and practices. America's position in the world market in coming decades could be impaired by adherence to our customary units of measurement. Further postponement of the program of coordinated metric conversion will only result in greater barriers to our international trade.

"Unless the United States makes the commitment to 'go metric' over this decade, international standards will not adequately reflect the needs and products of U.S. industry," Secretary Peterson added. "If American technology is to compete in the world market, standards used in the development of new U.S. products and technologies must be written into these international standards. This would ensure that other nations bear their fair share in the process of harmonizing world trade.

"I am recommending that the metric conversion program be extended over a decade and have the advantage of well-considered plans to ensure a minimum of difficulty and confusion. The job of planning this voluntary conversion would be placed in the hands of those most affected through representation on the National Metric Conversion Board.

"Although some sectors will find it advantageous to convert more quickly, others more slowly, a decade following agreement on the national voluntary plan should see the country through the awkward period of dual usage," Secretary Peterson said.

The United States is the last industrially developed nation which has not established a national policy committing itself and facilitating conversion to the metric system, although Congress in 1866 passed a law making it legal to use the metric system in commerce and trade. The 3-year study by the Bureau in cooperation with some 55 Government agencies, industry, and almost every sector of society, was completed in response to an Act of Congress. The report's recommendations were:

- That the United States change to the International Metric System deliberately and carefully;
- That this be done through a coordinated national program;
- That the Congress assign the responsibility for guiding the change, and anticipating the kinds of special problems described in the Report, to a central coordinating body responsive to all sectors of our society;
- That within this guiding framework, detailed plans and timetables be worked out by these sectors themselves;
- That early priority be given to educating every American schoolchild and the public at large to think in metric terms;
- That immediate steps be taken by the Congress to foster U.S. participation in international standards activities;
- That in order to encourage efficiency and minimize the overall costs to society, the general rule should be that any changeover costs shall "lie where they fall";
- That the Congress, after deciding on a plan for the Nation, establish a target date 10 years ahead, by which time the U.S. will have become predominantly, though not exclusively, metric; and
- That there be firm Government commitment to this goal.

standards and recommended practices

SMPTE Recommended Practices Approved

On July 13, 1972, the Society's Board of Governors approved three SMPTE Recommended Practices. SMPTE Recommended Practice RP 46-1972, Density of Color Films and Slides for Television, was developed jointly by the Color and Television Committees in an effort to specify density parameters which conform to international agreements through the CCIR. SMPTE Recommended Practices RP 27.6-1972, Specifications for Gray-Scale Operational Alignment Test Pattern for Studio and Field Television Cameras and RP 27.7-1972, Specifications for Gray-Scale Operational Alignment Test Pattern for Telecine Cameras, have been designed to facilitate the operational alignment of television systems on the live stage and telecine components. A subcommittee report describing this work was published in the December 1967 *Journal*. Copies of these and other SMPTE Recommended Practices may be obtained from Society Headquarters upon request.

American National Standard Reaffirmed

On July 11, 1972, the American National Standards Institute, taking the recommendation of the SMPTE Engineering Committees and American National Standards Committee PH22, reaffirmed without change American National Standard Dimensions for 35 mm Motion-Picture Film, Perforated 32 mm, 2R-2994, PH22.73-1966. The standard was published in the March 1966 *Journal*.

American National Standard Withdrawn

On July 11, 1972, the American National Standards Institute approved the withdrawal of American National Standard Specifications of 8 mm Magnetic Sound Reproducing Characteristic, PH22.134-1963. Withdrawal action was initiated because (a) the test film specified in Section 2 has never been available and (b) there is doubt as to the legitimacy of standardizing the electrical output of the sound reproducing system rather than the acoustical output. The standard was published in the July 1963 *Journal*.

International Standard Approved

The International Organization for Standardization (ISO), whose activities in the field of cinematography were described in the November 1967 *Journal* (pp. 1113–1115), approved on April 15, 1972 International Standard ISO 1700-1972, Cutting and Perforating Dimensions of 8 mm Type S Motion-Picture Raw Stock Film. The document is in complete accord with American National Standard Dimensions for 8 mm Motion-Picture Film, Perforated Super 8, 1R-1667, PH22.149-1967. Attention is directed to the fact that only the technical content is published here. Copies of the complete recommendation are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018. — Alex E. Alden, Staff Engineer.

SMPTE RECOMMENDED PRACTICE — RP 46-1972

Density of Color Films and Slides for Television

Introduction

In May, 1964, the Joint Subcommittee of the Color and Television Engineering Committees of the SMPTE issued a report entitled "Considerations in Color Film Production for Color Television" as an appendix for a future recommended practice for contrast and density range of color films for color television. The report, which is considered to be a part of this recommended practice and which is included as an appendix, emphasizes careful control of the original photography, including such items as lighting and stage practice recommendations. The significance of the densities specified in this practice should be considered with regard to the factors discussed in the appendix, particularly the last two paragraphs.

In March, 1966, Issue No. 2 of the SMPTE Color Television Reference Film was released for sale. This issue and Issue No. 3 (released in July, 1967) closely followed the recommendations in the initial article. Successful telecasting of prints of these issues as well as other commercial material conforming to the initial recommendation has lead to the following specifications regarding density levels for color prints which reproduce well on a color or black-and-white television system.

In its Final Interim Meeting in Geneva in September, 1969, the International Radio Consultative Committee (CCIR) recommended, as part of its Standards for the International Exchange of Monochrome and Colour-Television Programmes on Film, CCIR Recommendation 265-2, density and color balance parameters which conform to this experience. Since the CCIR recommendation has been accepted internationally, the SMPTE Recommended Practice is designed to follow it as much as possible.

1. *Scope*

This recommendation specifies important density values of color 16mm and 35mm motion-picture films and slides intended for television transmission.

2. *Density Requirements*

2.1 The method of density measurement shall be in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral quality of the densitometer should conform to ISO Recommendation R 5-1955, Diffuse Transmission Density (Photography), for diffuse visual density, Type VI-b.

2.2 The density corresponding to television white level should be 0.3 to 0.4 (See Note 1). This value is not intended to apply to specular highlights and other small areas where details need not be reproduced.

2.3 The maximum density of a film is determined by scene contrast and the film transfer characteristic. Dark or black areas, in which faithful reproduction of detail may not be essential, may have densities in the order of 2.5 (See Note 2). However, both image gradation and color in such areas may be distorted or lost in television reproduction.

Notes

1. Television white level preferably corresponds to a fully-lighted object in the scene having a reflectance of about 60 percent. This results in reproduction of fully-lighted human faces which have reflectances of 35 to 15 percent at film densities 0.2 to 0.5 greater than the density corresponding to television white.

2. Although this value appears higher than that recommended for black-and-white films (SMPTE Recommended Practice RP 7-1970, Density and Contrast Range of Black-and-White Films and Slides for Television), it is in effect no higher. Silver image films scatter light such that the effective density in the television film chain is increased by an average factor of 1.35 over that measured in singly diffused light. For dye images, this light scatter factor (Callier Q) is approximately 1.0.

Approved July 1972

SMPTE RECOMMENDED PRACTICE — RP 27.6-1972

Specifications for Gray-Scale Operational Alignment Test Pattern for Studio and Field Television Cameras

1. *Scope*

Format, dimensions and optical diffuse densities are specified for a test pattern transparency to be used as an operational alignment tool for studio and field television camera systems.

2. *Purpose*

The test pattern is suitable for the following operational checks in a television system:

(a) Light-signal transfer characteristics of a television camera

(b) Signal compression or clipping in a camera video amplifier system

(c) Operation of camera gamma-correction circuitry

(d) Operational setup and balance of gain and black level controls

(e) Amplitude tracking among the video signal channels of a color television camera.

3. *Format*

3.1 Pattern. A reproduction of the test pattern is shown in Fig. 1.

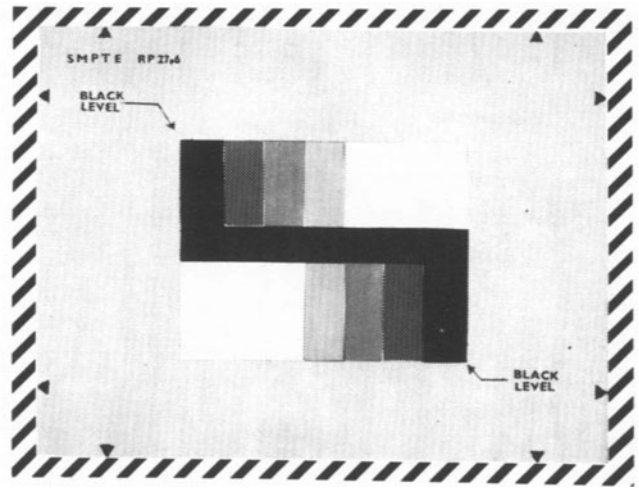


Figure 1
Reproduction of Test Pattern

Approved July 1972

3.2 Pattern progression of transmission values for the gray-scale follows a 2.5-power law with increments of the variable from the minimum to maximum.

3.3 An additional area (B) of lesser transmission located between the two gray scales provides a "blacker-than-black" area.

3.4 Surround. The basic surround area (A) is of uniform transmission one-half step between the levels of Steps 5 and 6.

3.5 Arrows and Border. The eight boundary arrows and black-and-white border define the edge of the test pattern area and the scanned area.

3.6 Pattern Identification. The identification number of this document shall appear on the pattern as specified in the figures.

4. *Dimensions*

4.1 The dimensions of the test pattern shall be as shown in Fig. 2 and the table.

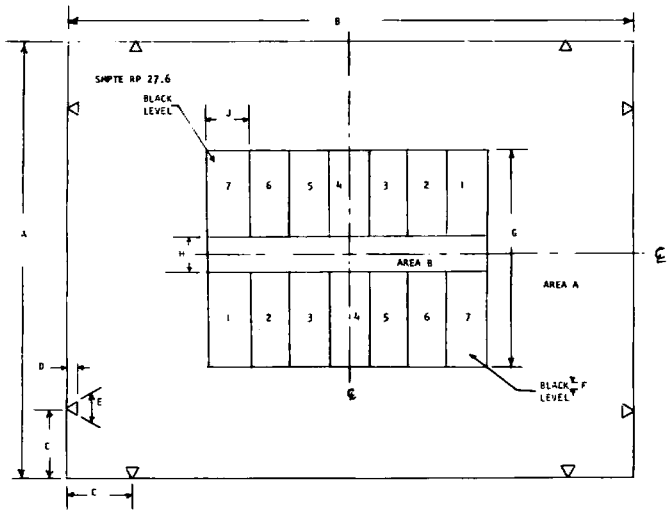


Figure 2

Dimensional Drawing of Test Pattern

	Dimensions	Percent	Inches 2x2	Inches 8x10	
A	Scanned image height	100	0.813	6.30	
B	Scanned image width	133.3333	1.121	8.40	
C	Position of arrow	15.0	0.126	0.94	
D	Arrow length	4.0	0.031	0.25	
E	Arrow shape in degrees				40.0
F	Letter and number height	2.5	0.021	0.16	
G	Overall bar height	50.0	0.422	3.15	
H	Axial bar height	8.0	0.068	0.50	
J	Bar width	9.57	0.081	0.60	

4.1.1 All bars shall be positioned symmetrically in respect to the centerlines of the image area within ± 2 percent of the respective dimension.

4.2 Image Size. The size of the area indicated by the eight boundary arrows shall be as follows:

4.2.1 2x2 in test slides and 8x10 in transparencies shall have Category 3 dimensions, as specified in American National Standard Dimensions and Optical Specifications of Test Slides and Transparencies for Television, PH22.144-1965 (Reaffirmed 1969).

4.3 Black-and-White Border. The dimensions of the black-and-white border shall be as follows:

4.3.1 Height and width dimensions of the black-and white border for 2x2 in slides and 8x10 in transparencies are specified in ANSI PH22.144-1965.

5. *Optical Densities*

5.1 Optical Densities. All optical densities shall be measured in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral characteristics of the densitometer used for measuring diffuse visual density, type VI-b, shall conform to ISO Recommendation R5-1955, Diffuse Transmission Density (Photography).

5.2 The densities of the steps and areas shall be as follows:

Steps	Density	Transmission (Percent)
1	0.30 ± 0.02	50.0
2	0.45 ± 0.02	35.4
3	0.62 ± 0.02	23.8
4	0.83 ± 0.05	14.8
5	1.08 ± 0.05	8.22
6	1.42 ± 0.05	3.80
7	1.90 ± 0.05	1.25
Areas		
A	1.24 ± 0.05	5.76
B	2.40 ± 0.10	0.40

The density difference between the steps and areas shall be as follows with a tolerance of ± 0.02:

Step 1 — Step 2	0.15
Step 2 — Step 3	0.17
Step 3 — Step 4	0.21
Step 1 — Step 5	0.25
Step 5 — Area A	0.16
Area A — Step 6	0.18
Step 6 — Step 7	0.48

The density of any step or area shall not vary more than ± 5 percent over the spectral range of 400 to 700 nanometers.

5.3 The density of the arrows and identification shall be between 0.3 and 0.4.

Appendix

(The Appendix is not a part of this SMPTE Recommended Practice, but is included for information purposes.)

A1. *Application*

The neutral step pattern is intended to serve several essential functions in the alignment of studio and field television camera systems wherein the normal scene contrast handling capability is limited to 10:1.*

A2. *Transfer Characteristic*

One such function is to provide a simple output signal waveform from which the camera system can be adjusted to a reference transfer characteristic or gamma. The pattern configuration is shown in Fig. 1. The waveform appears as two crossed staircases when viewed at line scan on a waveform monitoring oscilloscope. The stairs consist of seven treads and six risers which will cross on the fourth step.

The progression of transmission values for the steps follows a 2.5-power law with increments of the variable over a contrast range of 10:1. This exponent was chosen as an approximation of the transfer characteristic of a typical color picture display tube. Consequently, the signal waveform from a camera system, gamma-corrected to complement the display tube transfer characteristic, will appear as a smooth progression of steps from reference black level to reference white level.

Adjustment of gamma correction circuits to a specified transfer characteristic can be accomplished by setting the steps at predetermined signal levels, viewed on the waveform monitoring oscilloscope. For example, if the crossover at the fourth step is at approximately 60 IRE units and if no setup is present, the average transfer characteristic will be 1/2.5 or 0.4. If the crossover is higher than this, the transfer characteristic will be less than 0.4; conversely, if the crossover is lower, the transfer characteristic will be greater than 0.4.

A3. *Neutral Color Balance and Contrast Range*

A second function of the pattern is to compare the transfer characteristics of the multiple channels of a color camera in order to facilitate adjustment of neutral color balance among channels over signal levels corresponding to the scene contrast range to be transmitted in normal operation.

A4. *Iris Compensation and Blanking Clipping*

A third function of the pattern is to produce a "blacker-than-black" signal level for setting the iris compensation adjustment found in some cameras, and for checking blanking clipping circuit operation. For this purpose a horizontal strip of high density is provided between the step patterns. Except when making the iris compensation adjustment, this portion of the pattern should not appear in the waveform, since it is darker than the minimum brightness intended to be transmitted and thus will be clipped by the blanking circuitry.

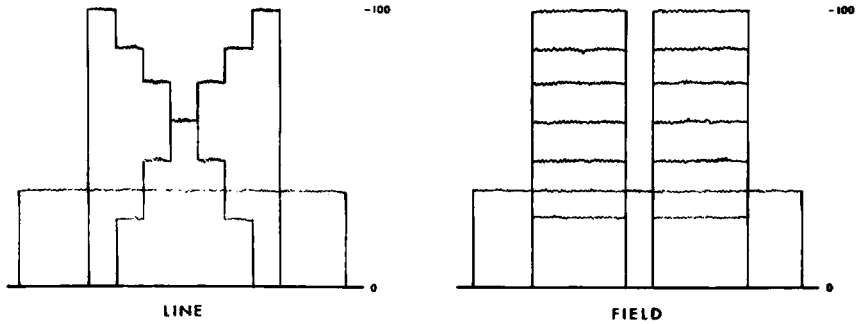
*A second pattern design specified in SMPTE Recommended Practice RP 27.7, Specifications for Gray Scale Operational Alignment Test Pattern for Telecine Cameras, is intended for use with telecine cameras where motion picture contrast ranges, considerably in excess of 10:1, are transmitted.

A5. *Shading Correction*

A fourth function of the pattern is to provide a signal suitable for adjustment of shading correction circuits. The mid-range density surrounding the stairsteps permits adjustment for a uniform signal level and for neutral balance among channels over the full scanned raster. This level falls between steps five and six.

A6. *Waveform Presentation*

A typical waveform monitoring oscilloscope presentation at line and field sweep rates as it appears at the input of the encoder is shown below.



A7. *Interpretation of Transmission Densities*

The transmission densities are specified in terms of diffuse measurement, and the pattern is specified to be made of a material which does not introduce any scattering of light. The latter criterion is to obviate the need for a Callier Q correction factor when the pattern is used with an optical system having a specular transmission characteristic. If, however, the pattern is to be used only with a diffuse light source, a diffusing material such as photographic silver may be used.

SMPTE RECOMMENDED PRACTICE — RP 27.7-1972

Specifications for Gray-Scale Operational Alignment Test Pattern for Telecine Camera

1. *Scope*

Format, dimensions and optical diffuse densities are specified for a test pattern transparency designed to facilitate the operational alignment of telecine camera systems used in the transmission of film and transparent slides.

2. *Purpose*

The test pattern is suitable for operational checks of the following characteristics of a television telecine camera system:

(a) Light-signal transfer characteristics of a television camera

(b) Signal compression or clipping in the video signal channels

(c) Operation of camera gamma-correction circuitry

(d) Operational setup and balance of gain and black level controls

(e) Amplitude tracking among the video signal channels of a color television camera.

This pattern is intended to be reproduced on a transparent slide suitable for placement at the field lens of a telecine camera and to be illuminated by a projector normally used with the camera for television transmissions.

3. *Format*

3.1 Pattern. A reproduction of the test pattern is shown in Fig. 1.

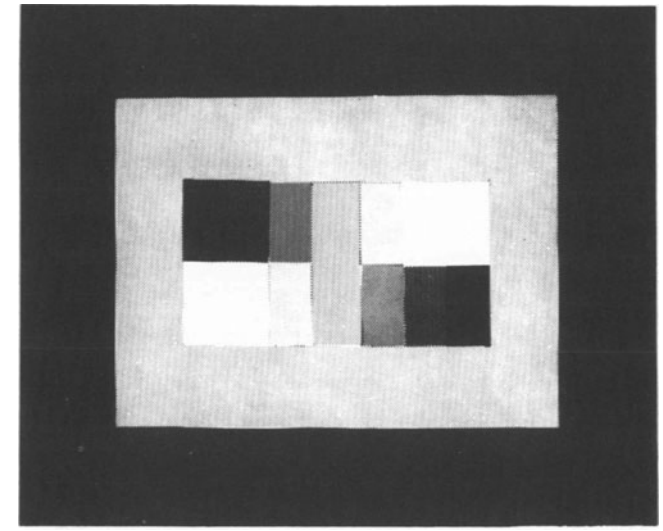


Figure 1
Reproduction of Test Pattern

Approved July 1972

3.2 Steps

3.2.1 The steps in the pattern follow a 2.5-power law increase in transmission, over a 40:1 contrast range, from the next-to-most dense step to the least dense step.

3.2.2 The most dense step falls at a one-half step increment below the adjacent step on the 2.5-power law curve.

3.3 Surround

3.3.1 The surround area A is a uniform density at one-half step increment between Steps 4 and 5.

3.3.2 The surround area B defines the edge of the test pattern area.

3.4 Identification. The number of this Recommended Practice shall appear on the slide over the opaque area, and thus will not be reproducible over the television system.

4. *Dimensions*

4.1 Pattern

4.1.1 The dimensions of the test pattern shall be as shown in Fig. 2 and the table.

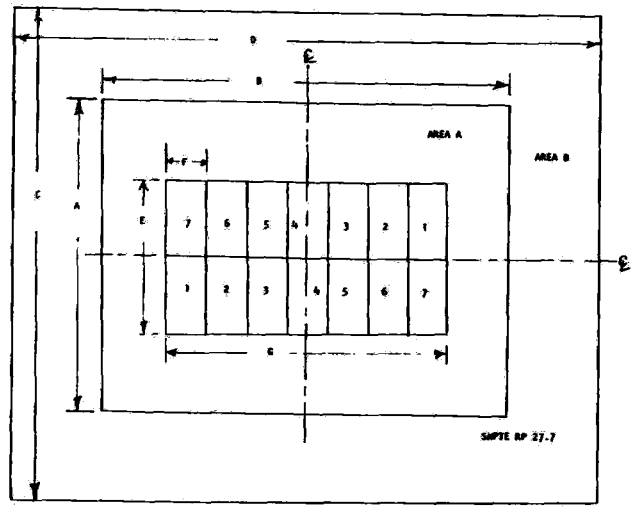


Figure 2

Dimensional Drawing of Test Pattern

Dimensions		Inches
A	Scanned image height	2.06 ± 0.06
B	Scanned image width	2.75 ± 0.06
C	Height of Area B	3.25*
D	Width of Area B	4.00*
E	Overall bar height	1.00 ± 0.06
F	Bar width	0.25 nom
G	Width of seven bars	2.00 max

* See 4.2.1. for tolerance.

4.1.2 All bars shall be positioned symmetrically in respect to the centerlines of the image area within ± 2 percent of the respective dimension.

4.1.3 To facilitate manufacture of the gray-scale steps, a narrow, opaque black border may be placed around each step. Surround area A may be composed of up to four strips of material. In this case, the junctions between strips may be covered with narrow strips of opaque material.

4.2 Slide

4.2.1 The dimensions of the slide shall be in accordance with American National Standard Slides and Opaques for Television Film Camera Chains, PH22.91-1954 (Reaffirmed 1969). Applicable dimensions from PH22.91-1954 are tabulated below:

Parameter	Dimension
Slide height	$3^1_4 + {}^1_{64} - {}^1_{32}$ in
Slide width	$1 + {}^1_{64} - {}^1_{32}$ in
Slide thickness	$^3_{32}$ in maximum

5. *Optical Densities*

5.1 Measurements. All optical densities shall be measured in accordance with American National Standard Method of Determining Transmission Density of Motion-Picture Films, PH22.27-1960 (Reaffirmed 1969). The spectral characteristics of the densitometer used for measuring diffuse visual density, type VI-b, shall conform to ISO Recommendation R5-1955, Diffuse Transmission Density (Photography).

5.2 Transmission. The pattern shall be reproduced upon a non-scattering spectrally neutral material which will provide the same transmission characteristics for diffuse and specular light sources.

5.3 Density Values. The densities of the steps and areas shall be as follows:

Steps	Density	Transmission (Percent)
1	0.30 ± 0.01	50.0
2	0.48 ± 0.01	32.9
3	0.70 ± 0.02	19.9
4	0.98 ± 0.02	10.6
5	1.34 ± 0.03	4.5
6	1.90 ± 0.04	1.25
7	2.35 ± 0.05	0.45
Areas		
A	1.14 ± 0.03	7.2
B	Opaque	0

The density of any step or area shall not vary more than ± 5 percent over the spectral range of 400 to 700 nanometers.

Appendix

(The Appendix is not a part of this SMPTE Recommended Practice, but is included for information purposes.)

A1. *Application*

The neutral step pattern is intended to serve several essential functions in the alignment of telecine camera systems wherein the scene contrast handling capability may exceed to a significant degree the 40:1 limit normally imposed upon live cameras.* It is provided in a 3^1_4 x 4 in size for use at the field lens position of telecine cameras with illumination from the associated film projector.

A2. *Transfer Characteristic*

One such function is to provide a simple output signal waveform from which the camera system can be adjusted to a reference transfer characteristic or gamma. The pattern configuration is shown in Fig. 1. The waveform appears as two crossed staircases when viewed at line scan on a waveform monitoring oscilloscope. The stairs consist of seven treads and six risers which will cross on the fourth step.

The progression of transmission values for steps one through six follows a 2.5-power law; with increments of the variable, over a contrast range of 10:1. This exponent was chosen as an approximation of the transfer characteristic of a typical color picture display tube. Consequently, for these steps the signal waveform from a camera system, gamma-corrected to complement the display tube transfer characteristic, will appear as a smooth progression of steps from near black level to reference white level.

The transmission of step seven has been chosen to fall at one-half an increment below step six on a 2.5-power law. This provides an additional contrast range relative to step one of slightly over 100:1 which normally is encountered in motion-picture film. It is to be noted, however, that in present-day operational equipment, tonal gradations over the range of densities between the value of steps six and seven usually are not reproduced faithfully because of black compression and gamma-correction circuit limitations.

Adjustment of gamma-correction circuits to a specific transfer characteristic can be accomplished by setting the steps at predetermined signal levels, viewed on the waveform monitoring oscilloscope. For example, if the crossover at the fourth step is at approximately 50 IRE units, the average transfer characteristic will be 1/2.5 or 0.4. If the crossover is higher than this, the transfer characteristic will be less than 0.4; conversely, if the crossover is lower, the transfer characteristic will be greater than 0.4.

A3. *Neutral Color Balance and Contrast Range*

A second function of the pattern is to compare the transfer characteristics of the multiple channels of a color camera in order to facilitate adjustment of neutral color balance among channels over signal levels corresponding to the film contrast range to be transmitted in normal operation.

* An alternate pattern design specified in SMPTE Recommended Practice RP 27.6, Specifications for Gray Scale Operational Alignment Test Pattern for Studio and Field Television Cameras, is intended for use with live cameras where the maximum acceptable scene range is 40:1.

A4. *Blanking Clipping*

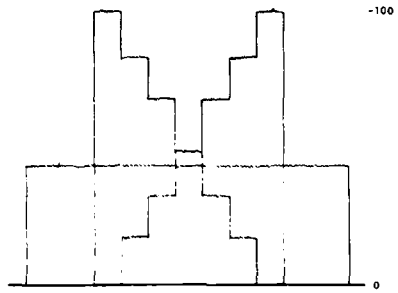
A third function of the pattern is to check blanking clipping circuit operation. For this purpose, clipping action on step seven can be observed on a waveform monitoring oscilloscope as blanking or black level controls are adjusted. For normal setup, step seven should be set at blanking level.

A5. *Shading Correction*

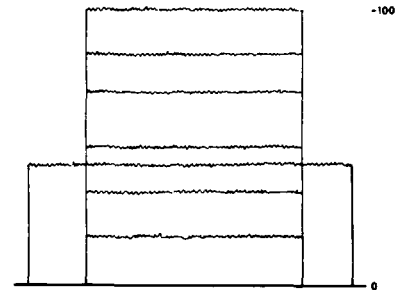
A fourth function of the pattern is to provide a signal suitable for adjustment of shading correction circuits. The mid-range density surrounding the stairsteps permits adjustment for a uniform signal level and for neutral balance among channels over the full scanned raster. This level falls between steps four and five.

A6. *Waveform Presentation*

A typical waveform monitoring oscilloscope presentation at line and field sweep rates as it appears at the input of the encoder is shown below.



LINE



FIELD

A7. *Interpretation of Transmission Densities*

The transmission densities are specified in terms of diffuse measurement, and the pattern is specified to be made of a material which does not introduce any scattering of light. The latter criterion is to obviate the need for a Callier Q correction factor when the pattern is used with an optical system having a specular transmission characteristic.

Cinematography — 8 mm type S motion-picture raw stock film — Cutting and perforating dimensions

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the raw stock cutting and perforating dimensions for 8 mm Type S motion-picture film.

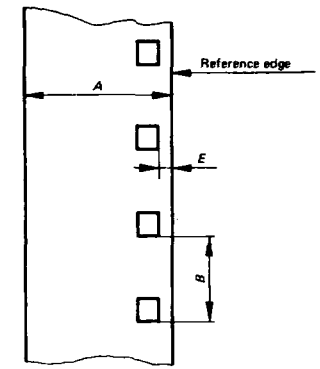
2 REFERENCE

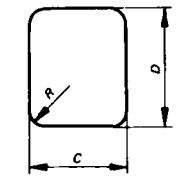
ISO/R 543, *Definition and marking of safety film for motion-picture uses.*

3 DIMENSIONS AND CHARACTERISTICS

The dimensions and tolerances specified in the table apply to raw stock safety film as defined in ISO/R 543, immediately after cutting and perforating.

If required by usage, the manufacturer should indicate the atmospheric conditions applied to the dimensional control at the time of cutting and perforating.





TABLE

Dimension	mm	in
A	7.975 ± 0.040	0.314 0 ± 0.001 6
B	4.234 ± 0.010	0.166 7 ± 0.000 4
C	0.914 ± 0.010	0.036 0 ± 0.000 4
D	1.143 ± 0.010	0.045 0 ± 0.000 4
R	0.13 ± 0.025	0.005 ± 0.001 0
E	0.51 ± 0.05	0.020 ± 0.002
L [1]	423.4 ± 0.40	16.67 ± 0.016

1) Dimension *L* represents the length of any 100 consecutive perforation intervals.

APPENDIX

Z.1 UNIFORMITY OF PERFORATIONS

The dimensions given in this International Standard represent the practice of film manufacturers in that the dimensions and tolerances are for film stock immediately after perforation. The punches and dies themselves are made to tolerances considerably smaller than those given, but since film is a plastic material, the dimensions of the slit and perforated film stock never agree exactly with the dimensions of the slitters, punches and dies. Film can shrink or swell due to loss or gain in moisture content or can shrink due to loss of solvent. These changes invariably result in changes in the dimensions during the life of the film. The change is generally uniform throughout a roll.

The uniformity of pitch, hole size and margin (dimensions ***B, C, D,*** and ***E***) is an important variable affecting steadiness. Variations in these dimensions, from roll to roll, are of little significance compared to variations from one perforation to the next. Actually, it is the maximum variation from one perforation to the next within a small group of consecutive perforations that is important.

Z.2 EQUIPMENT DESIGN

It is the common tendency of film to expand when exposed to high relative humidity. Allowance should be made for this factor in equipment design and in no case should the equipment design fail to accomodate a film 8.08 mm (0.318 in) width under the conditions of use.