INTERNATIONAL STANDARD

# ISO/IEC 10089

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# Information technology — 130 mm rewritable optical disk cartridge for information interchange



*Technologies de l'information — Cartouches de disques optiques réutilisables à diamètre 130 mm pour l'échange d'information*



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## Contents

## 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 10089 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.



Annexes A, B, C, E, F, G and K form an integral part of this International Standard. Annexes D, H, I and J are for information only.

## INTRODUCTION

This International Standard specifies the characteristics of 130 mm optical disk cartridges (ODC) of the type providing for information to be written, read and erased many times using the magneto-optical effect.

This International Standard together with a standard for volume and file structure provides for full data interchange between data processing systems.

# Information technology — 130 mm rewritable optical disk cartridge for information interchange

## 1 Scope

This International Standard specifies

- definitions of the essential concepts;
- the environment in which the characteristics are to be tested;
- the environments in which the cartridge are to be operated and stored;
- the mechanical, physical and dimensional characteristics of the case and of the optical disk;
- the magneto-optical characteristics and the recording characteristics for recording the information, for reading the information and for erasing it many times, so as to provide physical interchangeability between data processing systems;
- two formats for the physical disposition of the tracks and sectors, the error correction codes, the modulation methods used for recording and the quality of the recorded signals.

## 2 Conformance



A 130 mm rewritable optical disk cartridge is in conformance with this International Standard if it meets all the mandatory requirements of clauses 8 to 16, and either those of clause 17 or those of clause 18.



## 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 listed 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 - Wrought stainless steels.*

IEC 950:1986, *Safety of information technology equipment including electrical business equipment*

## 4 Conventions and notations

The following conventions and notations apply in this International Standard.

a) In each field the information is recorded so that the most significant byte (byte 0) is recorded first. Within each byte the least significant bit is numbered bit 0, the most significant bit (i.e. bit 7 in an 8-bit byte) is recorded first. This order of recording applies also to the data input of the error-correcting codes, to the cyclic redundancy code, and to their code output.

b) Unless otherwise stated, numbers are expressed in binary notation. Where hexadecimal notation is used, the hexadecimal digits are shown between parentheses.

c) bit combinations are shown with the most significant bit to the left.

d) Negative values are expressed in TWO's complement notation.

e) The setting of bits is denoted by ZERO and ONE.

f) The name of entities, e.g. specific tracks, fields, etc., is shown with a capital initial.

## 5 List of acronyms

| | |
|---|---|
| ALPC | Auto Laser Power Control |
| AM | Address Mark |
| CAV | Constant Angular Velocity |
| CRC | Cyclic Redundancy Code |
| DDS | Disk Definition Structure |
| DMA | Defect Management Area |
| DMP | Defect Management Pointers |
| DTM | Defect Management Track |
| ECC | Error Correction Code |
| EDAC | Error Detection and Correction Code |
| ID | Identifier |
| LBA | Logical Block Address |
| ODC | Optical Disk Cartridge |
| ODF | Offset Detection Flag |
| PA | Postamble |
| PDL | Primary Defect List |
| PEP | Phase-Encoded Part of the Control Tracks |
| RLL(2,7) | Run Length Limited (code) |
| R-S | Reed-Solomon (code) |
| R-S/LDC | Reed-Solomon Long Distance Code |
| SDL | Secondary Defect List |
| SFP | Standard Formatted Part of the Control Tracks |
| SM | Sector Mark |
| VFO | Variable Frequency Oscillator |
| 4/15 (Modulation) | Conversion table of 8 bit bytes to 15-Channel bit representation on the disk |



## 6 Definitions

For the purposes of this International Standard, the definitions given in ISO/IEC 9171-1 and the following definitions apply.

**6.1** **case** : The housing for an optical disk, that protects the disk and facilitates disk interchange.

**6.2** **Clamping Zone** : The annular part of the disk within which the clamping force is applied by the clamping device. [ISO/IEC 9171-1]

**6.3** **Control Track** : A track containing the information on media parameters and format necessary for writing, reading and erasing the remaining tracks on the optical disk. [ISO/IEC 9171-1]

**6.4** **cyclic redundancy check (CRC)** : A method for detecting errors in data. [ISO/IEC 9171-1]

**6.5** **defect management** : A method for handling the defective areas on the disk. [ISO/IEC 9171-1]

**6.6** **disk reference plane** : A plane defined by the perfectly flat annular surface of an ideal spindle onto which the clamping zone of the disk is clamped, and which is normal to the axis of rotation. [ISO/IEC 9171-1]

**6.7** **entrance surface** : The surface of the disk on to which the optical beam first impinges. [ISO/IEC 9171-1]

**6.8** **error correction code (ECC)** : An error-detecting code designed to correct certain kinds of errors in data. [ISO/IEC 9171-1]

**6.9** **format** : The arrangement or layout of the data on a medium. [ISO/IEC 9171-1]

**6.10 hub** : The central feature on the disk which interacts with the spindle of the disk drive to provide radial centring and the clamping force. [ISO/IEC 9171-1]

**6.11 interleaving** : The process of allocating the physical sequence of units of data so as to render the data more immune to burst errors. [ISO/IEC 9171-1]

**6.12 Kerr rotation** : The rotation of the plane of polarization of an optical beam upon reflection from the recording layer as caused by the magneto-optical Kerr effect.

**6.13 land and groove** : A trench-like feature of the disk, applied before the recording of any information, and used to define the track location. The groove is located nearer to the entrance surface than the land with which it is paired to form a track. [ISO/IEC 9171-1]

**6.14 mark** : A feature of the recording layer which may take the form of a magnetic domain, a pit, or any other type or form that can be sensed by the optical system. The pattern of marks represents the data on the disk.

**6.15 optical disk** : A disk that will accept and retain information in the form of marks in a recording layer, that can be read with an optical beam. [ISO/IEC 9171-1]

**6.16 optical disk cartridge (ODC)**: A device consisting of a case containing an optical disk. [ISO/IEC 9171-1]

**6.17 polarization** : The direction of polarization of an optical beam is the direction of the electric vector of the beam.

NOTE 1 The plane of polarization is the plane containing the electric vector and the direction of propagation of the beam. The polarization is right-handed when to an observer looking in the direction of propagation of the beam, the end-point of the electric vector would appear to describe an ellipse in the clockwise sense.



**6.18 pre-recorded mark** : A mark so formed as to be unalterable by magneto-optical means.

**6.19 read power** : The read power is the optical power, incident at the entrance surface of the disk, used when reading.



NOTE 2 It is specified as a maximum power that may be used without damage to the written data. Lower power may be used providing that the signal-to-noise ratio and other requirements of this International Standard are met.

**6.20 recording layer** : A layer of the disk on, or in, which data is written during manufacture and/or use. [ISO/IEC 9171-1]

**6.21 Reed-Solomon code** : An error detection and/or correction code which is particularly suited to the correction of errors which occur in bursts or are strongly correlated. [ISO/IEC 9171-1]

**6.22 rewritable optical disk** : An optical disk in which the data in specified areas can be rewritten by an optical beam.

**6.23 spindle** : The part of the disk drive which contacts the disk and/or hub. [ISO/IEC 9171-1]

**6.24 substrate** : A transparent layer of the disk, provided for mechanical support of the recording layer, through which the optical beam accesses the recording layer.

**6.25 track** : The path which is followed by the focus of the optical beam during one revolution of the disk. [ISO/IEC 9171-1]

**6.26 track pitch** : The distance between adjacent track centrelines, measured in a radial direction. [ISO/IEC 9171-1]

**6.27 write-inhibit hole** : A hole in the case which, when detected by the drive to be open, inhibits both write and erase operations.

## 7 General description

The optical disk cartridge which is the subject of this International Standard consists of a case containing an optical disk. An optical beam is used to write data to, or to read data from, or to erase data from, the disk using the magneto-optical Kerr effect.

The disk can be recorded either only on one side or on both sides.

The disk is intended for use in a drive with optical access from one side only. To gain access to the second side of a disk recordable on both sides, the cartridge must be reversed before insertion into the drive.

Typically a disk recordable on one side consists of a transparent layer acting as a substrate with a recording layer on one side and a hub on the other. The recording layer is accessed by an optical beam through the substrate. A disk recordable on both sides consists of two disks recordable on one side assembled together with the recording layers on the inside.

Other constructions are permitted but must have the same characteristics.

## 8 Environments

### 8.1 Testing environment

Unless otherwise specified, tests and measurements made on the ODC to check the requirements of this International Standard shall be carried out in an environment where the air immediately surrounding the ODC is within the following conditions.

| | |
|---|---|
| Temperature | : 23 °C ± 2 °C |
| Relative humidity (RH) | : 45 % to 55 % |
| Atmospheric pressure | : 75 kPa to 105 kPa |



Before testing, the ODC shall be conditioned in this environment for 48h minimum. No condensation on or in the ODC shall occur.



### 8.2 Operating environment

Optical disk cartridges used for data interchange shall be operated in an environment where the air immediately surrounding the ODC is within the following conditions.

| | |
|---|---|
| Temperature | : 10 °C to 50 °C |
| Relative humidity | : 10 % to 80 % |
| Wet bulb temperature | : 29 °C max. |
| Atmospheric pressure | : 75 kPa to 105 kPa |
| Temperature gradient | : 10 °C /h max. |
| Relative humidity gradient | : 10 % /h max. |
| Magnetic field | : during loading and unloading of the cartridge the magnetic field strength at the recording layer shall not exceed 48 000 A/m. |

No condensation on or in the ODC shall be allowed to occur.

If an ODC has been exposed during storage and/or transportation to conditions outside those specified in this clause, it shall be acclimatized in the operating environment for at least 2h before use. In the operating environment an ODC shall be capable of withstanding a thermal shock of up to 20 °C when inserted into, or removed from, the drive.

See also annex I.

### 8.3 Storage environment

Storage environment is the ambient condition to which the ODC without any additional protective enclosure is exposed when stored.

#### 8.3.1 Short-term storage

For a maximum period of 14 consecutive days the ODC shall not be exposed to environmental conditions outside those given below.

| | |
|---|---|
| Temperature | : -20 °C to 55 °C |
| Relative humidity | : 5 % to 90 % |
| Wet bulb temperature | : 29 °C max. |
| Atmospheric pressure | : 75 kPa to 105 kPa |
| Temperature gradient | : 20 °C /h max. |
| Relative humidity gradient | : 20 % /h max. |
| Magnetic field | : The magnetic field strength in the volume of the cartridge shall nowhere exceed 48 000 A/m |

No condensation on or in the ODC shall be allowed to occur.

#### 8.3.2 Long-term storage

For a storage period longer than 14 days the optical disk cartridge shall not be exposed to environmental conditions outside those given below.

| | |
|---|---|
| Temperature | : -10 °C to 50 °C |
| Relative humidity | : 10 % to 90 % |
| Wet bulb temperature | : 29 °C max. |
| Atmospheric pressure | : 75 kPa to 105 kPa |
| Temperature gradient | : 15 °C /h max. |
| Relative humidity gradient | : 10 % /h max. |
| Magnetic field | : The magnetic field strength in the volume of the cartridge shall nowhere exceed 48 000 A/m |

No condensation on or in the ODC shall be allowed to occur.



### 8.4 Transportation

This International Standard does not specify requirements for transportation; guidance is given in annex J.

## 9 Safety requirements

The cartridge and its components shall satisfy the safety requirements of IEC 950, when used in its intended manner or in any foreseeable use in an information processing system.

## 10 Dimensional and mechanical characteristics of the case

### 10.1 General

The case shall be a rigid, protective enclosure of rectangular shape and include a shutter which uncovers access windows upon insertion into the drive, and automatically covers them upon removal from the drive. The case shall have means for positioning and identifying the cartridge, and write-inhibit holes.

The dimensions of the inside of the case are not specified in this International Standard, but are determined by the movement of the disk inside the case allowed by 13.5 and 13.6.

### 10.2 Case drawings

The case is represented schematically by the following drawings.

- Figure 1 shows the hub dimensions.

- Figure 2 shows a composite drawing of Side A of the case in isometric form, with the major features identified from Side A.
- Figure 3 shows the envelope of the case with respect to a location hole at the intersection of the X and Y axes and reference plane P.
- Figure 4 shows the surfaces S1, S2, S3 and S4 which establish the reference plane P.
- Figure 4a shows the details of surface S3.
- Figure 5 shows the details of the insertion slot and detent.
- Figure 6 shows the gripper slots, used for automatic handling.
- Figure 7 shows the write-inhibit holes.
- Figure 8 shows the media ID sensor holes.
- Figure 9 shows the shutter sensor notch.
- Figure 10 shows the head and motor window.
- Figure 11 shows the shutter opening features.
- Figure 12 shows the capture cylinder.
- Figure 13 shows the user label areas.

## 10.3 Sides, reference axes and reference planes

### 10.3.1 Relationship of Sides A and B



The features essential for physical interchangeability are represented in figure 2. When Side A of the cartridge faces upwards, Side A of the disk faces downwards. Sides A and B of the case are identical as far as the features given here are concerned. The description is given for one side only. References to Sides A and B can be changed to B or A respectively.



Only the shutter and the slot for the shutter opener, described in 10.14 and 10.15 are not identical for both sides of the case.

### 10.3.2 Reference axes and case reference planes

There is a reference plane P for each side of the case. Each reference plane P contains two orthogonal axes X and Y to which the dimensions of the case are referred. The intersection of the X and Y axes defines the centre of the location hole. The X axis extends through the centre of the alignment hole.

## 10.4 Materials

The case shall be constructed from any suitable materials such that it meets the requirements of this International Standard.

## 10.5 Mass

The mass of the case without the optical disk shall not exceed 150 g.

## 10.6 Overall dimensions (see figure 3)

The total length of the case shall be

$$L_1 = 153{,}0 \text{ mm} \pm 0{,}4 \text{ mm}$$

The distance from the top of the case to the reference axis X shall be

$$L_2 = 127{,}0 \text{ mm} \pm 0{,}3 \text{ mm}$$

The distance from the bottom of the case to the reference axis X shall be

$L_3$ = 26,0 mm ± 0,3 mm

The total width of the case shall be

$$L_4 = 135{,}0 \text{ mm} \begin{matrix} + \ 0{,}0 \text{ mm} \\ - \ 0{,}6 \text{ mm} \end{matrix}$$

The distance from the left-hand side of the cartridge to the reference axis Y shall be

$$L_5 = 128{,}5 \text{ mm} \begin{matrix} + \ 0{,}0 \text{ mm} \\ - \ 0{,}5 \text{ mm} \end{matrix}$$

The distance from the right-hand side of the cartridge to the reference axis Y shall be

$L_6$ = 6,5 mm ± 0,2 mm

The width shall be reduced on the top by the radius

$R_1 = L_4$

originating from a point defined by $L_5$ and

$L_7$ = 101,0 mm ± 0,3 mm

The two corners of the top shall be rounded with a radius

$R_2$ = 1,5 mm ± 0,5 mm

and the two corners at the bottom with a radius

$R_3$ = 3,0 mm ± 1,0 mm



The thickness of the case shall be

$L_8$ = 11,00 mm ± 0,30 mm



The eight long edges of the case shall be rounded with a radius

$R_4$ = 1,0 mm max.

**10.7 Location hole (see figure 3)**

The centre of the location hole shall coincide with the intersection of the reference axes X and Y. It shall have a square form with a side length of

$$L_9 = 4{,}10 \text{ mm} \begin{matrix} + \ 0{,}00 \text{ mm} \\ - \ 0{,}06 \text{ mm} \end{matrix}$$

held to a depth of

$L_{10}$ = 1,5 mm (i.e. typical wall thickness)

after which a cavity extends through to the alignment hole on the opposite side of the case.

The lead-in edges shall be rounded with a radius

$R_5$ = 0,5 mm max.

**10.8 Alignment hole (see figure 3)**

The centre of the alignment hole shall lie on reference axis X at a distance of

$L_{11}$ = 122,0 mm ± 0,2 mm

from the reference axis Y.

The dimensions of the hole shall be