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RP 40-2003
Revision of RP 40-1995

SMPTE RECOMMENDED PRACTICE

Specifications for 35-mm Projector Alignment and Screen Image Quality Test Film

1 Scope

This practice describes the content and dimensions of the image on a 35-mm motion-picture test film intended for alignment and evaluation of 35-mm motion-picture projection. This practice also gives procedures for the use of various elements of the test film image.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this practice are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI/SMPTE 93-1998, Motion-Picture Film (35-mm) — Perforated BH

SMPTE 59-1998, Motion-Picture Film (35-mm) — Camera Aperture Images and Usage

SMPTE 195-2000, Motion-Picture Film (35-mm) — Motion-Picture Prints — Projectable Image Area

3 Figures

The test film image is shown in figure 1. Figure 2 identifies various elements of the test film image and should be referred to in conjunction with the following clauses. Figure 3 shows the resolution target in detail.

4 Dimensions

4.1 Lines other than resolution targets (figure 2, A) and inch scales (figure 2, L)

Lines shall be centered on the nominal dimensions indicated. Horizontal lines shall be 0.0024 in (0.061 mm) wide and vertical lines shall be 0.0012 in (0.030 mm) wide.

4.2 Background squares (figure 2, B)

The height and width of the black and white squares which make up the image background shall be 0.004125 in (0.10478 mm). This dimension is 1/200 of the projectable image area width of 0.825 in (20.96 mm), and thus each square represents 0.5% of the projectable image width.

Approved
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4.3 Resolution targets (figure 2, C and figure 3)

These targets shall be patterned after National Institute of Science and Technology test charts. The black-and-white lines which make up the resolution targets shall each have a width in millimeters equal to the reciprocal of twice the number of line pairs per millimeter indicated next to the pattern. Thus, the black and white lines in the 80 line pairs per millimeter segment of the resolution target will each be 0.00625 mm (approximately 0.000246 in) wide. The rosettes at the center of the resolution targets shall begin with the equivalent of approximately 8 line pairs per millimeter, and theoretically converge to an infinite number of line pairs per millimeter.

4.4 Projectable image areas (figure 2, D)

The dimensions of the projectable image areas shall be as specified in SMPTE 195 and as indicated by the dimensions shown on the test image.

4.5 Anamorphic ovals (figure 2, E) and central diamond (figure 2, F)

The anamorphic ovals shall have a height (major axis) two times the width (minor axis). The central diamond also shall have a vertical length twice its horizontal dimension.

4.6 Shutter ghost test images (figure 2, G)

The shutter ghost test images shall consist of white squares on a black background. The vertical dimension of the white squares and the vertical dimension of the black areas above and below the white squares all shall be equal. The black areas to either side of and between the white squares shall each be one-half the width of the white square.

4.7 Jump test pattern (figure 2, H)

Two horizontal sets of lines and spaces shall be located as shown in figure 1. The lines and spaces shall each be 0.001031 in (0.02619 mm) wide, corresponding to one-quarter of the dimensions of the background blocks.

4.8 High resolution line pairs (figure 2, J)

Two vertical sets of resolution targets, one of 80 line pairs per millimeter and one of 85 line pairs per millimeter, shall be located as shown in figure 1.

4.9 Inch scales (figure 2, L)

Scales marked in 0.010-in (0.25-mm) increments shall be located at both sides and the top and bottom of the image as shown in figure 1. The inch numerical values given shall indicate the distance between their respective marks.

4.10 Location on film and tolerances

The center of the test image shall be within ± 0.001 in (0.03 mm) of the center of the projectable image area specified in SMPTE 195. All projectable image area lines shall be within ± 0.002 in (0.05 mm) of the nominal dimensions shown on the test image.

5 Film types and exposure

The test film described in this practice shall be photographed using a style B camera aperture as specified in SMPTE 59. Because of the need for extreme steadiness in the test film, it is recommended that these test films be manufactured as camera originals using pin-registered cameras. When manufactured as camera originals, the image shall be photographed so as to project correctly in the usual print emulsion position (emulsion toward light source). If the test films are to be manufactured as prints, the printing method must be capable of maintaining the resolution of the original image and shall not introduce any unsteadiness in the images.

The test film described in this practice shall be produced on 35-mm motion-picture film manufactured in accordance with ANSI/SMPTE 93. A perforation pitch of 0.1866 in (4.74 mm) or 0.1870 in (4.75 mm) is acceptable.

The test film described in this practice shall be produced on a black-and-white silver-image film capable of at least 80% modulation transfer at 80 line pairs per millimeter. It may also be produced on a color positive film in which the exposure has been limited to the top (magenta) layer only to provide maximum sharpness.

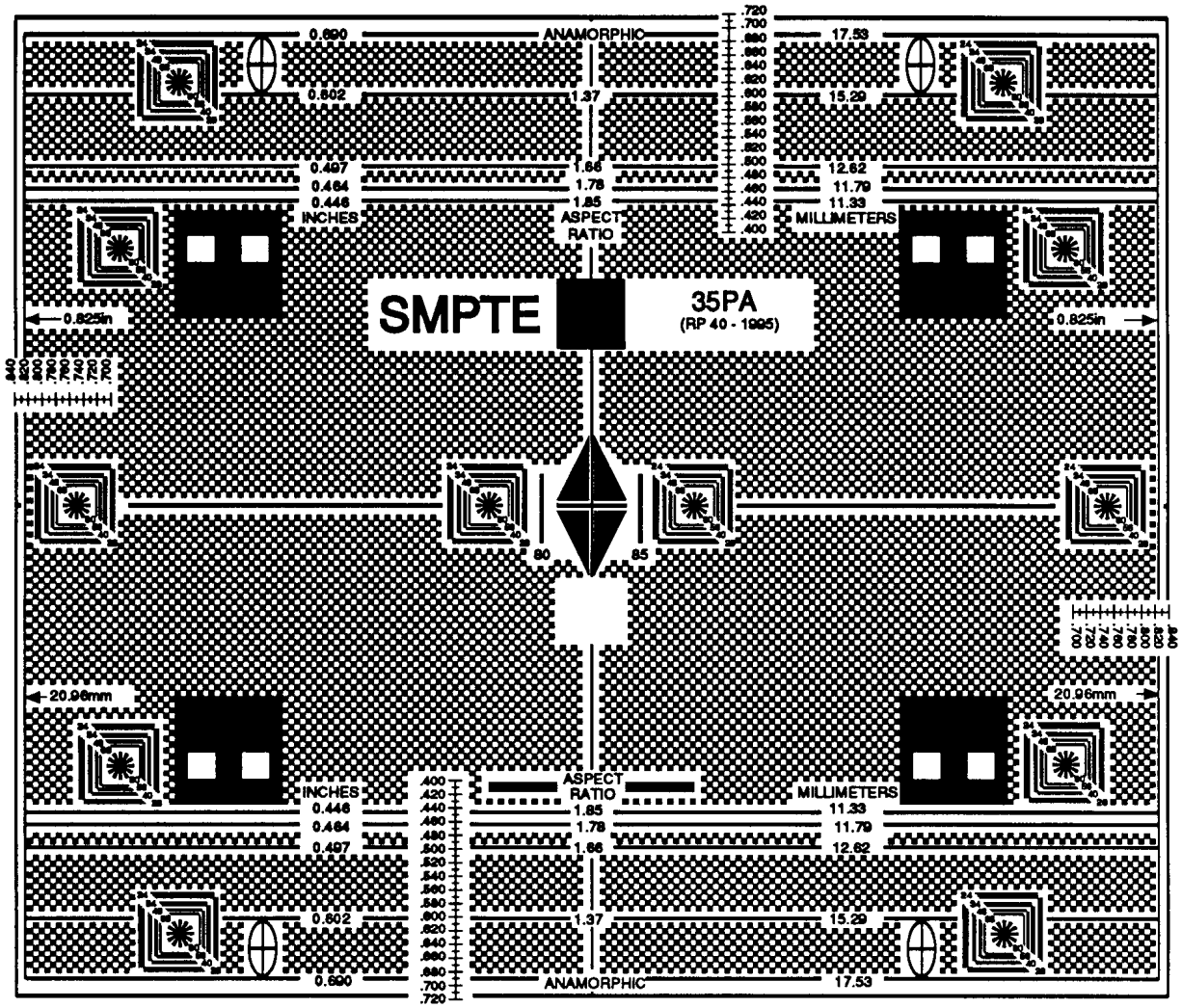

Figure 1– Test film image

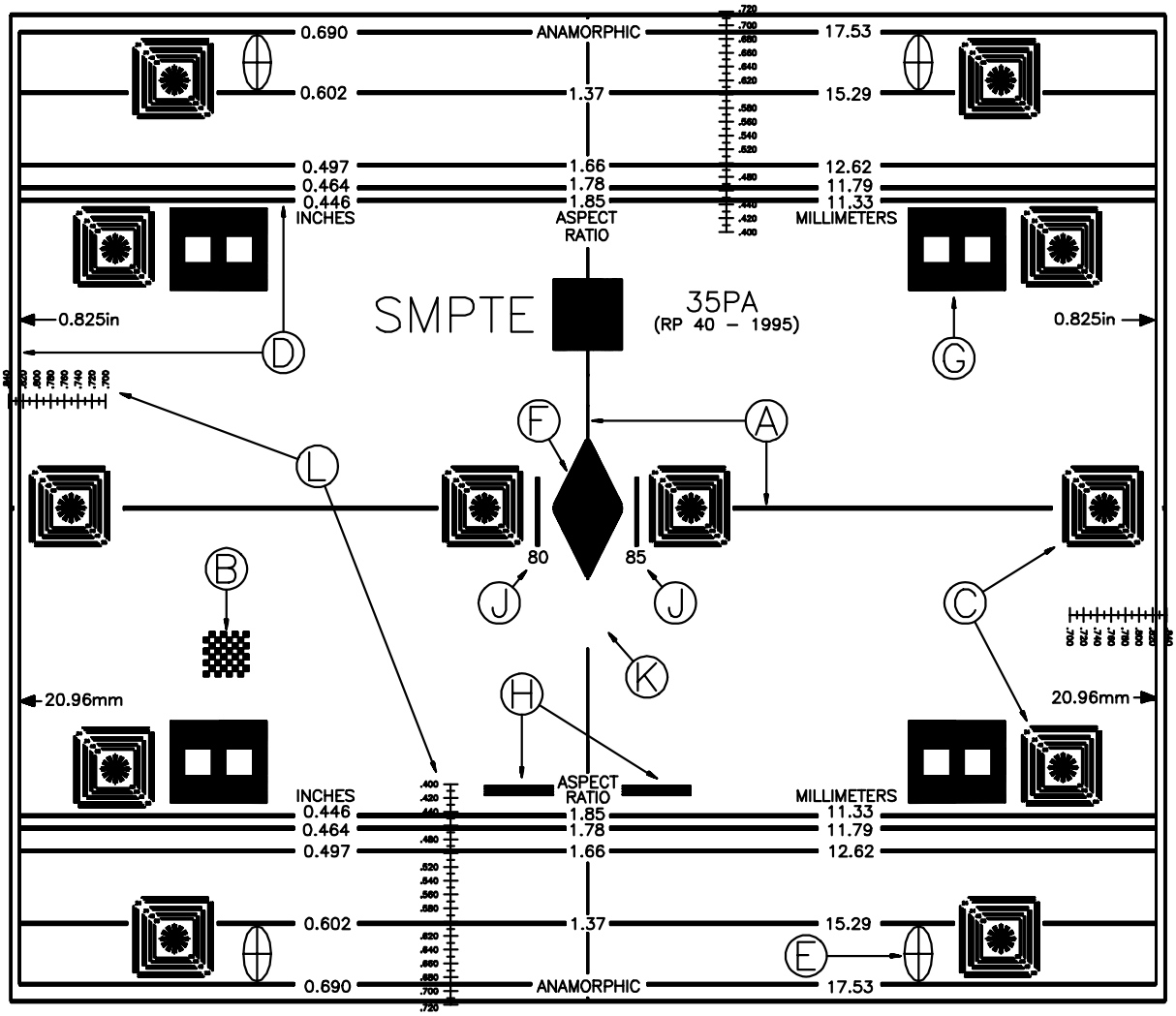

Figure 2 – Elements of test film image

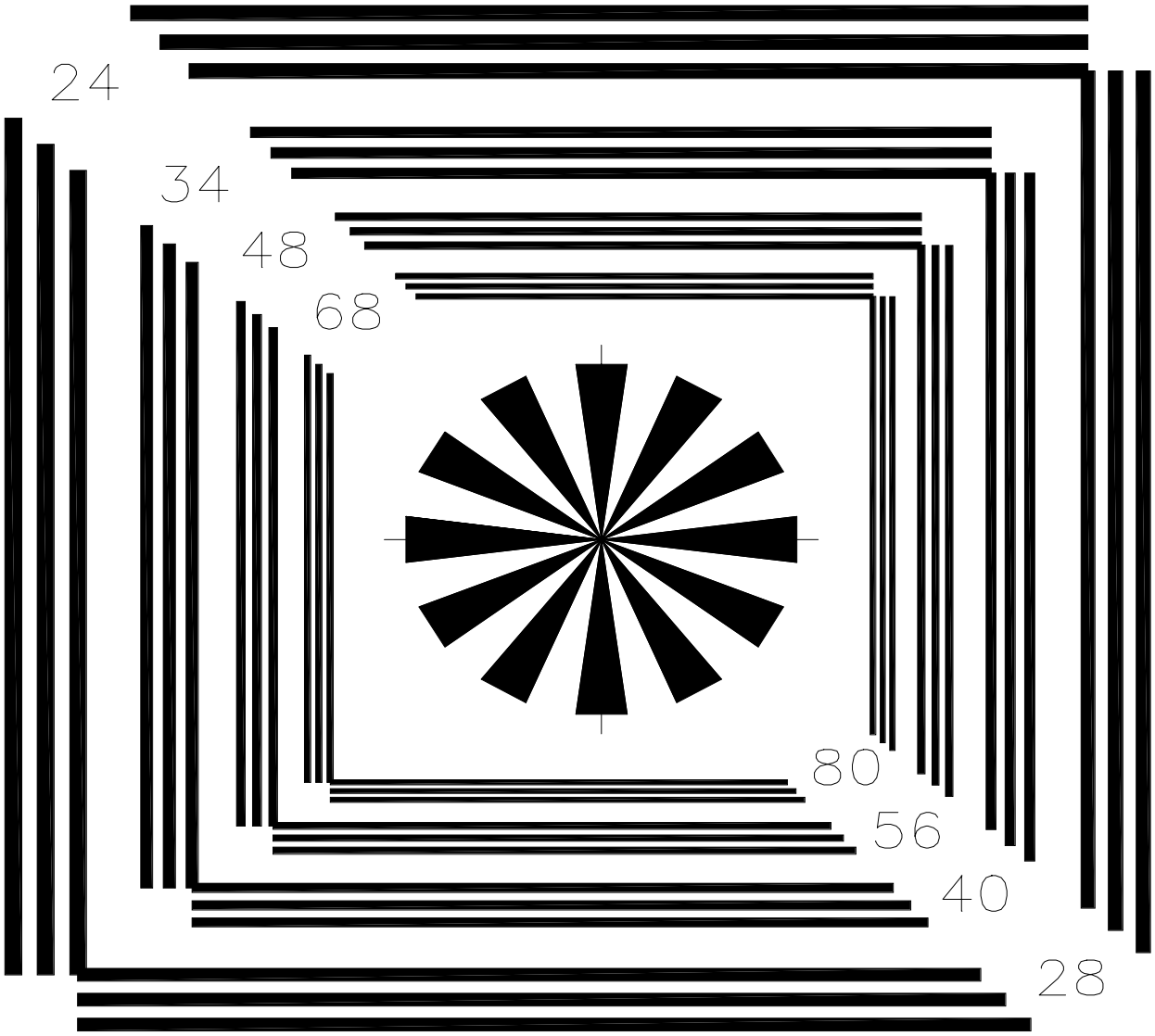

Figure 3 – Detail of resolution target

Annex A (informative)
Use of the test images

A.1 Background squares

The background squares provide for an approximate 50% transmission of the incident radiant energy so as to be equivalent to the performance of an average release print. The pattern provides a quick reference for overall image focus and quality.

The background squares may be used for an objective evaluation of jump (vertical motion) and weave (horizontal motion). Place a stationary object in the projection path so as to cast a sharp edged shadow on the screen. Evaluate the amount to which the edge of a square moves in relation to the stationary shadow. Since each square is 0.5% of the projectable image width, a movement of one-half square would be equal to 0.25% of the projectable image width of 0.825 in (20.96 mm), or approximately 0.0002 in (0.005 mm) (see SMPTE RP 105).

A.2 Resolution targets

When viewing the resolution test images, a line pair image is considered to be resolved when it can be clearly discerned to consist of three black lines and two white lines.

A.3 Projectable image areas

Four projectable image areas, as specified in SMPTE 195, are shown in the test image. These are:

Style A: General theatrical release prints commonly referred to as nonanamorphic or wide screen, in both 1.66:1 aspect ratio and 1.85:1 aspect ratio.

Style B: Theatrical release prints with an anamorphic image, with 2.39:1 aspect ratio;

Style C: Classic theatrical prints with 1.37:1 aspect ratio.

Also shown is a projectable image area with an aspect ratio of 1.78:1. This is equivalent to the 16:9 aspect ratio used in high-definition television production.

These projectable image areas may be used for the evaluation of projector aperture plates and the projectable image area boundaries and location as they appear on the screen. The width of the lines on the test film image which show the various projectable image areas are well within reasonable tolerances for these projectable areas; thus a projection aperture which shows any portion of the appropriate lines, but does not extend beyond them, is correctly sized.

A.4 Anamorphic ovals and center diamond

With the proper deanamorphising lens on the projection system, the ovals will appear as perfect circles and the diamond will appear as a square. Also, the horizontal and vertical lines in the image will appear to be of the same width. The length of the vertical and horizontal axes in the oval can be measured on the screen, and should be equal with perfect 2:1 deanamorphising.

A.5 Shutter ghosts

Perfect shutter timing relative to the film pull-down will result in no ghosts above or below the white squares in the shutter test images. Ghosts below the white square indicate the shutter is opening too soon; ghosts above the white square indicate the shutter is closing too late.

A.6 Jump test pattern

The width of each black and white line of the jump test pattern (figure 2, H) is equal to one-quarter of the dimension of the background blocks. If the vertical jump of the projector is more than one-quarter of a block, these lines and spaces will blur into a gray area. If the lines and spaces continue to appear individually, the vertical jump is less than one-quarter of a block.

A.7 High-resolution line pairs

The 80 and 85 line pairs per millimeter vertical targets on each side of the center diamond (figure 2, J), give a clear indication, separate from the main resolution targets, of the projection system's ability to achieve the resolution of the test film.

A.8 Clear area

The clear area below the center diamond (figure 2, K) may be used for screen luminance measurements with the film in the projector.

A.9 Inch-scale markings

The inch-scale markings (figure 2, L) may be used to determine the location and size of nonstandard image areas and to estimate deviation from standard projectable image areas.

NOTE – A test film manufactured to these specifications is available from the SMPTE.

Annex B (informative)
Bibliography

SMPTE RP 105-2003, Method for Determining the Degree of Jump and Weave in 70-, 35- and 16-mm Motion-Picture Projected Images