INTERNATIONAL STANDARD

ISO/IEC 30192

Third edition

Information technology — Digitally recorded media for information interchange and storage — 120 mm Single Layer (25,0 Gbytes per disk) and Dual Layer (50,0 Gbytes per disk) BD Rewritable disk

Technologies de l'information — Supports enregistrés numériquement pour échange et stockage d'information — Disques BD réinscriptibles de 120 mm simple couche (25,0 Go par disque) et double couche (50,0 Go par disque)

PROOF/ÉPREUVE

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents) or the IEC list of patent declarations received (see patents.iec.ch).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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*.

This third edition cancels and replaces the second edition (ISO/IEC 30192:2016), which has been technically revised. It also incorporates the Amendment ISO/IEC 30192:2016/Amd.1:2019.

The main changes compared to the previous edition is the addition of requirements for physical accesss control and reserved area of BD application.

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.

Introduction

In March 2002, the Blu-ray Disc Founders, or BDF, came together to create optical disk formats with the large capacity and high-speed transfer rates that would be needed for recording and reproducing of high-definition video content. The first edition of Blu-ray Disc™ Rewritable Format Part 1 Version 1.0 was issued in June 2002 (capacity 23 GB with catridge).

The BDA issued Version 2.1 of the Blu-ray Disc™ Rewritable Format Part1 in October 2005 and Version 3.0 in June of 2010 (capacity 25 GB and 50 GB without cartridge).

To keep the compatibility of the removable medium in the market, just to make a standard is not enough, and it is necessary to check that the disks and devices can satisfy the specifications. The BDA conducts verification activities for both disks and devices and has established more than 10 testing Centres 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 BDA was formally requested 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 test methods for the estimation of lifetime of optical storage media for long-term data storage. In October 2011, the BDA responded that it had decided to pursue international standardization of the basic physical formats for the Recordable and Rewritable Blu-ray Disc™.

In December 2011, the BDA sent project proposals for international standardization of four formats. They are 120 mm Single Layer (25,0 Gbytes per disk) and Dual Layer (50,0 Gbytes per disk) BD Recordablee disks, 120 mm Single Layer (25,0 Gbytes per disk) and Dual Layer (50,0 Gbytes per disk) BD Rewritable disks, 120 mm Triple Layer (100,0 Gbytes per disk) and Quadruple Layer (128,0 Gbytes per disk) BD Recordable disks and 120 mm Triple Layer (100,0 Gbytes per disk) BD Rewritable disk.

A few additional specifications are required in order to write and read video recording applications, such as the BDMV and BDAV formats, which have been specified by the BDA for use on BD recordable disks. These specifications, which are related to the BD application, the file system and the content-protection system, are required for the disk, the generating system and the receiving system[1)].

The International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) draw attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO and IEC take no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO and IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO and IEC. Information may be obtained from the patent database available at www.iso.org/patents.

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

NOTE Blu-ray™, Blu-ray Disc™ and the logos are trademarks of the Blu-ray Disc Association.

1) For more information of the BD application, the content-protection system and the additional requirements for the Blu-ray™ Format specifications, see http://www.blu-raydisc.info.

Information technology — Digitally recorded media for information interchange and storage — 120 mm Single Layer (25,0 Gbytes per disk) and Dual Layer (50,0 Gbytes 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 25,0 Gbytes or 50,0 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. 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:

— two related but different types of this disk;

— conditions for conformance;

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

— mechanical and physical characteristics of the disk, which allow mechanical interchange between data processing systems;

— format of the information on the disk, including the physical disposition of the tracks and sectors;

— error-correcting codes and coding method used;

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

This document provides for interchange of disks between 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*

ISO 30193, *Information technology — Digitally recorded media for information interchange and storage — 120 mm Triple Layer (100,0 Gbytes per disk) BD Rewritable disk*

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

IEC 60068-2-30, *Environment 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 terms and definitions given in ISO/IEC 30193 apply.

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 http://www.electropedia.org/

4 Symbol and abbreviated terms

ac	alternating current
ADIP	address in pre-groove
APC	automatic power control
AU	address unit
AUN	address unit number
BCA	burst-cutting area
BIS	burst-indicating subcode
BPF	band-pass filter
CAV	constant angular velocity
cbs	channel bits
CNR	carrier-to-noise ratio
dc	direct current
DDS	disk definition structure
DFL	defect list
DI	disk information
DL	dual layer
DMA	disk management area
DMS	disk management structure
DOW	direct overwrite
DOW(n)	the n-th overwrite
DOW(0)	the initial recording
DSV	digital-sum value
DWP	disk write protect
EB	emergency brake
ECC	error correction code
lsb	least significant bit
L_{SHD}	second harmonic distortion level
L_{SHL}	second harmonic level
LSN	logical sector number
MM	MSK mark
MSB	most significant byte
msb	most significant bit
MSK	minimum shift keying
MW	monotone wobble
NRD	non-re-allocatable defect
NRZ	non-return-to-zero
NRZI	non-return-to-zero inverting
NWL	nominal wobble length
OPU	optical pick-up unit
PAA	physical ADIP address
PAC	physical access control
PBA	possibly bad area
PIC	permanent information and control data
PLL	phase-lock loop
PoA	post-amble
PP	push-pull
pp	peak-to-peak
PrA	pre-amble
PSN	physical sector number
R_H	relative humidity

EDC	error detection code	RMTR	repeated minimum transition run length
FAA	first ADIP address (of data zone)	R-M-W	read-modify-write
FS	frame sync	RS	Reed-Solomon (code)
FWHM	full width at half maximum	R_T	relative thickness
HF	high frequency	RUB	recording unit block
HFM	high frequency modulated	SER	symbol error rate
HMW	harmonic-modulated wave	SL	single layer
HPF	high-pass filter	S/N	signal-to-noise ratio
HTL	high-to-low	SPS	start position shift
I_{NHWS}	normalized HFM-wobble signal amplitude	STW	saw-tooth wobble
I_{NWS}	normalized wobble signal amplitude	Sync	synchronization
LAA	last ADIP address (of data zone)	TP	track pitch
LDC	long-distance code	TS	transmission stack
LPF	low-pass filter	wbs	wobbles
LSB	least significant byte	WP	write protect

5 Conformance

5.1 Optical disk

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

5.2 Generating system

A generating system shall be in conformance with this document if the optical disk it generates is in accordance with 5.1.

5.3 Receiving system

A receiving system shall be in conformance with this document if it is able to handle both Types of optical disks according to 5.1.

5.4 Compatibility statement

A claim of conformance by a generating or receiving system with this document 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.

6 Conventions and notations

6.1 Levels of grouping

Many times, data is collected into that data can be collected into higher level groups. For the clarity of the grouping hierarchy, in this document, the following levels of hierarchy is used.

Frame: the lowest level of grouping. Generally, frames contain bytes of information.

Block: the second level of grouping. Generally, blocks consist of a number of frames.

Cluster: the highest level of grouping. Clusters consist of several blocks.

Fragment: a level of grouping that can be applied by the application. A certain amount of data is allocated to a (fixed) number of consecutive clusters.

6.2 Representation of numbers

A measured value $x_{measured}$ may be rounded off to the least significant digit of the corresponding specified value x before being compared with this specified value.

EXAMPLES:

— The specification is: $x = 1{,}26^{+0{,}01}_{-0{,}02}$;

(nominal value = 1,26 with a positive tolerance of +0,01 and a negative tolerance of –0,02)

— a measured value in the range $1{,}235 \leq x_{measured} < 1{,}275$ fulfills this specification.

— The specification is: $x \leq 0{,}3$;

— a measured value $x_{measured} < 0{,}35$ fulfills this specification

(rounding off is applied for $0{,}30 < x_{measured} < 0{,}35$: $x_{rounded} = 0{,}3$);

— The specification is: $x < 0{,}3$:

— a measured value $x_{measured} = 0{,}299$ fulfills this specification

(no rounding off needs to be applied);

— a measured value $x_{measured} = 0{,}3$ exactly does not fulfil this specification.

In case the specified value is given as “maximum x units” or “minimum x units”, the measured value shall not be rounded off before comparing to the specified value. Parameters given in this way shall not violate the specified limits set by the exact value of x.

EXAMPLES:

— The specification is maximum 0,3 mm:

— a measured value of 0,300 mm fulfills this specification;

— a measured value of 0,301 mm does not fulfil this specification;

— The specification is minimum 3 dB:

— a measured value of 3,00 dB fulfills this specification;

— a measured value of 2,99 dB does not fulfil this specification.

Numbers in decimal notation are represented by the digits 0 to 9. The decimal symbol is "," (comma). In large numbers, the " " (space) can be used as digit grouping symbol.

Numbers in hexadecimal notation are represented by the hexadecimal digits 0 to 9 and A to F in parentheses or followed by lowercase "h". The character x in hexadecimal numbers represents any digit 0 to 9 or A to F.

Numbers in binary notation and bit patterns are represented by strings of digits 0 and 1, with the most significant bit shown to the left. The character *x* in binary numbers represents a digit 0 or 1.

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

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.

An uninterrupted sequence of *m* 0's in a bit pattern can be represented by $[0^m]$.

The setting of bits is denoted by ZERO and ONE.

In data fields composed of bytes, 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 8*n* 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.

In data fields composed of nibbles, the data is recorded so that the most-significant nibble, identified as nibble 0, shall be recorded first and the least-significant nibble last.

In a field of 4*n* bits, bit $b_{(4n-1)}$ shall be the most significant bit (msb) and bit b_0 the least significant bit (lsb). Bit $b_{(4n-1)}$ shall be recorded first.

A range of values is indicated as $x \sim y$, where the limits *x* and *y* are included in the range.

A list of integers is indicated as *i* .. *j*. The list contains all integers between *i* and *j* as well as *i* and *j* (e.g. *k* = 0 .. 7). If the step size is different from one, this is indicated as: *i*, (*i* + step) .. *j* (e.g. *k* = 1, 4 .. 16, where step = 3).

A group of parameters is indicated as param *m* .. *n* or P_m .. P_n. The group contains all parameters with an index between *m* and *n* as well as *m* and *n* (e.g. byte 16 .. 31, bit 7 .. 4, Add0 .. Add255).

If *x* is nearly equal to *y*, then it is expressed as $x \approx y$.

6.3 Integer calculus

div(*n*,*d*) represents the integer part of the division of *n* by *d*.

mod(*n*,*d*) represents the remainder of the division of *n* by *d*: mod(*n*,*d*) = *n* – *d* × div(*n*,*d*).

EXAMPLE

div(+11,+3) = +3	div(–11,+3) = –3	div(+11,–3) = –3	div(–11,–3) = +3
mod(+11,+3) = +2	mod(–11,+3) = –2	mod(+11,–3) = +2	mod(–11,–3) = –2

7 General descriptions of disk

The 120 mm optical disk that is the subject of this document consists of a substrate of about 1,1 mm nominal thickness. clamping is performed in the clamping zone.

The recording layer of the disk uses high-to-low (HTL) technology. Recorded HTL marks have lower reflection than the unrecorded layer(s).