INTERNATIONAL STANDARD

ISO/IEC 7811-6

First edition
1996-04-15

Identification cards — Recording technique —

Part 6:
Magnetic stripe — High coercivity

Carte d'identification — Technique d'enregistrement —
Partie 6: Piste magnétique à haute coercivité

Reference number
ISO/IEC 7811-6:1996(E)

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development on International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75% of the national bodies casting a vote.

International Standard ISO/IEC 7811-6 was prepared by Joint Technical Committee ISO/IEC JTC 1 *Information technology*, Subcommittee SC 17, *Identification cards and related devices.*

Annexes A to C form an integral part of this part of ISO/IEC 7811. Annex D and E is for information only.

Introduction

ISO/IEC 7811 is one of a series of standards describing the characteristics of identification cards as defined in clause 4 and the use of such cards for international interchange.

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Identification cards - Recording technique -

Part 6:
Magnetic stripe - High coercivity

1 Scope

This part of ISO/IEC 7811 specifies characteristics for a high coercivity magnetic stripe (including any protective overlay) on an identification card, the encoding technique and coded character sets.

Coercivity influences many of the quantities specified in this part of ISO/IEC 7811 but is not itself specified. The main characteristic of the high coercivity magnetic stripe is its improved resistance to erasure. This is achieved with minimal probability of damage to other magnetic stripes by contact while retaining read compatibility with magnetic stripes as defined in ISO/IEC 7811-2.

For the testing of these card requirements refer to ISO/IEC 10373.

This part of ISO/IEC 7811 specifies the requirements for cards used for identification. It takes into consideration both human and machine aspects and states minimum requirements.

2 Conformance

An identification card is in conformance with this part of ISO/IEC 7811 if it meets all mandatory requirements specified herein.

A prerequisite for conformance with this part of ISO/IEC 7811 is conformance to ISO/IEC 7810.

NOTE 1 - Numeric values in the SI and/or Imperial measurement system in this part of ISO/IEC 7811 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.

[1] Currently under revision.

3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 7811. At the time of publication the editions indicated were valid. All standards are subject to revision and parties to agreements based on this part of ISO/IEC 7811 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 4287-1:1984[1] - *Surface roughness - Terminology - Part 1: Surface and its parameters.*

ISO/IEC 7810:1995, *Identification cards - Physical characteristics.*

ISO/IEC 7811-2:1995, *Identification cards - Recording technique - Part 2: Magnetic stripe.*

ISO/IEC 7811-4:1995, *Identification cards - Recording technique - Part 4: Location of read-only magnetic tracks - Tracks 1 and 2.*

ISO/IEC 7811-5:1995, *Identification cards - Recording technique - Part 5: Location of read-write magnetic track - Track 3.*

ISO/IEC 10373:1993, *Identification cards - Test methods.*

4 Definitions

For the purposes of this part of ISO/IEC 7811, the definitions of "identification card" given in ISO/IEC 7810 and the following definitions apply.

4.1 primary standard: The primary standard is a set of reference cards which represents the values of U_R and I_R. The values and cards are established and maintained by Physikalisch-Technische Bundesanstalt (PTB).

4.2 secondary standard: The calibration system which supports this International Standard supplies secondary standards, designated RM7811-6, from which tertiary standards may be calibrated and supplied. The relationship between these secondary references and the primary standard is defined in the calibration certificate supplied with each card.

NOTE 2 - Secondary reference cards can be ordered from Physikalisch-Technische Bundesanstalt (PTB), Lab. 1.41 - Bundesallee 100, D-38116 Braunschweig, Germany. The source of secondary standards will be maintained for at least 10 years from the initial release of this part of ISO/IEC 7811.

4.3 unused un-encoded card: A card possessing all the components required for its intended purpose, which has not been subjected to any personalization or testing operation. The card has been stored in a clean environment without more than 48 hour exposure to day-light at temperatures between 5 °C to 30 °C and humidity between 10% to 90% without experiencing thermal shock.

4.4 unused encoded card: An unused, un-encoded card according to paragraph 4.3 which has only been encoded with all the data required for its intended purpose (e.g. magnetic encoding, embossing, electronic encoding). Any subsequent verification of encoded data is part of the encoding process and shall not alter encoded characteristics of the card. The environmental conditions in which the unused encoded card experiences are to be the same as for unused un-encoded card.

4.5 returned card: An embossed and/or encoded card after it has been issued to the card holder and returned for the purpose of testing.

4.6 flux transition: The location of the maximum of the magnetic flux component normal to the surface of the magnetic stripe.

4.7 reference current (I_R): The minimum recorded current amplitude which causes on the reference card, under the given test conditions, a readback voltage amplitude equal to 80% of the reference signal amplitude U_R, (see figure 5) at a density of 8 ft/mm (ft/mm = flux transitions per millimetre) [200 ftpi (ftpi = flux transitions per inch)].

4.8 demagnetisation current (I_d): The D C current value which reduces the average signal amplitude to 80% of the reference signal amplitude (U_R) on a reference card which has been encoded at a density of 20 ft/mm (500 ftpi) at a current of I_{min}.

4.9 reference flux level (F_R): The flux level in the test head that corresponds to the reference current I_R.

4.10 test recording currents: These values define two recording currents:

I_{min} = Recording current corresponding to 2,8 F_R

I_{max} = Recording current corresponding to 3,5 F_R

4.11 individual signal amplitude (U_i): The base-to-peak amplitude of a single readback voltage signal.

4.12 average signal amplitude (U_A): The average signal amplitude (U_A) is the sum of the absolute value of the amplitude of each signal peak (U_i) divided by the number of signal peaks (n) for a given track over the length of the magnetic stripe area.

$$U_A = \frac{\sum_{k=1}^{n} \left| U_{ik} \right|}{n}$$

4.13 reference signal amplitude (U_R): The maximum value of the average signal amplitude of a reference card corrected to the primary standard.

4.14 physical recording density: The number of flux transitions per unit length recorded on a track.

NOTE 3 - When testing with densities of 6 ft/mm (150 ftpi) and 16,6 ft/mm (420 ftpi) the correlation factors are:

$$\frac{U_A \text{ at 6 ft/mm (150 ftpi)}}{U_A \text{ at 8 ft/mm (200 ftpi)}} \times 100 = 100\ \%$$

$$\frac{U_A \text{ at 16,6 ft/mm (420ftpi)}}{U_A \text{ at 20 ft/mm (500 ftpi)}} \times 100 = 102\ \%$$

4.15 bit density: The number of data bits stored per unit of length (bits per mm or bits per inch).

4.16 bit cell: The distance between two clocking flux transitions. See figure 9.

4.17 sub interval: Nominally half the distance between two flux transitions. See figure 9.

4.18 normal use: Use as an identification card (see clause 4 of ISO/IEC 7810:1995), involving equipment processes appropriate to the card technology and storage as a personal document between equipment processes.

5 Physical characteristics of the identification card

The identification card shall conform to the specifications given in ISO/IEC 7810.

6 Physical characteristics of the magnetic stripe

6.1 Height and Surface profile of the magnetic stripe area

The magnetic stripe area is shown in figures 1 and 2.

6.1.1 Surface profile of the magnetic stripe area

The transverse surface profile of the magnetic stripe area shall not show a vertical deviation (a) of more than:

as shown in figure 3a:
$a \leq 9{,}5$ µm (375 µin) for the minimum width $W = 6{,}35$ mm (0.25 in)
$a \leq 15{,}4$ µm (607 µin) for the minimum width $W = 10{,}28$ mm (0.405 in)

as shown in figure 3b:
$a \leq 5{,}8$ µm (225 µin) for the minimum width $W = 6{,}35$ mm (0.25 in)
$a \leq 9{,}3$ µm (365 µin) for the minimum width $W = 10{,}28$ mm (0.405 in)

When the value of the bending stiffness of the card is less than 20 mm, the vertical deviation (a) shall be:
as shown in figure 3a:
$a \leq 7{,}3$ µm (288 µin) for the minimum width $W = 6{,}35$ mm (0.25 in)
$a \leq 11{,}7$ µm (466 µin) for the minimum width $W = 10{,}28$ mm (0.405 in)

as shown in figure 3b:
$a \leq 4{,}5$ µm (175 µin) for the minimum width $W = 6{,}35$ mm (0.25 in)
$a \leq 7{,}3$ µm (284 µin) for the minimum width $W = 10{,}28$ mm (0.405 in)
See figures 1, 2, 3 and 4.

6.1.2 Height of the magnetic stripe area

The vertical deviation (h) of the magnetic stripe area above the adjacent surface of the card shall be:

$-0{,}005$ mm (- 200 µin) $\leq h \leq 0{,}038$ mm (1500 µin)

NOTE 4 - Spiking in the profile caused by the material "squirt out" in hot stamping is not part of the stripe. It shall not extend above the magnetic stripe area height h as defined above.

6.2 Surface roughness

The average surface roughness (R_a) of the magnetic stripe area shall not exceed 0,4 µm (15.9 µin) in both the longitudinal and transverse directions.
Refer to ISO/IEC 4287 Part 1.

6.3 Adhesion of stripe to card

The stripe shall not separate from the card under normal use.

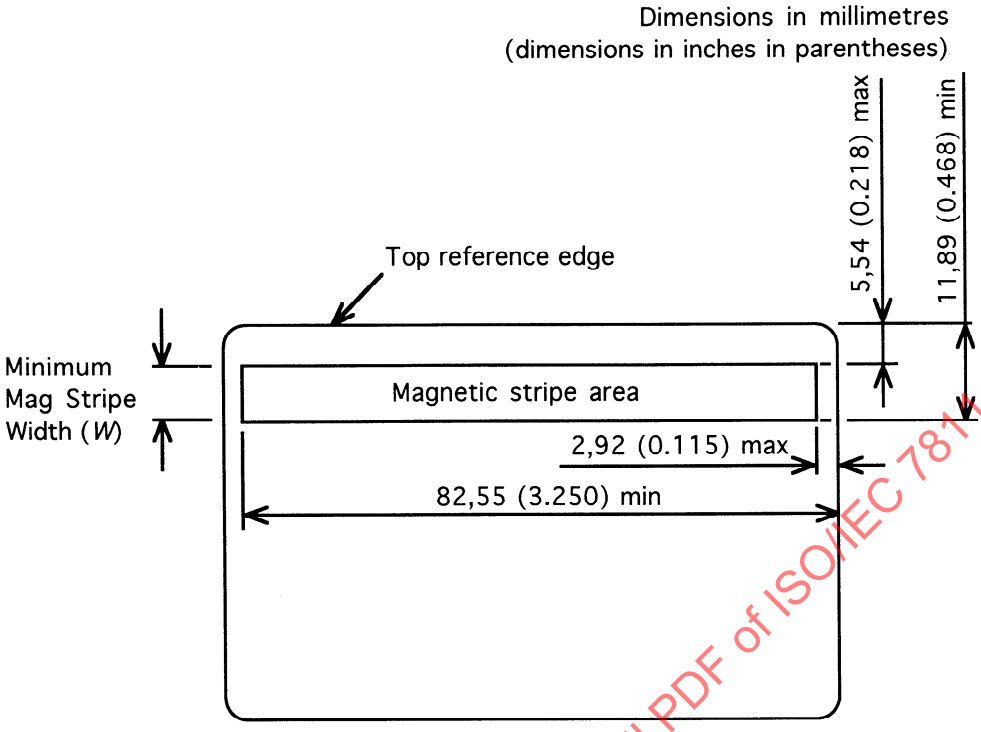


Figure 1 - Location of magnetic material for tracks 1 and 2 only on ID-1 type card

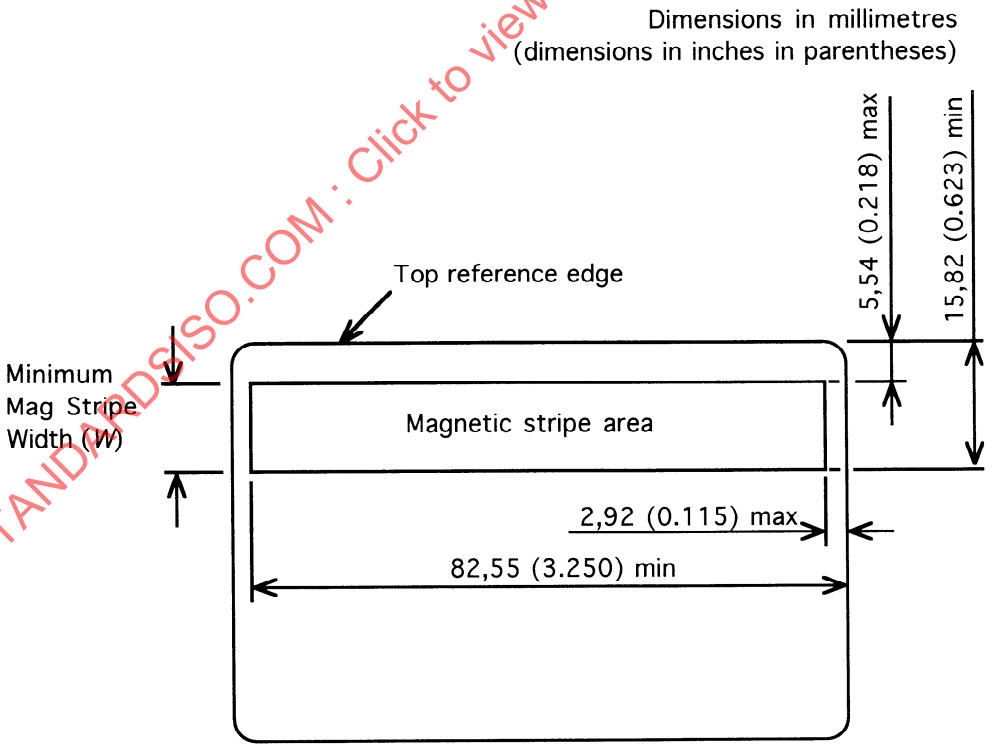
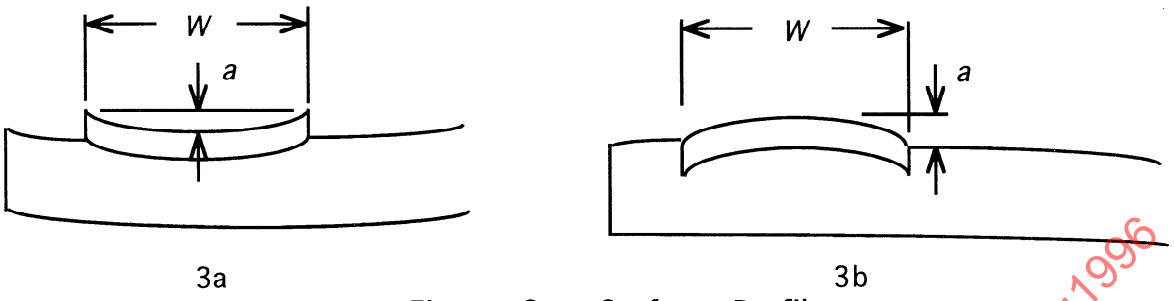
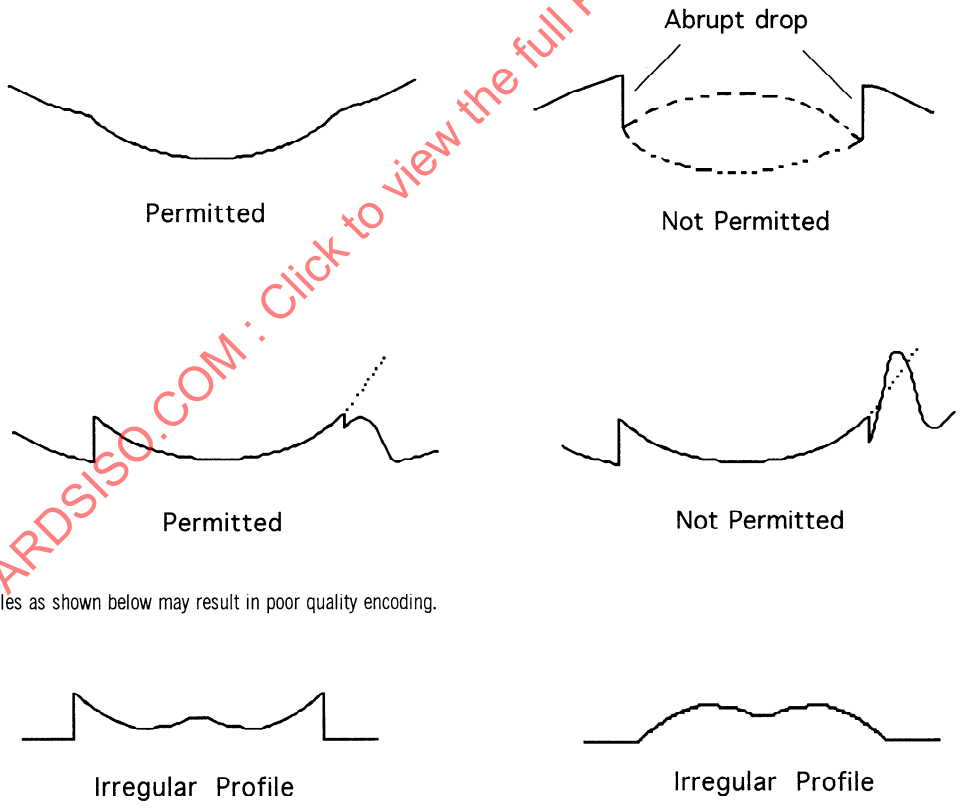


Figure 2 - Location of magnetic material for tracks 1, 2 and 3 on ID-1 type card



3a 3b

Figure 3 - Surface Profile



NOTE 5 - Irregular profiles as shown below may result in poor quality encoding.

Figure 4 - Profile Examples

6.4 Wear from Read/Write Head

Average signal amplitude (U_A) and individual signal amplitude (U_i) are measured before and after 2000 head wear cycles and shall result in:

U_A after $\geq$ 0,60 U_A before

U_i after $\geq$ 0,80 U_A after

6.5 Resistance to Chemicals

Average signal amplitude (U_A) and individual signal amplitude (U_i) are measured before and after short term exposure, as defined in the Test Method reference document.

U_A after $\geq$ 0,90 U_A before

U_i after $\geq$ 0,90 U_A after

Average signal amplitude (U_A) and individual signal amplitude (U_i) are measured before and after long term exposure (24 hours) to acid and alkaline artificial perspiration, as defined in the Test Method reference document.

U_A after $\geq$ 0,90 U_A before

U_i after $\geq$ 0,90 U_A after

7 Performance characteristics for the magnetic material.

The purpose of this section is to enable magnetic interchangeability between card and processing systems.

NOTE 6 - Media coercivity is not specified. The media's performance criteria, regardless of coercivity, is specified in 7.3.

7.1 General

This method uses a reference card whose material is traceable to the primary standard (see 4.1, 4.2).

7.2 Testing and operating environment

The testing environment for signal amplitude measurements is 23 °C ± 3 °C (73 °F ± 5 °F) and 40% to 60% relative humidity. When tested under otherwise identical conditions, the average signal amplitude measured at 8 ft/mm (200 ftpi) shall not deviate from its value in the above test environment by more than 15% after 5 minute exposure over the following operating environment range:

temperature: - 35 °C to 50 °C
(-30 °F to 122 °F)

relative humidity: 5% to 95% with a wet bulb temperature of 25 °C (77 °F)

7.3 Signal amplitude requirements for magnetic media

The requirements for recording characteristics of the card are shown in table 1 and figures 5 and 6.

Table 1 - Unused Unencoded Cards

Description	Densities ft/mm	Densities ftpi	Test Recording Current	Signal Amplitude Result	Requirement
Signal Amplitude	8	200	I_{min}	U_{A1}	$0{,}8\ U_R \le U_{A1} \le 1{,}2\ U_R$
Signal Amplitude	8	200	I_{min}	U_{i1}	$U_{i1} \le 1{,}26\ U_R$
Signal Amplitude	8	200	I_{max}	U_{A2}	$U_{A2} \ge 0{,}8\ U_R$
Signal Amplitude	20	500	I_{max}	U_{i2}	$U_{i2} \ge 0{,}68\ U_R$
Resolution	20	500	I_{max}	U_{A3}	$U_{A3} \ge 0{,}7\ U_{A2}$
Erasure	0	0	I_{min}, DC	U_{A4}	$U_{A4} \le 0{,}03\ U_R$
Extra Pulse	0	0	I_{min}, DC	U_{i4}	$U_{i4} \le 0{,}05\ U_R$
Demagnetization	0	0	I_d, DC	U_{A5}	$U_{A5} \ge 0{,}64\ U_R$
Demagnetization	0	0	I_d, DC	U_{i5}	$U_{i5} \ge 0{,}54\ U_R$
Waveform	3	75	I_{max}	U_{i6}, U_{A6}	$U_{i6} \le 0{,}05\ U_{A6}$
The slope of the saturation curve shall never be positive between I_{min} and I_{max}.					

NOTE 7 - It is not permissible to combine the above requirements mathematically.

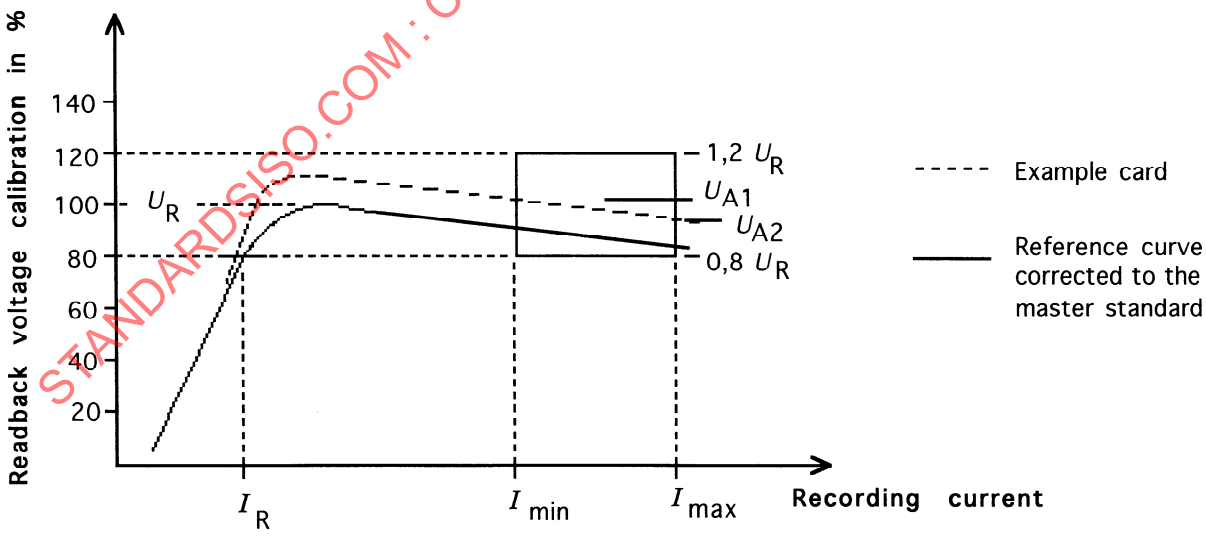
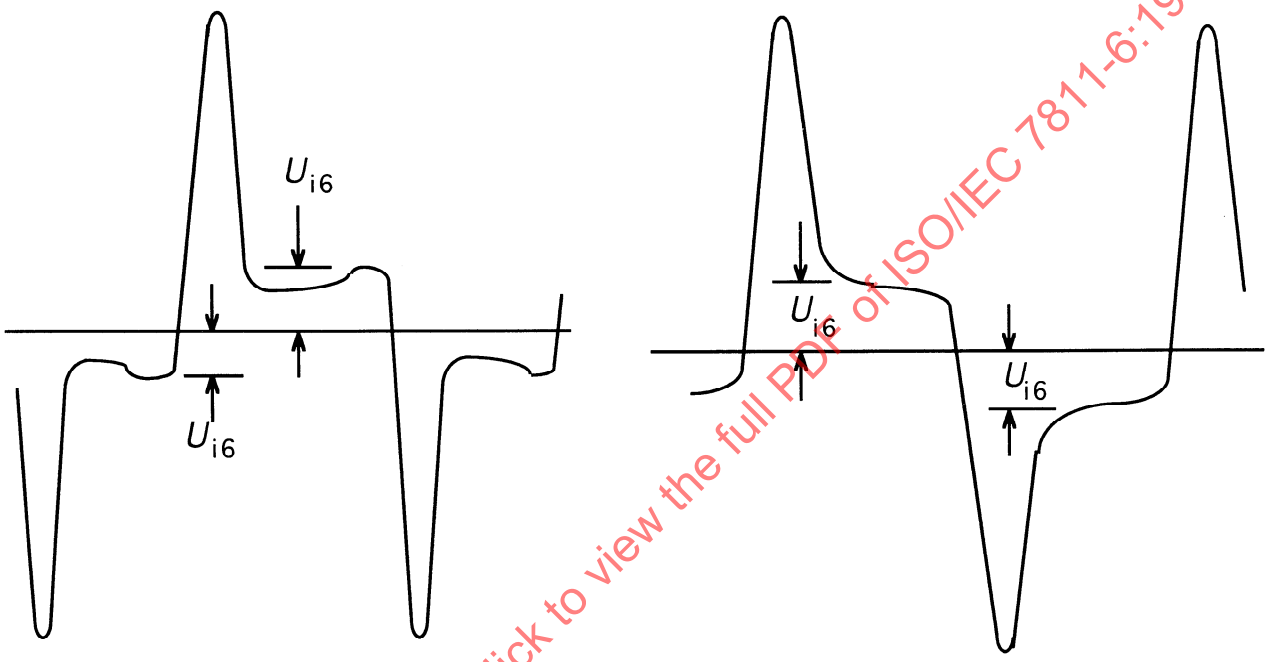


Figure 5 - Saturation curve of Secondary Reference Card and tolerance area at 8 ft/mm (200 ftpi)

NOTE 8 - The curve defines the master standard response (on a card). The window parameters are defined to produce a card that will be functional in the machine readable environment.



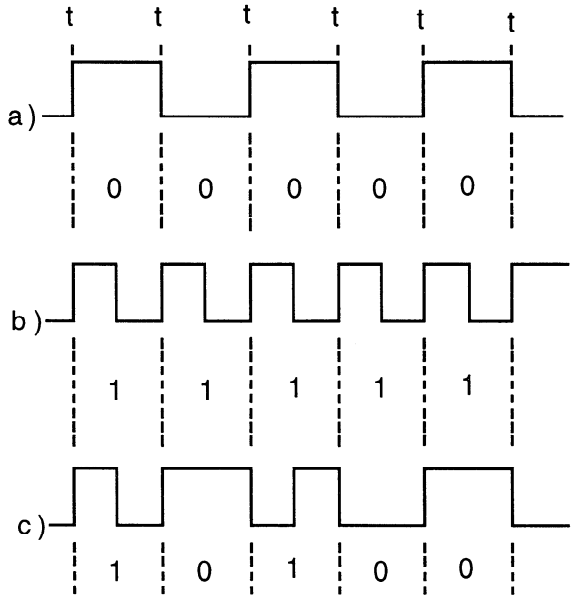
Extra peak **Flat area**

NOTE 9 - U_{i6} is measured at a point of minimum slope and maximum amplitude between flux transitions.

Figure 6 - Waveform Examples

8 Encoding technique

The encoding technique is known as two-frequency recording. This method allows for serial recording of self-clocking data (on each track) (see figure 7).



t, indicates self-clocking (timing) intervals

Figure 7 - Example of two-frequency encoding

The encoding comprises data and clocking transitions together. A flux transition occurring between clocks signifies that the bit is a "one" and the absence of a flux transition between clocking transitions signifies that the bit is a "zero".

The data shall be recorded as a synchronous sequence of characters without intervening gaps.

Recording shall be in a saturation mode with magnetization parallel to a line in the plane of the track.

Recording with a write current which is less than Imin may result in poor quality encoding.

9 Encoding specification, general

9.1 Angle of recording

The angle of recording shall be normal to the nearest edge of the card parallel to the magnetic stripe with the tolerance of ± 20 minutes.

The angle of recording (α) is determined by measuring the angle of the head gap when the reading amplitude is maximum (see figure 8).

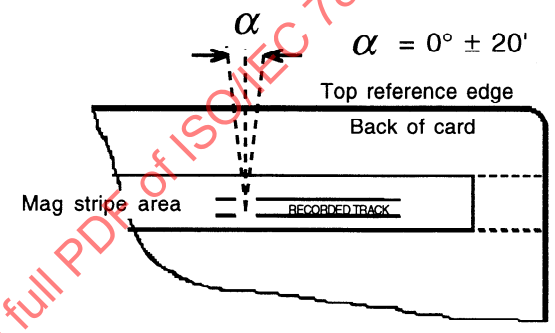


Figure 8 - Angle of recording

9.2 Nominal bit density

The nominal bit density shall be:

Track 1: 8,27 bpmm (210 bpi)
Track 2: 2,95 bpmm (75 bpi)
Track 3: 8,27 bpmm (210 bpi)

9.3 Signal amplitude requirements for Tracks 1, 2 and 3

The requirements for signal amplitude on tracks 1, 2 and 3 for unused encoded cards are as follows:

$$0{,}64\ U_R \leq U_i \leq 1{,}26\ U_R$$

The requirements for signal amplitude on tracks 1, 2 and 3 for returned cards are as follows:

$$0{,}52\ U_R \leq U_i \leq 1{,}26\ U_R$$

NOTE 10 - The requirements above specify the interchange signal amplitude limits for each of the encoded track locations at the specified bit densities. Signal amplitude requirements specified in Table 1 reflect the magnetic media limits at the specified recording frequency and recording test currents.

9.4 Bit configuration

In the bit configuration for each character on the magnetic area, the least significant bit (b_1) shall be encoded first and the parity bit last.

9.5 Direction of recording

The encoding shall begin from the right-hand side viewed from the side with the magnetic stripe and with the stripe at the top.

9.6 Leading and trailing zeroes

The lead-in up to the first data bit shall be recorded with zeroes and the space after the last bit shall also be recorded with zeroes.

NOTE 11 - Zeroes prior to 3,30 mm (0.130 in) or after 82,17 mm (3.235 in) from the right edge of the card when viewed from the back are not required to meet the specifications given herein.

10 Encoding specifications for read-only tracks

In addition to the relevant part of clause 9 the following specifications apply for read-only tracks 1 and 2.

10.1 Alphanumeric track, Track 1

10.1.1 Average bit density

The average bit density (B_a) shall be 8,27 bits per millimeter (210 bits per inch) ± 8% measured in a longitudinal direction parallel to the top reference edge.

10.1.2 Flux transition spacing variation

Flux transition spacing variations are shown in table 2 for unused encoded cards and in table 3 for returned cards. See also figure 9.

Table 2 - Flux Transition Spacing Variation for Unused Encoded Cards - Tracks 1 and 3

Description	Requirement	Variation
Average length between clocking flux transitions B_a	111 μm ≤ B_a ≤ 131 μm (4381 μin) (5143 μin)	± 8 %
Individual length between clocking flux transitions B_{in}	109 μm ≤ B_{in} ≤ 133 μm (4286 μin) (5238 μin)	± 10%
Adjacent bit-to- bit variation B_{in+1}	0,90 B_{in} ≤ B_{in+1} ≤ 1,1 B_{in}	± 10%
Subinterval length S_{in}	53 μm ≤ S_{in} ≤ 68 μm (2095 μin) (2667 μin)	± 12%
Subinterval length S_{in+1}	0,88 $B_{in}/2$ ≤ S_{in+1} ≤ 1,12 $B_{in}/2$	± 12%

NOTE 12 - B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in}.

Table 3 - Flux Transition Spacing Variation for Returned Cards - Tracks 1 and 3

Description	Requirement	Variation
Average length between clocking flux transitions B_a	111 μm ≤ B_a ≤ 131 μm (4381 μin) (5143 μin)	± 8 %
Individual length between clocking flux transitions B_{in}	103 μm ≤ B_{in} ≤ 139 μm (4048 μin) (5476 μin)	± 15%
Adjacent bit-to-bit variation B_{in+1}	0,85 B_{in} ≤ B_{in+1} ≤ 1,15 B_{in}	± 15%
Subinterval length S_{in}	48,4 μm ≤ S_{in} ≤ 72,6 μm (1905 μin) (2857 μin)	± 20%
Subinterval length S_{in+1}	0,7 $B_{in}/2$ ≤ S_{in+1} ≤ 1,3 $B_{in}/2$	± 30%

NOTE 13 - B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in}.

NOTE 14 - This table shows only the limits within which cards will function normally and does not imply any guarantee of flux transition spacing during valid term for issued card.

10.1.3 Coded character set

Table 4 - Coded character set for track 1

				b_6	0	0	1	1
				b_5	0	1	0	1
b_4	b_3	b_2	b_1	Column / Row	0	1	2	3
0	0	0	0	0	SP	0	(a)	P
0	0	0	1	1	(a)	1	A	Q
0	0	1	0	2	(a)	2	B	R
0	0	1	1	3	(c)	3	C	S
0	1	0	0	4	$	4	D	T
0	1	0	1	5	% (d)	5	E	U
0	1	1	0	6	(a)	6	F	V
0	1	1	1	7	(a)	7	G	W
1	0	0	0	8	(	8	H	X
1	0	0	1	9	)	9	I	Y
1	0	1	0	10	(a)	(a)	J	Z
1	0	1	1	11	(a)	(a)	K	(b)
1	1	0	0	12	(a)	(a)	L	(b)
1	1	0	1	13	-	(a)	M	(b)
1	1	1	0	14	.	(a)	N	^ (d)
1	1	1	1	15	/	? (d)	O	(a)

(a) These characters are available for hardware control purposes only and cannot contain information characters.

(b) These characters are reserved for additional national characters when required. They are not to be used internationally.

(c) These character is reserved for optional additional graphic symbols.

(d) These characters shall have the following meaning for this application:

Position 0/5 % represents "start" sentinel
Position 1/15 ? represents "end" sentinel
Position 3/14 ^ represents field separator

NOTE 15 - The coded character set above is identical to the coded character set in ISO/IEC 7811-2.

10.1.4 Maximum number of characters for ID-1 type card

The data characters, the control characters and the longitudinal redundancy check character shall together not exceed 79 characters, including start and end sentinels.

10.2 Numeric track, Track 2

10.2.1 Average Bit density

The average bit density (B_a) shall be 2,95 bits per millimeter (75 bits per inch) ±5% measured in a longitudinal direction parallel to the top reference edge.

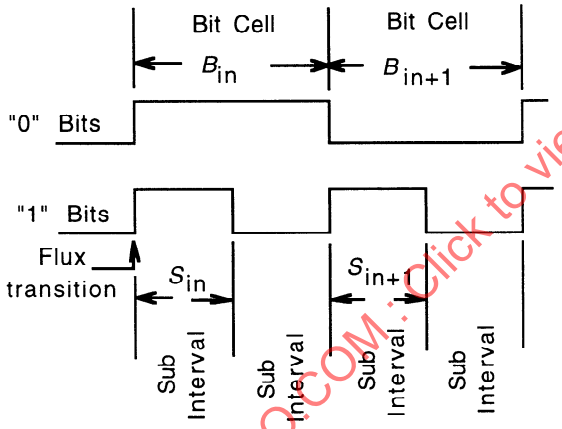


Figure 9 - Flux Transition Spacing Variation

10.2.2 Flux transition spacing variation

Flux transition spacing variations are shown in table 5 for unused encoded cards and in table 6 for returned cards. See also figure 9.

Table 5 - Flux Transition Spacing Variation for Unused Encoded Cards - Track 2

Description	Requirement	Variation
Average length between clocking flux transitions B_a	322 μm ≤ B_a ≤ 356 μm (12666 μin) (14000 μin)	± 5%
Individual length between clocking flux transitions B_{in}	315 μm ≤ B_{in} ≤ 362 μm (12400 μin) (14266 μin)	± 7 %
Adjacent bit-to-bit variation B_{in+1}	0,90 B_{in} ≤ B_{in+1} ≤ 1,1 B_{in}	± 10%
Subinterval length S_{in}	152 μm ≤ S_{in} ≤ 186 μm (6000 μin) (7333 μin)	± 10 %
Subinterval length S_{in+1}	0,88 $B_{in}/2$ ≤ S_{in+1} ≤ 1,12 $B_{in}/2$	± 12%

NOTE 16 - B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in}.

Table 6 - Flux Transition Spacing Variation for Returned Cards - Track 2

Description	Requirement	Variation
Average length between clocking flux transitions B_a	322 μm ≤ B_a ≤ 356 μm (12666 μin) (14000 μin)	± 5%
Individual length between clocking flux transitions B_{in}	288 μm ≤ B_{in} ≤ 389 μm (11333 μin) (15333 μin)	± 15%
Adjacent bit-to-bit variation B_{in+1}	0,85 B_{in} ≤ B_{in+1} ≤ 1,15 B_{in}	± 15%
Subinterval length S_{in}	135 μm ≤ S_{in} ≤ 203 μm (5333 μin) (8000 μin)	± 20%
Subinterval length S_{in+1}	0,7 $B_{in}/2$ ≤ S_{in+1} ≤ 1,3 $B_{in}/2$	± 30%

NOTE 17 - B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in}.

NOTE 18 - This table shows only the limits within which cards will function normally and does not imply any guarantee of flux transition spacing during valid term for issued card.

10.2.3 Coded character set

Table 7 - Coded character set for tracks 2 and 3

Bits					Row	Character
P	b_4	b_3	b_2	b_1		
1	0	0	0	0	0	0
0	0	0	0	1	1	1
0	0	0	1	0	2	2
1	0	0	1	1	3	3
0	0	1	0	0	4	4
1	0	1	0	1	5	5
1	0	1	1	0	6	6
0	0	1	1	1	7	7
0	1	0	0	0	8	8
1	1	0	0	1	9	9
1	1	0	1	0	10	a
0	1	0	1	1	11	b^1
1	1	1	0	0	12	a
0	1	1	0	1	13	b^2
0	1	1	1	0	14	a
1	1	1	1	1	15	b^3

a These characters are available for hardware control purposes only and cannot contain information characters (data content).

b^1 Start sentinel (start character)
b^2 Separator
b^3 End sentinel (stop character)

NOTE 19 - The coded character set above is identical to the coded character set in ISO/IEC 7811-2.

10.2.4 Maximum number of characters for ID-1 type card

The data characters, the control characters, the start and end sentinels, and the longitudinal redundancy check character shall together not exceed 40 characters.

11 Encoding specifications for read-write track, Track 3

In addition to the relevant parts of clause 9, the following specifications apply to read-write track, Track 3.

11.1 Average Bit density

The average bit density (B_a) shall be 8,27 bits per millimeter (210 bits per inch) ±8% measured in a longitudinal direction parallel to the top reference edge.

11.2 Flux transition spacing variation

Flux transition spacing variations are shown in Table 2 for unused encoded cards and in Table 3 for returned cards. See also figure 9.

11.3 Coded character set

The numeric coded character set in 10.2.4 shall be used.

11.4 Maximum number of characters for ID-1 type card

The data characters, the control characters, the start and end sentinels, and the longitudinal redundancy check character shall together not exceed 107 characters.

12 Error detection

Two techniques of error detection, as described below, shall be encoded. In both techniques, the leading and trailing zeroes shall not be regarded as data characters.

12.1 Parity

A parity bit for each encoded character shall be used. The value of the parity bit is defined such that the total quantity of one bits recorded, for each character, including the parity bit, shall be odd.

12.2 Longitudinal redundancy check (LRC)

The longitudinal redundancy check (LRC) character shall appear for each data track. The LRC character shall be encoded so that it immediately follows the end sentinel when the card is read in a direction giving the start sentinel first, followed by data and the end sentinel. The bit configuration of the LRC character shall be identical to the bit configuration of the data characters.

The LRC character shall be calculated using the following procedure:

The value of each bit in the LRC character, excluding the parity bit, is defined such that the total count of one bits encoded in the corresponding bit location of all characters of the data track, including the start sentinel, data, end sentinel, and LRC characters, shall be even.

The LRC characters parity bit is not a parity bit for the individual parity bits of the data track, but is only the parity bit for the LRC character encoded as described in 12.1.

Annex A

(normative)

Location of encoded data tracks

NOTE - The nominal centreline locations of encoded tracks are the same as those specified in Parts 4 and 5 of ISO/IEC 7811, however, the track widths are different. The beginning and end of encoding on each track, is the same as that specified in Parts 4 and 5 of ISO/IEC 7811.

Track 1 of encoded data shall extend between two lines 5,79 mm (0.228 in) and 8,33 mm (0.328 in) from the nearest parallel edge of the card, but not beyond 9,10 mm (0.358 in) from the nearest parallel edge of the card (see figure A.1).

Track 2 of encoded data shall extend between two lines 9,10 mm (0.358 in) and 11,63 mm (0.458 in) from the nearest parallel edge of the card, but not closer than 8,33 mm (0.328 in) to the nearest parallel edge of the card and not beyond 12,65 mm (0.498 in) from the nearest card edge (see figure A1).

Track 3 of encoded data shall extend between two lines 12,65 mm (0.498 in) and 15,19 mm (0.598 in) from the nearest parallel edge of the card, but encodings, including the effects of fringing, shall not extend closer than a line 11,63 mm (0.458 in) from the same card edge or beyond 15,82 mm (0.623 in) from that edge (see figure A.1).

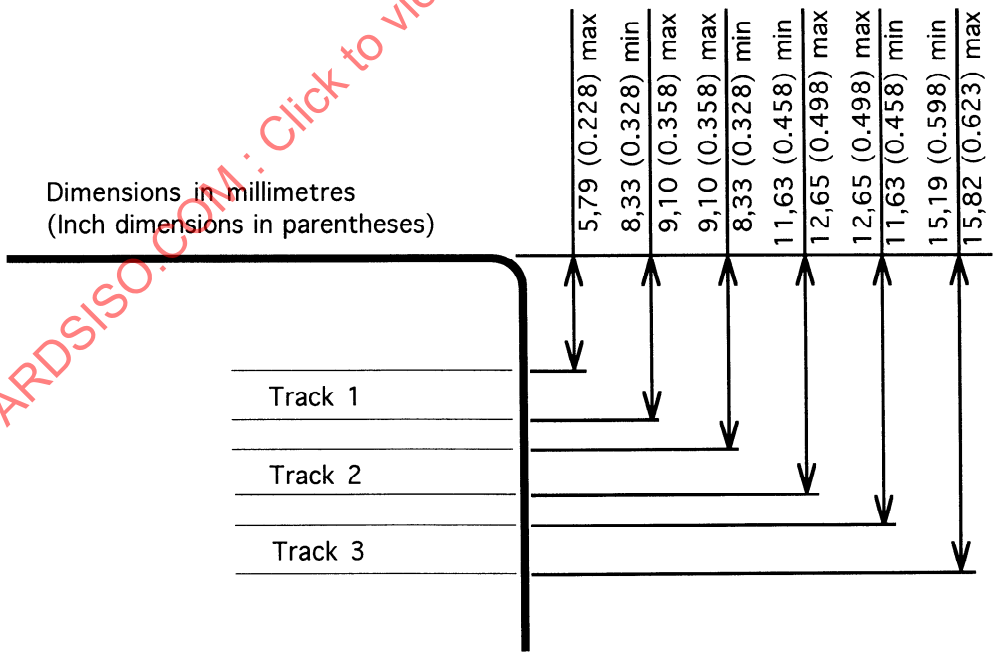


Figure A.1 - Location of encoded data tracks

Annex B

(normative)

Amplitude measurements

This Annex will be superseded by ISO/IEC 10373 - second edition.

The purpose of this test is to measure the signal amplitude, resolution, erasure, demagnetisation and waveform from the magnetic stripe on the sample card after writing to check conformity with the referenced document. Amplitude measurements are defined as the measurements of signal amplitude resolution, erasure and demagnetization.

B.1 Apparatus:

a) All the sequence of measurements shall be performed on the same equipment and under the same conditions.

b) The resolution of the reading system shall be between 85% and 100% when testing on a reference card at 8 ft/mm (200 ftpi) and 20 ft/mm (500 ftpi), using test recording current of I_{max}.

c) The overall width of that portion of the read or write head in contact with the stripe shall be more than 2,8 mm and less than 3,5 mm.

The radius of the head curvature at the gap shall be 19 mm ± 2,0 mm.

When testing materials above 80 kA/m (1000 oersteds), Reference Card RM7811-6 should be used. The test head used for writing shall also have the following characteristics: (See table B.1 and Annex C)

Write and sense coils shall be located on separate legs of the core as shown below:

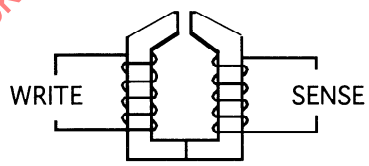


Figure B.1 - Arrangement of coils

NOTE - Alternate methods for measuring flux characteristics of the test head are permitted providing they give equivalent results to the method described herein.

Read and write heads shall be mechanically independent from each other.

Table B.1 - Test Head Specifications

	units	min.	max.
Read gap	mm (in)	0,010 (0.0004)	0,015 (0.0006)
Read width	mm (in)	1,0 (0.040)	1,6 (0.063)
Write gap	mm (in)	0,046 (0.0018)	0,056 (0.0022)
Write width	mm (in)	2,79 (0.110)	-
Azimuth error	minutes	-	10

The parameters of table B.1 shall be measured optically.

d) The force on the head shall be set to the minimum amount required to achieve the maximum output from a Reference Card RM7811-6 at time of calibration but do not exceed 7N (1.6 lbf).

NOTE - Typical head force is 3 N (0.7 lbsf).

e) The waveform of the write current measured at nominal recording densities of 8 ft/mm (200 ftpi) and 20 ft/mm (500 ftpi), shall be as defined in Table B.2. This is illustrated in figure B.2.

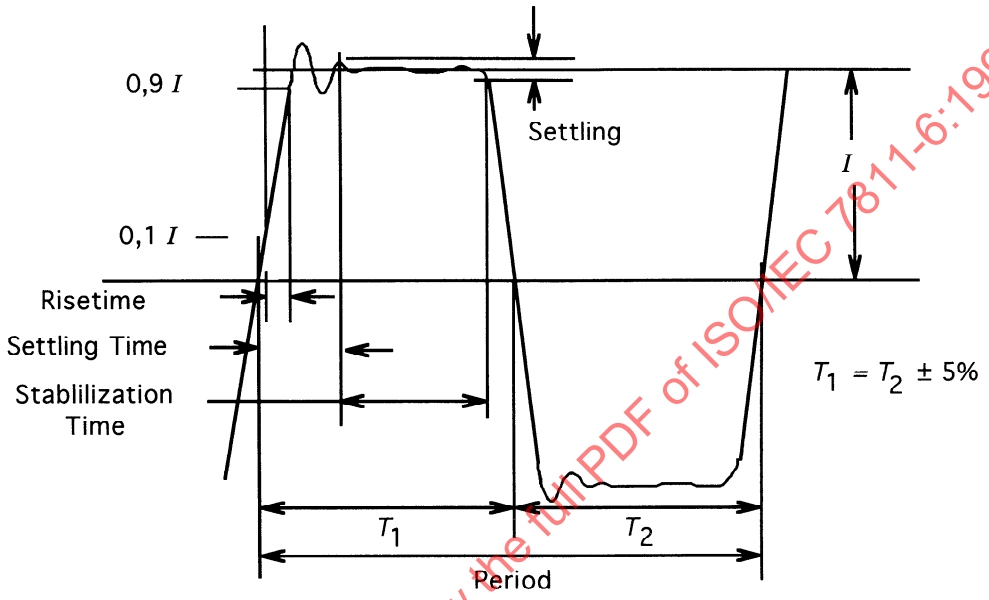


Figure B.2 - Write Current Waveform

Table B.2 - Write current waveform parameters

Parameter	maximum
Rise time	5% of the period
Overshoot	10% of the write current (I)
Settling time	15% of the period
Settling	± 2% of the stabilized write current (I)
	minimum
Stabilization time	30% of the period

f) The reading system shall have the following characteristics:

1) Linear amplifiers without automatic gain control with noise less than 0,5% of 100% reference signal amplitude and a frequency response which is flat within ± 0,2 dB wide band from frequencies corresponding to 0,25 cycles/mm (0,5 ft/mm) to 10,5 cycles/mm (21 ft/mm). This range corresponds to the characteristics of the bandpass of the filter described in 3) below. Outside this range the response may not rise.

2) A means, such as a storage oscilloscope for determining the amplitudes of the signal peaks.

3) Upper and lower band edges shall consist of, respectively, a second order high pass and a second order low pass filter (slopes 12 dB/octave). The response shall be flat within 0,2 dB wide band from frequencies corresponding to 0,25 cycles/mm (0,5 ft/mm) to 10,5 cycles/mm (21 ft/mm). Figure B.3 defines the band edges of the filter.

The filter response shall continue downward for at least one decade after the band edges, the response may not rise more than -40 dB outside this one decade range. Other filtering functions outside of the one decade range may be used. This filter is used for all measurements except the extra pulse U_{i4}.

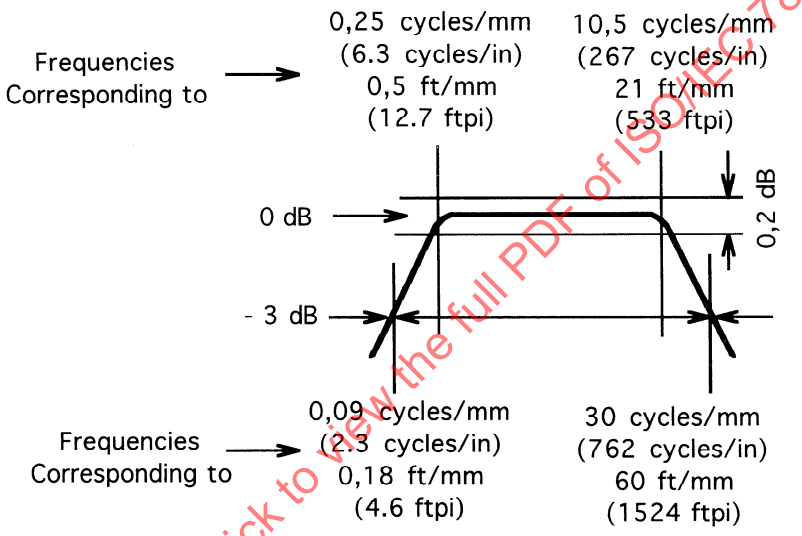


Figure B.3 - Filter Characteristics

g) The drive shall have a transport system with an average speed variation of no more than ±0,5% and stable head pressure.

Variations in velocity and head pressure will reduce the accuracy of measurement. If the drive used has a speed variation greater than ±0,5%, then the actual speed variation shall be recorded with the test results.

B.2 Procedure: All measurements are performed while reading in the same direction as writing. All measurements shall be taken after the same number of passes.

This test method is valid for materials above 80 kA/m (1000 oersteds).

a) The write head shall be characterized to find the relationship between flux output and write current.

For each current amplitude (I), the corresponding flux amplitude (F) is noted using the apparatus described below:

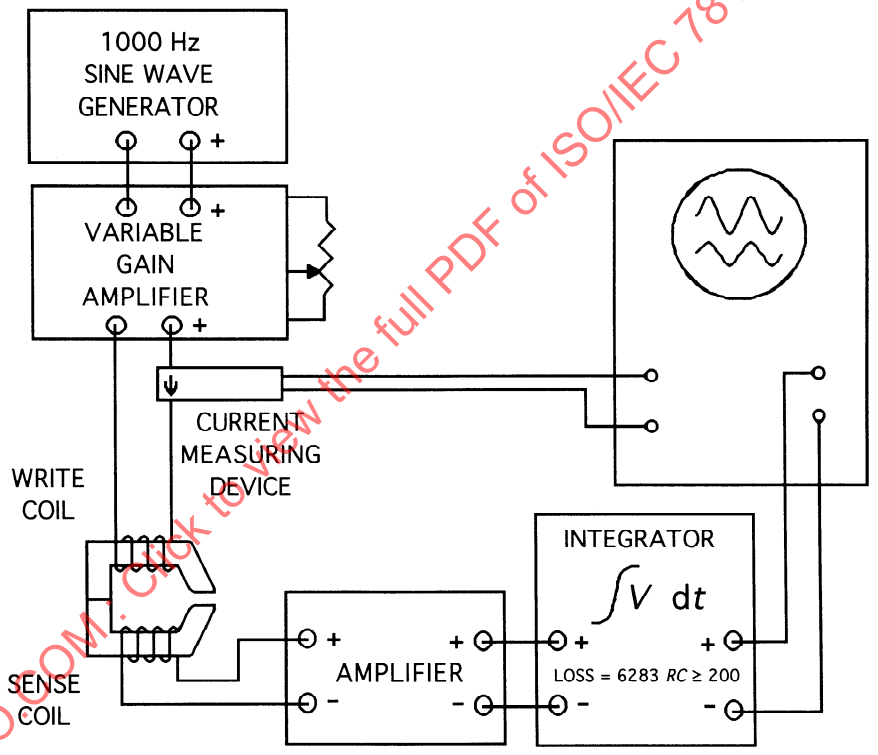


Figure B.4 - Typical Head Characterization Test Setup

b) To draw the saturation curve and to determine the maximum signal amplitude (U_{max}) and the reference current (I_R), a Reference Card RM7811-6 is used with the 8 ft/mm (200 ftpi) density. For each current amplitude the corresponding value of the average signal amplitude of the reference card is noted. Between each measurement the card is erased with an alternating current such that the average remaining signal is less than 5% of U_R.