INTERNATIONAL STANDARD

ISO/IEC 10373-2

First edition
1998-12-15

Identification cards — Test methods —

Part 2:
Cards with magnetic stripes

Cartes d'identification — Méthodes d'essai —

Partie 2: Cartes à bande magnétique

Reference number
ISO/IEC 10373-2:1998(E)

Contents

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. 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 10373-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Identification cards and related devices*.

ISO/IEC 10373 consists of the following parts, under the general title *Identification cards — Test methods*:

— *Part 1: General characteristics tests*

— *Part 2: Cards with magnetic stripes*

— *Part 3: Integrated circuit(s) cards*

— *Part 5: Optical memory cards*

Identification cards — Test methods —

Part 2:
Cards with magnetic stripes

1 Scope

ISO/IEC 10373 defines test methods for characteristics of identification cards according to the definition given in ISO/IEC 7810. Each test method is cross-referenced to one or more base standards, which may be ISO/IEC 7810 or one or more of the supplementary standards that define the information storage technologies employed in identification cards applications.

NOTE 1 - Criteria for acceptability do not form part of ISO/IEC 10373 but will be found in the International Standards mentioned above.

NOTE 2 - Test methods described in ISO/IEC 10373 are intended to be performed separately. A given card is not required to pass through all the tests sequentially.

This part of ISO/IEC 10373 defines test methods which are specific to magnetic stripe technology. ISO/IEC 10373-1, General characteristics, defines test methods which are common to one or more card technologies and other parts deal with other technology-specific tests.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 10373. 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 10373 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1302:1992, *Technical drawings - Method of indicating surface texture.*

ISO 2409:1992, *Paints and varnishes - Cross-cut test.*

ISO 3274:1996, *Geometric Product Specification (GPS) - Surface texture: Profile method - Nominal characteristics of contact (stylus) instruments.*

ISO 4288:1996, *Geometric Product Specification (GPS) - Surface texture: Profile method - Rules and procedures for the assessment of surface texture.*

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 - Track 1 and 2.*

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

ISO/IEC 7811-6:1996, *Identification cards - Recording technique - Part 6: Magnetic stripe - High coercivity.*

3 Terms and definitions

For the purposes of this part of ISO/IEC 10373, the following terms and definitions apply.

3.1
test method
method for testing characteristics of identification cards for the purpose of confirming their compliance with International Standards

3.2
testably functional
has survived the action of some potentially destructive influence to the extent that:

a) any magnetic stripe present on the card shows a relationship between signal amplitudes before and after exposure that is in accordance with the base standard

b) any integrated circuit(s) present in the card continues to show an Answer to Reset response[1] which conforms to the base standard

c) any contacts associated with any integrated circuit(s) present in the card continue to show electrical resistance and impedance which conform to the base standard

d) any optical memory present in the card continue to show optical characteristics which conform to the base standard

3.3
warpage
deviation from flatness

3.4
flux transitions per millimetre
ft/mm
the linear recording density applied to a track on a magnetic stripe

3.5
recording
creating a track of flux reversals according to a test method given in this standard, with the values of all applicable test parameters specified

3.6
encoding
creating a track of flux reversals whose spacing is modified, according to the F/2F coding scheme, to represent data

3.7
surface roughness
surface topology of an area of surface, qualified in the international standards by reference to various resolution determinants and methods of calculation

3.8
amplitude measurements (of a magnetic stripe)
measurement of readback signal amplitude, resolution, and erasure according to a test method given in this standard, with the values of all applicable test parameters specified

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[1] This part of ISO/IEC 10373 does not define any test to establish the complete functioning of integrated circuit(s) cards. The test methods require only that the minimum functionality (testably functional) be verified. This may, in appropriate circumstances, be supplemented by further, application specific functionality criteria which are not available in the general case.

3.9
flux transition spacing variation
deviation from nominal of measured values of the distance between adjacent flux transitions along a line parallel to the centre-line of the encoded track

3.10
magnetic stripe adhesion
strength of the bond between the magnetic stripe and the card

3.11
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

3.12
static saturation *M(H)* loop
a normal hysteresis loop for which the magnetic field strength is cycled between the extremes $-H_{max}$ to $+H_{max}$ at such a low rate of change that the loop is not influenced by the rate of change (see IEC 50(221))

3.13
coercivity
***H'*$_{cM}$ = *H'*$_{cJ}$**
the continuously applied magnetic field which reduces the magnetisation to zero from a previously saturated state in the opposite direction (see IEC 50(221)). The quantity of interest is that which is measured parallel to the longitudinal axis of the stripe

3.14
remanent coercivity
(H_r)
the applied magnetic field which when removed returns the material to a zero magnetisation state from a previously saturated state in the opposite direction. The quantity of interest is that which is measured parallel to the longitudinal axis of the stripe.

3.15
oersted
Oe
Gaussian cgs unit of magnetic field strength which is commonly used in the magnetic recording industry. Although there is no longer a normative relationship, one oersted may be taken to be equivalent to 79,578 A/m (see annex A (informative) of ISO 31-5:1992)

3.16
static demagnetisation
***S*$_{160}$**
the reduction in magnetisation under the influence of an opposing magnetic field; characterised by (M_r - M^+(-160)) ÷ M_r; the average slope of the "demagnetisation" quadrant of the static saturation $M(H)$ loop between magnetic field strength values of H = 0 and H = -160 kA/m

3.17
squareness
SQ
$M_r/M(H_{max})$ the ratio of the value of magnetisation (M) at zero magnetic field strength (H =0) to that at H_{max} obtained from the static saturation $M(H)$ loop

3.18
longitudinal squareness
***SQ*$_{||}$**
the squareness of the medium measured parallel to the longitudinal axis of the magnetic stripe

3.19
perpendicular squareness
***SQ*$_\perp$**
the squareness of the medium measured perpendicular to the plane of the magnetic stripe

3.20
switching field distribution
SFD
the difference between the field values at the intercept of the static saturation $M(H)$ loop with $M(H) = +0{,}5\ M_r$ and $M(H) = -0{,}5\ M_r$, divided by the coercivity, i.e.:

$$SFD = (|H_2| - |H_1|) \div H'_{cM}$$

where

$$M(-|H_1|) = +0{,}5 M_r$$

$$M(-|H_2|) = -0{,}5\ M_r$$

NOTE - Other definitions of SFD are commonly used that will give different results.

3.21
angle of maximum squareness
***Θ*(*SQ*$_{max}$)**
the angle between the direction at which the maximum value of squareness is found and the longitudinal axis of the magnetic stripe

3.22
resolution
the average signal amplitude at 20 ft/mm (500 ftpi) divided by the average signal amplitude at 8 ft/mm (200 ftpi), multiplied by 100, expressed as a percentage

4 Default items applicable to the test methods

4.1 Test environment

Unless otherwise specified, testing shall take place in an environment of temperature 23°C ± 3°C (73°F ± 5°F) and of relative humidity 40% to 60%.

4.2 Pre-conditioning

Where pre-conditioning is required by the test method, the identification cards to be tested shall be conditioned to the test environment for a period of 24 h before testing.

4.3 Selection of test methods

Unless otherwise specified, tests shall be applied according to the attributes of the card to be tested, as shown in table 1.

Table 1 — Selection of tests according to features present

Test method	Card has Mag stripe	Mag stripe is encoded
5.1 Card warpage - mag stripe area	✓	
5.2 Height and surface profile of the magnetic stripe	✓	
5.3 Surface roughness of the magnetic stripe	✓	
5.4 Wear test for magnetic stripe	✓	
5.5 Amplitude measurements	✓	✓
5.6 Flux transition spacing variation		✓
5.7 Magnetic stripe adhesion	✓	
5.8 Static magnetic characteristics[a]	✓	

[a] Static magnetic characteristics are an informative part of the base standard. Consequently, the associated tests are not mandatory.

4.4 Default tolerance

Unless otherwise specified, a default tolerence of ± 5% shall be applied to the quantity values given to specify the characteristics of the test equipment (e.g. linear dimensions) and the test method procedures (e.g. test equipment adjustments).

4.5 Total measurement uncertainty

The total measurement uncertainty for each quantity determined by these test methods shall be stated in the test report.

5 Test methods

5.1 Magnetic stripe area warpage

The purpose of this test is to measure the degree of warpage of a card test sample in the area of the magnetic stripe (see ISO/IEC 7810:1995).

The method is applicable to both embossed and unembossed cards.

5.1.1 Apparatus

The apparatus is shown in figure 1. It comprises:

a) a level rigid plate whose surface roughness is not greater than 3,2 µm (130 µin) in accordance with ISO 1302:1992. The plate shall contain an aperture to allow access for a micrometer probe;

b) a micrometer accurate to within 2,5 µm (98 µin)with a probe whose contact area is a hemisphere with a diameter in the range of 3 mm to 8 mm (0.1 in to 0.3 in). The force exerted by the probe shall be f = 0,6 N ± 0,3 N (0.13 lbf ± 0.07 lbf);

c) a means of applying a force F = 2,2 N (0.49 lbf) evenly distributed on the front face of the card opposite the magnetic stripe area.

not to scale

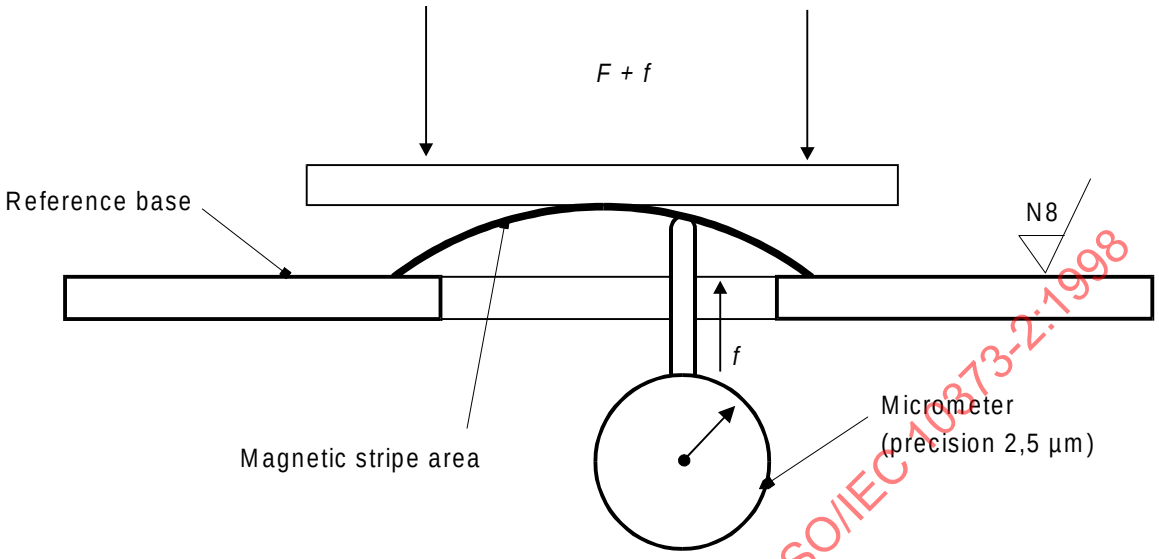


Figure 1 — Measuring arrangement

5.1.2 Procedure

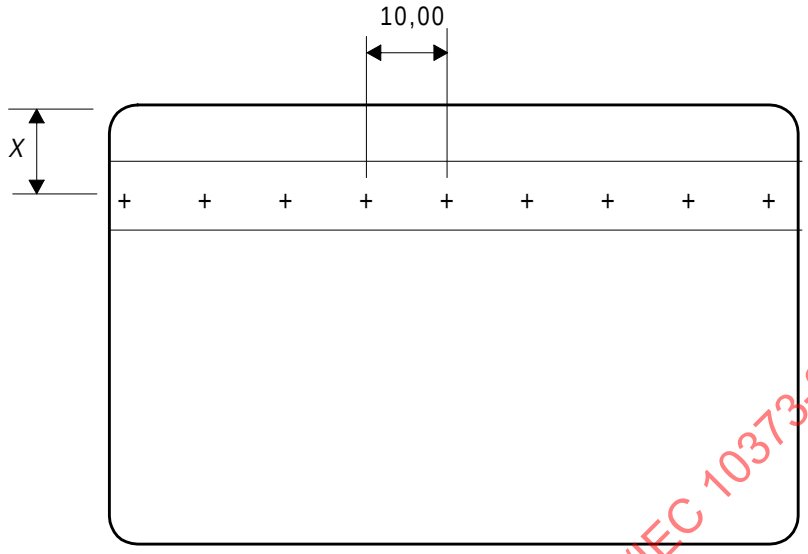
Place the sample card, front side up, on the level rigid plate. Position the magnetic stripe area to be measured over the aperture.

The load of 2,2 N (0.49 lbf) should be increased by an amount f to compensate for the micrometer force which is acting in the opposite direction to that force.

Apply the force F (+ f) directly over the magnetic stripe area on the front side of the card. Wait 1 minute before making any measurements.

Measure the card stripe area warpage at the nine positions along the stripe as shown in figure 2.

dimensions in mm
not to scale



NOTE - the value of *X* is given in table 2.

Figure 2 — Measuring points on the card

Table 2 — Position of the line of measuring points

Magnetic stripe area	Dimension *X* (mm)
Tracks 1 and 2	8,00
Tracks 1, 2 and 3	10,70

5.1.3 Test report

The test report shall give the maximum value obtained from the set of nine measurements.

5.2 Height and surface profile of the magnetic stripe

The purpose of this test is to determine the height and flatness of the magnetic stripe of a card test sample (see ISO/IEC 7811-2:1995 and ISO/IEC 7811-6:1996).

The location of the stripe is described in ISO/IEC 7811-4:1995 and ISO/IEC 7811-5:1995. The height of the magnetic stripe is determined by reference to the card and the stripe surface profile.

5.2.1 Apparatus

The following items are required:

a) a profilometer (see figure 3);

b) a notched rigid metal plate as shown in figure 4. Any rigid metal can be used to construct the plate, but its thickness shall be adjusted, according to the density of the material, to achieve a weight of 2,2 N ± 0,1 N (0.49 lbf ± 0.02 lbf). All dimensions of the plate shall be ± 0,5 mm (0.02 in) or better.

not to scale

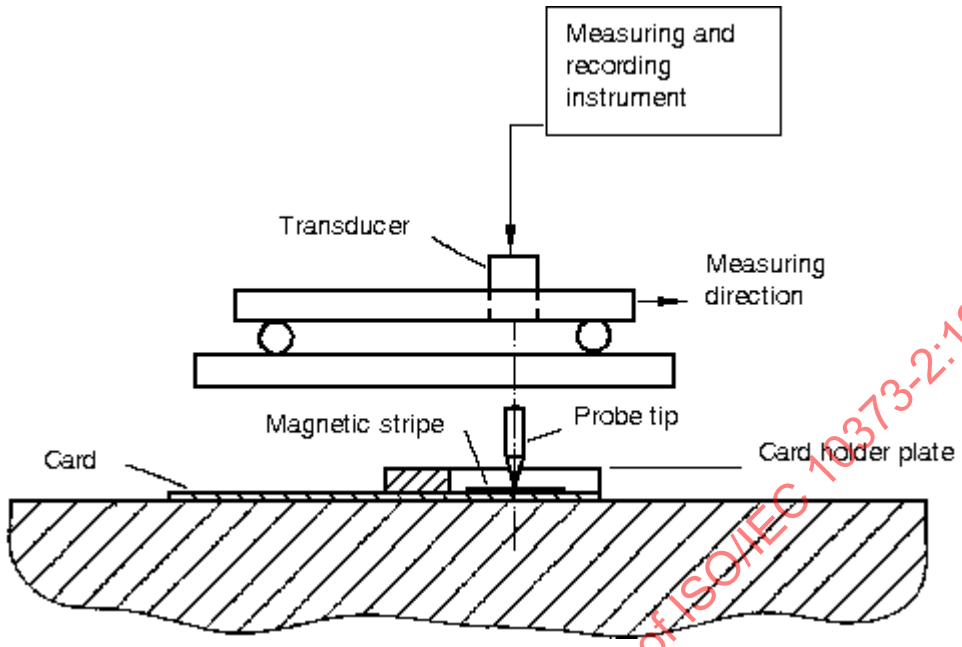


Figure 3 — Measuring device for the height and the profile of the magnetic stripe

not to scale
dimensions in millimetres

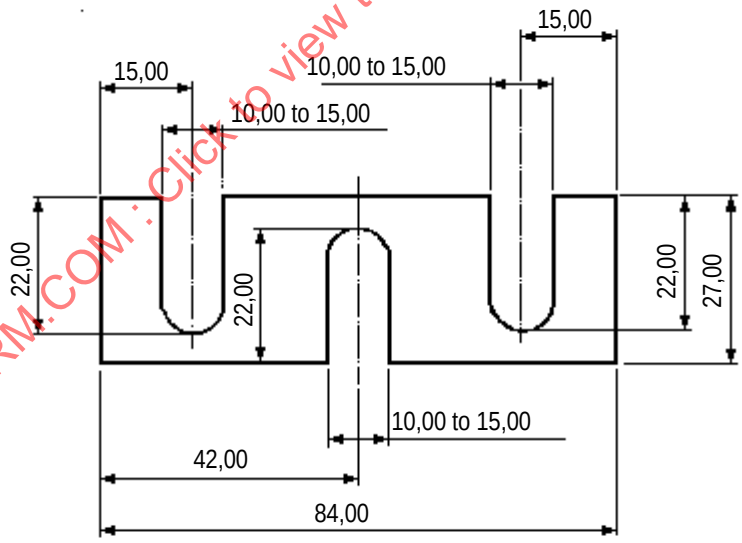


Figure 4 — Card holder plate (contact area)

5.2.2 Procedure

Hold the card to be tested under the notched rigid metal plate shown in figure 4.

Measure the height and the surface profile of the magnetic stripe and the surrounding card surface using a measuring recording instrument.

Measure the profile at a maximum speed of 1 mm/s (0.04 in/s) using a probe having a radius of 0,38 mm to 2,54 mm (0.015 in to 0.1 in) applied with a force of 0,5 mN to 6 mN (0.0001 lbf to 0.0013 lbf).

Take three measurements on each specimen across the width of the stripe. The three locations V, X and Y are defined as the distance of 15 mm ± 2 mm (0.59 in ± 0.08 in) from each end of the card and location X the centreline of the card (see figure 5).

not to scale
dimensions in millimetres

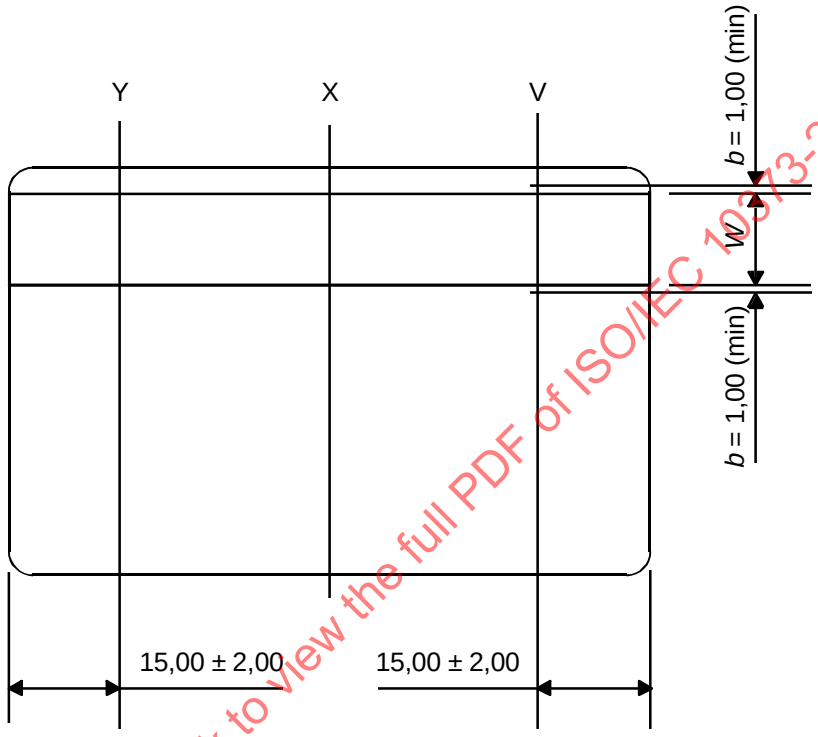


Figure 5 — Magnetic stripe profile measurement location

The starting point for measurement along each line V,X,Y begins 1 mm min (0.04 in min) above the top edge of the magnetic media and ends 1 mm min (0.04 in min) below the bottom edge of the magnetic media.

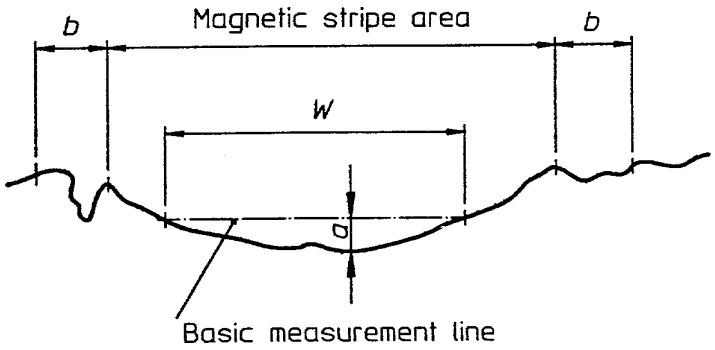
NOTE – In preparing the test card for the surface profile measurement, it is helpful to lightly scribe a line, using a sharp knife, parallel to the top reference edge of the card for locating the minimum stripe width *W* on the profile recording.

5.2.3 Expression of results

5.2.3.1 Surface profile of the magnetic stripe

For the measurements along V, X and Y line (see figure 5), form a first basic measurement line (see figure 6 and figure 7) by connecting the top and bottom points that define the edges of the minimum stripe width. The basic measurement line shall lie within 10° of the chart recording direction.

The maximum vertical deviation (*a*) is the distance between the basic measuring line and the point on the magnetic media furthest away from the basic measurement line. The measurement shall be made perpendicular to the chart recording direction.

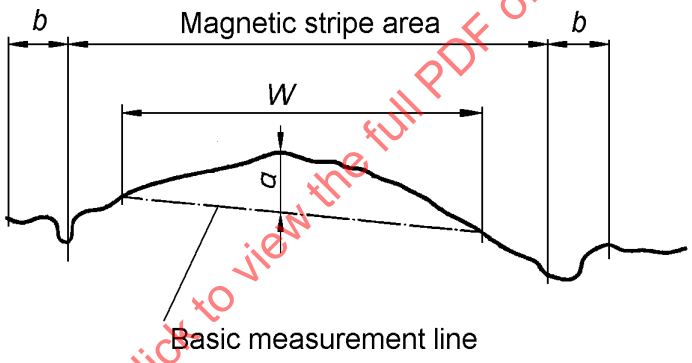


a = maximum vertical deviation

b = 1 mm (min)

W = minimum stripe width as specified in the relevant base standard

Figure 6 — Concave stripe profile



a = maximum vertical deviation

b = 1 mm (min)

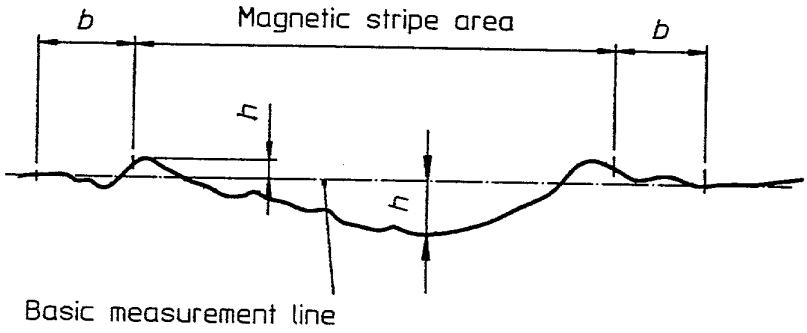
W = minimum stripe width as specified in the relevant base standard

Figure 7 — Convex stripe profile

5.2.3.2 Height of the magnetic stripe

For the three measurements along V, X and Y, form a basic measurement line by connecting the starting and ending points (see figure 8 and figure 9). The basic measurement line shall lie within 10º of the chart recording direction.

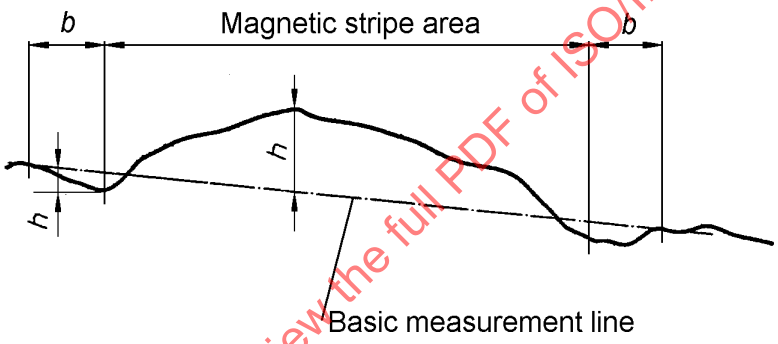
The maximal vertical deviation (*h*) is the distance between the basic measurement line and the point on the magnetic media furthest away from the basic measurement line. The measurement shall be made perpendicular to the chart recording direction.



b = 1 mm (min)

h = maximum vertical deviation as specified in the relevant base standard

Figure 8 — Concave stripe profile



b = 1 mm (min)

h = maximum vertical deviation as specified in the relevant base standard

Figure 9 — Convex stripe profile

5.2.4 Test report

5.2.4.1 Surface profile of the magnetic stripe

The test report shall give the values of the three measurements of maximum vertical deviation (*a*) obtained along lines V, X and Y.

5.2.4.2 Height of the magnetic stripe

The test report shall give the values of the three measurements of maximum vertical deviation (*h*) obtained along lines V, X and Y.

5.3 Surface roughness of the magnetic stripe

The purpose of this test is to determine the degree of roughness of the magnetic stripe of a card test sample (see ISO/IEC 7811-2:1995 and ISO/IEC 7811-6:1996).

5.3.1 Procedure

The surface roughness of the magnetic stripe shall be measured with a measuring recording instrument as shown in figure 3. All test conditions specified in 5.2 apply except:

— probe stylus has a radius of 2 µm (79 µin) or 5 µm (197 µin);

— cutoff wavelength and roughness evaluation length shall be chosen in accordance with ISO 3274 and ISO 4288;

— longitudinal and transverse measurements are taken on the stripe.

5.3.2 Test report

The test report shall give the centreline average R_a values of the magnetic stripe roughness obtained by measuring in both longitudinal and transverse directions.

5.4 Wear test for magnetic stripe

The purpose of this test is to determine the signal amplitude of the magnetic stripe of a card test sample after controlled abrasion (see ISO/IEC 7811-2:1995 and ISO/IEC 7811-6:1996).

5.4.1 Apparatus

A metal dummy head whose hardness is between 110 HV - 130 HV (Vickers scale) or its equivalent in Rockwell scale. The required dimensions are as shown in figure 10.

A rigid flat plate capable of holding the card still.

not to scale
dimensions in mm

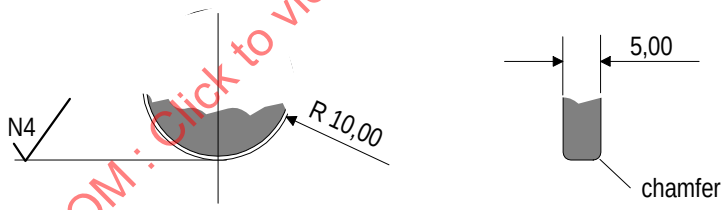


Figure 10 — Dimensions of the contact area of the dummy head

5.4.2 Procedure

Record the sample card[2] at 20 ft/mm (500 ftpi) using a test recording current of I_{min}, read and note the signal amplitude.

Fasten the card, magnetic stripe uppermost, to the flat plate so that the dummy head can traverse the length of the stripe or alternatively, the card can move under the head (see figure 11). Take care when mounting the card on the rigid flat plate to ensure that the card is held flat and fixed while the tests are performed.

Apply a force of 1,5 N ± 0,2 N (0.34 lbf ± 0.05 lbf)to the head and allow the head to move back and forth at a speed of between 200 mm/sec (7.9 in/s) and 500 mm/sec (19.7 in/s) for 2 000 cycles, (1 cycle is equivalent to one forward and one backward movement). Read the signal amplitude on the same apparatus and compare the result with the amplitude obtained at the beginning of the test.

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[2] Due to an error, the base standard may specify incorrect test recording conditions.

The position of the read and write heads shall be completely contained within the area of the zone of wear from the dummy head.

not to scale

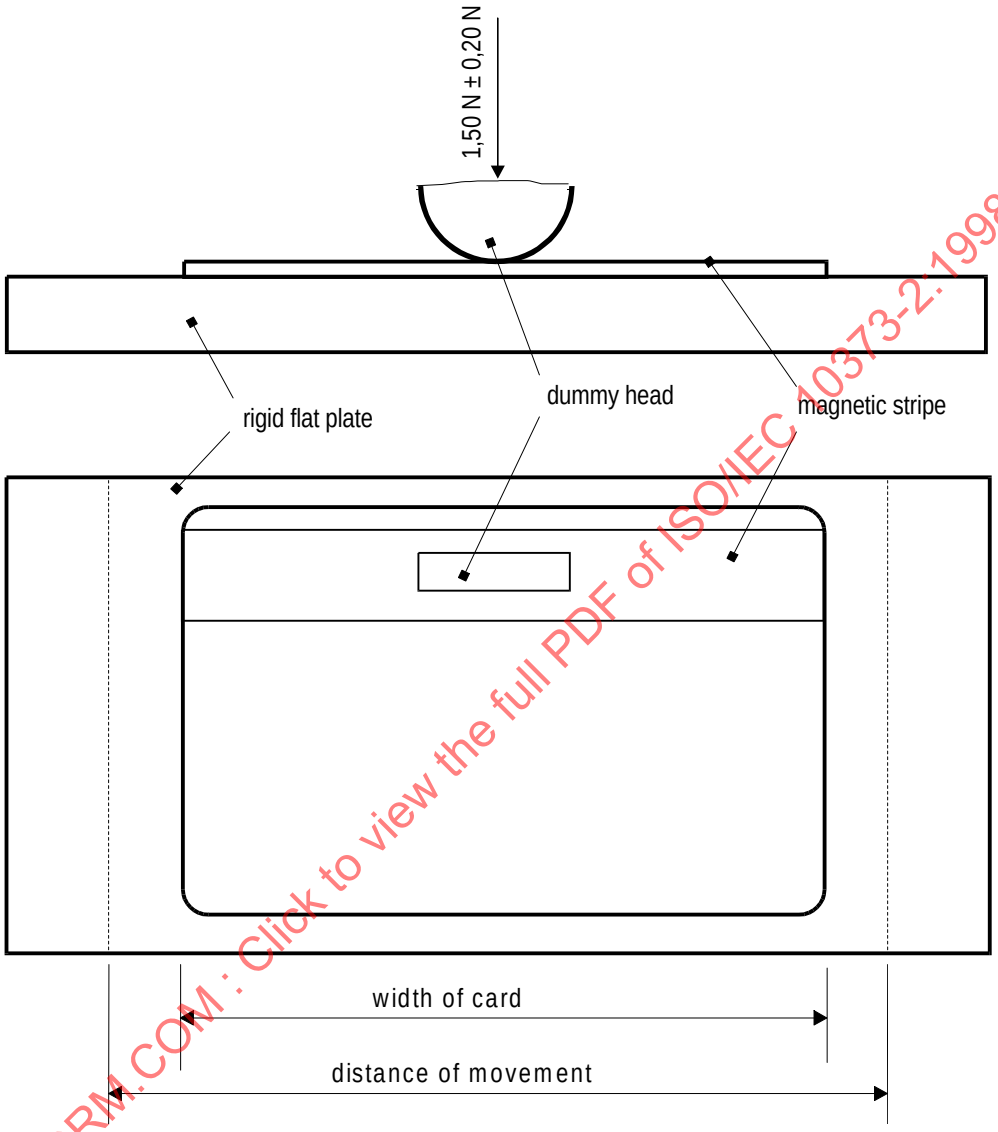


Figure 11 — Dummy head and magnetic stripe

5.4.3 Test report

The test report shall give the values of the signal amplitudes defined in the base standard, measured before and after wear.

5.5 Amplitude measurements

The purpose of this test is to measure the signal amplitude, resolution, erasure, demagnetisation and waveform characteristics of the magnetic stripe of a card test sample to check conformity with the appropriate base standard, i.e.

— for checking magnetic stripes with coercivities up to about 48 kA/m (600 oersteds) for conformance to ISO/IEC 7811-2:1995;

— for checking magnetic stripes with coercivities above 80 kA/m (1000 oersteds) for conformance to ISO/IEC 7811-6:1996.

NOTE - demagnetisation and waveform characteristics are requirements only of ISO/IEC 7811-6:1996.

5.5.1 Calibration reference

Calibration reference cards shall be selected according to the base standard against which conformance is to be checked:

When the base standard is ISO/IEC 7811-2:1995, use reference card type RM 7811-2.

When the base standard is ISO/IEC 7811-6:1996, use reference card type RM 7811-6.

NOTE 1 - Reference cards can be ordered from Physikalisch–Technische Bundesanstalt, Flab. 2.24 Bundesallee 100, D–38116 Braunschweig, Germany, whilst stocks last. This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO/IEC of the product named.

NOTE 2 - Cleaning agents may cause deterioration of the certified properties. Any reference cards so treated can no longer be considered certified and should be destroyed.

5.5.2 Apparatus

A record/read-back system is required which comprises the items and characteristics given in 5.5.2.1, 5.5.2.2, 5.5.2.3 and 5.5.2.4.

5.5.2.1 Mechanical drive

The card shall be held flat during the measurements.

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

NOTE - Variations in speed and head pressure will reduce the accuracy of measurement. In particular, it should be recognised that instantaneous (transient) speed variations will affect the accuracy of individual signal amplitude measurements.

If the drive used has a speed variation greater than ± 0,5%, then the actual speed variation shall be recorded with the test results.

5.5.2.2 Test heads

NOTE - Other gaps and constructions of test heads were allowed by the 1993 edition of ISO/IEC 10373 for testing compliance with ISO/IEC 7811-2. If such heads are used it must be shown that the results achieved are comparable to those obtained with the heads defined in Table 3. Although similar results can be obtained, significant differences can exist depending on the characteristics of the magnetic stripe being tested, such as magnetic stripe thickness or overcoat.

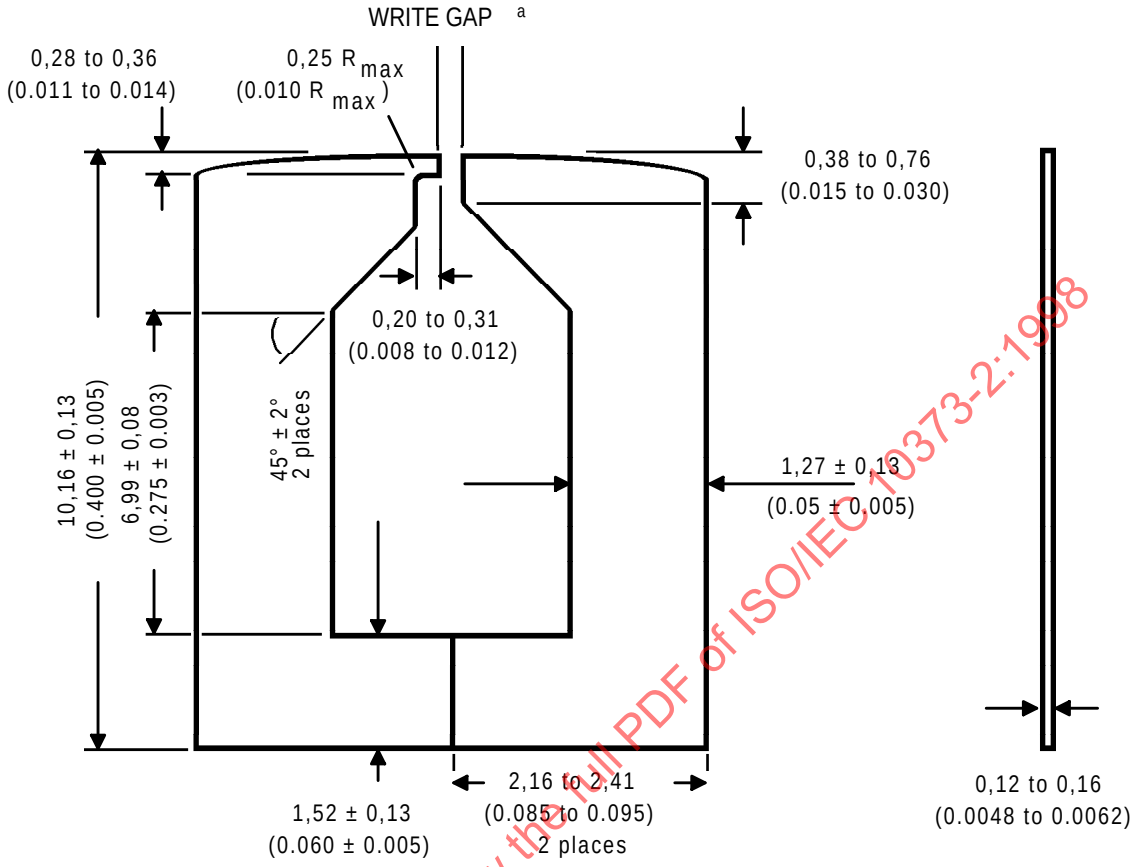
Test heads shall comprise separate write and read heads constructed in bodies of non-magnetic material, such as brass or aluminium.

To ensure adequate frequency response, the read head shall be constructed of laminated metal with a maximum thickness of 0,18 mm (0.0071 in).

The write head core shall be constructed of metal laminations conforming to figure 12. The front gap material shall be beryllium copper, free from ferromagnetic impurities.

NOTE - Discrepancies have been observed when wear resistant coatings have been used. Therefore, while it is admissible to use heads with wear resistant coatings for quality control purposes, it is recommended that such heads should not be used for product certification according to ISO/IEC 7811-2 or ISO/IEC 7811-6.

not to scale
dimensions in millimetres (inches)



a see Table 3 for value

Figure 12 — Test write head laminations

Coils of 100 turns shall be wound on each leg of the write head core in no more than 2 layers, with all four leads terminating in external leads, as shown in figure 13.

not to scale

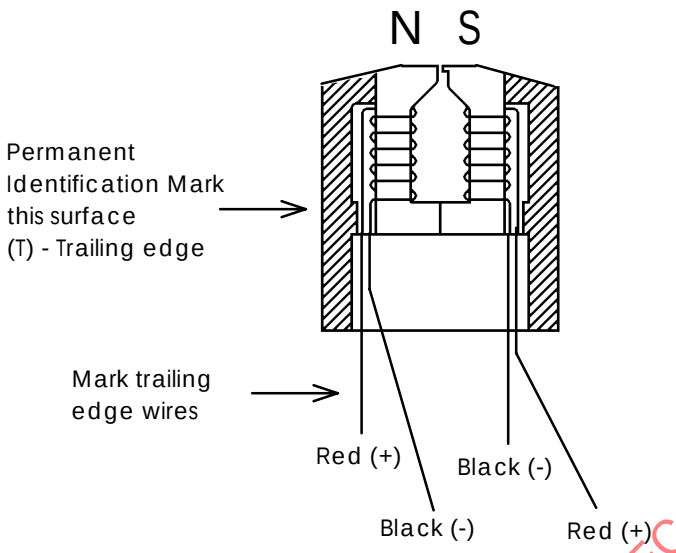


Figure 13 — Test write head coil connections

Gap and track widths etc. are given in table 3. All the quantities in the table shall be measured optically.

Table 3 — Test heads specification

all dimensions in mm (inches)

head function	Read	Write	
base standard	ISO/IEC 7811-2:1995 & ISO/IEC 7811-6:1996	ISO/IEC 7811-2:1995	ISO/IEC 7811-6:1996
lamination thickness	0,18 mm max. (0.0071 in max.)	see figure 12	
radius of curvature	19 mm ± 10 % (0.75 in ± 10 %)		
width of contact with stripe	2,8 mm to 3,5 mm (0.11 in to 0.14 in)		
width of magnetic core	1,0 mm to 1,6 mm (0.040 in to 0.065 in)	2,79 (0.110) min.	
gap	0,0114 mm to 0,0140 mm (0.00045 in to 0.00055 in)	0,025 mm ± 10 % (0.001 in ± 10 %)	0,051 mm ± 10 % (0.002 in ± 10 %)
saturation induction		0,8 T min. (8 kgauss min.)	2,3 T min (23 kgauss min.)

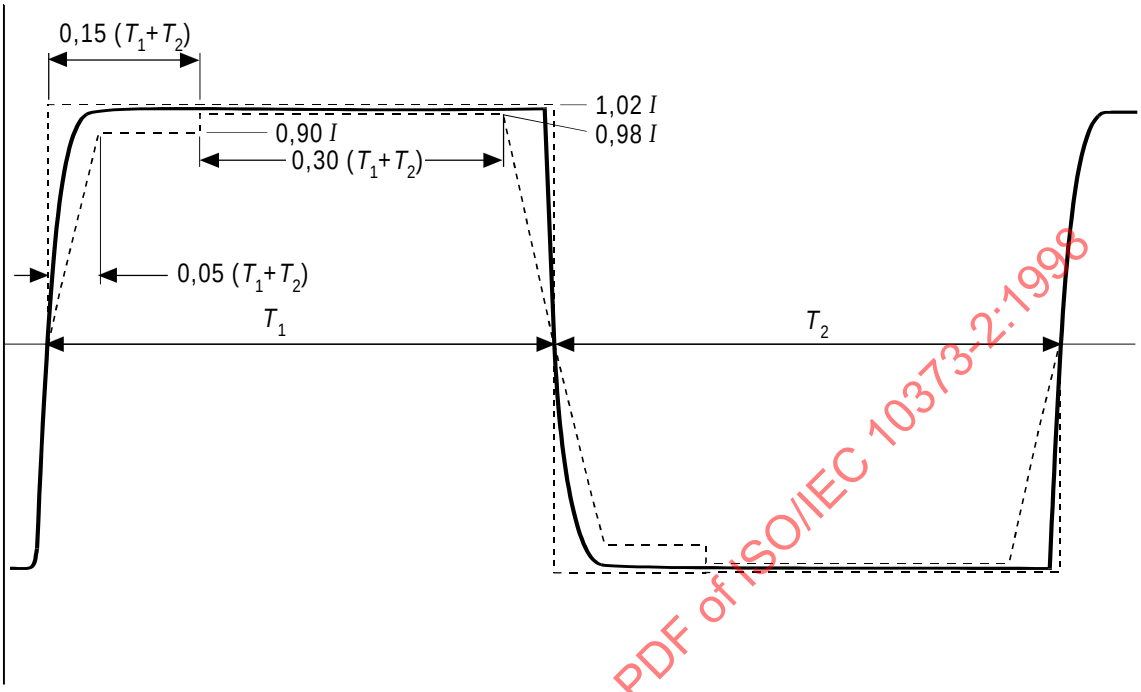
The heads shall be mounted such that they are mechanically independent from each other and such that the azimuth error is less than 10 minutes.

The force on the heads shall be set to the minimum amount required to achieve the maximum output from the reference card at the time of calibration but shall not exceed 7 N (1.6 lbf).

NOTE - A typical head force is 3 N (0.7 lbf).

5.5.2.3 Write head drive

The waveform of the recording current *I*, at nominal recording densities of 8 ft/mm (200 ftpi) and 20 ft/mm (500 ftpi), shall be as shown in figure 14.



NOTE 1 - The current waveform shall remain within the limits shown as broken lines.

NOTE 2 - The mark-space ratio of the waveform shall be such that $T1 = T2 \pm 5$ %

Figure 14 — Recording current waveform

5.5.2.4 Reading sub-system

The effective remanence of the read head when connected to the read-back sub-system shall not reduce the average signal amplitude of the reference card being used by more than 5% after 5 successive read-only passes.

The resolution of the read-back sub-system shall be between 85% and 100% when testing on the reference card being used at 8 ft/mm (200 ftpi) and 20 ft/mm (500 ftpi), using test recording current of I_{max} (see 5.5.3.3).

It shall comprise:

a) a linear amplifier

The amplifier shall be without automatic gain control and with noise less than 0,5% of U_R (see 5.5.3.2) 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 c) below. Outside this range the response may not rise.

b) display and measurement means

Equipment such as a storage oscilloscope for determining the amplitudes of the signal peaks.

c) a bandpass filter

This filter shall be used for all measurements except Erasure (U_{A4}) and Extra Pulse (U_{i4}).

The upper and lower band edges of the filter shall show a second order response (slope 12 dB/octave). The passband 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 15 shows the required characteristic.

The filter response shall continue downward for at least one decade after the band edges and shall not rise more than -40 dB outside this one decade range. Other filtering functions outside the one decade ranges may be used.

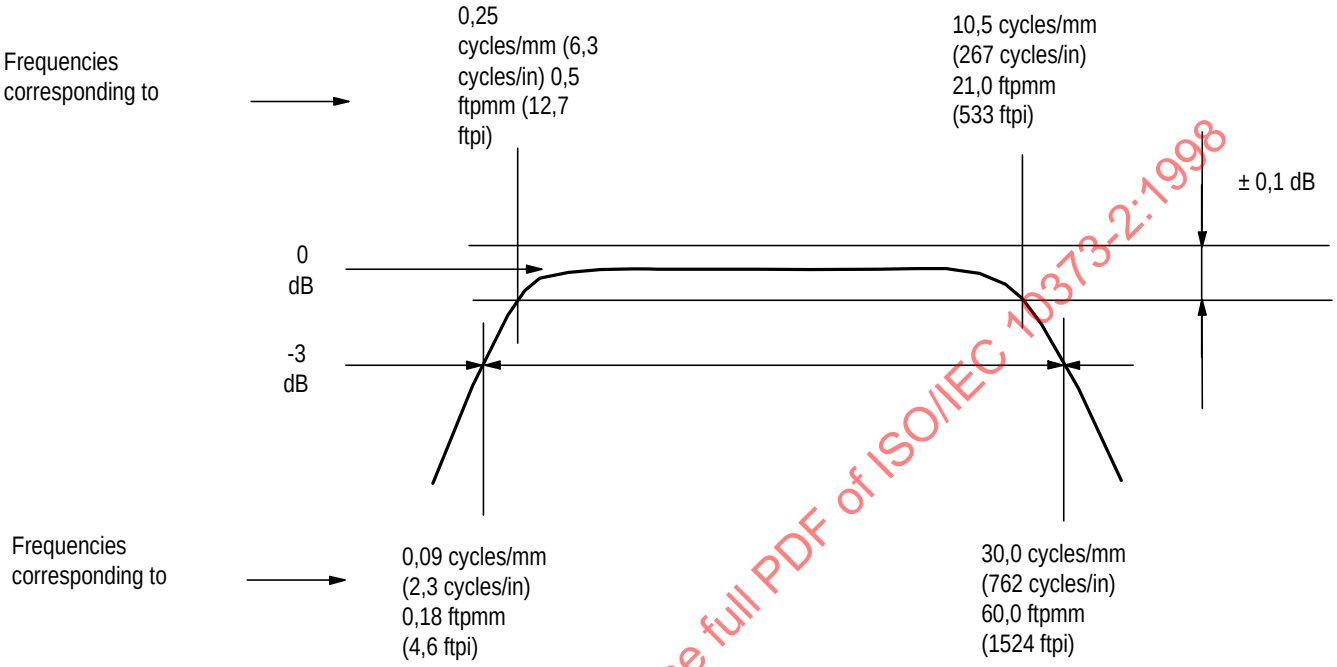


Figure 15 — Filter characteristic

5.5.3 Procedure

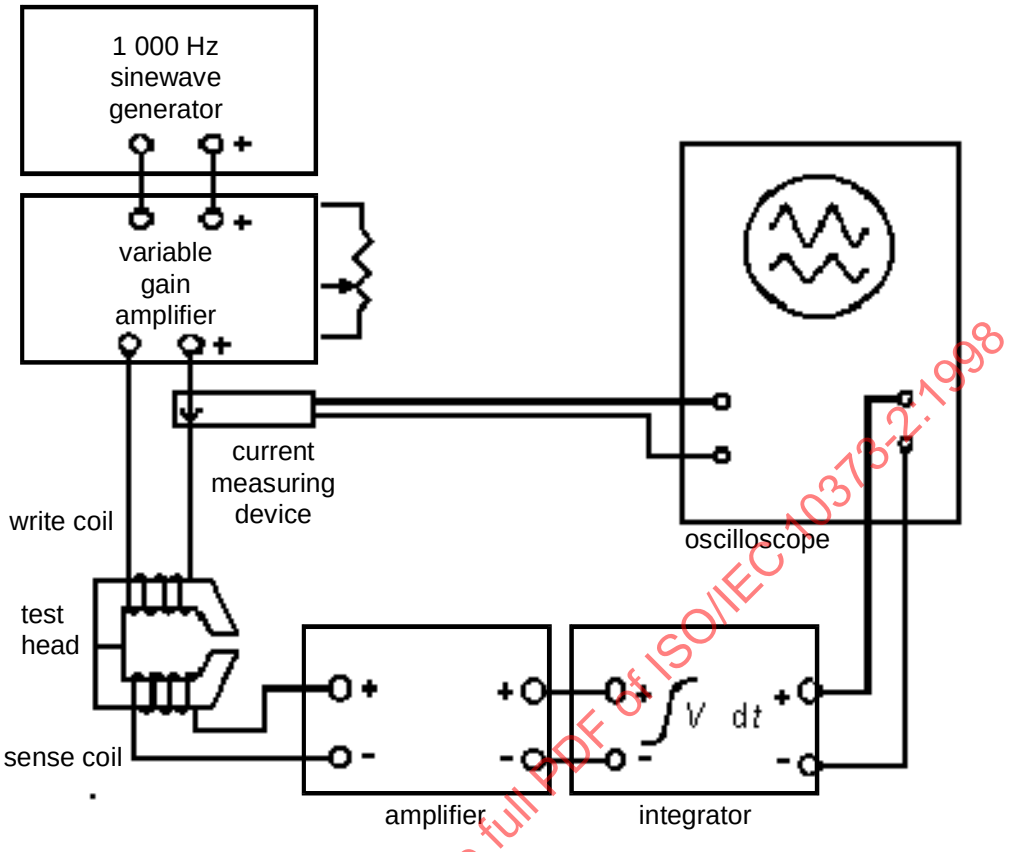
The entire sequence of measurements shall be performed on the same equipment and under the same conditions.

All measurements shall be performed while reading in the same direction as recording and shall be taken after the same number of passes.

5.5.3.1 Determine the flux/current characteristic of the test write head

Characterise the write head to find the relationship between flux output and write current in the following manner.

For each current amplitude (*I*), note the corresponding flux amplitude (*F*), using the apparatus described in figure 16.



NOTE 1 - The voltage/current linearity of the current source shall be better than ± 2%.

NOTE 2 - The loss of the integrator = $2000\pi \times RC \approx 6283 \times RC$ shall be at least 200.

Figure 16 — Typical head characterization test setup

5.5.3.2 Determine U_{max} and I_R from the reference card

Draw the saturation curve to determine the maximum signal amplitude (U_{max}) and reference current (I_R) using the reference card with the 8 ftpmm (200 ftpi) density. For each current amplitude, note the corresponding value of the average signal amplitude of the reference card.

Before recording at each current amplitude, erase the card with high frequency alternating current. The degree of erasure shall be sufficient to ensure that the average remaining signal is less than 0,05 U_R

This calibration process (which determines the value of U_R from the Reference Card) shall be performed such that the recording pass across the Reference Card is directly followed by the read pass.

NOTE - Any contact by write or read heads after the recording pass, before the reading pass occurs, may affect the resulting value of U_R.

Perform the calibration process at least three times. If output variation is greater than 2% (i.e.± 1%), repeat the calibration procedure.

NOTE - The user is advised to check the accuracy of the Reference Card periodically by comparing the signal output amongst five certified Reference Cards.

5.5.3.3 Derive the reference values

Calculate the reference signal amplitude (U_R) and test recording currents (I_{min} and I_{max}) as follows:

$$U_R = \frac{U_{max}}{a}$$

where a is the calibration factor for the reference card, defined as:

$$a = \frac{\text{reference card amplitude}}{\text{primary standard amplitude}}$$

Derive the values of the following reference quantities:

a) I_R = reference current when U is $0,8 \times U_R$.

b) F_R = reference flux when current is I_R.

c) For testing against ISO/IEC 7811-2:1995 requirements, I_{min} = current when flux is $3,5 \times F_R$; for testing against ISO/IEC 7811-6:1996 requirements, I_{min} = current when flux is $2,8 \times F_R$.

d) For testing against ISO/IEC 7811-2:1995 requirements, I_{max} = current when flux is $5,0 \times F_R$; for testing against ISO/IEC 7811-6:1996 requirements, I_{max} = current when flux is $3,5 \times F_R$.

When checking conformity with ISO/IEC 7811-2:1995 only, ensure that the following criteria are met:

— $U_{A2} \leq 0,95\ U_R$

— $0,9\ I_{max} \leq 5,0\ I_R \leq 1,1\ I_{max}$

When checking conformity with ISO/IEC 7811-6:1996 only, ensure that the following criteria are met:

— $U_{A2} \leq 0,95\ U_R$

— $0,8\ I_{max} \leq 3,5\ I_R \leq 1,2\ I_{max}$

5.5.3.4 Measure the card under test

Record and read the card under test under the various test conditions defined by the base standard.

Erase the card under test with high frequency alternating current before testing and before each individual test except for erasure and extra pulse. The degree of erasure shall be sufficient to ensure that the average remaining signal is less than $0,05\ U_R$.

Prior to erasing the card under test for erasure and extra pulse measurement, record it at a density of 8 ft/mm (200 ftpi) with a recording current of I_{max}.

Prior to perfoming the test for demagnetisation against the requirements of ISO/IEC 7811-6:1996, record the card at a density of 20 ft/mm (500 ftpi) with a recording current of I_{min}.

5.5.4 Test report

The test report shall give the values measured for the quantities defined by the base standard.

In addition to the total measurement uncertainty associated with each quantity, it shall also state the measured speed variation of the drive if greater than ± 0,5% and whether the test heads include wear resistant coatings.

5.6 Flux transition spacing variation

The purpose of this test is to determine the variation in flux transition positions on an encoded card test sample (see ISO/IEC 7811-2:1995 and ISO/IEC 7811-6:1996).

5.6.1 Apparatus

The apparatus for measuring transition to transition spacing variation shall conform to 5.5.2.1, 5.5.2.4. It shall also conform to those parts of 5.5.2.2 relevant to the read head.

Specifically, the apparatus shall maintain a 0,5% positional accuracy at 16.5 ft/mm (420 ftpi) within a wide range of card head velocities and shall be so constructed that it is protected from debris and contamination.

NOTE - Either the head or the card position may be measured while holding the other stationary.

Figure 17 shows a block schematic of the apparatus.

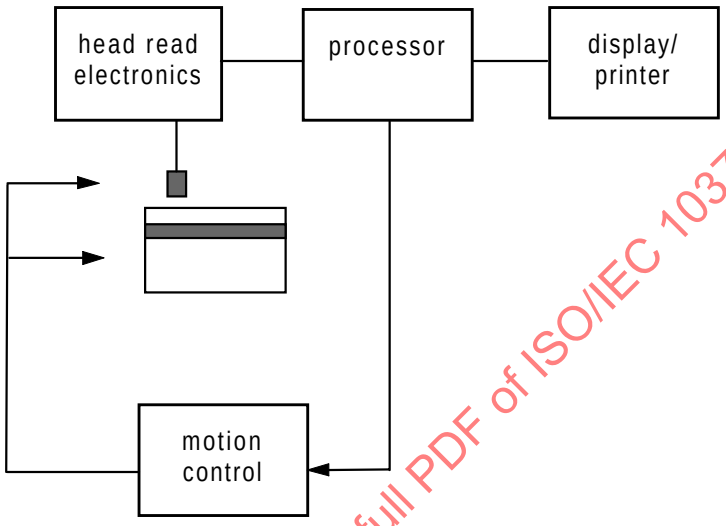


Figure 17 — Example measurement schematic

5.6.2 Procedure

Place the test specimen card in the apparatus.

The force on the head shall be set to the minimum amount required to achieve the maximum output from the card under test at the time of measurement but do not exceed 7 N (1.6 lb).

Activate the apparatus and obtain distance measurement between signal peaks for “ones” and “zeroes”.

5.6.3 Test report

The test report shall give the measured values of the quantities defined by the base standard, together with the total measurement uncertainty of each.

5.7 Magnetic stripe adhesion

The purpose of this test is to determine the degree of adhesion between the magnetic stripe and the body of a card test sample (see ISO/IEC 7811-2:1995 and ISO/IEC 7811-6:1996).

5.7.1 Apparatus

The following items are required:

— single blade cutting tool (see 4.1 of ISO 2409);

— transparent adhesive tape as specified in 4.4 of ISO 2409, tested according to IEC 454-2 and no more than 20 mm wide;