International Standard 8378/3

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

Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 3,8 tpmm (96 tpi), on both sides — Part 3: Track format B

Traitement de l'information — Échange de données sur cartouches à disquette de 130 mm (5,25 in) *utilisant un enregistrement à modulation de fréquence modifiée à* 7 958 ftprad, 3,8 tpmm (96 tpi), *sur les deux faces — Partie 3: Schéma de piste B*

Second edition — 1986-12-15

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Descriptors: data processing, information interchange, data transfer, data recording devices, magnetic disks, flexible disks, track formats, specifications.

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 8378/3 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

This second edition cancels and replaces the first edition published on 1986-04-15, clauses 0, 3 and 4 of which have been technically revised.

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 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad, 3,8 tpmm (96 tpi), on both sides — Part 3: Track format B

0 Introduction

ISO 8378 specifies the characteristics of 130 mm (5.25 in) flexible disk cartridges recorded at 7 958 ftprad, on 80 tracks on each side, using modified frequency modulation (MFM) recording.

ISO 8378/1 specifies the dimensional, physical, and magnetic characteristics of the cartridge so as to provide physical interchangeability between data processing systems.

ISO 8378/1 and ISO 8378/3, together with the labelling scheme specified in ISO 9293, provide for full data interchange between data processing systems.

ISO 8378/2 specifies an alternative track format for data interchange.

1 Scope and field of application

This part of ISO 8378 specifies the quality of recorded signals, the track layout, and a track format to be used on 130 mm (5.25 in) flexible disk cartridges intended for data interchange between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this part of ISO 8378 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 of this part of ISO 8378 was made using SI units.

2 Conformance

A flexible disk cartridge shall be in conformance with ISO 8378 when it meets all the requirements either of parts 1 and 2 or of parts 1 and 3 of ISO 8378.

3 References

ISO 646, *Information processing — ISO 7-bit coded character set for information interchange.*

ISO 2022, *Information processing — ISO 7-bit and 8-bit coded character sets — Code extension techniques.*

ISO 4873, *Information processing — ISO 8-bit code for information interchange — Structure and rules for implementation.*

ISO 8378, *Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at* 7 958 ftprad, 3,8 tpmm (96 tpi), *on both sides —*

Part 1: Dimensional, physical and magnetic characteristics.

Part 2: Track format A.

ISO 9293, *Information processing — Volume and file structure of flexible disk cartridges for information interchange.* [1)]

4 Track format

4.1 General requirements

4.1.1 Mode of recording

The mode of recording shall be Modified Frequency Modulation (MFM) for which the conditions are

a) a flux transition shall be written at the centre of each bit cell containing a ONE;

b) a flux transition shall be written at each cell boundary between consecutive bit cells containing ZEROs.

Exceptions to this are defined in 4.1.12.

1) At present at the stage of draft.

4.1.2 Track location tolerance of the recorded flexible disk cartridge

The centrelines of the recorded tracks shall be within ±0,042 5 mm (0.001 7 in) of the nominal positions, over the range of operating environment specified in ISO 8378/1.

4.1.3 Recording offset angle

At the instant of writing or reading a magnetic transition, the transition shall have an angle of 0° ± 18′ with the radius.

NOTE — As tracks may be written and overwritten at extremes of the tolerances given in 4.1.2 and 4.1.3, a band of old information may be left at one edge of the newly written data and would constitute unwanted noise when reading. It is, therefore, necessary to trim the edges of the tracks by erasure after writing.

4.1.4 Density of recording

4.1.4.1 The nominal density of recording shall be 7 958 ftprad. The nominal bit cell length is 125,7 µrad.

4.1.4.2 The long-term average bit cell length shall be the average bit cell length measured over a sector. It shall be within ±3,5 % of the nominal bit cell length.

4.1.4.3 The short-term average bit cell length, referred to a particular bit cell, shall be the average of the lengths of the preceding eight bit cells. It shall be within ±8 % of the long-term average bit cell length.

4.1.5 Flux transition spacing (see figure 1)

The instantaneous spacing between flux transitions may be influenced by the reading and writing process, the bit sequence recorded (pulse crowding effects), and other factors. The locations of the transitions are defined as the locations of the peaks in the signal when reading. Tests should be carried out using a peak-sensing amplifier.

4.1.5.1 The spacing between the flux transitions in a sequence of ONEs shall be between 80 % and 120 % of the short-term average bit cell length.

4.1.5.2 The spacing between the flux transition for a ONE and that between two ZEROs preceding or following it shall be between 130 % and 165 % of the short-term average bit cell length.

4.1.5.3 The spacing between the two ONE flux transitions surrounding a ZERO bit cell shall lie between 185 % and 225 % of the short-term average bit cell length.

4.1.6 Average signal amplitude

For each side the average signal amplitude on any non-defective track (see ISO 8378/1) of the interchanged flexible disk cartridge shall be less than 160 % of SRA_{1f} and more than 40 % of SRA_{2f}.

4.1.7 Byte

A byte is a group of eight bit-positions, identified B1 to B8, with B8 the most significant and recorded first.

The bit in each position is a ZERO or a ONE.

4.1.8 Sector

All tracks are divided into 9 sectors of 512 bytes.

4.1.9 Cylinder

A pair of tracks, one on each side, having the same track number.

4.1.10 Cylinder number

The cylinder number shall be a two-digit number identical with the track number of the tracks of the cylinder.

4.1.11 Data capacity of a track

The data capacity of a track shall be 4 608 bytes.

4.1.12 Hexadecimal notation

Hexadecimal notation shall be used hereafter to denote the following bytes:

(00) for (B8 to B1) = 00000000

(01) for (B8 to B1) = 00000001

(4E) for (B8 to B1) = 01001110

(FE) for (B8 to B1) = 11111110

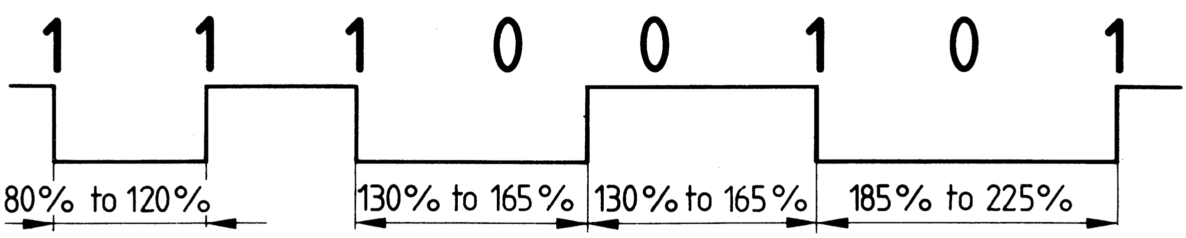

Figure 1

(FB) for (B8 to B1) = 11111011

(F8) for (B8 to B1) = 11111000

(A1)* for (B8 to B1) = 10100001

in (A1)* the boundary transition between B3 and B4 is missing.

4.1.13 Error detection characters (EDC)

The two EDC-bytes are hardware generated by shifting serially the relevant bits, specified later for each part of the track through a 16-bit shift register described by

$$X^{16} + X^{12} + X^5 + 1$$

(See also annex A.)

4.2 Track layout after the first formatting for all tracks

After the first formatting, there shall be 9 usable sectors on each track. The layout of each track shall be as shown in figure 2.

During formatting the rotational speed of the disk, averaged index to index, shall be 300 ± 6 r/min.

4.2.1 Index gap

At nominal density, this field shall comprise not less than 32 bytes and not more than 146 bytes, the content of which is not specified except that there shall be no (A1)*-bytes.

Writing the index gap is started when the index is detected. Any of the first 16 bytes may become ill-defined due to over-writing.

4.2.2 Sector identifier

This field shall be as given in table 1.

4.2.2.1 Identifier mark

This field shall comprise 16 bytes:

12 (00)-bytes

3 (A1)*-bytes

1 (FE)-byte

4.2.2.2 Address identifier

This field shall comprise 6 bytes.

4.2.2.2.1 Track address

This field shall comprise 2 bytes:

a) Cylinder number (C)

This field shall specify in binary notation the cylinder number from 00 for the outermost cylinder to 79 for the innermost cylinder.

b) Side number (Side)

This field shall specify the side of the disk. On side 0, it shall be (00) on all tracks. On side 1, it shall be (01) on all tracks.

4.2.2.2.2 Sector number (S)

The 3rd byte shall specify in binary notation the sector number from 01 for the 1st sector to 09 for the last sector.

The sectors may be recorded in any order of their sector numbers.

Table 1

Sector identifier							
Identifier mark			Address identifier				
			Track address		S		EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FE)	C 1 byte	Side 1 byte (00) or (01)	1 byte	1 byte (02)	2 bytes

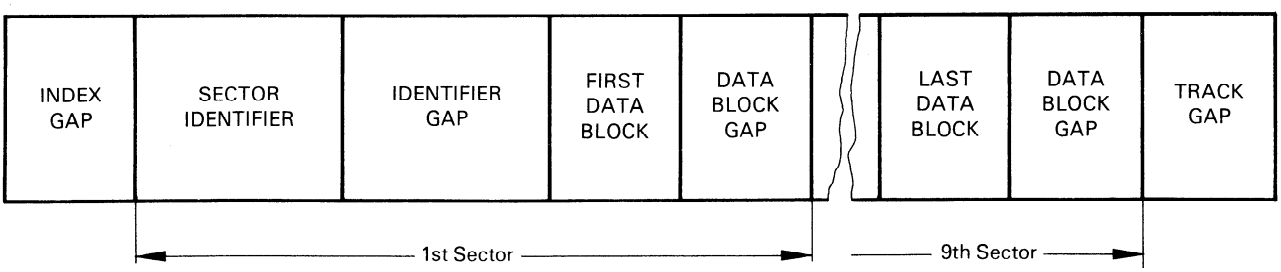

Figure 2

4.2.2.2.3 4th byte

The 4th byte shall always be a (02)-byte.

4.2.2.2.4 EDC

These two bytes shall be generated as defined in 4.1.13 using the bytes of the sector identifier starting with the first (A1)*-byte (see 4.2.2.1) of the identifier mark and ending with the 4th byte (see 4.2.2.2.3) of the address identifier.

If the EDC is incorrect, then the sector is defective. ISO 9293 specifies the handling of defective sectors.

4.2.3 Identifier gap

This field shall comprise 22 initially recorded (4E)-bytes. These bytes may have become ill-defined due to overwriting.

4.2.4 Data block

This field shall be as given in table 2.

Table 2

Data block				
Data mark			Data field	EDC
12 bytes (00)	3 bytes (A1)*	1 byte (FB)	512 bytes	2 bytes

4.2.4.1 Data mark

This field shall comprise

12 (00)-bytes

3 (A1)*-bytes

1 (FB)-byte

4.2.4.2 Data field

This field shall comprise 512 bytes. No requirements are implied beyond the correct EDC for the content of this field.

4.2.4.3 EDC

These two bytes shall be generated as defined in 4.1.13 using the bytes of the data block starting with the first (A1)*-byte of the data mark (see 4.2.4.1) and ending with the last byte of the data field (see 4.2.4.2).

If the EDC is incorrect, then the sector is defective. ISO 9293 specifies the handling of defective sectors.

4.2.5 Data block gap

This field shall comprise 80 initially recorded (4E)-bytes. It is recorded after each data block and it precedes the following sector identifier. After the last data block, it precedes the track gap.

4.2.6 Track gap

This field shall follow the data block gap of the last sector. (4E)-bytes are written until the index window is detected, unless it has been detected during writing of the last data block gap, in which case there shall be no track gap.

5 Coded representation of data

5.1 Standards

The contents of the data field shall be recorded and interpreted according to the relevant International Standards for the coding of information.

5.2 Coding methods

5.2.1 When the coding method requires it, the data field shall be regarded as an ordered sequence of 8-bit bytes.

Within each byte the bit positions shall be identified by B8 to B1. The high-order bit shall be recorded in position B1. The sequence of recording shall be high-order bit first.

When the data is encoded according to an 8-bit code, the binary weights of the bit positions shall be as shown in figure 3.

Bit position	B8	B7	B6	B5	B4	B3	B2	B1
Binary weights	128	64	32	16	8	4	2	1

Figure 3

When the data is encoded according to a 7-bit code, bit position B8 shall contain bit ZERO, and the data field shall be encoded in bit positions B7 to B1, using the same binary weights as shown above.

5.2.2 When the coding method requires it, the data field shall be regarded as an ordered sequence of bit positions, each containing a bit.

Annex A

EDC implementation

(This annex does not form part of the standard.)

Figure 4 shows the feedback connections of a shift register which may be used to generate the EDC bytes.

Prior to the operation, all positions of the shift register are set to ONE. Input data are added (exclusive OR) to the contents of position C_{15} of the register to form a feedback. This feedback is in its turn added (exclusive OR) to the contents of position C_4 and position C_{11}.

On shifting, the outputs of the exclusive OR gates are entered respectively into positions C_0, C_5 and C_{12}. After the last data bit has been added, the register is shifted once more as specified above.

The register then contains the EDC bytes.

If further shifting is to take place during the writing of the EDC bytes, the control signal inhibits exclusive OR operations.

To check for errors when reading, the data bits are added into the shift register in exactly the same manner as they were during writing. After the data, the EDC bytes are also entered into the shift register as if they were data. After the final shift, the register contents will be all ZERO if the record does not contain errors.

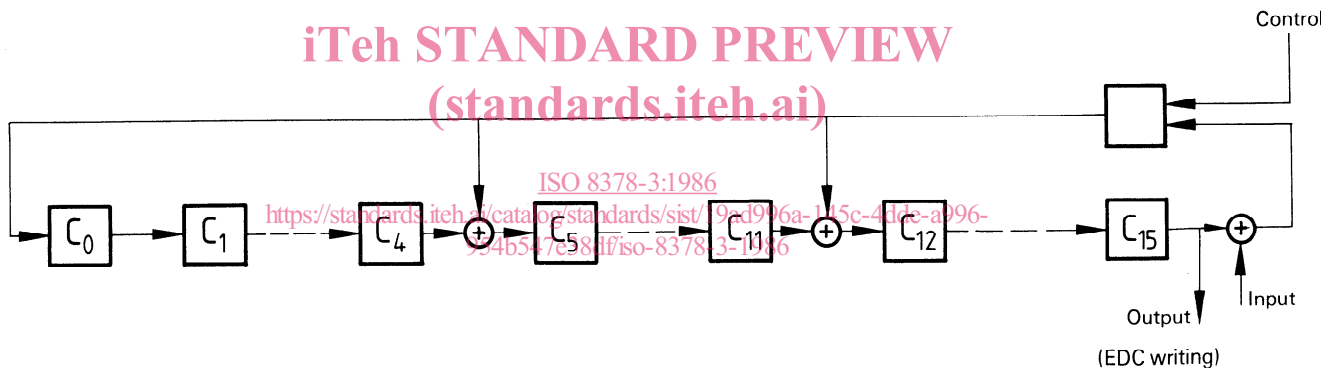

Figure 4