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STANDARD

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14169

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**Information technology — 90 mm flexible
disk cartridges for information
interchange — 21 MBytes formatted
capacity — ISO Type 305**

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*Technologies de l'information — Cartouches à disquette de 90 mm pour
l'échange d'information — Capacité formatée de 21 MB — Type ISO 305*
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Reference number
ISO/IEC 14169:1995(E)

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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 14169 was prepared by the Japanese Industrial Standards Committee (as Standard JIS X 6228 - 1994) with document support and contribution from ECMA 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 L form an integral part of this International Standard. Annexes M to T are for information only.

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Introduction

This International Standard specifies the characteristics of 90 mm flexible disk cartridges of 21 MBytes formatted capacity, recorded at 31 831 ftprad in the Inner Zone and 47 747 ftprad in the Outer Zone with sector servo tracking on 326 Data Tracks on each side, using 2-7 RLL recording.

This International Standard specifies the physical interchangeability of the unrecorded disk and the format interchangeability of recorded Data Tracks and Servo Tracks.

In reference to ISO/IEC 9983, flexible disk cartridges conforming to this International Standard are designated as ISO Type 305.

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Information technology - 90 mm flexible disk cartridges for information interchange - 21 MBytes formatted capacity - ISO Type 305

Section 1 - General

1 Scope

This International Standard specifies the characteristics of 90 mm flexible disk cartridges (FDC) of 21 Mbytes formatted capacity, recorded at 31 831 ftprad in the Inner Zone and 47 747 ftprad in the Outer Zone with sector servo tracking on 326 data tracks on each side, using 2-7 RLL recording.

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 recorded signals, the track layouts and the track formats of Data Tracks and Servo Tracks.

Such flexible disk cartridges are identified as ISO Type 305.

Together with a standard for volume and file structure, for instance ISO/IEC 9293, this International Standard provides for full data interchange between data processing systems.

2 Conformance

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2.1 Flexible disk cartridge

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

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2.2 Generating systems

A system generating an FDC for interchange shall be entitled to claim conformance with this International Standard if all recordings on the flexible disk meet the mandatory requirements of this International Standard.

2.3 Receiving systems

A system receiving an FDC for interchange shall be entitled to claim full conformance with this International Standard if it is able to handle any recording made on the flexible disk according to this International Standard.

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/IEC 9293:1994, *Information technology - Volume and file structure of disk cartridges for information interchange.*

ISO/IEC 9983:1995, *Information technology - Designation of unrecorded flexible disk cartridges.*

IEC 950:1991, *Safety of information technology equipment, including electrical business equipment.*

4 Definitions

For the purposes 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, identification holes and a write-inhibit hole.

- 4.3 Data Sector:** A sector comprising a Sector Identifier and a Data Block.
- 4.4 Data Track:** A track on which data are recorded on Data Sectors.
- 4.5 direction of rotation:** The direction of rotation shall be counter-clockwise when looking at Side 0.
- 4.6 disk:** A flexible disk which accepts and retains, on the specified side or sides, magnetic signals intended for input/output and storage purposes.
- 4.7 Error Correcting Code (ECC):** A mathematical procedure yielding bits used for the detection and correction of errors.
- 4.8 Error Detecting Code (EDC):** A mathematical procedure yielding bits used for the detection of errors.
- 4.9 flux transition frequency:** The number of flux transition per second (ftps).
- NOTE 1 - In this International Standard, the frequencies to be used in the Outer Zone are indicated by the subscript OZ, those to be used in the Inner Zone are indicated by the subscript IZ (see 11.3.1.1).
- 4.10 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.
- 4.11 index:** The signal generated in the index transducer of the drive by the drive spindle once per revolution.
- 4.12 Inner Zone:** The inner subdivision of the recording area of a surface of the disk.
- 4.13 input bit:** Bits which represent input data.
- 4.14 Line of Access of the head:** The straight line described by the centre of the gap of the read/write head when positioned from Track -004 to Track 328.
- 4.15 liner:** Suitable material between the case and the disk to provide cleaning action and protection from abrasion.
- 4.16 Master Standard Reference Flexible Disk Cartridge:** A flexible disk cartridge selected as the standard for Reference Fields, signal amplitudes, resolution, peak shift, and overwrite. Tracks 000 and 325 are declared as Reference Tracks.
- The reference tracks are calibrated at 600 rpm.
- NOTE 2 - This Master Standard has been established at the Reliability Centre for Electronic Components of Japan (RCJ), 1-1-12 Hachiman-cho, Higashikurume-shi, Tokyo 203, Japan.
- 4.17 Outer Zone:** The outer subdivision of the recording area of a surface of the disk.
- 4.18 peak value:** The zero to crest value of the output voltage of the read head.
- 4.19 Primary Identification hole:** A through-hole provided on the case to identify the FDC specified by this International Standard.
- 4.20 Reference Field:** The Typical Field of the Master Standard Reference Flexible Disk Cartridge. There are two Reference Fields, one for each side.
- 4.21 Secondary Identification hole:** An identification hole provided on Side 0 of the case to identify the FDCs specified by this International Standard.
- 4.22 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 3 - Secondary Standard Reference Flexible Disk Cartridges can be ordered under part number JRM 6228 from the Reliability Centre for Electronic Components of Japan (RCJ), 1-1-12 Hachiman-cho, Higashikurume-shi, Tokyo 203, Japan until the year 2004. (see annex T).
- It is intended that these be used for calibrating tertiary reference disks for use in routine calibration.
- 4.23 Sector Block:** A block consisting of a Servo Sector followed by either two or three Data Sectors, and a Sector Block Gap.

- 4.24 **sector servo:** A method of position control, whereby head positioning information is recorded at the beginning of each Sector Block.
- 4.25 **Servo Sector:** A sector which has a Servo Identifier and servo data.
- 4.26 **Servo Track:** A track on which Servo Sectors are permanently recorded.
- 4.27 **shutter:** A device which uncovers the head windows upon insertion of the cartridge into a drive, and automatically covers them upon removal from the drive.
- 4.28 **Side:** Side 0 is the side engaged by the spindle. Side 1 is the opposite side.
- 4.29 **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 (see 11.3.1.1):
SRA1 is the Average Signal Amplitude from a recording written using $3f_{OZ}$ at Track 000.
SRA2 is the Average Signal Amplitude from a recording written using $8f_{IZ}$ at Track 325.
- 4.30 **Standard Reference Current:** The current that produces the Reference Field.
- 4.31 **Test Recording Current:** The current the relationship of which to the Standard Reference Current is defined for each zone and for each flux transition frequency.
- 4.32 **Typical Field:** In the plot of the Average Signal Amplitude against the Recording Field at a specified recording density, the minimum field that causes an Average Signal Amplitude equal to 95% of the maximum Average Signal Amplitude.
- 4.33 **write-inhibit hole:** A through-hole with a sliding cover, provided on the case to inhibit writing on the disk when the hole is uncovered.

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5 Conventions and Notations

5.1 Representation of numbers

- A measured value is rounded off to the least significant digit of the corresponding specified value. It implies that a specified value of 1,26 with a positive tolerance of +0,01, and a negative tolerance of -0,02 allows a range of measured values from 1,235 to 1,275.
- Letters and digits in parentheses represent numbers in hexadecimal notation.
- The setting of a bit is denoted by ZERO or ONE.
- Numbers in binary notation and bit combinations are represented by strings of ZEROs and ONES.
- Numbers in binary notation and bit combinations are shown with the most significant byte to the left, and with the most significant bit in each byte to the left.
- Negative values of numbers in binary notation are given in TWO's complement.
- In each field the data is processed so that the most significant byte (byte 1) is processed first. Within each byte the least significant bit, numbered B_1 , is processed last, the most significant bit, numbered B_8 , is processed first. This order of processing applies also to the data input to the Error Detecting and Correcting circuits and to their output.

5.2 Names

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

6 Acronyms

ECC	Error Correcting Code
EDC	Error Detecting Code
FFT	Fast Fourier Transform
LED	Light Emitting Diode
SRA	Standard Reference Amplitude
SVDT	Servo data
SVIDA	Servo Identifier A
SVIDB	Servo Identifier B
2-7 RLL	2-7 Run Length Limited (code)

7 General description

7.1 Drawings

In the enclosed drawings:

- Figure 11 shows Side 0 and enlarged cross-sections through the Location and Secondary Identification holes;
- Figure 12 shows Side 1;
- Figure 13 shows at a larger scale the top part of Side 0 without shutter;
- Figures 14, 15 show the disk with hub;
- Figure 16 shows the interface between the cartridge and the drive.

7.2 Main elements

The main elements of the flexible disk cartridge are

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

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7.3 Description

The case is of a substantially square form. It includes a central hole on one side, head windows covered by a shutter on both sides, identification holes 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.

7.4 Marking of the FDC

It is recommended that the case be clearly marked with the ISO Type No. ISO 305 of the FDC.

Section 2 - Environments, mechanical and physical characteristics

8 General requirements

8.1 Environment, transportation and safety

8.1.1 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:ISO

temperature:	23 °C ± 2 °C
relative humidity:	40 % to 60 %
conditioning before testing:	24 h min.

For the tests specified in 11.3 the temperature and 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 magnetic head, shall not exceed 4 000 A/m.

8.1.2 Operating environment

Cartridges used for data interchange shall be capable of operating 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 h.

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 magnetic head, shall not exceed 4 000 A/m.

8.1.3 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 4 - 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.

8.1.4 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 h
relative humidity:	8 % to 90 %

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

8.1.5 Safety

The flexible disk cartridge and its components shall satisfy the requirements of IEC 950.

8.2 Materials

8.2.1 Case

The case may be constructed from any suitable material such that it meets the requirements of 9.7.

8.2.2 Liner

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

8.2.3 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. metal particles).

8.2.4 Hub

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

9 Dimensional characteristics

9.1 Case

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 (figures 11 and 12).

9.1.1 Shape

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

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

9.1.2 Thickness (figure 12)

In the area extending 8,5 mm from each of the two edges as shown in figure 12, 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 A, 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

$$r_2 = 0,40 \text{ mm} \pm 0,25 \text{ mm}$$

9.1.3 Hub access hole (figure 11)

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

$$l_3 = 40,00 \text{ mm} \pm 0,15 \text{ mm}$$

$$l_4 = 31,00 \text{ mm} \pm 0,15 \text{ mm}$$

9.1.4 Locating holes (figures 11 and 13)

9.1.4.1 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 11) shall be

$$d_3 = 1,5 \text{ mm min.}$$

$$l_8 = 0,2 \text{ mm} \pm 0,1 \text{ mm}$$

$$l_9 = 1,0 \text{ mm min.}$$

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

9.1.4.2 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 (see cross-section B-B in figure 11)

$$l_6 = 3,6 \text{ mm} \pm 0,1 \text{ mm}$$

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 9.1.4.1.

9.1.5 Label area

9.1.5.1 Side 0 (figure 11)

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

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

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

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

9.1.5.2 Side 1 (figure 12)

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

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

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

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

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9.1.6 Head windows (figure 13)

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

9.1.6.1 Location

The location of the head windows shall be defined by

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

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

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

9.1.6.2 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

$$r_3 = 0,5 \text{ mm} \pm 0,1 \text{ mm}$$

$$r_4 = 0,5 \text{ mm} \pm 0,1 \text{ mm}$$