
**Information technology — Data interchange
on 356 mm optical disk cartridges —
WORM, using phase change technology —
Capacity: 14,8 Gbytes and 25 Gbytes per
cartridge**

*Technologies de l'information — Échange de données sur cartouches de
disques optiques 356 mm [WORM], utilisant la technologie de changement
de phase — Capacité: 14,8 Gbytes et 25 Gbytes par cartouche*



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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. 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 15898 was prepared by ECMA (as ECMA-260) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval of national bodies of ISO and IEC.

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

Information technology — Data interchange on 356 mm optical disk cartridges — WORM, using phase change technology — Capacity: 14,8 Gbytes and 25 Gbytes per cartridge

Section 1 - General

1 Scope

This International Standard specifies the characteristics of 356 mm Optical Disk Cartridges (ODCs) of the type providing for information to be written once and read many times.

This International Standard specifies:

- definitions of essential concepts,
- the environment in which the characteristics shall be tested,
- the environments in which the cartridge shall be operated and stored,
- the mechanical, physical and dimensional characteristics of the case and of the optical disk,
- the optical characteristics and the recording characteristics for recording the information once and for reading it many times, so as to provide physical interchangeability between data processing systems.
- the format for the physical disposition of the tracks and sectors, the error correction codes, the modulation methods used for recording and the quality of the recorded signals.

Together with a standard for volume and file structure, this International Standard provides for full data interchange between data processing systems.

2 Conformance

2.1 Optical disk cartridge

An optical disk cartridge shall be in conformance with this International Standard if it meets all the mandatory requirements herein.

2.2 Generating system

A manufacturer of a system generating an ODC for interchange shall be in conformance with this International Standard if the ODC it generates is in accordance with 2.1.

2.3 Receiving system

A manufacturer of a system receiving an ODC for interchange shall be entitled to claim conformance with this International Standard if it is able to handle an ODC according to 2.1.

2.4 Compatibility statement

A claim of conformance by a generating or receiving system with this International Standard shall include a statement listing any other ECMA or International Optical Disk Cartridge Standard(s) supported. This statement shall specify the number of the standard(s) and whether support includes reading or both reading and writing.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were 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 editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 646:1991, *Information technology — ISO 7-bit coded character set for information interchange.*

IEC 950:1991, *Safety of information technology equipment.*

4 Definitions

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

- 4.1 actual write power:** The actual write power is two times the recording beam power exiting the objective lens for a time averaged measurement of 50 % duty cycle optical pulses where the pulse length is measured at one half the peak power.
- 4.2 air sandwich disk:** A disk which consists at least of a substrate with a recording layer and a cover separated by two annular spaces providing an enclosed air gap for the recording layer.
- 4.3 band:** An annular area of the optical disk recording zone.
- 4.4 baseline reflectance:** The reflectance of an unwritten, non-grooved area of a disk through the protective layer.
- 4.5 birefringence:** The property of a material which causes incident light waves of different polarizations to be refracted differently by the material.
- 4.6 case:** An enclosure which protects the optical disk and carrier from contamination and damage due to physical handling. The case may include space for physical labelling, write-inhibit features and provisions for automatic handling to facilitate disk interchange.
- 4.7 clamping zone:** The annular part of the disk within which the clamping force is applied by the clamping device.
- 4.8 cover sheet:** A transparent covering placed at a pre-determined distance from the recording surface to protect the optical disk from surface contamination and to cause surface contaminants to be out of focus.
- 4.9 cross-talk level:** The ratio of the level of a spurious signal generated by an adjacent track to the level of the signal of that track.
- 4.10 cyclic redundancy check (CRC):** A method to detect errors in data.
- 4.11 defect management:** In real time, refers to automated programs for altering read or write power, focus or tracking when difficulties are detected, and for the decision to abandon sectors of high error content. In batch mode, refers to guidelines for disk rewrite or retirement.
- Note – Disk retirement is retention of a disk which can be read but not written.
- 4.12 disk reference plane:** A plane defined by the perfectly flat annular surface of an ideal spindle which contacts the clamping zone of the disk and which is normal to the axis of rotation.
- 4.13 entrance surface:** The disk surface onto which the optical beam first impinges.
- 4.14 error correction code (ECC):** An error-detecting code designed to correct certain kinds of errors in data.
- 4.15 error detection and correction (EDAC):** A family of methods in which redundancy is added to data in known fashion and is written with the data. Upon readback, a decoder removes the redundancy and uses the redundant information to detect and correct erroneous channel symbols.
- 4.16 format:** The arrangement or layout of the data on a data medium.
- 4.17 hub:** The central feature on the disk which interacts with the spindle of the disk drive to provide radial centring and clamping force and, in some cases, axial location.
- 4.18 interleaving:** The process of allocating the physical sequence of units of data to render the data more immune to burst errors.
- 4.19 mark:** A feature of the recording layer that may take the form of an amorphous spot, crystalline spot, a pit, or other form that can be sensed by the optical system. The pattern of marks represents the data on the disk.
- 4.20 mark edge:** The transition between a region with a mark and one without a mark or vice versa, along a track.
- 4.21 mark edge recording:** A recording method which uses a mark edge to represent a channel bit.
- 4.22 narrow band signal-to-noise ratio:** The ratio of the root mean square (RMS) voltage of a signal at a specified frequency to the RMS voltage of the noise in a specified bandwidth, expressed in decibels.
- 4.23 noise floor:** The noise spectrum in a specified bandwidth.
- 4.24 optical disk:** A disk containing information in the form of marks in a recording layer that can be read with an optical beam.

- 4.25 optical disk carrier:** A framework which captures and holds an optical disk except when the optical disk is mounted on the disk drive spindle. The carrier provides the interface with the equipment for handling of an optical disk. The carrier and the optical disk are permanently mated and as a sub-assembly interchangeable with any case, disk drive or library equipment.
- 4.26 optical disk cartridge (ODC):** A device consisting of a case containing an optical disk and carrier.
- 4.27 optical retardation:** The change, after passage through a birefringent material, of the phase between two orthogonally, linearly polarized plane waves associated with a given propagation direction.
- 4.28 perimeter ring:** An outside diameter feature of the optical disk to provide an interface to the carrier and to handling devices of an optical disk drive.
- 4.29 pre-formatted mark:** A mark written by the manufacturer for use by the optical disk drive.
- 4.30 protective layer:** A transparent layer on the disk provided for mechanical protection of the recording layer, through which the optical beam accesses the recording layer.
- 4.31 read power:** The incident power specified at the entrance surface that can be used to read the data on the disk without damaging the recording layer.
- 4.32 recording layer:** A layer of the disk on or in which data is written during manufacture and/or use.
- 4.33 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.
- 4.34 spindle:** The part of the disk drive which contacts the disk and/or the hub.
- 4.35 tilt:** The angle which the normal to the entrance surface makes with the normal to the disk reference plane.
- 4.36 track:** A 360 ° segment of the path which is to be followed by the read beam during reading or the write beam during writing.
- 4.37 track pitch:** The distance between adjacent track centrelines measured in a radial direction.
- 4.38 write power:** The incident power specified at the entrance surface used to produce marks.
- 4.39 zone:** An annular area of the disk.

5 Conventions and notations

Bits and bytes mean data bits and bytes unless otherwise specified.

5.1 Representation of numbers

The following conventions apply to numbers:

- A measured value is rounded off to the least significant digit of the corresponding 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. A value $\geq 0,015$ is rounded up to 0,02 and a value $< 0,015$ is rounded down to 0,01.
- 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 digits 0 and 1.
- Numbers in binary notation and bit combinations are shown with the most significant bit to the left.
- Negative values of numbers in binary notation are given in TWO's complement.
- In the sector headers, character data are recorded according to the IRV of ISO/IEC 646.
- All other data are stored as binary integers.
- Multiple-byte binary data are stored least significant byte first.

5.2 Names

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

6 List of acronyms

AM	Address mark
CRC	Cyclic Redundancy Code
DCF	Data Control Field
DMA	Defect Management Area
DM-M	Delay Modulation Mark
EDAC	Error Detection and Correction
ECC	Error Correction Code
GDL	Grown Defect List
ID	Inside diameter
IDENT	Identification
LSB	Least Significant Byte
MSB	Most Significant Byte
NRZ	Non Return to Zero
OD	Outside diameter
ODC	Optical Disk Cartridge
PAD	Tracking pad
PDL	Primary Defect List
RA	Reallocation Area
RLL	Run length limited (code)
RPM	Revolutions per minute
R-S/LDC	Reed-Solomon long distance code
SDL	Secondary Defect List
VFO	Variable frequency oscillator

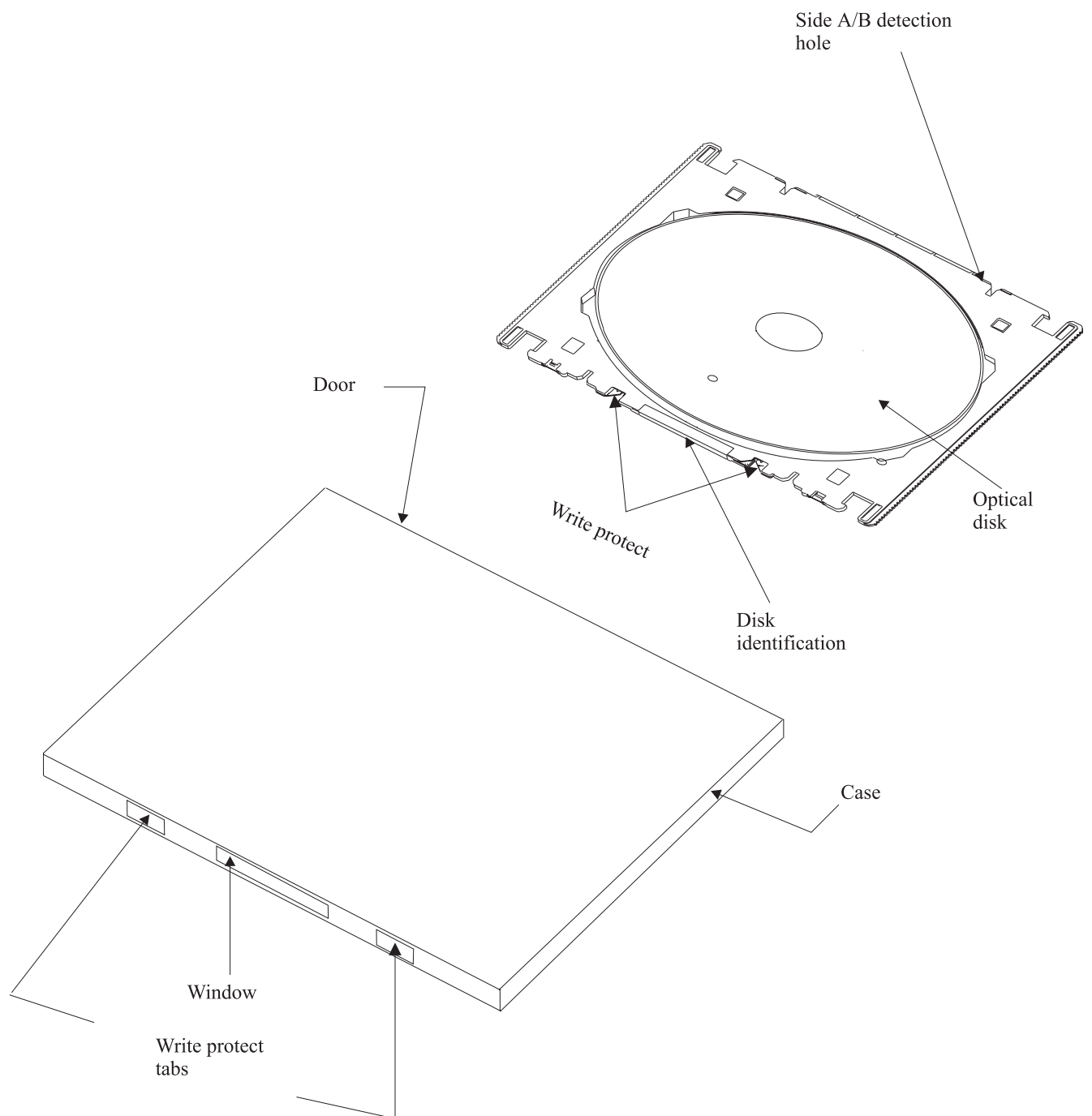
7 General description of the optical disk cartridge

The optical disk cartridge which is the subject of this International Standard consists of a case containing an optical disk and carrier sub-assembly.

The case provides protection from contaminants and during human handling. The case has an access door for automatic unload and load of the carrier and the disk.

The carrier supports and retains the disk during loading into the drive or unloading from it, and while being moved by an automated library storage device.

The optical disk is recordable on both sides. Data is written onto the disk as marks in the form of crystalline spots in the amorphous recording layer with a focused optical beam, using the phase-change effect between crystalline and amorphous states. The composition of the recording layer is such that the marks cannot be erased or transformed back into an unrecorded state. The data can be read with a focused optical beam, using the phase-change effect as the reflective difference between amorphous and crystalline states. The beam accesses the recording layer through a thin transparent protective layer (cover sheet) on the disk surface.



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Figure 1 - Optical disk cartridge

8 General requirements

8.1 Environments

8.1.1 Test environment

Unless otherwise specified, tests and measurements made on the ODC to check the requirements of this International Standard shall be carried out in an environment where the air immediately surrounding the ODC is within the following conditions.

temperature	: 23 °C ± 2 °C
relative humidity	: 45 % to 55 %
atmospheric pressure	: 75 kPa to 110 kPa
air cleanliness	: Class 100 000 (see annex A)
conditioning before testing	: 48 h min.

Before testing, the ODC shall be conditioned in this environment for 48 h minimum. No condensation on or in the ODC shall occur.

8.1.2 Operating environment

Optical disk cartridges used for data interchange shall be operated in an environment where the air immediately surrounding the optical disk and carrier is within the following conditions when the drive has reached its stable operating conditions.

temperature	: 10 °C to 50 °C
relative humidity	: 10 % to 80 %
wet bulb temperature	: 29 °C max.
atmospheric pressure	: 75 kPa to 110 kPa
temperature gradient	: 10 °C / h max.
relative humidity gradient	: 10 % / h max.
air cleanliness	: Class 100 000 (see annex A)

No condensation on or in the ODC shall be allowed to occur.

If an ODC has been exposed during storage and/or transportation to conditions outside those specified above, it shall be acclimatized in the operating environment for at least 2 h before use.

8.1.3 Storage environment

Storage environment is the ambient condition to which the ODC, without any additional protective enclosure, is exposed when stored.

8.1.3.1 Short-term storage

For a time of six consecutive weeks the optical disk cartridge within its specified shipping package shall not be exposed to the environmental conditions outside those given below.

temperature	: -20 °C to +55 °C
relative humidity	: 5 % to 90 %
wet bulb temperature	: 29 °C max.
atmospheric pressure	: 75 kPa to 110 kPa
temperature gradient	: 20 °C / h max.
relative humidity gradient	: 20 % / h max.

No condensation on or in the optical disk assembly shall be allowed to occur.

8.1.3.2 Long-term storage

For a storage period longer than six consecutive weeks the optical disk cartridge shall not be exposed to environmental conditions outside those given below.

temperature	: -10 °C to 50 °C
relative humidity	: 10 % to 90 %
wet bulb temperature	: 29 °C max.
atmospheric pressure	: 75 kPa to 110 kPa
temperature gradient	: 15 °C / h max.

relative humidity gradient : 10 % / h max.

air cleanliness : Class 100 000 (see annex A)

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

8.1.4 Transportation

This International Standard does not specify requirements for transportation but guidance is given in annex R.

8.2 Temperature shock

In the operating environment an ODC shall be capable of withstanding a thermal 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 950 and its components shall not constitute any safety or health hazard when used in its 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 950.

9 Reference Drive

The Reference Drive is a drive for which several critical components have well defined properties and which is used to test write and read parameters of the disk for conformance to this International Standard.

9.1 Optical system

The basic set-up of the optical system of the Reference Drive used for measuring the write and read parameters is shown in figure 2. Different components and locations of components are permitted, provided that the performance remains the same as that of the setup in figure 2. 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.

- a) Write and read wavelength : 680 nm $\pm$ 10 nm
- b) Numerical aperture (NA) : 0,50 $\pm$ 0,01
- c) Focused spot size in each dimension : 0,75 μ m $\pm$ 0,04 μ m
- d) Wave front at recording layer : $\leq$ 0,045 rms

(through 90 μ m thick coversheet)

and coma3 : $\leq$ 0,10 | rms

and astig3 : $\leq$ 0,13 | rms

and spher3 : $\leq$ 0,10 | rms

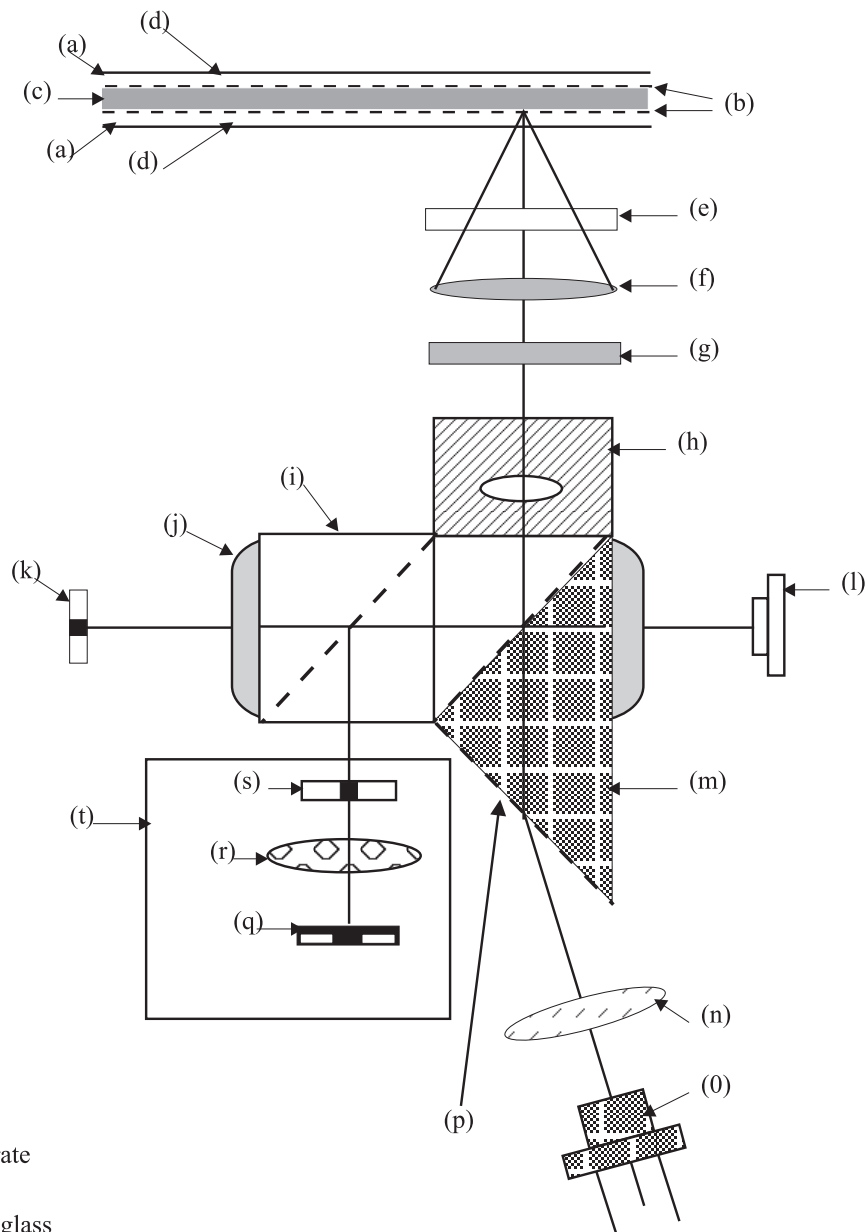
where:

coma3 = third order coma aberration

astig3 = third order astigmatism aberration

spher3 = third order spherical aberration

- e) Polarization of the light: circular
- f) Detection method:
 - Reflected light collected by central aperture method
 - Transitions detected by gated second derivative method
- g) The data rate for testing shall be 30 Mega channel bits per second.



- (a) Cover sheet
- (b) Recording layers
- (c) Aluminum substrate
- (d) air
- (e) AR coated cover glass
- (f) 0,50 NA objective lens in actuator
- (g) 680 nm QWP
- (h) Turning prism
- (i) BS cube, $RS = 0,25$
- (j) Cylinder lens
- (k) RF / split cell phase tracking detector
- (l) Front facet detector
- (m) Achromatic beam expander / "leaky" polarization beamsplitter $RS = 1,0$ $RP = 0,05$
- (n) Collimating lens
- (o) SDL 680 nm 30 mW laser diode
- (p) AR coating for p, all other surfaces coated for 670 to 700 nm
- (q) Focus detector
- (r) Assembly lens
- (s) Dual prism
- (t) Dual half-aperture focus detector

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Figure 2 - Optical system of the Reference Drive

9.2 Read conditions

Marks on the disk shall be read from the disk with a constant optical power. The read power shall be = 1,0 mW.

9.3 Write conditions

Marks are written on the disk by pulses of optical power superimposed upon the read power. The pulse shape shall be as specified in annex L.

The write power is the optical power incident at the entrance surface when writing in the user area.

The write power shall be determined according to annex L.

The test patterns to be written shall be as specified in annex L.

9.4 Tracking

The tracking channel of the drive provides the tracking error signals to control the servos for the radial tracking of the optical beam.

9.5 Rotation of the disk

The direction of rotation shall be counterclockwise for side A and clockwise for side B as seen from the optical head of the disk drive.

Section 2 - Mechanical and physical characteristics

10 Dimensional and mechanical characteristics of the case

10.1 General (figures 1, 3, 4, and 9)

The case contains the 356 mm optical disk which is captured within the carrier. The case provides the optical disk and carrier sub-assembly protection from contaminants and during human handling. (see figure 1)

The case shall enclose the carrier and optical disk at all times when they are external to a disk drive or automated library storage equipment.

Any case shall be interchangeable with any carrier.

The case shall be a rigid, protective enclosure of rectangular shape and include a means for positioning and retaining the carrier and optical disk.

The case shall have write protect tabs that interface with the carrier and the tabs shall also be accessible for manual enable or inhibit (see figure 3).

The case shall have an access door for automated unload and load of the carrier and optical disk (see figure 4).

The case shall have a window for viewing the label on the end of the carrier and the case shall have areas provided for manufacturer labels (see figure 3).

The case shall provide drive/backup roller surfaces for disk drive cartridge load and unload operations (see figure 9).

10.2 Case drawings

The case is represented schematically in the following drawings.

Figure 1	shows a typical optical disk cartridge,
Figure 3	shows the case bottom surface,
Figure 4	shows the case top surface,
Figure 5	shows the case write protect tabs,
Figure 6	shows the case overall dimensions,
Figure 7	shows the case door opener force location,
Figure 8	shows the case window location,
Figure 9	shows the case autoloader drive surfaces.

10.3 Relationship of sides and interface with carrier

10.3.1 Relationship of sides

The case shall be interchangeable with any carrier and shall accept a carrier with either Side A up or Side B up.

10.3.2 Interface with carrier

The case shall mechanically retain the carrier and optical disk sub-assembly. The case shall allow the carrier and optical disk sub-assembly to be loaded and unloaded through the case door.

10.3.3 Write protect features (figure 5)

The case shall have write-protect features to interface with the carrier. Side A of the optical disk shall be down and write-protected under the following conditions:

- a) The letter "A" is correctly seen on the carrier label when viewed through the case window.
- b) The left-hand write protect tab is positioned so that the arrow on the tab is in alignment with the arrow on the case.
- c) The carrier write protect feature blocks the write protect holes in the carrier (see 11.11).
- d) The write protect mode selected shall remain with the carrier when loaded into a disk drive and the case is removed from the disk drive.
- e) The case write protect tabs shall be automatically moved into the position that is consistent with the carrier write protect mode when the carrier and optical disk sub-assembly is reloaded into a case.

10.4 Materials

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

10.5 Mass

The total mass of the empty case shall be less than 1,5 kg.

10.6 Case dimensions

10.6.1 Overall dimensions of the case (figure 6)

The length, width, and height of the case shall be:

$$L_1 = 443,76 \text{ mm} \pm 1,50 \text{ mm}$$

$$L_2 = 421,84 \text{ mm} \pm 0,64 \text{ mm}$$

$$L_3 = 25,40 \text{ mm} \pm 0,51 \text{ mm}$$

10.6.2 Opening force of the case door (figure 7)

The case door shall be opened by a force applied at the following locations:

$$L_4 = 35,81 \text{ mm} \pm 3,2 \text{ mm}$$

$$L_5 = 12,70 \text{ mm} \pm 1,5 \text{ mm}$$

The opening force shall be:

$$F_1 = 7,50 \text{ N min.}$$

10.6.3 Location of the case window (figure 8)

The location of the case window from case side shall be:

$$L_6 = 151,0 \text{ mm} \pm 0,64 \text{ mm}$$

The width of the window shall be:

$$L_7 = 101,0 \text{ mm min.}$$

The location of the window from the case top or bottom surface shall be:

$$L_8 = 6,35 \text{ mm} \pm 0,25 \text{ mm}$$

The height of the window shall be:

$$L_9 = 12,50 \text{ mm min.}$$

10.6.4 Case write protect tabs (figure 5)

A case write protect tab shall be enabled when an arrow on the tab is in alignment with an arrow on the case. The write protect conventions are specified in 10.3.3.

10.6.5 Case autoload drive surfaces (figure 9)

The drive roller surface location on the top and bottom case surfaces from the case side shall be:

$$L_{10} = 9,65 \text{ mm} \pm 0,51 \text{ mm}$$

The width of the roller surface of the drive shall be:

$$L_{11} = 38,10 \text{ mm max.}$$

The force exerted on drive roller surface by the drive roller shall be:

$$F_2 = 62,30 \text{ N max.}$$

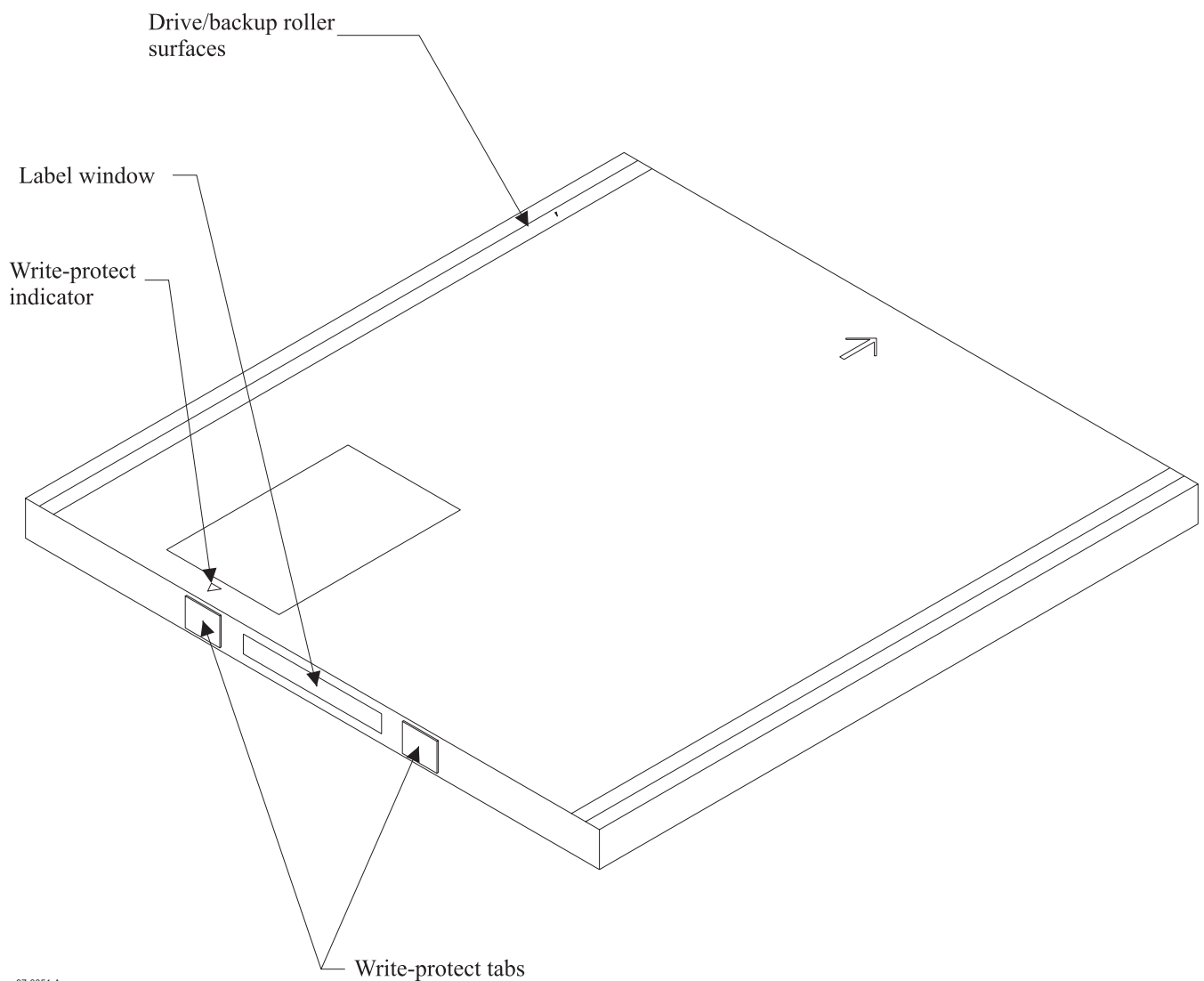
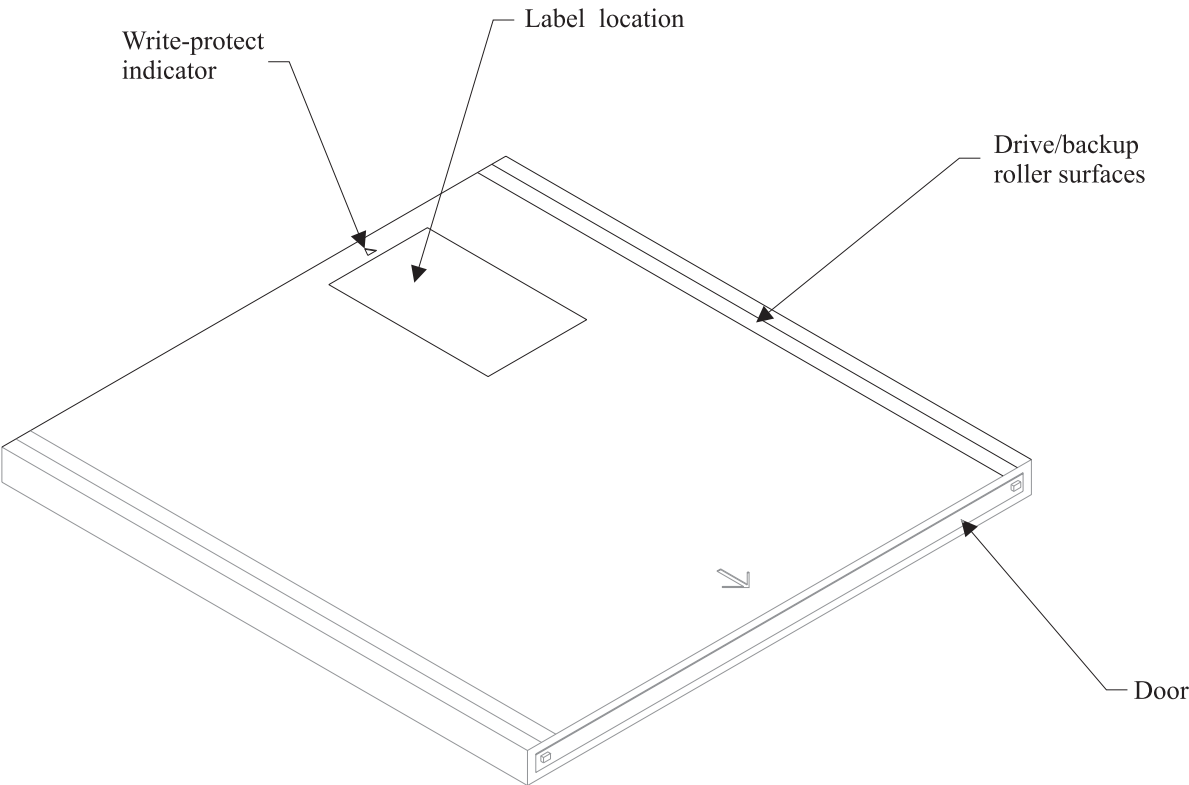
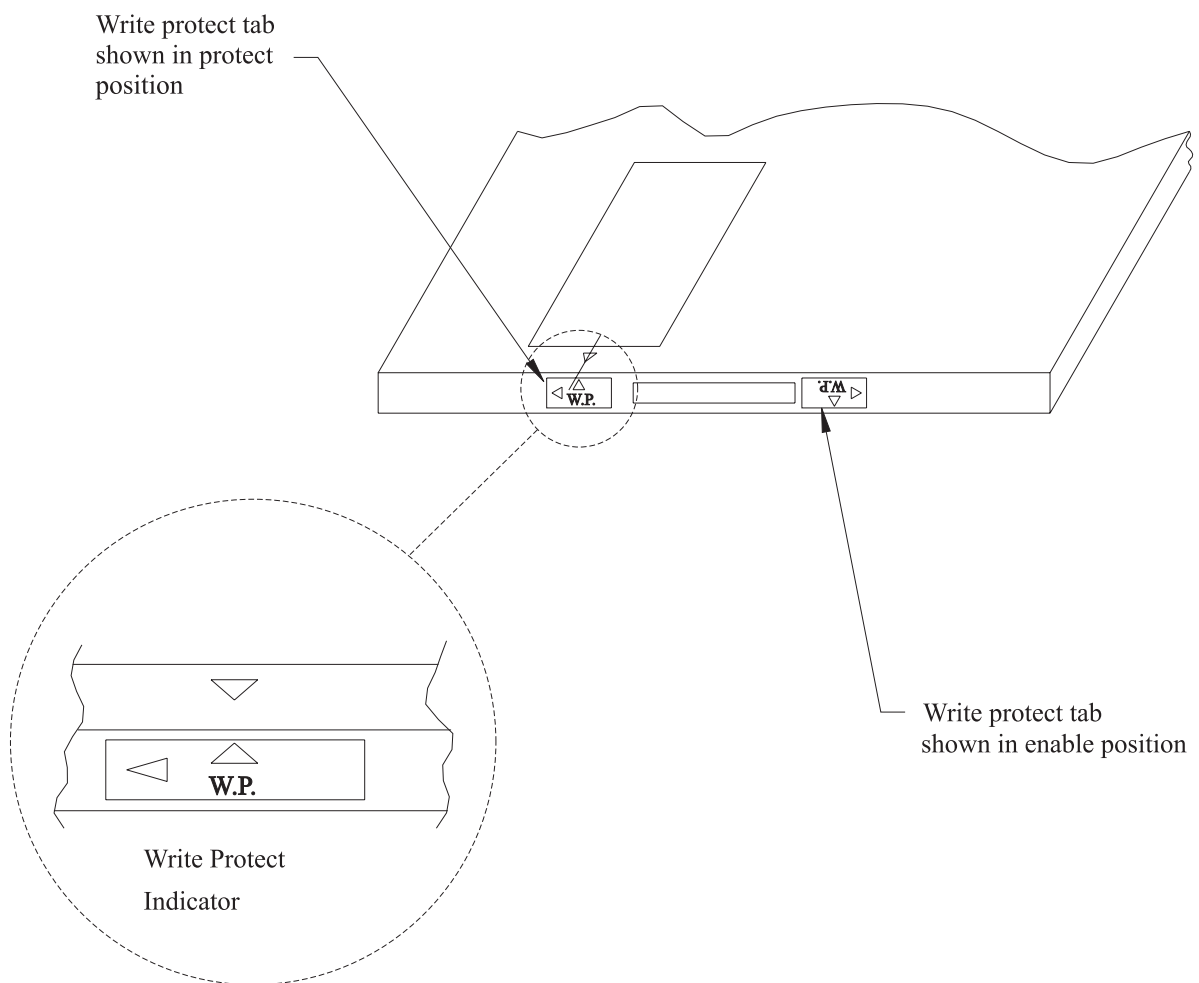


Figure 3 - Bottom surface of the case



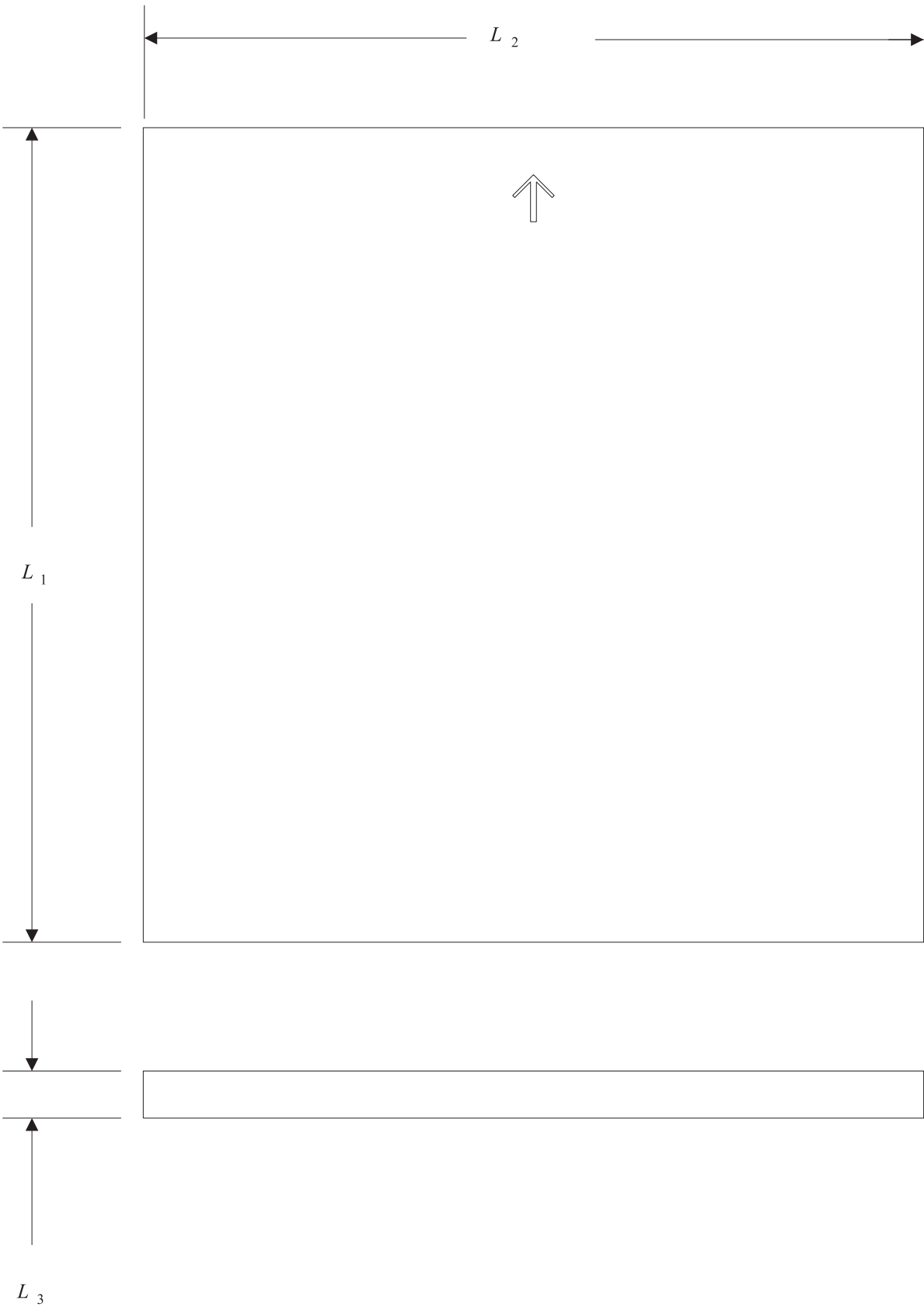
97-0052-A

Figure 4 - Top surface of the case



97-0053-A

Figure 5 - Write-protect tabs



97-0054-A

Figure 6 - Overall dimensions of the case

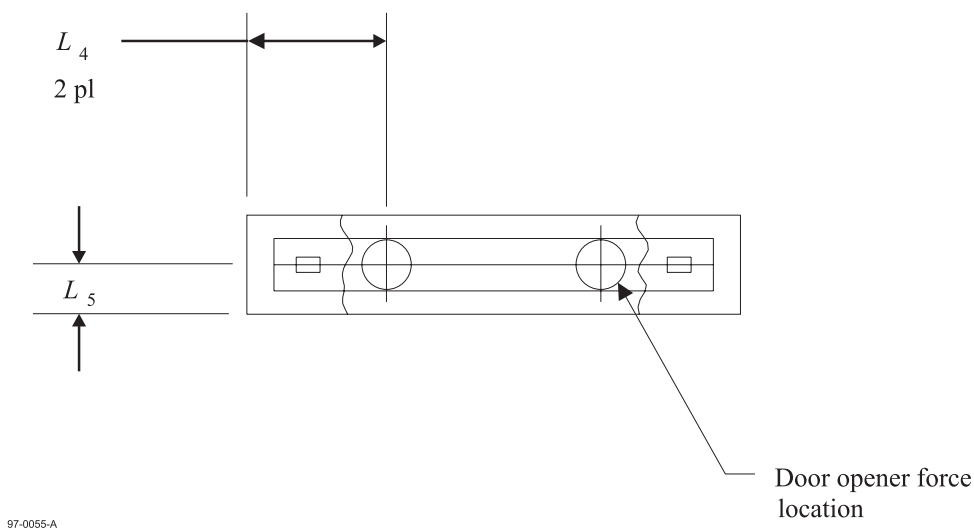


Figure 7 - Door opener force location

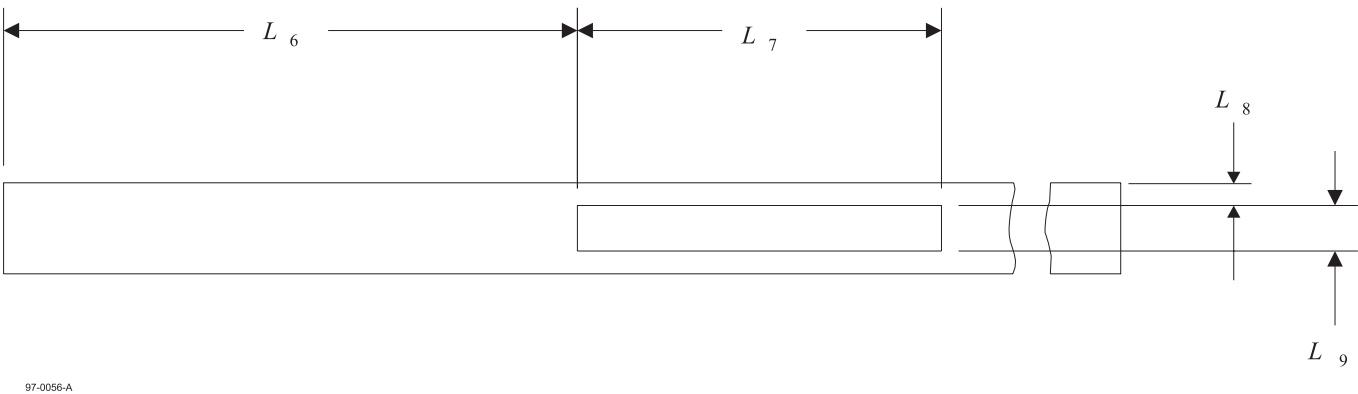
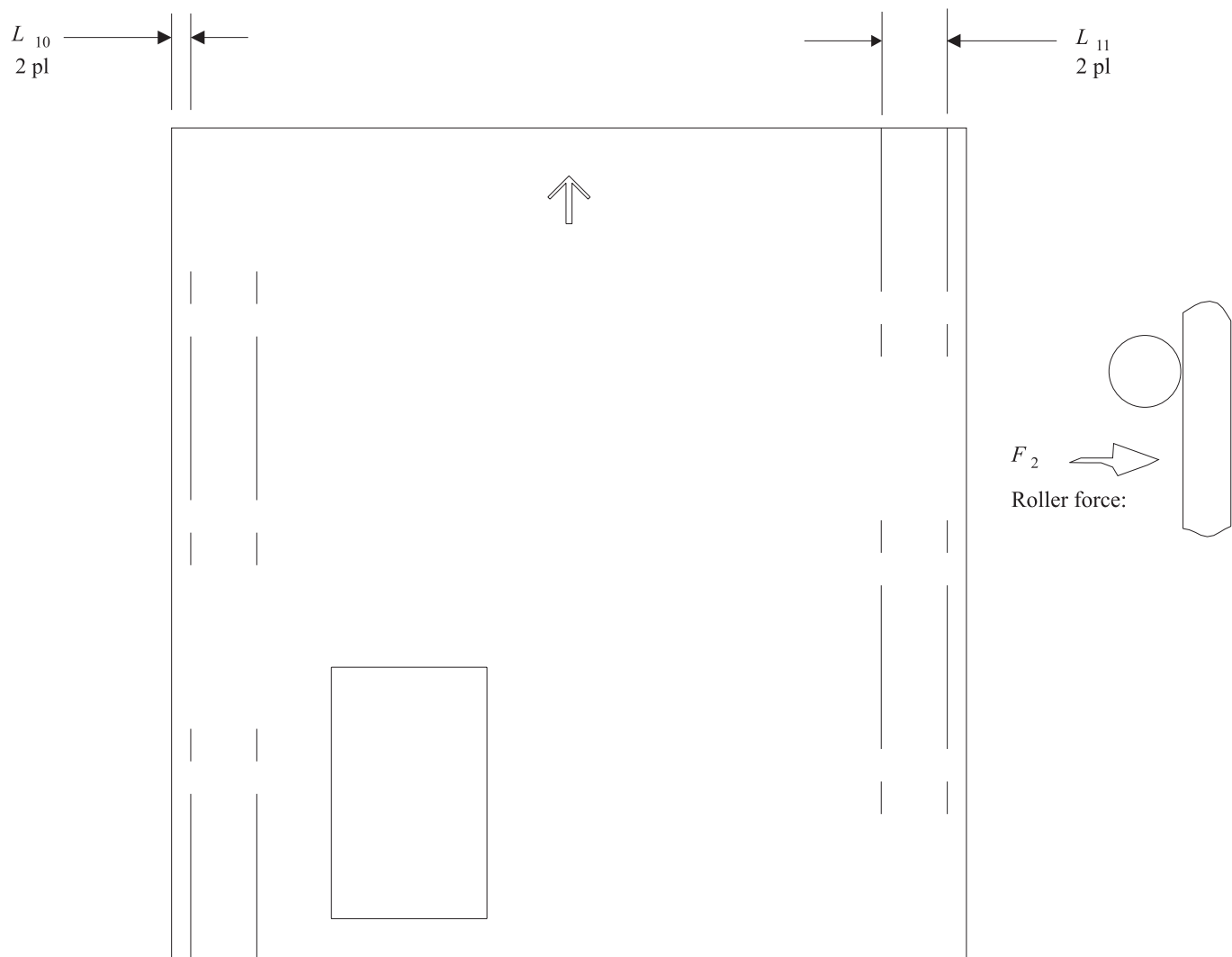


Figure 8 - Window location



97-0057-A

Figure 9 - Autoload drive surfaces of the case

11 Dimensional and mechanical characteristics of the carrier

11.1 General (figure 10)

The function of the carrier is to capture and retain the optical disk and to provide the interface with optical disk drives and automated library storage equipment.

The carrier shall be capable of supporting and retaining an optical disk while being manipulated or moved to any position during transportation or storage in a case, during load into and unload from a disk drive and while being moved by automated library storage devices.

The carrier and optical disk shall be permanently mated and are interchangeable as a sub-assembly. The optical disk is separated from the carrier only when the disk is mounted on the disk drive spindle.

The carrier shall provide symmetry for optical disk centreline location regardless of the orientation of the optical disk and carrier sub-assembly in the disk drive.

Both the carrier label end and the opposite end shall be able to be inserted into the storage cells of automated library storage equipment with Side A either up or down.

Both the carrier label end and the opposite end shall be able to be inserted into a disk drive incorporated within automated library storage equipment with Side A either up or down.

The carrier shall enable release of the optical disk by the disk drive during loading of the optical disk on to the disk drive spindle. The four carrier latch release holes provide the interface to the disk drive for applying a force F_3 to unlatch the carrier and to release the disk.

The carrier latch points, locator pin slots, and latch release holes in conjunction with the disk drive's carrier and disk handling devices shall enable the disk drive to maintain a common centreline between the disk and the disk drive spindle during disk release from the carrier and during disk centring and clamping to the disk drive spindle.

The separated carrier and the spindle mounted and clamped optical disk shall allow unobstructed access to the recording zone by a recording head scanning in from the outer edge.

The mating carrier shall recapture the optical disk upon dismount of the optical disk from the spindle by the disk drive.

The carrier label shall indicate the optical disk Side A and Side B and the proper orientation shall be maintained between the optical disk side and the carrier label.

The main elements of the carrier are tooth racks, latch points, locator pin slots, Side A and Side B hole, write protect holes, latch release holes, disk type sensor notches, disk capacity hole, and a label area.

11.2 Carrier drawings

The carrier is represented schematically by the following drawings:

Figure 10	shows a typical carrier,
Figure 11	shows the optical disk centre location in the carrier,
Figure 12	shows the carrier dimensions,
Figure 13	shows the write protect definition,
Figure 14	shows the side A and side B sensor hole and disk capacity sensor hole,
Figure 15	shows the carrier location within the case,
Figure 16	shows the carrier locator slot locations when the carrier is inside the case,
Figure 17	shows carrier latch point locations when the carrier is inside the case,
Figure 18	shows carrier latch release hole locations,
Figure 19	shows the unlatched carrier latch release hole locations when the optical disk is released,
Figure 20	shows carrier locator pin slot locations,
Figure 21	shows the carrier label location,
Figure 22	shows the carrier label.

11.3 Sides, reference axes and reference planes

11.3.1 Relationship between Side A and Side B (figure 10)

The carrier label shall indicate the optical disk Side A and Side B and the proper orientation shall be maintained between the optical disk side and the carrier label.

The Side A of the optical disk shall face downwards when the carrier label Side A is correctly seen when viewed through the case window.

11.3.2 Reference axes and reference features (figure 13)

Datum A is the top or bottom carrier rail surface. Datum B consists of carrier latch points. Datum C is a carrier locator pin slot. The two carrier latch points at either end of the carrier define the datum B dependent upon which carrier end is inserted first into automated library storage equipment. Any one of the four locator pin slots defines the C datum dependent upon carrier orientation.

11.4 Materials

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

11.5 Mass

The mass of the carrier without the optical disk shall not exceed 600 g.

11.6 Location of the optical disk centre in the carrier (figure 11)

The carrier shall locate the optical disk centre with respect to the carrier latch points and the carrier locator pin slot as follows:

$$L_{12} = 199,42 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{13} = 112,98 \text{ mm} \pm 0,51 \text{ mm}$$

11.7 Overall dimensions of the carrier (figure 12)

The overall length of the carrier shall be:

$$L_{14} = 423,62 \text{ mm} \pm 0,90 \text{ mm}$$

The overall width of the carrier shall be:

$$L_{15} = 406,25 \text{ mm} \pm 0,51 \text{ mm}$$

The width of the carrier guide rail shall be:

$$L_{16} = 396,14 \text{ mm} \pm 0,51 \text{ mm}$$

The location of the carrier lead edge from datum B shall be:

$$L_{17} = 12,40 \text{ mm} \pm 0,25 \text{ mm}$$

The width of the carrier lead edge shall be:

$$L_{18} = 5,08 \text{ mm} \pm 0,25 \text{ mm}$$

The length of the carrier lead edge shall be:

$$L_{19} = 70,60 \text{ mm min.}$$

The location of the lead edge from datum C shall be:

$$L_{20} = 44,50 \text{ mm max.}$$

11.8 Cutouts (figure 12)

The carrier shall have cutouts to provide clearance for disk drive devices for handling of the optical disk during spindle mounting and dismounting operations.

The location of the cutouts shall be:

$$L_{21} = 102,40 \text{ mm min.}$$

$$L_{22} = 87,60 \text{ mm min.}$$

$$L_{23} = 68,80 \text{ mm max.}$$

$$L_{24} = 172,0 \text{ mm min.}$$

The cutout angle shall be:

$$A_1 = 30^\circ \text{ max.}$$

11.9 Carrier latch points and latch actuation force (figure 12)

The carrier latch point location from datum C shall be:

$$L_{25} = 56,13 \text{ mm} \pm 0,36 \text{ mm}$$

$$L_{26} = 282,09 \text{ mm} \pm 0,36 \text{ mm}$$

The carrier length when the carrier is unlatched and the disk is released shall be:

$$L_{27} = 438,56 \text{ mm} \pm 1,12 \text{ mm}$$

The carrier latch actuation force is applied at the carrier latch release holes as indicated in figure 11. The latch actuation force shall be:

$$F_3 = 18,0 \text{ N min.}$$

11.10 Carrier guide rails and carrier thickness (figure 12)

The carrier features a guide rail on each side for interface with disk drive and automated library carrier handling devices.

The rail lead in angle shall be:

$$A_2 = 30^\circ \pm 2^\circ$$

The depth of the rail shall be:

$$L_{28} = 2,92 \text{ mm} \pm 0,13 \text{ mm}$$

The pitch of the rail teeth shall be:

$$L_{29} = 5,08 \text{ mm} \pm 0,25 \text{ mm}$$

The clearance of the rail teeth shall be:

$$L_{30} = 1,27 \text{ mm} \pm 0,13 \text{ mm}$$

Except the lead tooth, all teeth shall have a flat top surface:

$$L_{31} = 1,27 \text{ mm} \pm 0,25 \text{ mm}$$

The location of the lead tooth shall be:

$$L_{32} = 6,22 \text{ mm} \pm 0,25 \text{ mm}$$

The location of the lead tooth on one rail relative to the location of the lead tooth on the other rail shall be within $\pm 0,76 \text{ mm}$.

The flat surface of the lead tooth shall be:

$$L_{33} = 0,51 \text{ mm} \pm 0,13 \text{ mm}$$

The angle of the flanks of the teeth with the rail shall be rounded off by a radius:

$$R_1 = 0,38 \text{ mm} \pm 0,25 \text{ mm}$$

The angle formed by the flanks of two adjacent teeth shall be:

$$A_3 = 50^\circ \pm 2^\circ$$

The end surfaces of the rail shall be rounded off by a radius:

$$R_2 = 3,175 \text{ mm} \pm 0,500 \text{ mm}$$

Tooth profile tolerances shall not be cumulative.

The thickness of the carrier rail shall be:

$$L_{34} = 3,81 \text{ mm} \pm 0,13 \text{ mm}$$

The carrier thickness shall be:

$$L_{35} = 10,29 \text{ mm max.}$$

The disk drive force on the carrier rail shall be applied to the carrier rail as indicated in figure 11 and shall be:

$$F_4 = 9,0 \text{ N min.}$$

11.11 Carrier write protect hole (figure 13)

The five write protect holes are located from the carrier centreline and datum C. When the carrier is unlatched and the optical disk is released and clamped to the spindle, the locations shall be:

$$L_{36} = 193,70 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{37} = 201,65 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{38} = 209,60 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{39} = 204,52 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{40} = 21,44 \text{ mm} \pm 0,51 \text{ mm}$$

The diameter of the five write protect holes shall be:

$$D_1 = 6,10 \text{ mm min.}$$

The "A label side" shall have three holes and the "B label side" shall have only two holes as shown in figure 13.

11.12 25 Gbyte capacity sensor hole (figure 14)

The sensor hole shall be located opposite to the write protect carrier end to enable the disk drive to sense that the disk is a 25 Gbyte disk.

The design centre for the hole diameter and the location from the carrier latch (datum B) and datum C shall be:

$$D_2 = 6,10 \text{ mm min.}$$

$$L_{41} = 16,51 \text{ mm} \pm 0,51 \text{ mm}$$

$$L_{40} = 21,44 \text{ mm} \pm 0,51 \text{ mm}$$

The "A label side" shall have a hole but the corresponding "B label side" position shall not have a hole as shown in figure 14.

No hole shall mean that the ODC is 14,8 Gbyte capacity.

11.13 Carrier Side A or Side B sensor hole (figure 14)

A sensor hole shall be located opposite to the write protect carrier end to enable the disk drive to sense Side A and Side B of the optical disk.

The design centre for the hole diameter and the location from the carrier latch point (datum B) and the carrier location pin slot (datum C) shall be:

$$D_3 = 6,10 \text{ mm min.}$$

$$L_{42} = 2,24 \text{ mm}$$

$$L_{43} = 204,52 \text{ mm}$$

True position shall be within a circle of diameter 0,38 mm at maximum material condition.

The sensor hole shall be open when Side A is down in the carrier and the carrier label A is correctly seen through the case window.

11.14 Carrier disk type sensor notches (figure 14)

Two notches shall be located on each end of the carrier used to capture an optical disk with a 1,2 mm thick protective layer construction. Notches shall not be present or shall be blocked on carriers used to capture an optical disk with a 90 µm thick protective layer.

Note - These notches enable backwards compatibility with ISO/IEC 10885 that allowed both types of disc construction.

The location and size of the notches shall be as follows:

$$L_{44} = 59,28 \text{ mm} \pm 0,50 \text{ mm}$$

$$L_{45} = 166,67 \text{ mm} \pm 0,50 \text{ mm}$$

$$L_{46} = 9,53 \text{ mm} \pm 0,50 \text{ mm}$$

$$L_{47} = 6,05 \text{ mm} \pm 0,50 \text{ mm}$$

11.15 Carrier location within the case (figure 15)

The carrier shall be located as follows within the case to enable interface with the disk drive, case and carrier handling devices:

The carrier bottom edge to case rail support surface shall be:

$$L_{48} = 3,80 \text{ mm max.}$$

The case rail support location from the case top or bottom surface shall be:

$$L_{49} = 10,50 \text{ mm} \pm 1,27 \text{ mm}$$

11.16 Carrier locator pin slot characteristics and location within the case (figure 16)

The four carrier locator pin slots, when the carrier is in the latched position within the case, shall be positioned from the case side as follows:

$$L_{50} = 97,94 \text{ mm} \pm 2,25 \text{ mm}$$

The carrier registration edge location from the door end of the case shall be:

$$L_{51} = 21,51 \text{ mm max.}$$

The four carrier locator pin slots depth shall be:

$$L_{52} = 18,60 \text{ mm max.}$$

The four carrier locator pin slots width shall be:

$$L_{53} = 5,46 \text{ mm} \pm 0,05 \text{ mm}$$

The carrier locator pin slot lead in location shall be:

$$L_{54} = 3,45 \text{ mm} \pm 0,13 \text{ mm}$$

The carrier locator pin slot lead in angle shall be:

$$A_4 = 34^\circ \pm 6^\circ$$

11.17 Carrier latch point location when the carrier is inside the case (figure 17)

The carrier latch points at the case door end enable the disk drive to secure the carrier allowing separation and retraction of the case.

The carrier rail to case edge shall be:

$$L_{55} = 11,96 \text{ mm} \pm 0,38 \text{ mm}$$

The carrier latch point location from the case side shall be:

$$L_{56} = 41,81 \text{ mm} \pm 1,85 \text{ mm}$$

The distance between carrier latch points shall be:

$$L_{57} = 338,23 \text{ mm} \pm 0,76 \text{ mm}$$

The latched carrier location from the door end of the case shall be:

$$L_{58} = 29,21 \text{ mm max.}$$

The carrier latch point clearance shall be:

$$L_{59} = 22,90 \text{ mm min.}$$

The carrier latch point width shall be:

$$L_{60} = 5,28 \text{ mm} \pm 0,25 \text{ mm}$$

The carrier latch clearance shall be:

$$L_{61} = 17,45 \text{ mm} \pm 0,63 \text{ mm}$$

Carrier separation and reinsertion resistance forces shall be 22 N max.

11.18 Carrier latch release hole locations (figure 18)

The carrier latch release hole locations from datum B shall be:

$$L_{62} = 50,72 \text{ mm min.}$$

$$L_{63} = 37,77 \text{ mm max.}$$

$$L_{64} = 348,87 \text{ mm max.}$$

$$L_{65} = 360,30 \text{ mm min.}$$

The carrier latch release hole locations from datum C shall be:

$$L_{66} = 24,26 \text{ mm max.}$$

$$L_{67} = 33,91 \text{ mm min.}$$

$$L_{68} = 250,47 \text{ mm max.}$$

$$L_{69} = 259,61 \text{ mm min.}$$

A clearance for an optional carrier latch-lock feature is required. Such a feature shall be retractable upon contact with disk drive release pins. The required clearance shall be:

$$L_{70} = 3,38 \text{ mm max.}$$

The carrier latch release hole angle shall be:

$$A_5 = 30^\circ \pm 2^\circ$$

11.19 Carrier latch release hole locations for unlatched carrier (figure 19)

The pair of carrier latch release holes at the write protect end of the carrier are a greater distance from the pair of release holes at the other end of the carrier when the carrier is unlatched to release the disk. The distance shall be:

$$L_{71} = 339,725 \text{ mm} \pm 0,510 \text{ mm}$$

11.20 Location of carrier locator pin slots (figure 20)

The carrier locator pin slots are datum C.

The carrier edge location from datum C shall be:

$$L_{72} = 85,09 \text{ mm} \pm 0,25 \text{ mm}$$

The distance between locator pin slots shall be:

$$L_{73} = 225,95 \text{ mm} \pm 0,25 \text{ mm}$$

The carrier locator pin slot lead in shall be located from the latch point as follows:

$$L_{74} = 7,32 \text{ mm} \pm 0,38 \text{ mm}$$

11.21 Carrier label location (figure 21)

The carrier label shall be located on the write protect end of the carrier as follows:

$$L_{75} = 78,49 \text{ mm} \pm 1,52 \text{ mm}$$

$$L_{76} = 12,07 \text{ mm} \pm 1,52 \text{ mm}$$

11.22 Carrier label (figure 22)

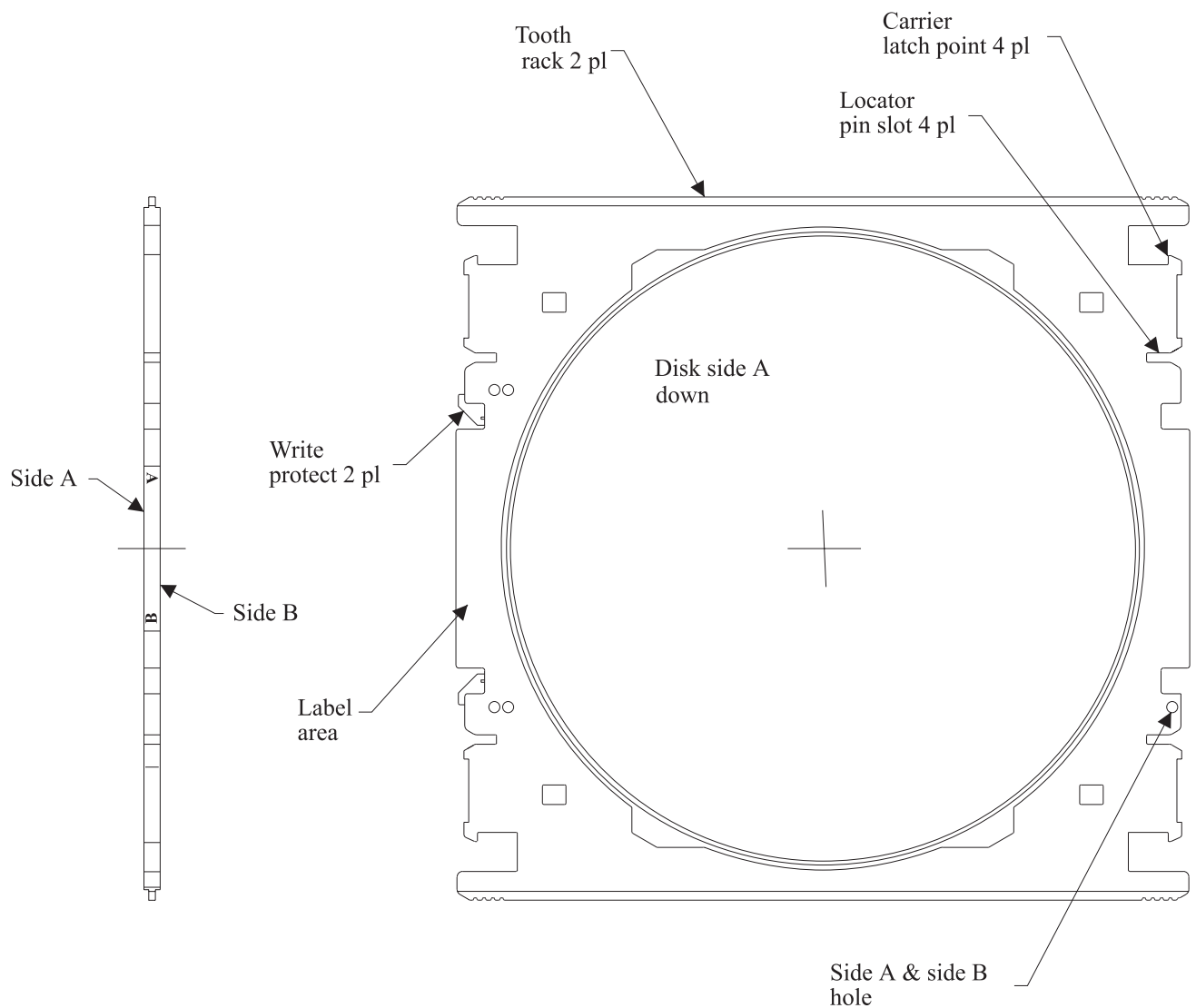
The carrier label size shall be as follows:

$$L_{77} = 78,0 \text{ mm max.}$$

$$L_{78} = 22,61 \text{ mm max.}$$

11.23 Carrier label characteristics (figure 22)

Field 1 shall be the Side A designator. Field 2 shall be the Side B designator.



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Figure 10 - Typical carrier

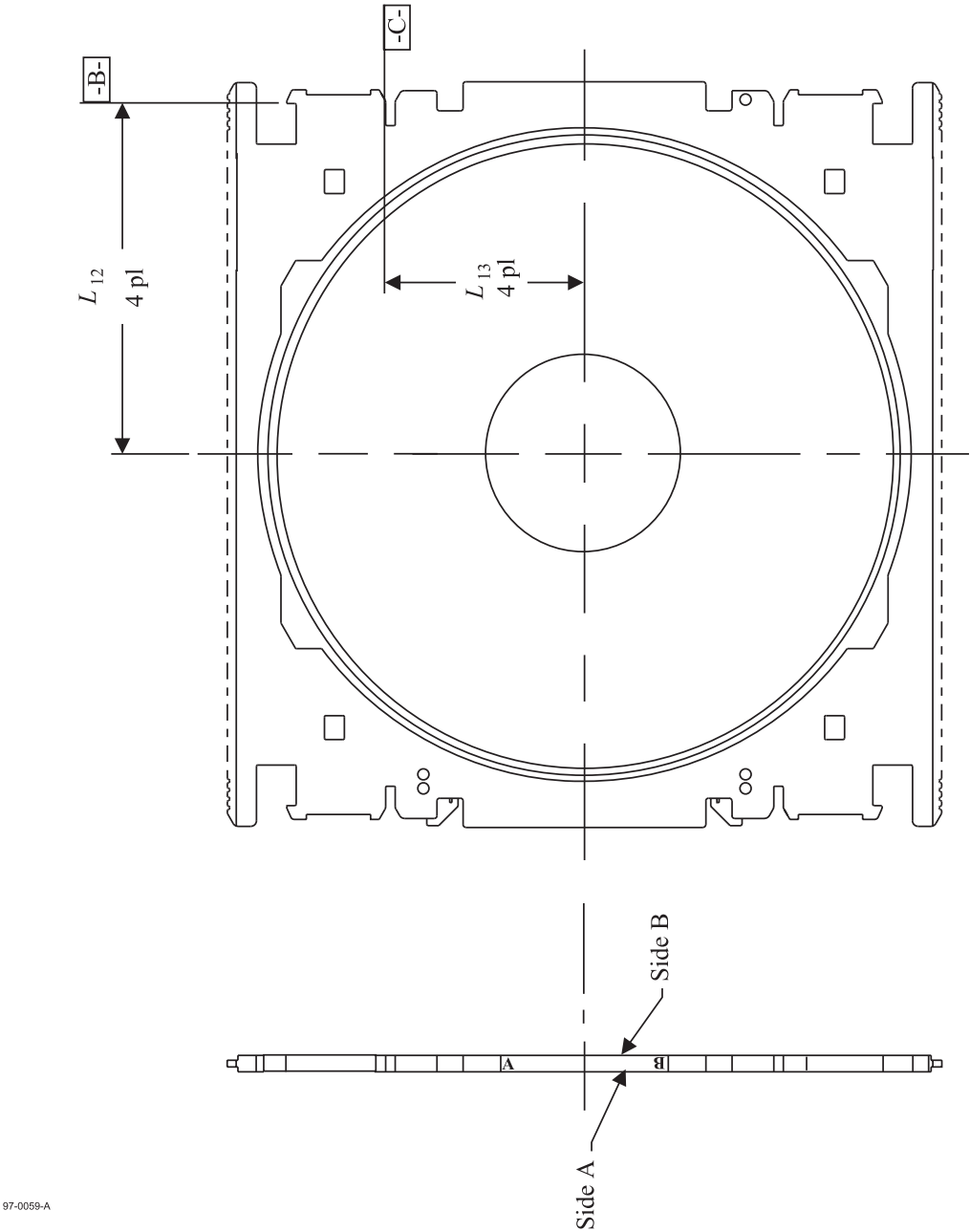
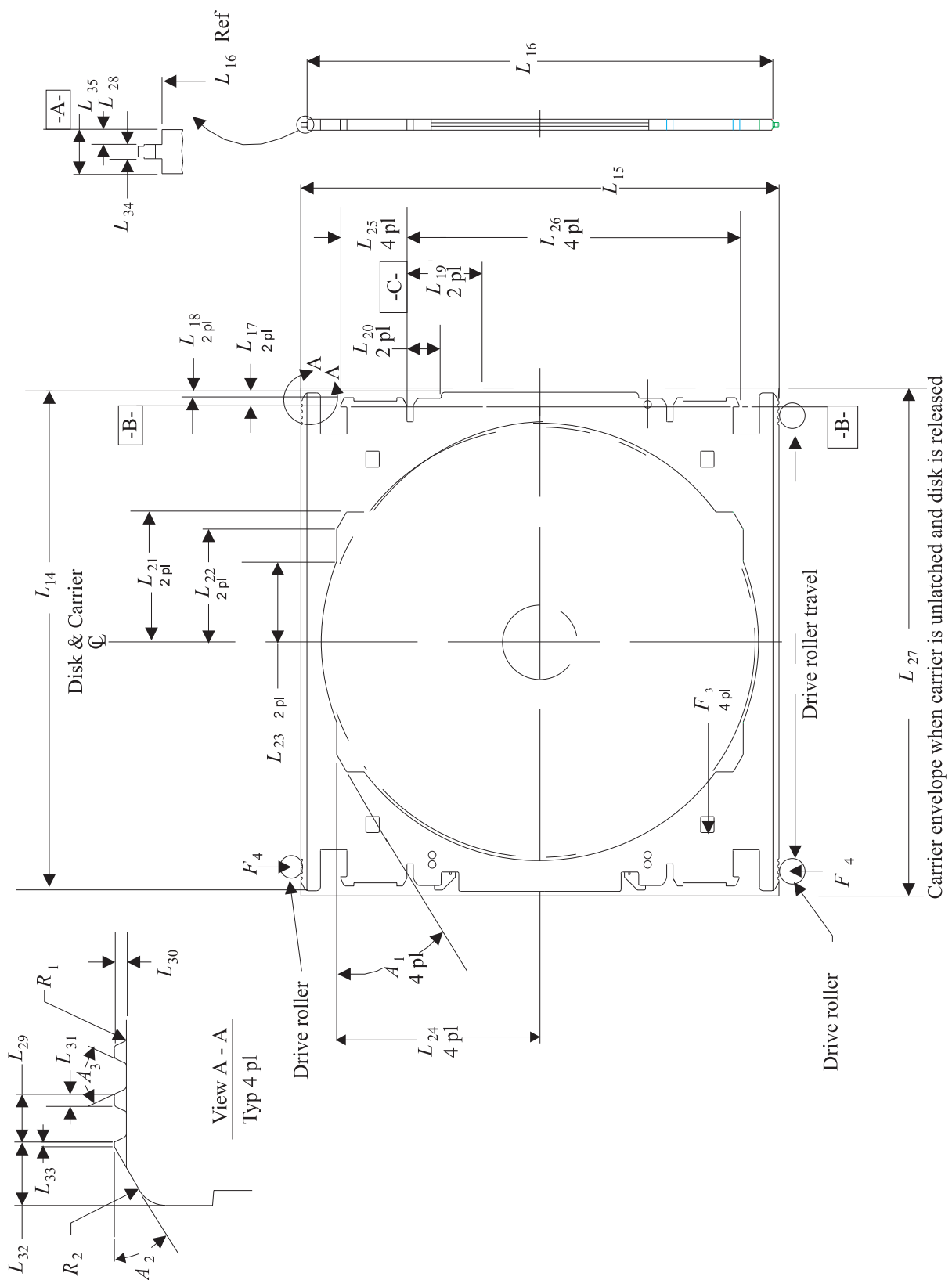


Figure 11 - Optical disk centre location in carrier



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Figure 12 - Carrier dimensions

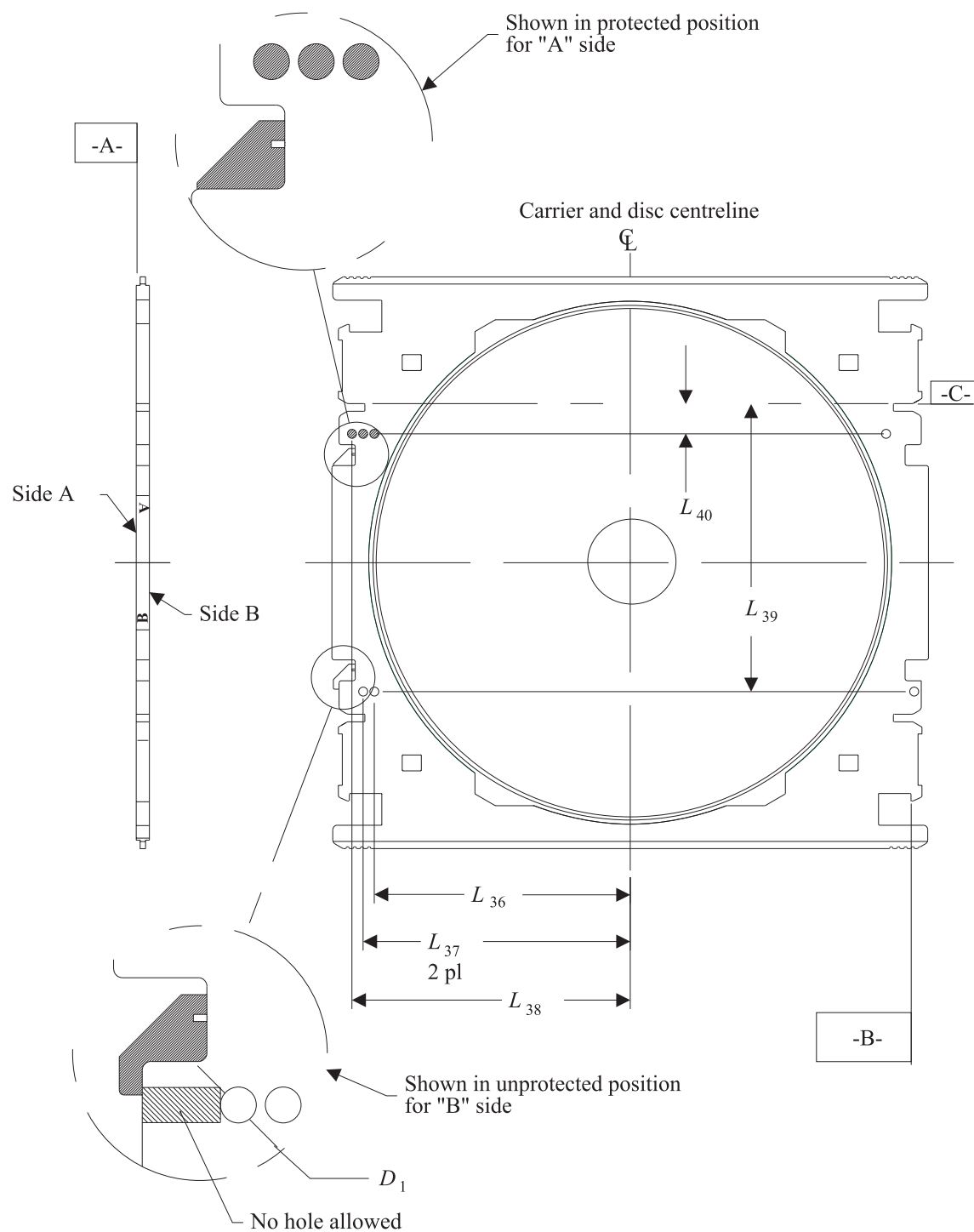
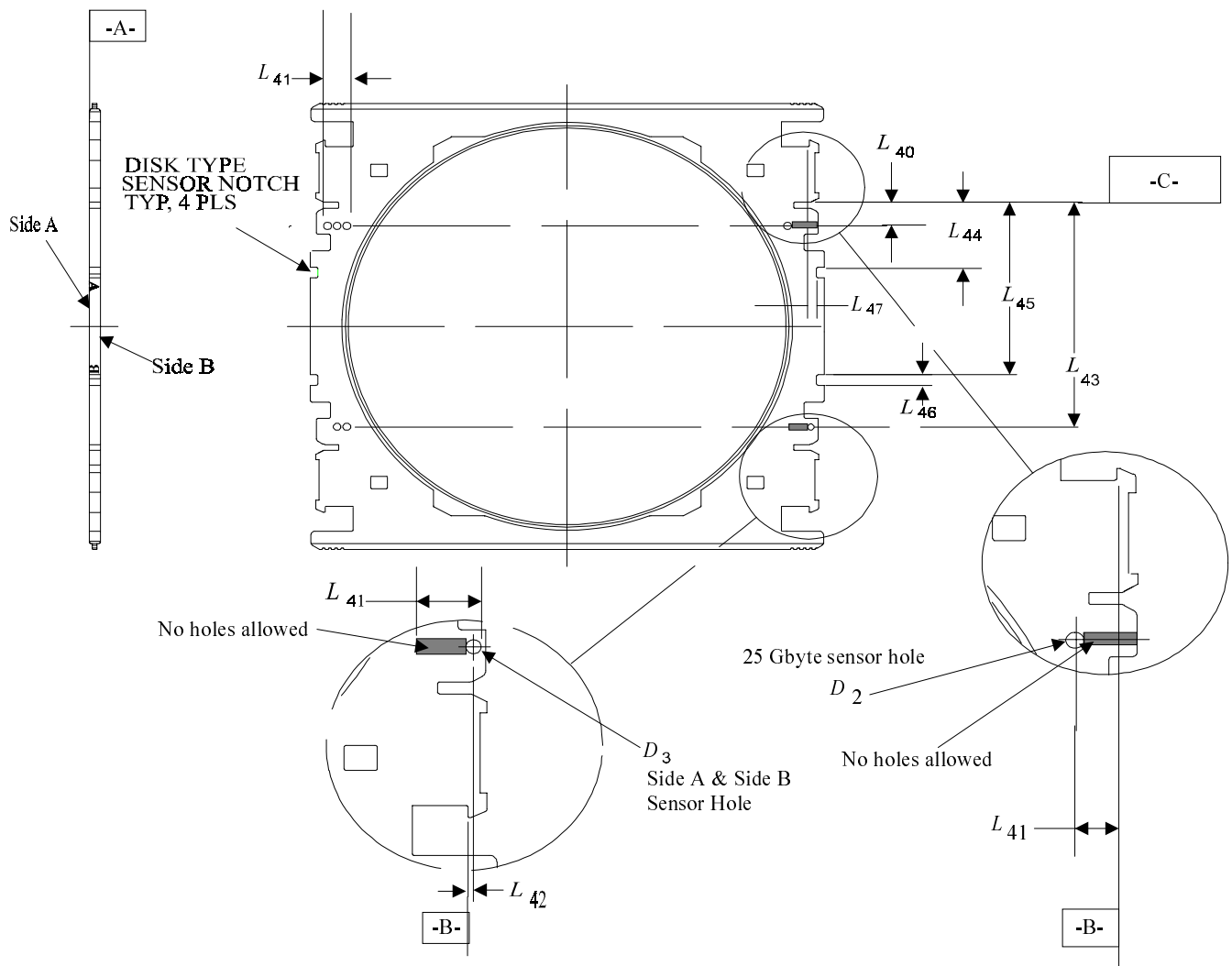
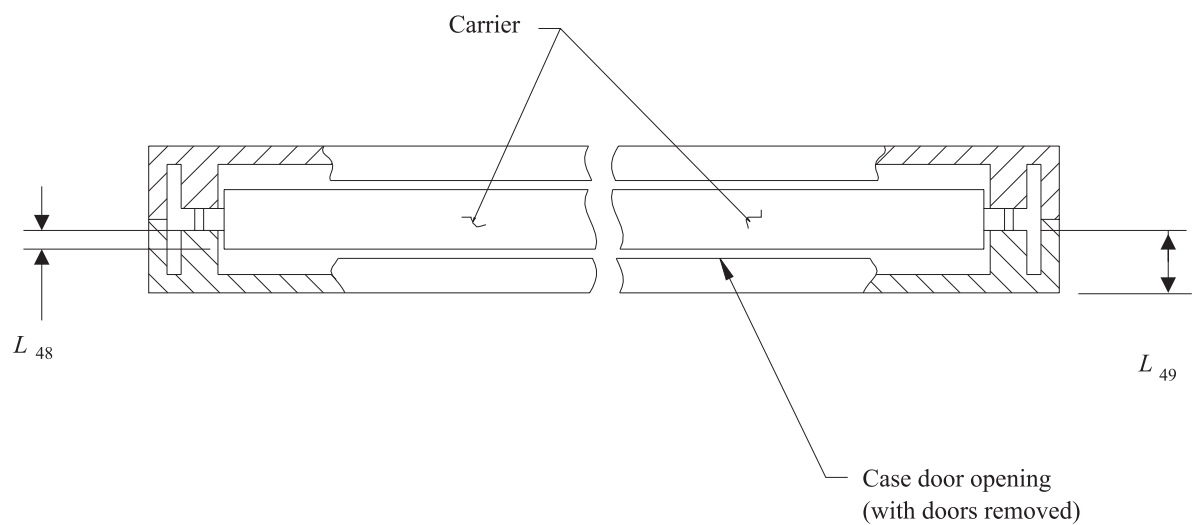


Figure 13 - Write protect definition carrier unlatched, disk clamped



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Figure 14 - Side A and Side B sensor hole, disk type sensor notches, and disk capacity sensor hole



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