(1) the study of 16mm image steadiness, (2) the use of motion pictures for teaching and training, or (3) the revision of PH22.11, "Dimensions of 16mm Projection Reels."

The committee received reports of the activities of Committee PH7 on Photographic Audio-Visual Standards and of the Ad Hoc Committee concerned with possible revisions of the Universal Leader.

More than 20 standards which are the responsibility of the 16mm and 8mm Committee are up for five-year review. Most of these need editorial revision, chiefly with regard to nomenclature for 8mm film. After some discussion, it was proposed that an accelerated procedure be used with standards requiring editorial modification, but not technical changes. This should materially reduce the workload for this committee and the numerous other groups involved in approving standards.

GEORGE H. GORDON
Chairman

Standards Committee Report

The Standards Committee met on 22 April 1974.

Because test films and tapes are of such importance to the Society, an Ad Hoc Committee has been formed under the chairmanship of R. Colburn to review this entire program with a view toward upgrading its quality and broadening its scope.

Of major interest to the Standards Committee is the question of Consumer Performance and Safety Standards. It is well known that the public and government agencies favor such standards, and there was much discussion regarding the role the Society should play. It was the consensus of the Standards Committee that the Society should sponsor such standards in our fields of interest, and to this end Herb Farmer will form an Ad Hoc Group to draft a trial Performance and Safety Standard for Motion-Picture Projectors. The draft standard will be reviewed with the Society's legal counsel, and if the counsel approves the draft standard, the Board of Governors will be petitioned to enlarge the scope of the Society's standardizing activities to include Consumer Performance and Safety Standards.

The Committee, once again, emphasized the policy of not developing standards on equipment available from only a single source.

The Committee has been concerned, for some time, with the problem of recruiting new members into the standards activity of the Society. In order to keep standardizing activities viable and current, it is important that younger members be enlisted from time to time, yet this does not always happen. It was the consensus of the Committee that there is no single way of solving the problem, and that it is the responsibility of all individuals concerned with standardization to try to convince companies to support the activities and to recruit suitable members.

C. E. ANDERSON
Chairman

standards and recommended practices

Approved American National Standards

On 9 July 1974, the American National Standards Institute approved C98.11-1974, Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s.

The standard does not reflect a technical change but has been revised in terms of the shortcircuit flux method. It no longer bases its calibration on a primary reference level recording specified in C98.10.

Inasmuch as compliance with American National Standards is purely voluntary, these standards will become truly effective when broad publicity is given to their existence. ANSI and SMPTE would appreciate any personal influence to promote the use of this standard where such action is appropriate. Copies of these standards may be obtained for a nominal fee from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Draft American National Standards

Two Draft American National Standards are published here for a trial period and public review: PH22.41, Dimensions of Photographic Sound Records on 16mm Motion-Picture Prints, and PH22.80, Specifications for Scanning-Beam Uniformity Test Film for 16mm Motion-Picture Sound Reproducers.

These revisions do not reflect a technical change from the original versions but have been updated and clarified to facilitate their use.

Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters prior to 1 December 1974. The proposals have been submitted to American National Standards Committee PH22. All comments received through *Journal* publication will be reviewed before conclusion of Committee action.

Approved International Standards

The International Organization for Standardization (ISO) approved International Standards ISO 543-1974, Motion-Picture Safety Film—Definition, Testing and Marking, and ISO 1188-1974, Recording Characteristic for Magnetic Sound Record on 16mm Motion-Picture Film—Specifications, the technical content of which are published here for information: ISO 543-1974, basically a reaffirmation of the earlier issue which was an ISO Recommendation. It is in complete agreement with American National Standard PH1.25 which is the basis for PH22.31, Specifications for Motion-Picture Safety Film, and ISO 1188-1974, a new standard which reflects the change from a 100 microsecond recording characteristic to the recently adopted 70 microsecond practice. The Society's Sound Committee is preparing a similar standard to cover the 70 microsecond practice, which is a change from the USA practice of a compromise 35 microsecond characteristic in use up to this time. It is anticipated that the change in the USA practice will be effective in mid 1975.

Copies of all International Standards are sold through the American National Standards Institute, 1430 Broadway, New York, NY 10018.

ISO is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. The International Standards published here were developed by Technical Committee 36 on Cinematography. The work of this Committee is administered by the Engineering Department of the SMPTE which functions as the secretariat in ANSI's name. The report of the last meeting of the Committee was published in the February 1974 *Journal of the SMPTE*.—Alex E. Alden, *Staff Engineer*

ANSI C98.11–1974
Revision and Consolidation of C98.10-1969 and C98.11-1969

ican National Standard
cations for an audio level and equency test tape for quadruplex nagnetic tape recorders operating at 7.5 in/s

Secretariat: Society of Motion Picture and Television Engineers, Inc.

. Scope

ecifies an audio frequency for adjusting the sensitivity esponse of the audio repro- quadruplex video magnetic ating at a tape speed of 7.5 in accordance with Amer- ard Frequency Response and Recorders and Reproducers One for 2-inch Quadruplex e Operating at 15 and 7.5

al Specifications

Records. The dimensions of nstituting this test tape shall n National Standard Dimen- o and Tracking Control Rec- Magnetic Tape Quadruplex 7.5 in/s, C98.6-1973.

he nominal linear speed of e 7.5 in/s in accordance with Standard Speed of 2-inch x Video Magnetic Tape Re-).

sections shall be recorded nted television magnetic re- mensions of which are speci- tional Standard Dimensions agnetic Tape, C98.1-1963

No video signal of any kind

2.5 Tracking Control Signal. A tracking control signal, conforming to that specified in SMPTE Recommended Practice on Specifications of Tracking Control Record for 2-inch Quadruplex Video Magnetic Tape Recordings, RP 16-1970, as applicable, shall be recorded throughout the tape.

2.6 Test sections shall be recorded on Audio Record No. 1.

2.7 Voice announcement at the beginning of *this tape shall provide identification as to the* applicable American National Standard and test tape manufacturer. Each test section and segment shall be preceded by voice announcements identifying the content. Voice announcements shall be recorded at a level approximately 5 dB below operating level. (See 3.1 below.)

2.8 Weighted Peak Flutter. The weighted peak flutter of this test tape shall not exceed 0.2 percent.

3. Test Sections

3.1 SMPTE Quadruplex Audio Operating Level Test. This section is used to calibrate the sensitivity of an audio reproducing system.

3.1.1 Frequency. The frequency of the recording shall be 1000 Hz ± 2 percent when the tape is reproduced at exactly 7.5 in/s.

3.1.2 Tape Flux Per Unit Width. The SMPTE Quadruplex Audio Operating Level Test recording has an rms shortcircuit tape flux per unit track width of 110 ± 3 nanowebers per meter of track width. (110 nWb/m corresponds to 110 pWb/mm, and 11 mMx/mm.)

3.1.3 Flux Level Variation. The flux level variation during the length of the tone shall fall within an envelope whose total width is 0.5 dB.

3.1.4 Distortion. The total harmonic distortion of this section, when reproduced, shall not exceed 2 percent.

3.1.5 Duration. The minimum duration of this section shall be one minute.

3.2 Frequency Response Test. This section is to be used to calibrate the frequency response of the audio reproducing system of a video magnetic tape recorder.

3.2.1 Frequencies. The following test segment frequencies (in hertz) shall be recorded in the order given.

1000 (reference) / 63 / 125 / 250 / 500 / 1000 / 2000 / 4000 / 8000 / 10 000 / 12 500 / 16 000 / 1000 (reference)

The frequency of each recording shall be ± 2 percent of its specified value when the tape is reproduced at exactly 7.5 in/s.

3.2.2 Tape Flux Level vs Frequency. The shortcircuit tape flux level versus frequency shall be as given by the following equation:

$$L_\Phi(f) \text{ re } 110\text{nWb/m} = -9.8 + 10\log^{10}\{[1+(F_1/f)^2]/[1+(f/F_h)^2]\}\text{[dB]}$$

where f is the frequency at which the response is being computed; F_1 is the low-frequency transition frequency, 80 Hz; and F_h is the high-frequency transition frequency, 4500 Hz. A graph of this equation is shown in the figure. A table of values of the tape flux and flux level is also given.

3.2.3 Flux Level Variation. T
at each frequency, up to a
kHz, shall be within ± 0.5
specified in Sec. 3.2.2. Abo
tolerance shall be increase
The tolerances may be exte
provided that a calibration
with the test tape by the m
calibration figures furnished
shall represent the levels to
braically to the reproducer o
the particular test tape is repr
addition of these factors, the
reproducer will be that whic
sulted if the test tape flux v
been exactly as specified in S

3.2.4 Duration. The duration
sponse test segments shall b
ten seconds.

3.3 Azimuth. The tape flux sh
the reference edge of the tape
alignment error not to exceed ±
(± 3 minutes of angle).

4. Calibratio

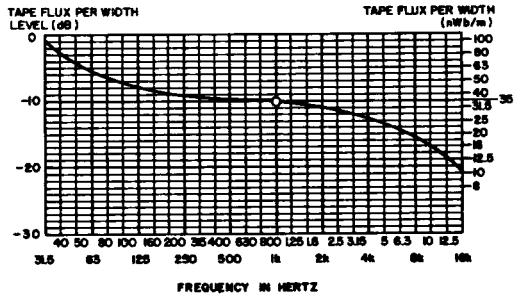
4.1 Calibration of Tape Flux.
tape flux on the test tape shall b
means of the calibrated short-g
core reproducer technique. This
scribed in the following referenc

American National Standard
uring Recorded Flux of Magn
ords at Medium Wavelengths

J. G. McKnight, "Flux and fl
sponse measurements and st
magnetic recording," J. SMP
June 1969.

R. C. Lovick, R. E. Bartow and
cording and calibration of s
reproducer test films," J. SMP
June 1969.

American National Standards Institute, 1430 Broadway, New York, N.Y. 10018



Flux and Flux Level vs Frequency

FLUX AND FLUX LEVEL VERSUS FREQUENCY

Frequency	Flux Per Width	
Hz	nWb/m	Relative Level dB
31.5	99.7	—1.1
40	79.6	—2.8
50	67.0	—4.3
63	57.2	—5.7
80	50.2	—6.8
100	45.5	—7.7
125	42.0	—8.3
160	39.8	—8.8
200	38.2	—9.2
250	37.3	—9.4
315	36.7	—9.6
400	36.0	—9.7
500	35.7	—9.8
630	35.4	—9.8
800	35.1	—9.9
1000	34.8	—10.0
1250	34.1	—10.1
1600	33.5	—10.3
2000	32.6	—10.6
2500	31.0	—11.0
3150	29.1	—11.6
4000	26.6	—12.3
5000	23.7	—13.3
6300	20.6	—14.5
8000	17.5	—16.0
10 000	14.6	—17.6
12 500	11.9	—19.3
16 000	9.7	—21.1

[1] Flux and flux level versus frequency calculated at "preferred frequencies" using the equation given in Sec. 3.2.2.

4.2 Flux Level Variation Measurements. All flux level variations shall be measured with a meter or graphic level recorder which has a full-wave rectified average measurement law and the dynamics of the standard volume indicator (vu meter), as specified in American National Standard Volume Measurements of Electrical Speech and Program Waves, C16.5-1954 (R1961).

4.3 Weighted Peak Flutter Measurement. Weighted peak flutter shall be measured in accordance with American National Standard Method for Measurement of Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. A guide to proper usage and an explanation of the calibration techniques should be supplied with each test tape.

A2. Although stated in a different way, the flux specified in Sec. 3.1.2 is the same as previously standardized in American National Standard Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s, C98.10-1969, and the flux/frequency response given in Sec. 3.2.2 is the same as that standardized in American National Standard Electrical Characteristics of Audio Record One for 2-in Quadruplex Video Magnetic Tape Recording at 15 and 7.5 in/s, C98.3-1970.

Draft American National Standard

Dimensions of Photographic Sound Records on 16 mm Motion-Picture Prints

PH22.41

Revision of PH22.41-1969

1. Scope

1.1 This standard specifies the lateral location and dimensions of variable-area and variable-density photographic sound records on 16 mm motion-picture prints.

1.2 This standard also specifies the picture-sound *displacement.*

1.3 The standard further specifies the area scanned in the sound reproducer.

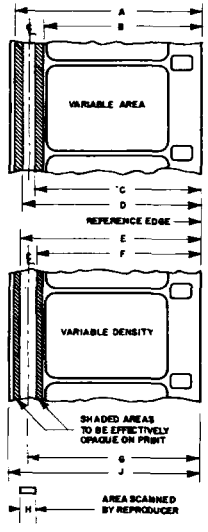
2. Sound Record

2.1 The dimensions and location of the sound records shall be as specified in the figure and table.

2.2 The recording and reproducing slit images shall be positioned at an angle of 90° ± 5′ to the reference edge of the film.

3. Reproducing Speed

The recording shall be made so that the sound record will reproduce properly at 24 perforations per second (approximately 36 feet [11 meters] per minute or 7.2 inches [18.3 centimeters] per second). *This is equivalent to the projection speed* of the picture film of 24 frames per second.



4. Picture-Sound Displacement

The sound record on the film shall precede the center of the corresponding picture (Frame 0) by *a distance of 26 frames* ± ½ *frame* in the direction of film travel during normal projection.

Dimensions	Inches	Millimeters
C	0.540 ± 0.002	13.72 ± 0.05
D	0.600 ± 0.002	15.24 ± 0.05
E	0.610 ± 0.002	15.49 ± 0.05
F	0.530 ± 0.002	13.46 ± 0.05
	Reference Dimensions	
A	0.620 nom	15.75 nom
B	0.513 nom	13.03 nom
G	0.570 nom	14.48 nom
H	0.071 nom	1.80 nom
J	0.628 nom	15.95 nom

NOTE 1: Motion-picture prints conforming to this standard are usually projected in accordance with American National Standard Specifications for Projector Usage of 16 mm Motion-Picture Film, PH22.10-1973.

NOTE 2: Motion-picture prints conforming to this standard are usually made on film made in accordance with long-pitch dimensions specified in American National Standard Dimensions for 16 mm Motion-Picture Film Perforated 1R, PH22.109-1974.

NOTE 3: Motion-picture prints described in this standard are printed in accordance with American National Standard Location of Printed Areas in 16 mm Picture and Sound Contact Printing, PH22.48-1965 (R1969).

NOTE 4: Where the original sound record has been reduction printed in some stage of the process, it may be impossible to obtain the black septum on either side of the recorded area. The presence of a clear septum between the sound and picture areas which does not encroach on the minimum tolerances of the printed area shall not be a basis for rejection of prints. Shaded septum areas are intended to include all unused areas on both sides of the sound record, up to the picture on one side and the film edge on the other. In no case shall the reduction printed area begin farther than 0.530 in (13.46 mm) nor extend less than 0.610 in (15.49 mm) from the reference edge of the film.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

A1. As a working procedure, the accuracy of picture-sound separation in a projection print is judged by screening in a review room. When the sound record is reproduced, the distance from the center of the projector aperture to the sound-scanning point should be adjusted to bring picture and sound into synchronism for the average observer. This distance should be shortened by one frame for each approximate 50 ft (15 m) of distance from loudspeaker to audience.

A2. The dimensions in this standard are measured from *the perforated edge which is the edge used in the factory* control of 16 mm-width films. Guiding from the perforated edge is the prevalent practice in the manufacture of 16 mm projectors. Films printed in 32 mm width and subsequently slit to 16 mm width will be guided and positioned from factory-slit edges. Films printed on 35 mm-*width stock will either have one or no factory-made edge.* The most common method would leave no factory-slit edge.

Draft American National Standard

Specifications for Scanning-Beam Uniformity Test Film for 16 mm Motion-Picture Sound Reproducers

PH22.80

Revision of PH22.80-1966

1. Scope

1.1 This standard describes a film, the use of which is limited to the determination of the uniformity of scanning-beam illumination in 16 mm motion-picture sound reproducers.

1.2 *This test film is not intended to be used for* the determination of the correct position of the scanning beam with respect to the reference edge of the film.

2. Test Film

2.1 The test film shall be a print from an original negative or a directly recorded negative.

2.2 The test record shall consist of a 1000-Hz, variable-area recording.

2.3 At full modulation, the test record shall have an overall width of 0.0050 ± 0.0005 inch (0.127 ± 0.013 mm), as measured between opposite amplitude peaks. It shall be approximately sinusoidal.

2.4 The test track shall move laterally at a uniform rate from one edge of the scanned area to the other, as specified in the figure and table.

3. Definitions

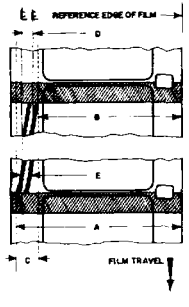
3.1 For the purpose of this standard, the edge of the test track nearest the nonperforated edge of the film shall be called the outboard edge, and the opposite edge shall be called the inboard edge.

3.2 Centerline Sweep. The centerline sweep of the test track is defined as the lateral displacement of the centerline of the test track from its initial position to its final position.

3.3 *Total Test Track Sweep. The total test track* sweep is defined as the sum of the centerline sweep and the overall width of the test track.

4. Dimensions

The dimensions and position of the sound track shall be as specified in the figure and table. (Dimension A extends to the outboard edge of the test track in its initial position. Dimension B extends to the inboard edge of the test track in its final position. Dimensions A and B shall be measured at points opposite the first image area frameline next to the start and end splice of the test record negative. Dimension C is the nominal total sweep and Dimension D is the nominal centerline sweep.)



Dimensions	Inches	Millimeters
A	0.604 $^{+\ 0.000}_{-\ 0.001}$	15.34 $^{+\ 0.00}_{-\ 0.03}$
B	0.535 $^{+\ 0.001}_{-\ 0.000}$	13.59 $^{+\ 0.03}_{-\ 0.00}$
C	0.069 nom	1.75 nom
D	0.064 nom	1.63 nom
E	0.0050 ± 0.0005	0.127 ± 0.013

5. Film Stock

The film stock used shall be cut and perforated in accordance with long-pitch dimensions specified in American National Standard Dimensions for 16 mm Motion-Picture Film Perforated 1R, PH22.109-1974.

6. Density

Variations in density of the clear and dense areas shall not result in a reproduced output variation exceeding ± ½ dB.

7. Test Film Length

Each test film shall carry three identical prints of the total length of the test track. In each, the test track shall start near the edge of the film and travel toward the image area. The length of the test track shall be approximately 30 ft.

NOTE: A test film conforming to this standard is available from the Society of Motion Picture and Television Engineers.

Appendix

(The Appendix is not a part of this American National Standard, but is included for information purposes only.)

Before the test film described in this document is used, it is recommended that correct placement of the scanning beam be determined by means of the buzztrack test film, as specified in American National Standard Specifications of 16 mm Buzz-Track Test Film, Photographic Type, PH22.57-1963 (R1969).

The uniformity of scanning-beam illumination should be measured by means of a standard volume indicator, as specified in American National Standard Volume Measurements of Electrical Speech and Program Waves, C16.5-1954 (R1961), connected to the output of the sound projector amplifier. The illumination of the scanning beam should be adjusted according to the instructions furnished by the equipment manufacturer.

Variations of the output of the meter should be observed while running the full length of one test track print, spliced into a loop, through the equipment.

Accumulated density and dimensional variations in scanning-beam uniformity test films can contribute up to ± 1.5 dB in observed output. If larger output variation is found, it may be the result of inaccurate centering of the scanning beam, dirt or nonuniform illumination of the scanning image.

Cinematography — Motion-picture safety film — Definition, testing and marking

1 SCOPE AND FIELD OF APPLICATION

1.1 This International Standard defines safety film intended for motion-picture use, and specifies tests and the marking.

1.2 The term "safety film" as used in this International Standard includes all perforated film used in the motion-picture industry. Specifically included are leaders, including unperforated leaders; sensitized stock based on the silver halide, dye transfer, vesicular or other image-producing systems; raw and processed stock; and magnetically coated perforated film.

1.3 Motion-picture films are classified as safety film if they are difficult to ignite, slow burning and low in nitrate nitrogen content as specified in this International Standard.

2 IGNITION TIME

2.1 Definition

Motion-picture films are classified as difficult to ignite when the ignition time is greater than 10 min at the temperature specified below.

2.2 Method of measurement

2.2.1 *Preparation of test sample*

Cut a sample 35 mm (1.38 in) long and 8 mm (0.32 in) wide from the film to be tested. The sample shall be free of perforations as far as is practicable. Condition the sample for at least 4 h at a temperature of 20 ± 2 °C (68 ± 4 °F) and a relative humidity of 50 ± 5 %.

2.2.2 *Procedure*

Make the test in an electric resistance oven, the interior of which is in the form of a vertical cylinder (preferably with a rounded bottom), having a diameter of 70 mm (2 3/4 in) and a mean height of 70 mm. The top of the oven shall be closed by means of a closely overlapping lid having two holes of 7 mm (0.28 in) and of 15 mm (0.59 in) respectively, the centres being at a distance of about 15 mm from each other. Introduce a thermocouple through the smaller opening, the connecting wires having a porcelain coating fitted tightly into the hole. Alternatively, the temperature in the cylinder may be measured by means of a mercury thermometer protected from rising heat by means of a cork disk lying a little above the lid.

2.2.2.1 TEMPERATURE OF TESTS

Bring the oven to, and maintain it at, a temperature of 300 ± 3 °C (572 ± 5 °F). When this temperature is reached, attach the sample to a thin U-shaped wire hook and introduce it through the larger opening. Fix the thermocouple (or the thermometer) and the sample in such a way that the thermojunction (or the mercury bulb) and the centre of the sample are at an equal depth of about 35 mm (1.38 in).

2.2.2.2 PREPARATION FOR TESTS

Between tests, thoroughly air the oven.

2.2.3 *Expression of results*

Record the time interval from the insertion of the sample to the ignition of the sample as the ignition time.

3 BURNING TIME

The burning time may be determined by either of the two methods specified.

3.1 First method of measurement

3.1.1 *Principle*

Motion-picture films having a thickness equal to or greater than 0,08 mm (0.003 in) are classified as slow burning when the burning time is not less than 45 s. Motion-picture films having a thickness less than 0,08 mm (0.003 in) are classified as slow burning when the burning time is not less than 30 s.

3.1.2 *Preparation of test samples*

Cut three samples each 40 cm (15.7 in) long and 35 mm (1.38 in) wide from the film to be tested. If only films narrower than 35 mm are available, samples 40 cm (15.7 in) long and their full width may be tested.[1] Mark each sample at a point 5 cm (2 in) from each end. If the sample is not already perforated, perforate it with holes 3 mm (0.12 in) in diameter along both edges, at intervals of not more than 20 mm (0.8 in). Condition the sample for at least 4 h at a temperature of 20 ± 2 °C (68 ± 4 °F) and a relative humidity of 50 ± 5 %.[2]

3.1.3 *Procedure*

Measure the burning time of motion-picture films as follows : thread a wire having a diameter of not more than 0,5 mm (0.02 in) through the perforations on one side so that the sample is supported at points not more than 20 mm (0.8 in) apart. With the wire stretched horizontally and the sample hanging vertically from it, ignite the bottom corner of one end.

3.1.4 *Test conditions*

Make the test in a room free from draughts. Carry out at least three tests.

3.1.5 *Expression of results*

Record the time which elapses from the moment the flame reaches the first mark until it reaches the second mark as the burning time. If the sample does not ignite or if the flame does not reach the second mark, classify the film as slow burning.

3.2 Alternative method of measurement

3.2.1 *Principle*

Motion-picture films are classified as slow burning if each of six samples fulfils one of the following conditions :

a) the sample fails to burn beyond the specified mark;

b) a period of not less than 120 s elapses from the time of ignition of the alcohol to the time at which the flame reaches the specified mark.

3.2.2 *Preparation of test samples*

Take the test samples from either end or both ends of the continuous length of film which is to be examined. For the purpose of the burning test, take six samples, each of a length of 533 mm (21 in) for both 35 mm and 16 mm film. Test the samples in the condition in which they are cut from the continuous length without removal of protective or magnetic coatings, stripes or emulsion. Condition the samples for at least 4 h at a temperature of 20 ± 2 °C (68 ± 4 °F) and a relative humidity of 50 ± 5 %.[2]

NOTE — It is important to observe that the whole of the samples for both methods of test shall be taken from the same continuous length, and that if the roll of film to be examined contains splices, then each individual continuous length shall be examined separately. The object of taking six samples for the burning test is to obtain accurate results in the test and not to confirm the homogeneity of the film; the samples may therefore be taken consecutively.

3.2.3 *Apparatus for 35 mm film*

Test samples of 35 mm film on an apparatus complying with the following requirements :

The apparatus shall consist essentially of two semicircular supports, each L-shaped in cross-section, curved to a radius of 178 mm (7 in), spaced apart at a suitable distance for supporting the film within the angles, and structurally completed by a base-plate tying the two ends together (see figure 1).

The two supports shall be made of mild steel, about 1,2 mm (0.05 in) thick, and shall be spaced so that their inner edges are 25,4 mm (1 in) apart, the spacers being of wire, shaped as shown in figure 2.

The film sample shall be held in position over the semicircular supports by two strips of spring steel, 4,8 mm wide by 0,12 mm thick (3/16 in by 0.005 in), each of which is riveted at one end to a support (see figure 3). The other ends of the two steel strips shall be connected, at the appropriate distance apart, by a thin steel crossbar (see figure 4). At the igniting end there shall be, between the supports, a flat platform of heat insulating material (mica, asbestos, etc.) on which a small alcohol cup may be placed. The upper surface of the platform shall be 25 mm (about 1 in) above the base-plate and shall be 20 mm (0.8 in) long by 10 mm (0.4 in) wide.

The apparatus for 16 mm film is similar in general design.

The alcohol cup shall be of copper and shall have the dimensions shown in figure 5.

One curved support shall carry two register lines or marks, as shown in figure 1, which shall be clearly visible when the film sample is in position, and which shall be marked A and B respectively.

The mark A shall be 38 mm (1.5 in) above the base-plate at the igniting end. The mark B shall represent the position which would be occupied by the end of a piece of film 457 mm (18 in) long, whose other end coincides with the mark A.

1) Motion-picture films, when tested by this method, have similar flame propagation characteristics and about the same burning times, regardless of whether the width of the sample tested is 16 mm or 35 mm.

2) Experience has shown that safety film will meet the requirements for burning time when conditioned to any relative humidity in the range of 10 to 70 %. The more stringent range of 50 ± 5 % of this test method is specified in the interest of obtaining strictly comparable results. Likewise, the 4 h conditioning time is not critical and may be reduced to 1 h minimum if the urgency of the test makes this desirable.

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3.2.4 *Procedure for 35 mm film*

Place the 533 mm (21 in) film sample in the trough formed by the two L-section supports, with its end in line with the mark A. Draw the steel strips over and hold them by a small spring which clips on to the crossbar which joins them at their free end (see figure 4). Thus the film is securely held by a narrow portion at each side and the centre portion of approximately 25 mm (about 1 in) of the film is in free air. If the sample to be tested is a coated film, place the sample with the coating upwards. Place the copper cup on the platform centrally below the film; place 0,3 ml of alcohol (not less than 95 %) in it and ignite.

3.2.5 *Apparatus for 16 mm film*

The apparatus is similar in general form to that specified above for the testing of 35 mm film. The circular supports are curved to a radius of 229 mm (9 in). They shall be made of mild steel about 0,9 mm (0.035 in) thick, formed to the dimensions shown in figure 7, and shall be spaced so that their inner edges are 12 mm (0.47 in) apart, the spacers being of wire shaped as shown in figure 7. The film sample shall be held in position by steel strips, similar to those for the test of 35 mm film. The upper surface of the platform of heat insulating material shall be 25 mm (about 1 in) above the base-plate and shall be 10 mm (0.40 in) square. The alcohol cup shall be of copper and of the dimensions shown in figure 6. The mark A shall be 38 mm (1.5 in) above the base-plate at the igniting end. The mark B represents the position which would be occupied by the end of a piece of film 457 mm (18 in) long, whose other end coincides with the mark A.

3.2.6 *Procedure for 16 mm film*

The method of carrying out the test shall be similar to that specified for 35 mm film. The length of the 16 mm film sample shall be 533 mm (21 in) and 0,3 ml of alcohol shall be placed in the metal cup.

3.2.7 *Expression of results*

Record the time which elapses from the time of ignition until the flame reaches Mark B as the burning time. If, for each of six samples, the sample does not ignite or if the flame does not reach Mark B within 120 s, classify the film as slow burning.

4 NITRATE NITROGEN CONTENT

4.1 Definition

Motion-picture films which have a nitrate nitrogen content of not more than a certain percentage by mass, depending on the method used, are classified as having a low nitrogen content. This percentage is 0,40 % when the De Varda method is used, whereby the error in nitrogen content owing to the presence of the gelatin layer is taken into account. The percentage is 0,36 % when the Schulze-Tiemann method is used.

4.2 First method of measurement – De Varda method

4.2.1 *Preparation of test sample*

Condition the test sample for at least 4 h at a temperature of 20 ± 2 °C (68 ± 4 °F) and a relative humidity of 50 ± 5 %.

4.2.2 *Procedure*

Cut 5 g (11 grains) of the film into small pieces (25 mm (about 1 in) by 6 mm (0.24 in)) and place them in an 800 ml Kjeldahl flask. Add 90 ml of 30 % sodium hydroxide solution and 10 ml of ethyl alcohol.[1] Connect the flask with a rubber stopper to a vertical cooler. Heat on a steam bath or over an open flame at 30 to 40 °C (86 to 104 °F) and add 25 ml of 30 % hydrogen peroxide slowly, with agitation. Boil slowly until the hydrogen peroxide is reacted. If necessary, add another 25 ml portion of hydrogen peroxide and continue the boiling until it is reacted. Boil for 15 min until the reaction is completed.

Then adjust the contents of the flask to approximately 200 ml using distilled water. (If desired, the test may be conveniently held over for the night at this point). Then evaporate the solution over a small flame to about 75 ml in order to remove any traces of ammonia, after which cool it to room temperature.

Dilute the solution to 350 ml with distilled water.[2] Add 2,5 g (36 grains) of De Varda's alloy and quickly connect the flask to the Kjeldahl apparatus. Make this addition through a funnelled tube, so that no alloy clings to the flask neck. Leave the mixture for 1 h and then distil with great care. Collect approximately 150 ml of distillate in a 500 ml receiving flask containing about 50 ml of approximately 4 % boric acid solution. Titrate the contents of the flask with 0,1 N sulphuric acid, using methyl red as indicator.

4.2.3 *Expression of results*

Carry out a blank determination on the reagents, using the same quantities as are used in the actual determination. Calculate the percentage of nitrate nitrogen by the formula

$$\frac{(A - B) \times 0{,}1 \times 0{,}014 \times 100}{5} = (A - B) \times 0{,}028$$

where

A is the amount, in millilitres, of 0,1 N sulphuric acid used for the sample;

B is the amount, in millilitres, of 0,1 N sulphuric acid used for the blank determination.

1) A denatured ethyl alcohol may be used which does not contain nitrogen compounds.

2) The volume at this point shall be controlled within ± 10 ml, because of the influence of alkali dilution upon the rate of reaction of De Varda's alloy.

4.3 Alternative method of measurement – Schulze-Tiemann method

4.3.1 *Preparation of test sample*

Take the sample from either end or both ends of the continuous length of film which is to be examined. For the purposes of this test for nitrate nitrogen content, take three samples, each of a length 152 mm (6 in) for 35 mm film and 305 mm (12 in) for 16 mm film. Condition the samples for at least 4 h at a temperature of 20 ± 2 °C (68 ± 4 °F) and a relative humidity of 50 ± 5 %.

4.3.2 *Procedure*

Cut the film into strips approximately 6,35 mm (1/4 in) wide by 25 mm (about 1 in) long. Weigh about 10 g of the film into the flask A (capacity about 250 ml) and add about 50 ml of water to cover the film, ensuring that no film is stuck to the sides of the flask. Replace the rubber bung fitted with the delivery tube and filling tube (see figure 8). Turn on the water supply to the tube jacket of the eudiometer; raise the levelling arm B, open taps C and D and pour 24 % sodium hydroxide solution into cup E until the eudiometer tube is full, taking care that there are no air bubbles enclosed. Close taps C and D. Close spring clip F on the delivery tube of the apparatus and fully open clip G. Light a burner under the flask and bring the water to a boil. Allow to boil for 30 s. Continue boiling and, without removing the burner, close clip G and open clip F at the same time. Pour 45 ml of aqueous saturated iron(II) chloride solution into the boiling tube H. When steam issues from the end of the delivery tube J, place this under the sodium hydroxide in cup K. Close clip F and open clip G simultaneously. The steam from the flask now passes through the iron(II) chloride solution, boiling it. Continue boiling until most of the water in the flask has been boiled away and no more air bubbles pass up through the iron(II) chloride solution.

Remove the burner and close clip G. Gently lift the eudiometer tube jacket off the rubber stopper L, and slip the lower end of the eudiometer over the end of the delivery tube J, clamping the tube jacket in this position. Pour about 5 ml of the 24 % sodium hydroxide solution into the cup E at the upper end of the eudiometer.

A vacuum will have formed in the reaction flask A. Slowly open clip G and allow the iron(II) chloride solution to run slowly into the flask. Close clip G just before the last of the iron(II) chloride has run out. Pour 45 ml of concentrated hydrochloric acid into the boiling tube and, by opening clip G, allow the whole of this, except the last 1 ml or so, to be drawn into the flask. Close clip G. Pour 5 ml of iron(II) chloride solution into the boiling tube. Replace the burner under the reaction flask and gradually bring the contents of the flask to a boil, keeping one hand on clip G and the other on clip F. Open clip G slightly, so that iron(II) chloride just drips into the flask.

As decomposition of the nitrogen compound proceeds, pressure will gradually develop in the flask and a point will be reached at which the gas evolved will begin to drive the iron(II) chloride back into the boiling tube (for greater accuracy, use a capillary tube), i.e. when the flask has attained atmospheric pressure. As soon as the drop of iron(II) chloride on the end of the tube begins to recede, close clip G and open clip F simultaneously. Slide clip F off the rubber tube and allow it to rest on the lower part of the delivery tube against cup K.

Boil the contents of the flask until no more gas collects in the eudiometer, agitating the flask fairly vigorously in the later stages of the reaction. When this agitation no longer produces gas bubbles, remove the burner and close the delivery tube with clip F.

Support the eudiometer tube jacket with one hand, slacken the supporting clamp with the other and carefully replace the bottom of the eudiometer tube on the rubber bung L. Fill the cup at the top of the eudiometer with 24 % sodium hydroxide solution. Open tap C and lower the levelling tube until the level of the sodium hydroxide in it is well below the level of the sodium hydroxide in the eudiometer. Partially open tap D and allow the bulk of the sodium hydroxide in the cup to be drawn into the eudiometer. Close tap D and raise the levelling tube B until the sodium hydroxide in B and in the eudiometer are at the same level. Clamp B in this position.

When the temperature of the gas in the eudiometer is constant, as shown by the thermometer in the overflow tube of the eudiometer jacket, readjust the sodium hydroxide in B and in the eudiometer to the same level and read the volume of the gas collected; correct this according to the correction chart for the eudiometer used. Note the temperature of the gas. Read the barometer.

Carry out a blank determination using the correct amounts of reagents with no film present. Subtract this blank from the volume of nitric oxide collected after both volumes have been corrected to normal temperature and pressure. A Farmer gas calculator, which can be obtained at the usual laboratory stockists, simplifies the calculation considerably.

4.3.3 *Method of calculation*

The percentage nitrogen is given by the formula

$$V \times \frac{273}{(273 + t)} \times \frac{(p - P)}{760} \times \frac{100}{m} \times \frac{14{,}01}{22{,}41} \times \frac{1}{1\,000} =$$

$$\frac{V \times (p - P)}{(273 + t) \times m} \times F$$

where

F is a constant ($\log F = \bar{2}{,}351\,4$);

m is the mass, in grams, of sample taken;

V is the volume, in millilitres, of gas collected;

t is the temperature of the gas collected, in degrees Celsius;

p is the barometric pressure at the time of the determination, in millimetres of mercury;

P is the vapour pressure of 24 % sodium hydroxide solution at t °C, in millimetres of mercury.

5 FIELD TEST

5.1 Principle

The following test method may be used for quickly identifying whether most motion-picture films are of the safety or of the nitrate variety, without technical equipment or the expenditure of large amounts of specimen film. However, it does not determine compliance of a film with this International Standard.

5.2 Preparation of test sample

Cut a piece of film approximately 16 mm (0.63 mm) wide and 35 mm (1.38 in) long. Bend the film lengthwise and crease it sufficiently so that when released it will stand upright.

5.3 Procedure

Stand the film sample (with the crease vertical) on a flat surface, such as an ashtray, glass plate, concrete floor, etc. This shall be done at a safe distance from all film stocks.

With a match flame, ignite one of the top corners of the film.

Anyone unfamiliar with the burning of safety and nitrate photographic films should first conduct this test on samples of both types of film, the identities of which are known.

5.4 Expression of results

If the film ignites easily, burns downward rapidly and vigorously with a bright yellow flame, and is completely consumed in less than 15 s, it probably contains dangerous quantities of cellulose nitrate and probably will not pass the tests of this International Standard for safety film. If the film sample ignites with difficulty and burns only partially or if it burns completely in a time not under 15 s, it is likely but not assured that the sample will pass the tests of this International Standard.

6 MARKING

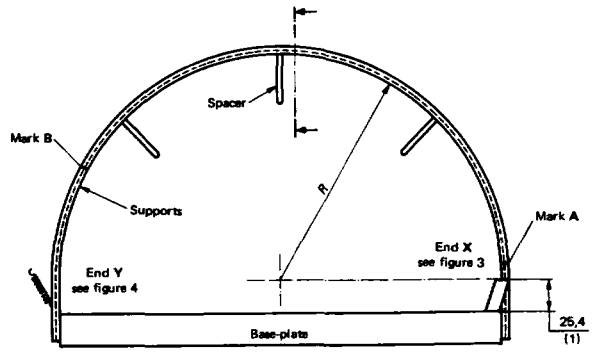
Motion-picture film on safety base shall be suitably marked as such[1]. This does not apply to film having only a magnetic coating.

1) a) In some countries, markings between perforations or along the edge of the film comprising *S* or SAFETY have been used.

b) An alternative or supplementary way of marking is by means of a fluorescent compound in or on the film base.

National regulations may require these or other markings.

Dimensions in millimetres (Inch values in parentheses)



	35 mm	16 mm
R	178 (7)	229 (9)

FIGURE 1 – General arrangement of apparatus for flammability test of safety film

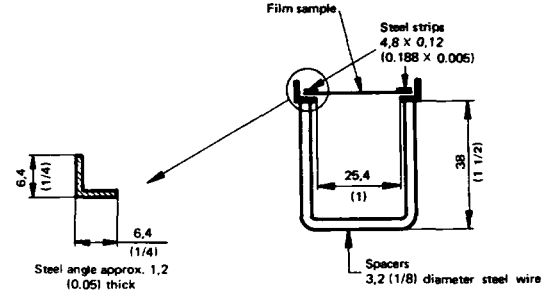


FIGURE 2 – Section through supports showing wire spacers for 35 mm film apparatus

Dimensions in millimetres (Inch values in parentheses)

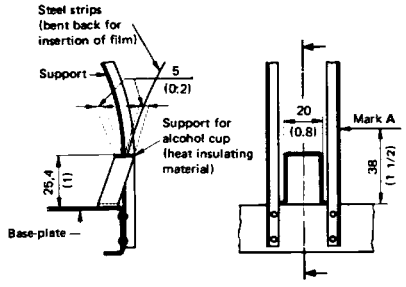


FIGURE 3 – **Detail of end X for 35 mm film apparatus**

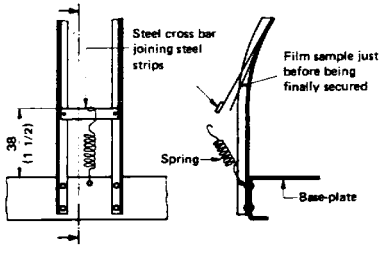


FIGURE 4 – **Detail of end Y for 35 mm film apparatus**

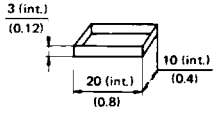


FIGURE 5 – **Alcohol cup for 35 mm film apparatus**

Dimensions in millimetres (Inch values in parentheses)

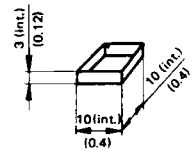


FIGURE 6 – **Alcohol cup for 16 mm film apparatus**

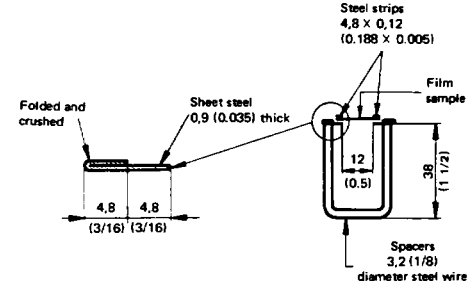


FIGURE 7 – **Section through supports, showing wire spacers for 16 mm film apparatus**

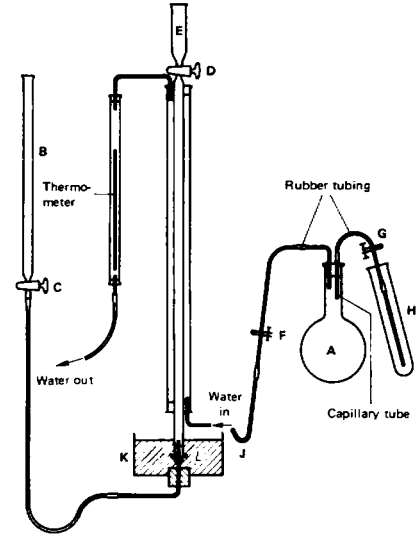


FIGURE 8 – **Schulze-Tiemann method for determination of nitrate nitrogen content**

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Cinematography – Recording characteristic for magnetic sound record on 16 mm motion-picture film – Specifications

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the recorded characteristic for magnetic sound records on 16 mm perforated magnetic film and 16 mm motion-picture film with magnetic striping when used at the nominal speed of 24 frames (18,3 cm or 7.2 in) per second, or 25 frames (19,05 cm or 7.5 in) per second.

2 RECORDED CHARACTERISTIC

With constant sine-wave signal applied to the input of the recording system, the nominal characteristic in effective values of the short-circuit magnetic flux versus frequency shall fall with increasing frequency in conformity with the impedance of a parallel combination of a capacitance and a resistance having a time constant $t = 70\ \mu s$.

The curve defined above is represented by

$$N \text{ (in decibels)} = -10 \log (1 + 4\pi^2 f^2 t^2)$$

where

f is the frequency in hertz;

t is the time constant in seconds.

The approximate numerical values are given in the table.

3 TOLERANCES

3.1 Magnetic sound records on films for the exchange of television programmes shall be recorded to the characteristic specified in clause 2 within the tolerances given in figure 1.

3.2 In the case of sound records primarily intended for reproduction on portable equipment, the tolerances of figure 2 may be applied instead of the tolerances of figure 1.

NOTE – This International Standard has substantially the same technical content as the relevant portion of CCIR Recommendation 265-2.

TABLE – Approximate numerical values of the recorded characteristics

Frequency Hz	N dB
40	– 0,00
50	– 0,00
63	– 0,00
80	– 0,01
100	– 0,01
125	– 0,01
160	– 0,02
200	– 0,03
250	– 0,05
315	– 0,08
400	– 0,13
500	– 0,21
630	– 0,32
800	– 0,51
1 000	– 0,77
1 250	– 1,15
1 600	– 1,75
2 000	– 2,49
2 500	– 3,44
3 150	– 4,65
4 000	– 6,12
5 000	– 7,66
6 300	– 9,38
8 000	– 11,26
10 000	– 13,08
12 500	– 14,95
16 000	– 17,03

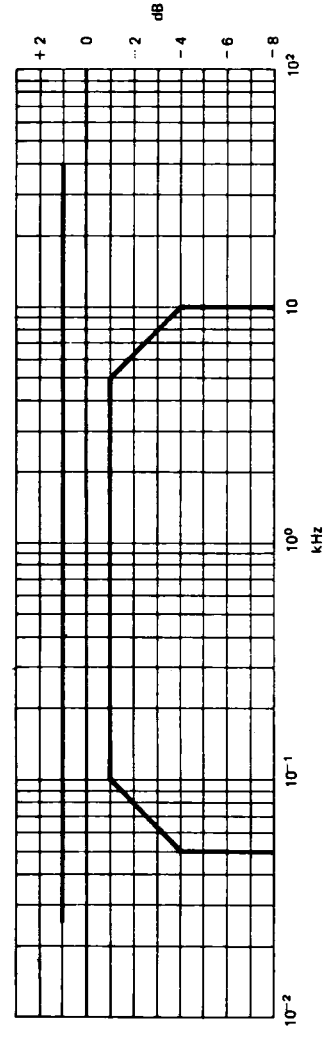

FIGURE 1 – Tolerances on recorded levels : 16 mm film for the exchange of television programmes

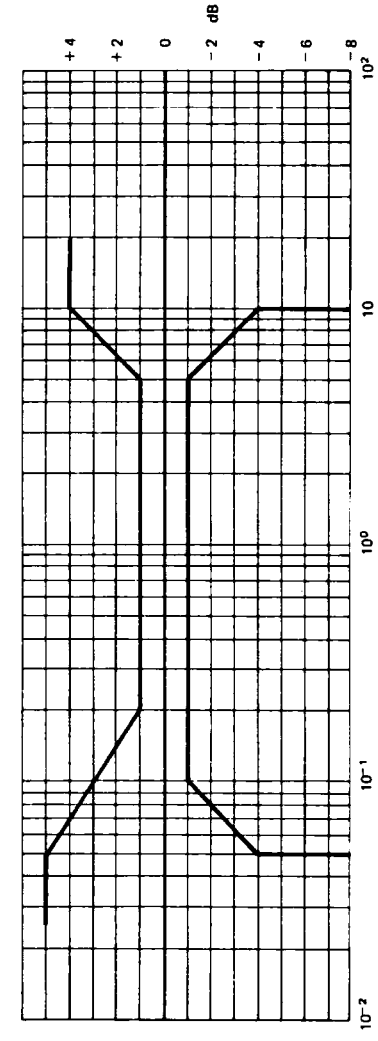

FIGURE 2 – Tolerances on recorded levels : 16 mm film intended for reproduction on portable equipment