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# INTERNATIONAL STANDARD



# 1001

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

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## Information processing — Magnetic tape labelling and file structure for information interchange

*Traitement de l'information — Étiquetage de bandes magnétiques et structure des fichiers pour l'échange d'information*

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**Descriptors** : data processing, information interchange, files, magnetic tapes, data layout, tags (data processing), logical structure, information marks.

## FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up 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.

International Standard ISO 1001 was developed by Technical Committee ISO/TC 97, *Computers and information processing*, and was circulated to the member bodies in October 1976.

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It has been approved by the member bodies of the following countries :

Australia	Italy	ISO 1001:1979
Belgium	Japan	South Africa, Rep. of
Brazil	Korea, Rep. of	Spain
Chile	Mexico	Sweden
Czechoslovakia	Netherlands	Switzerland
France	Philippines	United Kingdom
Germany, F. R.	Poland	USA
Hungary	Romania	

No member body expressed disapproval of the document.

This International Standard differs technically from ISO/R 1001-1969 particularly in the introduction of the concept of levels of labelling, a different treatment of the user labels, and the deletion of the block sequence indicator feature.

A detailed description of the differences is given in annex C, together with the reasons for making the changes.

In recognition of the rapid pace of development, this International Standard, in common with many others in the data processing field, is the subject of continuing development. In due course ISO/R 1001 will become obsolete. However in the interim period it will be necessary to retain ISO/R 1001 in order to provide time for implementors and users to make the necessary adjustments to their systems.

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# Information processing — Magnetic tape labelling and file structure for information interchange

## 0 INTRODUCTION

The aim of this International Standard is to facilitate the interchange of information recorded on magnetic tapes between different users and different computers.

This is accomplished by means of magnetically recorded labels to identify and structure files, and by providing a means of describing the basic characteristics of the blocks containing the records that constitute a file.

The features provided by this International Standard allow the user to consider only the logical structure of his files.

This International Standard contains specifications for four levels of labelling. This provides a fully compatible, well-nested system of labels for use of smallest and simplest, to largest and most sophisticated computing systems, and ensures the capability for interchange among them with fewest restrictions.

In most implementations of this International Standard a general purpose operating system will be in use, but in other cases there may only be installation or user written input/output routines which may form part of a special purpose operating system. This has been allowed for in this International Standard by avoiding the term "operating system" and using instead "label handling routines".

However, for proper implementation of this International Standard the installation or user written input/output routines are expected to provide the same minimum facilities as a general purpose operating system within the area defined by this International Standard.

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the file structure for information interchange, and specifies magnetically recorded labels to identify the files, the file sections and the reels of tape.

This International Standard establishes four levels of label formats, blocking structure, and tape-mark relationships on magnetically recorded tapes so that these volumes can be used for information interchange.

A recorded magnetic tape intended to be interchanged between systems of potentially different architecture is expected to correspond to one of these four levels. The constraints of this standard may not be needed to apply to data not intended for interchange between systems of potentially different architecture.

It is the intention of this International Standard, not that every instance of its implementation should necessarily include all of its provisions, but that each implementation be able to produce and accept volumes that correspond to a level selected by the implementors.

Failure to conform to this International Standard may result in loss of the ability to interchange data effectively.

## 2 REFERENCES

ISO 646, *7-bit coded character set for information processing 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/R 1001, *Magnetic tape labelling and file structure for information interchange*.

ISO 1861, *Information processing — 7-track, 12,7 mm (0.5 in) wide magnetic tape for information interchange recorded at 8 rpmm (200 rpi)*.

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

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

ISO 1864, *Information processing – Unrecorded 12,7 mm (0.5 in) wide magnetic tape for information interchange – 8 and 32 rpm (200 and 800 rpi), NRZI, and 63 rpm (1 600 rpi), phase encoded.*

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.*

**3 DEFINITIONS**

For the purposes of this International Standard, the following terms have the meanings indicated. For a better explanation, the concepts have, where appropriate, been listed separately as logical and physical. The definition of a term that is used in an International Standard related to this subject conforms to its usage in that International Standard; the definition of a term that is in common use in a context related to this International Standard conforms to that common usage.

LOGICAL	PHYSICAL
<p><b>record</b> : Related data treated as a unit of information.</p> <p><i>Examples.</i> In the context of business data, a transaction record, a customer's account record.</p> <ul style="list-style-type: none"> <li>– The delineation of a record may be arbitrary and determined by the designer of the information format.</li> <li>– A record may be recorded in all or part of a block or in more than one block.</li> </ul>	<p><b>block</b> : A group of characters written or read as a unit.</p> <ul style="list-style-type: none"> <li>– A block may contain one or more complete records.</li> <li>– A block may contain segments of one or more spanned records. A single block shall not contain multiple segments of the same spanned record.</li> </ul>
<p><b>file</b> : A collection of information consisting of records pertaining to a single subject.</p> <p><i>Examples.</i> In the context of business data, a payroll file, an inventory file.</p> <ul style="list-style-type: none"> <li>– The delineation of a file may be arbitrary.</li> <li>– A file may be recorded on all or part of a volume, or on more than one volume.</li> </ul>	<p><b>volume</b> : A dismountable physical unit of storage media, for example a reel of magnetic tape.</p> <ul style="list-style-type: none"> <li>– A volume may contain part of a file, a complete file or more than one file.</li> <li>– A volume may contain sections of one or more files but not multiple sections of the same file.</li> </ul>
<p><b>file section</b> : That part of a file that is recorded on any one volume.</p> <ul style="list-style-type: none"> <li>– The sections of a file shall not have sections of other files interspersed.</li> </ul>	
<p><b>file set</b> : A collection of one or more related files, recorded consecutively on a volume set.</p>	<p><b>volume set</b> : A collection of one or more volumes, on which a file set is recorded.</p>
<p><b>unspanned record</b> : A record contained in a file in which each record by design ends in the block in which it begins.</p>	

LOGICAL	PHYSICAL
<p><b>spanned record</b> : A record contained in a file in which each record may begin in one block and end in another.</p> <p>– Each record consists of one or more segments. Records are contained in one or more consecutive blocks, such that only one segment of each record can appear in any one block (see figures 4 and 5).</p>	
<p><b>record segment</b> : That part of a spanned record that is contained in any one block.</p> <p>– The segments of a record shall not have segments of another record interspersed.</p>	
<p><b>unblocked record</b> : A record contained in a file in which each block by design contains only one record or record segment.</p>	
<p><b>blocked record</b> : A record contained in a file in which each block may contain more than one record or record segment.</p>	
<p><b>fixed-length record</b> : A record contained in a file in which all the records by design have the same length.</p>	
<p><b>variable-length record</b> : A record contained in a file in which the records may have different lengths.</p>	

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**label** : A record at the beginning or at the end of a volume or of a file, that identifies, characterizes and/or delimits that volume or file. A label is not considered to be part of a file.

**label group** : A collection of one or more contiguous label sets that delimit one end of a volume, of a file section or of a file (see table 1).

**label set** : A collection of contiguous labels with the same label identifier.

**tape mark** : A delimiter used to indicate the boundary between file data and label groups and also between certain label groups.

**label identifier** : Three characters recorded in the label to identify the label (see table 1).

NOTE – The tape mark configuration is specified in the relevant recorded magnetic tape standards (see clause 2).

TABLE 1 – Classification of labels

Label Group Name	Label Set Name	Label Identifier
Beginning of Volume	Volume Header	VOL
	User Volume Header	UVL
Beginning of File or of File Section	File Header	HDR
	User File Header	UHL
End of First or of Intermediate File Section	End of Volume (Volume Trailer)	EOV
	User Trailer (User End of Volume)	UTL
End of File or of Last File Section	End of File (File Trailer)	EOF
	User Trailer (User End of File)	UTL

**double tape mark :** A delimiter consisting of two consecutive tape marks that is used to indicate the end of a volume or of a file set.

NOTE — Two consecutive tape marks also occur when an empty file section or an empty file exists on a volume, in which case they are not interpreted as a double mark but rather as two single tape marks framing an empty file section. In this context "empty" means that no blocks are present between the tape mark following the Beginning of File Label Group and the tape mark preceding the End of Volume or End of File Label Group of that file section or file.

**operating system :** Software that controls the execution of computer programs and that may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services.

NOTE — An operating system may be used in a single installation, or it may be used in many installations, as is frequently the case when it is provided by a supplier.

**label handling routines :** A set of routines that process labels and that are an integral part of a system's software.

NOTES

1 The system software may be an operating system provided by

a supplier or it may be provided by an installation or a user. In either case it provides at least the label facilities required by this International Standard.

2 This International Standard has been written as if the label handling routines were not contained in the user program.

4 FORMATS AND CONTENTS OF LABELS

In this International Standard "n" means any numeric character from 0 to 9. An "a" means any numeric, alphabetic or special character of the centre four columns of the ISO 7-bit code table except position 5/15 and those positions where there is provision for alternative graphic representation. (See clause 2.)

In 4.1 to 4.9 the meaning of the table headings is the following :

- CP : character position in the label
- Field name : reference name of the field
- L : length of the field (number of characters)
- Content : content of the field

4.1 Volume Header Label (System Label VOL1) : See below.

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CP	Field name		Content
1 – 3	Label Identifier	3	VOL
4	Label Number	1	1
5 – 10	Volume Identifier	6	"a" characters. Permanently assigned by the owner to identify this volume.
11	Accessibility	1	"a" character. Indicates restrictions on access to the information on the volume. Space means no restrictions.
12 – 37	Reserved for Future Standardization	26	Spaces
38 – 51	Owner Identifier	14	"a" characters. Indicates the owner of the volume.
52 – 79	Reserved for Future Standardization	28	Spaces
80	Label Standard Version	1	Indicates the version of this International Standard to which the labels and data formats in the volume conform. 3 means this version. 1 means the version specified in ISO/R 1001.



## 4.5 Second End of Volume Label (System Label EO2)

CP	Field name	L	Content
1 – 3	Label Identifier	3	EOV
4	Label Number	1	2
5 – 80	Same as the corresponding fields in HDR2.	total 76	Same as the corresponding fields in HDR2.

## 4.6 First End of File Label (System Label EOF1)

CP	Field name	L	Content
1 – 3	Label Identifier	3	EOF
4	Label Number	1	1
5 – 54	Same as the corresponding fields in HDR1.	total 50	Same as the corresponding fields in HDR1.
55 – 60	Block Count	6	"n" characters. Denotes the number of data blocks since the preceding Beginning of File Section Label Group. This count excludes label blocks and tape mark blocks.
61 – 80	Same as the corresponding fields in HDR1.	total 20	Same as the corresponding fields in HDR1.

## 4.7 Second End of File Label (System Label EOF2)

CP	Field name	L	Content
1 – 3	Label Identifier	3	EOF
4	Label Number	1	2
5 – 80	Same as the corresponding fields in HDR2.	total 76	Same as the corresponding fields in HDR2.

## 4.8 Other system Labels (HDR3 – HDR9, EO3 – EO9, EOF3 – EOF9)

CP	Field name	L	Content
1 – 3	Label Identifier	3	HDR, EO3 or EOF3 as appropriate.
4	Label Number	1	3, 4, 5, 6, 7, 8 or 9
5 – 80	Reserved for System Software Use	76	"a" characters.

4.9 User Volume Labels (UVLn)

CP	Field name	L	Content
1 – 3	Label Identifier	3	UVL.
4	Label Number	1	1, 2, 3, 4, 5, 6, 7, 8 or 9.
5 – 80	Reserved for Installation Use	76	“a” characters.

4.10 User File Labels (UHLa, UTLa)

CP	Field name	L	Content
1 – 3	Label Identifier	3	UHL or UTL as appropriate.
4	Label Number	1	“a” character.
5 – 80	Reserved for User Application	76	“a” characters.

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5 PROCESSING OF LABEL FIELDS

5.5 First File Header Label (HDR1)

5.1 Fields in VOL1, HDR1, EOVI and EOF1 labels

5.5.1 File Set Identifier (CP 22 – 27)

All fields are written with content as specified.

The identification shall be the same for all files of a set.

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5.2 Fields in UVLn, HDR2 – HDR9, EOVI – EOVI and EOF2 – EOF9 labels

5.5.2 File Section Number (CP 28 – 31)

If the system software elects to write any of these labels, then the fields are written as specified in this International Standard. If the system software elects to read any of these labels, then the contents may be treated as needed.

The number of the first section of a file is 0001. This number is increased by 1 for each successive volume of the file.

5.3 Use of data in label fields

5.5.3 File Sequence Number (CP 32 – 35)

On input, the system may override data found in labels being processed by that system with the new values of that data provided from other sources. The new values may be supplied before the file is processed (for example compiled values) or after the processing has begun (for example system control statements), at the option of the system implementors. However, data found in VOL1 is not overlaid or overridden.

The File Sequence Number of the first file in a file set is 0001. This number is increased by 1 for each successive file of the set. In all the labels for a given file, whether that file be single or multi-volume, this field contains the same number.

5.4 Volume Header Label (VOL1)

5.5.4 Generation Number (CP 36 – 39)

The Volume Header Label must be preserved, except as specified below. This does not preclude the rewriting of the label with the content unchanged.

The Generation Number of the first generation of a file is 0001. If subsequent generations of a file are noted, this number is increased by 1 for each successive generation of the file.

The Volume Header Label may be changed only if authorized by the owner, and then only as prescribed by the owner.

5.5.5 Generation Version Number (CP 40 – 41)

The Generation Version Number of the first attempt to produce a generation of a file is 00. If the number of subsequent attempts to produce that generation of the file is noted, this number is increased by 1 at each subsequent attempt.

The Generation Version Number is reset to 00 when the Generation Number (HDR1 CP 36 – 39) is increased by 1.

### 5.5.6 Creation Date (CP 42 – 47)

A file is regarded as having no significant creation date when the value in this field is space followed by five zeros.

### 5.5.7 Expiration Date (CP 48 – 53)

A file is regarded as expired on a day whose date is equal to, or later than the date given in this field. When this condition is satisfied, the remainder of the volume set may be overwritten. To be effective on multi-file volumes, therefore, the Expiration Date of a file must be less than, or equal to the Expiration Dates of all previous files on the volume set. A value of space followed by five zeros indicates an expired file.

## 5.6 Second File Header Label (HDR2)

### 5.6.1 Block Length (CP 6 – 10)

The count of this field includes not only data but also buffer offset, Segment Control Words and padding. The actual maximum block capacity for data is thus reduced by the additional items, in order that the block should not exceed the maximum length specified in the applicable recorded magnetic tape standards.

### 5.6.2 Reserved for System Software Use (CP 16 – 50)

On input and/or output, this field may be used by those system software routines which recognize the System Code in HDR1, which will identify the particular system software routine that created the file. In interchange the contents of this field are ignored.

### 5.6.3 Buffer Offset Length (CP 51 – 52)

Certain systems may require additional information at the front of each data block. This could include block length, the block address of the last record in the block, initial padding for word machines, dates, times of transmission etc. The length of the additional information will be specified in this field. If no such information is included, the contents of this field are 00.

## 6 ARRANGEMENTS OF LABELS AND DATA

### 6.1 Labels

A label is an 80 character block, the character positions (CP) of which are numbered 1 to 80. However, this may be extended by padding characters (see clause 9).

System label sets are symmetric about a file section. That is, corresponding labels shall be recorded in each File Header Label Set, End of Volume Label Set, and End of File Label Set for the entire file.

Numbered labels shall be recorded in consecutive ascending order. The first label shall be numbered "1". User Header Labels and User Trailer Labels have no such restrictions.

### 6.2 Placement of tape marks

Label groups are always delimited by a tape mark except at the beginning of a volume, where the beginning of volume and beginning of file label groups are contiguously recorded with no intervening tape mark.

### 6.3 Volume Header Labels

The first block on a volume shall be the Volume Header Label (VOL1). This label shall not be used at any other place in the volume.

If User Volume Labels (UVL1 – UVL9) are used they shall immediately follow the VOL1 label.

### 6.4 File Header Labels

Each file shall be preceded by header labels, the first of which shall be the First File Header Label (HDR1). If other file header labels are used, they shall immediately follow the HDR1 label.

If User File Header Labels (UHL<sub>a</sub>) are used, they shall immediately follow the last HDR<sub>n</sub> label.

### 6.5 Data

File data shall follow the last label of the Beginning of File Label Group and be separated from the label group by a tape mark.

### 6.6 End of File Labels

The End of File Label (EOF1) shall follow the last data block of the file and be separated from that file by a tape mark.

If other End of File Labels (EOF2 – EOF9) are used, they shall immediately follow the EOF1 label.

The contents of these labels, except for Label Identifier and Block Count, are exact copies of the corresponding HDR1 – HDR9 labels for the file section.

If User End of File Labels (UTL<sub>a</sub>) are used, they shall immediately follow the last EOF<sub>n</sub> label.

### 6.7 Tape mark after End of File Label Group

If the file ends within a volume a tape mark shall immediately follow the last label of the End of File Label Group.

If the file is the last file on a file set a double tape mark shall immediately follow the last label of the End of File Label Group.

### 6.8 End of Volume Labels

If the file extends over the end of a volume, the End of Volume Label (EOV1) shall follow the last data block on that volume and be separated from that data block by a tape mark.

If other End of Volume Labels (EOV2 – EOVS) are used they shall immediately follow the EOVS label.

The contents of these labels, except for Label Identifier and Block Count, are exact copies of the corresponding HDR1 – HDR9 labels for the file section.

**6.8.1** If user End of Volume Labels (UTLs) are used they shall immediately follow the last EOVS label.

**6.8.2** The last label of an End of Volume Label Group shall always be followed by a double tape mark.

### 6.9 Empty file or file section

When an empty file or empty file section is present the rules stated in 6.5, 6.6 and 6.8 will cause two consecutive tape marks to be written between the Beginning of File Label Group and the End of File or End of Volume Label Group.

### 6.10 Continuation file section in a multi-volume file

The first data block of a continuation file section shall be preceded by a Beginning of File Label Group and a tape mark as described in 6.4 and 6.5.

This includes an exact copy of the last File Header Label Set on the previous volume, except that the File Section Number (HDR1, CP 28 – 31) is increased by 1 (see 5.5.2).

### 6.11 Coincidence of end of file and end-of-tape marker

If the end of a file and the end of a volume coincide, then, unless the system avoids the situation by, for example, erasing the current block, three situations are possible :

**6.11.1** The end-of-tape marker is recognized while the system is writing the last data block of the file. In this case the system will complete writing the data block and close the volume as described in 6.8 and continue the file on the next volume as described in 6.10 except that no data blocks will be written on the next volume but an End of File Label Group as described in 6.6 (see 7.1.1).

**6.11.2** The end-of-tape marker is recognized while the system is writing the End of File Label Group and the file is not the last file of a set. In this case the system will complete writing the End of File Label Group. The Beginning of File Label Group of the next file will then be written, followed by an empty file section and the volume is then terminated by an End of Volume Label Group. The Beginning of File Label Group will then be rewritten at the start of the next volume (see 7.1.2).

**6.11.3** The end-of-tape marker is recognized while the system is writing the End of File Label Group and the file is the last file of a set. In this case the configuration used to terminate the file set shall be as described in 7.1.1.

### 6.12 Coincidence of beginning of file and end-of-tape marker

If the end-of-tape marker is recognized while the system is writing the Beginning of File Label Group, then it will complete the writing of that group, terminate the volume by writing an empty file section followed by an End of Volume Label Group and rewrite the Beginning of File Label Group at the start of the next volume (see 7.1.3).

## 7 STRUCTURING THE FILES

Label sets and tape marks are used to establish the file structure according to the following rules, as illustrated in figures 1 to 3. In these figures the beginning of the tape is at the left, and the end of the tape is at the right. Labels are indicated by their first four characters and a tape mark is represented by an asterisk (\*).

### 7.1 Configuration of files

The various configurations of files that can be formed according to the following rules, are illustrated in figure 1. The rules and figures are presented including only the VOL1, HDR1, EOVS and EOF1 labels. Additional labels, where used, shall be included as specified in 7.4.

**7.1.1** As described in 6.11.1, the labelling configuration to be used when the end-of-tape marker is recognized while the last data block of the file is being written is as shown in figure 2.

**7.1.2** As described in 6.11.2, the labelling configuration to be used when the end-of-tape marker is recognized while the label handling routine is writing the End of File Label Group, is as shown in figure 3. There is one exception, described in 6.11.3, if the End of File Label Group belongs to the last file of a file set, then the file set will be terminated on that volume by the use of the configuration EOF1 followed by a double tape mark.

**7.1.3** As described in 6.12, the labelling configuration resulting when the end-of-tape marker is recognized while the label handling routine is writing the Beginning of File Label Group, is as shown in figure 3. Note that the File Section Number (HDR1 CP 28 – 31) is 1 on the original volume and 2 on the continuation volume.

### 7.2 Label groups and tape marks

There shall be no tape mark within a label group. Whenever figures 1, 2 and 3 indicate a tape mark following a HDR1, EOVS or EOF1 label, that tape mark shall actually follow the last label of the entire group.

### 7.3 Label groups and volumes

Every label group shall be completed on the volume where the first label of the group was recorded.