INTERNATIONAL STANDARD ISO 1864

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

Information processing — Unrecorded 12,7 mm (0.5 in) wide magnetic tape for information interchange — 8 and 32 rpmm (200 and 800 rpi), NRZI, and 63 rpmm (1 600 rpi), phase-encoded

Traitement de l'information — Bande magnétique vierge, de 12,7 mm (0,5 in) de large, pour l'échange d'information — 8 et 32 rangées par millimètre (200 et 800 rpi), NRZI, et 63 rangées par millimètre (1 600 rpi) par codage de phase

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magnetic tape specification ? digital recording ?
magnetic tape characteristics ? magnetic tape testing ?

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Descriptors : data processing, magnetic tapes, half-inch magnetic tapes, virgin medium, information interchange, ~~coding~~.

Some sort of clairvoyant perhaps!

Price based on 7 pages

FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up 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.

International Standard ISO 1864 was drawn up by Technical Committee ISO/TC 97, *Computers and information processing*, and circulated to the Member Bodies in September 1974.

It has been approved by the Member Bodies of the following countries :

Australia	Hungary	Spain
Belgium	Italy	Switzerland
Bulgaria	New Zealand	Turkey
Canada	Poland	United Kingdom
Czechoslovakia	Portugal	U.S.A.
France	Romania	U.S.S.R.
Germany	South Africa, Rep. of	Yugoslavia

No Member Body expressed disapproval of the document.

This International Standard cancels and replaces ISO Recommendation R 1864-1971 of which it constitutes a technical revision.

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Information processing – Unrecorded 12,7 mm (0.5 in) wide magnetic tape for information interchange – 8 and 32 rpmm (200 and 800 rpi), NRZI, and 63 rpmm (1 600 rpi), phase-encoded

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the characteristics of 12,7 mm (0.5 in) wide magnetic tape with reel, to enable magnetic and mechanical interchangeability of such tape between information processing systems utilizing a recommended ISO code.

This International Standard applies solely to magnetic tape for digital recording using the NRZI method of recording at 8 and 32 rpmm (200 and 800 rpi) or the phase-encoded method of recording at 63 rpmm (1 600 rpi) in which the direction of magnetization is nominally longitudinal.

2 DEFINITIONS

For the purpose of this International Standard, the following defintions apply :

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

2.2 reference tape : A tape which has been selected for given properties for use in calibration.

2.3 secondary reference tape : A tape intended for routine calibrating purposes, whose performance is known and stated in relation to that of a reference tape.

2.4 signal amplitude reference tape : A reference tape selected as a standard for signal amplitude.

NOTE – A master standard (computer amplitude reference) has been established at the U.S. National Bureau of Standards (NBS) based on reference tapes and heads. Secondary signal amplitude reference tapes are available from NBS under the part number SRM 3 200.

2.5 reference field : For any specified packing density, the minimum field applied to a signal amplitude reference tape which causes an output signal equal to 95 % of the maximum output.

2.6 standard reference amplitude : The average peak-to-peak signal amplitude derived from the signal amplitude reference tape (SRM 3 200) on the NBS measurement system, or equivalent, under the recording conditions specified in 4.13.

2.7 reference edge : The edge further from an observer, when the tape is lying flat and the magnetic surface uppermost and the direction of movement for recording from left to right.

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

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

2.10 packing density : The number of bits of recorded information per unit length of track.

2.11 row : 7 to 9 transversely related locations (one on each track) in which bits are recorded.

2.12 position of flux transition : That point which exhibits the maximum free-space flux density normal to the tape surface.

3 ENVIRONMENT

3.1 Testing environment

Unless otherwise stated, all measurements made on a tape to check compliance with the requirements of this International Standard and all tests prescribed for a tape in the document shall be carried out under the environmental conditions of 23 ± 2 °C (73 ± 5 °F) and relative humidity 40 to 60 %, after at least 24 h conditioning in the same environment.

3.2 Storage environment

Unrecorded tape : Temperature 5 to 50 °C (41 to 122 °F); relative humidity 20 to 80 %, wet bulb not to exceed 27 °C (80 °F).

Recorded tape : Same as unrecorded except the maximum storage temperature shall be 32 °C (90 °F). If this temperature is exceeded, performance may be affected.

4 CHARACTERISTICS OF TAPE

4.1 Materials

The tape shall consist of a base material (oriented polyethylene terephthalate film or its equivalent) coated on one side with a strong yet flexible layer of ferromagnetic material dispersed in a suitable binder.

4.2 Width

The width of the tape shall be $12{,}7\ ^{0}_{-0{,}1}$ mm ($0.500\ ^{0}_{-0.004}$ in).

4.3 Total thickness of tape

The total thickness of the tape, at any point, shall be 0,048 ± 0,008 mm (0.001 9 ± 0.000 3 in).

4.4 Base material thickness

The thickness of the base material shall be 0,038 mm (0.001 5 in) nominal.

4.5 Coating thickness

The coating thickness shall not exceed 0,015 mm (0.000 6 in).

4.6 Length

The normal minimum length of tape is 732 m (2 400 ft), splice-free. If the length of tape is less than 732 m (2 400 ft), the length must be stated. Maximum tape length is limited by thickness, *E* value (see 4.7), moment of inertia and reel dimensions.

4.7 *E* value

The *E* value is defined as the radial distance by which the reel flanges extend beyond the outermost layer of a tape which has been wound at a tension of 2 to 3 N (7 to 10 ozf) on the specified reel. The minimum *E* value shall be 3,2 mm (1/8 in).

4.8 Elastoplastic properties

The elastoplastic properties of the tape shall be such that when the tape is subjected to a tension of 30 N (6.75 lbf) for a period of 3 min under any combination of temperature and relative humidity within the ranges of 10 to 50 °C (50 to 122 °F) and 20 to 80 % relative humidity, the permanent elongation measured with negligible tension after a second 3 min internal is less than 1,0 %.

4.9 Longitudinal curvature

There shall be a minimum radius of curvature for the edge of the tape, defined and tested by allowing a 1 m (or 36 in) length of tape to unroll and assume its natural curvature on a flat surface. The minimum radius shall be 33 m (108 ft); if measured over an arc of a circle, this corresponds to a deviation of 3,8 mm from a 1 m chord (or 1/8 in from a 36 in chord).

4.10 Tape wind

Tape shall be wound, with its magnetic surface toward the reel hub, in a clockwise direction; i.e. when the reel is viewed from the front, the loose end of the tape hangs from the right side of the reel. Tape shall be wound with a tension of 2 to 3 N (7 to 10 ozf). (See figure 2.)

4.11 Magnetic properties

The magnetic properties of the tape are not defined here by B-H loops or similar parameters, but are defined by the testing procedures given in 4.13 to 4.16.

4.12 Test density

For the purpose of testing tape in accordance with this International Standard, the packing density of flux transitions shall not be less than that of the nominal value for an all "ones" pattern for the system with which the tape is to be used. In addition, for this test the flux transitions shall be uniformly spaced. The track configuration shall conform to ISO 1861, ISO 1862, ISO 1863 and ISO 3788 as appropriate.

4.13 Recording current

The relationship between the recording current (I_r) and the current required to produce the reference field (I_f) at various packing densities in flux transitions per millimetre (ftpmm) or per inch (ftpi) is as follows :

Packing density	Ratio $\frac{I_r}{I_f}$
For 8 ftpmm (200 ftpi)	2,0 to 2,2
For 32 ftpmm (800 ftpi)	2,0 to 2,2
For 126 ftpmm (3 200 ftpi)	1,75 to 1,85

4.14 Average signal amplitude

The average signal amplitude is defined as the average value of the peak-to-peak output voltage over at least 76 mm (3 in) of a tape that has been recorded under the conditions of 4.13 on all tracks.

When played back on a system, each channel of which has been calibrated by means of a signal amplitude reference tape, the average signal amplitude shall be within ± 10 % of the standard reference amplitude at 8 ftpmm (200 ftpi), within ± 10 % at 32 ftpmm (800 ftpi), and within $^{+25}_{-10}$ % at 126 ftpmm (3 200 ftpi).

NOTE – This test shall be conducted on the read-while-write pass for both tapes and in accordance with instructions issued with the signal amplitude reference tape.

4.15 Ease of erasure

When a tape has been recorded at 8 ftpmm (200 ftpi) or 32 ftpmm (800 ftpi) according to this International Standard and then passed through a longitudinal unidirectional steady field of 79 500 A/m (1 000 Oe), the average peak-to-peak output level, over a distance of at least 76 mm (3 in), of the remaining unwanted signal plus tape

noise shall not exceed 4 % of the standard reference amplitude at 126 ftpmm (3 200 ftpi). The field for erasure shall be reasonably uniform, such as that in the middle of a solenoid.

4.16 Test for drop-outs and drop-ins

These tests shall be carried out in the "in contact" condition and over the entire tested area, which shall extend from 0,2 m (8 in) before the beginning-of-tape reflective marker (BOT) to 3,0 m (10 ft) beyond the end-of-tape reflective marker (EOT). (See figure 1.)

4.16.1 *Drop-outs*

When a tape has been recorded on all tracks, with an 8 or 32 ftpmm (20 or 800 ftpi) signal, as defined in 4.12 and 4.13, and is played back on a system each channel of which has been calibrated as in 4.14, any signal from any track, when measured base-to-peak, which is less than 50 % of half the standard reference amplitude is considered a drop-out. At 126 ftpmm (3 200 ftpi) a drop-out is defined as any pair of consecutive output pulses from any track whose peak-to-peak amplitude is less than 35 % of the standard reference amplitude.

4.16.2 *Drop-ins*

Following DC-erasure of the tape on the machine used for conducting the drop-out test as described in 4.16.1, any signal from any track when measured base-to-peak which exceeds 10 % of half the standard reference amplitude is considered a drop-in.

NOTE – When performing the tests in 4.16.1 and 4.16.2, the output or resultant signal must be measured on the same relative pass for both the signal emplitude reference tape and the tape under test, i.e. read-while-write or read-on-first-pass-after-write. The standard reference amplitude shall be measured at the appropriate density.

4.16.3 *Rejected region*

A rejected region is an area of tape extending across the full width of the tape and not more than 10 mm (0.4 in) length which contains areas of tape which on two consecutive tests exhibit drop-outs or drop-ins.

NOTE – A limit on the frequency of occurrence of rejected regions on a tape is not an absolute requirement for interchange. It is considered impractical to specify limits for the following reasons :

a) the performance of test equipment for magnetic tape is not uniform but depends on such things as tape tension, head design and the method of guiding employed;

b) different machines and systems of programming vary in their ability to tolerate rejected regions on tapes.

4.17 Reflective markers

Each reel of tape shall be furnished with two photo-reflective markers, each consisting of, or equivalent to, a transparent plastic base with a metallic (for example vaporized aluminium) coating sandwiched between the base and a thin layer of low cold flow thermal setting adhesive.

Reflective markers shall be placed on the side of the tape which does not carry the magnetic surface, and they shall be on opposite edges of the tape with the beginning-of-tape reflective marker (BOT) on the reference edge.

The width of the markers shall be $4{,}8 \pm 0{,}5$ mm (0.19 ± 0.02 in).

The length of the markers shall be 28 ± 5 mm (1.1 ± 0.2 in).

The thickness of the markers, measured after their application to the tape, shall be not greater than 0,020 mm (0.000 8 in).

The beginning-of-tape relfective marker (BOT) shall be placed $4{,}9 \pm 0{,}6$ m (16 ± 2 ft) from the beginning of the tape and the end-of-tape marker (EOT) shall be placed $7{,}6\ ^{+1{,}5}_{0}$ m ($25\ ^{+5}_{0}$ ft) from the end of the tape.

The distance from the outer edge of a marker to the adjacent edge of the tape shall be 0,8 mm (0.03 in) maximum and the marker shall not protrude beyond the edge of the tape.

The markers shall be free of wrinkles and excessive adhesive. The surface of the reflective markers shall be non-conductive.

NOTE – It is desirable to employ the thinnest markers which perform satisfactorily to minimize the distortion of layers of tape adjacent to them.

4.18 Cupping

Cupping is the departure across the width of tape from a flat surface. The maximum cupping of a 6,35 mm (0.25 in) long length of tape shall not exceed 0,25 mm (0.01 in) when placed concave side down on a smooth flat surface. The time between cutting and the measurement should be 1 h.

4.19 Opacity

Opacity is a characteristic which limits the amount of transmission of light through the tape. The opacity of tape shall not be less than 95 % over the range of wavelength from 0,4 to 1,5 μm.

4.20 Resistance

The electrical resistance of the magnetic surface shall not exceed $5 \times 10^8\ \Omega$/square but shall be greater than $5 \times 10^5\ \Omega$/square.

NOTE – **resistance per square** : The surface resistance of a square area of any size, measured between electrodes placed along two opposite sides of the square. The unit of measurement is the ohm.

4.21 Reflectivity

4.21.1 *Marker reflectivity*

The photo-reflective marker shall possess a reflectivity of at

least 90 % compared to a reference standard[1], over an angle of incidence of light from 45 to 60° and over the range of wavelengths from 0,4 to 1,5 μm.

4.21.2 *Tape backing reflectivity*

The tape backing shall possess a reflectivity not exceeding 25 % of that of the reference standard[1] when measured under the conditions specified in 4.21.1.

5 REEL (SPOOL)

5.1 Reels shall be so constructed that any profile section taken through the centre axis of the reel conforms to figure 3 except where taken so as to pass through the relieved portion of the write-enable ring groove. The section shall, in this case, conform to the profile of figure 3, with appropriate deviations permitted at the ring groove relief as illustrated in section Z-Z.

5.2 Dimension *L* (figure 3) defines the mounting surface of reels. The ring groove relief (figure 3) is not required so long as the ring type designated for that reel does not protrude beyond the reel mounting surface.

5.3 All dimensions shown in figure 3, including those in detail sections, shall be held to the tolerances specified in the table.

5.4 Thickness of the flange portion of the reels may be varied, but must fall entirely within the cross-hatched envelopes defined by dimensions J_f, J_r, K_f, K_r and *M*.

5.5 Hub and flanges need not be integral, but may be separate parts at the manufacturer's option as long as all other requirements of this International Standard are met.

5.6 Bosses, ribs, or raised designs are permitted on the outside surfaces of the flanges, provided that they do not extend beyond the cross-hatched envelope of figure 3.

5.7 Flanges may have holes to permit threading tape onto the hub. Size and shape of flange holes shall be optional, having such a minimum dimension as not to inhibit the usual technique of manual threading.

5.8 Reels may be constructed from any suitable material or materials so long as the dimensional and inertial requirements of this International Standard are maintained.

5.9 Reels are not symmetrical. The flanges differ primarily in the presence or absence of a groove for the write-enable ring, which must be adjacent to the mounting pedestal for correct machine operation.

5.10 The outside cylindrical surface of the bulb shall be concentric with the centre bore (dimensions *C* and *A* respectively of figure 3) within 0,254 mm (0.01 in).

5.11 Dimension *A* shall not be less than 93,5 mm (3.680 in) when the reel is fully loaded with tape wound at 3,4 N (12 ozf) constant tension. The value 3,4 N (12 ozf) only concerns dimension *A* and in no way widens the limits of the tape tension specified in 4.7 and 4.10.

5.12 The moment of inertia of the tape and reel combined shall not exceed 0,010 5 kg·m² (574 oz·in²). In general, this will require a reel whose moment of inertia does not exceed 0,002 75 kg·m² (150 oz·in²).

5.13 Identification of reel of tape

5.13.1 *Owner identification*

A labelling area shall be provided on the front flange of the reel to provide ownership identification.

5.13.2 *Manufacturer's reel identification*

The manufacturer's identification may be placed on the reel.

5.13.3 *Interchange identification*

A labelling area shall be provided on the front flange. Suitable labels shall be used for marking the contents of the reel of the tape. Adhesive labels, if employed, shall leave no residue when removed. The use of pencil or similar erasable marking is not allowed.

5.13.4 *Manufacturer's tape identification*

The tape manufacturer's identification may be placed on one or both ends of the tape.

5.14 Write-enable ring

5.14.1 When installed in the write-enable ring groove, the top surface of the write-enable ring must be such that it does not protrude above the annular surface that lies between dimensions *A* and *D* in figure 3.

5.14.2 All write-enable rings must have a tab to facilitate removal from the groove.

5.14.3 Dimensions and materials used must be such that the write-enable ring may be installed and removed with reasonable effort and remain seated during normal use. Furthermore, the ring must be constructed so as not to interfere with normal tape transport performance.

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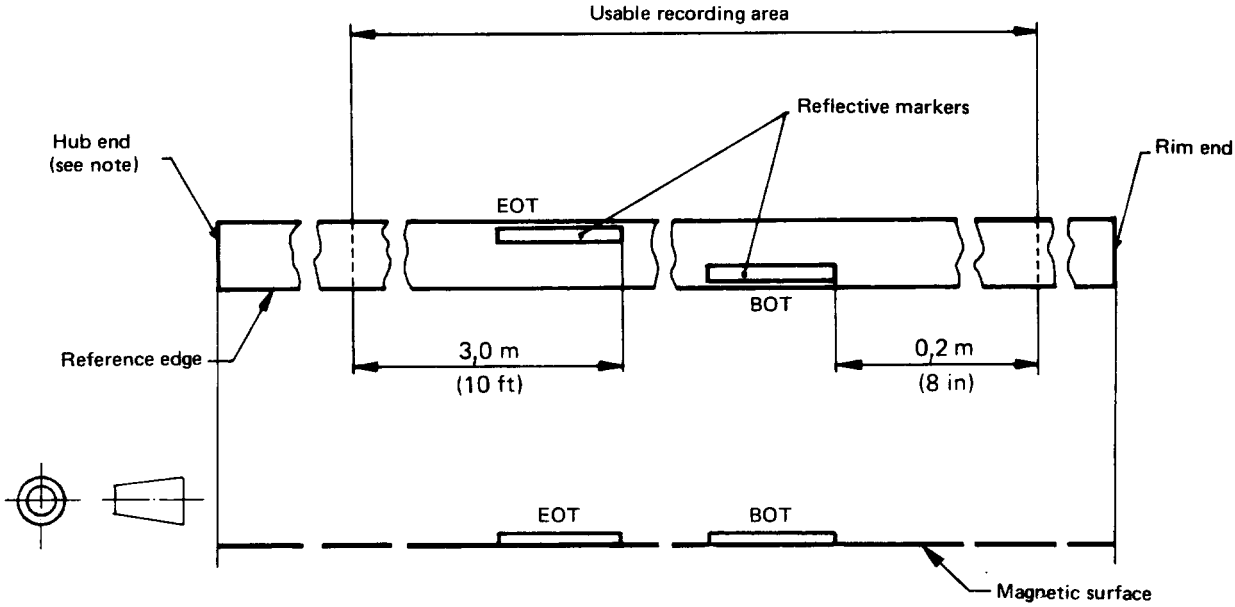
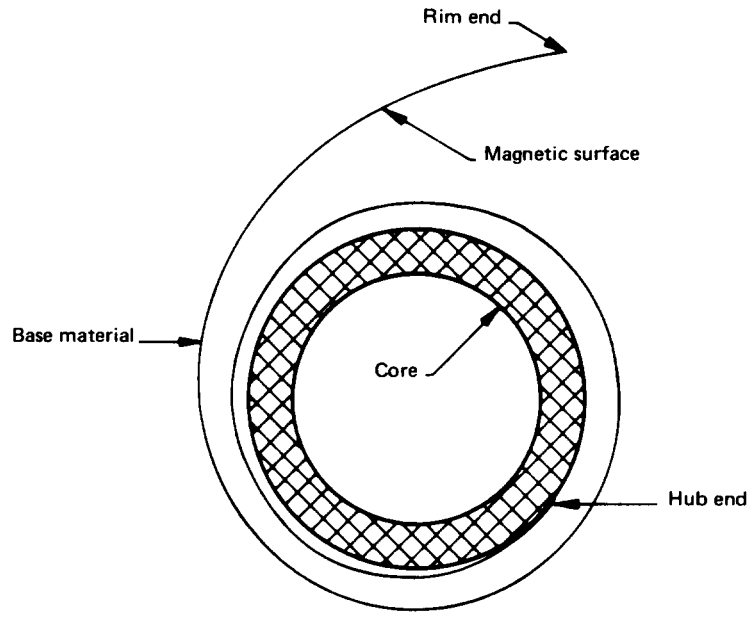
1) The reference standard should be constructed from a piece of aluminium Al-Mg1 Si Cu (see ISO/R 209) with a flat face dimension of 30 mm (1.2 in) by 5 mm (0.2 in) with a surface roughness *R* (arithmetical mean deviation) between 0,008 μm (0.32 μin) and 0,016 μm (0.63 μin) (see ISO/R 468). The standard should be resurfaced periodically to prevent a reflectivity shift due to oxidation.



NOTE – Tape shall not be attached to the hub.

FIGURE 1 – **Reflective markers and recording area**

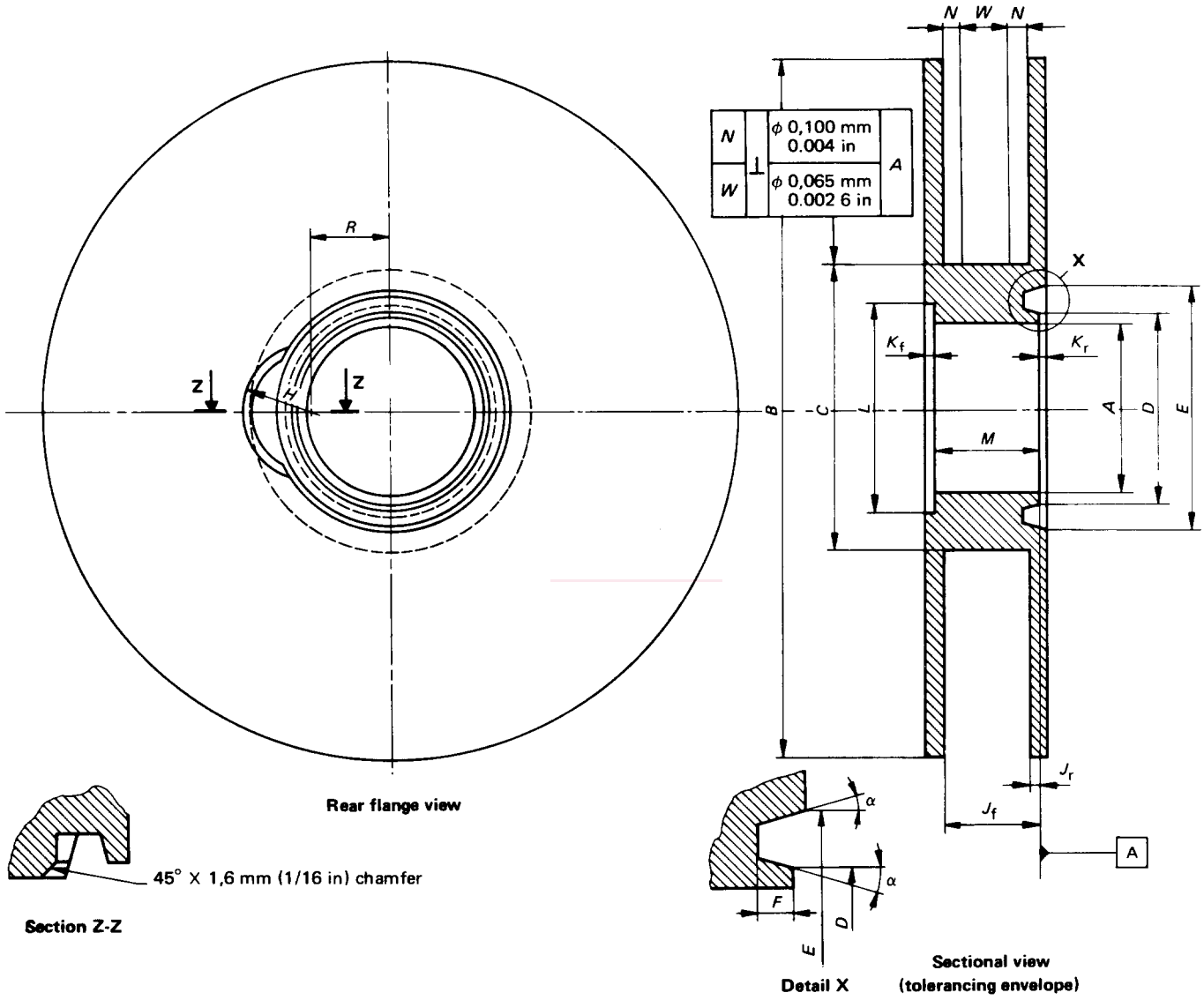


NOTES

1 Spool viewed from the front. Write-enable ring groove at the rear.

2 The tape shall not be attached to the hub.

FIGURE 2 – **Direction of tape wind**



Rear flange view

Section Z-Z

Detail X

Sectional view
(tolerancing envelope)

FIGURE 3 – Tape reel

TABLE — **Dimensions and tolerances**

Dimension	mm		in	
	nominal	tolerances	nominal	tolerances
A	93,68	+ 0,13 − 0,08	3.688	+ 0.005 − 0.003
B	266,70	± 0,51	10.500	± 0.020
C	130,18	(*N*) ± 0,20 (*W*) ± 0,13	5.125	(*N*) ± 0.008 (*W*) ± 0.005
D	98,42	± 0,13	3.875	± 0.005
E	111,46	± 0,13	4.388	± 0.005
F	6,35	+ 0,25 0	0.250	+ 0.010 0
H	19,05	± 0,38	0.750	± 0.015
J_f	15,80	+ 0,64 − 0,13	0.622	+ 0.025 − 0.005
J_r	2,46	+ 0,13 − 0,64	0.097	+ 0.005 − 0.025
K_f	3,18 maximum		0.125 maximum	
K_r	2,03 maximum		0.080 maximum	
L	104,78 minimum		4.125 minimum	
M	18,24	± 0,13	0.718	± 0.005
N	1,5		0.065	
R	42,60	± 0,25	1.677	± 0,010
α	4°	± 15′	4°	± 15′