

Specification for

Magnetic six-disk packs for data processing —

Part 1: Mechanical and magnetic
properties

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Foreword

This British Standard has been published under the authority of the Data Processing Industry Standards Committee.

Work on magnetic disk packs began at the International Organization for Standardization (ISO) in June, 1968, with the setting up of a Working Group under the Secretariat of Germany. The first meeting of the Working Group took place in June, 1969, when it was quickly established that International Standards were desirable for a six-disk pack. Since that date, work on this standard has been carried out concurrently with the international discussions.

It was realized that because of the rapid development taking place in the data processing equipment, standardization on this initial project should be completed quickly in order to proceed with the other designs, e.g. eleven-disk packs.

The principles adopted in the derivation of these standards have been based on interchange. Manufacturers will therefore be able to retain many individual design features while incorporating those essential for interchange. Although the parameters quoted will of course have been based on existing materials and methods, wherever possible the use of alternatives which would maintain the original requirements has been permitted.

This Part of this British Standard incorporates both the mechanical and magnetic characteristics and a further Part of this standard (BS 4850, "*Magnetic six-disk packs for data processing*", Part 2, "*Track format*") specifies the patterns of magnetization on the disk. Other British Standards will be considered as the technical discussions at ISO are developed, and will also be drafted concurrently with the ISO documents.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 26, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

1 General

1.1 Scope

This Part of this British Standard specifies the mechanical and magnetic characteristics of magnetic six-disk packs necessary for interchange.

NOTE The titles of the British Standards referred to in this standard are listed on the inside back cover.

1.2 General requirements

After exposure to the range of conditions specified in this Part of the standard, the disk pack shall meet all the other requirements of this Part and of Part 2 on track format.

2 Mechanical characteristics

2.1 Environment

2.1.1 Operating conditions. The operating temperature shall lie within the range from 15 °C to 50 °C (60 °F to 120 °F) at a relative humidity of 8 % to 80 %; the wet bulb reading shall not exceed 26 °C (78 °F). Before a disk pack is put into operation it shall be conditioned within its covers for a minimum of two hours 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.

2.1.2 Storage conditions

2.1.2.1 Unrecorded. 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 pack shall be able to withstand a relative humidity of 8 % to 80 %.

2.1.2.2 Recorded. 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 pack shall be able to withstand a relative humidity of 8 % to 80 %. The stray magnetic field intensity shall not exceed 4 000 A/m.

A suggested accelerated storage life test is included in Appendix A.

2.1.3 Conditions for mechanical tests. Unless otherwise stated, measurements shall be carried out at 23 ± 3 °C (73 ± 5 °F), 40 % to 60 % r.h. after 24 h of acclimatization. Tests shall be carried out with the disk pack in the upright position, unless otherwise stated.

2.2 Shock and vibration

The disk pack shall withstand exposure to shock and/or vibration and still meet all dimensional and functional specifications of this standard.

Two recommended test procedures are described in Appendix B. Any damage to the cover shall not be a failure criterion.

2.3 Materials

Unless otherwise stated, the disk pack may be constructed from any suitable materials so long as the dimensional, inertial and other functional requirements of this standard are maintained. The material and surface finish of the sector disk shall permit reading the notches by eddy current and optical transducers. Material for hub, disk support, disk substrate and sector disk shall have the thermal co-efficient of expansion of $(24 \pm 2) \times 10^{-6}$ per °C [$(13.33 \pm 1.11) \times 10^{-6}$ per °F], which is the same as that for aluminium alloy.

The materials and design of the disk pack should be based on an intended life time of five years minimum.

2.4 Dimensions

For the purposes of determining height, the disk pack is considered to be resting on a reference ball having a diameter of 38.894 mm (1.531 25 in), the line through the base of which is the reference line (see Figure 3 and Figure 6).

2.4.1 Overall height (see Figure 1). The overall height h_1 of the disk pack with top and bottom cover shall be

$$h_1 = 115 \text{ mm (4.5 in) maximum.}$$

2.4.2 Top cover (see Figure 1)

2.4.2.1 Outside diameter. The outside diameter d_1 of the top cover shall be

$$d_1 = 370 \text{ mm (14.55 in) maximum.}$$

2.4.2.2 Concentricity. The top cover shall be concentric with the cover centreline within 1.0 mm (0.04 in) total indicated runout¹⁾.

2.4.2.3 Clearance. The vertical clearance h_2 between the lower edge of the top cover and the reference line shall be

$$h_2 = 10 \text{ mm (0.39 in) minimum.}$$

2.4.3 Hub (see Figure 3)

2.4.3.1 Body height. The height of the hub body h_3 shall be

$$h_3 = 35.3 \pm 0.4 \text{ mm (1.390} \pm 0.015 \text{ in).}$$

2.4.3.2 Bore relief. The bore may be relieved within a zone of height h_4 .

$$h_4 = 20.6 \pm 1.5 \text{ mm (0.81} \pm 0.06 \text{ in)}$$

extending above height h_5 .

$$h_5 = 6.3 \pm 0.8 \text{ mm (0.25} \pm 0.03 \text{ in).}$$

2.4.3.3 Location. The height of the hub h_6 above the reference line shall be

$$h_6 = 21 \pm 0.5 \text{ mm (0.822} \pm 0.012 \text{ in).}$$

2.4.3.4 Bore taper. The taper of the hub bore shall be

$$(1 \pm 0.0002) : 2.$$

2.4.3.5 Bore finish. The finish of the bore shall be 1.6 μm to 0.8 μm (63 μin to 32 μin) arithmetical mean deviation.

2.4.4 Spindle lock (see Figure 3 and Figure 4)

2.4.4.1 Thread specification. The thread of the spindle lock shall be a two start thread of type 8UNS-2A or 16 UNC-2A, of nominal diameter d_2 .

$$d_2 = 9.52 \text{ mm (0.375 in).}$$

2.4.4.2 Thread length. The length of full thread h_7 shall be

$$h_7 = 7.4 \text{ mm (0.29 in) minimum.}$$

2.4.4.3 Chamfer. The lower end of the spindle lock shall be chamfered, having a minor diameter of d_3

$$d_3 = 7.4 \pm 0.2 \text{ mm (0.293} \pm 0.008 \text{ in)}$$

and an angle γ

$$\gamma = 30 \pm 2^\circ.$$

2.4.4.4 Location. The height h_8 of the flange of the spindle lock from the reference line shall be

$$h_8 = 59.048 \begin{matrix} +0.175 \\ -0.255 \end{matrix} \text{ mm (2.325} \begin{matrix} +0.007 \\ -0.010 \end{matrix} \text{ in).}$$

2.4.4.5 Length. The length h_9 of the lower part of the spindle lock shall be

$$h_9 = 19.65 \pm 0.15 \text{ mm (0.774} \pm 0.006 \text{ in).}$$

2.4.4.6 Diameter over safety balls

2.4.4.6.1 The diameter d_4 of the lower part of the spindle lock with the safety balls expanded shall be

$$d_4 = 10.97 \text{ mm (0.432 in) maximum.}$$

The safety balls shall not extend before the lockshaft pin is at a distance h_{22} from the flange of the spindle lock.

$$h_{22} = 18.5 \text{ mm (0.728 in) maximum.}$$

¹⁾ Also known as Full Indicated Movement, FIM (see BS 308).

The safety balls shall cease to extend when the lockshaft pin is at a distance h_{23} from the flange of the spindle lock.

$h_{23} = 14.3 \text{ mm (0.563 in)}$ minimum.

2.4.4.6.2 The diameter d_5 with relaxed balls shall be

$d_5 = 9.65 \text{ mm (0.38 in)}$ maximum.

2.4.4.7 *Location of safety balls.* The height h_{10} of the centres of the safety balls from the spindle lock flange shall be

$h_{10} = 8.66 \pm 0.24 \text{ mm (0.341} \pm 0.009 \text{ in)}$.

2.4.4.8 *Hole for lockshaft pin.* The diameter d_6 of the hole for the penetration of the drive spindle lockshaft pin into the spindle lock shall be

$d_6 = 3.0 \text{ mm (0.12 in)}$ minimum.

2.4.4.9 *Clearance for lockshaft pin.* The clearance for the penetration of the drive spindle lockshaft pin into the spindle lock shall extend to a maximum height h_{11} from the flange.

$h_{11} = 12.5 \text{ mm (0.492 in)}$ maximum.

2.4.4.10 *Removal of top cover.* The top cover shall be removable when the lockshaft has penetrated into the spindle lock to a height h_{12} from the flange.

$h_{12} = 13.8 \pm 0.5 \text{ mm (0.543} \pm 0.020 \text{ in)}$.

2.4.5 **Sector disk** (see Figure 5 and Figure 6)

2.4.5.1 *Diameter.* The diameter d_7 of the sector disk shall be

$d_7 = 362.74 \pm 0.25 \text{ mm (14.281} \pm 0.010 \text{ in)}$.

2.4.5.2 *Thickness.* The thickness e_1 of the sector disk shall be

$e_1 = 1.3 \pm 0.08 \text{ mm (0.051} \pm 0.003 \text{ in)}$.

2.4.5.3 *Number of notches.* The sector disk shall have at its circumference 21 rectangular notches.

2.4.5.4 *Location of notches*

2.4.5.4.1 The angle α between the leading edges of two adjacent notches in the range 1 to 20 (see Figure 5) shall be $\alpha = 18^\circ 0' \pm 4'$.

The tolerance is not cumulative.

An additional notch X (see Figure 5) shall be provided between notches 1 and 2 for index identification.

2.4.5.4.2 The angle β between the leading edges of notches 1 and X shall be $\beta = 2^\circ 23' \pm 4'$.

2.4.5.5 *Depth of notches.* The radial depth of the notches shall be limited by the radius r_1 .

$r_1 = 178.0 \text{ mm (7.008 in)}$ maximum.

2.4.5.6 *Width of notches.* The width e_2 of the notches shall be

$e_2 = 1.9 \pm 0.2 \text{ mm (0.075} \pm 0.008 \text{ in)}$.

2.4.5.7 *Location.* The height h_{13} from the bottom surface of the sector disk to the reference line shall be

$h_{13} = 17.95 \pm 0.55 \text{ mm (0.707} \pm 0.022 \text{ in)}$.

2.4.5.8 *Edge relief.* All edges and corners of the sector disk may be relieved to a radius r_2 .

$r_2 = 0.4 \text{ mm (0.015 in)}$ maximum.

2.4.6 **Disk support** (see Figure 6). The radius r_3 of the disk support shall be

$r_3 = 95.3 \text{ mm (3.75 in)}$ maximum.

2.4.7 **Recording disk** (see Figure 6 and Figure 7)

2.4.7.1 *Diameter.* The diameter d_8 of the recording disk shall be

$d_8 = 356.4 \begin{matrix} + 0.0 \\ - 0.25 \end{matrix} \text{ mm (14.03} \begin{matrix} + 0.00 \\ - 0.01 \end{matrix} \text{ in)}$.

2.4.7.2 *Thickness.* The thickness e_3 of the recording disk shall be

$e_3 = 1.27 \pm 0.05 \text{ mm (0.050} \pm 0.002 \text{ in)}$.

2.4.7.3 Edge relief. For a distance e_4 from the outside edge of the recording disk, the disk contour may be relieved.

$e_4 = 1.3 \text{ mm (0.05 in)}$ maximum.

2.4.8 Location of the disks (see Figure 6). The disks shall be located from the reference line as follows:

1st disk: height from the upper surface to the reference line:

$$h_{14} = 20.83 \pm 0.52 \text{ mm (0.8200} \pm 0.0205 \text{ in)}.$$

2nd disk to 6th disk: height from the lower surface to the reference line:

$$h_{15} = 29.72 \pm 0.51 \text{ mm (1.1700} \pm 0.0200 \text{ in)}$$

$$h_{16} = 39.88 \pm 0.45 \text{ mm (1.5700} \pm 0.0175 \text{ in)}$$

$$h_{17} = 50.04 \pm 0.37 \text{ mm (1.9700} \pm 0.0145 \text{ in)}$$

$$h_{18} = 60.20 \pm 0.43 \text{ mm (2.3700} \pm 0.0170 \text{ in)}$$

$$h_{19} = 70.36 \pm 0.50 \text{ mm (2.7700} \pm 0.0195 \text{ in)}$$

2.4.9 Minimum clearance of lowest element (see Figure 6). The clearance of the lowest element of the disk pack shall be

$$h_{20} = 12 \text{ mm (0.474 in)}$$
 minimum

in the area between a radius r_4 and a radius r_5 :

$$r_4 = 74 \text{ mm (2.913 in)}$$
 minimum

$$r_5 = 90 \text{ mm (3.543 in)}$$
 maximum.

Within r_4 the clearance shall be (see **2.4.3.3** and Figure 3)

$$h_6 = 20.5 \text{ mm (0.810 in)}$$
 minimum.

2.4.10 Height without top cover (see Figure 6). The height h_{21} of the disk pack, without the top cover, above the reference line shall be

$$h_{21} = 95.3 \text{ mm (3.75 in)}$$
 maximum.

2.4.11 Hub/disks relationship

2.4.11.1 Axial runout. The axial runout of the recording disks and of the sector disk at any diameter is included in the dimensions given in **2.4.8**. The axial runout (i.e. the total indicator reading) at any speed up to the maximum specified in **2.7** shall not exceed:

0.3 mm (0.012 in) for the recording disks

0.5 mm (0.02 in) for the sector disk.

2.4.11.2 Acceleration of axial runout. The acceleration of the disk surface in the axial direction shall not exceed 280 m/s^2 ($11\,000 \text{ in/s}^2$) at any speed within the range 2 352 to 2 448 revolutions per minute.

2.4.11.3 Radial runout. The total indicated radial runout shall be

1) for the sector disk and the bottom two recording disks:

0.25 mm (0.01 in) maximum;

2) for the other disks:

0.5 mm (0.02 in) maximum.

2.4.11.4 Angular displacement. Up to a positive or negative acceleration of $3\,000 \text{ rad/s}^2$ there shall be no angular displacement between any disk and the hub when measured with a device capable of detecting a shift of three seconds of arc.

2.4.12 Location of magnetic surface. The area of the magnetic coating shall extend from a minor diameter of 208.3 mm (8.20 in) maximum to a major diameter of 353.6 mm (13.90 in) minimum.

2.5 Moment of inertia

The moment of inertia of the disk pack without covers shall not exceed $570 \times 10^{-4} \text{ kg m}^2$ (195 lb in²).

2.6 Balance

The disk pack shall be balanced within 200 g mm (0.28 oz in) in a single plane parallel to the disk surfaces. This plane is located $68.0 \pm 3.0 \text{ mm (2.71} \pm 0.12 \text{ in)}$ above the reference line.

2.7 Maximum speed

The disk pack shall be capable of withstanding the effects of stress at a speed of 2 500 revolutions per minute counterclock-wise as seen from the top.

2.8 Locking pull

The disk pack shall be held to the disk drive spindle by a force of 925 ± 145 N (206 ± 32 lbf), exerted by the downward pull of the disk drive lockshaft on the disk pack spindle lock.

2.9 Air feed openings

At least 12 openings having a minimum total area of 710 mm^2 (1.1 in^2) shall be equally distributed around the disk support between each pair of recording disks.

2.10 Air filter

2.10.1 Filter media. The filter media shall be of a screen type construction having a maximum spacing between strands of $44 \text{ }\mu\text{m}$ (0.00173 in). The material shall not contain tendrils or loose particles which may separate from the filter and enter the filtered system.

2.10.2 Air flow and pressure drop. The pressure drop across a clean air filter shall not exceed 11 mm (0.43 in) of water while passing $0.95 \pm 0.1 \text{ m}^3$ ($33 \pm 2 \text{ ft}^3$) of air per minute.

2.11 Air flow

Figure 8 shows the test configuration for airflow measurements. With the disk pack rotating at $2\,400 \pm 48$ revolutions per minute, the static pressure drop measured at the static pressure tap shall not exceed 13.5 mm (0.53 in) of water with an air flow through the disk pack of $0.95 \pm 0.1 \text{ m}^3$ ($33 \pm 2 \text{ ft}^3$) per minute of air measured at the air intake.

2.12 Thermal time constant

Within the conditions specified in 2.11, the disk pack thermal time constant shall not exceed 1 min. The thermal time constant is defined as the time required to reduce an initial temperature difference between the pack and the drive by 2/3.

2.13 Operational earthing

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

2.14 Physical characteristics of magnetic surfaces

2.14.1 Surface roughness. The surface roughness of the finished magnetic surface shall not exceed $0.09 \text{ }\mu\text{m}$ ($3.5 \text{ }\mu\text{in}$), arithmetic average, with a maximum deviation in height of $0.76 \text{ }\mu\text{m}$ ($30 \text{ }\mu\text{in}$) from the average, when measured with a 0.0025 mm (0.0001 in) stylus and a 0.75 mm (0.03 in) cutoff range.

2.14.2 Durability of magnetic surface

2.14.2.1 Resistance to chemical cleaning fluid. The magnetic surface of recording disks shall not be adversely affected by a 91 % solution of isopropyl alcohol (made from reagent grade isopropyl alcohol mixed with 9 % distilled or deionized water by volume) when this is used for cleaning.

2.14.2.2 Coating adhesion. The nature of the coating shall be such as to assure wear resistance under operating conditions and maintenance of adhesion and abrasive wear resistance. Suggested tests for assuring the durability of the coating are given in Appendix C.

2.14.2.3 Abrasive wear resistance. The coating shall be capable of withstanding wear due to head loading operations. A possible test method is described in Appendix C.

