

height limitation to about 20 ft above the stage floor.

The next compilation of figures that might be of interest is available aspect ratio. The maximum height and maximum width available indicate the following aspect ratios. In the first group the aspect ratio ranged from 1.5 to 1.87:1.00. In the second group the aspect ratio ranged from a low of 1.81 to a high of 2.27:1.00, the average being about 1.9:1.00 in this latter group. In the group of 1500 seats and over, the low aspect ratio was 2.06:1.00 and the high 2.30:1.00. If an aspect ratio greater than the average (and the average in these very large theaters is about 2.2) were desired, a sacrifice in the height of the picture would have to be accepted.

In column 4 is an interpolation of what would happen to aspect ratio, if all the available height and an arbitrary maximum width of 38 ft were to be used. The 38-ft maximum was chosen because greater magnification of picture image from 35mm film will show disturbing film grain. The

average maximum aspect ratio under these conditions comes close to 1.8:1.00.

Discussion

Morton D. O'Brien (Assistant Director, Projection and Sound, Loew's Theaters): In making your computations did you base them on the fact that every seat in the theater was available at these ratios and these sizes of screens or did you incorporate a loss of a certain amount of seats in these theaters?

Mr. Schlanger: The interpolations made in this analysis were based on the assumption that all existing seating would remain in use, but knowing that there would necessarily be some existing seats nearer the screen that would be less desirable with bigger screens.

William A. Shurcliff (Polaroid Corp.): Do I understand that over half the theaters in the country then cannot accommodate an aspect ratio more than about 1.9 unless they cut down the height?

Mr. Schlanger: The survey indicates that this may be so.

Standards PH22.5, —.12 and —.93 Related to 16mm and 35mm Low-Shrink Film

Three American Standards, approved by the American Standards Association on December 17, 1953, are published on the following pages. Two (PH22.5-1953 and PH22.12-1953) are revisions of previous standards; PH22.93-1953 is a new standard. These three standards were published previously for trial and comment, and the background information on their development and processing will be found in the December 1952 *Journal*.—*Henry Kogel, Staff Engineer*

American Standard
**Dimensions for 16mm Film,
 Perforated Two Edges**



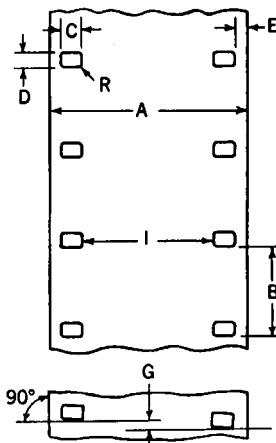
Reg. U.S. Pat. Off.

PH22.5-1953

Revision of Z22.5-1947

*UDC 778.5

Page 1 of 2 pages



Dimensions	Inches	Millimeters
*A	0.629 ± 0.001	15.98 ± 0.03
†B	0.3000 ± 0.0005	7.620 ± 0.013
C	0.0720 ± 0.0004	1.83 ± 0.01
D	0.0500 ± 0.0004	1.27 ± 0.01
*E	0.036 ± 0.002	0.91 ± 0.05
G	Not > 0.001	Not > 0.025
I	0.413 ± 0.001	10.490 ± 0.025
‡L	30.00 ± 0.03	762.00 ± 0.76
R	0.010	0.25

These dimensions and tolerances apply to negative and positive raw stock immediately after cutting and perforating.

* For low-shrink film as defined in Appendix 2, A shall be 0.628 ± 0.001 and E shall be 0.0355 ± 0.0020 in.

† In any group of four consecutive perforations, the maximum difference of pitch shall not exceed 0.001 in. and should be as much smaller as possible.

‡ This dimension represents the length of any 100 consecutive perforation intervals.

Approved December 17, 1953, by the American Standards Association, Incorporated
 Sponsor: Society of Motion Picture and Television Engineers

*Universal Decimal Classification

(These Appendixes are not a part of American Standard Dimensions for 16mm Film, Perforated Two Edges, PH22.5-1953.)

Appendix 1

The dimensions given in this standard represent the practice of film manufacturers in that the dimensions and tolerances are for film immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but owing to the fact that film is a plastic material, the dimensions of the slit and perforated film never agree exactly with the dimensions of the punches and dies. Shrinkage of the film, due to change in moisture content or loss of residual solvents, invariably results in a change in these dimensions during the life of the film. This change is generally uniform throughout the roll.

The uniformity of perforation is one of the most important of the variables affecting steadiness of projection.

Variations in pitch 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 that is important. This is one of the reasons for the method of specifying uniformity in dimension B.

Appendix 2

In the early days of 16mm film the safety base used for this film had the characteristic of shrinking very rapidly to a certain fairly definite amount and then not shrinking much more. Although this film tended to swell at high humidities, nevertheless the shrinkage that occurred in the package before the user received the film was always at least as great as any swell that might occur due to high humidities at the time of use. This meant that the user never encountered film, even at high humidities, that had greater width than that specified in the standards. This meant that camera and projector manufacturers seldom

ran into trouble so long as their film gates would readily pass film at the upper limit of the slitting tolerances, namely 0.630 in.

Within the past few years, however, a safety base with lower shrinkage characteristics began to be used. Although this film was less susceptible than the previous film to swelling at high humidities, nevertheless the shrinkage characteristics were low enough so that this shrinkage did not always compensate for the swell at high humidities.

For this reason film slit at the mid point of the tolerance for width, namely 0.629 in., would occasionally swell at high humidities to such an extent that it would bind in film gates designed to pass film with the width of 0.630 in. The manufacturers, therefore, were compelled to slit at the lower edge of the tolerance permitted by the previous edition of this standard. Variations in their slitting width, however, sometimes produced film slit below the limits of the standard.

This revision has therefore been adopted in order that the manufacturers may slit low-shrink film within the standard and still produce film which does not exceed 0.630 in. even at high humidities.

For the purpose of this specification, low-shrink film base is film base which, when coated with emulsion and any other normal coating treatment, perforated, kept in the manufacturer's sealed container for 6 months, exposed, processed, and stored exposed to air for a period not to exceed 30 days at 65 to 75 F and 50 to 60% relative humidity and measured under like conditions of temperature and humidity, shall have shrunk not more than 0.2% from its original dimension at the time of perforating. The final measurement should be made after conditioning the film for 24 hours to a humidity of $55 \pm 5\%$.

This definition of low-shrink film is to be used as a guide to film manufacturers, and departure therefrom shall not be cause for rejection of the film.

PH22.5-1953

American Standard
**Dimensions for 16mm Film,
 Perforated One Edge**



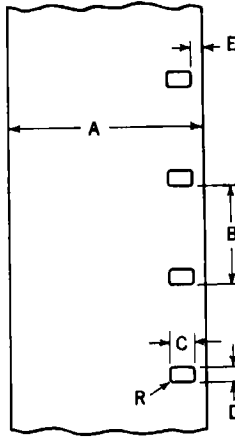
Reg. U.S. Pat. Off.

PH22.12-1953

Revision of Z22.12-1947

*UDC 778.5

Page 1 of 2 pages



Dimensions	Inches	Millimeters
* A	0.629 ± 0.001	15.98 ± 0.03
† B	0.3000 ± 0.0005	7.620 ± 0.013
C	0.0720 ± 0.0004	1.83 ± 0.01
D	0.0500 ± 0.0004	1.27 ± 0.01
* E	0.036 ± 0.002	0.91 ± 0.05
‡ L	30.00 ± 0.03	762.00 ± 0.76
R	0.010	0.25

These dimensions and tolerances apply to negative and positive raw stock immediately after cutting and perforating.

* For low-shrink film as defined in Appendix 2, A shall be 0.628 ± 0.001 and E shall be 0.0355 ± 0.0020 in.

† In any group of four consecutive perforations, the maximum difference of pitch shall not exceed 0.001 in. and should be as much smaller as possible.

‡ This dimension represents the length of any 100 consecutive perforation intervals.

Approved December 17, 1953, by the American Standards Association, Incorporated
 Sponsor: Society of Motion Picture and Television Engineers

*Universal Decimal Classification

(These Appendixes are not a part of American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.)

Appendix 1

The dimensions given in this standard represent the practice of film manufacturers in that the dimensions and tolerances are for film immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but owing to the fact that film is a plastic material, the dimensions of the slit and perforated film never agree exactly with the dimensions of the punches and dies. Shrinkage of the film, due to change in moisture content or loss of residual solvents, invariably results in a change in these dimensions during the life of the film. This change is generally uniform throughout the roll.

The uniformity of perforation is one of the most important of the variables affecting steadiness of projection.

Variations in pitch 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 that is important. This is one of the reasons for the method of specifying uniformity in dimension B.

Appendix 2

In the early days of 16mm film the safety base used for this film had the characteristic of shrinking very rapidly to a certain fairly definite amount and then not shrinking much more. Although this film tended to swell at high humidities, nevertheless the shrinkage that occurred in the package before the user received the film was always at least as great as any swell that might occur due to high humidities at the time of use. This meant that the user never encountered film, even at high humidities, that had greater width than that specified in the standards. This meant that camera and projector manufacturers seldom

ran into trouble so long as their film gates would readily pass film at the upper limit of the slitting tolerances, namely 0.630 in.

Within the past few years, however, a safety base with lower shrinkage characteristics began to be used. Although this film was less susceptible than the previous film to swelling at high humidities, nevertheless the shrinkage characteristics were low enough so that this shrinkage did not always compensate for the swell at high humidities.

For this reason film slit at the mid point of the tolerance for width, namely 0.629 in., would occasionally swell at high humidities to such an extent that it would bind in film gates designed to pass film with the width of 0.630 in. The manufacturers, therefore, were compelled to slit at the lower edge of the tolerance permitted by the previous edition of this standard. Variations in their slitting width, however, sometimes produced film slit below the limits of the standard.

This revision has therefore been adopted in order that the manufacturers may slit low-shrink film within the standard and still produce film which does not exceed 0.630 in. even at high humidities.

For the purpose of this specification, low-shrink film base is film base which, when coated with emulsion and any other normal coating treatment, perforated, kept in the manufacturer's sealed container for 6 months, exposed, processed, and stored exposed to air for a period not to exceed 30 days at 65 to 75 F and 50 to 60% relative humidity and measured under like conditions of temperature and humidity, shall have shrunk not more than 0.2% from its original dimension at the time of perforating. The final measurement should be made after conditioning the film for 24 hours to a humidity of $55 \pm 5\%$.

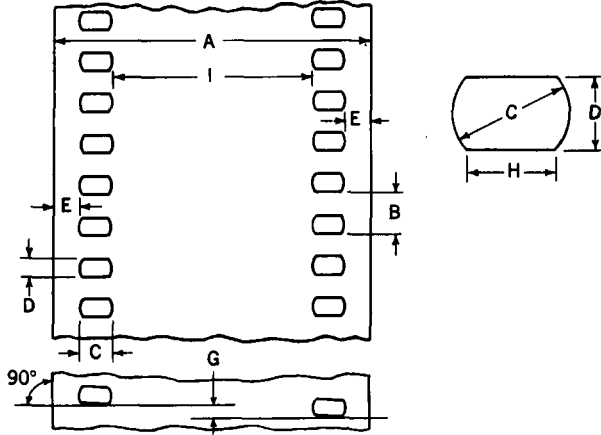
This definition of low-shrink film is to be used as a guide to film manufacturers, and departure therefrom shall not be cause for rejection of the film.

PH22.12-1953

American Standard
**Dimensions for
 35mm Motion-Picture Short-Pitch
 Negative Film**


 Reg. U.S. Pat. Off.
PH22.93-1953
 *UDC 778.5

Page 1 of 2 pages



Dimensions	Inches	Millimeters
A	1.377 ± 0.001	34.98 ± 0.03
B	0.1866 ± 0.0005	4.740 ± 0.013
C	0.1100 ± 0.0004	2.794 ± 0.01
D	0.073 ± 0.0004	1.85 ± 0.01
E	0.079 ± 0.002	2.01 ± 0.05
G	Not > 0.001	Not > 0.025
*H	0.082	2.08
I	0.999 ± 0.002	25.37 ± 0.05
† L	18.66 ± 0.015	474.00 ± 0.38

These dimensions and tolerances apply to low-shrink negative raw stock immediately after cutting and perforating.

This film is used for motion-picture negatives and certain special processes.

* A calculated value for a dimension not measured routinely in production.

† This dimension represents the length of any 100 consecutive perforation intervals.

This standard is based on American Standard Cutting and Perforating Dimensions for 35-Millimeter Motion Picture Negative Raw Stock, Z22.34-1949 and differs only in the values of B and L and the addition of a second Appendix.

Approved December 17, 1953, by the American Standards Association, Incorporated
 Sponsor: Society of Motion Picture and Television Engineers

*Universal Decimal Classification

(These Appendixes are not a part of American Standard Dimensions for 35mm Motion-Picture Short-Pitch Negative Film, PH22.93-1953.)

Appendix 1

The dimensions given in this standard represent the practice of film manufacturers in that the dimensions and tolerances are for film immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but owing to the fact that film is a plastic material, the dimensions of the slit and perforated film never agree exactly with the dimensions of the punches and dies. Shrinkage of the film, due to change in moisture content or loss of residual solvents, invariably results in a change in these dimensions during the life of the film. This change is generally uniform throughout the roll.

The uniformity of perforation is one of the most important of the variables affecting steadiness of projection.

Variations in pitch 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 that is important.

Appendix 2

Most motion-picture film is printed on sprocket-type printers. Maximum steadiness and definition are secured on a sprocket-type

printer when the negative film is somewhat shorter in pitch than the positive stock.

For many years, this difference in pitch has come about due to shrinkage of the negative film base on processing and aging.

There are currently becoming available new low-shrink film bases which do not shrink sufficiently to provide the necessary pitch differential between negative and print stock for proper printing on sprocket-type printers. This standard is intended to give dimensions for perforating low-shrink film material so that it will have, as nearly as possible, optimum dimensions at the time of printing.

For the purpose of this specification, low-shrink film base is film base which, when coated with emulsion and any other normal coating treatment, perforated, kept in the manufacturer's sealed container for 6 months, exposed, processed, and stored exposed to air for a period not to exceed 30 days at 65 to 75 F and 50 to 60% relative humidity and measured under like conditions of temperature and humidity, shall have shrunk not more than 0.2% from its original dimension at the time of perforating. The final measurement should be made after conditioning the film for 24 hours to a humidity of $55 \pm 5\%$.

This definition of low-shrink film is to be used as a guide to film manufacturers, and departure therefrom shall not be cause for rejection of the film.