
**Information technology — 130 mm optical
disk cartridges for information
interchange — Capacity: 5,2 Gbytes per
cartridge**

*Technologies de l'information — Cartouches de disques optiques de
130 mm pour l'échange d'informations — Capacité: 5,2 Gbytes par
cartouche*



1

Contents*Page*

Section 1 - General.....	1
1 Scope.....	1
2 Conformance	2
2.1 Optical Disk Cartridge (ODC)	2
2.2 Generating system.....	2
2.3 Receiving system.....	2
2.4 Compatibility statement	2
3 Reference	2
4 Definitions.....	2
4.1 asymmetry.....	3
4.2 band.....	3
4.3 case.....	3
4.4 clamping zone	3
4.5 control track	3
4.6 Cyclic Redundancy Check (CRC).....	3
4.7 defect management.....	3
4.8 direct overwrite	3
4.9 disk reference plane.....	3
4.10 entrance surface.....	3
4.11 Error Correction Code (ECC).....	3
4.12 format.....	3
4.13 hub.....	3
4.14 interleaving.....	3
4.15 Kerr rotation.....	3
4.16 land and groove	3
4.17 logical track.....	3
4.18 mark	3
4.19 mark edge	3
4.20 mark edge recording.....	3
4.21 optical disk	3
4.22 optical disk cartridge (ODC)	3
4.23 physical track	3
4.24 polarization.....	3
4.25 pre-recorded mark	4
4.26 read power.....	4
4.27 recording layer	4
4.28 Reed-Solomon code	4
4.29 space.....	4
4.30 spindle	4
4.31 substrate	4
4.32 track pitch.....	4

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4.33 write-inhibit hole	4
4.34 write once functionality	4
4.35 zone.....	4
5 Conventions and notations.....	4
5.1 Representation of numbers	4
5.2 Names	4
6 List of acronyms	5
7 General description of the optical disk cartridge	5
8 General requirements.....	6
8.1 Environments.....	6
8.1.1 Test environment	6
8.1.2 Operating environment	6
8.1.3 Storage environment.....	6
8.1.4 Transportation.....	7
8.2 Temperature shock.....	7
8.3 Safety requirements	7
8.4 Flammability.....	7
9 Reference Drive	7
9.1 Optical system	7
9.2 Optical beam.....	9
9.3 Read channels	9
9.4 Tracking.....	9
9.5 Rotation of the disk.....	10
Section 2 - Mechanical and physical characteristics.....	10
10 Dimensional and physical characteristics of the case	10
10.1 General description of the case	10
10.2 Relationship of Sides A and B.....	10
10.3 Reference axes and case reference planes.....	10
10.4 Case drawings.....	10
10.5 Dimensions of the case	11
10.5.1 Overall dimensions	11
10.5.2 Location hole	12
10.5.3 Alignment hole	12
10.5.4 Surfaces on Reference Planes P.....	12
10.5.5 Insertion slots and detent features.....	13
10.5.6 Gripper slots	14
10.5.7 Write-inhibit holes	14
10.5.8 Media sensor holes	15
10.5.9 Head and motor window.....	16
10.5.10 Shutter.....	16
10.5.11 Slot for shutter opener	17
10.5.12 Shutter sensor notch.....	17
10.5.13 User label areas.....	18
10.6 Mechanical characteristics.....	18
10.6.1 Materials	18
10.6.2 Mass.....	18
10.6.3 Edge distortion.....	18
10.6.4 Compliance	18
10.6.5 Shutter opening force.....	18
10.7 Drop test	18
11 Dimensional, mechanical and physical characteristics of the disk	19
11.1 General description of the disk	19
11.2 Reference axis and plane of the disk.....	19
11.3 Dimensions of the disk	19
11.3.1 Hub dimension.....	19
11.4 Mechanical characteristics.....	20

11.4.1	Material	21
11.4.2	Mass	21
11.4.3	Moment of inertia	21
11.4.4	Imbalance	21
11.4.5	Axial deflection	21
11.4.6	Axial acceleration	21
11.4.7	Radial runout	21
11.4.8	Radial acceleration	22
11.4.9	Tilt	22
11.5	Optical characteristics	22
11.5.1	Index of refraction	22
11.5.2	Thickness	22
11.5.3	Birefringence	22
11.5.4	Vertical Birefringence	22
11.5.5	Reflectance	23
11.5.5.1	General	23
11.5.5.2	Measured value	23
11.5.5.3	Requirement	23
12	Interface between cartridge and drive	23
12.1	Clamping method	23
12.2	Clamping force	23
12.3	Capture cylinder	23
12.4	Disk position in the operating condition	24
Section 3 - Format of information		39
13	Track geometry	39
13.1	Track shape	39
13.2	Direction of track spiral	39
13.3	Track pitch	39
13.4	Logical track number	39
13.5	Physical track number	39
14	Track format	39
14.1	Physical track layout	39
14.2	Logical track layout	40
14.3	Radial alignment	40
14.4	Sector number	40
15	Sector format	40
15.1	Sector layout	40
15.2	Sector mark	42
15.3	VFO fields	43
15.4	Address Mark (AM)	44
15.5	ID fields	44
15.6	Postamble (PA)	44
15.7	Transition Area (TA ₁)	45
15.8	Gap	45
15.9	Flag	45
15.10	Auto Laser Power Control (ALPC)	45
15.11	Sync	45
15.12	Data field	46
15.12.1	User data bytes	46
15.12.2	CRC and ECC bytes	46
15.12.3	Bytes for Sector Written Flag (SWF)	46
15.12.4	The bytes following SWF in the Data field of the 1 024-byte and 512-byte sector format	46
15.12.5	Resync bytes	47
15.13	Postamble field (PA ₂)	47
15.14	Buffer field	47
15.15	Transition Area (TA ₂)	47
16	Recording code	47

17 Formatted Zone.....	48
17.1 General description of the Formatted Zone	48
17.2 Division of the Formatted Zone	48
17.2.1 Lead-in Zone.....	50
17.2.2 Manufacturer Zones.....	50
17.2.2.1 Outer Manufacturer Zone	50
17.2.2.2 Inner Manufacturer Zone.....	51
17.2.3 User Zone	51
17.2.4 Reflective Zone.....	51
17.2.5 Control Track Zones	51
17.3 Control Track PEP Zone.....	51
17.3.1 Recording in the PEP Zone.....	52
17.3.2 Format of the tracks of the PEP Zone	52
17.3.2.1 Format of a sector	52
17.3.2.1.1 Preamble field.....	53
17.3.2.1.2 Sync field.....	53
17.3.2.1.3 Sector Number field.....	53
17.3.2.1.4 Data field	53
17.3.2.1.5 CRC	55
17.3.2.2 Summary of the format of the Data field of a sector.....	56
17.4 Control Track SFP Zones	56
17.4.1 Duplicate of the PEP information.....	57
17.4.2 Media information	57
17.4.3 System Information	59
18 Layout of the User Zone	60
18.1 General description of the User Zone	60
18.2 Divisions of the User Zone	60
18.3 User Area.....	61
18.4 Defect Management Areas (DMAs)	66
18.5 Disk Definition Structure (DDS)	67
18.6 Rewritable Zone.....	70
18.6.1 Location	71
18.6.2 Partitioning	71
18.7 Embossed Zone.....	71
18.7.1 Location	71
18.7.2 Partitioning	71
18.7.3 Parity sectors.....	71
18.8 Write Once Zone.....	72
18.8.1 Location	72
18.8.2 Partitioning	72
19 Defect Management in the Rewritable and Write Once Zones.....	72
19.1 Initialization of the disk	72
19.2 Certification.....	73
19.2.1 Slipping Algorithm	73
19.2.2 Linear Replacement Algorithm	73
19.3 Disks not certified.....	73
19.4 Write procedure	74
19.5 Primary Defect List (PDL)	74
19.6 Secondary Defect List (SDL)	75
Section 4 - Characteristics of embossed information.....	76
20 Method of testing.....	76
20.1 Environment	76
20.2 Use of the Reference Drive.....	76
20.2.1 Optics and mechanics	76
20.2.2 Read power	77
20.2.3 Read channels	77
20.2.4 Tracking.....	77
20.3 Definition of signals	77
21 Signal from grooves.....	78

21.1	Cross-track signal.....	79
21.2	Push-pull ratio.....	79
21.3	Divided push-pull signal.....	79
21.4	Phase depth.....	80
21.5	Track location.....	80
22	Signals from Headers.....	80
22.1	Sector Mark Signals.....	80
22.2	VFO signals.....	80
22.3	Address Mark, ID and PA signals.....	81
22.4	Timing jitter.....	81
22.5	Asymmetry.....	81
23	Signals from embossed Recording fields.....	81
23.1	Signal amplitude.....	81
23.2	Asymmetry.....	82
23.3	Timing Jitter.....	82
23.4	Byte Errors.....	82
24	Signals from Control Track PEP marks.....	82
Section 5 - Characteristics of the recording layer.....		83
25	Method of testing.....	83
25.1	Environment.....	83
25.2	Reference Drive.....	83
25.2.1	Optics and mechanics.....	83
25.2.2	Read power.....	83
25.2.3	Read Channel.....	84
25.2.4	Tracking.....	84
25.2.5	Signal detection for testing purposes.....	84
25.3	Write conditions.....	84
25.3.1	Write pulse and power.....	84
25.3.2	Write magnetic field and temperature.....	85
25.3.3	Pulse power determination.....	85
25.3.4	Media power sensitivity.....	85
25.4	Erase conditions.....	86
25.4.1	Erase power.....	86
25.4.2	Erase magnetic field.....	86
25.5	Definition of signals.....	86
26	Magneto-optical characteristics.....	86
26.1	Figure of merit for magneto-optical signal.....	86
26.2	Imbalance of magneto-optical signal.....	86
27	Write characteristics.....	87
27.1	Resolution.....	87
27.2	Narrow-band signal-to-noise ratio (NBSNR).....	87
27.3	Cross-talk ratio.....	88
27.3.1	Rewritable track test method.....	88
27.4	Timing Jitter.....	88
27.5	Media thermal interaction.....	89
28	Erase power determination.....	89
Section 6 - Characteristics of user data.....		90
29	Method of testing.....	90
29.1	Environment.....	90
29.2	Reference Drive.....	90
29.2.1	Optics and mechanics.....	90
29.2.2	Read power.....	90
29.2.3	Read Channel.....	90
29.2.4	Mark Quality.....	91

29.2.5 Channel bit clock	91
29.2.6 Binary-to-digital converters	91
29.2.7 Error correction	91
29.2.8 Tracking	91
30 Minimum quality of a sector	91
30.1 Headers	92
30.1.1 Sector Mark	92
30.1.2 ID fields	92
30.2 User-written data	92
30.2.1 Recording field	92
30.2.2 Byte errors	92
30.2.3 Asymmetry	92
30.2.4 Timing jitter	92
31 Data interchange requirements	92
31.1 Tracking	92
31.2 User-written data	92
31.3 Embossed data	92
31.4 Quality of disk	92
Annexes	93
A - Air cleanliness class 100 000	93
B - Edge distortion test	94
C - Compliance test	96
D - Test method for measuring the adsorbent force of the hub	98
E - CRC for ID fields	100
F - Interleave, CRC, ECC, Resync for the data field	101
G - Determination of Resync pattern	110
H - Read Channel for measuring jitter	115
J - Timing jitter measuring procedure	116
K - Definition of write pulse shape	118
L - Measurement of figure of merit	120
M - Implementation Independent Mark Quality Determination (IIMQD) for the interchange of recorded media	121
N - Requirements for interchange	124
P - Measurement implementation for Cross-track signal	126
Q - Asymmetry measuring definition	127
R - Office environment	129
S - Derivation of the operating climatic environment	130
T - Transportation	135
U - Sector retirement guidelines	136
V - Track deviation measurement	137

W - Values to be implemented in existing and future standards 141

X - Measurement of the vertical birefringence of the substrate 142

Y - Guidelines for the use of Type WO and WO-DOW ODCs 144

Z - Laser power calibration for evaluation of media power sensitivity..... 145

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. 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.

International Standard ISO/IEC 15286 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 23, *Optical disk cartridges for information interchange*.

Annexes A to Q form an integral part of this International Standard. Annexes R to Z are for information only.

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Information technology - 130 mm optical disk cartridges for information interchange - Capacity: 5,2 Gbytes per cartridge

Section 1 - General

1 Scope

This International Standard specifies the characteristics of a series of related 130 mm optical disk cartridges (ODCs) by using a number of Type designations.

A disk has two sides, called Side A and Side B. Each side can have a nominal capacity of 2,6 Gbytes.

Type R/W provides for data to be written, read and erased many times over the recording surface of the corresponding disk side, using the thermo-magnetic and magneto-optical effects.

Type P-ROM provides for a part of the disk surface to be pre-recorded and reproduced by stamping or other means. This part of the disk is read without recourse to the magneto-optical effect. All parts which are not pre-recorded provide for data to meet the requirements of Type R/W.

Type O-ROM provides for the whole of the disk surface to be pre-recorded and reproduced by stamping or other means. The corresponding disk sides are read without recourse to the magneto-optical effect.

Type DOW provides for data to be written and read many times over the recording surface of the corresponding disk side, using the direct overwrite thermo-magnetic and magneto-optical effects requiring a single external magnetic field.

Type P-DOW provides for a part of the disk surface to be pre-recorded and reproduced by stamping or other means. This part of the disk is read without recourse to the magneto-optical effect. All parts which are not pre-recorded provide for data to meet the requirements of Type DOW.

Type WO provides write once, read multiple functionality using the thermo-magnetic and magneto-optical effects.

Type WO-DOW provides write once, read multiple functionality using the direct overwrite thermo-magnetic and magneto-optical effects.

In addition, for each Type, this International Standard provides for cartridges containing a disk with a sector size of 512 bytes, cartridges containing a disk with a sector size of 1 024 bytes and cartridges containing a disk with a sector size of 2 048 bytes. All sectors of a disk are the same size.

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 magneto-optical characteristics of the disk, enabling processing systems to write data onto the disk;
- 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 Cartridge (ODC)

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(s) implemented.

2.2 Generating system

A claim of conformance with this International Standard shall specify which of Types R/W, DOW, P-ROM, P-DOW, O-ROM, WO and WO-DOW 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 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 International 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), or the Types of side, and whether support includes reading only or both reading and writing.

3 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60950:1991, *Safety of information technology equipment*.

4 Definitions

For the purposes of this International Standard, the following definitions apply.

- 4.1 asymmetry** : The deviation between the centre levels of the signals which give maximum and minimum amplitude.
- 4.2 band** : An annular area within the user zone on the disk having a constant clock frequency.
- 4.3 case** : The housing for an optical disk, that protects the disk and facilitates disk interchange.
- 4.4 clamping zone** : The annular part of the disk within which the clamping force is applied by the clamping device.
- 4.5 control track** : A track containing the information on media parameters and format necessary for writing, reading and erasing the remaining tracks on the optical disk.
- 4.6 Cyclic Redundancy Check (CRC)** : A method for detecting errors in data.
- 4.7 defect management** : A method for handling the defective areas on the disk.
- 4.8 direct overwrite** : a thermo-magnetic recording method using a specially designed media that does not require a separate erase pass.
- 4.9 disk reference plane** : A plane defined by the perfectly flat annular surface of an ideal spindle onto which the clamping zone of the disk is clamped, and which is normal to the axis of rotation.
- 4.10 entrance surface** : The surface of the disk on to which the optical beam first impinges.
- 4.11 Error Correction Code (ECC)** : An error-detecting code designed to correct certain kinds of errors in data.
- 4.12 format** : The arrangement or layout of information on the disk.
- 4.13 hub** : The central feature on the disk which interacts with the spindle of the disk drive to provide radial centring and the clamping force.
- 4.14 interleaving** : The process of allocating the physical sequence of units of data so as to render the data more immune to burst errors.
- 4.15 Kerr rotation** : The rotation of the plane of polarization of an optical beam upon reflection from the recording layer as caused by the magneto-optical Kerr effect.
- 4.16 land and groove** : A trench-like feature of the disk, 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.
- 4.17 logical track** : Either 31 consecutive sectors for disks with 512-byte sectors, 17 consecutive sectors for disks with 1 024-byte sectors or 7 consecutive sectors for disks with 2 048-byte sectors in one or more physical tracks. The first sector of each logical track is assigned sector number 0.
- 4.18 mark** : A feature of the recording layer which may take the form of a magnetic domain, a pit, or any other type or form that can be sensed by the optical system. The pattern of marks represents the data on the disk.
- NOTE - Subdivisions of a sector which are named "mark" are not marks in the sense of this definition
- 4.19 mark edge** : The transition between a region with a mark and one without a mark or vice versa, along the track.
- 4.20 mark edge recording** : A recording method which uses a mark edge to represent a Channel bit.
- 4.21 optical disk** : A 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)** : A device consisting of a case containing an optical disk.
- 4.23 physical track** : The path which is followed by the focus of the optical beam during one revolution of the disk. This path is not directly addressable.
- 4.24 polarization** : The direction of polarization of an optical beam is the direction of the electric vector of the beam.

NOTE - The plane of polarization is the plane containing the electric vector and the direction of propagation of the beam. The polarization is right-handed when to an observer looking in the direction of propagation of the beam, the end-point of the electric vector would appear to describe an ellipse in the clockwise sense.

4.25 pre-recorded mark : A mark so formed as to be unalterable by magneto-optical means.

4.26 read power : The read power is the optical power, incident at the entrance surface of the disk, used when reading.

NOTE - It is specified as a maximum power that may be used without damage to the written data. Lower power may be used providing that the signal-to-noise ratio and other requirements of this International Standard are met.

4.27 recording layer : A layer of the disk on, or in, which data is written during manufacture and/or use.

4.28 Reed-Solomon code : An error detection and/or correction code which is particularly suited to the correction of errors which occur in bursts or are strongly correlated.

4.29 space : The area between marks along the track.

4.30 spindle : The part of the disk drive which contacts the disk and/or hub.

4.31 substrate : A transparent layer of the disk, provided for mechanical support of the recording layer, through which the optical beam accesses the recording layer.

4.32 track pitch : The distance between adjacent track centrelines, measured in a radial direction.

4.33 write-inhibit hole : A hole in the case which, when detected by the drive to be open, inhibits both write and erase operations.

4.34 write-once functionality : A technique whereby a rewritable MO ODC is restricted to initialization and writing once only; erase is not permitted.

4.35 zone : An 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. 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 ZEROs and ONES.
- 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 last, the most significant bit (numbered 7 in an 8-bit byte) is recorded first. This order of recording applies also to the data input of the Error Detection and Correction circuits and their output.
- Unless otherwise stated, groups of decimal digits of the form xx ... x/yy ... y/zz ... z indicate that the value xx ... x applies to 2 048-byte sectors, yy ... y applies to 1 024-byte sectors and that the value zz ... z applies to 512-byte sectors.

5.2 Names

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

6 List of acronyms

ALPC	Auto Laser Power Control
AM	Address Mark
CRC	Cyclic Redundancy Code
DDS	Disk Definition Structure
DMA	Defect Management Area
DMP	Defect Management Pointers
DOW	Direct Overwrite
ECC	Error Correction Code
EDAC	Error Detection And Correction
ID	Identifier
LBA	Logical Block Address
LSB	Least Significant Byte
MO	Magneto-Optical
MSB	Most Significant Byte
ODC	Optical Disk Cartridge
O-ROM	Optical Read Only Memory
PA	Postamble
PDL	Primary Defect List
PEP	Phase-Encoded Part of the Control Tracks
P-DOW	Partial ROM Direct Overwrite
P-ROM	Partial Read Only Memory
RLL(1,7)	Run Length Limited (code)
R-S	Reed-Solomon (code)
R/W	Rewritable
R-S/LDC	Reed-Solomon Long Distance Code
SCSI	Small Computer System Interface
SDL	Secondary Defect List
SFP	Standard Formatted Part of the Control Tracks
SM	Sector Mark
SWF	Sector Written Flag
TA	Transition Area
TIA	Time Interval Analyzer
VFO	Variable Frequency Oscillator
WO	Write Once
WO-DOW	Write Once Direct Overwrite
ZCAV	Zoned Constant Angular Velocity

7 General description of the optical disk cartridge

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 a shutter. The windows are automatically uncovered by the drive when the cartridge is inserted into it.

The optical disk consists of two sides assembled together with their recording layers on the inside.

The optical disk may be recordable on both sides. Data can be written onto the disk as marks in the form of magnetic domains in the recording layer and can be erased from it with a focused optical beam, using the thermo-magnetic effect. Data may be written over existing data by modulating the intensity of the optical beam. 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 disk.

Part of the disk or the entire disk may contain 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.

The entire disk may be used for write once recording of data using the thermo-magnetic effect. This data can be read using the magneto-optic effect.

8 General requirements

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 in 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 Standard in the specified test environment provides data interchange over the specified ranges of environmental parameters in the operating environment. (See also annex R.)

The operating environment is the environment where the 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 also annex R.1)
magnetic field strength at the recording layer for any condition under which a beam is in focus	: 32 000 A/m max. (see also annex R.2)
magnetic field strength at the recording layer during any other condition	: 48 000 A/m max.

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 S).

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 also annex R.1)
magnetic field strength at the recording layer: 48 000 A/m max.	
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 is given in annex T.

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 IEC 60950, when used in the intended manner or in any foreseeable use in an information processing system.

8.4 Flammability

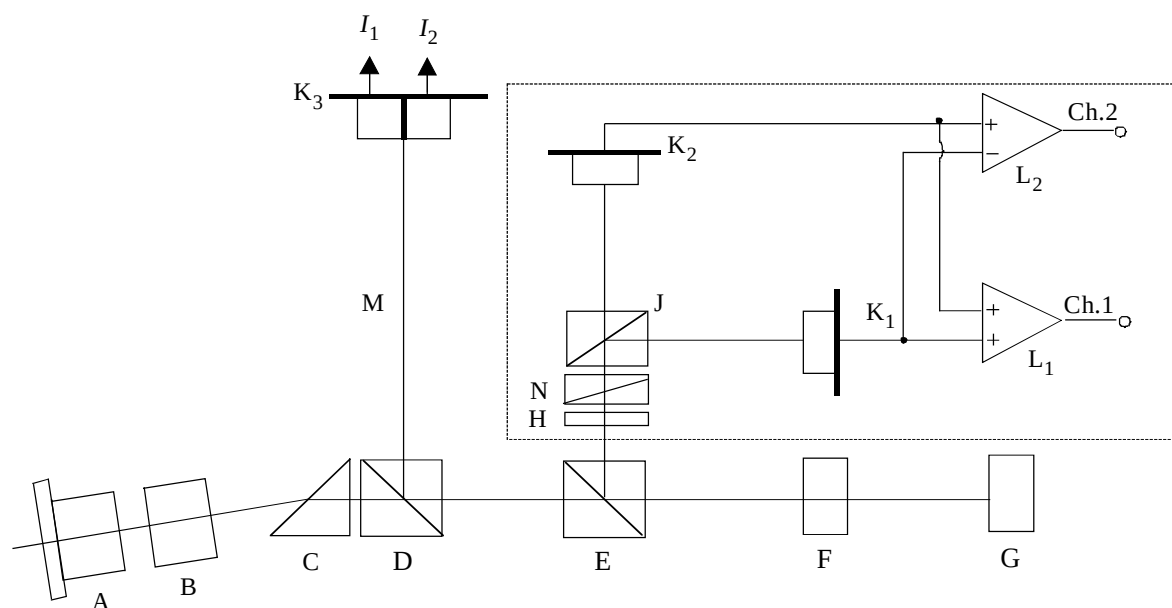
The cartridge and its components shall be made from materials that comply with the flammability class for HB materials, or better, as specified in Standard IEC 60950.

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 write, read and erase parameters of the disk for conformance to this International Standard. The critical components vary from test to test. This clause gives an outline of all components; components critical for tests in specific clauses are specified in those clauses.

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.



95-0041-A

A	Laser diode	G	Optical disk
B	Collimator lens	H	Optional half-wave plate
C	Optional shaping prism	I_1, I_2	Tracking signals from photodiode K_3
Ch.1	Channel 1	J	Polarizing beam splitter
Ch.2	Channel 2	K_1, K_2	Photodiodes for Channels 1 and 2
D	Beam splitter	K_3	Split photodiode
E	Polarizing beam splitter	L_1, L_2	d.c.-coupled amplifiers
F	Objective lens	M	Tracking Channel (see 20.3)
		N	Phase retarder

Figure 1 - Optical system of the Reference Drive

In the absence of polarization changes in the disk, 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 N shall be adjusted such that the optical system does not have more than $2,5^\circ$ phase retardation between the neutral polarization and the polarization perpendicular to it. This position of the retarder is called the neutral position.

The phase retarder can be used for the measurement of the narrow-band signal-to-noise ratio (see 27.2).

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 reflectance's R_p' and R_s' for beam splitter E, then the measured imbalance shall be multiplied by

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

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 photo-diode currents, and is used for reading user-written marks with the magneto-optical effect.

9.2 Optical beam

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

- | | | |
|----|---|--|
| a) | Wavelength (λ) | 685 nm
+10 nm
-10 nm |
| b) | Wavelength (λ) divided by the numerical aperture of the objective lens (NA) | $\lambda / NA = 1,245 \mu\text{m} \pm 0,018 \mu\text{m}$ |
| c) | Filling D/W of the aperture of the objective lens | $0,85 \pm 0,05$ |
| 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 | Linear - parallel to the groove where appropriate |
| f) | Extinction ratio | 0,01 max. |
| g) | The optical power and pulse width for writing, reading and erasing are specified in later clauses of this standard. | |

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°.

9.3 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 written marks, using the rotation of the polarization of 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 1dB from d.c. to 37 MHz.

Unless otherwise stated, the signal of Channel 1 and 2 are not equalized before detection. The signal from both channels shall be low-pass filtered with a 3-pole Butterworth filter with a cut-off frequency of one half the Channel clock frequency.

9.4 Tracking

The Tracking Channel of the drive provides the tracking error signals to control the servos 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.

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 $50,0 \text{ Hz} \pm 0,5 \text{ Hz}$. 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 3) is a rigid protective container of rectangular shape. It has spindle windows on both sides to allow the spindle of the drive to clamp the disk by its hub. Both sides of the case have a head window, one for the optical head of the drive, the other for the magnetic head providing the necessary magnetic fields. A shutter uncovers the windows upon insertion into the drive, and automatically covers them upon removal from the drive. The case has write-inhibit, reflectance detection, and rotation direction detection features, and gripper slots for an autochanger.

10.2 Relationship of Sides A and B

The features essential for physical interchangeability are represented in figure 3. 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, except as noted below. The description is given for one side only. References to Sides A and B can be changed to B or A respectively.

Only the shutter and the slot for the shutter opener, described in 10.5.10 and 10.5.11, are not identical for both sides of the case.

10.3 Reference axes and case reference planes

There is a reference plane P for each side of the case. Each 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 the hub dimensions.
- Figure 3 shows a composite drawing of Side A of the case in isometric form, with the major features identified from Side A.
- Figure 4 shows the envelope of the case with respect to a location hole at the intersection of the X and Y axes and reference plane P.
- Figure 5 shows the surfaces S1, S2, S3 and S4 which establish the reference plane P.
- Figure 5a shows the details of surface S3.
- Figure 6 shows the details of the insertion slot and detent.
- Figure 7 shows the gripper slots, used for automatic handling.
- Figure 8 shows the write-inhibit holes.

- Figure 9 shows the media ID sensor holes.
- Figure 10 shows the shutter sensor notch.
- Figure 11 shows the head and motor window.
- Figure 12 shows the shutter opening features.
- Figure 13 shows the capture cylinder.
- Figure 14 shows the user label areas.

10.5 Dimensions of the case

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

10.5.1 Overall dimensions

The total length of the case (see figure 4) 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 4) shall coincide with the intersection of the reference axes X and Y. It shall have a square form with a side length of

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

held to a depth of

$$L_{10} = 1,5 \text{ mm (i.e. typical wall thickness)}$$

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 4) 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

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

and

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

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 Reference Planes P

The reference plane P (see figures 5 and 5a) for a side of the case shall contain four surfaces (S_1 , S_2 , S_3 and S_4) on that side of the case, specified as follows:

- Two circular surfaces S_1 and S_2 .

Surface S_1 shall be a circular area centred around the square location hole and have a diameter of

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

Surface S_2 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 S_3 and S_4 , that follow the contour of the cartridge and shutter edges.

Surfaces S_3 and S_4 are shaped symmetrically.

Surface S_3 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
12

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

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

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

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

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 S_3 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 . Along the left hand side of surface S_3 there shall be a zone to protect S_3 from being damaged by the shutter. In order to keep this zone at a minimum practical width

$$R_{10} = 4,1 \text{ mm max}$$

This radius originates from the same point as R_9 .

10.5.5 Insertion slots and detent features

The case shall have two symmetrical insertion slots with embedded detent features (see figure 6). The slots shall have a length of

$$L_{20} = 26,0 \text{ mm} \pm 0,3 \text{ mm}$$

a width of

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

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 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

$$R_{11} = 3,0 \text{ mm} \pm 0,2 \text{ mm}$$

with the origin given by

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

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

$$L_{73} = 114,0 \text{ mm} \pm 0,3 \text{ mm}$$

The dimensions L_2 , L_{26} , and L_{73} 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 7) with a depth of

$$L_{28} = 5,0 \text{ mm} \pm 0,3 \text{ mm}$$

from the edge of the case and a width of

$$L_{29} = 6,0 \text{ mm} \pm 0,3 \text{ mm}$$

The upper edge of a slot shall be

$$L_{30} = 12,0 \text{ mm} \pm 0,3 \text{ mm}$$

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 8). 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

$$L_{31} = 8,0 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{32} = 111,0 \text{ mm} \pm 0,3 \text{ mm}$$

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 reference plane P of Side B of the case by more than

$$L_{33} = 0,5 \text{ mm}$$

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_{31} and

$$L_{34} = 11,0 \text{ mm} \pm 0,2 \text{ mm}$$

on Side A of the case.

10.5.8 Media sensor holes

There shall be two sets of four media sensor holes (see figure 9). The set of holes at the lower left hand corner of Side A of the case pertains to Side A of the disk. 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_{32} , L_{34} and

$$\begin{aligned} L_{35} &= 19,5 \text{ mm} \pm 0,2 \text{ mm} \\ L_{36} &= 17,0 \text{ mm} \pm 0,2 \text{ mm} \\ L_{37} &= 23,0 \text{ mm} \pm 0,2 \text{ mm} \\ L_{38} &= 29,0 \text{ mm} \pm 0,2 \text{ mm} \\ L_{39} &= 93,0 \text{ mm} \pm 0,3 \text{ mm} \\ L_{40} &= 99,0 \text{ mm} \pm 0,3 \text{ mm} \\ L_{41} &= 105,0 \text{ mm} \pm 0,3 \text{ mm} \end{aligned}$$

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 for Side A of the disk 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 reference plane P by

$$L_{42} = 0,1 \text{ mm max}$$

The holes are numbered consecutively from 1 to 4. Number 1 is the hole closest to the left hand edge of the case.

Hole No. 1 shall indicate high reflectance of Type O-ROM disks. The hole shall be open for a Type O-ROM disk with high reflectance. The hole shall be closed for ODCs of Type R/W, DOW, P-ROM, P-DOW, WO, and WO-DOW specified by this standard.

Hole No. 2 shall indicate whether Side B shall not be used, in which case the hole shall be open. When Side B shall be used, the hole shall be closed.

An optical disk cartridge conforming to this International Standard does not use holes No. 3 and 4. The holes shall be closed. The meaning of the each hole shall be as in table 1.

Table 1 - Media sensor holes

Sensor hole No.	Indication	Closed	Open
1	Reflectance range of disks	Low reflectance	High reflectance
2	Disk side accessible	Yes	No
3	Not used	Always	-
4	Not used	Always	-

10.5.9 Head and motor window

The case shall have a window on each side to enable the optical head and the motor to access the disk (see figure 11). The dimensions are referenced to a centreline, located at a distance of

$$L_{46} = 61,0 \text{ mm} \pm 0,2 \text{ mm}$$

to the left of reference axis Y.

The width of the head access shall be

$$L_{47} = 20,00 \text{ mm min}$$

$$L_{48} = 20,00 \text{ mm min}$$

and its height shall extend from

$$L_{49} = 118,2 \text{ mm min to}$$

$$L_{50} = 57,0 \text{ mm max}$$

The four inside corners shall be rounded with a radius of

$$R_{12} = 3,0 \text{ mm max}$$

The motor access shall have a diameter of

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

and its centre shall be defined by L_{46} and

$$L_{51} = 43,0 \text{ mm} \pm 0,2 \text{ mm}$$

10.5.10 Shutter

The case shall have a spring-loaded, unidirectional shutter (see figure 12) with an optional latch, designed to completely cover the head and motor windows when closed. A shutter movement of 41,5 mm minimum 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 right-hand side of the top of the shutter shall have a lead-in ramp with an angle

$$A_2 = 16^\circ \text{ max}$$

The distance from the reference planes P to the nearest side of the ramp shall be

$$L_{52} = 2,5 \text{ mm max}$$

The left hand side of the shutter shall not extend closer than

$$L_{52B} = 14,0 \text{ mm min}$$

to the datum plane.

10.5.11 Slot for shutter opener

The shutter shall have only one slot (see figure 12) 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 vertical edge used to push the shutter open shall be located at a distance of

$$L_{53} = 34,5 \text{ mm} \pm 0,5 \text{ mm}$$

from reference axis Y on Side B of the case.

The length of the slot shall be

$$L_{54} = 4,5 \text{ mm} \pm 0,1 \text{ mm}$$

and the angle of the lead-out ramp shall be

$$A_3 = 52,5^\circ \pm 7,5^\circ$$

The depth of the slot shall be

$$L_{55} = 3,5 \text{ mm} \pm 0,1 \text{ mm}$$

The width of the slot from the reference plane P of Side B of the case shall be

$$L_{56} = 6,0 \text{ mm} \begin{array}{l} + 0,5 \text{ mm} \\ - 0,0 \text{ mm} \end{array}$$

If a shutter latch is employed, the distance between the latch and reference plane P of Side B of the case shall be

$$L_{57} = 2,5 \text{ mm max}$$

The edges of the case beneath the shutter, upon which the shutter door opening mechanism may slide, shall have a thickness of

$$B_1 = 1,0 \text{ mm min}$$

located at

$$B_2 = 0,9 \text{ mm max}$$

from plane P (see detail A in figure 12).

The four edges shall also be straight to within

$$\text{STR (straightness of surface)} = 0,2 \text{ mm}$$

in both planes for length C_1 . (Length C_1 is defined by the manufacturer's shutter design. See detail in figure 12.)

10.5.12 Shutter sensor notch

The shutter sensor notch (see figure 10) is used to ensure that the shutter is fully open after insertion of the optical disk cartridge into the drive. Therefore, the notch shall be exposed only when the shutter is fully open.

The dimensions shall be

$$L_{43} = 3,5 \text{ mm} \pm 0,2 \text{ mm}$$

$$L_{44} = 71,0 \text{ mm} \pm 0,3 \text{ mm}$$

and

$$+ 0,0 \text{ mm}$$

$$L_{45} = 9,0 \text{ mm} \\ - 2,0 \text{ mm}$$

The notch shall have a lead-out ramp with an angle

$$A_1 = 45^\circ \pm 2^\circ$$

10.5.13 User label areas

The case shall have the following minimum areas for user labels (see figure 14):

- on Side A and Side B: 35,0 mm x 65,0 mm
- on the bottom side: 6,0 mm x 98,0 mm

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

$$\begin{aligned} L_{61} &= 4,5 \text{ mm min} \\ L_{62} - L_{61} &= 65,0 \text{ mm min} \\ L_{64} - L_{63} &= 35,0 \text{ mm min} \\ L_{65} &= 4,5 \text{ mm min} \\ L_{66} - L_{65} &= 65,0 \text{ mm min} \\ L_{67} + L_{68} &= 35,0 \text{ mm min} \\ L_8 - L_{71} - L_{72} &= 6,0 \text{ mm min} \\ L_4 - L_{69} - L_{70} &= 98,0 \text{ mm min} \end{aligned}$$

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 3N.

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 760 mm on to a concrete floor covered with a vinyl layer 2 mm thick. The cartridge shall withstand all such impacts without any functional failure.

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 and a recording layer coated on the other face. The recording layer can be protected from environmental influences by a protective layer. The Formatted Zone (see clause 17) of the substrate shall be transparent to allow an optical beam to focus on the recording layer through the substrate.

The two disk sides shall be assembled with the recording layer facing inwards.

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

11.2 Reference axis and plane of the disk

Some dimensions of the hub are referred to a Disk Reference Plane P (see figure 2). The Disk Reference Plane P is different from that described in 10.3 for the cartridge. P 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. This axis A passes through the centre of the centre hole of the hub, and is normal to Disk Reference Plane P.

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.

Note - Disks that conform to ISO/IEC 10089 and ISO/IEC 15486 are known to exist which have a total thickness of 3,2 mm.

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 is the area between the outer diameter of the clamping zone (D_6) and the inner diameter of the reflective zone (see clause 17).

The clearance zone shall be excluded from the total thickness requirement, however there shall be no projection from the Disk Reference Plane P in the direction of the optical system of more than 0,2 mm in this zone.

11.3.1 Hub dimension

The outer diameter of the hub (see figure 2) shall be

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

The height of the hub shall be

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

The diameter of the centre hole of the hub shall be

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

The height of the top of the centring hole at diameter D_9 , measured above the Disk Reference Plane P, 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 P. The hole shall extend through the substrate.

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

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

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

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

This 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 P 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

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

11.4 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 Standard. The only material properties specified by this International Standard are the magnetic properties of the magnetizable zone in the hub (see 11.3.1) and the optical properties of the substrate in the Formatted Zone (see 11.5).

11.4.2 Mass

The mass of the disk shall not exceed 120 g.

11.4.3 Moment of inertia

The moment of inertia of the disk relative to axis A shall not exceed $0,22 \text{ g}\cdot\text{m}^2$.

11.4.4 Imbalance

The imbalance of the disk relative to axis A shall not exceed $0,01 \text{ g}\cdot\text{m}$.

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 substrate, on its index of refraction and the deviation of the entrance surface from the Disk Reference Plane P on each side of the disk. The nominal position of the recording layer with respect to the Disk Reference Plane P on each side of the disk is determined by the nominal thickness of the substrate.

The deviation of any point of the recording layer from its nominal position, in a direction normal to the Disk Reference Plane P, shall not exceed $\pm 0,19 \text{ mm}$ for rotational frequencies of the disk as specified in 9.5. The deviation shall be measured by the optical system defined in clause 9.

11.4.6 Axial acceleration

The maximum allowed axial error $e_{\max}$ (see annex V) shall not exceed $\pm 0,7 \text{ }\mu\text{m}$, 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

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

where

$$\omega = 2\pi f$$

$$\omega_0 / 2\pi = 1550 \text{ Hz}$$

$$i = \sqrt{-1}$$

or any other servo with $|1+H|$ within 20% of $|1+H_s|$ in the bandwidth of 50 Hz to 170 kHz. Thus, the disk shall not require an acceleration of more than 22 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 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 A, the tolerances on the dimensions between axis A and the location of the track, and effects of non-uniformity's in the index of refraction.

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, 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 $\pm 0,09 \mu\text{m}$, 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

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

where

$$\omega = 2\pi f$$

$$\omega_0 / 2\pi = 2\,340 \text{ Hz}$$

$$i = \sqrt{-1}$$

or any other servo with $|1+H|$ within 20% of $|1+H_s|$ in the bandwidth of 50 Hz to 170 kHz. Thus, the disk shall not require an acceleration of more than $6,5 \text{ m/s}^2$ 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 P, shall not exceed 2,8 mrad.

11.5 Optical characteristics

11.5.1 Index of refraction

Within the Formatted Zone (see clause 17) the index of refraction of the substrate shall be within the range from 1,46 to 1,60.

11.5.2 Thickness

The thickness of the substrate from the entrance surface to the recording layer, within the Formatted Zone shall be:

$$0,509\,3 \times \frac{n^3}{n^2 - 1} \times \frac{n^2 + 0,265\,0}{n^2 + 0,592\,9} \text{ mm} \pm 0,05 \text{ mm}$$

where n is the index of refraction.

11.5.3 Birefringence

The effect of the birefringence of the substrate is included in the measurement of the imbalance of the magneto optical signal in Channel 2 of the Reference Drive (see 26.2)

11.5.4 Vertical Birefringence

The principal vertical birefringence value shall be contained as follows:

$$0 \leq |N_p - N_z| \leq 500 \times 10^{-6}$$

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 X).

11.5.5 Reflectance

11.5.5.1 General

The reflectance R is the value of the reflectance in-groove of an unrecorded and grooved area of the User Zone, measured through the substrate 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 3 of the Control Track PEP Zone (see 17.3.2.1.4), and
- in byte 19 of the Control Track SFP Zone (see 17.4.2).

11.5.5.2 Measured value

The measured value R_m of the reflectance shall be measured under the conditions a) to f) of 9.2 and those of 20.2.2 using the split photo detector $(I_1+I_2)_{IG}$.

Measurements shall be made in the User Zone in any track without embossed data fields.

11.5.5.3 Requirement

The value of R at the standard wavelength specified in 9.2 shall lie within the range of 0,10 to 0,25 for Type R/W, DOW, P-ROM, P-DOW, WO or WO-DOW disks and shall be not less than 0,35 for Type O-ROM disks.

At any point in the User Zone, the measured reflectance R_m shall meet the following requirement.

$$R(1 - 0,15) \leq (R_{mmax} + R_{mmin})/2 \leq R(1 + 0,15)$$

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

$$(R_{mmax} - R_{mmin}) / (R_{mmax} + R_{mmin}) \leq 0,13$$

where

R_{mmax} is the maximum value of measured reflectance in the User Zone, and

R_{mmin} is the minimum value of measured reflectance in the User Zone.

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 centering 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 D shall be in the range of 8,0 N to 12,0 N.

12.3 Capture cylinder

The capture cylinder (see figure 13) 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 two pins mentioned and the centre of the hub. The bottom of the cylinder is parallel to the Disk Reference Plane P, and shall be located at a distance of

$$L_{58} = 0,5 \text{ mm min.}$$

above the Disk 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

$$L_{59} = 4,3 \text{ mm max.}$$

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

$$D_{12} = 3,0 \text{ mm max.}$$

Its centre shall be defined by the nominal values of L_{46} and L_{51} .

12.4 Disk position in the operating condition

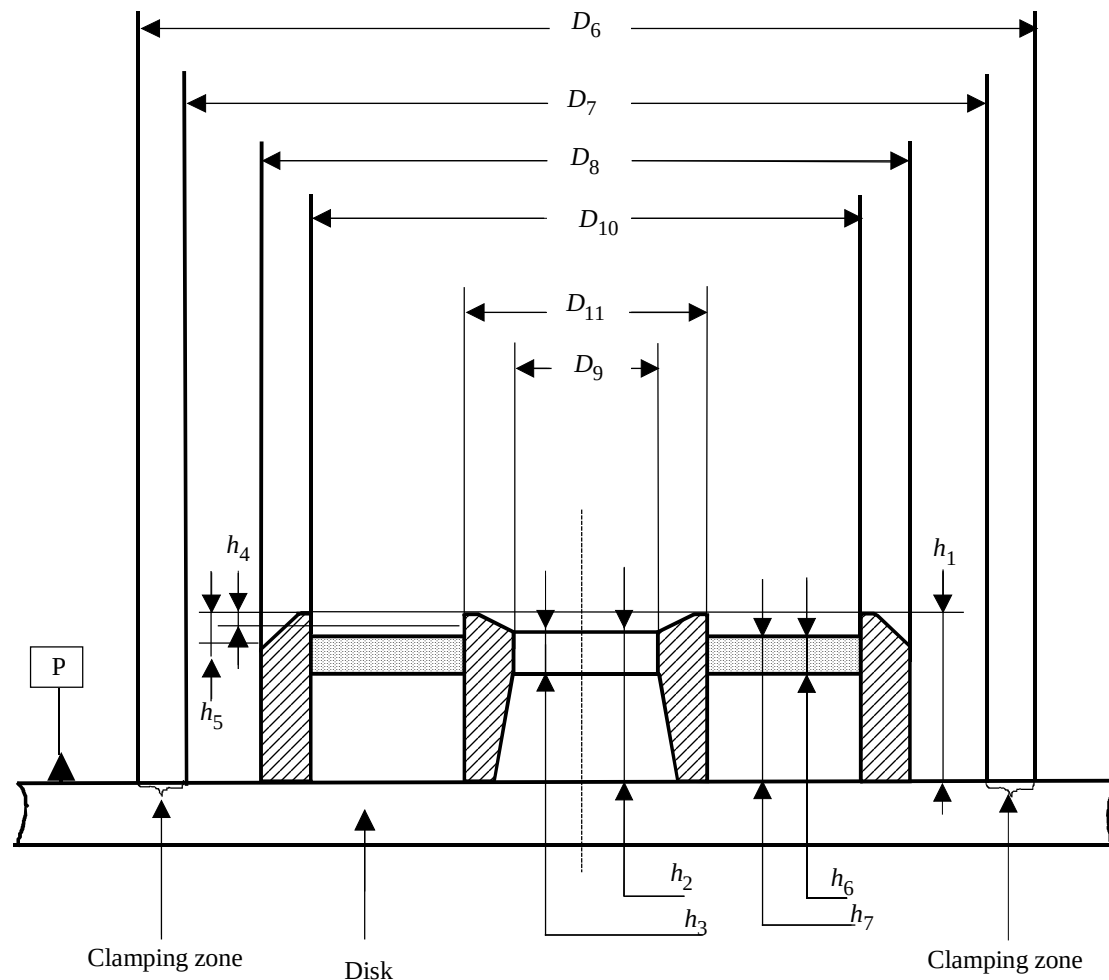
When the disk is in the operating condition (see figure 13) within the drive, the position of the active recording layer shall be

$$L_{60} = 5,35 \text{ mm} \pm 0,15 \text{ mm}$$

above the Disk 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 50 Hz shall not exceed 0,01 N·m, when the axis of rotation is within a circle of diameter

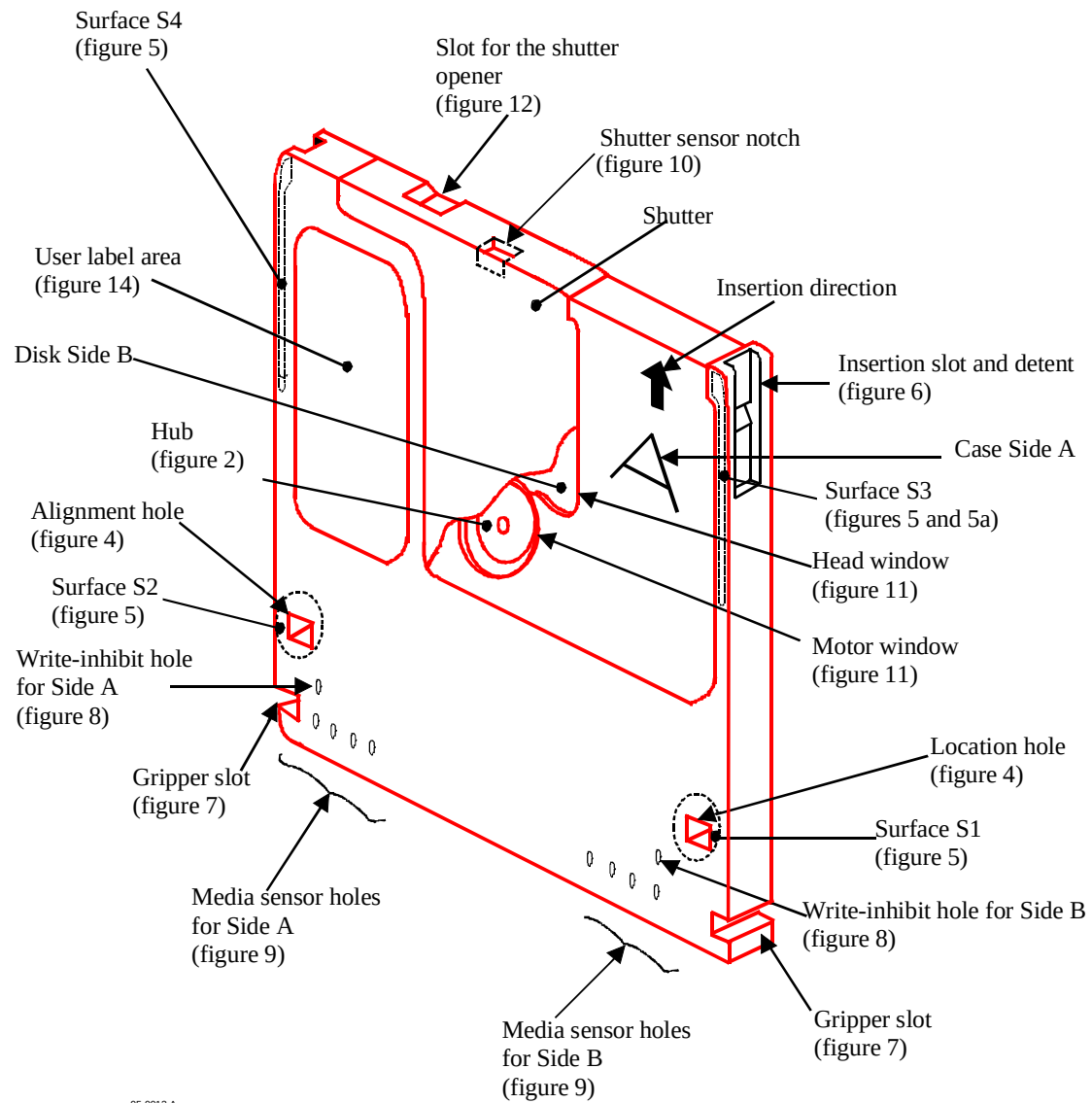
$$D_{13} = 0,2 \text{ mm max.}$$

and a centre given by the nominal values of L_{46} and L_{51} .



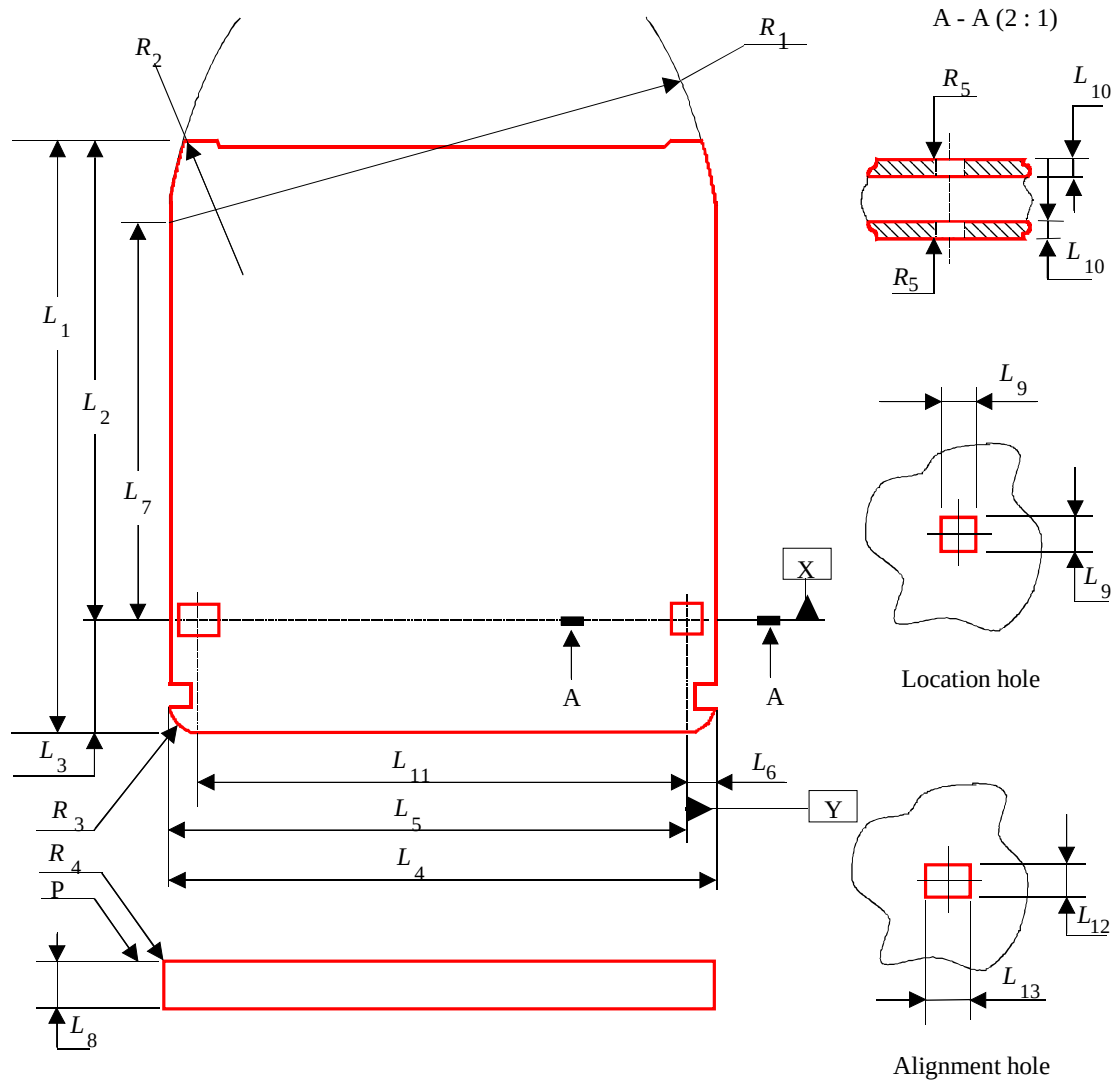
94-0131-A

Figure 2 - Hub dimensions



95-0013-A

Figure 3 - Case



95-0014-A

Figure 4 - Overall dimensions and reference axes

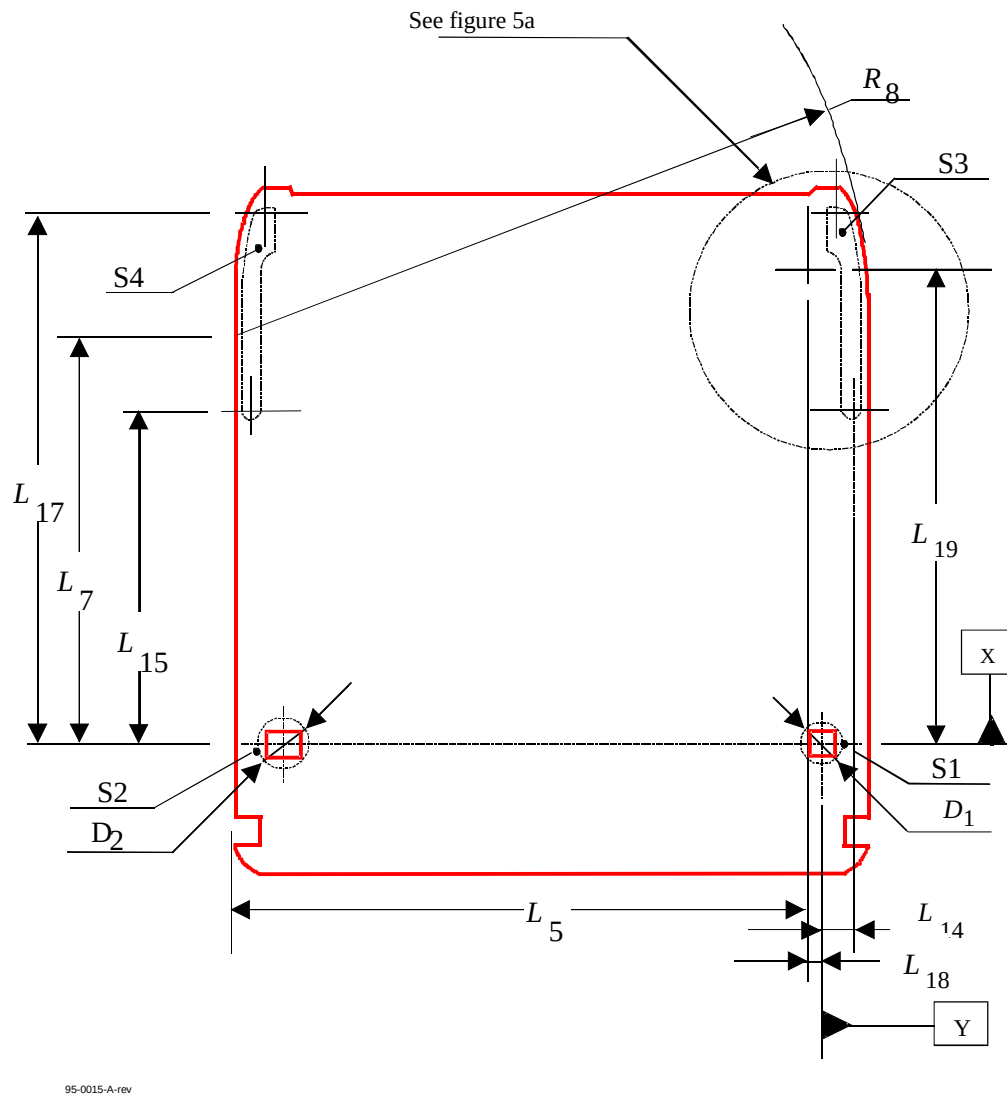
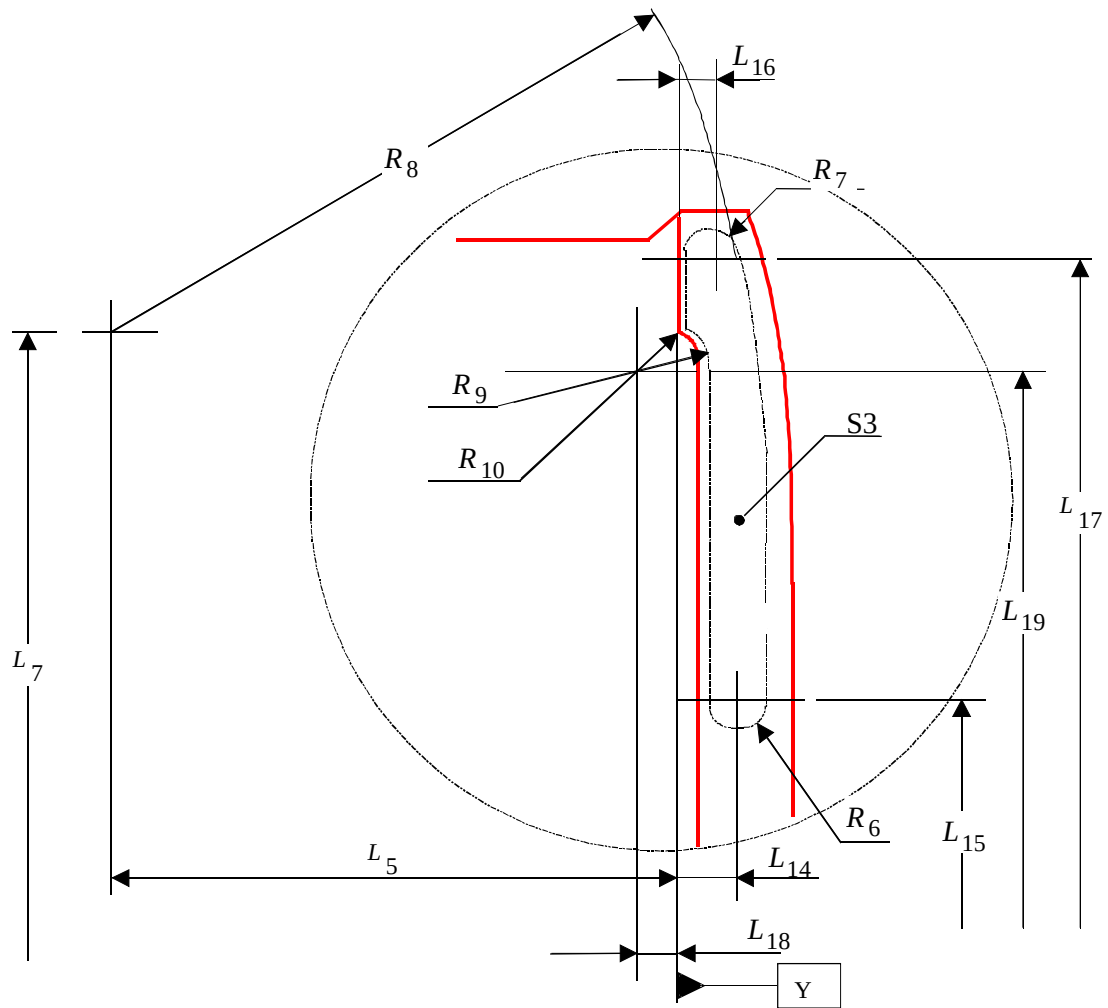


Figure 5 - Surfaces S1, S2, S3 and S4 of the reference plane P



95-0016-A-rev

Figure 5a - Detail of surface S3

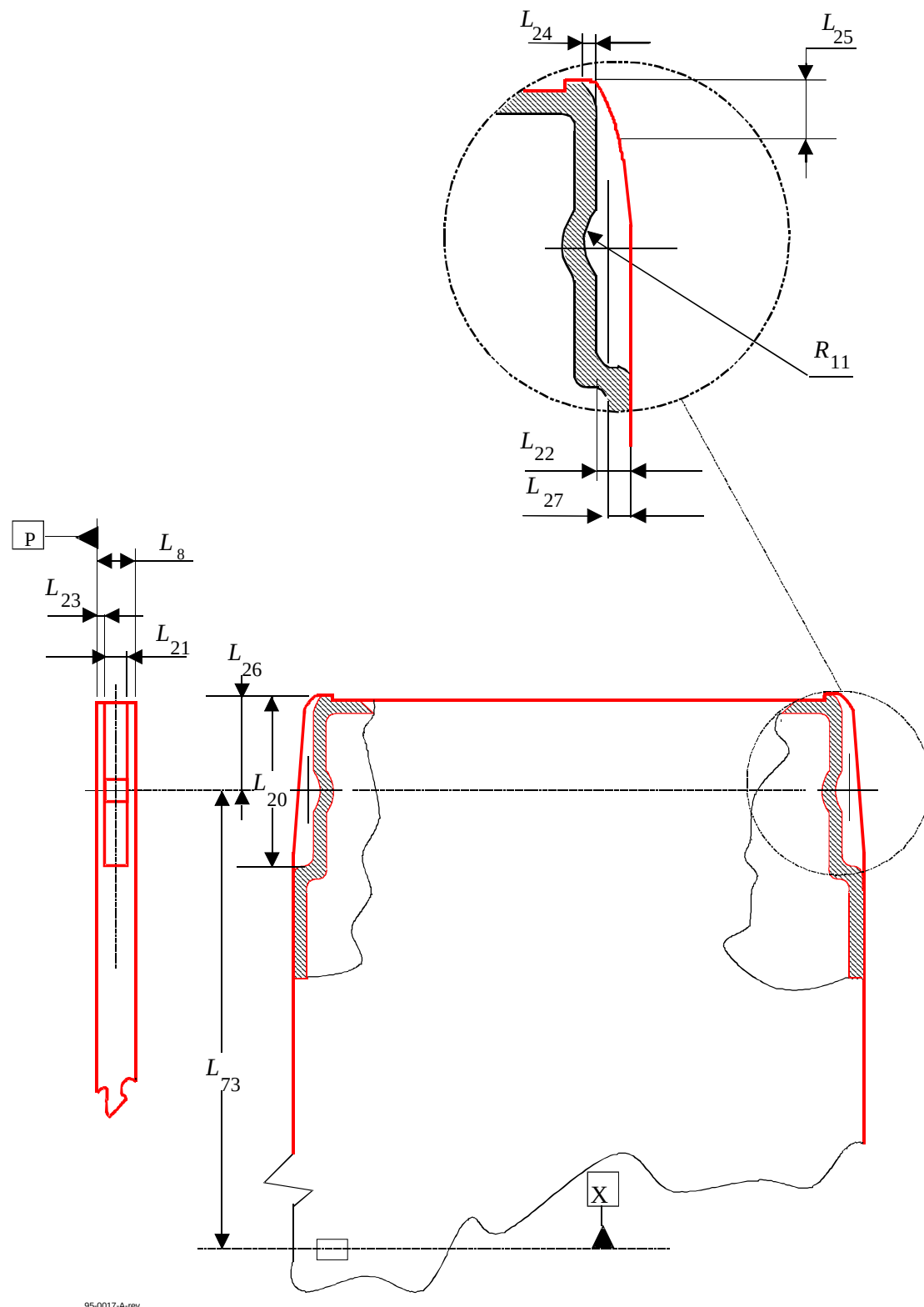
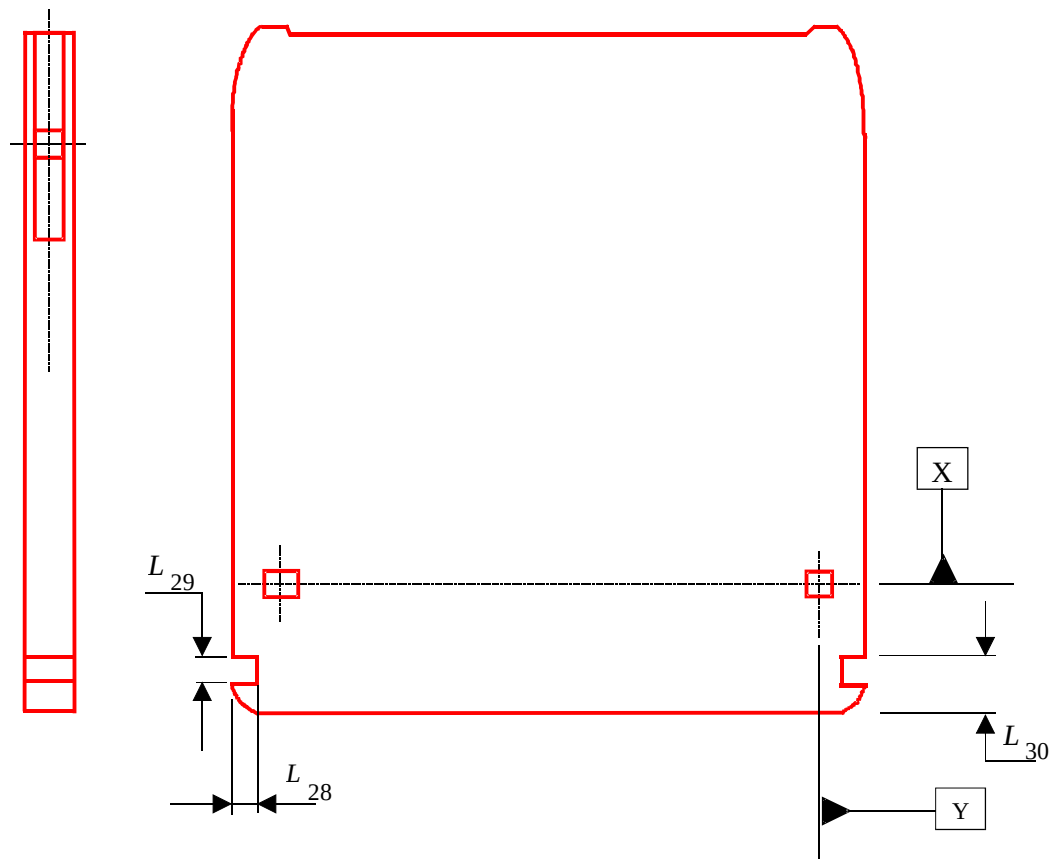


Figure 6 - Insertion slot and detent



95-0018-A-rev

Figure 7 - Gripper slots

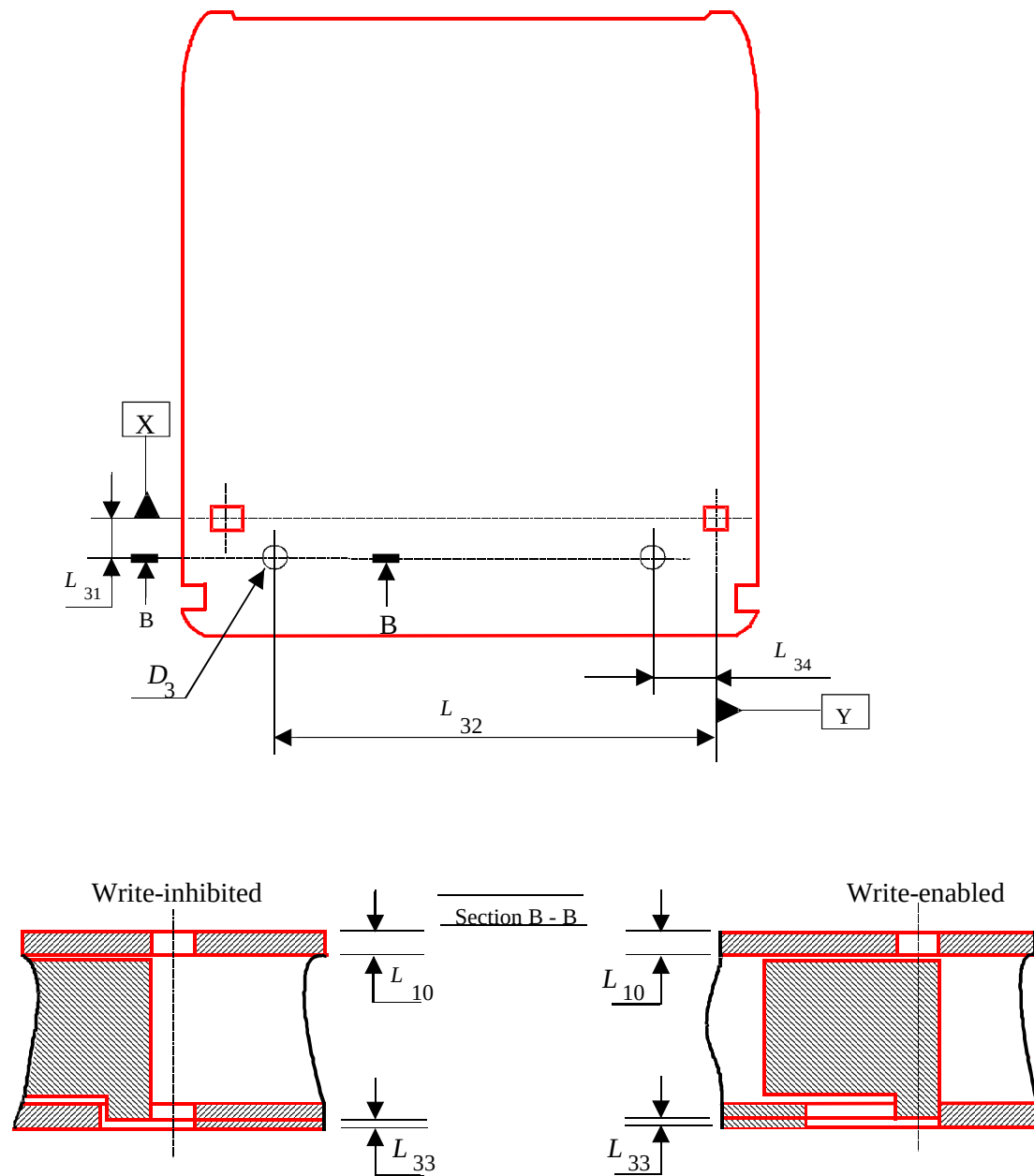
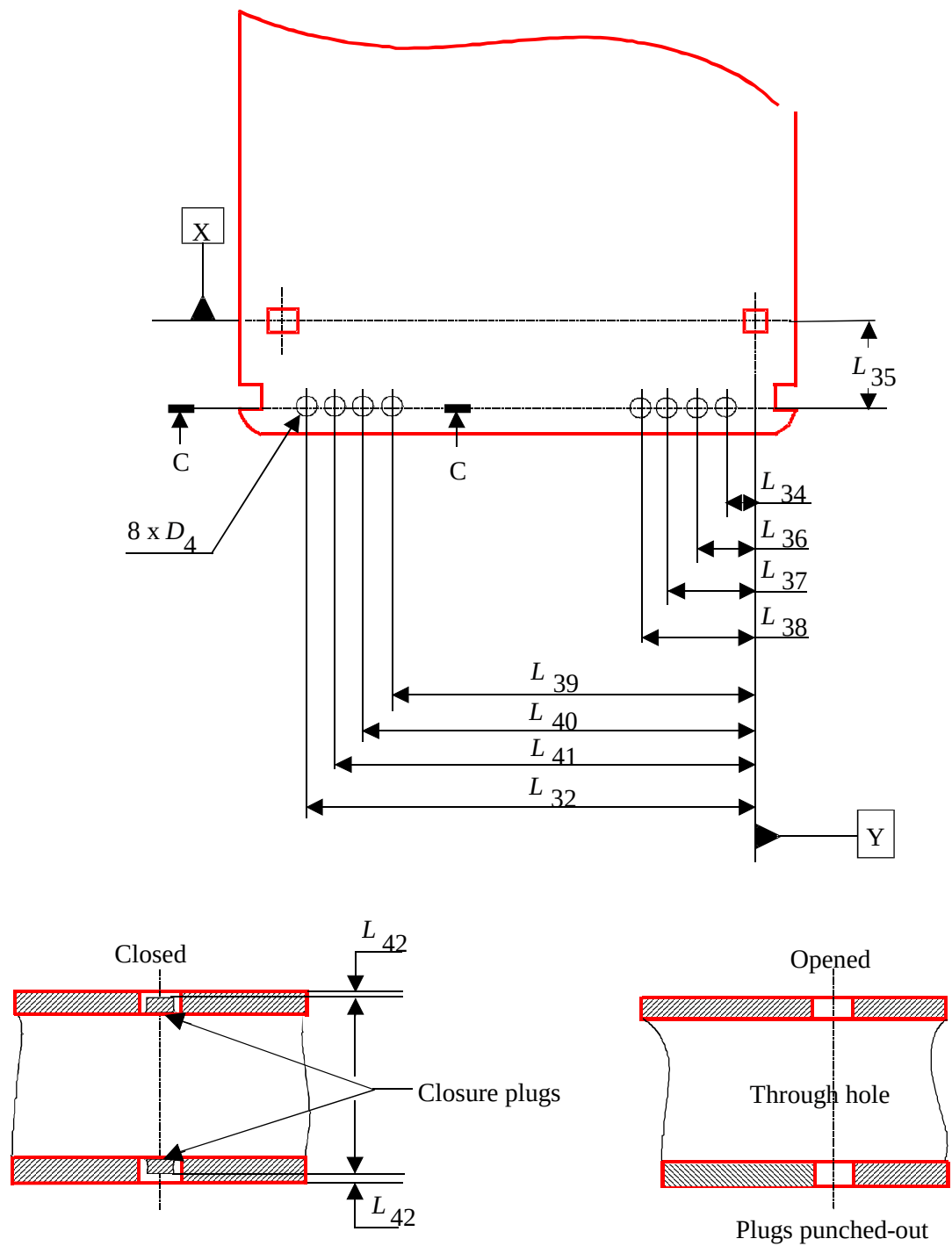


Figure 8 - Write-Inhibit holes



95-0020-A-rev

Figure 9 - Media ID sensor holes

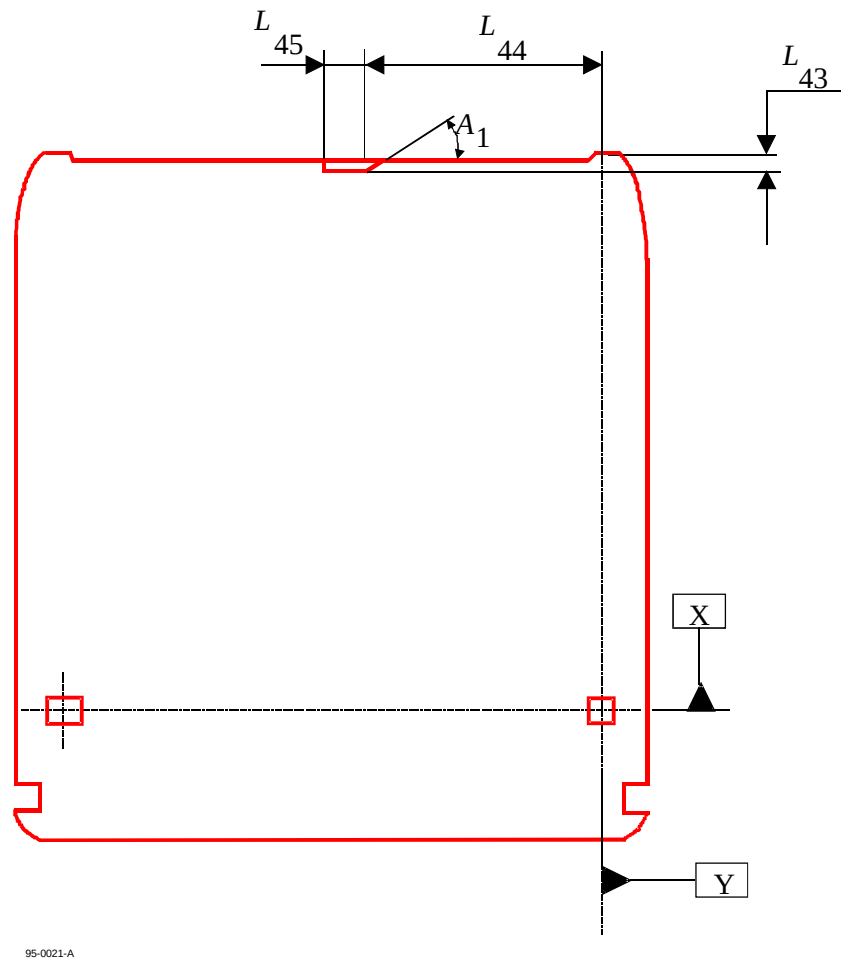


Figure 10 - Shutter sensor notch viewed from Side A

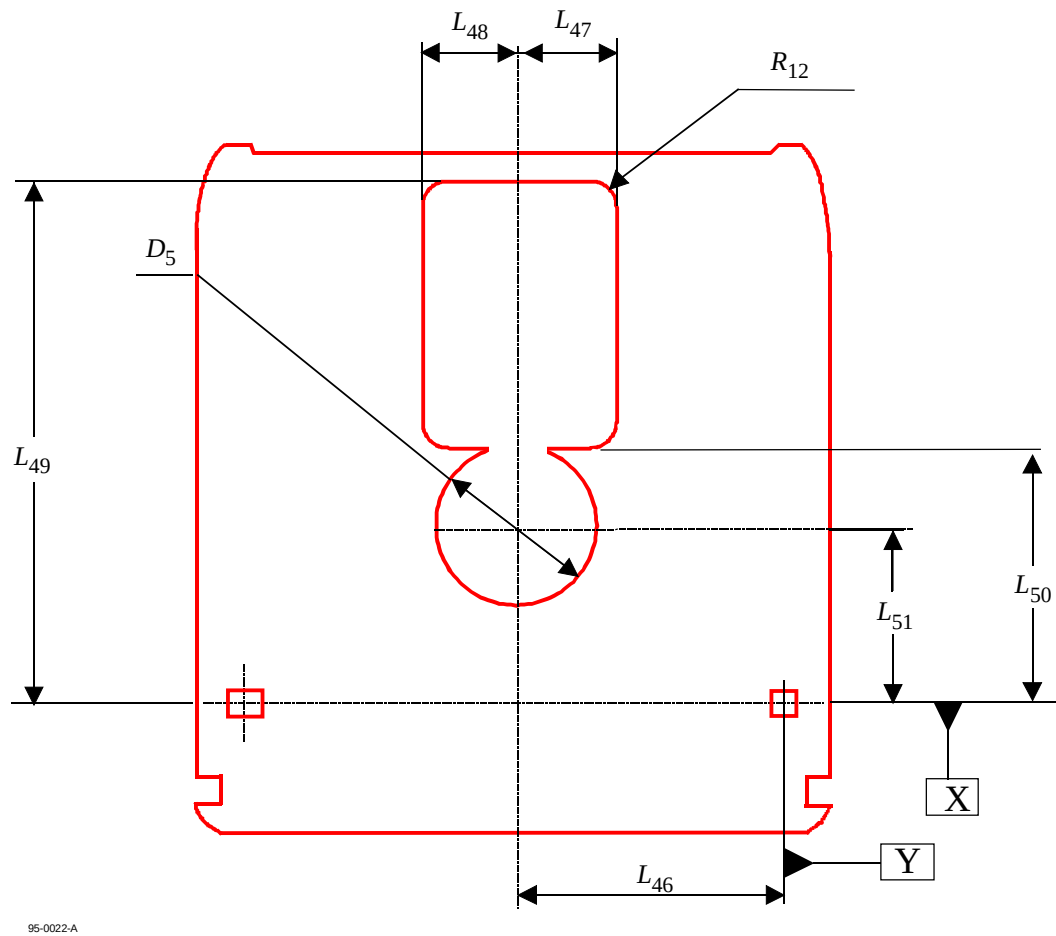


Figure 11 - Head and motor window

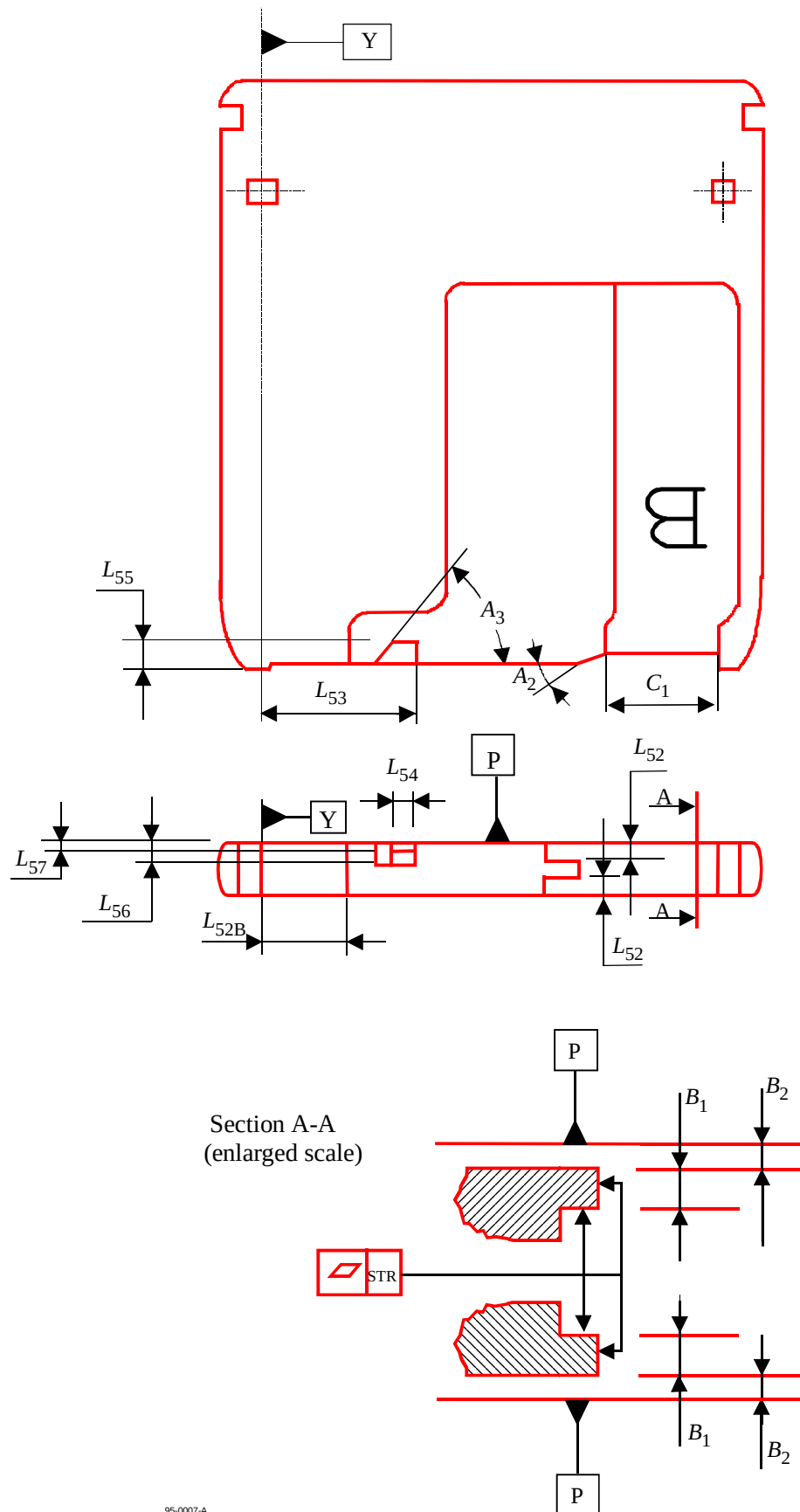
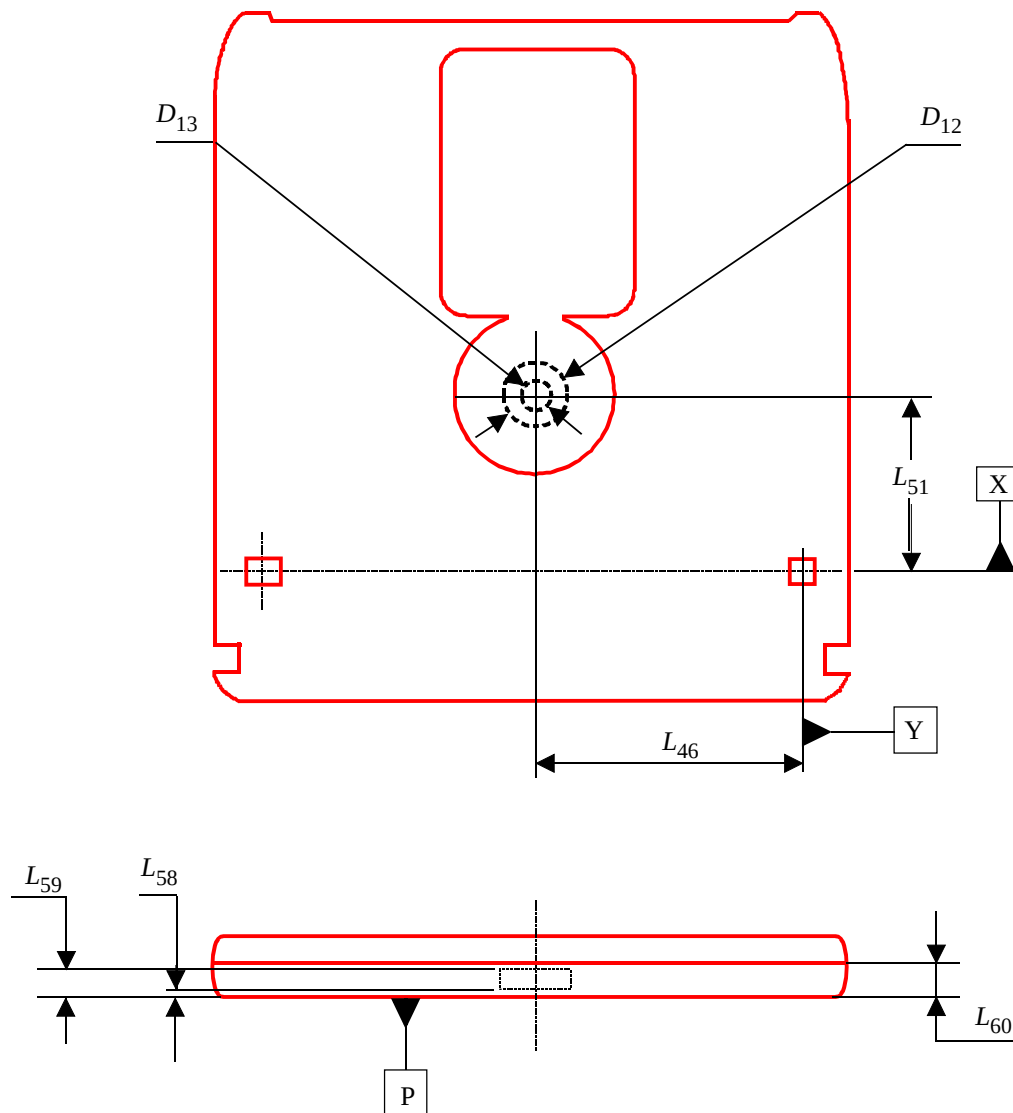


Figure 12 - Shutter opening features



95-0024-A

Figure 13 - Capture cylinder

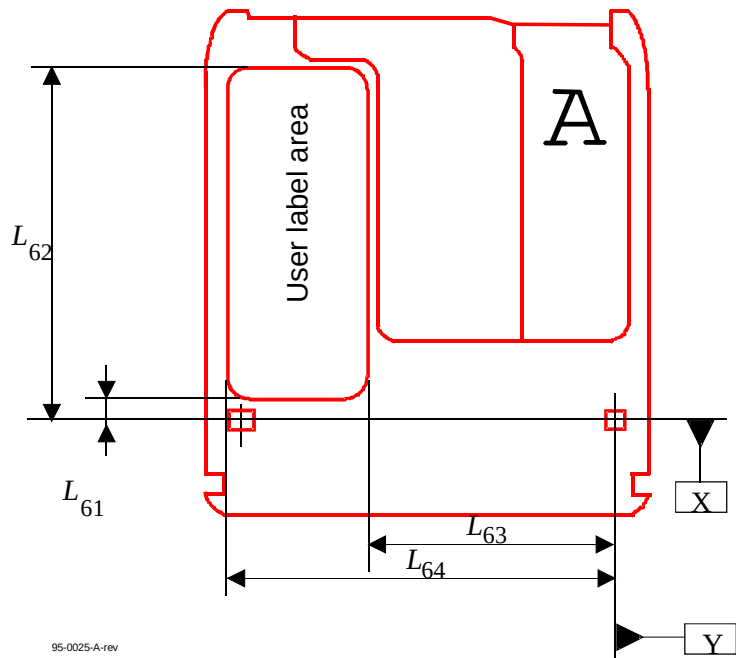


Figure 14a - User label area on Side A

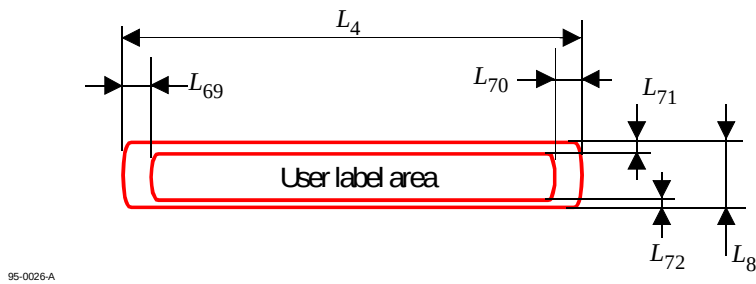


Figure 14b - User label area on bottom surface

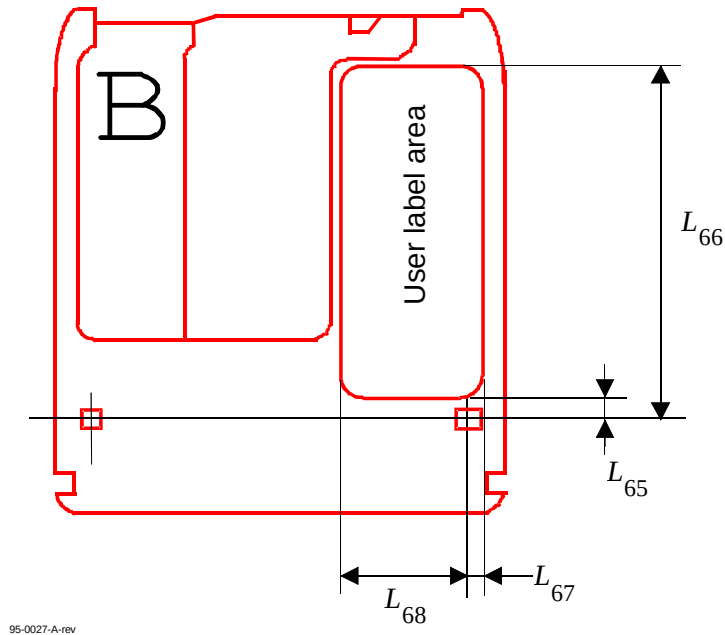


Figure 14c - User label area on Side B