

# INTERNATIONAL STANDARD

**ISO/IEC**  
**13549**

First edition  
1993-12-15

---

---

## **Information technology — Data interchange on 130 mm optical disk cartridges — Capacity: 1,3 gigabytes per cartridge**

*Technologies de l'information — Échange de données sur cartouches de  
disque optique de diamètre 130 mm — Capacité: 1,3 gigabyte par  
cartouche*



Reference number  
ISO/IEC 13549:1993(E)

**Contents**

	<b>Page</b>
<b>Section 1 - General</b>	<b>1</b>
<b>1 Scope</b>	<b>1</b>
<b>2 Conformance</b>	<b>1</b>
<b>2.1 Optical disk cartridge (ODC)</b>	<b>1</b>
<b>2.2 Generating system</b>	<b>1</b>
<b>2.3 Receiving system</b>	<b>1</b>
<b>3 Normative reference</b>	<b>1</b>
<b>4 Definitions</b>	<b>2</b>
<b>4.1 band</b>	<b>2</b>
<b>4.2 case</b>	<b>2</b>
<b>4.3 Channel bit</b>	<b>2</b>
<b>4.4 Clamping Zone</b>	<b>2</b>
<b>4.5 control track</b>	<b>2</b>
<b>4.6 Cyclic Redundancy Check (CRC)</b>	<b>2</b>
<b>4.7 defect management</b>	<b>2</b>
<b>4.8 disk reference plane</b>	<b>2</b>
<b>4.9 entrance surface</b>	<b>2</b>
<b>4.10 Error Correction Code (ECC)</b>	<b>2</b>
<b>4.11 format</b>	<b>2</b>
<b>4.12 fully embossed disk</b>	<b>2</b>
<b>4.13 fully rewritable disk</b>	<b>2</b>
<b>4.14 hub</b>	<b>2</b>
<b>4.15 interleaving</b>	<b>2</b>
<b>4.16 Kerr rotation</b>	<b>2</b>
<b>4.17 land and groove</b>	<b>2</b>
<b>4.18 logical track</b>	<b>3</b>
<b>4.19 Logical ZCAV</b>	<b>3</b>
<b>4.20 mark</b>	<b>3</b>
<b>4.21 ODC with write once, read multiple functionality</b>	<b>3</b>
<b>4.22 optical disk</b>	<b>3</b>
<b>4.23 optical disk cartridge (ODC)</b>	<b>3</b>
<b>4.24 partially embossed disk</b>	<b>3</b>
<b>4.25 physical track</b>	<b>3</b>
<b>4.26 physical track group</b>	<b>3</b>

© ISO/IEC 1994

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

4.27	pitch	3
4.28	polarization	3
4.29	pre-recorded mark	3
4.30	read power	3
4.31	recording layer	3
4.32	Reed-Solomon code	3
4.33	spindle	3
4.34	substrate	3
4.35	write-inhibit hole	3
5	Conventions and notations	4
5.1	Representation of numbers	4
5.2	Names	4
6	List of acronyms	4
7	General description of the optical disk cartridge	4
8	General requirements	5
8.1	Environments	5
8.1.1	Testing environment	5
8.1.2	Operating environment	5
8.1.3	Storage environment	6
8.1.4	Transportation	6
8.2	Temperature shock	6
8.3	Safety requirements	6
8.4	Flammability	6
9	Reference Drive	6
9.1	Optical system	6
9.2	Optical beam	8
9.3	Read channels	8
9.4	Tracking	8
9.5	Rotation of the disk	8
<b>Section 2 - Mechanical and physical characteristics</b>		<b>9</b>
10	Dimensions and mechanical characteristics of the case	9
10.1	General	9
10.2	Case drawings	9
10.3	Sides, reference axes and reference planes	9
10.3.1	Relationship of Sides A and B	9
10.3.2	Reference axes and case reference planes	9
10.4	Materials	9
10.5	Mass	9
10.6	Overall dimensions	10
10.7	Location hole	10
10.8	Alignment hole	11
10.9	Surfaces on reference plane P	11
10.10	Insertion slots and detent features	12

10.11	Gripper slots	12
10.12	Write-inhibit holes	13
10.13	Media sensor holes	13
10.14	Head and motor window	14
10.15	Shutter	14
10.16	Slot for shutter opener	14
10.17	Shutter sensor notch	15
10.18	User label areas	15
11	Dimensional and physical characteristics of the disk	16
11.1	Dimensions of the disk	16
11.1.1	Outer diameter	16
11.1.2	Thickness	16
11.1.3	Clamping zone	16
11.1.4	Clearance zone	16
11.2	Mass	16
11.3	Moment of inertia	16
11.4	Imbalance	16
11.5	Axial deflection	16
11.6	Axial acceleration	16
11.7	Dynamic radial runout	17
11.8	Radial acceleration	17
11.9	Tilt	17
12	Drop test	18
13	Interface between disk and drive	18
13.1	Clamping Technique	18
13.2	Dimensions of the hub	18
13.2.1	Outer diameter of the hub	18
13.2.2	Height of the hub	18
13.2.3	Diameter of the centre hole	18
13.2.4	Height of the top of the centre hole at diameter $D_9$	18
13.2.5	Centring length at diameter $D_9$	18
13.2.6	Radius at diameter $D_9$	18
13.2.7	Chamfer at diameter $D_8$	19
13.2.8	Outer diameter of the magnetizable ring	19
13.2.9	Inner diameter of the magnetizable ring	19
13.2.10	Thickness of the magnetizable material	19
13.2.11	Position of the top of the magnetizable ring relative to the disk reference plane	19
13.3	Clamping method	19
13.4	Clamping force	19
13.5	Capture cylinder for the hub	19
13.6	Disk position in the operating condition	20
14	Characteristics of the substrate	35
14.1	Index of refraction	35
14.2	Thickness	35
15	Characteristics of recorded and embossed information	35

<b>15.1</b>	<b>Method of testing</b>	<b>35</b>
15.1.1	Environment	35
15.1.2	Use of the Reference Drive	35
15.1.3	Read conditions	36
15.1.4	Write conditions	36
15.1.5	Erase conditions	37
<b>15.2</b>	<b>Baseline reflectance</b>	<b>37</b>
15.2.1	General	37
15.2.2	Measured value	37
15.2.3	Requirement	37
<b>15.3</b>	<b>Magneto-optical recording in the Data Zone</b>	<b>38</b>
15.3.1	Resolution	38
15.3.2	Imbalance of magneto-optical signal	38
15.3.3	Vertical birefringence	38
15.3.4	Figure of merit for magneto-optical signal	38
15.3.5	Narrow-band signal-to-noise ratio	39
15.3.6	Cross-talk ratio	39
15.3.7	Ease of erasure	40
<b>15.4</b>	<b>Characteristics of information</b>	<b>41</b>
15.4.1	Groove-related signals	41
15.4.2	Properties of pre-recorded marks	42
15.4.3	Parameters of the read characteristics	43
<b>Section 3</b>	<b>Format of information</b>	<b>44</b>
<b>16</b>	<b>Features</b>	<b>44</b>
<b>16.1</b>	<b>Geometry of physical tracks</b>	<b>44</b>
16.1.1	Shape	44
16.1.2	Direction of rotation	44
16.1.3	Physical track pitch	44
<b>16.2</b>	<b>Formatted Zone</b>	<b>44</b>
16.2.1	Data Zone	44
16.2.2	Reflective Zone	45
16.2.3	SFP Transition Zone	45
16.2.4	Inner Control Track SFP Zone	45
16.2.5	Inner Manufacturer Zone	45
16.2.6	Outer Manufacturer Zone	45
16.2.7	Outer Control Track SFP Zone	45
16.2.8	Lead-out Zone	45
16.2.9	Track number	45
<b>16.3</b>	<b>Control tracks</b>	<b>46</b>
<b>16.4</b>	<b>PEP Zone</b>	<b>47</b>
16.4.1	Recording in the PEP Zone	47
16.4.2	Cross-track loss	47
16.4.3	Format of the tracks of the PEP Zone	48
16.4.4	Summary of the format of the Data field of a sector	51
<b>16.5</b>	<b>Control Track SFP Zones</b>	<b>51</b>

<b>16.5.1</b>	<b>Duplicate of the PEP information</b>	<b>52</b>
<b>16.5.2</b>	<b>Media information</b>	<b>52</b>
<b>16.5.3</b>	<b>System Information</b>	<b>57</b>
<b>16.5.4</b>	<b>Unspecified content</b>	<b>58</b>
<b>16.6</b>	<b>Requirements for interchange of a user-recorded cartridge</b>	<b>58</b>
<b>16.6.1</b>	<b>Requirements for reading</b>	<b>58</b>
<b>16.6.2</b>	<b>Requirements for writing and erasing</b>	<b>58</b>
<b>Section 4</b>	<b>Physical and logical format</b>	<b>59</b>
<b>17</b>	<b>Physical format</b>	<b>59</b>
<b>17.1</b>	<b>Track layout</b>	<b>59</b>
<b>17.1.1</b>	<b>Tracking</b>	<b>59</b>
<b>17.2</b>	<b>Sector format</b>	<b>60</b>
<b>17.2.1</b>	<b>Sector Mark</b>	<b>60</b>
<b>17.2.2</b>	<b>VFO fields</b>	<b>61</b>
<b>17.2.3</b>	<b>Address Mark (AM)</b>	<b>61</b>
<b>17.2.4</b>	<b>ID fields</b>	<b>61</b>
<b>17.2.5</b>	<b>Postamble (PA)</b>	<b>62</b>
<b>17.2.6</b>	<b>Offset Detection Flag (ODF)</b>	<b>62</b>
<b>17.2.7</b>	<b>Gap</b>	<b>62</b>
<b>17.2.8</b>	<b>Flag</b>	<b>62</b>
<b>17.2.9</b>	<b>Auto Laser Power Control (ALPC)</b>	<b>62</b>
<b>17.2.10</b>	<b>Sync</b>	<b>62</b>
<b>17.2.11</b>	<b>Data field</b>	<b>62</b>
<b>17.2.12</b>	<b>Buffer</b>	<b>63</b>
<b>17.3</b>	<b>Recording code</b>	<b>63</b>
<b>18</b>	<b>Logical format</b>	<b>64</b>
<b>18.1</b>	<b>Format of the Data Zone</b>	<b>64</b>
<b>18.1.1</b>	<b>Defect Management Areas</b>	<b>64</b>
<b>18.1.2</b>	<b>Type R/W (Fully rewritable disks)</b>	<b>66</b>
<b>18.1.3</b>	<b>Type O-ROM (Fully embossed disks)</b>	<b>66</b>
<b>18.1.4</b>	<b>Type P-ROM (Partially embossed disks)</b>	<b>67</b>
<b>18.1.5</b>	<b>Type WO (Write once disks)</b>	<b>67</b>
<b>18.2</b>	<b>Partitioning</b>	<b>67</b>
<b>18.2.1</b>	<b>Type R/W (Fully rewritable disks)</b>	<b>67</b>
<b>18.2.2</b>	<b>Type P-ROM (Partially embossed disks)</b>	<b>67</b>
<b>18.2.3</b>	<b>Type O-ROM (Fully embossed disks)</b>	<b>67</b>
<b>18.2.4</b>	<b>Type WO (Write once disks)</b>	<b>67</b>
<b>18.3</b>	<b>Defect management</b>	<b>70</b>
<b>18.3.1</b>	<b>R/W and WO Zones: Spare sectors</b>	<b>70</b>
<b>18.3.2</b>	<b>Embossed groups: Parity sectors</b>	<b>73</b>
<b>Section 5</b>	<b>Characteristics of User Data</b>	<b>74</b>

<b>19</b>	<b>Minimum quality of a sector</b>	<b>74</b>
<b>19.1</b>	<b>Headers</b>	<b>74</b>
<b>19.1.1</b>	<b>Sector Mark</b>	<b>74</b>
<b>19.1.2</b>	<b>ID fields</b>	<b>74</b>
<b>19.2</b>	<b>User-written data</b>	<b>74</b>
<b>19.3</b>	<b>Embossed data</b>	<b>74</b>
<b>20</b>	<b>Data interchange requirements</b>	<b>74</b>
<b>20.1</b>	<b>Tracking</b>	<b>74</b>
<b>20.2</b>	<b>User-written data</b>	<b>74</b>
<b>20.3</b>	<b>Embossed data</b>	<b>74</b>
<b>20.4</b>	<b>Quality of the disk</b>	<b>74</b>
<b>Annexes</b>		
<b>A</b>	<b>Air cleanliness class 100 000</b>	<b>75</b>
<b>B</b>	<b>CRC for ID fields</b>	<b>77</b>
<b>C</b>	<b>Definition of write pulse width</b>	<b>78</b>
<b>D</b>	<b>Interleave, CRC, ECC, Resync for the Data field</b>	<b>79</b>
<b>E</b>	<b>Measurement of the figure of merit</b>	<b>85</b>
<b>F</b>	<b>Test method for measuring the adsorbant force of the hub</b>	<b>86</b>
<b>G</b>	<b>Office environment</b>	<b>88</b>
<b>H</b>	<b>Derivation of the operating climatic environment</b>	<b>88</b>
<b>J</b>	<b>Transportation</b>	<b>92</b>
<b>K</b>	<b>Track deviation measurement</b>	<b>92</b>
<b>L</b>	<b>Read power, write power and erase power for 50 Hz operation</b>	<b>96</b>
<b>M</b>	<b>Guidelines for sector retirement</b>	<b>97</b>
<b>N</b>	<b>Guidelines for the use of ODCs of Type WO</b>	<b>97</b>
<b>P</b>	<b>Measure of substrate vertical birefringence</b>	<b>98</b>

## 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 of an International Standard requires approval by at least 75% of the national bodies casting a vote.

International Standard ISO/IEC 13549 was prepared by the European Computer Manufacturers Association (as Standard ECMA-184) and was adopted, under a special "fast-track procedure", by Joint Technical Committee ISO/IEC JTC 1 *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

Annexes A to F form an integral part of this International Standard, annexes G to P are for information only.

## Patents

During the preparation of the ECMA standard, information was gathered on patents upon which application of the standard might depend. Relevant patents were identified as belonging to IBM and the Sony Corporation. However, neither ECMA nor ISO/IEC can give authoritative or comprehensive information about evidence, validity or scope of patent and like rights. The patent holders have stated that licences will be granted under reasonable and non-discriminatory terms. Communications on this subject should be addressed to

IBM  
Storage Systems Products Division  
Tucson, Arizona 85744 USA

Sony Corporation  
Licensing and Trademark Division  
6-7-35 Kitashinagawa  
Shinagawa-ku  
Tokyo 141  
Japan



## Introduction

This International Standard specifies the characteristics of 130 mm Optical Disk Cartridges (ODC) with a capacity of 1,3 Gbytes per cartridge. This International Standard is the first of a series of International Standards for ODCs of different capacities, based on the optical disk cartridge specified in ISO/IEC 10089. Whilst the latter specifies a fully re-writable disk, this International Standard specifies four related, but different implementations of such cartridges, viz.

- |                   |  |
|-------------------|--|
| <b>Type R/W</b>   | Provides for data to be written, read, and erased many times over the whole of both recording surfaces of the disk using the thermo-magnetic and magneto-optical effects.  |
| <b>Type P-ROM</b> | Provides for a part of both disk surfaces to be pre-recorded and reproduced by stamping or other means. This part of the disk is read without recourse to the magneto-optical effect. All parts which are not pre-recorded, provide for data to meet the requirements of Type R/W. |
| <b>Type O-ROM</b> | Provides for the whole of both disk surfaces to be pre-recorded and reproduced by stamping or other means. This type of disk is read without recourse to the magneto-optical effect.   |
| <b>Type WO</b>    | Provides write once, read multiple functionality on the whole of both disk surfaces using the thermo-magnetic and magneto-optical effects.   |

# Information technology — Data interchange on 130 mm optical disk cartridges — Capacity: 1,3 gigabytes per cartridge

## Section 1 - General

### 1 Scope

This International Standard specifies

- the conditions for conformance testing;
- the environments in which the cartridges are to be operated and stored;
- the mechanical, physical and dimensional characteristics of the case and of the cartridges, so as to provide mechanical interchangeability between the data processing systems;
- the format of the information on the disk, both embossed and user-written, including the physical disposition of the tracks and sectors, the error correction codes, and the modulation method used;
- the characteristics of the embossed information on the disk;
- the magneto-optical characteristics of the disk, enabling processing systems to write data onto the disk;
- the minimum quality of user-written data on the disk, enabling data processing systems to read data from the disk.

This International Standard provides for interchange between optical disk drives. Together with a standard for volume and file structure, it provides for full data interchange between data processing systems.

### 2 Conformance

#### 2.1 Optical disk cartridge (ODC)

An optical disk cartridge claiming conformance with this International Standard shall specify its Type. It shall be in conformance if it meets all mandatory requirements specified herein for that Type.

#### 2.2 Generating system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported. A system generating an ODC for interchange shall be entitled to claim conformance with this International Standard if it meets the mandatory requirements of this Standard for the Type(s) specified.

#### 2.3 Receiving system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported.

A system receiving an ODC for interchange shall be entitled to claim conformance with this International Standard if it is able to handle any ODC which conforms to this International Standard for the Type(s) specified.

### 3 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was 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 standard listed below.

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