

Wärmeaustauscher an eine Auftragsvorrichtung gebracht, die davon unter Druck eine gleichmässige Schicht auf die Emulsionsfläche des Films aufträgt. In der Entwicklungskammer wird eine konstant klimatisierte, wassergesättigte Atmosphäre unterhalten, indem Wasser im Umlauf gesprüht wird um Temperaturverluste zu vermeiden, die sich durch Verdampfungen des viskosen Entwicklers ergeben könnten. Der Entwickler wird dadurch entfernt, dass ein Wassersprühstrahl zwischen der Entwicklungskammer und dem Fixierabteil eingeschaltet wird. Durch Vergleichsprojektionen wurde zwischen den Ergebnissen von normaler Entwicklung und viskoser Schichtentwicklung eine sehr genaue Ähnlichkeit gezeigt. Wegen besonderer Wirkungen im unteren Gebiet der Schwärzungskurve erzeugt die viskose Schichtentwicklung ein etwas schärferes Bild. (Üb. J. A. Greuter)

### Verbesserte Kopierschwärzungen - Filter für die Densitometrie von Vorkopier-Farbmaterial

ORAN E. MILLER und STANLEY A. POWERS [695]

Ein neuer Filtersatz, genannt "Status M" zur Verwendung in elektronischen Farb-Densitometern erlaubt Ablesungen, welche gute Annäherungswerte genauer Kopierschwärzungen ergeben, wenn als Kopiermaterial Eastman Color Print Film oder Kodak Color Kopiermaterial zusammen mit Kodacolor oder Ektacolor Filmen verwendet wird. Die Fertigung und Vorteile der neuen Filter werden beschrieben und die Genauigkeit der Filter illustriert, indem Status M Ablesungen mit genauen Kopierschwärzungen verglichen werden. Die Bedeutung und Anwendungsmöglichkeiten der Kopierschwärzung werden rekapituliert. Es wird dabei besonders auf

die Standardisierung der Kopierschwärzung sowohl innerhalb des Labors als auch im Zusammenhang mit anderen Labors Wert gelegt. (Üb. J. A. Greuter)

### Ein neues Verfahren zur Bezeichnung des "Safe Title" Raumes auf dem Bildschirm der Fernseh-Vorschau

JOHN L. BOOR [700]

Probleme bezüglich Verluste beim Abstutzen werden kurz besprochen. Eine Beschreibung einer originellen Methode zur simultanen Bezeichnung eines identischen "safe title" Raumes auf sämtlichen Vorschauwirmen in einem Fernsehsystem wird gegeben. Durch einen elektronischen Erzeuger werden Bezeichnungssignale, gleichzeitig mit dem Videosignal, in die Vorschauwirmen geliefert. Vorteile des Systems sind kurz umrissen.

## standards and recommended practices

### Proposed American Standards

Five Proposed American Standards are published here for a trial period and public approval. Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to October 31.

Four of these proposals are a set of film dimensions standards covering 32mm film intended for use in production of 16mm films. The first two, PH22.71, Dimensions for 32mm Motion-Picture Film, 2R-3000, and PH22.72, Dimensions for 32mm Motion-Picture Film, 4R-3000, are proposed revisions of

existing standards. Actually, they are complete reaffirmations of the technical information differing only in an editorial manner to facilitate their use. The other two are companion standards covering the short-pitch version of the same film sizes: PH22.141, Dimensions for 32mm Motion-Picture Film, 2R-2994, and PH22.142, Dimensions for 32mm Motion-Picture Film, 4R-2994.

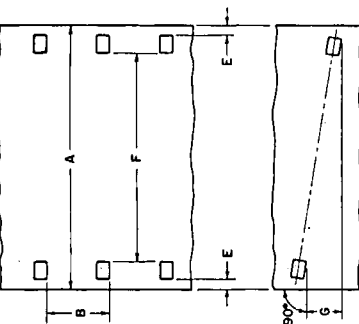
The remaining proposal, PH22.140, Specifications of 16mm Multifrequency Test Film, Perforated 1R-3000, Magnetic Type, is a new standard describing the popular magnetic test film supplied by the Society for the past ten years.—A.E.A.

# Dimensions for 32mm Motion-Picture Film, 2R-3000

PH22.71

Revision of  
PH22.71-1957

Page 1 of 2 pages



## 1. Scope

This standard specifies the cutting and perforating dimensions for 32mm motion-picture film having two rows of 16mm-type perforations, one row near each edge, and a perforation length pitch of 0.3000 in.

## 2. Dimensions

- 2.1 The dimensions shall be as given in the figure and table.
- 2.2 These dimensions pertain to a safety film as defined in Appendix A5.
- 2.3 These dimensions apply to material immediately after cutting and perforating.
- 2.4 Dimension L represents the length of any 100 consecutive pitch intervals.

| Dimensions                                       | Inches          | Millimeters    |
|--|-----------------|----------------|
| A Film Width                                     | 1.256 ± 0.001   | 31.900 ± 0.025 |
| B Length Pitch                                   | 0.3000 ± 0.0005 | 7.620 ± 0.013  |
| C Perforation Width                              | 0.0720 ± 0.0004 | 1.829 ± 0.010  |
| D Perforation Height                             | 0.0500 ± 0.0004 | 1.270 ± 0.010  |
| E Edge to Perforation                            | 0.0355 ± 0.0020 | 0.90 ± 0.05    |
| F Width between Perforations                     | 1.041 ± 0.002   | 26.44 ± 0.05   |
| G Perforation Skewness                           | 0.001 max       | 0.03 max       |
| L Length Pitch (100 consecutive pitch intervals) | 30.00 ± 0.03    | 762.0 ± 0.8    |
| R Radius of Perforation Fillet                   | 0.010 ± 0.001   | 0.25 ± 0.03    |

## Notes

- 1. The title of this standard was established by the application of a nomenclature system developed for all film dimension standards. Each title provides an indication of the film width, a code designation for the perforation shape (BH, KS, DH, or CS) or the number of rows of perforations (1R, 2R, or 4R), depending upon which is the significant factor, and the perforation pitch without the decimal point.
- 2. The dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947.

## Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 32mm Motion-Picture Film, 2R-3000, PH22.71, 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 agree exactly with the dimensions of the slitters, 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

NOT APPROVED

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 dimensional changes during film life. 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 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. Where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at time of printing (sprocket-type printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (2) the film thickness, (3) the film shrinkage and the rate at which shrinkage occurs.

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

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

For many years this desired difference in pitch was caused by the negative film's shrinkage during processing and aging. Current film bases shrink less than the earlier ones; hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing, and the aging that takes place before the release prints are made, then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative stock is 0.1866 in. 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 optimum width for 16mm film, which often goes through channels of fixed size, is controlled by the shrinkage characteristics of the films involved. Thus, in times past there have been standards for the width of 16mm stock of the "usual" shrinkage and for stock to obtain films of approximately the same width, regardless of the type of film base, during their useful life. This standard is based on the values adapted to "low-shrink" film base, since nearly all films now manufactured in the U.S. meet the definition noted below.

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

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

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

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

A6. When this film is used in the ultimate production of 16mm film, it is important that this 16mm film does not exceed 0.630 in. in width at time of use.

PH22.71—NOT APPROVED

# Dimensions for 32mm Motion-Picture Film, 4R-3000

PH22.72

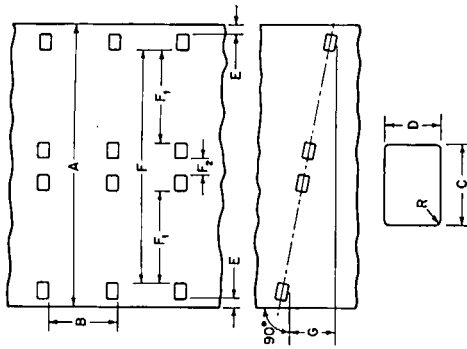
Revision of  
PH22.72-1957

## 1. Scope

This standard specifies the cutting and perforating dimensions for 32mm motion-picture film having four rows of 16mm-type perforations and a perforation length pitch of 0.3000 in.

## 2. Dimensions

- 2.1 The dimensions shall be as given in the figure and table.
- 2.2 These dimensions pertain to a safety film as defined in Appendix A5.
- 2.3 These dimensions apply to material immediately after cutting and perforating.
- 2.4 Dimension L represents the length of any 100 consecutive pitch intervals.



| Dimensions   | Inches          | Millimeters    |
|--|-----------------|----------------|
| A Film Width   | 1.256 ± 0.001   | 31.900 ± 0.025 |
| B Length Pitch   | 0.3000 ± 0.0005 | 7.620 ± 0.013  |
| C Perforation Width  | 0.0720 ± 0.0004 | 1.829 ± 0.010  |
| D Perforation Height                                       | 0.0500 ± 0.0004 | 1.270 ± 0.010  |
| E Edge to Perforation                                      | 0.0355 ± 0.0020 | 0.90 ± 0.05    |
| F Width between Perforations                               | 1.041 ± 0.002   | 26.44 ± 0.05   |
| F <sub>1</sub> Width between Outer and Center Perforations | 0.413 ± 0.001   | 10.49 ± 0.03   |
| F <sub>2</sub> Width between Center Perforations           | 0.071 ± 0.001   | 1.80 ± 0.03    |
| G Perforation Skewness                                     | 0.001 max       | 0.03 max       |
| L Length Pitch (100 consecutive pitch intervals)           | 30.00 ± 0.03    | 762.0 ± 0.8    |
| R Radius of Perforation Fillet                             | 0.010 ± 0.001   | 0.25 ± 0.03    |

## Notes

- 1. The title of this standard was established by the application of a nomenclature system developed for all film dimension standards. Each title provides an indication of the film width, a code designation for the perforation shape (8H, 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 Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947.

## Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 32mm Motion-Picture Film, 4R-3000, PH22.72, but is included to facilitate its use.)

- A1. The dimensions given in this standard represent the practice of film manufacturers in that the dimensions and tolerances are for film stock immediately after perforation. The punches and dies themselves

are made to tolerances considerably smaller than those given, but since film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches, and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in dimensional changes during film life. 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 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. Where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at time of printing (sprocket-type printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (2) the film thickness, (3) the film shrinkage and the rate at which shrinkage occurs.

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

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

For many years this desired difference in pitch was caused by the negative film's shrinkage during processing and aging. Current film bases shrink less than the earlier ones; hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing, and the aging that takes place before the release prints are made, then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative stock is 0.1866 in. 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 optimum width for 16mm, which often goes through channels of fixed size, is controlled by the shrinkage characteristics of the films involved. Thus, in times past there have been standards for the width of 16mm stock of the "usual" shrinkage and for stock of "low-shrinkage" characteristics. The purpose was to obtain films of approximately the same width, regardless of the type of film base, during their useful life. This standard is based on the values adopted for "low-shrink" film base, since nearly all films now manufactured in the U.S. meet the definition noted below.

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

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

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

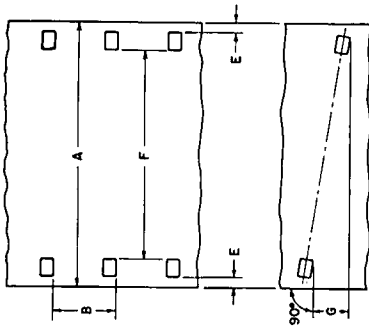
A5. This film is to be made on safety base complying with American Standard Specifications for Safety Photographic Film, PH1.25-1956, reaffirmed in 1962.

A6. When this film is used in the ultimate production of 16mm film, it is important that this 16mm film does not exceed 0.630 in. in width at time of use.

## Dimensions for 32mm Motion-Picture Film, 2R-2994

PH22.141

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### 1. Scope

This standard specifies the cutting and perforating dimensions for 32mm motion-picture film having two rows of 16mm-type perforations, one row near each edge, and a perforation length pitch of 0.2994 in.

### 2. Dimensions

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

2.2 These dimensions pertain to a safety film as defined in Appendix A.5.

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

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

| Dimensions                                       | Inches          | Millimeters    |
|--|-----------------|----------------|
| A Film Width                                     | 1.256 ± 0.001   | 31.900 ± 0.025 |
| B Length Pitch                                   | 0.2994 ± 0.0005 | 7.605 ± 0.013  |
| C Perforation Width                              | 0.0720 ± 0.0004 | 1.829 ± 0.010  |
| D Perforation Height                             | 0.0500 ± 0.0004 | 1.270 ± 0.010  |
| E Edge to Perforation                            | 0.0355 ± 0.0020 | 0.90 ± 0.05    |
| F Width between Perforations                     | 1.041 ± 0.002   | 26.44 ± 0.05   |
| G Perforation Skewness                           | 0.001 max       | 0.03 max       |
| H Length Pitch (100 consecutive pitch intervals) | 29.94 ± 0.03    | 760.5 ± 0.8    |
| R Radius of Perforation Fillet                   | 0.010 ± 0.001   | 0.25 ± 0.03    |

### Notes

- The title of this standard was established by the application of a nomenclature system developed for all film dimension standards. Each title provides an indicating of the film width, a code designation for the perforation shape (B, K, S, DH, or CS) or the number of rows of perforations (1R, 2R, or 4R), dependent on which is the significant factor, and the perforation pitch without the decimal point.
- The dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947.

### Appendix

This Appendix is not a part of Proposed American Standard Dimensions for 32mm Motion-Picture Film, 2R-2994, PH22.141, but is included to facilitate its use.

- The dimensions given in this standard represent the practice of film manufacturers; 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 dimensional changes during film life. 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 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. Where step-primers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at time of printing (sprocket-type printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (2) the film thickness, (3) the film shrinkage and the rate at which shrinkage occurs.

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

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

For many years this desired difference in pitch was caused by the negative film's shrinkage during processing and aging. Current film bases shrink less than the earlier ones; hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing, and the aging that takes place before the release prints are made, then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative stock is 0.1866 in. 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  $0.3 \pm 0.1$  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 optimum width for 16mm film, which often goes through channels of fixed size, is controlled by the shrinkage characteristics of the films involved. Thus, in times past there have been standards for the width of 16mm stock of the "usual" shrinkage and for stock of "low shrinkage" characteristics. The purpose was to obtain films of approximately the same width, regardless of the type of film base, during their useful life. This standard is based on the values adapted to "low-shrink" film base, since nearly all films now manufactured in the U.S. meet the definition noted below.

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

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

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

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

A6. When this film is used in the ultimate production of 16mm film, it is important that this 16mm film does not exceed 0.630 in. in width at time of use.

# Dimensions for 32mm Motion-Picture Film, 4R-2994

PH22.142

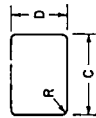
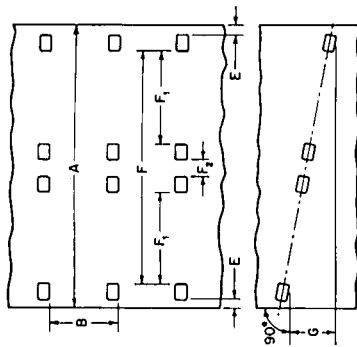
Page 1 of 2 pages

## 1: Scope

This standard specifies the cutting and perforating dimensions for 32mm motion-picture film having four rows of 16mm-type perforations and a perforation length pitch of 0.2994 in.

## 2. Dimensions

- 2.1 The dimensions shall be as given in the figure and table.
- 2.2 These dimensions pertain to a safety film as defined in Appendix A5.
- 2.3 These dimensions apply to material immediately after cutting and perforating.
- 2.4 Dimension L represents the length of any 100 consecutive pitch intervals.



| Dimensions   | Inches          | Millimeters    |
|--|-----------------|----------------|
| A Film Width   | 1.256 ± 0.001   | 31.900 ± 0.025 |
| B Length Pitch   | 0.2994 ± 0.0005 | 7.605 ± 0.013  |
| C Perforation Width  | 0.0720 ± 0.0004 | 1.829 ± 0.010  |
| D Perforation Height                                       | 0.0500 ± 0.0004 | 1.270 ± 0.010  |
| E Edge to Perforation                                      | 0.0355 ± 0.0020 | 0.90 ± 0.05    |
| F Width between Perforations                               | 1.041 ± 0.002   | 26.44 ± 0.05   |
| F <sub>1</sub> Width between Outer and Center Perforations | 0.413 ± 0.001   | 10.49 ± 0.03   |
| F <sub>2</sub> Width between Center Perforations           | 0.071 ± 0.001   | 1.80 ± 0.03    |
| G Perforation Skewness                                     | 0.001 max       | 0.03 max       |
| L Length Pitch (100 consecutive pitch intervals)           | 29.94 ± 0.03    | 760.5 ± 0.8    |
| R Radius of Perforation Fillet                             | 0.010 ± 0.001   | 0.25 ± 0.03    |

## Notes

- 1. The title of this standard was established by the application of a nomenclature system developed for all film dimension standards. Each title provides an indication of the film width, a code designation for the perforation shape (BH, KS, DH, or CS) or the number of rows of perforations (1R, 2R, or 4R), depending upon which is the significant factor, and the perforation pitch without the decimal point.
- 2. The dimensions in the inch system are the fundamental standard. The dimensions in the metric system are practical approximations based on American Standard Practice for Inch-Millimeter Conversion for Industrial Use, B48.1-1933, reaffirmed in 1947.

## Appendix

(This Appendix is not a part of Proposed American Standard Dimensions for 32mm Motion-Picture Film, 4R-2994, PH22.142, but is included to facilitate its use.)

- A1. The dimensions given in this standard represent the practice of film manufacturers in that the dimensions and tolerances are for film stock immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but since film is a plastic material, the

dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in dimensional changes during film life. 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 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. Where step-printers are used, and the film is stationary when exposed, the choice of pitch is not strictly limited. Where the film moves continuously over a cylindrical surface at time of printing (sprocket-type printer), there are three major considerations involved in choosing the pitch. These considerations are: (1) the sprocket diameter, (2) the film thickness, (3) the film shrinkage and the rate at which shrinkage occurs.

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

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

For many years this desired difference in pitch was caused by the negative film's shrinkage during processing and aging. Current film bases shrink less than the earlier ones; hence a shorter initial pitch becomes desirable. To satisfy this requirement for picture- or sound-negatives, it is common manufacturing practice to aim for a pitch value 0.2 percent shorter than the positive stock onto which they will be printed. The additional shrinkage that occurs during processing, and the aging that takes place before the release prints are made, then bring the pitch differential close to the optimum and desired value of 0.3 percent. Accordingly, the pitch chosen for the negative stock is 0.1866 in. or 0.2994 in., depending on whether the film width is 35mm or 16mm.

Low-shrink negative film perforated to these dimen-

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

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

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

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

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

A6. When this film is used in the ultimate production of 16mm film, it is important that this 16mm film does not exceed 0.630 in. in width at time of use.

PH22.142—NOT APPROVED

# Specifications of 16mm Multifrequency Test Film, Perforated 1R-3000, Magnetic Type

PH22.140

Page 1 of 2 pages

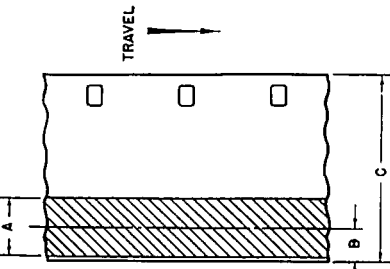


Table 1

| Dimensions | Inches        | Millimeters |
|------------|---------------|-------------|
| A          | 0.200 ± 0.002 | 5.08 ± 0.05 |
| B          | 0.103 ± 0.002 | 2.62 ± 0.05 |
| C          | 0.628 nom     | 15.95 nom   |

## 1. Scope

This standard specifies a multifrequency magnetic sound test film for use in standardizing the replay chain for magnetic sound film.

## 2. Test Film

**2.1 Dimensions of Sound Record.** The location and dimensions of an originally recorded magnetic sound record shall be in accordance with American Standard 200-Mil Magnetic Sound Record on 16mm Film Base Perforated One Edge, PH22.97-1956. (See figure and Table 1.)

**2.2 Test Frequencies.** The normal surface induction of the signal recorded on the film shall vary with frequency in accordance with the numerical values of Table 2: Tone frequencies and length of each section shall be in accordance with Table 2.

Table 2

| Frequency, cycles | Tone Footage, feet | Signal Level*    |                      | Frequency, cycles | Tone Footage, feet | Signal Levels    |                      |
|-------------------|--------------------|------------------|----------------------|-------------------|--------------------|------------------|----------------------|
|                   |                    | db ref. 10 gauss | absolute level gauss |                   |                    | db ref. 10 gauss | absolute level gauss |
| 7000†             | 30                 | +8.7             | 27.2                 | 3000              | 6                  | +4.7             | 17.2                 |
| 400               | 12                 | -10              | 3.16                 | 4000              | 6                  | +6.2             | 20.4                 |
| 50                | 6                  | -20              | 1.0                  | 5000              | 6                  | +7.2             | 22.9                 |
| 100               | 6                  | -17.8            | 1.29                 | 6000              | 6                  | +8.2             | 25.7                 |
| 200               | 6                  | -14.3            | 1.93                 | 7000              | 6                  | +8.7             | 27.2                 |
| 300               | 6                  | -11.8            | 2.57                 | 8000              | 6                  | +9.2             | 28.8                 |
| 500               | 6                  | -8.3             | 3.85                 | 9000              | 6                  | +10.2            | 32.4                 |
| 1000              | 6                  | -2.7             | 7.33                 | 10000             | 6                  | +11.2            | 36.3                 |
| 2000              | 6                  | +2.2             | 12.9                 | 400               | 12                 | -10              | 3.16                 |

\* The signal level tolerance shall be within ±1.5 db.  
† For azimuth adjustment.

**2.3 Mean Film Speed.** The recording and reproducing mean film speed shall be at a rate of 24 perforations per second (approximately 36 feet per minute). Deviations from the mean speed shall not exceed ±1 percent.

**2.4 Frequency Tolerance.** The recorded signal shall not vary in excess of ±2 percent of the nominal frequency of each portion of the test track.

## 3. Calibration

**3.1 Calibration Method.** The film shall be calibrated in accordance with the short-gap method, as described in the following references:

J. D. Bick, "Methods of measuring surface induction of magnetic tape," J. Audio Eng. Soc., 1:4, Jan. 1953, reprinted Jour. SMPTE, 60: 516-525, April (Pt. II) 1953.

E. D. Daniel and P. E. Axon, "The reproduction of signals recorded on magnetic tape," Proc. IEE, Part III: 157, May 1953.

Robert Schwartz, Sheldon I. Wilpon and Frank A. Comerci, "Absolute measurement of signal strength on magnetic recordings," Jour. SMPTE, 64: 1-5, January 1955.

A separate table shall be supplied with each test film showing the correction for each frequency which shall be added algebraically to the output level measured using the film to give a recorded level related to the frequency in accordance with Table 2.

**3.2 Calibration Tolerance.** The calibration tolerance shall be within ± 1/2 db of the true signal level.

(NOTE: A test film in accordance with this standard is available from the Society of Motion Picture and Television Engineers.)

**2.5 Reference Signal Level.** The 400-cycle signal shall be -10 db absolute level (3.16 gauss) in accordance with American Standard Specifications of 16mm 400-Cycle Signal Level Test Film, Perforated 1R-3000, Magnetic Type, PH22.132-1963. (A test film in accordance with PH22.132 is available from the Society of Motion Picture and Television Engineers.)

**2.6 Permissible Flutter.** The total rms flutter of the sound record shall not exceed 0.1 percent, as measured in accordance with American Standard Method for Determining Flutter Content of Sound Recorders and Reproducers, Z57.1-1954.

**2.7 Film Stock.** The film stock used for the test film shall be cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.

**2.8 Film Identification.** Each test film shall be provided with a suitable leader and trailer identifying the test film.

**2.9 Distortion.** The total harmonic distortion of each of the recorded signals from 50 to 3000 cps shall not exceed 3 percent.

(NOTE: The present state of the art does not permit the meaningful measurement of harmonic distortion above 3000 cps.)