tion. That the experiment was a success is proven by the subject, Howard Payne, having increased his performance to set a new British record in the sport and to achieve the Olympic qualifying standard.

The final paper by S. F. Goldstein, M. E. J. Holwill and N. R. Sylvester of Queen Elizabeth College, London, had an intriguing title, "Laser Micro-Beam Irradiation of Micro-Organisms." It was presented by Dr. Goldstein and concerned studies of sperm-like micro-organisms and the action of their whip-like tails. The laser micro-beam is used to cut the tail at different points along it and then note the ability of the organism to maintain or change its mode of tail action is noted. The films are made through a microscope with a synchronized strobe-illumination. A number of interesting facts about the decision-making cells of such organisms have been deduced.

The conference as a whole ran very smoothly and all papers were clearly presented. Discussion was widespread and active especially in the coffee lounge around the exhibits including a live demonstration of the Dawe Cine-Strobe.

The Association's next conference is to be in conjunction with the Shock-Tube Liaison Group and will be held at Liverpool University about Easter 1970. The Autumn Conference 1970 will be in London and will be a report of the Denver International Conference.

Erratum

There is given below information to correct what was regrettably not properly given in the original *Journal* publication.

NOVEMBER 1969

On pp. 941, 942, paper by Max Berry and John Poole, Figs. 10 through 15:

Figure titles remain in the order given but figures (diagrams) should be transposed as follows: the diagram printed as Fig. 10 becomes Fig. 15; diagrams printed as Figs. 11 through Fig. 15 become Figs. 10 through 14, respectively.

standards and recommended practices

Approved American National Standards

On September 2, 1969, the American National Standards Institute approved four new American National Standards which are published here for your information.

Three of the standards, PH22.8-1969, Dimensions of Projectable Image Area on 16mm Motion-Picture Film, PH22.20-1969, Dimensions of Projectable Image Area on 8mm Motion-Picture Film, and PH22.58-1969, Dimensions of Projectable Image Area on 35mm Nonanamorphic Motion-Picture Film, are in fact reaffirmations of the earlier issues being modified editorially to specify the pictorial area on the film and not an opening in a piece of metal. Previously these documents were referred to as projection aperture standards. It is obvious that the aperture dimension will vary with respect to its physical location in the optical system and cannot be specified in a standard.

The fourth standard, PH22.152-1969, Dimensions of Projectable Image Area on 70mm Motion-Picture Film, reflects established engineering practices.

American National Standard Reaffirmed

On October 15, 1969, the American National Standards Institute, taking the recommendation of the SMPTE Engineering Committees and the ANSI Standards Committee PH22, reaffirmed without change PH22.35-1962, Dimensions for 16-Tooth 35mm Motion-Picture Projector Sprockets (published in May 1962 *Journal*).

Withdrawal of American National Standards

On October 9, 1969, the American National Standards Institute approved the withdrawal of the following two ANSI Standards. The withdrawal of PH22.60-1959, Theater Sound Test Film for 35mm Motion-Picture Sound Reproducing Systems, and PH22.79-1950, 16-Millimeter Sound Projector Test Film has been initiated because it was felt that the subject matter was inappropriate as an ANSI Standard and has been published as an SMPTE Recommended Practice, RP 35, Specifications for Theater Test Film for Motion-Picture Projection Sound Reproducing Systems, published in the November 1968 *Journal*. PH22.60 and PH22.79 were published in the November 1948 and April 1950 issues of the *Journal*.— *A.E.A.*

USA Standard

USAS PH22.8–1969

Dimensions of Projectable Image Area on 16mm Motion-Picture Film

Revision of PH22.8-1957

Approved September 2, 1969
Sponsor: Society of Motion Picture and Television Engineers, Inc.

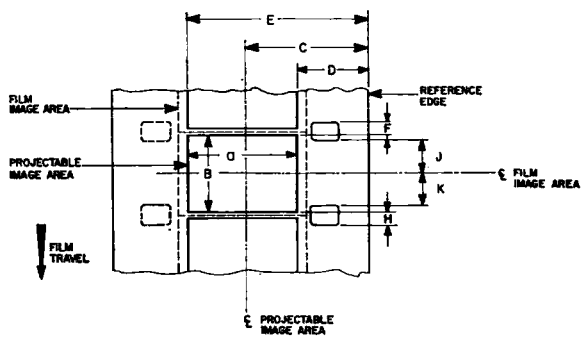
1. Scope

This standard specifies the maximum dimensions of the film image area intended for projection from a 16mm motion-picture film, and the placement of this area relative to the perforations and the reference edge of the film.

2. Dimensions

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

2.2 The angle between the horizontal edges of the image area and the reference edge of the film shall be 90° ± ½°.



PROJECTABLE AREA ON FILM AS SEEN LOOKING THROUGH THE FILM TOWARD THE LENS

Dimensions	Inches	Millimeters
B	0.286 max	7.26 max
D	0.122 min	3.10 min
E	0.506 max	12.85 max
F=H	within 0.014	within 0.36
The following values are included for convenience		
a	0.380 ref	9.65 ref
c	0.314 ref	7.98 ref
j=k	nominally equal	nominally equal

3. Relationship to Other Standards

3.1 This standard may be used as the basis for establishing picture areas from original photography for final viewing because it presents a description of the picture area on the projection print that is usable for the indicated purposes of the print (which is of primary importance because the projection print is the most commonly interchanged item). (See Appendix A2.)

3.2 The following standards define image areas for other important phases of motion-picture operations, and are consistent with this standard and with one another under currently acceptable commercial practice:

PH22.7-1964, Dimensions of 16mm Motion-Picture Camera Aperture Image

PH22.46-1946 (R1959), 16-Millimeter Positive Aperture Dimensions and Image Size for Positive Prints Made from 35-Millimeter Negatives

PH22.47-1946 (R1959), Negative Aperture Dimensions and Image Size for 16-Millimeter Duplicate Negatives Made from 35-Millimeter Positive Prints

PH22.48-1965, Location of Printed Areas in 16mm Picture and Sound Contact Printing

PH22.92-1953 (R1959), Enlargement Ratio for 16mm to 35mm Optical Printing

PH22.96-1963 (R1969), Dimensions for Television Image Area on 16mm Motion-Picture Film

SMPTE RP 8-1968, Safe Action and Safe Title Areas for TV Transmission

NOTE 1: Camera and Printer Apertures. The actual image on the film is significantly larger than the maximum area intended for projection, so that in placement of the images throughout the sequence of films the tolerance is not restrictive of commercial practice. Upper limits have been established through consideration of good practice in avoiding frame overlap, encroachment upon areas reserved for optical sound records, flare from perforation edges, etc. Lower limits are similarly related to the avoidance of image effects at a defined edge, tolerances in film positioning, etc.

NOTE 2: Projector Aperture. Dimensions B, D, and E define the maximum image area on the film that is available for projection. They do not define the opening in the aperture plate of a projector. The size of this opening may differ from Dimensions a and B, for example, because of the physical separation necessary between the aperture plate and the film to avoid scratching the film, the slant of the marginal rays accepted by the projection lens, etc.

NOTE 3: Actual Projected Area. It is recognized that, in many cases, the actual film image area that is projected may be smaller than the projectable maximum and, in some cases, may be non-rectangular (for example, an irregular four-sided figure bound by either straight or curved lines). Such departures may result from equipment considerations, such as slight inconsistencies among lenses, screen sizes, etc.; from geometric limitations such as the screen surface being at an angle other than 90° from the projection axis, or being nonplanar, or both; and from aesthetic considerations such as pictorial composition within more restrictive image limits. In the absence of specific instructions to the contrary, it is intended that the actual projected film image area be the largest appropriately-shaped figure that can be inscribed within the specified dimensions.

When the picture outline on the screen is defined by the projector aperture, it is customary to round the corners of the projected film area. A maximum corner radius of 0.020 in. (0.51mm) at the film plane is recommended.

NOTE 4: Film Perforations. Film intended for projection with this image area is normally perforated as specified in USA Standard Dimensions for 16mm Motion-Picture Film, 2R-3000, PH22.5-1964, and USA Standard Dimensions for 16mm Motion-Picture Film, 1R-3000, PH22.12-1964.

NOTE 5: Print Preparation. Prints conforming to this standard are prepared for use as specified in USA Standard Specifications for Projector Usage of 16mm Motion-Picture Film Perforated Two Edges, PH22.10-1964, and USA Standard Specifications for Projector Usage of 16mm Motion-Picture Film Perforated One Edge, PH22.16-1965.

Appendix

(This Appendix is not a part of this USA Standard, but is included to facilitate its use.)

A1. Centerlines

The centerlines of the image area are given for convenience in interpreting the standard, facilitating such applications as the optical design of equipment, and assisting in the understanding of suitable mechanical embodiments related to projectable image area.

A2. Projectable Image Area

Essentially, the entire image within the maximum established by this standard will be transferred in such operations as reduction or enlargement printing (PH22.46, PH22.47 and PH22.92), for television broadcasting (PH22.96), etc. Since the entire area will be presented, it is important that the projectable area include only material that meets recognized standards for technical and artistic excellence.

A3. Image Area for Television

It is recognized that home television receivers are adjusted to show a distribution of picture sizes, ranging downward from the maximum. Guides to picture composition, based upon a statistical survey of receivers in use, are presented in SMPTE Recommended Practice RP 8. Note that some portion of the audience will see the entire transmitted area, but for certainty in presentation of critical information over broadcast television, such information should be confined to a smaller, central area.

USA Standard

Dimensions of Projectable Image Area on 8mm Motion-Picture Film

USAS PH22.20–1969

Revision of PH22.20-1957

Approved September 2, 1969
Sponsor: Society of Motion Picture and Television Engineers, Inc.

1. Scope

This standard specifies the maximum dimensions of the film image area intended for projection from an 8mm motion-picture film, and the placement of this area relative to the perforations and the reference edge of the film.

2. Dimensions

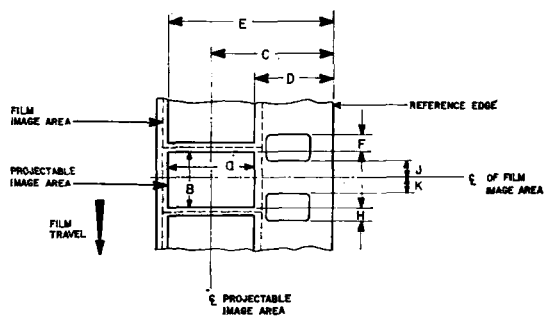
2.1 The dimensions shall be as given in the figure and table.

2.2 The angle between the horizontal edges of the image area and the reference edge of the film shall be 90° ± ½°.

3. Relationship to Other Standards

3.1 This standard may be used as the basis for establishing picture areas from original photography for final viewing because it presents a description of the picture area on the projection print that is usable for the indicated purposes of the print (which is of primary importance because the projection print is the most commonly interchanged item).

3.2 USA Standard Dimensions of 8mm Motion-Picture Camera Aperture Image, PH22.19-1964, defines the image area for other important phases of motion-picture operations, and is consistent with this standard under currently acceptable commercial practice.



PROJECTABLE AREA ON FILM AS SEEN LOOKING THROUGH THE FILM TOWARD THE LENS

Dimensions	Inches	Millimeters
B	0.130 max	3.30 max
D	0.117 min	2.97 min
E	0.293 max	7.44 max
F=H	within 0.014	within 0.36
The following values are included for convenience		
a	0.172 ref	4.37 ref
c*	0.205 ref	5.21 ref
j=k	nominally equal	nominally equal

*See Appendix.

NOTE 1: Camera and Printer Apertures. The actual image on the film is significantly larger than the maximum area intended for projection, so that in placement of the images throughout the sequence of films the tolerance is not restrictive of commercial practice. Upper limits have been established through consideration of good practice in avoiding frame overlap, encroachment upon areas reserved for sound records, flare from perforation edges, etc. Lower limits are similarly related to the avoidance of image effects at a defined edge, tolerances in film positioning, etc.

NOTE 2: Projector Aperture. Dimensions B, D, and E define the maximum image area on the film that is available for projection. They do not define the opening in the aperture plate of a projector. The size of this opening may differ from Dimensions a and B, for example, because of the physical separation necessary between the aperture plate and the film to avoid scratching the film, the slant of the marginal rays accepted by the projection lens, etc.

NOTE 3: Actual Projected Area. It is recognized that, in many cases, the actual film image area that is projected may be smaller than the projectable maximum and, in some cases, may be non-rectangular (for example, an irregular four-sided figure bound by either straight or curved lines). Such departures may result from equipment considerations, such as slight inconsistencies among lenses, screen sizes, etc.; from geometric limitations such as the screen surface being at an angle other than 90° from the projection axis, or being nonplanar, or both; and from aesthetic considerations such as pictorial composition within more restrictive image limits. In the absence of specific instructions to the contrary, it is intended that the actual projected film image area be the largest appropriately-shaped figure that can be inscribed within the specified dimensions.

When the picture outline on the screen is defined by the projector aperture, it is customary to round the corners of the projected film area. A maximum corner radius of 0.010 in. (0.25mm) at the film plane is recommended.

NOTE 4: Film Perforations. Film intended for projection with this image area is normally perforated as specified in USA Standard Dimensions for 16mm Motion-Picture Film, Perforated 8mm, 2R-1500, PH22.17-1965.

NOTE 5: Print Preparation. Prints conforming to this standard are prepared for use as specified in USA Standard Specifications for Projector Usage of 8mm Motion-Picture Film Perforated One Edge, PH22.22-1964.

Appendix

(This Appendix is not a part of this USA Standard, but is included to facilitate its use.)

The centerlines of the image area are given for convenience in interpreting the standard, facilitating such applications as the optical design of equipment, and assisting in the understanding of suitable mechanical embodiments related to projectable image area. Note that the centerline of the projectable image area is displaced from the centerline of the film by 0.048 in. (1.22mm) nominal.

USA Standard

USAS PH22.58–1969

Dimensions of Projectable Image Area on 35mm Nonanamorphic Motion-Picture Film

Revision of PH22.58-1954

Approved September 2, 1969
Sponsor: Society of Motion Picture and Television Engineers, Inc.

1. Scope

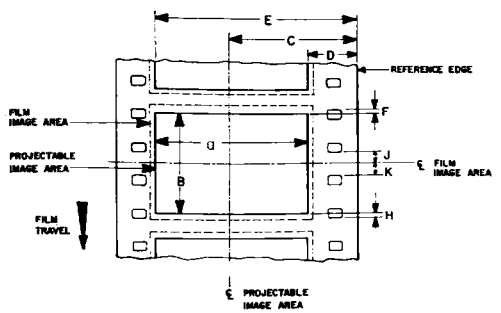
This standard specifies the maximum dimensions of the film image area intended for projection from a 35mm nonanamorphic motion-picture film, and the placement of this area relative to the perforations and the reference edge of the film.

2. Dimensions

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

3. Relationship to Other Standards

3.1 This standard may be used as the basis for establishing picture areas from original photography for final viewing because it presents a description of the picture area on the projection print that is usable for the indicated purposes of the print (which is of primary importance because the projection print is the most commonly interchanged item). (See Appendix A2.)



PROJECTABLE AREA ON FILM AS SEEN LOOKING THROUGH THE FILM TOWARD THE LENS

Dimensions	Inches	Millimeters
B	0.602 max	15.29 max
D	0.324 min	8.23 min
E	1.151 max	29.24 max
F=H	within 0.012	within 0.30
The following values are included for convenience		
a	0.825 ref	20.96 ref
c*	0.738 ref	18.75 ref
j=k	nominally equal	nominally equal

*See Appendix.

3.2 The following standards define image areas for other important phases of motion-picture operations, and are consistent with this standard and with one another under currently acceptable commercial practice:

PH22.46-1946 (R1959), 16-Millimeter Positive Aperture Dimensions and Image Size for Positive Prints Made from 35-Millimeter Negatives

PH22.47-1946 (R1959), Negative Aperture Dimensions and Image Size for 16-Millimeter Duplicate Negatives Made from 35-Millimeter Positive Prints

PH22.59-1966, Dimensions of 35mm Motion-Picture Camera Aperture Images

PH22.92-1953 (R1959), Enlargement Ratio for 16mm to 35mm Optical Printing

PH22.95-1963 (R1969), Dimensions for Television Image Area on 35mm Motion-Picture Film

PH22.111-1965, Dimensions of Exposed Areas for Picture and Photographic Sound on 35mm Motion-Picture Prints Made on Continuous Contact Printers

SMPTE RP 8-1968, Safe Action and Safe Title Areas for TV Transmission

NOTE 1: Camera and Printer Apertures. The actual image on the film is significantly larger than the maximum area intended for projection, so that in placement of the images throughout the sequence of films the tolerance is not restrictive of commercial practice. Upper limits have been established through consideration of good practice in avoiding frame overlap, encroachment upon areas reserved for optical sound records, flare from perforation edges, etc. Lower limits are similarly related to the avoidance of image effects at a defined edge, tolerances in film positioning, etc.

NOTE 2: Projector Aperture. Dimensions B, D, and E define the maximum image area on the film that is available for projection. They do not define the opening in the aperture plate of a projector. The size of this opening may differ from Dimensions a and B, for example, because of the physical separation necessary between the aperture plate and the film to avoid scratching the film, the slant of the marginal rays accepted by the projection lens, etc.

NOTE 3: Actual Projected Area. It is recognized that, in many cases, the actual film image area that is projected may be smaller than the projectable maximum, and in some cases, may be non-rectangular (for example, an irregular four-sided figure bound by either straight or curved lines). Such departures may result from equipment considerations, such as slight inconsistencies among lenses, screen sizes, etc.; from geometric limitations such as the screen surface being at an angle other than 90° from the projection axis, or being nonplanar, or both; and from aesthetic considerations such as pictorial composition within more restrictive image limits. In the absence of specific instructions to the contrary, it is intended that the actual projected film image area be the largest appropriately-shaped figure that can be inscribed within the specified dimensions.

NOTE 4: Film Perforations. Film intended for projection with this image area is normally perforated as specified in USA Standard Dimensions for 35mm Motion-Picture Film, DH-1870, PH22.1-1964, and USA Standard Dimensions for 35mm Motion-Picture Film, KS-1870, PH22.36-1964.

NOTE 5: Print Preparation. Prints conforming to this standard are prepared for use as specified in USA Standard 35mm Photographic Sound Motion-Picture Film, Usage in Projector, PH22.3-1961.

Appendix

(This Appendix is not a part of this USA Standard, but is included to facilitate its use.)

A1. Centerlines

The centerlines of the image area are given for convenience in interpreting the standard, facilitating such applications as the optical design of equipment, and assisting in the understanding of suitable mechanical embodiments related to projectable image area. Note that the centerline of the projectable image area is displaced from the centerline of the film by 0.050 in. (1.27mm) nominal.

A2. Projectable Image Area

Essentially, the entire image within the maximum established by this standard will be transferred in such operations as reduction or enlargement printing (PH22.46, PH22.47 and PH22.92), for television broadcasting (PH22.95), etc. Since the entire area will be presented, it is important that the projectable area include only material that meets recognized standards for technical and artistic excellence.

A3. Image Area for Television

It is recognized that home television receivers are adjusted to show a distribution of picture sizes, ranging downward from the maximum. Guides to picture composition, based upon a statistical survey of receivers in use, are presented in SMPTE Recommended Practice RP 8. Note that some portion of the audience will see the entire transmitted area, but for certainty in presentation of critical information over broadcast television, such information should be confined to a smaller, central area.

A4. Image Area for Theatrical Projection

For aesthetic and practical reasons, theatrical projection may present 35mm images in such a manner that the full width of the projectable area is shown but the projected height is less than maximum. Photography designed primarily for theatrical exhibition recognizes this and is composed for the more elongated rectangles. Several aspect ratios for the final projected picture are recognized through usage:

	Film Image Height	
Aspect Ratio	Inches	Millimeters
1.38:1	0.602 max	15.29 max
1.66:1	0.497 ref	12.62 ref
1.75:1	0.472 ref	11.99 ref
1.85:1	0.446 ref	11.33 ref

In every case, it is intended that the projected area be symmetrically located about the horizontal centerline of the maximum projectable area.

It is recommended that pictures designed to be shown at aspect ratios other than that specified in this standard be so marked in a conspicuous manner. The Universal Leader (described in USA Standard Specifications for Leaders and Cue Marks for 35mm and 16mm Sound Motion-Picture Release Prints, PH22.55-1966) provides for aspect ratio identification on frames 6-10.

A5. Centering of Image

For convenience in threading and framing the projector, the vertical centering of the pictorial information may be judged from the circular pattern surrounding the timing numbers in the Synchronizing Section of the Universal Leader as follows:

Full Frame	0.602 max	1.38:1
Larger White Circle	0.535 ref	RP 8
Smaller White Circle	0.446 ref	1.85:1

USA Standard

USAS PH22.152-1969

Dimensions of Projectable Image Area on 70mm Motion-Picture Film

Approved September 2, 1969
Sponsor: Society of Motion Picture and Television Engineers, Inc.

1. Scope

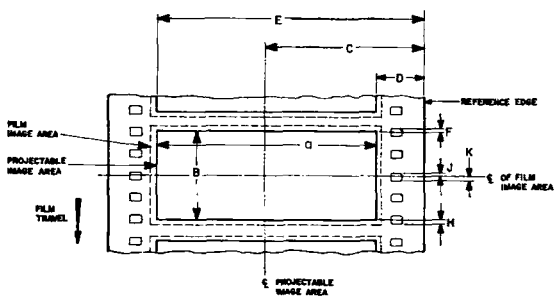
This standard specifies the maximum dimensions of the film image area intended for projection from a 70mm motion-picture film, and the placement of this area relative to the perforations and the reference edge of the film.

2. Dimensions

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

3. Relationship to Other Standards

This standard may be used as the basis for establishing picture areas from original photography for final viewing because it presents a description of the picture area on the projection print that is usable for the indicated purposes of the print (which is of primary importance because the projection print is the most commonly interchanged item). (See Appendix A2.)



PROJECTABLE AREA ON FILM AS SEEN LOOKING THROUGH THE FILM TOWARD THE LENS

Dimensions	Inches	Millimeters
B	0.870 max	22.10 max
D	0.420 min	10.67 min
E	2.334 max	59.28 max
F=H	within 0.008	within 0.20
The following values are included for convenience		
a	1.912 ref	48.56 ref
c	1.377 ref	34.98 ref
j=k	nominally equal	nominally equal

NOTE 1: Camera and Printer Apertures. The actual image on the film is significantly larger than the maximum area intended for projection, so that in placement of the images throughout the sequence of films the tolerance is not restrictive of commercial practice. Upper limits have been established through consideration of good practice in avoiding frame overlap, encroachment upon areas reserved for sound records, flare from perforation edges, etc. Lower limits are similarly related to the avoidance of image effects at a defined edge, tolerances in film positioning, etc.

NOTE 2: Projector Aperture. Dimensions B, D, and E define the maximum image area on the film that is available for projection. They do not define the opening in the aperture plate of a projector. The size of this opening may differ from Dimensions a and B, for example, because of the physical separation necessary between the aperture plate and the film to avoid scratching the film, the slant of the marginal rays accepted by the projection lens, etc.

NOTE 3: Actual Projected Area. It is recognized that, in many cases, the actual film image area that is projected may be smaller than the projectable maximum and, in some cases, may be non-rectangular (for example, an irregular four-sided figure bound by either straight or curved lines). Such departures may result from equipment considerations, such as slight inconsistencies among lenses, screen sizes, etc.; from geometric limitations such as the screen surface being at an angle other than 90° from the projection axis, or being nonplanar, or both; and from aesthetic considerations such as pictorial composition within more restrictive image limits. In the absence of specific instructions to the contrary, it is intended that the actual projected film image area be the largest appropriately-shaped figure that can be inscribed within the specified dimensions.

NOTE 4: Film Perforations. Film intended for projection with this image area is normally perforated as specified in USA Standard Dimensions for 70mm Motion-Picture Film, Perforated 65mm, KS-1870, PH22.119-1967.

Appendix

(This Appendix is not a part of this USA Standard, but is included to facilitate its use.)

A1. Centerlines

The centerlines of the image area are given for convenience in interpreting the standard, facilitating such applications as the optical design of equipment, and assisting in the understanding of suitable mechanical embodiments related to projectable image area.

A2. Projectable Image Area

Essentially, the entire image within the maximum established by this standard will be transferred in such operations as reduction printing and other indirect uses of the picture information. Since the entire area will be presented, it is important that the projectable area include only material that meets recognized standards for technical and artistic excellence.