

INTERNATIONAL STANDARD

NORME INTERNATIONALE



ID format for 50 mm magneto-optical disc system

Format de l'identifiant pour un système à disque magnéto-optique de 50 mm



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**ID FORMAT FOR 50 mm MAGNETO-OPTICAL
DISC SYSTEM**

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FDIS	Report on voting
100/870/FDIS	100/912/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

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ID FORMAT FOR 50 mm MAGNETO-OPTICAL DISC SYSTEM

1 Scope

This International Standard specifies the characteristics of 50 mm Optical Disc Cartridges (ODC) with a capacity of 730 Mbytes per Cartridge. This regulation covers the logical format of removable 50 mm magneto-optical discs used on digital still cameras, digital movie cameras, electronic albums and similar devices and combinations of these devices that record, play or process the digital data of still pictures, motion pictures and audio. This standard specifies the recording and reproducing format and processing method of files of still pictures, motion pictures and audio on 50 mm magneto-optical discs so that the users can use these discs on various compatible devices.

2 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.

IEC 60950-1:2001, *Information technology equipment – Safety – Part 1: General requirements*

ISO/IEC 13346-1:1995, *Information technology – Volume and file structure of write-once and rewritable media using non-sequential recording for information interchange – Part 1: General*

3 Terms and definitions

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

3.1

band

part of the Data Zone comprising a fixed number of consecutive physical tracks

3.2

base band wobble address

address information formed by wobbling with bi-phase modulation

3.3

case

housing for an optical disc, that protects the disc and facilitates disc interchange

3.4

channel bit

smallest element for the representation of data on a disc. It is recorded as either a space or a mark

3.5

clamping zone

annular part of the disc within which the clamping force is applied by the clamping device

3.6

control zone

zone containing the information on media parameters and format necessary for writing and reading the remaining tracks of the optical disc

3.7

Cyclic Redundancy Check CRC

method for detecting errors in data

3.8

data clock

clock for data detection and data recording, generated by a PLL synchronized to fine clock marks

3.9

defect management

method for handling the defective areas on the disc

3.10

disc reference plane

plane defined by the perfectly flat annular surface of an ideal spindle onto which the clamping zone of the disc is clamped, and which is normal to the axis of rotation

3.11

ECC Block

group of frames to perform ECC 32 kB ECC Block execute Error Correction with a set of 16 frames

3.12

embossed information

information so formed as to be unalterable by magneto-optical means

3.13

entrance surface

surface of the disc onto which the optical beam first impinges

3.14

Error Correction Code

ECC

error-detecting code designed to correct certain kinds of errors in data

3.15

Fine Clock Mark

embossed mark on disc for generating a clock

3.16

format

arrangement of information on the disc

3.17

frame

least physical addressable unit, which holds 2 048 data bytes and ECC bytes, and is comprised numbers of segments

3.18**interleaving**

process of allocating the physical sequence of units of data so as to render the data more immune to burst errors

3.19**land and groove**

trench-like feature of the disc, 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

3.20**Logical Zone**

user data area including spare sector for Defect Management

3.21**magnetic field modulation**

technique for recording encoded information on the disc by switching a recording magnetic field between two opposite directions

3.22**optical disc**

disc that will accept and retain information in the form of marks in a recording layer that can be read with an optical beam

3.23**optical disc cartridge****ODC**

device consisting of a case containing an optical disc

3.24**polarization**

direction of polarization of an optical beam is the direction of the electric vector of the beam

3.25**protective coating**

layer coated on top of the recording layer to protect from environmental influences and emergency landing of magnetic head

3.26**read power**

optical power, incident at the entrance surface of the disc, used when reading

3.27**recording magnetic field**

magnetic field that switches between two opposite directions (both perpendicular to the disc surface) according to the encoded information. When the focus spot of a laser beam heats the disc sufficiently, this magnetic field causes a permanent magnetic domain in the magneto-optical layer on the disc

3.28**recording layer**

layer of the disc on or in which data is written during manufacture and/or use

3.29**Reed-Solomon code**

error detection and/or correction code which is particularly suited for the correction of errors which occur in bursts or are strongly correlated

**3.30
sector**

least logical addressable unit from host interface, which holds 2 048 user bytes with Defect Management process adopted

**3.31
segment**

subdivision of a Frame bounded by an interval of Fine Clock Mark. The first segment of a frame is used as an address segment

**3.32
spindle**

part of the disc drive which is in contact with the disc

**3.33
substrate**

transparent layer of the disc, provided for mechanical support of the recording layer, through which the optical beam accesses the recording layer

**3.34
track**

path which is followed by the focus of the optical beam during one revolution of the disc. A track consists of a groove or a land

**3.35
track pitch**

distance between adjacent track (a groove and a land) centre lines, measured in a radial direction

**3.36
zone**

annular area of the disc

4 Conventions and notations

4.1 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 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 0 and 1.
- Numbers in binary notation and bit combinations are shown with the most significant bit to the left.
- Negative values of numbers in binary notation are given in TWO's complement.
- 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 first, the most significant bit (numbered 7 in an 8-bit byte) is recorded last. This order of recording applies also to the data input of the Error Detection and Correction circuits and to their output.

4.2 Names

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

5 List of acronyms

ALPC	Auto Laser Power Control
ADB	Address Data Bit
CDS	Codeword Digital Sum
CRC	Cyclic Redundancy Check
DCB	Data Channel Bit
DDS	Disc Definition Structure
DMA	Defect Management Area
DSV	Digital Sum Value
ECC	Error Correction Code
EDC	Error Detection Code
FA1	Functional Area 1
FA2	Functional Area 2
FCM	Fine Clock Mark
ID	Identifier
IED	ID Error Detection code
LSB	Least Significant Byte
LZ	Logical Zone
MO	Magneto-Optical
MSB	Most Significant Byte
NRZI	Non Return to Zero Inverted
ODC	Optical Disc Cartridge
PDL	Primary Defect List
PI	Parity of Inner-code
PO	Parity of Outer-code
R/W	Rewritable
RS	Reed-Solomon
SDL	Secondary Defect List
ZCAV	Zoned Constant Angular Velocity
ZCLV	Zoned Constant Linear Velocity

6 General description of the optical disc cartridge

The optical disc cartridge which is the subject of this standard consists of a case containing an optical disc.

The case is a protective enclosure for the disc. 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 disc is recordable on one side. Data can be written onto the disc as marks in the form of magnetic domains in the recording layer and can be overwritten with new data with a focused optical beam, using the thermo-magnetic effect. The data can be read with a focused optical beam, using the magneto-optical effect. The beam accesses the recording layer through the transparent substrate of the disc.

7 General requirements

7.1 Environments

7.1.1 Testing environment

Temperature:	23 °C ± 2 °C
Relative humidity:	45 % to 55 %
Atmospheric pressure:	60 kPa to 106 kPa
Air cleanliness:	Class 100 000

7.1.2 Operating environment

Temperature:	0 °C to 60 °C
Relative humidity:	3 % to 85 %
Absolute humidity:	1 g/m ³ to 30 g/m ³
Atmospheric pressure:	60 kPa to 106 kPa
Temperature gradient:	10 °C/h maximum
Relative humidity gradient:	10 %/h maximum
Air cleanliness:	office environment
Magnetic field strength at the recording layer for any condition under which a beam is in focus:	2 000 A/m maximum
Magnetic field strength at the recording layer during any other condition:	48 000 A/m maximum

7.1.3 Storage environment

Temperature:	–20 °C to 70 °C
Relative humidity:	3 % to 90 %
Absolute humidity:	1 g/m ³ to 30 g/m ³
Atmospheric pressure:	60 kPa to 106 kPa
Temperature gradient:	15 °C/h maximum
Relative humidity gradient:	10 %/h maximum
Air cleanliness:	office environment
Magnetic field strength at the recording layer:	48 000 A/m maximum

7.1.4 Transportation

This standard does not specify requirements for transportation; guidance is given in Annex I.

7.2 Temperature shock

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

7.3 Safety requirements

The cartridge shall satisfy the safety requirements of IEC 60950, when used in the intended manner or in any foreseeable use in an information processing system.

8 Reference drive

8.1 Optical system

The basic set-up of the optical system of the reference drive used for measuring the write and read 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 disc is minimized so as not to influence the accuracy of the measurements.

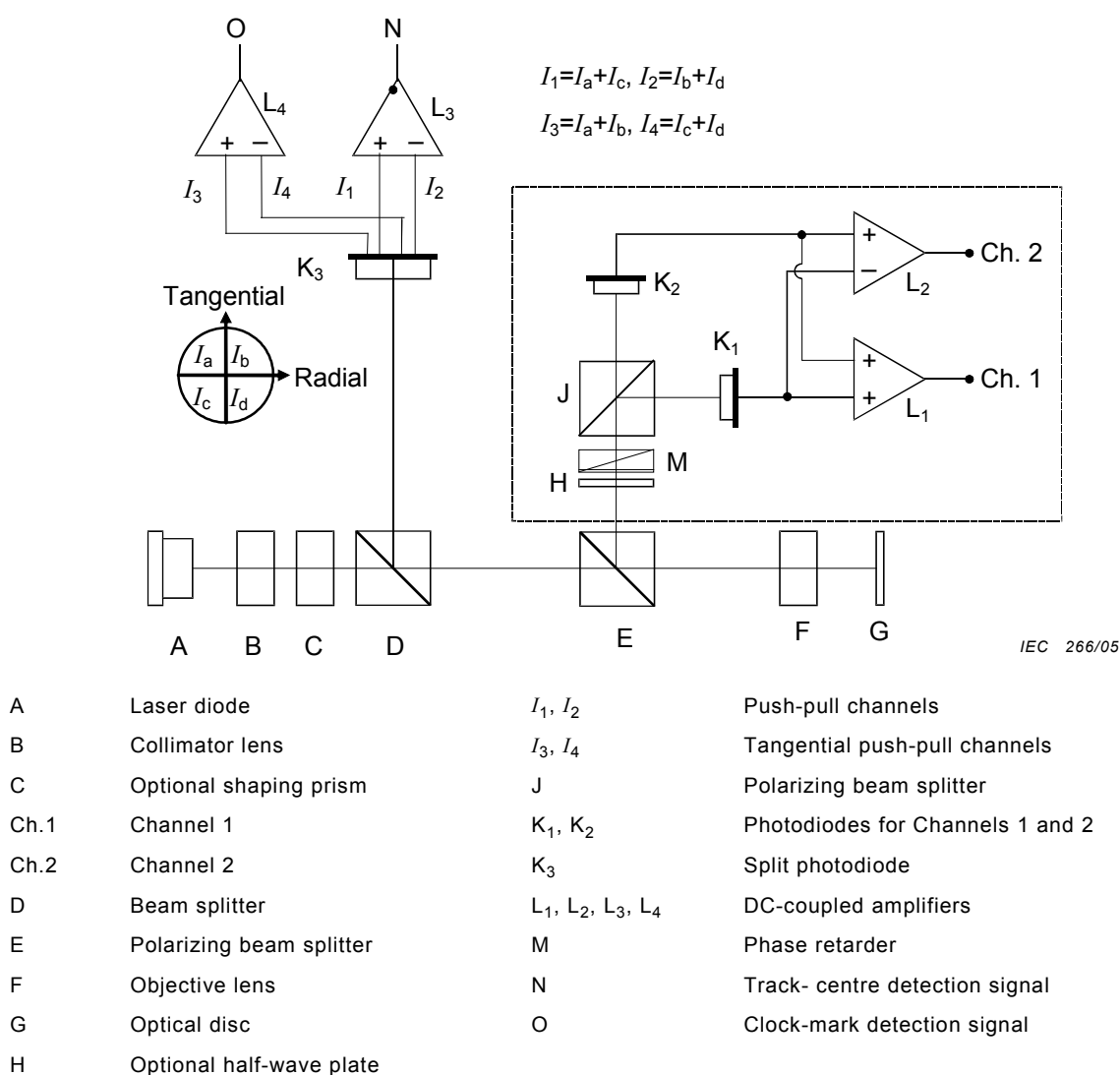


Figure 1 – Optical system of the reference drive

In the absence of polarization changes in the disc, the polarizing beam splitter J shall be aligned to make the signal of detector K_1 equal to that of detector K_2 . The direction of polarization in this case is called the neutral direction. The phase retarder M shall be adjusted in such a way that the optical system does not have more than 2,5° phase retardation between the neutral polarization and the polarization perpendicular to it. This position of the retarder is called the neutral position.

The beam splitter J shall have a p-s intensity reflectance ratio of at least 100.

The beam splitter E shall have an intensity reflectance R_p from F to H of nominally 0,30 for the neutral polarization direction. The reflectance R_s for the polarization perpendicular to the neutral direction shall be nominally 0,95. The actual value of R_s shall not be smaller than 0,90.

The imbalance of the magneto-optical signal is specified for a beam splitter with nominal reflectance. If the measurement is made on a drive with reflectances R_p' and R_s' for beam splitter E, then the measured imbalance shall be multiplied by

$$\sqrt{\frac{R_s \cdot R_p'}{R_p \cdot R_s'}}$$

to make it correspond to the nominal beam splitter E.

The output of Channel 1 is the sum of the currents through photodiodes K_1 and K_2 and is used for reading embossed marks. The output of Channel 2 is the difference between photodiode currents and is used for reading user-written marks with the magneto-optical effect.

8.2 Optical beam

The focused optical beam used for writing and reading data shall have the following properties:

- a) Wavelength (λ): 650 nm $\pm$ 10 nm
- b) Wavelength (λ) divided by the numerical aperture of the objective lens (NA):
 $\lambda/NA = 1,083 \mu\text{m} \pm 0,017 \mu\text{m}$
- c) Filling D/W of the aperture of the objective lens:
Radial 0,85 $\pm$ 0,05; tangential 0,85 $\pm$ 0,05
- d) Variance of the wavefront of the optical beam near the recording layer, after passing through an ideal substrate:
0 to $\lambda^2/330$
- e) Polarization: Perpendicular to the track
- f) Extinction ratio: 0,01 max.
- g) The optical power for writing and reading and the magnetic field shall be as specified in Clause 12.

D is the diameter of the lens aperture and W is the beam diameter of the Gaussian beam where the intensity is $1/e^2$ of the maximum intensity.

The extinction ratio is the ratio of the minimum over the maximum power observed behind a linear polarizer in the optical beam, which is rotated over at least 180°.

8.3 Read channels

Two read channels shall be provided to generate signals from the marks in the recording layer. Channel 1 shall be used for reading the embossed marks, using the diffraction of the optical beam by the marks. Channel 2 shall be used for reading the user-written marks, using the rotation of the polarization of the optical beam due to the magneto-optical effect of the marks. The read amplifiers after the photo-detectors in Channel 1 and Channel 2 shall have a flat response within 1 dB from DC to 10 MHz for rotational frequencies of the disc as specified in 8.5.

8.4 Tracking

The Tracking Channel of the drive provides the tracking error signal to control the servo for the axial and radial tracking of the optical beam. The method of generating the axial tracking error is not specified for the reference drive. The radial tracking error is generated by a split photodiode detector in the Tracking Channel. The division of the diode runs parallel to the image of the tracks on the diode.

8.5 Rotation of the disc

The spindle shall position the disc as specified in 9.3. It shall rotate the disc at a linear speed of 4,8 m/s.

The direction of rotation shall be counter-clockwise when viewed from the objective lens.

9 Mechanical and physical characteristics

9.1 Dimensional and physical characteristics of the cartridge

9.1.1 Cartridge Outline (Figure 2)

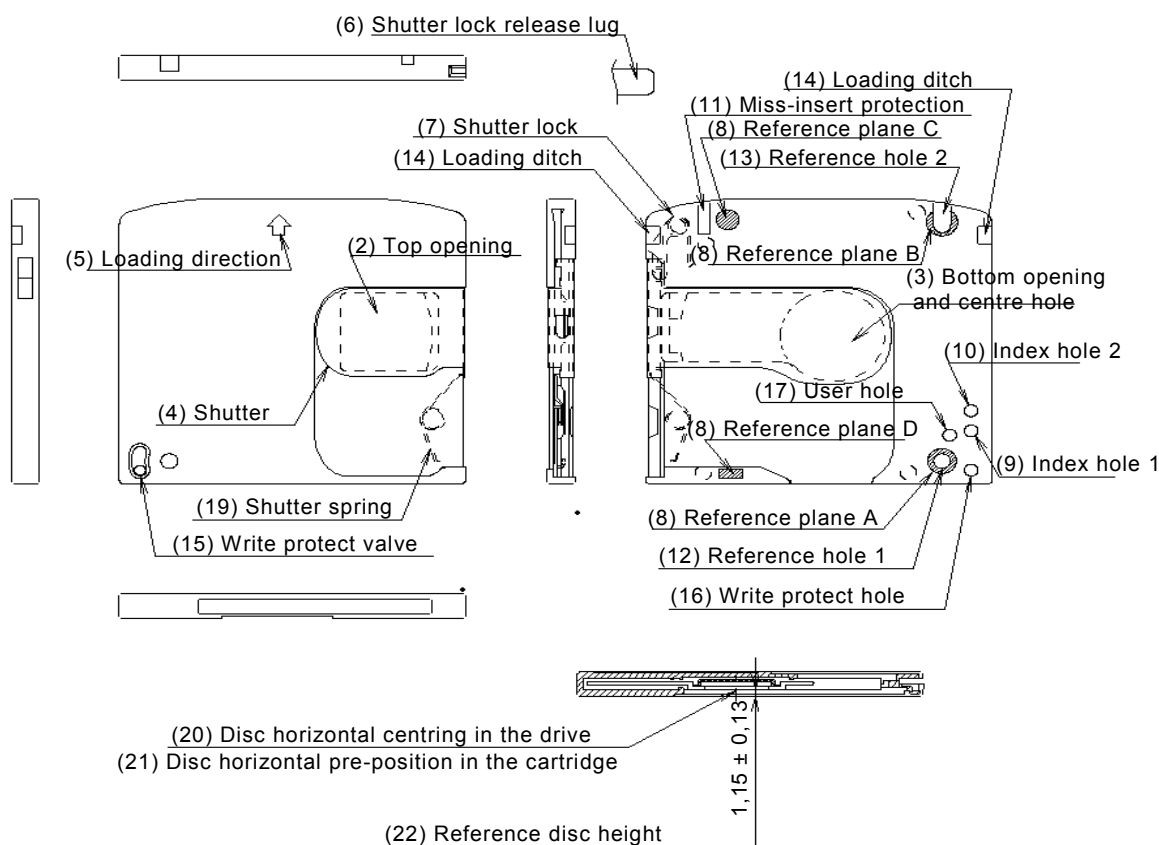
The cartridge is a rectangular parallelepiped having a curvature on one side. It has the hole (centre hole) on the bottom side to accept a disc rotating axis from the drive. It has a top opening for the magnetic head on the top side, and a bottom opening for the optical head of the drive on the bottom side.

The shutter of the cartridge, when left as it is, always covers the access window (top opening, bottom opening) and the centre hole by the force from shutter spring and the shutter lock. When the cartridge is inserted into the drive, the shutter fully opens the access window and the centre hole, being ready for recording/reading operation. When it is pulled out of the drive, the shutter again closes the access window and centre hole by using the force from the shutter spring.

The cartridge can insert the drive when correctly directed to the drive. The cartridge is set to write enable or write protected.

- | | |
|-------------------------------------|---|
| (1) Dimensions: | 56,5 (<i>D</i>) mm × 59,5 (<i>W</i>) mm × 4,8 (<i>H</i>) mm |
| (2) Top opening: | Magnetic head |
| (3) Bottom opening and centre hole: | Optical head and disc rotating axis |
| (4) Shutter: | Covers top and bottom opening and bottom centre hole |
| (5) Loading direction: | An arrowhead indicating the loading direction is marked on the top side |
| (6) Shutter-lock release lug: | For insertion depth into the cartridge (see Figure 2) |
| (7) Shutter lock: | Shutter engages with shutter lock while the shutter is closed. |
| (8) Reference planes: | Four, A to D, on the bottom side |
| (9) Index hole 1: | – |
| (10) Index hole 2: | – |
| (11) Miss-insert protection | Allows the cartridge inserted to the bottom of the drive only when it is in the correct direction |
| (12) Reference hole 1: | Circle |
| (13) Reference hole 2: | U-shape |
| (14) Loading ditch: | Two symmetrical ditches for power loading |
| (15) Write protect valve: | Slides to open/close the write protect hole (16) |

- (16) Write protect hole: Open when the write protect valve knob is at up position – write protect – depth 3 mm min. Closed when the write protect valve knob is at down position – write enable – depth $1_{-0,1}^{+0,3}$ mm
- (17) User hole: Open – depth 3 mm min. Closed – depth $1_{-0,1}^{+0,3}$ mm
- (18) Holding area: Cartridge holding force in the holding area 1,5 N to 4 N
- (19) Shutter spring: Applies force to the shutter in the direction to top/bottom opening (2), (3)
- (20) Disc horizontal centring in the drive: $((X - 18,8)^2 + (Y - 24,8)^2) \text{ mm} \leq (0,15)^2 \text{ mm}$
- (21) Disc horizontal pre-positioning in the cartridge: $((X - 18,8)^2 + (Y - 24,8)^2) \text{ mm} \leq (0,8)^2 \text{ mm}$
- (22) Disc reference height: 1,15 mm $\pm$ 0,13 mm (from the cartridge reference plane)
- (23) Turntable inclination: 0,3° max.
- (24) Shutter locking force: 5 N min.
- (25) Cartridge mass: 20 g maximum (including disc)
- (26) Fixing by screw: The cartridge can be screw-assembled. For location of screw, see Figure 9.
- (27) Standard test tools: See Annexes B, C and D.



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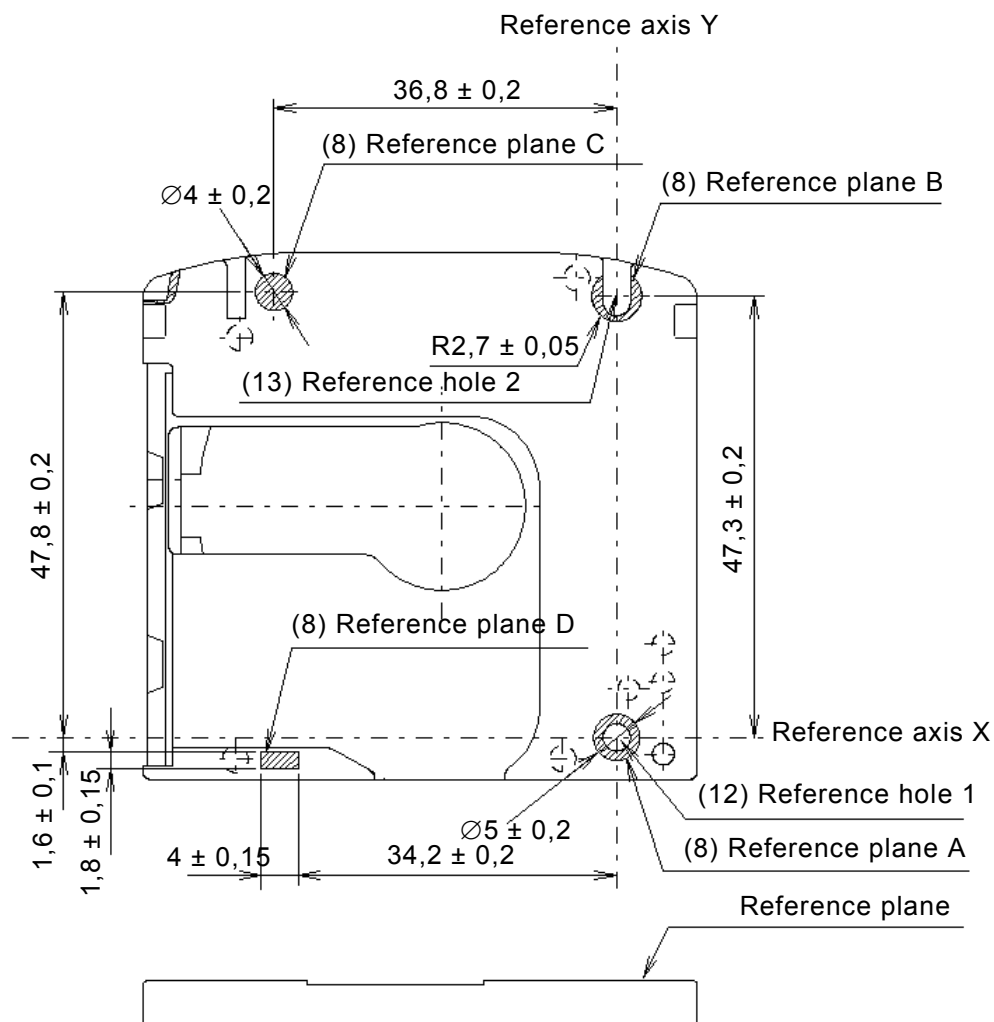
Figure 2 – Outline of cartridge

9.1.2 Cartridge reference line and reference plane (see Figure 3)

The plane defined with the reference planes A, B and C is the reference plane.

The cartridge reference lines: the line connecting the reference holes 1 and 2 together is the reference axis Y, the line normal to the reference axis Y and passing the centre of the reference hole 1 is the reference axis X.

Reference planes A, B, C and D and reference holes 1 and 2 are located at the position shown in Figure 3.



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Figure 3 – Cartridge reference line and reference plane

9.1.3 Cartridge shape

Width (see Figures 4 and 5):	$59,5 \begin{smallmatrix} 0 \\ -0,4 \end{smallmatrix}$ mm
Depth (see Figures 4 and 5):	$56,5 \begin{smallmatrix} +0,6 \\ 0 \end{smallmatrix}$ mm
Thickness (see Figures 4 and 5):	4,8 mm $\pm$ 0,2 mm
Cartridge reference plane flatness (see Annex B):	0,1 mm max.
Cartridge flatness (see Annex C):	0,1 mm max.
Curvature (see Annex D):	The cartridge shall pass through the reference tool smoothly by its gravity
Screw (see Figure 9):	The cartridge can be screw-assembled. The screw location is shown in Figure 9

9.1.4 Mass

Maximum mass:	20 g max.(including disc)
---------------	---------------------------

9.1.5 Bottom centre hole

Diameter (see Figure 5):	$\varnothing 18 \begin{smallmatrix} +0,2 \\ 0 \end{smallmatrix}$ mm
--------------------------	---

9.1.6 Opening

Top opening (see Figure 4):	$15,5 \begin{smallmatrix} +0,4 \\ 0 \end{smallmatrix}$ mm
Bottom opening (see Figure 5):	$13,7 \begin{smallmatrix} +0,4 \\ 0 \end{smallmatrix}$ mm

9.1.7 Holding area and label area (see Figures 4 and 8)

Holding area: see Figure 8.

Label area is on the topside without the holding area.

No label area on the bottom side of the cartridge.

The cartridge may have a label area on the rear side.

The depth of the label area is 0,3 mm maximum. The label should be put within the label area.

9.1.8 Shutter

9.1.8.1 Function (see Figure 6)

The shutter shall be capable of covering the top opening, bottom opening and centre hole.

9.1.8.2 Shutter closing force

A force of 0,5 N to 0,7 N shall be enough to close the shutter fully. With the cartridge kept fixed, measure the closing force of the shutter on the spring scale when the shutter completely releases the centre hole located on the bottom side of the cartridge.

9.1.8.3 Shutter locking force

The shutter locking force shall be 5 N min.

9.1.8.4 Material

The material shall be metal

9.1.8.5 Play between the shutter and shutter lock at shutter full-closed position

The play shall be 0,6 mm max.

9.1.8.6 Shutter full-open position (see Figures 4, 5 and 6)

The engaged parts of the cartridge and the shutter are E and F, respectively.

9.1.9 Write protect hole (see Figures 2 and 5)**9.1.9.1 Diameter**

The diameter shall be $2,4^{+0,1}_0$ mm.

9.1.9.2 Depth of hole

Write protect: 3 mm min.

Write enable: $1^{+0,3}_{-0,1}$ mm

9.1.9.3 Function

Table 1 – Write protection

Write protect hole	Function
CLOSE	Write enable
OPEN	Write protection

9.1.10 User hole (see Figures 2 and 5)**9.1.10.1 Diameter**

The diameter shall be $2,4^{+0,1}_0$ mm.

9.1.10.2 Depth of hole

User hole open: 3 mm min.

User hole close: $1^{+0,3}_{-0,1}$ mm

9.1.10.3 Function

Table 2 – User hole

User hole	Function
CLOSE	-
OPEN	-

A cartridge conforming to this specification does not use a hole. The hole shall be closed.

9.1.11 Index hole (see Figures 2 and 5)

9.1.11.1 Diameter of index hole

The diameter shall be $2,4^{+0,1}_0$ mm.

9.1.11.2 Depth of hole

OPEN: 2,4 mm min.
CLOSE: 0,1 mm max.

9.1.11.3 Function

Table 3 – Index hole

Index hole 1	Index hole 2	Function
CLOSE	CLOSE	-
CLOSE	OPEN	-
OPEN	CLOSE	-
OPEN	OPEN	-

A cartridge conforming to this specification does not use holes. The holes shall be closed.

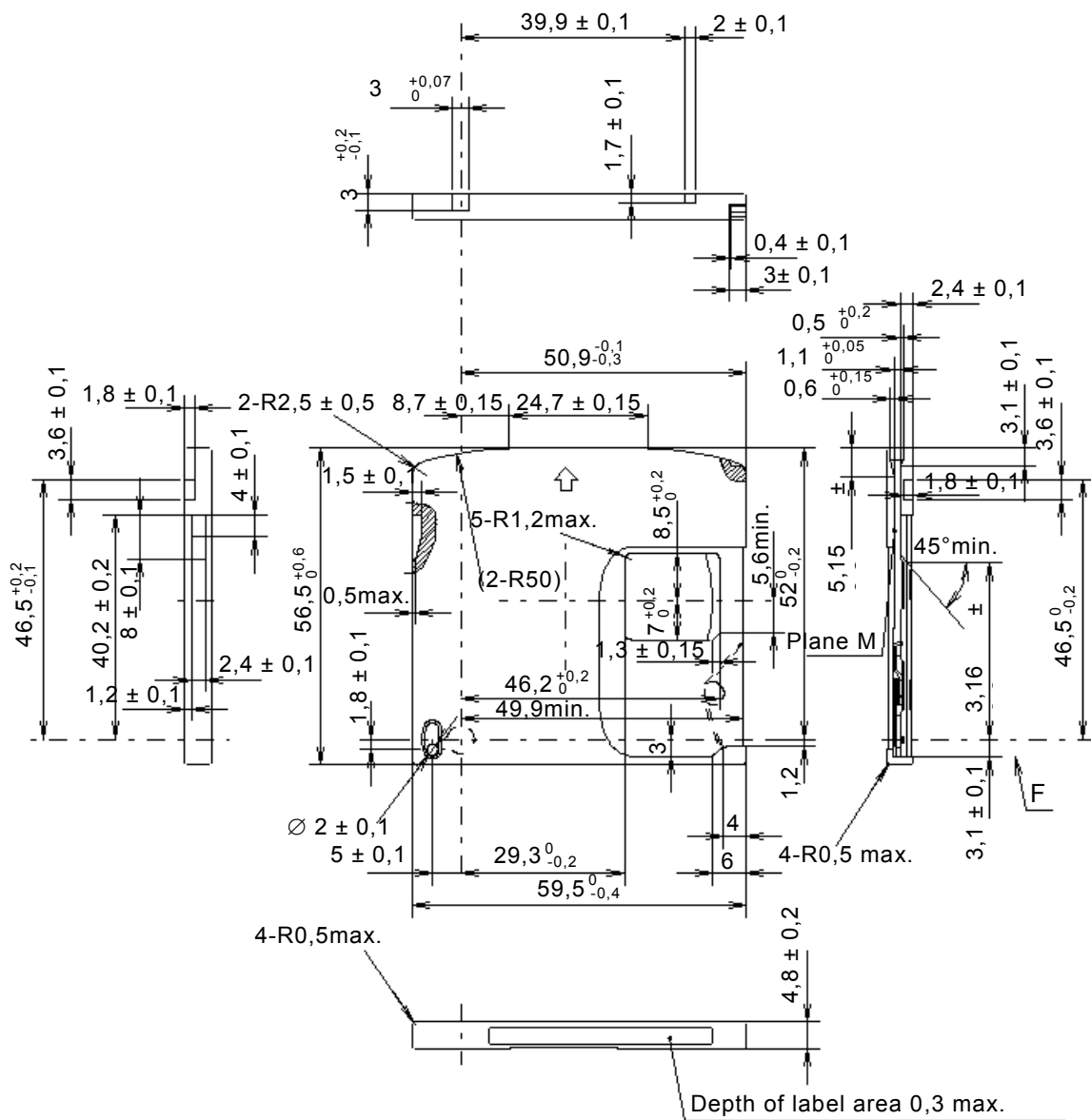
9.1.12 Cartridge holding force

9.1.12.1 Holding force per point

The holding force shall be 1 N max.

9.1.12.2 Total holding force

The total holding force shall be 1,5 N to 4 N.



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Figure 4 – Cartridge Top and Side View

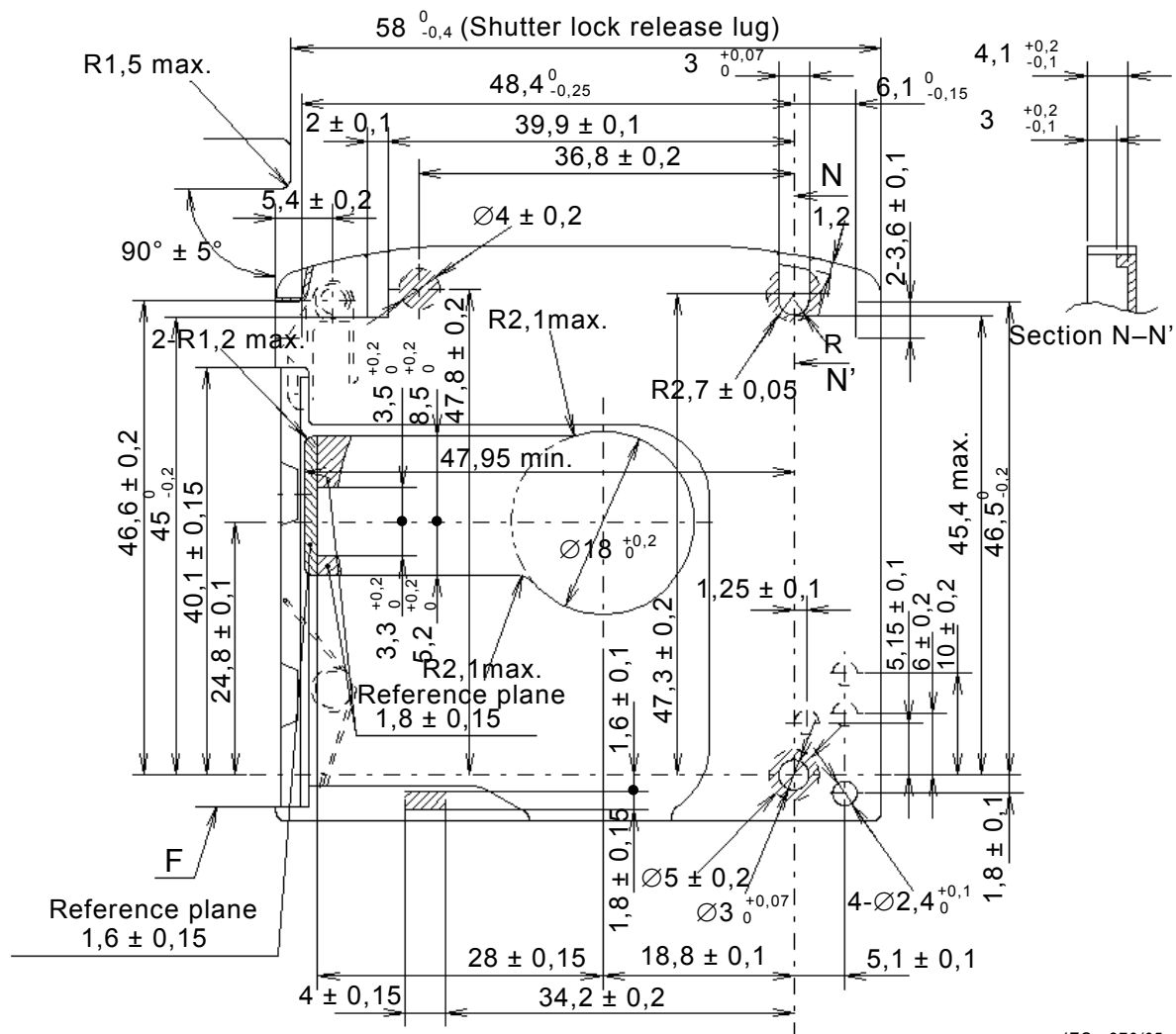


Figure 5 – Cartridge Bottom View

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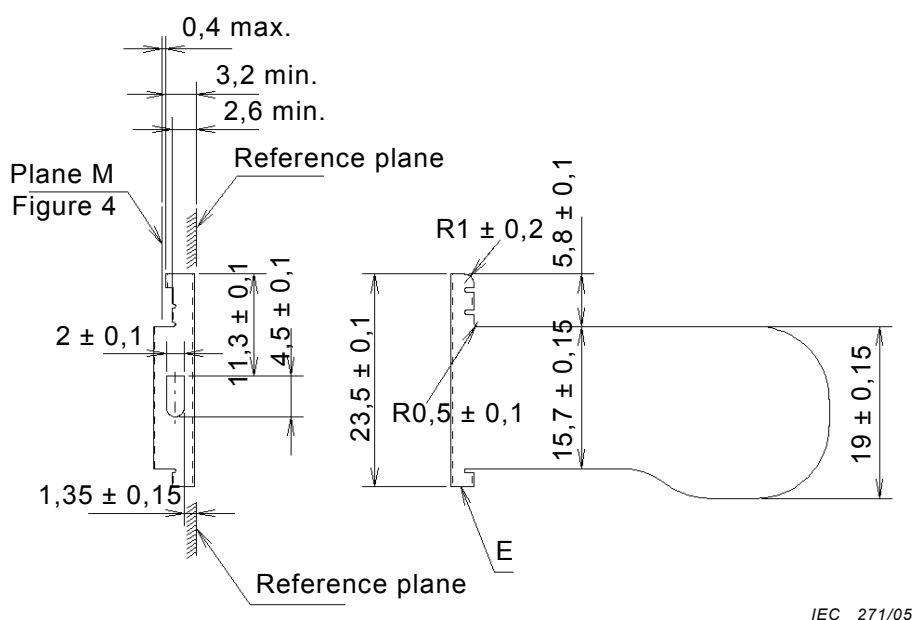


Figure 6 – Shutter

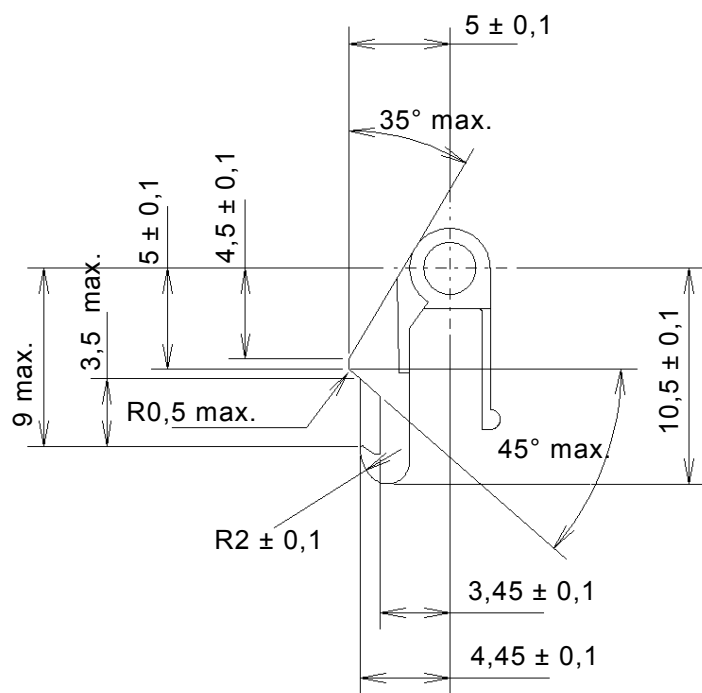
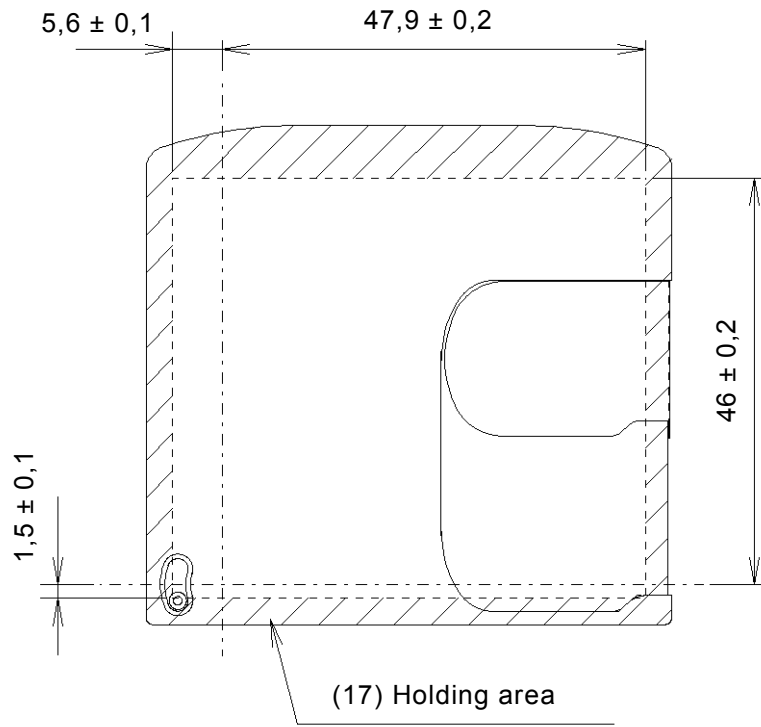
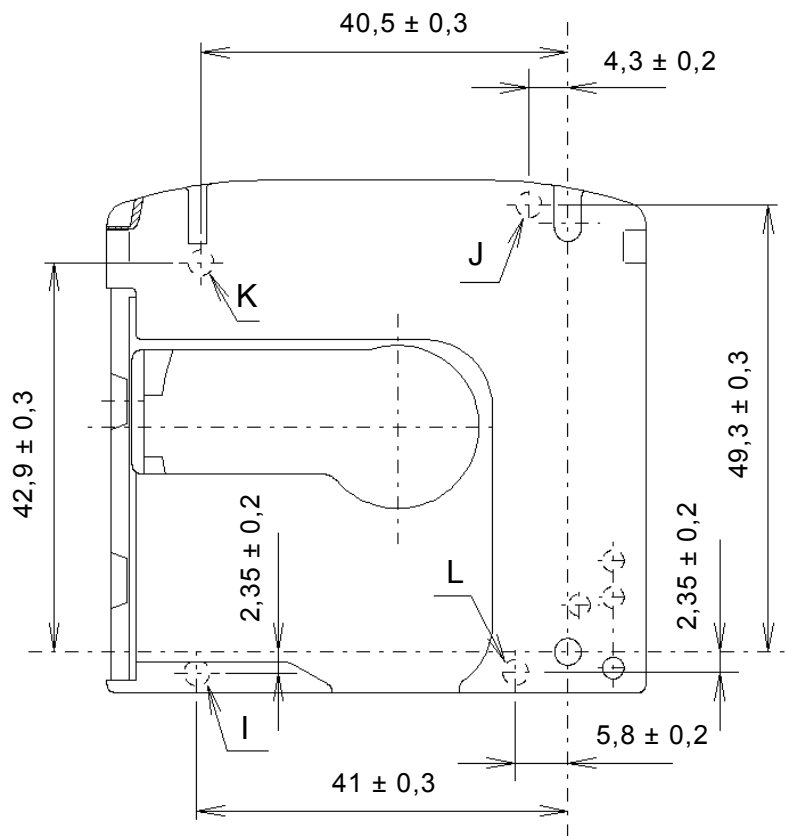


Figure 7 – Shutter lock



IEC 273/05

Figure 8 – Holding area



Note; I, J, K, L Screw hole area

IEC 274/05

Figure 9 – Screw location

9.2 Dimensional, mechanical and physical characteristics of the disc

9.2.1 General description of the disc

The disc shall consist of a circular substrate with a recording layer that can be protected from environmental influences by a protective layer. The information zone of the substrate is transparent to allow an optical beam to focus on the recording layer through the substrate. The disc substrate has a centre hole for providing the radial centring of the disc.

9.2.2 Reference axis and plane of the disc

The disc reference plane P is defined by the perfectly flat annular surface of an ideal spindle onto which the clamping zone of the disc is clamped, and which is normal to the axis of rotation of this spindle. This axis H passes through the centre of the centre hole of the disc and is normal to plane P.

9.2.3 Dimensions of the disc (see Figure 10)

9.2.3.1 Disc

The dimensions of the disc shall be measured in the testing environment. The dimensions of the disc in an operating environment can be estimated from the dimensions specified below.

Outer diameter = 50,8 mm $\pm$ 0,2 mm

Excluding axial deflection (see 9.2.4.5), the total thickness of the disc shall not exceed 0,7 mm in the range from

Ø 23,0 mm max.
to outer diameter – 1,0 mm.

Diameter of the centre hole = 11,0^{+0,05}_{0,0} mm

The eccentricity between the outline circle and the centre hole shall not exceed 0,1 mm.

The normal position of the recording layer = 1,6 mm $\pm$ 0,05 mm from the reference plane P in a direction normal to plane P.

Outer diameter of the clamping block = 16,8 mm $\pm$ 0,01 mm

9.2.3.2 Clamping zone

Outer diameter of the clamping zone = 16,4 mm min.

Inner diameter of the clamping zone = 11,4 mm max.

Thickness of the clamping zone = 0,7 mm $\pm$ 0,05 mm

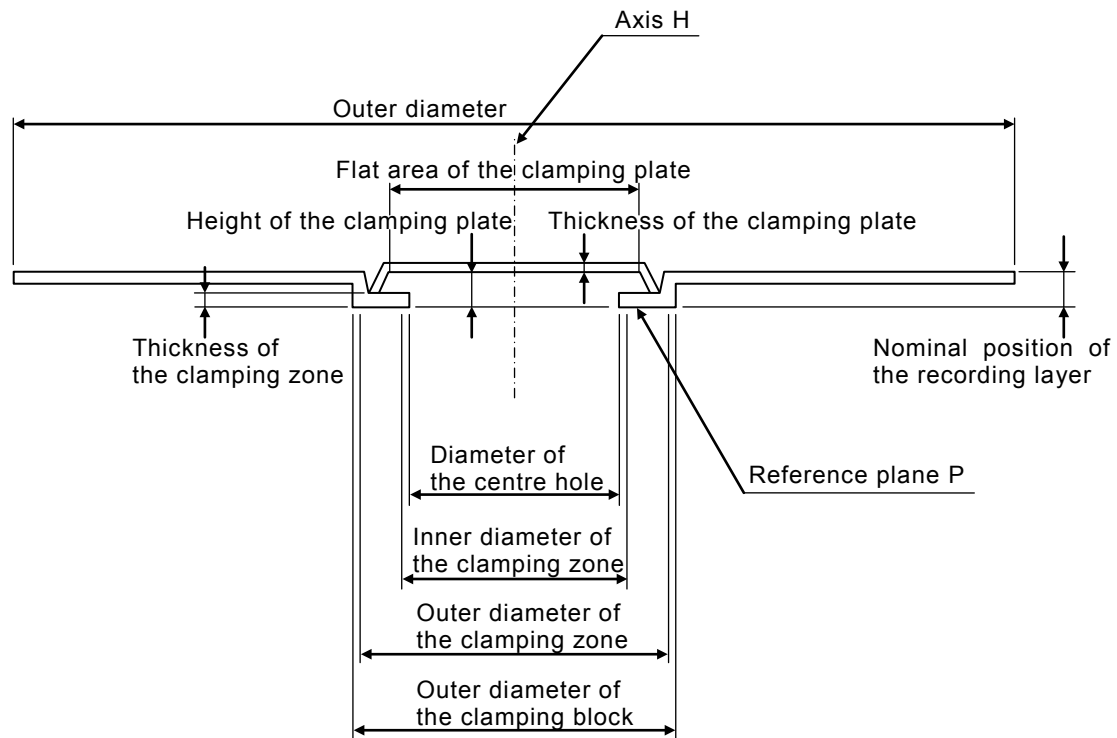
Thickness of the clamping plate = 0,4 mm $\pm$ 0,04 mm

Height of the clamping plate = 1,7 mm $\pm$ 0,1 mm

from the reference plane, in the range of < Ø 9,0 mm.

Flat area diameter of the clamping plate = 9,85 mm min.

The disc clamping force shall be less than 5 N.



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Figure 10 – Disc dimensions

9.2.4 Mechanical characteristics

All requirements in this clause shall be met in the testing environment.

9.2.4.1 Material

The disc shall be made from any suitable materials in such a way that it meets the requirements of this standard.

9.2.4.2 Mass

The mass of the disc shall not exceed 3 g.

9.2.4.3 Moment of inertia

The moment of inertia of the disc relative to axis H shall not exceed 0,001 g/m².

9.2.4.4 Imbalance

The imbalance of the disc relative to axis H shall not exceed 0,001 g/m.

9.2.4.5 Axial deflection

The axial deflection of the disc is measured as the axial deviation of the recording layer. Thus, it comprises the tolerances on the thickness of the substrate, on its index of refraction and the deviation of the entrance surface from plane P. The nominal position of the recording layer with respect to reference plane P is determined by the nominal thickness of the substrate.

The deflection of any point of the recording layer in the Information Zone from its nominal position, in a direction normal to plane P, shall not exceed $\pm 0,10$ mm for rotational frequencies of the disc as specified in 8.5.

9.2.4.6 Axial acceleration

The maximum allowed axial error $e_{\max}$ shall be specified in 11.1.3.4. The rotational frequency of the disc shall be 50 Hz. The stationary part of the motor is assumed to be motionless (no external disturbances). The measurement shall be made using a servo with the transfer function

$$H_s(i\omega) = \frac{1}{3} \left(\frac{\omega_0}{i\omega} \right)^2 \frac{1 + \frac{3i\omega}{\omega_0}}{1 + \frac{i\omega}{3\omega_0}}$$

where

$$\begin{aligned}\omega &= 2\pi f \\ \omega_0/2\pi &= 2\,125 \text{ Hz} \\ i &= \sqrt{-1}\end{aligned}$$

or any other servo with $|1+H|$ within 20 % of $|1+H_s|$ in the bandwidth of 50 Hz to 100 kHz. Thus, the disc shall not require an axial acceleration of more than $35,0 \text{ m/s}^2$ at low frequencies from the servo motor of the Reference Servo.

9.2.4.7 Radial run-out

The radial run-out of the tracks in the recording layer in the Information Zone is measured as seen by the optical head of the Reference Drive. Thus it includes the distance between the axis of rotation of the spindle and reference axis H, the tolerances on the dimensions between axis H and the location of the track, and effects of non-uniformities in the index of refraction.

The run-out, defined as the difference between the maximum and the minimum distance of the centre of any track from the axis of rotation, measured along a fixed radial line over the one revolution of the disc, shall not exceed $50 \text{ }\mu\text{m}$ at a rotation frequency of 50 Hz.

9.2.4.8 Radial acceleration

The maximum allowed tracking error $e_{\max}$ shall be as specified in 11.1.3.4. The rotational frequency of the disc shall be 50 Hz. The stationary part of the motor is assumed to be motionless (no external disturbances). The measurement shall be made using a servo with the transfer function.

$$H_s(i\omega) = \frac{1}{3} \left(\frac{\omega_0}{i\omega} \right)^2 \frac{1 + \frac{3i\omega}{\omega_0}}{1 + \frac{i\omega}{3\omega_0}}$$

where

$$\begin{aligned}\omega &= 2\pi f \\ \omega_0/2\pi &= 2\,125 \text{ Hz} \\ i &= \sqrt{-1}\end{aligned}$$

or any other servo with $|1+H|$ within 20 % of $|1+H_s|$ in the bandwidth of 50 Hz to 100 kHz. Thus, the disc shall not require a radial acceleration of more than $7,5 \text{ m/s}^2$ at low frequencies from the servo motor of the Reference Servo.

9.2.4.9 Tilt

The tilt is the angle which the normal to the entrance surface, averaged over an area of 1 mm in diameter, makes with the normal to plane P. It shall not exceed

- 6,0 mrad (radial)
- 5,0 mrad (tangential)
- 6,0 mrad (all over)

in the Information Zone.

9.2.5 Optical characteristics

9.2.5.1 Index of refraction

The index of refraction of the substrate in the Information Zone shall be within the range from 1,46 to 1,60.

9.2.5.2 Thickness of the substrate

The thickness of the substrate, from the entrance surface to the recording layer, in the Information Zone shall be

$$0,9 \leq n \times d \leq 1,0$$

where n is the index of refraction and d is the thickness of the substrate.

9.2.5.3 Reflectance

The reflectance R is the value of the reflectance on-land and in-groove of the Data Zone of the disc measured through the substrate and does not include the reflectance of the entrance surface.

The value of R at the standard wavelength specified in 8.2 shall lie within the range from 0,12 to 0,25.

At any point of the Data Zone, the value R shall meet the requirement

$$(R_{\max} - R_{\min}) / (R_{\max} + R_{\min}) \leq 0,3$$

where

$R_{\max}$ is the maximum value of measured reflectance in the Data Zone;

$R_{\min}$ is the minimum value of measured reflectance in the Data Zone.

9.2.5.4 Birefringence

The birefringence of the transparent substrate in the Information Zone shall be less than 100 nm (double pass).

9.2.6 Protective coating

9.2.6.1 General description of protective coating

The protective coating shall cover the recording layer to protect from environmental influences and to fly the slider with a magnetic head.

The slider with magnetic head usually does not touch the protective coating at under the operating condition of over 4,5 m/s linear velocity.

The protective coating shall not disturb recording magnetic field.

9.2.6.2 General description of the operating zone

The operating zone is part of the protective coating area. It is the area over which the slider with a magnetic head can fly.

9.2.6.3 Characteristics of the protective coating in the operating zone (Figure 11)

The dimensions and physical characteristics of the protective coating in the operating zone shall meet the requirements specified in 9.2.6.4 to 9.2.6.7.

9.2.6.4 Dimensions of the protective coating in the operating zone

Inner diameter of the operating zone = 24,6 mm max.

Outer diameter of the operating zone = 48,8 mm min.

The thickness of the protective coating in the operating zone shall not exceed 20 μm (see Figure 11).

9.2.6.5 Surface roughness

The surface roughness of the protective coating in the operating zone is determined by the value of R_y .

R_y shall not exceed 1,6 μm at any point of the operating zone.

9.2.6.6 Surface irregularity

Surface irregularity of the protective coating in the operating zone shall not exceed 10 μm at any point of the operating zone.

9.2.6.7 Friction force and wear in thickness test (see Annex E)

The friction force should not exceed 50 mN after 100 times Contact Start-Stop wear test.

9.2.6.8 Dimensions of the protective coating outside the operating zone

The thickness of the protective coating in the zone outside the operating zone shall not exceed 100 μm from the recording layer (see Figure 11).

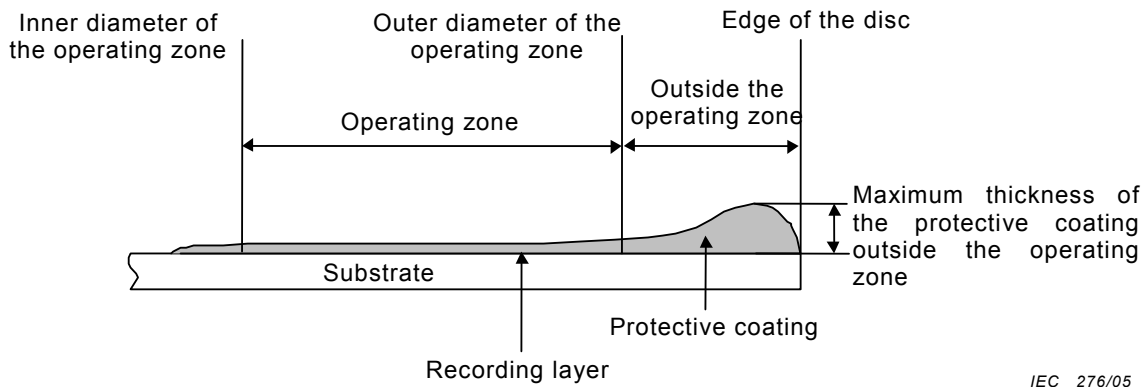


Figure 11 – Thickness of the protective coating

9.3 Interface between cartridge and drive

9.3.1 Disc Horizontal Centring in the Drive

Disc horizontal centring tolerance from the centre of the reference hole:

$$((X - 18,8)^2 + (Y - 24,8)^2) \text{ mm} \leq (0,15)^2 \text{ mm}$$

9.3.2 Disc Horizontal Pre-positioning tolerance in the Cartridge

$$((X - 18,8)^2 + (Y - 24,8)^2) \text{ mm} \leq (0,8)^2 \text{ mm}$$

The clamping block shall be inside of the centre hole of the cartridge.

9.3.3 Disc Reference Height (see Figure 2)

Disc reference height from the cartridge reference plane while drive is running:

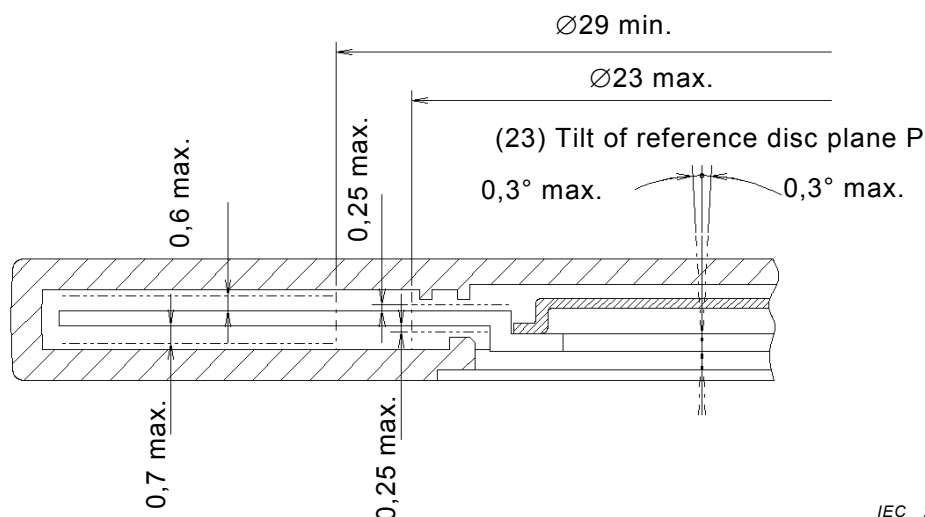
$$1,15 \text{ mm} \pm 0,13 \text{ mm}$$

9.3.4 Gap between the Disc and Cartridge Internal Wall (see Figure 12)

When set to the disc reference height of 1,15 mm, the disc can move up and down by the distance shown below without touching the internal wall of the cartridge.

(Turntable tilt angle: 0,3° max.; disc height: 1,15 mm ± 0,13 mm; drive reference plane flatness: 0,1 mm max.)

Ø 23,0 mm max.:	+0,25 mm from the top surface of the disc
	–0,25 mm from the bottom surface of the disc
Ø 29,0 mm min.:	+0,60 mm from the top surface of the disc
	–0,70 mm from the bottom surface of the disc



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Figure 12 – Gap between the disc and the internal wall of the cartridge

10 Format of information

10.1 Track geometry

10.1.1 Track shape

The Information Zone shall contain tracks intended for the Continuous Servo tracking method. In certain areas of the discs, a track shall be composed on a groove or a land, where each groove has the straight groove, Fine Clock Mark fields, frame mark fields for addressing and Address fields by staggered one-side wobble. A groove is a wide trench-like feature, and the width of the groove is almost equal to that of the land, the bottom of which is located nearer the entrance surface than the land. The centre of a track is the centre of the land or groove. Each track shall form a 360° turn of a continuous spiral.

10.1.2 Direction of track spiral

Land and groove form a double spiral. The track shall spiral inward from the outer diameter to the inner diameter when the disc rotates counter-clockwise as viewed from the optical head.

10.1.3 Track pitch

The track pitch is the distance between centrelines of land and groove, measured in a radial direction. It is around 0,6 μm . The track pitch is precisely defined in terms of a groove pitch for convenience of measurement. The groove pitch shall be 1,20 $\mu\text{m} \pm 0,03 \mu\text{m}$.

10.1.4 Position of Control track

The start position of inner Control tracks shall be 14,67 mm $\pm 0,10$ mm.

The start position of outer Control tracks shall be 23,92 mm $\pm 0,10$ mm.

10.2 Track format

10.2.1 General description of track format

Each track shall have n frames, and each frame has an address which is expressed by a combination of Band Number, Track Number and Frame Number described below (see 10.3.2.5)

10.2.2 Band Number

Band 1 shall be the first band of the Data Zone. The Band Number shall be increased by 1 for each band. Their located radii shall be as specified in Table 5.

The Band Number is given in the Address field of the Address Segment (see 10.3.2.5.3).

10.2.3 Track Number

Track 0 shall be the first track of each data band, Lead-in and Lead-out zone. Their located radii shall be as specified in Table 5. The track number located at radii smaller than that of track 0 should be increased by 1 for each Land and Groove track (see 10.3.2.5.4 and 10.3.2.5.8).

10.2.4 Frame Number

Frame 0 shall be the first frame of each track.

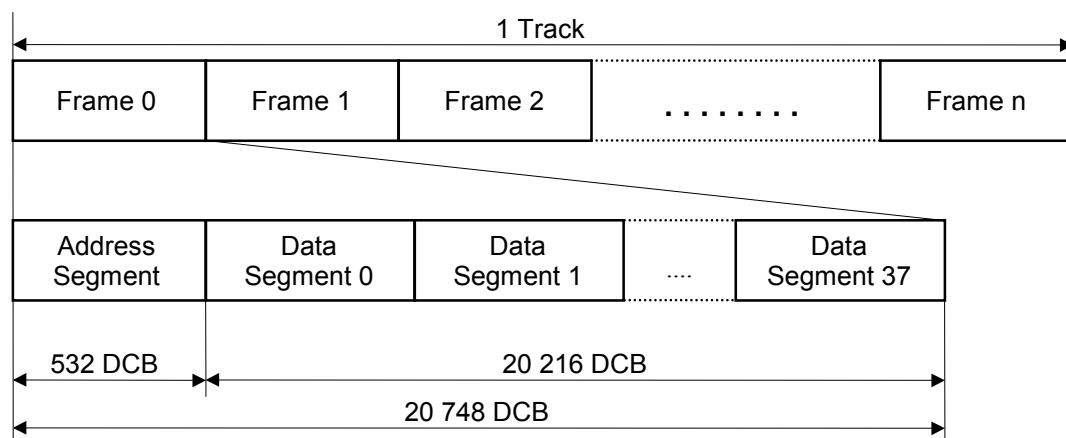
The Frame Number shall be increased by 1 for each frame.

The Frame Number is given in the address field of the Address Segment (see 10.3.2.5.2).

10.2.5 Track layout

On each track there shall be n frames (n is described in 10.6.2). A frame shall have a length of 20 748 Data Channel bits.

The layout of the track shall be as specified in Figure 13.



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Figure 13 – Track layout

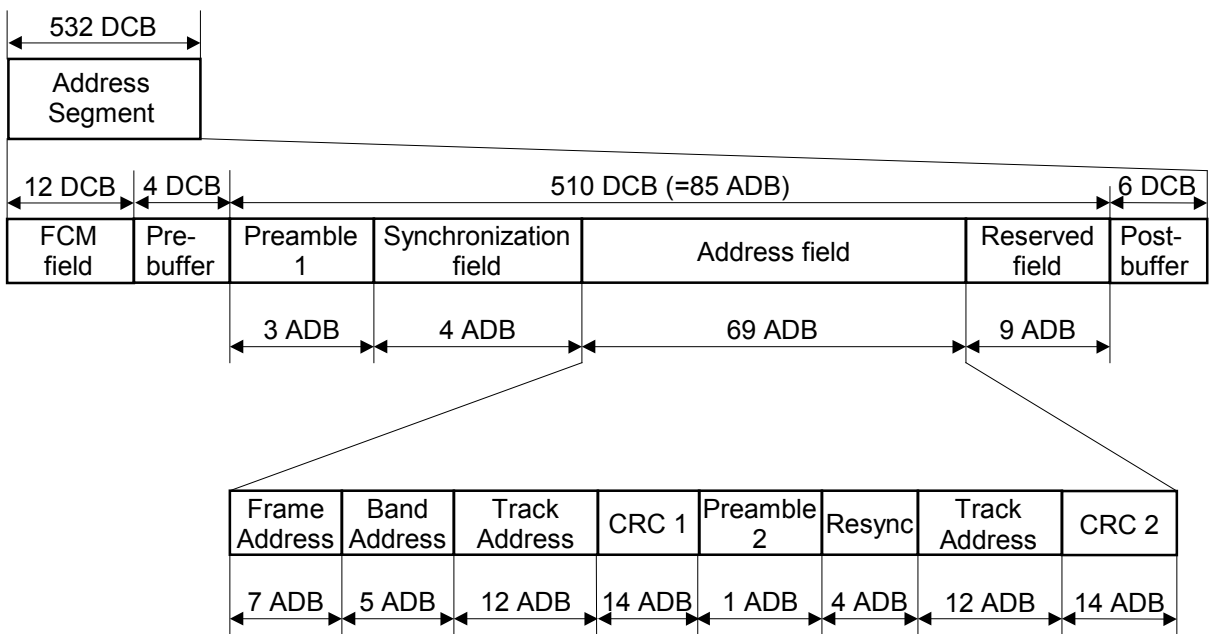
10.3 Frame format

10.3.1 General description of frame format

Each frame in ECC Block shall comprise an Address Segment and 38 Data Segments. The Address Segment shall have a length of 532 Data Channel bits.

10.3.2 Address Segment

Each Address Segment shall comprise a Fine Clock Mark field, a Pre-buffer field, preamble 1, a Synchronization field, an Address field and a Post-buffer field. The Address field data shall be modulated by Biphas-Mark code except for a Preamble 2 and a Resync field. In this Biphas-Mark code, 0 means 10 patterns at a double ADB rate, in the same way, 1 means 01 pattern at a double ADB rate. 1 Address Data bit equals to 6 Data Channel bits. The layout of the Address Segment shall be as specified in Figure 14. Wobble patterns of the Address Segment are shown in Figure 15.



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Figure 14 – Layout of the Address Segment

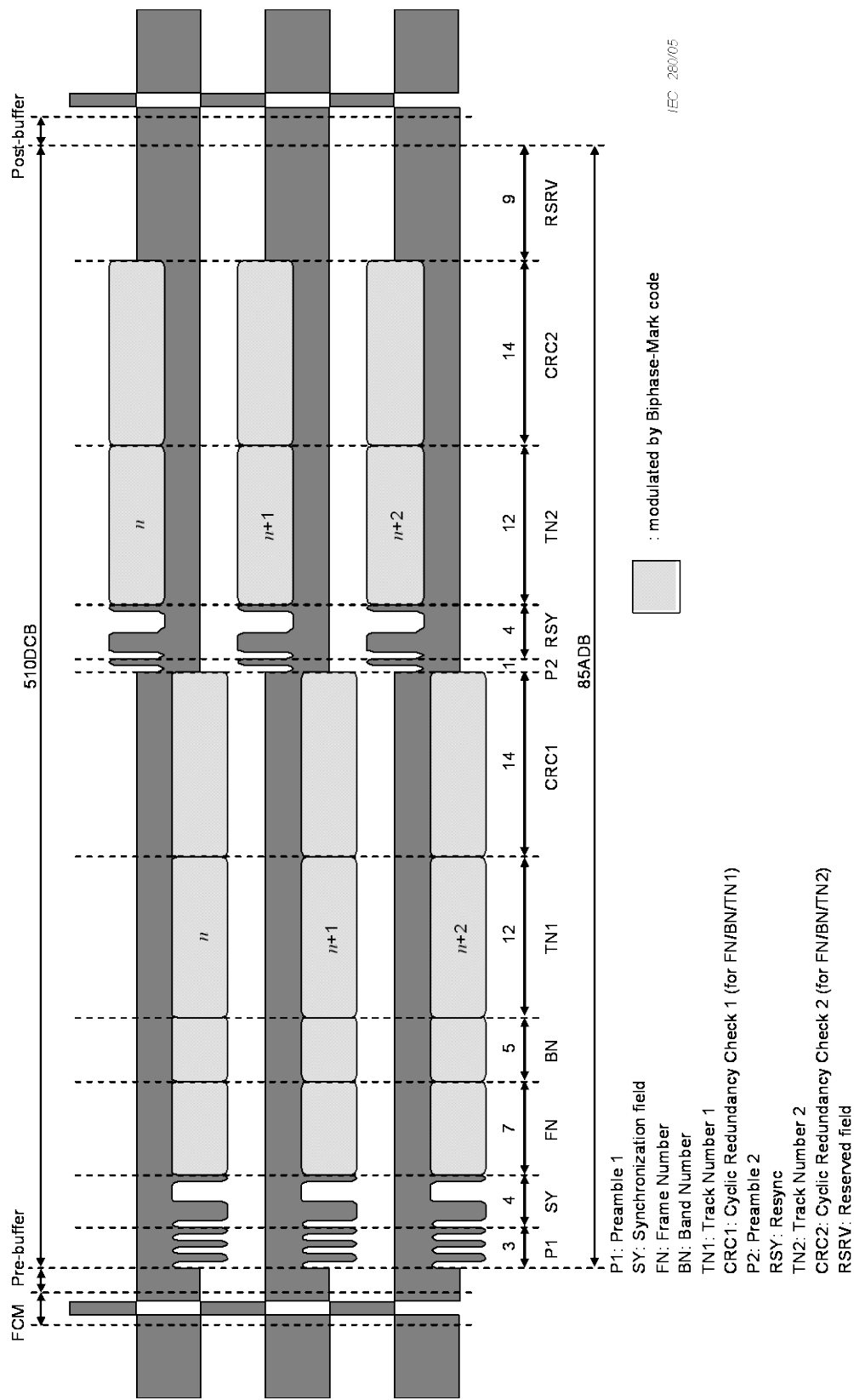


Figure 15 - Wobble Pattern of the Address Segment

10.3.2.1 Fine Clock Mark field

See 10.3.3.2.

10.3.2.2 Pre-buffer field

The Pre-buffer field shall have a length of 4 Data Channel bits with straight groove.

10.3.2.3 Preamble 1 field

The Preamble 1 field shall have a length of 3 Address Data bits set to 000. The Preamble 1 pattern is 101010 which pattern is expressed at a double ADB rate.

10.3.2.4 Synchronization field

For Synchronization with the address data, the Biphas-Mark code rule is violated.

The Synchronization field shall have a length of 4 Address Data bits. The Synchronization pattern is 10001110 which pattern is expressed at a double ADB rate.

10.3.2.5 Address field

10.3.2.5.1 General description of the Address field

The Address Segment shall have 1 Address field which has a length of 69 Address Data bits. The Address field shall comprise a Frame Number field, a Band Number field, a Track Number – 1 field, a CRC 1 field, a Preamble 2 field, a Resync field, a Track Number – 2 field and a CRC 2 field.

10.3.2.5.2 Frame Number field

The Frame Number field shall have a length of 7 Address Data bits.

The Frame Number format is according to the Frame Number in 10.2.5. The Frame Number shall be converted into Gray Code with the most significant bit first as follows:

Frame Number: 7-bit Gray Code, MSB in bit-1 of the Address field.

10.3.2.5.3 Band Number field

The Band Number field shall have a length of 5 Address Data bits.

The Band Number format is according to the Band Number in 10.2.2. The Band Number shall be converted into Gray Code with the most significant bit first as follows:

Band Number: 5-bit Gray Code, MSB in bit-8 of the Address field.

10.3.2.5.4 Track Number 1 field

The Track Number 1 field shall have a length of 12 Address Data bits.

The Track Number 1 format is according to the Track Number in 10.2.3. The Track Number 1 shall be converted into Gray Code with the most significant bit first as follows:

Track Number 1: 12-bit Gray Code, MSB in bit-13 of the Address field .

10.3.2.5.5 CRC 1 field

The CRC 1 field shall have a length of 14 Address Data bits.

For error detection of the Frame Number, the Band Number and the Track Number – 1, the CRC 1 field shall have 14-bit CRC and shall be calculated according to the Gray Code . The CRC codeword must be divisible by the check polynomial.

The most significant bit of the CRC 1 codeword is bit-1; the least significant bit is bit-38 of the Address field. The CRC parity bits (bit-25...38) are inverted on the disc.

The check polynomial is:

$$P(X) = X^{14} + X^{12} + X^{10} + X^7 + X^4 + X^2 + 1$$

10.3.2.5.6 Preamble 2 field

The Preamble 2 field shall comprise 1 Address Data bit. The Preamble 2 pattern is 01 which pattern is expressed at a double ADB rate.

10.3.2.5.7 Resync field

For re-synchronization with the address data, the Biphas-Mark code rule is violated.

The Resync field shall have a length of 4 Address Data bits. The resync pattern is 01110001 which pattern is expressed at a double ADB rate.

10.3.2.5.8 Track Number 2 field

The Track Number 2 field shall have a length of 12 Address Data bits.

The Track Number 2 format in groove is according to the Track Number in 10.2.3. The Track Number 2 format on land is according to the Track Number plus 1 in 10.2.3. The Track Number 2 shall be converted into Gray Code with the most significant bit first as follows:

Track Number 2: 12-bit Gray Code, MSB in bit-44 of the Address field .

10.3.2.5.9 CRC 2 field

The CRC 2 field shall have a length of 14 Address Data bits.

For error detection of the Frame Number, the Band Number and the Track Number 2, the CRC 2 field shall have 14-bit CRC and shall be calculated after Gray coding. The CRC codeword must be divisible by the check polynomial.

The most significant bit of the CRC 2 codeword is bit-1, the least significant bit is bit-69 of the Address field (skipping from bit-13 to bit-43). The CRC 2 parity bits (bit-56...69) are inverted on the disc.

The check polynomial is:

$$P(X) = X^{14} + X^{12} + X^{10} + X^7 + X^4 + X^2 + 1$$

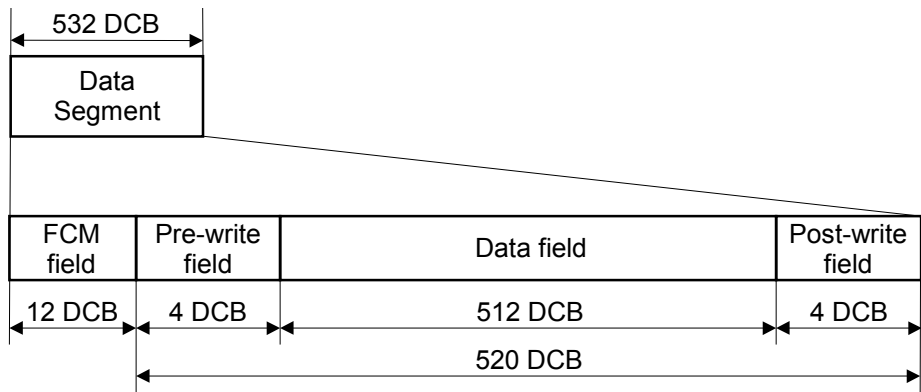
10.3.2.6 Post-buffer field

The post-buffer field shall have a length of 6 Data Channel bits with straight groove.

10.3.3 Data Segments

10.3.3.1 General description of the Data Segments

Each Data Segment shall consist of a Fine Clock Mark field, a Pre-write field, a Data field and a Post-write field. The layout of the Data Segments shall be as specified in Figure 16.



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Figure 16 – Layout of the Data Segment

10.3.3.2 Fine Clock Mark field

The Fine Clock Mark field shall have a length of 12 Data Channel bits, and contain a Fine Clock Mark.

The Fine Clock Mark is used for generating the Data Channel clock. Patterns of this mark are shown in Figure 15.

10.3.3.3 Pre-write field and Post-write field

The Pre-write field and the Post-write field shall comprise 4 Data Channel bits respectively. The fields are used for suppressing interference from the residual signals that may remain after overwriting.

The Pre-write field bits of the first Data Segment shall be set to 1100. If the last bit of the Data field is 0, the Post-write field bits of the current Data Segment and the Pre-write field bits of the next Data Segment shall be set to 0011 and 1100 respectively. If the last bit of the Data field is 1, the Post-write field bits of the current Data Segment and the Pre-write field bits of the next Data Segment shall be set to 1100 and 0011 respectively.

The patterns of these bits are shown in Figure 17.

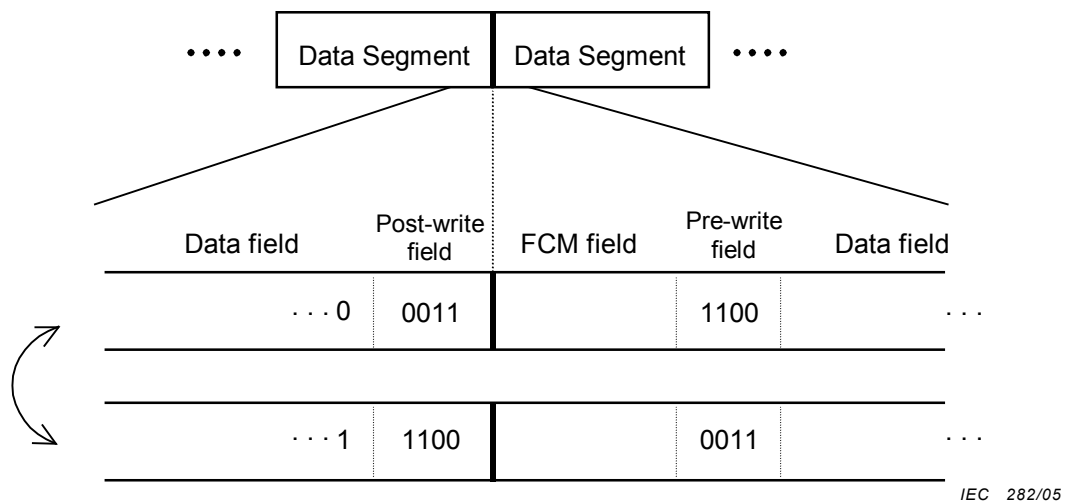


Figure 17 – The patterns of the Pre-write field and the Post-write field

10.3.3.4 Data field

The Data field shall have a length of 512 Data Channel bits. It may contain user written data. Data shall be written in this field using the Data clock frequency specified in table 4 for each data band.

10.3.3.5 Address Data clock frequency

The Address Data clock frequency is specified in Table 4.

The Address Data clock frequency shall be constant within the whole band irrespective of the radial position.

The length of one period of the Address Data clock is called an Address Data bit.

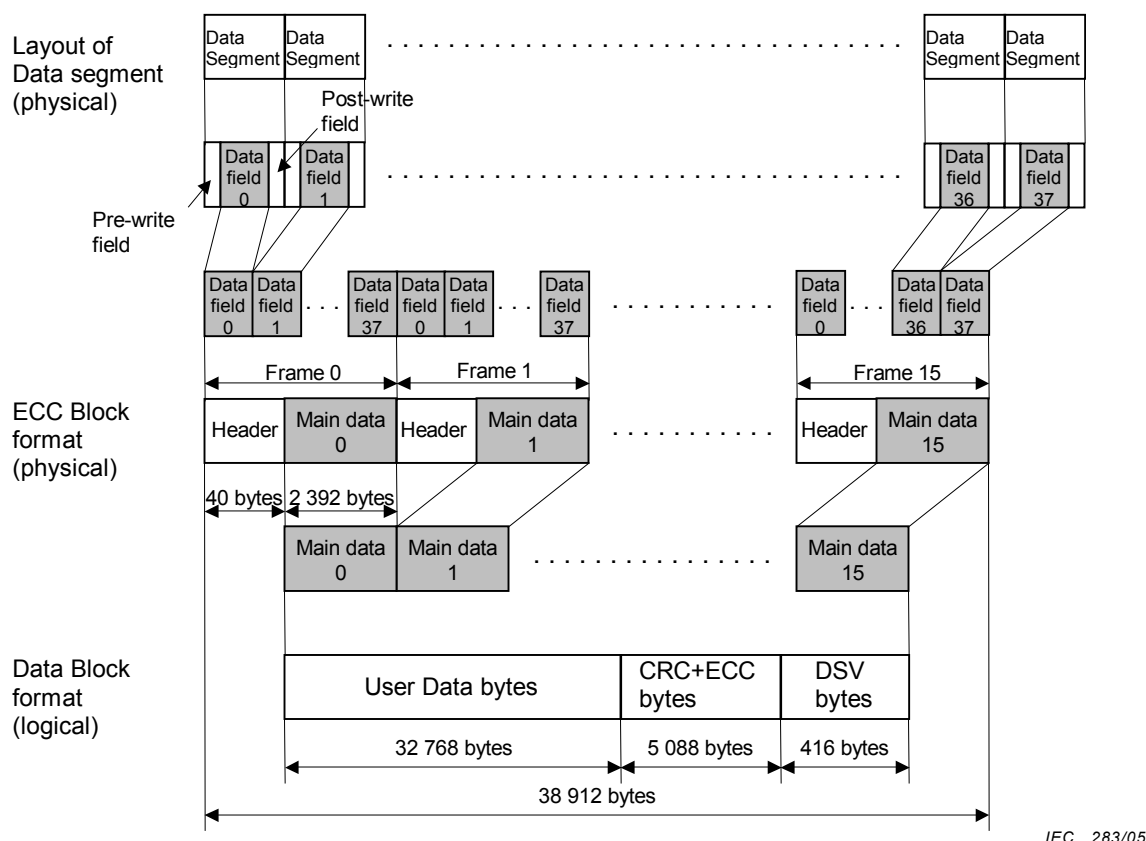
Table 4 – Nominal Address Data clock frequencies when the disc rotates at 50 Hz

Zone	f_{Ad} kHz
Lead-in Zone	
Outer Buffer Zone	5 532,80
Outer Control Zone	
Boundary tracks	5 532,80
Control tracks	5 532,80
Boundary tracks	5 532,80
Outer Test Zone	
for drives	5 532,80
for manufacturers	5 532,80
Data Zone	
Band 1	5 532,80
Band 2	5 359,90
Band 3	5 187,00
Band 4	5 014,10
Band 5	4 841,20
Band 6	4 668,30
Band 7	4 495,40
Band 8	4 322,50
Band 9	4 149,60
Band 10	3 976,70
Band 11	3 803,80
Band 12	3 630,90
Lead-out Zone	
Inner Test Zone	
for manufacturers	3 630,90
for drives	3 630,90
Inner Control Zone	
Boundary tracks	3 630,90
Control tracks	3 630,90
Boundary tracks	3 630,90
Inner Buffer Zone	3 630,90

10.4 ECC Block format

10.4.1 ECC Block layout

An ECC Block shall comprise 16 frames. Each block shall have a total length of 38 912 bytes and shall comprise several fields as shown in Figure 18.



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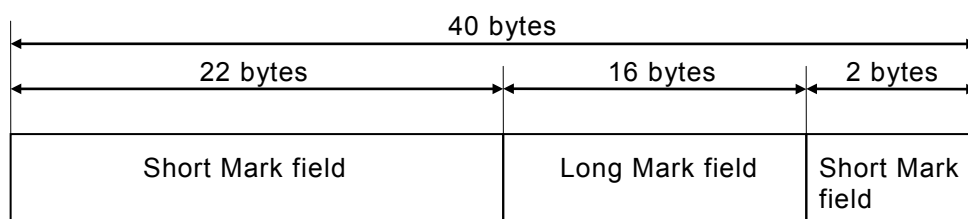
Figure 18 – ECC Block layout

10.4.2 Header

The Header shall start at the beginning of each frame. The length of each Header shall be equal to 40 bytes and it shall comprise three fields as shown in Figure 19.

The first 22 bytes and the last 2 bytes in the Header are the Short Mark fields. The Short Mark fields are used for phase compensation of the read data clock that is applied for data detection and optimising the read power level of the optical beam. Each field shall consist of 2T repeated data (11001100...).

The Long Mark field is used for the adjustment of reproduced signal gain and for optimising the read power level of the optical beam. The length of the field shall be equal to 16 bytes. The field shall consist of 8T repeated data (1111111100000000....).



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Figure 19 – Header**10.4.3 User data bytes**

The User data bytes are 32 768 bytes for recording user data.

10.4.4 CRC+ECC bytes

The Cyclic Redundancy Check and Error Correction Code bytes are used by the error detection and correction system to rectify erroneous data. The bytes shall be as specified in Annex F.

10.4.5 DSV bytes

See 10.5.

10.4.6 Sector number

Each 32kB ECC Block, which comprises 16 frames, shall be assigned 16 logical Sector numbers respectively. The first Sector number and last one on each band is shown in Table 8. The sectors shall be numbered consecutively onto whole groove track first in a Logical Zone.

Sector 0 shall be the 6th frame of track 49 on Band 1.

10.5 Recording code

The NRZI coding itself has no DC component suppressing capability. The NRZI Plus coding can suppress the low-frequency components of the channel bit stream by the DC component suppressing method which adds several redundant bits to the data stream and convolute them before NRZI modulating. These redundant bits shall be called DSV bytes.

The NRZI Plus coding is a method of converting n data words into $n + 1$ channel codewords. In this standard, the word size and data block size shall be decided as follows.

	4 bits (MSB first)
Data block size:	91 (words)
Kind of redundant bit:	0000 to 1111 (pure binary)

The NRZI Plus coding firstly converts a data block of 91 words into 16 types of a data block of 92 words.

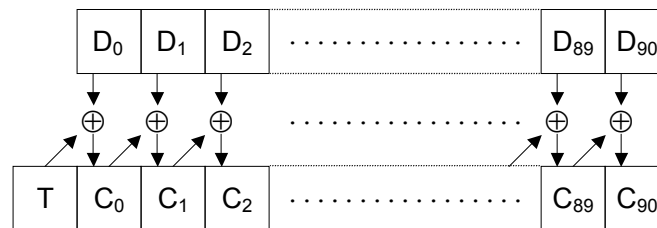
Secondly, the converted 16 type data blocks are coded by the NRZI coding.

Finally one data block having peak DSV (Digital Sum Variation) at the last word of the data block as close to 0 as possible is selected from NRZI-coded 16 type data blocks. This conversion shall be as specified in Figure 20 and 21.

Coding:

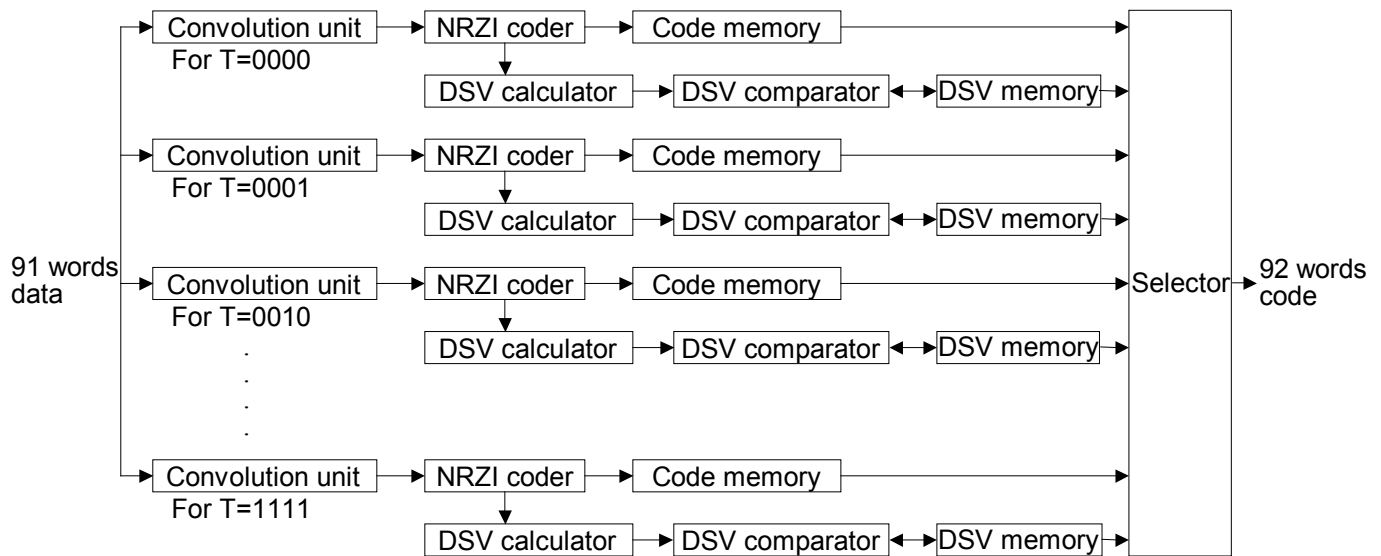
Decoding:

$$C_i = \begin{cases} D_i \oplus T & (i = 0) \\ D_i \oplus C_{i-1} & (i = 1, \dots, 90) \end{cases} \quad D_i = \begin{cases} C_i \oplus T & (i = 0) \\ C_i \oplus C_{i-1} & (i = 1, \dots, 90) \end{cases}$$



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Figure 20 – NRZI Plus convolution method



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Figure 21 – NRZI Plus convolution method

In this conversion, an initial value of memorized DSV shall be set to 0. If an absolute value of DSV, which is calculated by CDS whenever the convolution of data word and NRZI coding of convoluted data are performed on each type data block, is greater than the absolute value of the memorized DSV, the calculated DSV shall be memorized as the peak DSV of the data block.

NOTE CDS is a value summed from the beginning of the codeword to the end of the codeword. A bit "1" and "0" within a codeword is translated into 1 and –1 respectively.

At the convolution and NRZI coding of the last word data of 16 type data blocks, one data block which has minimum absolute value of the memorized DSV shall be chosen. The DSV at the end of the chosen data block shall be set the initial memorized DSV of the next data block conversion.

The bit sequence of 37 856 bytes data of the User data bytes, CRC bytes, and ECC bytes shall be recorded in NRZI Plus code. The data sequence is recorded in MSB first.

45,5 bytes data block: 832 times

Total length of DSV bytes: 416 bytes

In Figure 21, the NRZI coder shall be reset before each Main data is input to the NRZI Plus code, i.e. the NRZI pre-state for coding of Main data shall be set to 0.

10.6 Format of the Information Zone

10.6.1 General description of the Information Zone

The Information Zone contains all information on the disc relevant for data interchange. The information comprises wobbled data and, possibly, user-written data. This clause defines the layout of the information; the characteristics of the signals obtained from this information are specified in Clause 11.

10.6.2 Division of the Information Zone

The Information Zone is divided into three parts: a Lead-in Zone, a Data Zone, and a Lead-out Zone. The Data Zone is intended for recording of user data. The Lead-in and Lead-out Zones contain control information for the drive and zones for performing tests by the manufacturer or drive.

The division of the Information zone shall be as given in Table 5. The dimensions given in Table 5 are for reference only and are nominal locations. The tolerances are determined by the tolerance on the position of Control track as specified in 10.1.4.

Table 5 – Layout of the Information Zone

Zone	Nominal Radius Start-End (mm)	Band Number	Number of Tracks	Number of Frames	Track Number Start-End
Lead-in Zone					
Outer Buffer Zone	24,500 0 to 23,928 2	0	954	30	0 to 476
Outer Control Zone					
Boundary tracks	23,927 6 to 23,927 0	0	2	30	477 to 477
Control tracks	23,926 4 to 23,921 0	0	10	30	478 to 482
Boundary tracks	23,920 4 to 23,919 8	0	2	30	483 to 483
Outer Test Zone					
for drives	23,919 2 to 23,910 2	0	16	30	484 to 491
for manufacturers	23,909 6 to 23,900 6	0	16	30	492 to 499
Data Zone					
Band 1	23,900 0 to 23,591 0	1	516	30	0 to 257
Band 2	23,590 4 to 22,779 8	2	1 352	29	0 to 675
Band 3	22,779 2 to 21,983 0	3	1 328	28	0 to 663
Band 4	21,982 4 to 21,157 4	4	1 376	27	0 to 687
Band 5	21,156 8 to 20,347 4	5	1 350	26	0 to 674
Band 6	20,346 8 to 19,554 2	6	1 322	25	0 to 660
Band 7	19,553 6 to 18,728 6	7	1 376	24	0 to 687
Band 8	18,728 0 to 17,921 0	8	1 346	23	0 to 672
Band 9	17,920 4 to 17,132 6	9	1 314	22	0 to 656
Band 10	17,132 0 to 16,307 0	10	1 376	21	0 to 687
Band 11	16,306 4 to 15,501 8	11	1 342	20	0 to 670
Band 12	15,501 2 to 14,694 2	12	1 346	19	0 to 672

Table 5 (*continued*)

Zone	Nominal Radius Start-End (mm)	Band Number	Number of Tracks	Number of Frames	Track Number Start-End
Lead-out Zone					
Inner Test Zone					
for manufacturers	14,693 6 to 14,684 6	13	16	19	0 to 7
for drives	14,684 0 to 14,675 0	13	16	19	8 to 15
Inner Control Zone					
Boundary tracks	14,674 4 to 14,673 8	13	2	19	16 to 16
Control tracks	14,673 2 to 14,667 8	13	10	19	17 to 21
Boundary tracks	14,667 2 to 14,666 6	13	2	19	22 to 22
Inner Buffer Zone	14,666 0 to 14,000 6	13	1 110	19	23 to 577
NOTE The radii of a Zone given in the table refer to the nominal positions of the centres of the first and the last tracks of the Zone.					

10.6.3 Control Zones

There shall be an Outer Control Zone and an Inner Control Zone. They shall contain control information in the reserve area of frame information as specified in Annex G.

10.6.4 Test Zone

There shall be an Outer Test Zone and an Inner Test Zone. Each Test Zone shall comprise 32 tracks.

The Test Zone for drives are intended for tests to check write and read operations.

The Test Zone for manufacturers is intended for quality test by the media manufacturer.

10.6.5 Data Zone

The Recording fields of the Data Zone may be user-written in the format specified in 10.3. The layout of the Data Zone is specified in 10.7.

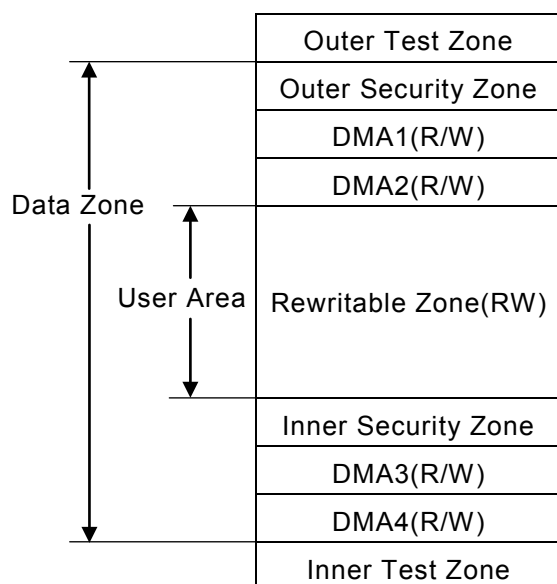
The Data Zone shall be divided into 12 Bands numbered from 1 to 12. Each Band shall consist of the number of tracks specified in Table 5.

In addition, the Data Zone shall be partitioned into 177 groups as specified in 10.7.5.

10.7 Format of the Data Zone

10.7.1 General description of the Data Zone

The Data Zone shall contain four Defect Management Areas (DMAs) and two security areas. Two DMAs and a security area exist at the beginning of the Zone and another half exists at the end of the Zone. The area between these areas is called the User Area (see Figure 22).



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Figure 22 – Layout of the Data Zone and Test Zones**10.7.2 Security Zones**

The two Security Zones comprise Security Area I and Security Area II. This zone is available when bit 2 of Byte 4 in the Control Zone is set to 1 as described in Annex G.

10.7.3 Defect Management Areas (DMAs)

The four Defect Management Areas contain information on the structure of the Data Zone and on defect management. The length of each DMA shall be 4 ECC Blocks. Two of the DMAs, DMA1 and DMA2, shall be located near the outer diameter of the disc; two others, DMA3 and DMA4, shall be located near the inner diameter of the disc. Table 6 indicates the boundaries of the DMAs as one of the examples.

Table 6 – Locations of the DMAs

	Band	Start Address		End Address		Number of ECC Blocks	Number of Frames
		Track	Frame	Track	Frame		
DMA1	1	45Groove	24	47Groove	27	4	64
DMA2		45Land	24	47Land	27	4	64
DMA3	12	664Groove	14	668Groove	1	4	64
DMA4		664Land	14	668Land	1	4	64

(Each DMA shall contain a Disc Definition Structure (DDS), a Primary Defect List (PDL), and a Secondary Defect List SDL). The contents of the four PDLs shall be identical and the contents of the four SDLs shall be identical.

After initialization of the disc, each DMA shall have the following content.

The first DMA frame shall contain DDS.

The second DMA frame shall be the first frame of the PDL.

The SDL shall be located in the second ECC block of the DMA.

The lengths of the PDL and SDL are determined by the number of entries in each.

The content of the DMA sectors following the SDL is not specified and shall be ignored in interchange.

The contents of the DDS are specified in 10.7.4; those of the PDL and SDL are specified in 10.8.6 and 10.8.7.

10.7.4 Disc Definition Structure (DDS)

The DDS shall consist of a table with a length of one sector. It specifies the condition of certification, number of bands and so on. The DDS shall be recorded in the first sector of each DMA at the end of initialization of the disc.

The information given in Table 7 on the disc structure shall be recorded in each of the four DDSs.

Table 7 – Byte assignment of the Disc Definition Structure (DDS)

BP	Description	Content
0	DDS Identifier	0x0A
1	DDS Identifier	0x0A
2-3	Reserved	0x00
4	Number of Band (MSB)	0x00
5	Number of Band (LSB)	0x0C
6	Number of Logical Zone (MSB)	0x00
7	Number of Logical Zone (LSB)	0xB1
8-31	Reserved	0x00
32	Certification condition of Band 1	–
33	Certification condition of Band 2	–
34	Certification condition of Band 3	–
35	Certification condition of Band 4	–
36	Certification condition of Band 5	–
37	Certification condition of Band 6	–
38	Certification condition of Band 7	–
39	Certification condition of Band 8	–
40	Certification condition of Band 9	–
41	Certification condition of Band10	–
42	Certification condition of Band11	–
43	Certification condition of Band12	–
44-255	Reserved	0x00
256	Certification condition of LZ0	–
:	Certification condition of LZ1	–
:	Certification condition of LZ175	–
432	Certification condition of LZ176	–
433-2047	Reserved	0x00
2048-32767	PDL	–
32768-131072	SDL	–