



**Information technology — Data interchange
on 130 mm optical disk cartridges of type
WORM (Write Once Read Many) using
irreversible effects — Capacity: 2,6 Gbytes
per cartridge**

*Technologies de l'information — Échange de données sur cartouches de
disque optique de 130 mm de type WORM utilisant des effets
irréversibles — Capacité: 2,6 Gbytes par cartouche*



Contents

Section 1 - General	1
1 Scope	1
2 Conformance	1
2.1 Optical Disk Cartridge (ODC)	1
2.2 Generating system	1
2.3 Receiving system	1
2.4 Compatibility statement	1
3 Normative reference	1
4 Definitions	2
4.1 band	2
4.2 case	2
4.3 clamping zone	2
4.4 control track	2
4.5 Cyclic Redundancy Check (CRC)	2
4.6 defect management:	2
4.7 disk reference plane	2
4.8 entrance surface	2
4.9 Error Correction Code (ECC)	2
4.10 format	2
4.11 hub	2
4.12 interleaving	2
4.13 land and groove	2
4.14 logical track	2
4.15 mark	2
4.16 mark edge	2
4.17 mark edge recording	2
4.18 optical disk	2
4.19 optical disk cartridge (ODC)	2
4.20 physical track	2
4.21 polarization	2
4.22 pre-recorded mark	2
4.23 read power	2
4.24 recording layer	2
4.25 Reed-Solomon code	2
4.26 space	3
4.27 spindle	3
4.28 substrate:	3
4.29 track pitch	3
4.30 write-inhibit hole	3
4.31 zone	3

© ISO/IEC 1998

All rights reserved. Unless otherwise specified, 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

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 Test environment	4
8.1.2 Operating environment	4
8.1.3 Storage environment	5
8.1.4 Transportation	5
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
Section 2 - Mechanical and physical characteristics	7
10 Dimensional and physical characteristics of the case	7
10.1 General description of the case	7
10.2 Relationship of Sides A and B	8
10.3 Reference axes and case reference planes	8
10.4 Case Drawings	8
10.5 Dimensions of the case	8
10.5.1 Overall dimensions	8
10.5.2 Location hole	9
10.5.3 Alignment hole	9
10.5.4 Surfaces on Reference Planes P	10
10.5.5 Insertion slots and detent features	11
10.5.6 Gripper slots	11
10.5.7 Write-inhibit holes	11
10.5.8 Media sensor holes	12
10.5.9 Head and motor window	13
10.5.10 Shutter	13
10.5.11 Slot for shutter opener	14
10.5.12 Shutter sensor notch	14
10.5.13 User label areas	14
10.6 Mechanical characteristics	15
10.6.1 Materials	15
10.6.2 Mass	15
10.6.3 Edge distortion	15
10.6.4 Compliance	15
10.6.5 Shutter opening force	15
10.7 Drop test	15
11 Dimensional, mechanical and physical characteristics of the disk	15
11.1 General description of the disk	15
11.2 Reference axis and plane of the disk	15
11.3 Dimensions of the disk	16
11.3.1 Hub dimension	16

11.4 Mechanical characteristics	17
11.4.1 Material	17
11.4.2 Mass	17
11.4.3 Moment of inertia	17
11.4.4 Imbalance	17
11.4.5 Axial deflection	17
11.4.6 Axial acceleration	17
11.4.7 Radial runout	18
11.4.8 Radial acceleration	18
11.4.9 Tilt	18
11.5 Optical characteristics	18
11.5.1 Index of refraction	18
11.5.2 Thickness	18
11.5.3 Birefringence	18
11.5.4 Vertical Birefringence	18
11.5.5 Reflectance	19
12 Interface between cartridge and drive	19
12.1 Clamping method	19
12.2 Clamping force	19
12.3 Capture cylinder	19
12.4 Disk position in the operating condition	20
Section 3 - Format of information	35
13 Track geometry	35
13.1 Track shape	35
13.2 Direction of track spiral	35
13.3 Track pitch	35
13.4 Logical track number	35
13.5 Physical track number	35
14 Track format	35
14.1 Physical track layout	35
14.2 Logical track layout	35
14.3 Radial alignment	36
14.4 Sector number	36
15 Sector format	36
15.1 Sector layout	36
15.2 Sector Mark	36
15.3 VFO fields	37
15.4 Address Mark (AM)	38
15.5 ID fields	38
15.6 Postamble (PA)	38
15.7 Gap	39
15.8 Flag	39
15.9 Auto Laser Power Control (ALPC)	39
15.10 Sync	39
15.11 Data field	39
15.11.1 User data bytes	40
15.11.2 CRC and ECC bytes	40
15.11.3 Bytes for Defect Management Pointers (DMP)	40
15.11.4 Resync bytes	40
15.12 Buffer field	40
16 Recording Code	40
17 Formatted Zone	41
17.1 General description of the Formatted Zone	41

17.2 Division of the Formatted Zone	41
17.2.1 Lead-in Zone	43
17.2.2 Manufacturer Zones	43
17.2.3 User Zone	44
17.2.4 Reflective Zone	44
17.2.5 Control Track Zones	44
17.3 Control Track PEP Zone	44
17.3.1 Recording in the PEP Zone	44
17.3.2 Format of the tracks of the PEP Zone	45
17.4 Control Track SFP Zones	49
17.4.1 Duplicate of the PEP information	49
17.4.2 Media information	49
17.4.3 System Information	51
18 Layout of the User Zone	52
18.1 General description of the User Zone	52
18.2 Divisions of the User Zone	52
18.2.1 Reserved Area Use	52
18.3 User Area	53
18.4 Defect Management Areas (DMAs)	54
18.5 Disk Structure Table (DST)	55
18.6 Write Once Read Many (WORM) Zone	56
18.6.1 Location	57
18.6.2 Partitioning	57
19 Defect Management for WORM Media	57
19.1 Initialization of the disk	57
19.2 Defect Management Pointers	57
19.3 Write procedure	58
19.3.1 Read Procedure	58
Section 4 - Characteristics of embossed information	60
20 Method of testing	60
20.1 Environment	60
20.2 Use of the Reference Drive	60
20.2.1 Optics and mechanics	60
20.2.2 Read power	60
20.2.3 Read Channels	60
20.2.4 Tracking	60
20.3 Definition of signals	60
21 Signal from grooves	62
21.1 Cross-track signal	62
21.2 Push-pull signal	62
21.3 Divided push-pull signal	62
21.4 Phase depth	63
21.5 Track location	63
22 Signals from Headers	63
22.1 Sector Mark Signals	63
22.2 VFO signals	63
22.3 Address Mark, ID and PA signals	63
22.4 Timing jitter	64
23 Signals from embossed Recording fields	64
23.1 Signal amplitude	64
23.2 Modulation method offset	64
23.3 Timing Jitter	64
23.4 Byte Errors	65

24 Signals from Control Track PEP marks	65
Section 5 - Characteristics of the recording layer	66
25 Method of testing	66
25.1 Environment	66
25.2 Reference Drive	66
25.2.1 Optics and mechanics	66
25.2.2 Read power	66
25.2.3 Read Channel	66
25.2.4 Tracking	66
25.2.5 Signal detection for testing purposes	66
25.3 Write conditions	66
25.3.1 Write pulse and power	66
25.3.2 Pulse power determination	67
25.3.3 Media power sensitivity	67
25.4 Definition of signals	67
26 Imbalance of difference signal	68
27 Write characteristics	68
27.1 Resolution	68
27.2 Narrow-band signal-to-noise ratio	68
27.3 Cross-talk ratio	69
27.3.1 WORM track test method	69
27.4 Timing Jitter	69
27.5 Media thermal interaction	69
Section 6 - Characteristics of user data	70
28 Method of testing	70
28.1 Environment	70
28.2 Reference Drive	70
28.2.1 Optics and mechanics	70
28.2.2 Read power	70
28.2.3 Read amplifiers	70
28.2.4 Mark Quality	70
28.2.5 Channel bit clock	71
28.2.6 Binary-to-digital converters	71
28.2.7 Error correction	71
28.2.8 Tracking	71
29 Minimum quality of a sector	71
29.1 Headers	71
29.1.1 Sector Mark	71
29.1.2 ID fields	71
29.2 User-written data	71
29.2.1 Recording field	71
29.2.2 Byte errors	71
29.2.3 Modulation method offset	71
29.2.4 Timing jitter	71
30 Data interchange requirements	71
30.1 Tracking	72
30.2 User-written data	72
30.3 Quality of disk	72
Annexes	
A - Air cleanliness class 100 000	73

B - Edge distortion test	74
C - Compliance test	76
D - Test method for measuring the adsorbent force of the hub	78
E - CRC for ID fields	80
F - Interleave, CRC, ECC, Resync for the Data Field	81
G - Determination of Resync pattern	85
H - Read Channel for measuring NBSNR and jitter	90
J - Timing jitter measuring procedure	91
K - Definition of write pulse shape	92
L - Implementation Independent Mark Quality Determination (IIMQD) for the interchange of recorded media	93
M - Requirements for interchange	96
N - Measurement implementation for Cross-track signal	98
P - Values to be implemented in existing and future standards	99
Q - Office environment	100
R - Derivation of the operating climatic environment	101
S - Transportation	106
T - Sector retirement guidelines	107
U - Track deviation measurement	108
V - Measure of the vertical birefringence of the substrate	112
W - Laser Power Calibration for evaluation of media power sensitivity	114

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 15486 was prepared by ECMA (as ECMA-238) 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 N form an integral part of this International Standard. Annexes P to W are for information only.

Information technology — Data interchange on 130 mm optical disk cartridges of type WORM (Write Once Read Many) using irreversible effects — Capacity: 2,6 Gbytes per cartridge

Section 1 - General

1 Scope

This International Standard specifies the characteristics of a 130 mm optical disk cartridge (ODC) of Type WORM (Write Once Read Many) with a capacity of 2,6 Gbytes. Type WORM ODCs use writing effects that are inherently irreversible. Written marks cannot be erased and attempted modification of the written marks are detectable.

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 cartridge, so as to provide mechanical interchange ability 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, the modulation methods used;
- the characteristics of the embossed information on the disk;
- the recording 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 shall be in conformance with this International Standard if it meets the mandatory requirements specified herein. A claim of conformance shall state that the ODC is of Type WORM.

2.2 Generating system

A generating system shall be in conformance with this International Standard if the ODC it generates is in accordance with 2.1.

2.3 Receiving system

A receiving system shall be in conformance with this International Standard if it is able to handle an ODC according to 2.1

2.4 Compatibility statement

A claim of conformance by a generating or receiving system with this International Standard shall include a statement listing any other International Optical Disk Cartridge standard(s) supported by the system for which conformance is claimed. This statement shall specify the number of the standard(s), including, where appropriate, the ODC Type(s), or the Types of side, and whether support includes reading only or both reading and writing.

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 edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 950:1991, *Safety of information technology equipment.*