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Information technology — Digitally recorded media for information interchange and storage — 120 mm triple layer (100,0 GB per disk) BD rewritable disk

Technologies de l'information — Supports enregistrés numériquement pour échange et stockage d'information — Disques BD réinscriptibles de 120 mm triple couche (100,0 Go par disque)

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 23, *Digitally recorded media for information interchange and storage*.

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This fourth edition cancels and replaces the third edition (ISO/IEC 30193:2020), which has been technically revised. It also incorporates the Amendment ISO 30193:2021/DAmd1.

The main changes compared to the previous edition are as follows:

— The missing condition of pulse width regarding residual errors has been added.

— The editorial errors amendments for ISO/IEC 30190 to ISO/IEC 30192 have been applied.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

In March 2002, the Blu-ray Disc Founders (BDF) came together to create optical-disk formats with large capacity and high-speed transfer rates that would be needed for recording and reproducing high-definition video content. This joint effort turned out to be fruitful and the first version of its Blu-ray Disc™[1)] Rewritable format Part 1 version 1.0, with cartridge, was issued in June 2002.

The Blu-ray Disc Association (BDA) issued version 2.1 of the Blu-ray Disc™ rewritable format Part 1 in October 2005 and version 3.0, without cartridge, in June 2010.

To maintain compatibility of the removable medium in the market, a standard alone is not enough. It is necessary to check that the disks and devices can satisfy the specifications. The BDA also conducts verification activities for both disks and devices and has established more than 10 testing centers in Asia, Europe and the USA.

Blu-ray™ disks, players, recorders and PC drives/software based on BDA standards became popular all over the world. The BDA gave consumer applications the highest priority in the first few years. But it was known, of course, that international standardization would be required before many government entities and their contractors would be allowed to use Blu-ray Disc™. In January and February 2011, the chairs of ISO/IEC JTC 1/SC 23 and JIIMA (Japan Image and information Management Association) formally requested the BDA to consider international standardization. The reason for this was to enable the inclusion of writable BDs along with DVDs and CDs in an international standard specifying the test methods for the estimation of a lifetime of optical storage media for long-term data storage. In October 2011, the President of the BDA responded that the organization had decided to pursue international standardization for the basic physical formats for the recordable and rewritable Blu-ray™ formats.

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In December 2011, the BDA sent project proposals for international standardization of four formats to ISO/IEC JTC 1/SC 23 via the Japanese national body. They are 120 mm single layer (25,0 GB per disk) and dual layer (50,0 GB per disk) BD recordable disks, 120 mm single layer (25,0 GB per disk) and dual layer (50,0 GB per disk) BD rewritable disks, 120 mm triple layer (100,0 GB per disk) and quadruple layer (128,0 GB per disk) BD recordable disks and 120 mm triple layer (100,0 GB per disk) BD rewritable disk.

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This document specifies the mechanical, physical and optical characteristics of a 120 mm rewritable optical disk with a capacity of 100,0 GB.

A few additional specifications are required in order to write and read video-recording applications, such as BDAV format which had been specified by the BDA for use on BD rewritable disks. These specifications, which are related to the BD application (BDAP), the file system or the content-protection system, are required for the disk, the generating system and the receiving system. For more information about the BDAP, the content-protection system and the additional requirements for the Blu-ray™ format specifications, see http://www.blu-raydisc.info.

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Information technology — Digitally recorded media for information interchange and storage — 120 mm triple layer (100,0 GB per disk) BD rewritable disk

1 Scope

This document specifies the mechanical, physical and optical characteristics of a 120 mm rewritable optical disk with a capacity of 100,0 GB. 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. User data can be written, read and overwritten many times using a reversible method. This disk is identified as a BD rewritable disk.

This document specifies the following:

— the one disk type;

— the conditions for conformance;

— the environments in which the disk is to be operated and stored;

— the mechanical and physical characteristics of the disk, in order 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 used;

— the characteristics of the signals recorded on the disk, enabling data processing systems to read data from the disk.

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This document provides for interchange of disks between disk drives. Together with a standard for volume and file structure, it provides for full data interchange between data processing systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

ISO 9352, *Plastics — Determination of resistance to wear by abrasive wheels*

IEC 60068-2-2, *Environmental testing — Part 2-2: Tests — Test B: Dry heat*

IEC 60068-2-30, *Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60950-1, *Information technology equipment — Safety — Part 1: General requirements*

3 Terms and definitions

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

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ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
BD
disk having a *cover layer* (3.4) around 0,1 mm thick and a *substrate* (3.43) around 1,1 mm thick on which data is read or recorded by an optical pick-up unit (OPU) using 405 nm laser diode and numerical aperture, NA = 0,85 lens

Note 1 to entry: User data recorded on a disk is formatted using 17PP modulation and an LDC+BIS Code.

3.2
BD application
BDAP
contents standard specified for a *BD* (3.1), e.g. a video application, which requires area for a content-protection system and for its own defect-management system on the disk

3.3
channel bit
cbs
element by which the binary value ZERO or ONE is represented by *pits* (3.27), *marks* (3.19) and *spaces* (3.42) on a disk

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3.4
cover layer
transparent layer with precisely controlled optical properties that covers the *recording layer* (3.33) closest to the *entrance surface* (3.10) of a disk

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3.5
data zone *n*
area between the inner zone and the outer zone on *layer Ln* (3.17)

3.6
defective cluster
cluster in a *user-data area* (3.47) that has been registered in a defect list as unreliable or uncorrectable

3.7
DSV
digital-sum value
arithmetic sum obtained from a bit stream by assigning the decimal value +1 to *channel bits* (3.3) set to ONE and the decimal value −1 to channel bits set to ZERO

3.8
disk reference plane
plane defined by the perfect flat annular surface of an ideal spindle, onto which the clamping zone of a disk is clamped, that is normal to the axis of rotation

3.9
embossed HFM area
area on a disk where information has been stored by means of an *HFM groove* (3.13) during manufacturing of the disk

3.10
entrance surface
surface of a disk onto which the optical beam first impinges

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3.11
erased groove
blank *groove* (3.12) on a disk that has been erased by irradiating the *track* (3.44) using only erase power level, P_{EO}, as determined by the OPC algorithm

3.12
groove
trench-like feature of a disk connected to a *recording layer* (3.33)

Note 1 to entry: In case of triple-layer disk, one groove can be carried by the *substrate* (3.43) and other grooves can be carried by the *spacer layer* (3.41) or the *cover layer* (3.4) (see Figure 1) grooves are used to define the *track* (3.44) locations.

In the BD rewritable system, there are 3 types of grooves:

— *wobbled groove* (3.49) in rewritable area containing address information;

— *HFM groove* (3.13) in *embossed HFM area* (3.9) containing permanent information and control data;

— straight groove without any modulation in the BCA zone.

3.13
HFM groove
high-frequency modulated groove
groove (3.12) modulated in the radial direction with a rather high bandwidth signal

Note 1 to entry: HFM groove creates a data channel with sufficient capacity and data rate for replicated information.

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3.14
information area
area on a disk in which information can be recorded

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3.15
information zone
recorded part of the *information area* (3.14)

3.16
land
surface of a *recording layer* (3.33) between successive windings of a *groove* (3.12)

3.17
layer L*n*
one *recording layer* (3.33) of a disk identified by *n*

Note 1 to entry: layer L(*n*+1) is closer to the *entrance surface* (3.10) of a disk than layer L*n*.

3.18
layer type
identification of a disk using the number of layer(s)

Note 1 to entry: In case of triple-layer disk, the layer type is TL (see Clause 7).

3.19
mark
feature of a *recording layer* (3.33), which can take the form of an amorphous domain in the crystalline recording stack due to recording, that can be sensed by an optical read-out system

Note 1 to entry: The pattern of marks and *spaces* (3.42) represents the data on a disk.

3.20
mark polarity
polarity of reflectivity change when *marks* (3.19) are recorded

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3.21
measurement velocity
linear velocity at which a disk is measured during reading

Note 1 to entry: The *n*x measurement velocity means the measurement velocity of *n* times the *reference velocity* (3.36).

3.22
modulation bit
alternative form representing the data, that is more suited to be transmitted via a communication channel or to be stored on a storage system

3.23
NRZI conversion
method of converting modulation-bit stream into a physical signal

3.24
on-groove
geometry where *grooves* (3.12) are nearer to the *entrance surface* (3.10) of a disk than the *lands* (3.16)

3.25
padding
process in a drive to fill up the missing sectors in a 64K cluster, which consists of 32 *sectors* (3.40), with all 00h data when the host supplies less than the 32 sectors and needs to fill up the cluster

3.26
phase change
physical effect by which an area of a *recording layer* (3.33) is irradiated by a laser beam and heated in order to change from a crystalline state to an amorphous state and vice versa

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3.27
pit
feature of a *recording layer* (3.33), which can take the form of a depression in or elevation on the *land* (3.16) surface, that can be sensed by the optical read-out system

Note 1 to entry: The pattern of pits and *spaces* (3.42) represents the data on a disk.

3.28
polarization
direction of the electric field vector of an optical beam

Note 1 to entry: The plane of polarization is the plane containing the electric field vector and the direction of propagation of the beam.

3.29
pre-recorded area
area on a disk where information has been recorded by the manufacturer/supplier of the disk by applying standard recording techniques after finishing of the replication process

3.30
protective coating
optional additional layer on top of the *cover layer* (3.4) provided for extra protection against scratches and other types of damage

3.31
reading velocity
linear velocity at which a disk is actually read

Note 1 to entry: The *n*x reading velocity means the reading velocity of *n* times the *reference velocity* (3.36).

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3.32
read-modify-write
R-M-W
process in a drive to read full content of a 64K cluster, which consists of 32 *sectors* (3.40), replace the sector(s) concerned and write back the full cluster to a disk when one or more, but less than 32, sector(s) in a cluster is(are) rewritten

3.33
recording layer
part of a disk consisting of a stack of films of specific materials on or in which data is written during manufacture and/or use

3.34
reference servo
servomechanism of a reference drive with parameters defined for measuring disks

3.35
recording velocity
linear velocity at which a disk is recorded

Note 1 to entry: The *n*x recording velocity means the recording velocity of *n* times the *reference velocity* (3.36).

3.36
reference velocity
linear velocity that results in the nominal channel-bit rate of 66 000 Mbit/s

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3.37
reserved
<value> value(s) not used in this document

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3.38
reserved
<field> field(s) not specified in use, to be ignored in interchange and to be set to ZERO as value

3.39
rewritable area
area on a disk where information can be recorded by means of *marks* (3.19) and *spaces* (3.42) using the phase-change effect and during the manufacture and/or use of the disk

3.40
sector
minimum-size addressable data part of a *track* (3.44) in the *information zone* (3.15)

3.41
spacer layer
transparent layer with precisely-controlled optical properties separating two *recording layers* (3.33)

3.42
space
area separating *pits* (3.27) or *marks* (3.19) in the tangential direction in the context of HF signals

Note 1 to entry: The pattern of *pits* (3.27), *marks* (3.19) and spaces represents the data on a disk.

3.43
substrate
layer, which can be transparent or not, provided for the mechanical support of a *recording layer* (3.33)

3.44
track
360° turn of a continuous spiral, formed by a *groove* (3.12)

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