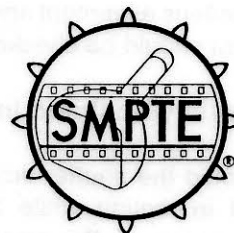# SMPTE TEST FILM PROGRAM

35-PA 35-mm Projector Alignment Test Film
35-IQ 35-mm Image Quality Test Film

The SMPTE 35-PA Test Film is designed to facilitate quantitative measurements of projector alignment and performance. It is produced as a camera original on black-and-white high-resolution 35-mm stock perforated BH-1866. The SMPTE 35-IQ Test Film contains the same pattern also produced as a camera original, but is made in two sections: the first section is photographed on high-resolution black-and-white stock perforated BH-1866 and the second section photographed on magenta image layer of color print stock perforated BH-1870. These films are produced in accordance with SMPTE Recommended Practice RP 40-1995.

> **Specifications:**
> - Camera original
> - Acetate base
> - SMPTE RP 40-1995
> - For 35-PA
>   - black-and-white film stock perforated BH-1866
> - For 35-IQ
>   - first section, black-and-white film stock perforated BH-1866
>   - second section, magenta image only on color print stock perforated BH-1870

Directions for Use

Overall Focus

The checkerboard background pattern should appear sharp, and the individual squares should be clearly observable. Notice particularly the extreme edges and corners of the screen. Since the projected frame assumes a slightly spherical image plane while in the aperture due to the absorption of incident radiant energy, it is not uncommon to have a slight fall-off in definition at the corners of the screen when the center is sharply focused. If moving the lens through focus produces sharp squares at the corners, a compromise focus can be found; if the corner areas cannot be brought into sharp focus, a check of the optical system is in order.

Image Resolution

Ten resolution targets, based on National Institute of Standards and Technology resolution charts, are incorporated in the test film pattern. During the projection of the film, the resolution targets can be used to determine the ability of the projection system to transfer film image information to the screen. To evaluate resolution properly, the observer should be close enough to the screen to be able to see the smaller lines in the resolution targets. As the lens is slowly moved through focus, the observer should determine the finest group of lines which can be discerned as individual lines; i.e., three black lines and two white lines. The number identifying this group of lines represents the resolution of the projection system in line pairs per millimeter. It is not uncommon for the resolution of the vertical line pairs to be higher than the horizontal line pairs due to image movement. Additional vertical sets of 80 and 85 line pairs per millimeter are located on either side of the center diamond. The average well-maintained theater should resolve 56 or more horizontal and vertical line pairs per millimeter at the center of the screen. An ideal system would display the same resolution at the corners of the screen as at the center.

Projector Alignment

When the film-optical system is performing satisfactorily, evaluate the entire screen area as a whole. When proper focus has been achieved at the center of the screen, the four corners should be equal in appearance. While moving through focus, if the focus sweeps across the screen, and if it is impossible to make all four corners look alike, the projector

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February 1996

gate/lens alignment and/or the projector/screen alignment should be checked.

Travel Ghost and Image Unsteadiness

Should the shutter timing be incorrect, with the film still in motion while the shutter is partially open, smearing of the image will occur. This is easily checked by viewing the white squares in the black areas, which will show bleeding of the white into the black or vice versa in the vertical direction. To correct this travel ghost, make the appropriate shutter adjustment in accordance with the projector manufacturer's recommendations. If the travel ghost cannot be eliminated, the equipment must be repaired.

To measure vertical (jump) and horizontal (weave) image unsteadiness, place an object near the screen which will cast a sharp shadow on the screen. Move the object so that the shadow is adjacent to the edge of a background square and observe the movement of the square relative to the shadow's edge. With spherical projection (non-anamorphic), horizontal movement of one full square represents 0.5% of the image width of 0.825 in. For vertical movement, the table below gives percentages of various image heights for movement of one full square. Empirical evidence has shown that a movement of 0.125% or less (less than one-quarter square) is an achievable performance.

Aspect ratio	Projectable image area (H in x W in)	Movement*
1.37:1	0.602 x 0.825	0.69%
1.66:1	0.497 x 0.825	0.83%
1.85:1	0.446 x 0.825	0.93%
2.39:1	0.690 x 0.825	0.60%
*for one full square		

For a quick check of vertical image unsteadiness (jump), the line pairs located to either side of the words "ASPECT RATIO" at the bottom of the screen are one-quarter of the dimension of the background squares. If the vertical movement is greater than one-quarter of a square, the black and white lines will blur into a gray area. If the black and white lines continue to appear individually, the vertical movement is less than one-quarter of a square, and therefore less than one-quarter of the movement percentages given in the table above.
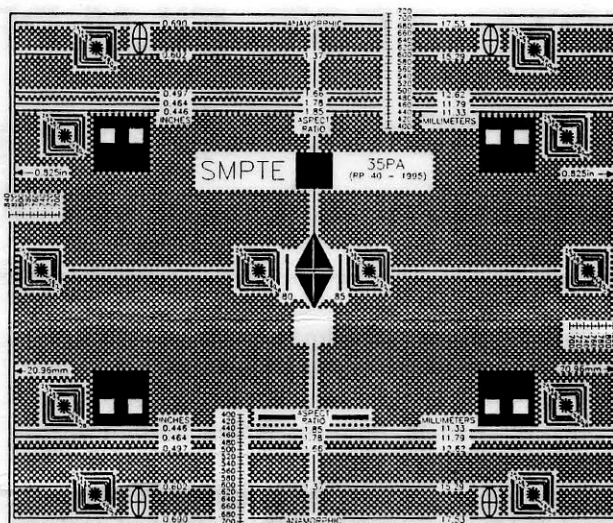
Screen Image Size

It is important that the exact film image intended for projection be shown on the screen. The test film displays the projectable image areas given in SMPTE 195-1993 and an additional image area equivalent to the aspect ratio for wide-screen television (1.78:1). An aperture plate and screen masking which places an image on the screen that includes some portion, but not all, of the width of each of the boundary lines of the appropriate image area is well within the tolerances for that image area.

In addition, scales marked in increments of 0.010 in are included on all four sides of the test film image. These may be used to create non-standard image areas or to judge the amount by which a screen image exceeds or crops the standard image areas. These scales are located based upon the center location for standard image areas ("sound aperture"), which is at the crossing of the horizontal and vertical lines within the central diamond, and is displaced 0.050 in horizontally from the physical centerline of the film.

Anamorphic Images

The main vertical lines in the image on the test film are one-half the width of the main horizontal lines. With a de-anamorphising lens in use, these lines should appear on the screen as the same width. In addition, with an exact 2 to 1 expansion, the ovals at the top and bottom of the screen should appear as perfect circles and the central diamond should appear as a square at a 45° angle. For precise determination of the expansion, the horizontal and vertical lines in the ovals (circles) can be measured on the screen, and should be equal.