Standards and Recommended Practices

Approved American National Standards

Three American National Standards were approved by the American National Standards Institute on June 28, 1991: ANSI/SMPTE 194-1991, Motion-Picture Film (35-mm) – Projector Usage – Release Prints Having Four Perforations per Frame; ANSI/SMPTE 209M-1991, Motion-Picture Film (8-mm Type S) – Magnetic Audio Records – Recorded Characteristic; and ANSI/SMPTE 86-1991, Motion-Picture Film – Magnetic Audio Records – Two, Three, Four and Six Records on 35-mm and One Record on 17.5-mm Magnetic Film. Copies of the standards are available for a nominal fee from Society Headquarters.

Withdrawn SMPTE Recommended Practice

Withdrawal of an SMPTE Recommended Practice was recently approved: RP 137-1986, Data Tracks on Low-Dispersion Magnetic Coatings on 35-mm Motion-Picture Film. Withdrawal was approved because the film is no longer manufactured and the practice is not being used.

– Sherwin H. Becker, Director of Engineering

SMPTE STANDARD **ANSI/SMPTE 194-1991**
Revision and redesignation of ANSI PH22.194-1984

for Motion-Picture Film (35-mm) — Projector Usage — Release Prints Having Four Perforations per Frame

1 Scope

1.1 This standard specifies the position of the emulsion for 35-mm motion-picture release prints having four perforations per frame and the position of the magnetic striping relative to the projector lens.

1.2 The standard also specifies the rate of projection for systems defined in 1.1 and the relevant standards on location of the picture and audio records.

2 Position of photographic emulsion and magnetic striping

2.1 The photographic emulsion shall be on the side of the film which faces away from the projector lens. The projectable image area is specified in ANSI PH22.195-1984.

2.2 The magnetic striping shall be on the side of the film which faces the projector lens. Relevant standards on audio records are listed in annex B.

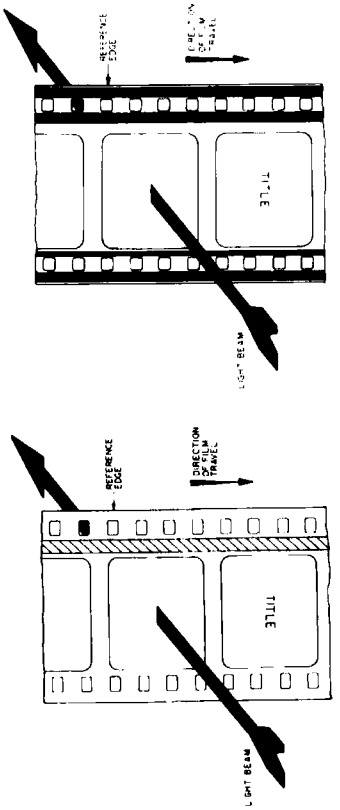

Figure 1

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3 Projection frame rate

The standard frame rate for motion-picture projection is 24 frames per second. However, it is recognized that nonstandard frame rates are sometimes used for specific applications. For example, 24, 25, or 30 frames per second may be used for motion-pictures intended for television, higher or lower frame rates may be used for special effects and analysis, and nonstandard rates may be used for special motion-picture systems. The use of nonstandard frame rates requires notification and agreement of all parties concerned with the use of the particular film.

4 Framing adjustment

It is customary to provide a vertical framing adjustment movement of at least 0.315 in (8.00 mm) above and below the normal image position, as specified in ANSI PH22.195-1984.

Annex A (informative)
Positioning of audio records

When the audio records are reproduced, the distance from the audio-scanning point to the center of the projector aperture shall be adjusted to bring the picture and sound into synchronism for the average observer. Since sound travels at a rate of about 1100 ft (335 m) per second (approximately 50 ft [15 m] in 1/24 second), synchronism can be achieved by repositioning the audio record in the projector one frame for every 50 ft from the average observer.

Annex B (informative)
Bibliography

ANSI PH22.40-1984, Motion-Picture Film (35-mm) — Photographic Audio Records — Release Prints

ANSI/SMPTE 137-1988, Motion-Picture Film (35-mm) — Four Magnetic Audio Records — Release Prints

ANSI PH22.195-1984, Motion-Picture Film (35-mm) — Projectable Image Area — Motion-Picture Prints

SMPTE STANDARD

ANSI/SMPTE 209M-1991
Revision and redesignation of
ANSI PH22.209-1984

for Motion-Picture Film (8-mm Type S) —
Magnetic Audio Records — Recorded Characteristic

1 Scope

This standard specifies the recorded characteristic of magnetic audio records on 8-mm type S motion-picture prints and full-coat motion-picture magnetic film conforming to ANSI/SMPTE 149-1988, running at the nominal speed of 24 frames (102 mm [4.0 in]) per second or 25 frames (106 mm [4.2 in]) per second.

2 Recorded characteristics

The recorded relative short circuit magnetic flux level versus frequency shall be as given by the following equation:

$$L_\phi = 0.02738 - 10 \log_{10} \left(\frac{1 + (2\pi\tau_h)^2 f^2}{1 + \frac{1}{(2\pi\tau_l)^2 f^2}} \right) \text{dB}$$

where L_ϕ is the recorded relative short circuit magnetic flux level in decibels, f is the frequency in hertz, τ_l is the low-frequency time constant of 3180 µs, τ_h is the high-frequency time constant of 90 µs, and 0.02738 is a constant calculated to make $L_\phi = 0$ at the reference frequency of 315 Hz.

The appropriate numerical values of the recorded relative short circuit magnetic flux level, L_ϕ, for a series of preferred 1/3-octave frequencies in hertz are given in table 1.

3 Tolerances

Magnetic audio records on the film shall be recorded to the characteristic specified in clause 2 within the tolerances given in figure 1.

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Table 1 – Relative flux level (Lφ) versus frequency

Hz	dB
50	3.04
63	2.15
80	1.45
100	0.98
125	0.65
160	0.40
200	0.24
250	0.11
315	0.00
400	– 0.12
500	– 0.26
630	– 0.46
800	– 0.76
1000	– 1.17
1250	– 1.73
1600	– 2.57
2000	– 3.55
2500	– 4.74
3150	– 6.18
4000	– 7.84
5000	– 9.51
6300	–11.34
8000	–13.29
10 000	–15.15

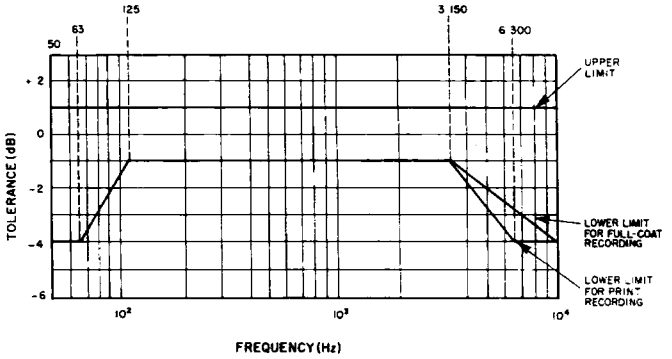

Figure 1 - Tolerances on recorded levels

Annex A (informative)
Bibliography

ANSI/SMPTE 149-1988, Motion-Picture Film (8-mm Type S) — Perforated 1R

SMPTE STANDARD

ANSI/SMPTE 86-1991
Revision, redesignation, and consolidation of
ANSI PH22.86-1981,
ANSI/SMPTE 108-1986 and
ANSI/SMPTE 186-1986

for Motion-Picture Film — Magnetic Audio Records — Two, Three, Four and Six Records on 35-mm and One Record on 17.5-mm Magnetic Film

1 Scope

This standard specifies the position, dimensions, reproducing speed, and identity of the two-, three-, four-, or six-track magnetic audio records on 35-mm magnetic film, and one single-track record on 17.5-mm magnetic film. It also specifies the assignment of records to the various tracks on the magnetic coating on the film in relation to the direction of film travel.

2 Audio records

2.1 The lateral location and width of the magnetic audio records shall be as specified in the figures and tables.

2.2 The recordings shall be made so that the azimuth of the record is at an angle of 90° ± 3′ to the reference edge of the film.

2.3 The audio records shall be recorded in such a manner that they can be reproduced properly by reproducing heads whose gaps are positioned along a common plane and in line. The gap width for erase heads shall be a minimum of 10% wider than the gap width of the record being erased.

3 Reproducing speed

The recordings shall be made and clearly identified so that the audio records will reproduce properly at 96 or 120 perforations per second, corresponding to 24 or 30 frames per second, respectively. Twenty-four frames per second correspond to a linear speed of 18 in (457 mm) per second; 30 frames per second correspond to 22.4 in (570 mm) per second.

4 Assignment of records

4.1 The principal assignment for the two-track format (see figure 1) is for the prime audio record on track No. 1 and time code on track No. 2.

4.2 Formats of 17.5-mm usually result from slitting 35-mm film into two equal strips; in this case, the record adjacent to the perforation shall be the No. 1 record as specified in figure 2 and table 2. This shall also be the No. 1 record if it is a single recording made for 35-mm film.

4.3 For monophonic recordings, the prime audio record shall be placed on track No. 1 for all formats.

4.4 For stereophonic recordings, the track assignment shall be as follows:

Three-track format

1	2	3
Left	Center	Right

Four-track format

1	2	3	4
Left	Center	Right	(Surround)

For two-track stereophonic records containing phase-related material, two adjacent tracks shall be used (preferably in the three-track format, see figure 2). These shall be clearly identified on all reels and containers, giving the format and the assignment of the tracks. Head tones shall only be placed on the two tracks containing audio program.

The two-track format (see figure 1) is specifically excluded for recording two-track stereophonic records.

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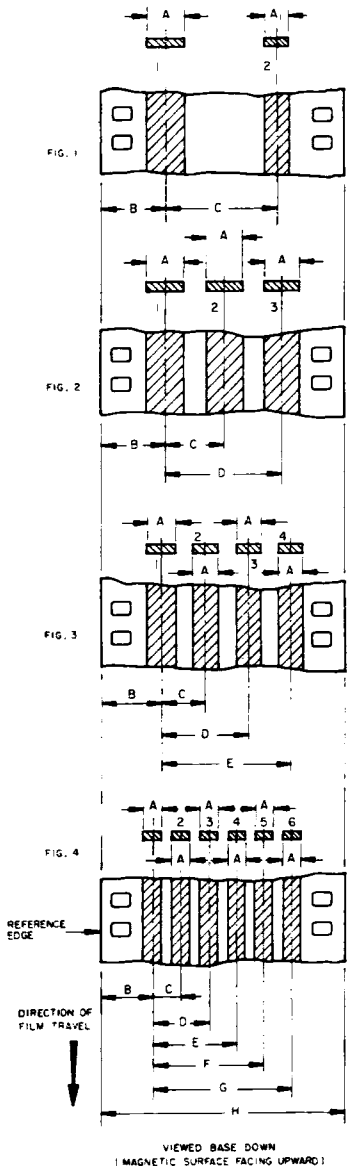

Table 1 – Dimensions for two magnetic audio records (as shown in figure 1)

Dimensions	Inches	Millimeters
A	0.200 $^{+\ 0.004}_{-\ 0}$	5.0 $^{+\ 0.1}_{-\ 0}$
A_1	0.150 $^{+\ 0.004}_{-\ 0}$	3.8 $^{+\ 0.1}_{-\ 0}$
B	0.339 ± 0.002	8.6 æ 0.05
C	0.725 ± 0.002	18.4 æ 0.05

Table 2 – Dimensions for three magnetic audio records (as shown in figure 2)

Dimensions	Inches	Millimeters
A	0.200 $^{+\ 0.004}_{-\ 0}$	5.0 $^{+\ 0.1}_{-\ 0}$
B	0.339 ± 0.002	8.6 ± 0.05
C	0.350 ± 0.002	8.9 ± 0.05
D	0.700 ± 0.002	17.8 ± 0.05
H	1.377 ref	34.97 ref

Table 3 – Dimensions for four magnetic audio records (as shown in figure 3)

Dimensions	Inches	Millimeters
A	0.150 $^{+\ 0.004}_{-\ 0}$	3.8 $^{+\ 0.1}_{-\ 0}$
B	0.314 ± 0.002	7.9 ± 0.05
C	0.250 ± 0.002	6.4 ± 0.05
D	0.500 ± 0.002	12.8 ± 0.05
E	0.750 ± 0.002	19.2 ± 0.05
H	1.377 ref	34.97 ref

Table 4 – Dimensions for six magnetic audio records (as shown in figure 4)

Dimensions	Inches	Millimeters
A	0.100 ± 0.002	2.4 ± 0.05
B	0.289 ± 0.002	7.34 ± 0.05
C	0.160 ± 0.002	4.06 ± 0.05
D	0.320 ± 0.002	8.12 ± 0.05
E	0.480 ± 0.002	12.18 ± 0.05
F	0.640 ± 0.002	16.24 ± 0.05
G	0.800 ± 0.002	20.30 ± 0.05

NOTE – The metric values listed in the tables are not exact conversions and deviate from accepted practice. They are based upon the practice of those countries using the metric system. Head assemblies made to either system of dimensions will be, for all practical purposes, interchangeable.

4.5 Because of the diversity of practices applied in the use of the six-track format, track assignments shall be clearly identified with each roll of film. (All reels and containers shall indicate the format and assignment of the tracks.)

5 Supplementary records

Supplementary records for recording time and control codes and other ancillary signals shall be located as shown in figure 5 and table 5.

Table 5 – Dimensions of supplementary records

Dimensions	Inches	Millimeters
A	0.045 $^{+\ 0.004}_{-\ 0}$	1.14 $^{+\ 0.10}_{-\ 0}$
B	0.038 ± 0.002	0.97 ± 0.05
C	1.310 ± 0.002	33.27 ± 0.05

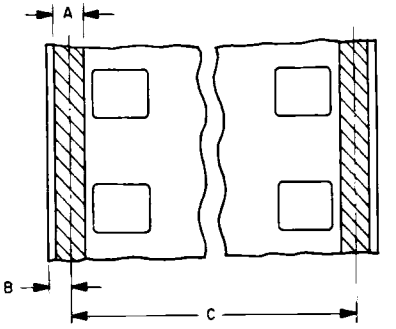

Figure 5 – Supplementary records

Annex A (informative)

A.1 Record width

The width of the recorded area must be measured with great care because it relates directly to the calculation of flux per unit track width.

When the recording head gap is narrower than the width of the coating or stripe, there is a measurement complication involving both the uncertainties in viewing the track and in determining the fringing effect.

If the recording head is available, the track width is best measured indirectly by measuring the gap width and adding to this dimension twice the thickness of the test record magnetic coating. This correction will usually be 0.0003 to 0.0006 in (8 to 15 µm).

If the recording head is unavailable, the record may be made visible by the use of a carbonyl iron suspension. Care should be taken to apply the minimum amount sufficient to make the recording visible, so that the developed image is not wider than the actual recorded area.

A.2 Reproducing head gap width

If precision measurements or calibration is to be made on magnetic audio records made in accordance with this standard, reproducing head gaps of the same width or wider than the recorded track must be used to prevent edge effects or fringing.

A.3 Erase heads

Erasing head gaps used to erase the records specified in this standard should be substantially wider than the record specified.

A.4 Magnetic coating

The dimensions of the magnetic coating are not specified, but shall be wide enough to permit the placement of the audio records in accordance with the appropriate formats in this standard. If the recordings are made on striped motion-picture stock, the width of the stripes shall be at least 0.010 in (0.25 mm) beyond both edges of each record.

A.5 Related standard

ANSI/SMPTE 139-1986, Motion-Picture Film (35-mm) — Perforated KS