

INTERNATIONAL  
STANDARD

**ISO/IEC**  
**13481**

First edition  
1993-12-15

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**Information technology — Data  
interchange on 130 mm optical disk  
cartridges — Capacity: 1 gigabyte per  
cartridge**  
**(standards.iteh.ai)**

*Technologies de l'information — Échange de données sur cartouches de  
disque optique de diamètre 130 mm — Capacité: 1 gigabyte par  
cartouche*  
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Reference number  
ISO/IEC 13481:1993(E)

**Contents**

	<b>Page</b>
<b>Section 1 - General</b>	<b>1</b>
1 Scope	1
2 Conformance	1
2.1 Optical Disk Cartridges	1
2.2 Generating System	1
2.3 Receiving System	1
3 Normative references	2
4 Definitions	2
4.1 case	2
4.2 Cyclic Redundancy Check (CRC)	2
4.3 embossed mark	2
4.4 entrance surface	2
4.5 Error Correction Code (ECC)	2
4.6 field	2
4.7 format	2
4.8 groove	2
4.9 interleaving	2
4.10 Kerr rotation	2
4.11 land and groove	2
4.12 mark	2
4.13 optical disk	2
4.14 optical disk cartridge (ODC)	2
4.15 polarization	2
4.16 recording layer	2

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4.17	Reed-Solomon code	2
4.18	rewritable optical disk	2
4.19	sector	2
4.20	substrate	2
4.21	track	3
4.22	write-once functionality	3
4.23	zone	3
5	Conventions and notations	3
5.1	Representation of numbers	3
5.2	Names	3
6	List of acronyms	3
7	General description of the optical disk cartridge	4
8	General requirements	4
8.1	Environments	4
8.1.1	Testing environment	4
8.1.2	Operating environment	4
8.1.3	Storage environment	5
8.1.4	Transportation	5
	<a href="https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993">https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993</a>	
8.2	Temperature shock	5
8.3	Safety requirements	5
8.4	Flammability	5
9	Reference drive	5
9.1	Optical system	5
9.2	Optical beam	7
9.3	Read channels	7
9.4	Tracking	7
9.5	Rotation of the disk	7
<b>Section 2 - Mechanical and physical characteristics</b>		<b>8</b>
10	Dimensions and mechanical characteristics of the case	8
10.1	General	8
10.2	Case drawings	8
10.3	Sides, reference axes and reference planes	8
10.3.1	Relationship of Sides A and B	8
10.3.2	Reference axes and case reference planes	8

<b>10.4</b>	<b>Materials</b>	<b>8</b>
<b>10.5</b>	<b>Mass</b>	<b>9</b>
<b>10.6</b>	<b>Overall dimensions</b>	<b>9</b>
<b>10.7</b>	<b>Location hole</b>	<b>9</b>
<b>10.8</b>	<b>Alignment hole</b>	<b>10</b>
<b>10.9</b>	<b>Surfaces on reference planes P</b>	<b>10</b>
<b>10.10</b>	<b>Insertion slots and detent features</b>	<b>11</b>
<b>10.11</b>	<b>Gripper slots</b>	<b>11</b>
<b>10.12</b>	<b>Write-inhibit holes</b>	<b>12</b>
<b>10.13</b>	<b>Media sensor holes</b>	<b>12</b>
<b>10.14</b>	<b>Head and motor window</b>	<b>13</b>
<b>10.15</b>	<b>Shutter</b>	<b>13</b>
<b>10.16</b>	<b>Slot for shutter opener</b>	<b>13</b>
<b>10.17</b>	<b>Shutter sensor notch</b>	<b>14</b>
<b>10.18</b>	<b>User label areas</b>	<b>14</b>
<b>11</b>	<b>Dimensional and physical characteristics of the disk</b>	<b>15</b>
<b>11.1</b>	<b>Dimensions of the disk</b>	<b>15</b>
<b>11.1.1</b>	<b>Outer diameter</b>	<b>15</b>
<b>11.1.2</b>	<b>Thickness</b>	<b>15</b>
<b>11.1.3</b>	<b>Clamping zone</b>	<b>15</b>
<b>11.1.4</b>	<b>Clearance zone</b>	<b>15</b>
<b>11.2</b>	<b>Mass</b>	<b>15</b>
<b>11.3</b>	<b>Moment of inertia</b>	<b>15</b>
<b>11.4</b>	<b>Imbalance</b>	<b>15</b>
<b>11.5</b>	<b>Axial deflection</b>	<b>15</b>
<b>11.6</b>	<b>Axial acceleration</b>	<b>15</b>
<b>11.7</b>	<b>Dynamic radial runout</b>	<b>15</b>
<b>11.8</b>	<b>Radial acceleration</b>	<b>16</b>
<b>11.9</b>	<b>Tilt</b>	<b>16</b>
<b>12</b>	<b>Drop test</b>	<b>16</b>
<b>13</b>	<b>Interface between disk and drive</b>	<b>16</b>
<b>13.1</b>	<b>Clamping technique</b>	<b>16</b>
<b>13.2</b>	<b>Dimensions of the hub</b>	<b>16</b>
<b>13.2.1</b>	<b>Outer diameter of the hub</b>	<b>16</b>
<b>13.2.2</b>	<b>Height of the hub</b>	<b>16</b>
<b>13.2.3</b>	<b>Diameter of the centre hole</b>	<b>16</b>
<b>13.2.4</b>	<b>Height of the top of the centre hole at diameter <math>D_9</math></b>	<b>16</b>

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ISO/IEC 13481:1993

13.2.5	Centring length at diameter $D_9$	16
13.2.6	Chamfer at diameter $D_9$	17
13.2.7	Chamfer at diameter $D_8$	17
13.2.8	Outer diameter of the magnetizable ring	17
13.2.9	Inner diameter of the magnetizable ring	17
13.2.10	Thickness of the magnetizable material	17
13.2.11	Position of the top of the magnetizable ring relative to the disk reference plane	17
13.3	Magnetizable material	17
13.4	Clamping force	17
13.5	Capture cylinder for the hub	17
13.6	Disk position in the operating condition	18
14	Characteristics of the substrate	33
14.1	Index of refraction	33
14.2	Thickness	33
<b>Section 3 - Format of information</b>		<b>33</b>
15	Track geometry	33
15.1	Track shape	33
15.2	Direction of rotation	33
15.3	Track pitch	33
15.4	Track number	33
16	Track format	33
16.1	Formatted Zone	33
16.2	Control tracks	36
16.3	Control Track PEP Zone	37
16.3.1	Recording in the PEP Zone	37
16.3.2	Cross-track loss	37
16.3.3	Format of the tracks of the PEP Zone	38
16.4	Control Track SFP Zones	41
16.4.1	Duplicate of the PEP information	41
16.5	Media information	42
16.6	System Information	48
16.7	Unspecified content	49
16.8	Requirements for interchange of a user-recorded cartridge	49

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[ISO/IEC 13481:1993](https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993)

<https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993>

<b>16.8.1</b>	<b>Requirements for reading</b>	<b>49</b>
<b>16.8.2</b>	<b>Requirements for writing and erasing</b>	<b>49</b>
<b>17</b>	<b>Sector format</b>	<b>49</b>
<b>17.1</b>	<b>Sector Mark (SM)</b>	<b>51</b>
<b>17.2</b>	<b>VFO areas</b>	<b>52</b>
<b>17.3</b>	<b>Address Mark (AM)</b>	<b>52</b>
<b>17.4</b>	<b>ID and CRC</b>	<b>52</b>
<b>17.5</b>	<b>Postamble (PA)</b>	<b>53</b>
<b>17.6</b>	<b>Offset Detection Flag (ODF)</b>	<b>53</b>
<b>17.7</b>	<b>Gap</b>	<b>53</b>
<b>17.8</b>	<b>Flag</b>	<b>53</b>
<b>17.9</b>	<b>Auto Laser Power Control (ALPC)</b>	<b>53</b>
<b>17.10</b>	<b>Sync</b>	<b>53</b>
<b>17.11</b>	<b>Data field</b>	<b>53</b>
<b>17.11.1</b>	<b>User bytes</b>	<b>53</b>
<b>17.11.2</b>	<b>CRC and ECC</b>	<b>53</b>
<b>17.11.3</b>	<b>Bytes for control information</b>	<b>54</b>
<b>17.11.4</b>	<b>Last bytes of the Data field of the 512-byte sector format</b>	<b>54</b>
<b>17.11.5</b>	<b>Resync</b>	<b>54</b>
<b>17.12</b>	<b>Buffer</b>	<b>54</b>
<b>18</b>	<b>Recording code</b>	<b>54</b>
<b>19</b>	<b>Defect management</b>	<b>54</b>
<b>19.1</b>	<b>Media initialization</b>	<b>55</b>
<b>19.1.1</b>	<b>Media initialization with certification</b>	<b>55</b>
<b>19.1.2</b>	<b>Media initialization without certification</b>	<b>55</b>
<b>19.2</b>	<b>Write and read procedure</b>	<b>55</b>
<b>19.3</b>	<b>Layout of the User Zone</b>	<b>56</b>
<b>19.3.1</b>	<b>Disk Definition Structure (DDS)</b>	<b>57</b>
<b>19.3.2</b>	<b>Primary Defect List (PDL)</b>	<b>58</b>
<b>19.3.3</b>	<b>Secondary Defect List (SDL)</b>	<b>59</b>
<b>19.3.4</b>	<b>Zone Structure Table (ZST)</b>	<b>60</b>
<b>Section 4 - Characteristics of embossed information</b>		<b>62</b>
<b>20</b>	<b>ZCAV format</b>	<b>62</b>

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<https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993>

<b>20.1</b>	<b>Tracking</b>	<b>62</b>
<b>20.2</b>	<b>Characteristics of pre-recorded information</b>	<b>62</b>
<b>20.2.1</b>	<b>Groove-related signals</b>	<b>62</b>
<b>20.2.2</b>	<b>Properties of pre-recorded marks</b>	<b>63</b>
<b>20.2.3</b>	<b>Parameters of the read characteristics</b>	<b>64</b>
<b>Section 5 - Characteristics of the recording layer</b>		<b>65</b>
<b>21</b>	<b>Characteristics of the recording layer</b>	<b>65</b>
<b>21.1</b>	<b>Test conditions</b>	<b>65</b>
<b>21.1.1</b>	<b>General</b>	<b>65</b>
<b>21.1.2</b>	<b>Read conditions</b>	<b>65</b>
<b>21.1.3</b>	<b>Write conditions</b>	<b>65</b>
<b>21.1.4</b>	<b>Erase conditions</b>	<b>66</b>
<b>21.2</b>	<b>Baseline reflectance</b>	<b>67</b>
<b>21.2.1</b>	<b>General</b>	<b>67</b>
<b>21.2.2</b>	<b>Actual value</b>	<b>67</b>
<b>21.2.3</b>	<b>Requirement</b>	<b>67</b>
<b>21.3</b>	<b>Magneto-optical recording in the User Zone</b>	<b>67</b>
<b>21.3.1</b>	<b>Resolution</b>	<b>67</b>
<b>21.3.2</b>	<b>Imbalance of magneto-optical signal</b>	<b>68</b>
<b>21.3.3</b>	<b>Figure of merit for magneto-optical signal</b>	<b>68</b>
<b>21.3.4</b>	<b>Narrow-band signal-to-noise ratio</b>	<b>68</b>
<b>21.3.5</b>	<b>Cross-talk ratio</b>	<b>69</b>
<b>21.3.6</b>	<b>Ease of erasure</b>	<b>69</b>
<b>Annexes</b>		
<b>A</b>	<b>Definition of write and erase pulse width</b>	<b>70</b>
<b>B</b>	<b>Measurement of figure of merit</b>	<b>71</b>
<b>C</b>	<b>Values to be implemented in future standards</b>	<b>72</b>
<b>D</b>	<b>Pointer fields</b>	<b>73</b>
<b>E</b>	<b>CRC for ID fields</b>	<b>74</b>
<b>F</b>	<b>Interleave, CRC, ECC, Resync for the Data field</b>	<b>75</b>
<b>G</b>	<b>Sector retirement guidelines</b>	<b>81</b>
<b>H</b>	<b>Office environment</b>	<b>82</b>
<b>J</b>	<b>Transportation</b>	<b>83</b>

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[ISO/IEC 13481:1993](https://standards.iteh.ai/catalog/standards/sist/c40d21b9-e7fc-4d62-af1c-5408a1357c2f/iso-iec-13481-1993)

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<b>K - Requirements for interchange</b>	<b>84</b>
<b>L - SCSI Logical Block to Physical Sector Mapping</b>	<b>86</b>
<b>M - Derivation of the operating climatic environment</b>	<b>89</b>
<b>N - Air cleanliness class 100 000</b>	<b>93</b>
<b>P - Guidelines for using ODCs of Type W/O</b>	<b>95</b>

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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 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 13481 was prepared by the European Computer Manufacturers Association (as Standard ECMA-183) 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, B, D, E, F, K, L and N form an integral part of this International Standard. Annexes C, G, H, J, M and P are for information only.

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## 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 the MAXOPTIX 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

MAXOPTIX CORPORATION  
2520 Junction Avenue  
SAN JOSE – CA 95 134  
USA

## Introduction

This International Standard specifies the characteristics of 130 mm Optical Disk Cartridges (ODC) with a capacity of 1 Gbyte per cartridge. This International Standard specifies two related but different implementations of such cartridges, viz.

**Type R/W** 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.

**Type WO** Provides write once, read multiple functionality on the whole of both disk surfaces using the thermo-magnetic and magneto-optical effects.

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## Information technology - Data interchange on 130 mm optical disk cartridges - Capacity: 1 gigabyte per cartridge

### Section 1 - General

#### 1 Scope

This International Standard specifies the characteristics of 130 mm optical disk cartridges (ODCs) with a capacity of 1 Gigabyte per cartridge. It specifies two related, but different implementations of such cartridges:

**Type R/W** 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.

**Type WO** Provides write once, read multiple functionality on both disk surfaces using the thermo-magnetic and magneto-optical effects.

This International Standard specifies:

- the conditions for conformance testing and the reference drive;
- the environments in which the cartridges are to be operated and stored;
- the mechanical, physical and dimensional characteristics of the case and of the cartridge, so as to provide mechanical interchangeability between 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.

It also 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. Interchange involves the ability to write, read and erase data without introducing any error.

#### 2 Conformance

##### 2.1 Optical disk cartridges

An ODC claiming conformance with this International Standard shall specify its Type. It shall conform to this International Standard 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 Standard if it meets all 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 recording made on the cartridge according to 2.1 on the Type(s) specified.

### 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 - Part 13: Wrought stainless steels*.

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 **case:** The housing for an optical disk, that protects the disk and facilitates disk interchange.
- 4.2 **Cyclic Redundancy Check (CRC):** A method for detecting errors in data.
- 4.3 **embossed mark:** A mark so formed as to be unalterable by magneto-optical means.
- 4.4 **entrance surface:** The surface of the disk on to which the optical beam first impinges.
- 4.5 **Error Correction Code (ECC):** An error-detecting code designed to correct certain kinds of errors in data.
- 4.6 **field:** A subdivision of a sector.
- 4.7 **format:** The arrangement or layout of information on the disk.
- 4.8 **groove:** See 4.11.
- 4.9 **interleaving:** The process of allocating the physical sequence of units of data so as to render the data more immune to burst errors.
- 4.10 **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 effect.
- 4.11 **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.
- 4.12 **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.
- NOTE - Subdivisions of a sector which are named "mark" are not marks in the sense of this definition.
- 4.13 **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.
- 4.14 **optical disk cartridge (ODC):** A device consisting of a case containing an optical disk.
- 4.15 **polarization:** The direction of polarization of an optical beam is the direction of the electric vector of the beam.
- NOTE - 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.
- 4.16 **recording layer:** A layer of the disk on, or in, which data is written during manufacture and/or use.
- 4.17 **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.
- 4.18 **rewritable optical disk:** An optical disk in which the data in specified areas can be written, erased and rewritten by an optical beam.
- 4.19 **sector:** The smallest addressable part of a track in the information zone of a disk that can be accessed independently of other addressable parts of the zone.
- 4.20 **substrate:** A transparent layer of the disk, provided for the mechanical support of the recording layer, through which the optical beam accesses the recording layer.

**4.21 track:** The path which is to be followed by the focus of the optical beam during one revolution of the disk.

**4.22 write-once functionality:** A disk with write-once functionality can be initialized and written once in specified areas and read many times by an optical beam. Erasing of data in these specified areas is not permitted.

**4.23 zone:** An annular area of the disk.

## 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 the 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 bit to the left.
- Bit combinations are shown with the most significant bit to the left.
- Negative values of numbers in binary notation are expressed in TWO's complement notation.
- In each field the data is recorded so that the most significant byte (byte 0) is recorded first. Within each byte the least significant bit is numbered 0 and is recorded last, the most significant bit (numbered 7 in an 8-bit byte) is recorded first. This order of recording applies also to the data input of the Error Detection and Correction circuits and to their output.

### 5.2 Names

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

ISO/IEC 13481:1993

<http://standards.iso.org/standards/catalog/standards/iec/13481/iec-13481-1993.html>

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## 6 List of acronyms

AM	Address Mark
CCS	Continuous Composite Servo (tracking method)
CRC	Cyclic Redundancy Code
DDS	Disk Definition Structure
DMA	Defect Management Area
DMP	Defect Management Pointers
ECC	Error Correction Code
ID	Identifier
LBA	Logical Block Address
LDC	Long Distance Code
LSB	Least Significant Byte
MSB	Most Significant Byte
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
SCSI	Small Computer Systems Interface
SDL	Secondary Defect List
SFP	Standard Formatted Part of the Control Tracks
SM	Sector Mark
VFO	Variable Frequency Oscillator
ZCAV	Zoned Constant Angular Velocity

## ZST Zone Structure Table

**7 General description of the optical disk cartridge**

The optical disk cartridge which is the subject of this International Standard consists of a case containing an optical disk.

The case is a protective enclosure for the disk. It has access windows covered by a shutter. The windows are automatically uncovered by the drive when the cartridge is inserted into it.

The optical disk is recordable on both sides. Data can be written onto the disk as mark in the form of magnetic domains in the recording layer and can be erased from it with a focussed optical beam, using the thermo-magnetic effect. The data can be read with a focussed optical beam, using the magneto-optical Kerr effect. The beam accesses the recording layer through the transparent substrate of the disk.

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, the cartridge must be reversed before insertion into the drive.

**8 General requirements****8.1 Environments****8.1.1 Testing environment**

The test environment is the environment where the air immediately surrounding the optical disk cartridge shall have the following properties

temperature	: 23 °C ± 2 °C
relative humidity (RH)	: 45 % to 55 %
atmospheric pressure	: 60 kPa to 106 kPa
air cleanliness	: Class 100 000 (see annex N)

No condensation on or in the ODC shall occur. Before testing, the optical disk cartridge shall be conditioned in this environment for 48h min. It is recommended that, before testing, the entrance surface of the optical disk be cleaned according to the instructions of the manufacturer of the disk.

Unless otherwise stated, all tests and measurements shall be made in this testing environment.

**8.1.2 Operating environment**

This International Standard requires that an optical disk cartridge which meets all requirements of this International Standard in the specified test environment provides data interchange over the specified ranges of environmental parameters in the operating environment.

The operating environment is the environment where the air immediately surrounding the optical disk cartridge shall have the following properties

temperature	: 5 °C to 55 °C
relative humidity	: 3 % to 85 %
absolute humidity	: 1 g/m <sup>3</sup> to 30 g/m <sup>3</sup>
atmospheric pressure	: 60 kPa to 106 kPa
temperature gradient	: 0 °C /h max.
relative humidity gradient	: 10 % /h max.
air cleanliness	: Office environment (see annex H)
magnetic field strength at the recording layer for any condition under which a beam is in focus	: 32 000 A/m max.
magnetic field strength at the recording layer during any other condition.	: 48 000 A/m max.

No condensation on or in the optical disk cartridge shall be allowed to occur. If an optical disk cartridge has been exposed to conditions outside those specified in this clause, it shall be acclimatized in an allowed operating environment for at least 2 h before use (see also annex M).

### 8.1.3 Storage environment

The optical disk cartridge without any protective enclosure shall not be stored in an environment outside the range allowed for storage. The storage environment is defined as an environment where the air immediately surrounding the optical disk cartridge shall have the following properties

temperature	: -10 °C to 55 °C
relative humidity	: 3 % to 90 %
absolute humidity	: 1 g/m <sup>3</sup> to 30 g/m <sup>3</sup>
atmospheric pressure	: 60 kPa to 106 kPa
temperature gradient	: 15 °C /h max.
relative humidity gradient	: 10 % /h max.
air cleanliness	: Office environment (see annex H)
magnetic field strength at the recording layer	: 48 000 A/m max.

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

### 8.1.4 Transportation

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

### 8.2 Temperature shock

The optical disk cartridge shall withstand a temperature shock of up to 20°C when inserted into, or removed from, the drive.

### 8.3 Safety requirements

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

### 8.4 Flammability

The cartridge and its components shall be made from materials that comply with the flammability class for HB materials, or as specified in IEC 950.

## 9 Reference Drive

The Reference Drive is a collection of several critical components which have well defined properties and which are used to test write, read and erase parameters of the disk for conformance to this International Standard. The critical components vary from test to test. This clause gives an outline of all components; components critical for tests in specific clauses only are specified in these clauses.

### 9.1 Optical system

The basic set-up of the optical system of the Reference Drive used for measuring the write, read and erase parameters is shown in figure 1. Different components and locations of components are permitted, provided that the performance remains the same as that of the set-up in figure 1. The optical system shall be such that the detected light reflected from the entrance surface of the disk is minimized so as not to influence the accuracy of the measurements.