

INTERNATIONAL STANDARD

ISO/IEC 12248

First edition
1993-12-15

Information technology — 3,81 mm wide magnetic tape cartridge for information interchange — Helical scan recording — DATA/DAT-DC format using 60 m and 90 m length tapes

*Technologies de l'information — Cartouche de bande magnétique de
3,81 mm de large pour l'échange d'information — Enregistrement par
balayage en spirale — Format DATA/DAT-DC utilisant des bandes
de 60 m et 90 m de long*



Reference number
ISO/IEC 12248:1993(E)
AVA Documents
Document Sharing Hub

Contents	Page
1 Scope	1
2 Conformance	1
2.1 Magnetic tape cartridge	1
2.2 Generating system	1
2.3 Receiving system	1
3 Normative references	1
4 Definitions	2
4.1 Absolute Frame Number (AFN)	2
4.2 algorithm	2
4.3 Area ID	2
4.4 Automatic Track Finding (ATF)	2
4.5 Average Signal Amplitude	2
4.6 azimuth	2
4.7 back surface	2
4.8 byte	2
4.9 cartridge	2
4.10 Channel Bit	2
4.11 Codeword	2
4.12 Data Format ID	2
4.13 End of Data (EOD)	2
4.14 End of Information (EOI)	2
4.15 End of Partition (EOP)	2
4.16 entity	2
4.17 Error Correcting Code (ECC)	2
4.18 flux transition position	2
4.19 flux transition spacing	2
4.20 frame	2
4.21 group	2
4.22 Logical Beginning of Tape (LBOT)	2

© ISO/IEC 1993

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 the publisher.

ISO/IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

4.23	Logical End of Tape (LEOT)	2
4.24	magnetic tape	3
4.25	master reference	3
4.26	Master Standard Amplitude Calibration Tape	3
4.27	Master Standard Reference Tape	3
4.28	Optimum Recording Field	3
4.29	partition	3
4.30	partition reference	3
4.31	Physical Beginning of Tape (PBOT)	3
4.32	Physical End of Tape (PEOT)	3
4.33	physical recording density	3
4.34	pre-recording condition	3
4.35	processed record	3
4.36	processed record sequence	3
4.37	processing	3
4.38	record	3
4.39	Reference Recording Field	3
4.40	Secondary Standard Amplitude Calibration Tape	3
4.41	Secondary Standard Reference Tape	3
4.42	Separator Mark	3
4.43	Standard Reference Amplitude	4
4.44	tape noise amplitude	4
4.45	Tape Reference Edge	4
4.46	track	4
5	Environment and safety	4
5.1	Testing environment	4
5.2	Operating environment	4
5.3	Storage environment	4
5.4	Transportation	4
5.5	Safety	5
5.6	Flammability	5
Section 2	- Requirements for the case	5
6	Dimensional and mechanical characteristics of the case	5
6.1	General	5
6.2	Overall dimensions	5
6.3	Loading grip	6
6.4	Holding areas	6
6.5	Notches of the lid	6
6.6	Lid dimensions	6
6.7	Optical detection of the beginning and end of tape	7
6.8	Bottom side	8
6.8.1	Locking mechanism of the slider	8
6.8.2	Access holes	9
6.8.3	Recognition, sub-datum and write-inhibit holes	9
6.8.4	Datum holes	10
6.8.5	Access room for tape guides	11
6.8.6	Holes for accessing the hubs	11

6.8.7	Internal structure of the lower half	11
6.8.8	Light path	12
6.8.9	Support areas	13
6.8.10	Datum areas	13
6.8.11	Relationship between support and datum areas and Reference Plane Z	13
6.9	Hubs	13
6.10	Leader and trailer attachment	14
6.11	Interface between the hubs and the drive spindles	14
6.12	Opening of the lid	14
6.13	Release of the hub locking mechanism	14
6.14	Label areas	15
Section 3	- Requirements for the unrecorded tape	26
7	Mechanical, physical and dimensional characteristics of the tape	26
7.1	Materials	26
7.2	Tape length	26
7.2.1	Length of magnetic tape	26
7.2.2	Length of leader and trailer tapes	26
7.3	Tape width	26
7.4	Discontinuities	26
7.5	Total thickness	26
7.6	Longitudinal curvature	26
7.7	Cupping	26
7.8	Coating adhesion	27
7.9	Layer-to-layer adhesion	27
7.10	Tensile Strength	28
7.10.1	Breaking Strength	28
7.10.2	Yield Strength	28
7.11	Residual elongation	28
7.12	Electrical resistance of coated surfaces	28
7.13	Light transmittance of tape	29
8	Magnetic recording characteristics	29
8.1	Optimum recording field	30
8.2	Signal amplitude	30
8.3	Resolution	30
8.4	Overwrite	30
8.4.1	Physical recording densities of 750,6 and 3 002 ftpmm	30
8.4.2	Physical recording densities of 83,4 ftpmm and 1 001 ftpmm	31
8.5	Ease of erasure	31
8.6	Tape quality	31
8.6.1	Missing pulses	31
8.6.2	Missing pulse zone	31
8.7	Signal-to-noise ratio (S/N) characteristic	31

Section 4 - Format	32
9 DATA/DAT-DC format	32
9.1 General	32
9.2 Basic Groups	32
9.2.1 Basic Groups for Group Format 0	32
9.2.2 Basic Groups for Group Format 1	34
9.3 Sub-groups	35
9.3.1 G1 Sub-group	35
9.3.2 G2 Sub-group	36
9.3.3 G3 Sub-group	36
9.3.4 G4 Sub-group	37
9.3.5 Main Data Block	42
9.4 Sub-Data area	43
9.4.1 Pack Item No. 1	44
9.4.2 Pack Item No. 2	45
9.4.3 Pack Item No. 3	47
9.4.4 Pack Item No. 4	48
9.4.5 Pack Item No. 5	48
9.4.6 Pack Item No. 6	49
9.4.7 Pack Item No. 7	50
9.4.8 Sub Data Block	50
9.5 Basic Group structure	52
9.5.1 User Data	52
9.5.2 System Data	53
9.5.3 Record ID list	57
9.5.4 Heuristic Recovery Data Area	62
10 Method of recording	62
10.1 Physical recording density	62
10.2 Long-Term average bit cell length	62
10.3 Short-Term average bit cell length	62
10.4 Rate of change	62
10.5 Bit shift	62
10.6 Read signal amplitude	62
10.7 Maximum recorded levels	62
11 Track geometry	63
11.1 Track configuration	63
11.2 Average track pitch	63
11.3 Variations of the track pitch	63
11.4 Track width	64
11.5 Track angle	64
11.6 Track edge linearity	64
11.7 Track length	64
11.8 Ideal tape centreline	64
11.9 Azimuth angles	64

12	Recording of blocks on the tape	64
12.1	Recorded Main Data Block	64
12.2	Recorded Sub Data Block	64
12.3	Margin Blocks, Preamble Blocks and Postamble Blocks	65
12.4	Spacer Blocks	65
13	Format of a track	65
13.1	Track capacity	65
13.2	Positioning accuracy	65
13.3	Tracking scheme	65
14	Group Formats	68
14.1	Group Format 0	68
14.2	Group Format 1	68
14.3	Extended Gap Frames	69
14.3.1	Extended Leading Gap Frames	69
14.3.2	Extended Trailing Gap Frames	69
14.4	Types of Groups	69
14.4.1	Normal Groups	70
14.4.2	Spare Groups	70
14.4.3	Amble Groups	70
14.4.4	Header Groups	70
15	Magnetic tape layout	71
15.1	Load/Unload Area	71
15.2	Lead-in Area	72
15.2.1	Preamble	72
15.2.2	Header	72
15.2.3	Format Parameter Set	74
15.2.4	Master Reference	79
15.2.5	Postamble	84
15.3	Partition	85
15.3.1	Partition Preamble	85
15.3.2	Partition Reference	85
15.3.3	Partition Postamble	96
15.3.4	Partition Data	96
15.3.5	End of Partition (EOP)	96
15.3.6	Unused Area	97
15.4	EOI	97
15.5	Repeated Groups	97
15.6	Repeated Frames within a Normal Group	97
15.7	Relocation of Defective Groups	98
15.8	Appending	98
15.8.1	Seamless appending	98
15.8.2	Non-seamless appending	100
15.9	Overwrite	101

15.9.1	Overlapped track width	102
15.9.2	Non-overlapped track width	102
15.9.3	Rules for overwrite	102

Annexes

A	Measurement of the light transmittance of the prisms	103
B	Recognition holes	105
C	Means for opening the lid	106
D	Measurement of light transmittance of tape and leaders	107
E	Measurement of Signal-to-Noise Ratio	110
F	Method for determining the nominal and the maximum allowable recorded levels	111
G	Representation of 8-bit bytes by 10-bit pattern	112
H	Measurement of bit shift	118
J	Recommendations for transportation	121
K	Method of measuring track edge linearity	122
L	Read-After-Write	123
M	Data allocation and C3 parity	124

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 12248 was prepared by the European Computer Manufacturers Association (ECMA) (as Standard ECMA-171) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Annexes A, D, E, F, G, H, K and M form an integral part of this International Standard. Annexes B, C, J and L are for information only.

Introduction

ISO/IEC have produced a series of International Standards for cassettes and cartridges containing magnetic tapes of different width and characteristics. Of these, the following relate to helical scan recording.

ISO/IEC 10777:1991, *3,81 mm wide magnetic tape cartridge for information interchange - Helical scan recording - DDS format*

ISO/IEC 11319:1993, *8 mm wide magnetic tape cartridge for information interchange - Helical scan recording*

ISO/IEC 11321:1992, *3,81 mm wide magnetic tape cartridge for information interchange - Helical scan Recording - DATA/DAT format*

ISO/IEC 11557:1992, *3,81 mm wide magnetic tape cartridge for information interchange - Helical scan recording - DDS-DC format using 60 m and 90 m length tapes, 2nd edition*

ISO/IEC 12246:1993, *8 mm wide magnetic tape cartridge, dual azimuth format for information interchange - Helical scan recording*

ISO/IEC 12247:1993, *3,81 mm wide magnetic tape cartridge for information interchange - Helical scan recording - DDS format using 60 m and 90 m length tapes*

Information technology - 3,81 mm wide magnetic tape cartridge for information interchange - Helical scan recording - DATA/DAT-DC format using 60 m and 90 m length tapes

Section 1 - General

1 Scope

This International Standard specifies the physical and magnetic characteristics of a 3,81 mm wide magnetic tape cartridge to enable interchangeability of such cartridges. It also specifies the quality of the recorded signals, the recorded format and the recording method, thereby allowing data interchange between drives by means of such magnetic tape cartridges. The format used is known as DATA/DAT-DC.

This International Standard specifies two types of cartridges which, for the purpose of this International Standard, are referred to as Type A and Type B.

For Type A, the magnetic tape has a nominal thickness of 13 μm and a nominal length of up to 60,5 m.

For Type B, the magnetic tape has a nominal thickness of 9 μm and a length of up to 92,0 m.

Information interchange between systems by means of this International Standard also requires the use, at a minimum, of a labelling and file structure and an interchange code which are agreed upon by the interchange parties. It is not within the scope of this International Standard to specify the labelling and file structure, or the interchange code.

2 Conformance

2.1 Magnetic tape cartridge

A tape cartridge shall be in conformance with this International Standard if it meets all mandatory requirements specified herein for either Type A or Type B. The tape requirements shall be satisfied throughout the extent of the tape.

2.2 Generating system

A system generating a magnetic tape cartridge for interchange shall be entitled to claim conformance to this International Standard if all recordings on the tape meet the mandatory requirements of this International Standard. A claim of conformance shall state whether cartridges of Type A or Type B or both are supported.

2.3 Receiving system

A system receiving a magnetic tape cartridge for interchange shall be entitled to claim conformance with this International Standard if it is able to handle any recording made on the tape according to this International Standard. A claim of conformance shall state whether cartridges of Type A or Type B or both are supported.

3 Normative references

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

ISO/R 527:1966, *Plastics - Determination of tensile properties*.

ISO/IEC 646:1991, *Information technology - ISO 7-bit coded character set for information interchange*.

ISO 1302:1992, *Technical drawings - Method of indicating surface texture*.

ISO/IEC 11576:1993, *Information technology - Procedure for the registration of algorithms for the lossless compression of data.*

IEC 950:1991, *Safety of information technology equipment, including electrical business equipment*

4 Definitions

For the purposes of this International Standard, the following definitions apply.

- 4.1 Absolute Frame Number (AFN):** A sequence number allocated to, and recorded in, each frame.
- 4.2 algorithm:** A set of rules for transforming the logical representation of data.
- 4.3 Area ID:** An identifier for each area of the tape specifying the types of frame written therein.
- 4.4 Automatic Track Finding (ATF):** A method by which tracking is achieved.
- 4.5 Average Signal Amplitude:** The average peak-to-peak value of the output signal from the read head at the fundamental frequency of the specified physical recording density, over a minimum of 7,8 mm of track, exclusive of missing pulses.
- 4.6 azimuth:** The angular deviation, in degrees, minutes and seconds of arc, made by the mean flux transition line with the line normal to the centreline of the recorded track.
- 4.7 back surface:** The surface of the tape opposite to the magnetic coating which is used to record data.
- 4.8 byte:** An ordered set of bits acted upon as a unit.
- 4.9 cartridge:** A case containing magnetic tape stored on twin hubs.
- 4.10 Channel Bit:** A bit after 8-to-10 transformation.
- 4.11 Codeword:** A word which is generated by a processing algorithm. The number of bits in a Codeword is variable, and is not specified in this International Standard.
- 4.12 Data Format ID:** An identifier specifying which data format is being used on the tape.
- 4.13 End of Data (EOD):** The point where the host stopped writing data on the tape.
- 4.14 End of Information (EOI):** A group which indicates the end of partition area in a tape.
- 4.15 End of Partition (EOP):** A group which indicates the end of data area in a partition.
- 4.16 entity:** A unit of recorded data, comprising a processed record sequence resulting from the application of a common processing algorithm.
- 4.17 Error Correcting Code (ECC):** A mathematical algorithm yielding check bytes used for the detection and correction of errors.
- 4.18 flux transition position:** That point which exhibits maximum free-space flux density normal to the tape surface.
- 4.19 flux transition spacing:** The distance along a track between successive flux transitions.
- 4.20 frame:** A pair of adjacent tracks with azimuth of opposite polarity, in which the track with the positive azimuth precedes that with the negative azimuth.
- 4.21 group:** A number of frames constituting a recorded unit.
- 4.22 Logical Beginning of Tape (LBOT):** The point along the length of the tape where the recording of data for interchange commences.
- 4.23 Logical End of Tape (LEOT):** A point along the length of the tape which indicates the approach, in the direction of tape motion, of the partition boundary or physical end of tape.

4.24 magnetic tape: A tape which will accept and retain magnetic signals intended for input, output, and storage purposes on computers and associated equipment.

4.25 master reference: The area which contains partition information in the tape.

4.26 Master Standard Amplitude Calibration Tape: A pre-recorded tape on which the standard signal amplitudes have been recorded in the tracks of positive azimuth, 23,0 µm wide, at nominal track pitch, on an AC-erased tape.

NOTE 1 - The tape includes recordings made at 83,4 ftpmm, 333,6 ftpmm, 500,4 ftpmm, 1001 ftpmm and 1501 ftpmm.

NOTE 2 - The Master Standard Amplitude Calibration Tape has been established by the Sony Corporation.

4.27 Master Standard Reference Tape: A tape selected as the standard for Reference Recording Field, Signal Amplitude, Resolution Overwrite and Signal-to-Noise Ratio.

NOTE 3 - The Master Standard Reference Tape has been established by the Sony Corporation.

4.28 Optimum Recording Field: In the plot of Average Signal Amplitude against the recording field at the physical recording density of 3002 ftpmm, the field that causes the maximum Average Signal Amplitude.

4.29 partition: Partition of a tape in which user data is recorded.

4.30 partition reference: The area which contains group information in the partition.

4.31 Physical Beginning of Tape (PBOT): The point where the leader tape is joined to the magnetic tape.

4.32 Physical End of Tape (PEOT): The point where the trailer tape is joined to the magnetic tape.

4.33 physical recording density: The number of flux transitions per unit length of track, expressed in flux transitions per millimetre (ftpmm).

4.34 pre-recording condition (maximum recorded levels): The recording levels above which a tape intended for interchange shall not previously have been recorded.

4.35 processed record: A sequence of Codewords which result from the application of processing to data.

4.36 processed record sequence: A sequence of one or more processed records which start on an 8-bit boundary and end on a subsequent 8-bit boundary.

4.37 processing: The use of an algorithm to transform host data into Codewords.

4.38 record: Related data treated as a unit of information.

4.39 Reference Recording Field: The optimum recording field of the Master Standard Reference Tape.

4.40 Secondary Standard Amplitude Calibration Tape: A tape pre-recorded as defined for the Master Standard Amplitude Calibration Tape; the outputs of which are known and stated in relation to that of the Master Standard Amplitude Calibration Tape.

NOTE 4 - The Secondary Standard Amplitude Calibration Tape can be ordered from the Sony Corporation, Audio Device Business Department, Component Marketing Group 4-10-18, Takanawa, Minato-ku, Tokyo 108, Japan, under Part Number TY-7000 G until the year 2000. It is intended that these be used for calibrating tertiary tapes for use in routine calibration.

4.41 Secondary Standard Reference Tape: A tape the performance of which is known and stated in relation to that of the Master Standard Reference Tape.

NOTE 5 - A Secondary Standard Reference Tape can be ordered from the Sony Corporation, Audio Device Business Department, Component Marketing Group 4-10-18, Takanawa, Minato-ku, Tokyo 108, Japan, under Part Number RSD 1079 until the year 2000. It is intended that these be used for calibrating tertiary tapes for use in routine calibration.

4.42 Separator Mark: A record containing no user data, which is used to separate data.

4.43 Standard Reference Amplitude: The Average Signal Amplitude from the tracks of positive azimuth of the Master Standard Amplitude Calibration Tape at a specified physical recording density.

4.44 tape noise amplitude: The tape noise amplitude is the subtractive value of amplifier noise from total noise in rms.

4.45 Tape Reference Edge: The bottom edge of the tape when viewing the recording side of the tape with the PEOT of the tape to the observer's right.

4.46 track: A diagonally positioned area on the tape along which a series of magnetic signals may be recorded.

5 Environment and safety

Unless otherwise stated, the conditions specified below refer to ambient conditions in the air immediately surrounding the cartridge.

5.1 Testing environment

Unless otherwise stated, tests and measurements made on the tape cartridge to check the requirements of this International Standard shall be carried out under the following conditions:

temperature	: 23 °C ± 2 °C
relative humidity	: 40 % to 60 %
conditioning period before testing	: 24 h

5.2 Operating environment

Cartridges used for data interchange shall be capable of operating under the following conditions:

temperature	: 5 °C to 45 °C
relative humidity	: 20 % to 80 %
wet bulb temperature	: 26 °C max.

There shall be no deposit of moisture on or in the cartridge.

Conditioning before operating:

If a cartridge has been exposed during storage and/or transportation to a condition outside the above values, before use the cartridge shall be conditioned in the operating environment for a time at least equal to the period during which it has been out of the operating environment, up to a maximum of 24 h.

NOTE 6 - Rapid variations of temperature should be avoided.

5.3 Storage environment

For long term or archived storage of cartridges the following conditions shall be observed:

temperature	: 5 °C to 32 °C
relative humidity	: 20 % to 60 %
maximum wet bulb temperature	: 26 °C max.

The stray magnetic field at any point on the tape shall not exceed 4 000 A/m. There shall be no deposit of moisture on or in the cartridge.

5.4 Transportation

Recommended limits for the environment to which a cartridge may be subjected during transportation, and the precautions to be taken to minimize the possibility of damage, are provided in annex J.

5.5 Safety

The cartridge and its components shall satisfy the requirements of IEC 950.

5.6 Flammability

The cartridge and its components shall be made from material which, if ignited from a match flame, do not continue to burn in a still carbon dioxide atmosphere.

Section 2 - Requirements for the case

6 Dimensional and mechanical characteristics of the case

6.1 General

The case of the cartridge shall comprise:

- an upper half- a lower half,
- a slider movably mounted on the lower half,
- a lid pivotally mounted on the upper half.

In the drawings, using third angle projection, an embodiment of the cartridge is shown as an example.

- | | |
|---------------|--|
| Figure 1 | is a perspective view of the cartridge seen from the top. |
| Figure 2 | is a perspective view of the cartridge seen from the bottom. |
| Figure 3 | is a partial view of the rear side. |
| Figure 4 | is a schematic view showing the Reference Planes X, Y, and Z. |
| Figure 5 | shows the front side. |
| Figure 6 | shows the top side with the lid in closed position. |
| Figure 7 | shows the left side. |
| Figure 8 | shows the top side with the lid in open position. |
| Figure 9 | shows the left side with the lid in open position. |
| Figure 10 | shows the bottom side with the lid and the slide in closed position. |
| Figure 11 | shows the bottom side with the lid and the slider in open position. |
| Figure 12 | is a view from the top of the inside of the lower half with the upper half removed. |
| Figure 13 | is a view of the bottom half with the lid and the slider in open position. |
| Figure 14 | is a view of the left side with the lid and the slider in open position. |
| Figure 15 | is a top view of a hub. |
| Figure 16 | is a side view of a hub with partial cross section. |
| Figure 17 | is a partial cross-section through a hub and both halves of the case showing the interface with the drive spindle. |
| Figure 18 | shows at a larger scale the lid in the open position. |
| Figure 19, 20 | show at a larger scale the functional relationship between the lid and the locking mechanism of the hubs. |
| Figure 21, 22 | show the label areas on the top and the rear side. |

The dimensions are referred to three orthogonal Reference Planes X, Y, and Z (figure 4).

6.2 Overall dimensions (figures 6 and 7)

The overall dimensions of the case with the lid in the closed position shall be:

$$L_1 = 73,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_2 = 54,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_3 = 10,5 \text{ mm} \pm 0,2 \text{ mm}$$

The edges formed by the rear side and left and right sides shall be rounded off with a radius

$$R_1 = 1,5 \text{ mm max.}$$

The two edges of the lid shall be rounded off with a radius

$$R_2 = 0,5 \text{ mm max.}$$

6.3 Loading grip (figure 6)

The top side shall have a loading grip for loading and positioning the cartridge into the drive. The position and dimensions of the loading grip shall be

$$L_4 = 25,5 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_5 = 10 \text{ mm min.}$$

$$L_6 = 5,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_7 = 2,0 \text{ mm min.}$$

The depth of the loading grip below surface of the top side shall be

$$0,5 \text{ mm} \begin{matrix} + 0,2 \\ - 0,0 \end{matrix} \text{ mm}$$

6.4 Holding areas (figure 6)

The two areas shown shaded in figure 6 shall be the areas along which the cartridge shall be held down when inserted in the drive. Their positions and dimensions shall be

$$L_8 = 6,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_9 = 5,0 \text{ mm} \pm 0,1 \text{ mm}$$

6.5 Notches of the lid (figures 5 and 8)

The lid shall have two pairs of notches.

The first pair of notches, the slider lock release notches, allows elements of the drive to release the locking mechanism of the slider. The positions and dimensions of these notches shall be

$$L_{10} = 0,4 \text{ mm max.}$$

$$L_{11} = 3,0 \text{ mm min.}$$

$$L_{12} = 1,2 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{13} = 49,8 \text{ mm} \pm 0,2 \text{ mm}$$

The second pair of notches, the slider movement notches, allows elements of the drive to move the slider from closed to open position (see also 6.8.1). The positions and dimensions of these notches shall be

$$L_{11} = 3,0 \text{ mm min.}$$

$$L_{14} = 0,9 \text{ mm min.}$$

$$L_{15} = 7,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{16} = 36,00 \text{ mm} \pm 0,15 \text{ mm}$$

6.6 Lid dimensions (figures 6 to 8)

The lid is shown in closed position in figures 6 and 7. Its dimensions shall be

$$L_{17} = 1,2 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{18} = 6,8 \text{ mm} \pm 0,4 \text{ mm}$$

$$L_{19} = 1,1 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{20} = 2,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{21} = 6,4 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{22} = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$R_3 = 6,8 \text{ mm} \pm 0,4 \text{ mm}$$

The lid shall have a chamfer of 45° with a length of

$$L_{23} = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

There shall be a dimensional relationship between the height L_{24} shown in figure 7, which includes the slider and the upper half, and the height L_{25} of the lid. When a vertical force of 1 N is exerted on the upper half the following conditions shall be met

$$L_{24} = 10,5 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{25} \leq L_{24}$$

When no force is exerted

$$L_{24} = 10,9 \text{ mm max.}$$

In figure 8 the lid is shown in open position. The distance from the front edge of the lid to the rear side shall be

$$L_{26} = 55,5 \text{ mm} \pm 0,3 \text{ mm}$$

6.7 Optical detection of the beginning and end of tape (figures 9 and 12)

Means for the optical detection of the beginning and end of tape shall be provided. These shall consist of a pair of windows on the left and right sides of the case (see also figure 18). The design of these windows allows this detection for two different drive designs:

- either a light source and a detector are provided in the drive on each side of the cartridge, in which case the light enters the case through the upper windows, falls on a prism (see section A-A) mounted inside the case which reflects this light so that it goes through the tape and falls on the detector through the lower window; the light transmittance of the prism shall be greater than 50 % of that of a reference prism when measured as specified in annex A,
- or, the light of a light source within the drive passes through the tape from inside the cartridge and falls through the lower windows on to the detectors placed on each side of the case.

The positions and dimensions of these windows allow the cartridge to be used with drives implementing either system, they shall be

$$L_{27} = 6,20 \text{ mm} \pm 0,10 \text{ mm}$$

$$L_{28} = 7,65 \text{ mm} \pm 0,10 \text{ mm}$$

$$L_{29} = 1,50 \text{ mm} \begin{matrix} + 0,20 \\ - 0,00 \end{matrix} \text{ mm}$$

$$L_{30} = 3,9 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{31} = 1,8 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{32} = 7,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{33} = 2,5 \text{ mm min.}$$

Dimension L_{32} specifies the position of the rear edge of the windows relative to Reference Plane Y. Dimension L_{33} shall be measured relative to this rear edge.

6.8 Bottom side (figures 10 and 11)

The bottom side is shown in figure 10 with the lid and the slider in closed position and in figure 11 with both in the open position.

The dimension L_{34} of the bottom half, L_{35} of the slider and L_{36} of the lid shall satisfy the following conditions

$$L_{34} = 73,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{35} \leq L_{34}$$

$$L_{36} \leq L_{34}$$

6.8.1 Locking mechanism of the slider

The cartridge shall have a locking mechanism for the slider which locks it in the closed and open positions. The design of this mechanism is not specified by this International Standard, except for the different forces acting on the slider, and for its detent.

The slider shall be spring-loaded by a spring holding it in closed position when it is unlocked. The force required to operate the slider shall not exceed 2 N.

The slider shall have two grooves with an opening at both ends. The detent of the locking mechanism shall protrude through these openings so as to hold the slider in both open and closed positions. The detent shown in cross section C-C is only an example of implementation.

The grooves are parallel to Reference Plane Z and aligned with the slider lock release notches of the lid. The positions and dimensions of the grooves and of the openings for the detent of the locking mechanism when the slider is in the closed position shall be

$$L_{37} = 1,2 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{38} = 49,8 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{39} = 10,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{40} = 2,0 \text{ mm} \begin{matrix} + 0,5 \\ - 0,1 \end{matrix} \text{ mm}$$

$$L_{41} = 3,0 \text{ mm min.}$$

$$L_{42} = 1,5 \text{ mm min.}$$

$$L_{43} = 0,8 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{44} = 0,8 \text{ mm} \begin{matrix} + 0,5 \\ - 0,1 \end{matrix} \text{ mm}$$

$$\lambda = 45^\circ \text{ min.}$$

$$L_{45} = 0,65 \text{ mm} \pm 0,05 \text{ mm}$$

The position and dimensions of the openings for the detent when the slider is held in the open position are determined by L_{39} , L_{40} , L_{43} , and L_{44} .

In the closed position of the slider, the maximum force to be exerted on the detent in a direction perpendicular to Reference Plane Z and over a stroke of 0,65 mm shall be 0,5 N max.

In the open position of the slider the holding force shall be 0,3 N min.

6.8.2 Access holes

The slider shall have two circular access holes (see section B-B) which, in the open position of the slider, allow penetration of the drive spindles into the hubs. The diameters of these access holes shall be

$$d_1 = 10,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$d_2 = 12,0 \text{ mm max.}$$

6.8.3 Recognition, sub-datum and write-inhibit holes

The bottom half shall have a number of holes on an edge at its rear. This edge shall be defined by

$$L_{46} = 45,2 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{47} = 49,2 \text{ mm} \pm 0,2 \text{ mm}$$

The centres of these holes lie on a line perpendicular to Reference Plane Y at a distance from Reference Plane X of

$$L_{48} = 47,2 \pm 0,2 \text{ mm}$$

6.8.3.1 Recognition holes

There shall be four recognition holes numbered from 1 to 4 as shown in figure 10. Their position and dimensions shall be

$$d_3 = 2,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{49} = 1,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{50} = 56,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{51} = 4,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{52} = 1,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{53} = 3,0 \text{ mm min.}$$

All recognition holes shall have the cross-section shown in cross-section F-F in figure 11 for recognition hole No. 1

One of the two cross-sections F-F shows a recognition hole closed by means of a plug, the other shows it with the plug punched out. These plugs shall withstand an applied force of 0,5 N max. without being punched out.

This International Standard prescribes the following states of these holes:

Recognition holes No. 1 and No. 3 shall be closed

Recognition hole No. 2 shall be closed for Type A cartridges

Recognition hole No. 2 shall be open for Type B cartridges

Recognition hole No. 4 may be open or closed

Other combinations of the recognition holes 1, 2, and 3 are reserved for future applications (see annex B).

6.8.3.2 Write-inhibit hole

The position and dimensions of the write-inhibit hole shall be

$$d_4 = 2,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{50} = 56,0 \text{ mm} \pm 0,3 \text{ mm}$$

When the write-inhibit hole is open, recording on the tape is inhibited, when it is closed recording is enabled.

The write-inhibit hole shall have the cross-section shown in cross-section F-F in figure 11 for recognition hole No. 1. One of the two cross-sections F-F shows the hole closed by means of a plug, the other shows it with the hole punched out. These plugs shall withstand an applied force of 0,5 N max without being punched out.

The case may have a movable element allowing to open and close the write-inhibit hole. If present, this element shall be such that the state of write-inhibit hole is visible (see figure 3 as an example). Such an element shall be neither broken nor moved by a force smaller than 0,5 N.

Regardless of whether a plug or a movable element is used to select the open and closed states of the write-inhibit hole, the following dimensions from cross-section F-F shall define the closed and open states, respectively.

$$L_{52} = 1,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{53} = 3,0 \text{ mm min.}$$

6.8.3.3 Sub-datum holes

These holes are used to position the cartridge in the drive. Their position and dimensions shall be as follows:

- The hole seen below the write-inhibit hole in figure 11 shall have an elongated form and the same cross-section E-E as shown for the other hole.

$$L_{54} = 45,5 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{55} = 3,5 \text{ mm} \begin{matrix} + 0,1 \\ - 0,0 \end{matrix} \text{ mm}$$

$$L_{56} = 2,50 \text{ mm} \begin{matrix} + 0,05 \\ - 0,00 \end{matrix} \text{ mm}$$

- The position and dimensions of the other sub-datum hole shall be

$$d_5 = 2,50 \text{ mm} \begin{matrix} + 0,05 \\ - 0,00 \end{matrix} \text{ mm}$$

$$d_6 = 1,0 \text{ mm min.}$$

$$L_{57} = 5,5 \text{ mm} \pm 0,1 \text{ mm.}$$

$$L_{58} = 2,0 \text{ mm min.}$$

$$L_{59} = 1,2 \text{ mm min.}$$

The edge of both sub-datum holes shall have a chamfer of

$$0,2 \text{ mm} \pm 0,1 \text{ mm.}$$

6.8.4 Datum holes

The lower half has two datum holes also used to position the cartridge within the drive. One of them has an elongated form, the other is circular. Cross-section AD-D shown for the latter also applies to the former. Their position and dimensions shall be

$$L_{60} = 51,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{61} = 2,80 \text{ mm} \begin{matrix} + 0,05 \\ - 0,00 \end{matrix} \text{ mm}$$

$$L_{62} = 3,5 \text{ mm} \begin{matrix} + 0,1 \\ - 0,0 \end{matrix} \text{ mm}$$

$$L_{63} = 3,0 \text{ mm min.}$$

$$d_7 = 2,80 \text{ mm} \begin{matrix} + 0,05 \\ - 0,00 \end{matrix} \text{ mm}$$

The upper edge of both datum holes shall have a chamfer of $0,2 \text{ mm} \pm 0,1 \text{ mm}$.

6.8.5 Access room for tape guides

When the cartridge is inserted into the drive, tape guides in the drive are pulling out the tape toward the heads of the drive. The shape and dimensions of the access room provided by the cartridge for these tape guides shall be (see also 6.8.7.5):

$$L_{64} = 3,1 \text{ mm max.}$$

$$L_{65} = 5,6 \text{ mm min.}$$

$$L_{66} = 11,0 \text{ mm max.}$$

$$L_{67} = 7,0 \text{ mm} \begin{matrix} + 0,7 \\ - 0,0 \end{matrix} \text{ mm}$$

$$L_{68} = 6,7 \text{ mm min.}$$

$$\alpha = 45^\circ \pm 1^\circ$$

$$L_{69} = 47,9 \text{ mm min.}$$

$$L_{70} = 3,30 \text{ mm} \begin{matrix} + 0,00 \\ - 0,15 \end{matrix} \text{ mm}$$

6.8.6 Holes for accessing the hubs

The lower half has two holes through which the spindles of the drive can access the hubs when the slider is in the open position. The positions and dimensions of these holes shall be

$$d_8 = 9,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{71} = 29,00 \text{ mm} \pm 0,15 \text{ mm}$$

$$L_{72} = 10,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{73} = 30,0 \text{ mm} \pm 0,1 \text{ mm}$$

6.8.7 Internal structure of the lower half (figure 12)

In figure 12 the different elements of the inside of the lower half are shown. There shall be a locking mechanism for the hubs to prevent them from rotating when the lid is in the closed position. The design of this locking mechanism is not specified by this International Standard, thus it is not shown in figure 12. Locking and unlocking of the hubs shall depend upon the position of the lid as specified in 6.13.

6.8.7.1 Diameter of the wound tape

The diameter of the tape wound on a hub shall be

$$d_9 = 36,5 \text{ mm max.}$$

6.8.7.2 Tape wind

The magnetic surface of the tape shall face outwards.

6.8.7.3 Tape motion

The forward direction of tape motion is from the left side of the cartridge to its right side (see figures 1 and 2).

6.8.7.4 Guide posts

The tape shall pass around two guide posts in the cartridge, the axes of which are perpendicular to Reference Plane Z and passes through the centres of the datum holes. The position and dimensions of these guide posts shall be:

- their positions are determined by that of the centres of the datum holes,
- their cross-section shall be circular with a radius

$$R_4 = 3,0 \text{ mm} \pm 0,1 \text{ mm}$$

over an angle of 180° in clockwise sense starting at angle

$$\rho = 45^\circ \pm 1^\circ$$

- their cross-section over the other half of 180° is not specified by this International Standard.

6.8.7.5 Position of the tape in the case (view A)

When the tape runs from one guide post to the other it shall remain between two planes parallel to Reference Plane Z. The distance of these planes to Reference Plane Z shall be

$$L_{74} = 1,4 \text{ mm min.}$$

$$L_{75} = 6,4 \text{ mm max.}$$

The design centre for the position of the tape centreline is

$$L_{76} = 3,9 \text{ mm}$$

The height of the access room specified in 6.8.5 for the tape guides shall be

$$L_{77} = 8,0 \text{ mm} \begin{matrix} + 0,6 \\ - 0,0 \end{matrix} \text{ mm}$$

6.8.7.6 Tape path zone

When the cartridge is inserted into the drive, the tape is pulled outside the case by tape guides as mentioned above. It is then no longer in contact with the guide posts. The tape path zone of the case is the zone in which the tape must be able to move freely. This zone is defined by

$$L_{78} = 5,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{79} = 56,5 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{80} = 8,0 \text{ mm} \pm 0,2 \text{ mm}$$

6.8.8 Light path (figure 12)

As specified in 6.7 there is a lower window in the right and left sides of the case through which light having passed through the tape can pass and fall on a detector of the drive. In order to ensure that the corresponding light path is not obstructed by inner elements of the case, its configuration in this zone shall be as follows:

The position and dimension of the lower window are specified by L_{30} and L_{31} (see figure 9). The dimensions

$$L_{81} = 1,5 \text{ mm max.}$$

$$L_{82} = 5,0 \text{ mm min.}$$

ensure that no elements of the case obstruct the light path.

6.8.9 Support areas (figure 13)

When the cartridge is inserted into the drive and held in position by forces perpendicular to Reference Plane Z acting on the holding areas (see 6.4), it shall be supported by three supporting areas A', B' C' on its bottom side, shown shaded in figure 13. The position and dimensions of these areas shall be as follows:

- Areas A' and B' are not specified by this International Standard because they depend on parts of the lower half for which this International Standard does not specify requirements.

- Area C' shall be defined by

$$L_{83} = 1,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{84} = 49,0 \text{ mm} \pm 0,3 \text{ mm}$$

6.8.10 Datum areas (figure 13)

There shall be two annular datum surfaces A and B and one circular such surface C. All three datum areas shall lie in Reference Plane Z. Their position and dimensions shall be:

- Datum area A shall be centred on the intersection of Reference Planes X, Y, and Z, its inner diameter shall be d_7 (see 6.8.4 and figure 11), its outer diameter shall be

$$d_{10} = 5,0 \text{ mm} \pm 0,1 \text{ mm}$$

- Datum area B shall be centred on the intersection of Reference Planes X and Z at a distance L_{60} (see 6.8.4 and figure 11) from the centre of datum area A. Its inner dimensions shall be L_{61} and L_{62} , its outer diameter shall be d_{10} .

- Datum area C shall be centred on a point defined by

$$L_{85} = 42,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{86} = 25,5 \text{ mm} \pm 0,3 \text{ mm}$$

Its diameter shall be d_{10} .

6.8.11 Relationship between support and datum areas and Reference Plane Z (figure 14)

Support area A' shall be coplanar with datum area A within 0,1 mm.

Support area B' shall be coplanar with datum area B within 0,1 mm.

Support area C' shall be parallel to Reference Plane Z within 0,1 mm. It shall be at a distance

$$L_{87} = 1,10 \text{ mm} \pm 0,05 \text{ mm}$$

from Reference Plane Z.

6.9 Hubs (figures 15, 16)

The dimensions of the hub shall be

$$d_{11} = 6,60 \text{ mm} \begin{matrix} + 0,08 \\ - 0,00 \end{matrix} \text{ mm}$$

$$d_{12} = 8,8 \text{ mm} \begin{matrix} + 0,0 \\ - 0,1 \end{matrix} \text{ mm}$$

$$d_{13} = 15,00 \text{ mm} \pm 0,05 \text{ mm}$$

$$\beta = 60^\circ \pm 1^\circ$$

$$\gamma = 45^\circ \pm 1^\circ$$

$$L_{88} = 2,5 \text{ mm} \begin{matrix} + 0,1 \\ - 0,0 \end{matrix} \text{ mm}$$

$$L_{89} = 2,60 \text{ mm} \begin{matrix} + 0,20 \\ - 0,00 \end{matrix} \text{ mm}$$

The two cylindrical surfaces with diameters d_{11} and d_{13} shall be co-axial within 0,05 mm.

The torque necessary to rotate the hub with a partially or fully wound tape shall be 0,0002 N·m max.

6.10 Leader and trailer attachment

The material of the leader and trailer and their attachment to the hubs and to the tape shall be such that when subjected to a force of 5 N max. they will neither break nor be detached from the hubs or the tape.

6.11 Interface between the hubs and the drive spindles (figure 17)

The interface between the hubs and the spindles shown in figure 17 in cross-section is specified in terms of the following relationships:

$$d_{15} - d_{14} = \begin{matrix} 1,2 \text{ mm max.} \\ 1,0 \text{ mm min.} \end{matrix}$$

$$L_{91} - L_{90} = 1,3 \text{ mm max.}$$

NOTE 7 - It is expected that the top of the drive spindle will not penetrate within the hub beyond a distance $L_d = 7,65 \text{ mm max}$ above Reference Plane Z.

6.12 Opening of the lid (figure 18)

When the lid is opened its lower front edge moves along an arc of a circle with radius

$$R_5 = 9,6 \text{ mm} \pm 0,2 \text{ mm}$$

The centre of rotation is defined by L_{17} and L_{21} . The end position of the lid, i.e. when it is fully open, is defined by

$$L_{92} = 10,9 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{93} = 0,3 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{94} = 6,3 \text{ mm} \pm 0,2 \text{ mm}$$

The force F required to open the lid shall not exceed 1,2 N. It shall be applied at a distance

$$L_{95} = 5,0 \text{ mm} \pm 0,1 \text{ mm}$$

measured parallel to Reference Plane Z from centre of rotation of radius R_5 (see also annex C).

6.13 Release of the hub locking mechanism (figures 19, 20)

As mentioned in 6.8.7 the design of the locking mechanism for the hubs is not specified by this International Standard, except that it shall be connected to the lid so that the hubs are locked or unlocked as a function of the angular position of the lid.

When the lid rotates from the closed to the open position (clockwise as seen in figures 19, 20) the hubs shall remain locked as long as the lid has not reached the position defined by

$$L_{96} = 7,0 \text{ mm}$$

$$L_{97} = 7,5 \text{ mm} \pm 0,2 \text{ mm}$$

The hubs shall be completely released as soon as the lid has reached the position defined by

$$L_{98} = 10,3 \text{ mm}$$

$$L_{99} = 6,6 \text{ mm} \pm 0,2 \text{ mm}$$

6.14 Label areas (figures 21, 22)

On top and rear sides of the case there shall be an area on which adhesive labels can be placed. The dimensions of these areas shall be

$$L_{100} = 28,9 \text{ mm max.}$$

$$L_{101} = 5,2 \text{ mm min.}$$

$$L_{102} = 43,4 \text{ mm max.}$$

$$L_{103} = 39,4 \text{ mm max.}$$

$$L_{104} = 8,8 \text{ mm max.}$$

$$R_6 = 0,5 \text{ mm min.}$$

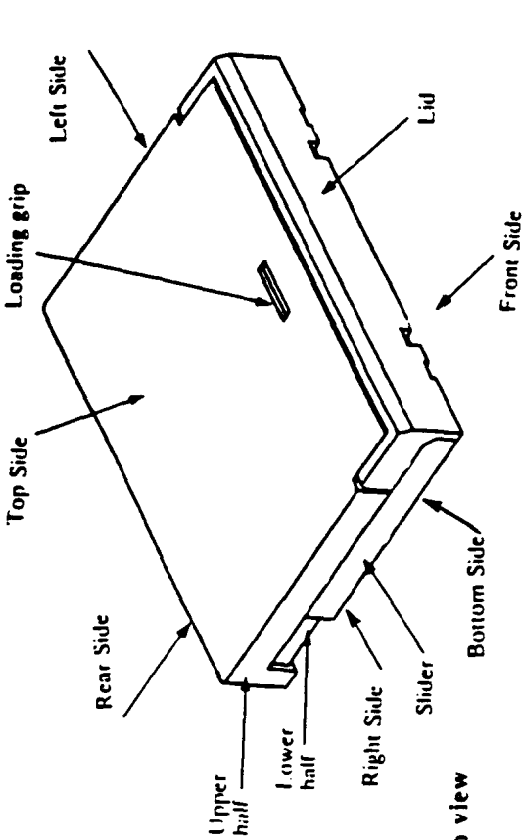


Figure 1 - Top view

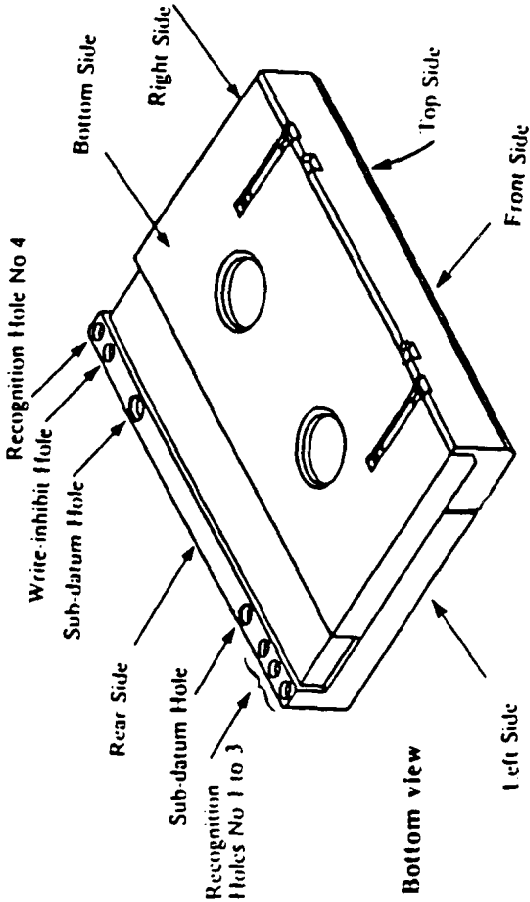


Figure 2 - Bottom view

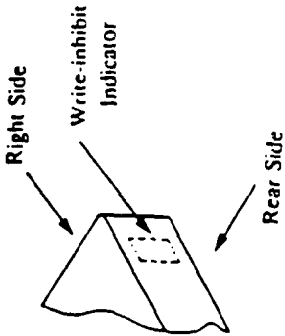


Figure 3 - Partial view of the rear side

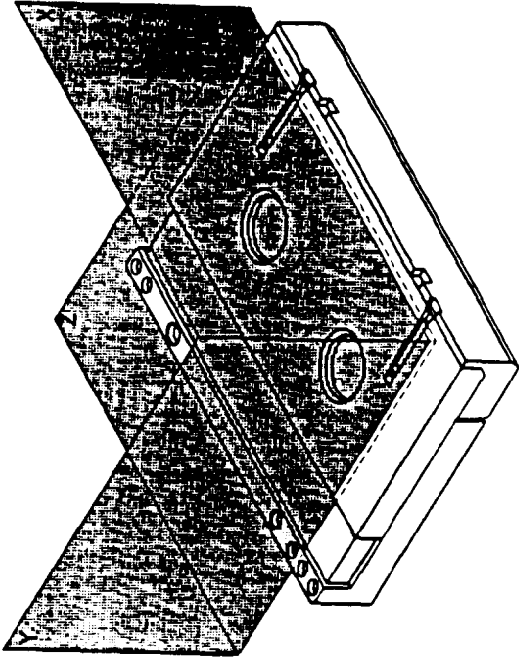


Figure 4 - Reference Planes X, Y, Z

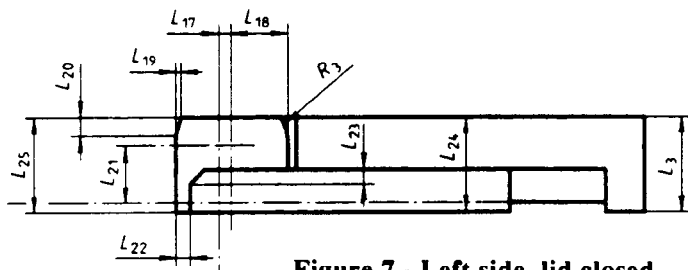


Figure 7 - Left side, lid closed

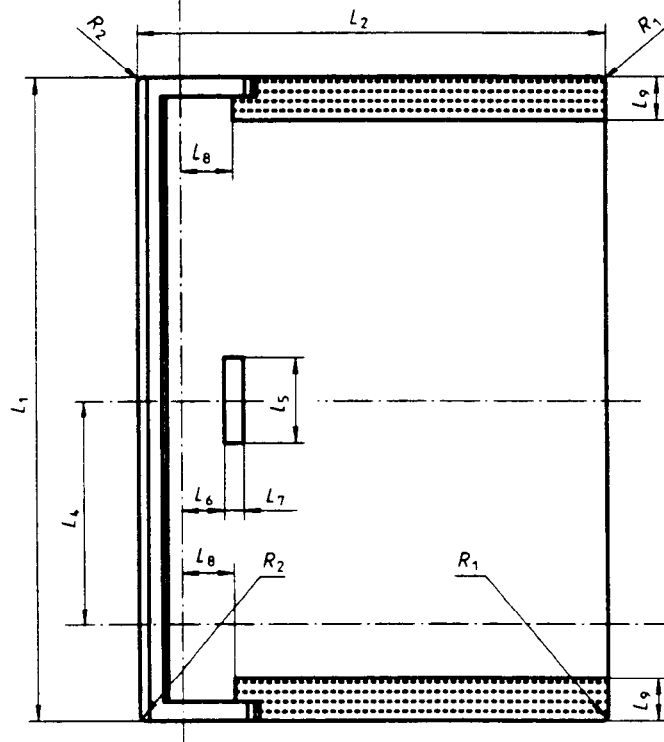


Figure 6 - Top side, lid closed

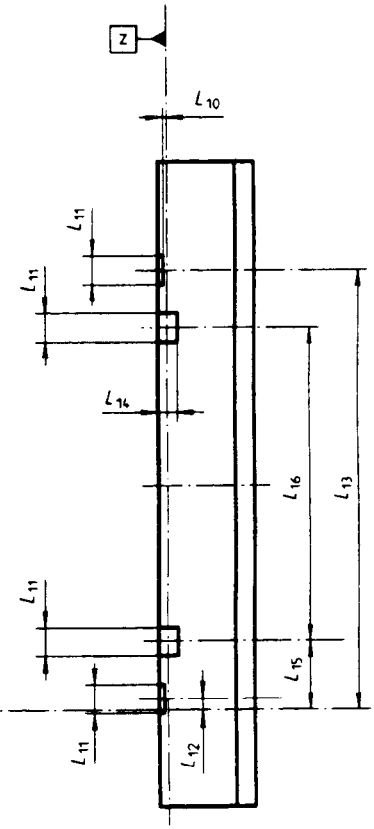


Figure 5 - Front side, lid closed

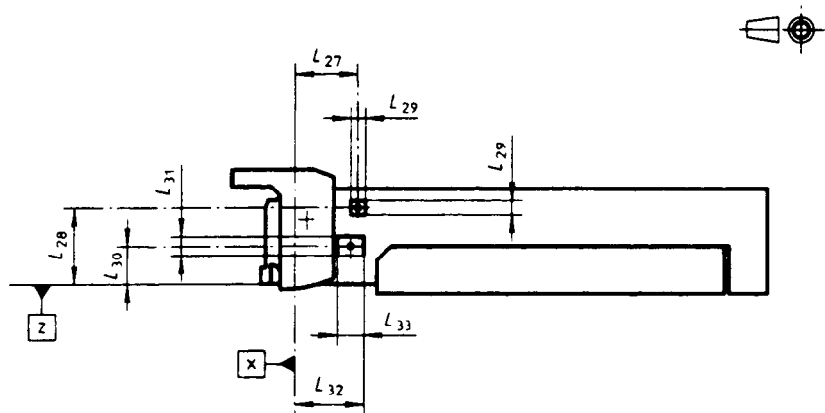


Figure 9 - Left side, lid open

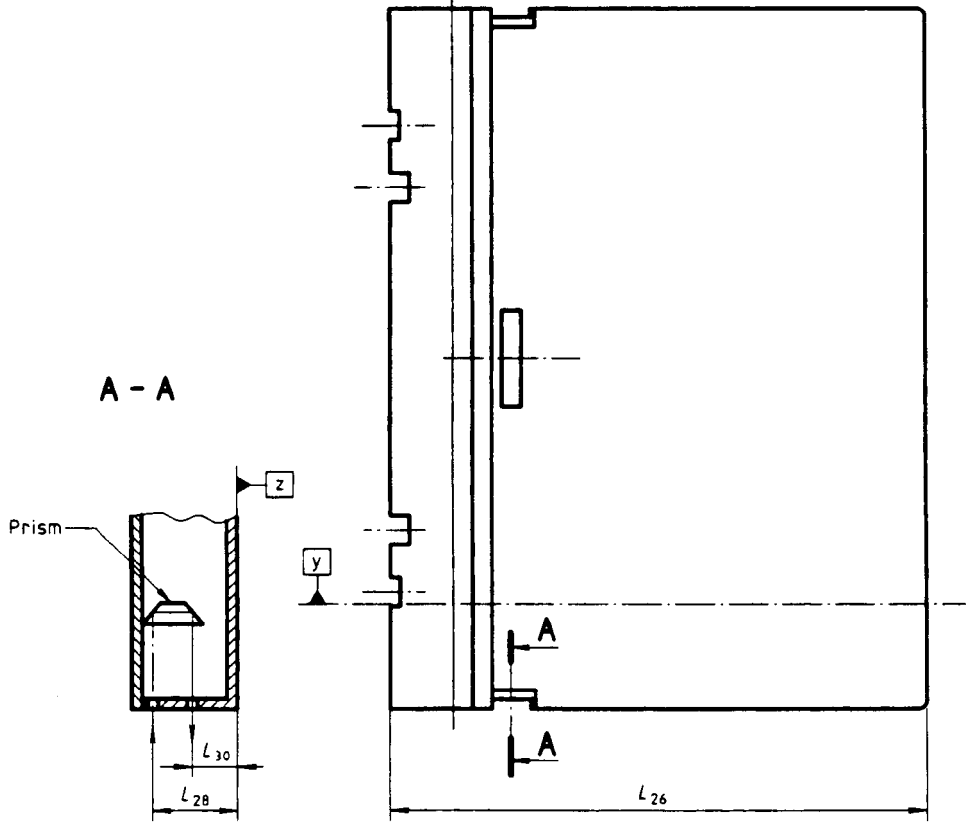


Figure 8 - Top side, lid open

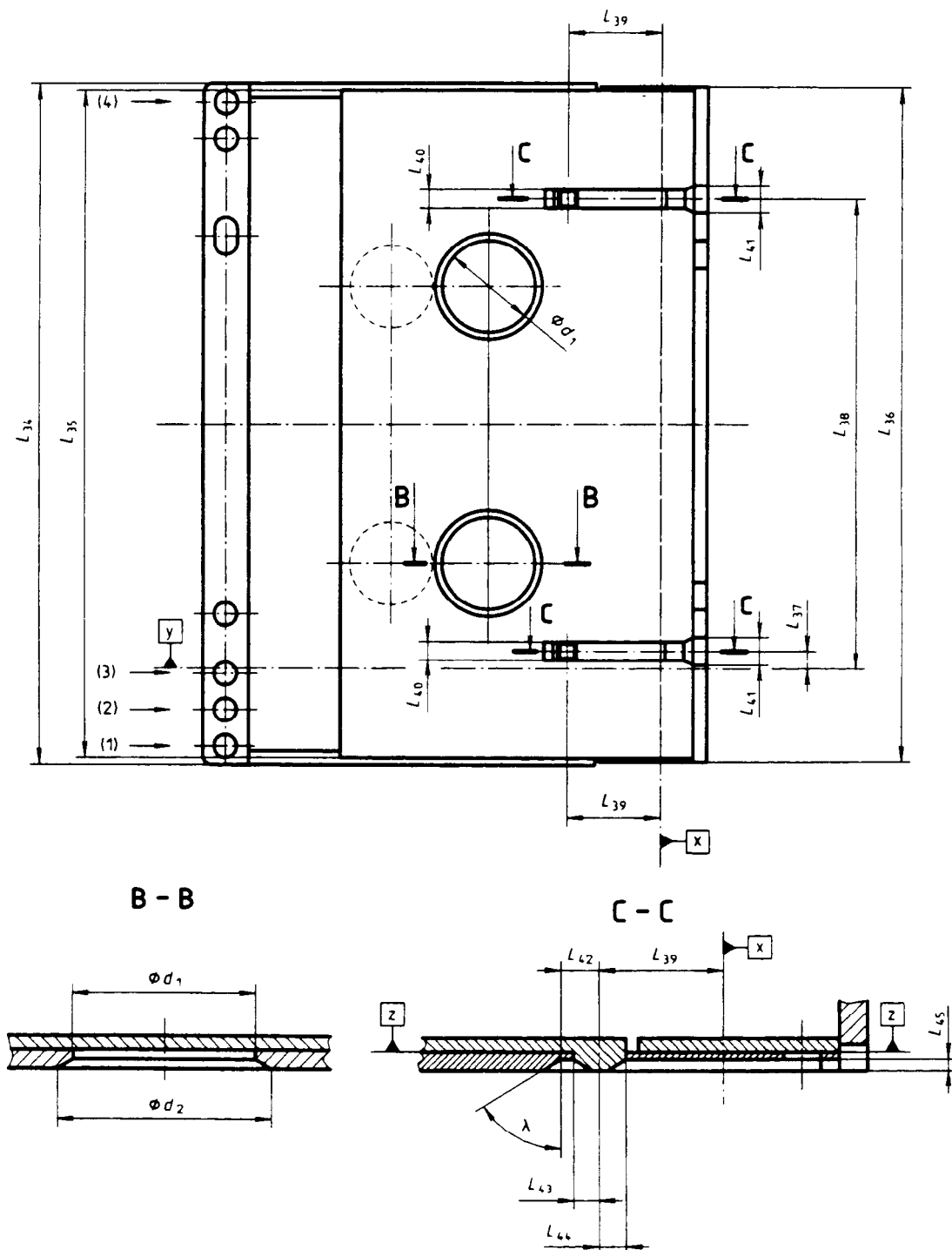


Figure 10 - Bottom side, lid closed

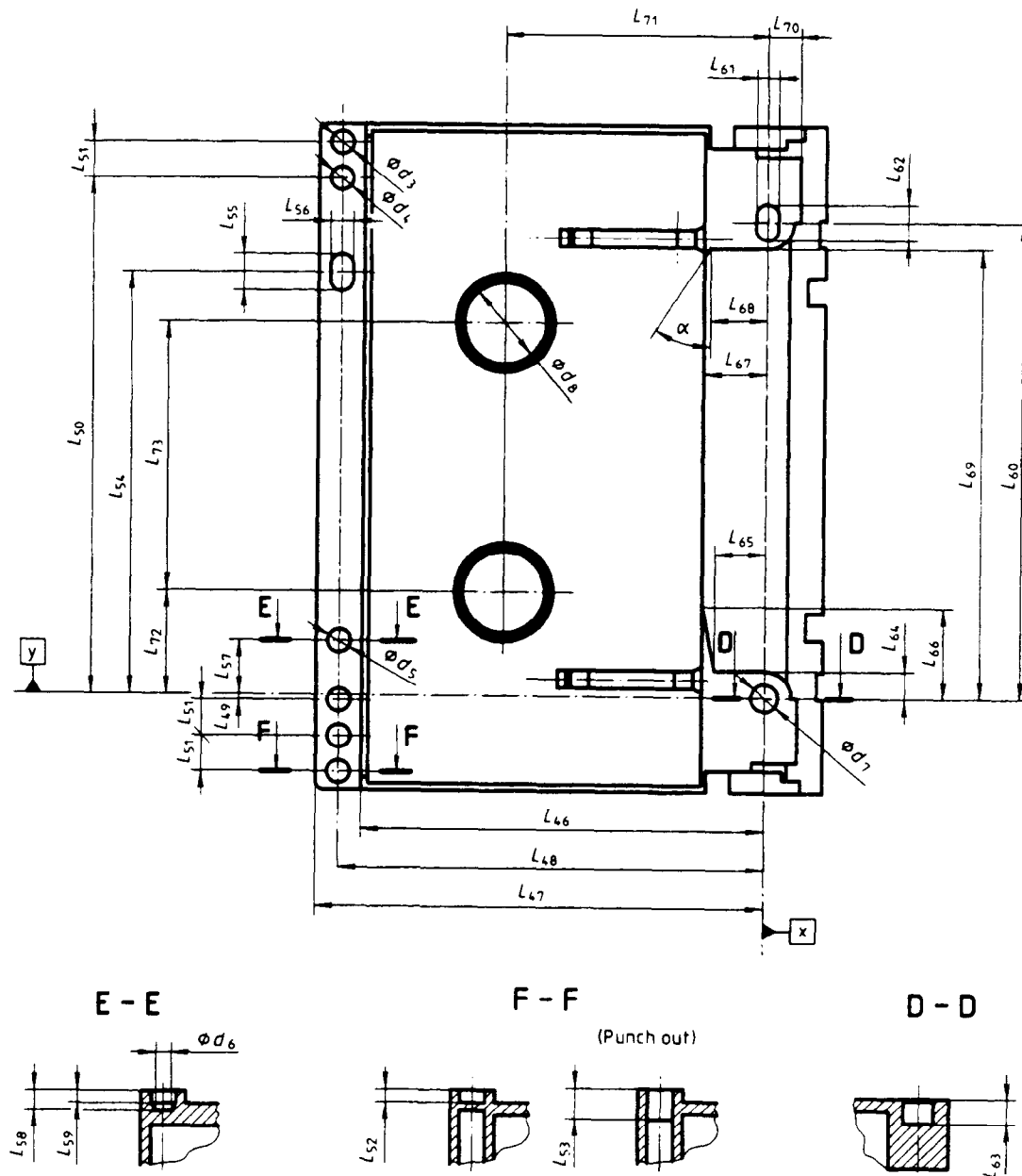
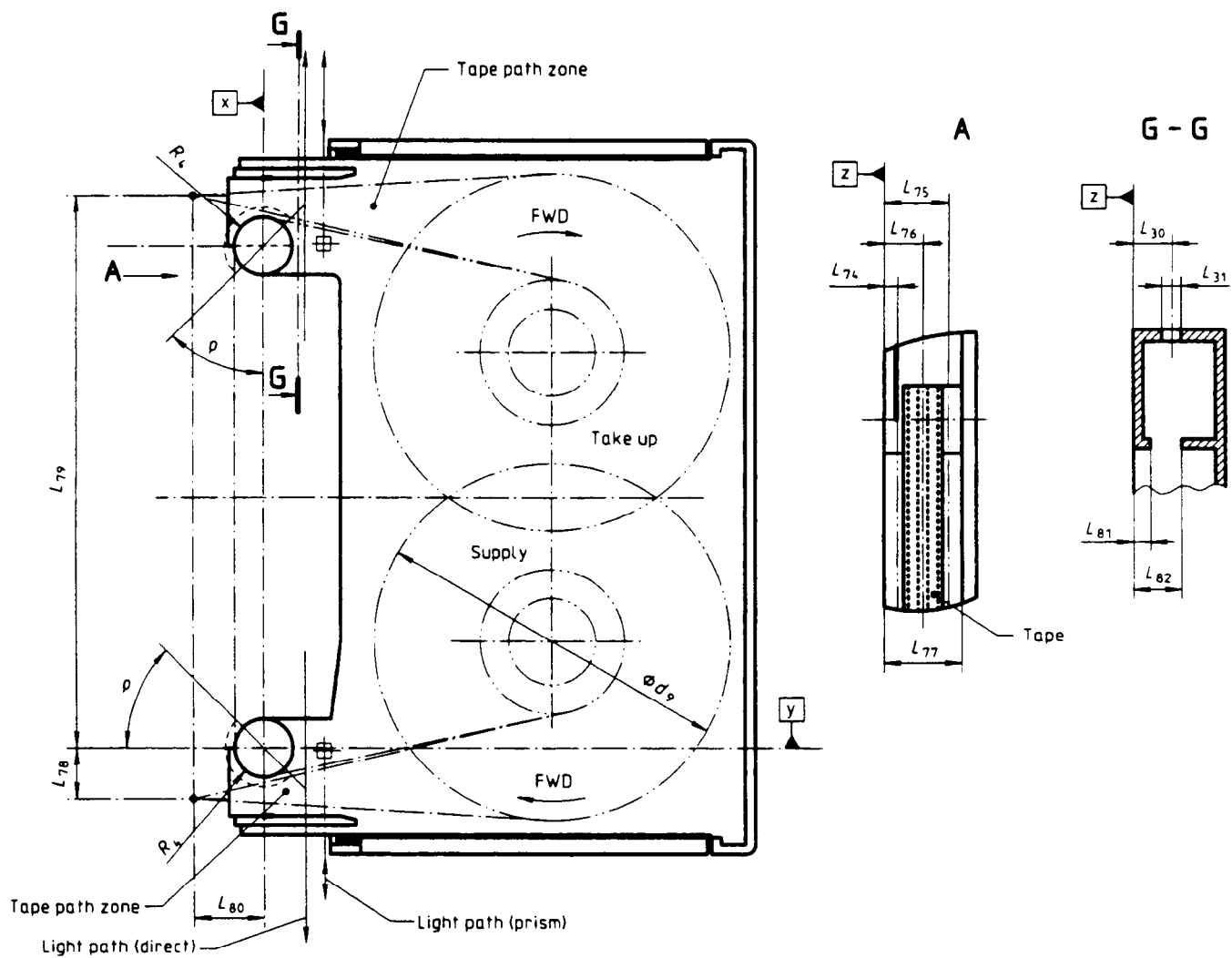


Figure 11 - Bottom side, lid open



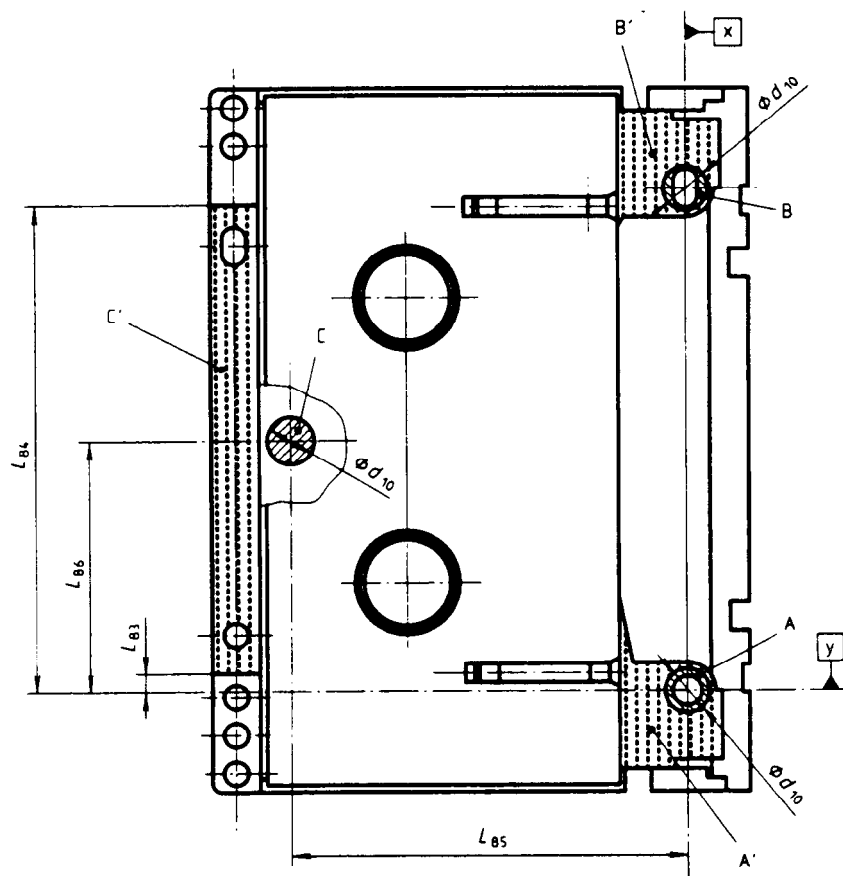


Figure 13 - Bottom side, lid and slider in open position

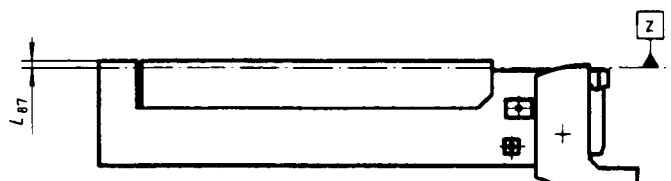


Figure 14 - Left side, lid open

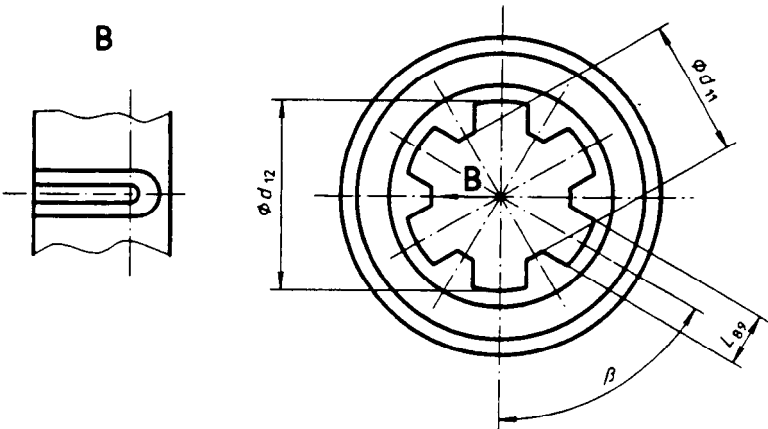


Figure 15 - Top view of a hub

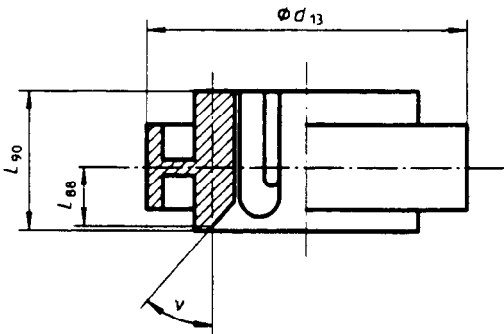


Figure 16 - Side view of a hub

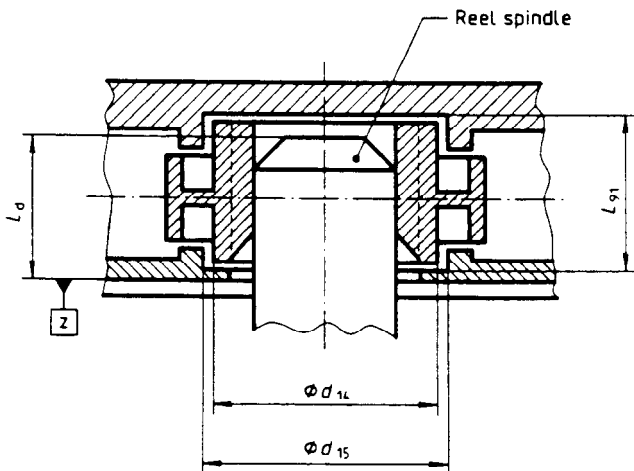


Figure 17 - Interface with the drive spindle

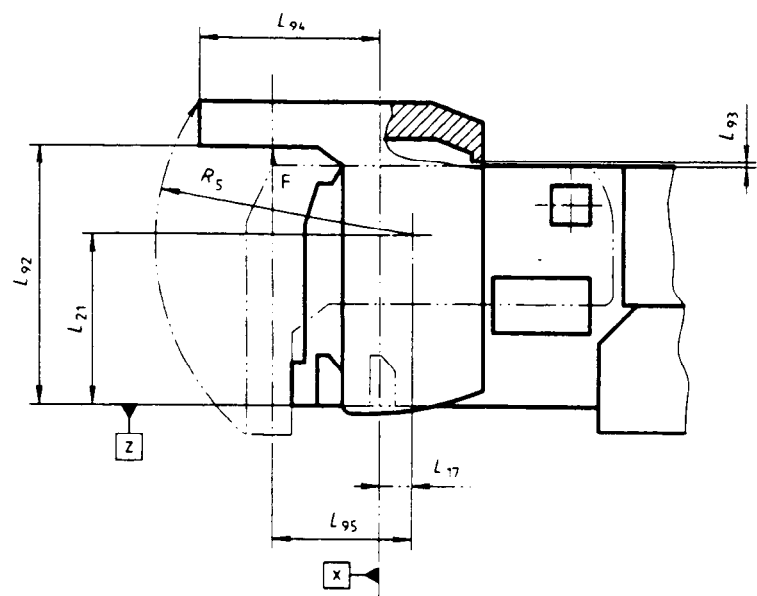


Figure 18 - Lid in completely open position

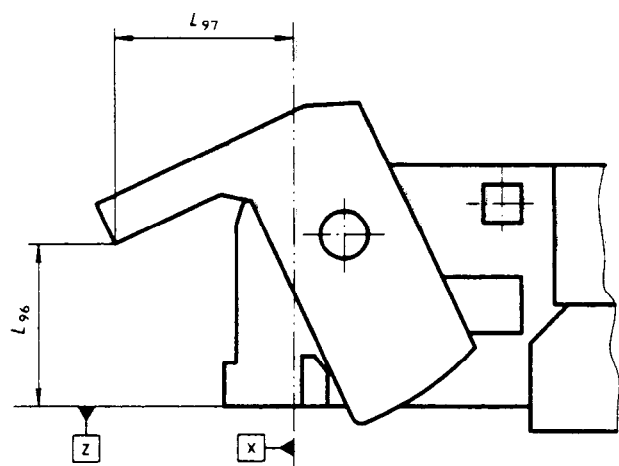


Figure 19 - Extreme position of the lid for which the hubs are still locked

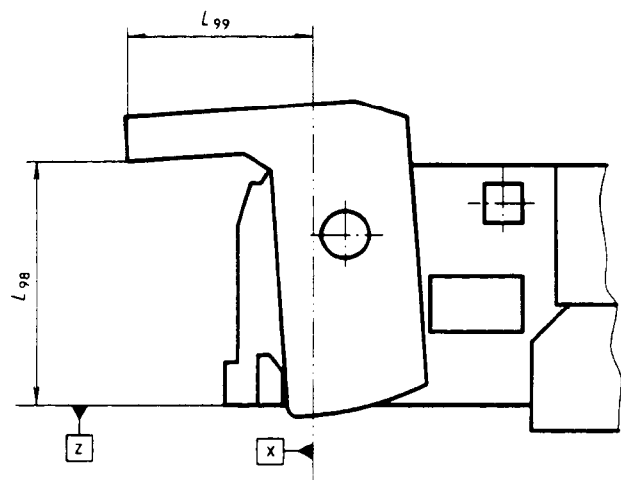


Figure 20 - Minimum position of the lid for which the hubs are completely unlocked

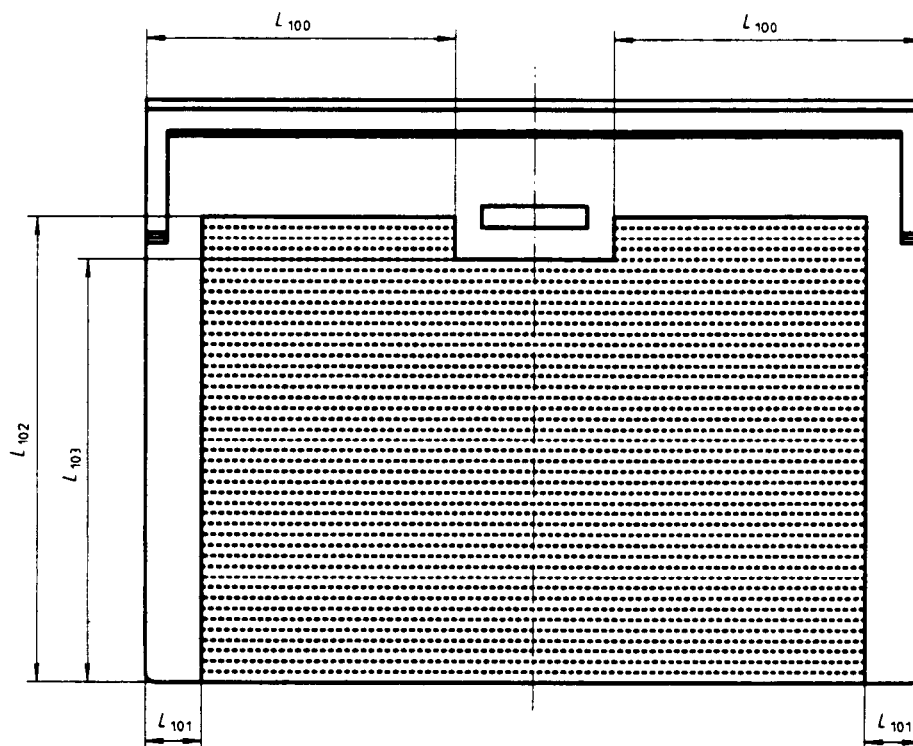


Figure 21 - Top side, label area

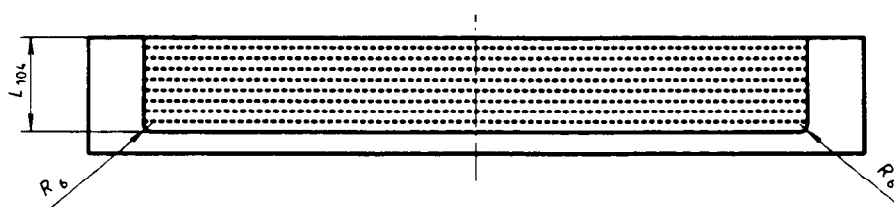


Figure 22 - Rear side, label area

Section 3 - Requirements for the unrecorded tape

7 Mechanical, physical and dimensional characteristics of the tape

7.1 Materials

The recordable area of the tape shall consist of a base material (oriented polyethylene terephthalate or its equivalent) coated on one side with a strong yet flexible layer of ferromagnetic material. The back surface may be coated.

The leader and trailer tapes shall consist of a translucent length of the same or equivalent base material without the ferromagnetic coating or the back coating.

7.2 Tape length

7.2.1 Length of magnetic tape

The length of tape between PBOT and PEOT shall be

- For Type A: between 3,0 m and 60,5 m
- For Type B: between 3,0 m and 92,0 m

7.2.2 Length of leader and trailer tapes

The length of the leader and trailer tapes shall be 60 mm ± 5 mm.

7.3 Tape width

The width of the magnetic tape and of the leader and trailer tapes shall be

$$3,81 \text{ mm} \begin{matrix} + 0,00 \\ - 0,02 \end{matrix} \text{ mm}$$

The width shall be measured across the tape from edge to edge when the tape is under a tension of 0,18 N max.

7.4 Discontinuities

Between PBOT and PEOT there shall be no discontinuities such as those produced by tape splicing or perforations.

7.5 Total thickness

The total thickness of the magnetic tape at any point shall be

- For Type A: 13 µm ± 1 µm
- For Type B: 9,0 µm ± 0,8 µm

7.6 Longitudinal curvature

The radius of the curvature of the edge of the tape shall not be less than 33 m.

Procedure

Allow a 1 m length of tape to unroll and assume its natural curvature on a flat smooth surface. Measure the deviation from a 1 m chord. The deviation shall not be greater than 3,8 mm. This deviation corresponds to the minimum radius of curvature of 33 m if measured over an arc of a circle.

7.7 Cupping

The departure across the width of tape from a flat surface shall not exceed 0,5 mm.

Procedure

Cut a $1,0 \text{ m} \pm 0,1 \text{ m}$ length of tape. Condition it for a minimum of 3 hours in the test environment by hanging it so that the coated surface is freely exposed to the test environment. From the centre of the conditioned tape cut a test piece of length 25 mm approximately. Stand the test piece on its end in a cylinder which is at least 25 mm high with an inside diameter of $4,1 \text{ mm} \pm 0,2 \text{ mm}$. With the cylinder standing on an optical comparator measure the cupping by aligning the edges of the test piece to the reticule and determine the distance from the aligned edges to the corresponding surface of the test piece at its centre.

7.8 Coating adhesion

The force required to peel any part of the coating from the tape base material shall not be less than 0,05 N.

Procedure

Take a test piece of the tape approximately 380 mm long and scribe a line through the recording coating across the width of the tape 125 mm from one end. Using a double-sided pressure sensitive tape, attach the full width of the test piece to a smooth metal plate, with the recording surface facing the plate. Fold the sample over 180° , attach the metal plate and the free end of the test piece to the jaws of a tensometer and set the speed of the jaw separation to 254 mm per min. Note the force at which any part of the coating first separates from the base material. If this is less than 0,05 N, the test has failed. If the test piece peels away from the double-sided pressure sensitive tape before the force exceeds 0,05 N, an alternative type of double-sided pressure sensitive tape shall be used. If the back surface of the tape is coated, repeat a) to d) for the back coating

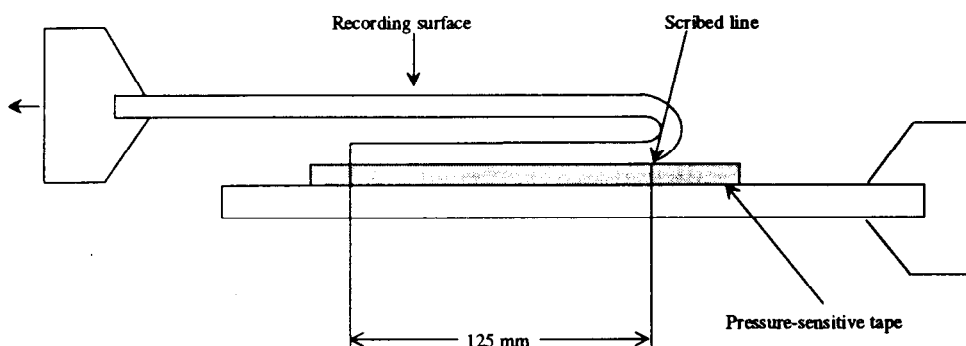


Figure 23 - Setup for measuring coating adhesion

7.9 Layer-to-layer adhesion

Procedure

Attach one end of a test piece of magnetic tape of length 1 m to the surface of a glass tube of external diameter 36 mm.

Wind the tape on to the tube at a tension of 1,1 N.

Store the wound test piece in a temperature of $45^\circ\text{C} \pm 3^\circ\text{C}$ and relative humidity of 80 % for 4 h.

Store for a further 24 h in the Testing Environment.

Apply a 0,1 N force to the free end of the test piece and allow it to unwind slowly.

There shall be no tendency for the test piece to stick or for the coating to peel.

7.10 Tensile Strength

Measurements shall be made in accordance with ISO/R 527. The length of the test sample shall be 200 mm. The rate of elongation for all tensile tests shall be 100 mm/m - ISO/R 527, Rate D.

7.10.1 Breaking Strength

Load the test piece until the breaking point is reached. The force required to reach that point is defined as the breaking strength of the tape.

The Breaking Strength shall be

- For Type A: not less than 9 N
- For Type B: not less than 6 N

7.10.2 Yield Strength

The Yield Strength is the force necessary to produce 3 % elongation of the tape.

The Yield Strength shall be

- For Type A: greater than 1,4 N
- For Type B: greater than 0,9 N

7.11 Residual elongation

Measure the original length of a test piece of approximately 1 m with an applied tension force of 0,05 N.

Apply for 3 minutes an additional force of

- For Type A: 1,5 N
- For Type B: 1,0 N

Remove the additional force and measure the length after a further 3 min.

The residual elongation, expressed as a percentage of the original length shall be less than 0,03 %.

7.12 Electrical resistance of coated surfaces

The electrical resistance of any square area of the recording surface shall be within the range of

$10^5 \Omega$ to $5 \times 10^8 \Omega$ for non-back coated tape.

$10^5 \Omega$ to $5 \times 10^{12} \Omega$ for back-coated tape.

The electrical resistance of the backcoating shall be less than

$9 \times 10^8 \Omega$

Procedure

Condition a test piece of tape in the test environment for 24 hours. Position the test piece over two 24-carat gold-plated, semicircular electrodes having a radius $R = 10$ mm and a finish of at least N4, so that the recording surface is in contact with each electrode (see figure 24). The electrodes shall be placed parallel to the ground and parallel to each other and spaced $d = 3,81$ mm apart. Apply a force F of 0,25 N to each end of the test piece. Apply a d.c. voltage of $100 \text{ V} \pm 10 \text{ V}$ across the electrodes and measure the resulting current flow. From this value, determine the electrical resistance.

Repeat for a total of five positions along the test piece and average the five resistance readings.

For back-coated tape, repeat the procedure with the backcoating in contact with the electrodes.

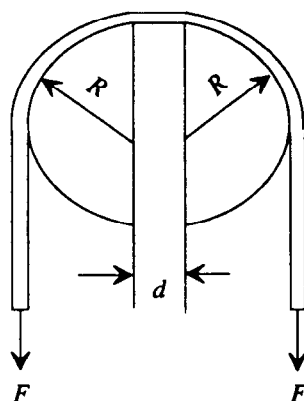


Figure 24 - Setup for measuring the electrical resistance

When mounting the test piece ensure that no conducting paths exist between the electrodes except that through the coating under test.

NOTE 8 - Particular attention should be given to keeping surfaces clean.

7.13 Light transmittance of tape

The light transmittance of the magnetic tape shall be less than, or equal to, 5 %.

The light transmittance of leader and trailer tapes shall be equal to, or greater than, 60 %.

The method for measuring light transmittance is given in annex D.

8 Magnetic recording characteristics

The magnetic recording characteristics shall be defined by the testing requirements given below.

When performing these tests, the output or resultant signal shall be measured on the same relative pass for both a tape calibrated to the Master Standard Reference Tape and the tape under test (read-while-write or first forward-read-pass) on the same equipment.

The following conditions shall apply to the testing of all magnetic recording characteristics, unless otherwise stated.

tape condition	: a.c. erased
diameter of the scanner	: 30,00 mm $\begin{matrix} + 0,05 \\ - 0,00 \end{matrix}$ mm
rotational speed of scanner	: 2000,0 rpm $\pm$ 0,2 rpm
tape speed	: 8,15 mm/s $\pm$ 0,04 mm/s
tape tension	: 0,10 N $\pm$ 0,01 N, measured at the input to the scanner
test tracks	: positive azimuth

write gap length	: 0,25 μm $\pm$ 0,03 μm
physical recording densities	: 83,4 ftpmm, 750,6 ftpmm, 500,4 ftpmm, 1 000 ftpmm, 1 501 ftpmm, 3 002 ftpmm (specified in each test).
recording current	: Test Recording Current
recording waveform	: square wave
read track width	: 20 μm $\pm$ 2 μm
write track width	: equal to, or greater than, the read track width
read output level	: taken at the appropriate fundamental frequency only

8.1 Optimum recording field

The optimum recording field shall be between 80 % and 126 % of the Reference Recording Field.

Traceability to the Reference Recording Field is provided by the calibration factor supplied with each Secondary Standard Reference Tape.

8.2 Signal amplitude

The Average Signal Amplitude at the physical recording density of 3 002 ftpmm shall be between 70 % and 160 % of that for the Master Standard Reference Tape.

The Average Signal Amplitude at the physical recording density of 83,4 ftpmm shall be between 70 % and 160 % of that for the Master Standard Reference Tape.

Traceability to the Average Signal Amplitudes of the Master Standard Reference Tape is provided by the calibration factors supplied with each Secondary Standard Reference Tape.

8.3 Resolution

The ratio of the Average Signal Amplitude at the physical recording density of 3 002 ftpmm to that at the physical recording density of 750,6 ftpmm shall be between 80 % and 140 % of the same ratio for the Master Standard Reference Tape.

For the physical recording densities of 1 001 ftpmm and 83,4 ftpmm the ratio shall be between 70 % and 126 % of the same ratio for the Master Standard Reference Tape.

Traceability to the resolutions for the Master Standard Reference Tape is provided by the calibration factors supplied with each Secondary Standard Reference Tape.

8.4 Overwrite

Overwrite is the ratio of the Average Signal Amplitude of the residual of a low density recording after overwriting with a recording at a higher density to the Average Signal Amplitude of the original low density recording.

Traceability to the overwrite ratios for the Master Standard Reference Tape is provided by the calibration factors supplied with each Secondary Standard Reference Tape.

8.4.1 Physical recording densities of 750,6 and 3 002 ftpmm

8.4.1.1 Procedure

First, a.c. erase the tape.

Record at the physical recording density of 750,6 ftpmm and measure the Average Signal Amplitude.

Overwrite at the physical recording density of 3 002 ftpmm and measure the Average Signal Amplitude of the residual 750,6 ftpmm signal.

Repeat for the Master Standard Reference Tape.

8.4.1.2 Requirements

The ratio

$$\frac{\text{Residual Average Signal Amplitude at 750,6 ftpmm after overwriting}}{\text{Average Signal Amplitude of the original recording at 750,6 ftpmm}}$$

shall be less than 140 % of the same ratio for the Master Standard Reference Tape.

8.4.2 Physical recording densities of 83,4 ftpmm and 1 001 ftpmm

8.4.2.1 Procedure

Repeat 8.4.1.1 for these densities.

8.4.2.2 Requirements

The ratio shall be less than 126 % of the same ratio for the Master Standard Reference Tape.

Traceability to the overwrite ratios for the Master Standard Reference Tape is provided by the calibration factors supplied with each Secondary Standard Reference Tape.

8.5 Ease of erasure

When a tape has been recorded at 750,6 ftpmm with the Test Recording Current and then passed through a longitudinal steady erasing field of 198 900 A/m, any remaining signal shall not exceed 3 % of the Standard Reference Amplitude for that density. The erasing field shall be reasonably uniform, for example, the field in the middle of a solenoid. This measurement shall be made with a band pass filter passing the first three harmonics.

8.6 Tape quality

8.6.1 Missing pulses

A missing pulse is a loss of read signal amplitude. A missing pulse exists when the base-to-peak read signal is 50 %, or less, of half the Average Signal Amplitude for the recording density of 1 501 ftpmm on the same tape.

8.6.2 Missing pulse zone

A missing pulse zone commences with a missing pulse and ends when 5 consecutive flux transitions are detected or when a length of 0,120 mm of track has been measured. Any further missing pulse results in a further missing pulse zone.

A missing pulse zone does not continue from one track to the next.

The missing pulse zone rate shall be less than one in $7,2 \times 10^4$ flux transitions and applies to both positive and negative azimuth tracks.

8.7 Signal-to-noise ratio (S/N) characteristic

The signal-to-noise ratio is the average rms read signal amplitude divided by the average integrated rms noise amplitude, and expressed in decibels.

$$S/N = 20 \log \frac{\text{Average rms read signal amplitude}}{\text{Average integrated rms noise amplitude}} \text{ decibels}$$

Requirement

The S/N for the tape under test (S/N_{tape}) shall be better than -3 dB relative to the S/N for the Master Standard Reference Tape (S/N_{MSRT}) when measured according to the procedure defined in annex E.

Traceability to the S/N_{MSRT} is provided by the calibration factor supplied with each Secondary Standard Reference Tape.

Section 4 - Format

9 DATA/DAT-DC format

9.1 General

Data to be recorded is sent from a host computer to the tape system together with three types of separator marks which indicate the logical separation(s) of the data. The user data, separator marks, and associated information are formed into groups before being recorded on the tape. Each group is recorded on a group of tracks. The part of each track in which the user data and partition information are recorded is called the Main Zone of the track. Additional information about the contents of the group, the location of the track(s) and the contents of the track(s) is recorded in two parts of each track called Sub Zones. The two Sub Zones together constitute the Sub Data Area of the track.

In addition, the host computer may send Partition Reference information which contains information related to the partition being written, including Protection, Number, Name, Flags, Start Frame Number, Number of Frames, Number of Groups, Start Group Number, Start Second Group Number, and Comments. This information is formed into a group and recorded on the tape in the Partition and Master Reference areas.

In the following description all operations on the data received from the host computer, including the use of error detection and correction codes, are described. Then the method of recording on the tape and the tape layout itself will be described. However, because of the inherent characteristics of this format, where required, advance references to the tape layout will also be made in the course of the description of the operations on the data.

9.2 Basic Groups

The data to be recorded shall be grouped in Basic Groups of 135 808 bytes for the Group Field 0 (see 14.1) or 238 596 bytes for Group Format 1 (see 14.2). Each Basic Group shall be identified by a running number allocated consecutively starting with 0. In each Basic Group the bytes are identified by a running number from 0 to 135 807 or from 0 to 238 595.

Data and Separator Marks received from the host computer shall be grouped in Basic Groups according to the following structure.

NOTE 9 - In this International Standard, there are three types of Separator Marks which can be received from the host, and are referred to as Separator 1, Separator 2, and Separator 3. Some other standards, e.g. those which define an interface between a tape drive and a host computer, use terms such as "search mark", "file mark", and "set mark". It is recommended that Separator 1 be equated to "search mark", Separator 2 be equated to "file mark", and Separator 3 be equated to "set mark".

9.2.1 Basic Groups for Group Format 0

Each Basic Group shall consist of user data and system data. User data shall consist of 131 072 bytes and system data of 4 736 bytes. User data and system data shall be mapped into a rectangular area which is (4 096 + 148) bytes wide and 32 bytes high. Each byte is allocated to a byte position (or offset address, see annex M) as follows:

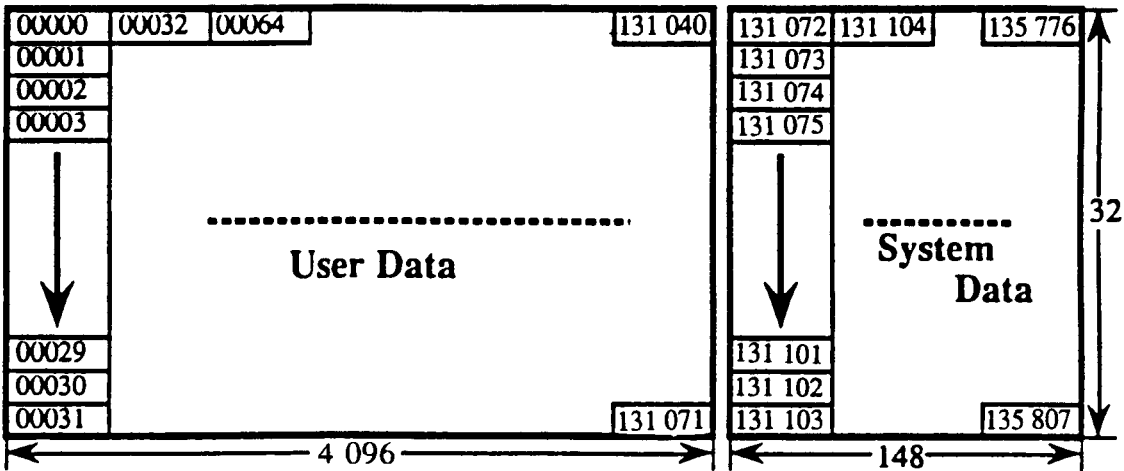


Figure 25 - Data allocation for Group Format 0

User data and system data of each Basic Group shall be further divided into Sub-groups as follows:

- Sub-groups containing each 5 760 bytes from the Basic Group.
- Sub-group containing 3 328 bytes from the Basic Group and 2 432 bytes C3 Parity generated by the tape system (see annex M),
- Sub-groups containing each 5 760 bytes of C3 parity,
- Sub-group containing 5 752 bytes of C3 parity and 8 bytes set to all ZEROs.

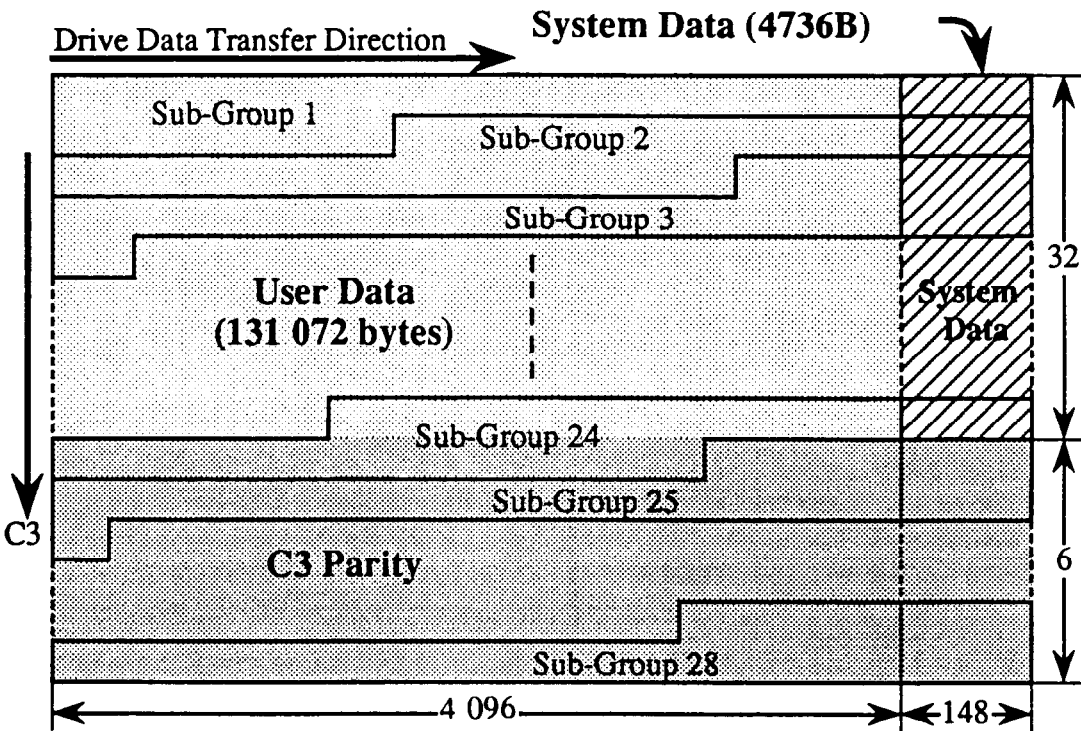


Figure 26 - Sub-group allocation Group Format 0