International Standard 8063/1

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Information processing — Data interchange on 6,30 mm (0.25 in) wide magnetic tape cartridge using IMFM recording at 252 ftpmm (6 400 ftpi) — Part 1: Mechanical, physical and magnetic properties

Traitement de l'information — Échange de données sur cartouche pour bande magnétique de 6,30 mm (0,25 in) *de large utilisant un enregistrement IMFM à* 252 ftpmm (6 400 ftpi) *— Partie 1: Caractéristiques mécaniques, physiques et magnétiques*

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8063/1 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Information processing — Data interchange on 6,30 mm (0.25 in) wide magnetic tape cartridge using IMFM recording at 252 ftpmm (6 400 ftpi) — Part 1: Mechanical, physical and magnetic properties

1 Scope and field of application

ISO 8063 specifies the characteristics of a tape cartridge using 6,30 mm (0.25 in) wide magnetic tape for data interchange between data processing systems.

ISO 8063/2 specifies the quality of the recorded signals, and the track format to be used on a 6,30 mm (0.25 in) magnetic tape cartridge recorded at 252 ftpmm (6 400 ftpi) using IMFM recording and the start/stop mode of operation.

This part of ISO 8063 specifies the dimensional, physical and magnetic characteristics of the cartridge, and the track layout.

Together with the labelling scheme specified in ISO 4341, ISO 8063/1 and ISO 8063/2 provide for full data interchange between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this part of ISO 8063 may have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor reconverted. The original design was made using the Imperial measurement system.

ISO 8063 applies to cartridges used for data interchange. Where it applies for testing only, this is specifically stated.

2 Conformance

A 6,30 mm (0.25 in) wide magnetic tape cartridge shall be in conformance with ISO 8063 if it meets all mandatory requirements of both ISO 8063/1 and ISO 8063/2.

3 References

ISO 646, *Information processing — ISO 7-bit coded character set for information interchange.*

ISO 2022, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques.*

ISO 4341, *Information processing — Magnetic tape cassette and cartridge labelling and file structure for information interchange.*

ISO 4873, *Information processing — ISO 8-bit code for information interchange — Structure and rules for implementation.*

4 Definitions

For the purpose of ISO 8063 the following definitions apply.

4.1 magnetic tape: A tape which accepts and retains magnetic signals intended for input/output and storage purposes of information processing and associated systems.

4.2 Reference Tape Cartridge: A tape cartridge selected for a given property for calibrating purposes.

4.3 Secondary Reference Tape Cartridge: A tape cartridge intended for routine calibrating purposes, the performance of which is known and stated in relation to that of the reference tape cartridge.

4.4 Typical Field: The minimum field which, when applied to the tape under test, causes a signal output equal to 95 % of the maximum signal output at the specified test density.

4.5 Reference Field: The minimum field which, when applied to the signal amplitude reference tape cartridge, causes a signal output equal to 95 % of the maximum signal output at the test density.

4.6 Test Recording Current: The recording current between 148 % and 152 % of the current required to produce the reference field at 252 ftpmm (6 400 ftpi).

4.7 Signal Amplitude Reference Tape Cartridge: A reference tape cartridge selected as a standard for signal amplitude and reference field.

NOTE — A Master Standard (Computer Amplitude Reference) Cartridge has been selected by the US National Bureau of Standards (NBS) to establish the reference level for average peak-to-peak signal amplitudes when recorded at

252 ftpmm (6 400 ftpi),

394 ftpmm (10 000 ftpi).

Secondary Standard Amplitude Reference Tape Cartridges are available from NBS under Part Number SRM 3217.[1)]

4.8 Average Signal Amplitude: The average peak-to-peak value of the signal output measured over at least 4 000 flux transitions.

4.9 Standard Reference Amplitude (SRA): The average peak-to-peak signal amplitudes of the Signal Amplitude Reference Tape Cartridge.

SRA_{252} is the average peak-to-peak signal amplitude when recording at 252 ftpmm (6 400 ftpi) using the appropriate Test Recording Current.

4.10 in-contact: An operating condition in which the magnetic surface of a tape is in physical contact with a magnetic head.

4.11 track: A longitudinal area of the tape along which a series of magnetic signals may be recorded.

4.12 physical recording density: The number of recorded flux transitions per unit length of track: flux transitions per millimetre (ftpmm) [flux transitions per inch (ftpi)].

4.13 data density: The number of data characters stored per unit length of tape; characters per millimetre (cpmm) [characters per inch (cpi)].

4.14 position of flux transitions: The position which exhibits the maximum free space flux density normal to the tape surface.

4.15 erasing field: A field of sufficient strength to remove the signals from the tape.

4.16 recording area: That part of the tape satisfying the requirements for magnetic properties.

5 Environment and transportation

5.1 Testing environment

Tests and measurements made on the cartridge to check the requirements of this part of ISO 8063 shall be carried out under the following conditions:

temperature: 23 ± 2 °C (73 ± 4 °F);

relative humidity: 40 % to 60 %;

wet-bulb temperature: 18 °C max. (64 °F max.);

conditioning before testing: 24 h min.

5.2 Operating environment

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

temperature: 5 to 45 °C (41 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.);

The temperature shall be measured in the air immediately surrounding the cartridge. Rapid temperature variations should be avoided. There shall be no deposit of moisture on or in the cartridge.

5.3 Storage environment

During storage it is recommended that recorded cartridges are kept within the following conditions:

temperature: 5 to 45 °C (41 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.);

5.4 Transportation

5.4.1 Transportation environment

During transportation, the cartridge may have been exposed to conditions outside the operating environment. It is recommended that the following conditions are not exceeded:

temperature: −40 °C to 45 °C (−40 to 113 °F);

relative humidity: 20 % to 80 %;

wet-bulb temperature: 26 °C max. (79 °F max.).

5.4.2 Transportation procedures

Responsibility for ensuring that adequate precautions are taken during transportation shall be with the sender. For transportation a rigid container free from dust or extraneous matter shall be used. The final package shall have a clean interior and a construction preventing ingress of dust or water. It is recommended that a sufficient space exists between cartridge and outer surface of the final container, so that risk of damage due to stray magnetic fields will be negligible.

1) NBS , Office of Standard Reference Materials, Room 311, Chemistry Building, Gaithersburg, M.D. 20899, USA.

5.5 Conditioning of the cartridge

Before use the cartridge shall be conditioned by exposure to 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 8 h).

The cartridge shall also be conditioned by running the tape one complete end-to-end pass in any of the following cases:

a) each time it is inserted in a drive;

b) after prolonged operation over a limited area;

c) when the temperature change to which the cartridge has been exposed is greater than 17 °C (30 °F).

5.6 Flammability

Tape or cartridge components shall be made from materials that, if ignited from a match flame, do not continue to burn in a still carbon dioxide atmosphere.

5.7 Toxicity

Tape or cartridge components which may cause bodily harm by contact, inhalation or ingestion during normal use of the cartridge shall not be used.

6 Characteristics of the tape

6.1 Mechanical properties

6.1.1 Tape width

The width of the tape shall be

$6{,}30\ ^{0}_{-0{,}06}$ mm (0.247 0 $^{+0.001\ 0}_{-0.001\ 5}$ in)

NOTE — Although the tolerances are expressed differently in the two measurement systems, the dimensions are equivalent.

6.1.2 Tape length

The length of the tape between the LP and the EW markers (see 6.1.4) shall be

$137{,}0\ ^{+\ 4{,}6}_{\ \ 0}$ m ($450\ ^{+\ 15}_{\ \ 0}$ ft)

6.1.3 Tape thickness

The thickness of the tape and of its coating shall be

— overall thickness: 19 µm nom. (0.000 75 in nom.)

— coating thickness: 6,6 µm max. (0.000 26 in max.).

6.1.4 Markers

In the tape there shall be a number of markers, the relative positions of which are shown in figure 2.

6.1.4.1 Beginning-of-tape (BOT)

A BOT marker shall be a pair of circular holes punched in the tape. There shall be three such markers, the innermost of which is used for the purpose of identifying the storage position for the cartridge. In the storage position, all of the recording area shall be wound on the supply hub and shall be protected by at least one layer of tape. The two other markers shall be used to ensure reliability of detection.

The diameter of the BOT holes shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.2 End-of-Tape (EOT)

An EOT marker shall be a single circular hole punched in the tape. There shall be three such markers along a single line. The first to pass the photo sensor during forward operation indicates that the recording area has been exceeded. The two other markers shall be used to ensure reliability of detection.

The diameter of the EOT holes shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.3 Load-Point (LP)

The LP marker shall be a single circular hole punched in the tape to indicate the beginning of the recording area in the forward direction.

The diameter of the LP hole shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.4.4 Early-Warning (EW)

The EW marker shall be a single circular hole punched in the tape for the purpose of indicating the approaching end of the recording area in the forward direction. Recording shall stop before the EOT marker is sensed.

The diameter of the EW marker shall be

1,17 ± 0,05 mm (0.046 ± 0.002 in).

6.1.5 Light transmittance

The tape shall have a light transmittance of less than 0,5 % measured according to annex A.

6.1.6 Tensile yield force

The tensile yield force of the tape, defined as the force required to elongate a sample by 3 %, shall be 6,7 N min. (1.5 lbf min.).

This elongation shall be measured with a static weighing tester at a constant rate of grip separation. A specimen of tape of at least 178 mm (7 in) shall be clamped with an initial separation of 102 mm (4 in) between the jaws. This specimen shall be elongated at a rate of 51 mm/min (2 in/min) until an elongation of at least 10 % is reached. The tensile yield force is the force required to produce the elongation of 3 %.

6.1.7 Layer-to-layer adhesion

Layer-to-layer adhesion shall be sufficiently low to meet the requirements of the test in annex B.

6.1.8 Cupping

Cupping is the departure across a tape (transversely to the tape motion) from a flat surface.

The maximum cupping of a 6,30 mm (0.25 in) long length of tape shall not exceed 0,38 mm (0.015 in) when placed concave side down on a smooth, flat surface. The time between cutting and the measurement shall be at least 1 h.

6.1.9 Leaders and splices

The cartridge shall contain no splices or spliced-in leaders.

6.1.10 Tape wind

The tape shall be wound on the hubs with the magnetic coating on the outside, and in such a way that during forward read/write operations the tape is unwound in a counter-clockwise direction viewed from above as shown in figure 3.

6.2 Electrical surface resistance

The electrical surface resistance of the magnetic surface of any square sample of the tape shall be within the range of

5×10^5 to 10^9 Ω

measured between electrodes placed on two opposite sides of the square, using a voltage of 500 ± 10 V.

6.3 Magnetic properties

The magnetic properties of the tape are defined by the testing requirements given below. When performing the tests, the output or resultant signal shall be measured on the same relative pass for both the Signal Amplitude Reference Tape Cartridge and the tape under test (i.e. either the read-whilst-write, or on equipment without read-whilst-write capability, on the first forward-read-pass) on the same equipment.

The in-contact condition shall be used for all tests.

6.3.1 Test density

The test density shall be 252 ftpmm nom. (6 400 ftpi nom.).

6.3.2 Test tracks

Testing shall be carried out on four tracks numbered 1 to 4. Track designation, location and width are specified in clause 7.

6.3.3 Typical field

The typical field of the tape under test shall be within ± 20 % of the Reference Field.

6.3.4 Average signal amplitude

When a tape has been recorded with the appropriate Test Recording Current, then played back on a system which has been calibrated by means of a Signal Amplitude Reference Tape Cartridge recorded under the same conditions, the Average Signal Amplitude of the tape under test shall be within ± 25 % of SRA_{252}.

6.3.5 Ease of erasure

When a tape has been recorded at 63 ftpmm (1 600 ftpi) with a recording current equal to 150 % of the Test Recording Current, and then passed through a longitudinal steady erasing field of 79 600 A/m (1 000 Oe), any remaining signal shall not exceed 3 % of the Standard Reference Amplitude SRA_{252}. The erasing field shall be reasonably uniform, for example the field in the middle of a solenoid. The measurement shall be made with a band pass filter passing at least the first three harmonics.

6.3.6 Test for missing pulses

This test shall be carried out on the test tracks in the in-contact condition and over the whole length of the recording area (see 6.3.8) using the Test Recording Current.

Any playback signal, when measured base-to-peak, which is less than 40 % of half SRA_{252} shall be a missing pulse.

NOTE – ISO 8063 does not specify a test for extra pulses as it has no relevance to the recording method IMFM specified in ISO 8063/2.

6.3.7 Rejected regions

A rejected region shall be an area of tape which exhibits missing pulses. The acceptable number of rejected regions is a matter of agreement between the parties concerned (see annex F).

6.3.8 Recording area

The recording area shall be that part of the tape tested according to 6.3.1 to 6.3.6. In the forward direction, it begins at least 686 mm (27 in) before the LP marker and ends at least 991 mm (39 in) after the EW marker (see figure 2).

7 Layout of tracks (see figure 1)

7.1 Reference plane B and reference edge

All positioning requirements shall be referred to the top of the base plate of the cartridge, which is reference plane B. The reference edge shall be the edge of the tape positioned at a distance from reference plane B

l_0 = 1,78 ± 0,01 mm (0.070 0 ± 0.000 5 in).

7.2 Number of tracks

There shall be four parallel tracks numbered track 4, track 1, track 2, and track 3. Track 4 is the track nearest to the reference edge, track 3 being the track farthest from the reference edge.

7.3 Track centreline location

The track centreline locations shall be

- for track 1: l_1 = 4,11 ± 0,20 mm (0.162 ± 0.008 in);
- for track 2: l_2 = 5,74 ± 0,20 mm (0.226 ± 0.008 in);
- for track 3: l_3 = 7,37 ± 0,20 mm (0.290 ± 0.008 in);
- for track 4: l_4 = 2,48 ± 0,20 mm (0.098 ± 0.008 in).

7.4 Track width

The track width shall be

0,914 ± 0,050 mm (0.036 ± 0.002 in).

8 Characteristics of the cartridge

8.1 General description

The cartridge shall be of a compact coplanar design with the tape and hubs completely enclosed by the casing, except for the belt capstan and the head openings. The drive shall be by means of a tensioned belt which is driven by the internal belt capstan which receives motion from an external motor (see figure 3). Tape guides shall be located inside the cartridge. A clear plastic top shall allow visual monitoring of the tape and shall not extend beyond the base except at the notches.

8.1.1 Dimensions

The dimensions of the cartridge shall be as shown in figure 4.

8.1.2 Cartridge positioning planes

The cartridge shall be referenced to the drive only in the cross-hatched areas shown in figure 5. The application of forces indicated by *F* and *F* in figure 5 is one method of ensuring correct registration of the cartridge to the positioning plane of the drive.

8.1.3 Attachment

The ends of the tape shall not be attached to the hubs.

8.1.4 Mounting position

It shall be possible to mount the cartridge in the drive in one position only; to ensure this, the cartridge shall have the following asymmetrical features (see figure 4):

a) a projection in one guide slot;

b) the guide slots shall be accessible on the head opening edge only.

8.1.5 Light sensing

The cartridge shall contain optical elements to permit photoelectric detection of the tape markers (see figure 6). The total light transmittance of both cover windows, including the effects of reflection from the mirror surface, sensed by a silicon photo-transistor shall be at least 50 %.

This requirement shall be satisfied for both

a) 2 000 ± 200 K incandescent light source, and

b) a 940 ± 50 nm LED light source.

8.1.6 Cartridge-in-position sensing

The cartridge shall have a flat area on the front surface, the dimensions of which are shown in figure 7. This area shall be used for mechanical sensing that the cartridge is in position for writing and reading.

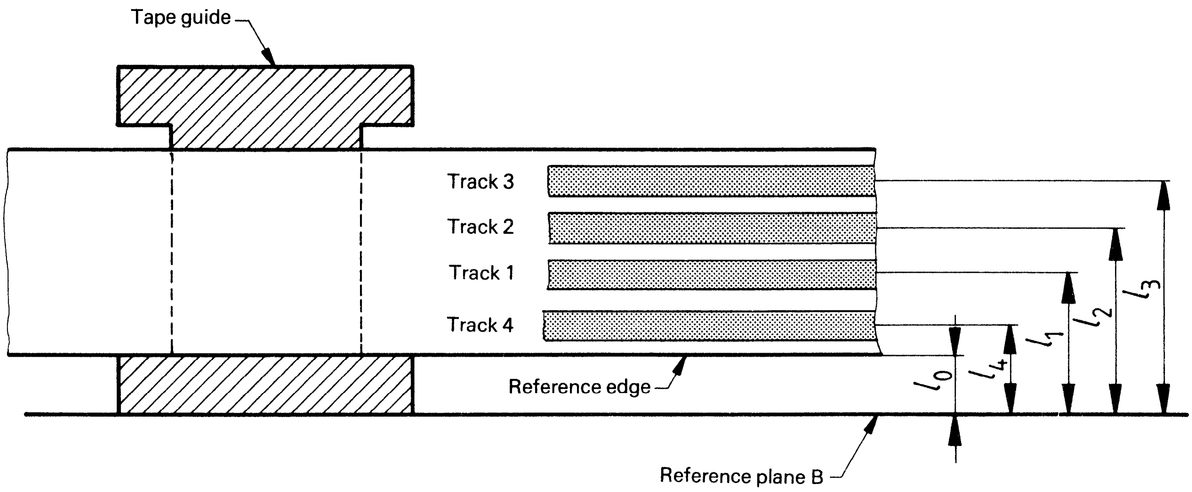

Figure 1 — Layout of tracks

8.1.7 Cartridge door

The cartridge shall have a door for protection of the tape during storage and transport. Requirements for opening the door are shown in figure 8.

8.2 File protection

The cartridge shall have a rotatable plug to prevent writing or erasing the tape, located as shown in figure 7.

8.3 Physical labels

8.3.1 Location and size

The rear surface of the cartridge, opposite the exposed tape, and a part of the top side of the cartridge shall allow the use of labels (see figure 9).

8.3.2 Interchange

Labels shall be used for marking the contents of cartridges. The use of pencil or erasable material is not permitted.

8.4 Tape guides

The tape shall be guided by tape guides contained within the cartridge (see figure 10). The drive shall not restrict the tape path in the transverse direction.

8.5 Speed

The cartridge shall be capable of being used at any nominal tape speed in the range 0,76 m/s (30 in/s) to 2,29 m/s (90 in/s).

NOTE — When using the higher speeds reliable data transfer is especially dependent on the careful design of the head-to-tape contact.

8.6 Instantaneous Speed Variation (ISV)

An Instantaneous Speed Variation Event is said to have occurred when the residual Time Displacement Error (TDE) exceeds 156 ns when measured at 0,76 m/s (30 in/s) and 252 ftpmm (6 400 ftpi). The number of ISV events shall be a matter of agreement between the parties concerned.

See Annex C for the method of test.

8.7 Acceleration

The cartridge shall be capable of withstanding any acceleration and deceleration of the tape up to a maximum of 50,8 m/s^2 (2 000 in/s^2).

8.8 Driving force

The tangential force required at the external driving surface of the belt capstan to maintain a constant operating speed shall be 1,0 ± 0,3 N (3.5 ± 1.0 ozf). The external radial load applied to the belt capstan when making this measurement shall be 5,6 ± 0,6 N (20 ± 2 ozf).

8.9 Total inertia

The total equivalent mass of all moving cartridge elements, when measured at the external driving surface of the capstan, shall be 0,022 kg max. (0.002 ozf·s^2/in max.).

8.10 Dynamic response

8.10.1 Definition

The speed response of tape motion to a step driving function applied to the belt capstan.

8.10.2 Requirement

The natural resonant frequency shall be a least 60 Hz.

8.10.3 Procedure

A drive capable of producing a pronounced overshoot of the tape speed should be used. The drive servo should be critically damped so that the overshoot observed is not that of the drive. The reciprocal of the time measured between the first two overspeed peaks is the natural resonant frequency.

8.11 Tape tension

8.11.1 Definitions

8.11.1.1 tape tension: The resultant force in the longitudinal direction of the tape on a cross-section of the tape taken through the tape perpendicular to the longitudinal direction.

8.11.1.2 instantaneous tension: The tape tension as measured at the cross-section of the tape located at the head position of the free tape path and averaged over 10 ms.

8.11.1.3 average tension (at a point along the length of the tape): The average value of instantaneous tension measured over 1 m (3 ft) of tape symmetrically located around that point.

8.11.1.4 dynamic tape tension (at a point along the length of the tape): The maximum variation of instantaneous tension over 1 m (3 ft) of tape symmetrically located around that point.

8.11.1.5 transverse tape tension variation: That variation of average tension across the tape produced by the difference in free tape path length between the two edges of the tape.

8.11.2 Requirements

8.11.2.1 Value of instantaneous tension

a) In the testing environment the instantaneous tension at any point along the length of the tape between LP and EW shall be between 0,28 N (1.0 ozf) and 0,98 N (3.5 ozf).

b) In the operating environment the instantaneous tension shall be between 0,14 N (0.5 ozf) and 1,12 N 4.0 ozf). When the temperature is brought back to that of the testing environment the requirements of a) shall be met.

8.11.2.2 Value of dynamic tension

The dynamic tension at any point along the length of the tape between LP and EW shall not exceed 0,21 N (0.75 ozf).

8.11.2.3 Requirement for transverse tension variation

The test rod shall not deviate from the horizontal by more than 4° at any point along the length of the tape from LP to EW.

8.11.3 Procedures

For test procedures, see annex D.

8.12 Drive ratio

The ratio of the tape speed to the surface speed of the external driving surface of the belt capstan shall be 0,76 ± 0,02.

8.13 Tape path length

The cartridge shall be used with drives causing an increase of the tape path length in the range 0,38 to 1,40 mm (0.015 to 0.055 in).

NOTE — The length of the tape path is the length of the straight tangent common to the tape guides when the cartridge is not mounted in the drive. It is measured between the two contact points of the tape with the guides. When the cartridge is mounted in the drive, the head and/or other parts of the drive provoke an increase of this tape path length which affects the initial tape tension.

8.14 Electrical resistance of the belt capstan

The electrical resistance of the belt capstan shall not exceed 1 MΩ when measured using the test equipment and test procedures described in annex E.

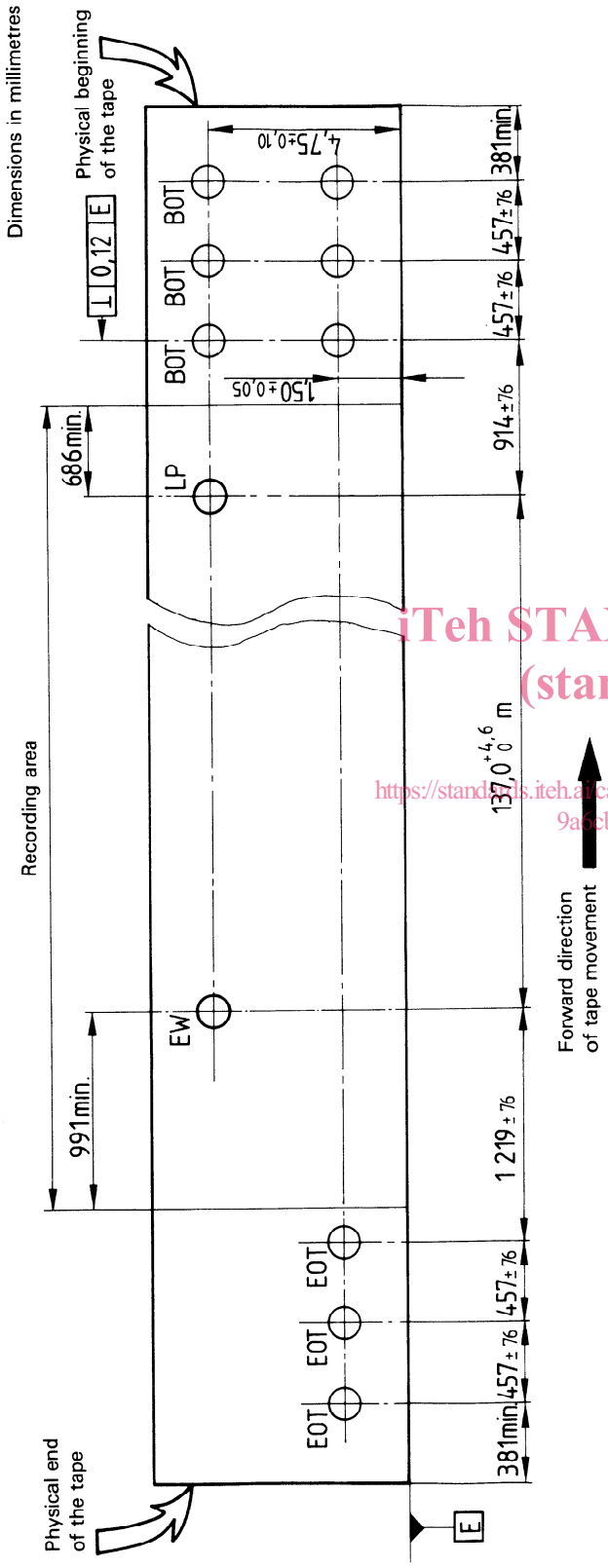

Figure 2a) — Position of the markers and recording areas (magnetic surface shown)

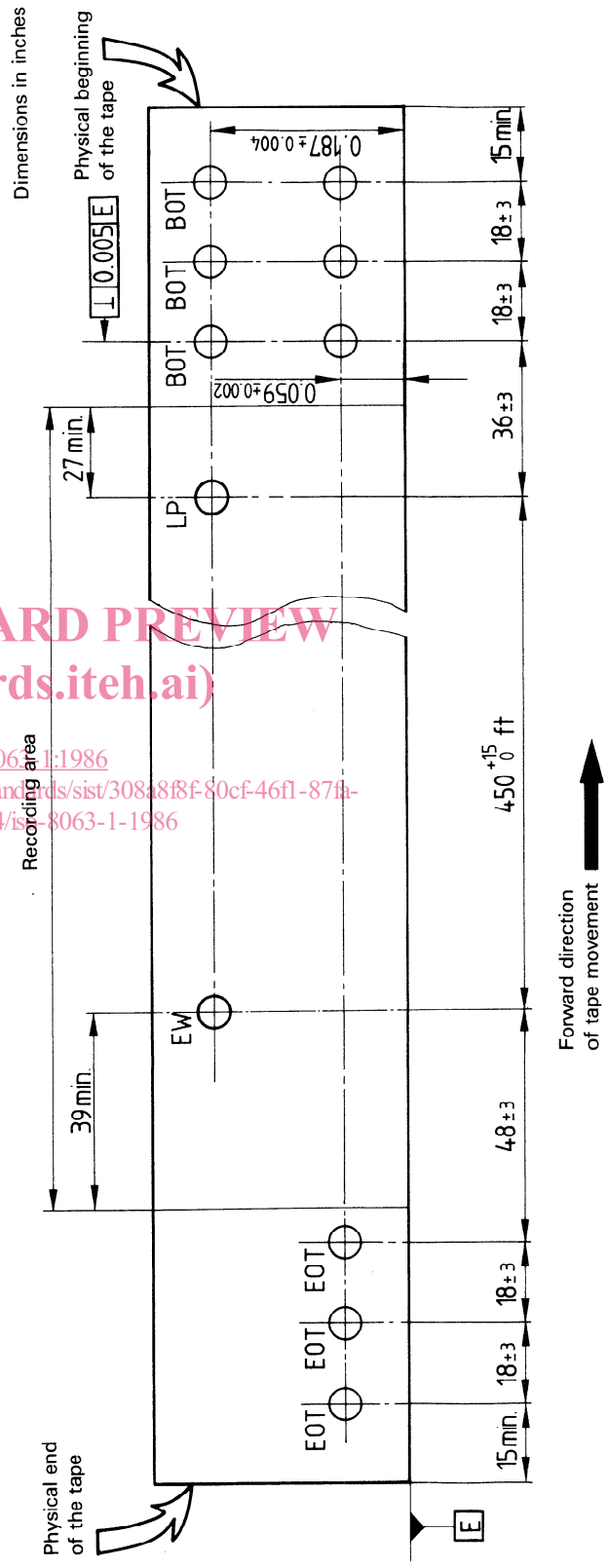

Figure 2b) — Position of the markers and recording areas (magnetic surface shown)

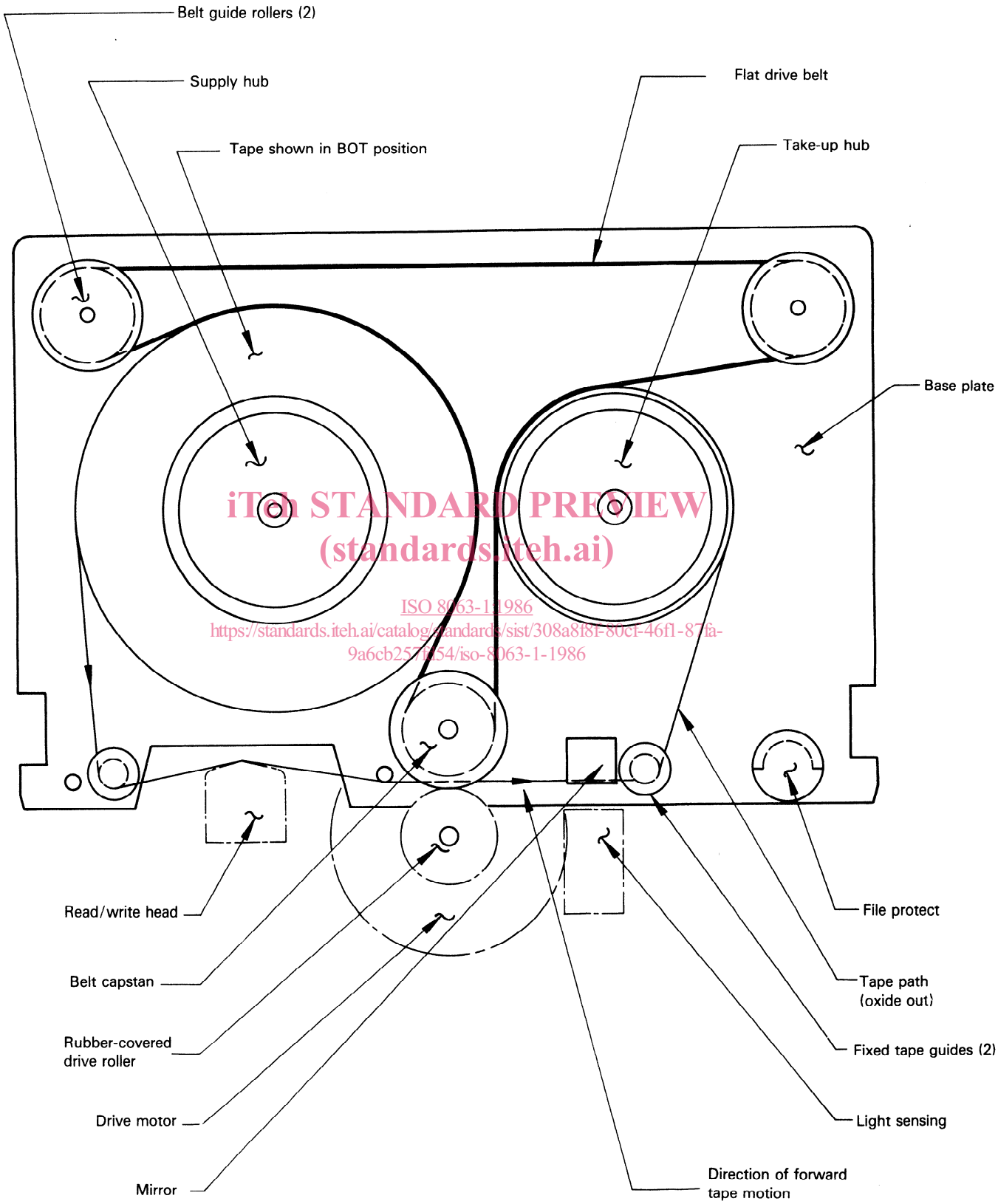

Figure 3 — Cartridge diagram