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RP 105-2003
Revision of RP 105-1995

SMPTE RECOMMENDED PRACTICE

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

Introduction

Acceptability of undesirable image movement in a projection system depends upon several factors such as the purpose of projection, the critical nature of the image, the ratio of viewing distance to screen image size, and the frequency and direction of the motion. Projection performance can be determined by identifying these parameters and classifying the various degrees of steadiness.

1 Scope

This practice identifies image motion, classifies the practical limits of acceptability of film jump and weave, and recommends a method of measurement for projection of 70-, 35-, and 16-mm motion-picture prints.

2 Definitions

2.1 apparent size of screen image: The viewer's impression of either jump or weave is related to the size of the film being projected and the apparent size of the screen image. For the purposes of this practice, four classifications can be established:

70-mm large appearing: A large appearing screen image as below, but with 70-mm film being projected.

35-mm and 16-mm large appearing: A large appearing screen image is one which is viewed from a last-row distance of 3.7 screen heights or less (vertical field of vision is 15° or greater).

medium appearing: A medium appearing film image is one which is viewed from a last-row distance of 3.7 to 5.7 screen heights (vertical field of vision is 10° to 15°).

small appearing: A small appearing screen image is one which is viewed from a last-row distance greater than 5.7 screen heights (vertical field of vision is 10° or less).

2.2 jump: The undesirable vertical motion (in normal systems where the film travel is vertical) of the projected image. Called jump because of its rapid motion, it is usually at the same frequency as the motion-picture frame rate (24 frame/s, etc.).

2.3 weave: The undesirable horizontal (side-to-side) motion (in normal systems where the film travel is vertical) of the projected image. Weave is normally at a much slower rate than the frame rate, and usually less noticeable.

3 Classification

3.1 For each classification of apparent size of the screen image, the following percentages of jump and weave indicate the practical limit of acceptability in terms of the percentage of the image height:

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Classification	Jump	Weave
70-mm large appearing screen images	0.08%	0.10%
35-mm and 16-mm large appearing screen images (Review rooms, premier theaters)	0.12%	0.20%
Medium appearing screen images (First-run theaters)	0.20%	0.25%
Small appearing screen images	0.30%	0.30%

3.2 The values specified are achievable when using SMPTE test films. Higher values may be expected from normal release prints which may be produced to less exacting tolerances, since they are not printed using a pin-registered step printer.

4 Recommended method of measurement

The recommended method of measurement is to project a test film made on a registration pin camera, such as the SMPTE 16-PA, as specified in SMPTE RP 82; the SMPTE 35-PA, as specified in SMPTE RP 40; or the SMPTE 70-PA, as specified in SMPTE RP 91.

These films have the overall area covered with a checkerboard pattern as given in table 1.

Project the appropriate test film under normal conditions. For 35-mm projection, jump should be measured with the format which uses the smallest film image height used in the theater, usually 1.85:1, and weave should be measured with the format which uses the largest film image width used in the theater, usually 2.4:1 anamorphic.

Place an appropriate device, such as a microphone stand, near the screen to provide a sharp shadow. Position the shadow to be adjacent to any background square and observe the amount of movement. As an example, using the 35-PA test film, if the vertical movement averages a quarter square and projection is at a 1.85:1 ratio, the jump is 0.94% divided by 4, or 0.235%.

Table 1 – Measurement

Aspect ratio	Projected image area	One square = percent vertical movement
1.37:1	0.602 × 0.825”	0.7%
1.66:1	0.497 × 0.825”	0.9%
1.78:1	0.471 × 0.825”	0.9%
1.85:1	0.446 × 0.825”	0.94%
2.4:1	0.700 × 0.838”	0.6%
	200 horizontal squares (1 square = 0.5%)	
70-PA	100 vertical squares (1 square = 1.0%) 220 horizontal squares (1 square = 0.46%)	
16-PA	100 vertical squares (1 square = 1.0%) 134 horizontal squares (1 square = 0.75%)	

Annex A (informative)
Additional data

A.1 This practice assumes that jump is the undesirable vertical motion that functions at frame-rate frequency, while weave is much slower, and perhaps slower than one-quarter of frame-rate frequency. Of course, random motion from splices or film damage might be more noticeable.

A.2 For convenience, table A.1 shows the practical limit of acceptability in terms of fractions of a block on the appropriate test film for each film and projector format. Note that closer viewing of larger screens demands steadier projection.

Table A.1 – Limit of acceptability

Apparent image size		35-mm format					70-mm	16-mm
		2.4	1.85	1.78	1.66	1.37		
Large	Jump	1/5	1/8	1/8	1/7	1/6	1/10	1/8
	Weave	2/5	2/5	2/5	2/5	2/5	1/5	1/4
Medium	Jump	1/3	1/5	1/5	1/4	1/3	1/10	1/5
	Weave	1/2	1/2	1/2	1/2	1/2	1/5	1/3
Small	Jump	1/3	1/3	3/8	1/2	1/2	1/10	1/2
	Weave	3/5	3/5	3/5	3/5	3/5	1/5	1/2

A.3 This practice assumes that other parameters, including equipment maintenance and test film perforation conditions, are noted.

A.4 The vewing distances described in 2.1 relate to the following common lens focal lengths, assuming that the projector is above the last row of seats. For 35-mm 1.85 aspect ratio projection, 3.7 screen heights will relate to a 42-mm focal length and 5.7 screen heights will relate to a 65-mm focal length.

Annex B (informative)
Bibliography

SMPTE RP 40-2003, Specifications for 35-mm Projector Alignment and Screen Image Quality Test Film

SMPTE RP 82-1995, Specifications for 16-mm Projector Alignment and Screen Image Quality Test Film

SMPTE RP 91-2002, Specifications for 70-mm Projector Alignment and Screen Image Quality Test Film