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**Information technology — Data interchange on
90 mm flexible disk cartridges using modified
frequency modulation recording at 31 831 ftprad
on 80 tracks on each side — ISO Type 303**

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*Technologies de l'information — Échange de données sur cartouche à
disquette de 90 mm utilisant un enregistrement à modulation de
fréquence modifiée à 31 831 ftprad, 80 pistes par face — ISO Type 303*

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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 JTC1. 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 10994 was prepared by the European Computer Manufacturers Association (as Standard ECMA-147) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Annexes A to D and G to K form an integral part of this International Standard. Annexes E and F are for information only.

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Information technology - Data interchange on 90 mm flexible disk cartridges using modified frequency modulation recording at 31 831 ftrpad on 80 tracks on each side - ISO Type 303

Section 1 - General

1 Scope

This International Standard specifies the characteristics of 90 mm flexible disk cartridges recorded at 31 831 ftrpad using modified frequency modulation recording, on 80 tracks on each side. Such flexible disk cartridges are identified as ISO Type 303.

It specifies the mechanical, physical and magnetic characteristics of the cartridge, so as to provide physical interchangeability between data processing systems.

It also specifies the method of recording, the quality of the recorded signals, the track layout and the track format.

Together with ISO 9293, this International Standard provides for full data interchange between data processing systems.

2 Conformance

A 90 mm flexible disk cartridge is in conformance with this International Standard if it meets all mandatory requirements specified herein.

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 683-13:1986 - *Heat-treatable steels, alloy steels and free-cutting steels - Part 13: Wrought stainless steels*

ISO 8860-1:1987 - *Information processing - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftrpad on 80 tracks on each side - Part 1: Dimensional, physical and magnetic characteristics*

ISO 8860-2:1987 - *Information processing - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftrpad on 80 tracks on each side - Part 2: Track format*

ISO 9293:1987 - *Information processing - Volume and file structure of flexible disk cartridges for information interchange*

ISO 9529-1:1989 - *Information processing systems - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 15 916 ftrpad, on 80 tracks on each side - Part 1: Dimensional, physical and magnetic characteristics*

ISO 9529-2:1989 - *Information processing systems - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 15 916 ftrpad, on 80 tracks on each side - Part 2: Track format*

ISO/IEC 9983:1989 - *Information processing systems - Designation of unrecorded flexible disk cartridges.*

4 Definitions

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

4.1 Average Signal Amplitude: The Average Signal Amplitude for a track is the arithmetically averaged value of the output voltages measured peak-to-peak over the whole track.

4.2 case: A protective enclosure including a shutter mechanism, an identification hole and a write-inhibit hole.

4.3 direction of rotation: The direction of rotation shall be counter-clockwise when looking at Side 0.

4.4 disk: A flexible disk which accepts and retains, on the specified side or sides, magnetic signals intended for input/output and storage purposes.

4.5 eraseability: The eraseability is the ratio (percentage) of the residual Average Signal Amplitude, after erasing the original signal, to the original Average Signal Amplitude on the specified track and at the specified flux transition density.

4.6 formatting: Writing the proper control information establishing the physical cylinders and the addresses of physical records on the surfaces of the flexible disk.

4.7 hub: A centring and referencing device attached to the disk which allows torque to be transmitted to the disk. The hub is attached to the centre of the disk. It ensures centring of the disk on the drive shaft in a unique angular position.

4.8 in-contact: An operating condition in which the magnetic surface of the disk is in physical contact with the magnetic heads.

4.9 Index: The signal generated in the index transducer of the drive by the drive spindle once per revolution.

4.10 initialization: Writing any information initially required to be on the flexible disk cartridge, e.g. the Volume Label, prior to the commencement of general processing use.

4.11 line of access: The straight line described by the centre of the gap of the read/write head as it is positioned from Track 00 to Track 79.

4.12 liner: Suitable material positioned between the case and the disk to provide cleaning action and protection from abrasion.

4.13 Master Standard Reference Flexible Disk Cartridge: A reference flexible disk cartridge selected as the standard for reference fields, signal amplitudes, resolution, peak shift, and reference erase field. Track 00 and Track 79 on both sides are declared as reference tracks.

The reference tracks are calibrated at 300 r/min.

NOTE 1 - This Master Standard has been established by the Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, D-3300 Braunschweig, Germany.

4.14 Reference Erase Field: The Reference Erase Field is the DC field which causes an eraseability of 5 % when measured for the Master Standard Reference Flexible Disk Cartridge.

There are two Reference Erase Fields, one for each side.

4.15 Reference Field: The Reference Field is the Typical Field of the Master Standard Reference Flexible Disk Cartridge. There are two Reference Fields, one for each side.

4.16 Secondary Standard Reference Flexible Disk Cartridge: A flexible disk cartridge the performance of which is known and stated in relation to that of the Master Standard Reference Flexible Disk Cartridge.

NOTE 2 - Secondary Standard Reference Flexible Disk Cartridges can be ordered from PTB, Lab. 1.41, under Part Number RM 10994 until the year 2001.

It is intended that these be used for calibrating tertiary cartridges for use in routine calibration.

4.17 shutter: A device which uncovers the head window upon insertion, and automatically covers them upon removal from the drive.

4.18 Side: Side 0 is the side engaged by the spindle. Side 1 is the opposite side.

4.19 Standard Reference Amplitude: The Standard Reference Amplitudes (SRAs) are the Average Signal Amplitudes derived from the reference tracks of the Master Standard Reference Flexible Disk Cartridge using the Test Recording Current.

There are four SRAs, two for each side:

SRA-1f is the Average Signal Amplitude from a recording written using 1f at Track 00.

SRA-2f is the Average Signal Amplitude from a recording written using 2f at Track 79.

4.20 Test Erase Current: The erase current between 148 % and 152 % of the erase current which produces the Reference Erase Field at test frequency 1f on track 00.

4.21 Test Recording Current: The current between 198 % and 202 % of the current which produces the Reference Field at 2f on Track 79. There are two Test Recording Currents, one for each side.

4.22 Typical Field: The minimum recording field which, when applied to a flexible disk cartridge, causes an average signal amplitude 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 density.

5 General description

5.1 Drawings

In the enclosed drawings:

- Figure 7 shows side 0 and enlarged cross-sections through the location holes;
- Figure 8 shows Side 1;
- Figure 9 shows at a larger scale the upper part of Side 0 without shutter;
- Figure 10 shows the disk with hub;
- Figure 11 shows the interface between the cartridge and the drive.

5.2 Main elements

The main elements of the flexible disk cartridge are

- the disk,
- the liner,
- the case.

5.3 Description

The cartridge is of a substantially square form. It includes a central hole on one side, a head window on both sides, an identification hole and a write-inhibit hole.

The liner is provided between the case and the disk. It comprises two layers of material between which the disk lies.

The disk has a central hole with a metal hub attached.

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Section 2 - Environments, mechanical and physical characteristics

6 General requirements

6.1 Environment and transportation

6.1.1 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 °C ± 2 °C
relative humidity	: 40 % to 60 %
conditioning before testing	: 24 h minimum

For the tests specified in 9.3 the temperature and the relative humidity shall be measured in the air immediately surrounding the cartridge drive. For all other tests 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 of the recording head, shall not exceed 4 000 A/m.

6.1.2 Operating environment

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

temperature	: 10 °C to 51,5 °C
relative humidity	: 20 % to 80 %
wet bulb temperature	: less than 29 °C

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 per hour. It is also recommended that the temperature and the relative humidity conditions when reading a cartridge are not at the opposite extremes to the conditions when it was recorded.

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 of the recording head, shall not exceed 4 000 A/m.

6.1.3 Storage environment

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

temperature	: 4 °C to 53 °C
relative humidity	: 8 % to 90 %

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

NOTE 3 - Cartridges which have been stored at temperatures and humidities exceeding the operating 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.

6.1.4 Transportation

Responsibility for ensuring that adequate precautions are taken during the transportation shall be with the sender. The cartridge shall be in a protective package free from dust or extraneous matter. It is recommended that a

sufficient space exists between cartridge and outer surface of the final container, so that risk of erasure due to stray magnetic fields will be negligible.

It is recommended that the following conditions are not exceeded:

temperature	: -40 °C to 60 °C
maximum rate of temperature change	: 20 °C per hour
relative humidity	: 8 % to 90 %

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

6.2 Materials

6.2.1 Case

The case may be constructed from any suitable material such that it meets the requirements of 7.7.

6.2.2 Liner

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

6.2.3 Disk

The disk may be constructed from any suitable material (e.g. bi-axially oriented polyethylene terephthalate) coated on both sides with a flexible layer of magnetic material (e.g. barium ferrite).

6.2.4 Hub

The hub shall be made of any suitable material (e.g. stainless steel alloy according to ISO 683-13, type 8).

7 Dimensional characteristics

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The dimensions of the cartridge are referred to two Reference Axes X and Y. They are two lines in space intersecting at right angles. The plane they define is the Reference Plane XY of the cartridge.

7.1 Case

7.1.1 Shape (figure 7)

The case has a rectangular form, its sides shall be

$$L_1 = 94,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_2 = 90,0 \text{ mm} \begin{matrix} + 0,4 \\ - 0,1 \end{matrix} \text{ mm}$$

The radius of three of its corners shall be

$$R_1 = 2,0 \text{ mm} \pm 1,0 \text{ mm}$$

The angle of its fourth corner shall be

$$\omega = 45^\circ \pm 2^\circ$$

7.1.2 Thickness

In the area extending 8,5 mm from each of the two edges as shown in figure 8, the thickness of the case shall be

$$E_1 = 3,3 \text{ mm} \pm 0,2 \text{ mm}$$

When the cartridge is inserted in the test gauge specified in annex G, a force of 0,2 N maximum, applied to the centre of the back edge shall cause the cartridge to pass through the gauge.

The edge radius shall be

$$R_2 = 0,40 \text{ mm} \pm 0,25 \text{ mm}$$

7.1.3 Hub access hole (figure 7)

On Side 0 there shall be a hub access hole the diameter of which shall be

$$D_1 = 26,50 \text{ mm min.}$$

The position of the centre of this hole shall be defined by

$$L_3 = 40,00 \text{ mm} \pm 0,15 \text{ mm}$$

$$L_4 = 31,00 \text{ mm} \pm 0,15 \text{ mm}$$

7.1.4 Locating holes (figures 7 and 9)

7.1.4.1 Primary locating hole

The centre of the primary locating hole shall be at the intersection of Reference Axes X and Y.

Its diameter shall be

$$D_2 = 3,6 \text{ mm} \pm 0,1 \text{ mm}$$

The dimensions of its section (see cross-section A-A in figure 7) shall be

$$D_3 = 1,5 \text{ mm min.}$$

$$L_8 = 0,2 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_9 = 1,0 \text{ mm min.}$$

$$L_{10} = 2,5 \text{ mm min.}$$

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7.1.4.2 Secondary locating hole

The centre of the secondary locating hole shall be on Reference Axis X, its distance from Reference Axis Y shall be

$$L_5 = 80,0 \text{ mm} \pm 0,2 \text{ mm}$$

It shall have a substantially rectangular shape. Its short axis shall be (cross-section B-B in figure 7)

$$L_6 = 3,6 \text{ mm} \pm 0,1 \text{ mm}$$

Its long axis shall be

$$L_7 = 4,4 \text{ mm} \pm 0,2 \text{ mm}$$

The dimensions D_3 , L_8 , L_9 and L_{10} of the cross-section of the secondary locating hole are as specified in 7.1.4.1.

7.1.5 Label area

7.1.5.1 Side 0 (figure 7)

The locations and dimensions of the label area of Side 0 shall be defined by

$$L_{11} = 3,5 \text{ mm min.}$$

$$L_{12} = 76,5 \text{ mm max.}$$

$$L_{14} = 60,0 \text{ mm min.}$$

7.1.5.2 Side 1 (figure 8)

The locations and dimensions of the label area of Side 1 shall be defined by

$$L_{11} = 3,5 \text{ mm min.}$$

$$L_{12} = 76,5 \text{ mm max.}$$

$$L_{13} = 20,0 \text{ mm min.}$$

7.1.6 Head windows (figure 9)

The locations and the dimensions of the two head windows are specified by the same set of dimensions.

7.1.6.1 Location

The location of the head windows shall be defined by

$$L_{15} = 12,3 \text{ mm min.}$$

$$L_{16} = 11,5 \text{ mm min.}$$

$$L_{17} = 35,5 \text{ mm} \pm 0,2 \text{ mm}$$

7.1.6.2 Dimensions

The width of the head windows shall be

$$L_{18} = 9,00 \text{ mm} \pm 0,20 \text{ mm}$$

The radius of their corners shall be

$$R_3 = 0,5 \text{ mm} \pm 0,1 \text{ mm}$$

The radius of their upper edge shall be

$$R_4 = 0,5 \text{ mm} \pm 0,1 \text{ mm}$$

7.1.7 Write-inhibit hole (figure 8)

7.1.7.1 Location

The centre of the write-inhibit hole shall be on Reference Axis Y. Its distance from Reference Axis X shall be

$$L_{19} = 67,75 \text{ mm} \pm 0,25 \text{ mm}$$

7.1.7.2 Dimensions

The dimensions of the write-inhibit hole shall be

$$L_{20} = 3,5 \text{ mm min.}$$

$$L_{21} = 4,0 \text{ mm min.}$$

7.1.7.3 Use

The write-inhibit hole is intended for use either with a mechanical switch or with an optical detector so that only when the hole is covered is writing on the disk possible. When covered, the closure device shall not extend outside the Reference Plane nor shall it deflect by more than 0,3 mm from the Reference Plane inside the case under the action of a force of 3 N.

Also when covered, the light transmittance of the write-inhibit hole area shall not exceed 1 %, when measured with an optical system as described in annex B.

7.1.8 Identification hole (figures 7 and 8)

The identification hole is provided to distinguish between the flexible disk cartridge specified by this International Standard from those specified by ISO 8860 and ISO/IEC 9529.

NOTE 4 - As no specification is given in ISO 8860 and ISO/IEC 9529 for the opacity of the case, it is recommended that detection of the identification hole is by mechanical means.

7.1.8.1 Location

The position of the centre of the identification hole shall be specified by L_5 and

$$L_{51} = 62,25 \text{ mm} \pm 0,25 \text{ mm}$$

7.1.8.2 Dimensions

The dimensions of the identification hole shall be

$$L_{49} = 3,5 \text{ mm min.}$$

$$L_{50} = 4,0 \text{ mm min.}$$

7.1.9 Profile of the shutter edge of the case (figures 7 and 9)

The edge on which the shutter is mounted shall have a profile defined by the following dimensions:

$$L_{22} = 80,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{23} = 76,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{24} = 68,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{25} = 64,50 \text{ mm} \pm 0,35 \text{ mm}$$

$$L_{26} = 57,00 \text{ mm} \pm 0,35 \text{ mm}$$

$$L_{27} = 55,5 \text{ mm} \pm 0,6 \text{ mm}$$

$$L_{28} = 3,5 \text{ mm min.}$$

$$L_{29} = 17,5 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{30} = 17,00 \text{ mm} \pm 0,15 \text{ mm}$$

$$L_{31} = 15,50 \text{ mm} \pm 0,25 \text{ mm}$$

$$L_{45} = 12,50 \text{ mm} \pm 0,25 \text{ mm}$$

$$\alpha = 45^\circ \pm 2^\circ$$

$$\beta = 135^\circ \pm 2^\circ$$

$$\omega = 45^\circ \pm 2^\circ$$

7.1.10 Shutter (figures 8 and 9)

The shutter shall slide upon insertion of the cartridge into the drive so as to uncover the head windows, and close automatically upon removal. The maximum resistance force at the fully open position shall be 1 N, and the minimum resistance force at the fully closed position shall be 0,2 N.

The path along which the shutter can slide is defined by L_{25} and L_{28} .

In the open position of the shutter, the distance from its leading edge to the Reference Axis Y shall be

$$L_{32} = 53,75 \text{ mm} \pm 1,25 \text{ mm}$$

The width of the windows of the shutter shall be

$$L_{33} = 12,0 \text{ mm} \pm 0,2 \text{ mm}$$

NOTE 5 - It is a requirement that the drive shall provide a mechanism whereby correct insertion of the cartridge into the drive causes the shutter to slide so as to uncover the head windows.

7.2 Liner

No part of the liner shall protrude by more than 0,2 mm into the head access windows.

7.3 Disk (figure 10)

7.3.1 Diameter

The diameter of the disk shall be

$$D_4 = 85,8 \text{ mm} \pm 0,2 \text{ mm}$$

7.3.2 Thickness

The thickness of the disk shall be

$$E_2 = 0,080 \text{ mm} \pm 0,008 \text{ mm}$$

7.4 Hub (figure 10)

The hub shall have a central part and a flange.

7.4.1 Dimensions

The diameter of the central part shall be

$$D_5 = 25,00 \text{ mm} \begin{matrix} + 0,00 \\ - 0,15 \end{matrix} \text{ mm}$$

The diameter of the flange shall be

$$D_6 = 31,15 \text{ mm max.}$$

The distance from the surface of the central part of the hub to the surface of Side 0 of the disk shall be

$$L_{34} = 1,36 \text{ mm} \pm 0,10 \text{ mm}$$

when measured at a radius R_7

$$R_7 = 14 \text{ mm nominal}$$

7.4.2 Hub orientation holes (figure 10)

The hub shall have two orientation holes. The first one at its centre, the second off centre.

7.4.2.1 First orientation hole

The first orientation hole shall have a square form defined by

$$L_{35} = 4,00 \text{ mm min.}$$

The position of the centre of rotation of the disk is defined by

$$L_{36} = 1,9955 \text{ mm}$$

measured from two sides of the hole. This centre of rotation shall be within 0,5 mm of the geometric centre of the disk.

The radius of the four corners of this hole shall be

$$R_5 = 1,0 \text{ mm} \pm 0,3 \text{ mm}$$

7.4.2.2 Second orientation hole

The position and dimensions of the sides of the rectangular second orientation hole are referred to two radial Reference Lines A and B that are perpendicular to each other. Their positions shall be specified by

$$\gamma = 15^\circ \pm 3^\circ$$

The length of the sides of this hole shall be

$$L_{37} = 8,0 \text{ mm} \pm 0,3 \text{ mm}$$