

INTERNATIONAL STANDARD

ISO/IEC 9171-1

First edition
1990-12-15

Information technology — 130 mm optical disk cartridge, write once, for information interchange —

Part 1: Unrecorded optical disk cartridge

*Technologies de l'information — Cartouche de disque optique de 130 mm,
non-réinscriptible, pour l'échange d'information —*

Partie 1: Cartouche de disque optique vierge



Reference number
ISO/IEC 9171-1 : 1990 (E)

AVA Documents
Document Sharing Hub

Table of Contents

	Page
1 Scope	1
2 Conformance	1
3 Normative references	1
4 Definitions	1
4.1 case	1
4.2 Clamping Zone	1
4.3 Control Track	1
4.4 cyclic redundancy check (CRC)	1
4.5 defect management	2
4.6 disk reference plane	2
4.7 entrance surface	2
4.8 error correction code (ECC)	2
4.9 format	2
4.10 groove	2
4.11 hub	2
4.12 interleaving	2
4.13 land and groove	2
4.14 mark	2
4.15 optical disk	2
4.16 optical disk cartridge (ODC)	2
4.17 recording layer	2
4.18 Reed-Solomon code	2
4.19 spindle	2
4.20 substrate	2
4.21 track	2
4.22 track pitch	2
5 General description	2

© ISO/IEC 1990

All rights reserved. No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

ISO/IEC Copyright Office • Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

6	Environments	3
6.1	Testing environment	3
6.2	Operating environment	3
6.3	Storage environments	3
6.3.1	Short-term storage	3
6.3.2	Long-term storage	4
7	Safety requirements	4
8	Dimensional and mechanical characteristics of the case	4
8.1	General	4
8.2	Case drawings	4
8.3	Sides, reference axes and reference planes	5
8.3.1	Relationship of Sides A and B	5
8.3.2	Reference axes and case reference planes	5
8.4	Materials	5
8.5	Mass	5
8.6	Overall dimensions (figure 3)	5
8.7	Location hole (figure 3)	6
8.8	Alignment hole (figure 3)	6
8.9	Surfaces for reference planes P (figures 4 and 4a)	6
8.10	Insertion slots and detent features (figure 5)	8
8.11	Gripper slots (figure 6)	8
8.12	Write-inhibit holes (figure 7)	8
8.13	Media sensor holes (figure 8)	9
8.14	Head and motor window (figure 10)	10
8.15	Shutter (figure 11)	10
8.16	Slot for shutter opener (figure 11)	10
8.17	Shutter sensor notch (figure 9)	11
8.18	User label areas (figure 13)	11
9	Dimensional and Physical Characteristics of the Disk	12
9.1	Dimensions of the disk	12
9.1.1	Outer diameter	12
9.1.2	Thickness	12
9.1.3	Clamping zone (figure 1)	12
9.1.4	Clearance zone	12
9.2	Mass	12
9.3	Moment of inertia	12
9.4	Imbalance	12
9.5	Axial deflection	12

9.6	Axial acceleration	12
9.7	Dynamic radial runout	13
9.8	Radial acceleration	13
9.9	Tilt	13
10	Drop test	13
11	Interface between disk and drive	13
11.1	Clamping technique	13
11.2	Dimensions of the hub (figure 1)	13
11.2.1	Outer diameter of the hub	13
11.2.2	Height of the hub	13
11.2.3	Diameter of the centre hole	13
11.2.4	Height of the top of the centre hole at diameter D_9	14
11.2.5	Centring length at diameter D_9	14
11.2.6	Chamfer at inner diameter D_9	14
11.2.7	Chamfer at outer diameter D_8	14
11.2.8	Outer diameter of the magnetizable ring	14
11.2.9	Inner diameter of the magnetizable ring	14
11.2.10	Thickness of the magnetizable material	14
11.2.11	Position of the top of the magnetizable ring relative to the disk reference plane	14
11.3	Magnetizable material	14
11.4	Clamping force	14
11.5	Capture cylinder for the hub (figure 12)	15
11.6	Disk position in the operating condition (figure 12)	15
12	Characteristics of the substrate	30
12.1	Index of refraction	30
12.2	Thickness	30
12.3	Birefringence	30
13	Characteristics of the recording layer	30
13.1	Test conditions	30
13.1.1	General	30
13.1.2	Read conditions	31
13.1.3	Write conditions	31
13.2	Baseline reflectance	31
13.2.1	General	31
13.2.2	Actual value	32
13.2.3	Requirement	32
13.3	Definitions of signals	32

13.4	Prerecorded marks	33
13.5	User-written data	33
13.5.1	Signal I_L	33
13.5.2	Signal I_H	33
13.5.3	Narrow-band signal-to-noise ratio (figure 15)	33
13.5.4	Cross-talk	34
ANNEX A - Office environment		35
ANNEX B - Transportation		36
ANNEX C - Measurement of birefringence		37
ANNEX D - Definition of write and erase pulse width		40

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 JTC 1. 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 9171-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

ISO/IEC 9171 consists of the following parts, under the general title: *Information technology — 130 mm optical disk cartridge, write once, for information interchange*:

Part 1: Unrecorded optical disk cartridge

Part 2: Recording format

Annexes C and D form an integral part of this part of ISO/IEC 9171. Annexes A and B are for information only.

INTRODUCTION

ISO/IEC 9171 specifies the characteristics of 130 mm optical disk cartridges (ODC) of the type providing for information to be written once and read many times. ISO/IEC 9171-2 specifies 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.

ISO/IEC 9171-1 and ISO/IEC 9171-2 together with a standard for volume and file structure provide for full data interchange between data processing systems.

This page intentionally left blank

Information technology — 130 mm optical disk cartridge, write once, for information interchange —

Part 1: Unrecorded optical disk cartridge

1 Scope

This part of ISO/IEC 9171 specifies

- definitions of essential concepts,
- the environment in which the characteristics are to be tested,
- the environments in which the cartridge is to be operated and stored,
- the mechanical, physical and dimensional characteristics of the case and of the optical disk,
- the optical characteristics and the recording characteristics for recording the information once and for reading it many times, so as to provide physical interchangeability between data processing systems.

2 Conformance

A 130 mm optical disk cartridge is in conformance with this part of ISO/IEC 9171 if it meets all the mandatory requirements specified therein.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 9171. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO/IEC 9171 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 *Heat treatable steels, alloy steels and free-cutting steels - Part 13 Wrought stainless steels*

IEC 950 *Safety of information technology equipment including electrical business equipment*

4 Definitions

For the purposes of this part of ISO/IEC 9171, the following definitions apply.

- 4.1 **case:** The housing for an optical disk, that protects the disk and facilitates disk interchange.
- 4.2 **Clamping Zone:** The annular part of the disk within which the clamping force is applied by the clamping device.
- 4.3 **Control Track:** A track containing the information on media parameters and format necessary for writing and reading the remaining tracks on the optical disk.
- 4.4 **cyclic redundancy check (CRC):** A method for detecting errors in data.

- 4.5 **defect management:** A method for handling defective areas on the disk.
- 4.6 **disk reference plane:** A plane defined by the perfectly flat annular surface of an ideal spindle on to which the clamping zone of the disk is clamped, and which is normal to the axis of rotation.
- 4.7 **entrance surface:** The surface of the disk on to which the optical beam first impinges.
- 4.8 **error correction code (ECC):** An error-detecting code designed to correct certain kinds of errors in data.
- 4.9 **format:** The arrangement or layout of the data on a medium.
- 4.10 **groove:** See 4.13.
- 4.11 **hub:** The central feature on the disk which interacts with the spindle of the disk drive to provide radial centring and the clamping force.
- 4.12 **interleaving:** The process of allocating the physical sequence of units of data so as to render the data more immune to burst errors.
- 4.13 **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.
- 4.14 **mark:** A feature of the recording layer which may take the form of a hole, a pit, a bubble or any other type or form that can be sensed by the optical system. The pattern of marks represents the data on the disk.
- 4.15 **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.
- 4.16 **optical disk cartridge (ODC):** A device consisting of a case containing an optical disk.
- 4.17 **recording layer:** A layer of the disk on, or in, which data is written during manufacture and/or use.
- 4.18 **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.
- 4.19 **spindle:** The part of the disk drive which contacts the disk and/or hub.
- 4.20 **substrate:** A transparent layer of the disk, provided for mechanical protection of the recording layer, through which the optical beam accesses the recording layer.
- 4.21 **track:** The path which is followed by the focus of the optical beam during one revolution of the disk.
- 4.22 **track pitch:** The distance between adjacent track centrelines, measured in a radial direction.

5 General description

The optical disk cartridge which is the subject of this part of ISO/IEC 9171 consists of a case containing an optical disk. An optical beam is used to write data to, or to read data from, the disk.

A disk can be recordable either on one 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.

A disk recordable on one side only consists of a transparent protective 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, each recordable on one side, and assembled together with the recording layers on the inside.

Other constructions are permitted but must have the same optical characteristics.

6 Environments

6.1 Testing environment

Unless otherwise specified, tests and measurements made on the optical disk cartridge to check the requirements of this part of ISO/IEC 9171 shall be carried out in an environment where the air immediately surrounding the optical disk cartridge is within the following conditions.

Temperature	23°C ± 2°C
Relative humidity	45% to 55%
Atmospheric pressure	100 kPa ± 3,5 kPa

Before testing the optical disk cartridge shall be conditioned in this environment for 48 h minimum. No condensation on or in the optical disk cartridge shall occur.

6.2 Operating environment

Optical disk cartridges used for data interchange shall be operated in an environment where the air immediately surrounding the optical disk cartridge 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.
Air cleanliness	office environment (see Annex A)

No condensation on or in the optical disk cartridge shall be allowed to occur.

If an optical disk cartridge has been exposed during storage and/or transportation to conditions outside those given above, it shall be acclimatised in the operating environment for at least 2 h 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.

6.3 Storage environments

Storage environment is the ambient condition to which the optical disk cartridge without any additional protective enclosure, is exposed when stored.

6.3.1 Short-term storage

For a maximum period of 14 consecutive days the optical disk cartridge 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.
Air cleanliness	office environment (see Annex A)

No condensation on or in the optical disk cartridge shall be allowed to occur.

6.3.2 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.
Air cleanliness	office environment (see Annex A)

No condensation on or in the optical disk cartridge shall be allowed to occur.

7 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.

8 Dimensional and mechanical characteristics of the case

8.1 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 part of ISO/IEC 9171, but are determined by the movement of the disk inside the case allowed by 11.5 and 11.6.

8.2 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 defines 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 defines the surfaces S₁, S₂, S₃ and S₄ which establish the reference plane P.
- Figure 4a is an enlarged view of surface S₃.
- Figure 5 defines the details of the insertion slot and detent.
- Figure 6 defines the gripper slots, used for automatic handling.
- Figure 7 defines the write-inhibit holes.
- Figure 8 defines the media ID sensor holes.
- Figure 9 defines the shutter sensor notch.
- Figure 10 defines the access holes for the head and the motor.
- Figure 11 defines the shutter opening features.
- Figure 12 defines the capture cylinder.

- Figure 13 defines the user label areas.

8.3 Sides, reference axes and reference planes

8.3.1 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 8.14 and 8.15 are not identical for both sides of the case.

8.3.2 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.

8.4 Materials

The case shall be constructed from any suitable materials such that it meets the requirements of this part of ISO/IEC 9171.

8.5 Mass

The mass of the case without the optical disk shall be 150 g max.

8.6 Overall dimensions (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

$$L_3 = 26,0 \text{ mm} \pm 0,3 \text{ mm}$$

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 to the reference axis Y shall be

$$L_6 = 6,5 \text{ mm} \pm 0,2 \text{ mm.}$$

The width shall be reduced on the top as defined by the radius

$$R_1 = L_4$$

originating from a point defined by L_5 and

$$L_7 = 101,0 \text{ mm} \pm 0,3 \text{ mm.}$$

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

$$R_2 = 1,5 \text{ mm} \pm 0,5 \text{ mm}$$

and the two corners at the bottom with a radius

$$R_3 = 3,0 \text{ mm} \pm 1,0 \text{ mm}.$$

The thickness of the case shall be

$$L_8 = 11,00 \text{ mm} \pm 0,30 \text{ mm}.$$

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

$$R_4 = 1,0 \text{ mm max.}$$

8.7 Location hole (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

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

held to a depth of

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

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

The lead-in edges shall be rounded with radius

$$R_5 = 0,5 \text{ mm max.}$$

8.8 Alignment hole (figure 3)

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

$$L_{11} = 122,0 \text{ mm} \pm 0,2 \text{ mm}$$

from the reference axis Y.

The dimensions of the hole shall be

$$L_{12} = 4,10 \text{ mm} \begin{array}{l} + 0,00 \text{ mm} \\ - 0,06 \text{ mm} \end{array}$$

and

$$L_{13} = 5,0 \text{ mm} \begin{array}{l} + 0,2 \text{ mm} \\ - 0,0 \text{ mm} \end{array}$$

held to a depth of L_{10} , after which a cavity expands through to the location hole on the opposite side of the case.

The lead-in edges shall be rounded with radius R_5 .

8.9 Surfaces for reference planes P (figures 4 and 4a)

The reference plane P for a side of the case shall contain four surfaces S_1 , S_2 , S_3 and S_4 on that side of the case, specified as follows:

- Two circular surfaces S_1 and S_2 .

Surface S_1 shall be a circular area centred around the square location hole and have a diameter of

$$D_1 = 9,0 \text{ mm min.}$$

Surface S_2 shall be a circular area centred around the rectangular alignment hole and have a diameter of

$$D_2 = 9,0 \text{ mm min.}$$

- Two elongated surfaces S_3 and S_4 , that follow the contour of the cartridge and shutter edges.

Surfaces S_3 and S_4 are shaped symmetrically.

Surface S_3 shall be defined by two circular sections with radii

$$R_6 = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

with an origin given by

$$L_{14} = 4,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{15} = 86,0 \text{ mm} \pm 0,3 \text{ mm}$$

and

$$R_7 = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

with an origin given by

$$L_{16} = 1,9 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{17} = 124,5 \text{ mm} \pm 0,3 \text{ mm}$$

The arc with radius R_7 shall continue on the right hand side with radius

$$R_8 = 134,0 \text{ mm} \begin{matrix} + 0,2 \text{ mm} \\ - 0,7 \text{ mm} \end{matrix}$$

which is a dimension resulting from $L_5 + L_{14} + R_6$ with an origin given by L_5 and L_7 . A straight, vertical line shall smoothly join the arc of R_6 to the arc of R_8 .

The left hand side of S_3 shall be bounded by radius

$$R_9 = 4,5 \text{ mm} \pm 0,3 \text{ mm}$$

which is a dimension resulting from $L_{18} + L_{14} - R_6$ with an origin given by

$$L_{18} = 2,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{19} = 115,5 \text{ mm} \pm 0,3 \text{ mm}$$

The left hand side of the boundary shall be closed by two straight lines. The first one shall smoothly join the arc of R_6 to the arc of R_9 . The second one shall run from the left hand tangent of R_7 to its intersection with R_9 . Along the left hand side of surface S_3 there shall be a zone to protect S_3 from being damaged by the shutter. In order to keep this zone at a minimum practical width,

$$R_{10} = 4,1 \text{ mm max.}$$

This radius originates from the same point as R_9 .