximum steadiness and definition are secured on a sprocket-type printer when the negative stock is somewhat shorter in pitch than the positive stock in the approximate proportion of the thickness of the film to the radius of curvature. For printing on a 72-tooth sprocket (circumference of about 12 in) with film 0.0055 to 0.0065 in (0.140 to 0.165 mm) 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 derived from Dimension L of the intermediate can vary ± 0.1 percent from the ideal pitch, which is 0.3 percent shorter than the positive stock, without blurring of picture and sound image being easily detected.

For many years this desired difference in pitch was caused by the shrinkage of the negative film during processing and aging. Current film bases shrink less than the earlier ones and hence a shorter initial pitch becomes *desirable. To satisfy this requirement* for picture or sound negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing and the aging that takes place before the release prints are made then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative or intermediate stock is 0.1664 in (4.227 mm).

Low-shrinkage negative film perforated to these dimensions should not thereafter shrink appreciably more than 0.2 percent under normal use conditions, and for a reasonable life span, so that the optimum pitch differential from the positive stock of 0.3 ± 0.1 percent is maintained. (The film should be measured after equilibration with air at 70°F and 55 percent relative humidity or at the conditions prevailing at the time of perforating.)

A3. The uniformity of pitch, hole size and margin (Dimensions B, C, D and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next within any small group of consecutive perforations. As an example, the uniformity of the margin is uniquely critical for optical printing. During the printing process, the placement of the image on the film is usually with respect to successive lateral pairs of perforations at one-frame intervals. During subsequent projection, however, the portion of the image projected is usually located, not by these perforations, but by the edge of the film. The lateral steadiness of the projected image is therefore directly related to the frame-to-frame uniformity of the margin.

A4. *The width for 16 mm film is controlled by the shrink*age characteristics of the films involved. Thus, there have been standards for the width of 16 mm 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-shrinkage" 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, 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 equipment design fail to accommodate a film of 0.630-in width.

A5. The tolerance for the slit width after processing was established to provide the laboratory with the maximum flexibility for the least critical application of commercial super 8 prints. For some commercial applications, such as photographic sound use, it will be necessary for the laboratory to consider much tighter tolerances. For these more critical uses, film shrinkage characteristics must be taken into account, and the film slit within ± 0.001 in (0.03 mm) variability.

Draft American National Standard

Dimensions for 35 mm Motion-Picture Film Perforated 32 mm, 2R

PH22.73

Revision and consolidation of PH22.73-1966 and PH22.138-1964

1. Scope

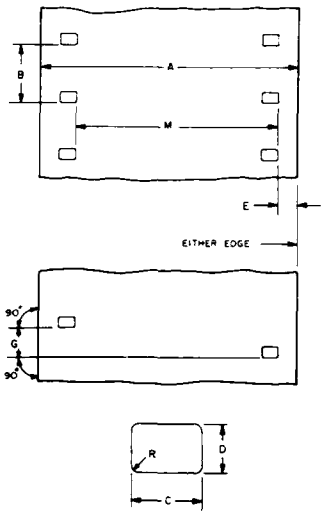
This standard specifies the cutting and perforating dimensions for 35 mm motion-picture film having two rows of 16 mm-type perforations, one row near each edge of the 35 mm film, and a perforation pitch of either 0.2994 or 0.3000 in.

2. Dimensions

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

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1973 (R-1967).

2.3 The dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2°F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.



Dimensions		Inches	Millimeters
A	Film width	1.377 ± 0.001	34.975 ± 0.025
B	Perforation pitch (long)	0.3000 ± 0.0004	7.620 ± 0.010
B′	Perforation pitch (short)	0.2994 ± 0.0004	7.605 ± 0.010
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	0.096 ± 0.002	2.44 ± 0.05
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitches	30.00 ± 0.03	762.0 ± 0.8
L′	100 consecutive perforation pitches	29.94 ± 0.03	760.5 ± 0.8
M	Lateral perforation displacement	1.113 ± 0.001	28.27 ± 0.03
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, etc.), depending upon which is the significant factor, or 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 National Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1947 (R-1933). The metric conversion of Dimension A is purposely chosen and shown to three decimal places to prevent the maximum width dimension from exceeding 35 mm.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. The user is reminded that, as a plastic, film can change dimensions temporarily due to moisture or temperature, or permanently due to solvent loss or strain effect.

A2. Film for positive use has a longitudinal pitch 0.2 percent longer than its companion negative. Shrinkage of the negative during aging and processing prior to printing will generally not exceed 0.2 percent. Thus, the negative stock is expected to be 0.3 ± 0.1 percent shorter than the positive. This difference will minimize slippage between the two on the 12-inch circumference sprocket of the printer, assuming a film thickness of 0.0055 to 0.0065 in (0.140 to 0.165 mm).

A3. The uniformity of pitch, hole size and margin (Dimensions B, C, D and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next within any small group of consecutive perforations. As an example, the uniformity of the margin is uniquely critical for optical printing. During the printing process, the placement of the image on the film is usually with respect to successive lateral pairs of perforations at one-frame intervals. During subsequent projection, however, the portion of the image projected is usually located, not by these perforations, but by the edge of the film. The lateral steadiness of the projected image is, therefore, directly related to the frame-to-frame uniformity of the margin.

A4. For historical background on the development of this standard, refer to A. J. Miller and A. C. Robertson, "Motion-picture film — its size and dimensional characteristics," Jour. SMPTE, 74: 3-11, Jan. 1965.

Draft American National Standard

Dimensions for 16 mm Motion-Picture Film Perforated 1R

PH22.109

Revision and consolidation of PH22.109-1965 and PH22.12-1964

1. Scope

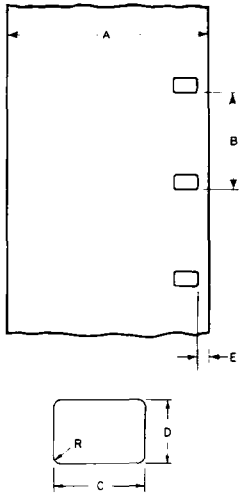
This standard specifies the cutting and perforating dimensions for 16 mm motion-picture film with perforations along one edge and a perforation pitch of either 0.2994 or 0.3000 in.

2. Dimensions

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

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1973 (R-1967).

2.3 The dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2°F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.



	Dimensions	Inches	Millimeters
A	Film width	0.628 ± 0.001	15.95 ± 0.03
B	Perforation pitch (long)	0.3000 ± 0.0004	7.620 ± 0.010
B′	Perforation pitch (short)	0.2994 ± 0.0004	7.605 ± 0.010
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	100 consecutive perforation pitches	30.00 ± 0.03	762.0 ± 0.8
L′	100 consecutive perforation pitches	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, etc.), depending upon which is the significant factor, or 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 National Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1947 (R-1933).

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. The user is reminded that, as a plastic, film can change dimensions temporarily due to moisture or temperature, or permanently due to solvent loss or strain effect.

A2. Film for positive use has a longitudinal pitch 0.2 percent longer than its companion negative. Shrinkage of the negative during aging and processing prior to printing will generally not exceed 0.2 percent. Thus, the negative stock is expected to be 0.3 ± 0.1 percent shorter than the positive. This difference will minimize slippage between the two on the 12-inch circumference sprocket of the printer, assuming a film thickness of 0.0055 to 0.0065 in (0.140 to 0.165 mm).

A3. The uniformity of pitch, hole size and margin (Dimensions B, C, D and E) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next within any small group of consecutive perforations. As an example, the uniformity of the margin is uniquely critical for optical printing. During the printing process, the placement of the image on the film is usually with respect to successive lateral pairs of perforations at one-frame intervals. During subsequent projection, however, the portion of the image projected is usually located, not by these perforations, but by the edge of the film. The lateral steadiness of the projected image is, therefore, directly related to the frame-to-frame uniformity of the margin.

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Draft American National Standard

Dimensions for 16 mm Motion-Picture Film Perforated 2R

PH22.110

Revision and consolidation of PH22.110-1965 and PH22.5-1964

1. Scope

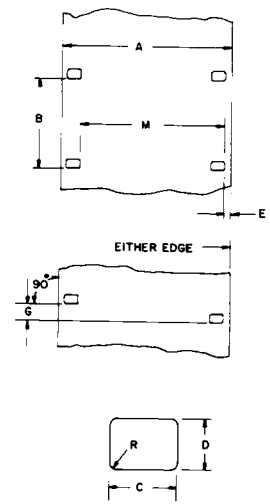
This standard specifies the cutting and perforating dimensions for 16 mm motion-picture film with perforations along both edges and a perforation pitch of either 0.2994 or 0.3000 in.

2. Dimensions

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

2.2 The dimensions pertain to a safety film as defined in American National Standard Specifications for Motion-Picture Safety Film, PH22.31-1973 (R-1967).

2.3 The dimensions apply at the time of cutting and perforating for film adjusted to a temperature of 23 ± 1°C (nominally converted to 73 ± 2°F) and a relative humidity of 50 ± 2 percent. The manufacturer may indicate other nominal humidity conditions under which the dimensions apply.



	Dimensions	Inches	Millimeters
A	Film width	0.628 ± 0.001	15.95 ± 0.03
B	Perforation pitch (long)	0.3000 ± 0.0004	7.620 ± 0.010
B'	Perforation pitch (short)	0.2994 ± 0.0004	7.605 ± 0.010
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
G	Perforation skewness	0.001 max	0.03 max
L	100 consecutive perforation pitches	30.00 ± 0.03	762.0 ± 0.8
L'	100 consecutive perforation pitches	29.94 ± 0.03	760.5 ± 0.8
M	Lateral perforation displacement	0.485 ± 0.001	12.32 ± 0.03
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, etc.), depending upon which is the significant factor, or 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 National Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1947 (R-1933).

Appendix

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Cinematography — Projector usage of 8 mm Type S motion-picture film for direct front projection

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the emulsion orientation, the rate of projection and the position of the image area for 8 mm Type S motion-picture film as used for direct front projection.

2 REFERENCES

ISO 1787, *Cinematography – Camera usage of 8 mm motion-picture film perforated Type S.*

ISO . . . , *Cinematography – 8 mm Type S motion-picture perforated film – Location and area of the image formed by the camera aperture and of the projectable image.* (In preparation.)

3 CHARACTERISTICS

The emulsion orientation of sound or silent release prints shall be toward the projection lens when the film is threaded for direct front projection, as shown in the Figure.

NOTES

1 This recommendation is feasible since an intermediate optical or contact step, necessary for quantity reproduction, can be arranged to produce prints with the recommended orientation. A common emulsion orientation facilitates intercutting among 8 mm Type S release prints and reversal original 8 mm Type S material.

2 It is recognized that some users will require contact reversal prints from original 8 mm Type S, particularly in the amateur field, but since these would not be intercut with commercial prints, picture focus should not be a problem. Reversal reduction prints can be made easily to comply with the recommended practice.

4 POSITION OF IMAGE

The perforation used for the film transport claw shall be two perforations above the perforation adjacent to the projected aperture when the transport claw is at the bottom of its stroke (the −2 position).

NOTES

1 This location coincides with the vertical transport claw location required of 8 mm Type S camera original film and thereby improves steadiness through cancellation of any variation of the perforation pitch.

2 The dimensions of the maximum image projected relative to the engaged film positioning perforation are specified in ISO . . . . It is customary to provide a framing movement of approximately 0,38 mm (0.015 in) above and below this position.

3 In specifying the film transport claw in section 4, the existence of projectors which use other than the −2 perforation to position the film is recognized. Future design, however, is expected to comply with the specification in this International Standard.

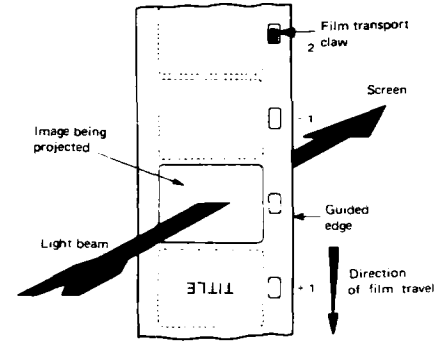
5 RATE OF PROJECTION

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

NOTES

1 In silent projectors having a fixed rate of projection, the rate shall be 18 frames per second with a tolerance appropriate for its intended use. Silent projectors having manually adjustable speed shall be capable of reaching a projection rate of 18 frames per second.

2 It is recognized that under certain conditions, silent material originally photographed at 18 frames per second or at 24 frames per second may be projected at 24 frames per second.



The film is shown as seen from the light source in the projector