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**Information processing - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 5,3 tpmm (135 tpi) on both sides - Part 1: Dimensional, physical and magnetic characteristics (ISO 8860-1:1987)**

Information processing - Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 5,3 tpmm (135 tpi) on both sides - Part 1: Dimensional, physical and magnetic characteristics (ISO 8860-1:1987, ed. 1)

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Informationsverarbeitung - Datenaustausch auf 90 mm (3.5 mm) Disketten mittels modifizierter Frequenzmodulationsaufzeichnung bei 7 958 ftprad, 5,3 tpmm (135 tpi), auf beiden Seiten - Teil 1: Mechanische, physikalische und Größenanforderungen (ISO 8860-1:1987, Ausg. 1)

Traitement de l'information - Echange de données sur cartouches a disquette de 90 mm (3,5 in) utilisant un enregistrement a modulation de fréquence modifiée a 7 958 ftprad, 5,3 tpmm (135 tpi) sur deux faces - Partie 1: Caractéristiques dimensionnelles, physiques et magnétiques (ISO 8860-1:1987, éd. 1)

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MINISTRSTVO ZA ZNANOST IN TEHNOLOGIJO  
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Part 1

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### English version

Information processing. Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation at 7 958 ftprad, 5.3 tpmm (135 tpi) on both sides. Part 1: dimensional, physical and magnetic characteristics (ISO 8860-1, 1st edition, 1987)

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## BRIEF HISTORY

The Technical Board has decided to submit the International Standard

ISO 8860-1, 1st edition 1987 "Information processing; Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad on 80 tracks each side; Part 1: Dimensional, physical and magnetic characteristics"

to the formal vote. The result of this vote was positive.

For the time being, this document exists only in the English and the French versions.

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According to the CEN/CENELEC Common Rules, the following countries are bound to implement this standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

## STATEMENT

The text of the International Standard ISO 8860-1, 1st edition, 1987, was approved by CEN as a European Standard without any modification.



# INTERNATIONAL STANDARD

ISO  
8860-1

First edition  
1987-07-01



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

**Information processing — Data interchange on 90 mm  
(3.5 in) flexible disk cartridges using modified  
frequency modulation recording at 7 958 ftprad on  
80 tracks on each side —**

**iTeh STANDARD PREVIEW**

**Part 1 :**

**Dimensional, physical and magnetic characteristics**

SIST EN 28860-1:1997

*Traitement de l'information — Echange de données sur cartouches à disquette de 90 mm  
(3,5 in) utilisant un enregistrement à modulation de fréquence modifiée (MFM) à 7 958 ftprad  
sur 80 pistes sur chaque face —*

*Partie 1 : Caractéristiques dimensionnelles, physiques et magnétiques*

Reference number  
ISO 8860-1:1987 (E)

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8860-1 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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# Information processing — Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad on 80 tracks on each side —

## Part 1 : Dimensional, physical and magnetic characteristics

### 0 Introduction

ISO 8860 specifies the characteristics of 90 mm (3.5 in) flexible disk cartridges recorded at 7 958 ftprad using modified frequency modulation (MFM) recording on 80 tracks on each side.

ISO 8860-2 specifies the track layout, the track format and the characteristics of the recorded signals.

ISO 8860-1 and ISO 8860-2, together with the labelling scheme specified in ISO 9293, provide for full data interchange between data processing systems.

### 1 Scope and field of application

This part of ISO 8860 specifies the dimensional, physical and magnetic characteristics of the cartridge, so as to provide physical interchangeability between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurements system in this part of ISO 8860 may have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor reconverted. The original design was made using SI units.

### 2 Conformance

A 90 mm (3.5 in) flexible disk cartridge shall be in conformance with this part of ISO 8860 if it meets all mandatory requirements contained herein.

### 3 References

ISO 683-13, *Heat-treated steels, alloy steels and free-cutting steels — Part 13 : Wrought stainless steels.*

ISO 8860-2, *Information processing — Data interchange on 90 mm (3.5 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad on 80 tracks on each side — Part 2 : Track format.*

ISO 9293, *Information processing — Volume and file structure of flexible disk cartridges for information interchange.*

### 4 Definitions

For the purpose of this International Standard the following definitions apply.

**4.1 recording disk :** A flexible disk which accepts and retains, on the specified side or sides, magnetic signals intended for input/output and storage purposes.

**4.2 hub :** A centring and referencing device attached to the centre of the disk which allows torque to be transmitted to the disk. It ensures centring of the disk on the drive shaft in a unique angular position.

**4.3 shutter :** A device which uncovers the head windows upon insertion, and automatically covers them upon removal from the drive.

**4.4 liner :** Suitable material positioned between the case and the disk to provide cleaning action and protection from abrasion.

**4.5 case :** A protective enclosure including a shutter mechanism and a write-inhibit hole.

**4.6 Master Standard Reference Flexible Disk Cartridge :** A reference flexible disk cartridge selected as the standard for reference fields, signal amplitudes, resolution, peak shift and overwrite. Track 00 and track 79 on both sides are declared as reference tracks.

The reference tracks are calibrated at 600 r/min. The calibration is also valid at 300 r/min.

NOTE — This master standard has been established by the Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, D-3300 Braunschweig, Germany, F.R.

**4.7 Secondary Standard Reference Flexible Disk Cartridge :** A flexible disk cartridge the performance of which is known and stated in relation to that of the Master Standard Reference Flexible Disk Cartridge.

NOTE — Secondary Standard Reference Flexible Disk Cartridges can be ordered from PTB Lab. 1.41 under Part Number RM 8860 as long as available. It is intended that these be used for calibrating further cartridges for use in routine calibration.

**4.8 Typical Field :** In the plot of average signal amplitude against recording field at the specified track and flux transition density, the Typical Field is the minimum field which causes a signal output equal to 95 % of the maximum Average Signal Amplitude.

**4.9 Reference Field :** The typical field of the Master Standard Reference Flexible Disk Cartridge.

There are two Reference Fields, one for each side.

**4.10 Test Recording Current :** The current between 148 % and 152 % of the current which produces the Reference Field at test frequency  $1f$  on track 00.

There are two Test Recording Currents, one for each side.

**4.11 Standard Reference Amplitudes (SRAs) :** The Average Signal Amplitudes derived from the reference tracks of the Master Standard Reference Flexible Disk Cartridge using the Test Recording Current.

There are four SRAs, two for each side.

$SRA_{1f}$  is the Average Signal Amplitude from a recording written using Test Frequency  $1f$  at Track 00.

$SRA_{2f}$  is the Average Signal Amplitude from a recording written using Test Frequency  $2f$  at Track 79.

**4.12 Average Signal Amplitude :** For a track : the arithmetically averaged value of the output voltages measured peak-to-peak over the whole track.

**4.13 in-contact :** An operating condition in which the magnetic surface of the disk is in physical contact with the magnetic heads.

**4.14 side :** Side 0 is the side engaged by the spindle. Side 1 is the opposite side.

**4.15 direction of rotation :** The direction of rotation shall be counter-clockwise when looking at Side 0.

**4.16 index :** The point on a track which determines the beginning and the end of the track.

**4.17 formatting :** Writing the proper control information, establishing the physical cylinders and the addresses of physical records on the surfaces of the flexible disk.

**4.18 initialization :** Writing any information initially required to be on the flexible disk cartridge, for example the Volume Label, prior to the commencement of general processing use.

## 5 General description

### 5.1 Figures

In figures 1 to 5 :

- Figure 1 shows Side 0 and enlarged cross-sections through the location holes;
- Figure 2 shows Side 1;
- Figure 3 shows at a larger scale the upper part of Side 0 without shutter;
- Figure 4 shows the disk with hub;
- Figure 5 shows the interface between the cartridge and the drive.

### 5.2 Main elements

The main elements of the flexible disk cartridge are

- the recording disk;
- the liner,
- the case.

### 5.3 Description

The cartridge is of a substantially square form. It includes a central hole on one side, a heat window on both sides and a write-inhibit hole.

The liner is provided between the case and the disk. It comprises two layers of material between which the disk lies.

The disk has a central hole with a metal hub attached.

## 6 General requirements

### 6.1 Environment and transportation

#### 6.1.1 Testing environment

Tests and measurements made on the cartridge to check the requirements of this International Standard shall be carried out under the following conditions :

temperature :  $23 \pm 2$  °C ( $73 \pm 4$  °F)

relative humidity : 40 to 60 %

conditioning before testing : 24 h minimum

For the tests specified in 9.3 the temperature and relative humidity shall be measured in the air immediately surrounding the cartridge drive. For all other tests the temperature and relative humidity shall be measured in the air immediately surrounding the cartridge.

The stray magnetic field at any point on the disk surface, including that resulting from the concentrating effect of the recording head, shall not exceed 4 000 A/m (50 Oe).

### 6.1.2 Operating environment

Cartridges used for data interchange shall be operated under the following conditions :

temperature : 10 to 60 °C (50 to 140 °F)

relative humidity : 8 to 80 %

wet bulb temperature : less than 29 °C (85 °F)

The temperature and relative humidity shall be measured in the air immediately surrounding the cartridge. It is recommended that the rate of change of the temperature should not exceed 20 °C (36 °F) per hour.

NOTE — For reliable interchange, it is recommended that the temperature and relative humidity conditions when reading are not the opposite extreme to the conditions when writing.

There shall be no deposit of moisture on or in the cartridge.

The stray magnetic field at any point on the disk surface, including that resulting from the concentrating effect of the recording head, shall not exceed 4 000 A/m (50 Oe).

### 6.1.3 Storage environment

During storage the cartridges shall be kept under the following conditions :

temperature : 4 to 53 °C (39 to 127 °F)

relative humidity : 8 to 90 %

There shall be no deposit of moisture on or in the cartridge.

The ambient stray magnetic field shall not exceed 4 000 A/m (50 Oe).

NOTE — Cartridges which have been stored at temperatures and humidities exceeding the operating conditions may exhibit degraded performance characteristics. Such cartridges should be subjected to a conditioning period of not less than 24 h within the operating environment prior to use.

### 6.1.4 Transportation

Responsibility for ensuring that adequate precautions are taken during transportation shall be with the sender. The cartridge shall be in a protective package free from dust or extraneous matter. It is recommended that a sufficient space exists between cartridge and outer surface of the final container, so that risk of erasure due to stray magnetic fields will be negligible.

It is recommended that the following conditions should not be exceeded :

temperature : -40 to 60 °C (-40 to 140 °F)

maximum rate of temperature change : 20 °C (36 °F) per hour

relative humidity : 8 to 90 %

There should be no deposit of moisture on or in the cartridge.

## 6.2 Materials

### 6.2.1 Case

The case, which may be constructed from any suitable material, shall comply with the requirements of annex A.

### 6.2.2 Liner

The material of the liner shall be able to retain dust or debris without damage to the disk.

### 6.2.3 Disk

The disk shall be constructed from any suitable material (for example bi-axially oriented polyethylene terephthalate) coated with a flexible layer of magnetic material.

### 6.2.4 Hub

The hub shall be made from any suitable material (for example stainless steel alloy in compliance with ISO 683-13, type 8).

## 7 Dimensional characteristics

The dimensions of the cartridge are referred to two reference axes X and Y, i.e. two lines in space intersecting at right angles. The plane they define is the Reference Plane XY of the cartridge.

### 7.1 Case

#### 7.1.1 Shape (see figure 1)

The case shall be of rectangular form, its sides shall be

$$l_1 = 94,0 \pm 0,3 \text{ mm } (3.700 \pm 0.012 \text{ in})$$

$$l_2 = 90,0 \begin{smallmatrix} +0,4 \\ -0,1 \end{smallmatrix} \text{ mm } \left( 3.540 \begin{smallmatrix} +0.016 \\ -0.004 \end{smallmatrix} \text{ in} \right)$$

The radius of three of its corners shall be

$$r_1 = 2,0 \pm 1,0 \text{ mm } (0.079 \pm 0.040 \text{ in})$$

The angle of its fourth corner shall be

$$\omega = 45^\circ \pm 2^\circ$$

#### 7.1.2 Thickness (see figure 2)

In the area extending 8,5 mm (0.335 in) from each of the two edges as shown in figure 2, the thickness of the case shall be

$$e_1 = 3,3 \pm 0,2 \text{ mm } (0.130 \pm 0.008 \text{ in})$$

When the cartridge is inserted in the test gauge specified in annex D, a force not exceeding 0,2 N (0.69 ozf), applied to the centre of the back edge shall cause the cartridge to pass through the gauge.

The edge radius shall be

$$r_2 = 0,40 \pm 0,25 \text{ mm } (0.150 \pm 0.010 \text{ in})$$

### 7.1.3 Hub access hole (see figure 1)

On Side 0 there shall be a hub access hole the diameter of which shall be

$$d_1 = 26,50 \text{ mm min. } (1.043 \text{ in min.})$$

The position of the centre of this hole shall be defined by

$$l_3 = 40,00 \pm 0,15 \text{ mm } (1.575 \pm 0.006 \text{ in})$$

$$l_4 = 31,00 \pm 0,15 \text{ mm } (1.220 \pm 0.006 \text{ in})$$

### 7.1.4 Locating holes (see figures 1 and 3)

#### 7.1.4.1 Primary locating hole

The centre of the primary locating hole shall be at the intersection of Reference Axes X and Y.

Its diameter shall be

$$d_2 = 3,6 \pm 0,1 \text{ mm } (0.142 \pm 0.004 \text{ in})$$

The dimensions of its section (see cross-section A-A in figure 1) shall be

$$d_3 = 1,5 \text{ mm min. } (0.059 \text{ in min.})$$

$$l_8 = 0,2 \pm 0,1 \text{ mm } (0.010 \pm 0.004 \text{ in})$$

$$l_9 = 1,0 \text{ mm min. } (0.039 \text{ in min.})$$

$$l_{10} = 2,5 \text{ mm min. } (0.098 \text{ in min.})$$

#### 7.1.4.2 Secondary locating hole

The centre of the secondary locating hole shall be on Reference Axis X, its distance from Reference Axis Y shall be

$$l_5 = 80,0 \pm 0,2 \text{ mm } (3.150 \pm 0.008 \text{ in})$$

It shall have a substantially rectangular shape. Its short axis shall be (cross-section B-B in figure 1)

$$l_6 = 3,6 \pm 0,1 \text{ mm } (0.142 \pm 0.004 \text{ in})$$

Its long axis shall be

$$l_7 = 4,4 \pm 0,2 \text{ mm } (0.173 \pm 0.008 \text{ in})$$

The dimensions  $d_3$ ,  $l_8$ ,  $l_9$  and  $l_{10}$  of the cross-section of the secondary locating hole are as specified in 7.1.4.1.

### 7.1.5 Label area

#### 7.1.5.1 Side 0 (see figure 1)

The locations and dimensions of the label area of Side 0 shall be

$$l_{11} = 3,5 \text{ mm min. } (0.138 \text{ in min.})$$

$$l_{12} = 76,5 \text{ mm max. } (3.012 \text{ in max.})$$

$$l_{14} = 60,0 \text{ mm min. } (2.362 \text{ in min.})$$

#### 7.1.5.2 Side 1 (see figure 2)

The locations and dimensions of the label area of Side 1 shall be

$$l_{11} = 3,5 \text{ mm min. } (0.138 \text{ in min.})$$

$$l_{12} = 76,5 \text{ mm max. } (3.012 \text{ in max.})$$

$$l_{13} = 20,0 \text{ mm min. } (0.787 \text{ in min.})$$

### 7.1.6 Head windows (see figure 3)

The locations and the dimensions of the two head windows are specified by the same set of dimensions.

#### 7.1.6.1 Location

The location of the head windows shall be defined by

$$l_{15} = 12,3 \text{ mm min. } (0.485 \text{ in min.})$$

$$l_{16} = 11,5 \text{ mm min. } (0.45 \text{ in min.})$$

$$l_{17} = 35,5 \pm 0,2 \text{ mm } (1.400 \pm 0.008 \text{ in})$$

#### 7.1.6.2 Dimensions

The width of the head windows shall be

$$l_{18} = 9,00 \pm 0,20 \text{ mm } (0.354 \pm 0.008 \text{ in})$$

The radius of their corners shall be

$$r_3 = 0,5 \pm 0,1 \text{ mm } (0.020 \pm 0.004 \text{ in})$$

The radius of their upper edge shall be

$$r_4 = 8,85 \text{ mm min. } (0.348 \text{ in min.})$$

### 7.1.7 Write-inhibit hole (see figure 2)

#### 7.1.7.1 Location

The centre of the write-inhibit hole shall be on Reference Axis Y. Its distance from Reference Axis X shall be

$$l_{19} = 67,75 \pm 0,25 \text{ mm } (2.667 \pm 0.010 \text{ in})$$