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# INTERNATIONAL STANDARD



# 3562

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INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

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## Information processing — Interchangeable magnetic single disk cartridge (top loaded) — Physical and magnetic characteristics

*Traitement de l'information — Chargeur interchangeable monodisque magnétique à chargement vertical —  
Caractéristiques mécaniques et magnétiques*

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## FOREWORD

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# Information processing — Interchangeable magnetic single disk cartridge (top loaded) — Physical and magnetic characteristics

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the general, physical, and magnetic characteristics for the interchange of magnetic single disk cartridges (top loaded) in order to facilitate the interchange of data between electronic data processing systems.

It does not apply to a specific design. It defines only the parameters relevant for interchange.

## 2 GENERAL DESCRIPTION

### 2.1 General figures

A typical single disk cartridge is shown in figures 1 to 3.

### 2.2 Main elements

The main elements of this single disk cartridge are:

- the top cover
- the seal inserted in the rim of the top cover
- the recording disk
- the disk hub
- the armature plate
- the protective cover
- the removable cover

### 2.3 Other elements

Only the main elements are shown in the drawings. Usual disk cartridges may generally comprise also a handle, a mechanism for disconnecting the removable cover from the position of figure 2 so that it can be placed in the position of figure 3, and means for removing the disk cartridge from the drive. These other elements are not represented as they are not part of this International Standard.

### 2.4 Non-working and working positions

Figure 2 shows the cartridge in the unmounted condition, in which the removable cover is maintained in contact with the seal in the top cover so as to prevent ingress of dirt and contamination. A means must be provided to safely restrain the disk within the cartridge during operator handling, shipping, etc.

Figure 3 shows the cartridge in the mounted position, with the removable cover on top of the cartridge. In this position the rim of the removable cover lies on the upper surface of the rim of the top cover. Not represented is the mechanism of the disk drive which exerts a downward retaining force on the pressure area of the removable cover.

### 2.5 Direction of rotation

The recording disk shall rotate counter-clockwise when viewed from the top.

## 3 GENERAL REQUIREMENTS

### 3.1 Operating, storage and test environments

#### 3.1.1 Operating environment

The operating temperature measured within the cartridge shall lie within the range 15 to 50 °C (60 to 120 °F) at a relative humidity of 8 to 80 %. The wet bulb reading shall not exceed 26 °C (78 °F). Before a cartridge is placed into operation, it shall be conditioned within its covers for a minimum of 2 h in the same environment as that in which the disk drive is operating. The above specified range does not necessarily apply to the disk drive.

#### 3.1.2 Storage environment

##### 3.1.2.1 UNRECORDED DISKS

The storage temperature shall lie within the range -40 °C to +65 °C (-40 °F to +150 °F), the wet bulb reading not exceeding 30 °C (85 °F). For wet bulb temperatures between 0,5 °C (33 °F) and 30 °C (85 °F) the disk cartridge shall be able to withstand a relative humidity of 8 to 80 %.

##### 3.1.2.2 RECORDED DISKS

The storage temperature shall lie within the range -40 °C to +65 °C (-40 °F to +150 °F), the wet bulb reading not exceeding 30 °C (85 °F). For wet bulb temperatures between 0,5 °C (33 °F) and 30 °C (85 °F) the disk cartridge shall be able to withstand a relative humidity of 8 to 80 %.

The stray magnetic field intensity shall not exceed 4 000 A/m.

**3.1.3 Test environment**

Unless otherwise stated, measurements shall be carried out at  $23 \pm 3 \text{ }^\circ\text{C}$  ( $73 \pm 5 \text{ }^\circ\text{F}$ ), 40 to 60 % relative humidity after 24 h of acclimatization. Tests shall be carried out with the disk cartridge in the upright position, unless otherwise stated.

**3.2 Resistance to shock and vibration**

The disk cartridge shall withstand the exposure to shock and/or vibration expected during normal operator usage and still meet all dimensional and functional specifications of this International Standard. Protection against shock and vibration during transportation and storage shall be subject to agreement between supplier and user.

**3.3 Materials**

Unless otherwise stated, the disk cartridge may be constructed from any suitable material so long as the dimensional, inertial and other functional requirements of this International Standard are maintained. The coefficient of thermal expansion of the disk material should preferably be :

$$\frac{\Delta l}{l \times \Delta t} = \frac{l_2 - l_1}{l(t_2 - t_1)} = (24 \pm 2) \times 10^{-6}/^\circ\text{C}$$

$$[(13.3 \pm 1) \times 10^{-6}/^\circ\text{F}]$$

where

- $l_1$  is the length at  $t_1 = 15 \text{ }^\circ\text{C}$  ( $60 \text{ }^\circ\text{F}$ );
- $l_2$  at  $t_2 = 50 \text{ }^\circ\text{C}$  ( $120 \text{ }^\circ\text{F}$ );
- $l = (l_2 + l_1)/2$ .

**4 PHYSICAL REQUIREMENTS**

**4.1 Dimensions**

**4.1.1 Overall external dimensions** (see figure 4)

**4.1.1.1 EXTERNAL DIAMETER**

The external diameter is equal to the outside diameter  $d_1$  of the rim of the top cover (see 4.1.2.2).

**4.1.1.2 EXTERNAL HEIGHT**

The external height is

$$h_1 \leq 62 \text{ mm (2.44 in.)}$$

**4.1.2 Top cover with protective cover** (see figures 5 to 8)

**4.1.2.1 REFERENCE AXIS**

The reference axis is a line through the centre of the cartridge from which all angles and certain dimensions are derived (see X-X in figure 6).

**4.1.2.2 OUTSIDE DIAMETER OF THE RIM**

The outside diameter of the rim of the top cover is

$$d_1 = 381,3 \pm 0,5 \text{ mm (15.010 } \pm 0.020 \text{ in.)}$$

**4.1.2.3 INSIDE DIAMETER OF THE RIM**

The inside diameter of the rim of the top cover is

$$d_2 = 370,3 \pm 0,4 \text{ mm (14.580 } \pm 0.015 \text{ in.)}$$

This dimension must be met above and immediately below the rim.

**4.1.2.4 HEIGHT BELOW THE RIM**

The height of the top cover below its rim is

$$h_2 = 32,90 \pm 0,13 \text{ mm (1.295 } \pm 0.005 \text{ in.)}$$

**4.1.2.5 HEAD WINDOW**

**4.1.2.5.1 Location**

The location of the head window is defined by the angles

$$\beta_1 = 11^\circ 0' \pm 15'$$

$$\beta_2 = 7^\circ 0' \pm 15'$$

**4.1.2.5.2 Edges**

The distance of the upper edge of the head window from the rim of the top cover is

$$h_3 \leq 4,0 \text{ mm (0.16 in.)}$$

The distance of the lower edge of the head window from the rim of the top cover is

$$h_4 \geq 30,7 \text{ mm (1.21 in.)}$$

**4.1.2.6 BRUSH WINDOW**

**4.1.2.6.1 Location**

The location of the brush window is defined by the angles

$$\gamma_1 \geq 58^\circ$$

$$\gamma_2 \leq 18^\circ 31'$$

**4.1.2.6.2 Edges**

The distance of the upper edge of the brush window from the rim of the top cover is

$$h_5 \leq 7,0 \text{ mm (0.27 in.)}$$

The distance of the lower edge of the brush window from the rim of the top cover is the same as  $h_4$  (see 4.1.2.5.2).

**4.1.2.7 BRUSH AREA** (see figure 7)**4.1.2.7.1 Location**

The location of the brush area is defined by the angle  $\delta$  and the radius  $r_1$  :

$$\delta = 52^\circ \text{ nominal, and}$$

$$r_1 = 220 \text{ mm (8.66 in) nominal.}$$

**4.1.2.7.2 Dimension**

The brush area has the form of a sector of a circle, its minimum surface is defined by the radius  $r_2$  centred as defined by  $\delta$  and  $r_1$  :

$$r_2 = 120 \text{ mm (4.72 in) nominal.}$$

**4.1.2.8 NOTCHES** (see figures 5 and 6)

The top cover comprises four notches  $N_1, N_2, N_3, N_4$ .

**4.1.2.8.1 Location of the notches**

Notch  $N_1$  : The location of notch  $N_1$  is defined by the angle

$$\alpha_1 = 20^\circ 0' \text{ nominal.}$$

Notch  $N_2$  : The location of notch  $N_2$  is defined by the angle

$$\alpha_2 = 20^\circ 0' \text{ nominal.}$$

Notch  $N_3$  : The location of notch  $N_3$  is defined by the angle

$$\alpha_3 = 64^\circ 0' \text{ nominal.}$$

Notch  $N_4$  : The location of notch  $N_4$  is defined by the angle

$$\alpha_4 = 51^\circ 0' \pm 15'.$$

**4.1.2.8.2 Depth of the notches**

All four notches have the same minimum depth defined by the radius

$$r_8 \leq 176,83 \text{ mm (6.962 in).}$$

**4.1.2.8.3 Width of the notches**

Notches  $N_1, N_2$  and  $N_3$  have the same width

$$w_1 \geq 12,7 \text{ mm (0.50 in).}$$

Notch  $N_4$  has a width

$$w_2 = 8,23 \pm 0,13 \text{ mm (0.324} \pm 0.005 \text{ in).}$$

**4.1.2.8.4 Edge**

The distance of the upper edge of the notches from the rim of the top cover is

$$h_6 \leq 23,0 \text{ mm (0.91 in).}$$

**4.1.2.8.5 Inside radii**

All inside radii shall not exceed 0,5 mm (0.02 in).

**4.1.2.9 SEAL****4.1.2.9.1 Location**

The seal is inserted in the lower surface of the rim of the top cover defined by the diameters  $d_1$  and  $d_2$  (see 4.1.2.2 and 4.1.2.3).

**4.1.2.9.2 Other requirements**

The material of the seal must be such that the seal does not protrude from the lower surface of the rim, when the cartridge is in the mounted position with the removable cover in the position of figure 3 and with the proper pressure applied to it (see 4.4.1).

**4.1.2.10 OPENING FOR THE INDEX TRANSDUCER****4.1.2.10.1 Location**

The location of the opening for the index transducer is defined by the distance  $a$  and radius  $r_3$  :

$$a = 14,5 \pm 0,5 \text{ mm (0.571} \pm 0.020 \text{ in) and}$$

$$r_3 = 112,5 \pm 0,5 \text{ mm (4.430} \pm 0.020 \text{ in).}$$

**4.1.2.10.2 Width**

The width of the opening for the index transducer is

$$w_3 = 29,0 \pm 0,5 \text{ mm (1.142} \pm 0.020 \text{ in).}$$

**4.1.2.10.3 Depth**

The distance of the bottom of the opening for the index transducer below the rim of the top cover is

$$h_7 \leq 25,7 \text{ mm (1.01 in).}$$

**4.1.3 Removable cover, pressure area** (see figure 9)

The removable cover comprises a pressure area which is defined as follows, when the removable cover is in the working position :

**4.1.3.1 NOMINAL RADIUS**

The nominal radius of the pressure area is

$$r_4 = 169,0 \text{ mm (6.65 in) nominal.}$$

**4.1.3.2 LIMITS**

The limits of the pressure area are defined by the radii

$$r_5 = 167,0 \text{ mm (6.57 in) nominal, and}$$

$$r_6 = 182,0 \text{ mm (7.17 in) nominal.}$$

**4.1.3.3 HEIGHT OVER THE RIM OF THE TOP COVER**

The height of the pressure area at radius  $r_4$  over the lower surface of the rim of the top cover is

$$h_8 = 45,5 \pm 1 \text{ mm (1.79} \pm 0.04 \text{ in).}$$

**4.1.3.4 SLOPE**

At radius  $r_4$  the slope of the pressure area is defined by the angle

$$\epsilon = 13 \pm 2^\circ.$$

**4.1.3.5 RIGIDITY**

The rigidity of the removable cover must be such that under the locking force specified in 4.4.2, it retains all the dimensions listed above.

**4.1.4 Disk** (see figures 10 and 11)**4.1.4.1 DIAMETER**

The diameter of the disk is

$$d_3 = 356,25 \pm 0,15 \text{ mm (14.026} \pm 0.006 \text{ in).}$$

**4.1.4.2 THICKNESS**

The thickness of the disk is

$$e_1 = 1,27 \pm 0,05 \text{ mm (0.050} \pm 0.002 \text{ in).}$$

**4.1.4.3 DISK EDGE RELIEF**

For a distance

$$b \leq 1,3 \text{ mm (0.05 in)}$$

from the outside edge of the disk, the disk contour may be relieved within the extended boundaries of the disk surfaces.

**4.1.4.4 LOCATION OF MAGNETIC SURFACE**

The area of the magnetic coating extends from an inside diameter of 208,3 mm (8.20 in) maximum to an outside diameter of 353,6 mm (13.92 in) minimum.

**4.1.5 Disk hub** (see figure 10)**4.1.5.1 DIAMETER**

The diameter of the disk hub is

$$d_4 \leq 187,45 \text{ mm (7.38 in).}$$

Up to a height

$$h_9 = 7,5 \text{ mm (0.295 in)}$$

from the lower surface of the armature plate, the diameter of the hub is

$$d_5 \leq 145,0 \text{ mm (5.70 in).}$$

**4.1.5.2 BORE****4.1.5.2.1 Angle**

The angle of the conical bore is

$$\theta = 40^\circ 0' + \frac{10'}{0}$$

**4.1.5.2.2 Upper diameter**

The diameter of the upper hole of the hub is

$$d_6 = 8,00 \pm 0,25 \text{ mm (0.314} \pm 0.010 \text{ in).}$$

**4.1.5.2.3 Finish**

The finish shall be of class N8 (maximum arithmetical mean deviation : 3,2  $\mu\text{m}$  (126  $\mu\text{in}$ ), see ISO/R 1302).

**4.1.5.3 COMPLIANCE**

With the disk hub supported by the armature plate, a centrally applied force of 67 N (15 lbf) shall result in a 0,15 to 0,28 mm (0.006 to 0.011 in) deflection.

**4.1.6 Armature plate** (see figures 10 and 12)**4.1.6.1 DIAMETERS**

The outer diameter of the armature plate is

$$d_7 = 145,8 \pm 0,2 \text{ mm (5.740} \pm 0.008 \text{ in).}$$

The inner diameter is

$$d_8 = 101,6 \pm 0,5 \text{ mm (4.00} \pm 0.02 \text{ in).}$$

**4.1.6.2 THICKNESS**

The thickness of the armature plate is

$$e_2 = 2,34 \pm 0,03 \text{ mm (0.092} \pm 0.001 \text{ in).}$$

**4.1.6.3 INDEX SLOT****4.1.6.3.1 Depth**

The minimum depth of the index slot is defined by the radius

$$r_7 \leq 71,2 \text{ mm (2.808 in).}$$

**4.1.6.3.2 Width**

The width of the index slot is

$$w_4 = 2,03 \begin{matrix} 0 \\ -0,13 \end{matrix} \text{ mm (0.080} \begin{matrix} 0 \\ -0.005 \end{matrix} \text{ in).}$$

**4.1.7 Disk and disk hub relationship** (see figure 10)**4.1.7.1 DISK HEIGHT OVER ARMATURE PLATE**

The height of the lower surface of the disk above the lower surface of the armature plate is

$$h_{10} = 15,09 \pm 0,28 \text{ mm (0.594} \pm 0.011 \text{ in).}$$

**4.1.7.2 AXIAL RUNOUT OF THE DISK**

The axial runout of the disk at any diameter, and any speed up to 2 500 rev/min, is included in the dimension  $h_{10}$ , but shall not exceed 0,28 mm (0.011 in).

**4.1.7.3 ACCELERATION OF AXIAL RUNOUT**

The acceleration of the disk surface in the axial direction shall not exceed 140 m/s<sup>2</sup> (5 500 in/s<sup>2</sup>) at any speed within the range 2 350 to 2 450 rev/min.

**4.1.7.4 RADIAL RUNOUT OF DISK**

The total indicated radial runout is

$$0,5 \text{ mm (0.02 in) maximum.}$$

**4.1.7.5 ANGULAR SHIFT BETWEEN THE DISK AND THE DISK HUB**

After the cartridge has experienced a positive or negative acceleration up to 3 000 rad/s<sup>2</sup>, the angular shift between the disk and the disk hub must remain equal to zero, when measured with a device capable of detecting a shift of 3" of arc.

**4.1.8 Armature plate and disk hub relationship** (see figure 10)**4.1.8.1 REFERENCE PLANE**

The reference plane is the plane on which rests a reference ball of diameter

$$d_9 = 12,7 \text{ mm (0.500 in).}$$

The rotational axis of the disk cartridge is perpendicular to the reference plane.

**4.1.8.2 HEIGHT OF THE ARMATURE PLATE**

The relationship between armature plate and the bore of the hub in the unmounted position is given by the height over the reference plane

$$h_{11} = 1,70 \pm 0,05 \text{ mm (0.067} \pm 0.002 \text{ in).}$$

**4.1.8.3 RADIAL RUNOUT OF THE ARMATURE PLATE**

The total indicated radial runout of the armature plate is

$$0,4 \text{ mm (0.016 in) maximum.}$$

**4.1.9 Armature plate and top cover relationship** (see figure 10)

The height of the top cover rim of the lower surface of the armature plate in the mounted position is

$$h_{12} = 33,15 \pm 0,25 \text{ mm (1.305} \pm 0.010 \text{ in).}$$

**4.1.10 Drive spindle and disk hub relationship** (see figure 10)

The drive spindle shall penetrate through the bore of the disk hub into a zone defined by

$$h_{13} = 18,83 \text{ mm (0.741 in) nominal, and}$$

$$h_{14} = 19,09 \text{ mm (0.752 in) nominal.}$$

**4.2 Moment of inertia**

The moment of inertia of the rotating parts of the disk cartridge shall not exceed 10 g·m<sup>2</sup> (34 lb·in<sup>2</sup>).

**4.3 Maximum speed**

The rotating parts of the disk cartridge shall be capable of withstanding the effect of stress at a speed of 2 500 rev/min.

**4.4 Locking forces****4.4.1 Hub locking force**

The disk hub shall be held to the disk drive spindle by a force of 155 ± 22 N (35 ± 5 lbf), exerted downwards on the armature plate.

**4.4.2 Removable cover locking force**

The covers of the disk cartridge in the mounted position shall be held against the disk drive by a force of 25 ± 10 N (5.60 ± 2.25 lbf), exerted downwards on the pressure area of the removable cover.

**4.5 Balance**

The rotating components of the disk cartridge shall be balanced within 100 g·mm (0.14 oz·in) when measured at 2 400 rev/min in a single plane parallel to the disk surface at  $h_{10}$ .

**4.6 Operational earthing**

The disk cartridge shall provide a discharge path from the disk to the drive spindle through the hub mechanism.

**4.7 Material of the armature plate**

The material of the armature plate shall permit the achievement of the specified hub locking force by magnetic means. It shall be electrically conductive.

**4.8 Physical characteristics of magnetic surface**

**4.8.1 Surface roughness**

The finished magnetic surface shall have a surface roughness less than 0,09 μm (3.5 μin) arithmetic average, with a maximum deviation in height of 0,76 μm (30 μin) from the average, when measured with a 2,5 μm (0.000 1 in) radius stylus and a 0,75 mm (0.03 in) cutoff range.

**4.8.2 Head gliding requirements**

In the band defined by the diameters 208,3 mm (8.20 in) and 353,6 mm (13.92 in), see 4.1.4.4, there shall be no head-to-disk contacts with heads flying at 1,25 μm (50 μin) at the inner diameter and increasing linearly to 1,65 μm (65 μin) at the outer diameter.

**4.8.3 Durability of magnetic surface**

**4.8.3.1 RESISTANCE TO CHEMICAL CLEANING FLUID**

The magnetic surface of the disk shall not be adversely affected when cleaned with a mixture consisting of 91 parts by volume of reagent grade isopropyl alcohol and 9 parts by volume of distilled or deionized water.

**4.8.3.2 COATING ADHESION**

The nature of the coating shall be such as to ensure the maintenance of adhesion under operating conditions. A possible test method is given in annex A.

**4.8.3.3 ABRASIVE WEAR RESISTANCE**

The coating shall be able to withstand operational wear. A possible test method is described in annex A.

**5 MAGNETIC REQUIREMENTS**

**5.1 General geometry, surfaces and heads**

The recording transducers shall be disposed as in figure 13. Head and surface details are as below.

Number (head or surface)	Head orientation
0 (Upper)	Down
1 (Lower)	Up

**5.2 Track geometry**

**5.2.1 Number of tracks**

There shall be 204 discrete concentric tracks per disk surface.

**5.2.2 Width of tracks**

The recorded track width on the disk surface after straddle erase shall be

$$0,175 - 0,025 \text{ mm } (0.0069 - 0.001 \text{ in}).$$

The area between the tracks shall be erased. A suggested method of measuring effective track width is given in annex B.

**5.2.3 Track locations**

**5.2.3.1 NOMINAL LOCATIONS**

The geometry of the head disk system is defined in figure 13. The nominal radii of the centrelines of all tracks can be calculated by using the equation :

$$R_n = R_{73} - (n - 73) \times S$$

with the centreline radius of track 73 at 23,0 °C (73.4 °F)

$$R_{73} = 148,175 \text{ mm } (5.8337 \text{ in}),$$

the incremental head movement

$$S = 0,254 \text{ mm } (0.0100 \text{ in}),$$

the track number

$$n = 0 \text{ to } 203.$$

**5.2.3.2 TRACK LOCATION TOLERANCE**

The centrelines of the recorded tracks measured at 23,0 °C (73.4 °F) shall be within ± 0,025 mm (0.001 in) of the nominal positions.

**NOTES**

1 As track 73 is used to set up the drive, it is to be expected that the position of track 73 will be within ± 7,5 μm (0.000 3 in) of the nominal position.

2 At other temperatures (within those specified in this International Standard) the nominal track centreline can be calculated using a linear coefficient of thermal expansion of  $24 \times 10^{-6} / ^\circ\text{C}$  ( $13.33 \times 10^{-6} / ^\circ\text{F}$ ).

**5.2.3.3 RECORDING OFFSET ANGLE**

At the instant of writing or reading a magnetic transition, the transition may have an angle of ± 30' maximum with the line of access.

**5.2.4 Identification**

For the purpose of testing, the following identifying system is used.

**5.2.4.1 TRACK IDENTIFICATION**

Track identification shall be by a three-digit decimal number (000 to 203) which counts tracks consecutively starting at the outermost track of each surface.

**5.2.4.2 SURFACE IDENTIFICATION**

The surfaces shall be numbered 0 and 1 to correspond to 5.1.

**5.2.4.3 CYLINDER ADDRESS**

A cylinder is defined as the tracks on the disk with a common track identification number.

**5.2.4.4 TRACK ADDRESS**

A four-digit decimal number shall be used for track address, with the three most significant digits defining the cylinder address and the remaining digit defining the surface address.

**5.2.5 Index**

Index is the point which determines the beginning and the end of a track. At the instant of detection of the leading edge of the index slot of the armature plate, the index is under the read-write gap on its line of access which forms an angle of 180° nominal with the leading edge of the index slot (see figure 14).

**5.2.6 Test areas****5.2.6.1 HEADER AREA**

For the purpose of testing, the header area is defined as that area starting not later than 120 μs after index and ending not sooner than 370 μs after index with the disk rotating at 2 400 rev/min.

**5.2.6.2 DATA AREA**

For the purpose of testing, the data area is defined as that area starting not later than 370 μs after index and continuing to the next index with the disk rotating at 2 400 rev/min.

**5.3 Test conditions and equipment****5.3.1 General conditions****5.3.1.1 ROTATIONAL SPEED**

The rotational speed shall be 2 400 ± 24 rev/min in any test period, the disk rotating counter-clockwise when viewed from above.

**5.3.1.2 TEMPERATURE**

The temperature of the air entering the disk cartridge shall be 27 ± 1 °C (81 ± 2 °F).

**5.3.1.3 RELATIVE HUMIDITY**

The relative humidity of the air entering the disk cartridge shall be between 40 and 60 %.

**5.3.1.4 CONDITIONING**

Before measurements commence, the disk cartridge shall be conditioned for 24 h in the same environment as that in which the test equipment is operating.

**5.3.2 Standard reference surfaces**

There are two standard reference surfaces which are held by approved agencies<sup>1)</sup> as the references by which all secondary standards will be calibrated.

**5.3.2.1 STANDARD AMPLITUDE REFERENCE SURFACE****5.3.2.1.1 Characteristics**

The standard amplitude reference surface shall be characterized in areas designated by a scratch and defined as beginning 50 μs after the edge of the scratch and ending 275 μs from this edge.

This surface when recorded at 1*f* (see 5.3.4.3) without tunnel erase, using an amplitude test head (see 5.3.3.1), gives the following output :

at a radius of 115,087 ± 0,254 mm (4.531 ± 0.010 in) :

7,0 mV peak-to-peak,

at a radius of 166,726 ± 0,254 mm (6.564 ± 0.010 in) :

11,5 mV peak-to-peak.

**5.3.2.1.2 Secondary standard amplitude reference surface**

This is a surface whose output is related to the standard amplitude reference surface via a calibration factor  $C_{AD}$ .

The calibration factor  $C_{AD}$  is defined as :

$$C_{AD} = \frac{\text{standard amplitude reference surface output}}{\text{secondary standard amplitude reference surface output}}$$

To qualify as a secondary standard amplitude reference surface, the calibration factor  $C_{AD}$  for such disks shall satisfy  $0,90 \leq C_{AD} \leq 1,10$  in the measured areas as defined in 5.3.2.1.1.

1) A calibration service is available from the National Bureau of Standards (NBS) in Gaithersburg, Maryland, U.S.A. and the Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany.

**5.3.2.2 STANDARD DATA REFERENCE SURFACE**

**5.3.2.2.1 Characteristics**

The standard data reference surface shall be characterized in an area designated by a scratch and defined as beginning 50 μs after the edge of the scratch and ending 275 μs from this edge.

The surface when recorded with straddle erase using a data test head (see 5.3.3.2) at a radius of 115,087 ± 0,254 mm (4.531 ± 0.010 in) gives an output of

- 4,0 mV peak-to-peak if recorded at 2f;
- 2,0 mV peak-to-peak if recorded at 4f (see 5.3.4.3).

**5.3.2.2.2 Secondary standard data reference surface**

This is a surface whose output is related to the standard data reference surface via the calibration factors C<sub>DD2</sub> (for 2f) and C<sub>DD4</sub> (for 4f).

The calibration factor C<sub>DD</sub> is defined as :

$$C_{DD} = \frac{\text{standard data reference surface output}}{\text{secondary standard data reference surface output}}$$

To qualify as a secondary standard data reference surface, the calibration factors C<sub>DD</sub> shall satisfy 0,90 ≤ C<sub>DD</sub> ≤ 1,10 for both frequencies in the measured area as defined in 5.3.2.2.1.

**5.3.3 Test heads**

**5.3.3.1 AMPLITUDE TEST HEADS**

Amplitude test measurements shall be taken with a suitable test head.<sup>1)</sup> To qualify as an amplitude test head the head calibration factor C<sub>AH</sub> shall satisfy 0,90 ≤ C<sub>AH</sub> ≤ 1,10.

The calibration factor C<sub>AH</sub> is defined as :

$$C_{AH} = \frac{\text{standard amplitude reference surface output}}{(\text{actual head voltage measured}) \times C_{AD}}$$

when measured on the two radii of the secondary standard amplitude reference surface at 1f (see 5.3.2.1.2).

**5.3.3.2 DATA TEST HEADS**

All measurements other than amplitude test measurements shall be taken with a suitable test head.<sup>2)</sup> To qualify as a data test head, the head calibration factor C<sub>DH</sub> shall satisfy 0,90 ≤ C<sub>DH</sub> ≤ 1,10.

The calibration factor C<sub>DH</sub> is defined as :

$$C_{DH} = \frac{\text{standard data reference surface output}}{(\text{actual head voltage measured}) \times C_{DD2}}$$

when measured on a secondary standard data reference surface at 2f (see 5.3.2.2.2) at the 115,087 mm (4.531 in) radius.

**5.3.3.2.1 Resolution**

The resolution of the data test head is defined as the ratio of the 4f to 2f average read amplitudes at the 115,087 mm (4.531 in) radius on the standard data reference surface, when measured over the same 225 μs sector. The resolution of a data test head shall be 40 to 60 %.

**5.3.3.2.2 Resonant frequency**

The resonant frequency of each of the read/write coils, when measured at the head-cable connector, shall be 4,2 MHz minimum.

**5.3.4 Specific conditions**

**5.3.4.1 CONDITIONS FOR AMPLITUDE TEST HEAD MEASUREMENTS**

**5.3.4.1.1 Write current**

The 1f current waveform measured at the head termination connector shall conform to figure 15, where :

$$\text{Write current } I_W = \frac{I_{W1} + I_{W2}}{2} = 35 \pm 1 \text{ mA}$$

$$\text{Overshoot} = 5 \text{ to } 10 \% \text{ of } I_W$$

The difference between the positive and negative amplitudes of the stationary write current I<sub>W</sub> shall be

$$|I_{W1} - I_{W2}| < 1 \text{ mA}$$

$$T_R = 140 \text{ to } 200 \text{ ns}$$

$$T_F = 140 \text{ to } 200 \text{ ns}$$

$$|T_R - T_F| \leq 20 \text{ ns}$$

Two consecutive half-periods T<sub>1</sub>, T<sub>2</sub> shall not differ by more than 2 %.

**5.3.4.1.2 DC erase current**

The DC erase current supplied to one of the read/write coils when DC erase is specified shall be

$$I_E = 35 \pm 1 \text{ mA}$$

**5.3.4.1.3 Read electronics**

The differential input impedance of the read electronics shall be 7,5 ± 0,37 kΩ in parallel with a distributed and lumped capacitance of 45 ± 5 pF measured at the head termination connector (see figure 16). The amplifier shall have a passband flat within 5 % from 0,1 to 2,0 MHz.

1) For example, IBM 2316 (2311 type) amplitude test head is a suitable test head.

2) For example, IBM 2316 (2314 type) data test head is a suitable test head.

### 5.3.4.2 CONDITIONS FOR DATA TEST HEAD MEASUREMENTS

#### 5.3.4.2.1 Write current

The  $2f$  write current waveform measured at the head termination connector shall conform to figure 15, where :

$$I_W = \frac{I_{W1} + I_{W2}}{2} = 35 \pm 1 \text{ mA for track 000 to track 127,}$$

$$I_W = 30 \pm 1 \text{ mA for track 128 to track 203,}$$

overshoot  $\leq 8\%$  of  $I_W$

The difference between the positive and negative amplitudes of the stationary write current  $I_W$  shall be

$$|I_{W1} - I_{W2}| < 1 \text{ mA}$$

$$T_R = 120 \text{ to } 160 \text{ ns}$$

$$T_F = 120 \text{ to } 160 \text{ ns}$$

$$|T_R - T_F| \leq 20 \text{ ns}$$

Two consecutive half-periods  $T_1$ ,  $T_2$  shall not differ by more than 2 %.

#### 5.3.4.2.2 DC erase current

The DC erase current supplied to one of the read/write coils when DC erase is specified shall be

$$I_E = 35 \pm 1 \text{ mA for track 000 to track 127,}$$

$$I_E = 30 \pm 1 \text{ mA for track 128 to track 203.}$$

#### 5.3.4.2.3 Read electronics

The differential input impedance of the read electronics shall be  $4,20 \pm 0,21 \text{ k}\Omega$  in parallel with a distributed and lumped capacitance of  $30 \pm 5 \text{ pF}$  measured at the head termination connector (see figure 16).

The read electronics shall be capable of accepting low impedance signal levels between 0,6 and 10,0 mV peak-to-peak. Linearity shall be within 3 % or 0,050 mV (whichever is larger) at frequencies between 0,5 and 3,0 MHz.

#### 5.3.4.3 TEST SIGNALS

The frequencies specified as  $1f$ ,  $2f$  and  $4f$  shall be

$$1f = (1\,250 \pm 1,25) \times 10^3 \text{ transitions/s}$$

$$2f = (2\,500 \pm 2,50) \times 10^3 \text{ transitions/s}$$

$$4f = (5\,000 \pm 5,00) \times 10^3 \text{ transitions/s}$$

#### 5.3.4.4 DC EDGE ERASURE

Edge erasure shall be used for all surface tests and track quality tests unless otherwise specified.

When using the tunnel erase (TE) amplitude test head, the edge erasure current shall be

$$I_{TE} = 40 \pm 2 \text{ mA.}$$

When using the straddle erase (SE) data test head, the edge erasure current shall be

$$I_{SE} = 35 \pm 1 \text{ mA.}$$

### 5.3.4.5 MAGNETIC RECORDING

Unless otherwise specified, all write operations shall be preceded by a DC erase operation (see 5.3.4.1.2 and 5.3.4.2.2).

#### 5.3.4.6 LOCATIONS

The track quality test requirements (see 5.4.2) shall also be met with an offset of 0,025 mm (0.001 in) from the nominal track position as defined in 5.2.3.

#### 5.3.4.7 HEAD LOADING FORCE

The net head loading force shall be  $3,43 \pm 0,10 \text{ N}$  ( $350 \pm 10 \text{ gf}$ ), centre pivot loading or equivalent.

## 5.4 Functional testing

### 5.4.1 Surface tests

#### 5.4.1.1 AMPLITUDE TEST

##### 5.4.1.1.1 Procedure

Write on any part of the recording surface at  $1f$  using an amplitude test head and read back.

##### 5.4.1.1.2 Result

The corrected read-back amplitude averaged over the highest  $50 \mu\text{s}$  sector shall be within the following peak-to-peak amplitude limits :

Maximum amplitude shall be 9,3 mV at the 115,087 mm (4.531 in) radius and increase proportionally to, but not exceed, 15,1 mV at the 166,726 mm (6.564 in) radius.

Minimum amplitude shall be 6,3 mV at the 115,087 mm (4.531 in) radius and increase proportionally to, or exceed 10,0 mV at the 166,726 mm (6.564 in) radius.

#### 5.4.1.2 RESOLUTION TEST

##### 5.4.1.2.1 Procedure

On any part of the recording surface write at  $2f$  and read back using a data test head. After DC erasing write at the same position at  $4f$  and read back.

##### 5.4.1.2.2 Result

In all cases the ratio  $\frac{\text{amplitude at } 4f}{\text{amplitude at } 2f}$  averaged over the same  $50 \mu\text{s}$  sector shall be  $0,55 \pm 0,20$ .

**5.4.1.3 OVERWRITE TEST**

**5.4.1.3.1 Procedure**

Write on track 000 at  $2f$  and measure the average amplitude of  $2f$  signal with a frequency-selective voltmeter. Without a DC erase overwrite once at  $4f$ , measure the average amplitude of  $2f$  signal with a frequency-selective voltmeter. Qualified overwrite heads (see 5.4.1.3.3) shall be used.

**5.4.1.3.2 Overwrite residual amplitude**

The overwrite residual amplitude is defined as

$$r = \frac{(\text{average amplitude of selectively measured } 2f \text{ signal after overwrite with } 4f) \times 100}{(\text{average amplitude of selectively measured } 2f \text{ signal before overwrite with } 4f)}$$

**5.4.1.3.3 Qualified overwrite heads**

A data test head is qualified as an overwrite test head when the overwrite residual amplitude  $r$  of the standard data reference surface written and overwritten with this head is between 3 and 5 %.

**5.4.1.3.4 Result**

The ratio of the overwrite residual amplitude of the disk to be tested to the overwrite residual amplitude of the data reference surface shall not exceed 1,3.

**5.4.1.4 POSITIVE MODULATION TEST**

**5.4.1.4.1 Procedure**

Using a data test head, write a track at  $2f$  and read back.

**5.4.1.4.2 Result**

The average base-to-peak amplitude measured at the highest amplitude  $50 \mu\text{s}$  sector of that track location shall be less than 146 % of the average base-to-peak amplitude of the full track.

**5.4.1.5 NEGATIVE MODULATION TEST**

**5.4.1.5.1 Procedure**

Using a data test head, write a track at  $2f$  and read back.

**5.4.1.5.2 Result**

The average base-to-peak amplitude measured at the lowest amplitude  $50 \mu\text{s}$  sector of that track location shall be greater than 75 % of the average base-to-peak amplitude of that track.

**5.4.2 Track quality tests**

Data test heads shall be used for all track quality tests.

Two methods, A and B, are described below for the track quality tests. Although it is recognized that neither of them

gives absolute correlation between computer and test equipment, both give acceptable correlation.

Method A is based on a fixed voltage reference.

Method B is based on track relative voltage references.

The method to be used shall be agreed between the interchange parties.

**5.4.2.1 MISSING PULSE TEST**

**5.4.2.1.1 Method A**

Procedure

Write on each track at  $2f$  and read back.

Result

A missing pulse is any read pulse whose base-to-peak amplitude is less than 25 % of the standard data reference surface output at  $2f$  (peak-to-peak), see 5.3.2.2.1, based on the peak amplitude occurring from 150 to 250 ns after the zero cross-over point of the analogue signal.

**5.4.2.1.2 Method B**

Procedure

Write on each track at  $2f$  and read back.

Result

A missing pulse is any read pulse whose base-to-peak amplitude is less than 60 % of the average base-to-peak amplitude of the preceding  $50 \mu\text{s}$  sector.

**5.4.2.2 EXTRA PULSE TEST**

**5.4.2.2.1 Method A**

Procedure

Write on each track at  $2f$  and read back. Then DC erase and read the residual amplitude.

Result

An extra pulse is any spurious read pulse whose amplitude is more than 40 % of the average base-to-peak  $2f$  amplitude of the tested track.

The maximum base-to-peak amplitude of any spurious read pulse(s) shall not exceed 22,5 % of the standard data reference surface output at  $2f$  (peak-to-peak), see 5.3.2.2.1.

**5.4.2.2.2 Method B**

Procedure

Write on each track at  $2f$ . Read back and note the highest peak-to-peak amplitude averaged over  $50 \mu\text{s}$  of track signal. Call this  $V_A$ . DC erase as in 5.3.4.2.2 and read the residual amplitude.

## Result

Any read back signal, measured base-to-peak, shall not exceed 25 % of  $1/2 V_A$ .

**5.4.2.3 EASE OF ERASURE TEST****5.4.2.3.1 Method A**

## Procedure

Write on each track at  $2f$  and read back. DC erase as in 5.3.4.2.2 and read the residual amplitude.

## Result

The peak-to-peak amplitude of the residual signal averaged over any  $50 \mu\text{s}$  sector of the erased track shall not exceed 4 % of the highest peak-to-peak amplitude averaged over a  $50 \mu\text{s}$  sector of that track. (The residual signal is measured independent of test system noise.)

The maximum peak-to-peak amplitude of the residual signal shall not exceed 10 % of the standard data reference surface output at  $2f$ , see 5.3.2.2.1.

**5.4.2.3.2 Method B**

## Procedure

Write on each track at  $2f$ , read back and note highest peak-to-peak amplitude averaged over  $50 \mu\text{s}$  of track signal.

Call this  $V_A$ . DC erase as in 5.3.4.2.2 and read the residual amplitude.

## Result

The average level of the highest  $50 \mu\text{s}$  sector of the read back signal shall not exceed 10 % of  $V_A$ .

**5.4.3 Rejection criteria****5.4.3.1 SURFACE TEST CRITERIA**

The disk shall meet the requirements of all the tests specified in 5.4.1.

**5.4.3.2 TRACK QUALITY CRITERIA****5.4.3.2.1 Error**

An error is a failure to meet any of the requirements of 5.4.2 (according to the agreed method).

**5.4.3.2.2 Error-free areas**

There shall be no errors in track of address 0000 nor in any header area (see 5.2.6.1). In addition, for purposes of data interchange, there shall be at least 400 error-free tracks on the disk. Further there shall be up to 6 additional error-free tracks for possible track re-assignment. (Complete error-free disks shall be subject to agreement between supplier and user.)

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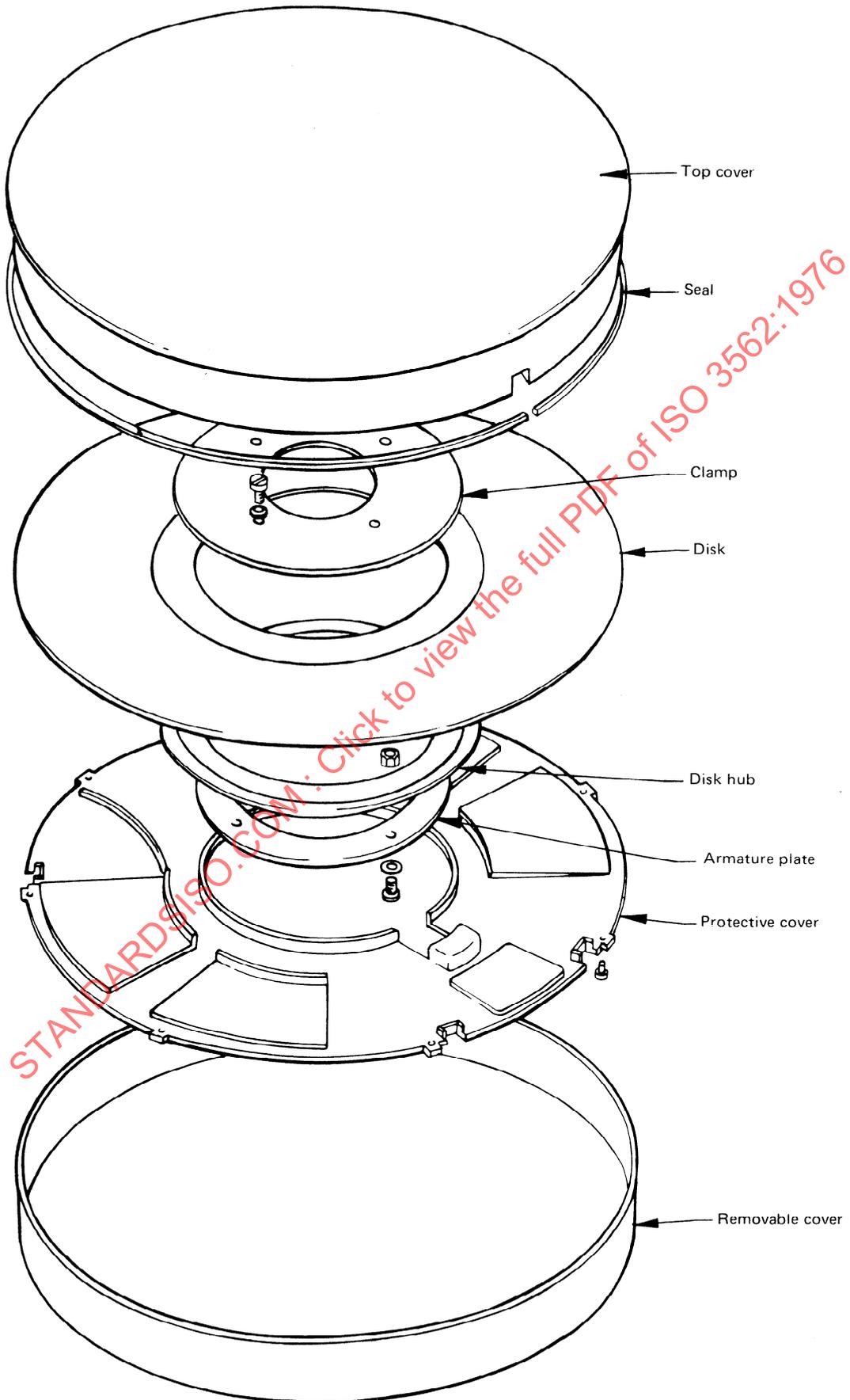


FIGURE 1 – Exploded view

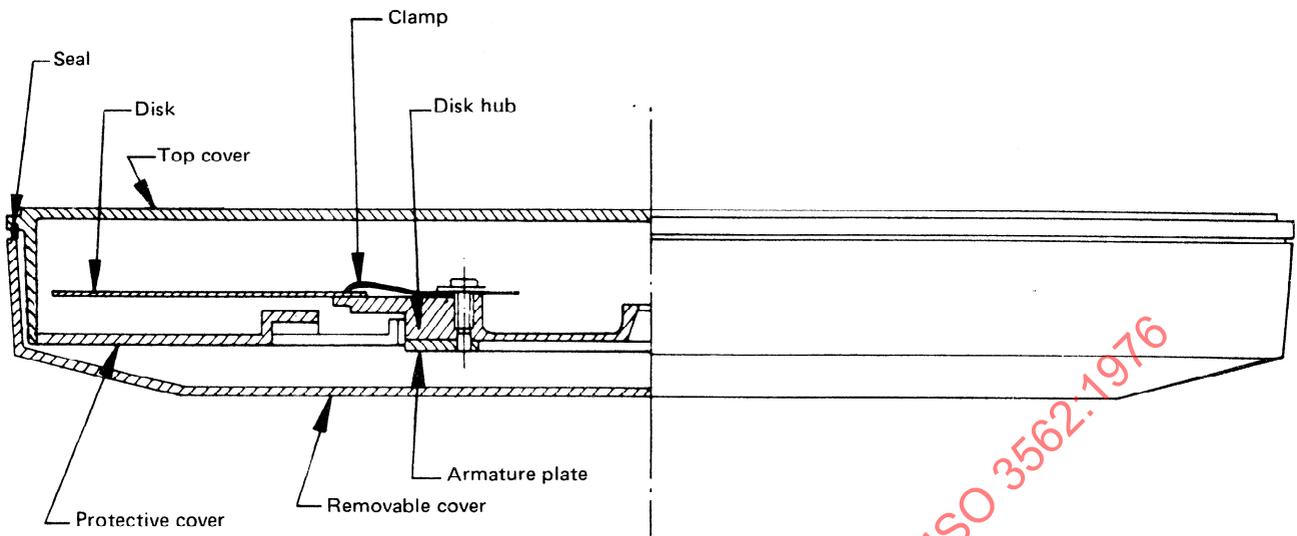


FIGURE 2 – Front view with partial cross-section

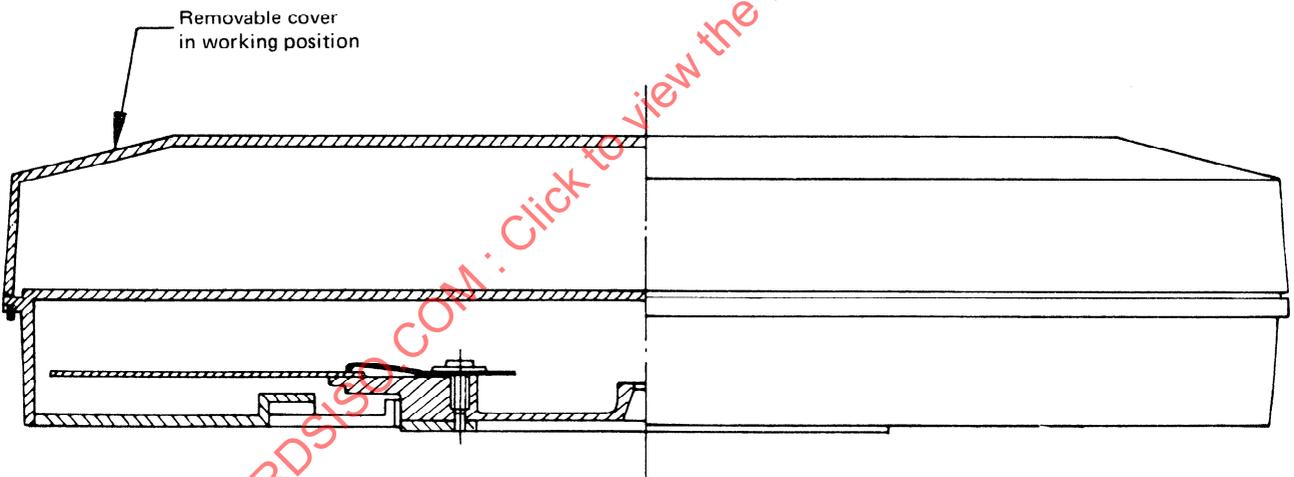


FIGURE 3 – Front view with partial cross-section with the removable cover in the working position

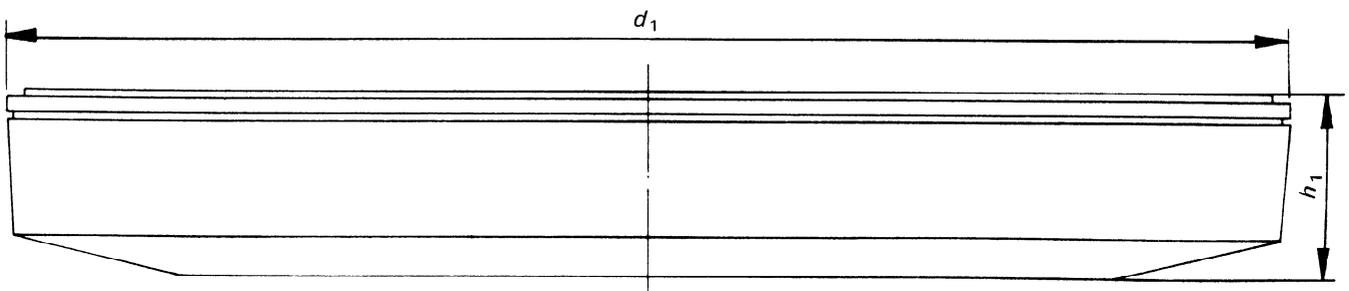
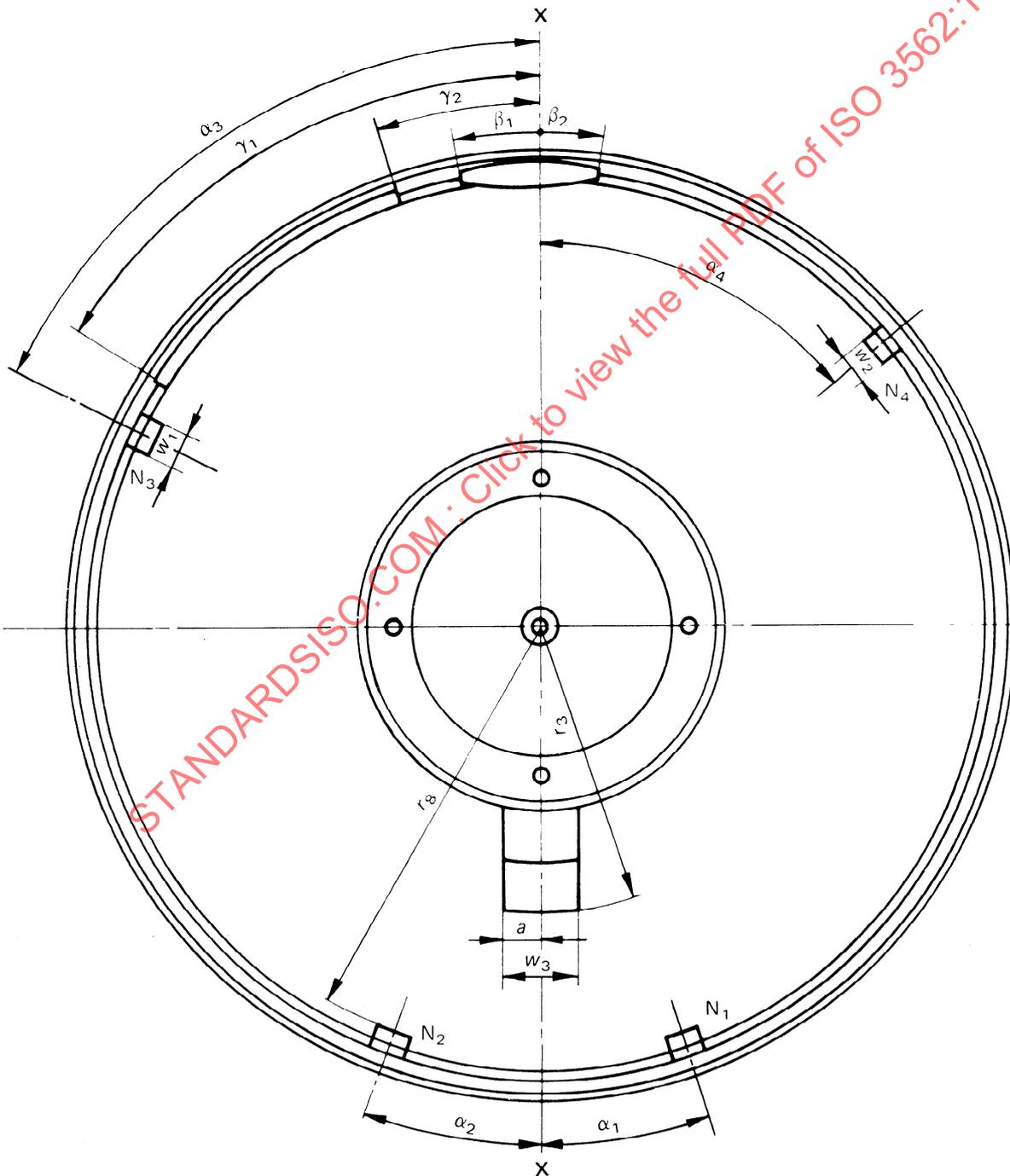
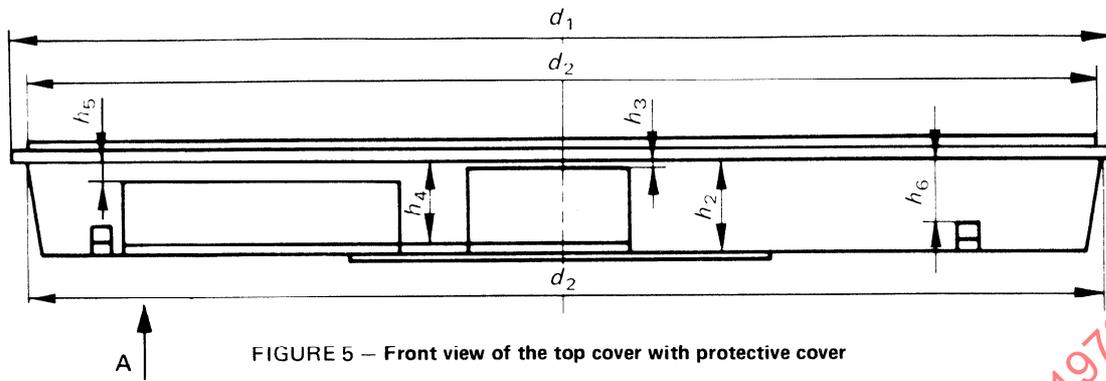


FIGURE 4 – Front view of the whole cartridge



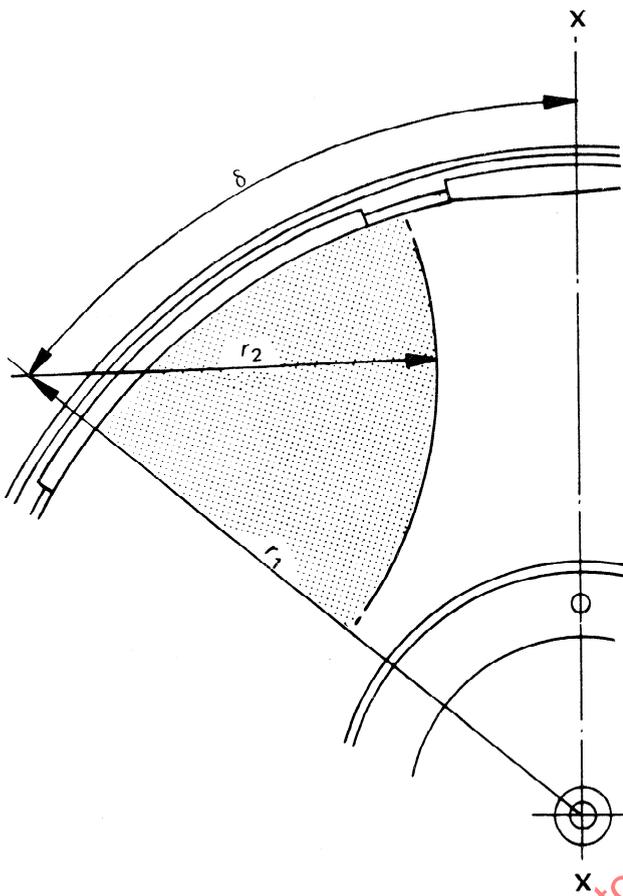


FIGURE 7 – Part of figure 6 with the brush area

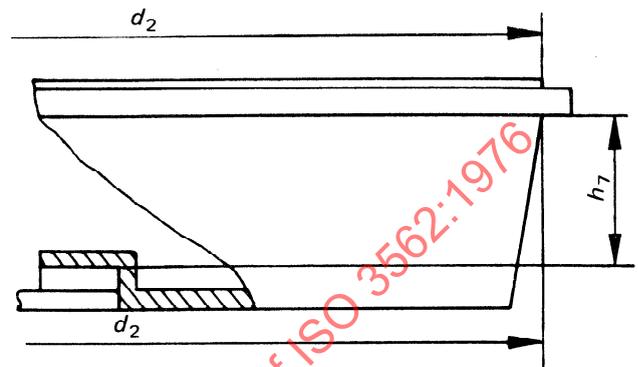


FIGURE 8 – Partial cross-section through the opening for the index transducer

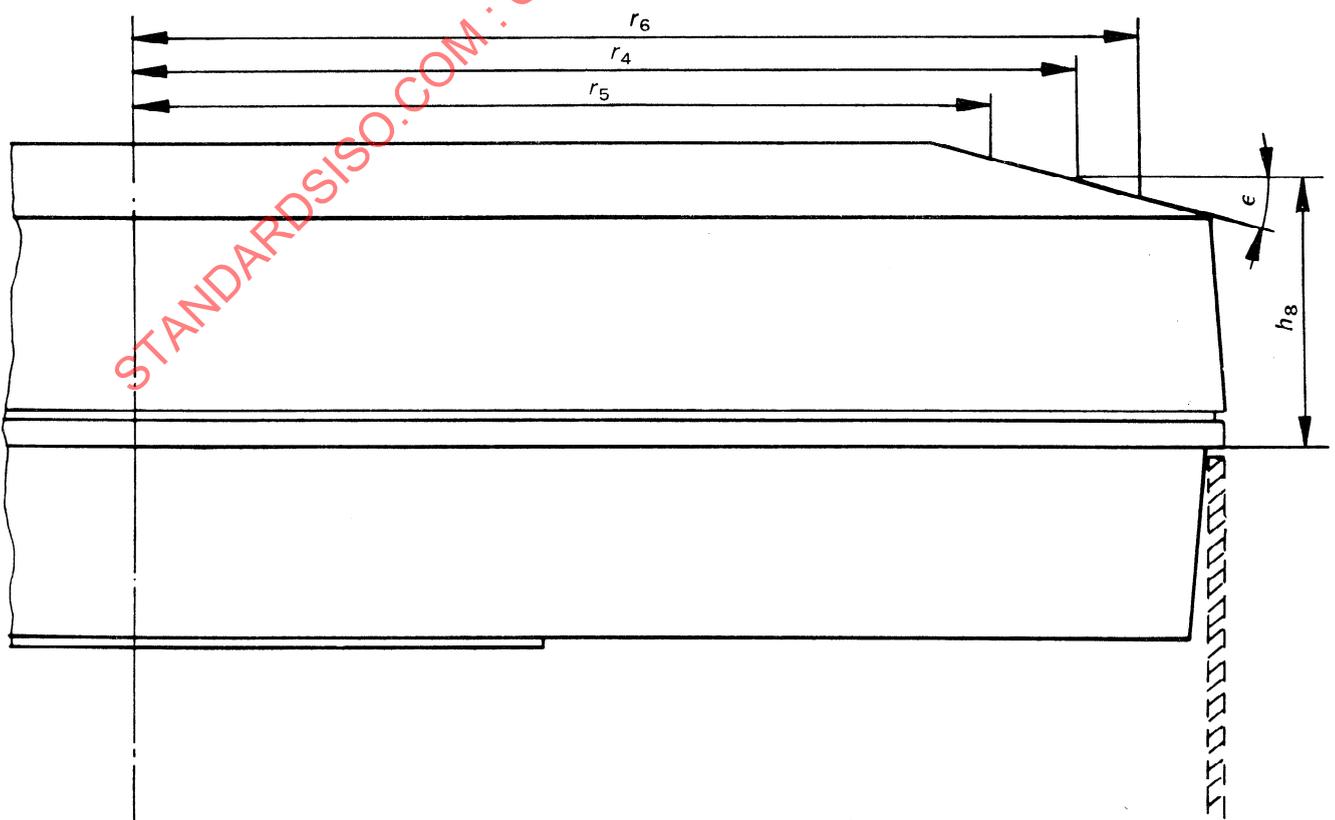


FIGURE 9 – Partial front view of the removable cover in the working position

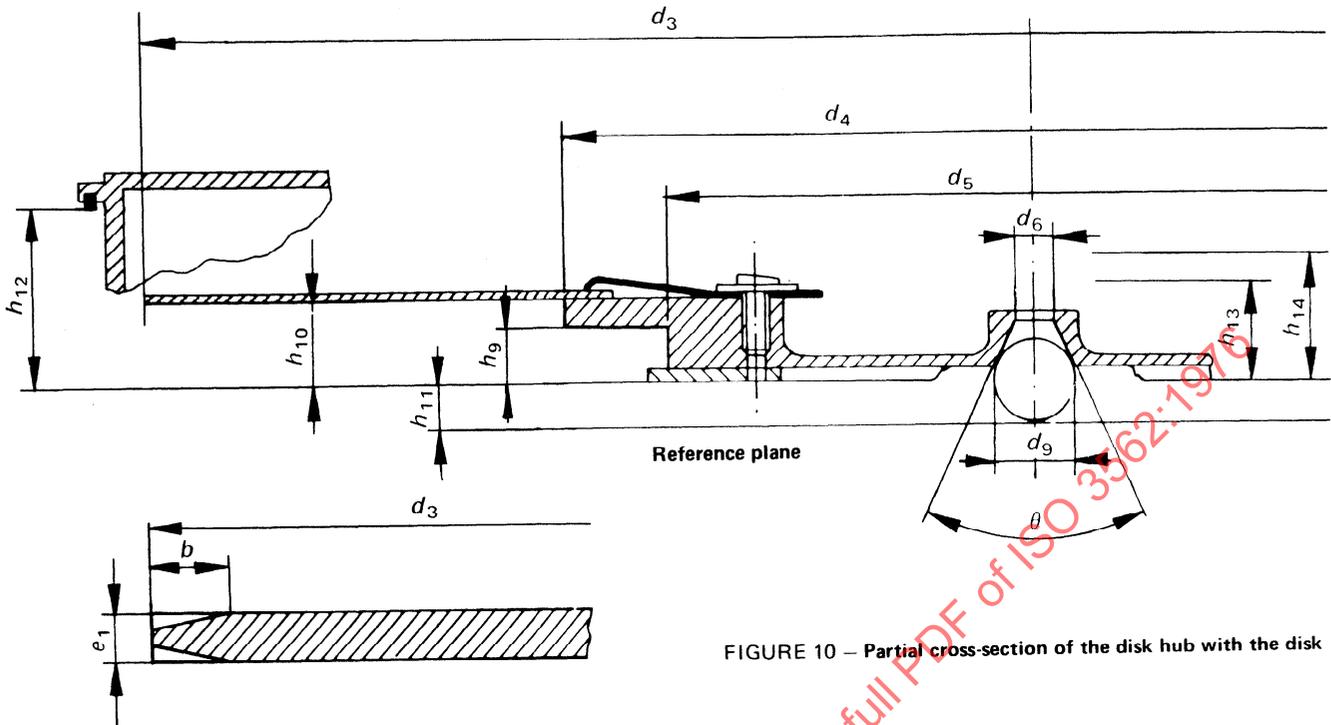


FIGURE 10 – Partial cross-section of the disk hub with the disk

FIGURE 11 – Enlarged cross-section of the disk edge

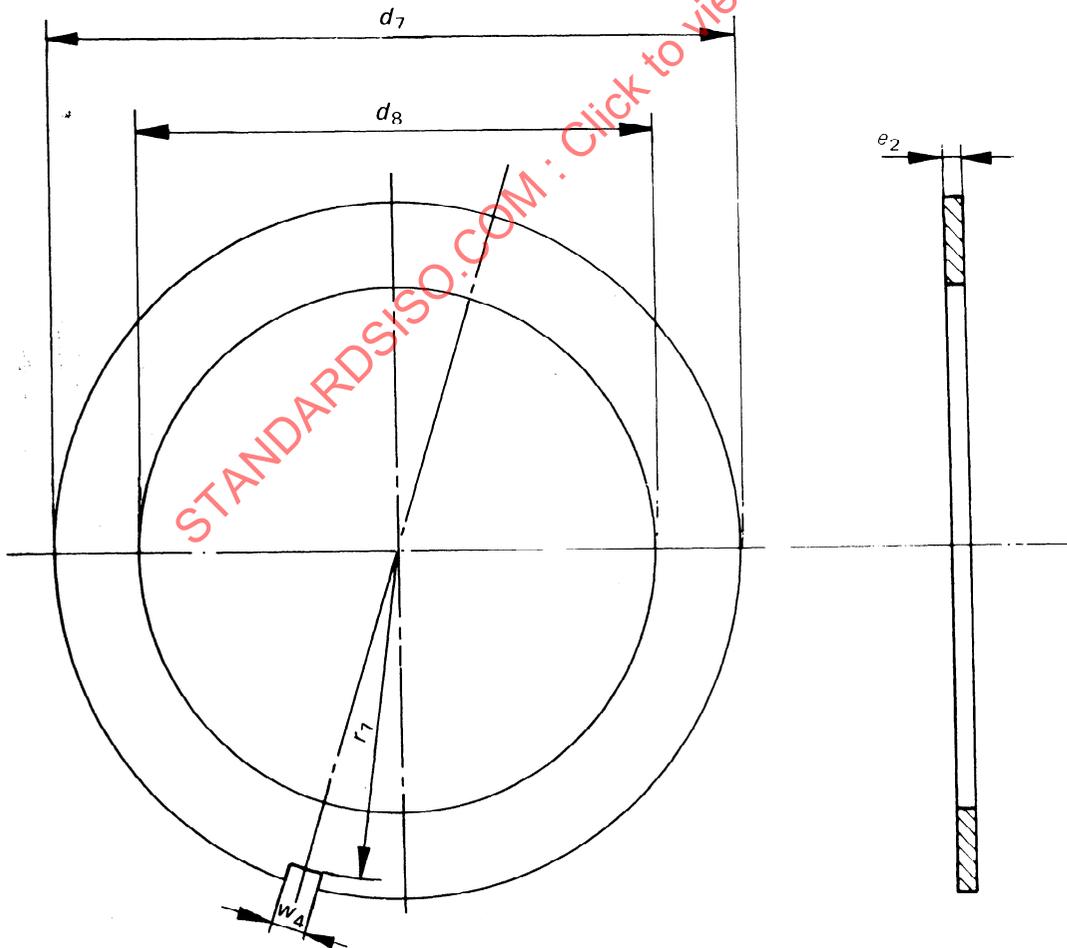


FIGURE 12 – Armature plate

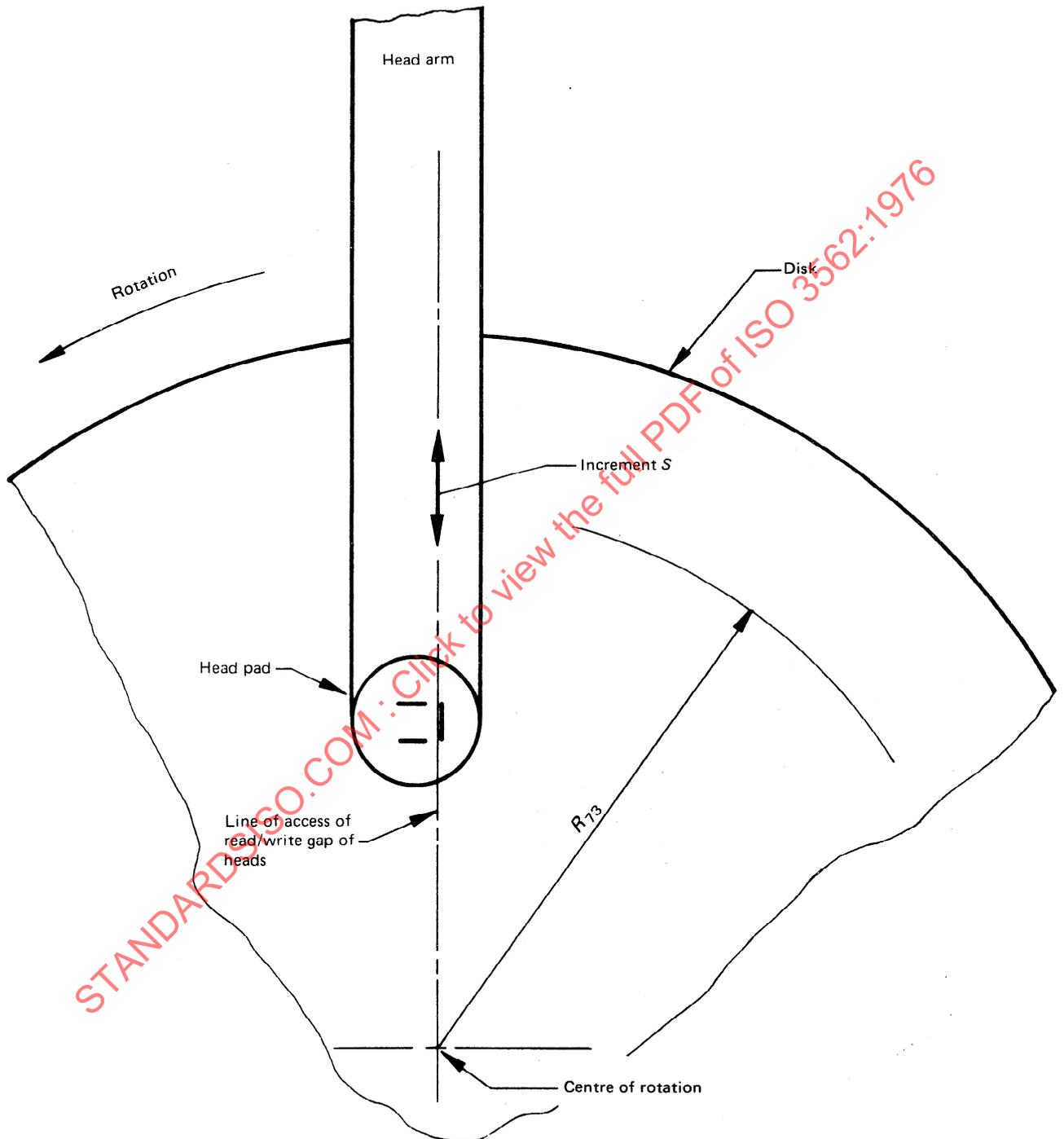


FIGURE 13 – Geometry of the head disk system

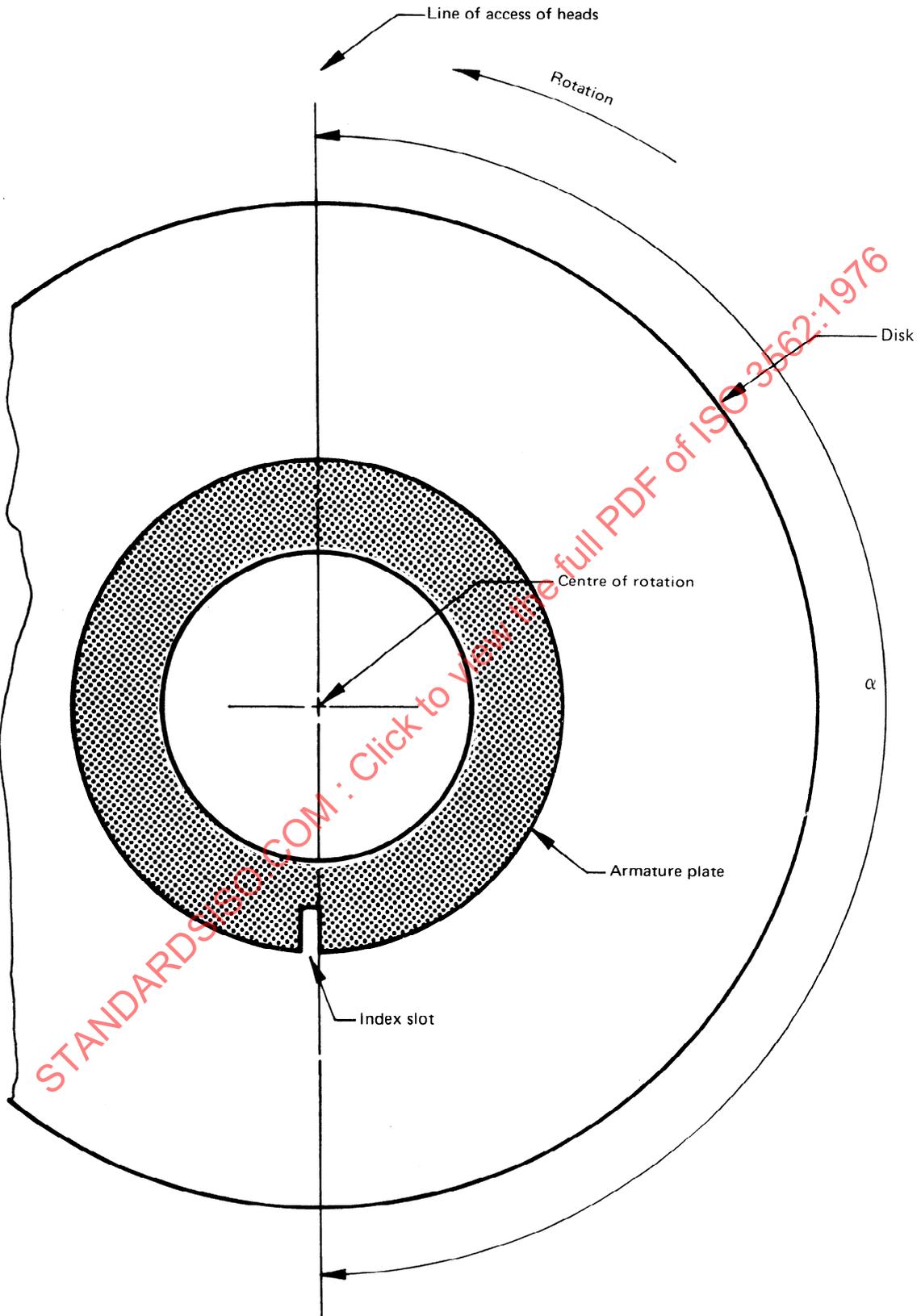


FIGURE 14 – Track index (top view on the armature plate)