INTERNATIONAL STANDARD

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Information technology — Data interchange on read-only 120 mm optical data disks (CD-ROM)

Technologies de l'information — Échange de données sur des disques optiques de diamètre 120 mm *à lecture unique (CD-ROM)*

Reference number
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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 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 10149 was prepared by the European Association for Standardizing Information and Communication Systems (as ECMA-130) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 23, *Optical disk cartridges for information interchange*, in parallel with its approval by national bodies of ISO and IEC.

This second edition cancels and replaces the first edition (ISO/IEC 10149:1989), which has been technically revised.

Annexes A to E form an integral part of this International Standard. Annex F is for information only.

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Information technology - Data interchange on read-only 120 mm optical data disks (CD-ROM)

1 Scope

This International Standard specifies the characteristics of 120 mm optical disks for information interchange between information processing systems and for information storage, called CD-ROM.

The optical disk specified by this International Standard is of the type in which the information is recorded before delivery to the user and can only be read from the disk. This International Standard specifies

- some definitions, the environments in which the characteristics of the disk shall be tested and the environments in which it shall be used and stored,
- the mechanical, physical and dimensional characteristics of the disk,
- the recording characteristics, the format of the tracks, the error-detecting and the error-correcting characters, and the coding of the information,
- the optical characteristics for reading the information.

These characteristics are specified for tracks recorded with digital data. According to this International Standard, a disk may also contain one or more tracks recorded with digital audio data. Such tracks shall be recorded according to IEC 908.

2 Conformance

An optical disk is in conformance with this International Standard if it conforms to all its mandatory requirements.

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 9660:1988, *Information processing - Volume and file structure of CD-ROM for information interchange.*

IEC 908:1987, *Compact disc digital audio system.*

4 Definitions

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

4.1 **Audio Track:** An Information Track containing digitally encoded audio information.

4.2 **concentricity:** The diameter of a circular tolerance zone within which the centres of two circular features must lie.

4.3 **Control byte:** An 8-bit byte from a table of 98 bytes, added to an F_2-Frame and containing addressing information.

4.4 **Digital Data Track:** An Information Track organized in sectors and containing digital user data.

4.5 **F_1-Frame:** A group of 24 8-bit bytes, being the output of the scrambler and input of the CIRC encoder.

4.6 **F_2-Frame:** A group of 32 8-bit bytes, being the output of the CIRC encoder.

4.7 **F_3-Frame:** A group of 33 8-bit bytes, being an F_2-Frame with a control byte, and input of the 8-to-14 encoder.

4.8 **Information Area:** An area on the disk with physical tracks, consisting of a Lead-in area, User Data area and a Lead-out area.

4.9 **Information Track:** An area on the disk containing a collection of user information.

4.10 **Physical Track:** A 360° turn of a continuous spiral line on the disk, followed by the optical stylus.

4.11 **radial acceleration:** The radial acceleration of any physical track in the direction of the axis of rotation of the disk, at a specified rotational speed.

4.12 **radial runout:** The difference between the maximum and the minimum distance of a physical track to the axis of rotation measured over one revolution.

4.13 **Section:** A group of 98 F_3-Frames containing one complete table of Control bytes.

4.14 **Sector:** The smallest addressable part of a Digital Data Track in the information area that can be accessed independently of other addressable parts of the area.

4.15 **User Data Area:** A part of the information area containing User Data.

5 Environments

5.1 Testing environments

5.1.1 Optical stylus

The optical stylus used for testing measurements shall have the following characteristics.

wavelength λ	: 780 nm ± 10 nm
polarization	: circular
numerical aperture	: 0,45 ± 0,01
intensity at the rim of the pupil of the objective lens	: larger than 50% of the maximum intensity value

The rms wave front error of the beam near the information layer shall be less than 0,07 λ. The contribution of the disk to this error shall be less than 0,05 λ.

5.1.2 Clamping

Where applicable, the disk shall be held between two concentric rings having an inner diameter of at least 29 mm and an outer diameter of at most 31 mm holding the disk with a force in the range 1 N to 2 N.

5.1.3 Normal testing environment

Unless otherwise stated, tests and measurements made on the disk to check the requirements of this International Standard shall be carried out under the following conditions:

temperature	: 25 °C ± 10 °C
relative humidity	: 45 % to 75 %
atmospheric pressure	: 96 kPa ± 10 kPa
conditioning before testing	: 24 h min.

No condensation on the disk shall be permitted to occur.

5.1.4 Restricted testing environment

Where specifically stated tests and measurements shall be carried out under the following conditions.

temperature	: 23 °C ± 2 °C
relative humidity	: 45 % to 55 %
atmospheric pressure	: 96 kPa ± 10 kPa
conditioning before testing	: 24 h min.

No condensation on the disk shall be permitted to occur.

5.2 Operating environment

Disks used for data interchange shall be operated under the following conditions, when mounted in the drive supplied with voltage and measured on the outside surface of the disk.

The disk exposed to storage conditions must be conditioned in the operating environment for at least two hours before operating.

temperature	: -25 °C to +70 °C
relative humidity	: 10 % to 95 %
absolute humidity	: 0,5 $g \cdot m^{-3}$ to 60,0 $g \cdot m^{-3}$
sudden change of temperature	: 50 °C max.
sudden change of relative humidity	: 30 % max.

There shall be no condensation of moisture on the disk.

5.3 Storage environment

Storage environment is the ambient condition to which the disk is exposed when stored. No condensation of moisture on the disk is permitted (see annex F).

temperature	: -20 °C to +50 °C
relative humidity	: 5 % to 90 %
wet bulb temperature	: 29 °C max.
atmospheric pressure	: 75 kPa to 105 kPa

6 Inflammability

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

7 Material

This International Standard specifies the material of the disk only in the information area (see 8.6). The remainder of the disk can be made of any material as long as all mandatory requirements of this International Standard are met.

The weight of the disk shall be within 14 g and 33 g.

8 Mechanical, physical and dimensional characteristics

Dimensional characteristics are specified for those parameters deemed mandatory for interchange and compatible use of the disk. Where there is freedom of design, only the functional characteristics of the elements described are indicated. The enclosed drawings show the dimensional requirements in summarized form. The different parts of the disk are described from the centre hole to the outside rim.

All diameters are referred to the centre of the centre hole.

Other dimensions are referred to two Reference Planes P and Q.

Figure 1 shows a cross-section of a part of the disk,

Figure 2 shows at a larger scale the edges of the centre hole,

Figure 3 shows at a larger scale a cross-section of the disk in the information area,

Figure 4 shows at a larger scale a cross-section of the rim area.

8.1 Reference planes

Reference Plane P is the primary Reference Plane. It is the plane on which the bottom surface of the clamping area (see 8.5) rests.

Reference Plane Q is the plane parallel to Reference Plane P at the height of the top surface of the clamping area.

8.2 Centre hole (figures 1 and 2)

The centre hole shall have a cylindrical shape. Its diameter shall be

$$d_1 = 15{,}0 \text{ mm} \begin{matrix} +0{,}1 \text{ mm} \\ -0{,}0 \text{ mm} \end{matrix}$$

Diameter d_1 shall be measured in the restricted testing environment.

The bottom edge of the centre hole may have a chamfer up to a height

$$h_1 = 0{,}1 \text{ mm max.}$$

above the bottom surface of the first transition area (see 8.3) at an angle

$$\alpha = 45°$$

Alternatively this edge may be rounded with a radius of not greater than 0,1 mm.

The top edge of the centre hole may present burrs which are permitted to extend by

$$h_2 = 0{,}2 \text{ mm max.}$$

above the top surface of the first transition area.

8.3 First transition area (figure 1)

The first transition area shall extend between diameter d_1 and diameter d_2.

$$d_2 = 20 \text{ mm} \begin{matrix} +6 \text{ mm} \\ -0 \text{ mm} \end{matrix}$$

In this whole area the top surface of the disk is permitted to be below Reference Plane Q by

$$h_3 = 0{,}2 \text{ mm max.}$$

and the bottom surface of the disk is permitted to be above Reference Plane P by

$$h_4 = 0{,}2 \text{ mm max.}$$

In addition, in the part of the area defined by

$$20 \text{ mm} < d_2 < 26 \text{ mm}$$

the top surface of the disk is permitted to be below Reference Plane Q by

$$h_5 = 0{,}4 \text{ mm max.}$$

and the bottom surface of the disk is permitted to be above Reference Plane P by

h_6 = 0,4 mm max.

8.4 Clamping area (figure 1)

The clamping area shall extend between the maximum value of diameter d_2 and diameter d_3.

d_2 (max.) = 26 mm

d_3 = 33 mm min.

The bottom surface of the clamping area shall be flat within 0,1 mm and shall lie on Reference Plane P.

The top surface of the clamping area shall be parallel to Reference Plane P within 0,2 mm, it defines Reference Plane Q.

The height of the top surface above Reference Plane P shall be

$$h_7 = 1{,}2 \text{ mm} \begin{matrix} +\,0{,}3 \text{ mm} \\ -\,0{,}1 \text{ mm} \end{matrix}$$

8.5 Second transition area (figure 1)

The second transition area shall extend between diameters d_3 and d_4.

d_4 = 44 mm max.

In this area the bottom surface of the disk is permitted to be either above Reference Plane P by

h_8 = 0,4 mm max.

or below Reference Plane P by

h_9 = 0,4 mm max.

and the top surface of the disk is permitted to be either above Reference Plane Q by

h_{10} = 0,4 mm max.

or below Reference Plane Q by

h_{11} = 0,4 mm max.

8.6 Information Area (figures 1 and 3)

The Information Area shall extend between diameters d_4 and d_5.

d_5 = 118 mm max.

The Information Area comprises the following zones.

– An inner buffer zone that extends between diameters d_4 and d_6.

$d_4 + 1 \text{ mm} \leq d_6 \leq 46 \text{ mm}$ max.

This diameter shall be measured in the restricted testing environment.

– A lead-in zone that extends between diameters d_6 and d_7.

$$d_7 = 50{,}0 \text{ mm} \begin{matrix} +\,0{,}0 \text{ mm} \\ -\,0{,}4 \text{ mm} \end{matrix}$$

This diameter shall be measured in the restricted testing environment.

– A user data zone that extends between diameter d_7 and d_8.

d_8 = 116 mm max.

This diameter shall be measured in the restricted testing environment.

– A lead-out zone that extends between diameters d_8 and d_9.

$d_9 = (d_8 + 1\ \text{mm})$ min.

– An outer buffer zone that extends between diameters d_9 and d_5, where

$d_9 + 1\ \text{mm} \leq d_5 \leq 118\ \text{mm}$

Between diameters d_4 and d_5 the disk shall consist of (figure 3):

– a transparent substrate,
– a reflective layer,
– a protective layer,
– an optional label.

The label may extend beyond the so-defined zone.

The height of the label above Reference Plane P shall be

$$h_{12} = 1{,}2\ \text{mm}\ ^{+\ 0{,}3\ \text{mm}}_{-\ 0{,}1\ \text{mm}}$$

The thickness e of the transparent substrate shall be

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

The bottom surface of the transparent substrate shall lie on Reference Plane P.

The index of refraction of the transparent substrate shall be

$1{,}55 \pm 0{,}10$

The birefringence of the transparent substrate expressed as a retardation (parallel beam, circularly polarized, normal incidence, double-pass) shall be

100 nm max.

The reflectance of the transparent substrate and reflective layer measured under normal incidence and parallel beam in an unrecorded part of the information area shall be

70% min.

The relative variation of this reflectance for frequencies below 100 Hz shall be less than 3% for a disk rotating at scanning velocity.

These parameters shall be measured at the wavelength specified in 5.1.1.

8.7 Rim area (figures 1 and 4)

The rim area shall extend between diameters d_5 and d_{10}.

$d_{10} = 120{,}0\ \text{mm} \pm 0{,}3\ \text{mm}$

This diameter shall be measured in the restricted testing environment.

Its concentricity relative to the largest circle inscribed in the centre hole shall be within

0,2 mm.

In the zone extending between diameters d_5 and d_{11}, where d_{11} shall satisfy both of the following conditions:

$d_{11} \geq d_5$

$117{,}7\ \text{mm} \leq d_{11} \leq 118{,}3\ \text{mm}$.

The bottom surface of the disk shall lie on the Reference Plane P and the height of the top surface above Reference Plane P shall be equal to h_{12}.

In the zone extending between diameters d_{11} and d_{10} the bottom surface of the disk is permitted to be below Reference Plane P by

h_{13} = 0,1 mm max.

and the top surface of the disk is permitted to be higher than h_{12} by

h_{14} = 0,1 mm max.

The values of h_{13} and h_{14} shall satisfy the condition:

$(h_{12} + h_{13} + h_{14}) \leq 1,5$ mm

In this zone the thickness of the disk is also permitted to decrease so that

$h_{16} - h1_5 = 0,6$ mm min.

as shown in figure 4.

8.8 General remarks

All heights specified in the preceding clauses and indicated by hi are independent from each other. This means, for example, that if the top surface of the first transition area is below Reference Plane Q by up to h_3 there is no implication that the bottom surface of this area has to be above Reference Plane P by up to h_4. Moreover, whilst the height and tolerances for the top surfaces of the clamping area and the information area (i.e. h_7 and h_{12}) have the same numerical values, this does not imply that the actual values have to be identical.

9 Mechanical deflection of the entrance surface

The following requirements apply to both a static disk and a disk clamped according to 5.1.2 and rotating at the scanning velocity.

The bottom surface of the information area (i.e. the entrance surface of the read beam) shall not deviate from Reference Plane P by more than ± 0,4 mm between d_6 and d_{11}. The rms value over one revolution shall not exceed 0,3 mm.

The angle which the normal to this entrance surface, averaged over an area of 2 mm diameter, makes with the normal to Reference Plane P shall not exceed 0° 36'. If a beam of light enters the disk along a normal to the Reference Plane P, then the angular deviation of the reflected beam in radial direction from the normal to Reference Plane P shall not exceed ± 1° 36'. This figure includes the tolerance on the parallelism of the information layer and the entrance surface.

10 Deflection of the reflective layer

With the disk clamped according to 5.1.2, and rotating at the scanning velocity, the deflection of the reflective layer is its axial deviation from its nominal position related to Reference Plane P (see 8.6) as seen by the optical stylus. Thus, it comprises the tolerances on the thickness, on the index of refraction and the deflection of the entrance surface. This deflection shall be measured between diameters d_4 and d_5.

a) Frequencies below 500 Hz

The deflection on either side of the nominal position of the reflective layer shall not exceed 0,5 mm. The rms value shall not exceed 0,4 mm. The acceleration of the reflective layer along a fixed line normal to the Reference Plane P shall not exceed 10 m/s2.

b) Frequencies above 500 Hz

The deflection on either side of the nominal position shall not exceed 1 µm.

11 Physical Track geometry

11.1 Physical Track shape

There shall be Physical Tracks between diameters d_6 and d_9 each of which forms a 360° turn of a continuous spiral line.