standards and recommended practices

Draft USA Standards

Five draft USA Standards are published here for a trial period and public review. Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters before November 31, 1968. The proposals have also been submitted to USASI Standards Committee PH22. Consequently, all comments received through *Journal* publication will be reviewed prior to the conclusion of action by the PH22 Committee.

Three of the proposals are revisions of existing standards: PH22.8, Dimensions of Projectable Image Area on 16mm Motion-Picture Film, PH22.20, Dimensions of Projectable Image Area on 8mm Motion-Picture Film, and PH22.58, 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 has become 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 additional two proposals are new standards reflecting established engineering practices: PH22.152, Dimensions of Projectable Image Area on 70mm Motion-Picture Film; and PH22.154, Dimensions of Projectable Image Area on Super 8 Motion-Picture Film.

Draft USA Standard Dimensions of

Projectable Image Area on 16mm Motion-Picture Film

PH22.8

Revision of PH22.8:1957

Page 1 of 3 pages

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

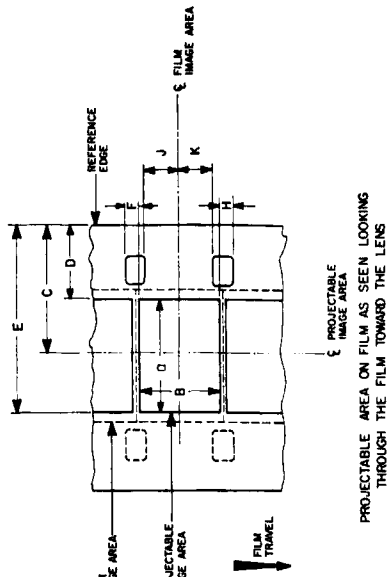
2.1 The dimensions shall be as given in the figure and table.

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

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:



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

NOT APPROVED

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, 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 non-planar, 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.

Draft USA Standard Dimensions of

Projectable Image Area on 8mm Motion-Picture Film

PH22.20

Revision of PH22.20-1957

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.

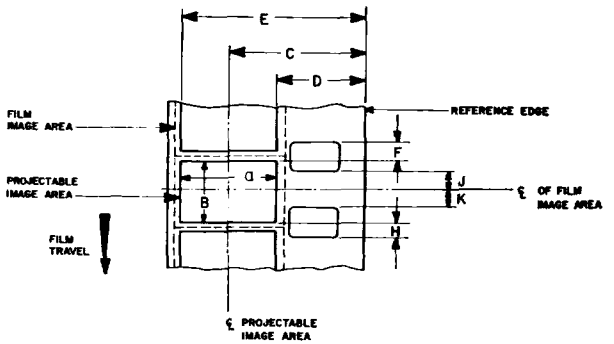
2. Dimensions

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).



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.

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.

NOT APPROVED

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.

Draft USA Standard Dimensions of

Projectable Image Area on 70mm Motion-Picture Film

PH22.152

1. Scope

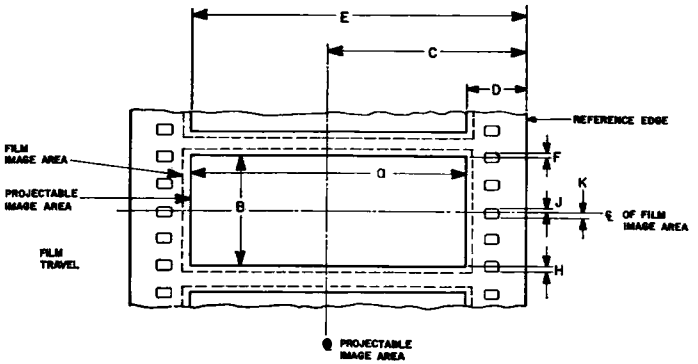
This standard specifies the maximum dimensions of the film image area intended for projection from a 70mm motion-picture film, and the placement of this area relative to the perforations and the reference edge of the film.

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

NOT APPROVED

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.

Draft USA Standard Dimensions of

Projectable Image Area on Super 8 Motion-Picture Film

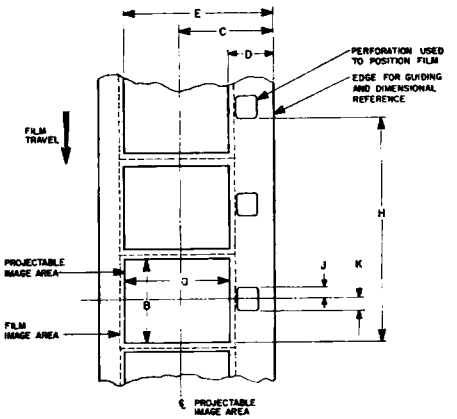
PH22.154

1. Scope

This standard specifies the maximum dimensions of the film image area intended for projection from a super 8 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.



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

Dimensions	Inches	Millimefers
B	0.158 max	4.01 max
D	0.063 min	1.60 min
E	0.278 max	7.06 max
H*	0.389 nom	9.88 nom
The following values are included for convenience		
a	0.209 ref	5.31 ref
c**	0.170 ref	4.32 ref
j=k	nominally equal	nominally equal

*See Note 6.

**See Appendix.

NOT APPROVED

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

2.3 Dimension H is measured lengthwise along the path of the film from the bottom of the maximum image area projected by the aperture to the bottom of the frame-positioning perforation (two perforations above the perforation adjacent to the projected image).

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 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:

PH22.153-1967, Location of Printed Area in Super 8 Optical Reduction Printing on 16mm Motion-Picture Film

PH22.157-1957, Dimensions of Camera Aperture Image on Super 8 Motion-Picture Film

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 non-planar, 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 8mm Motion-Picture Film, Perforated Super 8, 1R-1667, PH22.149-1967.

NOTE 5: Print Preparation. Prints conforming to this standard are prepared for use as specified in USA Standard Specifications for Projector Usage of Super 8 Motion-Picture Film, PH22.155-1967.

NOTE 6: Dimension H. In this format, the positioning of the projectable image with respect to the film perforations has been established by the nominal value H, together with limitations on image positioning in the following standards:

PH22.153-1967, Location of Printed Area in Super 8 Optical Reduction Printing on 16mm Motion-Picture Film

PH22.157-1967, Dimensions of Camera Aperture Image on Super 8 Motion-Picture Film

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 0.013 in. (0.33mm) nominal.

PH22.154—NOT APPROVED

Draft USA Standard Dimensions of

Projectable Image Area on 35mm Nonanamorphic Motion-Picture Film

PH22.58

Revision of PH22.58-1954

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.

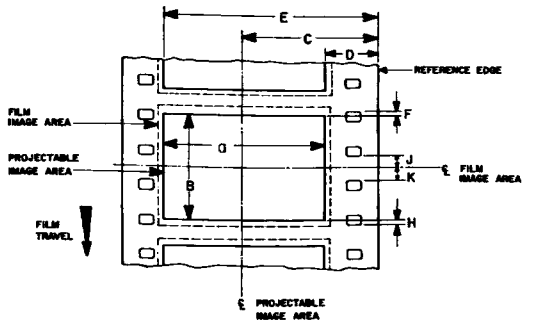
2. Dimensions

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.)

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:



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.

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 Dimensions

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

PH22.95-1963, 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