INTERNATIONAL STANDARD

ISO/IEC 15731

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Information technology — 12,65 mm wide magnetic tape cassette for information interchange — Helical scan recording — DTF-1 format

Technologies de l'information — Cassette de bande magnétique de 12,65 mm *de large pour l'échange d'information — Enregistrement par balayage en spirale — Format DTF-1*

Reference number
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Contents

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 15731 was prepared by ECMA (as Standard ECMA-248) 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, and B form an integral part of this International Standard. Annexes C and D are for information only.

ISO and IEC draw attention to the fact that it is claimed that compliance with this International Standard may involve the use of patents concerning the Master Standard Reference Tape and Secondary Standard Reference Tape given in clause 4.

ISO and IEC take no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO and IEC that he is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO and IEC. Information may be obtained from:

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Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights other than those identified above. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

Information technology — 12,65 mm wide magnetic tape cassette for information interchange — Helical scan recording — DTF-1 format

Section 1 - General

1 Scope

This International Standard specifies the physical and magnetic characteristics of magnetic tape cassettes, using magnetic tape 12,65 mm wide so as to provide physical interchange of such cassettes between drives. It also specifies the quality of the recorded signals, the recording method and the recorded format, called Digital Tape Format-1 (DTF-1), thereby allowing data interchange between drives by means of such cassettes. The format supports variable length Logical Records, high speed search, and the use of a registered algorithm for data compression.

This International Standard specifies two sizes of cassette. For the purposes of this International Standard the larger cassette is referred to as Type L, and the smaller as Type S.

Together with a standard for volume and file structure, e.g. ISO 1001, this International Standard provides for full data interchange between data processing systems.

2 Conformance

2.1 Magnetic tape cassette

A claim of conformance with this International Standard shall specify the Type of cassette. It shall be in conformance with this International Standard if

- the case meets all the requirements of clause 4 and clauses 6 to 10 for that Type
- the recording on the tape meets the requirements of clauses 11 to 17

2.2 Generating system

A claim of conformance with this International Standard shall specify which Type(s) of cassette is (are) supported. A system generating a magnetic tape cassette for interchange shall be in conformance with this International Standard if all the recordings that it makes, meet the mandatory requirements of this International Standard. A claim of conformance with this International Standard shall state whether or not one, or more, registered algorithm(s) is (are) implemented and, if so, the registered number(s) of (all) the implemented algorithm(s).

2.3 Receiving system

A claim of conformance with this International Standard shall specify which Type(s) of cassette is (are) supported. A system receiving a magnetic tape cassette for interchange shall be in conformance with this International Standard if it is able to handle any recording made on the tape according to this International Standard, and a claim of conformance shall state whether or not one, or more, registered algorithm(s) is (are) implemented and, if so, the registered number(s) of (all) the implemented algorithm(s).

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 indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 527 (all parts),	*Plastics — Determination of tensile properties.*
ISO 1001:1986,	*Information processing — File structure and labelling of magnetic tapes for information interchange.*
ISO/IEC 11576:1994,	*Information technology — Procedure for the registration of algorithms for the lossless compression of data.*
IEC 950:1991,	*Safety of information technology equipment.*
JIS-B-7502,	*Characteristics of plastic goods.*
SMPTE timecode:	(C98.12 : time and control code for video and audio tape for 525/60 television system).

4 Definitions

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

4.1 Absolute block number: A number N allocated to each block, indicating that the block is the Nth block from the beginning of the Logical volume containing it.

4.2 a.c. erase: A process of erasure utilizing alternating magnetic fields of decaying intensity.

4.3 algorithm: A set of rules for transforming the logical representation of data.

4.4 Append file: A new file added from the End of Data (EOD) of a Logical volume.

4.5 Append volume: A Logical volume added after the last Logical volume recorded on the cassette.

4.6 Average Signal Amplitude (ASA): The average peak-to-peak value of the signal output of a read head measured over a minimum of 1,40 mm of track, exclusive of missing pulses.

4.7 azimuth: The angular deviation, in degrees of arc, of the recorded flux transitions on a track from the line normal to the track centreline.

4.8 back surface: The surface of the tape opposite to the magnetic coating used to record data.

4.9 bit cell: A distance along the track allocated for the recording of a Channel bit.

4.10 block: A unit of data which is sent to the tape controller when a single write command is executed.

4.11 Block Management Table (BMT): A table included in each Track Set to manage blocks contained in that Track Set.

4.12 byte: An ordered set of bits acted upon as a unit.

4.13 cassette: A case containing magnetic tape stored on twin reels.

4.14 compressed data: A representation of host-transmitted data after transformation by a data compression algorithm.

4.15 Control Track: A track used for recording the servo control signals.

4.16 flux transition position: That point along a track on the magnetic tape that exhibits the maximum free-space flux density normal to the tape surface.

4.17 flux transition spacing: The distance along a track between successive flux transitions.

4.18 Logical track set ID: The track set ID assigned to each track set containing data received from the host.

4.19 Logical volume: A data entity received by the generating system from the host.

4.20 magnetic tape: A tape which will accept and retain the magnetic signals intended for input, output, and storage purposes.

4.21 Master Standard Reference Tape (MSRT): A tape selected as the standard for Signal Amplitude, Reference Field, Resolution and Signal to Noise Ratio (S/N).

NOTE - The Master Standard Reference Tape has been established at SONY Corporation.

4.22 physical recording density: The number of recorded flux transitions per unit length of track, specified as flux transitions per millimetre (ftpmm).

4.23 Reference Field (RF): The Typical Field of the MSRT. There are two Reference Fields:

RF1 is that for a helically recorded track
RF2 is that for a longitudinally recorded track.

4.24 Secondary Standard Reference Tape (SSRT): A tape the performance of which is known and stated in relation to that of the MSRT.

NOTE - Secondary Standard Reference Tapes can be ordered under the Part Number SSRT-DTF-1, from the Sony Corporation, Magnetic Product Group, Data Media Sales Division, 6-7-35 Kitashinagawa, Shinagawa-ku, TOKYO 141, Japan. In principle such tapes will be available for a period of 10 years from the publication of the International Standard. However, by agreement between ISO and Sony Corporation, this period may be shortened or extended to take account of demand for such SSRTs.

It is intended that these SSRTs be used for calibrating tertiary reference tapes for use in routine calibration.

4.25 Standard Reference Amplitude (SRA): The Average Signal Amplitude derived from the MSRT, using the appropriate Test Recording Current and the appropriate physical recording density. There are three SRAs: SRA1 is derived

from a helically recorded track, recorded at 3 201 ftpmm with TRC1. SRA2 is derived from a longitudinally recorded track at 20,75 ftpmm with TRC2. SRA3 is derived from a helically recorded track, recorded at 800,3 ftpmm with TRC1.

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

4.26 Standard Reference Current (Ir): The current that produces a Reference Field. There are two Irs:

Ir1 is the current that produces RF1 on a helically recorded track.
Ir2 is the current that produces RF2 on a longitudinally recorded track.

4.27 Tape Reference Edge: The lower edge of the tape when the magnetic coating is facing the observer and the supply reel is to the observer's right.

4.28 Test Recording Current (TRC): The current used to record an SRA. There are two Test Recording Currents:

TRC1 is 1,1 times Ir1
TRC2 is 1,0 times Ir2

4.29 track: A narrow, defined area on the tape along which a series of magnetic transitions may be recorded. A track may be parallel to the Tape Reference Edge or at an angle to it.

4.30 track angle: The angle between the centreline of a helically recorded track and the Tape Reference Edge.

4.31 Track Set: A set of four consecutive helical tracks uniquely identified by a track set identification.

4.32 Typical Field (TF): There are two TFs:

In the plot of the ASA against the recording field:

TF1 is the minimum recording field giving an ASA equal to 90 % of the maximum ASA at the physical recording density of 3 201 ftpmm on a helically recorded track.

TF2 is the value of the recording field for which the increase of ASA resulting from an increase of 1 dB of the recording field falls to 0,5 dB at the physical recording density of 20,75 ftpmm on a longitudinally recorded track.

4.33 Unique Identifier (UID): An unambiguous value uniquely distinct from every other UID.

4.34 word: A group (or set) of four 8-bit bytes, numbered 0 to 3, byte 3 being the most significant.

5 Conventions and notations

5.1 Representation of numbers

- A measured value is rounded off to the least significant digit of the corresponding specified value. It implies that a specified value of 1,26 with a positive tolerance of 0,01, and a negative tolerance of 0,02 allows a range of measured values from 1,235 to 1,275.
- Letters and digits in parentheses represent numbers in hexadecimal notation.
- The setting of a bit is denoted by ZERO or ONE.
- Numbers in binary notation and bit combinations are represented by strings of 0s and 1s. Within such strings, X may be used to indicate that the setting of a bit is not specified within the string.
- Numbers in binary notation and bit combinations are shown as Words with the MSB to the left, and with the msb in each byte to the left.
- Negative values of numbers in binary notion are given in TWOs complement.
- In each field the data is processed so that the MSB is processed first. Within each byte the msb (numbered 7 in an 8-bit byte) is processed first. This order of processing applies also to the data input to the Error Detection and Correction circuits and to their outputs, unless otherwise stated.

5.2 Names

The names of entities, e.g. specific tracks, fields, etc., are given with a capital initial.

6 Acronyms

ASA Average Signal Amplitude

CRC	Cyclic Redundancy Check
BMT	Block Management Table
BST	Bad Spot Table
DIT	Directory Information Table
DM	Dummy Track
ECC	Error Correcting Code
EOD	End of Data
FIT	File Information Table
LBOT	Logical Beginning of Tape
LEOT	Logical End of Tape
LIDT	Logical ID Table
lsb	Least Significant Bit
LSB	Least Significant Byte
msb	Most Significant Bit
MSB	Most Significant Byte
MSRT	Master Standard Reference Tape
NEOT	Near End of Tape
PBOT	Physical Beginning of Tape
PEOT	Physical End of Tape
SRA	Standard Reference Amplitude
SSRT	Secondary Standard Reference Tape
TF	Typical Field
TPS	Tracking Pilot Signal
TRC	Test Recording Current
TSID	Track Set Identification
UID	Unique Identifier
UT	Update Table
VEOV	Virtual End of Volume
VIT	Volume Information Table
VSIT	Volume Set Information Table

7 Environment and safety

The conditions specified below refer to ambient conditions immediately surrounding the cassette. Cassettes exposed to environments outside these limits may still be able to function usefully; however, such exposure may cause permanent damage.

7.1 Testing environment

Unless otherwise specified, tests and measurements made on the tape to check the requirements of this Standard shall be made under the following conditions.

temperature	23 °C ± 1 °C
relative humidity	48 % to 52 %
conditioning period before use	24 h min.

7.2 Operating environment

Cassettes used for data interchange shall be operated under the following conditions:

temperature	5 °C to 40 °C
relative humidity	20 % to 80 % non-condensing
wet bulb temperature	26 °C max

The cassette shall be conditioned before use 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 - Rapid variations of temperature should be avoided.

7.3 Storage environment

The following conditions shall be observed for storage.

temperature: 5 °C to 32 °C

relative humidity: 20 % to 60 %

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 cassette.

7.4 Transportation

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

7.5 Safety

The cassette and its components shall satisfy the requirements of ECMA-129 when used in the intended manner or in any foreseeable use in an information processing system.

7.6 Flammability

The tape and the case components shall be made from materials which, when ignited from a match flame, do not continue to burn in a still carbon dioxide atmosphere.

Section 2 - Requirements for the case

8 Dimensional and mechanical characteristics of the case

8.1 General

The case of the cassette shall comprise

- an upper half,
- a lower half,
- a lid pivotally mounted on the upper half
- a latch mechanism for the lid
- two reels for magnetic tape
- a locking mechanism for the reels
- a write-inhibit mechanism
- recognition holes.

In the drawings, embodiments of the cassettes are shown as examples.

For the Type S cassette the dimensions are referred to three orthogonal Reference Planes X, Y, and Z where

- The three datum areas A, B and C in the bottom surface of the case are in Plane Z
- Plane X is perpendicular to Plane Z and intersects the centres of datum holes A and B
- Plane Y is perpendicular to Plane X and Plane Z and intersects the centre of datum hole A.

For the Type L cassette the dimensions are referred to three orthogonal Reference Planes X, Y, and Z where

- The three datum areas E, F and G in the bottom surface of the case are in Plane Z
- Plane X is perpendicular to Plane Z and intersects the centres of datum holes E and F
- Plane Y is perpendicular to Plane X and Plane Z and intersects the centre of datum hole E.

Figures 1 to 19 and sub-clause 8.2 define the dimensions of the case and reels for a Type S cassette.

Figures 20 to 39 and sub-clause 8.3 define the dimensions of the case and reels for a Type L cassette.

8.2 Type S cassette

Figure 1 is a perspective view seen from the top.
Figure 2 is a perspective view seen from the bottom.
Figure 3 shows the top side with the lid closed using third angle projection.
Figure 4 shows the top side holding and label areas.

Figure 5 shows the bottom side with the lid removed.
Figure 6 shows the bottom side with the lid closed.
Figure 7 shows the details of the recognition holes.
Figure 8 shows the details of the write-inhibit plug.
Figure 9 shows the detail of the lid release insertion channel.
Figure 10 shows the lid unlock force direction.
Figure 11 shows the detail of the lid opening insertion channel.
Figure 12 shows the lid opening force direction.
Figure 13 shows the side view with the lid open.
Figure 14 shows the cassette reel.
Figure 15 shows the height of reels upon rotation.
Figure 16 shows the internal tape path.
Figure 17 shows the tape path to measure the extraction force.
Figure 18 shows the tape path to measure the friction torque of the take-up reel.
Figure 19 shows the tape access cavity requirements.

8.2.1 Overall dimensions (figure 3)

The overall dimensions of the case with the lid in the closed position are defined as follows. The total width of the case shall be

$l_1 = 96{,}0 \text{ mm} \pm 0{,}3 \text{ mm}$

The total length of the case shall be

$l_2 = 156{,}0 \text{ mm} \; {}^{+0{,}2 \text{ mm}}_{-0{,}3 \text{ mm}}$

The distance from the top of the case to the Reference Plane Z shall be

$l_3 = 25{,}0 \text{ mm} \pm 0{,}3 \text{ mm}$

The front-top bevel edge shall start in the top surface at a distance

$l_4 = 3{,}0 \text{ mm} \pm 0{,}5 \text{ mm}$ from the front side and shall terminate in the front side at a distance
$l_5 = 5{,}0 \text{ mm} \pm 0{,}5 \text{ mm}$ from the top surface.

The bottom-front edge of the case shall be rounded with a radius

$r_1 = 1{,}0 \text{ mm} \pm 0{,}1 \text{ mm}$

The distance from the rear side to plane X shall be

$l_6 = 9{,}0 \text{ mm} \; {}^{+0{,}2 \text{ mm}}_{-0{,}1 \text{ mm}}$

The distance from the right side to plane Y shall be

$l_7 = 8{,}0 \text{ mm} \; {}^{+0{,}2 \text{ mm}}_{-0{,}1 \text{ mm}}$

8.2.2 Holding areas (figure 4)

The holding areas, shown cross-hatched, lie in Plane Z and shall be the areas along which the cassette shall be held down when inserted into the drive. The left and right edge holding areas shall extend from the rear side a distance of

$l_8 = 69{,}4 \text{ mm min.}$

The width of the holding surface along the rear edge shall be

$l_9 = 10{,}2 \text{ mm min.}$

The width of the left and right holding surfaces shall be

$l_{10} = 5{,}7 \text{ mm min.}$

8.2.3 Window

A window may be provided on the top surface so that a part of the reels is visible. The window, if provided, shall not extend beyond the height of the cassette and shall not extend beyond the inner edge of the holding areas.

8.2.4 Label areas (figure 4)

A portion of the rear side of the cassette and a portion of the top surface of the cassette may be used for labels. The position and the size of the labels shall not interfere with the operation or clearance requirement of the cassette component parts. The area used for labels on the top surface shall not extend beyond the inner edges of the holding areas.

The position and dimensions of the label area on the rear side are defined as follows.

The distance from the top of the case to the top of the label area, and from the bottom of the label area to Plane Z, shall be

l_{11} = 3,0 mm ± 0,3 mm

The distance from both the left and right sides of the case to the edges of the label area shall be

l_{12} = 7,0 mm ± 0,3 mm

The depth of the top surface label depression shall be 0,3 mm max.

The depth of the rear side label depression shall be 0,5 mm ± 0,1 mm.

8.2.5 Datum areas and datum holes (figures 5 and 6)

The annular datum areas A, B and C shall lie in plane Z and determine the vertical position of the cassette in the drive.

The annular datum area D shall be parallel to datum plane Z and within 0,3 mm of it.

Each datum area shall have a diameter d_1 = 10,0 mm ± 0,1 mm and be concentric with the respective datum hole.

The centres of datum holes A and B lie in plane X.

The centre of datum hole A shall be at the intersection of planes X and Y.

The distance from the centre of the datum hole B to plane Y shall be

l_{13} = 140,0 mm ± 0,3 mm

The distance from the centre of the datum hole C to plane Y shall be

l_{14} = 120,0 mm ± 0,3 mm

The distance from the centre of the datum hole D to plane Y shall be

l_{15} = 20,0 mm ± 0,2 mm

The distance from the centre of the datum holes C and D to plane X shall be

l_{16} = 74,0 mm ± 0,2 mm

The diameter of datum holes A and D shall be

l_{17} = 5,5 mm $^{+0,1\ mm}_{-0,0\ mm}$ as shown in section C-C of figure 6

The depth of all four datum holes shall be

l_{19} = 9 mm min.

The distance across the flats of datum holes B and C shall be l_{17}

The distance of the elongation in datum holes B and C shall be

l_{18} = 8,00 mm ± 0,15 mm as shown in section E-E of figure 6.

8.2.6 Support areas (figure 5)

The cassette support areas are shown cross-hatched, in figure 5. Support areas A, B, C and D shall be coplanar with datum area A, B, C and D, respectively, within ± 0,05 mm.

The areas within 1 mm of the edge of the cassette shall not be included in the support areas and shall be recessed from the support areas.

The dimensions and position of the support areas shall be defined as follows.

The support area surrounding datum hole A shall be defined by