

Interchangeable magnetic twelve-disk pack for information processing —

Part 1: Specification for 100 Mbytes magnetic twelve-disk pack

[ISO title: Information processing-Interchangeable magnetic
twelve-disk pack (100 Mbytes)]

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Scientific Instrument Manufacturers' Association

This British Standard, having been prepared under the direction of the Data Processing Standards Committee, was published under the authority of the Executive Board on 31 October 1978

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National foreword

This British Standard has been prepared under the direction of the Data Processing Standards Committee. It is identical with ISO 4337 “*Information processing — Interchangeable magnetic twelve-disk pack (100 Mbytes)*” which was prepared by Subcommittee 10, Magnetic disks, of Technical Committee 97, Computers and information processing, of the International Organization for Standardization (ISO).

The United Kingdom is a participating member of both the subcommittee and the committee. Its delegations, appointed and briefed by the British Standards Institution Technical Committee DPS/4, Magnetic tape and magnetic disk packs, were involved in preparing this standard.

This standard, designated Part 1, deals with packs of 100 Mbytes capacity. A further draft proposal, DP 5653, is under consideration by Technical Committee 97, Subcommittee 10, for twelve-disk packs of 200 Mbytes.

Terminology and conventions. The text of the International Standard has been approved as suitable for publication, without deviation, as a British Standard. Some terminology and certain conventions are not identical with those used in British Standards; attention is especially drawn to the following.

The comma has been used as a decimal marker for metric units. In British Standards it is current practice to use a full point on the baseline as the decimal marker.

Wherever the words “International Standard” appear, referring to this standard, they should be interpreted as “British Standard”.

Cross references. For each of the following International Standards referred to in the text, there is a corresponding British Standard; these are as listed below:

International Standard	Corresponding British Standard
ISO 646:1967	BS 4730:1974 <i>The United Kingdom 7-bit data code (ISO-7-UK)</i> (Technically equivalent)
ISO 1302:1971	BS 308 <i>Engineering drawing practice</i> Part 2:1972 <i>Dimensioning and tolerancing of size</i> (Technically equivalent)
ISO 2022:1973	BS 4953:1973 <i>Code extension techniques for use with the United Kingdom 7-bit data code</i> (Technically equivalent)

NOTE *Textual error.* When adopting the text of the International Standard, the printing error given below was noticed. It has been corrected in this British Standard and has been reported to Technical Committee 97 in a proposal to amend the text of the International Standard.

In the caption to Figure 18 “nose” is deleted and replaced by “noise”.

In addition, it has been noticed that there is inconsistency in the use of the unit for the rate of rotation (see 4.13.1, 4.13.3, 5.2, 5.3 and 5.6). In 4.13.1 the unit “rev/min” should be read as min⁻¹.

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.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 46, 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 Scope and field of application

This International Standard specifies the general, physical, and magnetic characteristics and the pre-initialization for the physical interchange of 100 Mbytes magnetic twelve-disk packs, for use in electronic data processing systems.

Section 1. General description

2 General description

2.1 General figures

A typical twelve-disk pack is represented in Figure 1 to Figure 6:

- Figure 1 shows an exploded view;
- Figure 2 shows a vertical cross-section;
- Figure 3 shows, at an enlarged scale, the relationship between the top cover and the bottom protective disk;
- Figure 4 shows a schematic cross-section of part of the disk pack;
- Figure 5 shows a schematic cross-section of the spindle lock;
- Figure 6 shows an enlarged view of the edge of a disk.

2.2 Main elements

The main elements of this twelve-disk pack are:

- the top cover;
- the hub;
- the spindle lock;
- the protective disks;
- the recording disks;
- the servo surface;
- the bottom cover.

Other elements shown in the drawings are for better understanding of the figures only and are not part of the standard.

2.3 Direction of rotation

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

2.4 Pack capacity

A gross information capacity of 100 million 8-bit bytes is achieved in this 12-disk pack by the use of 19 data disk surfaces. Data are recorded on 404 tracks per data surface. The track spacing gives approximately 8 tracks per millimetre, each containing a maximum of 13 030 8-bit bytes of information. The recording density varies between outer and inner tracks and reaches a maximum of 159 bpmm on the innermost track.

Section 2. Mechanical and physical characteristics

3 General requirements

3.1 Operation and storage environment

3.1.1 Operation

The operating temperature — measured within the disk pack area of the drive — shall be within the range 15 °C (59 °F) to 57 °C (135 °F) at a relative humidity of 8 to 80 %. The wet bulb reading shall not exceed 26 °C (79 °F). Before a disk pack 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 time of acclimatization is dependent on the difference between the disk pack temperature and the environmental temperature of the disk drive. The minimum time may be calculated using a temperature gradient of 10 °C (18 °F) per hour.

The range specified above does not necessarily apply to the disk drive.

3.1.2 Storage

The storage temperature shall be within the range $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$) to $+65\text{ }^{\circ}\text{C}$ ($+150\text{ }^{\circ}\text{F}$), the wet bulb reading not exceeding $30\text{ }^{\circ}\text{C}$ ($86\text{ }^{\circ}\text{F}$). For wet bulb temperatures between $0,5\text{ }^{\circ}\text{C}$ ($33\text{ }^{\circ}\text{F}$) and $30\text{ }^{\circ}\text{C}$ ($86\text{ }^{\circ}\text{F}$) the disk pack shall be able to withstand a relative humidity of 8 % to 80 %.

It is recommended that the pack should not be stored under the extreme conditions of the above range. A temperature gradient of more than $10\text{ }^{\circ}\text{C}$ ($18\text{ }^{\circ}\text{F}$) per hour should be avoided.

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

3.2 Test conditions

Unless otherwise stated, measurements shall be carried out at $23 \pm 3\text{ }^{\circ}\text{C}$ ($73.4 \pm 5\text{ }^{\circ}\text{F}$), 40 % to 60 % relative humidity after 24 h of acclimatization. Tests shall be carried out with the disk pack in the upright position, unless otherwise stated.

3.3 Shock and vibration

The disk pack should withstand exposure to shock and/or vibration 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.

3.4 Material

Unless otherwise stated, the disk pack 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 all the recording disks shall be the same.

4 Dimensional characteristics

4.1 Reference plane

All dimensions are referred to a reference plane. It is the surface, perpendicular to the axis of the pack, on which the pack rests with its three rest buttons.

4.2 Overall external dimensions

4.2.1 Overall height (see Figure 2)

The overall height of the disk pack with top and bottom cover shall be

$$h_1 \leq 180\text{ mm (7.09 in.)}$$

4.2.2 Overall diameter (see Figure 2)

The overall diameter of the disk pack with top and bottom cover shall be

$$d_1 \leq 381\text{ mm (15.0 in.)}$$

4.3 Top cover (see Figure 3)

4.3.1 Outside radius, pack-centreline relationship

When measured with reference to the hub centreline the outside radius of the top cover shall be

$$183,65\text{ mm (7.230 in.)} < r_1 < 185,42\text{ mm (7.300 in.)}$$

4.3.2 Vertical distance

The vertical distance of the lower edge of the top cover below the reference plane shall be

$$h_2 = 3,56 \pm 1,47\text{ mm (0.140} \pm 0.058\text{ in.)}$$

4.4 Hub (see Figure 4)

4.4.1 Diameter of the flexure pads

The diameter of the three hub flexure pads shall be

$$d_2 = 44,432 \pm 0,005\text{ mm (1.749 3} \pm 0,000 2\text{ in.)}$$

measured at $20,0 \pm 0,5\text{ }^{\circ}\text{C}$ ($68 \pm 1\text{ }^{\circ}\text{F}$).

4.4.2 Height of the flexure pads

The height of the hub flexure pads shall be

$$h_3 = 1,91 \pm 0,13 \text{ mm } (0.075 \pm 0.005 \text{ in}).$$

4.4.3 Finish of the flexure pads

The finish shall be of class N5, i.e. $0,4 \mu\text{m}$ ($16 \mu\text{in}$) arithmetical mean deviation; see ISO 1302.

4.4.4 Relief of the flexure pads

The hub flexure pad shall be relieved to

$$d_3 = 44,478 \pm 0,015 \text{ mm } (1.751 \pm 0.000 6 \text{ in})$$

measured at $20,0 \pm 0,5 \text{ }^\circ\text{C}$ ($68 \pm 1 \text{ }^\circ\text{F}$).

4.4.5 Height of flexure pads from the reference plane

The height of the flexure pads from the reference plane shall be

$$h_4 = 1,40 \pm 0,30 \text{ mm } (0.055 \pm 0.012 \text{ in}).$$

4.4.6 Radial compliance of flexure pads

The radial compliance of each flexure pad shall be $1,0 \pm 0,2 \mu\text{m}$ ($40 \pm 8 \mu\text{in}$) per $4,5 \text{ N}$ (1 lbf) radial force located at the collet flexure pad with d_2 expanded to $44,450 0 \pm 0,002 5 \text{ mm}$ ($1.750 0 \pm 0.000 1 \text{ in}$).

4.4.7 Rest buttons

4.4.7.1 LOCATION

The three rest buttons shall be equally spaced on a circle of diameter

$$d_4 = 139,70 \pm 0,13 \text{ mm } (5.500 \pm 0.005 \text{ in}).$$

4.4.7.2 DIAMETER AND SHAPE

The diameter of the rest buttons shall be

$$d_5 = 11 \pm 1 \text{ mm } (0.43 \pm 0.04 \text{ in}).$$

Their rest surface shall be spherical with a radius

$$r_2 = 110 \pm 15 \text{ mm } (4.33 \pm 0.59 \text{ in}).$$

4.4.7.3 ROUGHNESS AND HARDNESS

The finish of the rest surfaces shall be of class N4, i.e. $0,2 \mu\text{m}$ ($8 \mu\text{in}$) arithmetical mean deviation; see ISO 1302. The hardness shall be 55 to 60 HRC (Rockwell scale C).

4.5 Spindle lock (see Figure 5)

4.5.1 Thread of the spindle lock

The thread of the spindle lock shall be a double lead thread of type 24 UNF-2A.

4.5.2 Diameter of the lower part of the spindle lock

The diameter of the lower part of the spindle lock shall be

$$d_6 = 9,37 \pm 0,13 \text{ mm } (0.369 \pm 0.005 \text{ in}).$$

4.5.3 Minimum full thread length

The full thread length of the spindle lock shall be

$$h_5 \geq 7,14 \text{ mm } (0.281 \text{ in}).$$

4.5.4 Chamfer

The lower end of the spindle lock shall be chamfered from an inner diameter

$$d_7 = 8,00 \pm 0,13 \text{ mm } (0.315 \pm 0.005 \text{ in}).$$

and an angle

$$\gamma = 45^\circ \pm 2^\circ.$$

4.5.5 Location of the shoulder of the spindle lock

The shoulder of the spindle lock shall be at a distance from the reference plane of

$$h_6 = 13,51 + {}^{0,23}_{0,30} \text{ mm } (0.532 + {}^{0,009}_{-0,012} \text{ in}).$$

4.5.6 Length of the lower part of the spindle lock

The length of the lower part of the spindle lock shall be

$$h_7 = 19,15 \pm 0,076 \text{ mm } (0.754 \pm 0.003 \text{ in}).$$

4.5.7 Maximum diameter of the lower part of the spindle lock

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

$$d_8 = 10,7 \pm 0,1 \text{ mm } (0.421 \pm 0.004 \text{ in}).$$

The safety balls shall not expand before the lockshaft pin is at a distance of

$$h_8 \leq 16,97 \text{ mm } (0.668 \text{ in})$$

from the shoulder of the spindle lock. The safety balls shall cease to expand when the lockshaft pin is at a distance of

$$h_9 \geq 14,65 \text{ mm } (0.577 \text{ in})$$

from the shoulder of the spindle lock

The diameter with relaxed balls shall be

$$d_9 \leq 9,53 \text{ mm } (0.375 \text{ in}).$$

4.5.8 Location of the safety balls

The centres of the safety balls shall be located with regard to the spindle lock shoulder at a distance of

$$h_{10} = 9,04 \pm 0,23 \text{ mm } (0.356 \pm 0.009 \text{ in}).$$

4.5.9 Hole for the penetration of the lockshaft pin

The diameter of the hole for the penetration of the drive spindle lockshaft pin into the spindle lock shall be

$$d_{10} = 3,18 \pm 0,13 \text{ mm } (0.125 \pm 0.005 \text{ in}).$$

4.5.10 Depth of penetration of the lockshaft pin

The clearance for the penetration of the drive spindle lockshaft pin into the spindle lock shall extend to a distance of

$$h_{11} \leq 13,84 \text{ mm } (0.545 \text{ in})$$

from the shoulder.

4.5.11 Removal of the top cover

It shall be possible to remove the top cover when the lockshaft has penetrated into the spindle lock to a distance of

$$h_{12} = 14,44 \pm 0,21 \text{ mm } (0.569 \pm 0.008 \text{ in})$$

from the shoulder.

4.6 Bottom protective disk (see Figure 4)

4.6.1 Diameter

The diameter of the bottom protective disk shall be

$$d_{11} = 360,37 \pm 0,25 \text{ mm } (14.188 \pm 0.010 \text{ in}).$$

4.6.2 Thickness

The thickness of the bottom protective disk shall be

$$e_1 = 1,30 \pm 0,08 \text{ mm } (0.051 \pm 0.003 \text{ in}).$$

4.7 Disk supports (see Figure 4)

The radius of all disk supports shall be

$$r_3 \leq 90,0 \text{ mm } (3.58 \text{ in}).$$

4.8 Recording disks

4.8.1 *Diameter* (see Figure 4)

The diameter of all recording disks shall be

$$d_{12} = 356,25 \pm 0,15 \text{ mm } (14.025 \pm 0.006 \text{ in}).$$

4.8.2 *Thickness* (see Figure 6)

The thickness of all recording disks shall be

$$e_2 = 1,905 \pm 0,025 \text{ mm } (0.075 \pm 0.001 \text{ in}).$$

4.8.3 *Disk edge chamfer* (see Figure 6)

For a distance

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

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

4.9 Top protective disk (see Figure 4)

4.9.1 *Diameter*

The diameter of the top protective disk shall be

$$d_{12} = 356,25 \pm 0,15 \text{ mm } (14.025 \pm 0.006 \text{ in}).$$

4.9.2 *Thickness*

The thickness of the top protective disk shall be

$$e_4 = 1,27 \pm 0,05 \text{ mm } (0.050 \pm 0.002 \text{ in}).$$

4.10 Location of the disks (see Figure 4)

The disks shall be located with regard to the reference plane as described in 4.10.1 to 4.10.3.

4.10.1 *Bottom protective disk*

The distance between the reference plane and the lower surface of the bottom protective disk shall be

$$h_{13} = 0,56 \text{ to } 1,41 \text{ mm } (0.022 \text{ to } 0.056 \text{ in}).$$

4.10.2 *Recording disks*

The distance above the reference plane to the recording disks shall be

$$h_{14} = 10,478 \pm 0,203 \text{ mm } (0.412 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{15} = 20,003 \pm 0,203 \text{ mm } (0.787 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{16} = 29,528 \pm 0,203 \text{ mm } (1.162 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{17} = 39,053 \pm 0,203 \text{ mm } (1.537 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{18} = 48,578 \pm 0,203 \text{ mm } (1.912 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{19} = 58,103 \pm 0,203 \text{ mm } (2.287 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{20} = 67,628 \pm 0,203 \text{ mm } (2.662 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{21} = 77,153 \pm 0,203 \text{ mm } (3.037 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{22} = 86,678 \pm 0,203 \text{ mm } (3.412 \text{ 5} \pm 0.008 \text{ in}),$$

$$h_{23} = 96,203 \pm 0,203 \text{ mm } (3.787 \text{ 5} \pm 0.008 \text{ in}).$$

4.10.3 *Top protective disk*

The distance between the reference plane and the lower surface of the top protective disk shall be

$$h_{24} = 105,982 \pm 0,432 \text{ mm } (4.172 \text{ 5} \pm 0.017 \text{ in}).$$

4.11 Location of the lowest element

The lowest element of the disk pack shall not extend outside an annular space defined by

$$h_{25} \leq 7,6 \text{ mm (0.30 in)}$$

and two radii

$$r_4 = 78,0 \text{ mm (3.07 in)},$$

$$r_5 = 96,5 \text{ mm (3.80 in)}.$$

4.12 Height without covers

The overall height of the disk pack, without covers, above the reference plane shall be

$$h_{26} \leq 123,0 \text{ mm (4.84 in)}.$$

4.13 Hub/disk relationship

4.13.1 Axial position limits of disk surfaces

With the disk pack revolving at any speed in the range 2 500 to 3 700 rev/min, the axial runout of the recording disks and the top and bottom protective disks (defined by stacking dimension h_{13} through h_{24} in Figure 4 shall remain within the axial position limits defined for each surface by the plus and minus tolerance around the datum dimension expressed as a dimension from the reference plane for that surface (dimensions h_{13} through h_{24}). This requirement shall apply to the area of all disk surfaces between a radius of 175,08 mm (6.893 in) minimum and a radius of 98,42 mm (3.875 in) maximum.

4.13.2 Axial runout of disks

The axial runout of any disk at any rotational frequency up to the maximum allowable rotational frequency (see 5.3) shall not exceed

0,15 mm (0.006 in) for the recording disks,

0,51 mm (0.020 in) for the protective disks,

total indicator reading.

4.13.3 Acceleration of axial runout

With the disk pack revolving at $3\,600 \pm 72 \text{ min}^{-1}$, the acceleration of the axial runout of the recording disk surfaces (measured with a high frequency cutoff defined by the flat response/high frequency asymptote intercept of 2 200 Hz and a high frequency fall-off of 18 dB per octave) in the area between a radius of 175,08 mm (6.893 in) minimum and a radius of 98,42 mm (3.875 in) maximum shall not exceed a peak acceleration from the base line of $\pm 76 \text{ m/s}^2 (\pm 3\,000 \text{ in/s}^2)$.

4.13.4 Horizontal runout of disks

The horizontal runout (i.e. the total indicator reading) shall not exceed 0,25 mm (0.010 in) for the recording disks, and 0,51 mm (0.020 in) for the top and bottom protective disks, referred to the centreline of the disk pack hub.

4.13.5 Angular shift between disks and hub

After the disk pack has experienced a positive or negative acceleration up to $3\,000 \text{ rad/s}^2$, the angular shift between disks and hub must remain equal to zero when measured with a device capable of detecting a shift of 3" of arc.

4.14 Location of magnetic surfaces

The area of the magnetic surface of the recording disks shall extend from an inside diameter of 190,5 mm (7.50 in) maximum to an outside diameter of 352,0 mm (13.86 in) minimum.

5 Physical characteristics

5.1 Moment of inertia

The moment of inertia of the disk pack without covers shall not exceed $107 \text{ g m}^2 (365.6 \text{ lb in}^2)$.

5.2 Balance

The disk pack shall be dynamically balanced. Residual unbalance shall be less than 100 g mm (0.14 oz in) when measured at $3\,600\text{ min}^{-1}$ in each of two planes parallel to the disk surface at $5,84 \pm 1,3\text{ mm}$ ($0.23 \pm 0.05\text{ in}$) above the upper surface of the top protective disk and below the lower surface of the bottom protective disk, respectively.

5.3 Maximum rotational frequency

The disk pack shall be capable of withstanding the effect of stress at a rotational frequency of $3\,700\text{ min}^{-1}$ counter-clockwise as viewed from the top.

5.4 Locking pull

The disk pack shall be held to the disk drive spindle by a force of $1\,550 \pm 450\text{ N}$ ($350 \pm 100\text{ lbf}$), exerted by the downward pull of the disk drive lockshaft on the disk pack spindle lock.

5.5 Ambient air

5.5.1 Filtered air

The filtered air in the immediate area of the disk pack shall be equivalent to a class 100 clean room (see Annex A).

5.5.2 Pressure

The static pressure in the immediate area of the disk pack shall be $0,25\text{ mbar}$ ($0.1\text{ inH}_2\text{O}$) minimum above the environment of the drive.

5.6 Thermal time constant

The thermal time constant is the time required to reduce an initial temperature difference between the pack and the drive by 2/3. The disk pack thermal time constant shall not exceed 1 min when measured with the disk pack rotating at $3\,600 \pm 72\text{ min}^{-1}$ and within the specified operating environment and conditions.

5.7 Electrical earthing

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

5.8 Physical characteristics of magnetic surfaces

5.8.1 Surface roughness

The finished magnetic surface shall have a surface roughness less than $0,05\text{ }\mu\text{m}$ ($2.0\text{ }\mu\text{in}$), arithmetic average, with a maximum deviation in height of $0,38\text{ }\mu\text{m}$ ($15\text{ }\mu\text{in}$) from average, when measured with a $2,5\text{ }\mu\text{m}$ ($0.000\,1\text{ in}$) stylus and a $750\text{ }\mu\text{m}$ (0.03 in) cutoff range.

5.8.2 Durability of magnetic surfaces

5.8.2.1 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 used for cleaning.

5.8.2.2 COATING ADHESION

The nature of the coating shall be such as to ensure wear resistance under operating conditions and maintenance of adhesion and abrasive wear resistance.

5.8.2.3 ABRASIVE WEAR RESISTANCE

The coating shall be able to withstand operational wear.

Section 3. Magnetic characteristics

6 Track and recording information — data surfaces

6.1 General geometry, surfaces and heads

Head and surface details shall be as in Figure 7 and Figure 13.

Track locations shall be referred to a Cartesian co-ordinate system, axes *X* and *Y*, with its origin on the axis of rotation of the disk pack.

6.2 Track geometry

6.2.1 Number of tracks

There shall be 411 discrete concentric tracks per data surface.

6.2.2 Width of tracks

The recorded track width on the data surface shall be

$$0,109 \pm 0,005 \text{ mm } (0.0043 \pm 0.0002 \text{ in}).$$

(A suggested method of measuring the track width is shown in Annex B.)

6.2.3 Track location

The centreline of any track shall lie within

$$\pm 0,005 \text{ mm } (0.0002 \text{ in})$$

of its corresponding data track centreline as defined in 10.1.5.3.

The incremental head movement and its tolerance are defined by the servo track information and shall correspond to the servo track spacing (see 10.1.5.4).

6.2.4 Location of the lines of access

There shall be two groups of heads each having a line of access A and B respectively. These lines of access shall be parallel to the *X* axis and shall have the ordinate

$$Y_A = + 7,772 \text{ mm } (0.306 \text{ in}),$$

$$Y_B = - 7,772 \text{ mm } (0.306 \text{ in}).$$

6.2.5 Recording offset angle

At the instant of writing or reading a magnetic transition, the transition may have an angle of

$$\pm 30' \text{ maximum}$$

with the line of access.

6.2.6 Identification of data tracks

For the purposes of testing data tracks, the identifying system specified in 6.2.6.1 to 6.2.6.4 is used.

6.2.6.1 DATA TRACK IDENTIFICATION

Data track identification shall be a three-digit decimal number (000 to 410) which numbers data tracks consecutively starting at the outermost data track of each data surface.

6.2.6.2 DATA SURFACE IDENTIFICATION

The data surfaces shall be numbered from 00 to 18 corresponding with the head numbers (see Figure 7).

6.2.6.3 CYLINDER

A cylinder is the set of data tracks on the data surfaces having the same data track identification.

6.2.6.4 DATA TRACK ADDRESS

A five-digit decimal number is used for data track address with the three most significant digits defining the cylinder address and the remaining two digits defining the data surface address.

7 Test conditions and equipment — data surfaces

7.1 General conditions

7.1.1 Rotational frequency

The rotational frequency shall be $3\,600 \pm 72 \text{ min}^{-1}$ in any test period. Rotation shall be counter-clockwise when viewed from above.

7.1.2 Temperature

The temperature of the air entering the disk pack area shall be

$$27 \pm 2 \text{ }^{\circ}\text{C } (81 \pm 4 \text{ }^{\circ}\text{F}).$$

7.1.3 Relative humidity

The relative humidity of the air entering the disk pack shall be between 30 and 70 %.

7.1.4 Conditioning

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

7.2 Standard reference data surface

7.2.1 Characteristics

The standard reference data surface shall be characterized at the innermost and outermost track. When recorded at $1f$ (see 7.8), using a data test head, the track average amplitude (see 7.7) shall be:

- 3,75 mV at track 000,
- 1,9 mV at track 410.

When recorded at $2f$ (see 7.8), using a data test head, the track average amplitude (see 7.7) shall be:

- 2,7 mV at track 000,
- 1,3 mV at track 410.

7.2.2 Secondary standard reference data surface

This is a surface whose output is related to the standard reference data surface via calibration factors C_{D1} at $1f$ and C_{D2} at $2f$.

The calibration factor C_D is defined as

$$C_D = \frac{\text{Standard reference data surface output}}{\text{Secondary standard reference data surface output}}$$

To qualify as a secondary standard reference data surface, the calibration factor C_D for such disks shall satisfy

$$0,90 \leq C_D \leq 1,10$$

at both measured tracks and at both frequencies.

7.3 Data test head

7.3.1 Description

Disk measurement shall be taken with a suitable test head¹⁾. The test head shall be calibrated to the standard reference data surface and used for amplitude and data testing of the data surfaces.

7.3.2 Gap width

The width of the recording gap (measured optically) shall be

$$109,0 \pm 2,5 \mu\text{m} \quad (0.0043 \pm 0.0001 \text{ in}).$$

7.3.3 Gap length

The length of the recording gap shall be

$$2,54 \pm 0,63 \mu\text{m} \quad (100 \pm 25 \mu\text{in}).$$

7.3.4 Offset angle

The angle between the read gap in the ferrite core and the line of access shall be

$$0^\circ \pm 30'.$$

7.3.5 Flying height

When flying over track 410, the test head shall have a flying height at the gap of

$$1,14 \pm 0,05 \mu\text{m} \quad (45 \pm 2 \mu\text{in}).$$

7.3.6 Inductance

The total head inductance shall be $9,4 \pm 0,2 \mu\text{H}$ measured in air at 1 MHz. One leg shall have an inductance of $2,70 \pm 0,05 \mu\text{H}$; the other leg shall have an inductance of $2,85 \pm 0,05 \mu\text{H}$.

¹⁾ Information on suitable test heads may be obtained from the Secretariat of ISO/TC 97, or from the ISO Central Secretariat.

7.3.7 Resonant frequency

As measured at the head cable connector, the resonant frequency of the head shall be

$$19,5 \pm 0,5 \text{ MHz.}$$

7.3.8 Resolution

The test head resolution shall lie between 65 and 79 % at track 000, and between 61 % and 75 % at track 410. Resolution is defined as

$$\frac{2f \text{ amplitude}}{1f \text{ amplitude}} \times 100 \text{ \%}.$$

7.3.9 Head loading force

The net head loading force shall be such as to achieve the flying height given in 7.3.5 and shall be within the limits

$$3,4 \pm 0,4 \text{ N } (0.76 \pm 0.09 \text{ lbf}).$$

7.3.10 Calibration factor

The data test head calibration factors C_{H1} at $1f$ and C_{H2} at $2f$ shall satisfy

$$0,90 \leq C_H \leq 1,10.$$

C_H is defined by

$$C_H = \frac{\text{Standard reference data surface output}}{\text{Actual head voltage measured}}$$

when measured on a standard reference data surface, or by

$$C_H = \frac{\text{Standard reference data surface output}}{(\text{Actual head voltage measured}) \times C_D}$$

when measured on a secondary standard reference data surface.

7.3.11 Overwrite capability

The overwrite capability of the head shall meet the following requirement.

Write with $1f$ on track 000 of a standard reference data surface and measure the average amplitude of the $1f$ signal with a frequency-selective voltmeter. Without DC erase, overwrite once at $2f$, measure the average amplitude of the residual $1f$ signal.

The ratio:

$$\frac{\text{Average amplitude of selectively measured } 1f \text{ signal after overwrite with } 2f}{\text{Average amplitude of selectively measured } 1f \text{ signal before overwrite with } 2f}$$

shall be $-50 \pm 5 \text{ dB}$.

7.4 Conditions for measurements using the data test head

7.4.1 Write current

The 2f write current shall conform to Figure 8. The current amplitude measured at the head termination connector shall be varied in seven levels as presented below:

Data tracks	Write current amplitude ($I_{w1} + I_{w2}$)	
0 to 63	180 mA	} tolerance $\pm 1\%$
64 to 127	173 mA	
128 to 191	166 mA	
192 to 255	160 mA	
256 to 319	153 mA	
320 to 383	147 mA	
384 to 410	140 mA	

The differences between the positive and negative amplitudes of the quiescent write current shall be $|I_{w1} - I_{w2}| < 2$ mA.

$$T_R = 46 \pm 3 \text{ ns},$$

$$T_F = 46 \pm 3 \text{ ns}.$$

$$\text{Overshoot : } (6,5 \pm 0,5) \% \text{ of } I_W = \frac{I_{W1} + I_{W2}}{2},$$

$$T_1 = T_2 \pm 2 \%.$$

7.4.2 DC erase current

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

Data tracks	DC erase current	
0 to 63	90,0 mA	} tolerance $\pm 1\%$
64 to 127	86,5 mA	
128 to 191	83,0 mA	
192 to 255	80,0 mA	
256 to 319	76,5 mA	
320 to 383	73,5 mA	
384 to 410	70,0 mA	

7.5 Read channel

7.5.1 Input impedance

The differential input impedance of the read channel shall be $900 \pm 45 \Omega$ in parallel with 25 ± 2 pF, including the pre-amplifier input impedance and all other distributed and lumped impedance measured at the head termination connector.

7.5.2 Frequency and phase characteristics

The frequency and phase characteristics are defined by the following:

- a) the frequency response shall be flat within $\pm 0,25$ dB from 0,1 MHz to 6,45 MHz ($0,06f$ to $4f$);
- b) the -3 dB roll-off point shall be at 9,675 MHz ($6f$);
- c) the attenuation above 9,675 MHz shall not be less than that given by a line drawn through zero at 9,675 MHz with a slope of -60 dB/decade;
- d) the phase shift shall be less than $\pm 5^\circ$ between 0,1 MHz and 6,45 MHz ($0,06f$ and $4f$).

7.5.3 Transfer characteristics

For inputs between 0,3 mV and 10,0 mV the transfer characteristic shall be linear within $\pm 3\%$ or $50\text{ }\mu\text{V}$, whichever is larger.

7.6 Automatic gain controlled amplifier

The AGC-amplifier shall produce an output voltage V_{AGC} constant to within $\pm 1\%$ for input voltages from $V_{\text{IN, min}} = 0,3$ mV to $V_{\text{IN, max}} = 10,0$ mV (see Figure 9).

Its response time shall be $3,4\text{ }\mu\text{s}$. All frequencies below 10 kHz shall be attenuated at a rate of 20 dB/decade.

7.7 Track average amplitude V_{TA}

The track average amplitude V_{TA} is the average of the peak-to-peak values of the signals over one revolution of the disk measured at the output of the data test head when electrically loaded as in 7.5.

7.8 Test signals

The recording frequencies specified as $1f$ and $2f$ shall be:

- $1f = (3\,225 \pm 3,225) \times 10^3$ transitions/s,
- $2f = (6\,450 \pm 6,450) \times 10^3$ transitions/s.

7.9 Use of DC erase

Unless otherwise specified all write operations shall be preceded by a DC erase operation.

8 Functional testing — data surfaces

8.1 Surface tests

8.1.1 Amplitude test

8.1.1.1 PROCEDURE

Write on any part of the data surface at $2f$, read back and measure the V_{TA} .

8.1.1.2 RESULT

The upper limit of V_{TA} corrected by C_{H} for the data test head shall be 1,8 mV at data cylinder 410 and shall increase linearly to a value of 3,6 mV at data cylinder 000. The corresponding lower limit shall be 0,95 mV at data cylinder 410 and shall increase linearly to a value of 1,8 mV at data cylinder 000 (see Figure 10).

8.1.2 Resolution test

8.1.2.1 PROCEDURE

Write on any part of the data surface at $1f$, read back and measure the V_{TA} . Then DC erase, write at the same position at $2f$, read back and again measure the V_{TA} .

8.1.2.2 RESULT

In all cases the ratio

$$\frac{\text{Average track amplitude of } 2f \text{ signal}}{\text{Average track amplitude of } 1f \text{ signal}}$$
shall be $0,70 \pm 0,20$.