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Information technology — Magnetic stripes on savingsbooks

Technologies de l'information — Zone magnétique des livrets d'épargne

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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 8484 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

This first edition of ISO/IEC 8484 cancels and replaces ISO 8484:1987, which has been technically revised. The user is encouraged to review this edition for revisions and updates. Most of the magnetic characteristics are based on ISO/IEC 7811-2, *Identification cards — Recording technique — Part 2: Magnetic stripe — Low coercivity*. Because savingsbooks are generally paper-based documents, some criteria and test methods have been taken from ISO/IEC 15457-2, *Identification cards — Thin flexible cards — Part 2: Magnetic recording techniques*. The major changes from the first edition are as follows.

— Wherever possible, the terms and definitions, criteria and test methods have been taken from ISO/IEC 7811-2.

— The reference material has changed from SRM 3200 to RM 7811/2.

— Signal amplitude requirements have been expanded (based on ISO/IEC 7811-2).

— This International Standard has changed from ISO to ISO/IEC.

— Classifications for unused and returned savingsbooks have been added.

— More complete flux transition spacing variation requirements have been added (based on ISO/IEC 7811-2).

— Magnetic stripe area surface profile and warpage requirements have been added.

— An optional high coercivity magnetic stripe has been added, based on ISO/IEC 7811-6 and RM 7811/6.

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.

NOTE Numbers for signal amplitude and flux transition spacing variation are taken from ISO/IEC 7811-2 and ISO/IEC 15457-2 and are based on testing performed on sample passbooks at two test facilities.

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Information technology — Magnetic stripes on savingsbooks

1 Scope

This International Standard specifies the characteristics and location of a magnetic stripe on a savingsbook as defined in Clause 4 and the use of such savingsbooks for international interchange. Compatibility with international interchange systems is provided through the requirements of this International Standard, enabling a savingsbook with a magnetic stripe to be read and possibly encoded in a device that is compatible with reading identification cards used in international interchange.

This International Standard specifies requirements for a magnetic stripe (including any protective overlay) on a savingsbook, the encoding technique and coded character sets. It also specifies the characteristics of the savingsbook cover such as stiffness, minimum size, surface irregularities, roughness and interaction between the cover material and the magnetic stripe. It takes into consideration both human and machine aspects and states minimum requirements.

Coercivity influences many of the quantities specified in this International Standard but is not itself specified. Exposure of the savingsbook to a magnetic field is likely to destroy the recorded data.

This International Standard defines performance criteria for savingsbooks. No consideration is given within this International Standard to the amount of use, if any, experienced by the savingsbook 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 savingsbooks against the parameters specified in this International Standard. References in the test method to cards shall refer to savingsbooks.

NOTE 1 Numeric values in the SI and/or Imperial measurement system in this International Standard 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.

NOTE 2 National systems may use different specifications, such as DIN, as well as proprietary specifications for closed systems.

2 Conformance

A savingsbook is in conformance with this International Standard 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 2493, *Paper and board — Determination of resistance to bending*

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

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

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4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
primary standard
set of reference cards established and maintained by Physikalisch-Technische Bundesanstalt (PTB) that represent the values of U_R and I_R designated RM 7811/2

4.2
secondary standard
reference card designated RM 7811/2 that is related to the primary standard as stated in the calibration certificate supplied with each card

NOTE Secondary standards can be ordered from Physikalisch-Technische Bundesanstalt (PTB), AG 2.52 - Bundesallee 100, D-38116 Braunschweig, Germany. The source of secondary standards will be maintained at least until 2008.

4.3
unused unencoded savingsbook
savingsbook 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 a 48 h exposure to daylight at temperatures between 5 °C and 30 °C and a humidity between 10 % and 90 % without experiencing thermal shock

4.4
unused encoded savingsbook
unused unencoded savingsbook (4.3) that has only been encoded with all the data required for its intended purpose (e.g. magnetic encoding, electronic encoding)

4.5
returned savingsbook
unused encoded savingsbook (4.4) after it has been issued to the savingsbook 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 3,5 F_R
I_{max} = recording current corresponding to 5,0 F_R

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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

4.16
subinterval
distance that is nominally half of the distance between two clocking flux transitions

4.17
savingsbook
bound and folded document comprising at least a front and back cover, usually made of paper-based materials, for identifying its holder and issuer, and which may carry data required as input for the intended use for transactions based thereon

4.18
normal use
use as a savingsbook (4.17), involving equipment processes appropriate to the savingsbook technology and storage as a personal document between equipment processes

5 Physical characteristics of the savingsbook cover

Before testing is carried out, the savingsbook shall be stored for a minimum of 24 h in an environment with a temperature of 23 °C ± 2 °C and relative humidity of (50 ± 10) %. Testing shall be carried out in the same environment, or as specified in ISO/IEC 10373-2. Unused encoded savingsbooks shall conform to the following characteristics.

A savingsbook with magnetic stripe shall remain usable under the following conditions:

temperature	5 °C to 40 °C
relative humidity	20 % to 80 % non-condensing
maximum wet bulb temperature	25 °C

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WARNING — The attention of savingsbook 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 sides of the savingsbook back cover in the area shown in Figure 1 that might interfere with the contact between the magnetic head and magnetic stripe.

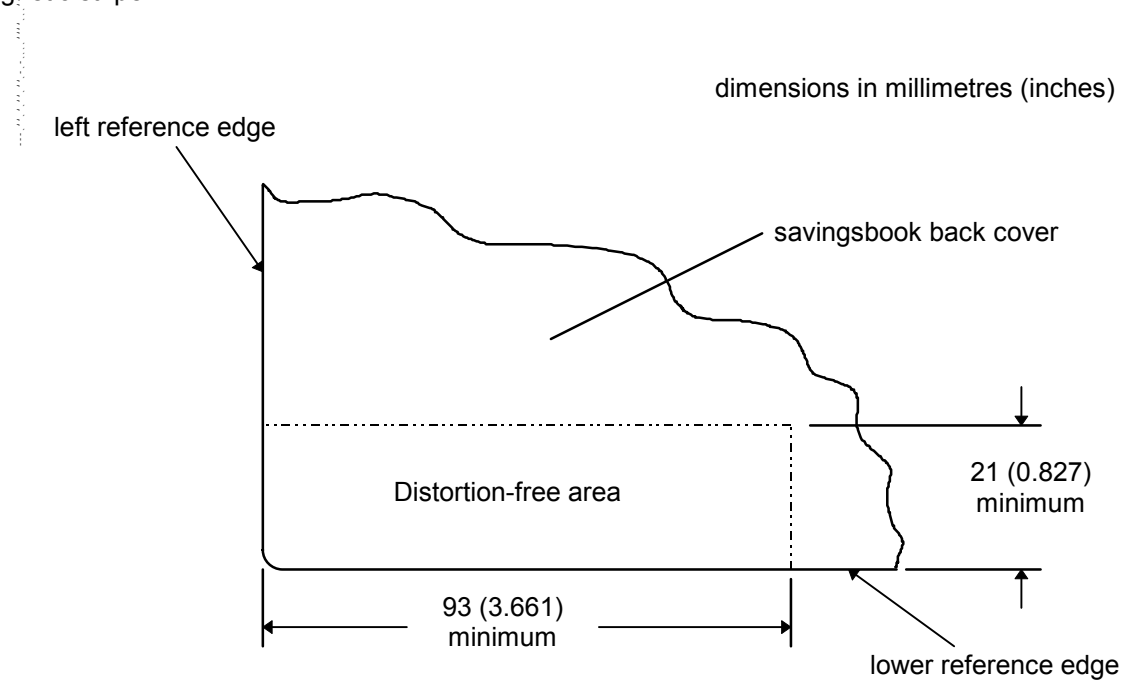


Figure 1 — Distortion-free area on savingsbook with magnetic stripe

Labels or other attachments located on the front or back of the savingsbook cover shall be outside of the distortion-free area.

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

5.3 Stiffness

The bending moment shall be greater than or equal to 0,032 N in the direction of the magnetic stripe (parallel to the lower reference edge) according to the bending moment method specified in ISO 2493.

NOTE The original test method was based on Tappi T489 os-76, which is now obsolete. According to this test method the arm is 50 mm long and the speed was 210 ± 20 degrees/minute. The requirement for the Tappi method was 0,0016 Nm which converts to 0,032 N = 1,6 Nmm / 0,05 m.

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5.4 Materials

After the magnetic stripe has been placed on the savingsbook cover, there shall be no reaction between the cover materials (both front and back) and the magnetic stripe that could cause any malfunction of the magnetic stripe in normal use.

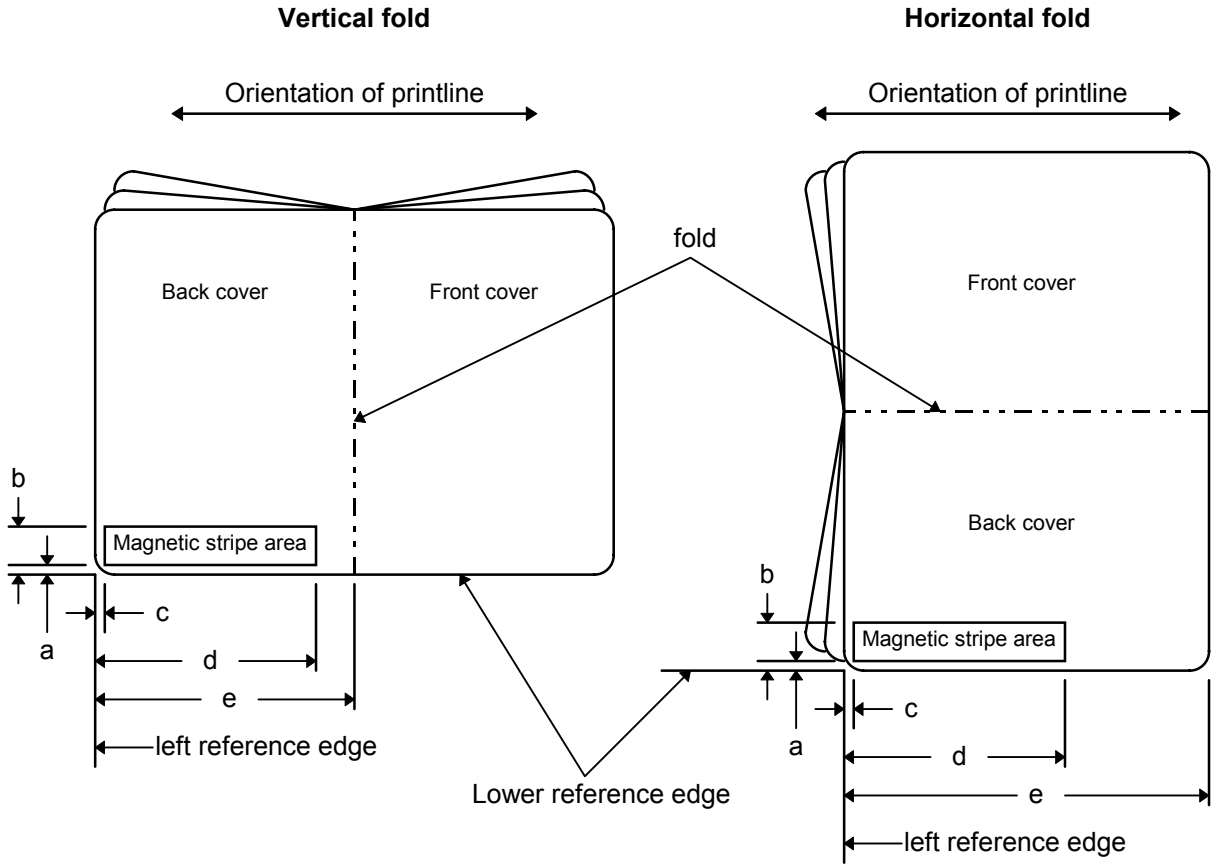
6 Physical characteristics of the magnetic stripe

6.1 Location

The magnetic stripe area shall be located on the outside of the savingsbook back cover as shown in Figure 2.

If the reader/encoder is integrated into a savingsbook printer, the magnetic stripe shall be parallel to the printline. In applications where a separate reader/encoder is used, it is generally preferable to have the magnetic stripe parallel to the fold irrespective of the type of savingsbook used. See Figure 2.

dimensions in millimetres (inches)



a maximum	b minimum	c maximum	d minimum	e minimum
5 (0.197)	19 (0.748)	2,9 (0.114)	90 (3.543)	100 (3.937)

Figure 2 — Location of magnetic material for savingsbook

NOTE This area is based on the magnetic stripe area defined by ISO/IEC 7811-2 for tracks 1, 2, and 3.

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6.2 Surface profile of the magnetic stripe area

The maximum vertical deviation (a) of the transverse surface profile of the magnetic stripe area shall be less than or equal to 8 μm (315 μin). See Figure 3.

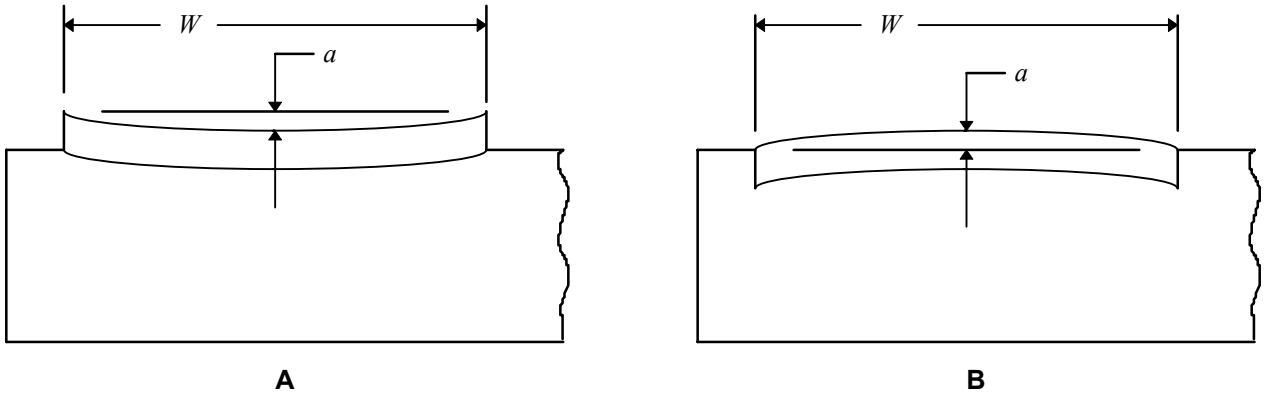


Figure 3 — Surface profile

6.3 Height of the magnetic stripe area

The vertical deviation (h) of the magnetic stripe area relative to the adjacent surface of the savingsbook shall be less than 0,102 mm (4000 μin).

6.4 Surface roughness

The surface roughness, R_a, of the magnetic stripe area shall be less than or equal to 1,4 μm (55.2 μin) in both the longitudinal and transverse directions when measured according to ISO 4287.

6.5 Adhesion of stripe to savingsbook

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

6.6 Resistance to environment

The magnetic stripe shall resist deterioration from exposure to light and other environmental factors encountered in normal use.

7 Performance characteristics for the magnetic material

7.1 General

The purpose of this clause is to enable magnetic interchangeability between savingsbook and processing systems. Media coercivity is not specified. Media performance criteria, regardless of coercivity, are 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.

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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 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 savingsbook are shown in Table 1, and Figures 3 and 4.

Table 1 — Signal amplitude requirements for unused unencoded savingsbooks

Description	Density ft/mm (ftpi)	Test recording current	Signal amplitude result	Requirement
Signal amplitude	8 (200)	I_{min}	U_{A1}	$0{,}8\ U_R \leqslant U_{A1} \leqslant 1{,}3\ U_R$
Signal amplitude	8 (200)	I_{min}	U_{i1}	$U_{i1} \leqslant 1{,}36\ U_R$
Signal amplitude	8 (200)	I_{max}	U_{A2}	$U_{A1} \geqslant U_{A2} \geqslant 0{,}8\ U_R$
Signal amplitude	20 (500)	I_{max}	U_{i2}	$U_{i2} \geqslant 0{,}65\ U_R$
Resolution	20 (500)	I_{max}	U_{A3}	$U_{A3} \geqslant 0{,}7\ U_{A2}$
Erasure	0	I_{min}, DC	U_{A4}	$U_{A4} \leqslant 0{,}03\ U_R$
Extra pulse	0	I_{min}, DC	U_{i4}	$U_{i4} \leqslant 0{,}05\ U_R$
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 savingsbooks tests and are **not** applicable for encoded savingsbooks.

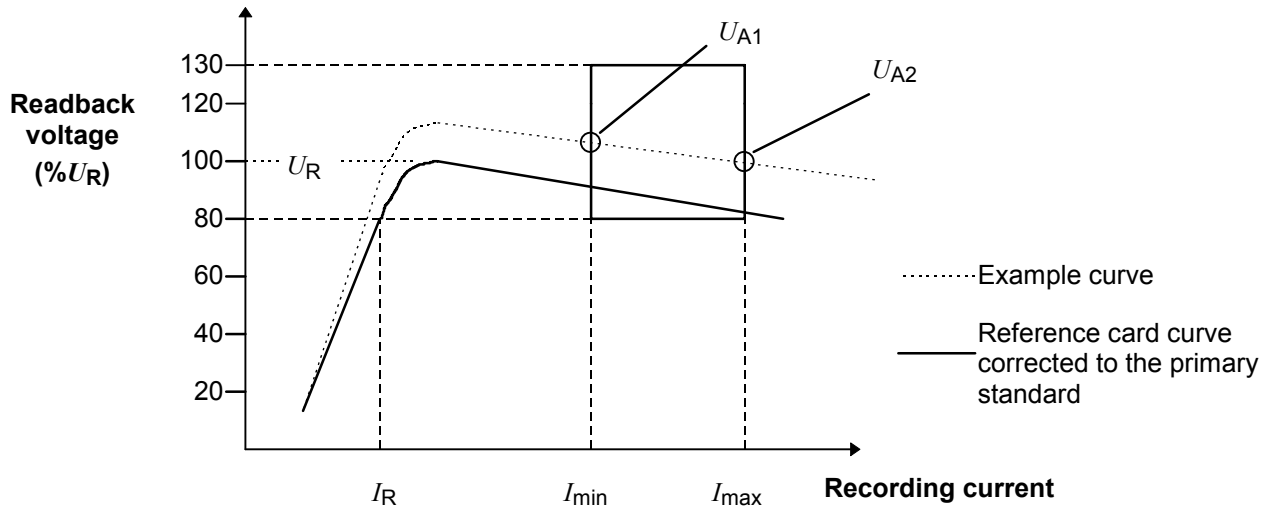


Figure 4 — Saturation curve example showing tolerance area at 8 ft/mm (200 ftpi)

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NOTE The curve defines the primary standard response (on a card). The window parameters define a savingsbook that will be functional in the machine readable environment. The corrected reference curve depicted above may not meet the specifications defined in 7.

As an option, a high coercivity magnetic stripe may be used. In this case, the performance requirements given in Annex A apply in place of those given in 7.3.

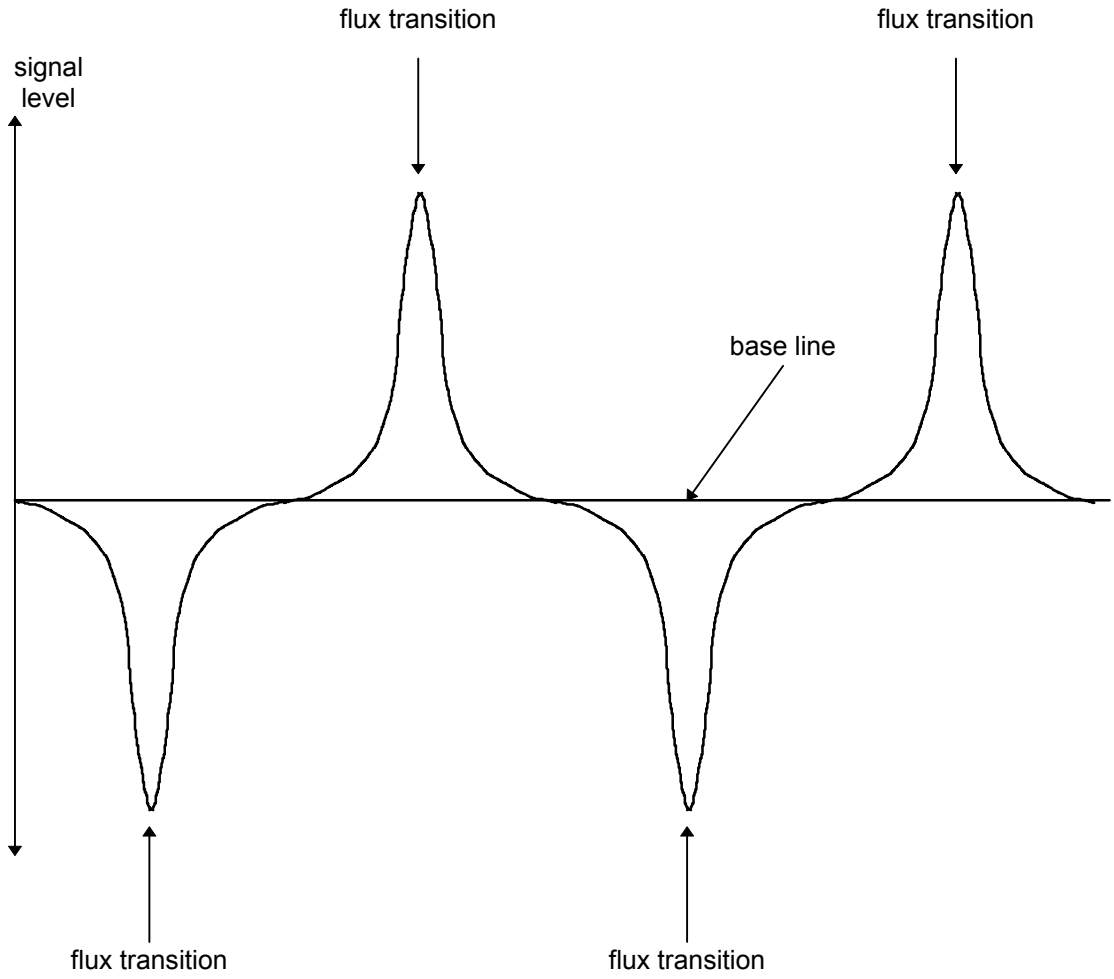
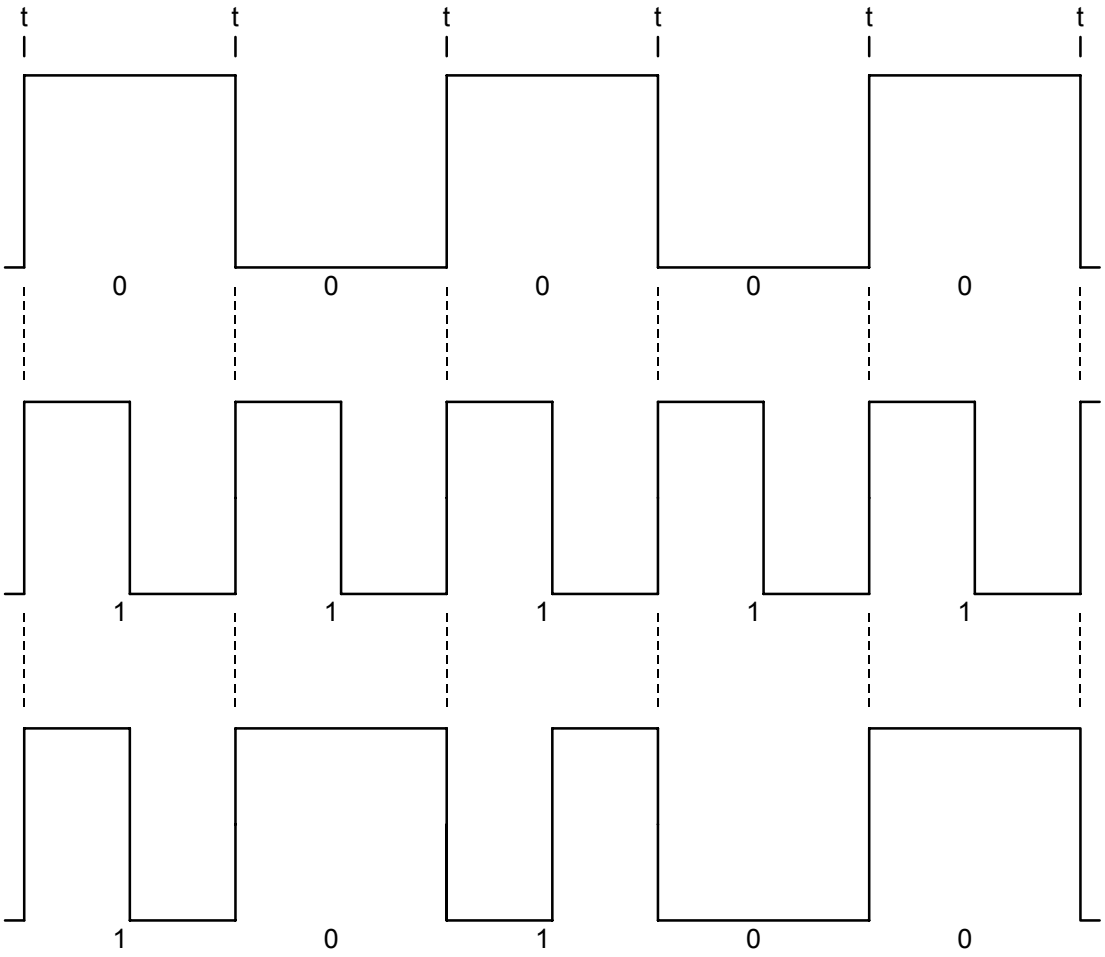


Figure 5 — Waveform example

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 6).

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t, indicates self-clocking (timing) intervals

Figure 6 — 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

NOTE The format and layout of the recording (i.e. number of characters and records, contents of records, definition of the gap between records, etc.) should be specified in a separate application standard or specification.

9.1 Angle of recording

The angle of recording shall be normal to the nearest edge of the savingsbook parallel to the magnetic stripe with a tolerance of $\pm$ 40 minutes. The angle of recording (α) is determined by measuring the angle of the head gap when the reading amplitude is maximum (see Figure 7).

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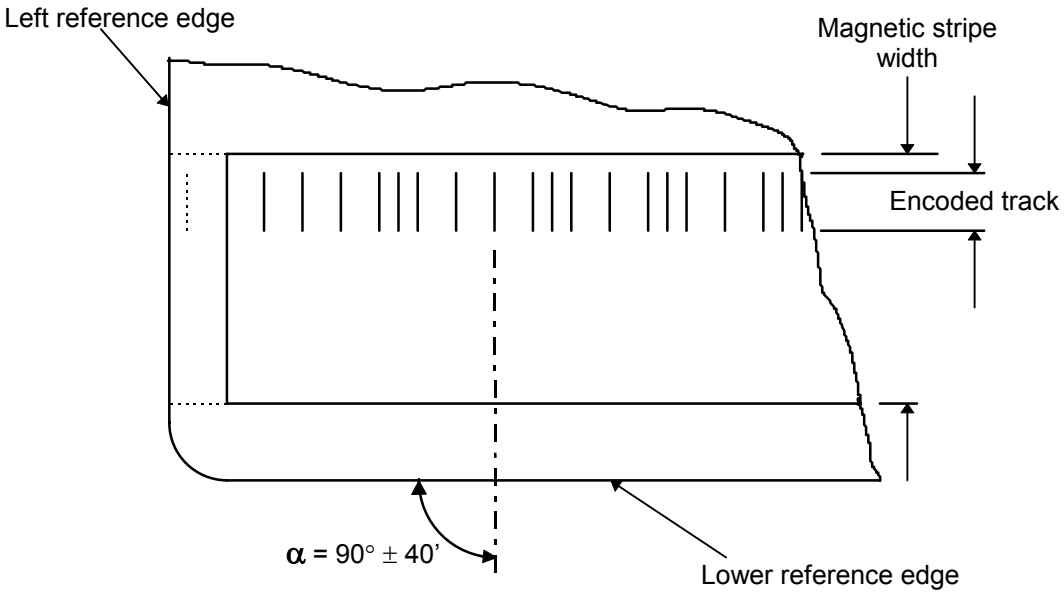


Figure 7 — Angle of recording

9.2 Nominal bit density

The nominal bit density shall be 8,27 bits/mm (210 bpi).

9.3 Signal amplitude requirements for track

The requirements for signal amplitude on track are as follows:

Unused encoded savingsbook: $0{,}64\ U_R \leqslant U_i \leqslant 1{,}36\ U_R$

Returned savingsbook: $0{,}52\ U_R \leqslant U_i \leqslant 1{,}36\ U_R$

NOTE The requirements above specify the interchange signal amplitude limits for the encoded track at the specified bit density. 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°) shall be encoded first and the parity bit last.

9.5 Direction of recording

The encoding shall begin from the left reference edge viewed from the side with the magnetic stripe and with the stripe at the bottom.

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 2,9 mm (0.114 in) or after 90 mm (3.543 in) from the left reference edge of the savingsbook when viewed from the back are not required to meet the specifications given herein.

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9.7 Average bit density

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

9.8 Flux transition spacing variation

Flux transition spacing variations are shown in Table 2 for unused encoded savingsbooks and in Table 3 for returned savingsbooks. See also Figure 8.

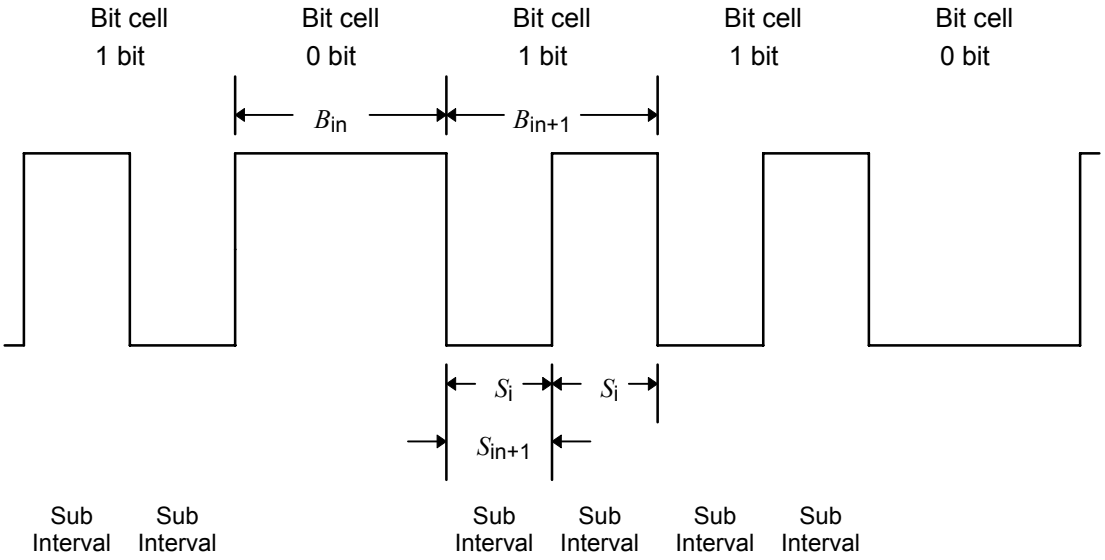


Figure 8 — Flux transition spacing variation

Table 2 — Flux transition spacing variation for unused encoded savingsbooks

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

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Table 3 — Flux transition spacing variation for returned savingsbooks

Term	Description	Requirement	Variation
B_a	Average length between clocking flux transitions	111 µm (4381 µin) $\leqslant B_a \leqslant$ 131 µm (5143 µin)	± 8 %
B_{in}	Individual length between clocking flux transitions	103 µm (4048 µin) $\leqslant B_{in} \leqslant$ 139 µm (5476 µin)	± 15 %
B_{in+1}	Adjacent bit-to-bit variation	0,85 $B_{in} \leqslant B_{in+1} \leqslant$ 1,15 B_{in}	± 15 %
S_{in}	Subinterval length	48,4 µm (1905 µin) $\leqslant S_{in} \leqslant$ 72,6 µm (2857 µin)	± 20 %
S_{in+1}	Adjacent subinterval length	0,70 $B_{in}/2 \leqslant S_{in+1} \leqslant$ 1,30 $B_{in}/2$	± 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 savingsbooks will function normally and does not imply any guarantee of flux transition spacing during valid term for issued savingsbooks.			

9.9 Coded character set

The coded character set shall be 5 bit numeric as shown in Table 4

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

The 3 characters **; = ?** shall have the following meanings:

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

Table 4 — 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.)													

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9.10 Maximum number of characters

The data characters, control characters, start and end sentinels, and longitudinal redundancy check character shall together not exceed 108 characters.

9.11 Re-recording

For each new recording the entire length of the magnetic stripe area shall be re-recorded and areas not used for data or control characters shall be filled with 0 bits.

10 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.

10.1 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.

10.2 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 savingsbook 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.

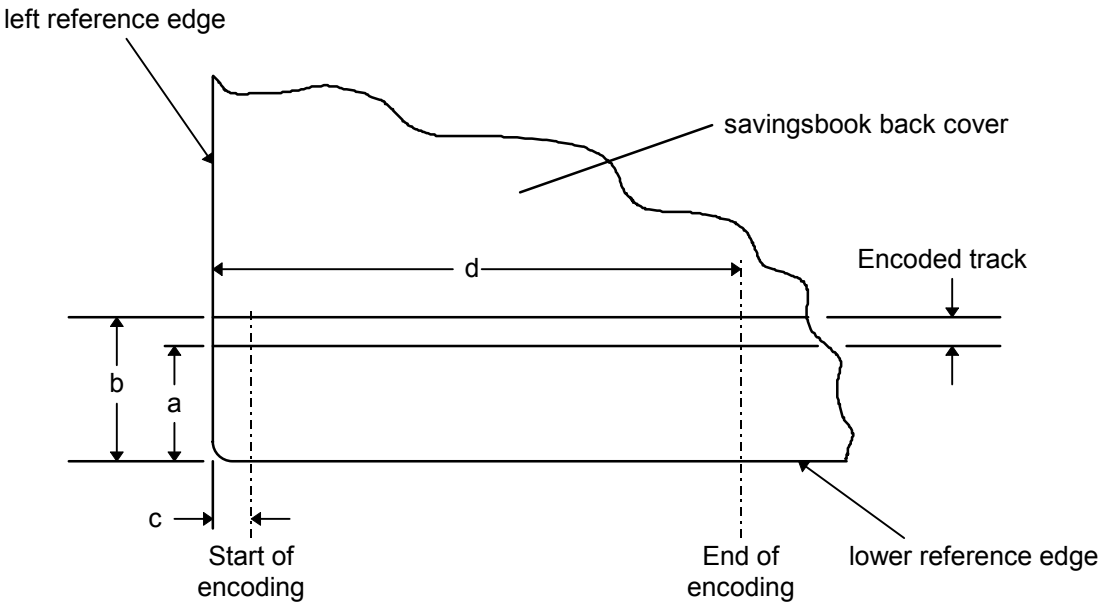
The value of each bit in the LRC character, excluding the parity bit, is defined such that the total count of one bits encoded in the corresponding bit location of all characters of the data track, including the start sentinel, data, end sentinel, and LRC characters, shall be even.

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 10.1.

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11 Location of encoded track

The encoded track shall be located between the two lines as shown in Figure 9. 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).



dimensions in millimetres (inches)

a	12,5 (0.492) maximum
b	15,3 (0.602) minimum
c	9,5 ± 1,00 (0.374 ± 0.039)
d	85 (3.346) maximum

Figure 9 — Location of encoded track

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Annex A
(normative)

Optional high coercivity magnetic stripe

A.1 Scope

This annex specifies the performance characteristics for an optional high coercivity magnetic stripe that may be used in place of the magnetic stripe specified by this International Standard.

A.2 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 7811-6, *Identification cards — Recording technique — Part 6: Magnetic stripe — High coercivity*

A.3 Terms and definitions

The terms and definitions given in Clause 4 apply. The definitions given in ISO/IEC 7811-6 shall be used in place of those given in Clause 4 for the following terms:

— primary standard,

— secondary standard,

— test recording currents.

The definition of demagnetisation current given in ISO/IEC 7811-6 applies.

A.4 Performance characteristics

The performance characteristics for the magnetic material of ISO/IEC 7811-6 apply.

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