
International Standard



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Information processing — File structure and labelling of magnetic tapes for information interchange

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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 1001 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

This second edition cancels and replaces the first edition (ISO 1001:1979), of which it constitutes a technical revision. <https://standards.iteh.ai/catalog/standards/sist/5b6d44f1-4c46-4239-b347-52b4e886b63d/iso-1001-1986>

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.

Contents

	Page
1 Scope and field of application	1
2 Conformance	1
2.1 Conformance of a magnetic tape volume set	1
2.2 Conformance of an information processing system	1
3 References	1
4 Definitions	1
4.1 application program	1
4.2 block	2
4.3 blocked	2
4.4 byte	2
4.5 file	2
4.6 file section	2
4.7 file set	2
4.8 fixed-length record	2
4.9 implementation	2
4.10 installation	2
4.11 label	2
4.12 originating system	2
4.13 originator	2
4.14 receiving system	2
4.15 recipient	2
4.16 record	2
4.17 segmented record	2
4.18 International Standard for information interchange	2
4.19 Tape Mark	2

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4.20	user	2
4.21	variable-length record	2
4.22	volume	2
4.23	volume set	2
5	Notation	2
6	Arrangement of labels and files	2
6.1	Arrangement of data on a volume	2
6.2	Arrangement of label groups	2
6.2.1	Labels	2
6.2.2	Label sets	3
6.2.3	Label groups	3
6.3	Arrangement of file sections	3
6.3.1	File section	3
6.3.2	Labelled-Sequence	3
6.4	Relationship of file sections to a volume	3
6.5	Arrangement of files and file sets	3
6.5.1	Files	3
6.5.2	File sets	4
6.6	Structure of a volume set	4
7	File structure for data interchange	4
7.1	Blocks	4
7.1.1	Characteristics	4
7.1.2	Block length	4
7.1.3	Offset field	4
7.1.4	Padding field	4
7.2	Records	4
7.2.1	Characteristics	4
7.2.2	Fixed-length records	4
7.2.3	Variable-length records	4
7.2.4	Segmented records	4
7.2.5	Coded representation of data	5
7.3	Files	5
7.3.1	Characteristics	5

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7.3.2	Consistency of file attributes between file sections	5
7.3.3	File organization	5
8	Format and contents of the labels and label sets	5
8.1	Character set and coding	5
8.2	Justification of characters	5
8.3	Volume Header Label Set (VOL1 to VOL9)	5
8.3.1	First Volume Header Label (VOL1)	6
8.3.2	Other Volume Header Labels (VOL2 to VOL9)	6
8.4	Installation Volume Label Set (UVL1 to UVL9)	7
8.4.1	Label Identifier (BP 1 to 3)	7
8.4.2	Label Number (BP 4)	7
8.4.3	Field reserved for installation use (BP 5 to 80)	7
8.5	File Header Label Set (HDR1 to HDR9)	7
8.5.1	First File Header Label (HDR1)	7
8.5.2	Second File Header Label (HDR2)	8
8.5.3	Other File Header Labels (HDR3 to HDR9)	9
8.6	User File Header Label Set (UHL)	9
8.6.1	Label Identifier (BP 1 to 3)	10
8.6.2	Label Number (BP 4)	10
8.6.3	Field reserved for application use (BP 5 to 80)	10
8.7	End of Volume Label Set (EOV1 to EOVS)	10
8.7.1	First End of Volume Label (EOV1)	10
8.7.2	Second End of Volume Label (EOV2)	10
8.7.3	Other End of Volume Labels (EOV3 to EOVS)	11
8.8	End of File Label Set (EOF1 to EOF9)	11
8.8.1	First End of File Label (EOF1)	11
8.8.2	Second End of File Label (EOF2)	11
8.8.3	Other End of File Labels (EOF3 to EOF9)	12
8.9	User File Trailer Label Set (UTL)	12
8.9.1	Label Identifier (BP 1 to 3)	12
8.9.2	Label Number (BP 4)	12
8.9.3	Field reserved for application use (BP 5 to 80)	12

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<https://standards.iteh.ai/catalog/standards/sist/500d4411-4c46-4259-b347-52b4e886b63d/iso-1001-1986>

9	Levels of interchange	12
9.1	Level 1	12
9.2	Level 2	12
9.3	Level 3	12
9.4	Level 4	12
10	Requirements for the description of systems	12
11	Requirements for an originating system	12
11.1	General	12
11.2	Files	13
11.3	Labels	13
11.4	Restrictions	13
12	Requirements for a receiving system	14
12.1	General	14
12.2	Files	14
12.3	Labels	14
12.4	Restrictions	14
Annexes		
A	IRV code table from ISO 646	15
B	Initialized volumes	16
C	Main differences between the first edition (1979) and the present (second) edition of this International Standard	17

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Information processing — File structure and labelling of magnetic tapes for information interchange

1 Scope and field of application

This International Standard specifies the file structure and the labelling of magnetic tapes for the interchange of information between users of information processing systems.

This International Standard also specifies

- volume and file structure;
- basic characteristics of the blocks containing the records constituting the file;
- recorded labels for identifying files, file sections and volumes of magnetic tapes;
- four nested levels of interchange.

Furthermore, this International Standard specifies requirements for the processes which are provided within information processing systems, to enable information to be interchanged between different systems, utilizing recorded magnetic tape as the medium of interchange. For this purpose it specifies the functions to be provided within systems which are intended to originate or receive magnetic tape volumes which conform to this International Standard.

2 Conformance

2.1 Conformance of a magnetic tape volume set

A magnetic tape volume set conforms to this International Standard when all information recorded on it conforms to the specifications of this International Standard. A statement of conformance shall identify the lowest level of interchange to which the contents of the magnetic tapes conform.

A prerequisite to such conformance is conformance of each volume of the volume set to the same International Standard for information interchange on magnetic tapes.

2.2 Conformance of an information processing system

An information processing system conforms to this International Standard if it meets all the requirements specified in this International Standard either for an originating system, or for a receiving system, or for both types of system. A statement of conformance shall identify which of these sets of requirements can be met by the system.

3 References

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

ISO 962, *Information processing — Implementation of the 7-bit coded character set and its 7-bit and 8-bit extensions on 9-track, 12,7 mm (0.5 in) magnetic tape.*

ISO 1862, *Information processing — 9-track, 12,7 mm (0.5 in) wide magnetic tape for information interchange recorded at 8 rpm (200 rpi).*

ISO 1863, *Information processing — 9-track, 12,7 mm (0.5 in) wide magnetic tape for information interchange recorded at 32 rpm (800 rpi).*

ISO 1864, *Information processing — Unrecorded 12,7 mm (0.5 in) wide magnetic tape for information interchange — 35 ftpmm (800 ftpi) NRZ1, 126 ftpmm (3 200 ftpi) phase encoded and 356 ftpmm (9 042 ftpi), NRZ1.*

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

ISO 3788, *Information processing — 9-track, 12,7 mm (0.5 in) wide magnetic tape for information interchange recorded at 63 rpm (1 600 rpi), phase-encoded.*

ISO 4873, *Information processing — 8-bit coded character set for information interchange.*

ISO 5652, *Information processing — 9-track, 12,7 mm (0.5 in) wide magnetic tape for information interchange — Format and recording, using group coding at 246 cpmm (6 250 rpi).*

4 Definitions

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

4.1 application program : A program that processes the contents of records belonging to a file, and may also process selected attribute data relating to the file or to the volume(s) on which it is recorded.

NOTE — An application program is a specific class of user as defined in this International Standard.

4.2 block : A group of bytes recorded consecutively in accordance with the relevant International Standard for information interchange.

NOTE — The minimum and maximum lengths of a block are specified in the relevant International Standard for information interchange.

4.3 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.

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

4.5 file : A named collection of information consisting of zero or more records.

4.6 file section : That part of a file that is recorded on any one volume.

4.7 file set : A collection of one or more files recorded consecutively on a set of volumes.

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

4.9 implementation : A set of processes within an information processing system which enable that system to behave as an originating system, or as a receiving system, or as both types of system.

4.10 installation : A person or other entity which controls the use of one or more implementations which process and interchange magnetic tapes.

NOTE — An installation is a specific class of user as defined in this International Standard.

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

4.12 originating system : An information processing system which can record a file set on a volume set for the purpose of data interchange with another system.

4.13 originator : A person who is responsible for issuing commands to an originating system.

4.14 receiving system : An information processing system which can read a file set from a volume set which has been recorded by another system for the purpose of data interchange.

4.15 recipient : A person who is responsible for issuing commands to a receiving system.

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

4.17 segmented record : A record contained in a file which is assigned to contain records that may have different lengths and that may be recorded entirely in one block or over more than one block.

4.18 International Standard for information interchange : A standard that specifies the recording method and the track format of a magnetic tape (for example ISO 1863).

4.19 Tape Mark : A control block used as a delimiter.

NOTE — The structure of Tape Marks is specified by the relevant International Standards for information interchange.

4.20 user : A person or other entity that causes the invocation of the services provided by an implementation.

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

4.22 volume : A dismountable reel of magnetic tape.

4.23 volume set : A collection of one or more volumes, on which a file set is recorded.

5 Notation

The following notation is used in this International Standard :

- BP : Byte position within the label
- L : Length of the field in number of byte positions
- a-character(s) : Any of the allowed characters (see 8.1)
- Digit(s) : Any digit from ZERO to NINE.

With the exception of SPACE, a group of capital letters in the content column of a table specifying label contents indicates that these characters shall appear in the order given and in the corresponding byte positions of the field specified, for example VOL in BP 1 to 3 of the Volume Header Labels. In the tables and throughout this International Standard, SPACE signifies the character coded in position 2/0 of ISO 646.

6 Arrangement of labels and files

6.1 Arrangement of data on a volume

A volume shall be recorded with a sequence of blocks and Tape Marks. The sequence shall commence with a block, and shall terminate within the usable recording area.

6.2 Arrangement of label groups

6.2.1 Labels

A label shall be a record that shall have a length of 80 bytes. Each label shall be recorded within the first or only 80 byte positions of a block. If the block contains any additional bytes, they shall be recorded with any desired bit combinations.

Each label shall be of one of the following types :

- Volume Header
- Installation Volume
- File Header
- User File Header
- End of File
- End of Volume
- User File Trailer

6.2.2 Label sets

A sequence of one or more labels of the same type, recorded in consecutive blocks, shall be a label set of that type. All labels in a set shall be numbered consecutively starting from 1, except those labels in the User File Header and User File Trailer Label Sets.

The labels in the User File Header and User File Trailer Label Sets may be identified in any order and may contain duplicate identifiers within a set.

6.2.3 Label groups

A label group shall consist of a mandatory label set, optionally followed by a second label set of a different type. Each label group shall be of one of the types listed in table 1, and shall include only those label sets listed in the corresponding entry of the table. The first set listed in each table entry is the mandatory set, and the second set listed is the optional set.

Table 1

Label group	Label sets
Beginning of Volume	Volume Header Installation Volume
Beginning of File Section	File Header User File Header
End of File Section	End of Volume User File Trailer
End of File	End of File User File Trailer

6.3 Arrangement of file sections

6.3.1 File section

A file section shall be recorded in a sequence of one or more blocks, or no blocks. If no blocks are recorded, the file section is regarded as empty.

6.3.2 Labelled-Sequence

6.3.2.1 A Labelled-Sequence shall consist of the sequence of blocks and Tape Marks as listed below, recorded consecutively :

- a) Beginning of File Section Label Group;
- b) Tape Mark;
- c) a file section;

d) Tape Mark;

e) either an End of File Label Group or an End of File Section Label Group, as required in 6.3.2.2;

f) Tape Mark.

6.3.2.2 If the file section is the last or only file section of a file, then the label group that follows it shall be an End of File Label Group. Otherwise the label group shall be an End of File Section Label Group.

NOTE — An End of File Section Label Group can only be the last label group on a volume because of the requirements of 6.5.1.

6.3.2.3 Within a Labelled-Sequence the information contained in the File Header Label Set, and in the End of File or End of Volume Label Set, shall apply to the file section that is recorded within the sequence.

6.3.2.4 Within a Labelled-Sequence the number of labels in an End of Volume or End of File Label Set shall be equal to the number of labels in the File Header Label Set. Within all Labelled-Sequences in which the file sections of a file are recorded, the number of File Header Labels shall be the same.

6.4 Relationship of file sections to a volume

The information on a volume shall consist of the sequence of blocks and Tape Marks as listed below, recorded consecutively:

- Beginning of Volume Label Group;
- one or more Labelled-Sequences;
- Tape Mark.

Any recording following the last Tape Mark of the sequence shall be ignored in interchange.

The information that identifies and describes the volume shall be contained in the Volume Header Label Set, within the Beginning of Volume Label Group.

6.5 Arrangement of files and file sets

6.5.1 Files

If a file is recorded entirely within one volume it shall consist of only one file section.

If a file is recorded over more than one volume, then only one file section of the file shall be recorded on any one volume, and

- the first file section shall be recorded as the last or only file section on a volume;
- any intermediate file section shall be recorded as the only file section on a volume;
- the last file section shall be recorded as the first or only file section on a volume.

All sections of a file shall be numbered consecutively starting from 1.

6.5.2 File sets

A file set shall consist of one or more files having a common file set identifier. All files in a file set shall be numbered consecutively starting from 1.

The files in a file set shall be recorded consecutively over a set of one or more volumes.

6.6 Structure of a volume set

A volume set shall be the set of volumes on which a file set is recorded. The volume set shall contain only one file set.

7 File structure for data interchange

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 in which part of a file section is recorded shall contain one or more Measured Data Units (MDU). Each MDU shall either be a fixed-length record, or shall contain a variable-length record or a record segment.

A block in which part of a file section is recorded may contain

- an Offset field preceding the first or only MDU;
- a Padding field following the last or only MDU.

The first or only MDU in a block shall begin at the first byte of the block after the Offset field (if any). Each subsequent MDU shall begin at the byte immediately following the last byte of the preceding MDU in that block. Each MDU shall end in the block in which it begins.

7.1.2 Block length

The length of a block shall be the number of bytes in the block. Within a file, all blocks may have different lengths. The length of a block shall be the sum of

- the lengths of the MDUs in the block;
- the length of the Offset field;
- the length of the Padding field.

A maximum block length shall be assigned for a file. The block length shall not exceed the maximum value specified by the relevant International Standard for information interchange.

7.1.3 Offset field

This field shall consist of not more than 99 bytes. It shall be reserved for implementation use. Its contents are not specified by this International Standard and may be ignored in interchange.

7.1.4 Padding field

This field shall consist of a number of bytes sufficient to extend the length of a block either

- a) to the minimum length required by the relevant International Standard for information interchange, or
- b) to a greater length as required by the implementation.

Each byte of this field shall contain bit combination b_8 to $b_1 = 0101\ 1110$. This field shall be ignored in interchange.

7.2 Records

7.2.1 Characteristics

A record shall have the following characteristics :

- a) A record may be either a fixed-length record, or a variable-length record, or a segmented record.
- b) A fixed-length record or a variable-length record shall be recorded entirely within one block; a segmented record may be recorded in a part of one or more blocks.
- c) The length of a record shall be the number of bytes in the record.

7.2.2 Fixed-length records

A fixed-length record shall be a record contained in a file that is assigned to contain only records of the same length. The minimum assigned length of a fixed-length record shall be one byte and the maximum assigned length shall not exceed the assigned block length less the length of the offset field. At least one byte of a fixed-length record shall not contain bit combination b_8 to $b_1 = 0101\ 1110$.

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 variable-length record shall be contained in an MDU. The MDU shall consist of a Record Control Word (RCW), followed immediately by the variable-length record. The RCW shall consist of four characters which shall be coded in accordance with ISO 646 and shall express the sum of the lengths of the record and of the RCW as a four-digit decimal number.

A maximum record length shall be assigned for a file. The length of any record in the file shall not exceed this value. The assigned maximum record length shall not be zero and shall not exceed the assigned block length less the length of the Offset field and less the length of the RCW.

The minimum length of a variable-length record shall be zero.

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 entirely in one block or over more than one block.

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 sections 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 the next non-empty file section of that file.

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 zero.

NOTE — 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 record segment shall be contained in an MDU. The MDU shall consist of a Segment Control Word (SCW), followed immediately by the record segment. The SCW shall consist of five characters which shall be coded in accordance with ISO 646.

The first character of the SCW is called the Segment Indicator. This character shall have one of the values 0, 1, 2 or 3 with the following meaning :

- 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 last four characters of the SCW shall express as a decimal number the sum of the lengths of the record segment and of the SCW.

The length of a record segment shall not exceed the assigned block length less the length of the Offset field and less the length of the SCW.

The minimum length of a record segment shall be zero.

7.2.5 Coded representation of data

The contents of each record shall be interpreted in accordance with the relevant International Standard for the coded representation of information.

7.3 Files

7.3.1 Characteristics

A file shall contain either only fixed-length records or only variable-length records or only segmented records.

7.3.2 Consistency of file attributes between file sections

The following label fields in the File Header Label Set for each file section of the same file shall contain the same characters :

- File Identifier (HDR1 BP 5 to 21)
- File Set Identifier (HDR1 BP 22 to 27)
- File Sequence Number (HDR1 BP 32 to 35)
- Generation Number (HDR1 BP 36 to 39)
- Generation Version Number (HDR1 BP 40 and 41)
- File Accessibility (HDR1 BP 54)
- Record Format (HDR2 BP 5)
- Block Length (HDR2 BP 6 to 10)
- Record Length (HDR2 BP 11 to 15)
- Offset Length (HDR2 BP 51 to 52)

7.3.3 File organization

The file organization shall be sequential.

8 Format and contents of the labels and label sets

8.1 Character set and coding

Unless otherwise stated, the characters in the labels shall be coded in accordance with ISO 646.

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

- 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

These 57 characters are referred to as "a-characters" (see annex A).

8.2 Justification of characters

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

- in each field, the contents of which are specified by this International Standard to be digits, the digits shall be right-justified and any remaining positions on the left shall be filled with ZEROS;
- in each field, the contents of which are specified by this International Standard to be a-characters, the a-characters shall be left-justified and any remaining positions on the right shall be filled with SPACES.

8.3 Volume Header Label Set (VOL1 to VOL9)

A Volume Header Label Set shall be a label set comprising at least one Volume Header Label and at most nine such labels.