SMPTE RECOMMENDED PRACTICE

RP 12–1988

Screen Luminance for Drive-In Theaters

1. *Scope*

1.1 This practice specifies the luminance (measured brightness) of the projection screens for drive-in theaters intended for the projection of motion-picture film at 24 frames/sec.

1.2 The practice defines luminance ratios among portions of the total screen area, and defines the acceptable variations as viewed from positions within the audience area.

1.3 The practice applies to both diffusing and directional screens.

1.4 Recognizing the complexities and difficulties of drive-in projection, the practice describes criteria for evaluation of performance that is less than optimum, based upon a minimum luminance level and a maximum luminance variation.

2. *Measurement*

2.1 Measurement of screen luminance and color of projection light is made with the projector in complete operation with its lens set at focus position, but with no film in the aperture, and under ambient light conditions similar to those existing during show time.

2.2 Screen luminance shall be measured with a photometer having the spectral luminous efficiency of the standard observer (photopic vision) as defined in American National Standard Nomenclature and Definitions for Illuminating Engineering, ANSI/IES RP 16-1986.

2.3 The acceptance angle of the photometer shall be 2 degrees or less. When in use within a theater, the instrument shall be so located along the line of sight to the screen area being measured as to accept light from a screen area no larger than a circle whose diameter is 10 percent of the screen width.

3. *Luminance Level*

3.1 In an ideal situation, when permitted by the technology of motion-picture projection, and when the viewing environment is sufficiently close to that of the indoor theater, the screen luminance and distribution shall be that specified in American National Standard for Motion-Picture Film—Screen Luminance and Viewing Conditions—Indoor Theater Projection, ANSI/SMPTE 196M-1986, 16 ± 2 footlamberts (55 ± 7 candelas per square meter), as measured from a position on the longitudinal centerline of the ramp area and midway between the foremost and rearmost ramps.

3.2 The recommended minimum luminance at the center of the screen shall be 7 fL (24 cd/m²), as measured from the central position defined in Section 3.1.

3.3 When maximum compromise must be made, as discussed in Appendixes A1 and A2, the luminance at the center of the screen, measured from any car position, shall in no case be less than 4.5 fL (15 cd/m²).

4. *Luminance Distribution*

4.1 The luminance at a distance of 10 percent of the screen width from the side edges of the screen, and on its horizontal axis, as measured from the central position defined in Section 3.1, shall be compared with the center luminance reading obtained, and shall fall within the range of 55 to 100 percent of that reading. The distribution of projection illumination shall be symmetrical about the geometric center of the screen.

4.2 The minimum luminance measured from any car position to any point on the horizontal centerline of the screen within the 10-percent points defined in Section 4.1 shall be no less than 33 percent of the maximum luminance on the horizontal centerline measured from that same position.

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5. *Spectral Distribution*

The light reflected from the screen shall have a spectral distribution approximating that of a black-body at a color temperature of 5400 K ± 400 K, the use of a short-arc xenon or carbon-arc light source being assumed.

6. *Multiple Projector Adjustment*

6.1 When the presentation involves changeovers among two or more projectors operating to the same screen format, their luminances as measured in Section 3.1 shall agree within a maximum range of 10 percent.

6.2 When the presentation involves changeovers among two or more projectors operating to different screen formats or areas, their luminances as measured in Section 3.1 shall agree within a maximum range of 15 percent.

6.3 The apparent color of the projection light from projectors intended for interchangeably sequential operation shall be consistent with one another within a range of no more than 400 K.

Appendix

(This Appendix is not part of the SMPTE Recommended Practice, but is included for information only.)

A1. Standard Luminance

As a minimum goal for theater maintenance and adjustment, it is a consensus that there is a working threshold for luminance below which picture quality is noticeably degraded. Under this condition, the operation becomes very sensitive to sky light, neighboring luminances interfere, adjustment of projection equipment becomes more critical, and mood or key variations in the prints become distracting and the presentation begins to lose its artistic purpose. Permissible luminance range is limited by the criterion that a good release print must provide acceptable quality when projected at any luminance within the range.

A2. Operating Luminance

Picture quality is most desirable in drive-in theaters where it is possible to achieve the luminance levels of indoor theaters. This practice recognizes, however, that there are many drive-in theaters wherein screen sizes, viewing conditions, and other factors dictate limitations not encountered in conventional indoor theaters. When a very large screen area, long projection throw distance, extended viewing distance, and high ambient light level are involved, it is necessary to achieve maximum efficiency in all elements of the system to ensure acceptable projection results.

The values in Sections 3.2 and 4.2 represent an operating compromise that may be useful. They also describe the minimum condition for an acceptable projected image where stray and ambient light can be considered negligible.

A3. Directional Screens

A maximum permissible luminance distribution range on a given screen is specified in Sections 4.1 and 4.2. This condition can be achieved by several procedures, including one or more of the following: choice of a screen with a suitable reflection pattern, limitation of the seating area so that no patron views the picture from an angle at which the luminance is outside the tolerance of the standard, and screen curvature.

Present directional screens show a large variation in gain with changes in the projection and viewing angles, necessitating the 5:1 luminance range in Section 4.2 when gain screens are fitted into existing theaters. Even this range effectively limits the maximum luminance gain of the screen; and the wider the theater becomes, the lower the maximum luminance gain must be to meet luminance specifications with most existing directional screens.

A4. Luminance Photometer

The measurement of luminance with uncertainty of less than 10 percent requires a good photometer. Since there are no true Lambertian surfaces, and even the theatrical matte screens may depart by more than 10 percent, the brightness will vary with the angle of observation. A photometer having a large field angle will indicate the average luminance within its field, and if this includes a large area of the screen (or of the screen and surround), this average may be substantially different from the observed brightness. It has been found that within the geometric restrictions under which photometers are used in theaters, their luminance indication correlates well with the observed brightness if the field angle of the photometer is about 2 degrees or smaller.

A photometer having a small field angle may receive light from such a small screen area as to detect luminance differences due to defects in the screen, imaging of the projection source, etc. When measuring the luminances required in Sections 3 and 4, the luminances of immediately adjacent areas should be observed to be sure the reading is relevant.

A5. Ambient Light

Recognizing the limitations in an outdoor environment, every effort should be made to keep ambient light on the screen to a minimum. This may be done by careful placement of the screen and controlling light sources in and around the theater. Distracting light sources (signs, streetlights, etc.) should be shielded, or kept out of the field of view of the audience.

SMPTE RECOMMENDED PRACTICE — RP 110–1988

Specifications for an Alignment Test Film for Anamorphic Attachments to 35-mm Motion-Picture Projectors

1. *Scope*

This practice specifies a test film for the alignment of anamorphic attachments or lenses for 35-mm motion-picture projectors.

2. *Test Pattern*

2.1 A reproduction of the alignment chart is shown in Fig. 1.

2.2 A chart showing the dimensions as measured on the test film is shown in Fig. 2.

2.3 The lettering shall be bold and of a style and size shown in the figures.

2.4 The vertical lines shall be one-half as wide as the horizontal lines so that during projection they will appear to be the same width.

3. *Test Film*

3.1 The test film shall be produced as a 35-mm print with white lines on a black background.

3.2 The test pattern shall be photographed and the center point positioned on the print as specified by Style B in American National Standard Dimensions of 35-mm Motion-Picture Camera Aperture Images, ANSI PH22.59-1974 (R1981).

3.3 The print shall be on motion-picture stock made in accordance with long-pitch dimensions specified in American National Standard for Motion-Picture Film (35-mm)—Perforated KS, ANSI/SMPTE 139-1986.

3.4 The emulsion position of the print shall be away from the projector lens for direct front projection.

3.5 The test film shall be supplied in an emulsion-in winding.

4. *Densities*

4.1 The black background shall have a neutral density greater than 1.9.

4.2 The density of the lines and lettering shall be below 0.3.

NOTE: Test films made in accordance with this practice are available from the Society of Motion Picture and Television Engineers.

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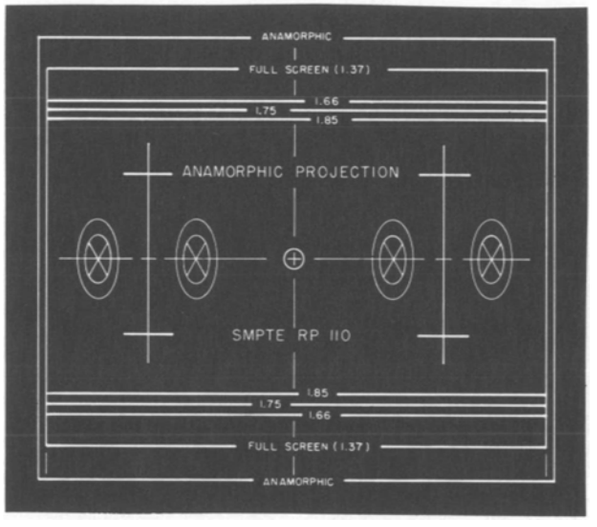

Fig. 1
Reproduction of Test Chart

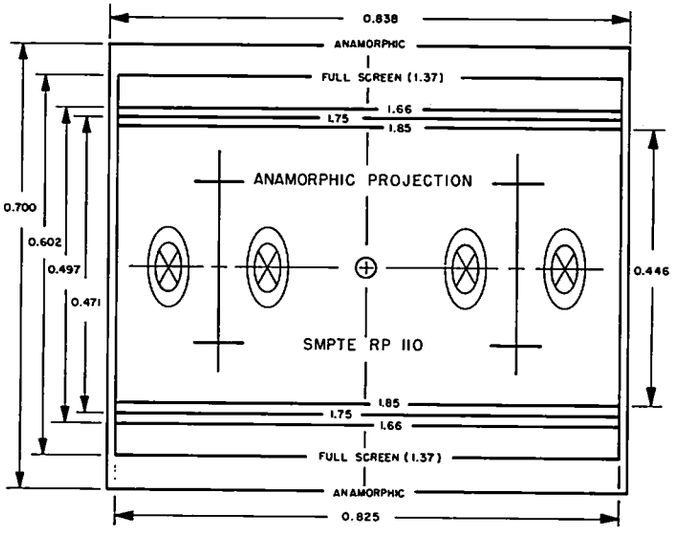

Fig. 2
Test Chart Dimensions

Appendix

(This Appendix is not part of the SMPTE Recommended Practice, but is included for information only.)

The test pattern is used for checking:

(a) The area being projected. The horizontal lines designate the projectable image area documented in American National Standard for Motion-Picture Film (35-mm) — Projectable Image Area — Motion-Picture Prints, ANSI/SMPTE 195-1984, permitting adjustment of *the screen masking to the desired aspect ratio or judgment* of how much image area is being lost outside the visible screen area.

(b) The alignment of the anamorphic attachment or lens. Anamorphic attachments and lenses for theatrical use are designed to expand the film image by 2X; consequently, the four circles at the sides should appear perfectly round and the circle at the center should be an ellipse twice as wide as it is high.

By rotating the attachment, the crossed lines can be made to appear perpendicular to each other. If both the vertical and horizontal lines do not appear sharp, the projection distance scale must be adjusted. First use the focus knob so that the horizontal lines are very sharp. Then adjust the distance ring so that the vertical lines become as sharp as possible, and lock the distance ring. If the sharpness of the vertical lines changes when the distance ring is locked, repeat the sequence, starting with the focus knob.