
**Identification cards — Recording
technique —**

**Part 6:
Magnetic stripe — High coercivity**

*Cartes d'identification — Technique d'enregistrement —
Partie 6: Bandeau magnétique — Haute coercitivité*

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Foreword.....	v
1 Scope	1
2 Conformance	1
3 Normative references	1
4 Terms and definitions	2
5 Physical characteristics of the identification card.....	4
5.1 Magnetic stripe area warpage	4
5.2 Surface distortions	4
6 Physical characteristics of the magnetic stripe	5
6.1 Height and surface profile of the magnetic stripe area	5
6.1.1 Surface profile of the magnetic stripe area.....	5
6.1.2 Height of the magnetic stripe area.....	7
6.2 Surface roughness	7
6.3 Adhesion of stripe to card	7
6.4 Wear of magnetic stripe from read/write head	7
6.5 Resistance to chemicals	7
7 Performance characteristics for the magnetic material	7
7.1 General.....	7
7.2 Testing and operating environment.....	8
7.3 Signal amplitude requirements for magnetic media	8
8 Encoding technique.....	10
9 Encoding specification, general.....	11
9.1 Angle of recording	11
9.2 Nominal bit density.....	11
9.3 Signal amplitude requirements for tracks 1, 2 and 3	11
9.4 Bit configuration	12
9.5 Direction of recording	12
9.6 Leading and trailing zeroes	12
10 Encoding specifications	13
10.1 Alphanumeric track, track 1.....	13
10.1.1 Average bit density.....	13
10.1.2 Flux transition spacing variation	13
10.1.3 Coded character set	14
10.1.4 Maximum number of characters for ID-1 type card.....	16
10.2 Numeric track, Track 2	16
10.2.1 Average bit density.....	16
10.2.2 Flux transition spacing variation	16
10.2.3 Coded character set	17
10.2.4 Maximum number of characters for ID-1 type card.....	17
10.3 Numeric track, Track 3	17
10.3.1 Average bit density.....	17
10.3.2 Flux transition spacing variation	17
10.3.3 Coded character set	17
10.3.4 Maximum number of characters for ID-1 type card.....	18
11 Error detection	18
11.1 Parity	18
11.2 Longitudinal redundancy check (LRC).....	18

12	Location of encoded tracks	18
Annex A	(informative) Read compatibility of magnetic stripes (ISO/IEC 7811-2 and ISO/IEC 7811-6)	20
Annex B	(normative) Signal amplitude measurements	21
Annex C	(informative) Magnetic stripe abrasivity	22
Annex D	(informative) Static magnetic characteristics	23

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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 of 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. 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.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 7811-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

This third edition cancels and replaces the second edition (ISO/IEC 7811-6:2001). It also incorporates the Amendment ISO/IEC 7811-6:2001/Amd.1:2005. The major changes from the second edition are as follows.

- Wherever possible, the same definitions, criteria and test methods are used in ISO/IEC 7811-2 and ISO/IEC 7811-6.
- The algorithm defined in Figure 7 of ISO/IEC 7811-6:2001 has been changed to produce more consistent results (incorporated from ISO/IEC 7811-6:2001/Amd.1:2005).

NOTE The requirements given in ISO/IEC 7811-4:1995 and ISO/IEC 7811-5:1995 were moved to Part 6 in the second edition.

Notes in this part of ISO/IEC 7811 are only used for giving additional information intended to assist in the understanding or use of the document. They do not contain provisions or requirements to which it is necessary to conform in order to claim compliance with this part of ISO/IEC 7811.

ISO/IEC 7811 consists of the following parts, under the general title *Identification cards — Recording technique*:

- *Part 1: Embossing*
- *Part 2: Magnetic stripe — Low coercivity*
- *Part 6: Magnetic stripe — High coercivity*
- *Part 7: Magnetic stripe — High coercivity, high density*
- *Part 8: Magnetic stripe — Coercivity of 51,7 kA/m (650 Oe)*
- *Part 9: Tactile identifier mark*

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Identification cards — Recording technique —

Part 6: Magnetic stripe — High coercivity

1 Scope

ISO/IEC 7811 defines the characteristics for identification cards as defined in Clause 4 of this part of ISO/IEC 7811 and the use of such cards for international interchange.

This part of ISO/IEC 7811 specifies requirements for a high coercivity magnetic stripe (including any protective overlay) on an identification card, the encoding technique and coded character sets. It takes into consideration both human and machine aspects and states minimum requirements.

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.

ISO/IEC 7811 provides criteria to which cards are to perform. No consideration is given within ISO/IEC 7811 to the amount of use, if any, experienced by the card prior to test. Failure to conform to specified criteria should be negotiated between the involved parties.

ISO/IEC 10373-2 specifies the test procedures used to check cards against the parameters specified in this part of ISO/IEC 7811.

NOTE 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 not be intermixed or reconverted. The original design was made using the Imperial measurement system.

2 Conformance

A prerequisite for conformance with this part of ISO/IEC 7811 is conformance with ISO/IEC 7810. An identification card is in conformance with this part of ISO/IEC 7811 if it meets all mandatory requirements specified herein. Default values apply if no others are specified.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 4287, *Geometrical Product Specifications (GPS) — Surface texture: Profile method — Terms, definitions and surface texture parameters*

ISO/IEC 7810, *Identification cards — Physical characteristics*

ISO/IEC 10373-1, *Identification cards — Test methods — Part 1: General characteristics*

ISO/IEC 10373-2, *Identification cards — Test methods — Part 2: Cards with magnetic stripes*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 7810 and the following apply.

4.1

primary standard

set of reference cards established and maintained by the Physikalisch-Technische Bundesanstalt (PTB) that represent the values of U_R and I_R designated RM7811-6

4.2

secondary standard

reference card designated RM7811-6 that is related to the primary standard as stated in the calibration certificate supplied with each card

NOTE Secondary standards can be ordered from Q-Card, 301 Reagan Street, Sunbury, PA 17801, USA. The source of secondary standards will be maintained at least until 2010.

4.3

unused un-encoded card

card possessing all the components required for its intended purpose, which has not been subjected to any personalization or testing operation, and which has been stored in a clean environment with no more than 48 h exposure to daylight and at temperatures between 5 °C and 30 °C and humidity between 10 % and 90 % without experiencing thermal shock

4.4

unused encoded card

card according to 4.3 that has only been encoded with all the data required for its intended purpose (e.g. magnetic encoding, embossing, electronic encoding)

4.5

returned card

card according to 4.4 after it has been issued to the card holder and returned for the purpose of testing

4.6

flux transition

location of the greatest rate of change with distance of the magnetisation

4.7

reference current

I_R

minimum recorded current amplitude under the given test conditions that causes, on the reference card, a readback signal amplitude equal to 80 % of the reference signal amplitude U_R , at a density of 8 flux transitions per millimetre (200 flux transitions per inch) as shown in Figure 6

4.8

reference flux level

F_R

flux level in the test head that corresponds to the reference current I_R

4.9**test recording currents**

two recording currents defined by:

$I_{\min}$ = recording current corresponding to $2,8 F_R$

$I_{\max}$ = recording current corresponding to $3,5 F_R$

4.10**individual signal amplitude**

U_i

base-to-peak amplitude of a single readback voltage signal

4.11**average signal amplitude**

U_A

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

4.12**reference signal amplitude**

U_R

maximum value of the average signal amplitude of a reference card corrected to the primary standard

4.13**physical recording density**

number of flux transitions per unit length recorded on a track

4.14**bit density**

number of data bits stored per unit of length (bits/mm or bpi)

4.15**bit cell**

distance between two clocking flux transitions

NOTE See Figure 11.

4.16**subinterval**

distance that is nominally half of the distance between two clocking flux transitions

NOTE See Figure 11.

4.17**demagnetisation current**

I_d

D.C. current value that reduces the average signal amplitude to 80 % of the reference signal amplitude (U_R) on a secondary reference card that has been encoded at a density of 20 ft/mm (500 fpi) at a current of $I_{\min}$

5 Physical characteristics of the identification card

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

WARNING — The attention of card issuers is drawn to the fact that information held on the magnetic stripe may be rendered ineffective through contamination by contact with dirt and certain commonly used chemicals including plasticizers. It should also be noted that any printing or screening placed on top of the magnetic stripe must not impair the function of the magnetic stripe.

5.1 Magnetic stripe area warpage

Application of a 2,2 N (0.5 lbf) load evenly distributed on the front face opposite the magnetic stripe shall bring the entire stripe within 0,08 mm (0.003 in) of the rigid plate.

5.2 Surface distortions

There shall be no surface distortions, irregularities or raised areas on both the front and the back of the card in the area shown in Figure 1 that might interfere with the contact between the magnetic head and magnetic stripe.

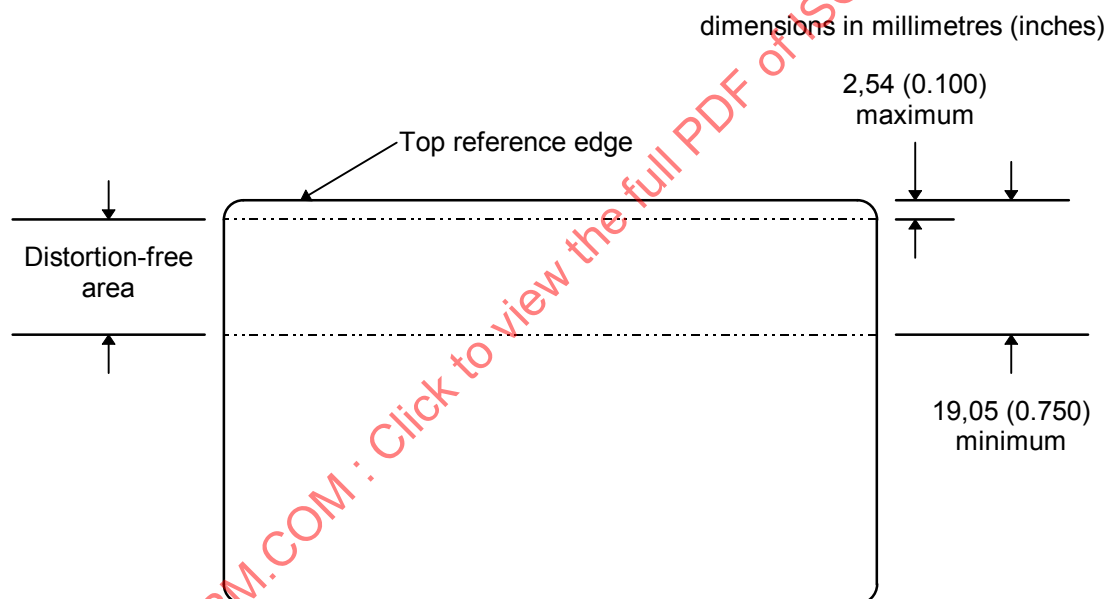


Figure 1 — Distortion-free area on card with magnetic stripe

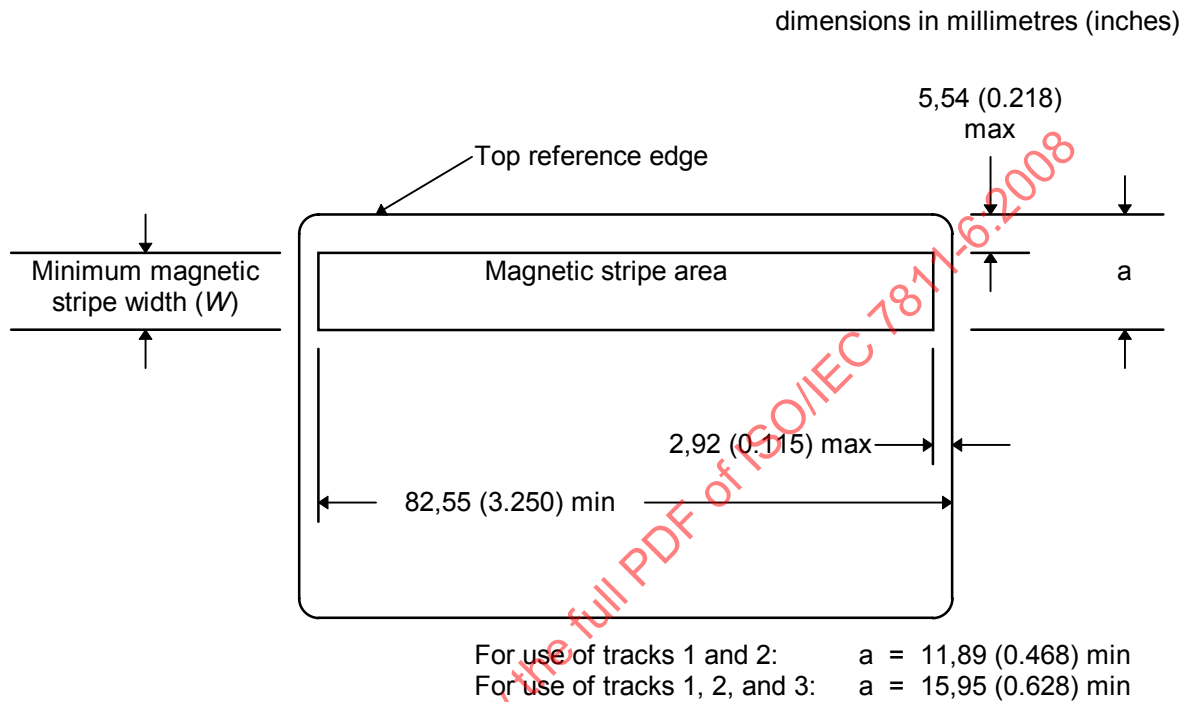
If a raised signature panel area is located on the front or back of the card, then it shall be no closer to the top edge of the card than 19,05 mm (0.750 in).

NOTE Raised areas and distortions on other areas of the card may cause card transport problems with magnetic stripe processing equipment resulting in reading or writing errors.

6 Physical characteristics of the magnetic stripe

6.1 Height and surface profile of the magnetic stripe area

The magnetic stripe area is located on the back of the card as shown in Figure 2.



NOTE In the case of the magnetic stripe area used for track 1 and 2, the dimension a as shown in Figure 2 of the magnetic media could be less than the maximum dimension b as shown in Figure 12 for the location of track 2 data on the card. It is desirable that the magnetic stripe area extend beyond the limits of the encoded track.

Figure 2 — Location of magnetic material for ID-1 type card

6.1.1 Surface profile of the magnetic stripe area

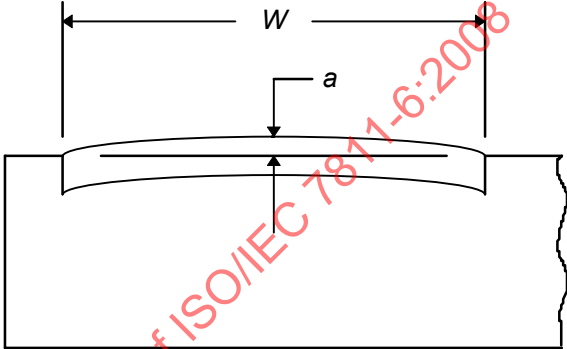
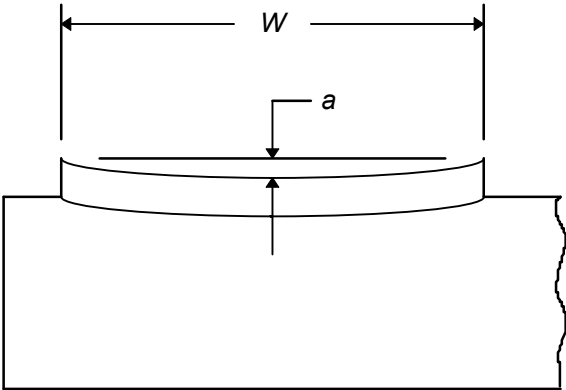
The maximum vertical deviation (a) of the transverse surface profile of the magnetic stripe area is shown below. See Figure 3, Figure 4, and Figure 5. The slope of the surface profile curve shall be limited to: $-4a/W < \text{slope} < 4a/W$.

When the bending stiffness value (see ISO/IEC 7810) for the card is 20 mm or more then the surface profile limits are:

Minimum stripe width	As shown in Figure 3A	As shown in Figure 3B
$W = 6,35 \text{ mm } (0.25 \text{ in})$	$a \leq 9,5 \text{ } \mu\text{m } (375 \text{ } \mu\text{in})$	$a \leq 5,8 \text{ } \mu\text{m } (225 \text{ } \mu\text{in})$
$W = 10,28 \text{ mm } (0.405 \text{ in})$	$a \leq 15,4 \text{ } \mu\text{m } (607 \text{ } \mu\text{in})$	$a \leq 9,3 \text{ } \mu\text{m } (365 \text{ } \mu\text{in})$

When the bending stiffness value (see ISO/IEC 7810) for the card is less than 20 mm then the surface profile limits are:

Minimum stripe width	As shown in Figure 3A	As shown in Figure 3B
$W = 6,35 \text{ mm (0.25 in)}$	$a \leq 7,3 \text{ }\mu\text{m (288 }\mu\text{in)}$	$a \leq 4,5 \text{ }\mu\text{m (175 }\mu\text{in)}$
$W = 10,28 \text{ mm (0.405 in)}$	$a \leq 11,7 \text{ }\mu\text{m (466 }\mu\text{in)}$	$a \leq 7,3 \text{ }\mu\text{m (284 }\mu\text{in)}$



A

B

Figure 3 — Surface profile

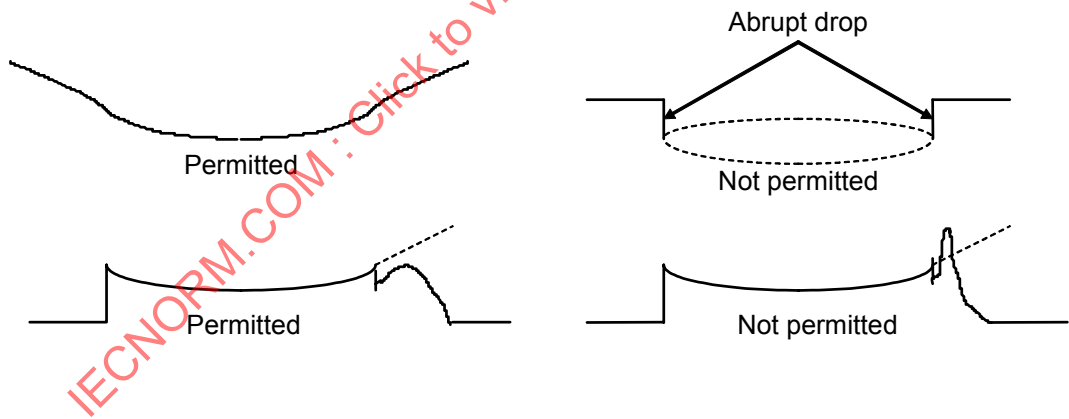


Figure 4 — Surface profile examples

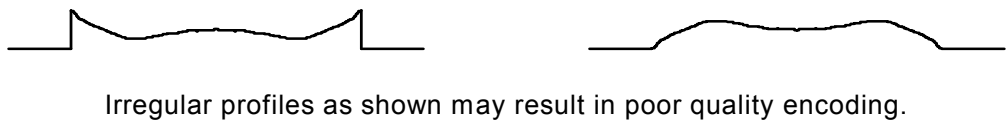


Figure 5 — Irregular surface profile examples

6.1.2 Height of the magnetic stripe area

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

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

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 $0,40 \text{ }\mu\text{m}$ ($15,9 \text{ }\mu\text{in}$) in both the longitudinal and transverse directions when measured according to ISO/IEC 4287.

6.3 Adhesion of stripe to card

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

6.4 Wear of magnetic stripe from read/write head

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

$$U_{A \text{ after}} \geq 0,60 U_{A \text{ before}} \quad \text{and} \quad U_{i \text{ after}} \geq 0,80 U_{A \text{ after}}$$

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 ISO/IEC 10373-1 and shall result in:

$$U_{A \text{ after}} \geq 0,90 U_{A \text{ before}} \quad \text{and} \quad U_{i \text{ after}} \geq 0,90 U_{A \text{ after}}$$

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 ISO/IEC 10373-1.

$$U_{A \text{ after}} \geq 0,90 U_{A \text{ before}} \quad \text{and} \quad U_{i \text{ after}} \geq 0,90 U_{A \text{ after}}$$

7 Performance characteristics for the magnetic material

7.1 General

The purpose of this section is to enable magnetic interchangeability between card and processing systems. Media coercivity is not specified. The media's performance criteria, regardless of coercivity, is specified in 7.3.

This method uses a reference card whose material is traceable to the primary standard (see Clause 4). All signal amplitude results from the use of the secondary reference card must be corrected by the factor supplied with the secondary reference card. Test methods given in ISO/IEC 10373-2 shall be used.

7.2 Testing and operating environment

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

temperature	-35 °C to 50 °C (-31 °F to 122 °F)
relative humidity	5 % to 95 %

7.3 Signal amplitude requirements for magnetic media

The requirements for recording characteristics of the card are shown in Table 1, and Figure 6 and Figure 7. The media's performance requirements specified in 7.3 shall be met in order to achieve improved resistance to erasure, and to enable magnetic interchange between card and processing systems. The properties in Annex D are intended as guidelines for magnetic material. Annex D is informative and shall not be used as performance criteria for cards.

Table 1 — Signal amplitude requirements for unused unencoded cards

Description	Density ft/mm (fpi)	Test recording current	Signal amplitude result	Requirement
Signal amplitude	8 (200)	$I_{\min}$	U_{A1}	$0,8 U_R \leq U_{A1} \leq 1,2 U_R$
Signal amplitude	8 (200)	$I_{\min}$	U_{i1}	$U_{i1} \leq 1,26 U_R$
Signal amplitude	8 (200)	$I_{\max}$	U_{A2}	$U_{A2} \geq 0,8 U_R$
Signal amplitude	20 (500)	$I_{\max}$	U_{i2}	$U_{i2} \geq 0,65 U_R$
Resolution	20 (500)	$I_{\max}$	U_{A3}	$U_{A3} \geq 0,7 U_{A2}$
Erase	0	$I_{\min}$, DC	U_{A4}	$U_{A4} \leq 0,03 U_R$
Extra pulse	0	$I_{\min}$, DC	U_{i4}	$U_{i4} \leq 0,05 U_R$
Demagnetisation	0	I_d , DC	U_{A5}	$U_{A5} \geq 0,64 U_R$
Demagnetisation	0	I_d , DC	U_{i5}	$U_{i5} \geq 0,54 U_R$
Waveform	3 (75)	$I_{\max}$	U_{i6} , U_{A6}	$U_{i6} \leq 0,07 U_{A6}$
U_{i6} is the absolute value of the largest signal amplitude in the U_{i6} measurement area as shown in Figure 7.				
The slope of the saturation curve shall never be positive between $I_{\min}$ and $I_{\max}$.				
NOTE It is not permissible to combine the above requirements mathematically. These values are for unencoded card tests and are not applicable for encoded cards.				

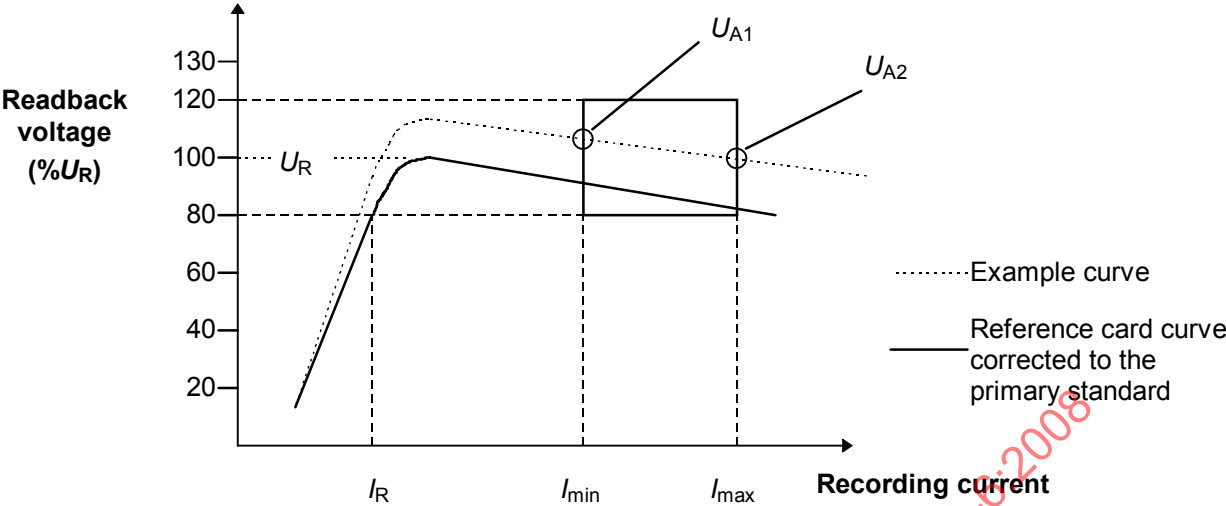
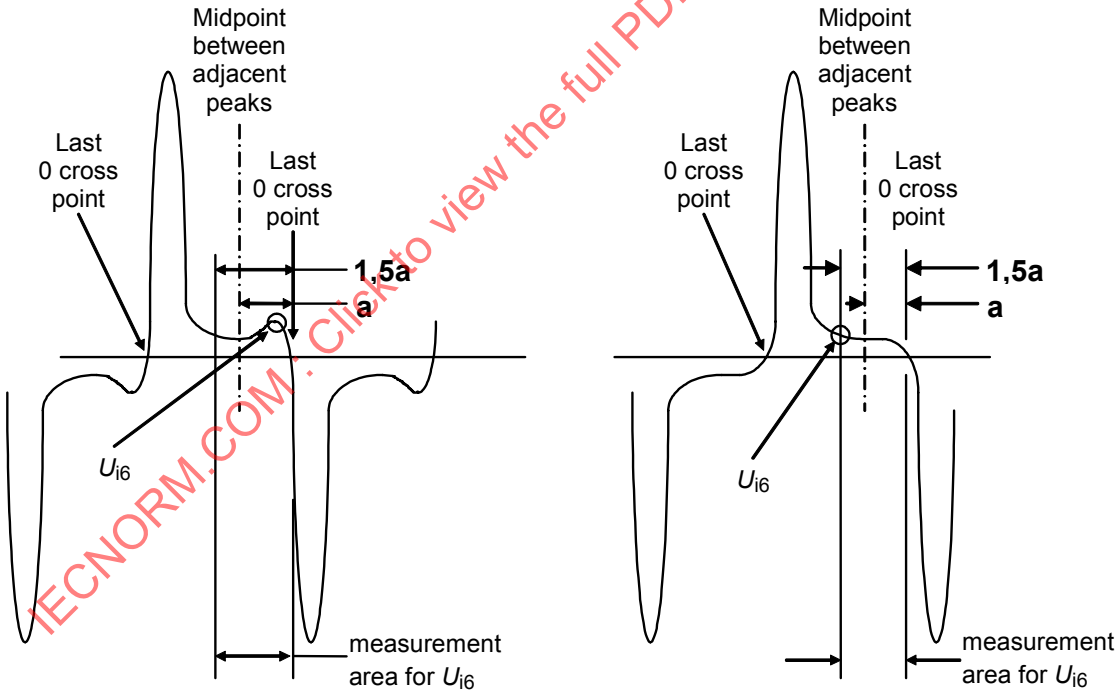


Figure 6 — Saturation curve example showing tolerance area at 8 ft/mm (200 fpi)

NOTE The curve defines the primary standard response (on a card). The window parameters define a card that will be functional in the machine readable environment.



1.	Find midpoint between 2 adjacent peaks.
2.	Find 0 crossing point for waveform between midpoint and adjacent peak.
3.	The measurement area is 1,5 times a (the distance between the midpoint and 0 cross point).
4.	Find the largest signal amplitude level in the measurement area defined in the figure.
5.	The absolute value of this level is the U_{i6} for the waveform.

Figure 7 — Waveform measurements

8 Encoding technique

The encoding technique for each track is known as two-frequency recording. This method allows for serial recording of self-clocking data. 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" (see Figure 8).

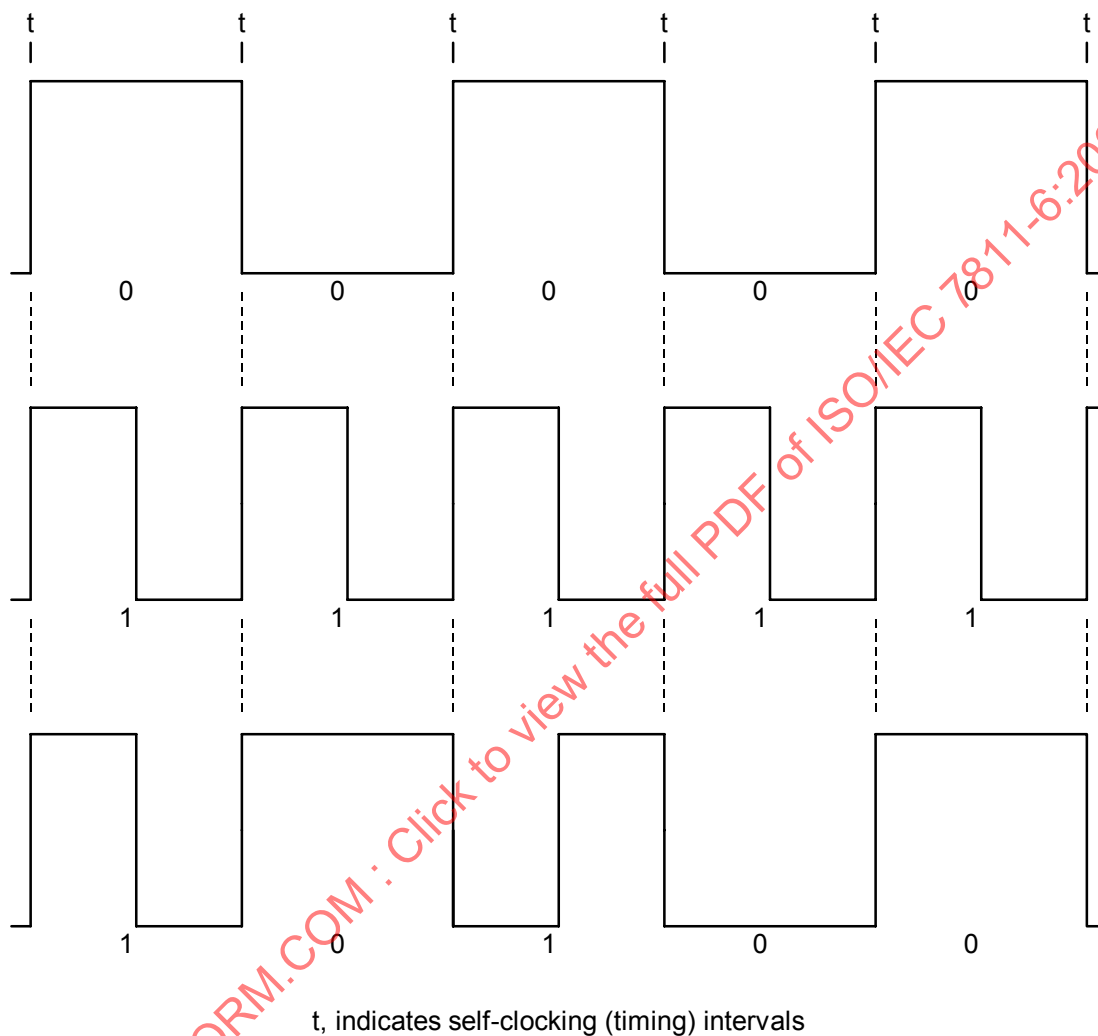


Figure 8 — Examples of two-frequency encoding

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

NOTE Recording with a write current which is less than $I_{\min}$ 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 a tolerance of ± 20 min. The angle of recording (α) is determined by measuring the angle of the head gap when the reading amplitude is maximum (see Figure 9).

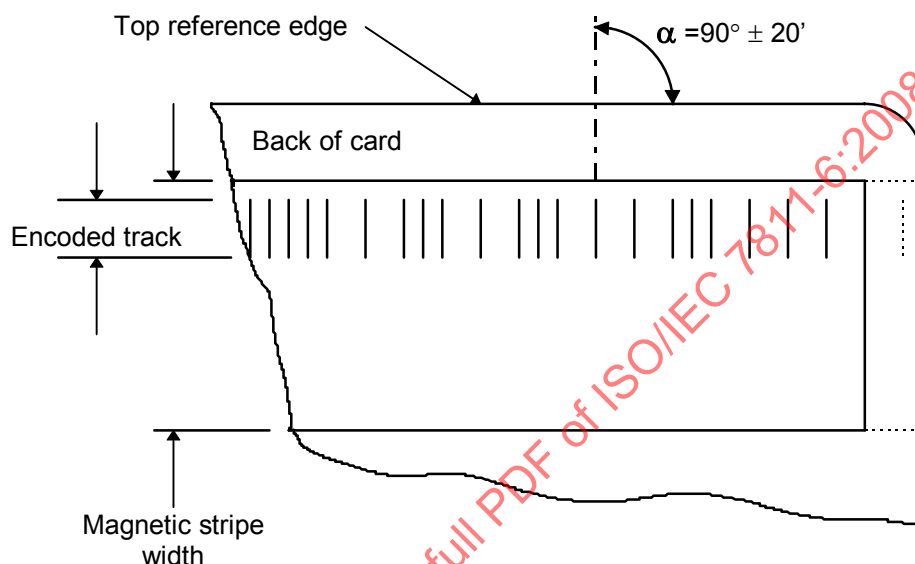


Figure 9 — Angle of recording

9.2 Nominal bit density

The nominal bit density for each of the tracks shall be:

for track 1 8,27 bits/mm (210 bpi),

for track 2 2,95 bits/mm (75 bpi),

for track 3 8,27 bits/mm (210 bpi).

9.3 Signal amplitude requirements for tracks 1, 2 and 3

The requirements for signal amplitude on tracks 1, 2 and 3 shall be as follows:

Unused encoded cards: $0,64 U_R \leq U_i \leq 1,36 U_R$

Returned cards: $0,52 U_R \leq U_i \leq 1,36 U_R$

There shall be no signal peaks between the minimum requirement ($0,64 U_R$ for Unused encoded cards or $0,52 U_R$ for Returned cards) and $0,07 U_R$.

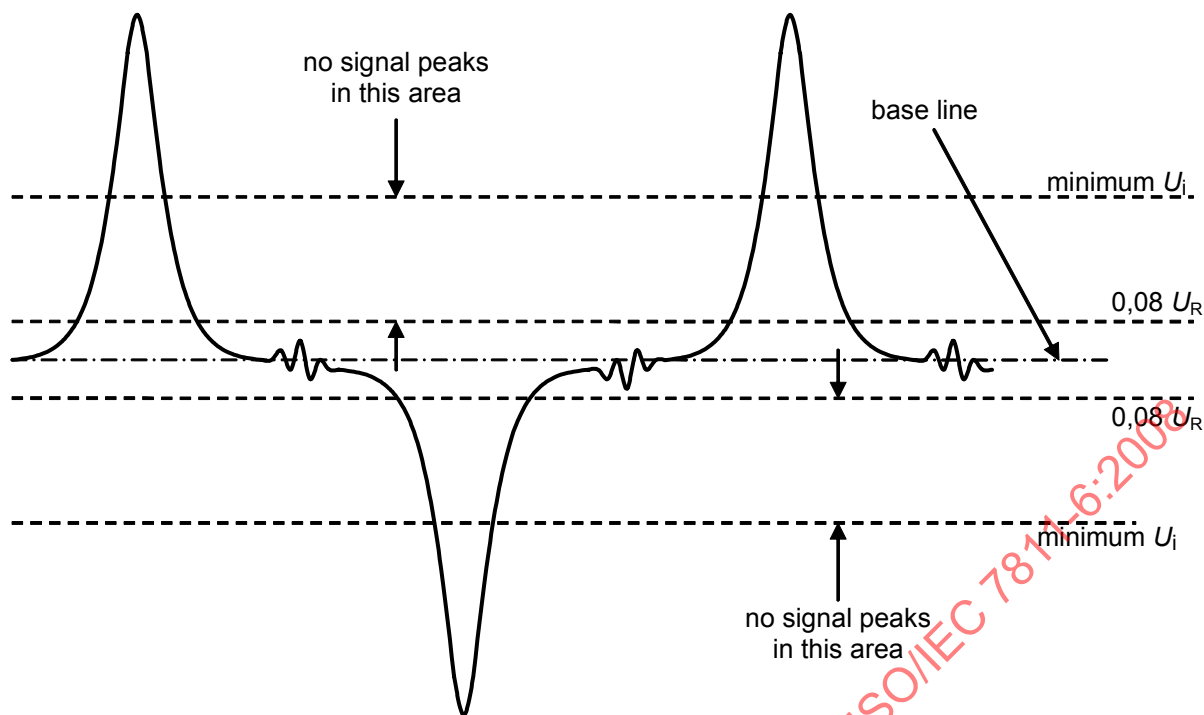


Figure 10 — Flux transition spacing variation

NOTE 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 (2^0) 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. 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

10.1 Alphanumeric track, track 1

10.1.1 Average bit density

The average bit density (B_a) shall be 8,27 bits/mm (210 bpi) $\pm 8\%$ 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 11.

Table 2 — Flux transition spacing variation for unused encoded cards-Track 1 and 3

Term	Description	Requirement	Variation
B_a	Average length between clocking flux transitions	$111\text{ }\mu\text{m (4381 }\mu\text{in)} \leq B_a \leq 131\text{ }\mu\text{m (5143 }\mu\text{in)}$	$\pm 8\%$
B_{in}	Individual length between clocking flux transitions	$109\text{ }\mu\text{m (4286 }\mu\text{in)} \leq B_{in} \leq 133\text{ }\mu\text{m (5238 }\mu\text{in)}$	$\pm 10\%$
B_{in+1}	Adjacent bit-to-bit variation	$0,90 B_{in} \leq B_{in+1} \leq 1,10 B_{in}$	$\pm 10\%$
S_{in}	Subinterval length	$53\text{ }\mu\text{m (2095 }\mu\text{in)} \leq S_{in} \leq 68\text{ }\mu\text{m (2667 }\mu\text{in)}$	$\pm 12\%$
S_{in+1}	Adjacent subinterval length	$0,88 B_{in}/2 \leq S_{in+1} \leq 1,12 B_{in}/2$	$\pm 12\%$
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-Track 1 and 3

Term	Description	Requirement	Variation
B_a	Average length between clocking flux transitions	$111\text{ }\mu\text{m (4381 }\mu\text{in)} \leq B_a \leq 131\text{ }\mu\text{m (5143 }\mu\text{in)}$	$\pm 8\%$
B_{in}	Individual length between clocking flux transitions	$103\text{ }\mu\text{m (4048 }\mu\text{in)} \leq B_{in} \leq 139\text{ }\mu\text{m (5476 }\mu\text{in)}$	$\pm 15\%$
B_{in+1}	Adjacent bit-to-bit variation	$0,85 B_{in} \leq B_{in+1} \leq 1,15 B_{in}$	$\pm 15\%$
S_{in}	Subinterval length	$48,4\text{ }\mu\text{m (1905 }\mu\text{in)} \leq S_{in} \leq 72,6\text{ }\mu\text{m (2857 }\mu\text{in)}$	$\pm 20\%$
S_{in+1}	Adjacent subinterval length	$0,70 B_{in}/2 \leq S_{in+1} \leq 1,30 B_{in}/2$	$\pm 30\%$
B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in} .			
NOTE 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.			

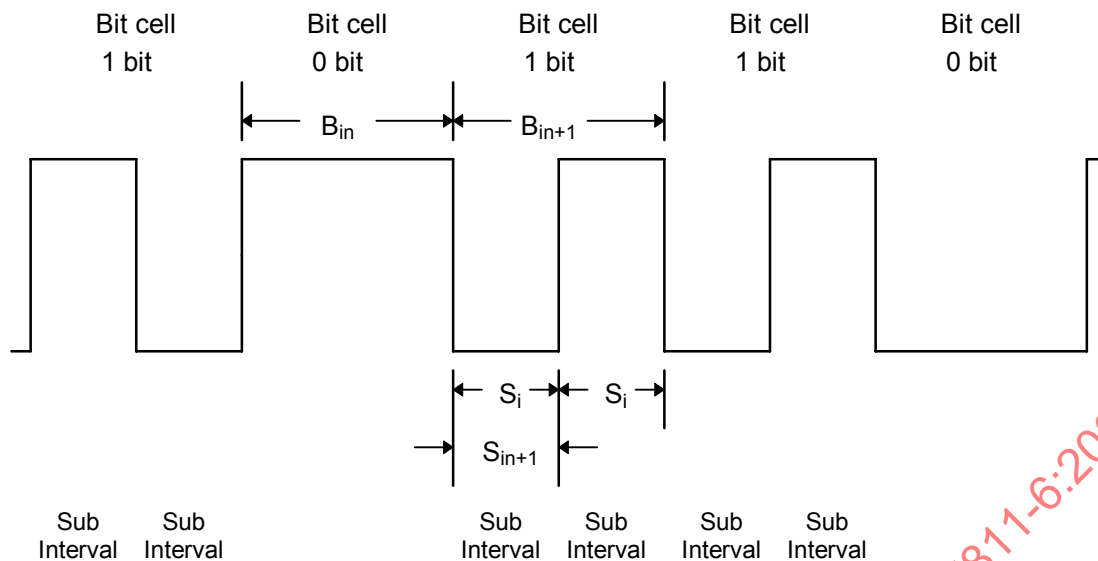


Figure 11 — Flux transition spacing variation

10.1.3 Coded character set

The coded character set for track 1 shall be 7 bit alphanumeric as shown in Table 4.

The 14 characters ! " & ' * + , ; < = > @ _ are available for hardware control purposes and may not be used for information (data content).

The 3 characters [\] are reserved for additional national characters when required. They must not be used internationally.

The character # is reserved for optional additional graphic symbols.

The 3 characters % ^ ? shall have the following meaning:

- % start sentinel
- ^ field separator
- ? end sentinel

Table 4 — Coded character set for 7 bit alphanumeric

	Char.	Binary								Char	Binary						
		P	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰			P	2 ⁵	2 ⁴	2 ³	2 ²	2 ¹	2 ⁰
	space	1	0	0	0	0	0	0		@	0	1	0	0	0	0	0
	!	0	0	0	0	0	0	1		A	1	1	0	0	0	0	1
	“	0	0	0	0	0	1	0		B	1	1	0	0	0	1	0
	#	1	0	0	0	0	1	1		C	0	1	0	0	0	1	1
	\$	0	0	0	0	1	0	0		D	1	1	0	0	1	0	0
	%	1	0	0	0	1	0	1		E	0	1	0	0	1	0	1
	&	1	0	0	0	1	1	0		F	0	1	0	0	1	1	0
	‘	0	0	0	0	1	1	1		G	1	1	0	0	1	1	1
	(	0	0	0	1	0	0	0		H	1	1	0	1	0	0	0
	)	1	0	0	1	0	0	1		I	0	1	0	1	0	0	1
	*	1	0	0	1	0	1	0		J	0	1	0	1	0	1	0
	+	0	0	0	1	0	1	1		K	1	1	0	1	0	1	1
	,	1	0	0	1	1	0	0		L	0	1	0	1	1	0	0
	-	0	0	0	1	1	0	1		M	1	1	0	1	1	0	1
	.	0	0	0	1	1	1	0		N	1	1	0	1	1	1	0
	/	1	0	0	1	1	1	1		O	0	1	0	1	1	1	1
	0	0	0	1	0	0	0	0		P	1	1	1	0	0	0	0
	1	1	0	1	0	0	0	1		Q	0	1	1	0	0	0	1
	2	1	0	1	0	0	1	0		R	0	1	1	0	0	1	0
	3	0	0	1	0	0	1	1		S	1	1	1	0	0	1	1
	4	1	0	1	0	1	0	0		T	0	1	1	0	1	0	0
	5	0	0	1	0	1	0	1		U	1	1	1	0	1	0	1
	6	0	0	1	0	1	1	0		V	1	1	1	0	1	1	0
	7	1	0	1	0	1	1	1		W	0	1	1	0	1	1	1
	8	1	0	1	1	0	0	0		X	0	1	1	1	0	0	0
	9	0	0	1	1	0	0	1		Y	1	1	1	1	0	0	1
	:	0	0	1	1	0	1	0		Z	1	1	1	1	0	1	0
	;	1	0	1	1	0	1	1		[	0	1	1	1	0	1	1
	<	0	0	1	1	1	0	0		\	1	1	1	1	1	0	0
	=	1	0	1	1	1	0	1		]	0	1	1	1	1	0	1
	>	1	0	1	1	1	1	0		^	0	1	1	1	1	1	0
	?	0	0	1	1	1	1	1		_	1	1	1	1	1	1	1
NOTE This coded character set is identical to the coded character set in ISO/IEC 7811-2 (derived from ASCII.)																	

10.1.4 Maximum number of characters for ID-1 type card

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

10.2 Numeric track, Track 2

10.2.1 Average bit density

The average bit density (B_a) shall be 2,95 bits/mm (75 bpi) $\pm 5\%$ measured in a longitudinal direction parallel to the top reference edge.

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 11.

Table 5 — Flux transition spacing variation for unused encoded cards-Track 2

Term	Description	Requirement	Variation
B_a	Average length between clocking flux transitions	$322\ \mu\text{m}\ (12667\ \mu\text{in}) \leq B_a \leq 356\ \mu\text{m}\ (14000\ \mu\text{in})$	$\pm 5\%$
B_{in}	Individual length between clocking flux transitions	$315\ \mu\text{m}\ (12400\ \mu\text{in}) \leq B_{in} \leq 363\ \mu\text{m}\ (14267\ \mu\text{in})$	$\pm 7\%$
B_{in+1}	Adjacent bit-to-bit variation	$0,90\ B_{in} \leq B_{in+1} \leq 1,10\ B_{in}$	$\pm 10\%$
S_{in}	Subinterval length	$153\ \mu\text{m}\ (6000\ \mu\text{in}) \leq S_{in} \leq 186\ \mu\text{m}\ (7333\ \mu\text{in})$	$\pm 10\%$
S_{in+1}	Adjacent subinterval length	$0,88\ B_{in}/2 \leq S_{in+1} \leq 1,12\ B_{in}/2$	$\pm 12\%$
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

Term	Description	Requirement	Variation
B_a	Average length between clocking flux transitions	$322\ \mu\text{m}\ (12667\ \mu\text{in}) \leq B_a \leq 356\ \mu\text{m}\ (14000\ \mu\text{in})$	$\pm 5\%$
B_{in}	Individual length between clocking flux transitions	$288\ \mu\text{m}\ (11333\ \mu\text{in}) \leq B_{in} \leq 390\ \mu\text{m}\ (15333\ \mu\text{in})$	$\pm 15\%$
B_{in+1}	Adjacent bit-to-bit variation	$0,85\ B_{in} \leq B_{in+1} \leq 1,15\ B_{in}$	$\pm 15\%$
S_{in}	Subinterval length	$136\ \mu\text{m}\ (5333\ \mu\text{in}) \leq S_{in} \leq 203\ \mu\text{m}\ (8000\ \mu\text{in})$	$\pm 20\%$
S_{in+1}	Adjacent subinterval length	$0,70\ B_{in}/2 \leq S_{in+1} \leq 1,30\ B_{in}/2$	$\pm 30\%$
B_{in+1} or S_{in+1} is the length between flux transitions immediately following and adjacent to B_{in} .			
NOTE 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

The coded character set for track 2 shall be 5 bit numeric as shown in Table 7.

The 3 characters : < > are available for hardware control purposes and shall not be used for data content.

The 3 characters ; = ? shall have the following meaning:

- ; start sentinel
- = field separator
- ? end sentinel

Table 7 — Coded character set for 5 bit numeric

	Char.	Binary						Char.	Binary				
		P	2 ³	2 ²	2 ¹	2 ⁰			P	2 ³	2 ²	2 ¹	2 ⁰
	0	1	0	0	0	0		8	0	1	0	0	0
	1	0	0	0	0	1		9	1	1	0	0	1
	2	0	0	0	1	0		:	1	1	0	1	0
	3	1	0	0	1	1		;	0	1	0	1	1
	4	0	0	1	0	0		<	1	1	1	0	0
	5	1	0	1	0	1		=	0	1	1	0	1
	6	1	0	1	1	0		>	0	1	1	1	0
	7	0	0	1	1	1		?	1	1	1	1	1
NOTE This coded character set is identical to the coded character set in ISO/IEC 7811-2 (derived from ASCII.)													

10.2.4 Maximum number of characters for ID-1 type card

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

10.3 Numeric track, Track 3

10.3.1 Average bit density

The average bit density (B_a) shall be 8,27 bits/mm (210 bpi) $\pm$ 8 % measured in a longitudinal direction parallel to the top reference edge.

10.3.2 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 11.

10.3.3 Coded character set

The coded character set for track 3 shall be 5 bit numeric as shown in Table 7.

The 3 characters : < > are available for hardware control purposes and shall not be used for data content.

The 3 characters ; = ? shall have the following meaning:

- ; start sentinel
- = field separator
- ? end sentinel

10.3.4 Maximum number of characters for ID-1 type card

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

11 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.

11.1 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.

11.2 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.

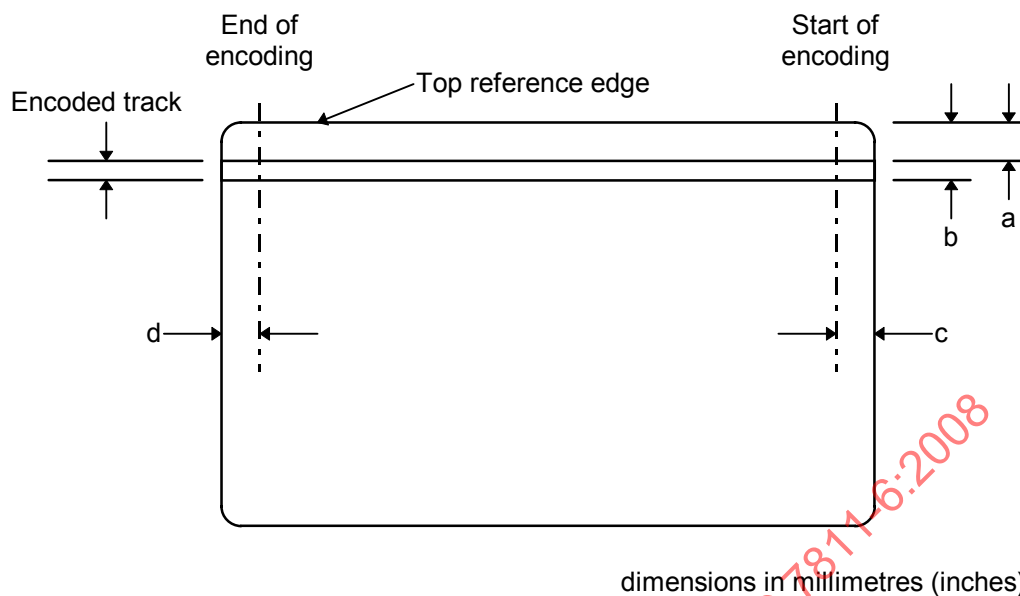
The LRC character shall be calculated using the following procedure:

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 11.1.

12 Location of encoded tracks

Each encoded track shall be located between the two lines as shown in Figure 12. The start of encoding is located at the centreline of the first "one" bit in the start sentinel. The end of encoding is located at the centreline of the last bit in the longitudinal redundancy check character (the last bit is the parity bit).



Term	Track 1	Track 2	Track 3
a		8,33 (0.328) minimum	11,63 (0.458) minimum
	5,79 (0.228) maximum	9,09 (0.358) maximum	12,65 (0.498) maximum
b	8,33 (0.328) minimum	11,63 (0.458) minimum	15,19 (0.598) minimum
	9,09 (0.358) maximum	12,65 (0.498) maximum	15,82 (0.623) maximum
c	7,44 ± 1,00 (0.293 ± 0.039)	7,44 ± 0,50 (0.293 ± 0.020)	7,44 ± 1,00 (0.293 ± 0.039)
d	6,93 (0.252) minimum	6,93 (0.252) minimum	----
NOTE All tracks have a minimum width of 2,54 (0.100).			

Figure 12 — Location of encoded tracks