International Standard ISO 8462/2

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

Information processing — Data interchange on 6,30 mm (0.25 in) magnetic tape cartridge using GCR recording at 394 ftpmm (10 000 ftpi), 39 cpmm (1 000 cpi) — Part 2 : Streaming mode

First edition — 1986-02-01

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

UDC 681.327.64 **Ref. No. ISO 8462/2-1986 (E)**

Descriptors : data processing, information interchange, magnetic tapes, 6,3 mm magnetic tapes, cassettes for magnetic tapes, recording tracks, magnetic recording, representation of characters, track formats.

Price based on 11 pages

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 8462/2 was prepared by Technical Committee ISO/TC 97, *Information processing systems*.

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.

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

© International Organization for Standardization, 1986 ●

Printed in Switzerland

Contents

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

Information processing — Data interchange on 6,30 mm (0.25 in) magnetic tape cartridge using GCR recording at 394 ftpmm (10 000 ftpi), 39 cpmm (1 000 cpi) — Part 2 : Streaming mode

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

1 Scope and field of application

ISO 8462 specifies the characteristics of a tape cartridge loaded with magnetic tape 6,30 mm (0.25 in) wide intended for digital recording at physical recording densities of 252 ftpmm (6 400 ftpi) and 394 ftpmm (10 000 ftpi).

ISO 8462/1 specifies the mechanical, physical and magnetic properties of a 6,30 mm (0.25 in) wide magnetic tape cartridge and methods for testing the surface quality of the tape. It also specifies the environmental conditions under which the cartridge shall be tested and operated, and recommends conditions for storage.

This part of ISO 8462 specifies a recording method and a data format intended for use in the streaming mode of operation. Two alternative track formats are specified :

- a 4-track format, and
- a 9-track format.

ISO 8462/1 and ISO 8462/2 provide for the physical interchange of cartridges between data processing systems, and specify a data format. A labelling standard for tape cartridges used in the streaming mode is under study. The availability of such a labelling standard will provide for full data interchange between data processing systems.

NOTE — Numeric values in the SI and/or Imperial measurement system in this part of ISO 8462 may have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system may be used, but the two should be neither intermixed nor reconverted. The original design was made using the Imperial measurement system.

2 Conformance

A 6,30 mm (0.25 in) wide magnetic tape cartridge shall be in conformance with ISO 8462 if it meets either all mandatory requirements of both ISO 8462/1 and ISO 8462/2 specified for the 4-track format or all mandatory requirements of both ISO 8462/1 and ISO 8462/2 specified for the 9-track format. The two formats shall not exist on the same cartridge.

In addition the code used shall conform with one of the codes specified in the documents referenced in clause 3.

3 References

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

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

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

ISO 8462/1, *Information processing — Data interchange on* 6,30 mm (0.25 in) *magnetic tape cartridge using GCR recording at* 394 ftpmm (10 000 ftpi), 39 cpmm (1 000 cpi) — *Part 1 : Mechanical, physical and magnetic properties.*

4 Hexadecimal notation

Hexadecimal notation is used hereafter to denote the following bytes :

(00) for (B8 to B1) = 0000 0000
(01) for (B8 to B1) = 0000 0001
(02) for (B8 to B1) = 0000 0010
(03) for (B8 to B1) = 0000 0011
(04) for (B8 to B1) = 0000 0100
(05) for (B8 to B1) = 0000 0101
(06) for (B8 to B1) = 0000 0110
(07) for (B8 to B1) = 0000 0111

5 Reference plane

The Reference Plane shall be the top of the base plate (plane B in ISO 8462/1).

The Reference Edge shall be that edge of the tape which is nearer to the top of the base plate.

The location of the centrelines of the tracks is referred to the Reference Plane.

6 Track geometry

6.1 Track location

The positions of the nine tracks are defined by specifying the distance of their centrelines from the Reference Plane (see figure 1).

6.2 Number of tracks

6.2.1 4-track format

In the 4-track format only tracks 0, 1, 2 and 3 are usable. Tracks are recorded sequentially from track 0 (see also 10.1).

6.2.2 9-track format

In the 9-track format all nine tracks are usable. Tracks are recorded sequentially from track 0 (see also 10.2).

6.3 Track width

The recorded track width shall be

— for a 4-track format : 0,914 ± 0,025 mm (0.036 ± 0.001 in);

— for a 9-track format : 0,343 ± 0,013 mm (0.013 5 ± 0.000 5 in).

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

7 Recording

7.1 Method of recording

The recording method shall be the "Non Return To Zero Mark" (NRZ1) method where a ONE is represented by a change of direction of longitudinal magnetization.

7.2 Physical recording densities

The maximum nominal physical recording density shall be 394 ftpmm. The nominal bit cell length shall be 2,54 µm.

Two other densities occur with the recording method described in this part of ISO 8462, namely :

197 ftpmm (5 000 ftpi)

131 ftpmm (3 333 ftpi)

7.3 Average bit cell length variations

7.3.1 Average bit cell length

The average bit cell length is the sum of the distances between the flux transitions in n bit cells divided by $(n-1)$. The tests below may be made in any continuously recorded pattern, provided that the first and the last bit cell each contain a flux transition.

7.3.2 Long-term average bit cell length

The long-term average bit cell length is the average bit cell length taken over at least 900 000 bit cells. The long-term average bit cell length shall be within ± 4 % of the nominal bit cell length.

7.3.3 Short-term average bit cell length

The short-term average bit cell length is the average bit cell length taken over 126 to 130 bit cells. The short-term average bit cell length shall be within ± 7 % of the long-term average bit cell length.

7.4 Flux transition spacing

In the following tests the results are expressed as the ratio of measurements; the effects of variations in long-term average bit-cell length and short-term average bit-cell length are thereby eliminated.

7.4.1 Instantaneous flux transition spacing

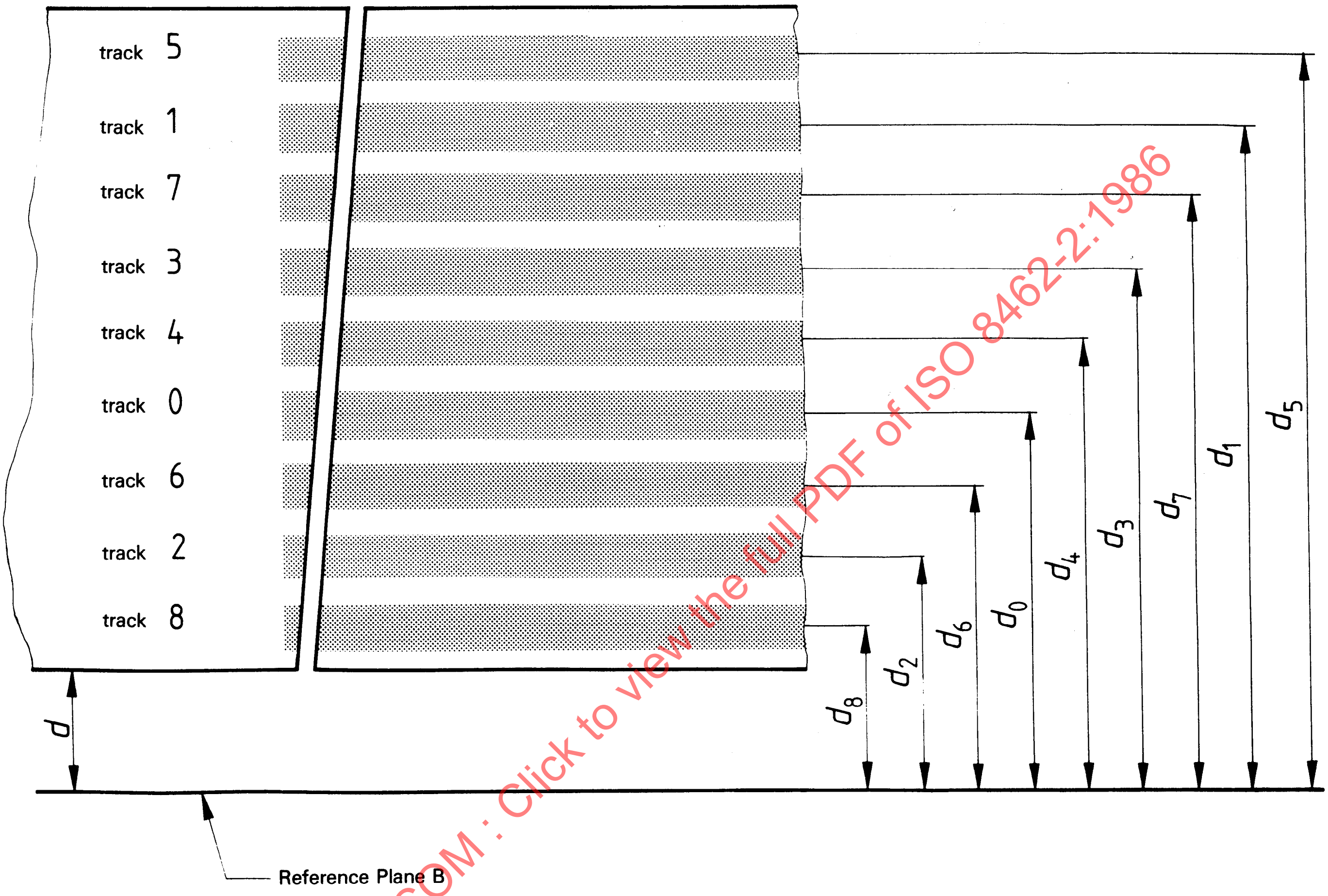
The instantaneous spacing between flux transitions is influenced by the reading and writing processes, the pattern recorded (pulse-crowding effect) and other factors.

Instantaneous spacings between flux transitions shall satisfy the following conditions (see figure 2).

In a sequence of flux transitions defined by the bit pattern 11100111, for example as occurs in the Block Marker (see 13.1.2), the centre flux transition of each group of three ONEs is called a Reference Flux Transition. The spacing between any pair of contiguous ONE flux transitions shall not deviate by more than 35 % from the bit cell length d_1 averaged over the five bit cells between reference flux transitions.

7.4.2 Rate of change of average flux transition spacing

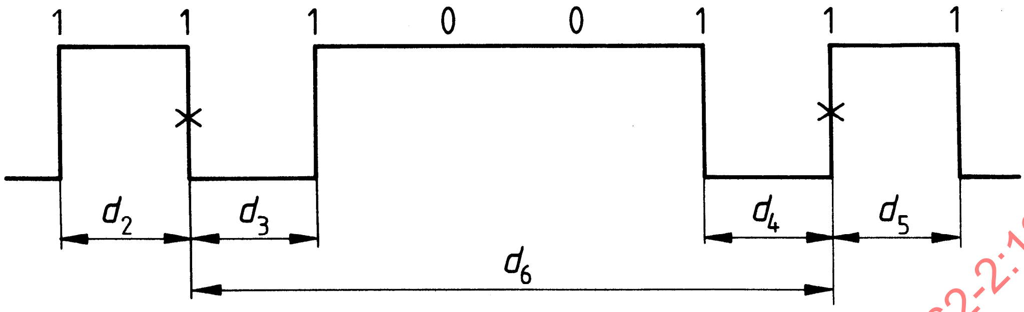
In a sequence of flux transitions defined by the data pattern 10100101 the rate of change of the average flux transition spacing, averaged over four flux transition spacings, shall not exceed 0,002 6 per flux transition spacing, i.e. in the pattern shown in figure 3.



STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

d = 1,773 mm (0.070 in) nominal
d_0 = 4,369 ± 0,107 mm (0.172 0 ± 0.004 2 in)
d_1 = 6,807 ± 0,107 mm (0.268 0 ± 0.004 2 in)
d_2 = 3,150 ± 0,107 mm (0.124 0 ± 0.004 2 in)
d_3 = 5,588 ± 0,107 mm (0.220 0 ± 0.004 2 in)
d_4 = 4,978 ± 0,107 mm (0.196 0 ± 0.004 2 in)
d_5 = 7,417 ± 0,107 mm (0.292 0 ± 0.004 2 in)
d_6 = 3,759 ± 0,107 mm (0.148 0 ± 0.004 2 in)
d_7 = 6,198 ± 0,107 mm (0.244 0 ± 0.004 2 in)
d_8 = 2,540 ± 0,107 mm (0.100 0 ± 0.004 2 in)

Figure 1

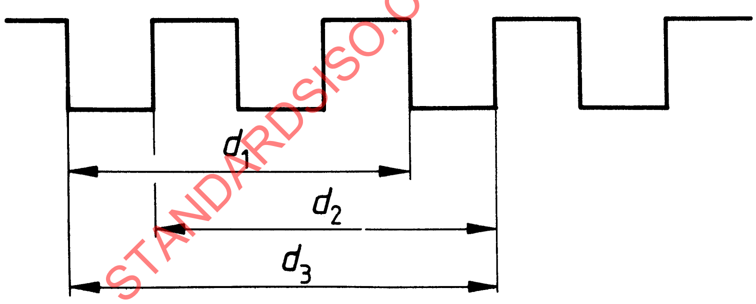


× denotes a reference flux transition

$1{,}35\,d_1 > d_2 > 0{,}65\,d_1$
$1{,}35\,d_1 > d_3 > 0{,}65\,d_1$
$1{,}35\,d_1 > d_4 > 0{,}65\,d_1$
$1{,}35\,d_1 > d_5 > 0{,}65\,d_1$
$d_1 = 0{,}20\,d_6$

Figure 2

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986



$$\frac{\left|\frac{d_1}{4} - \frac{d_2}{4}\right|}{\frac{d_3}{5}} \leqslant 0{,}002\,6$$

Figure 3

7.5 Signal amplitude of a recorded cartridge for data interchange

For the 4-track format the width of the track read shall be 0,508 ± 0,025 mm (0.020 ± 0.001 in) and shall be within the recorded track.

For the 9-track format the track read shall extend over the whole width of the recorded track.

When performing the tests, the output or resultant signal shall be measured on the same pass for both the Standard Amplitude Reference Tape Cartridge and the tape under test (i.e. the read-whilst-write pass or the first forward-read pass) on the same equipment. The signal amplitude shall be measured at a point in the read chain at which the signal is proportional to the rate of change of the flux induced in the head.

After writing, the cartridge shall meet the following requirements.

7.5.1 Average signal amplitude at nominal maximum density

At the nominal maximum density of 394 ftpmm (10 000 ftpi) the average peak-to-peak signal amplitude of any track shall be within + 50 % and −35 % of SRA_{394} (see ISO 8462/1). This averaging shall be made over the central 100 flux transitions of any 120 contiguous flux transitions in a block and over at least 100 blocks.

7.5.2 Minimum signal amplitude

When interchanged, a tape shall not contain in the valid information area any flux transition the base-to-peak signal amplitude of which is less than 25 % of half of SRA_{394} (see ISO 8462/1).

7.5.3 Maximum signal amplitude

The peak-to-peak signal amplitude at 131 ftpmm (3 333 ftpi) shall be less than three times SRA_{394}.

8 Erasure

The tape shall be AC erased.

After erasure any remaining signal amplitudes at, or below, twice the frequency corresponding to the maximum physical recording density shall be less than 3 % of SRA_{394}.

9 Recording offset angle

On any track the angle that a flux transition across the track makes with a line perpendicular to Reference Plane B shall not exceed 9′ of arc.

10 Use of tracks

10.1 4-track format

10.1.1 Each track shall be a data track and shall be written serially.

10.1.2 Tracks shall be recorded in the numerical order of their track numbers, starting with track 0.

10.1.3 Tracks 0 and 2 shall be recorded in the direction from the BOT marker to the EOT marker. Tracks 1 and 3 shall be recorded in the direction from the EOT marker to the BOT marker.

10.1.4 On track 0 a Reference Burst recorded at the maximum nominal recording density of 394 ftpmm (10 000 ftpi) shall be written between the BOT marker and data recorded on track 0. This Reference Burst shall commence not more than 381 mm (15 in) from the BOT marker and extend for a minimum length of 76,2 mm (3 in) and a maximum length of 101,6 mm (4 in) beyond the LP marker.

10.1.5 On tracks 0 and 2 data shall commence not less than 76,2 mm (3 in) and not more than 101,6 mm (4 in) after the LP marker. No data for interchange shall be recorded beyond 914,4 mm (36 in) after the EW marker.

10.1.6 On tracks 1 and 3 data shall commence not less than 25,4 mm (1 in) and not more than 50,8 mm (2 in) after the EW marker.

On track 1 the last Data or File Mark Block written shall end not more than 101,6 mm (4 in) and not less than 2,54 mm (0.1 in) before the LP marker, measured from the centre of the hole.

If Control Blocks are used at the end of tracks [see 13.4.2 b)], they shall be recorded starting at least 2,54 mm (0.1 in) after the LP marker on track 1. A Long Preamble shall be recorded between the last Data or File Mark Block and the Control Block.

On track 3 the last block written shall end not more than 685,8 mm (27 in) after the LP marker.

10.2 9-track format

10.2.1 Each track shall be a data track and shall be written serially.

10.2.2 Tracks shall be recorded in the numerical order of their track numbers, starting with track 0.

10.2.3 Tracks 0, 2, 4, 6 and 8 shall be recorded in the direction from the BOT marker to the EOT marker. Tracks 1, 3, 5 and 7 shall be recorded in the direction from the EOT marker to the BOT marker.

10.2.4 On track 0 a Reference Burst recorded at the maximum nominal recording density of 394 ftpmm (10 000 ftpi) shall be written between the BOT marker and data recorded on track 0. This Reference Burst shall commence not more than 381 mm (15 in) from the BOT marker and extend for a minimum length of 76,2 mm (3 in) and a maximum length of 101,6 mm (4 in) beyond the LP marker.

10.2.5 On tracks 0, 2, 4, 6 and 8 data shall commence not less than 76,2 mm (3 in) and not more than 101,6 mm (4 in) after the LP marker. No data for interchange shall be recorded beyond 914,4 mm (36 in) after the EW marker.

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

10.2.6 On tracks 1, 3, 5 and 7 data shall commence not less than 25,4 mm (1 in) and not more than 50,8 mm (2 in) after the EW marker.

On tracks 1 and 7 the last Data or File Mark Block written shall end not more than 101,6 mm (4 in) and not less than 2,54 mm (0.1 in) before the LP marker, measured from the centre of the hole.

If Control Blocks are used at the end of tracks [see 13.4.2 b)], they shall be recorded starting at least 2,54 mm (0.1 in) after the LP marker on tracks 1 and 7. A Long Preamble shall be recorded between the last Data or File Mark Block and the control Block.

On tracks 3 and 5 the last block written shall end not more than 685,8 mm (27 in) after the LP marker.

10.3 Summary of requirements for use of tracks and Reference Burst

Figure 4 summarizes the requirements specified in 10.1 and 10.2.

11 Coded representation of the data

11.1 General

The information intended for data interchange shall be coded and interpreted according to the relevant standards for the coding of information.

11.2 Coding methods

11.2.1 When required by the coding method, the coded representations to be recorded in the Data Field of a Data Block shall be regarded as an ordered sequence of 8-bit bytes.

Within each byte the bit positions shall be identified by B8 to B1. The high-order bit shall be represented in position B8 and the low-order bit in position B1.

When the data is encoded according to an 8-bit code, the binary weights of the bit positions shall be as follows :

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

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

Dimensions in millimetres

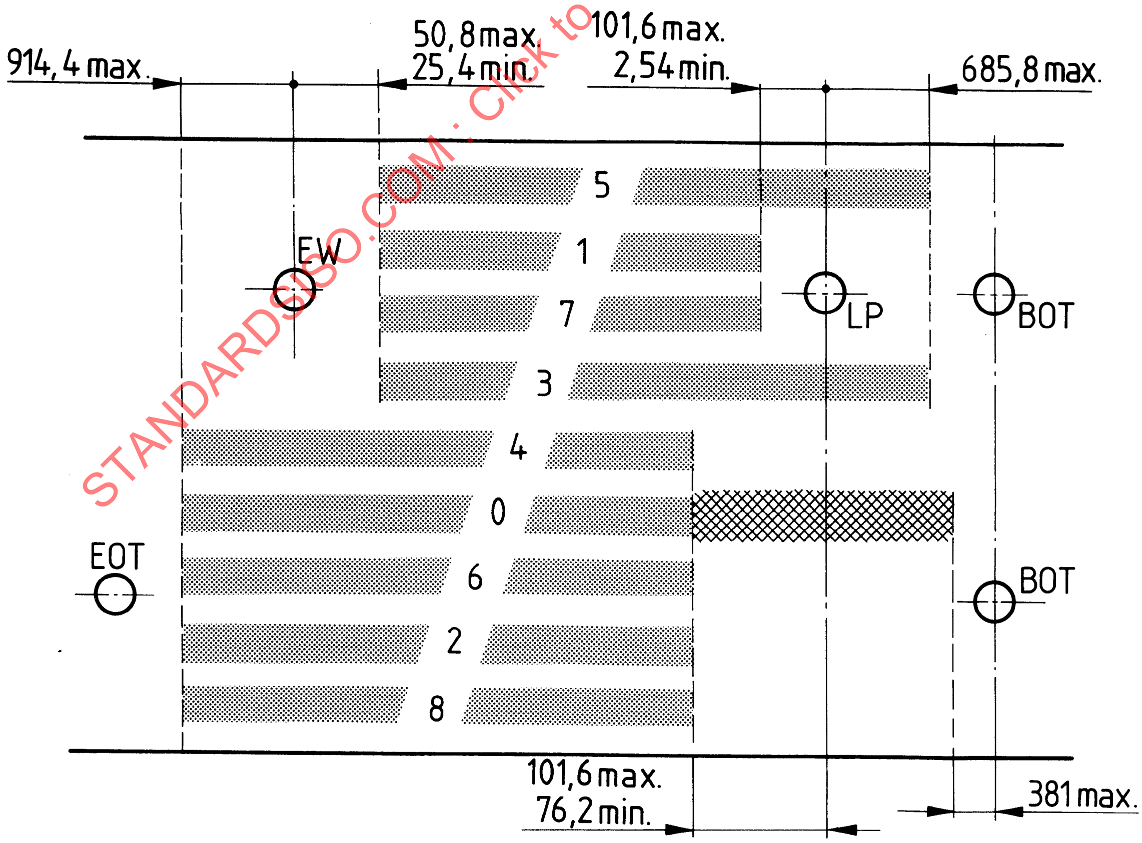


Figure 4

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

11.2.2 When required by the coding method, the coded representations to be recorded in the Data Field of a Data Block shall be regarded as an ordered sequence of bit positions, each containing a bit.

For the purpose of this part of ISO 8462 the sequence of bits shall be regarded as an ordered sequence of 8-bit bytes. Within a byte successive bits of the coded representation shall be allocated to bit positions B8 to B1 in that order.

12 Recording of coded characters on the tape

Prior to recording on the tape, the coded representations (see clause 11) shall be transformed as described below, except for the following fields :

- Preamble (13.1.1);
- Block Marker (13.1.2);
- Postamble (13.1.6);
- The Data field of File Mark Blocks (13.2.1).

12.1 Each 8-bit byte shall be split into two groups of four consecutive bits, one group containing the four most significant bits (B8 to B5) and one group containing the four least significant bits (B4 to B1).

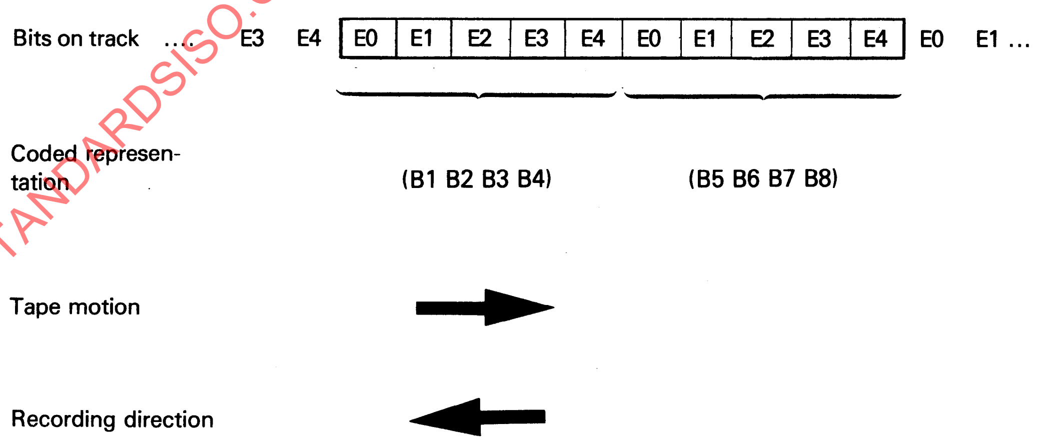
12.2 Each 4-bit group shall then be transformed into a 5-bit group in accordance with table 1.

Table 1

B8 B4	B7 B3	B6 B2	B5 B1	E4	E3	E2	E1	E0
0	0	0	0	1	1	0	0	1
0	0	0	1	1	1	0	1	1
0	0	1	0	1	0	0	1	0
0	0	1	1	1	0	0	1	1
0	1	0	0	1	1	1	0	1
0	1	0	1	1	0	1	0	1
0	1	1	0	1	0	1	1	0
0	1	1	1	1	0	1	1	1
1	0	0	0	1	1	0	1	0
1	0	0	1	0	1	0	0	1
1	0	1	0	0	1	0	1	0
1	0	1	1	0	1	0	1	1
1	1	0	0	1	1	1	1	0
1	1	0	1	0	1	1	0	1
1	1	1	0	0	1	1	1	0
1	1	1	1	0	1	1	1	1

Thus each 8-bit byte shall be recorded as a 10-bit byte on the tape.

12.3 For each 8-bit byte of the coded representation the most significant 4-bit group is deemed to be recorded first. As a consequence the 5-bit group corresponding to B8 to B5 shall be recorded first starting with E4 and the 5-bit group corresponding to B4 to B1 shall follow.



STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986

13 Track format

Each track may contain Data Blocks and File Mark Blocks. Control Blocks may be present as described in 13.4.

13.1 Data Block

A Data Block shall comprise the following fields :

Data Block					
Preamble	Block Marker	Data	Block Address	CRC	Postamble

13.1.1 Preamble

This field shall contain ONE bits, i.e. flux transitions recorded at the maximum nominal recording density of 394 ftpmm.

The Preamble of the first block of each track shall contain not less than 15 000 and not more than 30 000 ONEs. It is called a Long Preamble.

The Preamble of each of the following blocks of a track shall contain not less than 120 and not more than 300 ONEs. It is called a Normal Preamble.

However, a block shall contain a Preamble of not less than 3 500 and not more than 7 000 ONEs if the preceding block has an Elongated Postamble (see 13.1.6). Its recording shall begin not less than 3 000 and not more than 3 500 ONEs from the second CRC byte (see 13.1.5) of the preceding block. Such a Preamble is called an Elongated Preamble.

If Control Blocks are used at the end of tracks [see 13.4.2 b)], an Elongated Preamble shall be recorded between the last Data or File Mark Block on all tracks except track 1 and track 7. On track 1 and track 7 a Long Preamble shall be recorded between the last Data or File Mark Block and the Control Block.

13.1.2 Block Marker

This field identifies the start of the data. It consists of a fixed bit pattern

1 1 1 1 1 0 0 1 1 1

13.1.3 Data

This field contains the data of the block. It comprises 512 bytes.

13.1.4 Block Address

The Block Address shall comprise four bytes forming the following fields :

Block Address			
Track number	Block type	Block number	
1st byte	2nd byte	3rd byte	4th byte

13.1.4.1 Track number

This byte shall specify the track number as follows :

(00) shall indicate track 0
(01) shall indicate track 1
(02) shall indicate track 2
(03) shall indicate track 3
(04) shall indicate track 4
(05) shall indicate track 5
(06) shall indicate track 6
(07) shall indicate track 7
(08) shall indicate track 8

13.1.4.2 Block Type

This 4-bit field shall indicate whether the block is a Data Block, a File Mark Block or a Control Block.

0000 shall mean that the block is a Data Block or a File Mark Block (see 13.2).

0001 shall mean that the block is a Control Block (see 13.3 and 13.4).

Other bit combinations are reserved for future standardization and shall not be used.

13.1.4.3 Block Number

This field comprises the 20 bits from the 5th bit of the 2nd byte to the last bit of the 4th byte. It specifies in binary notation the block number from 1 to 1 048 575 by giving the weights 524 288, 262 144, 131 072, 65 536, 32 768, ..., 64, 32, 16, 8, 4, 2, 1 to these 20 bits. The most significant bit is the 5th bit of the second byte, the least significant bit is the last bit of the 4th byte.

13.1.4.4 GCR handling of Block Address

When recording the tape in GCR mode, the four bits of the Block Type and the four most significant bits of the Block Number shall be considered as one 8-bit byte.

13.1.5 CRC (Cyclic Redundancy Check)

The 16 bits following the Block Address of a Data Block shall be a Cyclic Redundancy Check character. This 16-bit character shall be written in each block following the Block Address and immediately preceding the postamble, the most significant bit being recorded first (see 12.3). The polynomial generating the CRC shall be

$$G(x) = x^{16} + x^{12} + x^{5} + 1$$

The CRC generation shall start with the most significant bit of the first data byte and end with the least significant bit of the Block Number field of the Block Address.

Prior to operation all positions of the shift-register shall be set to ONE.

STANDARDSISO.COM : Click to view the full PDF of ISO 8462-2:1986