
International Standard



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Information processing — File structure and labelling of flexible disk cartridges for information interchange

Traitement de l'information — Structure des fichiers et étiquetage des cartouches à disquette pour l'échange d'information

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Foreword

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No member body expressed disapproval of the document.

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Information processing — File structure and labelling of flexible disk cartridges for information interchange

1 Scope and field of application

This International Standard specifies requirements for the file structure and the labelling of flexible disk cartridges for the interchange of information between users of different information processing systems.

This International Standard specifies

- a) recorded labels to identify files, file sections, and volumes of flexible disk cartridges;
- b) basic characteristics of the blocks containing the records constituting the file;
- c) the file structure.

This International Standard specifies three nested levels of interchange so that

- a) at the first level, called BASIC INTERCHANGE (BI), it is possible to interchange data by using a minimum set of the facilities provided;
- b) at the second level, called EXTENDED INTERCHANGE LEVEL 1 (E1), it is possible to interchange data using the minimum set together with blocks having a length greater than that of the physical records and with blocked fixed-length records;
- c) at the third level, called EXTENDED INTERCHANGE LEVEL 2 (E2), it is possible to interchange data using the facilities of levels BI and E1 together with variable-length records and segmented records.

Annex A describes examples but does not form part of this standard.

Annex B gives disk parameter values derived from flexible disk data interchange standards, but does not form part of this standard.

2 Conformance

A flexible disk cartridge conforms to this International Standard when all interchange files and all labels recorded on it conform to the specifications of this International Standard. A state-

ment of conformity shall identify the level or levels of interchange to which the contents of the flexible disk cartridge conform.

A prerequisite is conformance to the applicable flexible disk cartridge data interchange standards identified in this International Standard for the different types of flexible disks.

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 — 8-bit coded character set for information interchange.*

ISO 5654, *Information processing — Data interchange on 200 mm (8 in) flexible disk cartridges using two-frequency recording at 13 262 ftprad on one side —*

Part 1: Dimensional, physical and magnetic characteristics.

Part 2: Track format.

ISO 6596, *Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using two-frequency recording at 7 958 ftprad on one side —*

Part 1: Dimensional, physical and magnetic characteristics.

Part 2: Track format for 1,9 tpm (48 tpi).¹⁾

ISO 7065, *Information processing — Data interchange on 200 mm (8 in) flexible disk cartridges using modified frequency modulation recording at 13 262 ftprad on two sides —*

Part 1: Dimensional, physical and magnetic characteristics.

Part 2: Track format for 1,9 tpm (48 tpi).¹⁾

ISO 7487, *Information processing — Data interchange on 130 mm (5.25 in) flexible disk cartridges using modified frequency modulation recording at 7 958 ftprad on two sides —*

Part 1: Dimensional, physical and magnetic characteristics.¹⁾

Part 2: Track format.¹⁾

1) At present at the stage of draft.

ECMA-59, *Data interchange on 200 mm flexible disk cartridges using two-frequency recording at 13 262 ftprad on both sides.*

ECMA-78, *Data interchange on 130 mm flexible disk cartridges using MFM recording at 7 958 ftprad on both sides, 3,8 tracks per millimetre.*

4 Definitions

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

4.1 block: A group of characters treated as a logical unit.

4.2 blocked: An attribute of records and record segments that indicates that they may begin at a byte that is not the first byte of a block.

4.3 byte: A string of eight binary digits operated upon as a unit.

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

NOTES

1 The cylinder number is a two-digit number identical to the track number.

2 On flexible disk cartridges that are recorded only on one side, cylinders comprise one track only.

4.5 extent: A set of physical records the addresses of which form a continuous ascending sequence.

4.6 file: A named collection of information consisting of records pertaining to a single subject.

4.7 file section: For a file recorded over more than one volume, that part of the file that is recorded in any one volume.

4.8 fixed-length record: A record contained in a file in which all the records have the same length.

4.9 formatting: Writing the proper control information establishing the cylinders and designating addresses of physical records on the surfaces of the flexible disk.

4.10 initialization: Writing of the Volume Label, the ERMAP Label, and any other information initially required to be on the flexible disk cartridge, prior to the commencement of general processing or use.

4.11 label: A record that identifies, characterizes and/or delimits a volume, a file or a file section on that volume.

4.12 natural order: An ascending sequence of integers starting with the lowest allowed value and proceeding, in increments of one, to the highest allowed value.

4.13 physical record: A fixed-length field containing the data of a sector.

4.14 physical record address: A five-digit number in which the cylinder address provides the two most significant digits, the side number provides the next most significant digit, and the sector number provides the two least significant digits.

4.15 record: Related data treated as a unit of information.

4.16 sector: That part of a track on a flexible disk cartridge that can be accessed by the magnetic heads in the course of predetermined angular displacements of the disk.

4.17 segmented record: A record contained in a file in which each record consists of one or more consecutive record segments.

4.18 track: That part of a flexible disk that can be accessed by a single magnetic head that is stationary while the disk makes a complete revolution.

4.19 variable-length record: A record contained in a file in which the records may have different lengths.

4.20 volume: A dismountable physical unit of storage medium, for example a flexible disk cartridge.

5 Notation

5.1 Specification of label content

5.1.1 In references to label contents throughout the following clauses of this International Standard, a notation is used with the significance shown in table 1.

Table 1 — Notation

Notation	Significance
CP	Character position within the label
L	Length of the field in number of characters
a-character	Any of the characters complying with the requirements of 8.1 for use in labels
Digit(s)	Any digit(s) from 0 to 9

5.1.2 With the exception of SPACE, a group of capital letters in the "content" column of a table specifying label contents indicates that the corresponding characters shall appear in the order given and in the corresponding character positions of the field specified [for example, VOL in CP 1 to 3 of the Volume

Label (see table 6)]. In the tables and throughout this International Standard, SPACE signifies the character coded in position 2/0 of ISO 646.

5.2 Label fields

Where the words of this International Standard are used to signify a specific label or label field (for example "Sector Sequence Indicator"), the words are printed with initial capitals throughout (except for prepositions).

6 Arrangement of labels and files

6.1 Applicability of this International Standard to identified types of flexible disk cartridge

The requirements of this International Standard are applicable to several types of flexible disk cartridge. Each type of cartridge is the subject of a separate data interchange standard. These standards are identified in table 3, together with the corresponding values of a parameter Recording-Type. The parameter Recording-Type is used in this International Standard to identify the data interchange standard to which the cartridge conforms, within the set of standards that apply to cartridges having the same physical dimensions.

Table 2 identifies those numerical parameters that characterize the differences, between the types of cartridge, that are significant for the requirements of this International Standard.

Table 2 — Parameters for data interchange standards

Number-Of-Sides
Cylinder-Limit
Index-Sector-Limit
Data-Sector-Limit
Data-Physical-Record-Length
Track-Data-Capacity

The values of the parameters listed in table 2 shall be obtained from data interchange standards as specified below. The values applicable to the data interchange standards listed in table 3 are quoted in annex B.

Number-Of-Sides: The number of sides of the disk on which recorded tracks shall be present.

Cylinder-Limit: The specified minimum number of good cylinders that shall be present from cylinder 01 to the cylinder having the highest specified cylinder number.

Index-Sector-Limit: The number of usable sectors on Track 00, Side 0, or on Track 00, Side 1.

NOTE — These numbers shall be the same on both sides.

Data-Sector-Limit: The number of usable sectors on each track other than Track 00, on Side 0 or Side 1.

Data-Physical-Record-Length: The number of bytes in the Data Field of a Data Block on each track other than Track 00, on Side 0 or Side 1.

Track-Data-Capacity: The numerical product of the parameters Data-Sector-Limit and Data-Physical-Record-Length.

Table 3 — Data interchange standards and parameter Recording-Type

Data interchange standard	Parameter Recording-Type
ISO 5654	1
ECMA-59	2
ISO 7065	M
ISO 6596	1
ISO 7487	M
ECMA-78	3

6.2 Number of sides

Where this International Standard specifies requirements for labels and files on side 0, such requirements shall always apply.

Where this International Standard specifies requirements for labels and files on side 1, such requirements shall apply to those types of flexible disk cartridge for which the parameter Number-Of-Sides in table 2 has the value 2, and shall not apply to those types of flexible disk cartridge for which the parameter has the value 1.

6.3 Organization of space on a flexible disk cartridge

The parameter Cylinder-Limit, which is shown in table 2, is used to specify the organization of space on a flexible disk cartridge.

Available space on a flexible disk cartridge shall be organized in the following way:

- a) An index cylinder (cylinder 00) shall be reserved for descriptive information about the volume, and the files recorded on the volume.
- b) A number of cylinders, the addresses of which range from 01 to Cylinder-Limit inclusive, shall be available for files.

NOTE — According to the data interchange standards, a unique cylinder number is associated with each cylinder. Two of these cylinders are intended to be used only when the volume contains one or more defective cylinders.

Each non-defective cylinder possesses a unique cylinder address, but a defective cylinder does not possess a cylinder address.

Cylinder addresses are assigned consecutively to the non-defective cylinders, in ascending sequence of cylinder numbers.

6.4 Index cylinder (cylinder 00)

The index cylinder (cylinder 00) on a flexible disk cartridge shall be reserved for descriptive information about the volume and the files recorded on the volume. The index cylinder shall

always be formatted with physical records that have a length of 128 data characters on side 0. On side 1, the physical record length depends on the type of flexible disk cartridge.

The number of physical records that shall appear on both tracks of the index cylinder shall be the value of the parameter Index-Sector-Limit in table 2.

The allocation of sectors on the index cylinder shall be as shown in table 4.

Table 4 — Sectors on the index cylinder (cylinder 00)

Side	Sector	Use
0	01 to 04	reserved for system use
0	05	reserved for Error Map Label (ERMAP)
0	06	reserved for future standardization
0	07	reserved for Volume Label (VOL1)
0	08 to Index-Sector-Limit	reserved for File Labels (HDR1)
1	01 to Index-Sector-Limit	

6.4.1 Sectors reserved for system use

Sectors 01 to 04 of side 0 shall be reserved for system use and shall be ignored in interchange. Their contents are not specified by this International Standard and shall not be overwritten, except if otherwise agreed by the sender and the recipient of the data.

6.4.2 Sector reserved for future standardization

Sector 06 of side 0 is reserved for future standardization and shall be ignored in interchange.

6.4.3 Sectors reserved for labels

Labels on the index cylinder shall be records that all have the same length. All labels shall be recorded within the first or only 128 character positions of the physical record. Sector 05 of side 0 shall be reserved for the Error Map Label (see 8.6). Sector 07 of side 0 shall be reserved for the Volume Label (VOL1). Sectors 08 to Index-Sector-Limit of side 0 and sectors 01 to Index-Sector-Limit of side 1 shall be reserved for File Labels (HDR1), one label per physical record, to describe the files recorded on cylinders with addresses 01 to Cylinder-Limit.

The File Labels may be recorded anywhere among the sectors reserved for them.

Unused sectors shall be deleted according to 10.2.

6.5 Contents of cylinders with addresses 01 to Cylinder-Limit

Cylinders with addresses 01 to Cylinder-Limit shall contain either allocated space or unallocated available space.

These cylinders shall be formatted with physical records the length of which in data characters shall be the value of the parameter Data-Physical-Record-Length in table 2. The number of such physical records that shall be recorded on side 0 and on side 1 of each cylinder shall be the value of the parameter Data-Sector-Limit in table 2.

Each physical record either shall be allocated to an extent, or shall be unallocated. All physical records allocated to an extent shall be identified by an HDR1 label contained in cylinder 00. All physical records not so indicated shall be unallocated. A physical record shall not be allocated to more than one extent.

Data that form part of a file shall be recorded only within an extent.

The contents of all unallocated physical records shall not form part of any file and may be ignored in interchange.

7 File structure for data interchange

NOTE — This clause specifies the file structure for data interchange in terms of data blocks and data records and identifies the label fields defined for that purpose.

7.1 Blocks

7.1.1 Characteristics

A block shall be a group of characters treated as a logical unit having the following characteristics:

- a) A block shall be recorded in all or part of a physical record, or over several physical records the addresses of which form a consecutive ascending sequence. This sequence shall include only the addresses of those non-defective physical records that are recorded on the volume.
- b) A block shall begin at the first byte of a physical record.
- c) A block may contain one or more complete records or record segments.

NOTE — A block is a logical entity not to be confused with data block described in 10.1.

7.1.2 Block length

The length of a block shall be the number of characters in the block. Within a file, all blocks shall have the same length. If the block length exceeds that of the physical record, the block length shall be an integer multiple of the physical record length.

The maximum length of a block that may be assigned on a flexible disk shall be equal to the total capacity of a data track.

NOTE — This does not imply that a block must begin and end on the same track.

The minimum length of a block shall be

- a) 1 character, when it contains a fixed-length record;
- b) 4 characters, when it contains a variable-length record;
- c) 5 characters, when it contains a segmented record.

7.1.3 Unused character positions

If the block length is smaller than the physical record length, the unused space between the end of the block and the end of the physical record shall be filled with NULs.

NOTE — In all other cases, the end of a block coincides with the end of a physical record.

7.1.4 Relation to extents

Within each extent, the data within consecutive physical records, excluding defective physical records, shall be considered to be grouped into consecutive blocks.

The first block of an extent shall begin at the first byte of the first non-defective physical record in the extent. A block shall be completely contained in one extent only.

7.2 Records

7.2.1 Characteristics

A record shall be related data treated as a unit of information having the following characteristics:

- a) A record may be recorded on all or part of one or more blocks.
- b) Within each block, the data shall be considered to be grouped into consecutive records or record segments.
- c) The first or only record or record segment of a block shall begin at the first byte of the block. Each successive record or record segment, if any, within the block shall begin at the byte immediately following the last character of the preceding record or record segment.
- d) The length of a record shall be the number of characters of the record.
- e) A fixed-length record, or a variable-length record, or a record segment shall end in the block in which it begins.

7.2.2 Fixed-length records

A fixed-length record shall be a record contained in a file that is assigned to contain records that all have the same length. The minimum assigned length of a fixed-length record shall be one data character and the maximum assigned length shall be equal to the block length.

7.2.2.1 Unblocked fixed-length records

An unblocked fixed-length record shall be a record contained in a file in which each block contains only one record.

7.2.2.2 Blocked fixed-length records

A blocked fixed-length record shall be a record contained in a file in which each block may contain more than one record.

7.2.2.3 Relation to blocks

The first or only record of a block shall begin at the first byte of the block. The space between the end of the last or only record of a block and the end of a block shall be filled with NULs.

7.2.3 Variable-length records

A variable-length record shall be a record contained in a file that is assigned to contain records that may have different lengths.

A Record Control Word (RCW) shall be recorded as the first four characters of the record. It shall express the record length as a four-digit decimal number coded according to ISO 646. These four characters shall be counted as part of the record length.

A maximum record length shall be assigned for a file. The length of any record in the file shall not exceed this assigned value. The assigned maximum record length shall not be greater than the block length.

The minimum length of a variable-length record shall be 4 characters.

7.2.3.1 Unblocked variable-length records

An unblocked variable-length record shall be a record contained in a file in which each block contains only one record.

7.2.3.2 Blocked variable-length records

A blocked variable-length record shall be a record contained in a file in which a block may contain more than one record.

7.2.3.3 Relation to blocks

The first or only record of a block shall begin at the first byte of the block. The space between the end of the last or only record of a block and the end of a block shall be filled with NULs.

7.2.4 Segmented records

A segmented record shall be a record contained in a file that is assigned to contain records that may have different lengths and that may be recorded partly in one block and partly in one or more other blocks in the same file.

That part of a segmented record that is recorded in one block is a record segment. There shall be only one segment of the same record in a block.

Successive segments of the same record within the same file shall be recorded in successive blocks.

Different segments of the same record shall only be recorded in different file sections if one of the segments is recorded in the last block of a file section, and the next segment of the record is recorded in the first block of another file section.

A maximum record length shall be assigned for a file. The length of any record in the file shall not exceed this assigned value. The assigned maximum record length is unbounded in that this International Standard specifies no limit to the number of record segments in a record.

A Segment Control Word (SCW) shall be recorded as the first five characters of each record segment. These characters shall be coded according to ISO 646.

The first character of the SCW is called the segment indicator. This shall have one of the values 0, 1, 2 or 3 as follows:

- 0 shall mean that the record begins and ends in this record segment;
- 1 shall mean that the record begins but does not end in this record segment;
- 2 shall mean that the record neither begins nor ends in this record segment;
- 3 shall mean that the record ends but does not begin in this record segment.

The record segment length includes the length of the SCW, and shall be expressed as a four-digit decimal number recorded as the last four characters of the SCW. The length of a record segment shall not be greater than the block length.

The minimum length of a record segment shall be five characters.

7.2.4.1 Unblocked segmented records

A file shall not contain unblocked segmented records.

7.2.4.2 Blocked segmented records

A blocked segmented record shall be a record contained in a file in which a block may contain segments of more than one record.

7.2.4.3 Relation to blocks

The first or only record segment of a block shall begin at the first byte of the block. The space between the end of the last or only record segment of a block and the end of the block shall be filled with NULs.

7.2.5 Coded representation of data

The characters in each record shall be interpreted according to the International Standards for the coded representation of character sets.

7.3 Files

7.3.1 Characteristics

A file shall be a named collection of records having the following characteristics:

- a) A file shall be recorded in all or part of a volume, or over more than one volume.

b) If a file is recorded over more than one volume, only one file section of that file shall be recorded in any one volume. Either all sections of a file shall be numbered consecutively starting with 01 or they shall all be unnumbered.

c) Each file or file section that is recorded on a volume shall be contained within a single extent.

7.3.2 Relation to volumes

A volume may contain one or more complete files or file sections.

A volume shall not contain more than one section of the same file.

7.3.3 Relation to extents

If one or more consecutive blocks at the end of an extent are not used to contain any records of a file or file section, these blocks shall be assigned as unused and shall not form part of the file. Any data that is recorded within these unused blocks shall be ignored in interchange.

If all blocks in an extent are assigned as unused, the whole file or file section shall be ignored in interchange.

7.3.4 Consistency of file attributes between file sections

Within the set of File Labels (HDR1) for the different file sections of the same file, those label fields that have the same field name taken from those listed below shall contain the same characters:

- a) File Identifier (CP 6 to 22).
- b) Block Length (CP 23 to 27).
- c) Record Format (CP 40).
- d) Bypass Indicator (CP 41).
- e) File Accessibility Indicator (CP 42).
- f) Write Protect (CP 43).
- g) Interchange Type (CP 44).
- h) Record Length (CP 54 to 57).
- j) Record Attribute (CP 63).
- k) File Organization (CP 64).

7.4 File organization

7.4.1 The file organization shall be sequential.

7.4.2 In a sequential file, if the records are unblocked, no record shall appear in a block unless the preceding block

contains a record. If the records are blocked, no record or record segment shall appear in a block unless the preceding block contains insufficient space to accommodate the next record or record segment. These requirements shall not apply to the first record or record segment of the file section.

7.4.3 If the records are blocked, any character positions that follow the last record in the last used block shall be ignored in interchange.

7.5 Record formats and attributes permitted for interchange

Within a file for interchange, the records shall have one of the following combinations of format and attributes:

- a) fixed-length, unblocked;
- b) fixed-length, blocked;
- c) variable-length, unblocked;
- d) variable-length, blocked;
- e) segmented, blocked.

7.6 Relevant fields for file structure

The following File Label (HDR1) fields are relevant for describing the file structure of the data to be interchanged:

- CP 23 to 27: Block Length
- CP 40 : Record Format
- CP 54 to 57: Record Length
- CP 63 : Record Attribute
- CP 64 : File Organization

Table 5 — International Reference Version (see ISO 646) showing characters permitted in labels (prohibited characters are shaded)

b7	0	0	0	0	1	1	1	1
b6	0	0	1	1	0	0	1	1
b5	0	1	0	1	0	1	0	1
	0	1	2	3	4	5	6	7
b4	b3	b2	b1					
0	0	0	0	0	NUL DLE	SP	0	@ P ` p
0	0	0	1	1	SOH DC1	!	1	A Q a q
0	0	1	0	2	STX DC2	"	2	B R b r
0	0	1	1	3	ETX DC3	#	3	C S c s
0	1	0	0	4	EOT DC4	\$	4	D T d t
0	1	0	1	5	ENQ NAK	%	5	E U e u
0	1	1	0	6	ACK SYN	&	6	F V f v
0	1	1	1	7	BEL ETB	'	7	G W g w
1	0	0	0	8	BS CAN	(8	H X h x
1	0	0	1	9	HT EM)	9	I Y i y
1	0	1	0	10	LF SUB	*	:	J Z j z
1	0	1	1	11	VT ESC	+	;	K [k [
1	0	0	0	12	FF IS4	,	<	L \ l
1	1	0	1	13	CR IS3	-	=	M] m }
1	1	1	0	14	SO IS2	.	>	N ^ n ~
1	1	1	1	15	SI IS1	/	?	0 _ O DEL

8 Format and contents of labels

8.1 Character set and coding

The characters in the labels shall be coded according to ISO 646.

The 57 characters used in the labels shall be those in the following positions of the International Reference Version (see table 5):

- 2/0 to 2/2
- 2/5 to 2/15
- 3/0 to 3/15
- 4/1 to 4/15
- 5/0 to 5/10
- 5/15

8.2 Justification of characters

In the label fields, characters shall be justified as follows:

- a) in each field the content of which is specified by this International Standard to be SPACES or digits, digits shall be right-justified, and any remaining positions on the left shall be filled either only with zeros or only with SPACES;
- b) in other fields, characters shall be left-justified, and any remaining positions on the right shall be filled with SPACES.

8.3 Labels

A volume shall contain a Volume Label (VOL1) and an Error Map Label (ERMAP). Each file or file section on the volume shall be identified through a File Label (HDR1). Each of these labels shall be recorded on cylinder 00 as a record with a length of 128 characters.

A label shall not be part of a file.