3561-76 4851903 0026341 4

F-54-05

# INTERNATIONAL STANDARD ISO 3561

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

## Information processing — Interchangeable magnetic six-disk pack — Track format

*Traitement de l'information — Chargeur interchangeable à six disques magnétiques — Schéma de piste*

**First edition — 1976-06-15**

UDC 681.327.63

Ref. No. ISO 3561-1976 (E)

**Descriptors** : data processing, magnetic storage, disk packs, recording tracks, specifications, dimensions.



Price based on 9 pages

295825

COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

**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 3561 was drawn up by Technical Committee ISO/TC 97, *Computers and information processing*, and was circulated to the Member Bodies in March 1975.

It has been approved by the Member Bodies of the following countries :

| | | |
|---|---|---|
| Belgium | Japan | Turkey |
| Czechoslovakia | New Zealand | United Kingdom |
| France | Poland | U.S.S.R. |
| Germany | Romania | Yugoslavia |
| Hungary | South Africa, Rep. of | |
| Italy | Switzerland | |

No Member Body expressed disapproval of the document.

© **International Organization for Standardization, 1976** •

Printed in Switzerland

COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026343 8

# Information processing — Interchangeable magnetic six-disk pack — Track format

## 1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the track format characteristics for the six-disk pack to be used for data interchange (see ISO 2864). The 7-bit coded character set specified in ISO 646 has been adopted, though, by agreement between the interchange parties, the 7-bit or 8-bit extensions specified in ISO 2022 may be used.

## 2 GENERAL REQUIREMENTS

### 2.1 Rotation speed and clock period

The total tolerance on rotation speed and clock period shall not exceed ± 2,4 % (see annex A).

### 2.2 Mode of recording

The mode of recording shall be double frequency where the start of every bit cell is a clock transition. A ONE is represented by a transition between two clock transitions.

At the nominal rotation speed of 2 400 rev/min, the all-ZERO pattern consists of $1,25 \times 10^6$ transitions per second nominally, and an all-ONES pattern consists of $2,50 \times 10^6$ transitions per second nominally.

### 2.3 Index

The index is a point which defines the beginning and the end of a track. Its location is specified as a true position in 5.1.2.5 of ISO 2864.

### 2.4 Track capacity

The capacity of a track is $31\,250 {}^{+768}_{-733}$ bits.

### 2,5 Track layout

Figure 1 shows the general track layout (see also annex B).

## 3 DEFINITIONS

**3.1 sector :** A track is divided into sectors. A sector may be further subdivided.

**3.2 home address :** The home address contains information which defines the physical location and characteristics of a track.

**3.3 count :** The count contains information which defines the physical location and characteristics of a sector.

**3.4 key :** Part of a sector in which information is recorded; its use is optional.

**3.5 data block :** Part of a sector in which information is recorded.

**3.6 gap :** The space between the various divisions of a track.

**3.7 byte (or octet) :** Eight serial bits, identified B8 to B1 with B8 as the most significant and recorded first.

**3.8 hexadecimal notation :**

$(00)_{16}$ denotes a byte (or octet) with B8 to B1 = 00000000

$(FF)_{16}$ denotes a byte (or octet) with B8 to B1 = 11111111

$(OE)_{16}$ denotes a byte (or octet) with B8 to B1 = 00001110

$(CC)_{16}$ denotes a byte (or octet) with B8 to B1 = 11001100

## 4 DETAILED DESCRIPTION OF TRACK LAYOUT

### 4.1 Sector 0

The first sector following index is unique in that it contains a home address and will therefore be described separately.

#### 4.1.1 *Index gap* (see figure 2)

This is a gap preceding the home address and shall be written so that the start of the home address is located within 30 ± 7 bytes from index. It is also a requirement that when this gap is initially written, 30 bytes of $(00)_{16}$ shall precede the home address. The first 14 bytes of $(00)_{16}$ may, as a result of interchange, be unreadable (see annex C).

#### 4.1.2 *Home address* (see figure 2)

The home address consists of 14 bytes as follows :

**4.1.2.1** Synchronization (6 bytes) as follows :

$(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(FF)_{16}$ $(OE)_{16}$

**4.1.2.2** F — Flag (1 byte). This is used to indicate defective and alternative tracks. The significance of the bits in this byte is as follows :

The first two bits (B8 and B7) are always ZERO. B6 to B3 are reserved for future standardization and are all ZERO.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

B2 B1 = 00 indicates good original track.

B2 B1 = 01 indicates good alternative track.

B2 B1 = 10 indicates defective track, alternative has been allocated.

B2 B1 = 11 indicates defective track, no alternative has been allocated.

**4.1.2.3** C – Cylinder (2 bytes). These specify in binary the address of the cylinder. The first byte is always ZERO. The second byte can have any value in the range 0 to 202.

**4.1.2.4** H – Head (2 bytes). These specify in binary the address of a track within a cylinder. The first byte is always ZERO. The second byte can have any value in the range 0 to 9.

**4.1.2.5** CRC – Cyclic redundancy check (2 bytes). These consist of the ONES complement of the remainder obtained after dividing the previous five information bytes by the code polynomial $(1 + x^{16})$. They can be used for error checking when reading.

**4.1.2.6** The home address ends with one byte $(CC)_{16}$.

**4.1.3** *Home address gap*

An 11-byte gap of $(00)_{16}$ is initially recorded between the end of the home address and the start of the count. The content of this gap may subsequently become undefined because of repeated writing operations.

**4.1.4** *Count of Sector 0* (see figure 3)

The count consists of 18 bytes as follows :

**4.1.4.1** Synchronization (6 bytes) as follows :

$(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(FF)_{16}$ $(OE)_{16}$

**4.1.4.2** F – Flag (1 byte). This is used for certain control and checking operations and is also used to indicate defective and alternative tracks. The significance of the bits in this byte is as follows :

B8 – This is ZERO for Sector 0. See 4.2.1 for the use of this bit in other sectors.

B7 – This is ZERO for Sector 0. See 4.2.1 for the use of this bit in other sectors.

B6 to B3 are reserved for future standardization and are all ZERO.

B2 and B1 – The state of these bits must always be the same as those in the home address (see 4.1.2.2).

**4.1.4.3** C and H – Cylinder and Head (4 bytes). These bytes are identical to those in the home address except when appearing on defective or alternative tracks. On a defective track, C and H contain cylinder and head number of the alternative track which replaces it. On an alternative track, C and H contain cylinder and head number of the defective track which it replaces.

**4.1.4.4** S – Sector (1 byte). It is used to identify sectors on the track.

**4.1.4.5** KL – Key length (1 byte). This specifies in binary the number of information bytes in the key.

**4.1.4.6** DL – Data length (2 bytes). These specifiy in binary the number of information bytes in the data block.

**4.1.4.7** CRC – Cyclic redundancy check (2 bytes). These consist of the ONES complement of the remainder obtained after dividing the previous nine information bytes by the code polynomial $(1 + x^{16})$. They can be used for error checking when reading.

**4.1.4.8** The count ends with one byte $(CC)_{16}$.

**4.1.5** *Count gap*

An 11-byte gap consisting of 9 bytes of $(FF)_{16}$ followed by 2 bytes of $(00)_{16}$ is initially recorded between the end of the count and the start of the key. The contents of this gap may subsequently become undefined because of repeated writing operations.

**4.1.6** *Key* (see figure 4)

The key consists of (KL + 9) bytes, where KL is the number of information bytes (see 4.1.4.5).

If KL in the preceding count is ZERO, the key and the following gap (4.1.7) are omitted and the count is followed by the data block (see 4.1.8). Otherwise the key is as follows :

**4.1.6.1** Synchronization (6 bytes) as follows :

$(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(FF)_{16}$ $(OE)_{16}$

**4.1.6.2** Information – This consists of a number of information bytes as specified in the KL portion of the preceding count. The data in these bytes shall be recorded in the 7-bit coded character set in accordance with ISO 646. However, by agreement between the interchange parties, data in some other 7-bit or 8-bit code structured in accordance with ISO 2022 may be recorded.

A 7-bit coded character shall be recorded so that the bits b7 to b1 of the coded character appear in positions B7 to B1 respectively (see 3.7); B8 shall be always ZERO. An 8-bit coded character shall be recorded so that bits a8 to a1 of the coded character are recorded in positions B8 to B1 respectively.

**4.1.6.3** CRC – Cyclic redundancy check (2 bytes). These consist of the ONES complement of the remainder obtained after dividing the previous information bytes by the code polynomial $(1 + x^{16})$. They can be used for error checking when reading.

**4.1.6.4** The key ends with one byte $(CC)_{16}$.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

#### 4.1.7 *Key gap*

An 11-byte gap consisting of 9 bytes of $(FF)_{16}$ followed by 2 bytes of $(00)_{16}$ is initially recorded between the end of the key and the start of the data block. The contents of this gap may subsequently become undefined because of repeated writing operations.

#### 4.1.8 *Data block* (see figure 5)

The data block consists of (DL + 9) bytes, where DL is the number of information bytes (see 4.1.4.6).

If DL in the preceding count is ZERO, the data block does appear in rudimentary form.

The data block is as follows :

**4.1.8.1** Synchronization (6 bytes) as follows :

$(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(FF)_{16}$ $(OE)_{16}$

**4.1.8.2** Information — This consists of a number of information bytes as specified in the DL portion of the preceding count. When this is ZERO, one byte $(00)_{16}$ is recorded. The data in these bytes shall be recorded in the 7-bit coded character set in accordance with ISO 646. However, by agreement between the interchange parties, data in some other 7-bit or 8-bit code structured in accordance with ISO 2022 may be recorded.

A 7-bit coded character shall be recorded so that bits b7 to b1 of the coded character appear in positions B7 to B1 respectively (see 3.7); B8 shall always be ZERO. An 8-bit coded character shall be recorded so that bits a8 to a1 of the coded character are recorded in positions B8 to B1 respectively.

**4.1.8.3** CRC — Cyclic redundancy check (2 bytes). These consist of the ONES complement of the remainder obtained after dividing the previous information bytes by the code polynomial $(1 + x^{16})$. They can be used for error checking when reading. If DL = 0 these two bytes may be missing.

**4.1.8.4** The data block ends with one byte $(CC)_{16}$. If DL = 0 this byte may also be missing.

#### 4.1.9 *Data block gap*

The gap between the end of the data block and the start of the next sector is initially recorded with $(FF)_{16}$.

Its initial length is :

$$21 + \left(\frac{537}{512} - 1\right) \cdot (KL + DL) \text{ bytes}$$

Any fraction is truncated.

KL — is the number of information bytes in the key.

DL — is the number of information bytes in the data block.

The contents of this gap may subsequently become undefined because of repeated writing operations.

The length of the gap may vary due to repeated writing operations; however, a minimum of 21 bytes shall always be present.

### 4.2 Subsequent sectors

#### 4.2.1 *Count* (see figure 6)

The count of subsequent sectors consists of 20 bytes as follows :

**4.2.1.1** Synchronization (8 bytes) as follows :

$(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(00)_{16}$ $(FF)_{16}$ $(FF)^{*}_{16}$ $(FF)^{*}_{16}$ $(OE)_{16}$

For $(FF)^{*}_{16}$ the clock transitions preceding the first five data transitions are missing.

**4.2.1.2** F — Flag (1 byte). This is used in each count for certain control and checking operations and can be used to indicate defective and alternative tracks. The significance of the bits in this byte are as follows :

B8 = 1 for the first sector following the Sector 0 and alternate sectors thereafter, and

B8 = 0 for the other sectors.

B7 = 1 indicates that the sector is an overflowing sector, i.e. the information in the associated data block is continued in another sector. Otherwise this bit must be 0.

B6 to B3 are reserved for future standardization and are all ZERO.

B2 to B1 : see count of Sector 0 (4.1.4).

**4.2.1.3** The remainder of the count is as described in 4.1.4.3 to 4.1.4.8.

#### 4.2.2 *Remainder of sector*

The remainder of the sector is as described in 4.1.5 to 4.1.9 except for the last sector.

### 4.3 Last sector

#### 4.3.1 *Count*

See 4.2.1.

#### 4.3.2 *Remainder of sector*

The remainder of the last sector except for the last gap is described in 4.1.5 to 4.1.8.

#### 4.3.3 *Last sector gap*

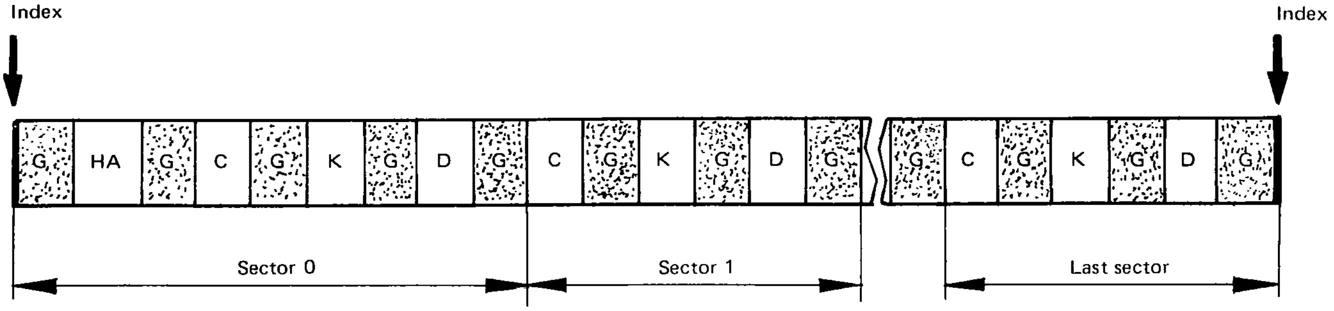
The gap following the last sector will be initially recorded as $(FF)_{16}$ to within ± 7 bytes of index.

It is also a requirement that the end of the last sector be located 20 ± 7 bytes before index when the track is recorded to the maximum capacity (see annex B) under worst-case conditions of disk speed and clock period (see also annex C).



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026346 3




G — Gap
HA — Home address
C — Count
K — Key
D — Data block

FIGURE 1 — **General track layout**

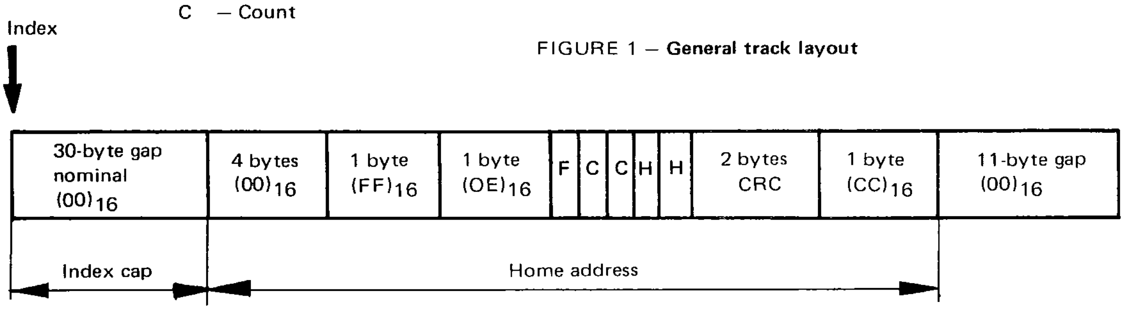



FIGURE 2 — **Home address (Sector 0)**

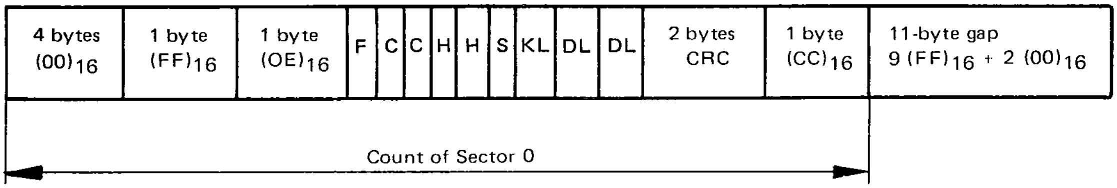



FIGURE 3 — **Count (Sector 0)**

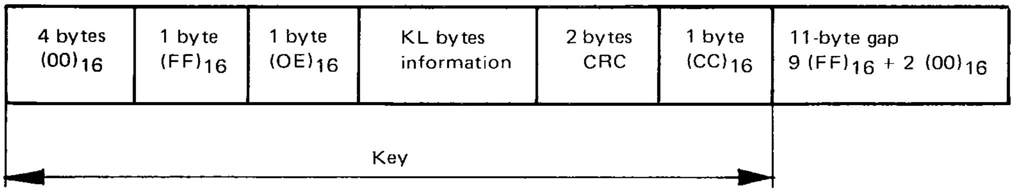



FIGURE 4 — **Key**

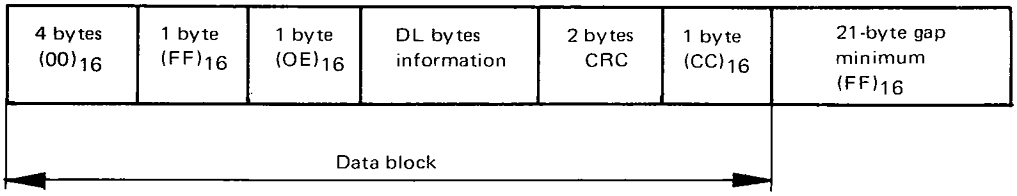



FIGURE 5 — **Data block**

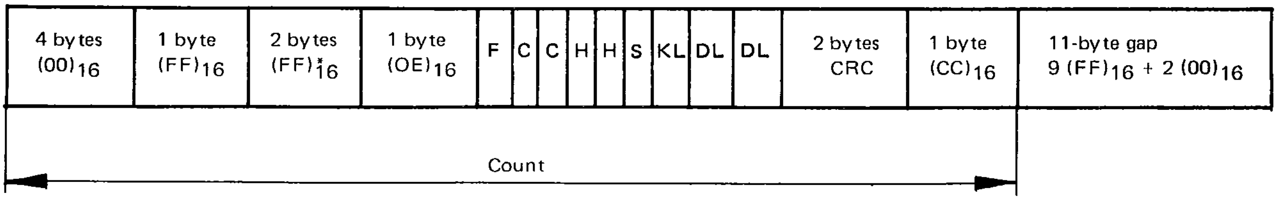



FIGURE 6 — **Count (other than Sector 0)**



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026347 5

ANNEX A
(not part of the standard)

## ROTATION SPEED AND CLOCK PERIOD TOLERANCE

If the nominal record length is $L$, the minimum record length is $L_1$, the maximum record length is $L_2$ and the tolerance is $x$ :

From current practice

$$\frac{L_2}{L_1} = 1{,}049$$

and

$$L_1 = L - x$$

$$L_2 = L + x$$

therefore

$$\frac{L + x}{L - x} = 1{,}049$$

$$L + x = 1{,}049\, L - 1{,}049\, x$$

and solving for $x$

$$x = \frac{0{,}049}{2{,}049} L$$

$$x = 2{,}39\ \%\ \text{of}\ L$$

Hence the figure 2,4 % is used.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026348 7

ANNEX B
(not part of the standard)

## TRACK DATA CAPACITY

The track capacity under worst-case conditions is 3 814 bytes.

The overhead of 82 bytes due to index gap, home address, gap after the home address, and end of track gap are deducted from the track capacity to arrive at a capacity of 3 732 bytes. In order to make the formulae below applicable to all sectors, a figure of 3 734 bytes is used, accounting for the fact that Sector 0 synchronization has no $(FF)^*_{16}$ bytes.

The number of bytes required for the sectors is given by the following formulae.

| Number of bytes for each sector | | | |
|---|---|---|---|
| Sectors (except for last) | | Last sector | |
| without key | with key | without key | with key |
| $61 + \frac{537\ DL}{512}$ | $81 + \frac{537\ (KL + DL)}{512}$ | 40 + DL | 60 + KL + DL |

The term 61 of the formula consists of :

- 21 bytes minimum gap which is used for write/read switching
- 20 bytes for the count area (see 4.2.1)
- 11 bytes gap between count (or key) and data block (see 4.1.7 or 4.1.5)
- 6 bytes synchronizing pattern in front of the data block (see 4.1.8.1)
- 2 bytes CRC of the data block (see 4.1.8.3)
- 1 byte $(CC)_{16}$ at the end of the data block (see 4.1.8.4)

The term 81 results as follows :

- 61 bytes as above
- 11 bytes gap between count and key (see 4.1.5)
- 6 bytes synchronizing pattern in front of the key (see 4.1.6.1)
- 2 bytes CRC of the key (see 4.1.6.3)
- 1 byte $(CC)_{16}$ at the end of the key (see 4.1.6.4)

The terms 40 and 60 are derived from the terms 61 and 81 as above minus the 21 bytes of the write/read switching gap.

The sum of the number of bytes for all sectors on a track shall not exceed 3 734 bytes.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026349 9

ANNEX C
(not part of the standard)

## INDEX NOTCH DETECTION TOLERANCES

A tolerance is given for the location of the start of the home address with respect to index to allow for equipment adjustment of the index notch detection system.

FIGURE 7 shows the effect, on the index gap and the gap after the last sector, of the tolerance on index notch detection under worst-case conditions of disk speed and clock period with maximum data capacity.

The following cases are covered :

A. This shows the location of the start of the home address and the end of the last sector with respect to index when the index notch is detected at its nominal position.

B. As case A but with the index notch detected early.

C. As case A but with the index notch detected late.

D. This shows a track which was formatted as in case B being read by equipment which detects the index notch early. For this equipment the index gap is shortened to 16 bytes while the gap after the last sector is increased to 41 bytes and contains $(00)_{16}$ in the last 14 bytes.

E. This shows a track which was formatted as in case C being read by equipment which detects the index notch early. For this equipment the index gap is lengthened to 44 bytes and contains $(FF)_{16}$ in the first 14 bytes. The gap after the last sector is shortened to 13 bytes.

In the above only the extreme cases are shown; intermediate values of the tolerance on index notch detection result in a situation where the first 14 bytes, read after the index notch has been detected, cannot be guaranteed. It is therefore recommended that these 14 bytes should be treated as undefined.

A further case is included which shows the conditions under which a minimum length gap after the last sector is written.

F. This shows a track which was partially formatted as in case C having the format completed, under worst-case conditions of disk speed and clock period with maximum data capacity, by equipment which detects the index notch early. The index gap is lengthened to 44 bytes leaving only 13 bytes after the last sector before the index notch is detected.

The 14 $(FF)_{16}$ bytes in the start of the index gap remain from the previous formatting operation.

It should be noted that in all the above cases the minimum gap between the end of the last sector and the start of the home address is 57 bytes.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

3561-76 4851903 0026350 5

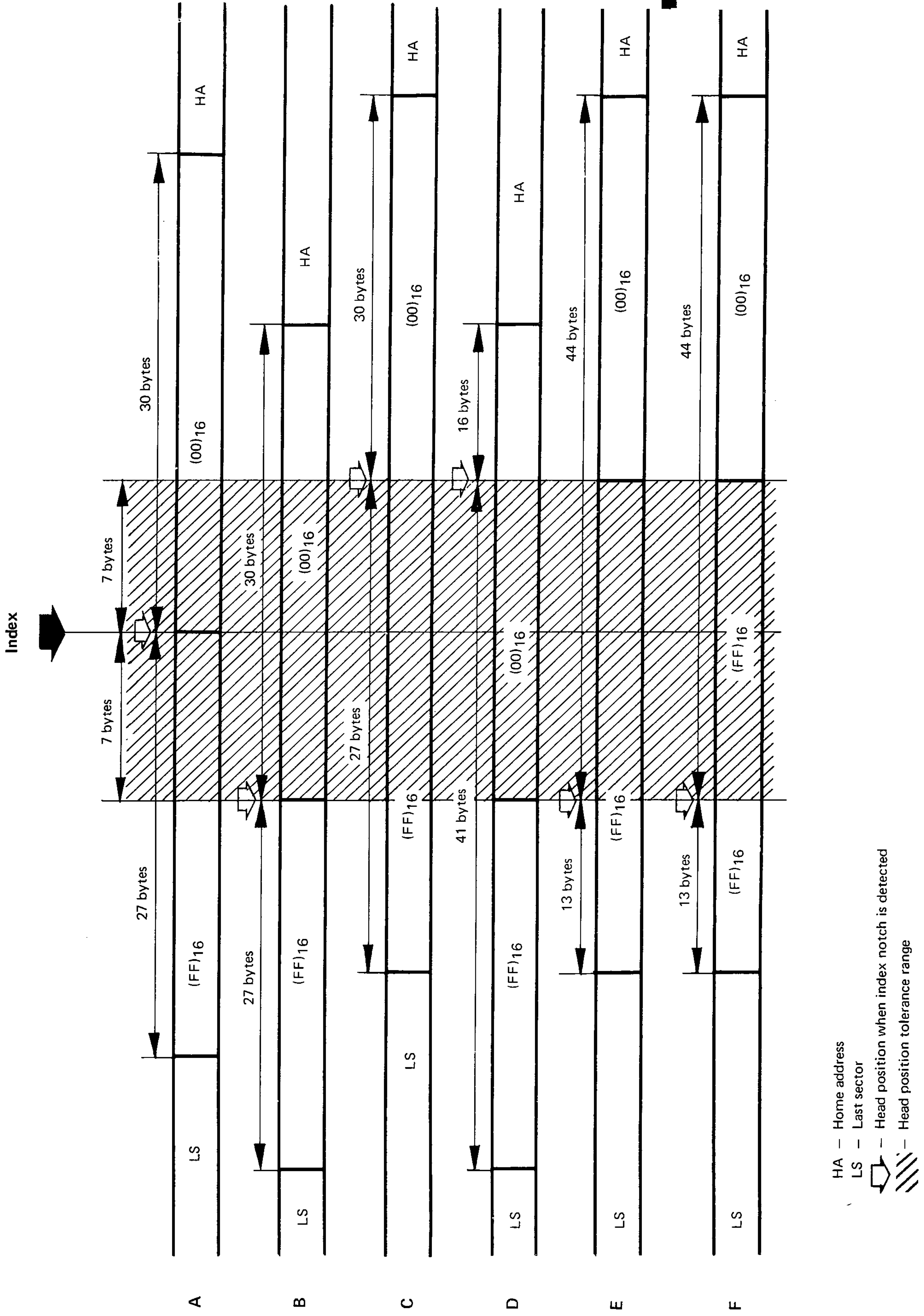



FIGURE 7 – Positions of last sector home address and head relative to index



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000

ANNEX D
(not part of the standard)

## FACTORS AFFECTING DATA INTERCHANGE

This annex provides some guidelines on the use of the format for data interchange.

### D.1 SYNCHRONIZATION BYTES

These are bytes at the start of the home address, count, key, and data block; their purpose is to enable equipment reading the information on the track to identify the start of the above areas. The synchronization bytes at the start of the count of all sectors, other than Sector 0, are special in that they contain a unique pattern of flux reversals which would not normally be encountered elsewhere on the track. This enables equipment reading the information on the track to locate the start of such a sector without reference to index. The synchronization bytes of the home address, Sector 0 count, keys, and data blocks are not special in this way. The home address and Sector 0 count are located from the index, and the keys and the data blocks are located from the preceding counts.

### D.2 UNDEFINED GAP CONTENTS

If information that lies within a track is updated, then at the point at which writing is started and terminated the information may be corrupted. Writing must be started and terminated such that the home address, counts, keys and data blocks remain as defined in the body of this document. To allow for flexibility in equipment design and to allow for disk speed tolerances, the point of switching from reading to writing and vice versa has not been precisely defined. This means that after a number of update operations a number of bytes in the gap may be corrupted and for example an $(FF)^{*}_{16}$ pattern may be generated. However, the gaps are initially defined in such a way that the chance of a complete set of count synchronization bytes being generated is negligible.



COPYRIGHT 2000 International Organization For Standardization
Information Handling Services, 2000