the takeup and the transport system. The entire housing is approximately 8 in (200 mm) high, 13 in (330 mm) wide, and 19 in (480 mm) in depth. Its weight is about 35 lb (16 kg). The electrical input is 60-Hz, 110-V, and its output is two wiring clips for attachment to the antenna of the TV receiver.

The continuous film transport will accept very thin base film and shows very little wear to the emulsion. Our system accepts the four Kodak-type cartridges as well as film on reels with automatic threading for all. Rewind is also automatic. At the onset of showing a film only the speed at which the pictures were taken needs to be set.

Discussion

Gordon Thompson (Bell-Northern Research): With the advent of continuous motion film transport, do you foresee the possibility of eliminating the sound/picture 18-frame spacing, in the course of simple editing of material that already has the sound imprinted on it?

Mr. Boon: The possibility, yes; the probability, no.

Glen C. Bull (Naval Photographic Center, Washington, D.C.): As a matter of clarification: is the Kodak video film player capable of magnetic playback (sound stripe) or optical as well, and which is the better?

Mr. Boon: As presently designed, it is magnetic; but an optical design has been considered. The magnetic is better for several reasons.

Lee H. Schank (Fairchild Industrial Products, Commack, N.Y.): Further as to the use of magnetic sound in the video-cassette player demonstrated, which resulted in Mr. Boon's affirmative answer, I would point out that the Kodak "optical" projector shown previously also was a magnetic sound type, further enforcing the need and, in fact, establishment of magnetic as the "practical" standard in addition to being the now-ratified ANSI standard — a clear requirement for low consumer cost.

standards and recommended practices

Draft American National Standards

Four Draft American National Standards which are revisions of previous issues prepared by the SMPTE Video Tape Recording Committee are published here for a trial period and public review.

Although C98.3, Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s (Revision of C98.3-1970), is a substantial revision of the 1970 issue, the technical content is unchanged. The frequency response was previously given in terms of a "standard system" having an "ideal" reproducing head followed by an RC equalizing network. Because of the difficulty in achieving and describing an "ideal" head, the committee decided to specify the system response in terms of the basic physical quantity of the recorded signal, i.e., the "shortcircuit tape flux."

C98.6, Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s (Revision of C98.6-1965), is basically an editorial revision of the 1965 issue. It does not reflect a technical change but has been rewritten to facilitate its use and more accurately specify the important parameters.

C98.8, Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Tape Recorders Operating at 15 in/s (Revision of C98.7-1969 and C98.8-1969), and C98.11, Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s (Revision of C98.10-1969 and C98.11-1969), have been revised in terms of the shortcircuit flux method and do not base their calibration on a primary reference level recording. Consequently, American National Standards C98.7-1969, Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, and C98.10-1969, Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s, will be withdrawn inasmuch as a primary reference level recording is no longer necessary.

Comments should be addressed to Alex E. Alden, Staff Engineer, at Society Headquarters before September 1, 1972. The proposals have been submitted to American National Standards Committee C98. Consequently, all comments received through *Journal* publication will be reviewed prior to conclusion of action by the Committee.

International Standard Approved

International Standard ISO 1785-1972, Location of the printed image area for printing to 8 mm Type S on 16 mm motion-picture film perforated 8 mm Type S, 1-4, was approved by the International Organization for Standardization (ISO) on April 1, 1972. ISO 1785 is in agreement with American National Standard Dimensions for Printed Area in Super 8 Printing on 16/8 mm Film Perforated 1-4, PH22.153-1971. Attention is directed to the fact that only the technical content is published here. Copies of the complete standard are available from the American National Standards Institute, 1430 Broadway, New York, NY 10018. — A.E.A.

Draft American National Standard

Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s

C98.3

Revision of C98.3-1970

1. Scope

This standard specifies the frequency response and operating level for recorders and reproducers for Audio Record One for 2-inch quadruplex video magnetic tape recording at 15 and 7.5 in/s (380 and 190 mm/s), as defined in Draft American National Standard Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, C98.6. It also specifies the field method of calibration of recorders and reproducers, utilizing the test tapes, as defined in Draft American National Standard Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, C98.8, and Draft American National Standard Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s, C98.11.

2. Operating Level

2.1 Recording and Reproducing Level Indicator. The audio recording and reproducing levels of a video magnetic tape recorder shall be monitored and adjusted with a standard volume indicator (vu meter), as specified in American National Standard Volume Measurements of Electrical Speech and Program Waves, C16.5-1954 (Reaffirmed 1961).

2.2 Recorder Operating Level. When a tape record is recorded from a sinusoidal voltage having a frequency of 1000 Hz, such that the rms shortcircuit tape flux per unit track width on the record is 110 ± 3 nanowebers per meter of track width, the recording volume indicator shall be adjusted to deflect to its reference level (0 dB) scale mark.

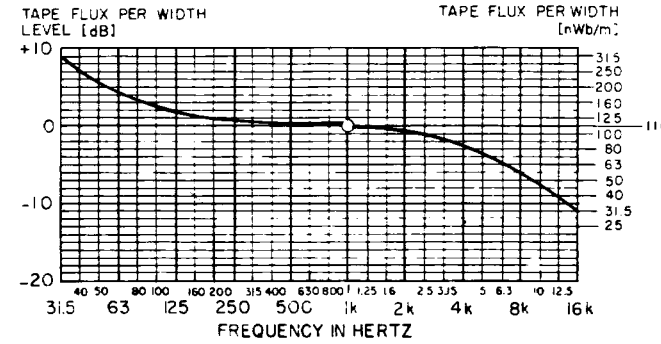
2.3 Reproducer Operating Level. When a tape record having an rms sinusoidal flux per width of 110 nWb/m and a frequency of 1000 Hz is reproduced, the reproducing volume indicator shall deflect to its reference level (0 db) scale mark.

3. Frequency Response

3.1 Recorder Flux/Frequency Response. When a tape record is recorded from a constant voltage level applied to the input terminals of the recording system, the shortcircuit tape flux level on the record versus frequency, $L_\Phi(f)$, shall be as given by the following equation:

$$L_\Phi(f) = 10 \log_{10} \{ [1 + (F_l/f)^2] / [1 - (f/F_h)^2] \} \text{ [dB]}$$

where f is the frequency at which the response is being computed; F_l 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.



Flux and Flux Level vs Frequency

3.2 Reproducer Flux/Frequency Response. When a tape record having a shortcircuit tape flux level versus frequency given in Sec. 3.1 is reproduced, the output voltage level of the reproducer versus frequency shall be constant.

4. Field Method of Calibrating Recorders and Reproducers

4.1 The practical calibration of a reproducer shall be performed by reproducing the Audio Level and Multifrequency Test Tape defined in Draft American National Standard Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, C98.8, or Draft American National Standard Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s, C98.11. The practical calibration of a recorder shall then be performed by recording on a medium representative of that to be used, and comparing the recording so made with the recording on the test tape.

4.2 The flux/frequency response of a reproducer shall be calibrated by reproducing the Frequency Response Test Section of the specified test tape. The reproducing equalizer is adjusted so that output voltage level versus frequency of the reproducer is constant.

4.3 The operating level of a reproducer shall be calibrated by reproducing the Audio Operating Level Test Section of the specified test tape. The reproducing gain control is adjusted so that the reproducing volume indicator deflects to its reference level (0 dB) scale mark.

4.4 The flux/frequency response of a recorder shall be calibrated by comparing the tape flux recorded by the recorder (with constant input voltage level), to the flux recorded on the Frequency Response Test Section of the specified test tape. The recording equalizer is adjusted so that the tape flux level versus frequency of a recorder (including the tape) is the same as that on the test tape.

4.5 The operating level of a recorder shall be calibrated by comparing the tape flux recorded by the recorder when the recording volume indicator deflects to its reference level (0 dB) scale mark, to the recording of the Audio Operating Level Test Section of the specified test tape. The recording gain control is adjusted so that, when the recording volume indicator deflects to its reference level (0 dB) scale mark, the recorded tape flux is the same as that on the test tape.

Appendix

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

A1. Although stated in a different way, the flux specified in Sec. 2.2 is the same as that previously standardized in American National Standard Specifications for a Primary Audio Reference Level Recording for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s, C98.7-1969, and 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, which are being revised and consolidated into other American National Standards.

The flux/frequency response given in Sec. 3.1 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.

A2. Previous frequency response standards for recorders and reproducers have been given in terms of a "standard reproducing system," having an "ideal" reproducing head followed by a standardized RC equalizing network whose time constant was given.

Because an adequate description of the "ideal" head and its interconnection to the following network is quite lengthy, it is simpler to specify the system responses in terms of the basic physical quantity for the recorded signal, the "shortcircuit tape flux." The concepts are explained in detail by J. G. McKnight in the paper "Flux and flux-frequency measurements and standardization in magnetic recording," J. SMPTE, 78: 457-472, June 1969.

Rather than specifying flux/frequency response in terms of admittances of electrical networks, the equation and graph of the response function have been specifically given. This equation does in fact describe the response of the previously specified RC equalizing network with "time constants" of 2000 and 35 microseconds.

Draft American National Standard

Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s

C98.6

Revision of C98.6-1965

1. Scope

This standard specifies both the locations for the edges of the video, audio and tracking control records, and the mechanical separation of the simultaneously-recorded information of the video and audio records, as recorded on 2-in quadruplex video magnetic tape.

2. Definitions

2.1 Transverse: Pertaining to dimensions or motions perpendicular to the tape travel.

2.2 Longitudinal: Pertaining to dimensions or motions parallel to the tape travel.

2.3 Downstream: Pertaining to locations on the tape longitudinally displaced from a given reference point, in the direction of tape travel.

2.4 Upstream: Pertaining to locations on the tape longitudinally displaced from a given reference point, in a direction opposite to tape travel.

2.5 Reference Edge: On a video tape containing quadruplex-recorded information, that longitudinal tape edge nearest the tracking control record.

2.6 Trailing Edge, Video Track: The upstream edge of the video track.

2.7 Transverse Reference Line: A line perpendicular to the reference edge and passing through a video track trailing edge at its lowest end (point T_o) as in Figure 1.

3. General

3.1 References. The transverse reference line and reference edge shall be the references for all dimensions in this standard.

3.2 Measurement Conditions. The dimensions specified in this standard are measured with no transverse or longitudinal tension applied to the tape. (See Appendix A4.)

3.3 Magnetic Coating. With the direction of tape travel as shown in all figures in this standard, the magnetic coating is on the surface facing the observer.

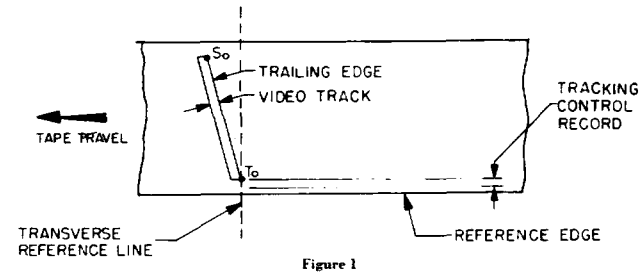


Figure 1
Definitions

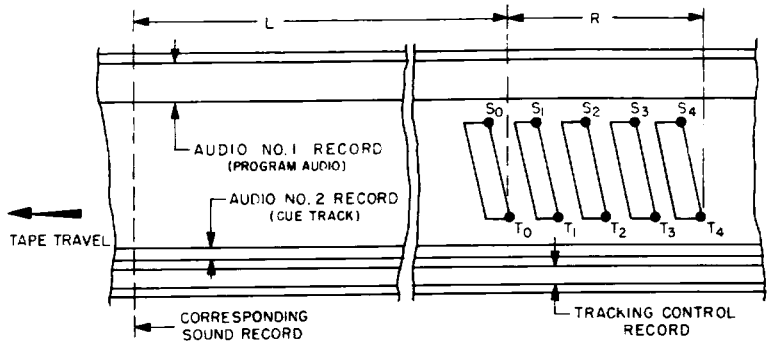


Figure 2
Longitudinal Dimensions

4. Longitudinal Dimensions

4.1 Average Video Track Pitch. For a tape recorded at 15 in/s (38.1 cm/s), the longitudinal distance, R, from a transverse reference line to a point, T_4, four tracks away (See Figure 2), shall be greater than 0.062438 in (1.58592 mm) and less than 0.062562 in (1.58907 mm). (An acceptable method for obtaining the accuracy required by the above dimensions is to measure the span occupied by 3072 tracks, which should be greater than 47.952 in (1217.98 mm) and less than 48.048 in (1220.42 mm).) See Appendixes A2 and A3.

For a tape recorded at 7.5 in/s (19.05 cm/s), the longitudinal distance from a transverse reference line to a point, T_4, four tracks away shall be greater than 0.031219 in (0.792962 mm) and less than 0.031281 in (0.794537 mm). (An acceptable method for obtaining the accuracy required by the above dimensions is to measure the span occupied by 3072 tracks, which should be greater than 23.976 in (608.99 mm) and less than 24.024 in (610.21 mm).) See Appendixes A2 and A3.

4.2 Video Track Spacing. The longitudinal distance from any transverse reference line to Points T_1, T_2 and T_3 shall be R/4, R/2 and 3R/4, respectively, with a tolerance of ± 0.00015 in (0.0038 mm), where R is the average video track pitch as determined in Section 4.1 for the tape being measured (See Figure 2). (The tolerances indicated cannot be readily measured on a pre-recorded tape by methods presently available. At the present state of the art, these dimensions are controlled by the head wheel manufacturer's ability to achieve coplanarity of the recording pole tips.) See Appendixes A2 and A3.

4.3 Video Track Curvature and Angle. The trailing edge of any video track shall fall between two parallel lines spaced apart by 0.001 in (0.025 mm).

For a tape recorded at 15 in/s, the two parallel lines shall make, with the reference edge, a positive angle no greater than 90° 36′ and no less than 90° 30′, when positioned so as to enclose the entire length of the video track trailing edge.

For a tape recorded at 7.5 in/s, the two parallel lines shall make, with the reference edge, a positive angle no greater than 90° 19′ 30″ and no less than 90° 13′ 30″, when positioned so as to enclose the entire length of the video track trailing edge.

4.4 Video Track Width. For a tape recorded at 15 in/s, the longitudinal width of any video track shall lie between 0.0095 in (0.241 mm) and 0.0105 in (0.267 mm), measured at any and all points along its transverse direction. For a tape recorded at 7.5 in/s, the video track width shall lie between 0.0045 in (0.114 mm) and 0.0055 in (0.140 mm).

4.5 Audio Record Displacement. Audio or other information which is time-coincident with video information recorded at a point, T, of any video track shall be recorded in Audio Record No. 1 (Program Audio) or Audio Record No. 2 (Cue Track), at a distance, L, downstream from that point, T, where L shall be at least 9.200 in (233.68 mm) and no more than 9.300 in (236.22 mm).

5. Transverse Dimensions

The transverse dimensions shall be as specified in Figure 3 and the table.

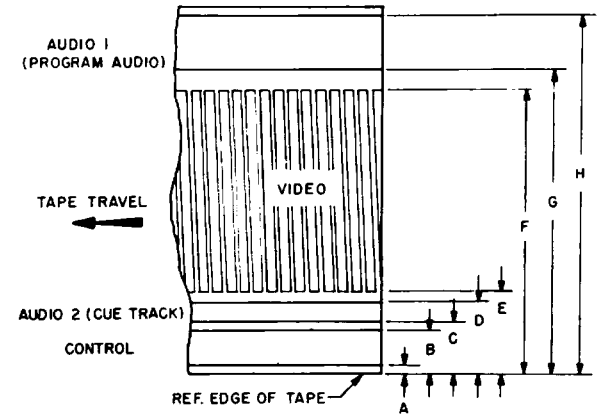


Figure 3
Transverse Dimensions

Dimensions	Inches		Millimeters	
	Min	Max	Min	Max
A	0.000	0.004	0.00	0.10
B	0.040	0.049	1.02	1.24
C	0.058	0.062	1.47	1.57
D	0.078	0.085	1.98	2.16
E	0.087	0.094	2.21	2.39
F	1.902	1.914	48.31	48.62
G	1.921	1.930	48.79	49.02
H	1.988	1.996	50.50	50.70

Appendix

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

A1. A magnetic record is that area in which magnetization conveying the intended signal exists. A common technique for measurement of record locations and dimensions is the use of carbonyl iron to make them visible.

A2. Since all recorded tapes exhibit wow and flutter to some degree, the span of measured tracks should be long enough to average out variations in video track pitch arising from wow or flutter. If other measuring methods are employed, appropriate averaging must be included in the measurement.

A3. The track pattern specified by Sections 4.1 and 4.2 results when the tape speed in inches per second and the head wheel rotational rate in revolutions per second are in the ratio of 0.0625:1 for 15 in/s recording practice, and in the ratio of 0.03125:1 for 7.5 in/s recording practice. Since both the head wheel rotational speed and the capstan metering rate are locked to the television frame rate, the speed of the tape will vary with the television frame rate. This speed variation will not alter the pattern placed on the tape. Replay rate of any recording, as well as the replay rate of the information contained in the

record, will be determined solely by the reference frequency to which the replay capstan and head wheel are synchronized.

Primary causes of departures from the video track pitch specified by Section 4.1 are incorrect capstan diameter, capstan slippage, or incorrect longitudinal tape stretch.

The tolerances specified in Section 4.1 reflect the magnitude of allowable changes in the ratio of tape speed to head wheel rotational speed. Variations in excess of those specified will not only result in improper video track pitch but will also result in an incorrectly placed control track on tapes recorded on machines having the control track head displaced from the plane of rotation of the video pole tips by approximately 0.7 in (18 mm), as is common practice in present-day transports. (See SMPTE Recommended Practice RP 16-1970, Specifications of Tracking Control Record for 2-in Quadruplex Video Magnetic Tape Recordings, for a description of the tracking control record.)

A4. Although, with sufficient care, measurements of track dimensions may be made with no transverse or longitudinal tension applied to the tape, tape-handling problems during measurements may be lessened by making two sets of measurements at two different longitudinal tensions and extrapolating data thus obtained to the zero-tension condition.

Draft American National Standard

Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 15 in/s

C98.8

Revision of C98.7-1969 and C98.8-1969

1. Scope

This standard specifies an audio frequency test tape to be used for adjusting the sensitivity and the frequency response of the audio reproducing system of quadruplex video magnetic tape recorders operating at a tape speed of 15 in/s (380 mm/s), in accordance with Draft American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, C98.3.

2. General Specifications

2.1 Dimensions of Records. The dimensions of pertinent records constituting this test tape shall conform to Draft American National Standard Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, C98.6.

2.2 Tape Speed. The nominal linear speed of this test tape shall be 15 in/s in accordance with American National Standard Speed of 2-inch Tape for Quadruplex Video Magnetic Tape Recording, C98.4-1970.

2.3 Stock. The test sections shall be recorded on transversely-oriented television magnetic recording tape, the dimensions of which are specified in American National Standard Dimensions of 2-inch Video Magnetic Tape, C98.1-1963 (Reaffirmed 1969).

2.4 Video Signal. No video signal of any kind shall be recorded.

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 Wow and Flutter. Total wow and flutter of this test tape shall not exceed 0.2 percent, as measured by the method defined in American National Standard Method of Measurement for Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

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 15 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 15 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:

$$L_\Phi(f) \text{ re } 110 \text{ nWb/m} = 0.2 + 10 \log_{10} \{[1 + (F_l/f)^2]/[1 + (f/F_h)^2]\} \text{ [dB]}$$

where f is the frequency at which the response is being computed; F_l 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. The tape flux level at each frequency shall be within ± 0.5 dB of the value specified in Sec. 3.2.2. The tolerance of ± 0.5 dB may be extended to ± 2 dB provided that a calibration chart is supplied with the test tape by the manufacturer. The calibration figures furnished with the test tape shall represent the levels to be added algebraically to the reproducer output level when the particular test tape is reproduced. With the addition of these factors, the output level of the reproducer will be that which would have resulted if the test tape flux vs frequency had been exactly as specified in Sec. 3.2.2.

3.2.4 Duration. The duration of frequency response test segments shall be approximately ten seconds.

3.3 Azimuth. The tape flux shall be parallel to the reference edge of the tape with an azimuth alignment error not to exceed ± 0.9 milliradians (± 3 minutes of angle).

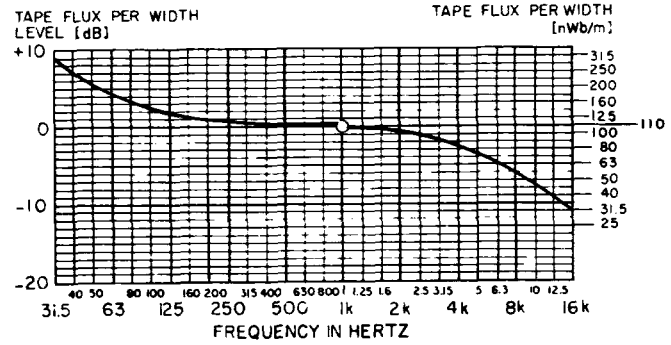
4. Calibration

4.1 Calibration of Tape Flux. The shortcircuit tape flux on the test tape shall be determined by means of the calibrated short-gap ferromagnetic core reproducer technique. This technique is described in the following references:

J. G. McKnight, "Flux and flux-frequency response measurements and standardization in magnetic recording," J. SMPTE, 78: 457-472, June 1969.

J. G. McKnight, "Tape flux measurement theory and verification," J. Aud. Eng. Soc., 18: 250-262, June 1970.

R. C. Lovick, R. E. Bartow and R. F. Scheg, "Recording and calibration of super-8 magnetic reproducer test films," J. SMPTE, 78: 473-481, June 1969.



Flux and Flux Level vs Frequency

FLUX AND FLUX LEVEL VERSUS FREQUENCY

Frequency Hz	Flux Per Width nWb/m	Relative Level dB
31.5	306	+8.9
40	252	+7.2
50	212	+5.7
63	181	+4.3
80	159	+3.2
100	144	+2.3
125	133	+1.7
160	126	+1.2
200	121	+0.8
250	118	+0.6
315	116	+0.4
400	114	+0.3
500	113	+0.2
630	112	+0.2
800	111	+0.1
1000	110	+0.0
1250	108	—0.1
1600	106	—0.3
2000	103	—0.6
2500	98.2	—1.0
3150	92.0	—1.6
4000	84.2	—2.3
5000	75.1	—3.3
6300	65.2	—4.5
8000	55.4	—6.0
10,000	46.1	—7.6
12,500	37.8	—9.3
16,000	30.7	—11.1

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 (Reaffirmed 1961).

4.3 Wow and Flutter Measurement. Wow and flutter shall be measured in accordance with American National Standard 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 15 in/s, C98.7-1969, 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

Specifications for an Audio Level and Multifrequency Test Tape for Quadruplex Video Magnetic Tape Recorders Operating at 7.5 in/s

C98.11

Revision of C98.10-1969 and C98.11-1969

1. Scope

This standard specifies an audio frequency test tape to be used for adjusting the sensitivity and the frequency response of the audio reproducing system of quadruplex video magnetic tape recorders operating at a tape speed of 7.5 in/s (190 mm/s), in accordance with Draft American National Standard Frequency Response and Operating Level of Recorders and Reproducers for Audio Record One for 2-inch Quadruplex Video Magnetic Tape Operating at 15 and 7.5 in/s, C98.3.

2. General Specifications

2.1 Dimensions of Records. The dimensions of pertinent records constituting this test tape shall conform to Draft American National Standard Dimensions of Video, Audio and Tracking Control Records on 2-inch Video Magnetic Tape Quadruplex Recorded at 15 and 7.5 in/s, C98.6.

2.2 Tape Speed. The nominal linear speed of this test tape shall be 7.5 in/s in accordance with American National Standard Speed of 2-inch Tape for Quadruplex Video Magnetic Tape Recording, C98.4-1970.

2.3 Stock. The test sections shall be recorded on transversely-oriented television magnetic recording tape, the dimensions of which are specified in American National Standard Dimensions of 2-inch Video Magnetic Tape, C98.1-1963 (Reaffirmed 1969).

2.4 Video Signal. No video signal of any kind shall be recorded.

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 Wow and Flutter. Total wow and flutter of this test tape shall not exceed 0.2 percent, as measured by the method defined in American National Standard Method of Measurement for Weighted Peak Flutter of Sound Recording and Reproducing Equipment, S4.3-1972.

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:

$$L_\Phi(f) \text{ re } 110\,\text{nWb/m} = 0.2 + 10\log_{10} \left\{ [1 + (F_l/f)^2]/[1 + (f/F_h)^2] \right\} \text{[dB]}$$

where f is the frequency at which the response is being computed; F_l 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. The tape flux level at each frequency shall be within = 0.5 dB of the value specified in Sec. 3.2.2. The tolerance of = 0.5 dB may be extended to = 2 dB provided that a calibration chart is supplied with the test tape by the manufacturer. The calibration figures furnished with the test tape shall represent the levels to be added algebraically to the reproducer output level when the particular test tape is reproduced. With the addition of these factors, the output level of the reproducer will be that which would have resulted if the test tape flux vs frequency had been exactly as specified in Sec. 3.2.2.

3.2.4 Duration. The duration of frequency response test segments shall be approximately ten seconds.

3.3 Azimuth. The tape flux shall be parallel to the reference edge of the tape with an azimuth alignment error not to exceed = 0.9 milliradians (= 3 minutes of angle).

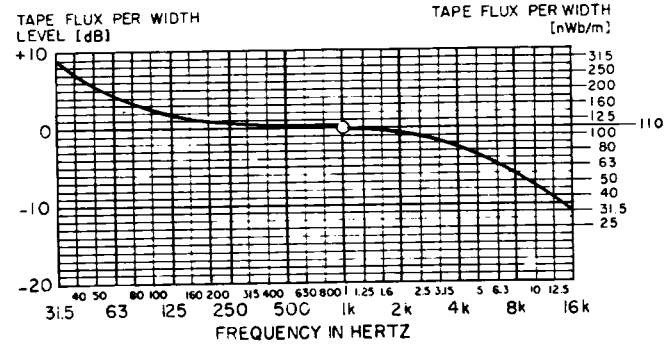
4. Calibration

4.1 Calibration of Tape Flux. The shortcircuit tape flux on the test tape shall be determined by means of the calibrated short-gap ferromagnetic core reproducer technique. This technique is described in the following references:

J. G. McKnight, "Flux and flux-frequency response measurements and standardization in magnetic recording," J. SMPTE, 78: 457-472, June 1969.

J. G. McKnight, "Tape flux measurement theory and verification," J. Aud. Eng. Soc., 18: 250-262, June 1970.

R. C. Lovick, R. E. Bartow and R. F. Scheg, "Recording and calibraton of super-8 magnetic reproducer test films," J. SMPTE, 78: 473-481, June 1969.



Flux and Flux Level vs Frequency

FLUX AND FLUX LEVEL VERSUS FREQUENCY

Frequency Hz	Flux Per Width nWb/m	Relative Level dB
31.5	306	+8.9
40	252	+7.2
50	212	+5.7
63	181	+4.3
80	159	+3.2
100	144	+2.3
125	133	+1.7
160	126	+1.2
200	121	+0.8
250	118	+0.6
315	116	+0.4
400	114	−0.3
500	113	+0.2
630	112	+0.2
800	111	+0.1
1000	110	+0.0
1250	108	−0.1
1600	106	−0.3
2000	103	−0.6
2500	98.2	−1.0
3150	92.0	−1.6
4000	84.2	−2.3
5000	75.1	−3.3
6300	65.2	−4.5
8000	55.4	−6.0
10,000	46.1	−7.6
12,500	37.8	−9.3
16,000	30.7	−11.1

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 (Reaffirmed 1961).

4.3 Wow and Flutter Measurement. Wow and flutter shall be measured in accordance with American National Standard 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.

Cinematography — Location of the printed image area for printing to 8 mm Type S on 16 mm motion-picture film perforated 8 mm Type S, 1 - 4

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the location and size of the 8 mm Type S printed picture image area for negative/positive and reversal printing on 16 mm motion-picture films with 8 mm Type S perforations in the 1-4 position.

2 REFERENCES

ISO 1781, *Cinematography — Projector usage of 8 mm motion-picture film perforated 8 mm Type S for direct front projection.* (At present at the stage of Draft.)

ISO 1787, *Cinematography — Camera usage of 8 mm motion-picture film perforated 8 mm Type S.*

3 DIMENSIONS AND CHARACTERISTICS

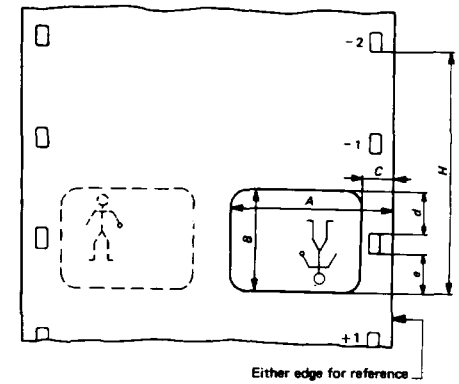
3.1 The dimensions shall be as referred to in the drawing and given in the table.

3.2 Two images may be printed on this film. The image on the left-hand side, is inverted and symmetrical to that on the right-hand side. The dimensions for this image, however, are taken from the left-hand edge of the film which then becomes the reference edge.

NOTES

1 The corners of the image may be rounded with a radius of 0.13 mm (0.005 in) or less.

2 When producing photographic (optical) sound prints, the portion of the printed picture area controlled by dimension *A* should be restricted from intruding into the printed area of the photographic sound track. (See Z.2 in the Appendix).



Dimension	mm	in
A	7.16 min.	0.282 min.
B	$4.22\ ^{0}_{-0.08}$	$0.166\ ^{0}_{-0.003}$
C	1.47 max.	0.058 max.
H	9.98 ± 0.05	0.393 ± 0.002

d and *e* shall differ from each other by no more than 0.20 mm.

APPENDIX

Z.1 In the use of 8 mm Type S film, the same perforation is used to position the film for camera exposure and for projection [minus two (− 2) from the perforation adjacent to the image at the aperture]. This is recommended to improve steadiness through cancellation of perforation variables. A motion-picture processing laboratory should take this factor into account where step printers are used in the preparation of release prints. Pertinent information is given in ISO 1781 and ISO 1787.

Z.2 When a photographic sound record is included on the print, a recommended maximum value for dimension *A* of 7.20 mm (0.283 5 in) should be considered. This value should provide a reasonable tolerance for the protection of the primary image area while establishing an available area for the development of photographic sound documents.