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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 $23 \pm 3^\circ\text{C}$ ($73 \pm 5^\circ\text{F}$), 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 $t_1 = 15^\circ\text{C}$ (60°F);

l_2 at $t_2 = 50^\circ\text{C}$ (120°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

$$\gamma_1 \geq 58^\circ \text{ and}$$

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

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 δ 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 δ 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

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

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

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

Up to a height

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

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

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

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 μm (126 μin), 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

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

4.1.6.3.2 Width

The width of the index slot is

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

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/s² (5 500 in/s²) 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

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

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/s², 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

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

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

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

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

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

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

4.2 Moment of inertia

The moment of inertia of the rotating parts of the disk cartridge shall not exceed 10 g·m² (34 lb·in²).

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

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

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)

$$R_{73} = 148,175 \text{ mm } (5.833 \text{ 7 in}),$$

the incremental head movement

$$S = 0,254 \text{ mm } (0.010 \text{ 0 in}),$$

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.