

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Video recording – 12,65 mm Type D-11 format –
Part 1: Tape recording**

**Enregistrement vidéo – Format de Type D-11 12,65 mm –
Partie 1: Enregistrement de bande**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2003 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester.

If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.

Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,...).

It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,...).

Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Video recording – 12,65 mm Type D-11 format –
Part 1: Tape recording**

**Enregistrement vidéo – Format de Type D-11 12,65 mm –
Partie 1: Enregistrement de bande**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

PRICE CODE
CODE PRIX

XB

ICS 33.160.40

ISBN 978-2-8322-0779-6

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD.....	5
1 Scope.....	7
2 Normative references	7
3 Abbreviations and acronyms.....	8
4 Environment and test conditions	8
4.1 Environmental conditions	8
4.2 Calibration tape	8
4.3 Record locations and dimensions	8
5 Tape and cassette physical specifications	8
5.1 Magnetic tape specifications	8
5.2 Cassette specifications.....	9
6 Tape record physical parameters.....	31
6.1 Tape speed	31
6.2 Helical record physical parameters.....	31
6.3 Longitudinal record physical parameters	31
7 Longitudinal track signal and magnetic parameters.....	35
7.1 Longitudinal track-record parameters	35
7.2 Control track record parameters	35
7.3 Time- and control-code track-record parameters	35
7.4 Cue recording.....	36
8 Helical track signal parameters and magnetization	37
8.1 Overview	37
8.2 Introduction	37
8.3 Helical track data parameters	38
8.4 Channel coding	50
8.5 Magnetization.....	50
8.6 Video data outer correction	51
8.7 Data arrangement in audio data sectors	52
Annex A (normative) Digital interfaces	62
Annex B (informative) Tape transport and scanner.....	64
Annex C (informative) Compatibility with the other digital formats using Type-L derivative cassettes	67
Annex D (informative) Compatibility with analog Type-L.....	68
Bibliography.....	69
Figure 1 – Top- and side-view dimensions (S-Cassette).....	11
Figure 2 – Bottom-view dimensions (S-Cassette)	12
Figure 3 – Datum areas, supporting areas, tape guides and associated dimensions (S- Cassette).....	14
Figure 4 – Reel location in the unlocked position (S-Cassette).....	15
Figure 5 – Protecting lid dimensions (S-Cassette).....	16
Figure 6 – Reel dimensions (S-Cassette).....	17

Figure 7 – Reel height in the unlocked position (S-Cassette)	17
Figure 8 – Unlocking lever insertion area (S-Cassette)	18
Figure 9 – Lid unlocking force (S-Cassette)	19
Figure 10 – Lid opening force (S-Cassette).....	19
Figure 11 – Reel spring force (S-Cassette)	19
Figure 12 – Safety plug strength (S-Cassette).....	20
Figure 13 – Extraction force (F1, F2) and friction torque (S-Cassette).....	20
Figure 14 – Top and side views (L-Cassette)	21
Figure 15 – Bottom view (L-Cassette)	22
Figure 16 – Datum areas, supporting areas and tape guides (L-Cassette).....	24
Figure 17 – Reel location in unlocked position (L-Cassette)	25
Figure 18 – Protecting lid (L-Cassette).....	26
Figure 19 – Reel dimensions (L-Cassette)	27
Figure 20 – Reel height in unlocked operation (L-Cassette)	27
Figure 21 – Unlocking lever insertion area (L-Cassette).....	28
Figure 22 – Lid unlocking force (L-Cassette).....	29
Figure 23 – Lid opening force (L-Cassette)	29
Figure 24 – Reel spring force (L- Cassette).....	29
Figure 25 – Safety plug strength (L-Cassette).....	30
Figure 26 – Extraction force (F1, F2) and friction torque (L-Cassette)	30
Figure 27 – Locations and dimensions of recorded tracks	33
Figure 28 – Locations and dimensions of tolerance zones of helical track records	34
Figure 29 – Recorded control code waveform	36
Figure 30 – Helical recording block diagram (Informative).....	37
Figure 31 – Helical playback block diagram (Informative).....	38
Figure 32 – Sector arrangement on helical track	39
Figure 33 – Sector and segment arrangement on helical track	40
Figure 34 – Video sync block format	41
Figure 35 – Audio sync block format	42
Figure 36 – Sync block identification bytes	43
Figure 37 – ID ₀ : Sync block number	45
Figure 38 – Segment, channel and track counts.....	47
Figure 39 – Video outer ECC	52
Figure 40 – 20/24 bit packing sequence	53
Figure 41 – Audio sample conversion block diagram.....	53
Figure 42 – Start and end sample number of burst data mode	54
Figure 43 – Continuous mode data mapping	55
Figure 44 – Audio auxiliary data words	56
Figure 45 – Audio data block layout	57
Figure 46 – Sync block shuffling (audio sector 0).....	58
Figure 47 – Sync block shuffling (audio sector 1).....	58
Figure 48 – Sync block shuffling (audio sector 2).....	59
Figure 49 – Sync block shuffling (audio sector 3).....	59

Figure 50 – AES3 channel sector shuffling.....	60
Figure A.1 – System overview.....	62
Figure B.1 – Possible scanner configuration (29,97 Hz, 25 Hz, 24 Hz and 23,98 Hz frame rates).....	65
Figure B.2 – Possible longitudinal head location and tape wrap (29,97 Hz, 25 Hz, 24 Hz and 23,98 Hz frame rates)	66
Table 1 – Record location and dimensions (29,97PsF/59,94I, 25PsF/50I, 24 PsF and 23,98PsF systems)	32
Table 2 – ID ₀ : Sync block number	46
Table B.1 – Parameters for a possible scanner design.....	64
Table B.2 – Data rate and recorded wavelength.....	64

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**VIDEO RECORDING –
12,65 mm TYPE D-11 FORMAT –****Part 1: Tape recording**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62356-1 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment

This bilingual version (2013-07) corresponds to the monolingual English version, published in 2003-12.

The text of this standard was submitted to the national committees for voting under the Fast Track Procedure as the following documents:

CDV	Report on voting
100/629/CDV	100/699/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2008-11. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

VIDEO RECORDING – 12,65 mm TYPE D-11 FORMAT –

Part 1: Tape recording

1 Scope

This International Standard specifies the format for the recording of Type D-11 compressed pictures, four channels of AES3 data and associated data which form helical records on 12,65 mm tape in cassettes. This standard also defines the helical track record parameters, the content and format of the longitudinal records and the cassette physical specifications.

The recording format supports frame frequencies of 30/1,001 Hz, 25 Hz, 24 Hz and 24/1,001 Hz.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61213:1993, *Analogue audio recording on video tape – Polarity of magnetization*

IEC 61237-1:1994, *Broadcast video tape recorders – Methods of measurement – Part 1: Mechanical measurements*

IEC 62356-2, *Video recording – 12,65 mm type D-11 format – Part 2: Picture compression and data stream*¹

IEC 62356-3, *Video recording – 12,65 mm type D-11 format – Part 3: Data mapping over SDTI*¹

ITU-R Recommendation BT.709:2004, *Parameter values for the HDTV* standard for production and international program exchange*

SMPTE 12M:1999, *Television – Audio and Film – Time and Control Code*

SMPTE 292M:1998, *Bit-Serial Digital Interface for High-Definition Television Systems*

SMPTE 276M:1995, *Transmission of AES-EBU Digital Audio Signals Over Coaxial Cable*

AES3-1992, *Serial transmission format for two-channel linearly represented digital audio data*

¹ To be published.

3 Abbreviations and acronyms

For the purposes of this document, the following abbreviations and acronyms apply.

AUX	Auxiliary
DCT	Discrete cosine transform
ECC	Error correcting code
EOB	End of block
I-NRZI	Interleaved non-return to zero inverted
MUX	Multiplex
VLC	Variable length coding

4 Environment and test conditions

4.1 Environmental conditions

Tests and measurements made on the system to check the requirements of this standard shall be carried out under the following conditions:

- temperature: $20\text{ °C} \pm 1\text{ °C}$
- relative humidity: $50\% \pm 2\%$
- barometric pressure: from 86 kPa to 106 kPa
- tape tension: $0,3\text{ N} \pm 0,05\text{ N}$
- tape conditioning: not less than 24 h

4.2 Calibration tape

Calibration tapes meeting the tolerances specified below should be made available by manufacturers of digital television tape recorders and players in accordance with this standard.

4.3 Record locations and dimensions

Geometrical location and dimensions of the recordings on the tape and their relative positions in regard to timing relations of the recorded signals shall be as specified in Figure 27 and Table 1. Tolerances shown in Table 1 should, however, be reduced by 50 % for calibration tapes.

5 Tape and cassette physical specifications

5.1 Magnetic tape specifications

5.1.1 Base

The base material shall be polyester or equivalent.

5.1.2 Tape width and width fluctuation

The tape width shall be $12,650\text{ mm} \pm 0,005\text{ mm}$. Tape width fluctuation shall not exceed $6\text{ }\mu\text{m}$ peak to peak. The value of tape width fluctuation shall be evaluated by measuring 10 points, each 20 mm apart, over a tape length of 200 mm.

5.1.1 Tape thickness

The tape thickness shall be from 12,5 µm to 13,8 µm.

5.1.2 Offset yield strength

The offset yield strength shall be greater than 15 N.

5.1.3 Magnetic coating

The magnetic tape used shall have a coating of metal particles or equivalent, longitudinally oriented. The coating coercivity shall be in the range of 120 000 A/m to 140 000 A/m, with an applied field of 800 000 A/m (10 000 oersted) as measured by a 50 Hz or 60 Hz BH meter or vibrating sample magnetometer (VSM).

5.2 Cassette specifications

5.2.1 Cassette dimensions

Two sizes of cassettes shall be identified as follows:

S cassette	96 × 156 × 25 mm	As shown in Figures 1 to 13
L cassette	145 × 254 × 25 mm	As shown in Figures 14 to 26

5.2.2 Tape length and recording time

Maximum tape length and recording time are recommended as follows:

S cassette	241 m $\begin{smallmatrix} +2 \\ 0 \end{smallmatrix}$ m	40 min for 29,97PsF/59,94I	48 min for 25PsF/50I	50 min for 24PsF	50 min for 23,98PsF
L cassette	732 m $\begin{smallmatrix} +2 \\ 0 \end{smallmatrix}$ m	124 min for 29,97PsF/59,94I	148 min for 25PsF/50I	155 min for 24PsF	155 min for 23,98PsF

5.2.3 Datum planes

Datum plane Z shall be determined by three datum areas, A, B and C, as shown in Figures 3a and 16a. Datum plane X shall be orthogonal to datum plane Z and shall include the centres of datum holes (a) and (b). Datum plane Y shall be orthogonal to both datum plane X and datum plane Z and shall include the centre of datum hole (a) as shown in Figures 2 and 15.

5.2.4 Tape winding

The magnetic coating side of the magnetic tape shall face outside on both the supply reel and the take-up reel as shown in Figures 4 and 17.

5.2.5 Label area and window area

The hatched areas shown in Figures 1 and 14 are for the label and window. Labels attached to the cassette shall not protrude above the outside cassette surface plane.

5.2.6 Guiding groove

For correct insertion into the VTR, four guiding grooves for S cassettes, as shown in Figures 1 and 2, and three guiding grooves for L cassettes, as shown in Figure 15, shall be provided.

5.2.7 Safety tab and safety plug for recording inhibition

For S cassettes, a safety plug at the supply reel side and a hole of minimum depth 10 mm from datum plane Z at the take-up reel side shall be provided as shown in Figure 2.

For L cassettes, a safety plug shall be provided at the take-up reel side as shown in Figure 15.

The safety plug shall not be deformed by 0,3 mm or more when a force of 2,0 N (204 gf) is applied to the centre of it, using a 2,5 mm diameter rod. See Figures 12 and 25.

5.2.8 Identification holes

Six identification holes (holes 1 to 6) shall be located as specified in Figures 2 and 15. For this format, holes 1, 2, 3, 4 and 6 shall be closed. Hole 5 shall be open.

5.2.9 Reels

5.2.9.1 Reel lock system

The reels shall be automatically unlocked when the cassette is inserted into the video tape recorder and/or player unit and automatically locked when the cassette is ejected from it.

The locations of the reels when in the unlocked position are shown in Figures 4 and 17. Dimensions of the reels are shown in Figures 6 and 19. Heights of the reels are shown in Figures 7 and 20.

The reel shall be completely released when the cassette lid is opened 23,5 mm minimum from datum plane Z.

5.2.9.2 Reel spring force

The reels assembled in the cassette shall be pressed by the reel spring with a specified force under the conditions specified in Figures 11 and 24. The spring force shall be $1,5 \text{ N} \pm 0,5 \text{ N}$ (153 gf $\pm$ 51 gf) for S cassettes and $3,5 \text{ N} \pm 0,5 \text{ N}$ (357 gf $\pm$ 51 gf) for L cassettes when pressing on a reel 2,4 mm above datum plane Z as shown in Figures 11 and 24.

5.2.9.3 Extraction force

The force (F1, F2) required to pull the tape out from the reel shall not exceed 0,17 N (17 gf), as specified in Figures 13a and 26a.

5.2.9.4 Friction torque

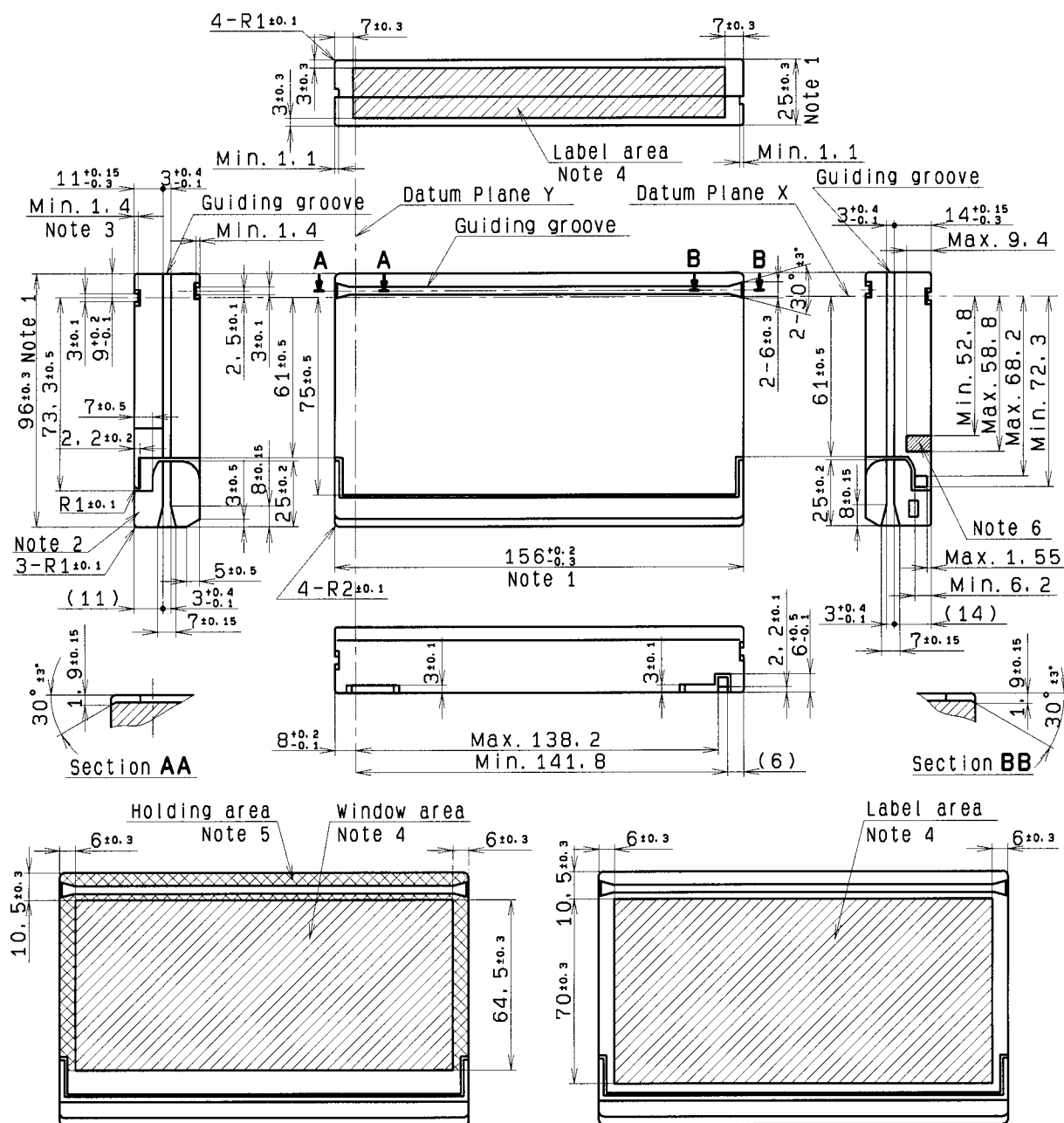
The torque required to wind the tape shall be less than 15 mN m (152 gf cm) for S cassettes and less than 30 mN m (305 gf cm) for L cassettes, as specified in Figures 13b and 26b.

5.2.10 Protecting lid

The cassette lid shall be automatically unlocked when the cassette is inserted into the video tape recorder and/or player unit and automatically locked when the cassette is ejected from it.

The unlocking lever insertion area is specified in Figures 8 and 21. The lid shall be unlocked when the lid lock lever is shifted in either direction A or B, as illustrated in Figures 9 and 22. The force required to unlock the lid shall be less than 1 N (101 gf) in the A direction or less than 1,5 N (152 gf) in the B direction.

The lid shall open 29,0 mm with a force of 1,5 N (152 gf) or less as specified in Figures 10 and 23.



IEC 2549/03

Dimensions in millimetres

NOTE 1 These dimensions are inspected by using limit gauges.

NOTE 2 No part of the lid shall protrude beyond the bottom plane of the cassette when the lid opens nor when it closes.

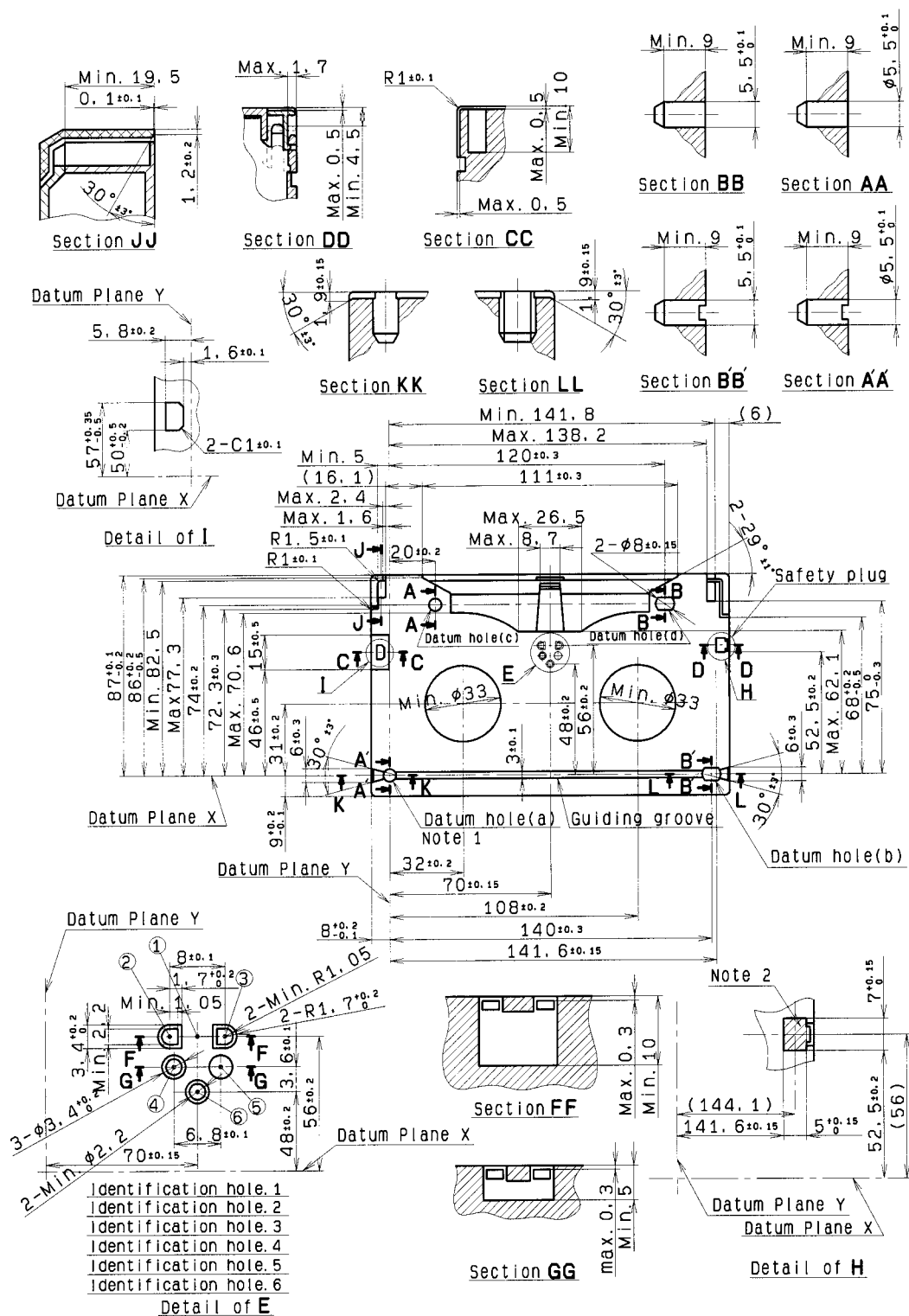
NOTE 3 These dimensions shall be specified based on datum plane Z.

NOTE 4 Label and/or window areas shown by the hatched area are available for the label and/or window.

NOTE 5 The cassette may be held in position by the recorder and/or player unit on the holding area shown by the cross-hatched area.

NOTE 6 The fine-hatched area shows the acceptable range of plug-notch position and depth at the side.

Figure 1 – Top- and side-view dimensions (S-Cassette)



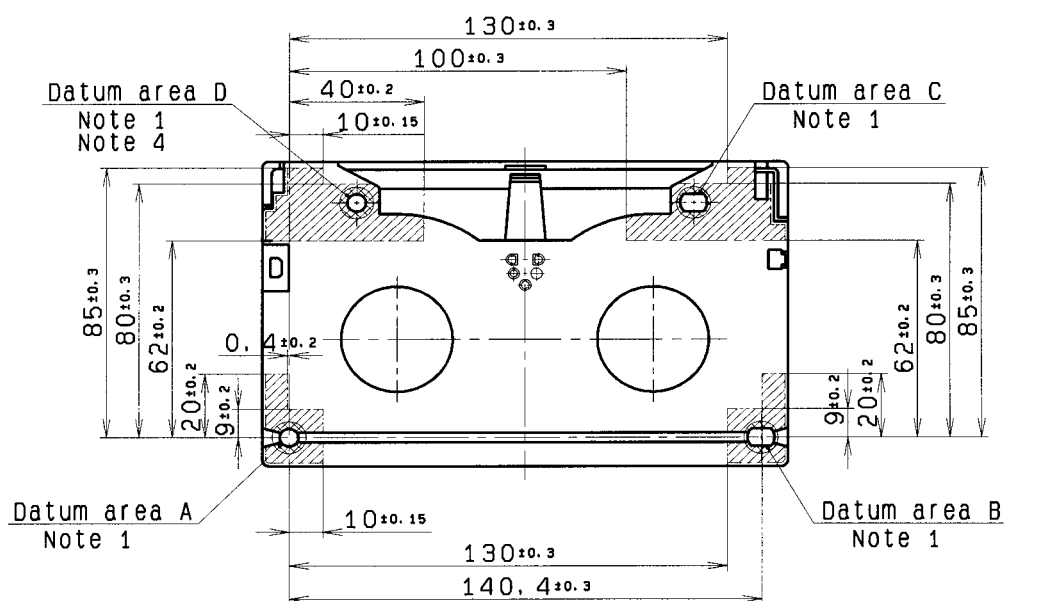
IEC 2550/03

Dimensions in millimetres

NOTE 1 Datum hole (a) is primary.

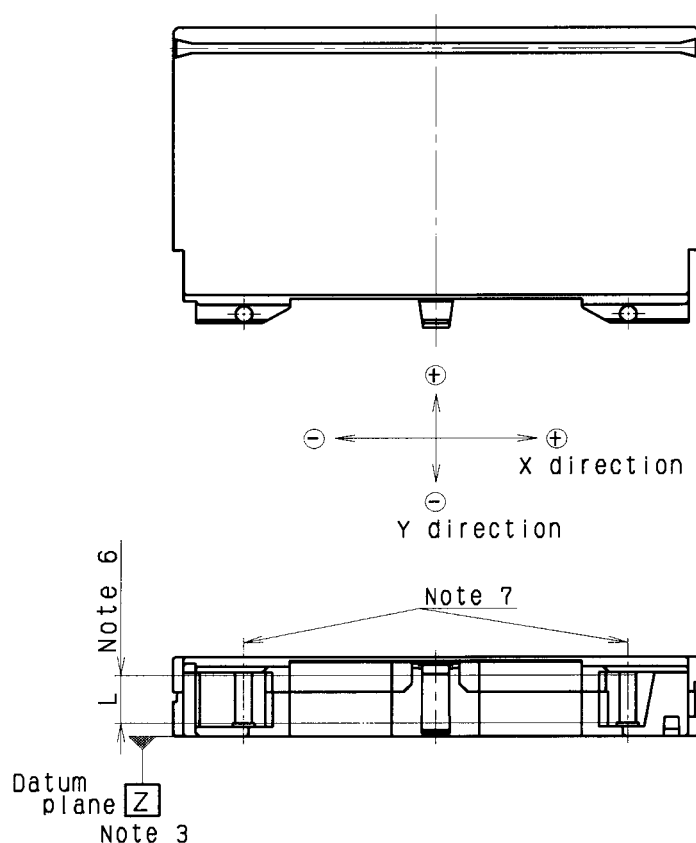
NOTE 2 The cross-hatched area shows the VTR detection area.

Figure 2 – Bottom-view dimensions (S-Cassette)



IEC 2551/03

Figure 3a – Datum areas and supporting areas



IEC 2552/03

Dimensions in millimetres

Figure 3b -Tape guides

NOTE 1 The cross-hatched areas 10 mm in diameter are datum areas.

NOTE 2 The four supporting areas shown by the hatched areas shall be coplanar with their corresponding datum areas within 0,05 mm of each of them.

NOTE 3 Datum plane Z shall be defined by the three datum areas, A, B, C.

NOTE 4 Datum area D shall be coplanar, within 0,3 mm, with datum plane Z.

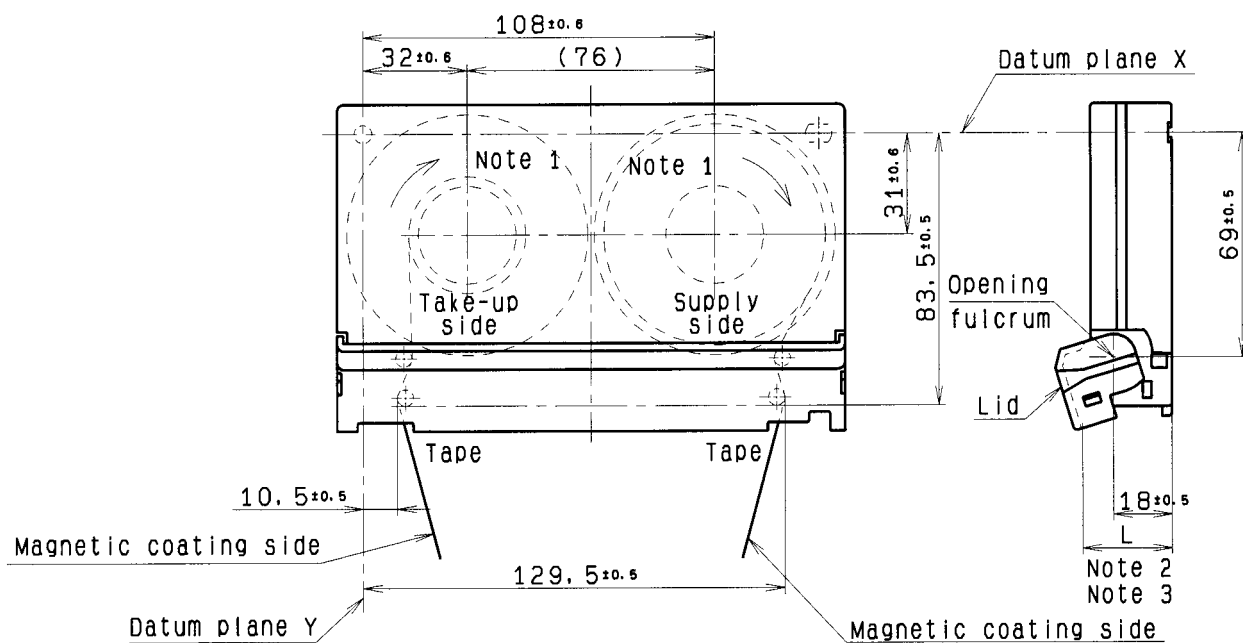
NOTE 5 The areas within 1 mm of the edges of a cassette shall not be included in the supporting areas.

Measurement *L*: 15 mm.

NOTE 6 The perpendicularity of tape guides is specified as follows (even if they themselves are tapered):

Direction Tape guide	X^a mm	Y^b mm
Supply side	0 ± 0,15	0 ± 0,15
Take-up side	0 ± 0,15	0 ± 0,15
^a Direction X: Parallel to the tape running direction. ^b Direction Y: Horizontally orthogonal to direction X.		

Figure 3 – Datum areas, supporting areas, tape guides and associated dimensions (S-Cassette)



IEC 2553/03

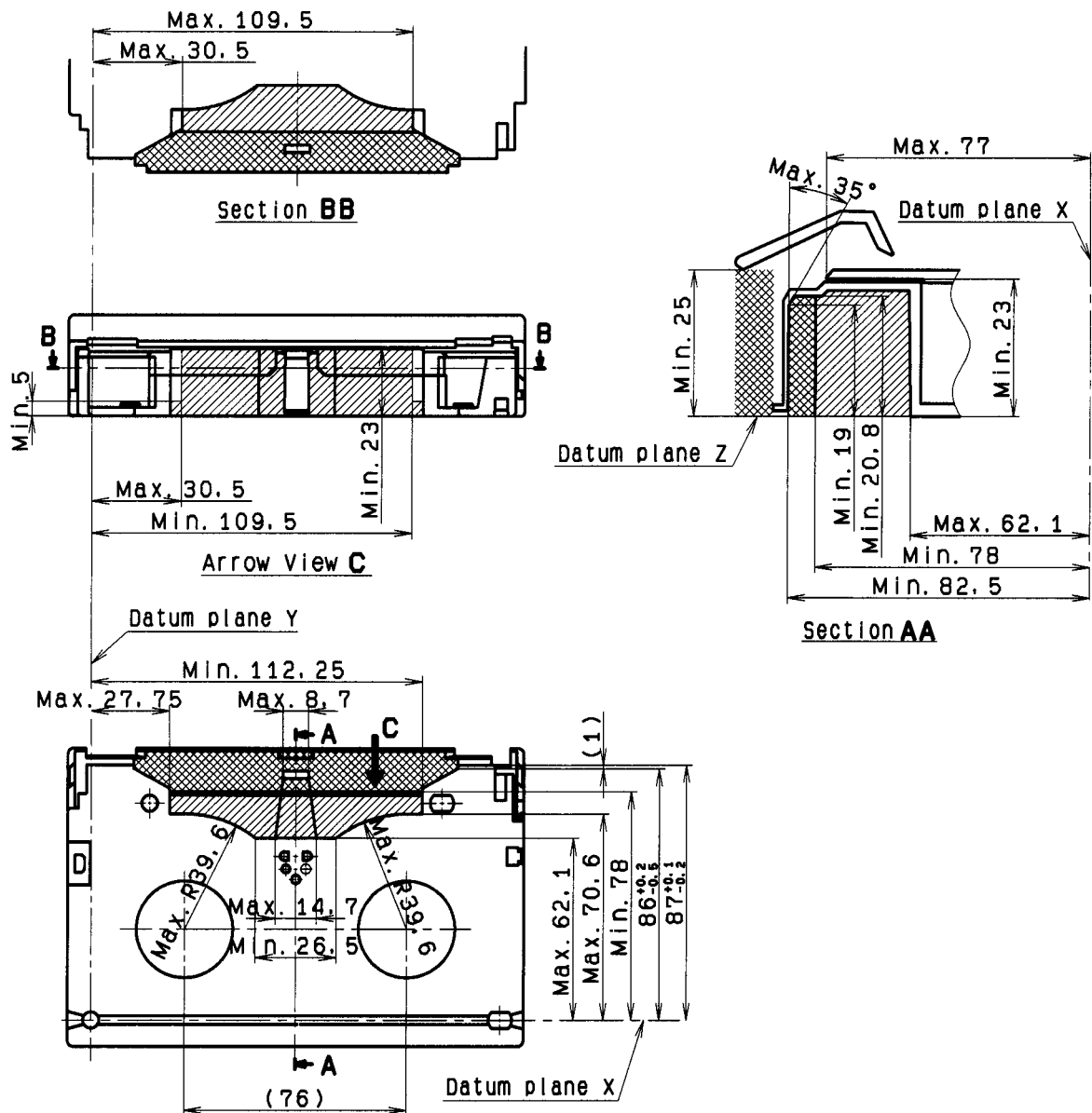
Dimensions in millimetres

NOTE 1 The rotating direction of reels during forward operation.

NOTE 2 The lid opening height L shall be 29 mm or more.

NOTE 3 The reel shall be reset completely when the lid opening height L is 23,5 mm.

Figure 4 – Reel location in the unlocked position (S-Cassette)



IEC 2554/03

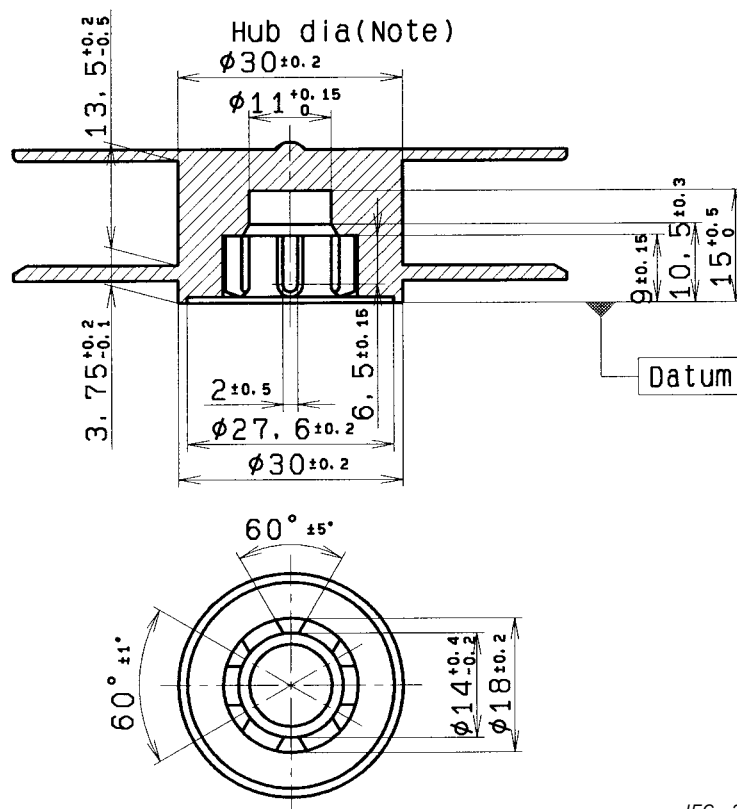
Dimensions in millimetres

NOTE 1 The hatched area is where the loading mechanism of the video tape recorder and/or player unit positions the video cassette when it is inserted.

NOTE 2 The hatched and cross-hatched areas are so designed that the loading mechanism of the video tape recorder and/or player unit unwinds and extends the magnetic tape towards the head drum after the lid opens.

Figure 5 – Protecting lid dimensions (S-Cassette)

(This condition is sometimes defined as “Minimum space for loading mechanism”).

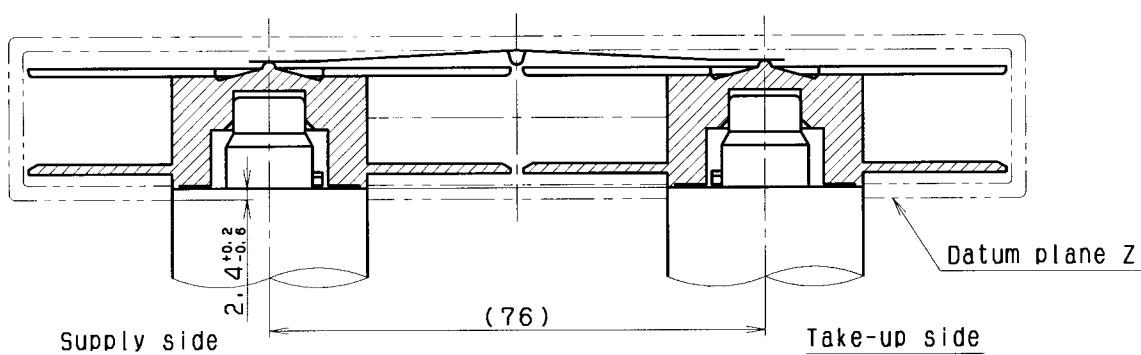


IEC 2555/03

Dimensions in millimetres

NOTE The reels with large hubs (hub diameter $53,3 \pm 0,2$ mm) can be used for cassettes whose recording time is less than 12 min.

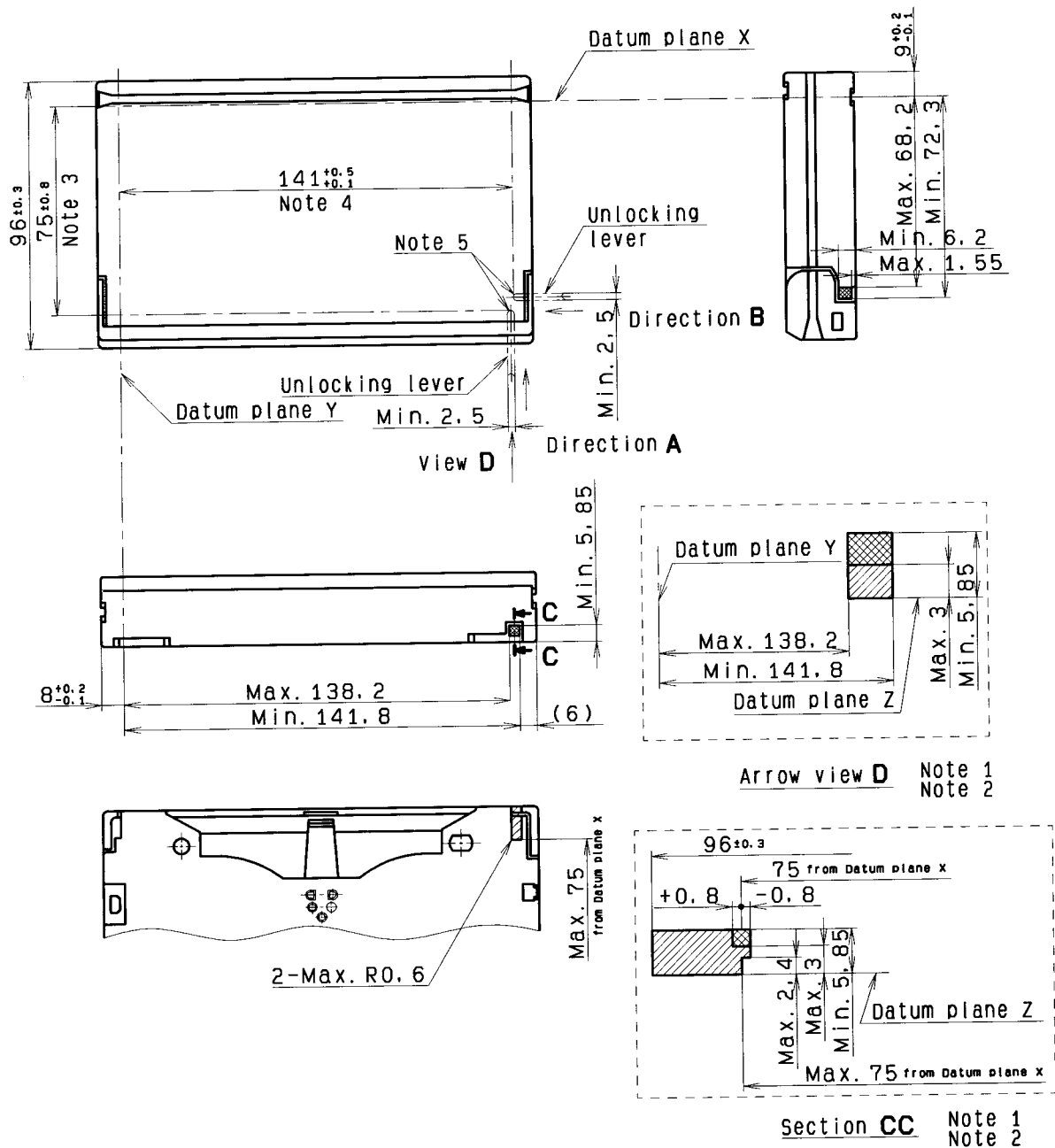
Figure 6 – Reel dimensions (S-Cassette)



IEC 2556/03

Dimensions in millimetres

Figure 7 – Reel height in the unlocked position (S-Cassette)



IEC 2557/03

Dimensions in millimetres

NOTE 1 The cross-hatched and hatched areas show the allowable total area where the unlocking lever extending from the video tape recorder and/or player unit can be inserted into a cassette.

NOTE 2 The cross-hatched area shows the range of the unlocking lever insertion which permits the lid to be unlocked.

NOTE 3 Allowable range within which the unlocking lever can be inserted in the A direction.

NOTE 4 Allowable range within which the unlocking lever can be inserted in the B direction.

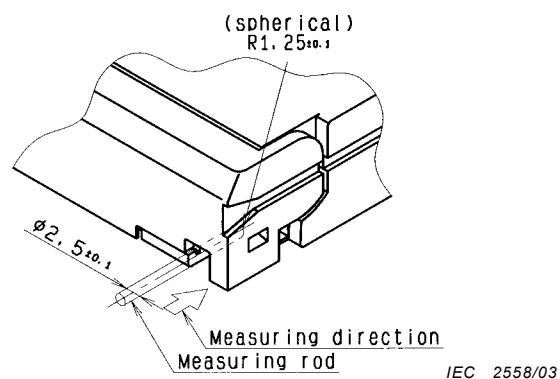
NOTE 5 The tip of the unlocking lever shall be shaped into a semicircle or hemisphere whose radius is a half of the unlocking lever width.

Figure 8 – Unlocking lever insertion area (S-Cassette)

Direction A

The force to unlock the lid shall be not greater than 1,0 N in the A direction.

Refer to Figure 8 regarding the measuring ranges.

**Direction B**

The force to unlock the lid shall be less than 1,5 N in the B direction.

Refer to Figure 8 regarding the measuring ranges.

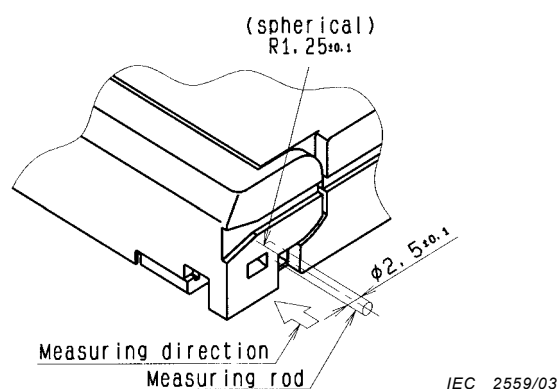
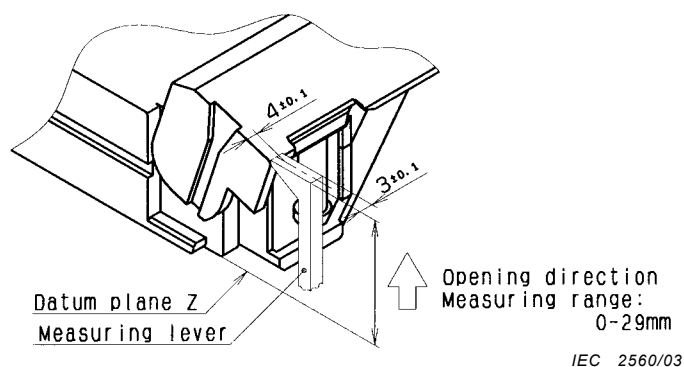


Figure 9 – Lid unlocking force (S-Cassette)

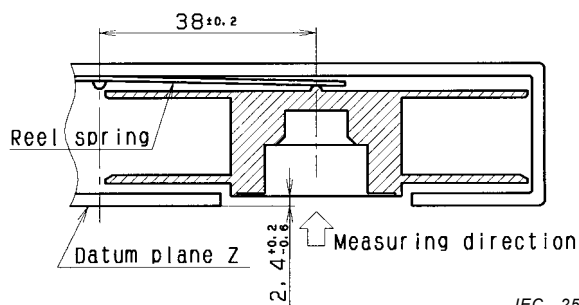
The maximum force to open the lid shall be 1,5 N.



Dimensions in millimetres

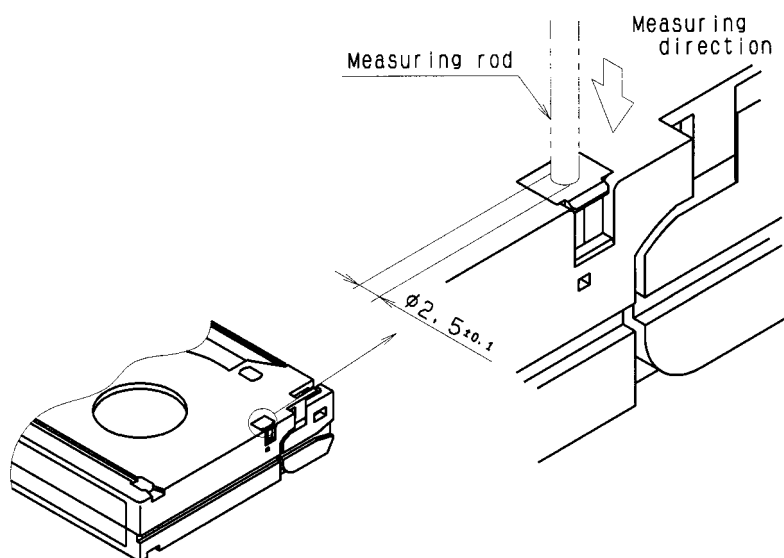
Figure 10 – Lid opening force (S-Cassette)

The force of the spring for pushing down the reel shall be $(1,5 \pm 0,5)$ N.



Dimensions in millimetres

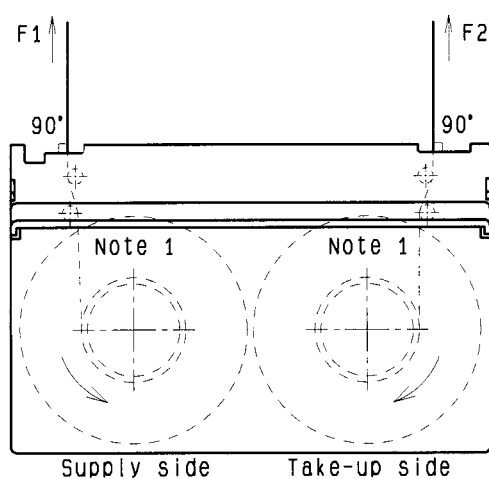
Figure 11 – Reel spring force (S-Cassette)



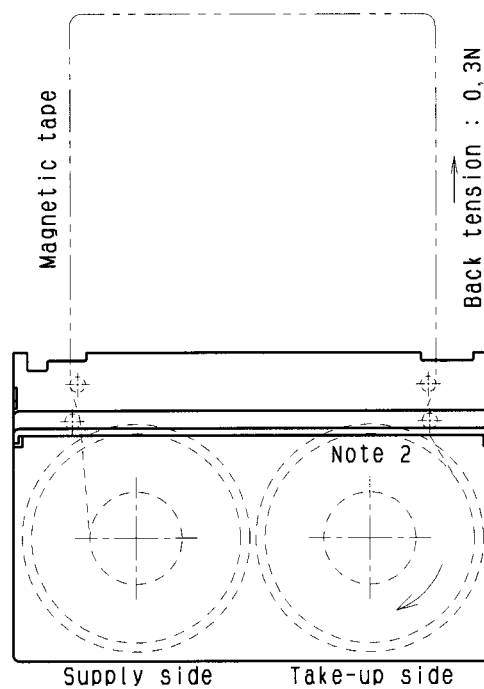
IEC 2562/03

Dimensions in millimetres

Figure 12 – Safety plug strength (S-Cassette)



IEC 2563/03



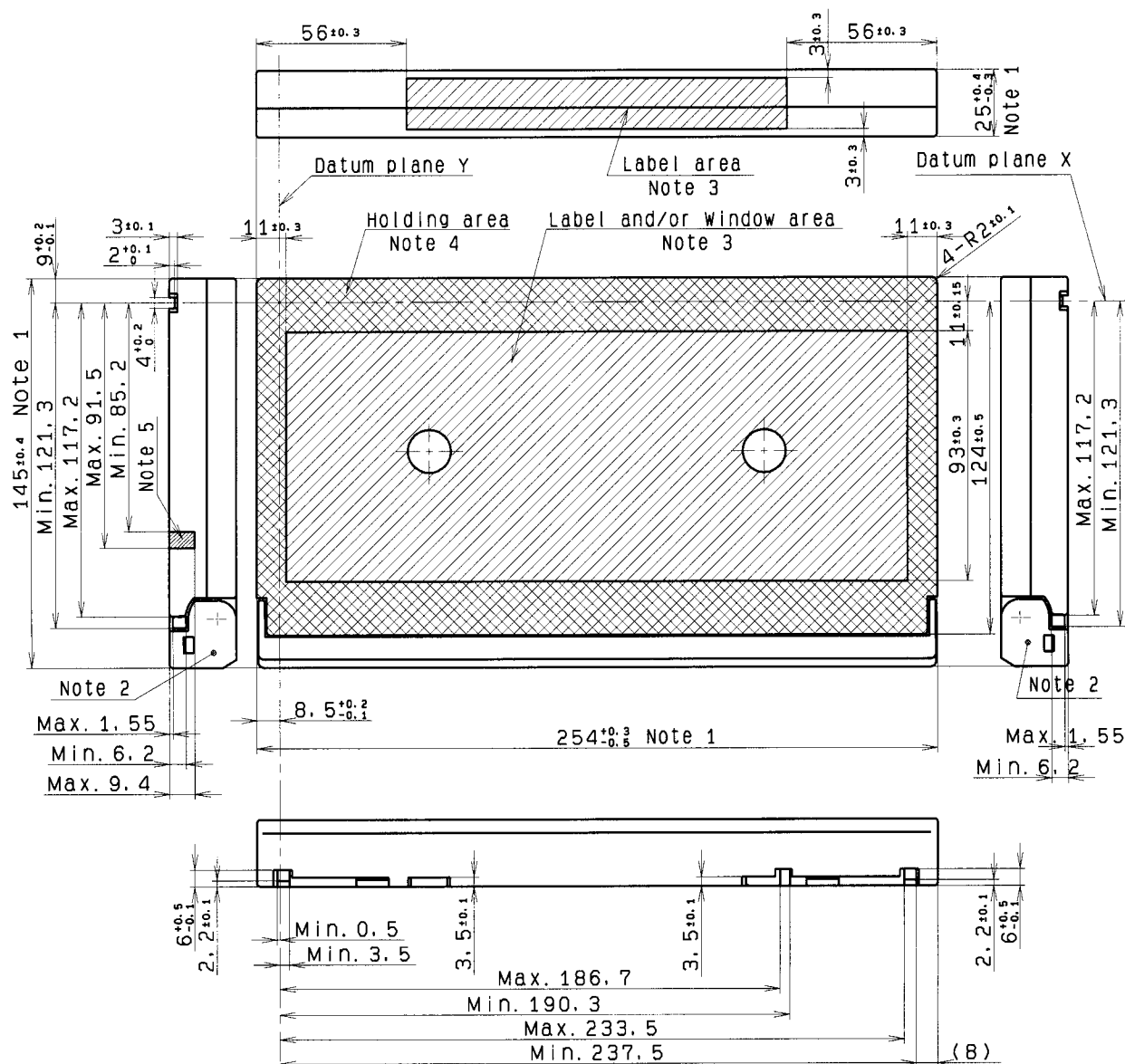
IEC 2564/03

Figure 13a – Extraction force (F1, F2) Figure 13b – Friction torque

NOTE 1 Holdback torque of 1 mN m.

NOTE 2 Friction torque to wind the tape.

Figure 13 – Extraction force (F1, F2) and friction torque (S-Cassette)



IEC 2565/03

Dimensions in millimetres

NOTE 1 These dimensions are inspected by using limit gauges.

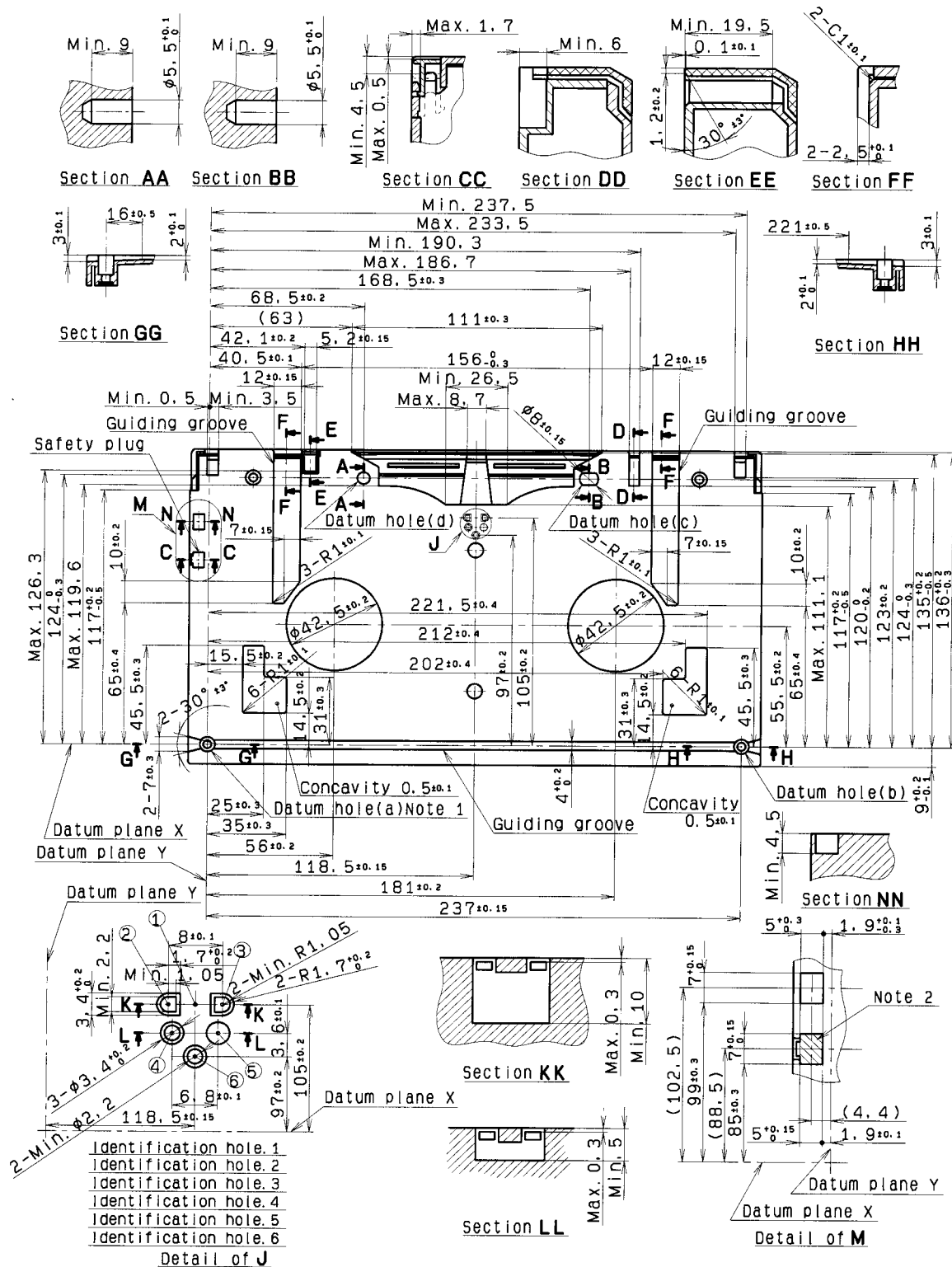
NOTE 2 No part of the lid shall protrude beyond the bottom plane of the cassette when the lid opens or when it closes.

NOTE 3 The label and/or window area shown by the hatched area is available for the label and/or window.

NOTE 4 The cassette may be held in position by the recorder and/or player unit on the holding area shown by the cross-hatched area.

NOTE 5 The fine-hatched area shows the acceptable range of plug-notch position and depth at the side.

Figure 14 – Top and side views (L-Cassette)



IEC 2566/03

Dimensions in millimetres

- NOTE 1 Datum hole (a) is primary.
NOTE 2 The cross-hatched area shows the VTR detection area.
NOTE 3 Datum holes (a) and (b) may be utilized for screw holes.

Figure 15 – Bottom view (L-Cassette)

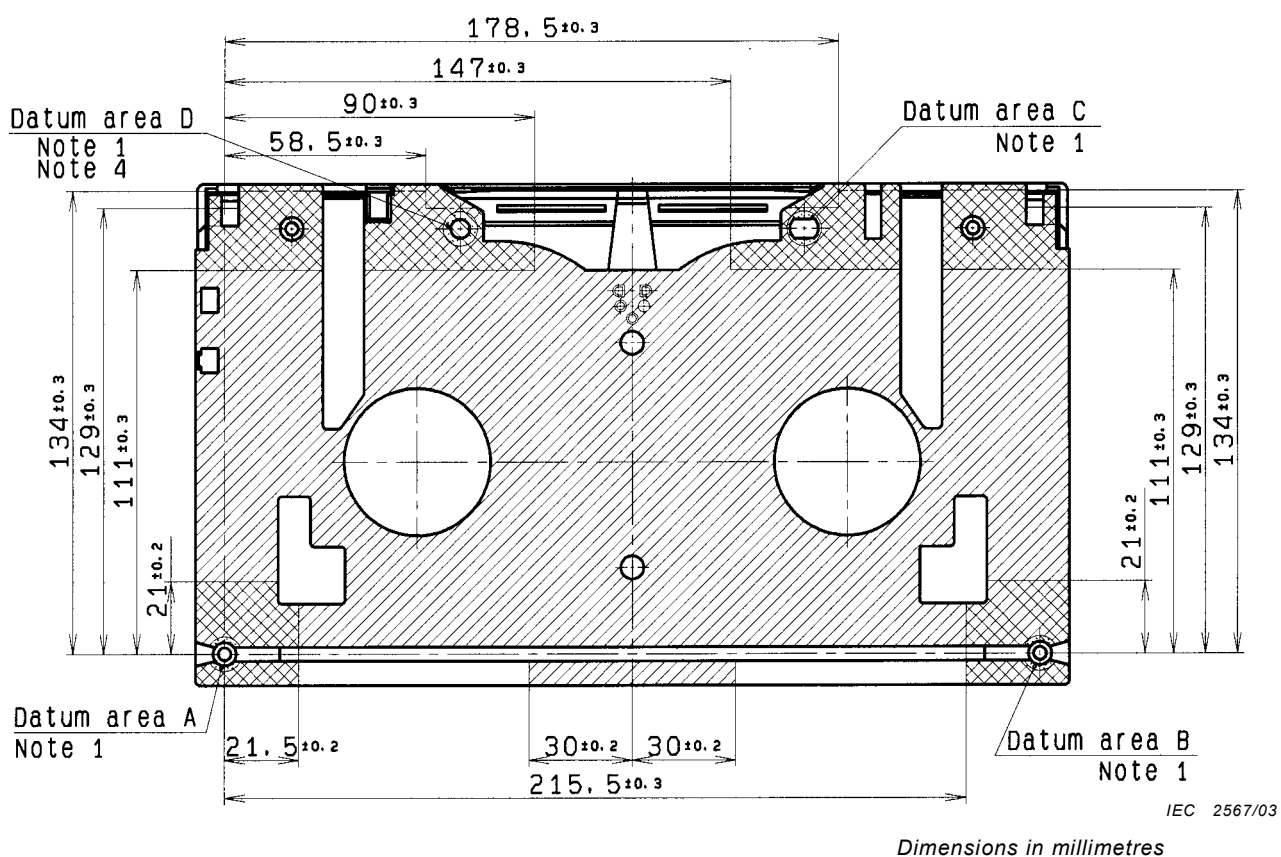


Figure 16a – Datum spots and supporting area

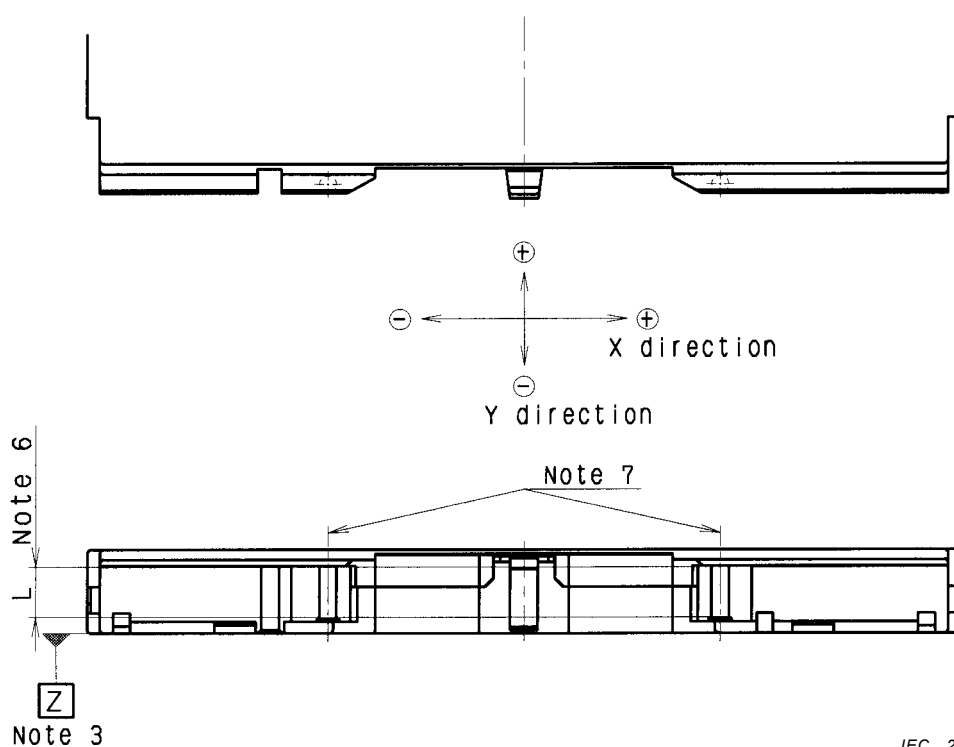


Figure 16b – Tape guides

NOTE 1 The four round areas 10 mm in diameter are datum areas.

NOTE 2 The four supporting areas shown by the cross-hatched areas shall be coplanar with their corresponding datum areas within 0,05 mm of each of them and shall be coplanar with the hatched areas.

NOTE 3 Datum plane Z shall be defined by the three datum areas, A, B, C.

NOTE 4 Datum area D shall be coplanar, within 0,3 mm, with datum plane Z.

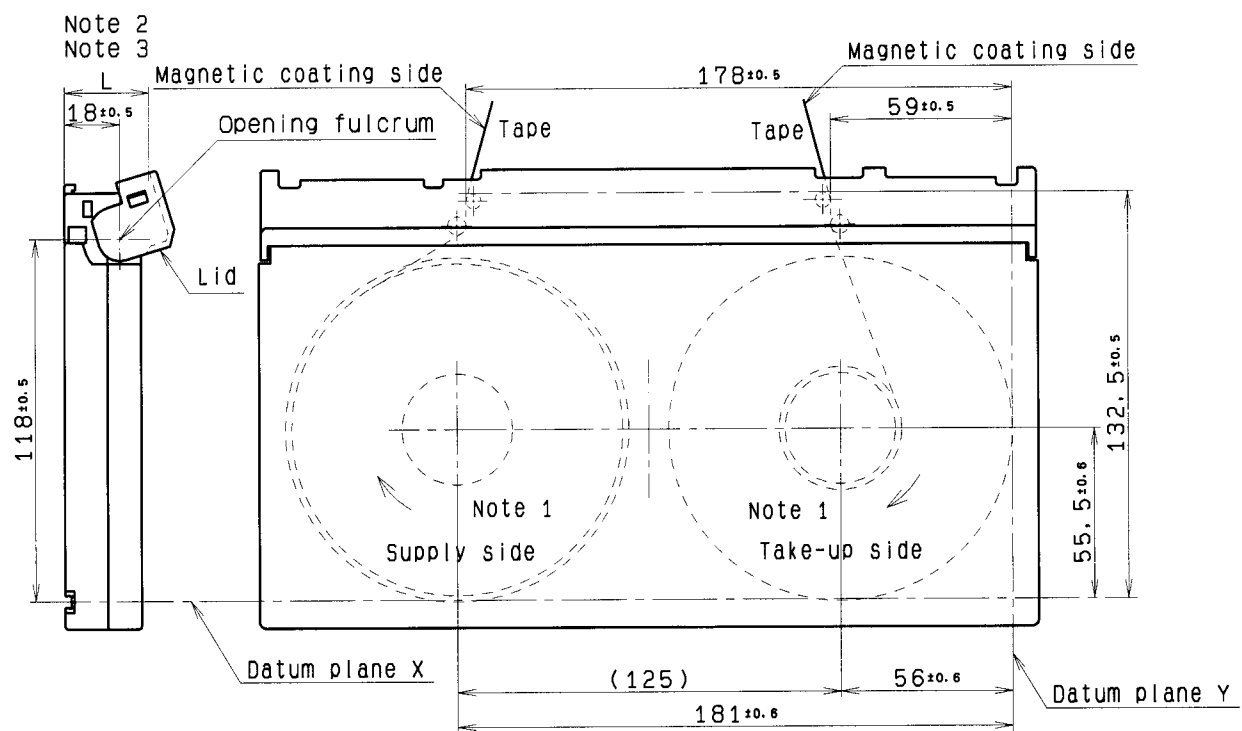
NOTE 5 The areas within 1 mm of the edges of the cassette shall not be included in the supporting areas.

Measurement *L*: 15 mm

NOTE 6 The perpendicularity of tape guides is specified as follows (even if they themselves are tapered).

Direction Tape guide	X^a mm	Y^b mm
Supply side	0 ± 0,15	0 ± 0,15
Take-up side	0 ± 0,15	0 ± 0,15
^a Direction X: Parallel to the tape running direction		
^b Direction Y: Horizontally orthogonal to direction X		

Figure 16 – Datum areas, supporting areas and tape guides (L-Cassette)

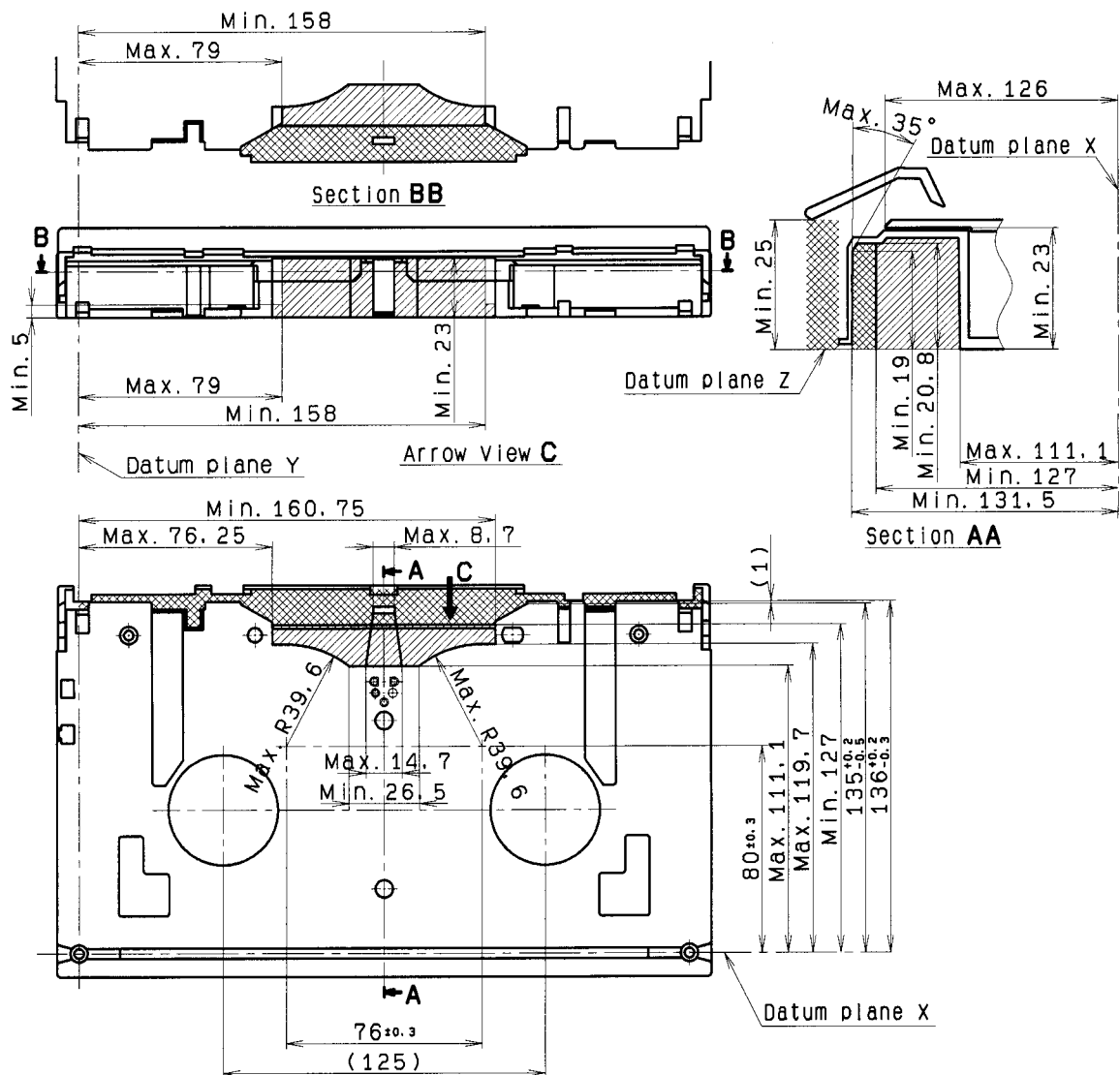


IEC 2569/03

Dimensions in millimetres

NOTE 1 The rotating direction of reels during forward operation.

NOTE 2 The lid opening height L shall be 29 mm or more.NOTE 3 The reel shall be reset completely when the lid opening height L is 23,5 mm.**Figure 17 – Reel location in unlocked position (L-Cassette)**



IEC 2570/03

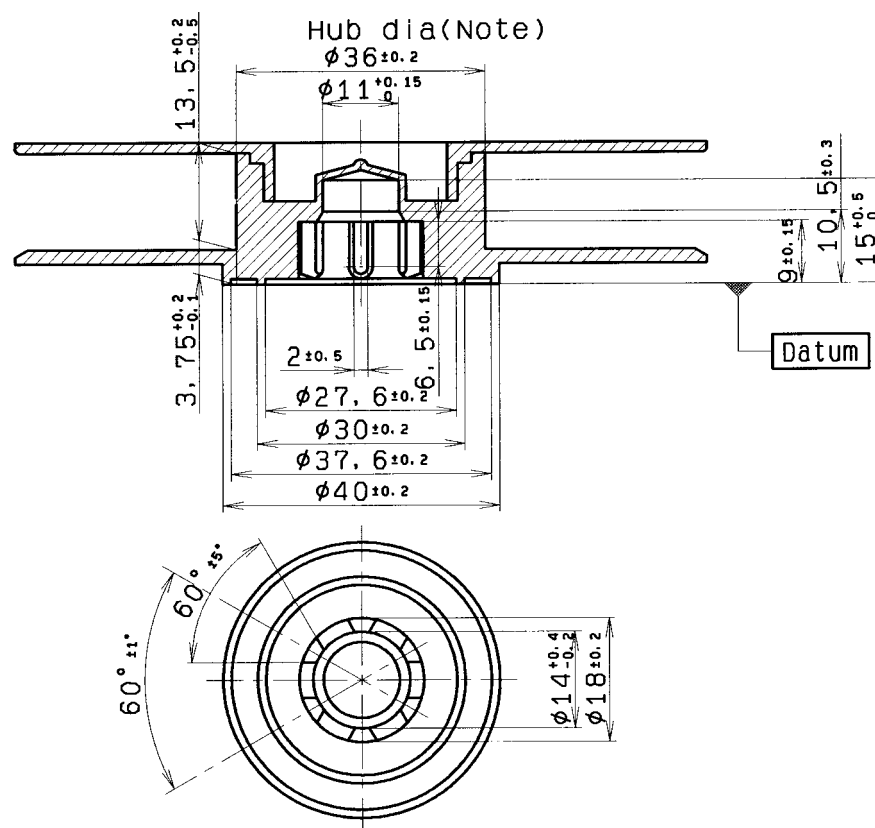
Dimensions in millimetres

NOTE 1 The hatched area is where the loading mechanism of the video tape recorder and/or player unit positions the video cassette when it is inserted.

NOTE 2 The hatched and cross-hatched areas are so designed that the loading mechanism of the video tape recorder and/or player unit unwinds and extends the magnetic tape towards the head drum after the lid opens.

Figure 18 – Protecting lid (L-Cassette)

(This condition is sometimes defined as “Minimum space for loading mechanism”).

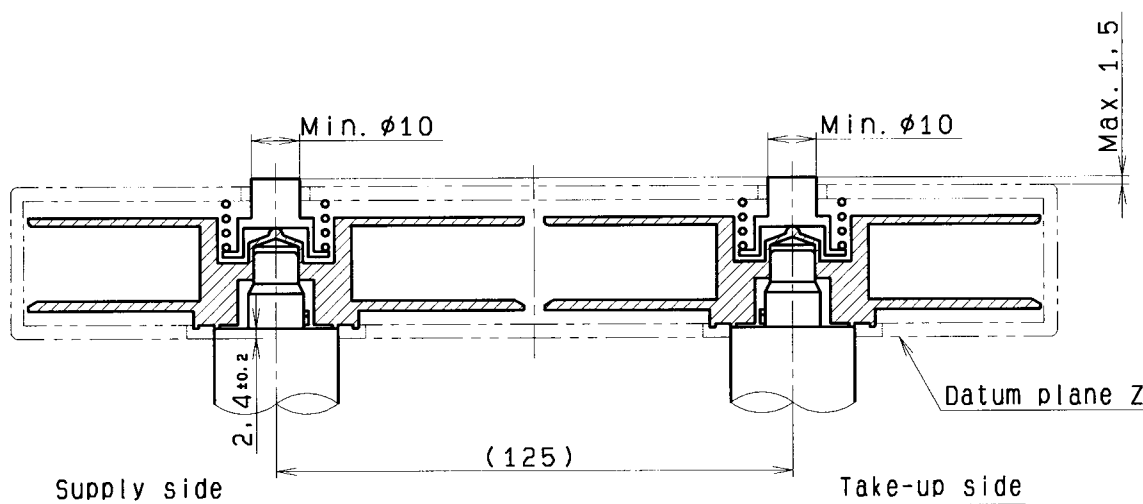


IEC 2571/03

Dimensions in millimetres

NOTE The reels with large hubs (hub diameter $53,3 \text{ mm} \pm 0,2 \text{ mm}$) can be used for cassettes whose recording time is less than 34 min.

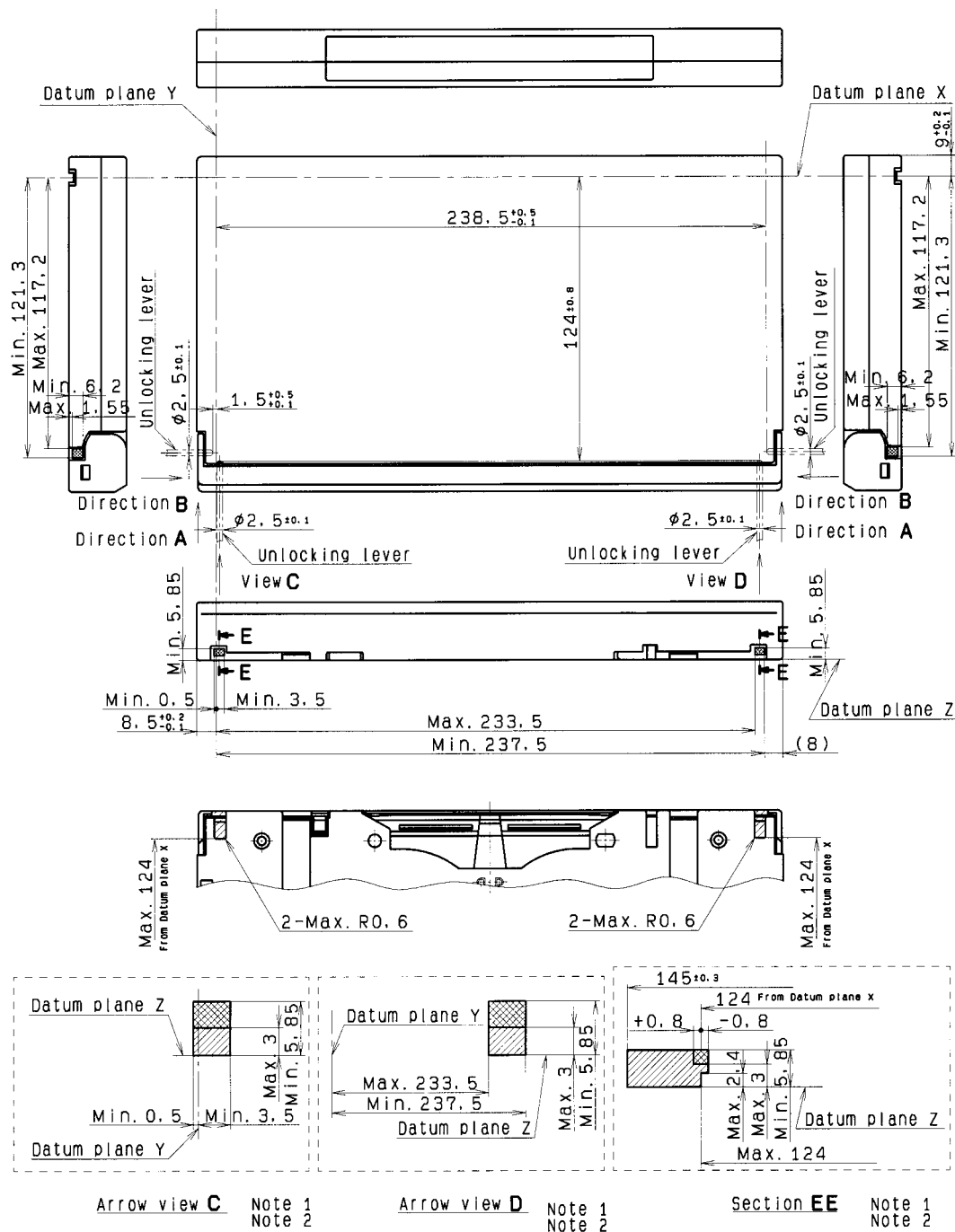
Figure 19 – Reel dimensions (L-Cassette)



IEC 2572/03

Dimensions in millimetres

Figure 20 – Reel height in unlocked operation (L-Cassette)



IEC 2573/03

Dimensions in millimetres

NOTE 1 The cross-hatched and hatched area shows the allowable total area where the unlocking lever extending from the video tape recorder and/or player unit can be inserted into a cassette.

NOTE 2 The cross-hatched area shows the range of the unlocking lever insertion which permits the lid to be unlocked.

NOTE 3 Allowable range within which the unlocking lever can be inserted in the A direction.

NOTE 4 Allowable range within which the unlocking lever can be inserted in the B direction.

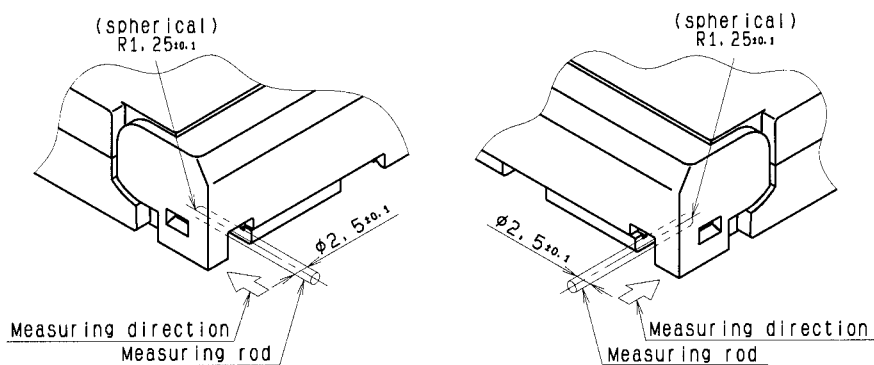
NOTE 5 The tip of the unlocking lever shall be shaped into a semicircle or hemisphere whose radius is a half of the unlocking lever width.

Figure 21 – Unlocking lever insertion area (L-Cassette)

Direction A

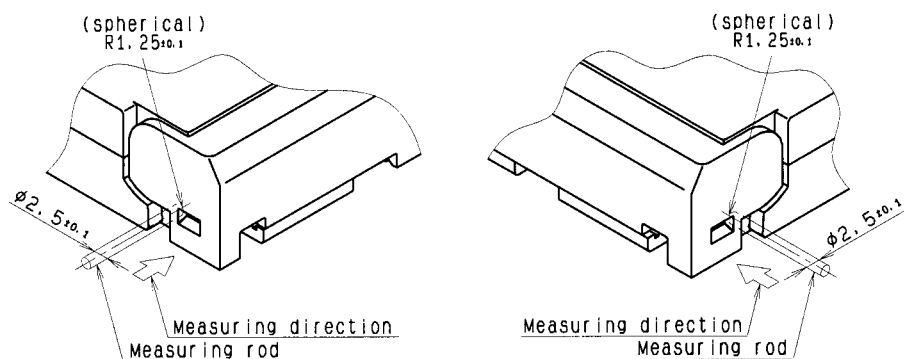
The force to unlock the lid shall be not greater than 1,0 N in the A direction.

Refer to Figure 21 regarding the measuring ranges.

**Direction B**

The force to unlock the lid shall be less than 1,5 N in the B direction.

Refer to Figure 21 regarding the measuring ranges.

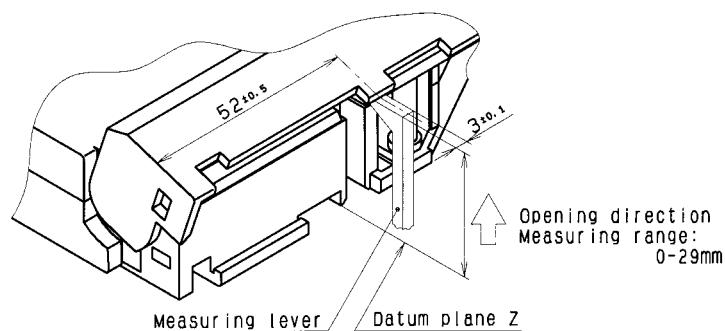


Dimensions in millimetres

IEC 2574/03

Figure 22 – Lid unlocking force (L-Cassette)

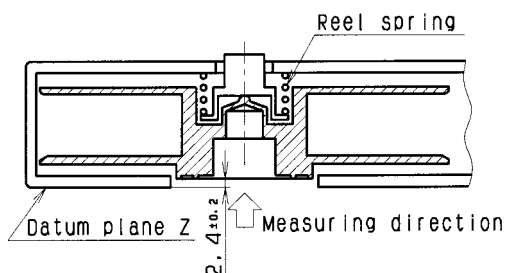
The maximum force to open the lid shall be 1,5 N.



IEC 2575/03

Figure 23 – Lid opening force (L-Cassette)

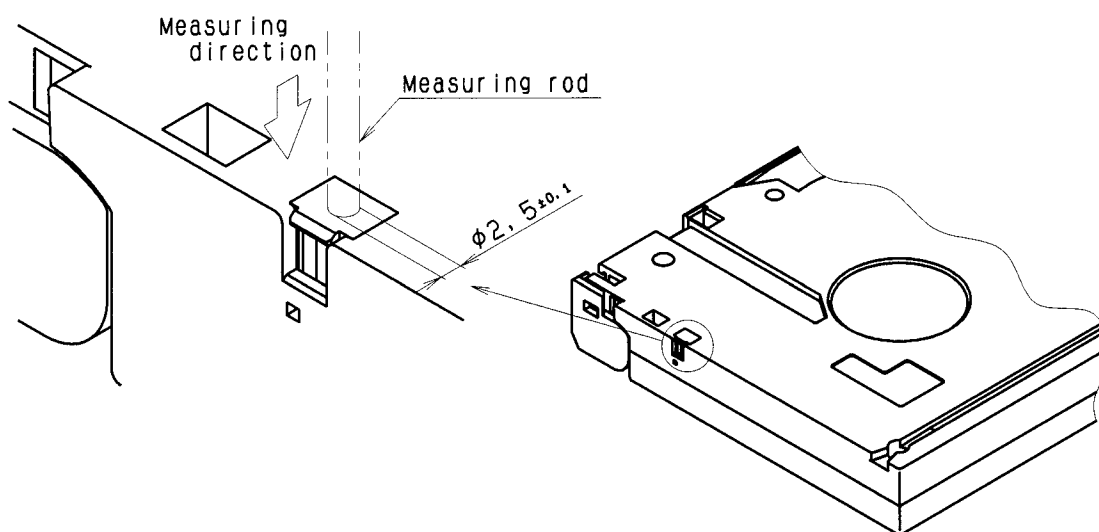
The force of the spring for pushing down the reel shall be $(3,5 \pm 0,5)$ N.



IEC 2576/03

Dimensions in millimetres

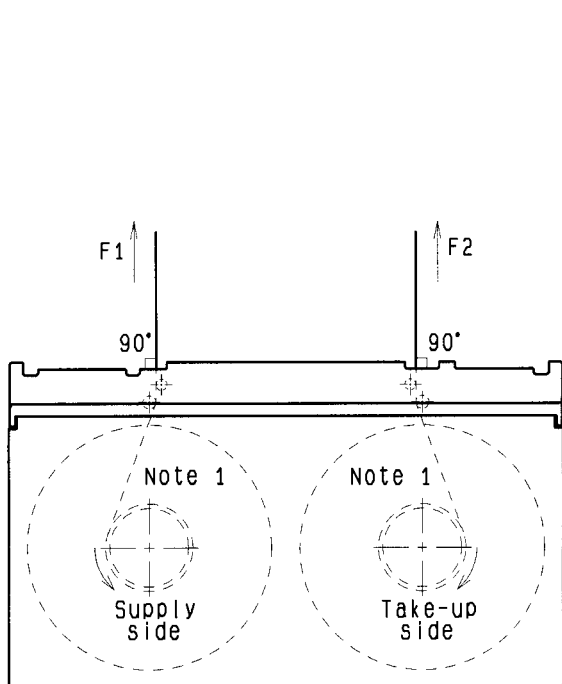
Figure 24 – Reel spring force (L- Cassette)



IEC 2577/03

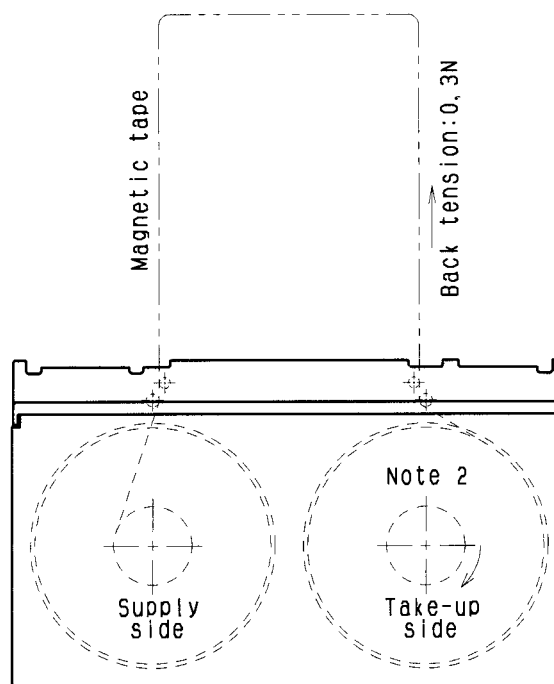
Dimensions in millimetres

Figure 25 – Safety plug strength (L-Cassette)



IEC 2578/03

Figure 26a – Extraction force (F1, F2)



IEC 2579/03

Figure 26b – Friction torque

NOTE 1 Holdback torque of 1 mN m.

NOTE 2 Friction torque to wind the tape.

Figure 26 – Extraction force (F1, F2) and friction torque (L-Cassette)

6 Tape record physical parameters

6.1 Tape speed

The tape speed shall be 96,7 mm/s for 29,97 Hz frame rates, 80,664 mm/s for 25 Hz frame rates, 77,437 mm/s for 24 Hz frame rates or 77,36 mm/s for 23,98 Hz frame rates. The tape speed tolerance shall be $\pm 0,2\%$.

6.2 Helical record physical parameters

6.2.1 Helical record location and dimensions

The reference edge of the tape for the dimensions specified in this standard shall be the lower edge as shown in Figure 27. The magnetic coating, with the direction of tape travel as shown in Figure 27, is on the side facing the observer.

The program reference point for each video frame is determined by the intersection of a line which is parallel to the reference edge of the tape at the distance Y from the reference edge and the centre-line of the first track in each video frame; that is track 0 of segment 0. The program reference point defines the start of the first video sector in the video frame.

The physical locations and dimensions of the helical recordings on the tape and their relative positions with regard to the time code start bit and the reference edge shall be as specified in Figure 27 and Table 1.

6.2.2 Helical track record tolerance zones

The lower edges of all four consecutive tracks shall be contained within the pattern of the four tolerance zones defined in Figure 28.

Each zone is defined by two parallel lines which are inclined at an angle of $4,626\ 44^\circ$ with respect to the tape reference edge.

The centre-lines of all zones shall be spaced apart by 0,021 7 mm. The width of zones 2, 3 and 4 shall be 0,008 mm. The width of zone 1 shall be 0,004 mm. These zones are established to contain track-angle errors, track-straightness errors and vertical-head offset tolerance.

The measuring techniques shall be as shown in IEC 61237-1, Clause 7.

6.2.3 Helical track gap azimuth

The azimuth angle of the head gaps used for recording the helical tracks shall be at an angle of α_0 or α_1 to the line perpendicular to the helical tracks, as specified in Figure 27 and Table 1.

The azimuth of the first track of every frame, that is the program reference point, shall be orientated in the counter-clockwise direction with respect to the line perpendicular to the track direction when viewed from the side of the tape carrying the magnetic recording.

6.3 Longitudinal record physical parameters

6.3.1 Longitudinal record location and dimensions

The track widths and tolerances of the cue control and time code tracks shall be as defined in Figure 27 and Table 1.

6.3.2 Longitudinal track gap azimuth

The azimuth angle of the head gaps used for recording the longitudinal tracks shall be perpendicular to the tracks.

**Table 1 – Record location and dimensions
(29,97PsF/59,94I, 25PsF/50I, 24 PsF and 23,98PsF systems)**

Dimensions		Dimensions in mm	
		Nominal	Tolerance
A	Time code track lower edge	0	Basic
B	Time code track upper edge	0,4	± 0,065
C	Control track lower edge	0,7	± 0,065
D	Control track upper edge	1,1	± 0,065
E	Program area lower edge	1,388	Derived
F	Program area upper edge	11,518	Derived
G	Cue track lower edge	11,85	± 0,065
H	Cue track upper edge	12,45	± 0,065
I	Helical track pitch (+/- azimuth)	0,02	Ref.
J	Helical track pitch (++) azimuth)	0,043 4	Ref.
K1	Video sector 0 length	56,166	Derived
K2	Video sector 1 length	57,985	Derived
L	Helical track total length	125,275	Derived
M	Audio sector length	2,002	Derived
N	Tracking data area length	0,546	Derived
P1	Control track reference to program reference	47,648	± 0,1
P2	TC start bit to program reference	171,899	± 0,2
X1	Location of start of video sector 0	0	± 0,07
X2	Location of start of video sector 1	67,291	± 0,07
X3	Location of start of audio sector 0	56,833	± 0,07
X4	Location of start of audio sector 1	59,107	± 0,07
X5	Location of start of audio sector 2	61,38	± 0,07
X6	Location of start of audio sector 3	63,653	± 0,07
X7	Location of start of tracking data	66,208	± 0,07
Y	Program area reference	1,417	Basic
W	Tape width	12,65	± 0,005
Dimensions		Angles (°)	
		Nominal	Tolerance
θ	Track angle	4,626 44	Basic
α0	Azimuth angle	- 15,269	± 0,17
α1	Azimuth angle	15,231	± 0,17
NOTE The above measurements shall be made under the conditions specified in Clause 4.			

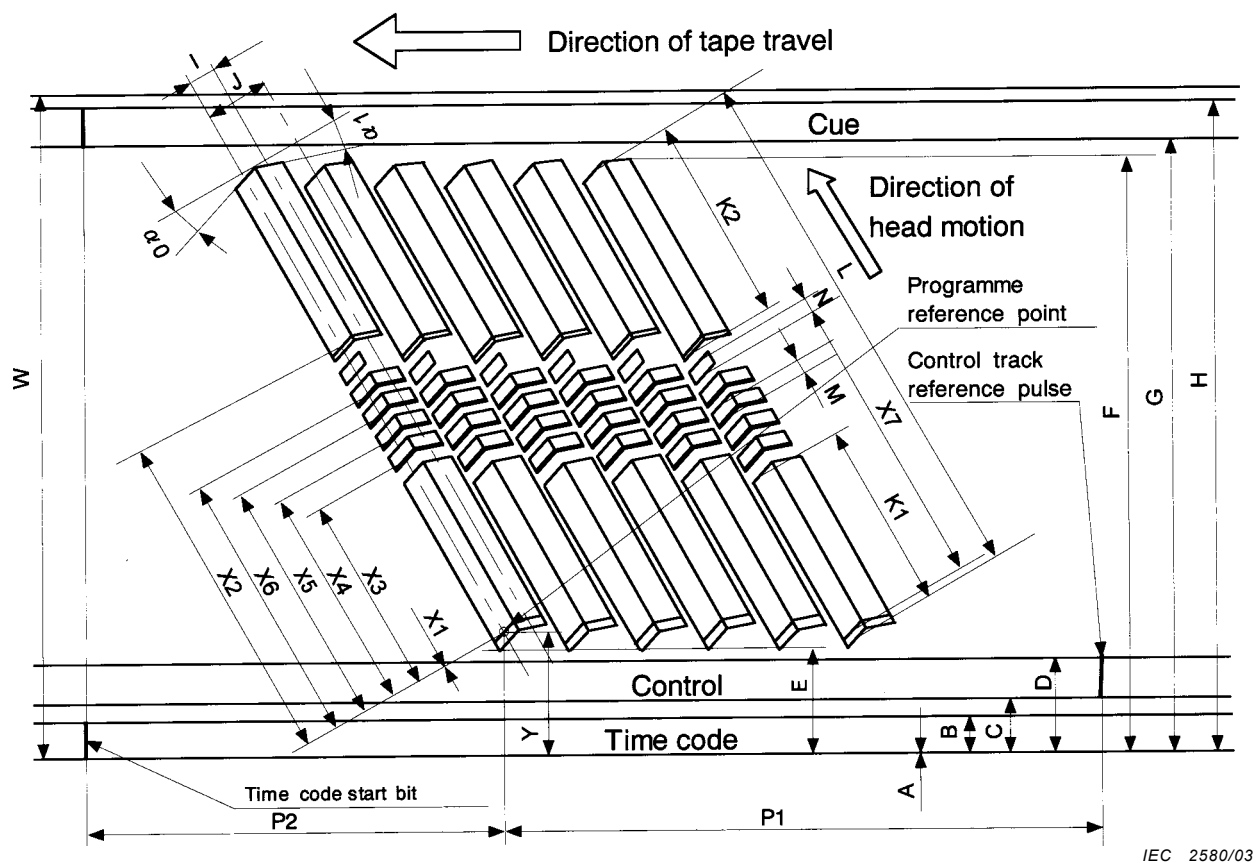
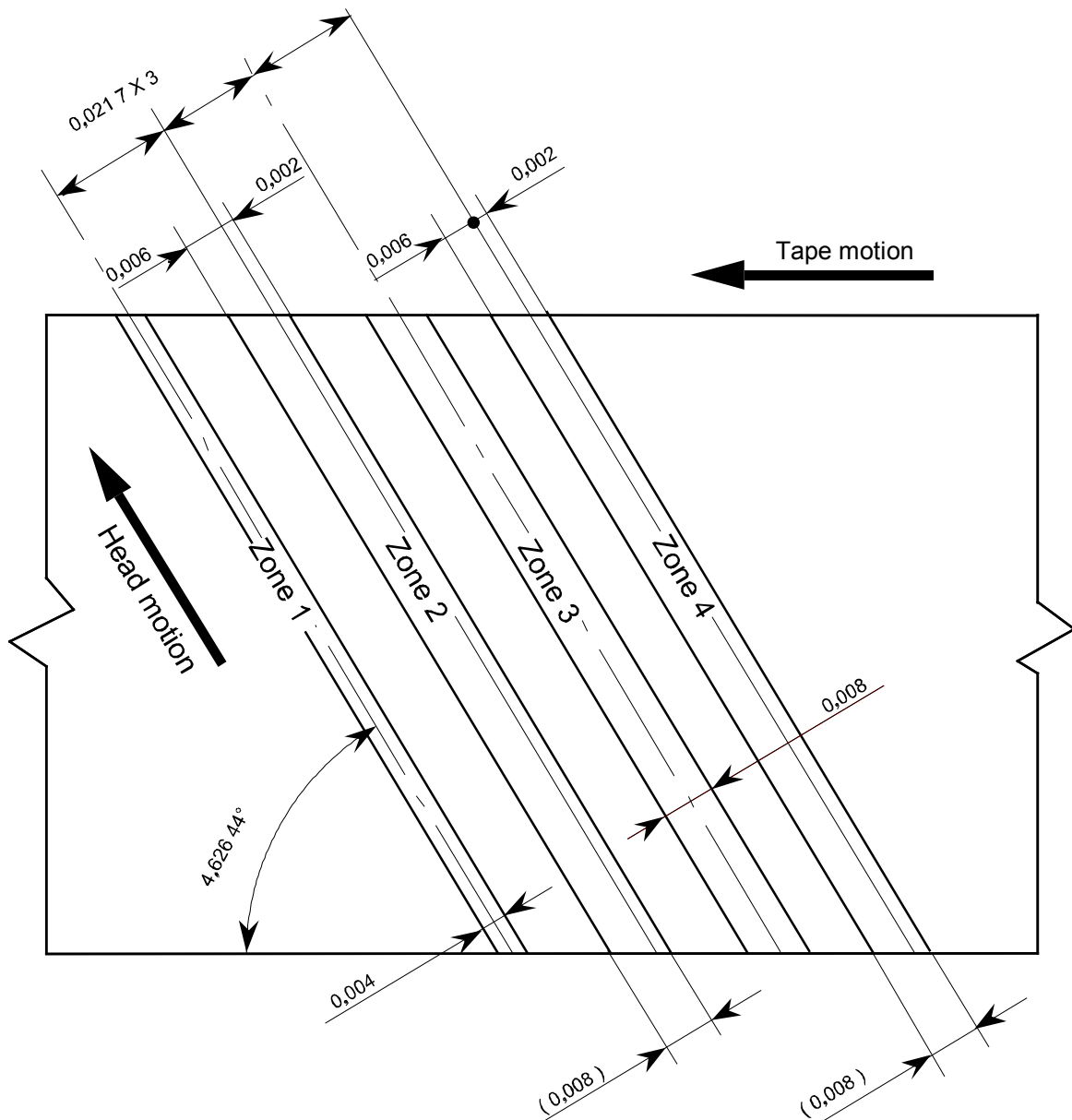


Figure 27 – Locations and dimensions of recorded tracks



IEC 2581/03

Figure 28 – Locations and dimensions of tolerance zones of helical track records

7 Longitudinal track signal and magnetic parameters

7.1 Longitudinal track record parameters

7.1.1 Method of recording

The control track and time code track signals shall be recorded using the hysteretic (non-bias) recording method.

7.1.2 Flux level

The recording level shall be at saturation of the magnetic domains which is defined as that point above which 0,5 dB increase in output level results from 1 dB increase of input level as indicated on an r.m.s. level meter.

7.2 Control track record parameters

7.2.1 Control track pulse period

The control track pulse, at the point of recording, shall be a series of pulses with a period of 16,683 ms $\pm$ 6 μ s (for 29,97 Hz frame rates), 20,000 ms $\pm$ 6 μ s (for 25 Hz frame rates), 20,833 ms $\pm$ 6 μ s (for 24 Hz frame rates) or 20,854 ms $\pm$ 6 μ s (for 23,98 Hz frame rates), as shown in Figure 29.

7.2.2 Control track pulse definition

The rising edge of all control track pulses should be timed to coincide with the input (reference) video.

The frame start point is defined as the midway point of the leading sync edge position which identifies the start of line 1 of the analog video signal represented by the input (reference) signal.

The control track pulses shall have nominal periods of 35T, 50T or 65T between the rising and falling edges where T is equal to 0,1668 ms (for 29,97 Hz frame rates), 0,200 ms (for 25 Hz frame rates), 0,20833 ms (for 24 Hz frame rates) or 0,20854 ms (for 23,98 Hz frame rates), as shown in Figure 29.

7.2.3 Flux polarity

The polarity of the tracking-control recording flux shall be defined by IEC 61213, Clause 5, and Figure 29.

7.3 Time and control code track record parameters

7.3.1 Time and control code signal format

The signal format recorded on the time code track shall be in accordance with SMPTE 12M.

7.3.2 Relationship to the helical track records

The time and control code information shall both refer to the video frame during which it is recorded.

7.3.3 Time and control code signal timing

An external record time and control code input that meets the specifications described in SMPTE 12M or a time and control code that is internally generated within the recorder shall be timed for recording such that the relationship between the “start of address” of the time and control code and the program reference point of a track with an even field address (count) for the video data is defined by Figure 27 and Table 1.

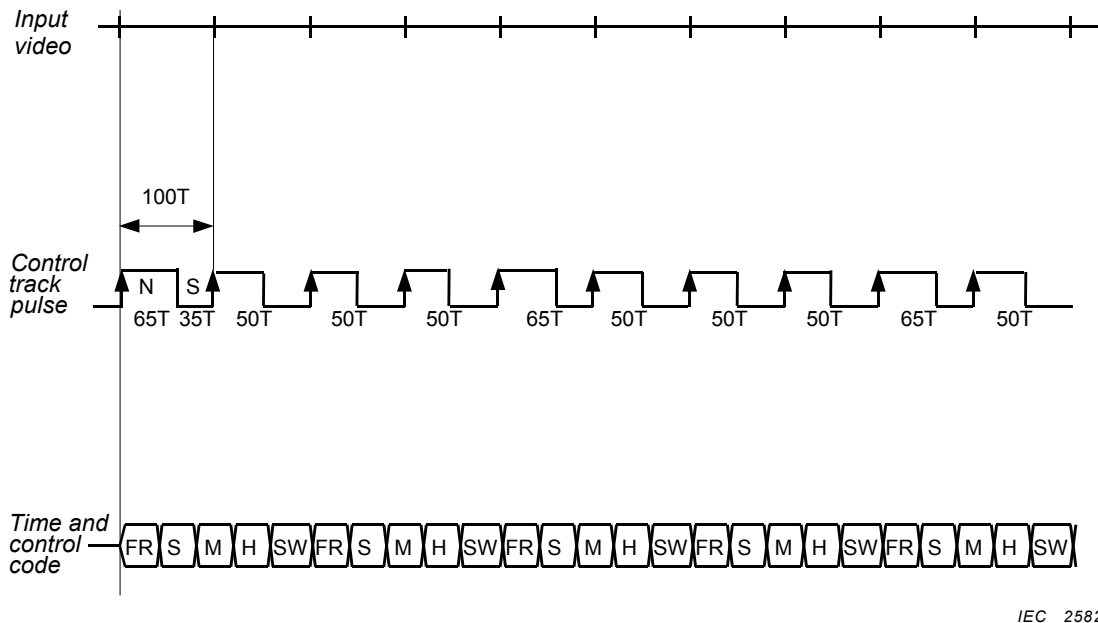


Figure 29 – Recorded control code waveform

NOTE The following definitions are used in Figure 29: FR: Frame, S: Second, M: Minute, H: Hour, SW: Sync Word.

7.4 Cue recording

7.4.1 Method of cue recording

The signals shall be recorded using the anhysteresis (a.c. bias recording) method.

7.4.2 Recording polarity

The recording polarity shall be in accordance with IEC 61213.

7.4.3 Flux level

The recorded reference audio level shall correspond to an r.m.s. magnetic short-circuit flux level of 125 nWb/m $\pm$ 10 nWb/m of track width at 1 kHz.

7.4.4 Relative timing

Cue information shall be recorded on the tape at a point referenced to the associated video information as defined by dimension P2 of Figure 27 and Table 1.

8 Helical track signal parameters and magnetization

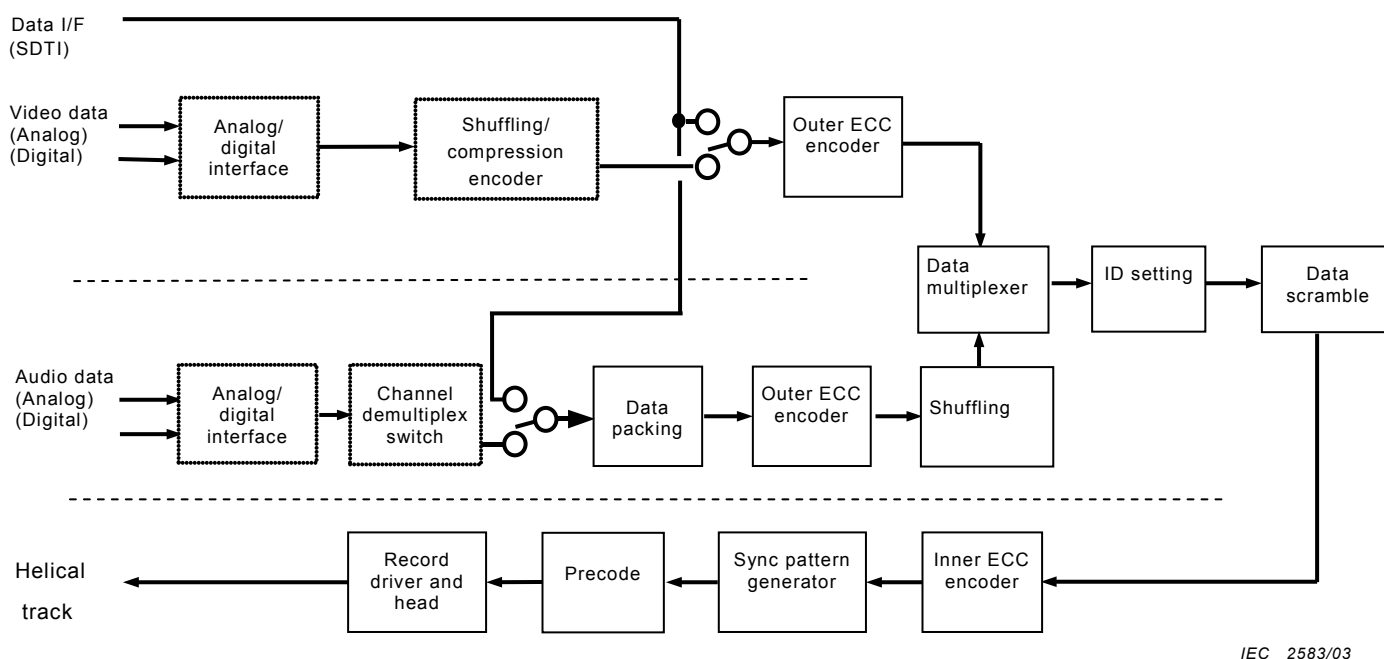
8.1 Overview

This clause defines how input signal data streams comprising a Type D-11 picture compression data stream and four AES3 data streams are mapped to the helical track records.

8.2 Introduction

8.2.1 System block diagrams

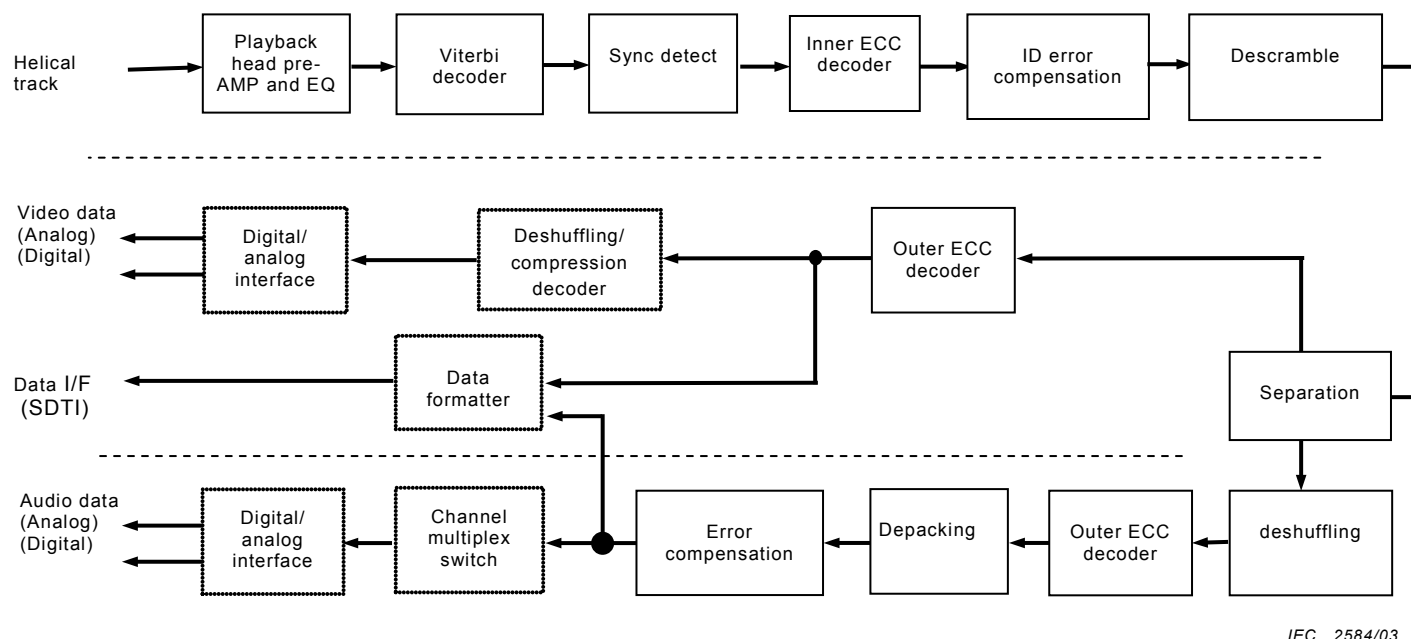
Figure 30 shows the recorder block diagram, identifying the basic schematic signal processing blocks used to map the Type D-11 picture compression data and four channels of AES3 data to create the helical track data records. Figure 30 also includes a Type D-11 encoder/shuffling block which is defined in IEC 62356-2. The data interface is defined in IEC 62356-3.



IEC 2583/03

Figure 30 – Helical recording block diagram (Informative)

Figure 31 shows the playback block diagram, identifying the basic schematic signal processing blocks used to map the helical track records to the Type D-11 compressed picture data stream and four AES3 data streams. Figure 31 also includes a decoder/deshuffling block which is defined in IEC 62356-2. The data interface is defined in IEC 62356-3.



IEC 2584/03

Figure 31 – Helical playback block diagram (Informative)

8.2.2 Labelling convention

The least significant bit is shown on the left and is the first recorded to tape. The lowest numbered byte is shown at the top-left and is the first encountered in the data stream.

A suffix "h" indicates a hexadecimal value.

8.3 Helical track data parameters

8.3.1 Helical track structure

The Type D-11 compressed picture data is recorded onto six sequential helical track pairs together with the associated AES3 data channels and tracking data.

Each helical track is subdivided into two sectors for video data, four sectors for audio data and one sector space for servo tracking data with edit guard bands between each sector.

The layout of the sectors and guard bands is shown in Figure 27.

Each audio and video sector shall be divided into the following components:

- a preamble containing a clock run-up sequence,
- a sequence of sync blocks each containing a sync pattern, an identification pattern, a fixed length data block and terminated with an error control block,
- a post-amble containing a sync pattern and an identification pattern.

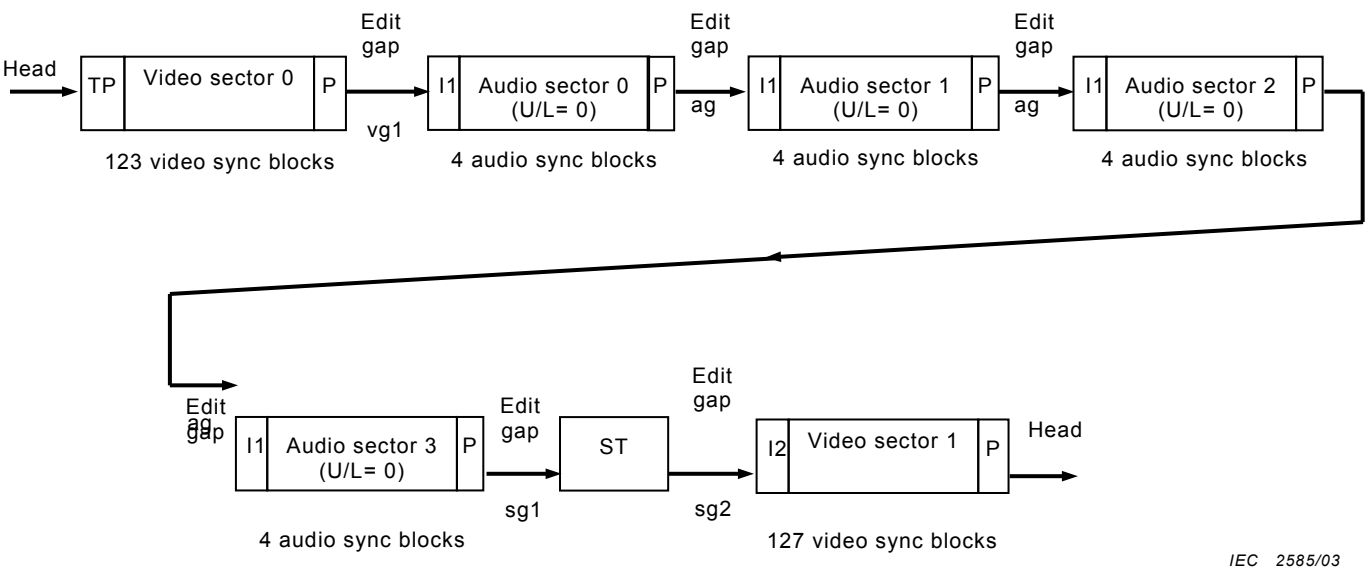
The servo tracking sector is defined in 8.2.6 and occurs only on the six tracks with the same azimuth alignment as illustrated in Figure 27.

8.3.2 Primary data components on the 12 helical tracks

Figure 32 shows the general arrangement of preambles, post-ambles, sync blocks, edit gaps and the tracking data blocks (where applicable) as a group for each of the eight helical tracks.

NOTE The 'ST' block is only present on the six helical tracks as identified in Figure 27.

Figure 33 shows the specific data arrangement and data sizes.



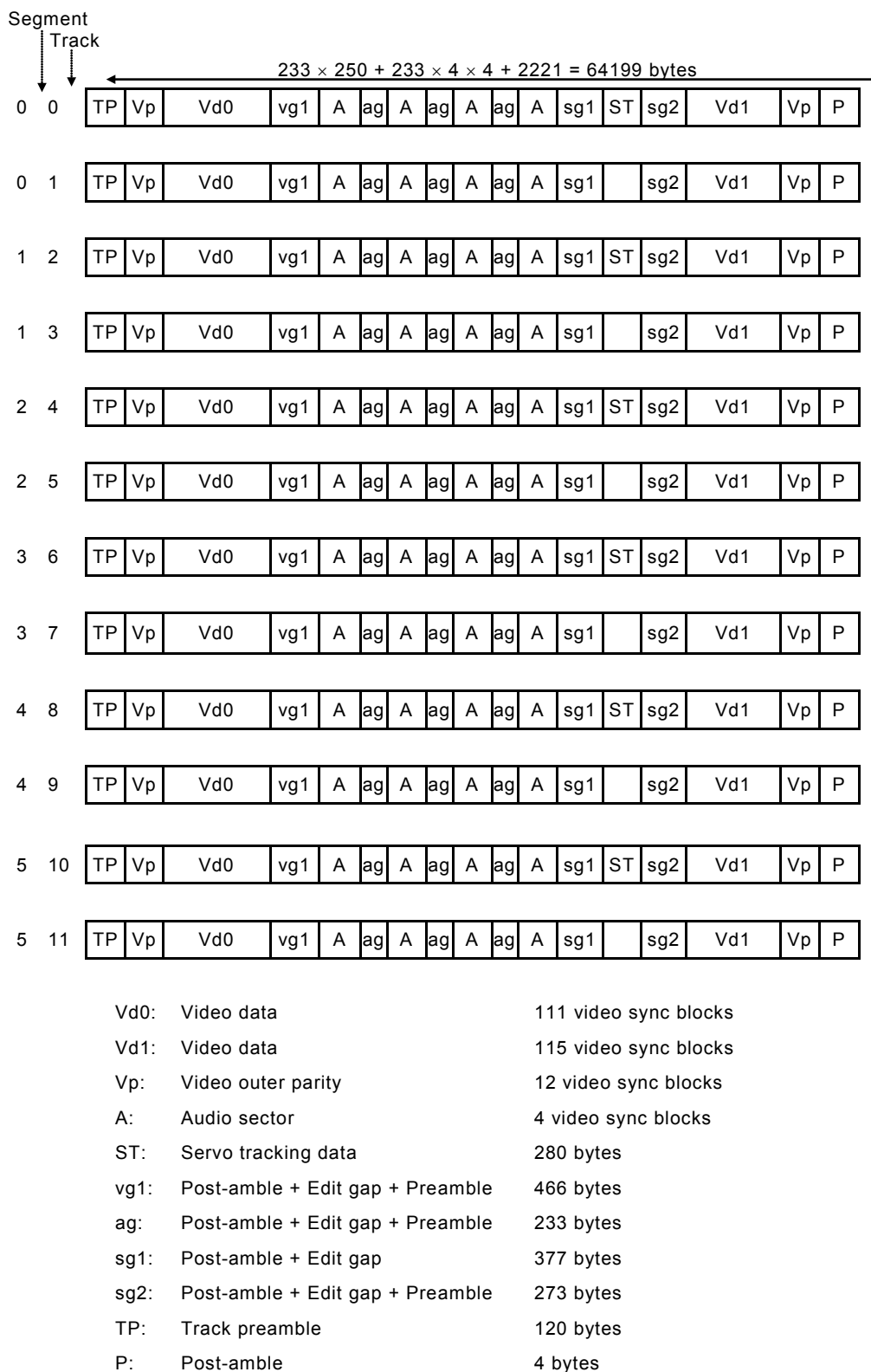
IEC 2585/03

:

- 1. TP: Track preamble
- 2. I1: In-track preamble 1
- 3. I2: In-track preamble 2
- 4. P: Post-amble (4 bytes)
- 5. vg1: P + Edit gap + I 1
- 6. vg2: P + Edit gap + I 1
- 7. ag: P + Edit gap + I 2
- 8. sg1: P + Edit gap
- 9. sg2: Edit gap + I 1
- 10. Video sync block 233 bytes
- 11. Audio sync block 233 bytes
- 12. ST: Servo tracking data

TP	120 (bytes)
I1	60 (bytes)
I2	120 (bytes)
P	4 (bytes)
vg1	466 (bytes)
ag	233 (bytes)
sg1	377 (bytes)
sg2	273 (bytes)
ST	280 (bytes)

Figure 32 – Sector arrangement on helical track



IEC 2586/03

Figure 33 – Sector and segment arrangement on helical track

8.3.3 Segment specification

8.3.3.1 Video sync blocks

The Type D-11 picture compression and data stream format provides compressed picture basic blocks and auxiliary basic blocks which shall be mapped into video sync blocks.

Segments 0 to 5 of the Type D-11 picture compression and data stream format shall be mapped to Segments 0 to 5 respectively as shown in Figure 33.

Channel 0 data from the Type D-11 picture compression and data stream format shall be mapped to even-numbered tracks in Figure 33 (tracks 0, 2, 4, 6, 8 and 10).

Channel 1 data from the Type D-11 picture compression and data stream format shall be mapped to odd-numbered tracks in Figure 33 (tracks 1, 3, 5, 7, 9 and 11).

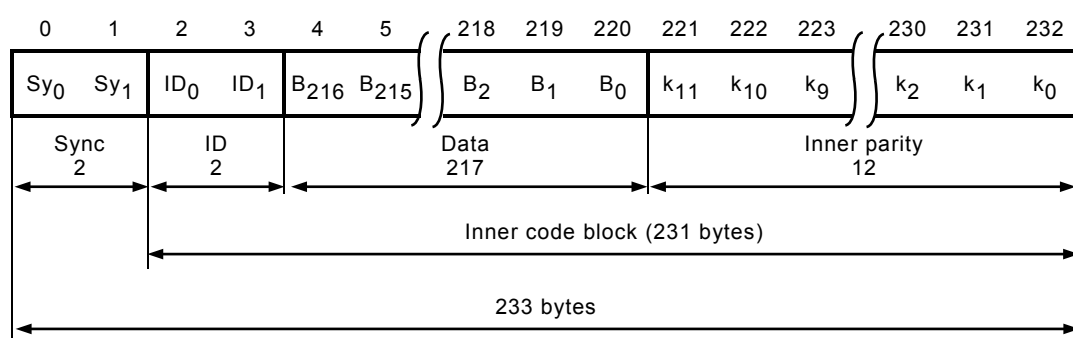
Each basic block specified in IEC 62356-2 shall be mapped into bytes 2 to 220 of a video sync block as defined in Figure 34. The value of byte 2 (ID_0) is modified according to the algorithm specified in 8.2.2.3.

For each track, the auxiliary basic block and the compressed picture basic blocks numbered '0' to '224' inclusive, specified in IEC 62356-2, shall be mapped into the video sync blocks numbered according to the algorithm specified in 8.2.3.3.

Every sync block shall contain a sync identification pattern of 2 bytes, 217 bytes of data, and an inner check code of 12 bytes.

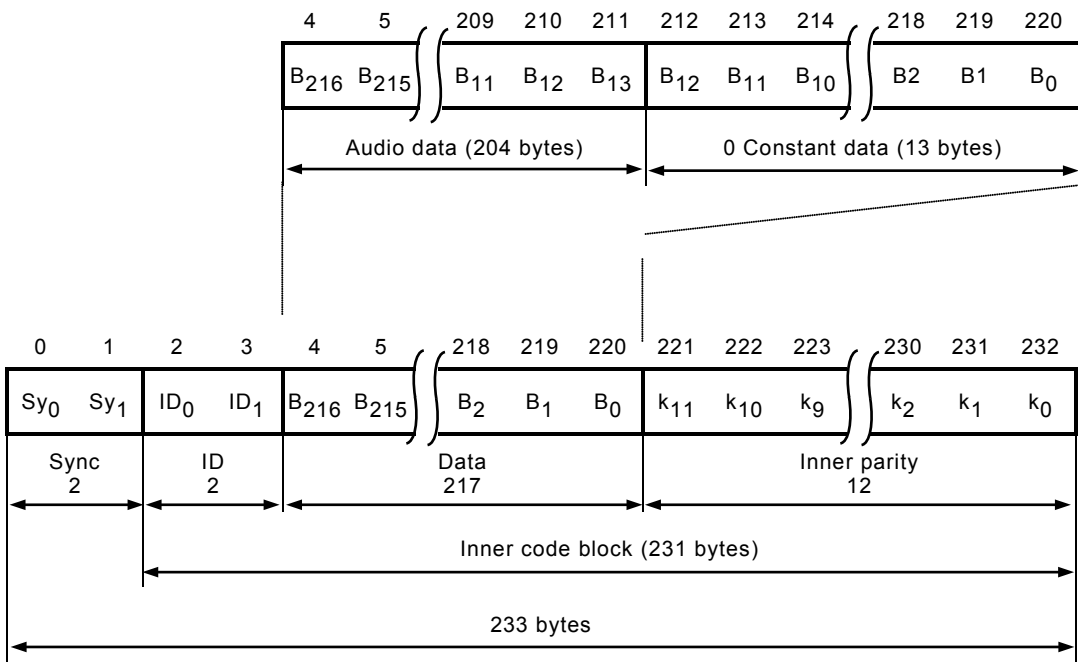
In audio sync blocks only, bytes in locations 212 to 220 inclusive shall be set to the value of '0'.

Figures 34 and 35 show the sync block format for, respectively, video sync blocks and audio sync blocks.



IEC 2587/03

Figure 34 – Video sync block format



IEC 2588/03

Figure 35 – Audio sync block format

8.3.3.2 Sync pattern

The length of the sync pattern shall be two bytes. The byte values shall be '2Eh' and 'D3h' leading to the bit sequence as shown below.

	MSB							
Byte 0 (Sy_0)	0	1	2	3	4	5	6	7
LSB	0	1	1	1	0	1	0	0

	MSB							
Byte 1 (Sy_1)	0	1	2	3	4	5	6	7
LSB	1	1	0	0	1	0	1	1

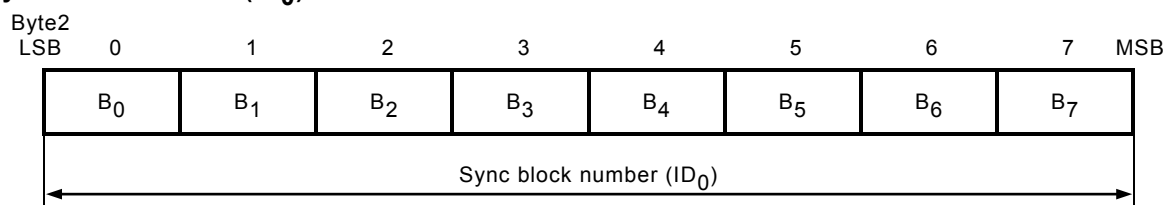
8.3.3.3 Sync block identification pattern

The length of the sync block identification (ID) pattern shall be two bytes.

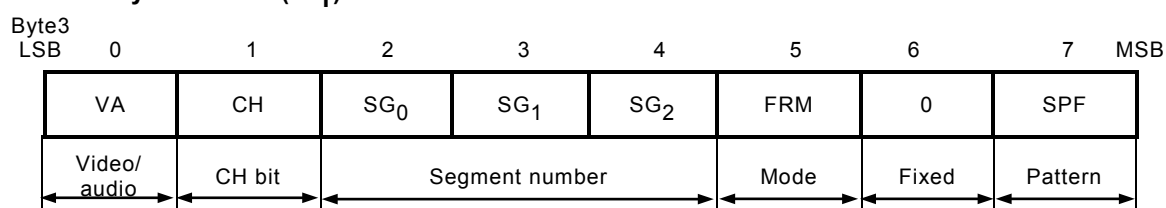
NOTE The ID pattern for video sync blocks is initialized to be the same as the BID pattern for basic blocks defined in IEC 62356-2. However, the value of the first byte of the BID is modified by the algorithm defined in this clause.

The first byte of the ID (ID₀) shall be used to uniquely identify every sync block within each helical track. The second byte of the ID (ID₁) shall be used to identify the sector type, channel and segment numbers. Figure 36 shows the pattern of the sync block identification.

Sync block number (ID₀)



Sector ID Sync blocks (ID_1)



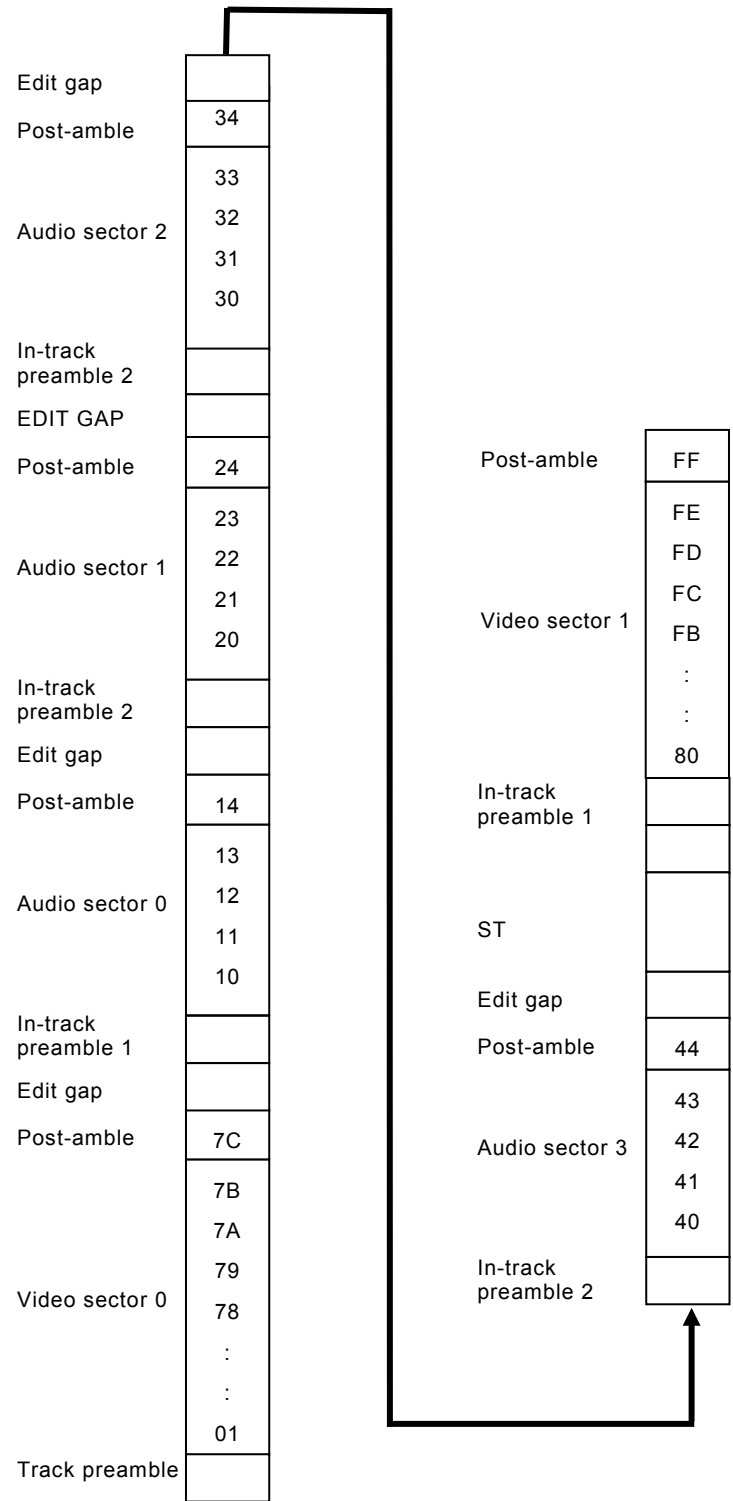
IEC 2589/03

Figure 36 – Sync block identification bytes

The first sync block ID byte (ID₀) follows a coded sequence, as shown in Figure 37 and syntax of the ID₀. The last ID₀ code of each sector shall be reserved for post-amble identification.

Syntax of the ID₀ algorithm for video sync blocks

ID ₀ Syntax	Comment
<pre> { for(Segment=0; Segment<6; Segment++) { for(BID₀=0; BID₀<256; BID₀++) { if(Segment mod 2) { if(BID₀=255) ID₀=13; elseif(BID₀>=110) ID₀= BID₀+18; else ID₀= BID₀+14; } else { if(BID₀=255) ID₀=123; elseif(BID₀>=110) ID₀= BID₀+18; else ID₀= BID₀+13; } } } } </pre>	Odd Segments Auxiliary Sync Block Even Segments Auxiliary Sync Block



IEC 2590/03

Figure 37 – ID₀: Sync block number

Table 2 – ID₀: Sync block number

Sector	Sync block number
Video sector V0	01 h to 7B h
Video sector V1	80 h to fE h
Audio sector A0	10 h to 13 h
Audio sector A1	20 h to 23 h
Audio sector A2	30 h to 33 h
Audio sector A3	40 h to 43 h

The second sync ID byte (ID₁) shall be used to define several data fields as shown in Figure 36.

The VA bit shall be used to distinguish between audio (= 1) and video (= 0) sectors.

The remaining bits of the second sync ID byte (ID₁), as shown in Figure 36, shall be as defined by BID₁ in IEC 62356-2. For information, these bits are described as follows.

The CH bit is used to distinguish between the two data channels corresponding to Channel 0 and Channel 1.

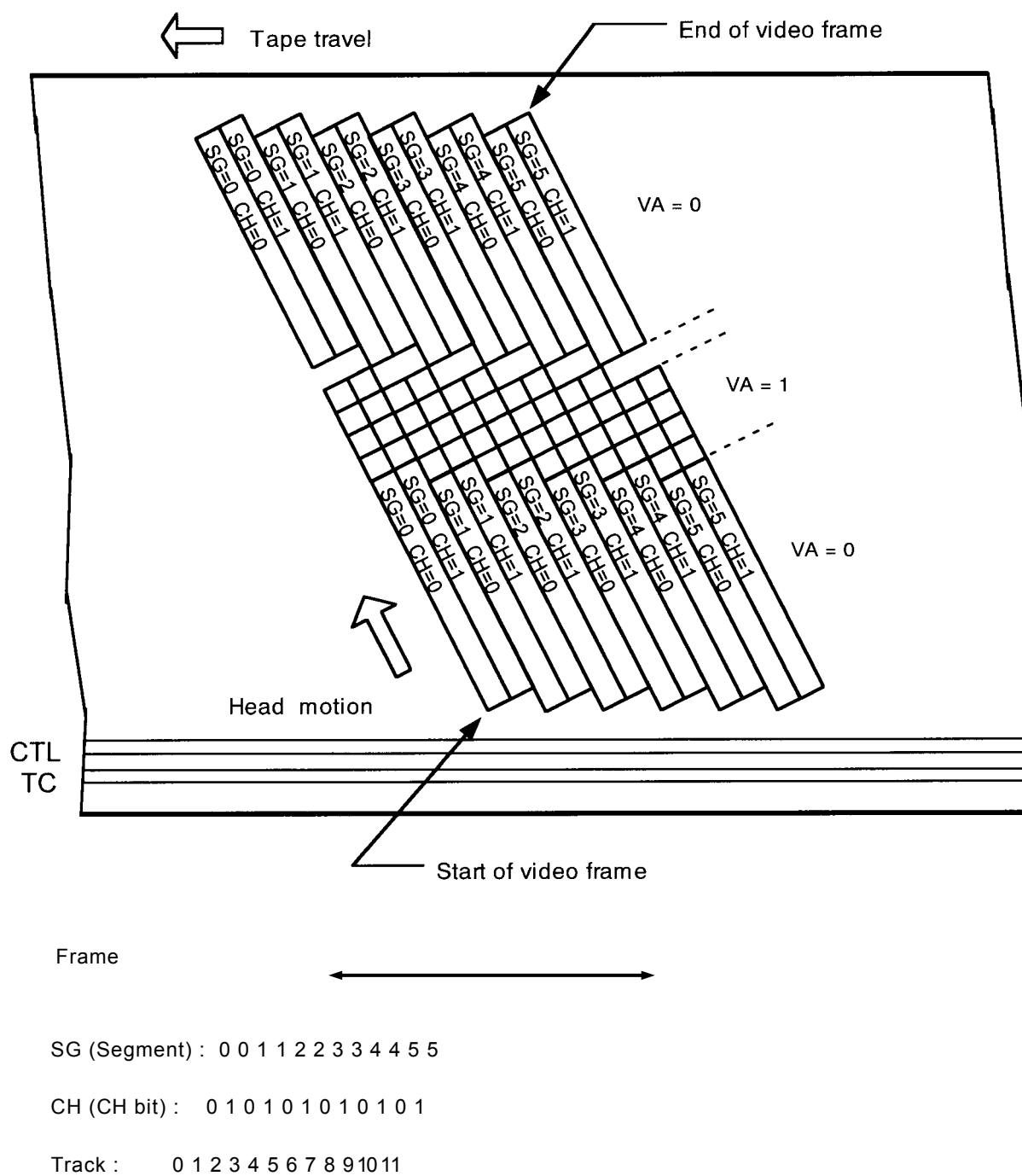
The SG bits (SG0, SG1, SG2) are used to identify among six segments corresponding to segment 0, 1, 2, 3, 4 and 5. The bit assignments for each segment are defined as follows.

	SG0	SG1	SG2
Segment 0:	0	0	0
Segment 1:	1	0	0
Segment 2:	0	1	0
Segment 3:	1	1	0
Segment 4:	0	0	1
Segment 5:	1	0	1

Bit 5 defines frame mode if set to “1” and field mode if set to “0”.

Bit 6 has a fixed value of “0”.

Bit 7 defines the shuffle pattern flag (SPF).



IEC 2591/03

Figure 38 – Segment, channel and track counts