
**Information technology — Data
Interchange on 130 mm Rewritable and
Write Once Read Many Ultra Density
Optical (UDO) Disk Cartridges —
Capacity: 30 Gbytes per Cartridge — First
Generation**

*Technologies de l'information — Échange de données sur cartouches
de disques de 130 mm de diamètre, pour réécriture et pour "write once
read many", de densité ultra-optique (UDO) — Capacité: 30 Go par
cartouche — Première génération*



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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 17345 was prepared by Ecma TC 31 (as ECMA-350) 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.

This second edition cancels and replaces the first edition (ISO/IEC 17345:2005), which has been technically revised.

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 JTC 1/SC 23 toward the development of International Standards for optical disks with a diameter of 80 mm, 90 mm, 120 mm, 130 mm, 300 mm and 356 mm. 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. The following International Standards for 130 mm disks have been published by Ecma and adopted by ISO/IEC JTC 1: ISO/IEC 11560:1992, ISO/IEC 13481:1993, ISO/IEC 13549:1993, ISO/IEC 13842:1995, ISO/IEC 15486:1998, ISO/IEC 18093:1999, ISO/IEC 22092:2002.

This International Standard specifies two types of double-sided ODCs — Rewritable (Type RW) and Write Once Read Many (Type WORM), both using thermo-optical Phase Change effects.

Information technology — Data Interchange on 130 mm Rewritable and Write Once Read Many Ultra Density Optical (UDO) Disk Cartridges — Capacity: 30 Gbytes per Cartridge — First Generation

Section 1 — General

1 Scope

This International Standard specifies the mechanical, physical, and optical characteristics of a 130 mm optical disk cartridge (ODC) that employs thermo-optical Phase Change effects to enable data interchange between such disks.

This International Standard specifies two types:

- Type RW (Rewritable) provides for data to be written read and erased many times over the recording surfaces of the disk.
- Type WORM (Write Once Read Many) provides for data once written to be read a multiplicity of times. This type uses a Write Once Read Many times recording material (written marks cannot be erased and attempted modifications of the written marks are detectable). Multisession (incremental write operations) recording may be performed on Type WORM disks.

The disk is two-sided with a nominal capacity of 15,0 Gbytes per side and the cartridge (two sides) provides a nominal capacity of 30,0 Gbytes.

This International Standard specifies:

- the conditions for conformance testing and the Reference Drive;
- the environments in which the cartridges are to be operated and stored;
- the mechanical, physical and dimensional characteristics of the cartridge so as to provide mechanical interchangeability between data processing systems;
- the format of the information on the disk, both embossed and user-written, including the physical disposition of the tracks and sectors, the error correction codes, the modulation methods used;
- the characteristics of the embossed information on the disk;
- the thermo-optical characteristics of the disk, enabling processing systems to write data onto the disk; and
- the minimum quality of user-written data on the disk, enabling data processing systems to read data from the disk.

This International Standard provides for interchange between optical disk drives. Together with a standard for volume and file structure, it provides for full data interchange between data processing systems.

2 Conformance

2.1 Optical disk

An ODC shall be in conformance with this International Standard if it meets all mandatory requirements specified therein.

A claim of conformance with this International Standard shall specify the Type, RW, WORM, implemented.

2.2 Generating system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported. A system generating an ODC for interchange shall be in conformance with this International Standard if it meets the mandatory requirements of this International Standard for the Type(s) supported.

2.3 Receiving system

A claim of conformance with this International Standard shall specify which Type(s) is (are) supported.

A system receiving an ODC for interchange shall be in conformance with this International Standard if it is able to process any recording made on the cartridge according to 2.1 on the Type(s) specified.

2.4 Compatibility statement

A claim of conformance with this International Standard shall include a statement listing any other Optical Disk Cartridge Standard supported by the system for which conformance is claimed. This statement shall specify the number of the Standard(s), including, where appropriate, the ODC Type(s), 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.

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

4 Terms and definitions

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

**4.1
asymmetry**
deviation between the centre levels of signals generated by two distinct repeating mark and space length patterns

**4.2
band**
annular area on the disk having a constant clock frequency

**4.3
case**
housing for an optical disk that protects the disk and facilitates disk interchange

4.4**Case Reference Plane**

plane defined for each side of the case, to which the dimensions of the case are referred

4.5**channel bit**

elements by which, after modulation, the binary values ZERO and ONE are represented by marks and spaces on the disk

4.6**clamping zone**

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

4.7**cover layer**

transparent layer of the disk through which the optical beam accesses the recording layer

4.8**Cyclic Redundancy Code****CRC**

method for detecting errors in data

4.9**data field**

subdivision of a sector intended for the recording of user data

4.10**Defect Management**

method for handling the defective areas on the disk

4.11**Disk Reference Plane**

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

4.12**entrance surface**

surface of the disk onto which the optical beam first impinges

4.13**Error Correction Code****ECC**

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

4.14**field**

subdivision of a sector

4.15**format**

arrangement or layout of information on the disk

NOTE The annular area on the disk bearing the format is the formatted zone.

4.16**hub**

central feature on the disk, which interacts with the spindle of the disk drive to provide radial centring and the clamping force

4.17

interleaving

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

4.18

land and groove

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

NOTE The land is located nearer to the entrance surface than the groove with which it is paired to form a Physical Track. Recording is performed on both the land and groove.

4.19

mark

feature of the recording layer which takes the form of a pit, change in the reflectivity, or any other type or form that can be sensed by the optical system

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

4.20

Mirror Area

area in which there is no embossed information, neither preformatted headers or grooves

4.21

optical disk

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

4.22

optical disk cartridge

ODC

device consisting of a case containing an optical disk

4.23

Phase Change

physical effect by which the area of a recording layer irradiated by a laser beam is heated so as to change from an amorphous state to a crystalline state and vice versa

4.24

Physical Block Address

PBA

numbering system of the data sectors defined to constitute a uniquely addressable sector location to the recording system

4.25

Physical Track

one revolution (360°) of adjacent groove-land pair

4.26

read power

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

4.27

recording layer

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

NOTE The recording layer may actually consist of a multiple layer stack of different materials or composite materials.

4.28**Recording Track**

one revolution (360°) of either a land feature or groove feature of the disk (Land Recording Track or Groove Recording Track) where recording may be performed

4.29**Reed-Solomon code**

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

4.30**sector**

smallest addressable part of a track in the formatted area of the disk

4.31**space**

area between marks along the track

4.32**spindle**

part of the disk drive which contacts the disk and/or hub

4.33**substrate**

layer of the disk provided for mechanical support of the recording layer

4.34**track**

path which is followed by the focus of the optical beam during exactly one revolution of the disk

4.35**track pitch**

distance between Land Recording Track centrelines and adjacent Groove Recording Track centrelines, measured in the radial direction

4.36**User Area**

area of the disk intended for the recording of user data

4.37**wobble**

periodic radial deviation of the track (groove or land) from the average centreline that is used as a supplemental timing signal

4.38**write-inhibit hole**

hole in the case which, when detected by the drive to be open, inhibits write operations

4.39**zone**

annular area of the disk

5 Conventions and notations

5.1 Representation of numbers

A measured value is 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 1,275.

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.

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

In each field the data is recorded so that the most significant byte (MSB), identified as Byte 0, is 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 $b_{(8n-1)}$ is recorded first.

A binary digit which can be set indifferently to ZERO or to ONE is represented by "x".

5.2 Names

The names of entities, e.g. specific tracks, fields, areas, zones, etc. are given a capital initial.

6 Acronyms

AM	Address Mark
CRC	Cyclic Redundancy Code
DDS	Disk Definition Structure
DIR	Drive Information Record
DMA	Defect Management Area
ECC	Error Correction Code
ESISIC	Enhanced Selective Inter-Symbol Interference Cancellation
ID	Identifier
LBA	Logical Block Address
LSB	Least Significant Byte
lsb	least significant bit
MSB	Most Significant Byte
msb	most significant bit
NA	Numerical Aperture
NBSNR	Narrow-Band Signal-to-Noise Ratio
NRZ	Non Return to Zero
ODC	Optical Disk Cartridge

PA	Postamble
PBA	Physical Block Address
PDL	Primary Defect List
PLL	Phase Locked Loop
PSA	Primary Spares Area
QWM	Quadrature Wobble Marks
QWMG	Quadrature Wobble Marks on Groove
QWML	Quadrature Wobble Marks on Land
RESYNC	Re-synchronization
RFO	Read Focus Offset
RLL	Run-Length Limited (code)
RW	Rewritable
SCSI	Small Computer System Interface
SDI	Specific Disk Information
SDL	Secondary Defect List
SPS	Start Position Shift
SSA	Secondary Spares Area
STOB	Six Time Oversampled Bi-Phase
SYNC	Synchronization
TA	Transition Area
TIA	Time Interval Analyzer
UDO	Ultra Density Optical (disk)
VAP	Verify and Protect
VFO	Variable Frequency Oscillator
WORM	Write Once Read Many
ZCAV	Zoned Constant Angular Velocity

7 General description

The optical disk cartridge, which is the subject of this International Standard, consists of a case containing an optical disk.

The case is a protective enclosure for the disk. It has access windows covered by two shutters. One of the windows is automatically uncovered by the drive when the cartridge is inserted into it.

The optical disk is made from two sides that are assembled together. Each side consists of a Phase Change recording layer placed between the substrate and the cover layer. The substrates of each side are bonded together.

The optical disk is recordable on both sides. Data can be written onto the disk as marks with Phase Change characteristics variations in the recording layer, using a focused optical beam. Data can be read by the optical beam using the change in reflectivity and diffraction between mark and space in the recording layer. The beam accesses the recording layer through the transparent cover layer of the disk.

Part of the disk contains read-only data in the form of pre-embossed pits. This data can be read using the diffraction of the optical beam by the embossed pits.

8 General requirement

8.1 Environments

8.1.1 Test environment

The test environment is the environment where the air immediately surrounding the optical disk cartridge has the following properties:

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

No condensation on or in the optical disk cartridge shall occur. Before testing, the optical disk cartridge shall be conditioned to this environment for 48 hours minimum. It is recommended that, before testing, the entrance surface of the disk 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.

8.1.2 Operating environment

This International Standard requires that an optical disk cartridge, which meets all requirements of this International Standard in the specified test environment, provides interchange over the specified ranges of environmental parameters in the operating environment.

The operating environment is the environment where air immediately surrounding the optical disk cartridge has the following properties:

Temperature :	5 °C to 55 °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 max.
Relative humidity gradient :	10 %/h max.
Air cleanliness :	Office environment (see Annex S)

No condensation on or in the optical disk cartridge shall occur. If an optical disk cartridge has been exposed to conditions outside those specified in this Clause, it shall be acclimatized in an allowed operating environment for at least 2 hours before use (see also Annex T).

8.1.3 Storage environment

The optical disk cartridge without any protective enclosure shall not be stored in an environment outside the range allowed for storage. The storage environment is defined as an environment where the air immediately surrounding the optical disk cartridge has the following properties:

Temperature :	-10 °C to 55 °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 max.

Relative humidity gradient : 10 %/h max.

Air cleanliness : Office environment (see Annex S)

No condensation on or in the optical disk cartridge shall occur.

8.1.4 Transportation

This International Standard does not specify requirements for transportation. Guidance for transportation is given in Annex U.

8.2 Temperature shock

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

8.3 Safety requirements

The cartridge shall satisfy the safety requirements of Standard ECMA-287, when used in the intended manner or in any foreseeable use in an information processing system.

8.4 Flammability

The cartridge and its components shall be made from materials that comply with the flammability class for HB materials, or better, as specified in Standard ECMA-287.

9 Reference Drive

The Reference Drive is a drive several critical components of which have well defined properties and which is used to test the read, write, and erase parameters of the disk for conformance to this International Standard. This section gives an outline of all components; components critical for tests in specific sections are specified in those sections.

9.1 Optical system

The basic set-up of the optical system of the Reference Drive used for measuring the write, read and erase 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 disk is minimized so as not to influence the accuracy of the measurements.

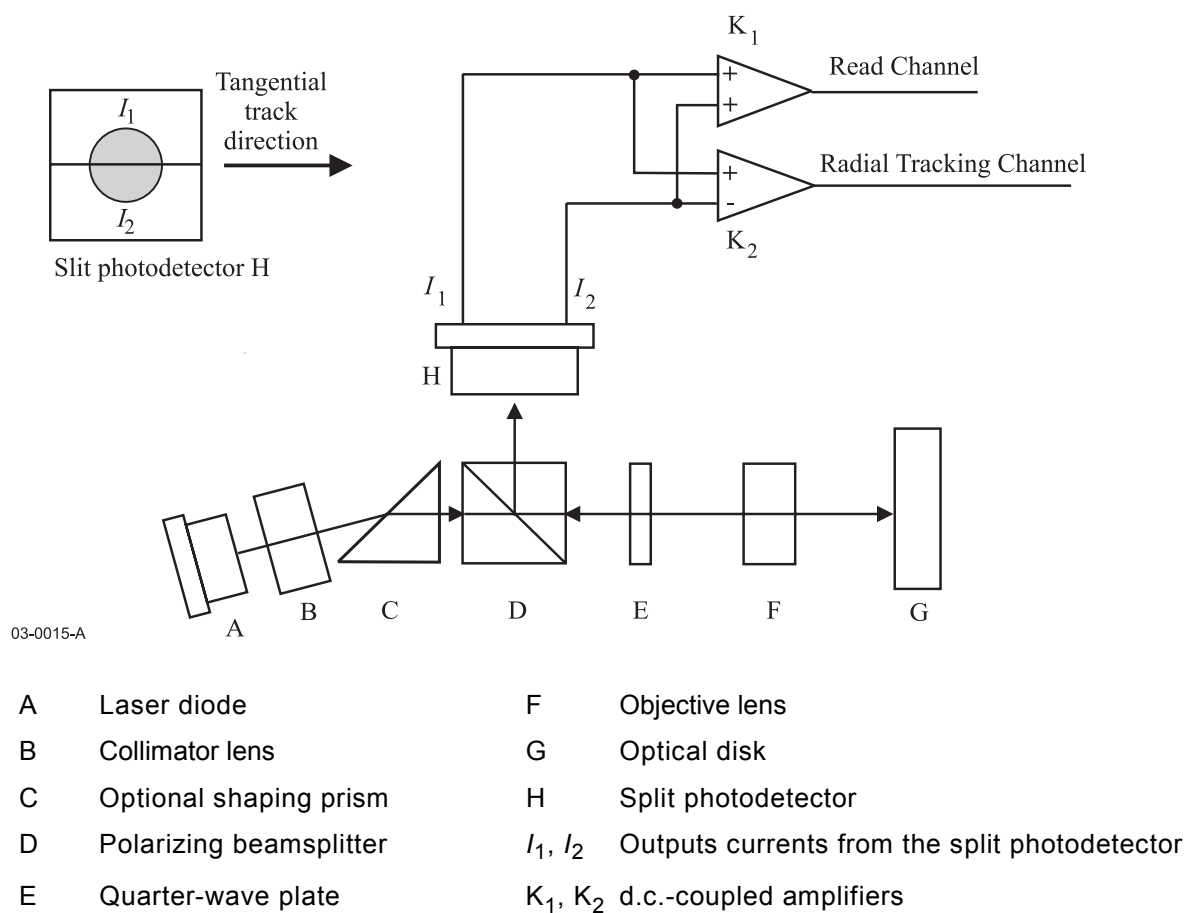


Figure 1 — Optical system of the Reference Drive

The combination of the polarizing beamsplitter D and quarter-wave plate E separates the incident optical beam and the beam reflected from the optical disk G. The polarizing beamsplitter D shall have a p-s intensity reflectance ratio of at least 90.

9.2 Optical beam

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

Wavelength (λ)	405 nm to 410 nm
Polarization	Circular
Numerical aperture	$0,70 \pm 0,01$
Light intensity at the rim of the pupil of the objective lens level	50 % to 60 % of the maximum intensity
Wave front aberration after passing through an ideal cover layer of the disk (Thickness: 0,1 mm and index of refraction: 1,55)	$0,033 \lambda$ rms max.
Relative intensity noise (RIN) $10 \log [(a.c. \text{ light power density/Hz})/d.c. \text{ light power}]$	- 130 dB/Hz max.

9.3 Read Channel

The Read Channel shall be used for reading embossed and written marks, using the changes in diffraction and reflectivity produced by the marks.

The Read Channel shall detect the total amount of light in the exit pupil of the objective lens.

The amplifier K_1 after the photodetector shall be d.c.-coupled and have a flat response within 1 dB from d.c. to 60 MHz.

9.4 Tracking

The method of generating the axial tracking error is not specified for the Reference Drive.

The radial tracking error is generated in the Radial Tracking Channel from the output currents of a split photodiode detector, the division of which runs parallel to the image of the tracks on the diode (see figure 1).

The radial tracking error signal relates to the difference in the amount of light in the two halves of the exit pupil of the objective lens.

The amplifier K_2 after the photodetector shall be d.c.-coupled with the bandwidth characteristics specified in clause 21.

The requirements for the accuracy with which the focus of the optical beam must follow the tracks is specified in 20.2.4.

9.5 Rotation of the disk

The spindle shall position the disk as specified in 12.4. It shall rotate the disk at $32,5 \text{ Hz} \pm 0,25 \%$ for Type RW and $35,0 \text{ Hz} \pm 0,25 \%$ for Type WORM. The direction of rotation of the disk side being tested shall be counter-clockwise when viewed from the objective lens.

Section 2 — Mechanical and physical characteristics

10 Dimensional and physical characteristics of the case

10.1 General description of the case

The case (see figure 2) is a rigid protective container of rectangular shape. It has windows on both side A and side B to allow the spindle of the drive to clamp the disk by its hub and to allow the head to access the disk. The A- or B-shutter uncovers the window upon insertion into the drive, and automatically covers it upon removal from the drive. The case has media identification, write-inhibit, mis-insertion features, detent for autoloading, gripper slots for an autochanger, label areas, and side identification inscriptions.

10.2 Relationship of Sides A and B

The features essential for physical interchangeability are represented in figure 2. When Side A of the cartridge faces upwards, Side A of the disk faces downwards. Sides A and B of the case are identical as far as the features given here are concerned. The description is given for one side only. References to Sides A and B can be changed to B or A respectively.

10.3 Reference axes and case reference planes

There is a Case Reference Plane P for each side of the case. Each Case Reference Plane P contains two orthogonal axes X and Y to which the dimensions of the case are referred. The intersection of the X and Y axes defines the centre of the location hole. The X axis extends through the centre of the alignment hole.

10.4 Case drawings

The case is represented schematically by the following drawings.

Figure 2 shows a composite drawing of Side A of the case in isometric form, with the major features identified from Side A.

Figure 3 shows the envelope of the case with respect to a location hole at the intersection of the X and Y axes of Case Reference Plane P.

Figure 4 shows the surfaces S1, S2, S3 and S4 which establish the Case Reference Plane P.

Figure 4a shows the details of surface S3.

Figure 5 shows the details of the insertion slot and detent.

Figure 6 shows the gripper slots, used for automatic handling.

Figure 7 shows the write-inhibit holes.

Figure 8 shows the media identification sensor holes.

Figure 9 shows the head and motor window.

Figure 10 shows the shutter opening features.

Figures 11a and 11b show the user label areas.

10.5 Dimensions of the case

10.5.1 Overall dimensions

The total length of the case (see figure 3) shall be

$$L_1 = 153,0 \text{ mm} \pm 0,4 \text{ mm}$$

The distance from the top of the case to the reference axis X shall be

$$L_2 = 127,0 \text{ mm} \pm 0,3 \text{ mm}$$

The distance from the bottom of the case to the reference axis X shall be

$$L_3 = 26,0 \text{ mm} \pm 0,3 \text{ mm}$$

The total width of the case shall be

$$L_4 = 135,0 \text{ mm} \begin{array}{l} + 0,0 \text{ mm} \\ - 0,6 \text{ mm} \end{array}$$

The distance from the left-hand side of the cartridge to the reference axis Y shall be

$$L_5 = 128,5 \text{ mm} \begin{array}{l} + 0,0 \text{ mm} \\ - 0,5 \text{ mm} \end{array}$$

The distance from the right-hand side of the cartridge to the reference axis Y shall be

$$L_6 = 6,5 \text{ mm} \pm 0,2 \text{ mm}$$

The width shall be reduced on the top by the radius

$$R_1 = L_4$$

originating from a point defined by L_5 and

$$L_7 = 101,0 \text{ mm} \pm 0,3 \text{ mm}$$

The two corners of the top shall be rounded with a radius

$$R_2 = 1,5 \text{ mm} \pm 0,5 \text{ mm}$$

and the two corners at the bottom with a radius

$$R_3 = 3,0 \text{ mm} \pm 1,0 \text{ mm}$$

The thickness of the case shall be

$$L_8 = 11,00 \text{ mm} \pm 0,30 \text{ mm}$$

The eight long edges of the case shall be rounded with a radius

$$R_4 = 1,0 \text{ mm max.}$$

10.5.2 Location hole

The centre of the location hole (see figure 3) shall coincide with the intersection of the reference axes X and Y. It shall have a square form with a side length of

$$L_9 = 4,10 \text{ mm} \begin{array}{l} + 0,00 \text{ mm} \\ - 0,06 \text{ mm} \end{array}$$

held to a depth of

$$L_{10} = 2,35 \text{ mm (i.e. typical wall thickness)}$$

after which a cavity extends through to the alignment hole on the opposite side of the case.

The lead-in edges shall be rounded with a radius

$$R_5 = 0,5 \text{ mm max.}$$

10.5.3 Alignment hole

The centre of the alignment hole (see figure 3) shall lie on reference axis X at a distance of

$$L_{11} = 122,0 \text{ mm} \pm 0,2 \text{ mm}$$

from the reference axis Y.

The dimensions of the hole shall be

$$L_{12} = 4,10 \text{ mm} \begin{array}{l} + 0,00 \text{ mm} \\ - 0,06 \text{ mm} \end{array}$$

and

$$L_{13} = 5,0 \text{ mm} \begin{array}{l} + 0,2 \text{ mm} \\ - 0,0 \text{ mm} \end{array}$$

held to a depth of L_{10} , after which a cavity extends through to the location hole on the opposite side of the case.

The lead-in edges shall be rounded with radius R_5 .

10.5.4 Surfaces on Case Reference Planes P

The Case Reference Plane P (see figures 4 and 4a) for a side of the case shall contain four surfaces (S1, S2, S3 and S4) on that side of the case, specified as follows:

Two circular surfaces S1 and S2.

Surface S1 shall be a circular area centred around the square location hole and have a diameter of

$$D_1 = 9,0 \text{ mm min.}$$

Surface S2 shall be a circular area centred around the rectangular alignment hole and have a diameter of

$$D_2 = 9,0 \text{ mm min.}$$

Two elongated surfaces S3 and S4, that follow the contour of the cartridge and shutter edges.

Surfaces S3 and S4 are shaped symmetrically.

Surface S3 shall be defined by two circular sections with radii

$$R_6 = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

with an origin given by

$$L_{14} = 4,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{15} = 86,0 \text{ mm} \pm 0,3 \text{ mm}$$

and

$$R_7 = 1,5 \text{ mm} \pm 0,1 \text{ mm}$$

with an origin given by

$$L_{16} = 1,9 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{17} = 124,5 \text{ mm} \pm 0,3 \text{ mm}$$

The arc with radius R_7 shall continue on the right hand side with radius

$$R_8 = 134,0 \text{ mm} \begin{array}{l} + 0,2 \text{ mm} \\ - 0,7 \text{ mm} \end{array}$$

which is a dimension resulting from $L_5 + L_{14} + R_6$ with an origin given by L_5 and L_7 . A straight, vertical line shall smoothly join the arc of R_6 to the arc of R_8 .

The left-hand side of S3 shall be bounded by radius

$$R_9 = 4,5 \text{ mm} \pm 0,3 \text{ mm}$$

which is a dimension resulting from $L_{18} + L_{14} - R_6$ with an origin given by

$$L_{18} = 2,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{19} = 115,5 \text{ mm} \pm 0,3 \text{ mm}$$

The left-hand side of the boundary shall be closed by two straight lines. The first one shall smoothly join the arc of R_6 to the arc of R_9 . The second one shall run from the left-hand tangent of R_7 to its intersection with R_9 .

10.5.5 Insertion slots and detent features

The case shall have two symmetrical insertion slots with embedded detent features (see figure 5). The slots shall have a length of

$$L_{20} = 35,0 \text{ mm} \pm 0,3 \text{ mm}$$

a width of

$$L_{21} = 6,0 \text{ mm} \begin{array}{l} + 0,3 \text{ mm} \\ - 0,0 \text{ mm} \end{array}$$

and a depth of

$$L_{22} = 3,0 \text{ mm} \pm 0,1 \text{ mm}$$

located

$$L_{23} = 2,5 \text{ mm} \pm 0,2 \text{ mm}$$

from Case Reference Plane P.

The slots shall have a lead-in chamfer given by

$$L_{24} = 0,5 \text{ mm max.}$$

$$L_{25} = 5,0 \text{ mm max.}$$

The detent notch shall be a semi-circle of radius

$$R_{10} = 3,0 \text{ mm} \pm 0,2 \text{ mm}$$

with the origin given by

$$L_{26} = 13,0 \text{ mm} \pm 0,3 \text{ mm}$$

$$L_{27} = 2,0 \text{ mm} \pm 0,1 \text{ mm}$$

$$L_{28} = 114,0 \text{ mm} \pm 0,3 \text{ mm}$$

The dimensions L_2 , L_{26} , and L_{28} are interrelated, their values shall be such so that they are all three within specification.

10.5.6 Gripper slots

The case shall have two symmetrical gripper slots (see figure 6) with a depth of

$$L_{29} = 5,0 \text{ mm} \pm 0,3 \text{ mm}$$

from the edge of the case and a width of

$$L_{30} = 6,0 \text{ mm} \pm 0,3 \text{ mm}$$

The upper edge of a slot shall be

$$L_{31} = 12,0 \text{ mm} \pm 0,3 \text{ mm}$$

above the bottom of the case.

10.5.7 Write-inhibit holes

Sides A and B shall each have a write-inhibit hole (see figure 7). The case shall include a device for opening and closing each hole. The hole at the left-hand side of Side A of the case, is the write-inhibit hole for Side A of the disk. The protected side of the disk shall be made clear by inscriptions on the case or by the fact that the device for Side A of the disk can only be operated from Side A of the case.

When writing and erasing on Side A of the disk is not allowed, the write-inhibit hole shall be open all through the case. It shall have a diameter

$$D_3 = 4,0 \text{ mm min.}$$

Its centre shall be specified by

$$L_{32} = 8,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{33} = 111,0 \text{ mm} \pm 0,3 \text{ mm}$$

on Side A of the case.

When writing is allowed on Side A of the disk, the write-inhibit hole shall be closed on Side A of the case, at a depth of typically L_{10} , i.e. the wall thickness of the case. In this state, the opposite side of the same hole, at Side B of the case, shall be closed and not recessed from the Case Reference Plane P of Side B of the case by more than

$$L_{34} = 0,3 \text{ mm max.}$$

The opposite side of the write-inhibit hole for protecting Side B of the disk shall have a diameter D_3 . Its centre shall be specified by L_{32} and

$$L_{35} = 11,0 \text{ mm} \pm 0,2 \text{ mm}$$

on Side A of the case.

10.5.8 Media identification sensor holes

There shall be two sets of two media sensor holes (see figure 8). The holes shall extend through the case, and have a diameter of

$$D_4 = 4,0 \text{ mm} \begin{matrix} + 0,3 \text{ mm} \\ - 0,0 \text{ mm} \end{matrix}$$

the positions of their centres shall be specified by L_{33} , L_{35} and

$$L_{36} = 19,5 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{37} = 17,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{38} = 105,0 \text{ mm} \pm 0,3 \text{ mm}$$

A hole is deemed to be open when there is no obstruction in this hole over a diameter D_4 all through the case.

A hole is deemed to be closed, when the hole is closed on both Side A and Side B of the case. The closure shall be recessed from Case Reference plane P by

$$L_{39} = 0,3 \text{ mm max.}$$

The holes closest to the long edges of the case are numbered 1. The other holes are numbered 2. The meaning of the status (closed, open) of each hole shall be as in table 1.

Table 1 — Media identification sensor holes

Sensor Hole No.	Indication	Closed	Open
1	Media Type	WORM	RW
2	Future use*	Yes	No

* This hole shall be closed in cartridges conforming to this International Standard.

10.5.9 Head and motor window

The case shall have a window on each side to enable the optical head and the motor spindle to access the disk (see figure 9). The dimensions are referenced to a centreline, located at a distance of

$$L_{40} = 61,0 \text{ mm} \pm 0,2 \text{ mm}$$

to the left of reference axis Y.

The width of the head access shall be defined by

$$L_{41} = 17,50 \text{ mm min.}$$

$$L_{42} = 17,50 \text{ mm min.}$$

and its height shall extend to

$$L_{43} = 118,2 \text{ mm min.}$$

The two inside corners shall be rounded with a radius of

$$R_{11} = 3,0 \text{ mm max.}$$

The motor spindle access shall have a diameter of

$$D_5 = 35,0 \text{ mm min.}$$

and its centre shall be defined by L_{40} and

$$L_{44} = 43,0 \text{ mm} \pm 0,2 \text{ mm}$$

10.5.10 Shutters

The case shall have two spring-loaded, unidirectional shutters (see figure 10), designed to completely cover the head and motor windows when closed. A shutter movement of 36,5 mm shall be sufficient to ensure that the head and motor window is opened to the minimum size specified in 10.5.9. The shutter shall be free to slide in a recessed area of the case in such a way as to ensure that the overall thickness of the case and shutter shall not exceed L_8 .

The top surface of the shutters shall be at

$$L_{45} = 126,7 \text{ mm} \pm 0,3 \text{ mm}$$

10.5.11 Slots for shutter opener

Both Side A and Side B shutter shall have only one slot (see figure 10) in which the shutter opener of the drive can engage to open the shutter. The slot shall be dimensioned as follows:

When the shutter is closed, the centre of the slot used to push the shutter open shall be located at a distance of

$$L_{46} = 55,0 \text{ mm} \pm 0,5 \text{ mm}$$

from reference axis Y on either side the case.

The length of the slot shall be

$$L_{47} = 7,0 \text{ mm} \pm 0,1 \text{ mm}$$

The depth of the slot shall be

$$L_{48} = 3,5 \text{ mm} \pm 0,5 \text{ mm}$$

The width of each slot from the Case Reference Plane P of Side A and B of the case shall be

$$L_{49} = 4,5 \text{ mm} \begin{array}{l} + 0,5 \text{ mm} \\ - 0,0 \text{ mm} \end{array}$$

10.5.12 Slots to prevent insertion into a MO-drive

The case shall have two non-moveable slots (see Figure 10) designed to prevent from insertion into MO-drives using cartridges conforming to ISO/IEC 22092 (or into drives using similar cartridge designs as specified in ISO/IEC 18093, ISO/IEC 15486, ISO/IEC 13842, ISO/IEC 13549, ISO/IEC 13481, and ISO/IEC 11560). These two non-moveable slots have no function when the case is inserted into a drive designed to receive cartridges conforming to this International Standard.

The edge designed to engage with the shutter opening arm of such MO-drives and so prevent further insertion, shall be located at a distance of

$$L_{50} = 36,5 \text{ mm} \pm 0,2 \text{ mm}$$

from reference axis Y on either side the case.

The length of the slot shall be

$$L_{51} = 4,5 \text{ mm} \pm 0,5 \text{ mm}$$

and the angle of the lead-out ramp shall be

$$A_1 = 60,0^\circ \pm 1,0^\circ$$

The depth of the slot shall be

$$L_{52} = 4,0 \text{ mm} \pm 0,5 \text{ mm}$$

With both side A and side B shutter closed the width of each slot shall be the full width of the case L_8 .

10.5.13 User label areas

The case shall have the following minimum areas for user labels (see figure 11a):

on Side A and Side B: 33,5 mm x 70,5 mm

on the bottom side: 7,0 mm x 115,0 mm

These areas shall be recessed by 0,2 mm min. Their positions are specified by the following dimensions and relations between dimensions.

$$L_{53} = 29,0 \text{ mm min.}$$

$$L_{54} - L_{53} = 70,5 \text{ mm min.}$$

$$L_{56} - L_{55} = 33,5 \text{ mm min.}$$

$$L_8 - L_{59} - L_{60} = 7,0 \text{ mm min.}$$

$$L_4 - L_{57} - L_{58} = 115,0 \text{ mm min.}$$

10.6 Mechanical characteristics

All requirements of this clause shall be met in the operating environment.

10.6.1 Materials

The case shall be constructed from any suitable materials such that it meets the requirements of this International Standard.

10.6.2 Mass

The mass of the case without the optical disk shall not exceed 150 g.

10.6.3 Edge distortion

The cartridge shall meet the requirement of the edge distortion test defined in Annex B.

10.6.4 Compliance

The cartridge shall meet the requirement of the compliance (flexibility) test defined in Annex C. The requirement guarantees that a cartridge can be constrained in the proper plane of operation within the drive.

10.6.5 Shutter opening force

The spring force on the shutter shall be such that the force required to open the shutter does not exceed 2 N. It shall be sufficiently strong to close a free-sliding shutter, irrespective of the orientation of the case.

10.7 Drop test

The optical disk cartridge shall withstand dropping on each surface and on each corner from a height of 1,2 m onto a concrete floor covered with a vinyl layer 2 mm thick. The cartridge shall withstand all such impacts without any functional failure.

The write-inhibit switches shall not move to change the state (open or closed) of the write-inhibit holes during the drop test.

10.8 Electro-static discharge test

The optical disk cartridge shall meet the electro-static discharge requirements specified in Annex D.

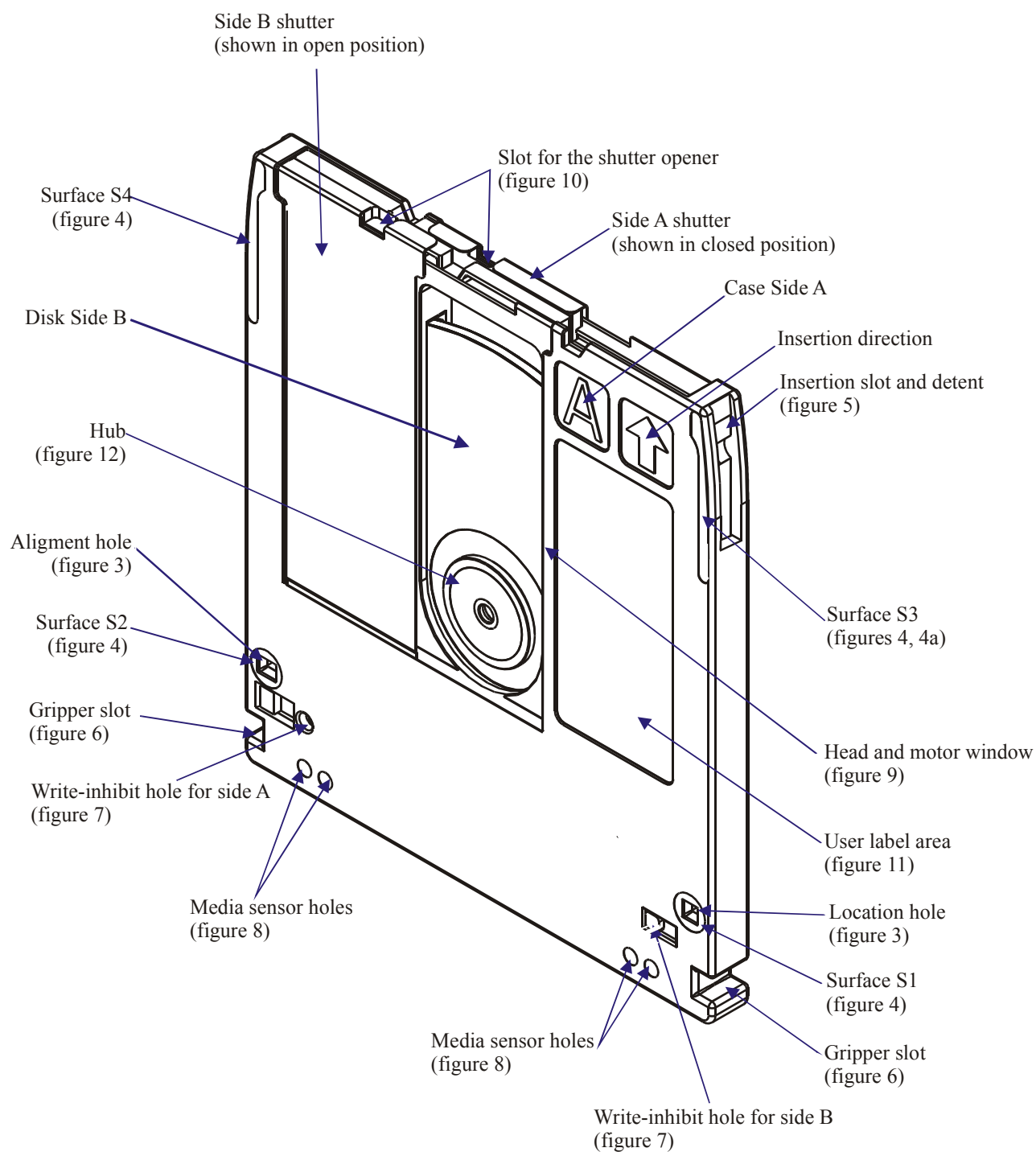


Figure 2 — Case

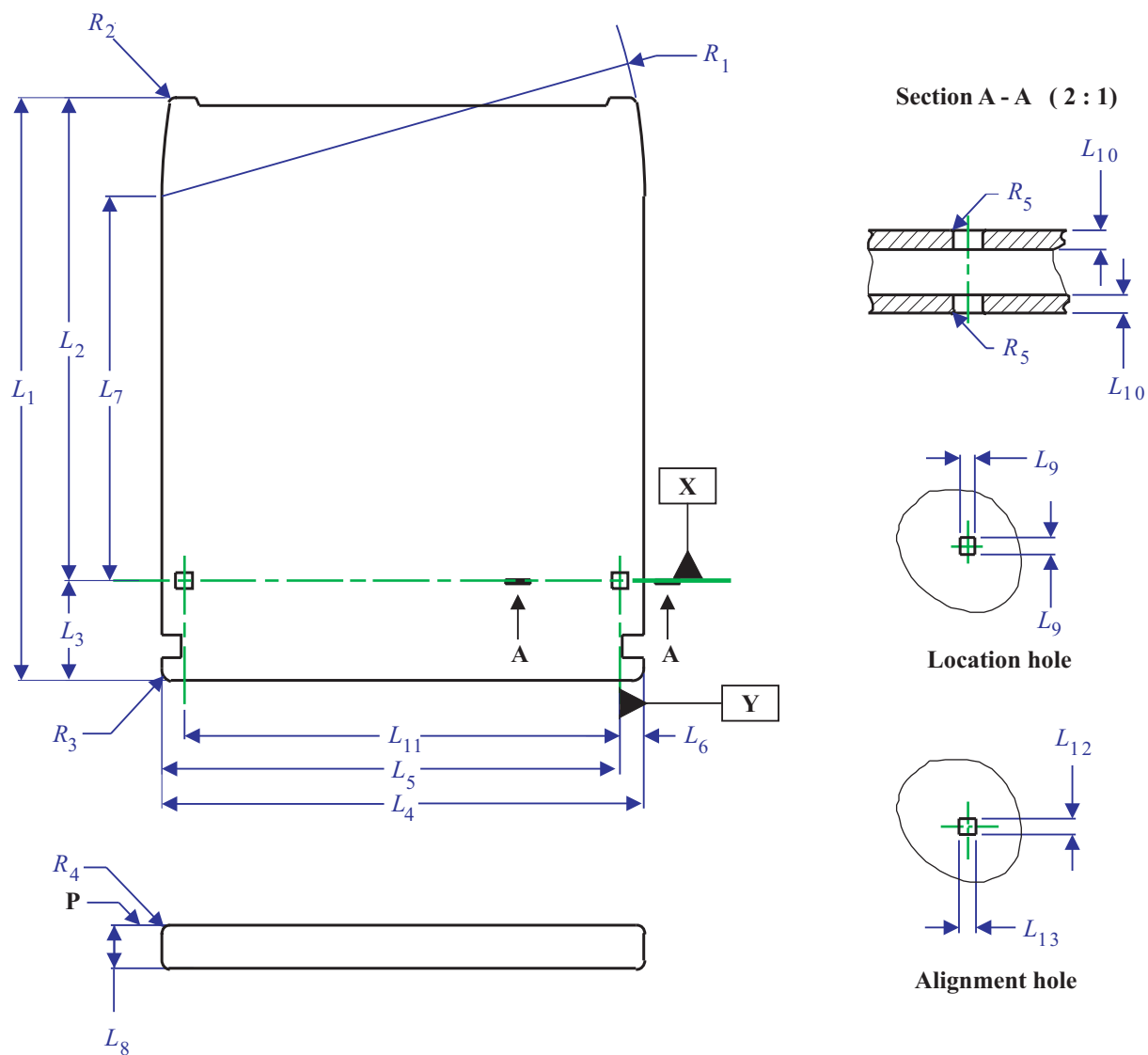


Figure 3 — Overall dimensions and reference axes

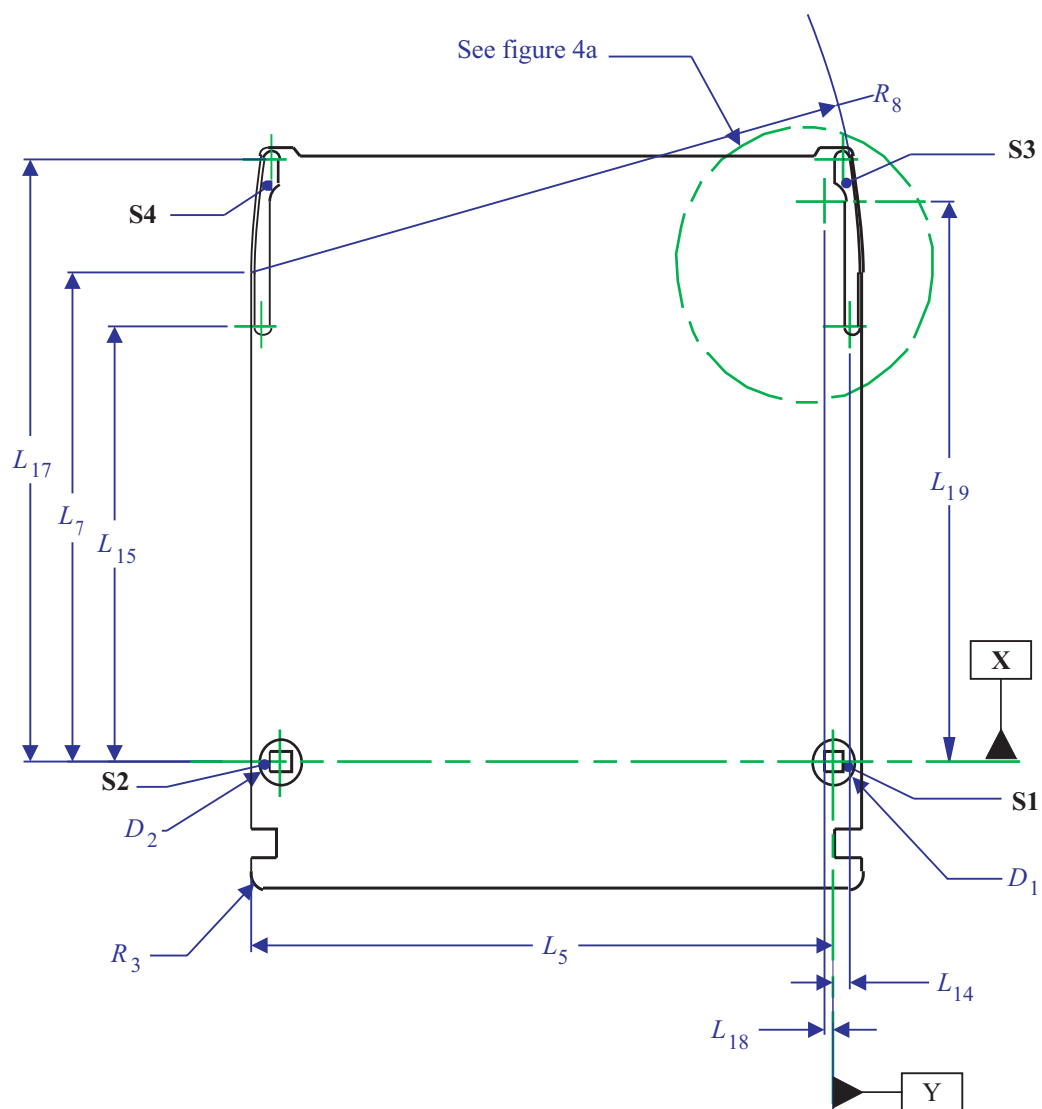


Figure 4 — Surfaces S1, S2, S3 and S4 of the Case Reference Plane P

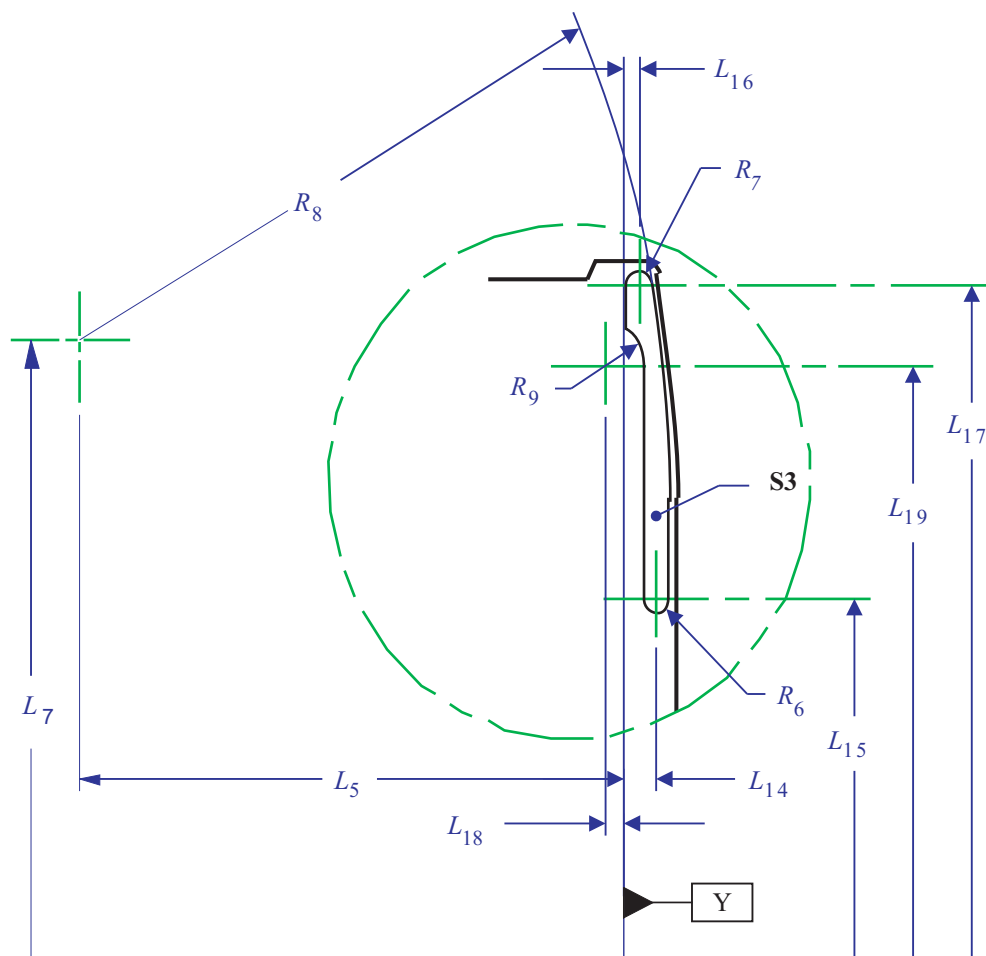


Figure 4a — Details of surface S3

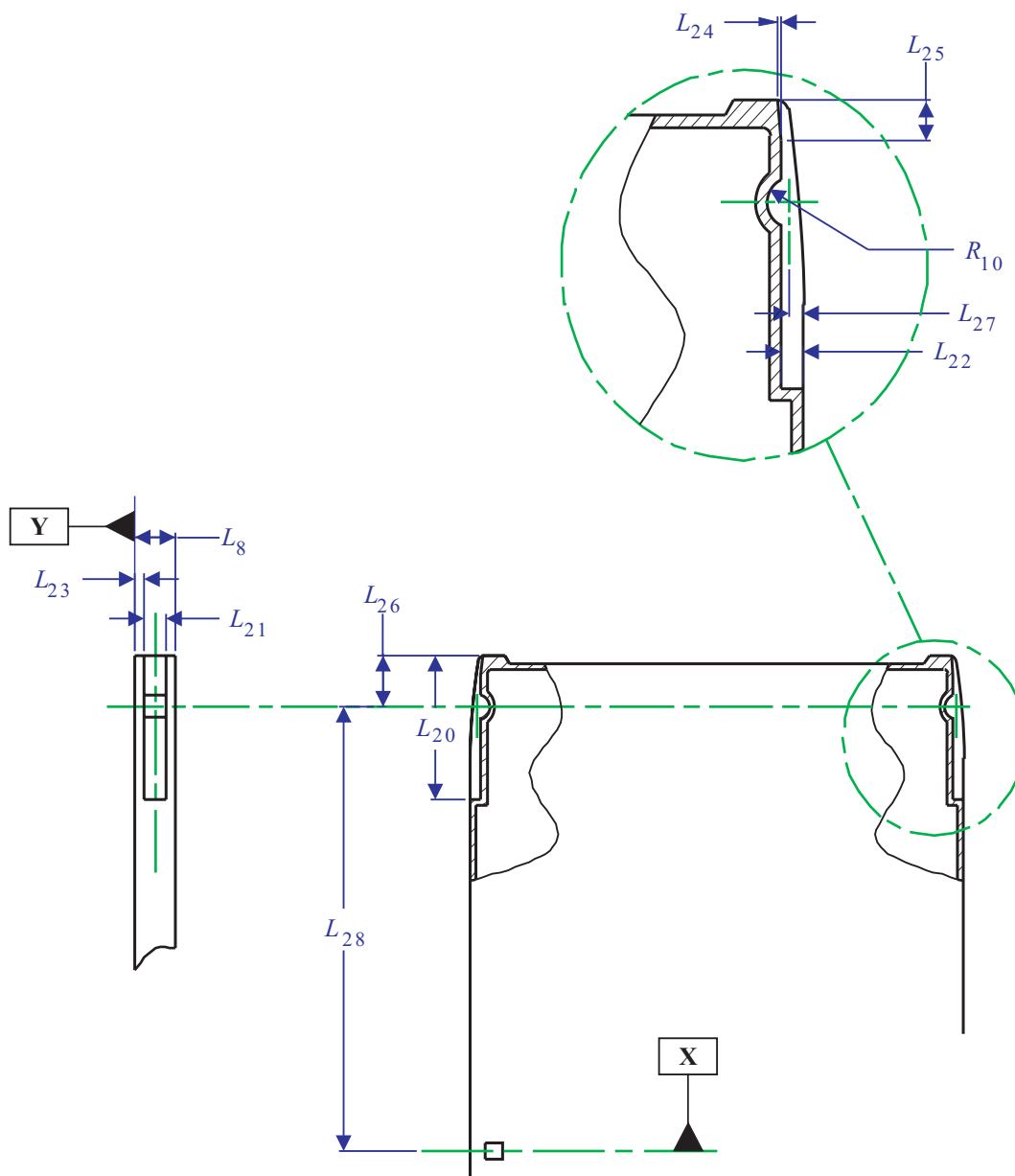


Figure 5 — Insertion slots and detents

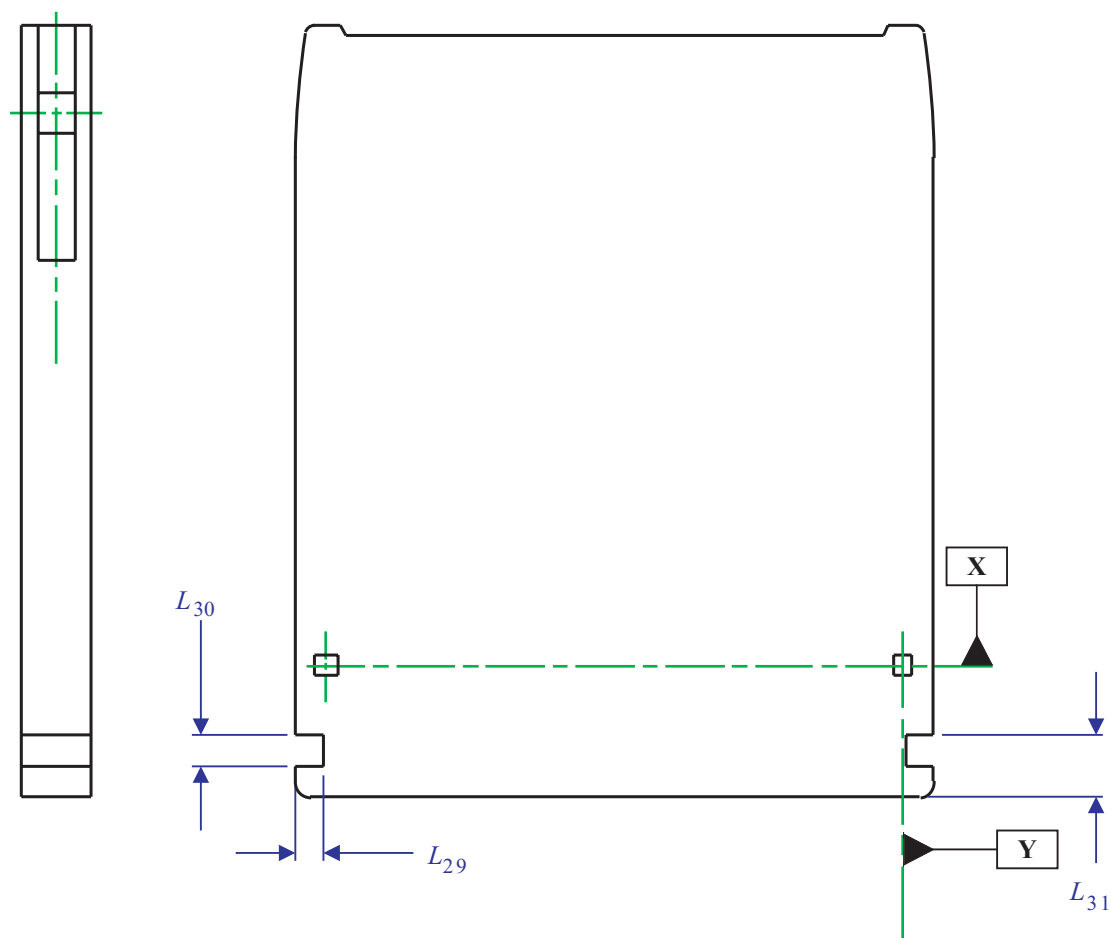


Figure 6 — Gripper slots

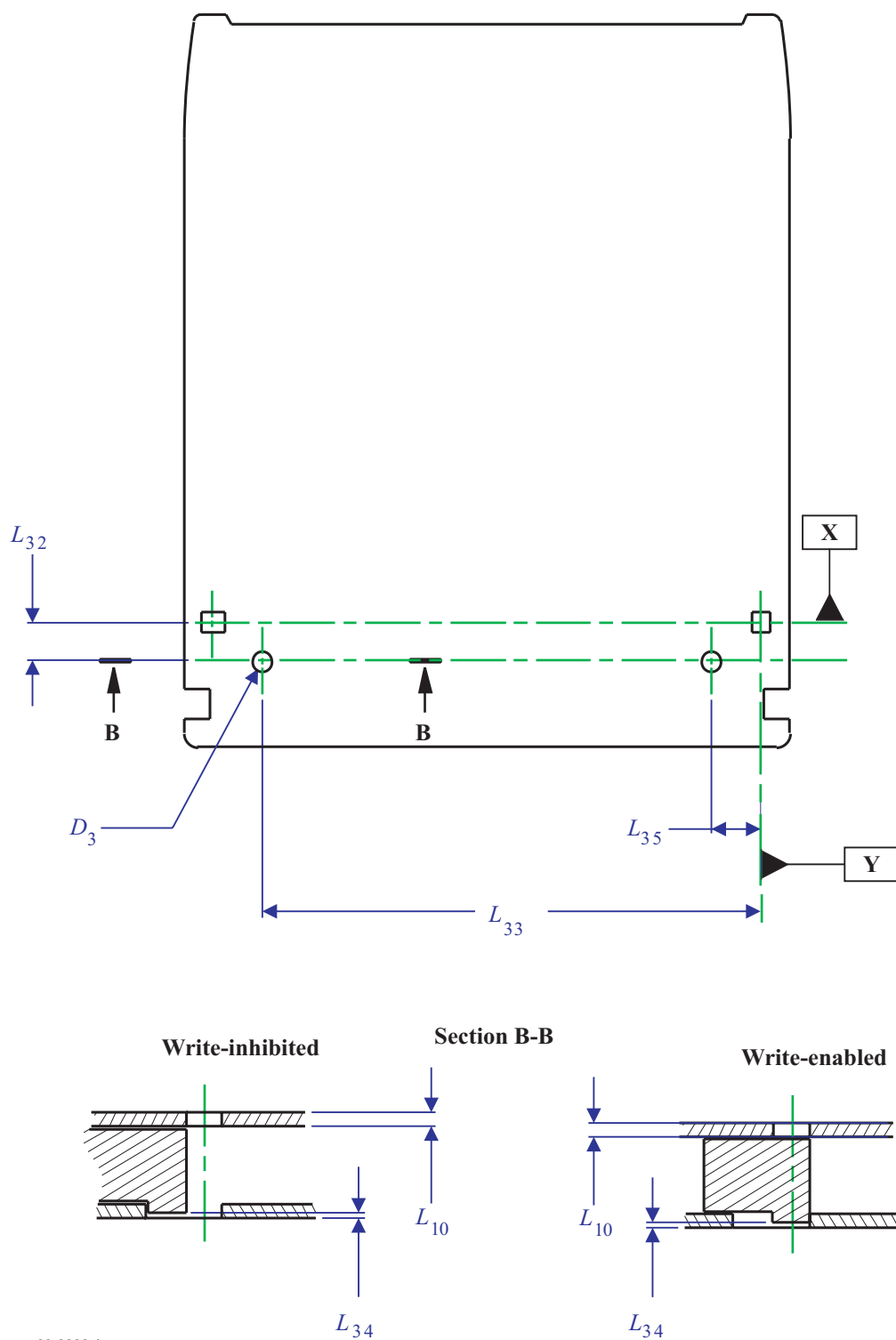


Figure 7 — Write-inhibit holes

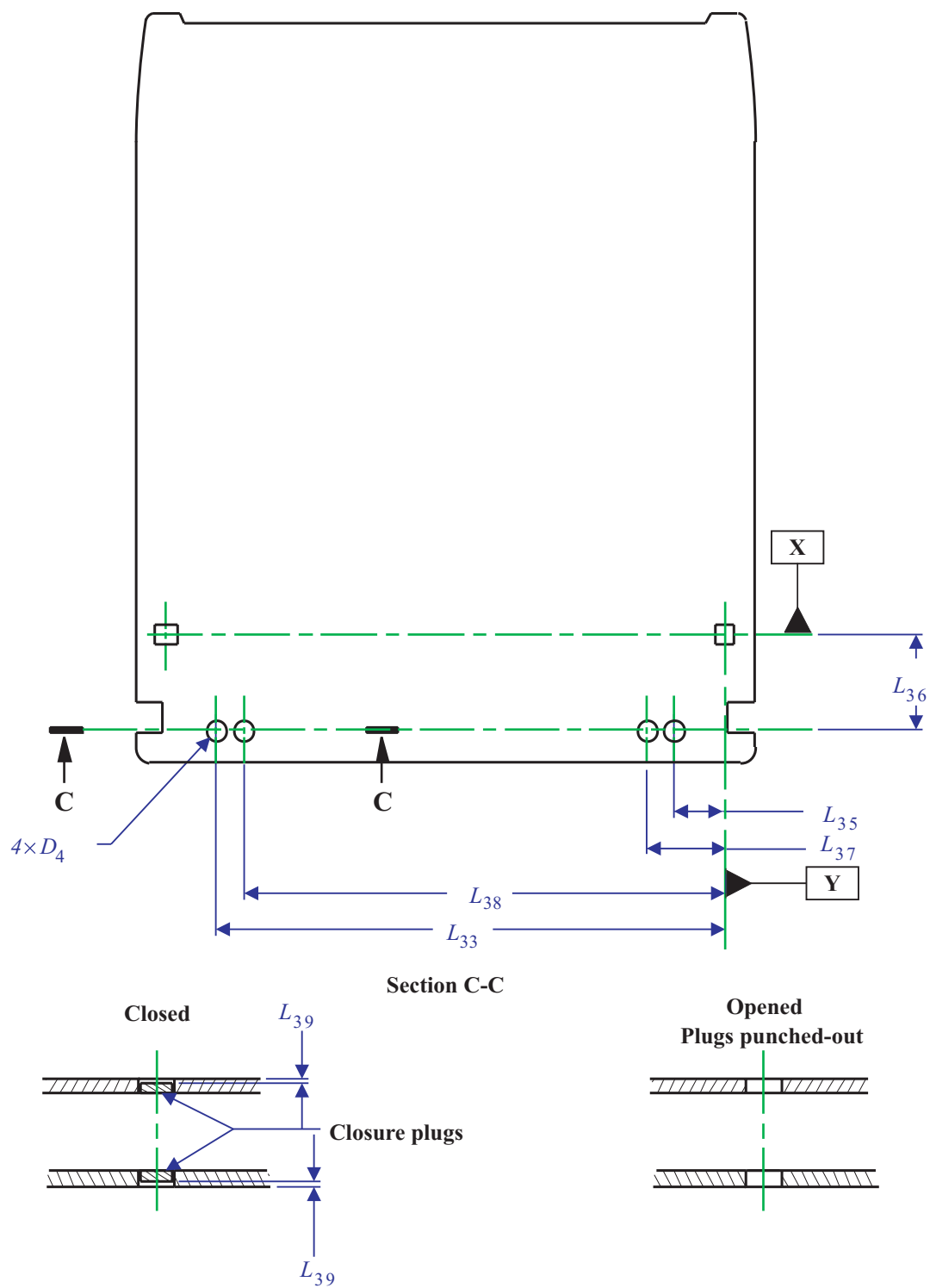


Figure 8 — Media identification sensor holes

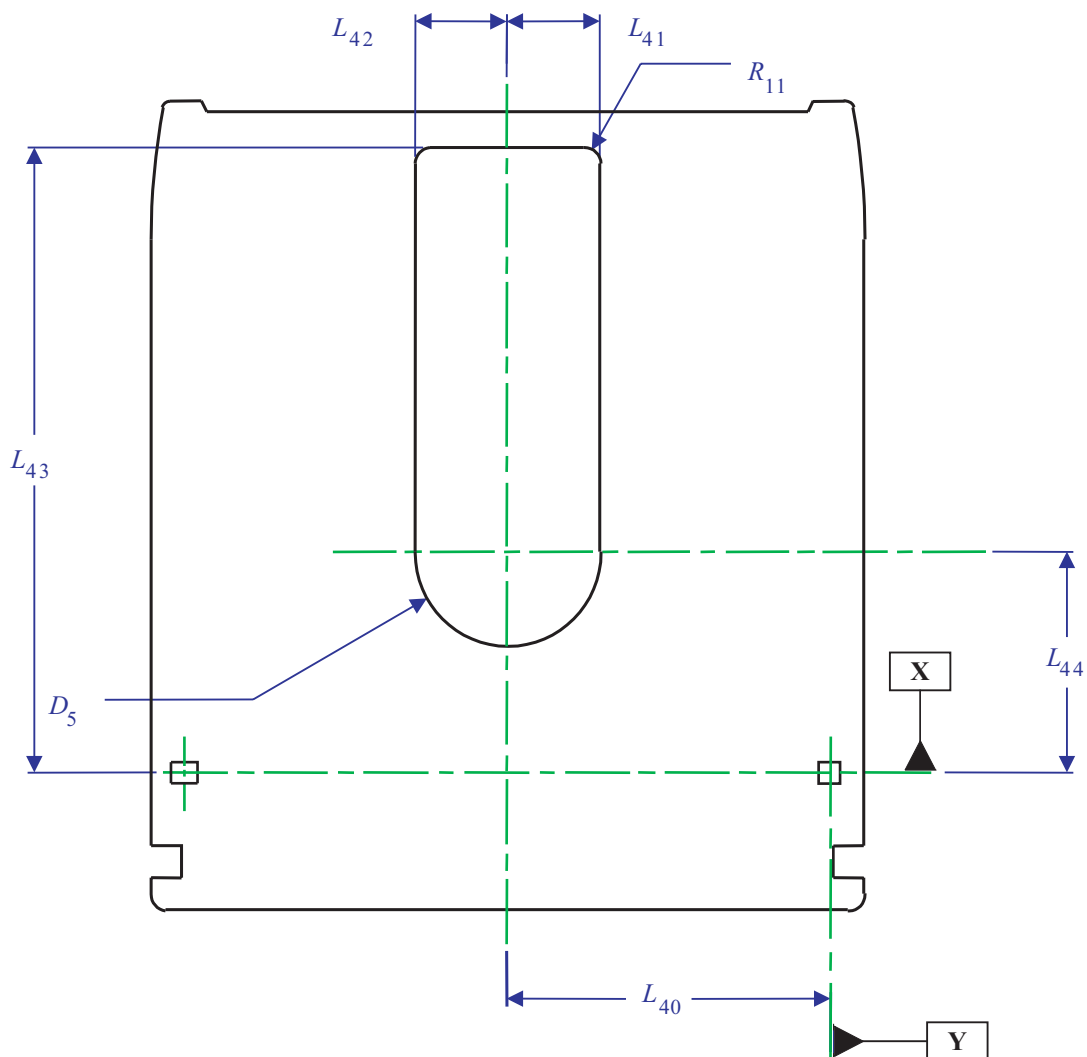


Figure 9 — Head and motor window

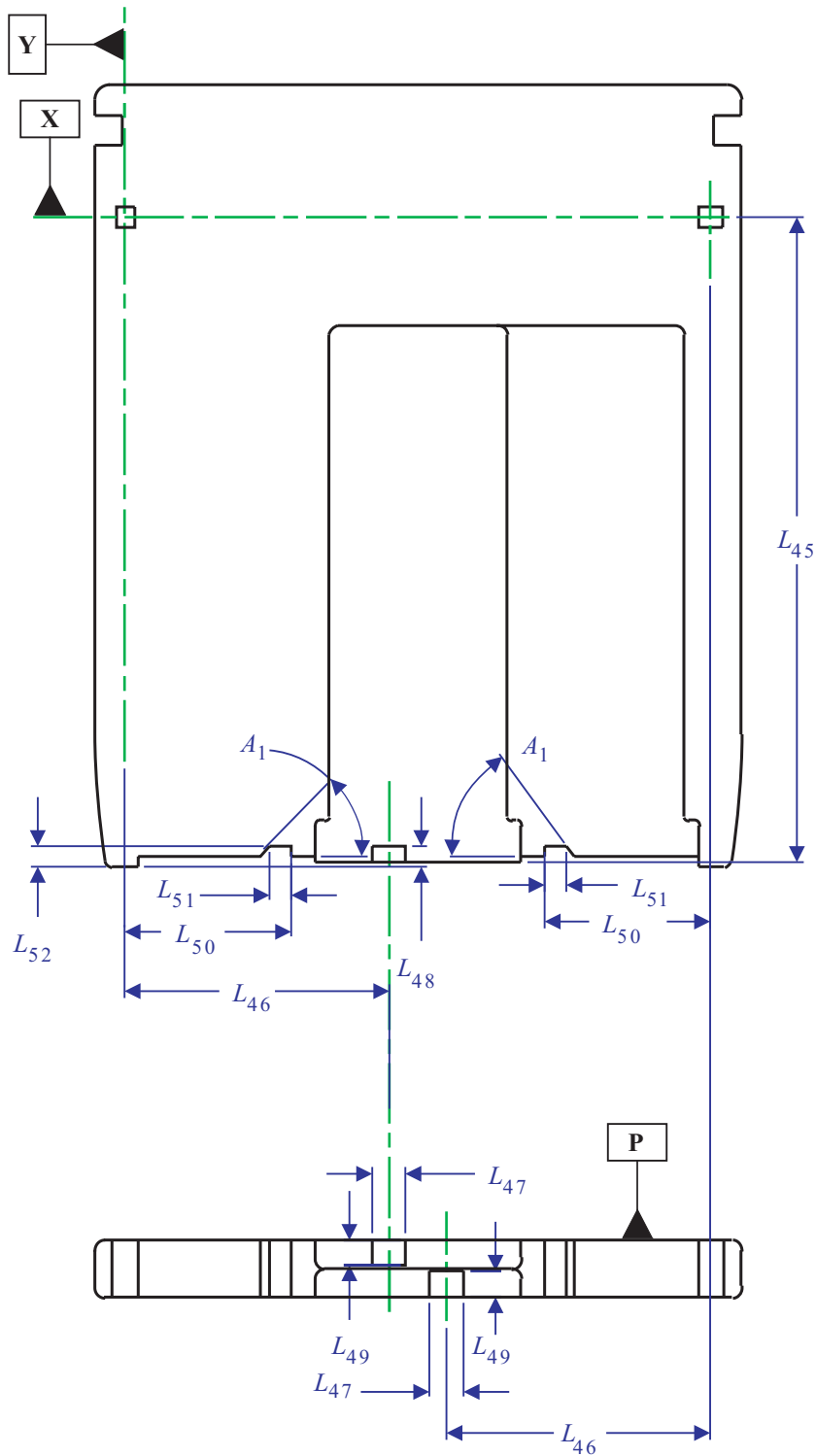


Figure 10 — Shutter opening features

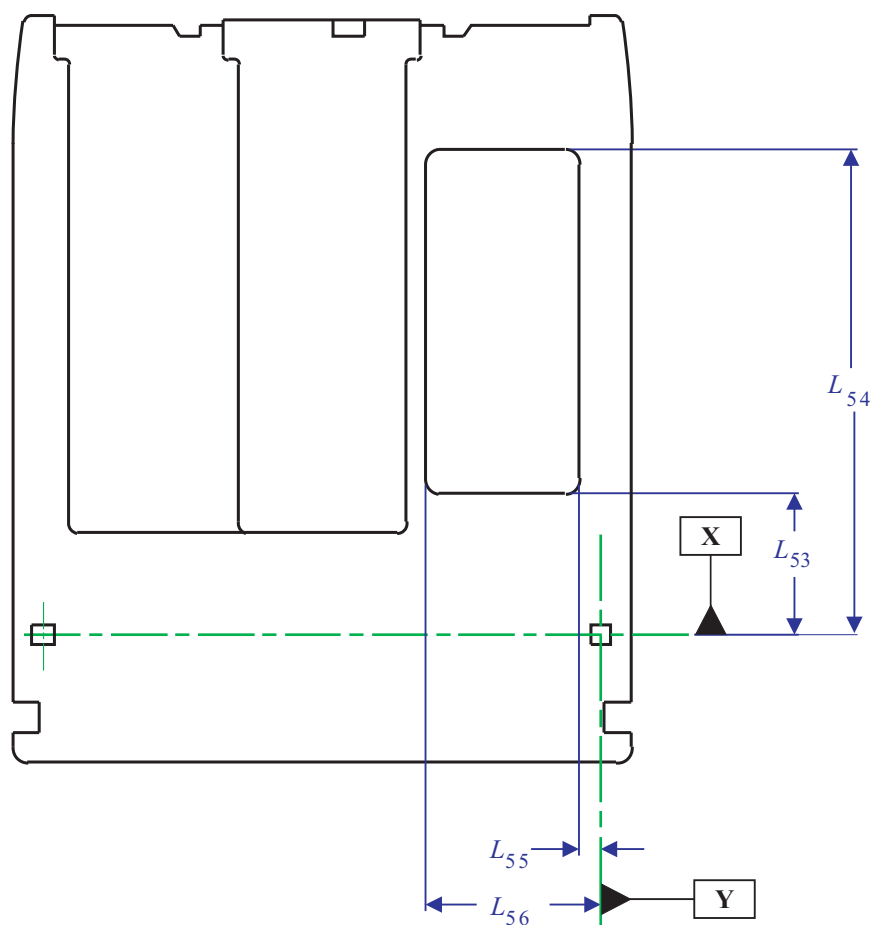


Figure 11a — User label area (Identical on Side A and Side B)

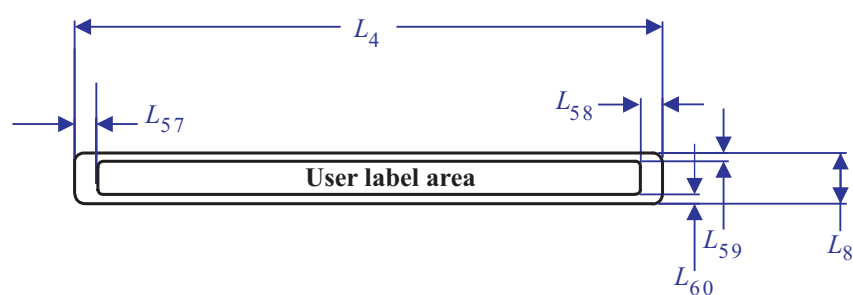


Figure 11b — User label area on bottom surface

11 Dimensional, mechanical, and physical characteristics of the disk

11.1 General description of the disk

The disk shall consist of two sides.

Each disk side shall consist of a circular substrate with a hub on one face. The substrate is coated with a recording layer on the same disk face as the hub. The recording layer is protected from environmental influences by a protective 100 µm thick cover layer. The cover layer shall be transparent to allow an optical beam to focus on the recording layer (see 11.5).

The two disk sides shall be assembled with the cover layer facing outwards.

The circular hubs are in the centre of the disk. They interact with the spindle of the drive, and provide the radial centring and the clamping force.

11.2 Reference axis and plane of the disk

Some dimensions of the hub are referred to a Disk Reference Plane D (see figure 12). The Disk Reference Plane D is different from Case Reference Plane P that is described in 10.3. Plane D is 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 of this spindle. The reference axis A of the disk passes through the centre of the centre hole of the hub, and is normal to Disk Reference Plane D.

The recording layer is nominally located on Disk Reference Plane D.

11.3 Dimensions of the disk

The dimensions of the disk shall be measured in the test environment. The dimensions of the disk in an operating environment can be estimated from the dimensions specified in this clause.

The outer diameter of the disk shall be 130,0 mm nominal. The tolerance is determined by the movement of the disk inside the case allowed by 12.3 and 12.4.

The total thickness of the disk outside the hub area shall be 2,40 mm min. and 2,80 mm max.

The Clamping Zone is the area on the disk where the clamping mechanism of the optical drive grips the disk and is defined by D_6 and D_7 .

The clearance zone extending from the outer diameter of the Clamping Zone (D_6) to the inner diameter of the reflective zone (see clause 17) shall be excluded from the total thickness requirement; however there shall be no projection from the Disk Reference Plane D in the direction of the optical system of more than 0,2 mm in this zone.

11.3.1 Hub dimensions

The outer diameter of the hub (see figure 12) shall be

$$\begin{array}{r} + 0,0 \text{ mm} \\ D_8 = 25,0 \text{ mm} \\ - 0,2 \text{ mm} \end{array}$$

The height of the hub shall be

$$\begin{array}{r} + 0,0 \text{ mm} \\ h_1 = 2,2 \text{ mm} \\ - 0,2 \text{ mm} \end{array}$$

The diameter of the centre hole of the hub shall be

$$\begin{array}{r} + 0,012 \text{ mm} \\ D_9 = 4,004 \text{ mm} \\ - 0,000 \text{ mm} \end{array}$$

The height of the top of the centring hole at diameter D_9 , measured above the Disk Reference Plane D, shall be

$$h_2 = 1,9 \text{ mm min.}$$

The centring length at diameter D_9 shall be

$$h_3 = 0,5 \text{ mm min.}$$

The hole shall have a diameter larger than, or equal to, D_9 between the centring length and the Disk Reference Plane D.

There shall be a radius at the rim of the hub at diameter D_9 with height

$$h_4 = 0,2 \text{ mm} \pm 0,1 \text{ mm}$$

At the two surfaces which it intersects, the radius shall be blended to prevent offsets or sharp ridges.

The height of the chamfer at the rim of the hub at diameter D_8 shall be

$$h_5 = 0,4 \text{ mm} \begin{array}{l} + 0,2 \text{ mm} \\ - 0,2 \text{ mm} \end{array}$$

The angle of the chamfer shall be 45° , or a corresponding full radius shall be used.

The outer diameter of the magnetizable ring shall be

$$D_{10} = 19,0 \text{ mm min.}$$

The inner diameter of the magnetizable ring shall be

$$D_{11} = 8,0 \text{ mm max.}$$

The thickness of the magnetizable material shall be

$$h_6 = 0,5 \text{ mm min.}$$

The position of the top of the magnetizable ring relative to the Disk Reference Plane D shall be

$$h_7 = 2,2 \text{ mm} \begin{array}{l} + 0,0 \text{ mm} \\ - 0,1 \text{ mm} \end{array}$$

The outer diameter of the Clamping Zone shall be

$$D_6 = 35,0 \text{ mm min.}$$

The inner diameter of the zone shall be

$$D_7 = 27,0 \text{ mm max.}$$

11.3.2 Cover layer dimensions

The inner diameter of the cover layer (see figure 12) shall be

$$D_{12} = 36,0 \pm 1,0 \text{ mm}$$

The outer diameter of the cover layer shall extend beyond the start of the Formatted Zone as described in clause 17.

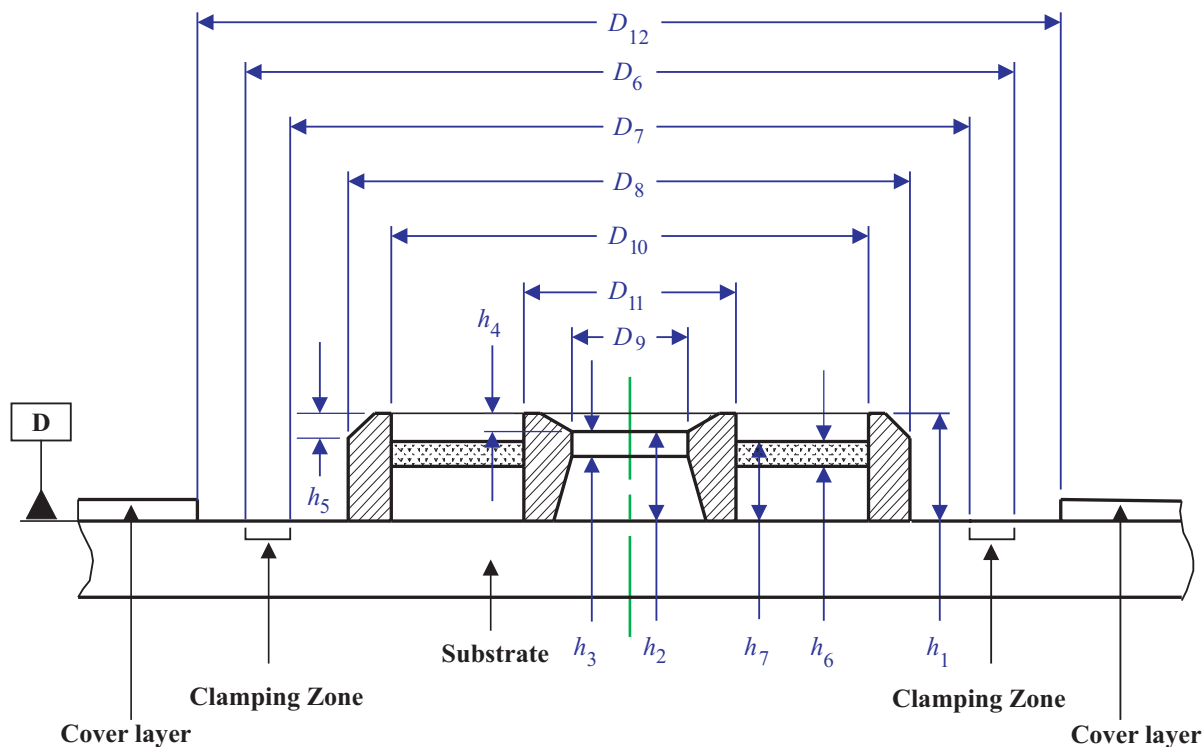


Figure 12 — Hub Dimensions

11.4 Mechanical characteristics

All requirements in this clause must be met in the operating environment.

11.4.1 Material

The disk shall be made from any suitable materials such that it meets the requirements of this International Standard. The only material properties specified by this International Standard are the magnetic properties of the magnetizable ring in the hub (see 11.3.1) and the optical properties of the cover layer in the Formatted Zone (see 11.5).

11.4.2 Mass

The mass of the disk shall not exceed 60 g.

11.4.3 Moment of inertia

The moment of inertia of the disk relative to axis A shall not exceed 0,13 g·m².

11.4.4 Imbalance

The imbalance of the disk relative to axis A shall not exceed 0,01g·m.

11.4.5 Axial deflection

The axial deflection of the disk is measured as the axial deviation of the recording layer. Thus it comprises the tolerances on the thickness of the cover layer, on its index of refraction, and the deviation of the entrance surface from the Disk Reference Plane D.

The deviation of any point of the recording layer from its nominal position, in a direction normal to the Disk Reference Plane D, shall not exceed 0,13 mm in the Formatted Zone for rotational frequencies of the disk as specified in 9.5. The deviation shall be measured by the optical system defined in 9.1.

11.4.6 Axial acceleration

The maximum allowed axial error $e_{\max}$ (see Annex V) shall not exceed 0,3 μm , measured using the Reference Servo for axial tracking of the recording layer. The rotational frequency of the disk shall be as specified in 9.5. 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

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

where $\omega = 2\pi f$, $\omega_0/2\pi = 1\,700\text{ Hz}$, $i = \sqrt{-1}$

or any other servo with $|1 + H|$ within the 20 % of $|1 + H_s|$ in the bandwidth of 20 Hz to 150 kHz. Thus, the disk shall not require an acceleration of more than 11,4 m/s^2 at low frequencies from the servo motor of the Reference Servo.

11.4.7 Radial runout

The radial runout of the tracks in the recording layer in the Formatted 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 A, the tolerances on the dimensions between axis A and the location of the track, and effects of non-uniformities in the index of refraction of the cover layer.

The radial runout is the difference between the maximum and the minimum distance of any track from the axis of rotation, measured along a fixed radial line over one physical track of the disk. The radial runout shall not exceed 50 μm as measured by the optical system under conditions of a hub mounted on a perfect sized test fixture shaft, for rotational frequencies of the disk as specified in 9.5.

11.4.8 Radial acceleration

The maximum allowed radial error $e_{\max}$ (see Annex V) shall not exceed 0,04 μm , measured using the Reference Servo for radial tracking of the tracks. The rotational frequency of the disk shall be as specified in 9.5. 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

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

where $\omega = 2\pi f$, $\omega_0/2\pi = 2\,540\text{ Hz}$, $i = \sqrt{-1}$

or any other servo with $|1 + H|$ within the 20 % of $|1 + H_s|$ in the bandwidth of 20 Hz to 150 kHz. Thus, the disk shall not require an acceleration of more than $3,4 \text{ m/s}^2$ at low frequencies from the servo motor of the Reference Servo.

11.4.9 Tilt

The tilt angle, defined as the angle which the normal to the entrance surface, averaged over a circular area of 1 mm diameter, makes with the normal to the Disk Reference Plane D, shall not exceed 2,8 mrad in the Formatted Zone.

11.4.10 Axial damping

The vibration of the disk clamped to a spindle with a clamping force of $8 \text{ N} \pm 1 \text{ N}$ shall have a first rotationally symmetric resonance frequency mode (umbrella mode) between 200 Hz and 250 Hz with a resonance peaking, measured at disk radius $61 \text{ mm} \pm 1 \text{ mm}$, smaller than 21 dB.

11.5 Optical characteristics

11.5.1 Index of refraction

The index of refraction of the cover layer within the Formatted Zone shall be $1,55 \pm 0,10$.

11.5.2 Thickness

The thickness of the cover layer shall be determined by its index of refraction as specified in figure 13.

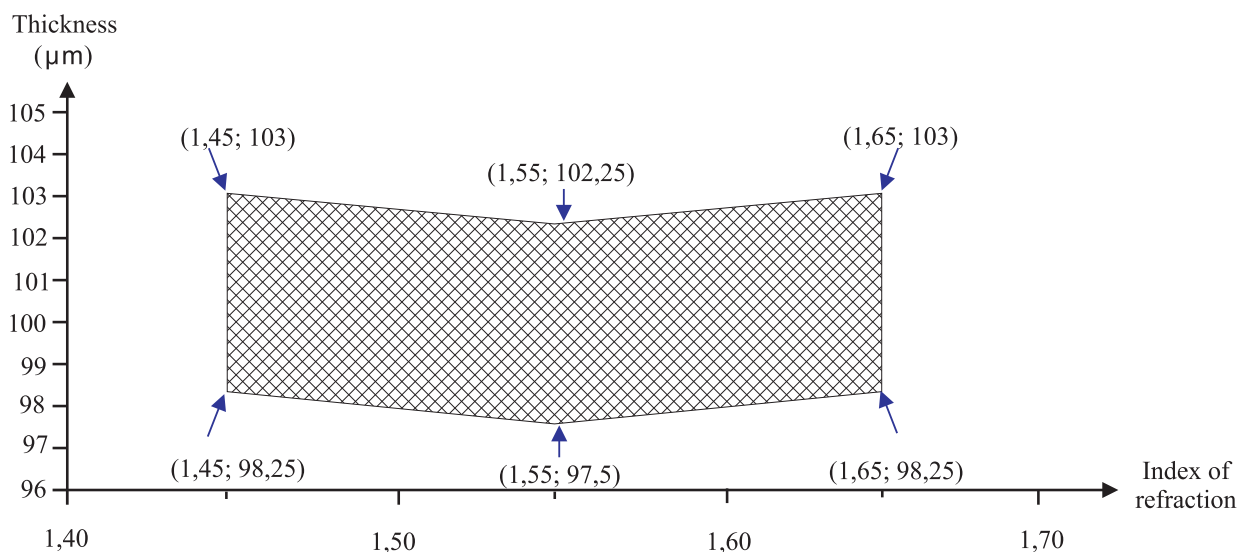


Figure 13 — Cover layer thickness as a function of the index of refraction

11.5.3 Birefringence

The birefringence value of the cover layer shall be contained as follows:

$$N_p - N_z \leq |500 \times 10^{-6}|$$

where N_p is the index of refraction along any direction in the plane of the disk and N_z is the index of refraction normal to the plane of the disk (see Annex W).

11.5.4 Reflectance

11.5.4.1 General

The reflectance R is the value of the reflectance in a Recording Track of the User Zone, measured through the cover layer and does not include the reflectance of the entrance surface.

The nominal value R , of the reflectance, shall be specified by the manufacturer in byte 39 of the SDI sectors (see 17.4.4).

11.5.4.2 Measured value

The measured value R_m of the reflectance shall be measured under the conditions of 9.2.

Measurements shall be made in the User Zone in any Recording Track.

11.5.4.3 Requirement

The value of reflectance prior to writing at the standard wavelength specified in 9.2 shall lie within the range 16,5% to 25,0 % for Type RW disks and within the range 15,5% to 20,5% for Type WORM disks.

The value of reflectance following writing at the standard wavelength specified in 9.2 shall lie within the range 11,5 % to 19,5% for Type RW disks and within the range 7,5 % to 13,0 % for Type WORM disks.

At any point in the User Zone, prior to writing or following writing on Type RW or Type WORM disks, the measured reflectance R_m shall meet the following requirement:

$$R(1 - 0,22) \leq (R_{m \max} + R_{m \min}) / 2 \leq R(1 + 0,22)$$

where $R_{m \max}$ and $R_{m \min}$ are the maximum and minimum values of the measured reflectance in the User Zone.

This requirement specifies the acceptable range for R_m , for all disks within the same value R . Additionally, the variation of R_m within one revolution shall meet the requirement:

$$(R_{m \max} - R_{m \min}) / (R_{m \max} + R_{m \min}) \leq 0,10$$

12 Interface between cartridge and drive

12.1 Clamping method

When the cartridge is inserted into the drive, the shutter of the case is opened and the drive spindle engages the disk. The disk is held against the spindle by an axial clamping force, provided by the magnetizable material in the hub and the magnets in the spindle. The radial positioning of the disk is provided by the centring of the axis of the spindle in the centre hole of the hub. A turntable of the spindle shall support the disk in its Clamping Zone, determining the axial position of the disk in the case.

12.2 Clamping force

The clamping force exerted by the spindle shall be less than 14 N.

The adsorbent force measured by the test device specified in Annex E shall be in the range of 8,0 N to 12,0 N.

12.3 Capture cylinder

The capture cylinder (see figure 14) is defined as the volume in which the spindle can expect the centre of the hole of the hub to be at the maximum height of the hub, just prior to capture. The size of the cylinder limits the allowable play of the disk inside its cavity in the case. This cylinder is referred to perfectly located and perfectly sized alignment and location pins in the drive, and includes tolerances of dimensions of the case and the disk between the pins mentioned and the centre of the hub. The bottom of the cylinder is parallel to the Case Reference Plane P, and shall be located at a distance of

$$L_{61} = 0,5 \text{ mm min.}$$

above the Case Reference Plane P of Side B of the case when Side A of the disk is to be used. The top of the cylinder shall be located at a distance of

$$L_{62} = 4,3 \text{ mm max.}$$

above the same Case Reference Plane P, i.e. that of Side B. The diameter of the cylinder shall be

$$D_{13} = 3,0 \text{ mm max.}$$

Its centre shall be defined by the nominal values of L_{40} and L_{44} (see 10.5.9).

12.4 Disk position in operating condition

When the disk is in the operating condition (see figure 14) within the drive, the position of the active recording layer shall be

$$L_{63} = 4,15 \text{ mm} \pm 0,15 \text{ mm}$$

above the Case Reference Plane P of that side of the case that faces the optical system.

Moreover, the torque to be exerted on the disk in order to maintain a rotational frequency of 35 Hz shall not exceed 0,01 N·m, when the axis of rotation is within a circle of diameter

$$D_{14} = 0,2 \text{ mm max.}$$

and a centre given by the nominal values of L_{40} and L_{44} (see 10.5.9).

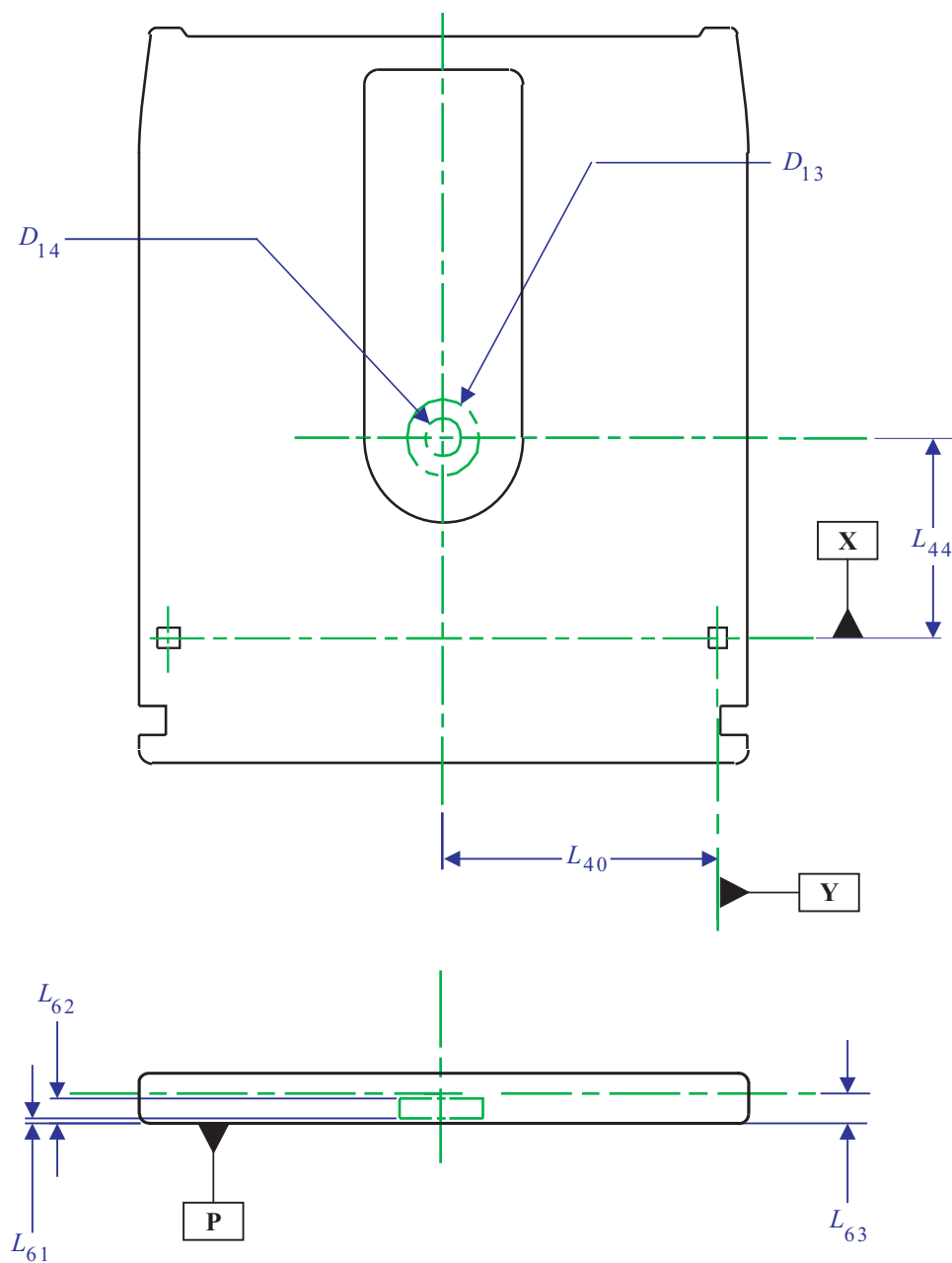


Figure 14 — Capture cylinder

Section 3 — Format of information

13 Track and Header geometry

13.1 Track and Header shape

The Formatted Zone shall contain tracks consisting of grooves or land, intended for the continuous servo method (see figure 15).

Both grooves and lands form continuous spirals except for Preformatted Header areas, where embossed marks are formed in non-grooved areas. A groove is a trench-like feature, the bottom of which is located farther from the entrance surface than the land. Within each 360° adjacent groove-land pair defined as a Physical Track, there are two Recording Tracks, one is located on the centreline of the groove (Groove Recording Track), and the other is located on the centreline of the land (Land Recording Track).

The Headers IDL0, IDL1, and IDL2 are aligned with the centreline of the Land Recording Track, and Headers IDG0, IDG1, and IDG2 are aligned with the centreline of the Groove Recording Track.

The QWM fields, QWML, QWMLG, follow IDL0, aligned to the centreline of the Land Recording Track, and IDG0, aligned to the centreline of the Groove Recording Track.

The shape of the groove and land shall be determined by the requirements in clause 21.

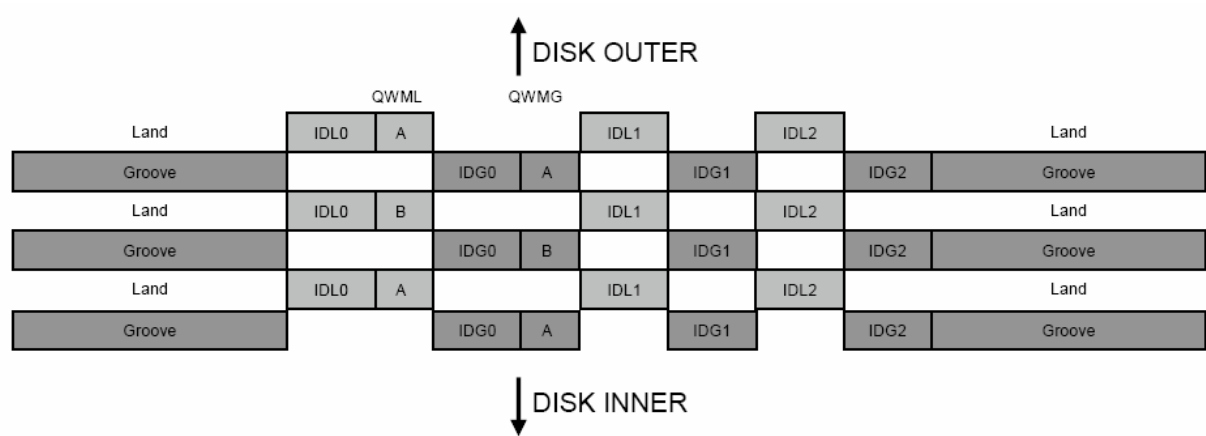


Figure 15a - Track and Header geometry

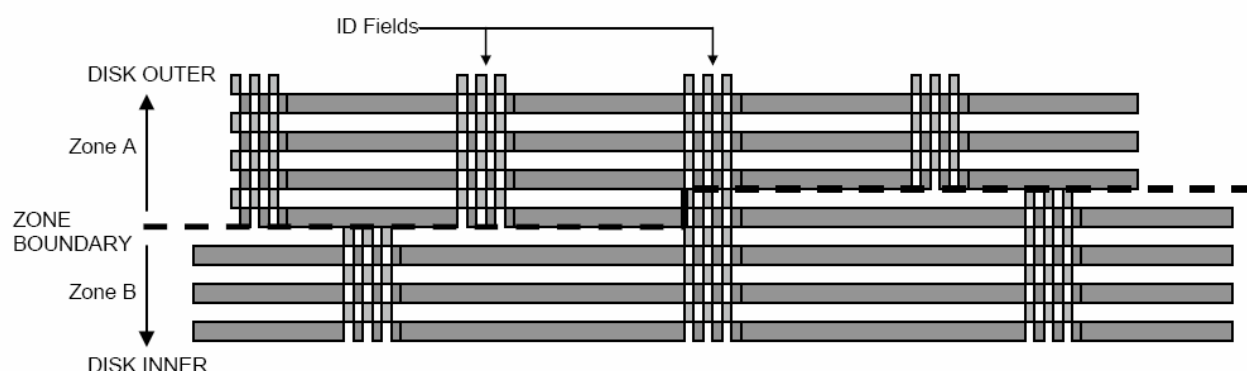


Figure 15b - Track details at zone boundary

Figure 15 - Groove and Land Recording Track geometry

13.2 Wobble groove

The groove shall be continuous between Preformatted Header regions, except for the Mirror Area defined in 13.3. The groove shall have a square wave shaped wobble with a period of 240 Channel bits. The frequency of the wobble shall be constant in each band.

The wobble shall complete 502,117 cycles between Preformatted Headers for Type RW media.

The wobble shall complete 499,117 cycles between Preformatted Headers for Type WORM media.

The wobble groove square wave shall begin immediately following the end of the IDG2 field and shall repeat until the start of the next IDL0 field. The displacement of the first half period of the square wave (first 120 Channel bits after IDG2, see figure 16) shall be in the direction of the disc outer.

The wobble characteristics shall comply with the specifications of 21.5. This will correspond to a peak-to-peak displacement of approximately 24 nm.

The Groove Recording Track centreline shall be defined as the point in the radial direction at which the displacement of the wobble toward the inner diameter and outer diameter of the disk are equal.

The Land Recording Track centreline shall be defined as the midpoint in the radial direction between the two adjacent Groove Recording Track centrelines.

The relative radial position of grooves, lands and Preformatted Header elements is illustrated on figure 16.

13.3 Mirror Area

The Mirror Area, included for media reflectivity test measurements, shall exist only in specific locations of the disk (see 14.3). The Mirror Area shall be an interruption in the groove immediately following the IDG2 field (see figure 17). The length of the Mirror Area shall be 240 Channel bits.

13.4 Direction of spiral

The track shall spiral inward from the outer diameter to the inner diameter, clockwise as viewed from the entrance surface.

13.5 Track pitch

The track pitch is the distance between adjacent Land Recording Track centrelines and Groove Recording Track centrelines, measured in a radial direction.

The track pitch for Type RW media shall be $0,400\ \mu\text{m} \pm 0,02\ \mu\text{m}$. The width of a group of bands corresponding to 44 375 Physical Tracks (88 750 Recording Tracks) shall be $35,50\ \text{mm} \pm 0,10\ \text{mm}$.

The track pitch for Type WORM media shall be $0,370\ \mu\text{m} \pm 0,02\ \mu\text{m}$. The width of a group of bands corresponding to 47 972 Physical Tracks (95 944 Recording Tracks) shall be $35,50\ \text{mm} \pm 0,10\ \text{mm}$.

13.6 Physical Track number

Track numbers used in this International Standard refer to Physical Tracks, i.e. to land and groove track recording pairs.

Physical Track 0 shall begin on the land of the first Physical Track containing Preformatted Headers at the outer diameter of the disk. The track numbers of Physical Tracks located at radii smaller than Physical Track 0 shall be increased by 1 for each Physical Track.

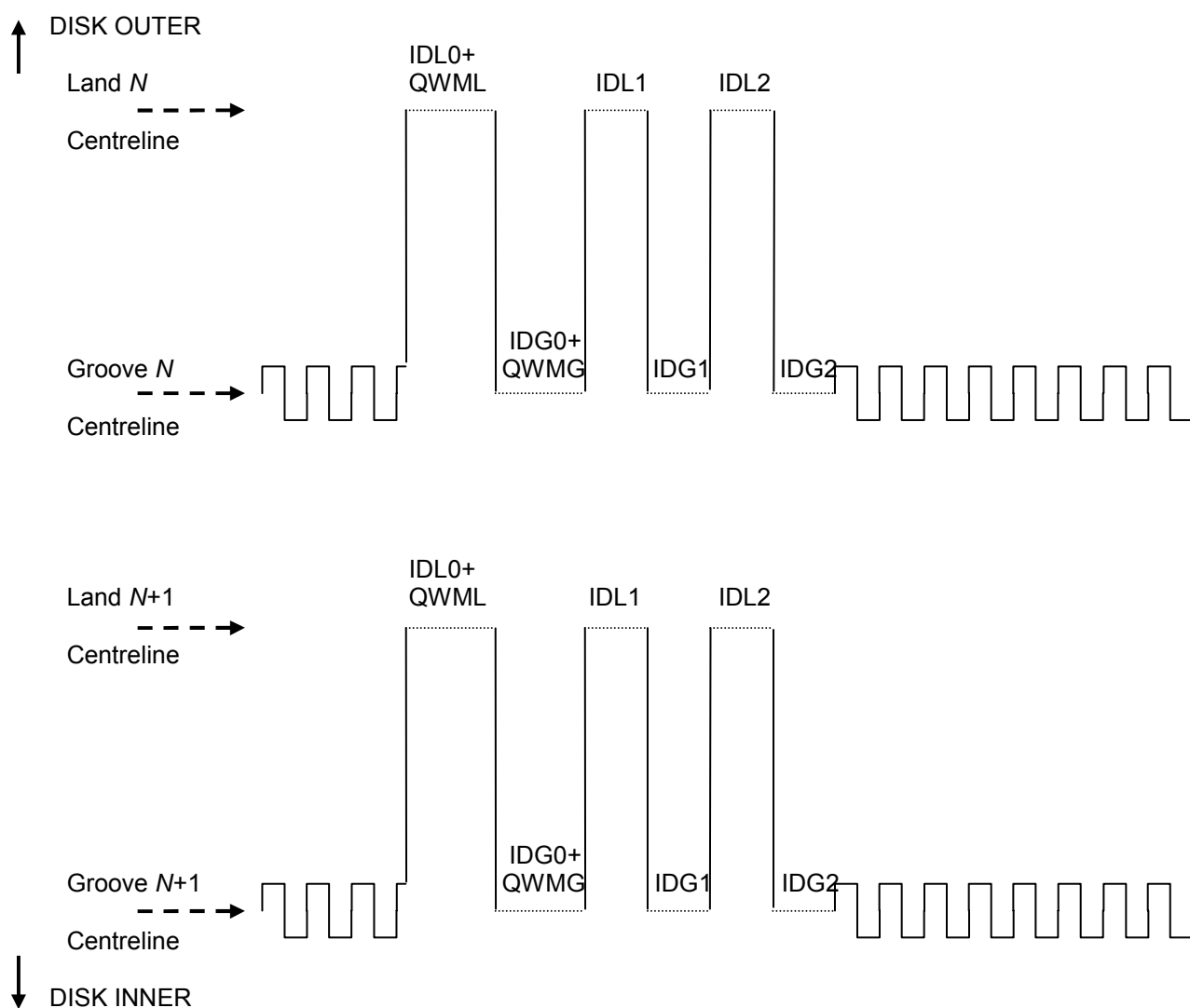


Figure 16 — Preformatted Header and wobble groove displacements