INTERNATIONAL STANDARD

**ISO/IEC 7811-7**

Second edition
2014-09-01

# Identification cards — Recording technique —

## Part 7: Magnetic stripe — High coercivity, high density

*Cartes d'identification — Technique d'enregistrement —*
*Partie 7: Bandeau magnétique — Haute coercitivité, haute densité*



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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information



The committee responsible for this document is Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.



This second edition cancels and replaces the first edition (ISO/IEC 7811-7:2004) of which it constitutes a major revision with the following changes.

— The primary standard cards held by Q-Card are used to calibrate the manufacture of secondary reference cards. Other primary standard cards held by PTB and Card testing International (CTI) are used as backup to replace cards held by Q-Card as they wear out.

— Delete reference to character sets in the Scope since none are used in this International Standard.

— List of major differences has been moved from the Introduction to Annex A.

— The supplier of secondary reference cards has changed from PTB to Q-Card.

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 — High coercivity of 51,7 kA/m (650 Oe)*

— *Part 9: Tactile identifier mark*

Notes in this International Standard are only used for giving additional information intended to assist in the understanding or use of the International Standard and do not contain provisions or requirements to which it is necessary to conform in order to be able to claim compliance with this International Standard.

 

# Identification cards — Recording technique —

# Part 7: Magnetic stripe — High coercivity, high density

## 1 Scope

This part of ISO/IEC 7811 is one of a series of International Standards describing the characteristics for identification cards as defined in the definitions clause 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 and encoding technique. 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.



This standard provides for a card capacity of approximately 10 times that of a card conforming to ISO/IEC 7811-6. The number of tracks has been increased to six, each track being approximately half the width of tracks conforming to ISO/IEC 7811-6, located so that readers designed to read these high density tracks will also be able to read cards conforming to ISO/IEC 7811-2 and ISO/IEC 7811-6. Data is encoded in 8 bit bytes using the MFM encoding technique. Data framing is used to limit error propagation and error correction techniques further improve reliability of reading.



It is the purpose of this series of International Standards to provide criteria to which cards shall perform. No consideration is given within these International Standards 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 might have been rounded off and therefore are consistent with, but not exactly equal to, each other. Either system can 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 documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 4287-1, *Surface roughness — Terminology — Part 1: Surface and its 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 by Physikalisch-Technische Bundesanstalt (PTB) and maintained by PTB, Q-Card, and WG1 secretariat that represent the values of UR and IR 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 1 to entry: Secondary standards can be ordered from Q-Card, 301 Reagan St., Sunbury, PA 17801, USA. The source of secondary standards will be maintained at least until 2018.

**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 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**
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 magnetization

**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 20 flux transitions per mm (508 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 2,2 $F_R$ and $I_{max}$ = recording current corresponding to 2,5 $F_R$

**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 values 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 for a data bit nominally the reciprocal of the bit density (see Figure 8)



**4.16**
**average bit cell**
$B_a$
product of bit cell length and sum of the actual distances for all flux transition intervals on a track divided by the sum of the nominal distances for all flux transition intervals on the track



**4.17**
**local average bit cell**
$B_{a6}$
comparison reference for a given flux transition interval equal to the nominal L1 distance multiplied by the sum of the actual distances for the previous six flux transition intervals divided by the sum of the nominal distances for the previous six flux transition intervals

L1 × (Σ actual)/(Σ nominal)

**4.18**
**demagnetization 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 40 ft/mm (1 016 ftpi) at a current of $I_{min}$

**4.19**
$L_1$
short distance between adjacent flux transitions nominally equal to 1 times the bit cell

**4.20**
$L_2$
medium distance between adjacent flux transitions nominally equal to 1,5 times the bit cell

**4.21**
***$L_3$***
long distance between adjacent flux transitions nominally equal to 2 times the bit cell

**4.22**
**FSC**
frame synchronization character

**4.23**
**CRC**
cyclic redundancy check

**4.24**
**CP**
column parity

**4.25**
***$U_F$***
magnitude of the individual element at 20 flux transitions per mm frequency of the Fourier spectrum for a given track over the length of the magnetic stripe area

## 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.

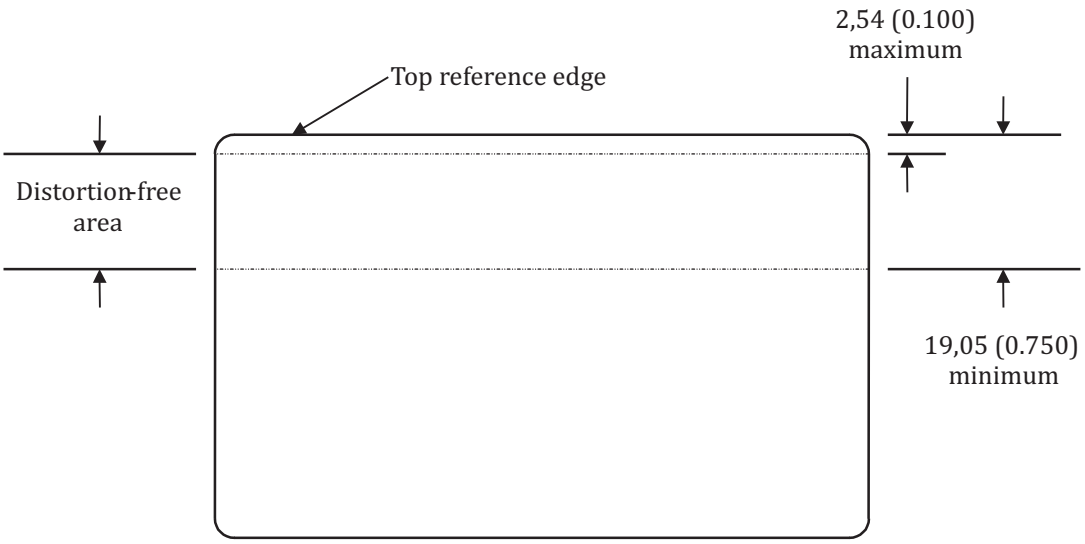


**Figure 1 — Distortion-free area on card with magnetic stripe**

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.

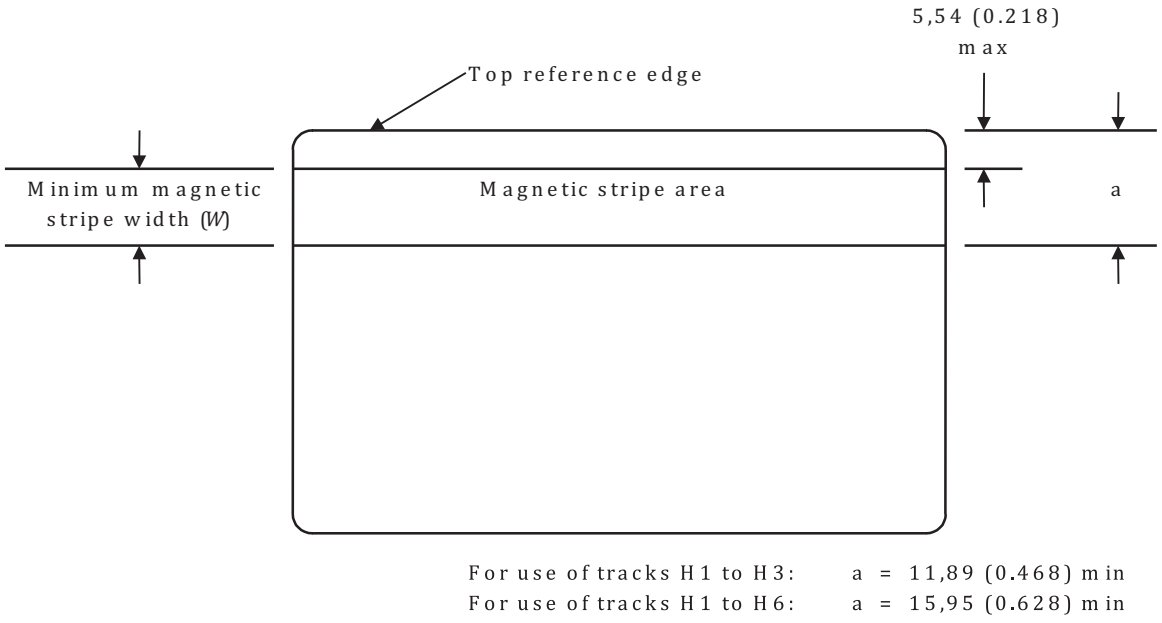


**Figure 2 — Location of magnetic material**

### 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 Figures 3, 4 and 5. The slope of the surface profile curve shall be limited to: -4a/W < 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 mm (0,25 in) | a ≤ 9,5 µm (375 µin) | a ≤ 5,8 µm (225 µin) |
| W = 10,28 mm (0,405 in) | a ≤ 15,4 µm (607 µin) | a ≤ 9,3 µm (365 µin) |

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 mm (0,25 in) | a ≤ 7,3 µm (288 µin) | a ≤ 4,5 µm (175 µin) |
| W = 10,28 mm (0.405 in) | a ≤ 11,7 µm (466 µin) | a ≤ 7,3 µm (284 µin) |



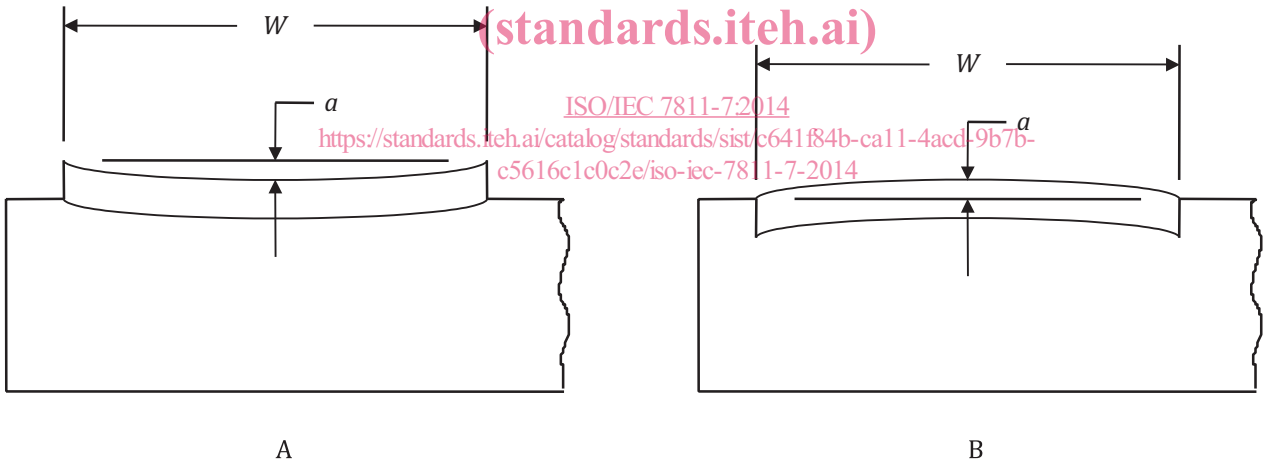


**Figure 3 — Surface profile**

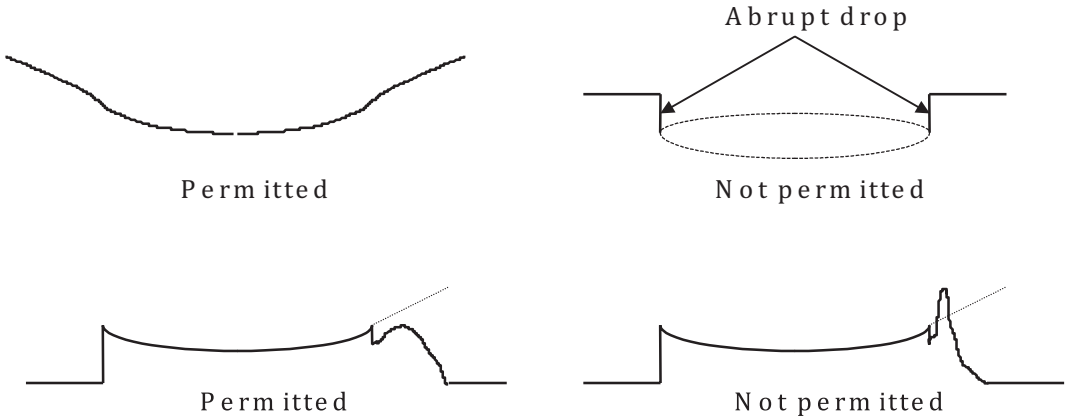


**Figure 4 — Surface profile examples**

Irregular profiles as shown may result in poor quality encoding.

**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 mm ( - 200 µin) ≤ $h$ ≤ 0,038 mm (1500 µin)

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 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.

## 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 2 000 wear cycles and shall result in:

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

### 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 referenced Test Method document) shall result in:

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

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 referenced Test Method document.

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

## 7 Performance characteristics for the magnetic material

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

### 7.1 General

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.



### 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 40 ft/mm (1 016 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 (-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 Figures 6 and 7. The media's performance requirements specified in section 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 C are intended as guidelines for magnetic material. Annex C 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 (ftpi) | Test recording current | Signal amplitude result | Requirement |
|---|---|---|---|---|
| Signal amplitude | 20 (508) | $I_{min}$ | $U_{A1}$ | $0{,}8\ U_R \leq U_{A1} \leq 1{,}2\ U_R$ |
| Signal amplitude | 20 (508) | $I_{min}$ | $U_{i1}$ | $U_{i1} \leq 1{,}26\ U_R$ |
| Signal amplitude | 20 (508) | $I_{max}$ | $U_{A2}$ | $U_{A2} \geq 0{,}8\ U_R$ |
| The slope of the saturation curve shall never be positive between $I_{min}$ and $I_{max}$.<br>It is not permissible to combine the above requirements mathematically. | | | | |