

INTERNATIONAL STANDARD



1001

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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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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.

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

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

CONTENTS	Page
0 Introduction	1
1 Scope and field of application	1
2 References	1
3 Definitions	2
4 Formats and contents of labels	4
4.1 Volume Header Label (System Label VOL1)	4
4.2 First File Header Label (System Label HDR1)	5
4.3 Second File Header Label (System Label HDR2)	6
4.4 First End of Volume Label (System Label EOVS)	6
4.5 Second End of Volume Label (System Label EOVS)	7
4.6 First End of File Label (System Label EOF1)	7
4.7 Second End of File Label (System Label EOF2)	7
4.8 Other system Labels (HDR3 – HDR9, EOVS – EOVS, EOF3 – EOF9)	7
4.9 User Volume Label (UVLn)	8
4.10 User File Labels (UHLn, UTLn)	8
5 Processing of label fields	8
5.1 Fields in VOL1, HDR1, EOVS and EOF1 labels	8
5.2 Fields in UVLn, HDR2 – HDR9, EOVS – EOVS and EOF2 – EOF9 labels	8
5.3 Use of data in label fields	8
5.4 Volume Header Label (VOL1)	8
5.5 First File Header Label (HDR1)	8
5.6 Second File Header Label (HDR2)	9
6 Arrangements of labels and data	9
6.1 Labels	9
6.2 Placement of tape marks	9
6.3 Volume Header Labels	9

6.4	File Header Labels	9
6.5	Data	9
6.6	End of File Labels	9
6.7	Tape mark after End of File Label Group	9
6.8	End of Volume Labels	9
6.9	Empty file or file section	10
6.10	Continuation file section in a multivolume file	10
6.11	Coincidence of end of file and end-of-tape marker	10
6.12	Coincidence of beginning of file and end-of-tape marker	10
7	Structuring the files	10
7.1	Configuration of files	10
7.2	Label groups and tape marks	10
7.3	Label groups and volumes	10
7.4	Grouping the labels	11
7.5	Examples of the grouping of labels	12
8	Block structure	12
8.1	Grouping records into blocks	12
8.2	Recording density	12
8.3	Size of data blocks	12
8.4	Character code in data	12
9	Padding	14
9.1	Use of padding	14
9.2	Fixed block length	14
9.3	Word-oriented computers	14
9.4	Padding of label blocks	14
9.5	Padding of data blocks	15
10	Levels of labelling	15
10.1	Facilities available at level 1	15
10.2	Facilities available at level 2	15
10.3	Facilities available at level 3	16
10.4	Facilities available at level 4	16
10.5	Description of media	17
ANNEXES		
A	Notes on implementation	18
B	Levels of labelling	22
C	Differences between versions of this standard	27

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 rpm (200 rpi)*.

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 — 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
record : Related data treated as a unit of information. <i>Examples.</i> In the context of business data, a transaction record, a customer's account record. — The delineation of a record may be arbitrary and determined by the designer of the information format. — A record may be recorded in all or part of a block or in more than one block.	block : A group of characters written or read as a unit. — A block may contain one or more complete records. — A block may contain segments of one or more spanned records. A single block shall not contain multiple segments of the same spanned record.
file : A collection of information consisting of records pertaining to a single subject. <i>Examples.</i> In the context of business data, a payroll file, an inventory file. — The delineation of a file may be arbitrary. — A file may be recorded on all or part of a volume, or on more than one volume.	volume : A dismountable physical unit of storage media, for example a reel of magnetic tape. — A volume may contain part of a file, a complete file or more than one file. — A volume may contain sections of one or more files but not multiple sections of the same file.
file section : That part of a file that is recorded on any one volume. — The sections of a file shall not have sections of other files interspersed.	
file set : A collection of one or more related files, recorded consecutively on a volume set.	volume set : A collection of one or more volumes, on which a file set is recorded.
unspanned record : A record contained in a file in which each record by design ends in the block in which it begins.	

LOGICAL	PHYSICAL
spanned record : A record contained in a file in which each record may begin in one block and end in another. — 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).	
record segment : That part of a spanned record that is contained in any one block. — The segments of a record shall not have segments of another record interspersed.	
unblocked record : A record contained in a file in which each block by design contains only one record or record segment.	
blocked record : A record contained in a file in which each block may contain more than one record or record segment.	
fixed-length record : A record contained in a file in which all the records by design have the same length.	
variable-length record : A record contained in a file in which the records may have different lengths.	

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

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

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).

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

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.

CP	Field name	L	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 EOVS)

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, EOVS — EOVS, EOF3 — EOF9)

CP	Field name	L	Content
1 — 3	Label Identifier	3	HDR, EOVS or EOF 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 (UVL_n)

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 (UHL_a, UTL_a)

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.

5 PROCESSING OF LABEL FIELDS

5.1 Fields in VOL1, HDR1, EOVI and EOF1 labels

All fields are written with content as specified.

5.2 Fields in UVL_n, HDR2 — HDR9, EOVI — EOVI and EOF2 — EOF9 labels

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.

5.3 Use of data in label fields

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.

5.4 Volume Header Label (VOL1)

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

5.5 First File Header Label (HDR1)

5.5.1 File Set Identifier (CP 22 — 27)

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

5.5.2 File Section Number (CP 28 — 31)

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

5.5.3 File Sequence Number (CP 32 — 35)

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.

5.5.4 Generation Number (CP 36 — 39)

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.

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_a) are used, they shall immediately follow the last HDR_n 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_a) are used, they shall immediately follow the last EOF_n 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 — EOV9) are used they shall immediately follow the EOV1 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 (UTLa) are used they shall immediately follow the last EOVL 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 7.1.2.

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, EOV1 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, EOV1 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.

Single-volume file

VOL1 HDR1* ----File A----*EOF1**

Multi-volume file

VOL1 HDR1* ----first section of File A-----*EOV1**
 VOL1 HDR1* -----last section of File A-----*EOF1**

Multi-file volume

VOL1 HDR1* ---File A---*EOF1* HDR1* ---File B---*EOF1**

Multi-volume multi-file

VOL1 HDR1*---File A---*EOF1* HDR1* ---first section of File B---*EOV1**
 VOL1 HDR1* -----intermediate section of File B-----*EOV1**
 VOL1 HDR1* ---last section of File B---* EOF1* HDR1* ---File C---*EOF1**

FIGURE 1 — Structure of magnetic tape files

-----last section of File A containing data-----*EOV1**
 (A)
 VOL1 HDR1** EOF1* HDR1* ---first section of File B----
 (A) (A) (B)

FIGURE 2 — Empty file section at beginning of volume

-----last section of File A-----*EOF1* HDR1** EOV1**
 (A) (B)
 VOL1 HDR1* -----first section of File B containing data---
 (B)

FIGURE 3 — Empty file section at end of volume

7.4 Grouping of labels

As described in 7.4.1, 7.4.2 and 7.4.3 labels shall be fitted into the file structure without otherwise modifying the relationship between VOL1, HDR1, EOV1, EOF1 labels and the files.

Illustrations of the order of these labels are given in 7.5.

7.4.1 The labels UVL1 — UVL9, when used, shall directly follow the VOL1 label. The Label Number of the consecutive UVLn labels shall be 1, 2, 3, 4, 5, 6, 7, 8 and 9 respectively.

7.4.2 The labels HDR2 — HDR9, EOV2 — EOV9 and EOF2 — EOF9, when used, shall directly follow a HDR1, EOV1 or EOF1 label with the same identifier. The label number of the consecutive optional labels shall be 2, 3, 4, 5, 6, 7, 8 and 9 respectively.

7.4.3 The labels UHLA, UTLA, when used, shall directly follow the labels as described in 7.4.2 and of the same label group. If, however, such labels do not exist, the labels UHLA and UTLA will directly follow a HDR1, EOV1 or EOF1 label of the same label group.

7.5 Examples of the grouping of labels

7.5.1 Physical beginning of tape to physical end of tape (not end of file)

VOL1 UVL1... UVLn HDR1 HDR2... HDRn UHLa...
UHLa* File data* EOF1... EOFn UTLa... UTLa**

7.5.2 Physical beginning of tape to end of intermediate file of a file set

VOL1 UVL1... UVLn HDR1 HDR2... HDRn UHLa...
UHLa* File data* EOF1... EOFn UTLa... UTLa*

7.5.3 Physical beginning of tape to end of file set

VOL1 UVL1... UVLn HDR1 HDR2... HDRn UHLa...
UHLa* File data* EOF1... EOFn UTLa... UTLa**

7.5.4 Beginning of new file (not beginning of tape) to physical end of tape (not end of file)

HDR1 HDR2... HDRn UHLa... UHLa* File data* EOF1...
EOFn UTLa... UTLa**

7.5.5 Beginning of any intermediate file of a file set (not beginning of tape) to end of file

HDR1 HDR2... HDRn UHLa... UHLa* File data* EOF1...
EOFn UTLa... UTLa*

7.5.6 Beginning of new file (not beginning of tape) to end of file set

HDR1 HDR2... HDRn UHLa... UHLa* File data* EOF1...
EOFn UTLa... UTLa**

8 BLOCK STRUCTURE

8.1 Grouping records into blocks

No explicit indication of the boundaries between records is required. There must be an integral number of records in a block for formats F and D. There must be an integral number of segments in a block for format S. Padded blocks are permitted (see clause 9). Truncated and varying length blocks are permitted.

8.1.1 Fixed-length records (F format)

No indication of record length is required within a file.

8.1.2 Variable-length records (D format)

The length of each record (i.e. the number of characters it contains) shall be recorded as the first field in each record. This field shall be counted as part of the record length. The record length shall be expressed as a decimal numeral, occupying the first four character positions of each record.

8.1.3 Spanned records (S format)

A Segment control Word (SCW) is included as the first five characters of each record segment.

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

- 0 — record begins and ends in this segment.
- 1 — record begins but does not end in this segment.
- 2 — record neither begins nor ends in this segment.
- 3 — record ends but does not begin in this segment.

Record length is unbounded in that there is no limit to the number of segments in a record. This does not prohibit the system software from limiting the size of a work area available to reconstruct a record.

The segment length is an arbitrary choice, and segments may be created and the lengths of existing segments changed when creating or copying a file in order to fit the size of the block to be written. The segment length includes the length of the SCW, and shall be expressed as a decimal numeral occupying the last four character positions of the SCW. There shall be only one segment of the same record in a block. The segments of a record shall not have segments of other records interspersed.

Records may span volumes.

Examples of the use of spanned records are given in figures 4 to 7.

8.1.4 Not more than one of the record formats described in 8.1.1 to 8.1.3 may be used in any one file.

8.1.5 By-pass or check-point records

Only relevant data blocks shall be written on a tape used for interchange. Since by-pass information or check-point records are considered to be extraneous to the interchange, and no standard means of identification is provided, the recording of by-pass and check-point information is not allowed on tapes for interchange.

8.2 Recording density

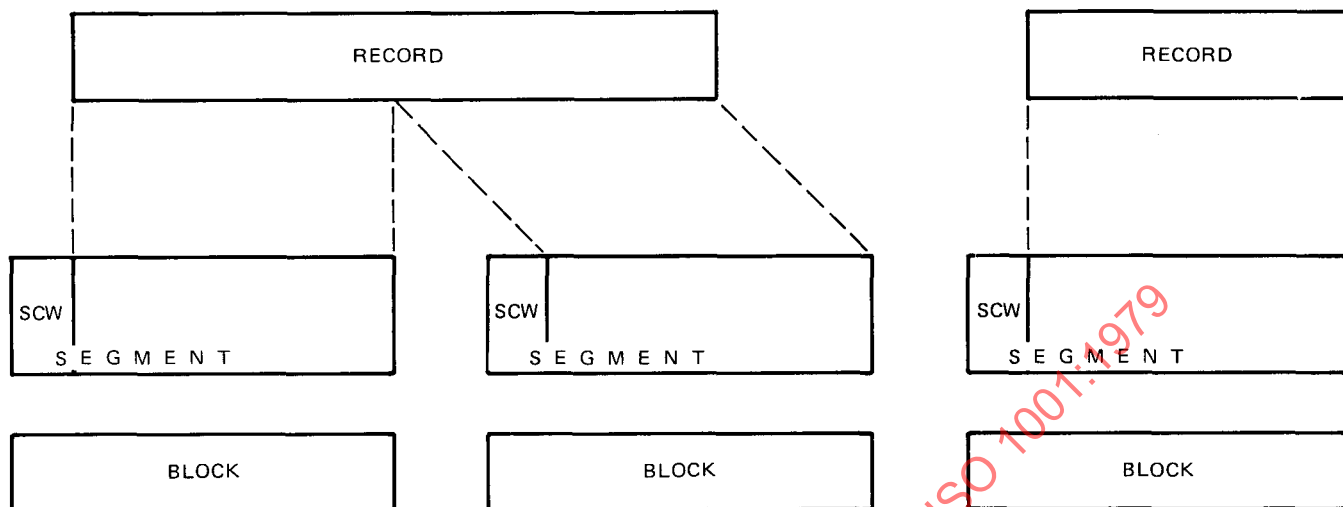
The blocks recorded on all volumes containing a file set shall be recorded at the same density.

8.3 Size of data blocks

The minimum and maximum size of data blocks are specified in the relevant recorded magnetic tape standard. (See clause 2).

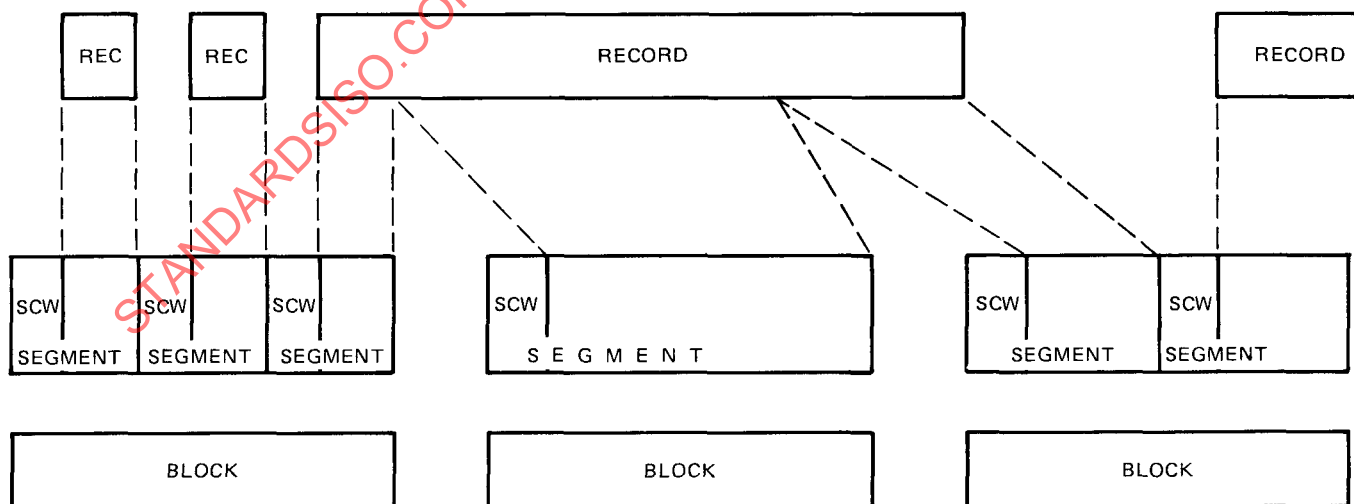
8.4 Character code in data

The data in each record and in buffer offset fields is recorded using only characters of the code table specified in ISO 646. Either a seven or eight bit code version structure as specified in the ISO 9-track recorded magnetic tape for information interchange standard may be used.



First block showing the maximum blocksize

FIGURE 4 — Spanned records, unblocked



All blocks showing the maximum blocksize

Last record continues
in next subsequent block

FIGURE 5 — Spanned records, blocked

1	2048	DATA	2043 characters
2	2048	DATA	2043 characters
3	0160	DATA	155 characters

SCW

FIGURE 6 — One spanned record, unblocked.
Record length 4241 characters
(each line represents a block).

1	2048	DATA	2043 characters
2	2048	DATA	2043 characters
3	0150	DATA	145 char.

SCW

1	1898	DATA	1893 char.
---	------	------	------------

SCW

2	2048	DATA	2043 characters
3	2005	DATA	2000 characters

SCW

NOTE — It is not a requirement that blocks should all be of the same size. In this figure the last block has been truncated — a situation that could arise with the last block of a file, or where it is essential to start the following record at the beginning of a block.

FIGURE 7 — Two spanned records, blocked.
Record # 1 : record length 4231 characters,
Record # 2 : record length 5936 characters
(each line represents a block).

9 PADDING

9.1 Use of padding

Whenever it becomes necessary or advisable to extend the recorded length of a block beyond the end of the last (or only) record in it, the block may be extended (padded) to the desired length.

9.2 Fixed block length

Whenever a magnetic tape is recorded by a device or program that is restricted to a minimum or fixed block

length, each data block and each label may be padded out to that minimum or fixed length.

9.3 Word-oriented computers

Whenever a magnetic tape is recorded by a word-oriented computer, all data-blocks and labels may be padded out to a multiple of the word length of that computer.

9.4 Padding of label blocks

Label blocks are padded out to the desired length, using any desired padding characters.

9.5 Padding of data blocks

Blocks within a file are padded out to the desired length using circumflex accent characters (position 5/14 of the ISO 7-bit code table). To ensure that padding after fixed-length blocked records can be distinguished from valid records, fixed-length records may not consist entirely of padding characters.

10 LEVELS OF LABELLING

The volume content as specified for each level described in this section acts as a ceiling on the volume content for each level. Note that UVL labels are not required at any of the levels described in 10.1 to 10.4.

10.1 Facilities available at level 1

10.1.1 File sets

File sets are single-file single-volume or single-file multi-volume.

10.1.2 Labels

VOL1, HDR1, EOVI, and EOF1 appear on the volume. All other standard labels may appear, but a system ignores and bypasses any additional labels it does not process. See clause 7 for the structuring of files.

10.1.3 Record/Block structures

Blocks consist of one or more fixed-length records.

10.1.4 Label fields

In a level 1 system, as a minimum the following basic label fields appear :

- a) VOL1
 - Label Identifier
 - Label Number
 - Volume Identifier
 - Accessibility
 - Label Standard Version
- b) HDR1, EOVI, EOF1
 - Label Identifier
 - Label Number
 - File Identifier
 - File Section Number
 - Expiration Date
 - Block Count

However, all fields of the VOL1, HDR1, EOVI and EOF1 labels must contain meaningful information in accordance

with this International Standard. Therefore to assist implementations, standard default values for certain fields are listed below. It should also be noted that fields which are Reserved for Future Standardization should be space-filled.

Label	CP	Field name	Default value
VOL1	38-51	Owner Identifier	Spaces
HDR1 EOVI EOF1	22-27	File Set Identifier	Spaces
	32-35	File Sequence Number	0001
	36-39	Generation number	0001
	40-41	Generation Version Number	00
	42-47	Creation Date	Δ00000
	54	Accessibility	Spaces
	61-73	System Code	Spaces

10.2 Facilities available at level 2

10.2.1 File sets

File sets are single-file single-volume, single-file multi-volume, multi-file single-volume, or multi-file multi-volume.

10.2.2 Labels

VOL1, HDR1, EOVI, and EOF1 appear on the volume. All other standard labels may appear, but a system ignores and by-passes any additional labels it does not process. See clause 7 for the structuring of the files.

10.2.3 Record/Block structures

Blocks consist of one or more fixed-length records.

10.2.4 Label fields

In a level 2 system, as a minimum the following basic label fields appear :

- a) VOL1
 - Label Identifier
 - Label Number
 - Volume Identifier
 - Accessibility
 - Label Standard Version
- b) HDR1, EOVI, EOF1
 - Label Identifier
 - Label Number
 - File Identifier
 - File Set Identifier

- File Section Number
- File Sequence Number
- Expiration Date
- Accessibility
- Block Count

However, all fields of the VOL1, HDR1, EOVI and EOF1 labels must contain meaningful information in accordance with this International Standard. Therefore to assist implementations, standard default values for certain fields are listed below. It should also be noted that fields which are Reserved for Future Standardization should be space-filled.

Label	CP	Field name	Default value
VOL1	38-51	Owner Identifier	Spaces
HDR1 EOV1 EOF1	36-39	Generation Number	0001
	40-41	Generation Version Number	00
	42-47	Creation Date	Δ00000
	61-73	System Code	Spaces

10.3 Facilities available at level 3

10.3.1 File sets

File sets are single-file single-volume, single-file multi-volume, multi-file single-volume, or multi-file multi-volume.

10.3.2 Labels

VOL1, HDR1, HDR2, EOVI, EOVI, EOF1, EOF2 appear on the volume. UHLA and UTLA appear if the user specifies them. All other standard labels may appear but a system ignores and by-passes any additional labels it does not process. See clause 7 for the structuring of files.

10.3.3 Record/Block structures

Blocks consist of one or more fixed-length records, or one or more variable-length records.

10.3.4 Label fields

In a level 3 system, as a minimum the following basic label fields appear :

- a) VOL1
 - Label Identifier
 - Label Number
 - Volume Identifier
 - Accessibility
 - Label Standard Version

- b) HDR1, EOVI, EOF1
 - Label Identifier
 - Label Number
 - File Identifier
 - File Set Identifier
 - File Section Number
 - File Sequence Number
 - Creation Date
 - Expiration Date
 - Accessibility
 - Block Count
- c) HDR2, EOVI, EOF2
 - Label Identifier
 - Label Number
 - Record Format
 - Block Length
 - Record Length
 - Buffer Offset Length

However, all fields of the VOL1, HDR1, HDR2, EOVI, EOVI, EOF1 and EOF2 labels must contain meaningful information in accordance with this International Standard. Therefore to assist implementations, standard default values for certain fields are listed below. It should also be noted that fields which are Reserved for Future Standardization should be space-filled.

Label	CP	Field name	Default value
VOL1	38-51	Owner Identifier	Spaces
HDR1 EOV1 EOF1	36-39	Generation Number	0001
	40-41	Generation Version Number	00
	61-73	System Code	Spaces
HDR2 EOV2 EOF2	16-50	Reserved for System Software Use	Spaces

10.4 Facilities available at level 4

10.4.1 File sets

File sets are single-file single-volume, single-file multi-volume, multi-file single-volume, or multi-file multi-volume.

10.4.2 Labels

VOL1, HDR1, HDR2, EOVI, EOVI, EOF1, EOF2 appear on the volume. UHLA and UTLA appear if the user specifies

them. All other standard labels may appear but a system ignores and by-passes any additional labels it does not process. See clause 7 for the structuring of files.

10.4.3 Record/Block structures

Blocks consist of one or more fixed-length records, one or more variable-length records, or one or more segments of spanned records.

10.4.4 Label fields

In a level 4 system, as a minimum the following basic label fields appear :

a) VOL1

Label Identifier

Label Number

Volume Identifier

Accessibility

Label Standard Version

b) HDR1, EOVS, EOF1

Label Identifier

Label Number

File Identifier

File Set Identifier

File Section Number

File Sequence Number

Generation Number

Generation Version Number

Creation Date

Expiration Date

Accessibility

Block Count

c) HDR2, EOVS, EOF2

Label Identifier

Label Number

Record Format

Block Length

Record Length

Buffer Offset Length

However, all fields of the VOL1, HDR1, HDR2, EOVS, EOVS, EOF1, EOF2 labels must contain meaningful information in accordance with this International Standard. Therefore to assist implementations, standard default values for certain fields are listed below. It should also be noted that fields which are Reserved for Future Standardization should be space-filled.

Label	CP	Field name	Default value
VOL1	38-51	Owner Identifier	Spaces
HDR1 EOVS EOF1	61-73	System Code	Spaces
HDR2 EOVS EOF2	16-50	Reserved for System Software Use	Spaces

10.5 Description of media

10.5.1 Domain

This section applies to the information recorded on a volume and not to the physical characteristics of the volume. For the purpose of this International Standard, only the portion of the volume between the beginning-of-tape marker and the double tape mark following the End of File Section Label Group or the last End of File Label Group is assumed to exist. Any content of the volume beyond the double tape mark is not considered part of the information in interchange and is not considered in determining the level of the volume.

10.5.2 Conditions

A volume (set) corresponds to a level under the following conditions :

- It and every file upon it contains all of the elements of labelling required at that level, and they are formatted and placed as specified in this International Standard, and they contain an accurate description of the volume or the file to which they pertain, and
- If it or any file upon it contains any elements of labelling optional at that level, then they are formatted and placed as specified in this International Standard, and contain an accurate description of the volume or file to which they pertain, and
- It and every file upon it contains only file sets or record/block formats permitted at that level, and
- It and every file upon it does not contain any element that is at variance with this International Standard, or any extension to elements of labelling defined in this International Standard.

ANNEX A

(Does not form a part of the standard)

NOTES ON IMPLEMENTATION

A.1 INTRODUCTION

This annex provides a guide for those implementing this International Standard, and explains and amplifies the information in the body of the document.

A.2 SYSTEM AND USER LABELS

A.2.1 System labels

The following system labels are always required :

VOL1
HDR1
EOV1
EOF1

As further defined in annex B (Levels of labelling), the following system labels may be required or may be optional :

HDR2
EOV2
EOF2

The remaining system labels are always optional :

HDR3 – HDR9
EOV3 – EOV9
EOF3 – EOF9

When used, these optional system labels can be expected to contain information pertinent to labelling functions more specialized than those contemplated in this International Standard. Such functions may be developed, defined, and implemented differently by the designers of different system software.

The contents of these optional system labels can be ignored in interchange. The writing of these labels is optional, but where used they must be written in conformity with the requirement of this International Standard in relation to content and position. There is no requirement under this International Standard to take action on the label content.

In all system labels, the actual interpretation and treatment of those fields designated "Reserved for System Software Use" can be the subject of special agreement between the interchange parties.

A.2.2 User labels

The following user labels fall into two categories.

The first category consists of UVL1 – UVL9

These labels are provided for the retention of data relative to the volume of magnetic tape. Such data as security information, purchase date, vendor, date of last certification, department assignment, etc., are illustrative of the type of items which can be contained in these labels. All of these data are parochial to a specific installation, or possibly a group of installations, and are to be ignored in general interchange.

User Volume Labels are intended primarily for installation use. If no requirement exists for the functions available under this usage, installations and the interchange parties may agree to an alternative use of those labels for application data.

Label handling routines provide only the Label Identifier and Number fields of User Volume Labels on output, and recognize these fields on input. The remainder of these labels (CP 5 – 80) are furnished to the label handling routines on output. On input, the User Volume Labels are passed by the label handling routines to the invoking facility.

The second category consists of :

UHLa
UTLa

These labels are handled partly by the label handling routines of the system, to the extent that they are recognized and passed on to the user on input, and are written to the tape on output.

Users provide the information in user labels UHLa and UTLa beyond the Label Identifier (CP 1 – 3) on output and utilize it on input.

When these labels are used, they must be written in conformity with the requirement of this International Standard in relation to content and position.

A.3 USE OF TAPE MARKS

A.3.1 At end of volume

The double tape mark at the end of each volume (figure 1) permits the following procedure to be used in accomplishing the operation "forward-space file":

Having read HDR1,

A – Index forward till three tape marks passed. Read the next block.

If HDR1 : One file has been indexed.

If tape mark : End of volume. Rewind.

If not end of set : Alternate, verify HDR1 on next volume, return to A.

An alternative procedure for that operation would be as follows :

Having read HDR1,

A – Index forward till two tape marks passed. Read the next block.

If EOVI : Rewind, alternate, verify HDR1 on next volume, return to A.

If EOF1 : Index forward till one tape mark passed. Read the next block.

If HDR1 : One file has been indexed.

If tape mark : End of set has been reached.

Thus, the double tape mark prevents tape runaway on forward spacing.

A.3.2 To frame an empty file section

Two consecutive tape marks appear at the beginning of the second volume in figure 2, and at the end of the first volume in figure 3; yet they are not interpreted as double tape marks, but rather as framing a "null" section of file. Conventional processing can proceed as follows :

Read HDR1 label.

Pass over or process any optional labels.

Read tape mark – switch to processing of file information.

Read tape mark – switch to processing of labels.

In figure 2, read File A – EOF1.

In figure 3, read EOVI occurring within File B.

A.4 USE OF FIELDS IN THE LABELS

A.4.1 Limitation on "a" characters

The limitation on "a" characters as described in clause 4 is intended as a guide to provide maximum interchangeability and consistent printing especially during international interchange. Checking for conformity to this limitation is not implied.

A.4.2 Volume Header Label (VOL1)

This label identifies the physical reel of magnetic tape, and the contents of the label relate to the identity of the volume.

A.4.2.1 Accessibility (CP 11)

This field is expected to refer to such categories of information as company confidential, proprietary, etc. This field is not intended to fulfil the requirements of national security (which will probably be accommodated in a government-specified User Volume Label), but this field might be used as an indicator in conjunction with such a User Volume Label.

An Accessibility field appears in both the Volume Header and File Header Labels, so that this function can be exercised either for the entire volume, or for each individual file, as desired.

A.4.2.2 Owner Identifier (CP 38 – 51)

It is likely that, in time, a standard method of identifying the owner will be defined.

In the absence of such a standard, the parties should agree among themselves to choose identifiers so that each party will be identified uniquely within the specific interchange environment.

A.4.2.3 Label Standard Version (CP 80)

This field is used to indicate whether or not the information recorded on this volume conforms to this International Standard. It also provides a means for extending this International Standard in the future should the need arise, with minimum conflict between the future standard and parochial practice that may develop in the meantime. It is intended to distinguish among future standard versions by the use of numerals in this field, rather than letters, to the extent possible.

A.4.3 First File Header Label (HDR1)

A.4.3.1 File Set Identifier (CP 22 – 27)

It is desirable that a unique identification be established. In most cases, this objective may be satisfied by duplicating the Volume Identifier (VOL1 CP 5 – 10) of the first or only volume of the set.

A.4.3.2 File Section Number (CP 28 – 31)

There are occasions when it is desired to read selectively one or more of the files within a multi-volume multi-file set. Through error, an attempt might be made to begin by reading an incorrect volume : one that happens to start in the middle of the file. The portion of the file held on each volume is termed a file section. The actual beginning of a file may be identified by "0001" in this field. Subsequent file sections of that file will be numbered sequentially on subsequent volumes.

A.4.3.3 Generation Version Number (CP 40 – 41)

This field is used to differentiate output data which has been produced by repeated processing or writing operations and which in all other respects would bear the same identification. For example, it may be used to distinguish between a partial file recorded during an aborted run, and the new copy of the same information recorded after return to a rescue point.

A.4.3.4 Accessibility (CP 54)

See A.4.2.1.

A.4.3.5 System Code (CP 61 – 73)

On output this field is inserted by the label handling routines to identify the system software that created the file. This field indicates the system that may have supplied Reserved for System Software Use (HDR2 CP 16 – 50), Other System Labels (HDR3 – HDR9, EOVS – EOVS9, EOF3 – EOF9), Buffer Offset Length (HDR2 CP 51 – 52) and/or buffer offset. The

value to be entered is a constant for a given system. It is likely that, in time, a standard method of identifying the system will be defined, however, in the interim period, implementors are recommended to define their own system codes.

The use of these facilities without identifying the system may result in loss of ability to interchange system data effectively.

A.4.4 Second File Header Label (HDR2)

A.4.4.1 Record Format (CP 5)

Implementors of computing and operating systems may find that they have a requirement to accommodate records in a format that does not conform to one specified in this International Standard. If such records are required by a system, they may be incorporated into a parochial version of this International Standard and appear only on volumes that are identified as other than this version of the standard in Label Standard Version (VOL1 CP 80). If volumes containing such record formats are interchanged, it is not within the purview of this International Standard.

A.4.4.2 Record Length (CP 11 – 15)

The content of this field is undefined if Record Format is other than F, D or S (see A.4.4.1). Any other value is outside this version of the International Standard (see Label Standard Version (VOL1 CP 80)).

A.4.4.3 Reserved for System Software Use (CP 16 – 50)

This field could contain any information needed to increase the efficiency of record processing by the system software. The System Code (HDR1 CP 61 – 73) may be used by label handling routines to determine the system software that created the file.

A.4.5 First End of Volume Label (EOV1) and first End of File Label (EOF1)

A.4.5.1 Block Count (CP 55 – 60)

This field is provided in order that when a magnetic tape is read the label handling routine may ensure that no blocks have been skipped and no spurious blocks have been inserted. The particular error of equal numbers of skipped and spurious blocks may escape detection.

ANNEX B

(Does not form a part of the standard)

LEVELS OF LABELLING

B.1 INTRODUCTION

In practice, interchange of file sets between systems would not be easy when many stages of implementation are possible. The number of stages is reduced to an optimum by the definition of a small number of levels. By limiting the facilities used in interchange to those of a standard level, the risk of a mismatch of facilities used will be much reduced, as also will be the amount of information provided external to the volumes interchanged.

This annex describes recommended methods for processing volumes that correspond to a level of this International Standard to ensure proper treatment and understanding of these volumes and their contents in information interchange.

It is not intended that every implementation should necessarily include all described provisions; however, each implementation should be able to produce and accept volumes that correspond to a level selected by the implementors.

It is intended that any volume (set) can be processed correctly by any system designed for an equal or higher level; and any system can process correctly any volume (set) of equal or lower level.

The processing of such a system of levels is proposed as an annex to the International Standard since it can only be advisory, and since the present International Standard is only concerned with standardization of the media.

B.2 SYSTEMS OF LEVELS OF LABELLING

In order to facilitate interchange of information among systems of dissimilar capabilities, the concept of levels of labelling is established. The level applies to the minimum facilities available in a system and to the maximum facilities resulting in the file set. Thus a system can limit the facilities it uses and produce a file set equivalent to that which can be produced or read by a system of lower level.

There are four levels numbered 1, 2, 3, and 4 in increasing order of complexity. The levels are so defined that systems software can process correctly all file sets in which the labelling level used is equal to or less than the system's nominated highest level. This applies equally to both reading and writing. Such levels act as floors on system capabilities.

Within a given level certain label fields are considered to be a basic part of that level. However, so as to avoid difficulties when a file set conforming to that level is read by systems software capable of handling a higher level, all label fields must contain meaningful information in accordance with this International Standard. Therefore, to assist the systems software writing the file set, default values have been specified which meet this criterion.

Standard labels and user labels not included in a given level may be present but may be ignored or by-passed by the systems software. Thus a HDR2 could be present in a level 1 set but would be considered as outside the interchange. However, those facilities of levels concerned with file formats and record formats cannot be enhanced in the same way without moving to a higher level since the resulting file set may be unreadable by the receiving system — for example, the addition of spanned records to a level 1 set as an optional facility requires that the option of providing HDR2 also be added to level 1, since the receiving system might not otherwise be able to properly handle the spanned records. Therefore, since the selection of such special optional facilities at a given level may result in a reduction of general interchangeability, it is recommended that whenever possible no such optional facilities should be added to the defined levels.

B.2.3.2 File security

A level 3 system assumes that a file is immediately accessible if both volume Accessibility (VOL1 CP 11) and file Accessibility (HDR1 CP 54) are equal to a space. If the contents of either or both fields are not spaces, access is denied unless the level 3 system provides additional controls. Such additional controls are not specified in this International Standard.

B.2.4 Level 4**B.2.4.1 Validity of labels**

In a level 4 system, it is recommended that the system should exercise responsibility for the format and content of all system label fields in VOL1, HDR1, HDR2, EOVS, EOF1 and EOF2.

Operating system control statements and common programming language declarations are edited to ensure that the labels are properly formatted and are self-consistent. On output, the file is constructed to be consistent with the label declarations. On input the system is responsible for interpreting the labels and ensuring the self-consistency of the file.

B.2.4.2 File security

A level 4 system assumes that a file is immediately accessible if both volume Accessibility (VOL1 CP 11) and file Accessibility (HDR1 CP 54) are equal to a space. If the contents of either or both fields are not spaces, access is denied unless the level 4 system provides additional controls. Such additional controls are not specified in this International Standard.

B.2.5 Responsibility for implementation of levels**B.2.5.1 System labels**

System labels (VOL1, HDR1 — HDR9, EOVS — EOVS, EOF1 — EOF9) are processed entirely by the label handling routines. The label handling routines write and read those labels and use the information in those labels.

Facilities for second system labels (HDR2, EOVS, EOF2) and for other system labels (HDR3 — HDR9, EOVS — EOVS, EOF3 — EOF9) are optional at levels 1 and 2. Facilities for other system labels (HDR3 — HDR9, EOVS — EOVS, EOF3 — EOF9) are optional at levels 3 and 4.

B.2.5.2 User Volume Labels

User Volume Labels (UVL1 — UVL9) are processed partly by the label handling routines to the extent that they are accepted from an installation label processing routine and written on a volume on output; and read from a volume, recognized, and passed to an installation label processing routine on input.

The label handling routines supply Label Identifier (UVLn CP 1 — 3) and Label Number (UVLn CP 4). The installation routine provides the information in the remainder of these labels (UVLn CP 5 — 80) on output and utilizes it on input. Interfaces to permit transfer of control between the label handling routines and the resident installation routine are provided.

These facilities are optional at each level.

B.2.5.3 User File Labels

User File Labels (UHLA and UTLA) are processed partly by the label handling routines, to the extent that they are accepted from user application object program routines and written on a volume on output; and read from a volume, recognized, and passed to user application object program routines on input.

The label handling routines supply Label Identifier (UHLA CP 1 — 3 or UTLA CP 1 — 3). The user routines provide Label Number (UHLA CP 4 or UTLA CP 4) and the information in the remainder of these labels (UHLA CP 5 — 80 or UTLA CP 5 — 80) on output and utilize it on input. Interfaces to permit transfer of control between the label handling routines and user routines are provided.

These facilities are optional at level 1 and level 2.

B.2.5.4 Output options

Selection of the level of labelling and provision of the facility for creation of labels optional at that level, or fields not required at that level, is at the option of the system implementors. Invocation of the facilities for creation of user labels is at the option of the user, if such facilities are provided. Invocation of the facilities for creation of other system labels (HDR3 — HDR9, EOVS — EOVS, EOF3 — EOF9) is at the option of the system.