

Digital audio tape cassette system (DAT) —

Part 1: Dimensions and characteristics

The European Standard EN 61119-1:1994 has the status of a British Standard

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Cooperating organizations

The European Committee for Electrotechnical Standardization (CENELEC), under whose supervision this European Standard was prepared, comprises the national committees of the following countries:

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National foreword

This British Standard has been prepared under the direction of the Electrotechnical Sector Board and is the English language version of EN 61119-1:1994 *Digital audio tape cassette system (DAT) — Part 1: Dimensions and characteristics*, published by the European Committee for Electrotechnical Standardization (CENELEC). It is identical with IEC 1119-1:1992, published by the International Electrotechnical Commission (IEC).

BS EN 61119 consists of the following Parts:

- *Part 1: Dimensions and characteristics;*
- *Part 2: DAT calibration tape;*
- *Part 3: DAT tape properties;*
- *Part 4: Character pack format¹⁾;*
- *Part 5: DAT for professional use;*
- *Part 6: Serial copy management systems¹⁾;*
- *Part 7: DAT logo application rule¹⁾.*

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 96, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ In preparation.

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Descriptors: Sound recording, digital recording, data recording devices, audiocassettes, magnetic tapes, track formats, dimensions, characteristics

English version

Digital audio tape cassette system (DAT) Part 1: Dimensions and characteristics

(IEC 1119-1:1992)

Système audionumérique à cassette (DAT)
Partie 1: Dimensions et caractéristiques
(CEI 1119-1:1992)

Digitales Tonband-Kassetten-System
Teil 1: Maße und Kennwerte
(IEC 1119-1:1992)

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

The CENELEC questionnaire procedure, performed for finding out whether or not the International Standard IEC 1119-1:1992 could be accepted without textual changes, has shown that no common modifications were necessary for the acceptance as European Standard.

The reference document was submitted to the CENELEC members for formal vote and was approved by CENELEC as EN 61119-1 on 15 May 1994.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-03-15
- latest date of withdrawal of conflicting national standards (dow) 1995-03-15

Annexes designated “normative” are part of the body of the standard. Annexes designated “informative” are given only for information. In this standard, Annex A, Annex B and Annex ZA are normative and Annex C and Annex D are informative.

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Introduction

The IEC draws attention to the fact that it is probable that the specifications contained in this standard are the subject of one or more patents.

The IEC has no precise information on the holders of such patents and cannot supply further details, but it is expected that the holders of such patents will be prepared to grant licences under reasonable and non-discriminatory terms.

1 Scope and object

This part of IEC 1119 is applicable to the digital audio tape (DAT) cassette system that records and/or plays back digital information such as PCM encoded audio and/or other data.

This part defines those parameters that affect the compatibility between cassettes and the associated tape recorders. It is also intended as a reference for manufacturers producing cassettes and/or tape recorders which are intended to conform with the system described in this part.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 1119. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 1119 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 268-11:1987, *Sound system equipment — Part 11: Application of connectors for the interconnection of sound system components*.

IEC 268-12:1987, *Sound system equipment — Part 12: Application of connectors for broadcast and similar use*.

IEC 268-15:1987, *Sound system equipment — Part 15: Preferred matching values for the interconnection of sound system components*.

IEC 958:1989, *Digital audio interface*.

IEC 1119-2:1991, *Digital audio tape cassette system (DAT) — Part 2: DAT calibration tape*.

IEC 1119-3:1992, *Digital audio tape cassette system (DAT) — Part 3: DAT tape properties*.

IEC 1119-4:199x, *Digital audio tape cassette system (DAT) — Part 4: Method of measurement for DAT recorder (under consideration)*.

IEC 1119-5:199x, *Digital audio tape cassette system (DAT) — Part 5: DAT for professional use (under consideration)*.

ISO 3901:1986, *Documentation — International Standard recording code (ISRC)*.

3 Description of the system

The information carrier is a magnetic tape of 3,81 mm width wound on flangeless hubs which are located in a cassette containing a slider and a lid to protect the tape from accidental damages. The tape is of the metal powder type or its equivalent. The digital information is recorded using the helical scanning principle and can be erased by over-writing. The digital information is read by magnetic heads using an automatic track finding (ATF) scheme to find and follow tracks. Two track widths and three tape speeds are defined.

It is possible to record sub code information in a main data area, either with or without audio signals.

4 Test conditions

Tests and measurements made on the system to verify conformity with the provisions of this part of IEC 1119 shall be carried out under the following conditions:

- Temperature: 20 °C ± 2 °C
- Relative humidity: 40 % to 60 %
- Barometric pressure: 86 kPa to 106 kPa
- Conditioning before testing: 24 h

5 Mechanical parameters

5.1 Cassette

5.1.1 Dimensions and tolerances

The cassette dimensions and tolerances are specified in Figure 2 to Figure 11 on pages 10 to 18.

In these figures, use is made of reference datum planes which are presented in Figure 7, page 15.

The Z-datum plane is defined by the datum areas A, B and C. The X-datum plane is defined through the centres of the positioning holes in the datum areas A and B, perpendicular to plane Z. The Y-datum is defined through the centre of the positioning hole in area A, perpendicular to planes Z and X.

Tolerances which are not specified in these figures shall be as in the following table:

	Tolerance
Length: L (mm)	
$6 \geq L$	$\pm 0,1$
$30 \geq L > 6$	$\pm 0,2$
$L > 30$	$\pm 0,3$
Angle ($^{\circ}$)	± 1

5.1.2 Outside view

The outside view is shown in Figure 1 on page 9.

5.1.3 Label area

The hatched area given in Figure 12 on page 19 is available for the labels of pre-recorded cassettes.

5.1.4 Window

The window shall be positioned within the label area.

5.1.5 Accidental erasure prevention (AEP)

5.1.5.1 Accidental erasure prevention hole

The cassette shall be provided with an accidental erasure prevention hole as shown in Figure 1 and in accordance with the table in 5.1.5.2.

If an accidental erasure prevention tag is provided, the tag shall be so constructed that it can withstand an applied force of 0,5 N.

5.1.5.2 Operation scheme and indication of accidental erasure prevention

Accidental erasure prevention may be indicated by a moving part, the colour of which shall not be red.

The operation scheme of the accidental erasure prevention is specified in the following table:

Possible to record		Impossible to record	
AEP hole	Indication-window	AEP hole	Indication-window
Closed "0"	Closed "0"	Open "1"	Open "1"

The position of the indication widow is shown in Figure 1, page 9.

5.1.6 Recognition holes

The cassette shall be provided with recognition holes (1) to (4) as shown in Figure 1.

The recognition holes (1), (2) and (3) distinguish magnetic tape types and magnetic tape thickness as follows:

- "0" ... hole closed;
- "1" ... hole open.

Hole (1)	Hole (2)	Hole (3)	Remarks
0	0	0	Metal powder tape or equivalent/13 μ m thickness
0	1	0	Metal powder tape or equivalent/thin tape
0	0	1	Wide track/13 μ m thickness
0	1	1	Wide track/thin tape
1	X	X	Reserved

Recognition hole (4) distinguishes pre-recorded tape:

- “0” hole closed: non pre-recorded tape;
- “1” hole open: pre-recorded tape.

When tags are provided for recognition, the tags shall be so constructed that they can withstand an applied force of 0,5 N.

5.1.7 Cassette holding area

The cassette holding area is shown in Figure 2, page 10.

5.1.8 Groove for loading grip

The groove for loading grip is shown in Figure 2.

5.1.9 Tape begin/end detection

Two tape end detection systems are provided: the prism system and the direct light path system are provided. The prism system makes use of light path via a prism installed in the cassette and the direct light path system makes use of direct light path via the cassette hole provided on the side of the cassette.

Figure 6, page 14, shows both the light paths and the prism position for tape end detection.

The transmissivity of the magnetic tape for light of wavelengths between 800 nm and 900 nm shall be 5 % or less.

The transmissivity of leader and trailer tapes for light of wavelengths between 800 nm and 900 nm shall be 60 % or more.

- 1) For the direct light path system, the detection accuracy of the tape begin and end is determined by the transmissivities of the magnetic tape and the leader and trailer tapes.
- 2) For the prism system, the detection accuracy of the tape begin and end is determined by the transmissivity of the prism installed in the cassette. The transmissivity of the prism shall be 50 % or more for 800 nm to 900 nm wavelength light. The definition of the transmissivity of the prism and the measuring method are shown in Annex A.

5.1.10 Lid

5.1.10.1 Lid configuration

The lid configuration is shown in Figure 10, page 17.

5.1.10.2 Force to open the lid

The force P_o to open the lid and release the hub lock as shown in Figure 10 shall be 1,2 N (6×10^{-3} Nm) or less.

5.1.10.3 Minimum height of the lid when open

The minimum height of the lid when open shall be 10,9 mm, as shown in Figure 10, page 17.

5.1.10.4 Dimensions of the hub lock and release

The dimensions of the hub lock and release shall be as shown in Figure 11, page 18.

5.1.10.5 Lid return spring

The use of two lid return springs is recommended. If a single lid return spring is used, it shall be placed on the tape supply side.

5.1.11 Slider locks

The use of two slider locks is recommended. If a single slider lock is used a dummy groove shall be provided.

5.1.11.1 Force to open the slider

The maximum force to open the slider shall be 2 N. The measurement method is shown in Annex B.

5.1.11.2 Release force of slider lock(s)

The release force of the slider lock shall be 0,5 N or less per slider lock at a pushing stroke of 0,65 mm.

5.1.11.3 Holding force

The holding force of the slider shall be 0,3 N minimum in the open position.

5.1.12 Hub

The shape and dimensions of the hub shall be as shown in Figure 8 and Figure 9, pages 16 and 17.

5.2 Tape**5.2.1 Magnetic tape****5.2.1.1 Magnetic tape length**

The length of the magnetic tape shall be determined by the following equation:

$$[(1 + 0,005) V_t \times (T + 1) \times 60/1\,000] \begin{smallmatrix} +1 \\ 0 \end{smallmatrix} \text{ m}$$

where

V_t is the tape speed (mm/s)

T is the recording time (min)

5.2.1.2 Magnetic tape width

The magnetic tape width shall be $3,81 \begin{smallmatrix} 0 \\ -0,02 \end{smallmatrix}$ mm.

5.2.1.3 Magnetic tape thickness

The magnetic tape thickness shall be $13 \mu\text{m} \pm 1 \mu\text{m}$.

5.2.2 Leader and trailer tapes**5.2.2.1 Dimensions**

The tape length shall be $60 \text{ mm} \pm 5 \text{ mm}$.

The tape width shall be $3,81 \begin{smallmatrix} 0 \\ -0,05 \end{smallmatrix}$ mm.

5.2.2.2 Retaining force

The retaining force of the splice shall be 5 N or more.

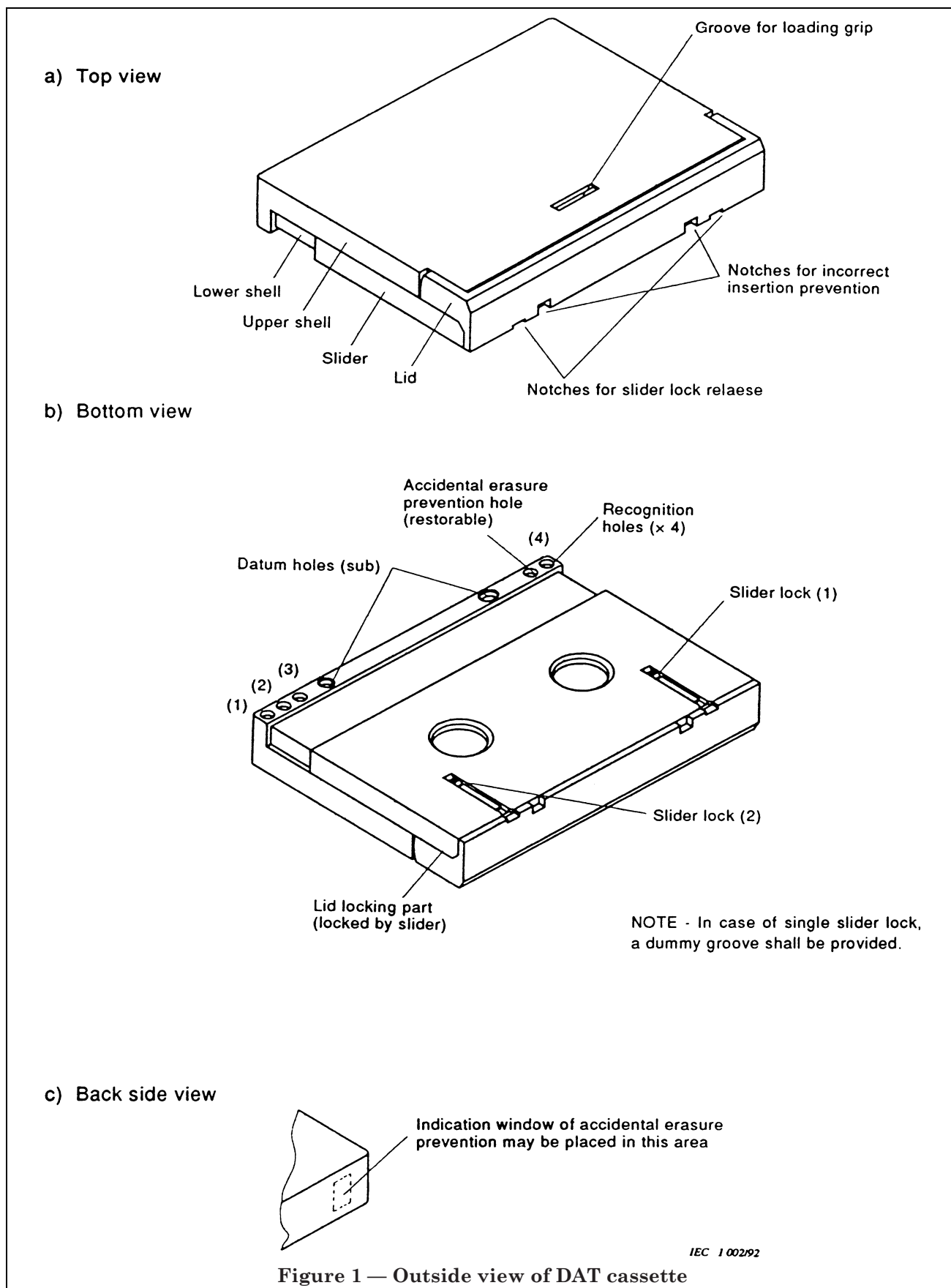
The retaining force of the hub clamp shall be 5 N or more.

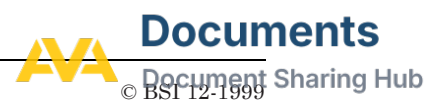
5.2.3 Tape winding

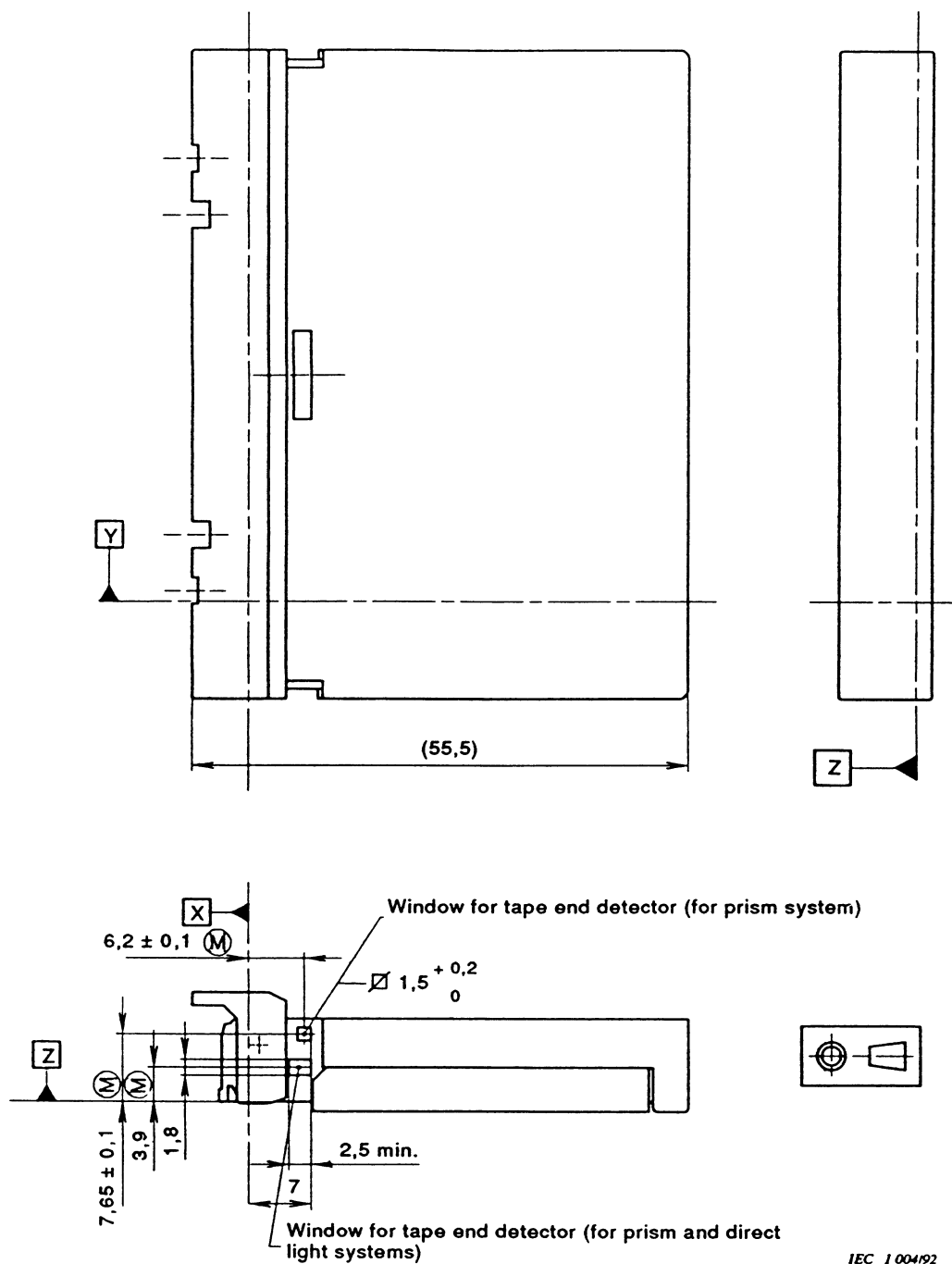
The recording side of the tape shall face outwards.

5.2.4 Single hub friction torque

The friction torque of a partially or fully wound hub shall not exceed $0,2 \times 10^{-3} \text{ Nm}$.





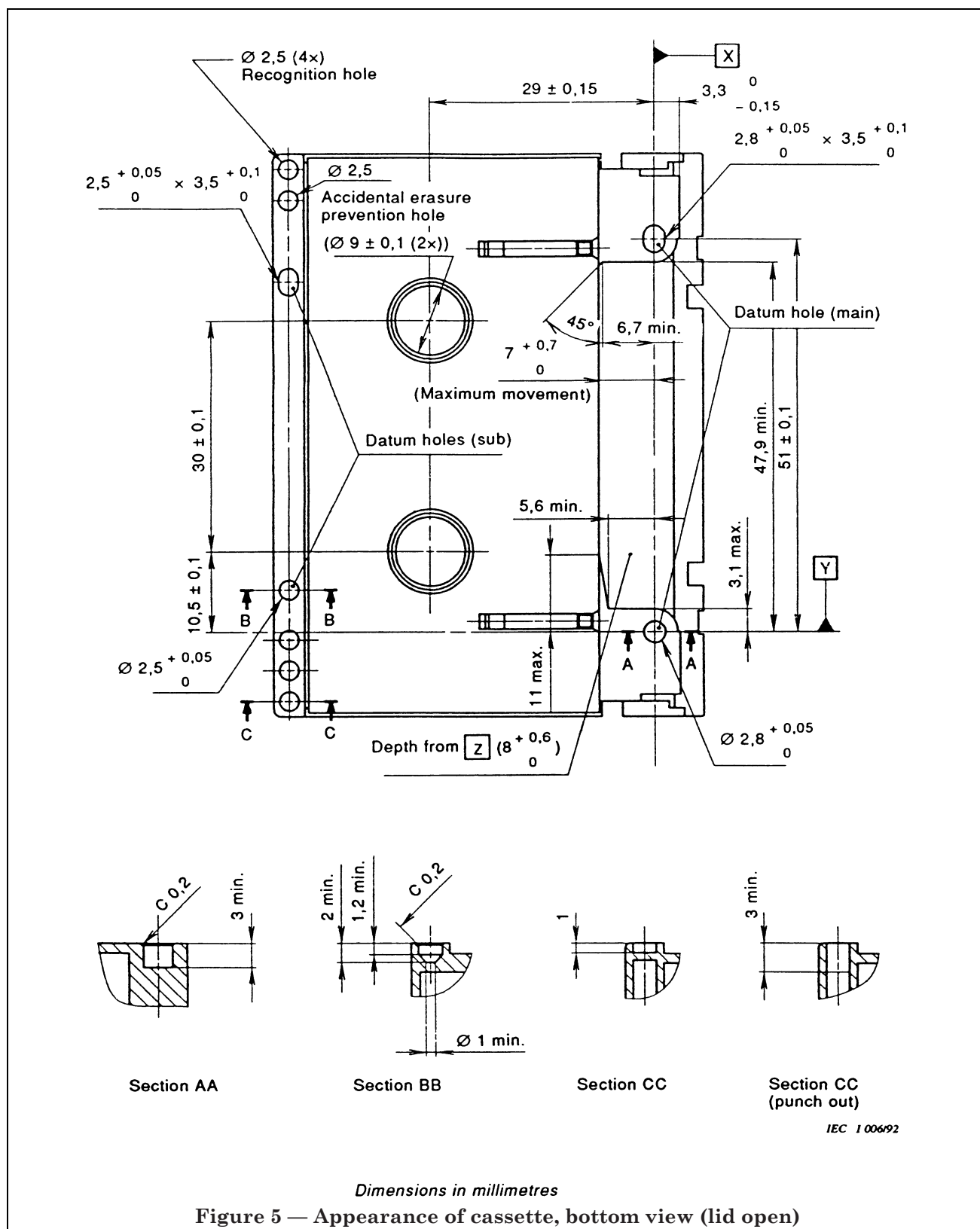


Dimensions in millimetres

Figure 3 — Appearance of cassette, top view (lid open)



Figure 4 — Appearance of cassette, bottom view (lid closed)



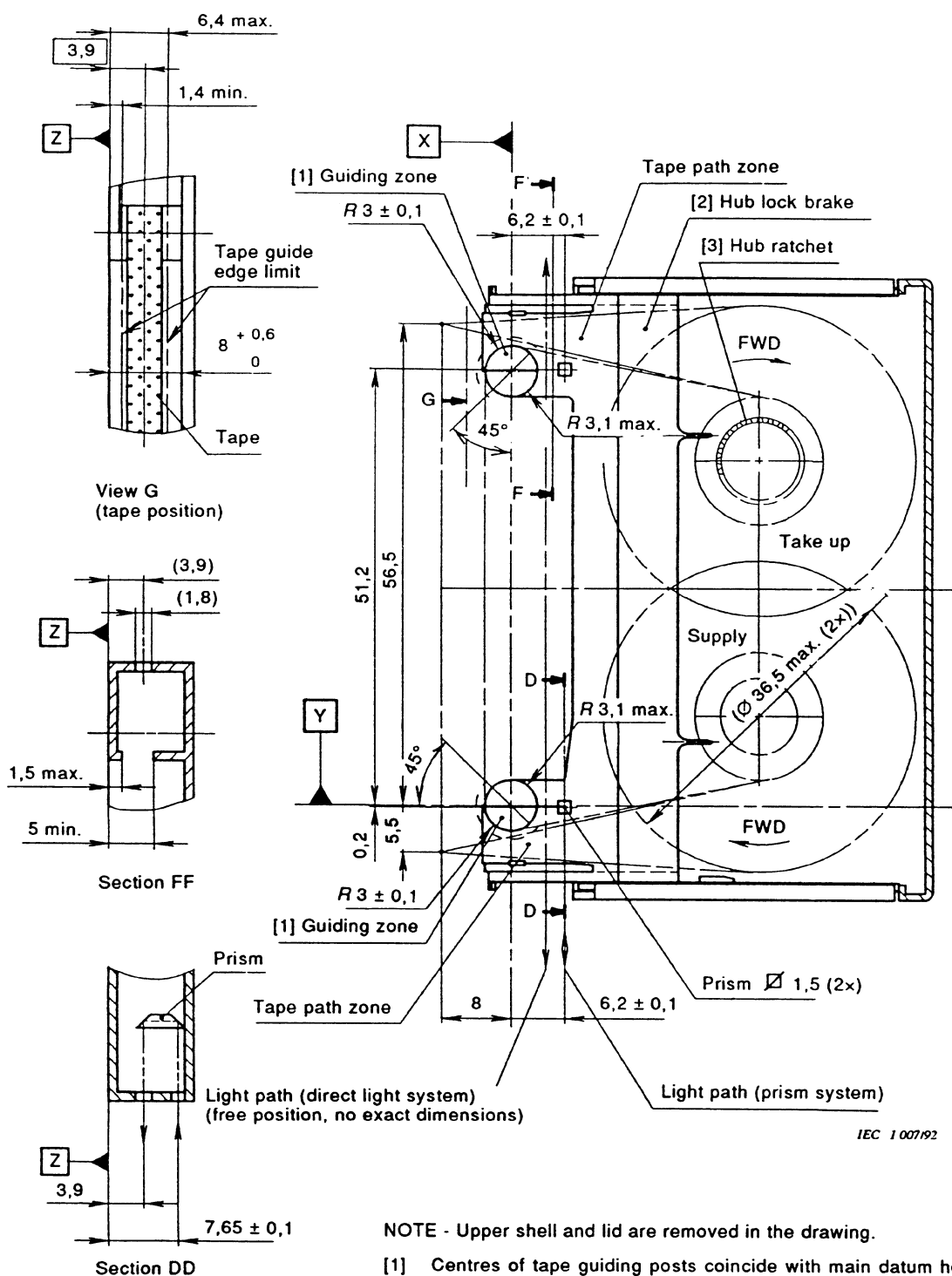
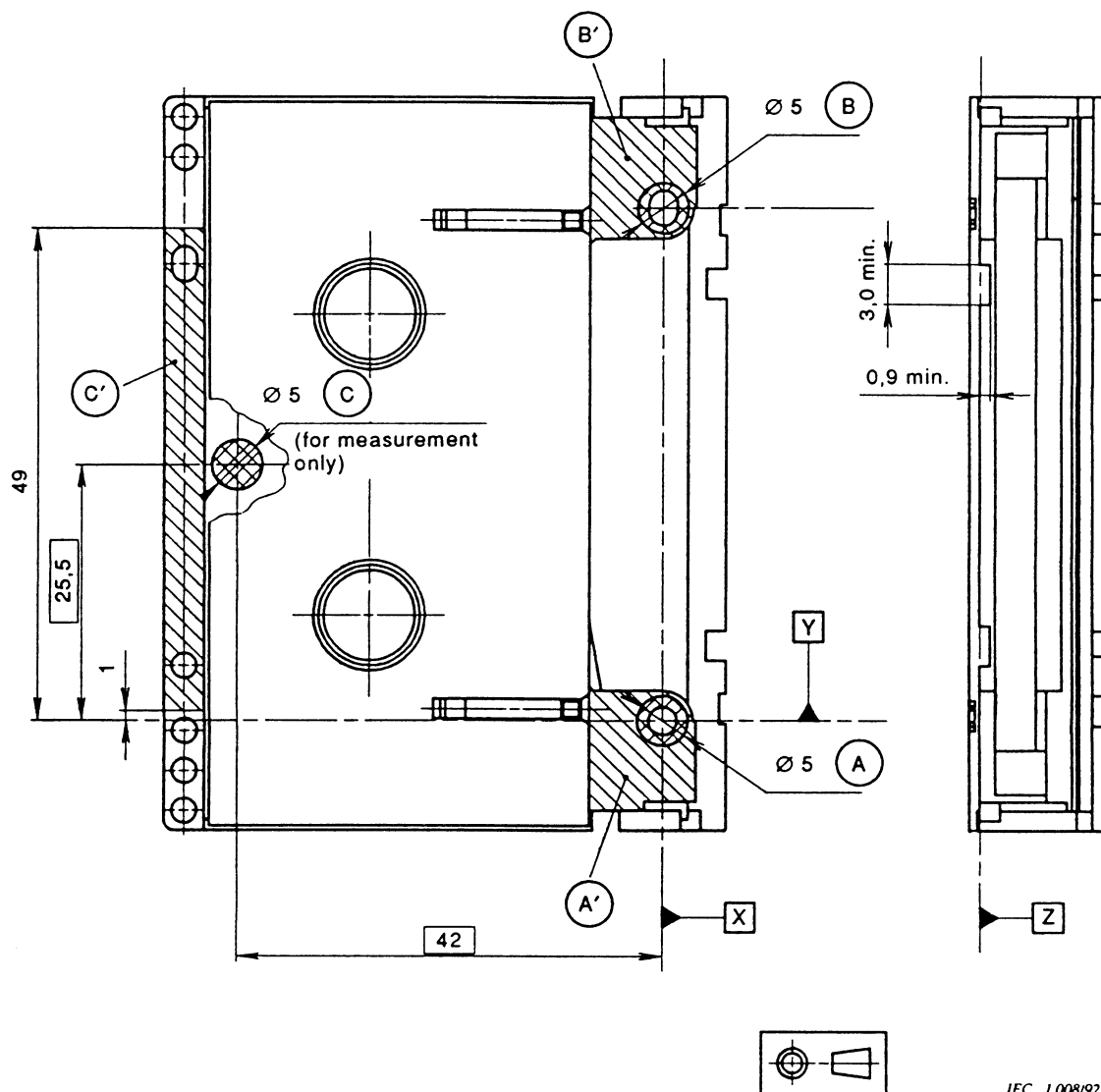


Figure 6 — Inner structure of cassette (tape path and light path)



IEC 1 008/92

Dimensions in millimetres

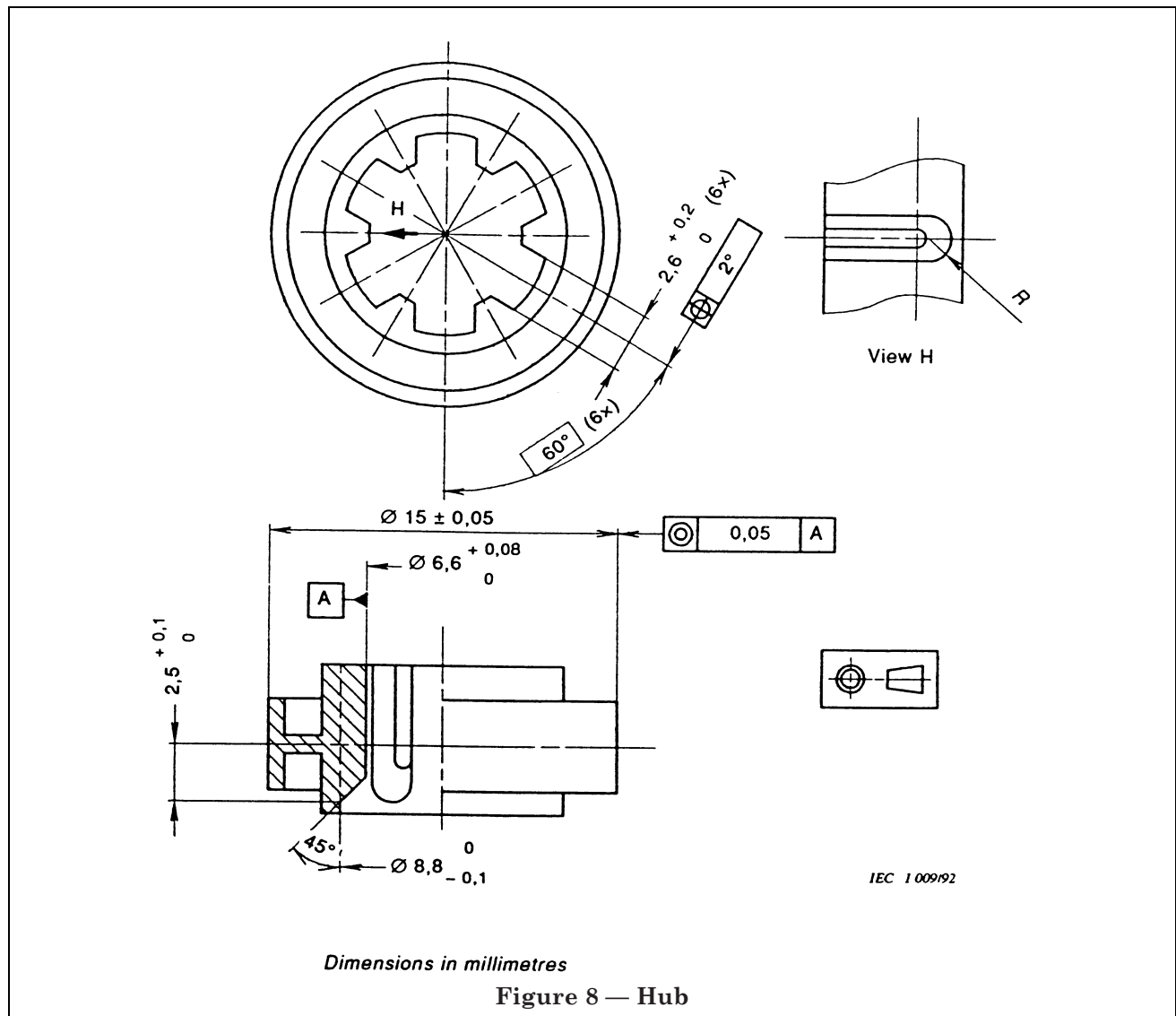
NOTE 1 The crosshatched areas 5 mm in diameter are datum areas.

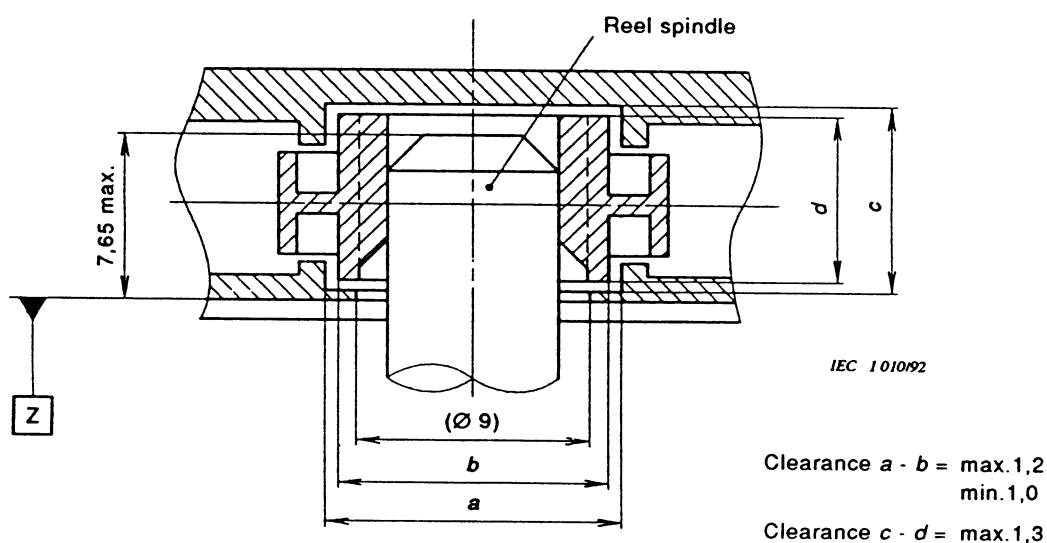
NOTE 2 Datum plane Z shall be determined by datum area A, B and C.

NOTE 3 The line hatched areas, which are support areas, shall be coplanar (or parallel) in datum plane Z with the following dimensions:

$A' = 0 \pm 0,05$; $B' = 0 \pm 0,05$; $C' = 1,1 \pm 0,05$

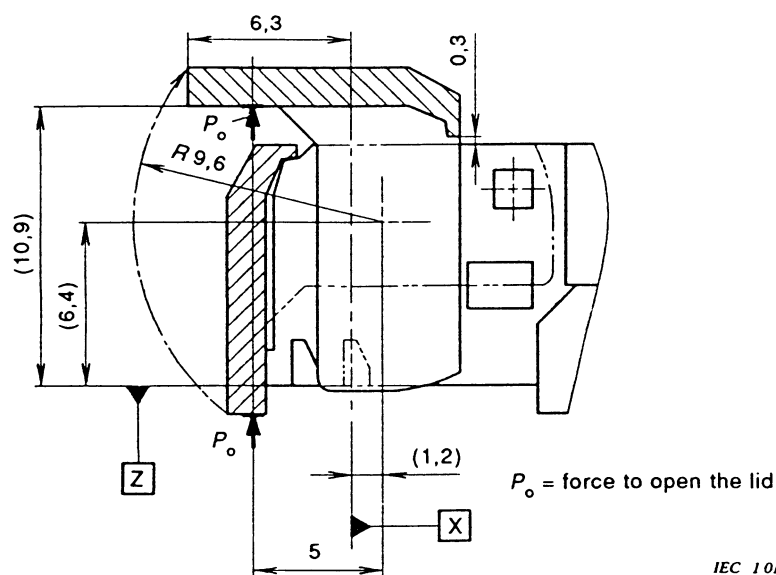
Figure 7 — Datum area





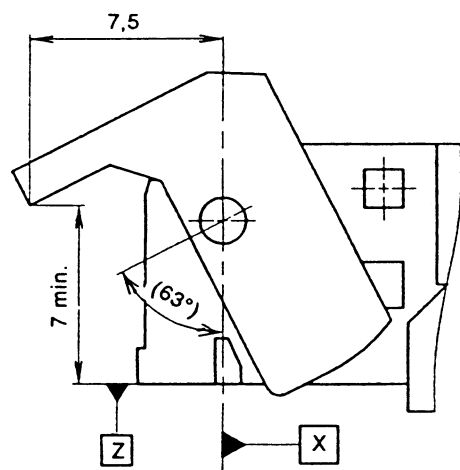
Dimensions in millimetres

Figure 9 — Hub clearance and limit of reel spindle height

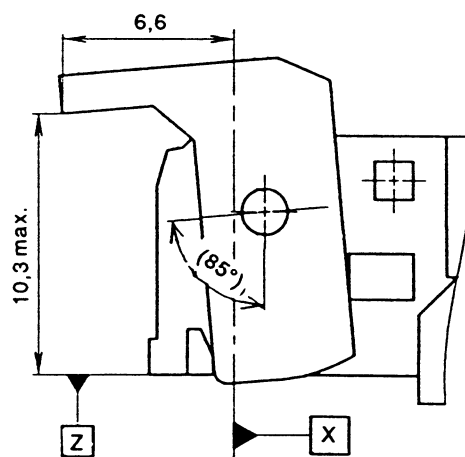


Dimensions in millimetres

Figure 10 — Lid configuration when rotated and opened over 90°



Hub locked position

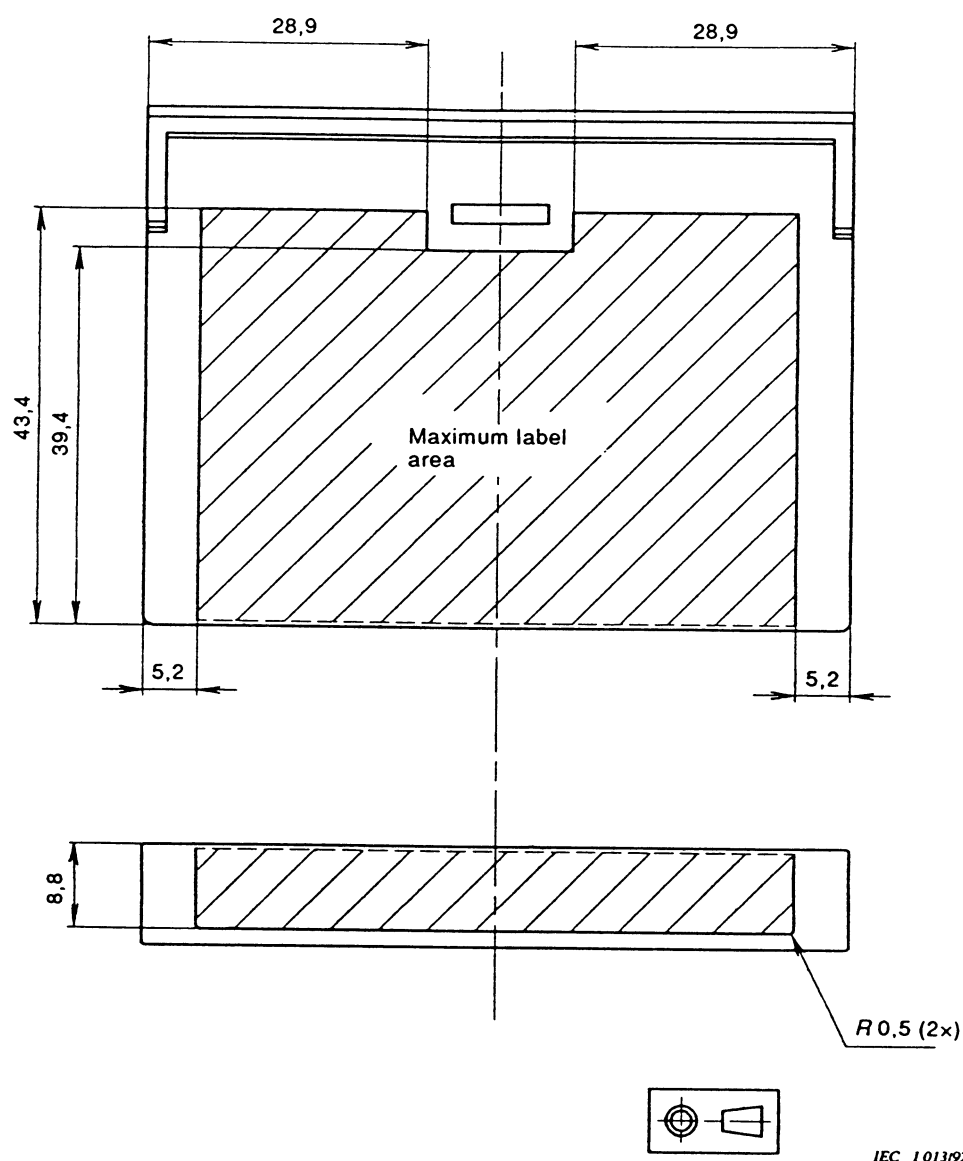


Hub released position

IEC 1012/92

Dimensions in millimetres

Figure 11 — Hub lock and release



Dimensions in millimetres

NOTE When the label is attached to the label area, the size of the cassette shall not exceed the maximum outer dimensions.

Figure 12 — Label area of pre-recorded cassette

6 Track configuration and patterns

6.1 Track configuration

The helical track pattern is formed by tape travel and rotation of a pair of inclined heads, one of which has a plus, and the other a minus azimuth angle.

The track configuration is shown in Figure 13 on page 21.

6.1.1 Tape speed and number of tracks per second

The speed of the magnetic tape and the number of tracks recorded per second are as follows:

Mode	Tape speed mm/s	Number of tracks/s
Normal track (normal speed)	$8,150 \pm 0,5 \%$	200/3
Normal track (half speed)	$4,075 \pm 0,5 \%$	100/3
Wide track	$12,225 \pm 0,5 \%$	200/3

6.1.2 Track angle

The angle of the track at the nominal tape speed of 8,150 mm/s or 4,075 mm/s shall be $6^{\circ} 22' 59,5''$ in normal track mode and $6^{\circ} 23' 29,4''$ in the wide track mode with the nominal tape speed of 12,225 mm/s.

6.1.3 Track pitch

The pitch of the tracks shall be 13,591 μm in the normal track mode and 20,41 μm in the wide track mode.

6.1.4 Track length

The length of the track shall be 23,501 mm in the normal track mode and 23,471 mm in the wide track mode.

6.1.5 Track centre

The centre of the track shall be 1,905 mm from the reference edge.

6.1.6 Head azimuth

The azimuth angle of the head gap shall be $\pm (20^{\circ} \pm 15')$.

6.1.7 Effective recording width

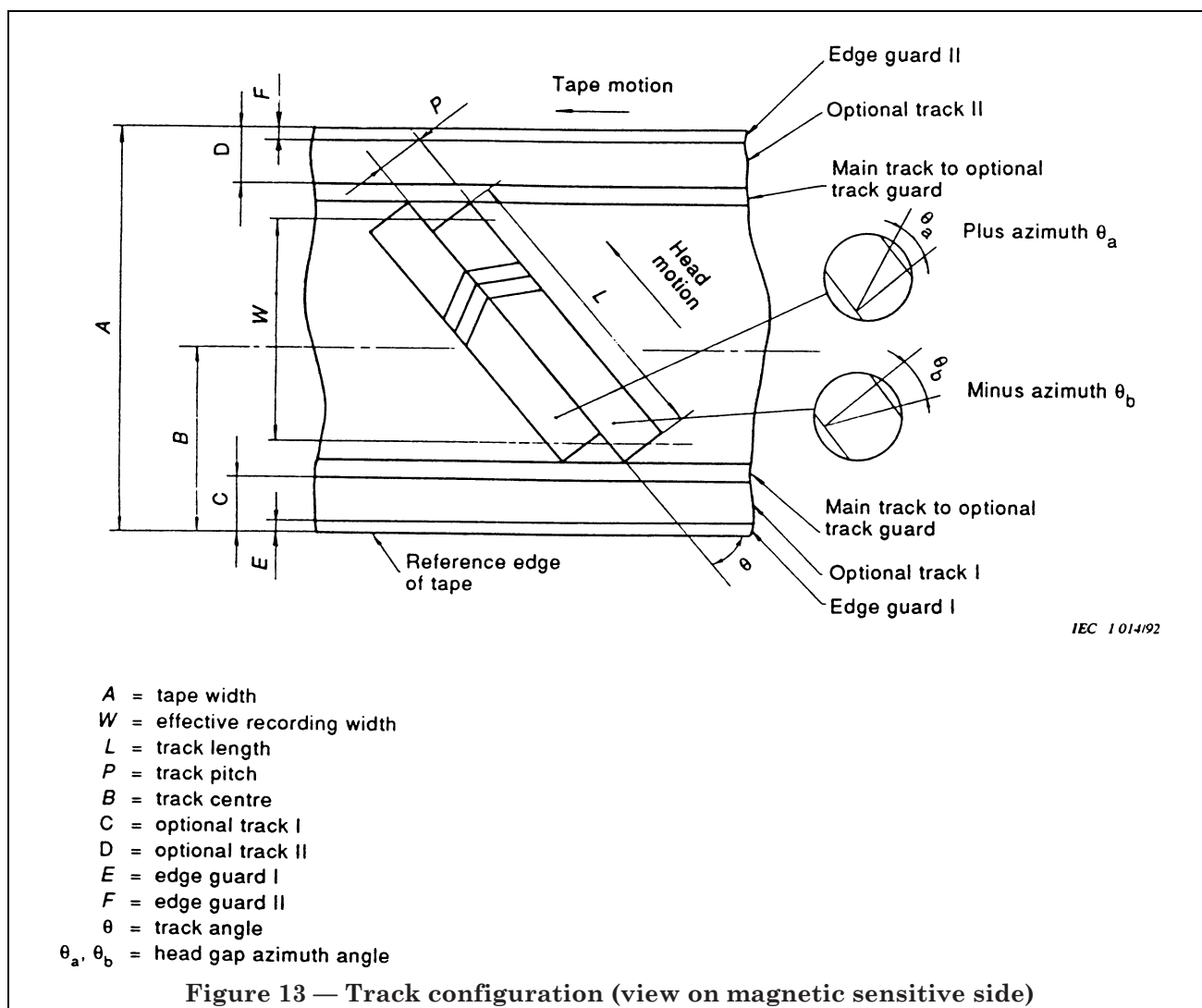
The effective recording width on the magnetic tape shall be 2,613 mm.

6.1.8 Definition of frame

A frame consists of a plus azimuth track and the following minus azimuth track.

6.1.9 Optional tracks

The width of each optional track including the edge guard (0,1 mm) shall be 0,5 mm.



6.2 Signal allocation

6.2.1 Recording format of track

The format of a track shall be in accordance with the following table.
A track consists of 196 blocks, each of which is composed of 360 channel bits.
Main data blocks and sub data blocks are encoded with 8 – 10 bits modulation as specified in 9.4 and 10.4.
Consequently, one block in these areas corresponds to 288 data bits.

↓
Head
motion

Area	Contents	Number of blocks
Marginal area	Margin 1	11
Sub area 1	Preamble 1	2
	Sub data area 1	8
	Postamble 1	1
ATF area 1	IBG 1	3 (2)
	ATF 1	5 (7,5)
	IBG 2	3 (1,5)
Main area	Preamble 2	2
	Main data area	128
ATF area 2	IBG 3	3 (2)
	ATF 2	5 (7,5)
	IBG 4	3 (1,5)
Sub area 2	Preamble 3	2
	Sub data area 2	8
	Postamble 2	1
Marginal area	Margin 2	11

↑
196 blocks

ATF: automatic track finding
IBG: inter-block gap

NOTE The numbers in parentheses are for wide track mode.

6.2.2 Positioning accuracy

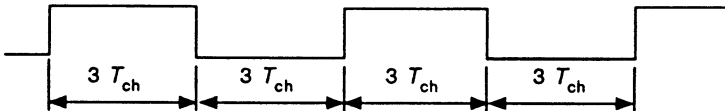
The positioning accuracy of any track shall be within ± 0,0267 mm in the direction of tape width (± 2 blocks along the track) as measured from the track centre.
When editing the existing ATF 1 and ATF 2 shall not be erased.

6.3 Recording signals

The recording signal may be regarded as a succession of channel bits, each of which is of duration T_{ch} .
The waveform of each signal is shown below, and since the significance of the recorded signal is independent of polarity, either the waveforms given below or their inverses are permitted.

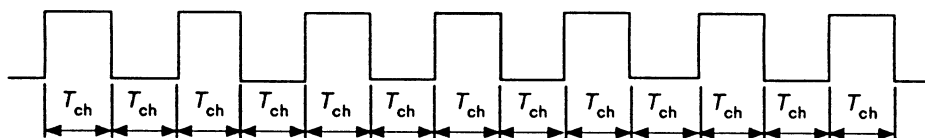
6.3.1 Inter-block gap (IBG)

The recording signal of IBG (1, 2, 3 and 4) is a continuous square wave with a succession of duration $3 T_{ch}$ as shown below.



6.3.2 Preamble, postamble and margin

The recording signal of preamble (1, 2 and 3), postamble (1 and 2) and margin (1 and 2) is a continuous square wave with a succession of duration T_{ch} as shown below.



6.3.3 Automatic track finding (ATF), main data area and sub data area

The recording signals of ATF (1 and 2), main data area and sub data area (1 and 2) are specified below.

- ATF: see ATF in 8.1.
- Main data area: see main data area format in clause 9.
- Sub data area: see sub data area format in clause 10.

7 Recording parameters

7.1 Recording level

7.1.1 Specification

The recording level is specified as a playback output level per unit track width in relation to the calibration tape. The playback output level of the square wave recorded on the reference tape by circuitry and heads of the equipment under test should be identical to that of the calibration tape at the frequencies with wavelengths of $72 T_{ch}$, $18 T_{ch}$, $12 T_{ch}$, $6 T_{ch}$ and $4 T_{ch}$, respectively. Only $72 T_{ch}$ corresponds to the pilot signal duration.

7.1.2 Measurement method

The playback output level is defined as the fundamental frequency output level of the playback signal obtained from a tape.

The recording level of a system is specified in order to guarantee the compatibility of cassettes and equipment.

Residual level is not negligible even after overwriting if the previously recorded level was too high and may cause some trouble. In particular, the remainder of the pilot signal $72 T_{ch}$ may cause mistracking. The recording level shall be as close as possible to that of the calibration tape though its tolerance is not specified. In particular the recording level of the pilot signal $72 T_{ch}$ shall not exceed that of the calibration tape.

In actual equipment, recording signals are continuous square waves with wavelengths of $72 T_{ch}$, $18 T_{ch}$, $12 T_{ch}$ or $6 T_{ch}$ in the ATF area and are 8 to 10 modulated signals with spread spectrum in the main data area and the sub data area. However, the recording level shall be adjusted using the continuous square waves signals with wavelengths of $72 T_{ch}$, $18 T_{ch}$, $12 T_{ch}$, $6 T_{ch}$ and $4 T_{ch}$.

7.2 Erasing method

Recorded signals shall be erasable by the overwrite method.

8 Tracking scheme

8.1 Automatic track finding (ATF)

8.1.1 Definition

Tracking is achieved by the automatic track finding (ATF) method. The ATF signal is allocated to two areas, one before and one after the main area, and both are separated from other data area by inter-block gaps (IBG).

The ATF signal consists of pilot signal (f_1), sync signals (f_2 and f_3) and a space signal (f_4).

The ATF signal allocation pattern repeats every four tracks, which corresponds to a pair of frames with even and odd address, each frame having plus and minus azimuth tracks.

The tracking error detecting algorithm is as follows. First, the frequency and length of the sync signal is detected. Then the crosstalk signal from the pilot signal of an adjacent track is sampled. After a fixed period, the crosstalk signal of another adjacent track is sampled. The difference between the two crosstalk levels is the tracking error.

Two ATF signal allocation formats are provided, one for normal mode and the other for wide track mode.

8.1.2 ATF signal allocation

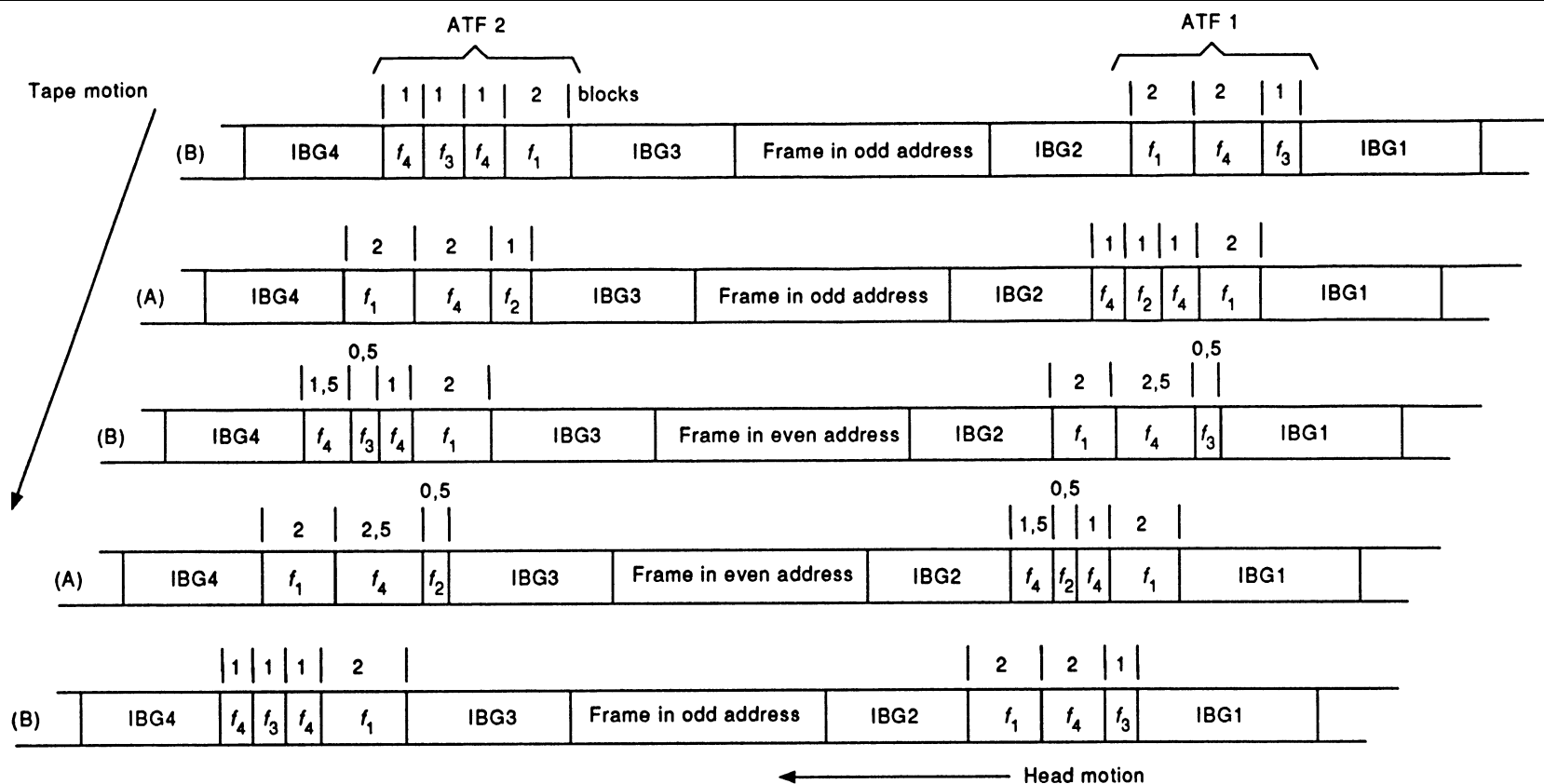
The ATF signal allocations for normal and wide track modes are given in Figure 14a and Figure 14b on pages 25 and 26, respectively. The numerals indicate the number of unit block length.

Sync signals f_2 and f_3 are used in the plus and minus azimuth tracks, respectively. The length of sync signal is 0,5 block in even frames and 1 block in odd frames.

In the wide track mode, the track pitch is 1,5 times that of the normal track mode, and thus the relative position between adjacent tracks differs from one mode to the other.

8.1.3 Recording signal

The recording signals of the pilot signal (f_1), the sync signals (f_2 and f_3) and the space signal (f_4) are continuous square waves with a succession of durations, of $36 T_{ch}$, $9 T_{ch}$, $6 T_{ch}$ and $3 T_{ch}$, respectively and are shown in Figure 15 on page 27.

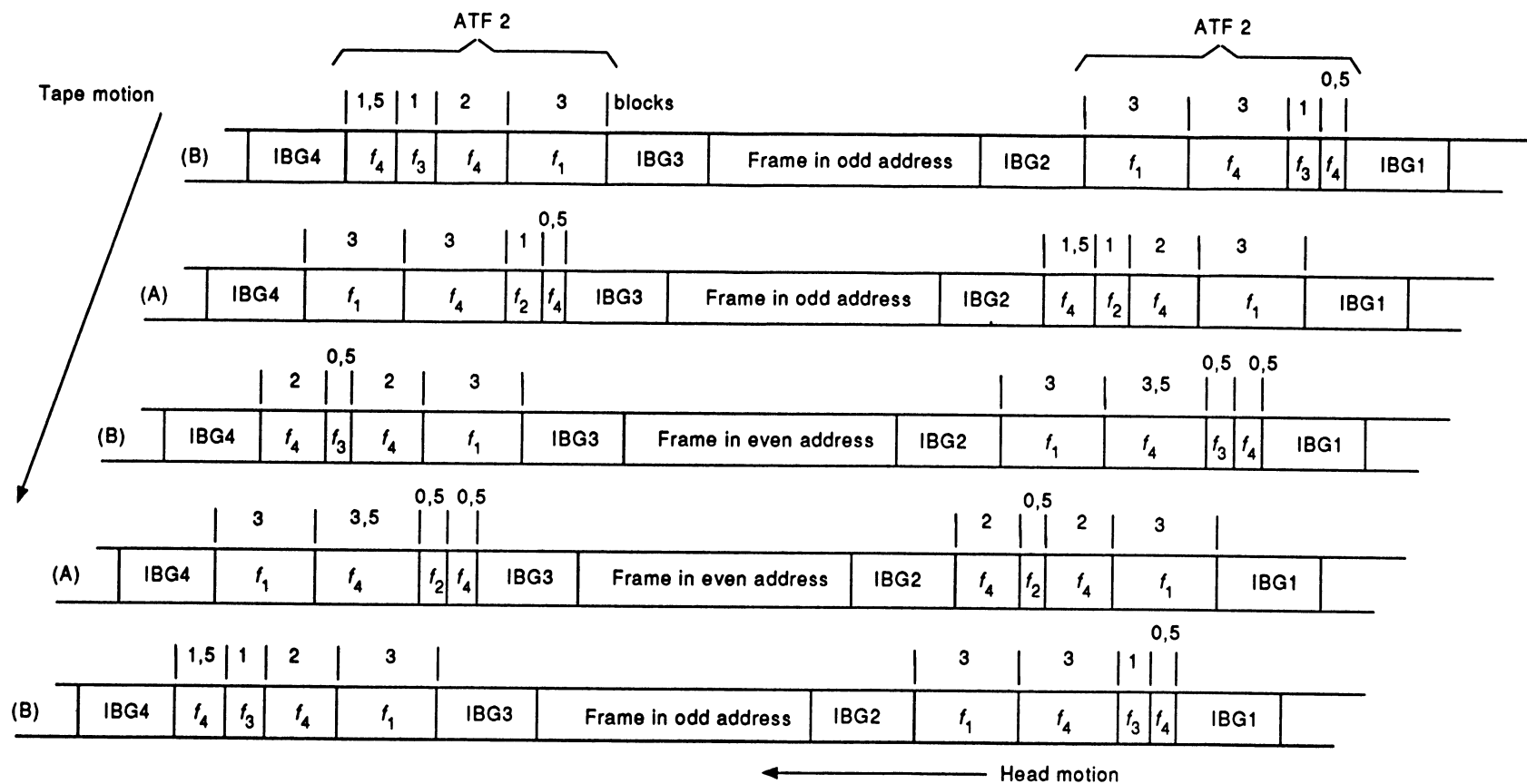


IEC 101592

- (A): plus azimuth track
(B): minus azimuth track

View of magnetic sensitive side

Figure 14a — ATF signal allocation (normal track mode)



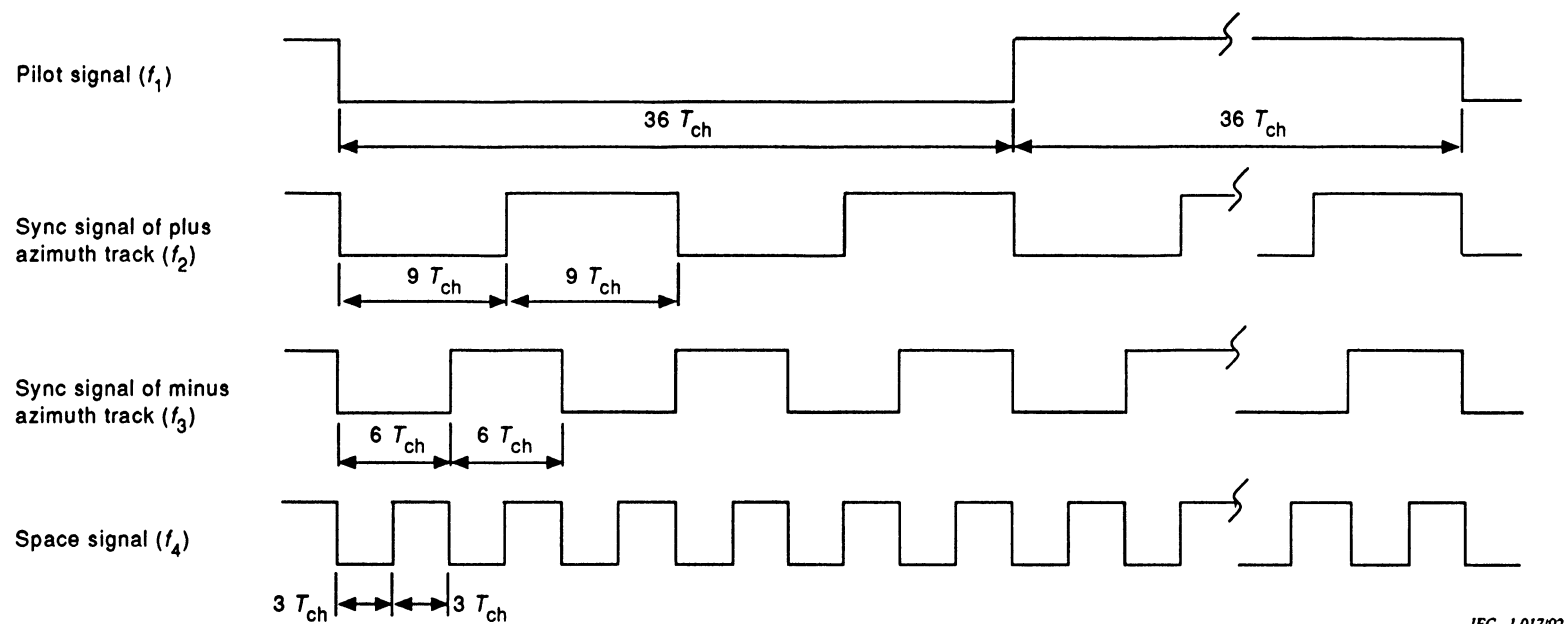
IEC 1016/92

(A): plus azimuth track

(B): minus azimuth track

View of magnetic sensitive side

Figure 14b — ATF signal allocation (wide track mode)



IEC 1017/92

 T_{ch} = duration of one channel bit

Figure 15 — Recording signal in ATF