Biographical Note

August Arnold

(The following Biographical Note has been made possible through the courtesy of W. Roth, Editor-in-Chief of *Fernseh- und Kino-Technik,* who supplied the *Journal* with information on the career of August Arnold. A translation and abridgment of the information thus supplied is included in the Biographical Note.)

August Arnold, a pioneer in the motion-picture industry and (with Robert Richter) the inventor of the Arriflex 35 camera, celebrated his 76th birthday 12 September 1974.

He was born in 1898 in Werfen, Salsburg, Austria. His father, Georg Diedrich Arnold, was an Imperial and Royal Forest officer. August Arnold completed his engineering studies in 1915 in Mittweida, Saxony; many years later (in 1961) he received an honorary degree, that of Doctor of Engineering, from the Technisch Hochschule Munchen.

In 1913, as high-school students, he and his friend, Robert Richter, became deeply interested in motion-picture technology, becoming fascinated with the hand-cranked cameras then in use. They studied filmmaking with a well-known Munich cameraman, Martin Kopp, and with Peter Ostermayr who had established a motion-picture studio in 1909. While still very young, Arnold filmed some 140 feature productions.

During World War I, he served in the Army; he was wounded and honorably discharged in 1917. That same year the two friends founded the firm of Arnold & Richter (ARRI) which, 57 years later, continues as one of the great names in the motion-picture industry. Robert Richter died in 1972 (*Journal,* p. 625, August 1972) but the firm still bears his name.

Because of their youth (they were only 19 years old), the two young men had to have special permission from the courts for this venture; they were declared of full age for the purpose of founding the firm. The original firm was housed in a small shop on the Turkenstrasse in Munich and the present plant, which over the years has become much, much larger, is still on that same street. The plant was virtually destroyed during World War II, but shortly after the end of the war it was rebuilt and modernized.

Beginning with its initial establishment, the firm manufactured motion-picture equipment including printing and processing machines; however, its most successful venture, in terms of worldwide recognition, was the development of the Arriflex camera, introduced in 1936. At present there are some 35,000 Arriflex cameras in use; even a few of the very early cameras are still being used.

During the years, Arnold has received many honors for his contributions to the motion-picture industry, among them, the Oscar Messter Medal, presented to him in 1953; that same year he also received the First Class Merit Cross of the Order of Merit of the German Federal Republic. In 1958 he received the Lanterna Magica Award and in 1965 he was presented with the Diesel Medal by the German Association of Inventors. In 1968 he received the Grand Cross of Merit of the German Federal Republic and in 1972 he was presented with the German Film Award, Filmband in Gold, presented by the Minister of the Interior.

In 1970 he was appointed Consul of the Republic of Togo for the State of Bavaria. He was presented with the Bavarian Order of Merit in 1972.

He was been a member of the Society since 1956 and was made a Fellow in 1968. Other professional societies which have honored him include the British Kinematograph, Sound and Television Society, which made him an Honorary Fellow in 1971, and the American Society of Cinematographers which, in 1972, made him an Honorary Member, a membership grade rarely bestowed by that society.

standards and recommended practices

Approved American National Standards

On 2 April 1975, the American National Standards Institute approved two new standards: C98.12-1975, Time and Control Code for Video and Audio Tape for 525 Line/60 Field Television Systems, specifies a digital code format for use on video and audio magnetic tape recorders to be used for timing and control purposes; and C98.13-1975, Dimensions of Cartridge Spools for 2-Inch Quadruplex Video Magnetic Tape, specifies the dimensions for a supply spool to be used in quadruplex equipment designed to utilize a reloadable cartridge or cassette.

Your attention is directed to C98.12 inasmuch as the time code specified is the same code which has been identified up to now as the SMPTE Code.

Reaffirmed American National Standards

On 2 April 1975, the American National Standards Institute, taking the recommendations of the SMPTE Engineering Committees and American National Standards Committee C98, reaffirmed without change the following American National Standards: C98.2-1963 (R1969), Specifications of Monochrome Video Magnetic Tape Leader (published in the December 1963 SMPTE *Journal*), and C98.9-1967, Specifications for Color Video Magnetic Tape Leader (published in the September 1967 SMPTE *Journal*).

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 these standards where such action is appropriate. Copies of the standards may be obtained for a nominal fee from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

Approved International Standards

The International Organization for Standardization (ISO) approved two International Standards, the technical content of which is published here for information: ISO 2967-1975, Cinematography — Magnetic Stripes for Sound Records on 35-mm Motion-Picture Film Perforated 8-mm Type S-5R (1-3-5-7-0)-Positions and Width Dimensions, is in complete agreement with American National Standard PH22.163-1968 (R1973); and ISO 3024-1975, Cinematography — Motion-Picture Camera Cartridge, 8-mm Type S, Model 1 — Camera Run Length, Perforation Cut-Out and End-of-Run Notch in Film — Specifications, is in complete agreement with American National Standard PH22.159.5-1974.

Complete copies of all International Standards are available from 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 C98.12–1975

American National Standard
time and control code for video and audio tape for 525 line/60 field television systems

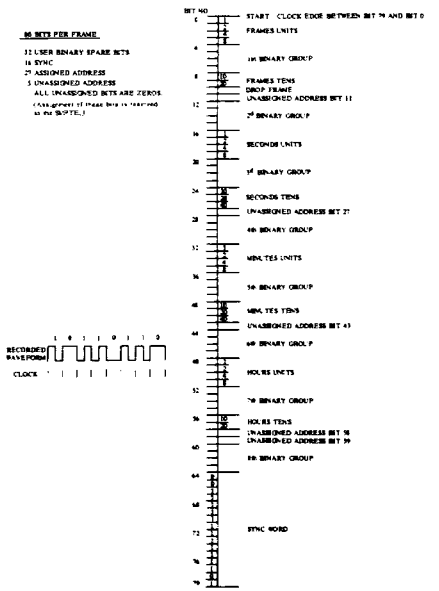
Approved April 2, 1975 Secretariat: Society of Motion Picture and Television Engineers, Inc.

1. Scope

This standard specifies a digital code format and modulation method for video and audio magnetic tape recorders to be used for timing and control purposes. The standard also specifies the location of the code on the tape and its relationship to other signals on the tape.

2. Modulation Method

The modulation method shall be such that a transition occurs at the beginning of every bit period. "One" is represented by a second transition one half a bit period from the start of the bit. "Zero" is represented when there is no transition within the bit period. (See Figure.)



3. Code Format

3.1 Each television frame shall be identified by a unique and complete address. A frame consists of two television fields or 525 horizontal lines.

3.1.1 The frames shall be numbered successively 0 through 29.

3.2 Each address shall consist of 80 bits numbered 0 through 79.

3.3 The bits shall be assigned as shown in the figure and described below:

- 0-3 Units of frame
- 4-7 First binary group
- 8-9 Tens of frames
- 10 Drop frame flag (See Sec. 3.7)
- 11 Unassigned address bit (0 until assigned by the SMPTE)
- 12-15 Second binary group
- 16-19 Units of seconds
- 20-23 Third binary group
- 24-26 Tens of seconds
- 27 Unassigned address bit (0 until assigned by the SMPTE)
- 28-31 Fourth binary group
- 32-35 Units of minutes
- 36-39 Fifth binary group
- 40-42 Tens of minutes
- 43 Unassigned address bit (0 until assigned by the SMPTE)
- 44-47 Sixth binary group
- 48-51 Units of hours
- 52-55 Seventh binary group
- 56-57 Tens of hours
- 58-59 Unassigned address bits (0 until assigned by the SMPTE)
- 60-63 Eighth binary group
- 64-79 Synchronizing word
  - 64-65 Fixed zero
  - 66-77 Fixed one
  - 78 Fixed zero
  - 79 Fixed one

3.4 Boundaries of Address. The address shall start at the clock edge before the first address bit (bit zero). The bits shall be evenly spaced throughout the address period, and they shall occupy fully the address period which is one frame. Consequently, the bit rate shall be 80 times the frame rate in frames per second. (See Sec. 3.1 for definition of a television frame.)

3.5 Timing of Start of Address. The start of the address shall occur at the beginning of the frame as defined by the leading edge of the third wide pulse of that vertical interval in which that edge is coincident with the leading edge of a horizontal sync pulse. The tolerance shall be plus or minus one line.

3.6 Use of Binary Groups. The binary groups are intended for storage of supplementary data by the users, and the 32 bits within the eight groups may be assigned in any fashion without restrictions. It is anticipated that the use of these bits will be standardized in the future.

3.7 Assigned and Unassigned Address Bits. Six bits are reserved within the address groups, one for identifying operational modes, and five unassigned but reserved for future assignment and defined as zeros until further specified by the SMPTE.

Bit No. 10—Drop Frame Flag. If certain numbers are being dropped to resolve the difference between real time and color time as defined in Sec. 4.2.2, a "1" shall be recorded.

Bits No. 11, 27, 43, 58, 59—Unassigned Address Bits. "0" until assigned by the SMPTE.

4. Time Discrepancies

4.1 Definitions of Real Time and Color Time:

Real time is defined as the time elapsed during the scanning of 60 fields (or any multiple thereof) in an ideal television system at a vertical field rate of exactly 60 fields per second.

Color time is defined as the time elapsed during the scanning of 60 fields (or any multiple thereof) in a color television system at a vertical field rate of approximately 59.94 fields per second.

4.2 Because the vertical field rate of a color signal is approximately 59.94 fields per second, straightforward counting at 30 frames per second (60 fields per second) will yield an error of −108 frames (+216 fields), equivalent to +3.6 seconds timing error, in one hour of running time. For correction of this time discrepancy, two methods of operation are allowed:

4.2.1 Uncompensated Mode. During a continuous recording, no numbers shall be omitted from the chain of addresses. Each address shall be increased by 1 frame over the frame number immediately preceding it. When this mode is used, bit No. 10 of each address shall be a "0" as specified in Sec. 3.7.

4.2.2 Compensated Mode. To resolve the color time error, the first two frame numbers (0, 1) at the start of each minute, except minutes 0, 10, 20, 30, 40 and 50, shall be omitted from the count. When this mode is used, bit No. 10 of each address shall be a "1" as specified in Sec. 3.7.

5. Structure of the Address Bits

5.1 The basic structure of the address is based upon the Binary Coded Decimal (BCD) system. Because the count in some cases does not rise to 9, conservation of bits is achieved because 4 bits are not needed as in an ordinary BCD code.

5.1.1 Units Frames. Bits 0-3—4 bit BCD arranged 1, 2, 4, 8. Count 0-9.

5.1.2 Tens Frames. Bits 8-9—2 bit BCD arranged 1, 2. Count 0-2.

5.1.3 Units Seconds. Bits 16-19—4 bit BCD arranged 1, 2, 4, 8. Count 0-9.

5.1.4 Tens Seconds. Bits 24-26—3 bit BCD arranged 1, 2, 4. Count 0-5.

5.1.5 Units Minutes. Bits 32-35—4 bit BCD arranged 1, 2, 4, 8. Count 0-9.

5.1.6 Tens Minutes. Bits 40-42—3 bit BCD arranged 1, 2, 4. Count 0-5.

5.1.7 Units Hours. Bits 48-51—4 bit BCD arranged 1, 2, 4, 8. Count 0-9.

5.1.8 Tens Hours. Bits 56-57—2 bit BCD arranged 1, 2. Count 0-2.

(The 24-hour clock system is used. 2:00 p.m. is 1400 hours.)

6. Position of the Address on the Video Tape

6.1 Audio No. 2 Track (Cue Track) Record on Quadruplex Recorders. The address shall be recorded upon the Audio No. 2 Track (Cue Track) whose location is specified in 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, C98.6–1973. Since the timing of the address is specified by Sec. 3.5, the position of its start point along the tape will be determined with respect to the video record by the position of the audio No. 2 head as set forth in C98.6–1973.

6.2 Audio Track Record on Helical Scan Recorders. When this code is used on helical scan recorders, provisions of Sections 2 through 5 shall apply. Since no American standards exist for helical scan recorders, location of the address has yet to be determined.

6.3 Recording in Vertical Interval of the Video Signal. The concept of the Time and Control Code includes consideration for recording the address in the vertical interval of the video signal. However, the characteristics of this method have not yet been specified.

American National Standard
dimensions of cartridge spools for 2-inch quadruplex video magnetic tape

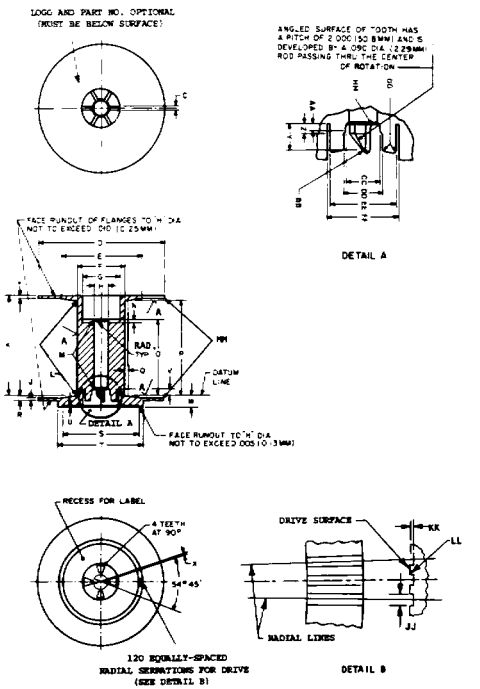
Approved April 2, 1975 Secretariat: Society of Motion Picture and Television Engineers, Inc.

1. Scope

This standard specifies the dimensions of a 2.7 inch (68.58 mm) diameter supply spool for quadruplex equipment designed to utilize a reloadable cartridge or cassette.

2. Dimensions

The dimensions of the spool shall be as specified in the figure and table.



DIMENSIONS		INCHES	MILLIMETERS
A		See Note 2	
C		0.060 (6 equal spaces)	1.52 (6 equal spaces)
D	(diameter)*	2.70 ± 0.010	68.58 ± 0.25
E	(diameter)	1.700 ± 0.030	43.18 ± 0.76
F	(diameter)†	1.000 +0.005 −0.010	25.40 +0.13 −0.25
G	(diameter)	0.812 ± 0.010	20.62 ± 0.25
H	(diameter)	0.313 +0.001 −0.000	7.95 +0.03 −0.00
J		0.055 ± 0.005	1.40 ± 0.13
K		2.120 ± 0.010	53.85 ± 0.25
L	(radius)	0.004 max	0.10 max
M		0.015 × 45° (chamfer)	0.38 × 45° (chamfer)
N		0.060	1.52
O		1.611 ± 0.010	40.92 ± 0.25
P		2.030 ± 0.005	51.56 ± 0.13
Q		0.070 ± 0.040	1.78 ± 1.02
R		0.090 ± 0.005	2.29 ± 0.13
S	(diameter)‡	1.625 ± 0.005	41.28 ± 0.13
T	(diameter)‡	1.820 ± 0.005	46.23 ± 0.13
U		0.020 min	0.51 min
		0.070 max	1.78 max
V		0.137 ± 0.005	3.48 ± 0.13
W		0.230 ± 0.005	5.84 ± 0.13
X		0.045 typ	1.14 typ
Y		0.227 ref	5.77 ref
Z		0.100	2.54
AA		0.090	2.29
BB	(radius)	0.01 typ	0.3 typ
CC	(diameter)	0.375 ± 0.010	9.52 ± 0.25
DD	(diameter)	0.410 ± 0.010	10.41 ± 0.25
EE	(diameter)	0.710 +0.040 −0.010	18.03 +1.02 −0.25
FF	(diameter)	0.750	19.05
GG	(radius)	0.031 max	0.79 max
HH	(radius)	0.031	0.79
JJ		0.017 min	0.43 min
		0.020 max	0.51 max
KK		0.005 min	0.13 min
		0.008 max	0.20 max
LL	(radius)	0.003 max typ	0.08 max typ
MM	(radius)	0.010 ± 0.005	0.25 ± 0.13

* D shall be concentric to H within 0.006 inch (0.15 mm).

† F shall be concentric with H within 0.002 inch (0.05 mm). Maximum taper in 2.030-inch (51.56 mm) dimension shall not exceed 0.002 inch (0.05 mm).

‡ S and T shall be concentric to H within 0.010 inch (0.25 mm).

NOTE 1: The teeth described in Detail A and the serrations described in Detail B are intended as alternate methods for driving the spools.

NOTE 2: Surfaces indicated by the letter A should contain surface finish designated as No. 63 (microinch measurement of surface polish), as defined in American National Standard Surface Texture, B46.1-1962 (R1971).

Cinematography — Motion-picture camera cartridge, 8 mm Type S, Model I — Camera run length, perforation cut-out and end-of-run notch in film — Specifications

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the camera run length of film supplied in an 8 mm Type S, Model I film camera cartridge of 15 m (50 ft) nominal capacity, and the length of film returned to the customer. Its purpose is to provide a uniform basis for the operation of film metering mechanisms in cameras.

This International Standard also specifies the dimensions and location of a perforation cut-out notch and a notch in the unperforated side of 8 mm Type S camera films which may be used to automatically indicate the end-of-run.

2 REFERENCES

ISO 1780, *Cinematography – Motion-picture camera cartridge, 8 mm Type S, Model I – Aperture opening, pressure pad and film load – Positions and dimensions.*[1)]

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

ISO 3067, *Cinematography – Motion-picture camera cartridge, 8 mm Type S, Model I – Notches for film speed, film identification and colour-balancing filter – Dimensions and positions.*

ISO 3654, *Cinematography – Motion-picture camera cartridge, 8 mm Type S, Model I – Camera fit and take-up core drive – Dimensions and specifications.*[1]

3 DIMENSIONS AND CHARACTERISTICS OF CAMERA RUN LENGTH

3.1 The camera run length of the film (see figure 1) can vary between 3 666 perforation pitches (15,5 m or 50.9 ft) and 3 710 perforation pitches (15,7 m or 51.5 ft). The overall length of the film is to be determined by the manufacturer to provide for the camera run length specified.

NOTE – A nominal perforation pitch, based on 72 pitches per foot, of 4,234 mm (0.166 7 in) is assumed for all specifications of the number of perforation pitches in a given film length.

3.2 The processed film returned to the customer shall consist of at least 3 600 pitches (15,24 m; 50.0 ft), the customer return length. The customer return length is that part of the camera run length available for subject matter. The customer return length shall commence following a leader of not more than 13 pitches, 55 mm (2.2 in), measured from the frame in the camera aperture as the cartridge is supplied by the manufacturer, and end at least 37 pitches, 157 mm (6.2 in), short of the final frame of the camera run length as limited by the perforation cut-out (see the annex).

NOTE – The sum of the minimum customer return length (3 600 perforation pitch intervals), leader (13 perforation pitch intervals), and trailer (37 perforation pitch intervals) is intentionally less than the minimum camera run length (3 666 perforation pitch intervals).

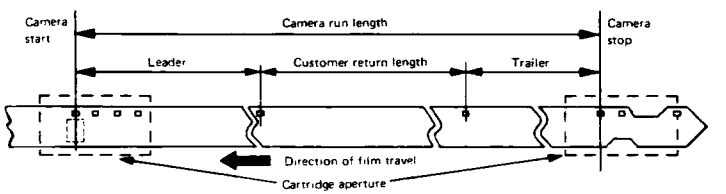
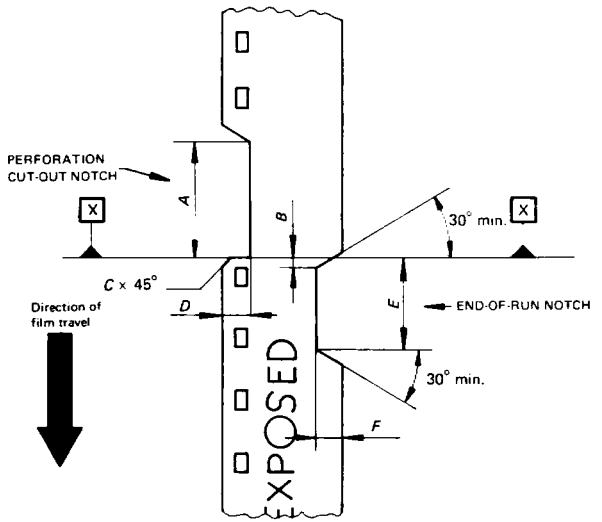


FIGURE 1 – Run length

NOTE – The end of the film should have a visual marking in the picture area, and the perforations should be cut out so that this final portion of the film will stop in the film cartridge aperture, and give the user a visual confirmation that all film has been exposed.

1) At present at the stage of draft.

4 DIMENSIONS AND CHARACTERISTICS OF PERFORATION CUT-OUT AND END-OF-RUN NOTCHES



Dimension	mm	in
*A**	5,38 min.	0.212 min.
*B***	0,30 max.	0,012 max.
C	0,55 max.	0.022 max.
D	1,50 min.	0.059 min.
E	4,52 ± 0,50	0.178 ± 0.020
F	0,80 min.	0.31 min.

* See 4.2.

** See 4.5.

FIGURE 2 – **Notch dimensions**

4.1 The dimensions shall be as specified in figure 2 and the table.

4.2 Datum line **X** is established by the lower edge of the perforation cut-out notch and is nominally perpendicular to the edge of the film.

The bevelled cut as shown in the perforation cut-out notch as defined by dimension *A* is shown as a matter of convenience and is not a specification.

The dimensions of the perforation cut-out notch have been found in practice to comply with the specifications of figure 2; however, the bevel at the top of dimension *A* shall not be considered as restricting to its application.

4.3 The bevelled cuts of 30° minimum apply to the top and bottom of the end-of-run notch and are to facilitate the entry of the camera-sensing finger and to reduce the possibility of catching or snagging the edge of the notch in the internal mechanism of the cartridge.

4.4 The inside and outside corners of the notches may have a radius of 0,3 mm (0.01 in) maximum.

4.5 Dimension *B* for the end-of-run notch shown in figure 2 is expressed as a maximum to ensure a minimum notch length. There is no functional need to specify a maximum notch length. The trailing edge of the notch, specified by dimension *B*, may approach or cross datum **X** so that the notch length could extend to the end of the film provided the notch depth, dimension *F*, is maintained.

ANNEX

A.1 The lengths of leader and trailer described are necessary to ensure that the fog produced near the camera aperture is removed. The material removed also provides space for identification numbers and allows for manufacturing variability in the length of the film.

A.2 The dimensional specifications of the end-of-run notch have been established to allow use of the cut-out designated by dimensions *M* and *N* in the upper half of the cartridge pressure pad as specified in ISO 1780.

A.3 The user is cautioned that some super 8 camera cartridge films currently available do not meet the minimum specifications of dimension *E* in figure 2. It is anticipated, however, that manufacturers will move towards the minimum specifications as it becomes necessary to change punches and dies through attrition or through new machine design.

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Cinematography — Magnetic stripes for sound records on 35 mm motion-picture film perforated 8 mm Type S-5R (1-3-5-7-0) — Positions and width dimensions

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the dimensional features of the magnetic stripes applied to 35 mm motion-picture raw stock, perforated 8 mm Type S-5R with perforations at location 1, 3, 5, 7 and 0 for subsequent slitting to 8 mm Type S processed motion-picture film complying with ISO 1700.

2 REFERENCES

ISO 1700, *Cinematography — 8 mm Type S motion-picture raw stock film — Cutting and perforating dimensions.*

ISO 3027, *Cinematography — Magnetic stripes and recording head gaps for sound record on 8 mm Type S motion-picture prints — Positions and widtn dimensions.*

ISO 3774, *Cinematography — 35 mm motion-picture film perforated 8 mm Type S (1-3-5-7-0) — Cutting and perforating dimensions.* [1]

3 FILM STOCK

3.1 The dimensions of the film stock shall conform to the specifications given in ISO 3774.

3.2 The dimensional features of the processed film after slitting shall conform to the requirements specified in ISO 1700.

4 LOCATION AND WIDTH OF MAGNETIC STRIPING

4.1 The location and width of the magnetic sound stripes and balance stripes shall be as given in the figure and the table.

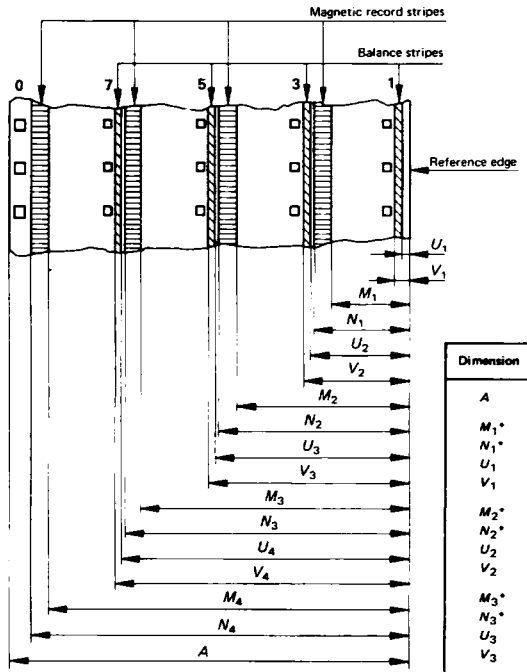
4.2 If the magnetic sound stripe increases the thickness of the film by more than 0,005 mm (0.000 2 in), a balance stripe shall be applied to effectively equalize the thickness at the two edges of the slit 8 mm film. The balance stripes should essentially have the same thickness and shall have the same composition as the sound record stripe.

4.3 The thickness of the magnetic sound record and balance stripe shall not exceed 0,020 mm (0.000 8 in).

4.4 The stripes shall be applied to the side of the film which when slit will be toward the light source when used in a projection system arranged for direct front projection onto a reflection type screen.

4.5 The dimensional features of the processed film after slitting shall conform to ISO 3027.

1) At present at the stage of draft.



Dimension	mm	in
A	34,98 nominal	1.377 nominal
M_1*	8,00 ± 0,05	0.315 ± 0.002
N_1*	8,68 ± 0,05	0.342 ± 0.002
U_1	0,84 ± 0,08	0.033 ± 0.003
V_1	1,14 ± 0,08	0.045 ± 0.003
M_2*	15,98 ± 0,05	0.629 ± 0.002
N_2*	16,66 ± 0,05	0.656 ± 0.002
U_2	8,81 ± 0,08	0.347 ± 0.003
V_2	9,12 ± 0,08	0.359 ± 0.003
M_3*	23,96 ± 0,05	0.943 ± 0.002
N_3*	24,64 ± 0,05	0.970 ± 0.002
U_3	16,79 ± 0,08	0.661 ± 0.003
V_3	17,10 ± 0,08	0.673 ± 0.003
M_4*	31,94 ± 0,05	1.257 ± 0.002
N_4*	32,62 ± 0,05	1 284 ± 0.002
U_4	24,77 ± 0,08	0.975 ± 0.003
V_4	25,07 ± 0,08	0.987 ± 0.003

* Notwithstanding the tolerances on M_1, N_1, M_2, N_2, M_3, N_3, M_4 and N_4, the difference between each pair of correlated N and M dimensions shall not be smaller than 0,635 mm (0.025 in).

NOTES

1 The tolerances for the recording stripes and balance stripes permit the use of a single wide stripe or two separate stripes where they are adjacent. If two stripes are used, the amount of separation between the stripes should be sufficient to permit slitting within the requirements of this International Standard without obtaining undesirable feather edges of magnetic material. The actual separation required should be determined by laboratory practice. In the event that the wide stripe mentioned above is used, then, if desired, U_1 may be decreased and N_4 may be increased so as to permit slitting within the magnetic coating.

2 The metric dimensions in the table are based upon the practice of countries using the metric system, and similarly the inch dimensions follow the practice of those countries using the inch system. In some instances, the figures are not exact conversions; the differences are small and films made to either system of dimensions will for all practical purposes be interchangeable.