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Information technology — Data interchange on 120 mm and 80 mm optical disk using +R DL format — Capacity: 8,55 Gbytes and 2,66 Gbytes per side (recording speed up to 8x)

Technologies de l'information — Échange de données sur disque optique de 120 mm et 80 mm utilisant le format +R DL — Capacité: 8,55 Go et 2,66 Go par face (vitesse d'enregistrement 8x)

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 25434 was prepared by Ecma International (as ECMA-364) 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.

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This second edition cancels and replaces the first edition (ISO/IEC 25434:2006), which has been technically revised.

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Introduction

Ecma Technical Committee TC 31 was established in 1984 for the standardization of Optical Disks and Optical Disk Cartridges (ODC). Since its establishment, the Committee has made major contributions to ISO/IEC toward the development of International Standards for 80 mm, 90 mm, 120 mm, 300 mm and 356 mm media. Numerous standards have been developed by TC 31 and published by Ecma, almost all of which have also been adopted by ISO/IEC under the fast-track procedure as International Standards.

In July 2004 a group of Companies proposed to TC 31 to develop a standard for 120 mm dual layer recordable optical disks using the WORM recording technology and based on the DVD – Read-Only standard (ISO/IEC 16448), the +RW format (ISO/IEC 17341) and the +R format (ISO/IEC 17344). TC 31 adopted this project and started the work that has resulted in the adoption of ISO/IEC 25434.

This International Standard specifies two Types of recordable optical disks, one (Type S9) making use of recording on only a single side of the disk and yielding a nominal capacity of 8,55 or 2,66 Gbytes per disk and the other (Type D18) making use of recording on both sides of the disk and yielding a nominal capacity of 17,1 or 5,32 Gbytes per disk.

In October 2005 a proposal was made to TC 31 to update this International standard for recording speeds up to 8 times the Reference velocity. TC 31 adopted this project which resulted in the adoption of ISO/IEC 25434 2nd Edition.

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This International Standard, taken together with a standard for volume and file structure, such as for instance developed in Ecma Technical Committee TC 15, provides the requirements for information interchange between systems.

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Information technology — Data interchange on 120 mm and 80 mm optical disk using +R DL format — Capacity: 8,55 Gbytes and 2,66 Gbytes per side (recording speed up to 8x)

Section 1 - General

1 Scope

This International Standard specifies the mechanical, physical and optical characteristics of 120 mm recordable optical disks with capacities of 8,55 Gbytes and 17,1 Gbytes. It specifies the quality of the recorded and unrecorded signals, the format of the data and the recording method, thereby allowing for information interchange by means of such disks. The data can be written once and read many times using a non-reversible method. These disks are identified as +R DL.

This International Standard also specifies 80 mm disks with capacities of 2,66 Gbytes and 5,32 Gbytes. These disks have the same characteristics as the 120 mm disks, except for some parameters related to the smaller dimensions. All parameters unique for the 80 mm disks are specified in Annex A.

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This International Standard specifies

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- two related but different Types of this disk (see Clause 7),
- the conditions for conformance,
- the environments in which the disk is to be tested, operated and stored,
- the mechanical, physical and dimensional characteristics of the disk, so as to provide mechanical interchange between data processing systems,
- the format of the information on the disk, including the physical disposition of the tracks and sectors, the error correcting codes and the coding method,
- the characteristics of the signals recorded on the disk, thus enabling data processing systems to read the data from the disk.

This International Standard provides for the interchange of disks 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

A claim of conformance with this International Standard shall specify the Type implemented. An optical disk shall be in conformance with this International Standard if it meets all mandatory requirements specified for its Type.

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2.2 Generating system

A generating system shall be in conformance with this International Standard if the optical disk 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 both Types of optical disk 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 standards supported. This statement shall specify the numbers of the standards, the optical disk types supported (where appropriate) and whether support includes reading only or both reading and writing.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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ISO 4873:1991, *Information technology — ISO 8-bit code for information interchange — Structure and rules for implementation*

ISO 16448:2002, *Information technology — 120 mm DVD — Read-only disk*

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ISO 16449:2002, *Information technology — 80 mm DVD — Read-only disk*

ISO 17341:2006, *Information technology — Data Interchange on 120 mm and 80 mm Optical Disk using +RW Format — Capacity: 4,7 Gbytes and 1,46 Gbytes per Side (Recording speed up to 4X)*

ISO 17344:2006, *Information technology — Data Interchange on 120 mm and 80 mm Optical Disk using +R Format — Capacity: 4,7 and 1,46 Gbytes per Side (Recording speed up to 16X)*

ISO 26925:2006, *Information technology — Digital storage media for information interchange — Data Interchange on 120 mm and 80 mm Optical Disk using +RW HS Format — Capacity: 4,7 and 1,46 Gbytes per Side (Recording speed 8X)*

ECMA-287 (2002), *Safety of electronic equipment*

4 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

4.1
Channel bit
the elements by which the binary values ZERO and ONE are represented by marks and spaces on the disk

4.2
Clamping Zone
the annular part of the disk within which the clamping force is applied by the clamping device

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4.3
Digital Sum Value (DSV)
the arithmetic sum obtained from a bit stream by allocating the decimal value +1 to bits set to ONE and the decimal value −1 to bits set to ZERO

4.4
Disk Reference Plane
a plane defined by the perfectly flat annular surface of an ideal spindle onto which the clamping Zone of the disk is clamped, and which is normal to the axis of rotation

4.5
dummy substrate
a layer, which may be transparent or not, provided for the mechanical support of the disk and, in some cases, of the recording layer as well

4.6
entrance surface
the surface of the disk onto which the optical beam first impinges

4.7
field
a subdivision of a sector

4.8
groove
a trench-like feature of the disk, applied before the recording of any information and used to define the track location

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NOTE The groove is located nearer to the entrance surface than the so-called land in between the grooves. The recording is made on the groove.

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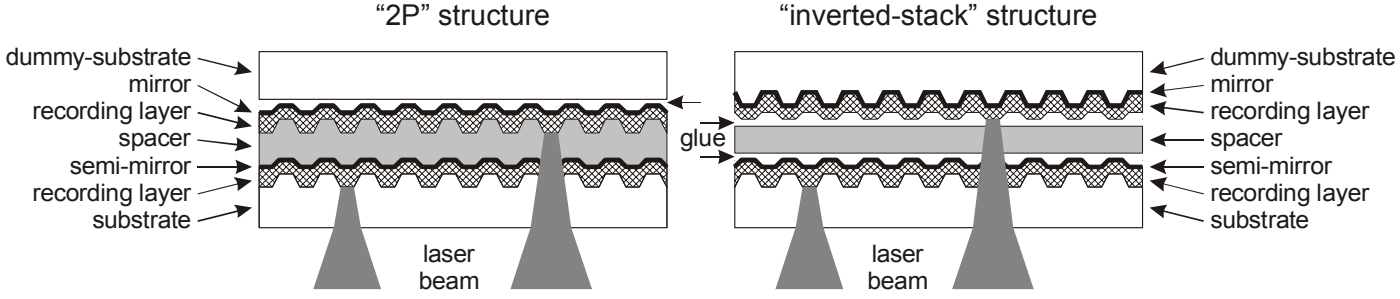
4.9
interleaving
the process of reallocating the physical sequence of units of data so as to render the data more immune to burst errors

4.10
layer structure
dual layer DVD discs generally are constructed according to one of the following two structures:

"2P" structure: in this method the first recording layer (L0) is applied to the substrate with the impressed pre-groove, after which the recording layer is covered with a semi-transparent mirror. On top of this structure a spacer layer is applied, which in general consists of a Photo-Polymerisation (2P) lacquer, in which the pre-groove for the second layer is impressed and fixated by means of UV-light. Next the second recording layer (L1) and a mirror are applied. Finally the dummy substrate is glued onto this structure.

"inverted-stack" structure: in this method the first recording layer (L0) is applied to the substrate with the impressed pre-groove, after which the recording layer is covered with a semi-transparent mirror. The dummy substrate with the impressed pre-groove for the second layer is covered with the mirror after which the recording layer (L1) is applied. Next the two substrates are glued together, separated by a spacer.



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4.11
mark
a non-reversible feature of the recording layer which may take the form of less reflective area, a pit, or any other type or form that can be sensed by the optical system

NOTE The pattern of marks and spaces represents the data on the disk.

4.12
Multi-session disk
a disk containing more than one set of Lead-in/Intro, Data, and Lead-out/Closure Zones

4.13
Physical 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

4.14
recording layer
a layer of the disk on which data is written during manufacture and/or use

4.15
Reed-Solomon code (RS)
an error detection and/or correction code

4.16
Reference velocity
the linear velocity that results in the nominal Channel bit rate of 26,156 25 Mbit/s

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4.17
Single-session disk
a disk containing a Lead-in Zone, one Data Zone and a Lead-out Zone

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4.18
session
a continuous part of the Information Zone of the disk consisting of a Lead-in or Intro Zone, a Data Zone and a Lead-out or Closure Zone

4.19
space
a feature of the recording layer represented by any area between two marks which can be sensed by the optical system

NOTE The pattern of marks and spaces represents the data on the disk.

4.20
spacer
a transparent layer of the disk, provided for achieving an accurate separation of the pair of recording layers which are accessed by the optical beam through the same entrance surface

4.21
substrate
a transparent layer of the disk, provided for mechanical support of the recording layer, through which the optical beam accesses the recording layer

4.22
track
a 360° turn of a continuous spiral

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4.23
track pitch
the distance between adjacent track centrelines, measured in a radial direction

4.24
VCPS
Video Content Protection System
a method to prevent unauthorized copying and/or redistribution of video data that is recorded in the DVD+R/+RW Video Format

NOTE See Annex P.

4.25
wobble
a continuous sinusoidal deviation of the track from the average centreline

NOTE Location information is included as phase modulated data in the wobble.

4.26
zone
an annular area of the disk

5 Conventions and notations

5.1 Representation of numbers

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A measured value may be rounded off to the least significant digit of the corresponding specified value. For instance, 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 1,274.

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Numbers in decimal notations are represented by the digits 0 to 9.

Numbers in hexadecimal notation are represented by the hexadecimal digits 0 to 9 and A to F in parentheses.

The setting of bits is denoted by ZERO and ONE.

Numbers in binary notations and bit patterns are represented by strings of digits 0 and 1, with the most significant bit shown to the left. In a pattern of n bits, bit b_{n-1} shall be the most significant bit (msb) and bit b_0 shall be the least significant bit (lsb). Bit b_{n-1} shall be recorded first.

Negative values of numbers in binary notation are given as Two's complement.

In each data field, the data is recorded so that the most significant byte (MSB), identified as Byte 0, shall be recorded first and the least significant byte (LSB) last.

In a field of 8n bits, bit $b_{(8n-1)}$ shall be the most significant bit (msb) and bit b_0 the least significant bit (lsb). Bit $b_{(8n-1)}$ shall be recorded first.

5.2 Names

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

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6 Abbreviations and acronyms

a.c.	alternating current	NRZ	Non Return to Zero
ADIP	Address in Pre-groove	NRZI	Non Return to Zero Inverted
ASM	Asymmetry	NSL	Normalized Slicing Level
BP	Byte Position	NWPW	Normalized Write Power Window
BPF	Band Pass Filter	OPC	Optimum Power Control
CAV	Constant Angular Velocity	OTP	Opposite Track Path
CLD	Constant Linear Density	PAA	Physical Address in ADIP
CLV	Constant Linear Velocity	PBS	Polarizing Beam Splitter
cm	current mark	PI	Parity of Inner-code
d.c.	direct current	PLL	Phase Locked Loop
DCB	Disk Control Block	PO	Parity of Outer-code
DCC	d.c. component suppression Control	PP	Push-Pull
DSV	Digital Sum Value	pp	peak-to-peak
ECC	Error Correction Code	ps	previous space
EDC	Error Detection Code	PSN	Physical Sector Number
EI	Extended Information	PTP	Parallel Track Path
HF	High Frequency	RIN	Relative Intensity Noise
ID	Identification Data	RPM	Revolutions per Minute
IED	ID Error Detection code	RS	Reed-Solomon code
LPF	Low Pass filter	RSV	Reserved
LSB	Least Significant Byte		(in use by specific applications)
lsb	Least Significant Bit	RUN	Recording UNit
LSN	Logical Sector Number	SDCB	Session DCB
MSB	Most Significant Byte	SNR	Signal to Noise Ratio
msb	Most Significant Bit	SYNC	Synchronization code
NA	Numerical Aperture	TOC	Table of Contents

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7 General description of the optical disk

The optical disk that is the subject of this Standard consists of two substrates bonded together by an adhesive layer, so that the recording layer(s) is (are) on the inside. The centring of the disk is performed on the edge of the centre hole of the assembled disk on the side currently accessed. Clamping is performed in the Clamping Zone. This Standard provides for two Types of such disks.

Type S9 consists of a substrate, a dummy substrate and two recording layers with a spacer between them. Both recording layers can be accessed from one side only. The capacity is 8,55 Gbytes for the 120 mm sized disk and 2,66 Gbytes for the 80 mm sized disk.

Type D18 consists of two substrates, each having two recording layers with a spacer between those two recording layers. From each side of the disk only one pair of recording layers can be accessed. The capacity is 17,1 Gbytes for the 120 mm sized disk and 5,32 Gbytes for the 80 mm sized disk.

Data can be written onto the disk as marks in the form of low-reflective spots in each of the recording layers with a focused optical beam. The data can be read with a focused optical beam, using the difference in the reflectivity between recorded marks and unrecorded spaces.

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Figure 1 shows schematically the two Types. The two layers forming a pair of recording layers that can be accessed from one side of the disk, are identified as Layer 0 (L0) and Layer 1 (L1). Layer 0 is the layer nearer to the entrance surface.

The beam accesses Layer 0 through a transparent substrate of the disk.

Layer 1 is accessed through the same transparent substrate, through Layer 0, which for this purpose has to be semi-transparent, and through a transparent spacer.

In the Type S9 disk the function of the adhesive layer can be provided by the spacer between the two recording layers, where Layer 1 is placed on the dummy substrate.

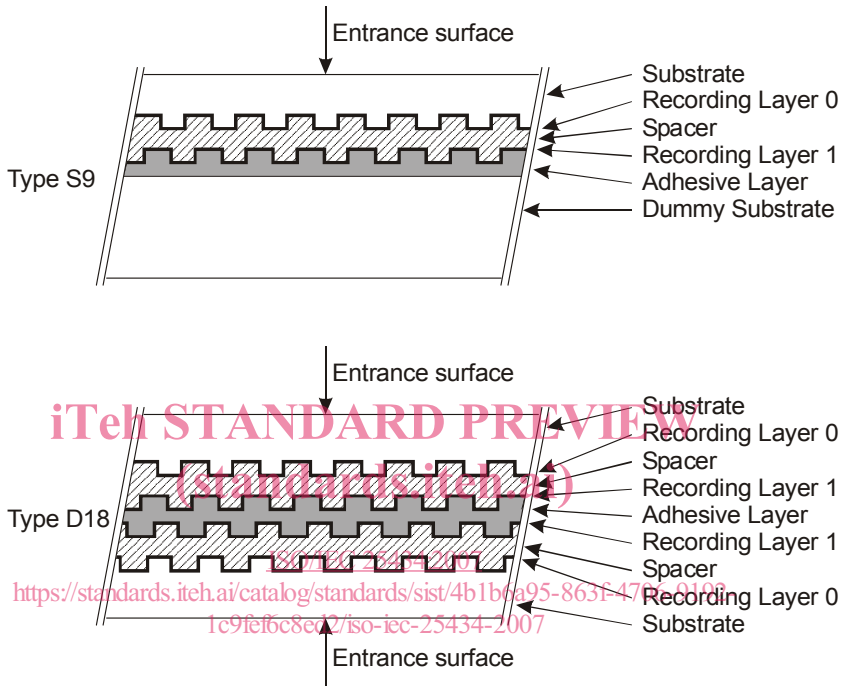

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Figure 1 — Types of +R DL disk

8 General Requirements

8.1 Environments

8.1.1 Test environment

In the test environment, the air immediately surrounding the disk shall have the following properties:

temperature	: 23 °C ± 2 °C
relative humidity	: 45 % to 55 %
atmospheric pressure	: 60 kPa to 106 kPa

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

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

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