

International Standard



6596/1

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

Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using two-frequency recording at 7 958 ftprad, 1,9 tpmm (48 tpi), on one side — Part 1 : Dimensional, physical and magnetic characteristics

Traitement de l'information — Échange de l'information sur cartouches à disquette de 130 mm (5,25 in) utilisant un enregistrement à deux fréquences à 7 958 ftprad, 1,9 tpmm (48 tpi), sur une face — Partie 1 : Caractéristiques dimensionnelles, physiques et magnétiques

Second edition — 1985-04-01

UDC 681.327.63

Ref. No. ISO 6596/1-1985 (E)

Descriptors : data processing, information interchange, data recording devices, magnetic disks, flexible disks, specifications, dimensions, physical properties, magnetic properties.

Price based on 16 pages

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 6596/1 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

ISO 6596/1 was first published in 1982. This second edition cancels and replaces the first edition, the following clauses of the previous edition have been technically revised: 6.1.9, 8.2.1.3, annex D, figure 4, figure 8 and figure 14.

Contents

	Page
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Definitions	1
4 General description	2
5 General requirements	2
6 Dimensional characteristics	3
7 Physical characteristics	5
8 Magnetic characteristics	5
Annexes	
A Measurement of the cartridge thickness	11
B Measurement of light transmittance	13
C Method for measuring the effective track width	15
D Use of additional tracks	16

This page intentionally left blank

STANDARDSISO.COM : Click to view the full PDF of ISO 6596-1:1985

Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using two-frequency recording at 7 958 ftrpad, 1,9 tpmm (48 tpi), on one side — Part 1 : Dimensional, physical and magnetic characteristics

0 Introduction

ISO 6596 specifies the characteristics of 130 mm (5.25 in) flexible disk cartridges recorded at 7 958 ftrpad on one side using two-frequency recording.

ISO 6596/2 specifies the quality of recorded signals, the track layout, and the track format to be used on a 130 mm (5.25 in) flexible disk cartridge, recorded at 7 958 ftrpad, 1,9 tpmm (48 tpi), on one side, using two-frequency recording, which is intended for data interchange between data processing systems.

Together with the labelling scheme to be specified in ISO 7665, ISO 6596/1 and ISO 6596/2 provide for full data interchange between data processing systems.

1 Scope and field of application

This part of ISO 6596 specifies the dimensional, physical and magnetic characteristics of the cartridge, so as to provide physical interchangeability between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this International Standard may have been rounded 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 Imperial units and further developments were made using SI units.

2 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 4873, *Information processing — 8-bit code for information interchange — Structure and rules for implementation*.

ISO 7665, *Information processing — File structure and labelling of flexible disc cartridges for information interchange*.

3 Definitions

For the purpose of this International Standard the following definitions apply.

3.1 flexible disk : A flexible disk which accepts and retains on the specified side or sides magnetic signals intended for input/output and storage purposes of information data processing and associated systems.

3.2 reference flexible disk cartridge : A flexible disk cartridge arbitrarily selected for a given property for calibrating purposes.

3.3. secondary reference flexible disk cartridge : A flexible disk cartridge intended for routine calibrating purposes, the performance of which is known and stated in relation to that of the reference flexible disk cartridge.

3.4 signal amplitude reference flexible disk cartridge : A reference flexible disk cartridge selected as a standard for recording field and signal amplitude.

NOTE — A master standard for signal amplitudes, reference fields, overwrite and resolution characteristics has been established by the Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100 in Braunschweig, Germany, F.R. Secondary reference flexible disk cartridges can be ordered from PTB Lab 5.11 under part number RM 6596 as long as available.

3.5 typical field : The minimum recording field which, when applied to a flexible disk cartridge, causes a signal output equal to 95 % of the maximum average signal amplitude when taken as a function of the recording field at the specified track and flux transition frequency of that flexible disk cartridge.

3.6 reference field : The typical field of the signal amplitude reference flexible disk cartridge.

3.7 test recording current : The current between 145 % and 155 % of the current which produces the reference field at 125 000 flux transitions per second (ftps) on track 00.

3.8 standard reference amplitudes : The average signal amplitudes derived from the signal amplitude reference flexible disk cartridge at the densities obtained when writing with 125 000 ftps on track 00 and with 250 000 ftps on track 34 using the test recording current (see 8.2).

3.9 average signal amplitude : The arithmetically averaged value for a track of the output voltages measured peak-to-peak over the whole track.

3.10 in contact : An operating condition in which the magnetic surface of the disk intended for data storage is in physical contact with the magnetic head.

3.11 formatting : Writing the proper control information, establishing the 35 physical tracks, and designating addresses of physical records on the flexible disk's surface.

3.12 initialization : Writing of the volume label, the ERMAP label and any other information initially required to be on the flexible disk cartridge prior to the commencement of general processing or use.

3.13 recording area : That area of the disk surface with which the head may come into contact.

4 General description

4.1 General figures

A typical flexible disk cartridge is represented in figures 1 to 3 as follows :

Figure 1 — Flexible disk cartridge, shows the cartridge seen from above, side 0 up.

Figure 2 — Section A-A, is a cross-section along line A-A in figure 1.

Figure 3 — Protective envelope with cartridge, shows a protective envelope with cartridge, side 1 up.

4.2 Main elements

The main elements of this flexible disk cartridge are

- the recording disk;
- the liner;
- the jacket.

The cartridge is stored in an envelope.

4.3 Description

The jacket is of a square form. It includes a central window, an index window and a head window in both sides.

The liner is fixed to the inside of the jacket. It comprises two layers of material between which the disk is held. The liner has the same openings as the jacket.

The disk has only a central window and an index window.

4.4 Optional features

The interchange characteristics of the jacket allow for variations in its construction. It may include flaps (for example, three flaps as shown in the figures, or none) and notches along the reference edge.

5 General requirements

5.1 Environment and transportation

5.1.1 Testing environment

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

temperature : 23 ± 2 °C (73 ± 4 °F)

relative humidity : 40 % to 60 %

conditioning before testing : 24 h minimum

The temperature and the relative humidity shall be measured in the air immediately surrounding the cartridge.

The stray magnetic field at any point on the disk surface, including that resulting from the concentrating effect on the recording head, shall not exceed 4 000 A/m (50 Oe).

5.1.2 Operating environment

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

temperature : 10 to 51,5 °C (50 to 125 °F)

relative humidity : 20 % to 80 %

wet bulb temperature : less than 29 °C (84 °F)

The temperature and the relative humidity shall be measured in the air immediately surrounding the cartridge. It is recommended that the rate of change of the temperature should not exceed 20 °C (36 °F) per hour.

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

The stray magnetic field at any point on the disk surface, including that resulting from the concentrating effect on the recording head, shall not exceed 4 000 A/m (50 Oe).

5.1.3 Storage environment

During storage the cartridges shall be kept under the following conditions :

temperature : 4 to 51,5 °C (40 to 125 °F)

relative humidity : 8 % to 80 %

Each cartridge shall be in an envelope and in an upright position.

The stray magnetic field shall not exceed 4 000 A/m (50 Oe).

NOTE — Cartridges which have been stored at temperatures and humidities outside the operating condition but within the storage conditions may exhibit degraded performance characteristics. Such cartridges should be subjected to a conditioning period of not less than 24 h within the operating environment prior to use.

5.1.4 Transportation

Responsibility for ensuring that adequate precautions are taken during transportation shall be with the sender. During transportation the cartridge shall be in its envelope and in a protective package. The latter shall be free from dust or extraneous matter. It shall have a clean interior and construction preventing ingress of dust and 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.

It is recommended that the following conditions should not be exceeded :

temperature : -40 to 51,5 °C (-40 to 125 °F)

maximum rate of temperature change : 20 °C (36 °F) per hour

relative humidity : 8 % to 90 %

No moisture shall condense in or on the cartridge.

5.1.5 Handling

The cartridge shall stay out of its envelope for the shortest time possible. When handling the cartridge the operator shall not touch the exposed magnetic surfaces of the disk and shall avoid exposing the cartridge to direct sunlight, moisture and dust.

5.2 Materials

5.2.1 Jacket

The jacket may be constructed from any suitable material.

5.2.2 Liner

The material of the liner shall be able to retain dust without damage to the disk.

5.2.3 Disk

The disk may be constructed from any suitable material (for example, bi-axially oriented polyethylene terephthalate) coated at least on one side with a strong and flexible layer of magnetic material (for example $\gamma\text{-Fe}_2\text{O}_3$).

5.2.4 Envelope

The envelope may be manufactured from any suitable material, (for example, paper).

5.3 Direction of rotation

The direction of rotation shall be counterclockwise when looking at side 0.

6 Dimensional characteristics

The dimensional characteristics listed in the sub-clauses below are indicated in figures 4 to 7 as follows :

Figure 4 — Jacket dimensions, shows the jacket.

Figure 5 — Cartridge thickness, shows a partial cross-section of the jacket.

Figure 6 — Disk dimensions, shows the disk.

Figure 7 — Disk thickness, shows a cross-section of the disk.

All dimensions are referred to the reference edge of the cartridge (see figure 4).

6.1 Jacket

6.1.1 Form

The jacket shall have a square form with angles of $90^\circ \pm 30'$ and a side length

$$l_1 = 133,3 \pm 0,4 \text{ mm } (5.250 \pm 0.015 \text{ in})$$

6.1.2 Thickness

6.1.2.1 Jacket wall and liner

In an area defined by

$$r_1 = 35 \text{ mm } (1.38 \text{ in})$$

$$r_2 = 50 \text{ mm } (1.97 \text{ in})$$

and with a probe having a diameter of 15 mm (0.59 in) applied against the cartridge with a force of 1 N (3.6 ozf), the thickness of the jacket wall and liner shall be

$$e_1 = 0,45 \pm 0,15 \text{ mm } (0.018 \pm 0.006 \text{ in})$$

6.1.2.2 Cartridge

The overall thickness of the cartridge shall be (see 6.1.7) :

$$1,2 \text{ mm (0.047 in)} < e_2 < 2,1 \text{ mm (0.083 in)}$$

when measured according to annex A.

The cartridge shall fall freely through a gauge with a $2,60 +0,05 \text{ mm (0.100 +0,002 in)}$ wide opening having flat and vertical walls and a depth of 150 mm (5.9 in).

6.1.3 Central windows

The central windows shall have a diameter

$$d_1 = 39,7 \pm 0,2 \text{ mm (1.56} \pm 0.01 \text{ in)}$$

The position of their centre is defined by

$$l_2 = 66,65 \pm 0,30 \text{ mm (2.624} \pm 0.012 \text{ in)}$$

6.1.4 Index windows

6.1.4.1 Location

The centre of the index windows shall be defined by

$$l_3 = 42,10 \pm 0,25 \text{ mm (1.657} \pm 0.010 \text{ in)}$$

$$l_4 = 60,00 \pm 0,25 \text{ mm (2.362} \pm 0.010 \text{ in)}$$

6.1.4.2 Diameter

The diameter of the index windows shall be

$$d_2 = 6,35 \pm 0,20 \text{ mm (0.250} \pm 0.008 \text{ in)}$$

6.1.5 Head windows

6.1.5.1 Location

The location of the lowest point of the head windows shall be defined by

$$l_5 = 3,30 \pm 0,25 \text{ mm (0.130} \pm 0.010 \text{ in)}$$

6.1.5.2 Dimensions

The width of the head windows shall be

$$l_6 = 12,7 \pm 0,2 \text{ mm (0.500} \pm 0.008 \text{ in)}$$

The nominal radius of their ends shall be

$$r_3 = 6,35 \text{ mm (0.250 in)}$$

Their length shall be

$$l_7 = 35,00 \pm 0,25 \text{ mm (1.378} \pm 0.010 \text{ in)}$$

6.1.6 Reference edge profile

Within an area defined by

$$l_8 = 25 \text{ mm (1.0 in)}$$

The reference edge shall have a convex profile; for example, rounded off with one or more radii of 0,3 mm min. (0.012 in min.).

6.1.7 Construction of the jacket

If the jacket utilizes flaps, their width shall be

$$l_9 = 12 \text{ mm max. (0.47 in max.)}$$

The total thickness e_2 of the cartridge with flaps shall satisfy the conditions of 6.1.2 (see annex A).

6.1.8 Notches

Two notches may be provided along the reference edge. If provided, they have to be entirely contained within areas defined by :

$$l_{10} = 48,0 \text{ mm min. (1.89 in min.)}$$

$$l_{11} = 58,0 \text{ mm max. (2.28 in max.)}$$

$$l_{12} = 75,0 \text{ mm min. (2.95 in min.)}$$

$$l_{13} = 85,5 \text{ mm max. (3.37 in max.)}$$

$$l_{14} = 2,0 \text{ mm max. (0.08 in max.)}$$

6.1.9 Write-enable notch

The position and size of the write-enable notch shall be defined by

$$l_{19} = 96,5 \pm 0,25 \text{ mm (3.799} \pm 0.008 \text{ in)}$$

$$l_{20} = 6,35 \pm 0,13 \text{ mm (0.250} \pm 0.005 \text{ in)}$$

$$l_{21} = 3,8 \pm 0,25 \text{ mm (0.150} \pm 0.008 \text{ in)}$$

If the notch is covered by any means, writing on the disk shall be inhibited.

6.2 Liner

The liner shall extend across the recording area (see 6.3.4). However, no part of the liner shall protrude by more than 0,5 mm (0.019 in) into the openings of the jacket.

6.3 Disk

6.3.1 Diameters

The external diameter of the disk shall be

$$d_3 = 130,2 \pm 0,2 \text{ mm (5.125} \pm 0.008 \text{ in)}$$

The inner diameter of the disk shall be

$$d_4 = 28,575 \pm 0,025 \text{ mm } (1.125 \pm 0.001 \text{ in})$$

6.3.2 Thickness

The thickness of the disk shall be

$$e_3 = 0,080 \pm 0,010 \text{ mm } (0.003 \text{ 0} \pm 0.000 \text{ 4 in})$$

6.3.3 Index hole

6.3.3.1 Location

The location of the index hole shall be defined by

$$r_4 = 25,4 \pm 0,1 \text{ mm } (1.000 \pm 0.004 \text{ in})$$

6.3.3.2 Diameter

The diameter of the index hole shall be

$$d_5 = 2,54 \pm 0,10 \text{ mm } (0.100 \text{ 0} \pm 0.003 \text{ 9 in})$$

6.3.4 Recording area

The recording area shall be defined by

$$r_5 = 31,3 \text{ mm max. } (1.23 \text{ in max.})$$

$$r_6 = 62,5 \text{ mm min. } (2.46 \text{ in min.})$$

6.3.5 Sides

For convenience of description two sides are defined

- side 0 is the side on which the disk is recorded and is accessed through side 0 of the jacket,
- side 1 is the other side.

7 Physical characteristics

7.1 Inflammability

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

7.2 Coefficient of linear thermal expansion of the disk

The coefficient of thermal expansion of the disk shall be

$$(17 \pm 8) \times 10^{-6} \text{ K}^{-1}$$

7.3 Coefficient of linear hygroscopic expansion of the disk

The coefficient of hygroscopic expansion of the disk shall be in the range

$$(0 \text{ to } 15) \times 10^{-6} \text{ per percent of relative humidity}$$

7.4 Opacity

7.4.1 Opacity of the jacket

The jacket shall have a light transmittance of less than 1 % using an LED with a nominal wavelength of $940 \pm 10 \text{ nm}$ as the radiation source when measured according to annex B.

7.4.2 Opacity of the disk

The disk shall have a light transmittance of less than 1 % using an LED with a nominal wavelength of $940 \pm 10 \text{ nm}$ as the radiation source when measured according to annex B.

7.5 Torque

7.5.1 Starting torque

The starting torque, without head and pads loaded to the cartridge, shall not exceed $0,01 \text{ N} \cdot \text{m}$ ($1.42 \text{ ozf} \cdot \text{in}$).

7.5.2 Running torque

When the disk cartridge is tested at a rotation speed of $300 \pm 6 \text{ r/min}$, with a pressure pad of $280 \pm 10 \text{ mm}^2$ ($0.434 \pm 0.015 \text{ in}^2$) surface applied with a force of $0,70 \pm 0,05 \text{ N}$ ($2.52 \pm 0.18 \text{ ozf}$) and located parallel to the head windows as defined in figure 8 by :

$$l_{15} = 44 \text{ mm } (1.73 \text{ in})$$

$$l_{16} = 55 \text{ mm } (2.16 \text{ in})$$

$$l_{17} = 7 \text{ mm } (0.28 \text{ in})$$

$$l_{18} = 35 \text{ mm } (1.38 \text{ in})$$

the torque necessary to rotate the disk shall not exceed $0,03 \text{ N} \cdot \text{m}$ ($4.26 \text{ ozf} \cdot \text{in}$).

8 Magnetic characteristics

8.1 Track geometry

8.1.1 Number of tracks

There shall be 35 discrete concentric tracks in the recording area (see 6.3.4) for data interchange (see annex D).

8.1.2 Width of tracks

The recorded track width on the disk surface shall be

$$0,300 \pm 0,025 \text{ mm } (0.0118 \pm 0.0010 \text{ in})$$

The area between the tracks shall be erased. The method of measuring effective track width is given in annex C.

8.1.3 Track location

8.1.3.1 Nominal locations

The nominal radius of the centrelines of all tracks shall be calculated by using the formula

$$R_n = 57,150 - \frac{25,4 n}{48} \text{ mm}$$

$$\left(R_n = 2.25 - \frac{n}{48} \text{ in} \right)$$

where n is the numeric value corresponding to the track number: $n = 0$ to 34 for data interchange (see also annex D).

8.1.3.2 Track location tolerance

The centrelines of tracks recorded for testing purposes shall be within $\pm 0,025 \text{ mm}$ (0.0010 in) of the nominal positions, when measured in the testing environment (see 5.1.1).

8.1.4 Track number

The track number shall be a two-digit decimal number (00 to 34) which identifies the tracks consecutively, starting at the outermost track (00) (see also annex D).

8.1.5 Index

The index is the point which determines the beginning and the end of a track. At the instant of having detected the leading edge of the index window, the index is under the read-write gap.

8.2 Functional testing

For the purpose of the following tests the same drive unit shall be used for writing and reading operations.

8.2.1 Surface tests

The magnetic properties of the data surface are defined by the testing requirements given below.

8.2.1.1 Test conditions

The disk shall be tested at $300 \pm 6 \text{ r/min}$. The test frequencies used shall be

$$1f = 125\,000 \pm 125 \text{ ftps}$$

$$2f = 250\,000 \pm 250 \text{ ftps}$$

The frequency(ies) to be used is (are) specified for each test.

8.2.1.2 Typical field

The typical field of the disk under test shall be within $\pm 20 \%$ of the reference field. It shall be measured using $1f$ on track 00.

8.2.1.3 Average signal amplitude

When a disk has been recorded with the test recording current, then read back on a system which has been calibrated by means of a signal amplitude reference flexible disk cartridge, recorded under the same conditions, the average signal amplitude of the disk under test shall be

- not more than 130 % on track 00 using $1f$;
- not less than 80 % on track 34 using $2f$;

of the appropriate standard reference amplitude.

8.2.1.4 Resolution

After recording, using the test recording current, on track 34, the ratio

$$\frac{\text{average signal amplitude using } 2f}{\text{average signal amplitude using } 1f}$$

shall be greater than 80 % of the value of the same ratio for the signal amplitude reference flexible disk cartridge.

8.2.1.5 Overwrite

On track 00 after recording with the test recording current, first using $1f$ and then overwriting with $2f$ for one revolution, the ratio

$$\frac{\text{residual average signal amplitude at } 1f \text{ after overwrite using } 2f}{\text{average signal amplitude after first recording using } 1f}$$

shall be less than 100 % of the value of the same ratio for the signal amplitude reference flexible disk cartridge. This test shall be performed with a frequency-selective voltmeter.

8.2.1.6 Modulation

Modulation shall be

$$\frac{\text{maximum mean} - \text{minimum mean}}{\text{maximum mean} + \text{minimum mean}} \times 100 \%$$

The maximum mean shall be the average value of the amplitude modulated output voltage in that part of the track with the maximum amplitudes, and the minimum mean shall be that in the respective part with the minimum amplitudes. Output voltage shall be measured peak-to-peak, averaging shall be done over about 2 000 consecutive flux transitions.

On track 00 using $1f$ and on track 34 using $2f$, modulation shall be less than 10 %.

8.2.2 Track quality tests

These tests shall be carried out using $2f$ and over all 35 usable tracks at the defined positions. The test recording current shall be used.

8.2.2.1 Missing pulse

Write a track at $2f$ with the appropriate test recording current. Any playback signal, when measured base-to-peak, which is less than 40 % of half the arithmetically averaged value of the output voltages measured peak-to-peak over the preceding 2 000 consecutive flux transitions, shall be a missing pulse.

8.2.2.2 Extra pulse

Write a track at $2f$ with the test recording current. Erase for one revolution with a constant direct current equivalent to the quiescent value of the test recording current.

Any playback signal, which when measured base-to-peak, including the statistical noise and the residual signal of the disk,

exceeds 30 % of half the average signal amplitude of the track under test, shall be an extra pulse.

8.2.3 Rejection criteria

8.2.3.1 Defective track

A track on which one or more missing and or extra pulses are detected in the same position(s) on consecutive passes shall be a defective track. The applicable number of consecutive passes shall be a matter for agreement between interested parties.

8.2.3.2 Requirements for tracks

As initially received from the medium supplier, the cartridges shall have no defective tracks.

8.2.3.3 Rejected cartridge

A cartridge which does not meet the requirements of 8.2.3.2 shall be rejected.

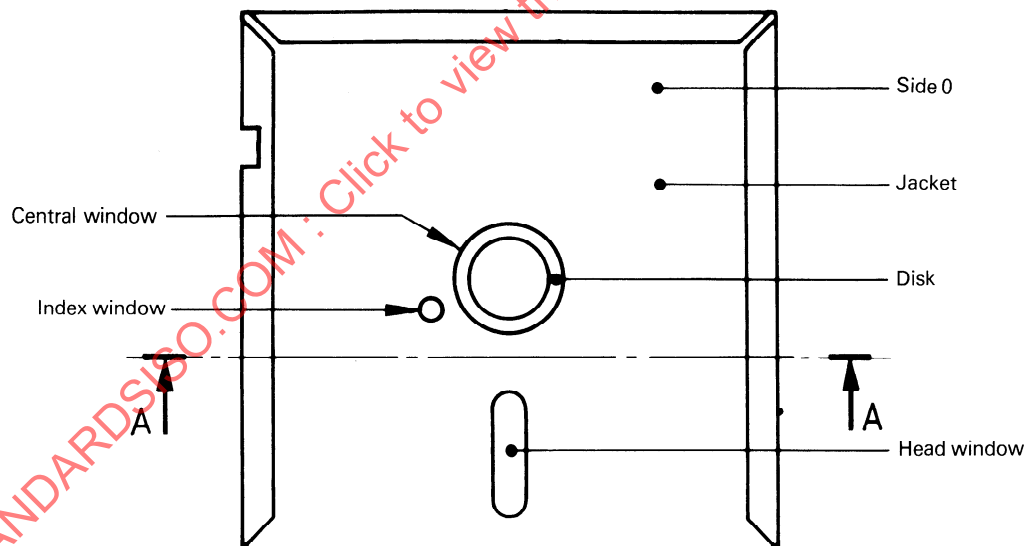


Figure 1 — Flexible disk cartridge

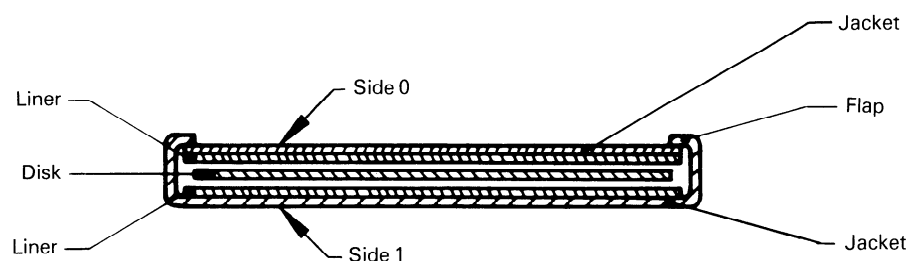


Figure 2 — Section A-A

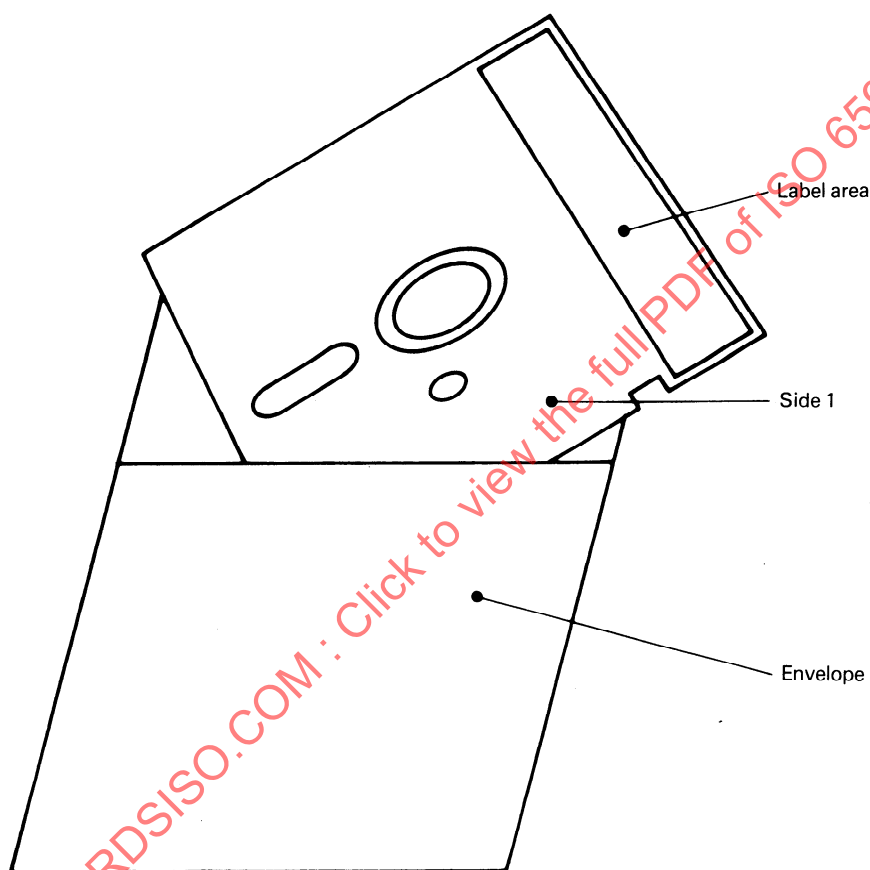


Figure 3 — Protective envelope with cartridge

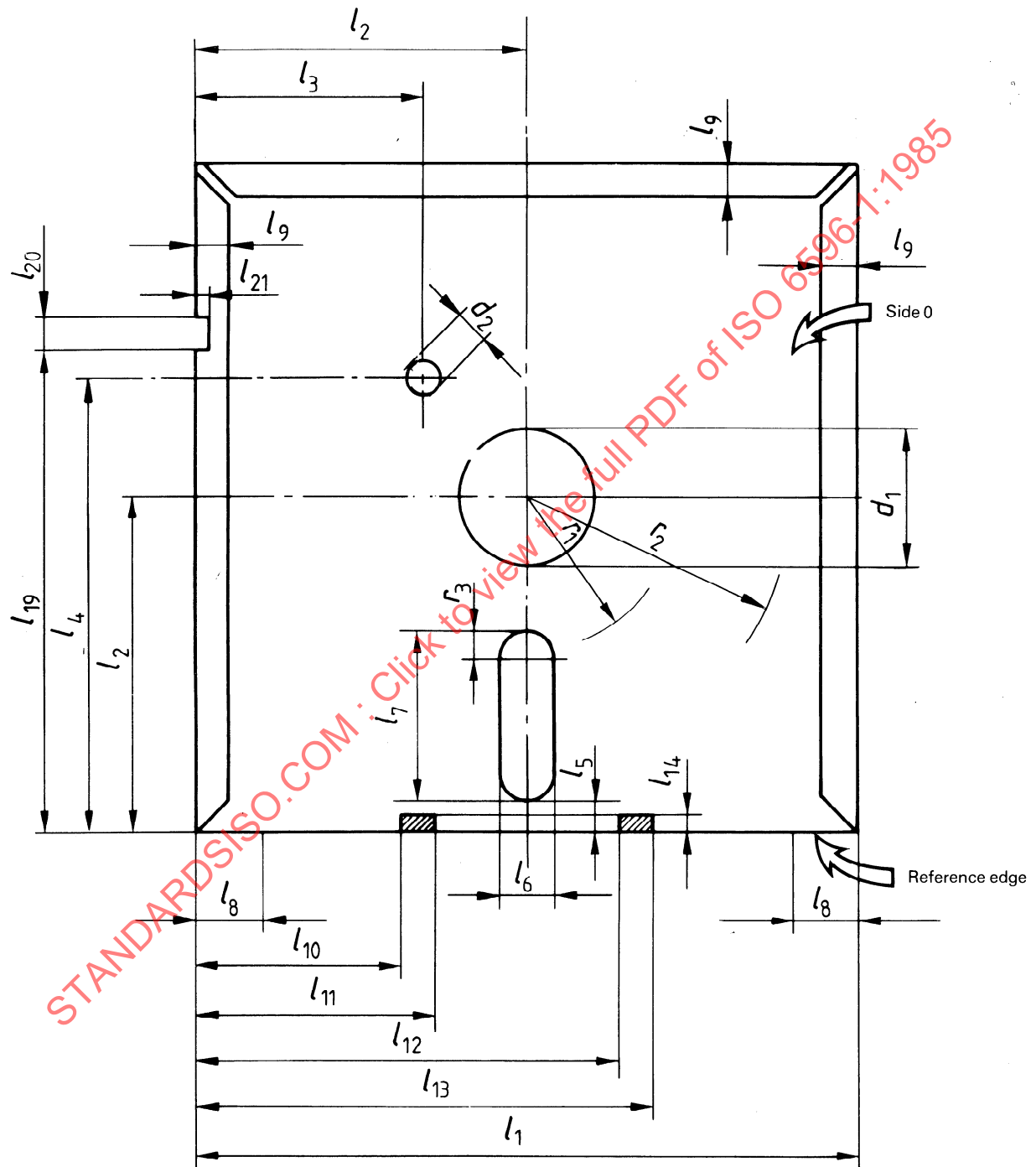


Figure 4 — Jacket dimensions

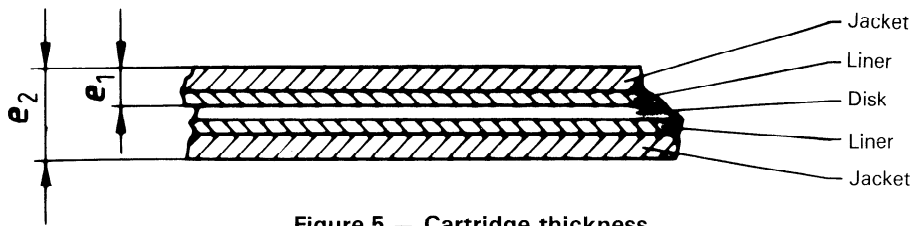


Figure 5 — Cartridge thickness

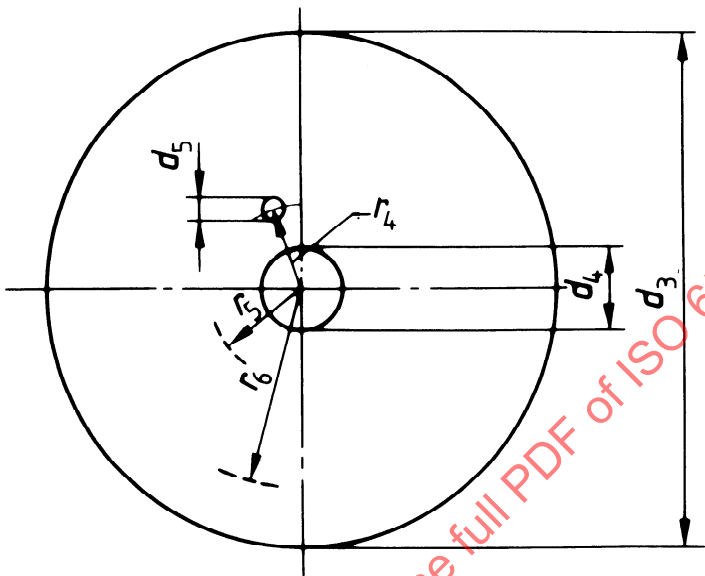


Figure 6 — Disk dimensions

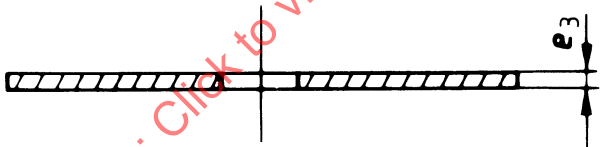


Figure 7 — Disk thickness

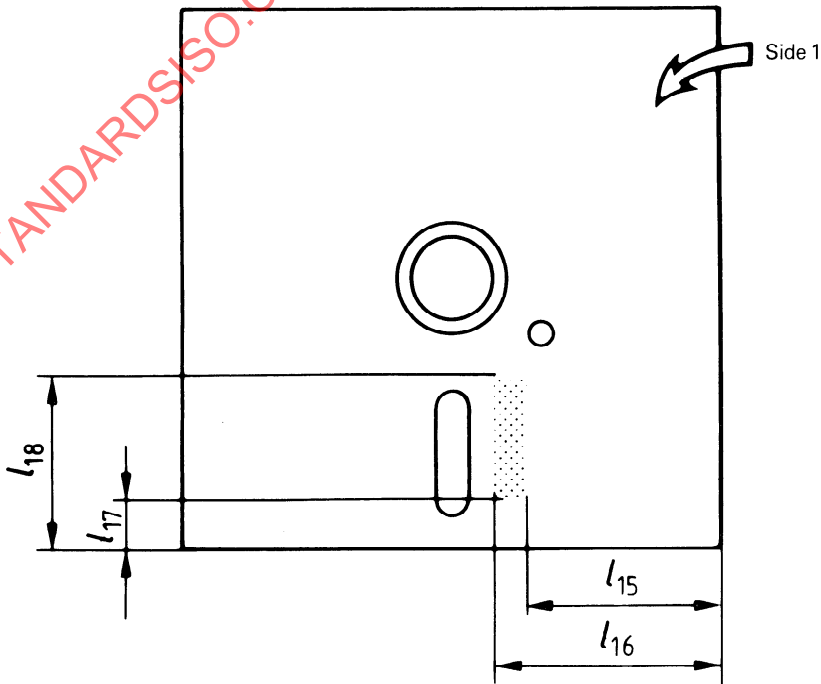


Figure 8 — Pressure pad area

Annex A

Measurement of the cartridge thickness

(This annex forms part of the standard.)

A.1 Maximum thickness

This value shall be measured for all edges using the gauge of figure 9. The cartridge shall be capable of entering the gauge for at least 15 mm (0.59 in) when a force of 1 N max. (3.6 ozf max.) is applied on the opposite edge.

A.2 Minimum thickness

This value shall be measured for all edges using the gauge of figure 10. This gauge has a length of 40 mm (1.57 in). When submitted to a force of 1 N (3.6 ozf) the cartridge shall enter the slot by less than 1 mm (0.039 in).

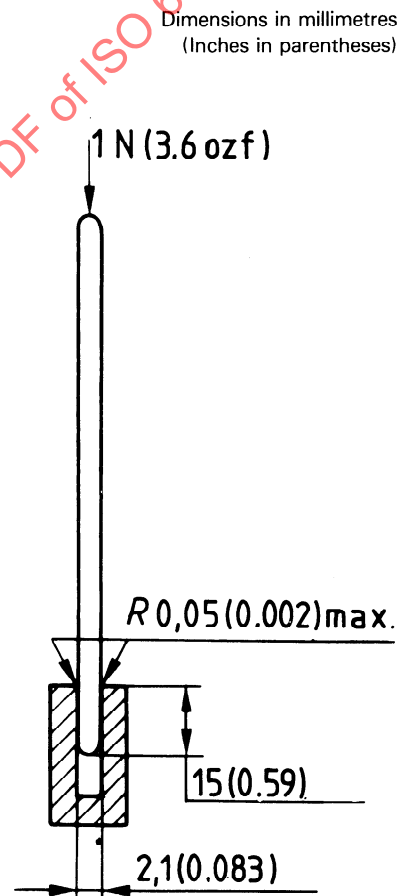
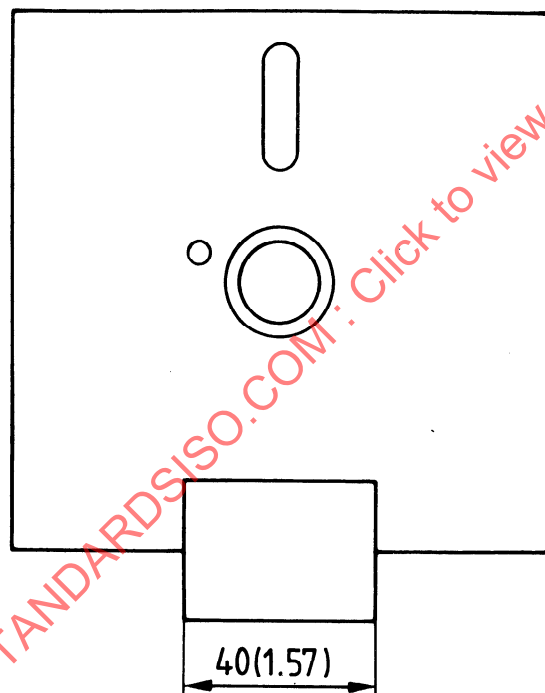


Figure 9 — Measuring gauge

Dimensions in millimetres
(Inches in parentheses)

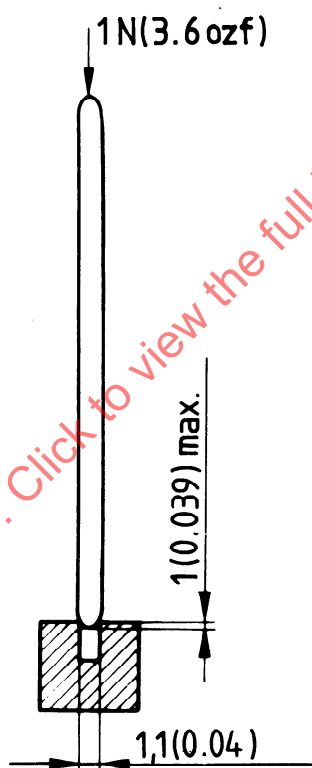


Figure 10 — Measuring gauge