

## SMPTE Recommended Practices

On February 14, 1964, the Society's Board of Governors gave approval to the revision of SMPTE Recommended Practice RP5, Dimensions of Patch Splices in 2-In. Video Magnetic Tape. This Recommended Practice is in fact the same document as published in 1960, except for the addition of data to reflect the currently used 7.5 in./sec recording speed.

Two new Recommended Practices, initiated by the Laboratory Practice Committee, were approved on January 28, 1964, by the Society's Board of Governors. SMPTE Recommended Practice RP14, Plotting Data from Sensitometric Strip, Exposed on Type Ib2 (Intensity Scale) Sensitometers, and SMPTE Recommended Practice RP15, Calibration of Densi-

tometers Used for Black-and-White Photographic Density Measurement, were prepared to help motion-picture laboratories establish standard techniques in sensitometric activities. Both provide standard methods which permit laboratories to establish a common language with respect to the highly important function of sensitometry in today's laboratory work.

Copies of these Recommended Practices may be acquired from Society Headquarters upon request.

Proposed Recommended Practice RP 18, Test Film for Checking 16mm Motion-Picture Sound Projectors, describes a film for rapid nontechnical checking and demonstrating 16mm projection equipment. Users of SMPTE test films will recognize the description as that of the well known and widely used Jiffy test film developed by the Society many years ago.—A.E.A.

## SMPTE RECOMMENDED PRACTICE RP 5-1964 (Revision of RP 5-1960)

# Dimensions of Patch Splices in 2-In. Video Magnetic Tape

### Introduction

This Recommended Practice originated in the Video Tape Recording Committee as a Proposed American Standard. At the November 12, 1958, meeting of the Committee it was decided that industry needs could best be met in this instance by an SMPTE Recommended Practice which was subsequently published in the February 1960 Journal. The initiating committee revised the recommendation to include the slower tape speed of 7.5 ips. The proposal, approved by the Video Tape Recording and Standards Committees, was published for trial and comment in the November 1963 Journal. It received final approval by the Society's Board of Governors on February 14, 1964.

### Recommendations

#### 1. Scope

1.1 This Recommended Practice specifies the dimensions and location of patch-type splices in magnetic video tape of 2-in. width. The recommendations are intended primarily for application in recording and reproducing studio practice.

#### 2. Location of the Splice

- 2.1 The angle of the cut with respect to the guided edge of the tape shall be as given in the diagram and table.
- 2.2 The cut shall be centered between two recorded video tracks and so located as to maintain continuity of video synchronizing pulse timing (Note 1).
- 2.3 The separation between the two cut edges after splicing shall not exceed 0.001 in. at any point along the cut.
- 2.4 The longitudinal distance between corresponding points on the recorded transverse video tracks immediately preceding and following the splice shall not depart from the average distance between successive tracks by more than  $\pm 0.0005$  in. (Note 1).

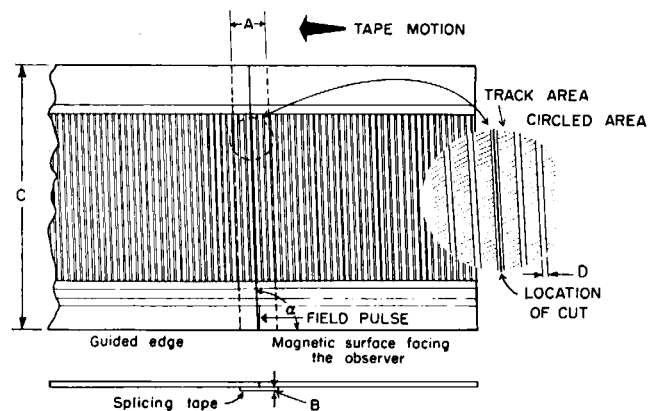
#### 3. Splicing Tape

3.1 The dimensions of the splicing tape shall be as given in the diagram and table.

#### 4. Characteristics of the Splice

- 4.1 The splicing tape on a finished splice shall not extend beyond the edges of the magnetic video tape.
- 4.2 The guided edge of the magnetic tape on the two sides of the splices shall lie on a common straight line when the tape surface is constrained to lie in a plane.

Note 1: Paragraphs 2.2 and 2.4 apply only to recorded tapes.



Note: Drawing not to scale

Dimensions*	Rate of Tape Travel	
	7.5 ips	15 ips
A Width of splicing tape	0.25 nom	0.25 nom
B Thickness of splicing tape	0.0007 max	0.0007 max
C Width of magnetic tape	2.0 nom	2.0 nom
D Distance between recorded tracks	0.0028 nom	0.0056 nom
$\alpha$ Angle of cut	$90^\circ 17' \pm 3'$	$90^\circ 33' \pm 3'$

\* All dimensions in inches except  $\alpha$ .

# Plotting Data from Sensitometric Strips Exposed on Type Ib2 (Intensity Scale) Sensitometers\*

This Recommended Practice originated in the Laboratory Practice Committee of the Society. Approved by the initiating and Standards Committees, the proposal was published for trial and comment in the December 1963 Journal. The recommendation received final approval by the Society's Board of Governors on January 28, 1964.

## 1. Scope

1.1 The purpose of this recommended practice is to specify the relationship of the spacings of the exposure scale (horizontal co-ordinate) of graph paper on which sensitometric data are plotted and the corresponding increments of the logarithm of exposure in the sensitometer when the exposure modulator is a step tablet.

## 2. Exposure Method

2.1 In a Type I b (intensity scale) sensitometer, the most common method of modulating the illumination falling upon the sample employs a step tablet. The exposure is made with the emulsion of the sample in contact with the modulator except for a thin, transparent acetate cover which protects the modulator against abrasion and foreign matter. The opening and closing of a shutter admits light for the required period of time. Step tablets may be cast with gelatin containing dyes or colloidal carbon or, alternatively, may be produced photographically by suitable exposure and development of film or plates.

2.2 With a step tablet as the exposure modulator, the illumination reaching the sample is dependent upon the transmittance of the various steps of the modulator. This assumes uniformity of illumination. Density, being the common logarithm of the reciprocal of the transmittance, is a more convenient method for specifying the light-stopping power of the segments of the modulator. Density may be measured with a densitometer calibrated in reference to American Standard Diffuse Transmission Density, PH2.19-1959.

2.3 The I b (intensity scale) sensitometer exposure modulator shall have step-to-step increments of 0.15 diffuse transmission density, Type V1-b. As modulators vary somewhat from this 0.15 increment, it may be necessary to adjust the step reference points on the exposure axis (horizontal co-ordinate) of the sensitometric graph paper to represent the actual densities of each step in the tablet.

*Note:* Single step departures of the order of 0.015, or less, from the ideal 0.15 density increment, when known, would not be considered significant. However, cumulative errors, especially those which occur in the same direction, are significant and can lead to erroneous results. (See Appendix.)

## 3. Method of Correction

3.1 The steps of the exposure modulator shall be measured with a densitometer reading in diffuse transmission density, Type V1-b, specified in American Standard

PH2.19-1959. Such densities are normally shown on the calibration chart accompanying each new step tablet.

3.2 If such a calibration chart is not available, the step tablet should be removed carefully from the sensitometer and from its removable protective cover, if any, and each step read on a densitometer. (See 3.1 above.)

3.3 Unless the step tablet modulator conforms to the following specifications, the sensitometric density data shall be plotted against the actual rather than the nominal densities of the step tablet:

(1) The density increment between any two adjacent steps shall be  $0.150 \pm 0.015$  density.

(2) The departure of any step from its nominal density value shall not exceed 0.02 density or 2 percent of its density value, whichever is greater. The nominal value is defined as the density of the lowest density step plus 0.15 times the number of steps above the lowest density step.

(3) Linearity. No individual step shall depart from the best linear fit through all the steps by more than a density of 0.02.

## 4. Method for Plotting Actual Densities of the Step Tablet Modulator

4.1 For laboratories using graph paper where the scale of the horizontal co-ordinate is as long or longer than the scale of the vertical co-ordinate: most laboratories carry a supply of printed graph sheets for the plotting of sensitometric data. These sheets normally carry a density scale on the vertical co-ordinate and a numbered "step" scale or log exposure reference on the horizontal co-ordinate. It is suggested that the density scale be cut off a graph sheet and placed along the horizontal co-ordinate of a second sheet. The scale of the first sheet should be oriented as shown in the Appendix.

4.2 The density readings of the exposed and processed sample may now be plotted against the actual step tablet densities.

4.3 For laboratories using graph paper where the horizontal co-ordinate is shorter than the vertical co-ordinate: on graph sheets where the horizontal co-ordinate carries  $7\frac{1}{2}$  equal divisions between each "step" or log exposure reference, each division represents 0.02 density of the sensitometer step tablet and may be used as reference to plot the densities of the step tablet against the densities of the exposed and processed sample.

4.4 Where there is no scale on the horizontal co-ordinate between each "step" or log exposure reference, a scale may be drawn to divide the space between each reference into  $7\frac{1}{2}$  equal parts. Each part will represent 0.02 density of the sensitometer step tablet. This scale may be moved up the sheet opposite the various density readings of the exposed and processed sample so as to locate the step tablet densities versus the processed sample densities.

## 5. Care of the Modulator

5.1 Step tablets are very delicate. To prevent damage, it is customary to protect the tablet with a thin, transparent acetate cover. The surface of the cover should be inspected from time to time to ensure that it is clean and free from abrasion. The acetate cover should be renewed when necessary to ensure

\* Loyd A. Jones, "Photographic sensitometry," Part I, *Jour. SMPE*, 17: 491-535, Oct. 1931; Part II, *Jour. SMPE*, 17: 695-742, Nov. 1931; Part III, *Jour. SMPE*, 18: 54-89, Jan. 1932; Part IV, *Jour. SMPE*, 18: 324-355, Mar. 1932.

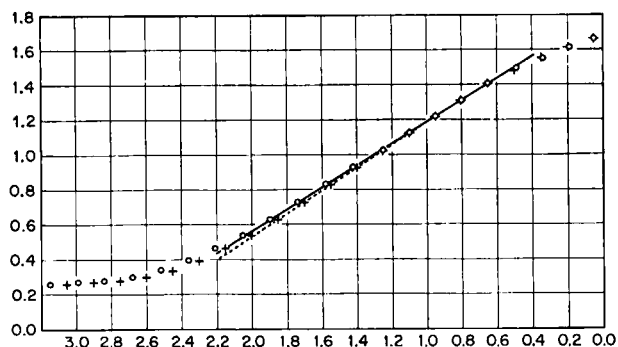
that the diffuse transmission densities of the modulator steps are not affected by dirt or abrasion on the cover.

5.2 While the density of step tablets normally changes little over periods ranging up to two years, it is suggested that they be checked for density from time to time.

#### Legend

---x---x Curve showing sample densities versus modulator densities assumed to have consecutive ideal increments of 0.15  
—o—o—o Curve showing same sample densities versus actual modulator densities for a modulator not meeting the criterion of 3.3 (2)

Appendix: Plotting data from sensitometric strips exposed on Type Ib2 (intensity scale) sensitometers.



## SMPTE RECOMMENDED PRACTICE RP 15-1964

# Calibration of Densitometers Used for Black-and-White Photographic Density Measurement

This Recommended Practice originated in the Laboratory Practice Committee of the Society. Approved by the initiating and Standards Committees, the proposal was published for trial and comment in the December 1963 Journal. The recommendation received final approval by the Society's Board of Governors on January 28, 1964.

### 1. Scope

- 1.1 The purpose of this recommended practice is to specify the means to be employed in the calibration of densitometers utilized in the measurement of diffuse transmission densities.
- 1.2 This practice applies to densitometers utilized for the measurement of processed black-and-white photographic films and plates or cast colloidal carbon tablets.

### 2. Types of Densitometers

- 2.1 In general, only those densitometers which conform to the geometric and spectral conditions specified by American Standard Diffuse Transmission Density, PH2.19-1959, are capable of giving accurate readings of American Standard diffuse transmission density for all types of photographic materials.
- 2.2 If a nonconforming densitometer is to be used with a given type of photographic material, it may be calibrated from reference samples composed of the same material. In this way, any densitometer may be calibrated to read "American Standard Diffuse Transmission Density," Type V1-b or Type P2-b, on any single type of photographic material to a degree of accuracy commensurate with the stability and reproducibility of the instrument itself. In general, a new calibration must be made to obtain accurate readings on a different material when a nonconforming densitometer is used.

### 3. Reference Specimen

- 3.1 A reference specimen shall be a calibrated gray scale which is stored with special care and used at intervals of

three months, more or less, as a primary reference against which to control the working specimens. (See 4.1.)

- 3.2 A densitometer conforming to the geometric and spectral conditions specified in American Standard PH2.19-1959, for either Type V1-b or Type P2-b, and measuring in American Standard diffuse transmission density, shall be used to calibrate the reference specimen.

*Note:* Calibrated reference specimens are sold by the fabricators of densitometers and sensitometers and by film manufacturers.

- 3.3 The reference specimen shall have a range of diffuse transmission densities from below 0.06 to 3.0 or greater.
- 3.4 The density variation within each step or within each specified calibration area shall be 0.01 or less.

*Note:* Care should be exercised in selecting reference specimens. They should be free from dirt spots and abrasions. The step or calibration area should be large enough to accommodate the largest aperture used for measuring the specimen and to allow for normal specimen-positioning variations. Good optical density stability is essential for reference specimens. In general, this can be accomplished by keeping the processed specimen two months or longer under normal laboratory lighting and temperature conditions.

- 3.5 A calibration chart shall accompany each reference specimen, giving the diffuse transmission densities of each step. It shall be noted on the calibration chart whether the diffuse transmission densities listed are American Standard diffuse visual densities Type V1-b or American Standard diffuse printing densities Type P2-b, (American Standard PH2.19-1959). Each reference specimen and corresponding calibration chart shall be identified by a code or serial number. The chart shall also show the type of film of which the reference specimen is made.
- 3.6 Each step of each of three reference specimens shall then be measured carefully on the laboratory densitometer to be controlled. The step-by-step measurements of one specimen shall be compared to the calibration chart

values for that specimen, and the deviations\* plotted versus the calibration chart values. Measurements of each of the other specimens shall also be compared to corresponding calibration values, and the deviations plotted upon the same chart (Appendix). This procedure establishes the correlation among reference specimens.

- 3.7 The procedure in 3.6 shall be repeated on the same densitometer at three-month intervals. If the correlation among reference specimens remains the same, it can be assumed that the specimens have not deteriorated.

*Note:* Even if used once a week for calibration, seasoned (see 3.4 footnote) reference specimens, when properly handled, might be expected to remain in good condition for about a year.

- 3.8 If the trimonthly check reveals that one specimen no longer correlates with the others, it shall be discarded. If the trimonthly check shows that the samples have maintained their original correlation but all three deviation curves have shifted, it may be assumed that the instrument calibration has changed. (However, it is remotely possible that all reference specimens have deteriorated equally.)

#### 4. Working Specimen

- 4.1 A working specimen shall be a calibrated gray scale which is used for the routine calibration of densitometers and measured for correct density against the reference specimens at intervals of three months, more or less.
- 4.2 For routine checking of the densitometer, it is not advisable to use the reference specimens. For this purpose, working specimens of the same material shall be used once they have been related directly or indirectly to the reference specimens.
- 4.3 The working specimen can be directly related to the reference specimens by deviating initial readings of the working specimen from those of a reference specimen calibration curve (3.6). These deviations, when plotted, shall constitute a working specimen calibration curve. The tolerances shown in 5.2 shall apply to the step values assigned to the working specimen.
- 4.4 The following alternate technique may be used in place of that outlined in 4.3: a working specimen may be selected and the step densities read on a densitometer which has been newly calibrated by means of the reference specimens. When this working specimen is subsequently used to check densitometer calibration, the instrument shall duplicate the original readings within a tolerance of  $\pm 0.01$  from density 0.00 to 2.0 and within  $\pm 0.02$  above a density of 2.0. (These tolerances apply to electronic physical densitometers such as the Westrex or Eastman Electronic densitometer. Other densitometers may require wider tolerances. See note after 5.2.) If this tolerance is exceeded in the same direction by three successive steps in one calibration check or by one step on three successive calibration checks, the instrument shall be evaluated with reference specimens. If this evaluation shows the instrument to be in calibration, the new density values shall be assigned to the working specimen, or the working specimen shall be replaced by a new one. If,

\* If, during the procedure, deviations in excess of the tolerances shown in 5.2 are obtained, the densitometer first could be recalibrated according to Section 5 and the procedure repeated. However, correlation curves obtained from a densitometer out of calibration (but operating properly) are valid.

however, the reference specimen confirms that the instrument is out of calibration, it shall be recalibrated, as in Section 5.

#### 5. Densitometer Calibration

- 5.1 The reference specimen shall be placed in the densitometer to be calibrated in the manner specified in American Standard PH2.19-1959; i.e., the emulsion side of the reference specimen shall face the receiver, except that if the incident radiation is diffuse, the emulsion side of the specimen shall face the diffuser.

*Note:* Reference specimens should be handled with care to prevent density changes resulting from abrasions, fingerprints or foreign materials such as grease or film-cleaning compounds.

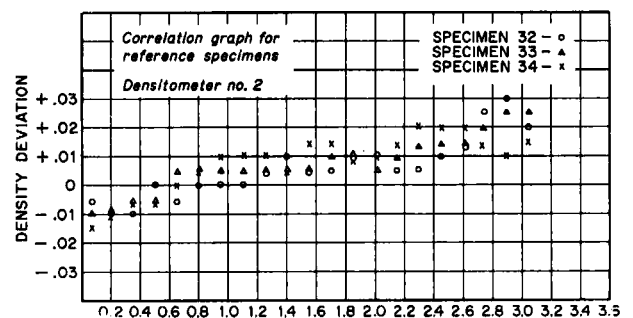
- 5.2 The values of diffuse transmission density of the type desired indicated by the densitometer under test shall agree with the values shown on the calibration chart accompanying the reference specimen. For routine sensitometric applications, tolerances may be allowed as follows:

Density	Tolerance
0.0 to 1.0	$\pm 0.01$
1.0 to 2.0	$\pm 0.015^*$
2.0 to 3.0	$\pm 0.02$
3.0 to 4.0	$\pm 0.03$

*Note:* Each individual densitometer will vary about its bias level. The amount of variation will depend upon the type and condition of the instrument. Precision or repeatability of individual densitometers will determine the need for and degree of replication of measurements. A statistical method for controlling this variability is outlined in the SMPTE book, "Control Techniques in Film Processing."

- 5.3 A densitometer which gives measured values with the reference specimen in excess of the tolerance in 5.2 shall be taken out of service for repair or adjustment. Alternatively, a correction table or chart may be utilized to permit adjustment of the measured values in accordance with the calibration chart.
- 5.4 If the densitometer under test is of the non-conforming type, its scope may be evaluated by measuring samples which vary in scattering power and spectral selectivity and comparing these results with those obtained by the standard method.

#### Appendix: American Standard diffuse visual density value (from reference specimen calibration chart).



\* It is impossible to read thousandths of a density point on all but the most precise instruments. This figure is given as a tolerance based on the statistical average of several readings.

# Test Film for Checking 16mm Motion-Picture Photographic Sound Projectors

## 1. Scope

This Recommended Practice describes a film and method for rapidly checking and demonstrating 16mm motion-picture projection and photographic sound performance. The film is suitable for use by projector manufacturers, service stations, educational organizations and camera stores. No test instruments are required.

## 2. Test Film

- 2.1 The film shall have a photographic sound record and accompanying picture. The sound record dimensions shall comply with American Standard Sound Record on 16mm Prints, PH22.41-1957, and the film stock used shall be cut and perforated in accordance with American Standard Dimensions for 16mm Film, Perforated One Edge, PH22.12-1953.
- 2.2 The test film shall contain sections selected by a special Engineering Committee of the Society of Motion Picture and Television Engineers to test for the following:

### Sound Samples

1. Faithful reproduction of wide-range music
2. Clarity of tone—piano
3. Correct sound track guiding—buzz track
4. Normal volume level
5. Compromise sound focus
6. Frequency response from 50 to 5,000 cycles
7. Dialogue intelligibility

### Picture Samples

1. General picture steadiness
2. Uniform aperture brightness
3. General picture quality

- 2.3 Each film shall be provided with a head and tail leader. The main title shall include the issue number of the film so that revised versions may be easily identified. Subtitles superimposed over each section shall indicate the particular projector sound and/or picture characteristic to be tested by that portion of the film.

- 2.4 Each film shall be accompanied by an instruction sheet indicating the procedure to be used in checking and demonstrating 16mm projection equipment.
- 2.5 The length of the film shall be approximately 135 feet.
- 2.6 Each film shall be wound on a reel and packed in a taped can.

## 3. Method of Use

- 3.1 With the projector set up for projection of a sound picture print and the loudspeaker(s) properly located in accordance with the instruction book furnished with the equipment, proceed as follows:
  - (a) Set tone control(s) to normal, thread test film into projector and set volume for comfortable loudness. If the sound optics have adjustable focus, adjust the focus to give the most satisfactory audio quality.
  - (b) Frame and focus picture for best overall screen image.
- 3.2 As the test sections are projected, observe the following:
  - (a) Listen for full range of orchestra. Note picture steadiness at top and sides. Note picture sharpness across the entire frame. White streaks on letters indicate travel ghost.
  - (b) Look for uniform picture brightness. Listen for smooth, even music; quaver indicates flutter.
  - (c) Silence or equal loudness of the two tones shows correct side-guide adjustment.
  - (d) Normal volume is established while listening to a 700-cycle tone. Use same gain setting each run.
  - (e) Three high tones (5,000 cycles) will indicate correct scanning assembly adjustment. Emulsion position is reversed in middle section.
  - (f) Seven distinct tones are frequencies of 50 to 5,000 cycles. All should reproduce well.
  - (g) Listen for natural sound of voices.

*Note:* A test film made in accordance with this Recommended Practice is available from the Society of Motion Picture and Television Engineers. (This film was formerly called "Jiffy" Test Film.)

## Proposed American Standards

Two Proposed American Standards and a Recommended Practice are published here for a trial period and public review. Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to June 15, 1964. If no adverse criticism is received by that date, the proposed standards will be submitted to the ASA Sectional Committee for further processing. The Proposed Recommended Practice, on the other hand, will be submitted directly to the SMPTE Board of Governors for final approval.

Proposed American Standard PH22.144, Dimensions and Optical Specifications of Test Slides and Transparencies for Television, is the first standard of a series describing technical transparencies for television. For several years, a subcom-

mittee of the Society's Television Committee, in cooperation with the Electronic Industries Association, has been updating material such as the well known RETMA Charts, for publication as American Standards. The Committee under the chairmanship of Dr. John H. Ladd has completed this fundamental standard describing the physical aspects of precision black-and-white slides. When approved, this standard will be the basic reference for mechanical dimensions, optical specifications and stability requirements.

Proposed American Standard C98.6, Dimensions of Video, Audio and Tracking Control Records on 2-In. Video Magnetic Tape, specifies the physical placement of the various records and tracks on video magnetic tape. This standard gives the data for the so called Quadruplex system of recording at both the 15 and 7.5 inch per second tape speeds.—A.E.A.