INTERNATIONAL STANDARD

ISO/IEC 10373-1

Second edition
2006-05-01

Identification cards — Test methods —

Part 1: General characteristics

Cartes d'identification — Méthodes d'essai —

Partie 1: Caractéristiques générales

Reference number
ISO/IEC 10373-1:2006(E)

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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.

International Standard ISO/IEC 10373-1 was prepared by 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 10373-1:1998), which has been technically revised. It also includes the Technical Corrigendum ISO/IEC 10373-1:1998/Cor.1:2002.

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

— *Part 1: General characteristics*

— *Part 2: Cards with magnetic stripes*

— *Part 3: Integrated circuit(s) cards with contacts and related interface devices*

— *Part 5: Optical memory cards*

— *Part 6: Proximity cards*

— *Part 7: Vicinity cards*

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Identification cards — Test methods —

Part 1:
General characteristics

1 Scope

ISO 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.

This part of ISO/IEC 10373 defines test methods which are common to one or more card technologies. Other parts of ISO/IEC 10373 define technology-specific test methods.

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

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

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 105-E04:1994, *Textiles — Tests for colour fastness — Part E04: Colour fastness to perspiration*

ISO 1302:2002, *Geometrical Product Specifications (GPS) — Indication of surface texture in technical product documentation*

ISO 1817, *Rubber, vulcanized — Determination of the effect of liquids*

ISO 9227:1990, *Corrosion tests in artificial atmospheres — Salt spray tests*

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

3 Terms and definitions

For the purposes of this document, 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

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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 which conforms to the base standard;

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

3.3
warpage
deviation from flatness

3.4
embossing relief height (of a character)
local increase in the height of the card surface produced by the embossing process

3.5
peel strength
ability of a card to resist separation of adjacent layers of material in its structure

3.6
resistance to chemicals
ability of a card to resist degradation of its performance and appearance as a result of exposure to commonly encountered chemicals

3.7
dimensional stability
ability of a card to resist dimensional variation when exposed to defined temperatures and humidity

3.8
adhesion or blocking
tendency of new cards to stick together when stacked

3.9
bending stiffness
ability of a card to resist bending

3.10
dynamic bending stress
cyclically applied bending stress of specified magnitude and orientation relative to the card

3.11
dynamic torsional stress
cyclically applied torsional stress of defined magnitude and orientation relative to the card

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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.

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3.12
(optical) transmittance factor
T
ratio of the measured (optical) flux transmitted by a specimen to the measured flux when the specimen is removed from the sampling aperture of the measuring device:

NOTE Not applicable to editions of ISO/IEC 7810 post-2003.

$$T = \Phi_\tau / \Phi_j$$

where

T is the transmittance factor

Φ_τ is the transmitted (optical) flux

Φ_j is the aperture flux

3.13
opacity
(optical) transmission density
D_T
logarithm to the base 10 of the reciprocal of the (optical) transmittance factor:

NOTE Not applicable to editions of ISO/IEC 7810 post-2003.

$$D_T = \log_{10} 1/T = \log_{10} \Phi_j / \Phi_\tau$$

3.14
normal use
use as an identification card (see clause 4 of ISO/IEC 7810:2003), involving equipment processes appropriate to the card technology and storage as a personal document between equipment processes

4 Default items applicable to the test methods

4.1 Test environment

Unless otherwise specified, testing shall take place in an environment having a temperature of 23 °C ± 3 °C (73 °F ± 5 °F) and relative humidity of 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

Tests shall be applied as required to test the attributes of the card defined by the relevant base standard.

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).

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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 Card warpage

The purpose of this test is to measure the degree of warpage of a card test sample.

5.1.1 Apparatus

A profile projector or similar device with a minimum precision of 0,05 mm (0.0020 in).

5.1.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Place the sample card on the level rigid plate of the measuring apparatus. At least three corners of the card shall rest on the plate (warpage of the card in convex form to the plate). Read the extent of warpage on the measuring device at the greatest point of displacement, measured from the front surface of the card (see Figure 1).

NOTE The point of maximum displacement is not necessarily at the centre of the card.

Not to scale

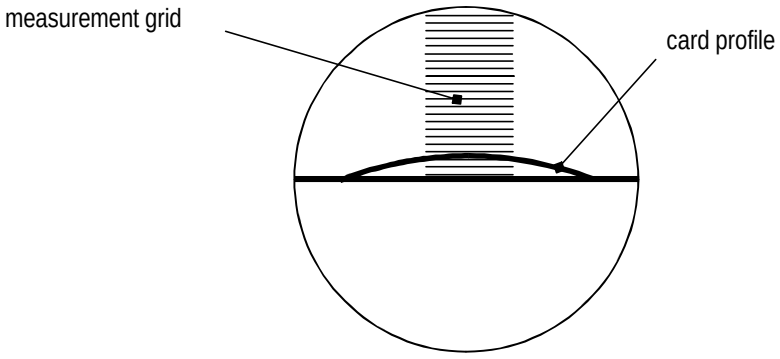


Figure 1 — Projector apparatus view of warpage measurement

5.1.3 Test report

The test report shall give the value of warpage measured at the greatest point of displacement.

5.2 Dimensions of cards

The purpose of this test is to measure the height, width and thickness of a card test sample.

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5.2.1 Thickness of card measurements

5.2.1.1 Apparatus

A micrometer with a flat anvil and spindle whose diameter is within the range of 3 mm to 8 mm (0.12 in to 0.32 in), having a precision of 0,005 mm (0.00020 in).

5.2.1.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Use the micrometer to measure the thickness of the card at four points, one in each of the four quadrants of the card (see Figure 2 for the location of the quadrants). The measurements shall be made at locations on the card that do not include signature panels, magnetic stripes or contacts (integrated circuit/s cards), or any other raised area. The micrometer force shall be 3,5 N to 5,9 N (0.79 lbf to 1.33 lbf).

5.2.1.3 Test report

The test report shall give the maximum and the minimum values of the four measurements.

not to scale

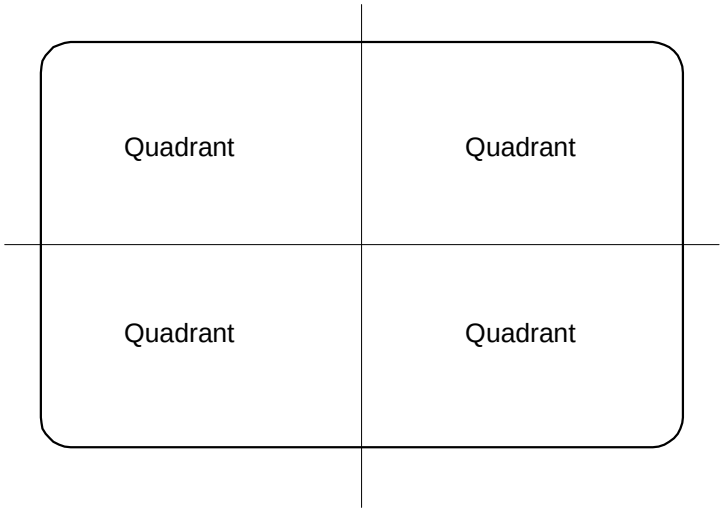


Figure 2 — Assignment of quadrants

5.2.2 Height and width of card measurement

5.2.2.1 Apparatus

The following items are required:

a) a level horizontal rigid surface having an average roughness not greater than 3,2 µm (0.000128 in) according to ISO 1302:2002;

b) a measuring device with a precision of 2,5 µm (0.0001 in);

c) a load of 2,2 N ± 0,2 N (0.495 lbf ± 0.045 lbf).

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5.2.2.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Place the sample card on the level horizontal rigid surface and flatten it under the load. Measure the height and width of the card. Find the maximum and minimum height and the maximum and minimum width.

5.2.2.3 Test report

The test report shall state whether the card conforms to the base standard and shall record the maximum and minimum values of height and width recorded.

5.3 Peel strength

The purpose of this test is to measure the peel strength between card layers.

5.3.1 Apparatus

The following items are required:

a) sharp cutting knife;

b) pressure sensitive adhesive filament (fibre reinforced) tape or a suitable clamp;

c) tensile tester equipped with chart recorder or equivalent;

d) gripping device;

e) (if required) stabilising plate backed with adhesive or adhesive tape and meeting the following requirements:

   1) the adhesive strength shall be sufficient to ensure that the plate and card do not separate during testing;

   2) the plate shall not bend during the measurement;

   3) the size of the plate shall be equal to, or greater than, the size of the card.

EXAMPLE A suitable plate might be a 60 mm × 90 mm × 2 mm aluminium plate backed with adhesive tape.

5.3.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Cut the card, or score through the layer, to produce sections of width 10,0 mm ± 0,2 mm (0.390 in ± 0.008 in) as shown in Figure 3.

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not to scale
dimensions in millimetres

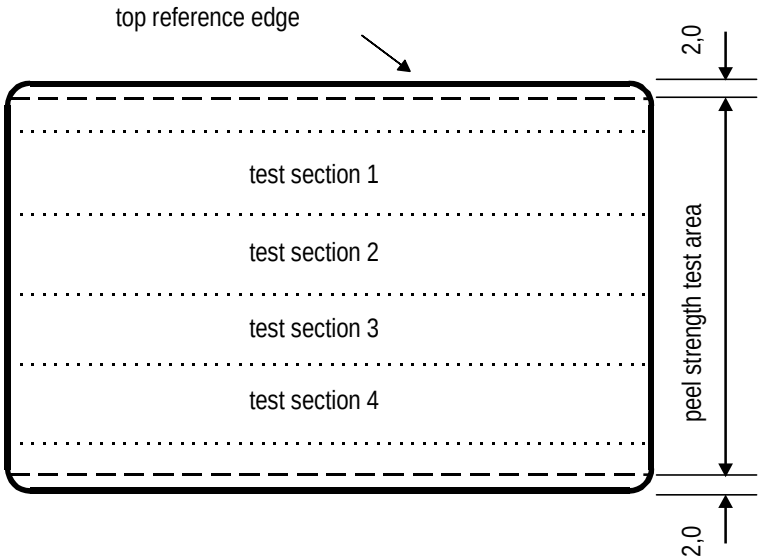


Figure 3 — Card preparation

Using a sharp knife, cut the layer back from the core approximately 10 mm (0.4 in) and apply the clamp or adhesive tape to the cut back edge of the layer and core as shown in Figure 4.

not to scale
dimensions in millimetres

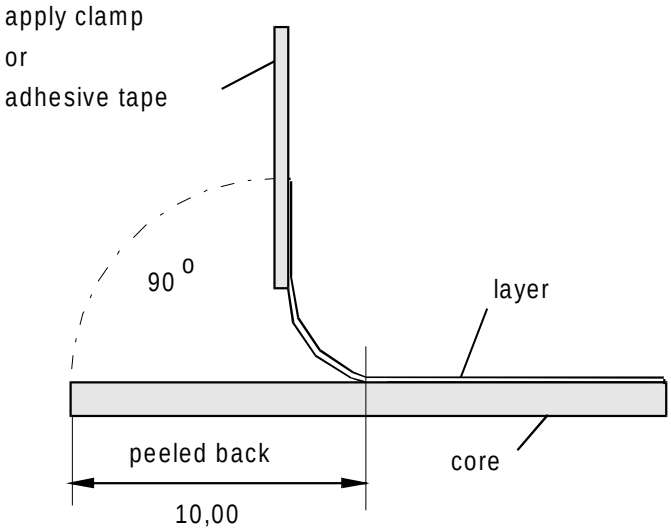


Figure 4 — Specimen preparation for peel test

If the peeling angle cannot be kept at 90° during the measurement, attach the stabilising plate to the core in advance.

Place the prepared specimen in the tensile tester fixture as shown in Figure 5. The card shall be fixed on the apparatus.

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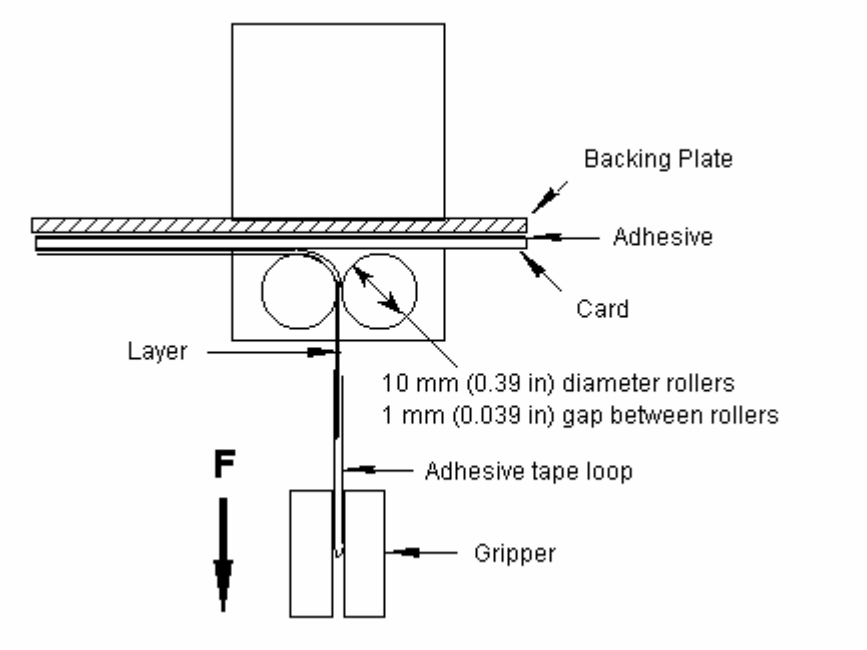


Figure 5 — Specimen mounted in tensile tester

Operate the tensile tester according to the manufacturers instructions at 300 mm/min (11.8 in/min) to determine the peel strength in N (lbf).

Excluding the first and last 5 mm and any features less than 1 mm in length (spikes) from consideration, find the test strip having the lowest peel strength value, using Figure 6 as a guide. Record this as the measured peel strength for the card.

NOTE Dimensions shown in Figure 6 are dimensions on the card.

not to scale
dimensions in millimetres

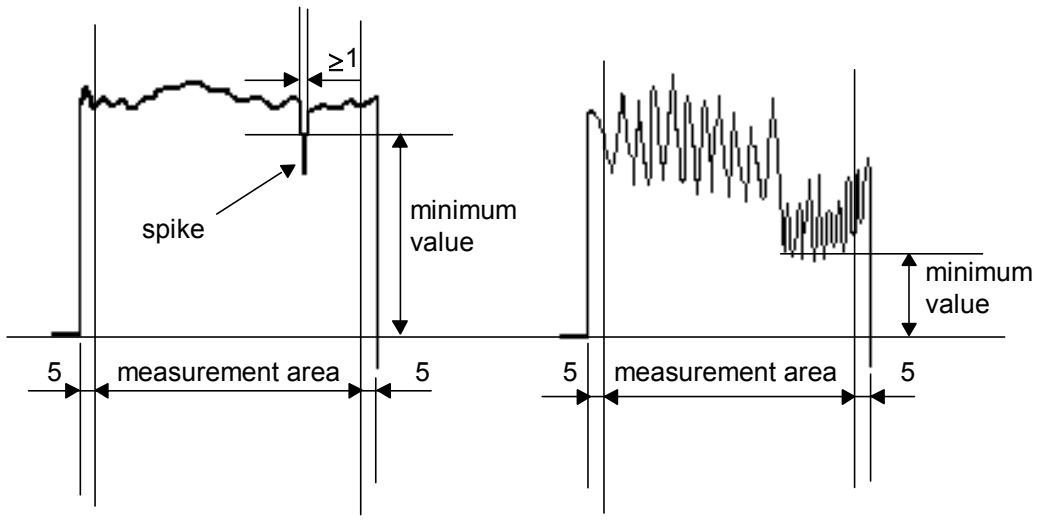


Figure 6 — Examples of peel strength chart recordings

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5.3.3 Test report

The test report shall give the measured peel strength, together with the test strip identifier. It shall also include the chart recording, clearly showing where the recorded minumum value was found, and shall state whether any tearing occurred.

5.4 Resistance to chemicals

The purpose of this test is to determine any adverse effects of a range of chemical contaminants on a card test sample.

5.4.1 Reagents

5.4.1.1 Solutions for short term contamination test

a) 5 % by mass aqueous solution of sodium chloride (NaCl, 98% minimum assay);

b) 5 % by mass aqueous solution of acetic acid (CH_3COOH, 99% minimum assay);

c) 5 % by mass aqueous solution of sodium carbonate (Na_2CO_3, 99% minimum assay);

d) 60 % by mass aqueous solution of ethyl alcohol (CH_3CH_2OH, grain alcohol, 93% minimum assay);

e) 10 % by mass aqueous solution of sucrose ($C_{12}H_{22}O_{11}$, 98% minimum assay);

f) Fuel B (according to ISO 1817);

g) 50 % by mass aqueous solution of ethylene glycol ($HOCH_2CH_3OH$, 98% minimum assay).

5.4.1.2 Solutions for long term contamination

a) salt mist;

b) artificial perspiration (both solutions shall be prepared in accordance with ISO 105-E04:1994),

   1) alkaline solution,

   2) acid solution.

5.4.2 Procedure

Use a different sample card for each test.

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Subject each card to a visual inspection to establish its appearance prior to test and record the results of that examination.

Perform any pre-exposure measurements required by the base standard.

For cards with a magnetic stripe, record each sample card at 20 ft/mm (500 ftpi) using a test recording current of I_{min} (or at the density and test recording current specified in the base standard), read and note the signal amplitude.

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Expose the card to the appropriate short term or long term contamination described in 5.4.2.1 and 5.4.2.2.

Immediately after exposure to Fuel B (5.4.1.1 f)), remove the residual chemicals from the surface using absorbent tissue and drying it for ≥ 15 minutes in a flue.

Immediately after removal from any of the other solutions (5.4.1.1.a), b), c), d), e) or g)), remove the residual chemicals from the surface by washing it in distilled water and drying it with absorbent tissue.

Perform any post-exposure measurements required by the base standard.

For cards with a magnetic stripe, read the signal amplitude on the apparatus used for the pre-exposure measurements and compare the result with the amplitude obtained at the beginning of the test.

Subject the card to a visual inspection to determine the effects of the test on its appearance and record the results of that examination.

5.4.2.1 Short term contamination

Submerge the card for 1 min in one of the solutions listed in 5.4.1.1 which shall be kept at a temperature between 20 °C and 25 °C.

5.4.2.2 Long term contamination

Expose the sample card to salt mist (see 5.4.1.2) for 24 h while mounted in a cabinet in accordance with ISO 9227:1990.

Submerge the sample card in each artificial perspiration solution (see 5.4.1.2) for 24 h.

5.4.3 Test report

The test report shall state whether the card is testably functional (see clause 3) following the test and shall give the results of:

a) any pre-exposure and post-exposure tests required by the base standard;

b) visual examination.

5.5 Card dimensional stability and warpage with temperature and humidity[2)]

The purpose of this test is to establish whether the dimensions and flatness of a card test sample remain within the requirements of the base standard after exposure to the specified environmental temperature and humidity.

5.5.1 Procedure

Pre-condition the sample card according to 4.2 before testing.

Place the sample card on a horizontal flat surface and expose it to each of the environments in the sequence listed below for 60 min.

–35°C ± 3°C (-31°F ± 5°F);

+50°C ± 3°C (+122°F ± 5°F) and 95 % ± 5 % relative humidity.

2) It is noted that humidity effects can still be observed over far longer periods of exposure.

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Following each exposure in the sequence, return the sample card to the default test environment described in 4.1 and retain it in this environment for 24 hours before measuring its dimensional stability and warpage.

5.5.2 Test report

The test report shall give the complete set of measured values of the sample card dimensions and card warpage, taken after each sub-cycle of exposure.

5.6 Adhesion or blocking

The purpose of this test is to determine any adverse effects when unembossed card test samples (finished cards) are stacked together.

5.6.1 Procedure

Pre-condition the unembossed sample cards according to 4.2 before testing.

Check whether each of the individual cards can be easily separated by hand.

Stack the cards in groups of five, all in the same orientation with the back sides of the cards down. Apply a uniform pressure of 2,5 kPa ± 0,13 kPa (0.362 psi ± 0.018 psi) over the top card surface.

Expose the stacked cards to an environment maintained at a temperature of 40°C ± 3°C (104°F ± 5°F) and a relative humidity of 40% to 60% for 48 hours.

At the end of the 48 hour period, return the stacked cards to the default test environment of 4.1 and check whether individual cards can be easily separated by hand.

Inspect the individual cards for visible deterioration attributable to the test, including any degree of:

— delamination;

— discolouration or colour transfer;

— changes to the surface finish;

— transfer of material from one card to an adjacent card;

— deformation of card when compared to card appearances prior to the test.

5.6.2 Test report

The test report shall state whether the cards were easily separated by hand after preconditioning and after exposure to the test environment. State whether any visible signs of deterioration were found. If any were found, it shall describe their nature and severity.

5.7 Bending stiffness

The purpose of this test is to determine whether the bending stiffness of a card test sample lies within the limits set by the base standard.

5.7.1 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

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Using the same apparatus as used in the Resistance to Heat Test (see 5.15), mount the sample card such that it is firmly clamped along the entire left side, front surface upwards.

Measure h_1 (see Figure 7).

Apply a load *F* equivalent to 0,7 N (0.16 lbf) within 3 mm (0.12 in) along the entire right side of the card for 1 min.

Measure h_2 (see Figure 8).

Remove the load *F*.

After one minute, measure h_3 (see Figure 9).

not to scale
dimensions in millimetres

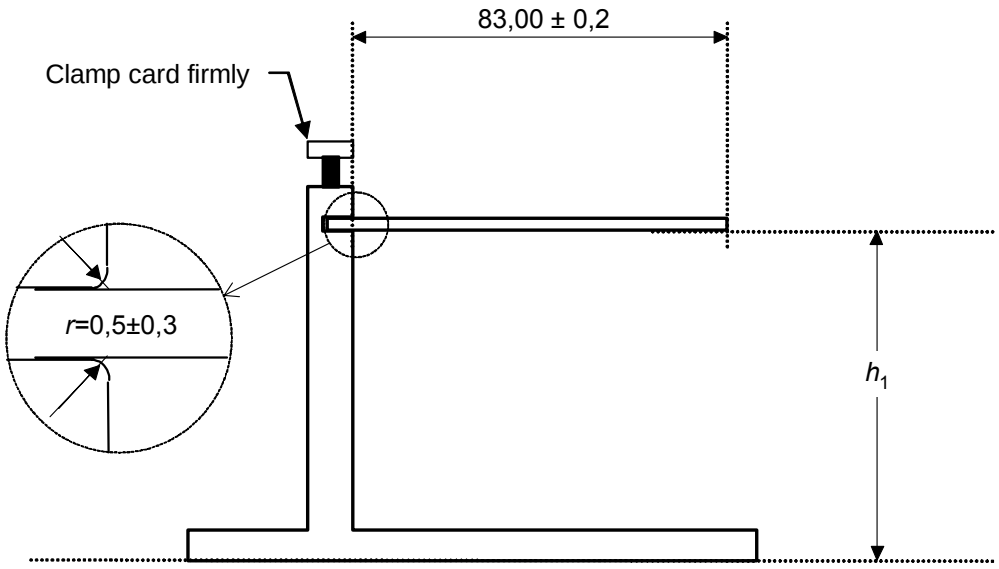


Figure 7 — Card in clamping device before loading

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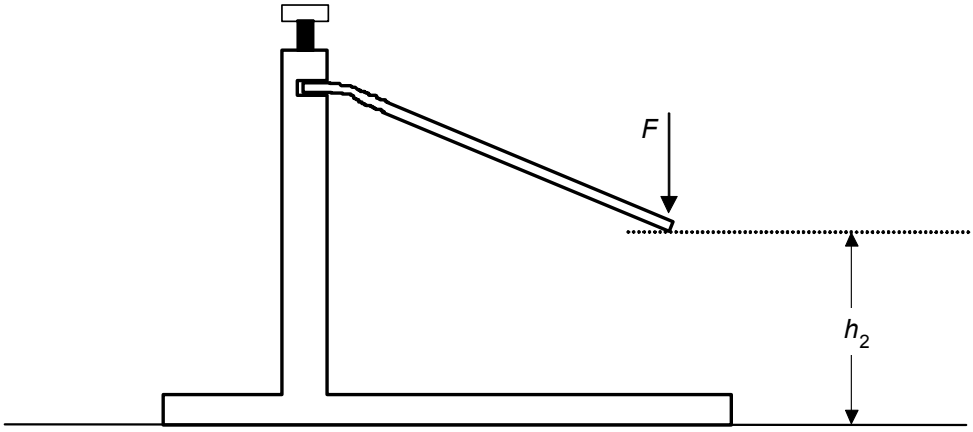


Figure 8 — Card in clamping device during loading

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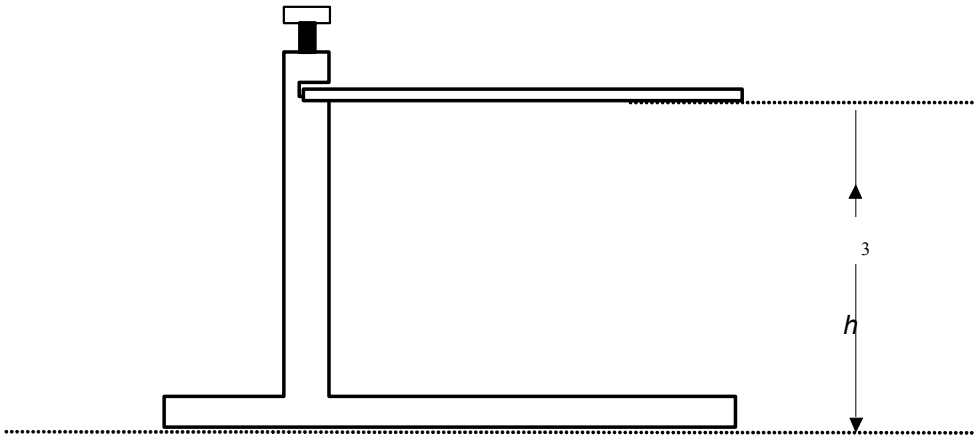


Figure 9 — Card in clamping device after unloading

5.7.2 Test report

The test report shall give the measured values of h_1, h_2 and h_3, together with the calculated values of the deflection (h_1 - h_2) under load and the deformation (h_1 - h_3) relative to the original condition remaining after removal of the load.

5.8 Dynamic bending stress

The purpose of this test is to determine any adverse mechanical or functional effects of bending stress in a card test sample.

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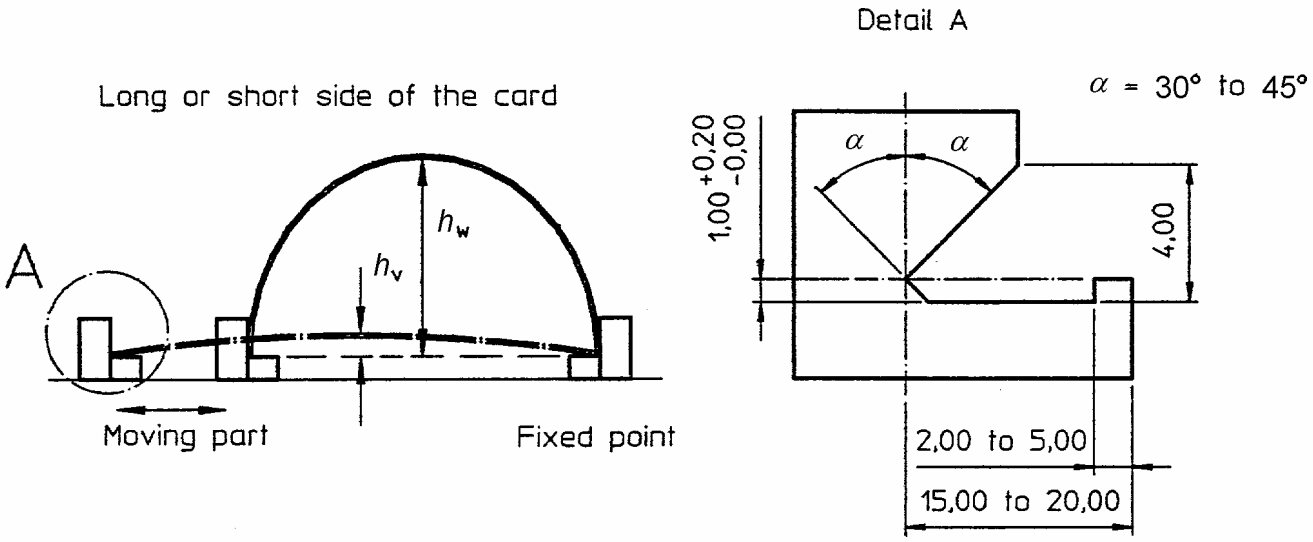
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5.8.1 Apparatus

The apparatus used to apply dynamic bending stress to the card under test shall be as shown in Figure 10.

The moving part of the apparatus is activated by a crank assembly such that the bending stress varies in a sinusoidal manner with a frequency of 0,5 Hz. The minimum deflection h_v is set by the starting position of the moving part and the maximum deflection h_w is set by adjusting its stroke.

not to scale
dimensions in millimetres



NOTE 1 h_v and h_w are both measured to the underside of the card.

NOTE 2 α of 30° is preferred to allow the equipment to be used interchangeably for flex testing of plastic card material in card durability tests.

Figure 10 — Test machine for unilateral bending

5.8.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Place the sample card between the jaws of the test machine shown in Figure 10, positioned such that the bend occurs by curvature of the width of the card along axis B (see Figure 11). If the card has contacts then it should first be positioned with the contacts uppermost.

Unless otherwise specified by the base standard, set the starting position of the apparatus to achieve a minimum deflection h_v of 2,00 mm ± 0,50 mm (0.079 in ± 0.020 in) and the stroke to achieve a maximum deflection h_w of 20,00 mm +0,00 mm, -1,00 mm (0.787 in +0.000 in, -0.039 in).

Apply one quarter the total number of bendings specified by the base standard or, if no such number is specified, 250 bendings.

Reposition the card such that the opposite face of the card is uppermost but the bend still occurs by curvature of the width of the card along axis B.

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Apply the same number of bendings as before.

Reposition the card and reset the test machine such that the original face of the card is uppermost but the bend occurs by curvature of the height of the card along axis A (see Figure 11). If the card has contacts then it should be positioned at this point with the contacts uppermost.

Not to scale

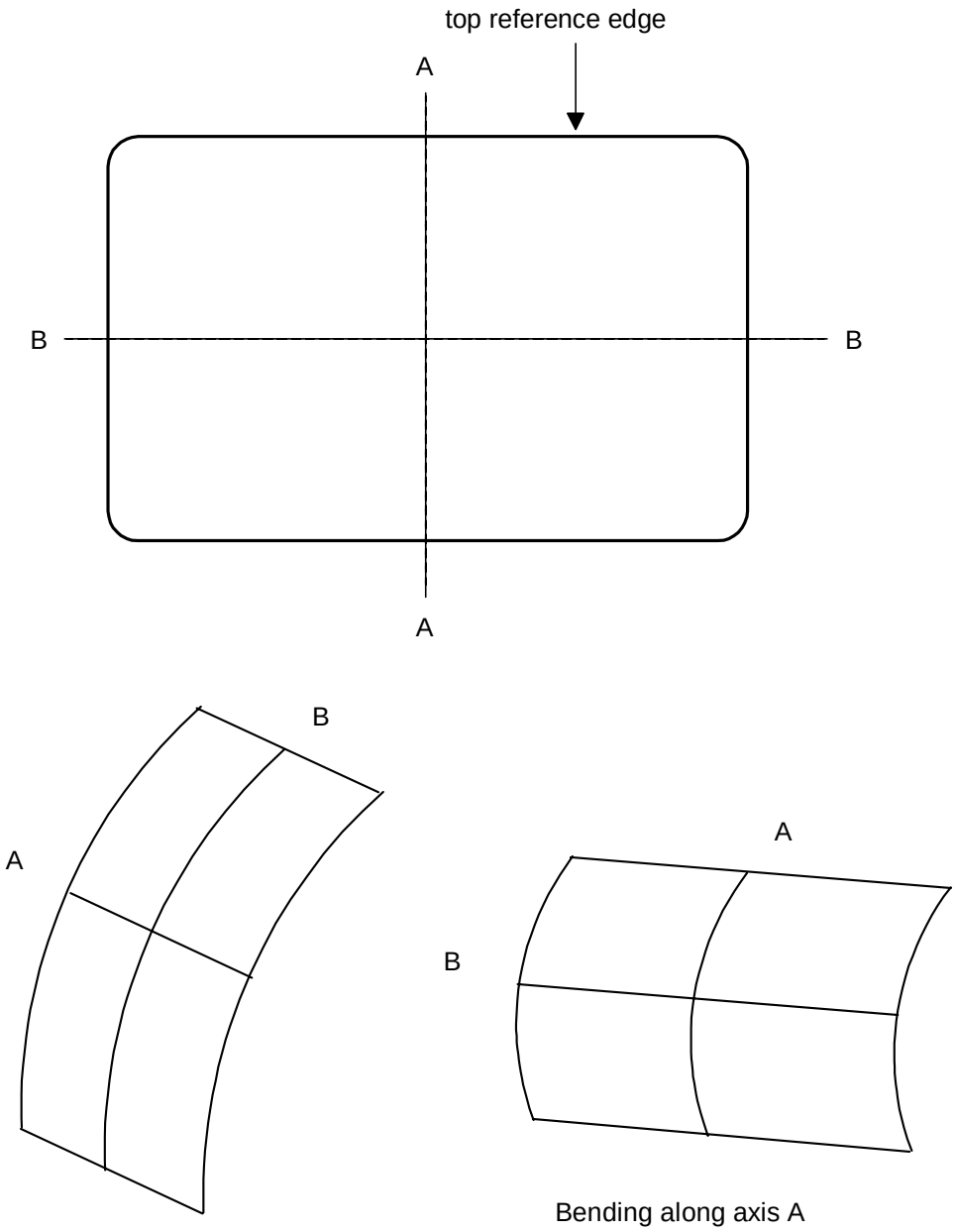


Figure 11 — Definition of axes

Unless otherwise specified by the base standard, set the starting position of the apparatus to achieve a minimum deflection h_v of 1,00 mm ± 0,50 mm (0.040 in ± 0.020 in) and the stroke to achieve a maximum deflection h_w of 10,00 mm +0,00 mm, –1,00 mm (0.39 in +0.00 in, -0.04 in).

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Apply the same number of bendings as before.

Reposition the card such that the opposite face of the card is uppermost but the bend still occurs by curvature of the height of the card along axis A.

Apply the same number of bendings as before.

Check that the card is testably functional (see clause 3) at the beginning and end of the test. It may also be checked at any convenient point during the course of the test.

5.8.3 Test report

The test report shall state whether or not the card is testably functional (see clause 3) at the end of the test.

5.9 Dynamic torsional stress

The purpose of this test is to determine any adverse mechanical or electrical effects arising from the repeated application of torsional stress to a card test sample.

5.9.1 Apparatus

The apparatus used to apply dynamic torsional stress to the card under test shall be as shown in Figure 12.

The apparatus varies the torsional stress applied in a sinusoidal manner up to a predetermined angular limit, as shown in Figure 13.

not to scale
dimensions in mm

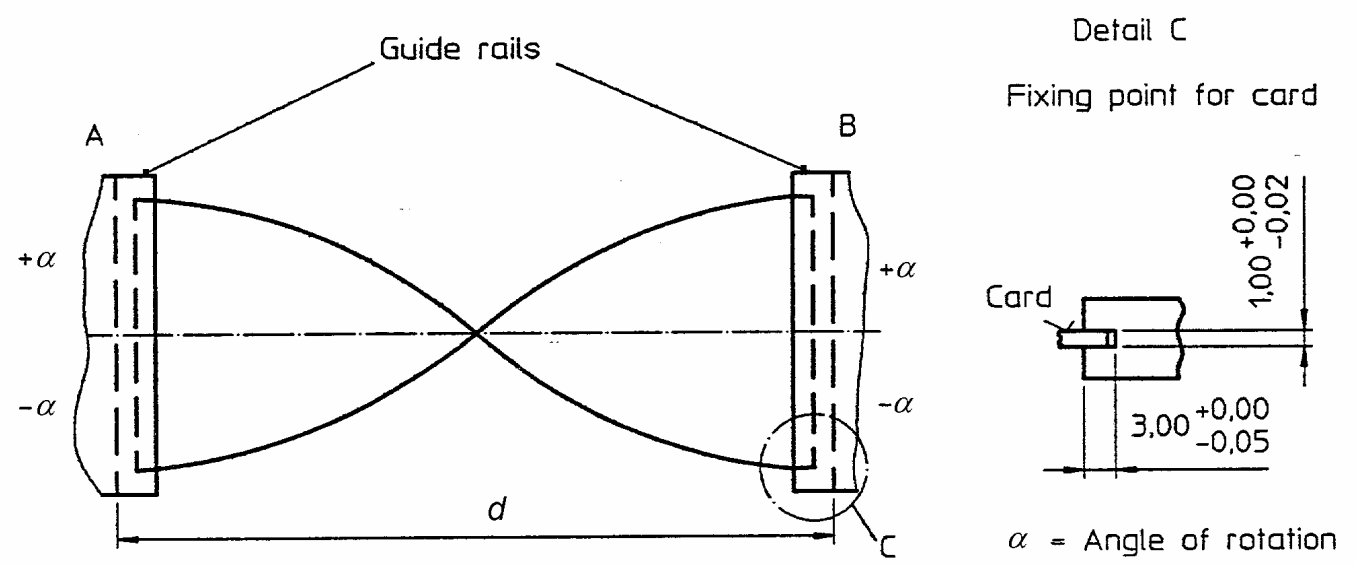


Figure 12 — Torsion test machine

5.9.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

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Position the card under test in the torsion test machine shown in Figure 12 so that it is loosely held in the grooves of the two guide rails, adjusting the distance *d* such that the short side edges of the card may be rotated through an angle up to $\pm \alpha$ relative to the neutral position.

Set the test frequency to 0,5 Hz and the angle of rotation α to 15° ± 1° and perform the number of torsion cycles specified by the base standard or, if no such number is specified, 1 000 torsion cycles.

Check that the card is testably functional (see clause 3) at the beginning and at the end of the test. It may also be checked during the test after one quarter of the torsion cycles specified in the base standard.

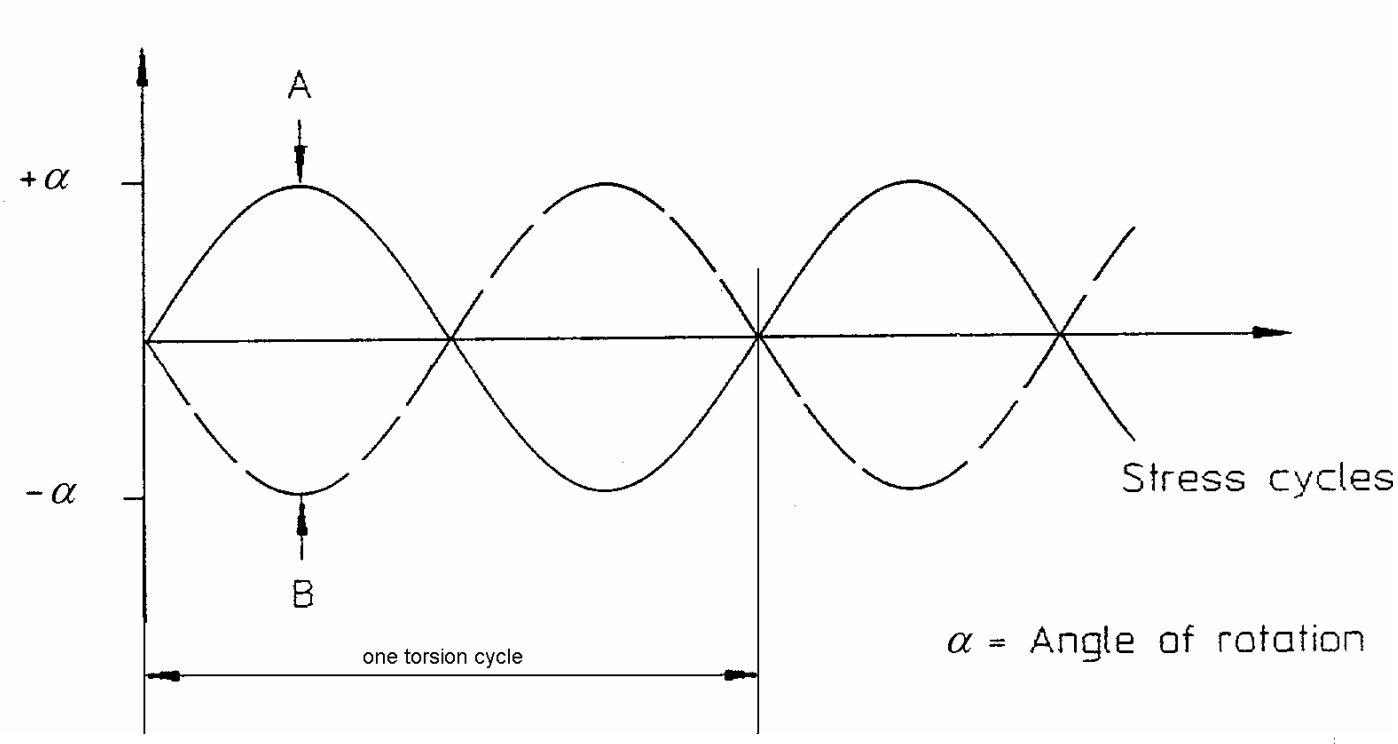


Figure 13 — Stress cycle function

5.9.3 Test report

The test report shall state whether or not the card is testably functional (see clause 3) at the end of the test.

5.10 Opacity

IMPORTANT — Two tests for opacity are given. This is the result of a planned migration in the base standard to a method intended to provide a more direct representation of the detection means employed in card handling devices. Users are warned to use only the method appropriate to the base standard to which the cards under test are required to conform.

5.10.1 Opacity for conformance to editions of ISO/IEC 7810 up to and including ISO/IEC 7810:2003

The purpose of this test is to determine the opacity of specified areas of a card test sample.

NOTE This test is required for applications in which the presence of a card is detected by its attenuation of light transmitted between a source and a sensor.

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5.10.1.1 Apparatus

A spectro-photometer with an integrating sphere light diffusing chamber able to measure opacity over a spectral range of 400 nm to 1 000 nm with an aperture of 8 mm.

5.10.1.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Calibrate the apparatus following the manufacturer's instructions.

Position the card sample nearest to the port of the integrating sphere (total light transmission mode for some apparatus).

Within the areas of the card specified by the base standard, find and record the minimum opacity over the range of wavelengths 400 nm to 1 000 nm, taking measurements at wavelength intervals of 20 nm.

NOTE The number of measurements required to find the minimum opacity will be reduced when the location has already been established

5.10.1.3 Test report

The test report shall give the recorded value of the minimum opacity, the wavelength range, and the location at which it was found.

5.10.2 Opacity for conformance to editions of ISO/IEC 7810 later than ISO/IEC 7810:2003

The purpose of this test is to determine the opacity of a card test sample in the areas specified by the base standard at two different Infrared (IR) wavelengths that are representative of those most commonly employed in applications in which the presence of a card is detected by its attenuation of light transmitted between an emitter and a detector[3)].

Note – At the time of publication, the most commonly employed IR emitters are GaAlAs (Gallium Aluminum Arsenide) or GaAs (Gallium Arsenide) light emitting diodes (LEDs) that emit IR light at peak wavelengths nominally at 860 nm and 950 nm respectively.

5.10.2.1 Apparatus

a) IR LED emitter and detector pairs with the following characteristics:

	Wavelengths	
	Near IR	Far IR
LED minimum radiant power (mW)	5	5
LED Peak emission wavelength (nm)	860 ± 10	950 ± 10
LED Spectral half band maximum width (nm)	50	50
Detector nominal wavelength for peak sensitivity (nm)	900	900

b) Material to block IR light with aperture for both LED and detector as shown in Figure 14.

3) Methods of card presence detection that use light of significantly different wavelengths than those used here may not function reliably with cards built to the post-2003 ISO/IEC 7810 opacity requirement.

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Dimensions in millimetres (inches)

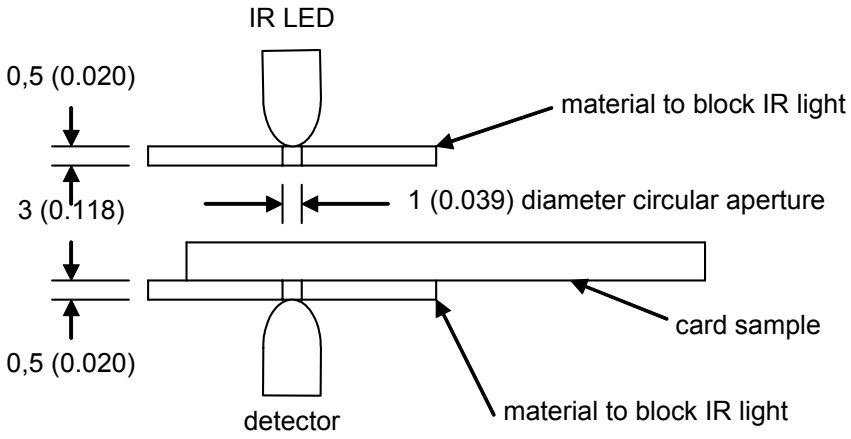


Figure 14 — IR LED and detector alignment

c) Suitable mount to position IR LED and detector in line, within ± 0,25 mm (0.010 in) and a cone angle of 5 degrees, and shield them from ambient light (see Figure 14 detail below).

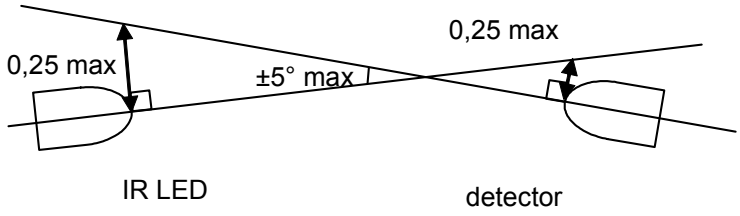


Figure 14 (detail) — Alignment of source and sensor

d) Circuit to control the emitter and provide means to measure the current through the detector as shown in Figure 15.

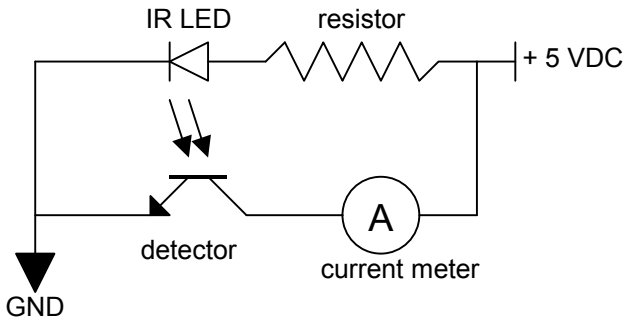


Figure 15 — Transmission Opacity Test Circuit (for each wavelength)

NOTE Select IR LED resistor for a forward current (I_F) not to exceed 90% of manufacturers maximum rating. A detector current of 5 to 15 ma when nothing is between the IR LED and detector is desirable.

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5.10.2.2 Procedure

If motorized equipment is used to scan the card, the distance between individual measurement positions should be less than or equal to half the diameter of the aperture. For a continuous scanning method the speed should be less than 0,05 times the aperture diameter divided by the response time of the LED/detector system

5.10.2.2.1 Calibration

Place the ORM7810 reference material, defined by the base standard, between the LED and detector, nearest to the detector. Record the current through the detector, I_{ref}. Move the reference material between the LED and detector to obtain the minimum current. Remove the reference material after calibration.

NOTE The ORM7810 reference material can be obtained from Eclipse Laboratories, 7732 West 78th Street, Bloomington, MN55439 USA <www.eclipselaboratories.com>.

5.10.2.2.2 Measurement

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Position the test card between the LED and detector, nearest to the detector. Record the maximum current through the detector, I_{card}, within the areas of the card specified by the base standard. Move the test card between the LED and detector to obtain the maximum current.

Find and record the opacity ratio: I_{card} / I_{ref} for each LED wavelength.

5.10.2.3 Test report

The test report shall give the recorded value of the minimum opacity ratio for each LED wavelength and the location at which it was found.

5.11 Ultraviolet light

The purpose of this test is to determine any adverse effects arising from exposure of a card test sample to ultraviolet light.

5.11.1 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Expose the sample card to monochromatic light at a wavelength of 254 nm, ensuring that the test environment conditions are maintained.

Expose the front of the card to a total energy of 0,15 Ws/mm^2, then repeat the process for the back of the card.

The irradiance at the surface of the card shall correspond to an exposure time of 10 minutes to 30 minutes, according to the formula:

$$\text{Time (s)} = \frac{0{,}15\ (\text{Ws} / \text{mm}^2)}{\text{Irradiance}\ (\text{W} / \text{mm}^2)}$$

EXAMPLE with an irradiance of 0,12 mW/mm^2, the exposure time is 20 min, 50 s.

Check that the card remains testably functional (see clause 3) at the end of the test.

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5.11.2 Test report

The test report shall state whether or not the card is testably functional (see clause 3) at the end of the test.

5.12 X-rays

The purpose of this test is to determine any adverse effects arising from exposure of a card test sample to X-rays.

5.12.1 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Expose both sides of the card to X-ray radiation with an acceleration voltage of 100 kV, to the dose defined in the standard.

Check that the card remains testably functional following the exposure.

5.12.2 Test report

The test report shall state whether or not the card is testably functional (see clause 3) at the end of the test.

5.13 Static magnetic fields

The purpose of this test is to determine any adverse effect of a static magnetic field on a card test sample.

5.13.1 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Introduce the card into a static magnetic field, the value of which is set in the base standard, such that the direction of the field is perpendicular to the plane of the card. The insertion speed shall be between 200 mm/s (7.9 in/s) and 250 mm/s (9.8 in/s).

Check that the card remains testably functional at the end of the test.

5.13.2 Test report

The test report shall state whether or not the card is testably functional (see clause 3) at the end of the test.

5.14 Embossing relief height of characters

The purpose of this test is to obtain the overall and the relief height of embossed imprinting characters in a card test sample.

5.14.1 Apparatus

A micrometer with a flat anvil and spindle whose diameter is within the range of 3 mm to 8 mm (0.12 in to 0.31 in).

5.14.2 Procedure

Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

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Use the micrometer with a force of 3,5 N to 5,9 N (0.78 lbf to 1.33 lbf) to measure the embossed height of any one character.

Calculate relief height by subtracting the thickness of the card, as measured in the relevant quadrant (see Figure 2) from the value of overall height obtained by direct measurement.

5.14.3 Test report

The test report shall give the value of overall and relief height for each character.

5.15 Resistance to heat

The purpose of this test is to determine whether the structure of the card remains stable within the requirements of the base standard while exposed to the required temperature. The resistance to heat of the complete card is measured by determining the deformation of the card after being exposed to a certain temperature.

The deformation of the card (Δh) with reference to a certain temperature is the maximum of the two results obtained with the card being placed into the test apparatus with the card front upwards (Δh_F) and the card back upwards (Δh_B).

5.15.1 Apparatus

Clamping device able to clamp sample cards firmly (see Figure 16), and a climatic chamber allowing temperature and humidity variations as described below.

5.15.2 Procedure

Precondition the sample cards according to 4.2 before testing and conduct the test under the test environment defined in 4.1. Mount the sample card in the clamping device such that it is clamped along the entire short side, with the front side up. For Integrated Circuit Cards with contacts, the cards shall be placed such that the contact location is opposite the clamping device. Measure h_1 as shown in Figure 16.

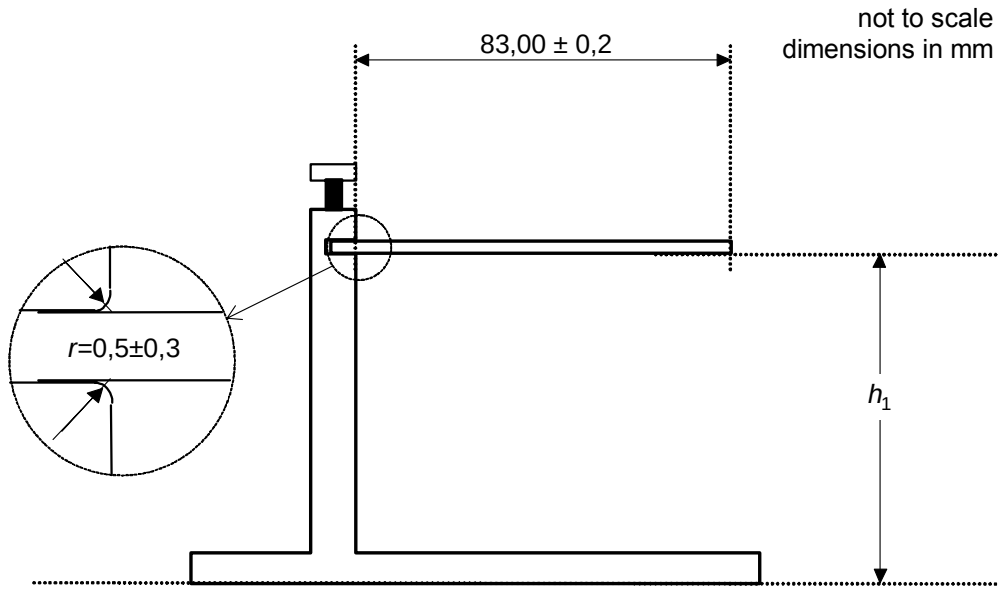


Figure 16 — Card in clamping device before exposure to temperature

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Place the clamping device with the card into a climatic chamber at the temperature and humidity conditions described in the base standard for a period of 4 hours. At temperatures above 50° C the climatic condition may be without humidity control, due to technical limitations of the climatic chamber. Ensure that the test card is not exposed to air currents in the chamber.

At the end of the test period, the clamping device with the card is removed from the chamber. After a cooling time of at least 30 minutes in a test environment conforming to 4.1, measure h_2 as shown in Figure 17.

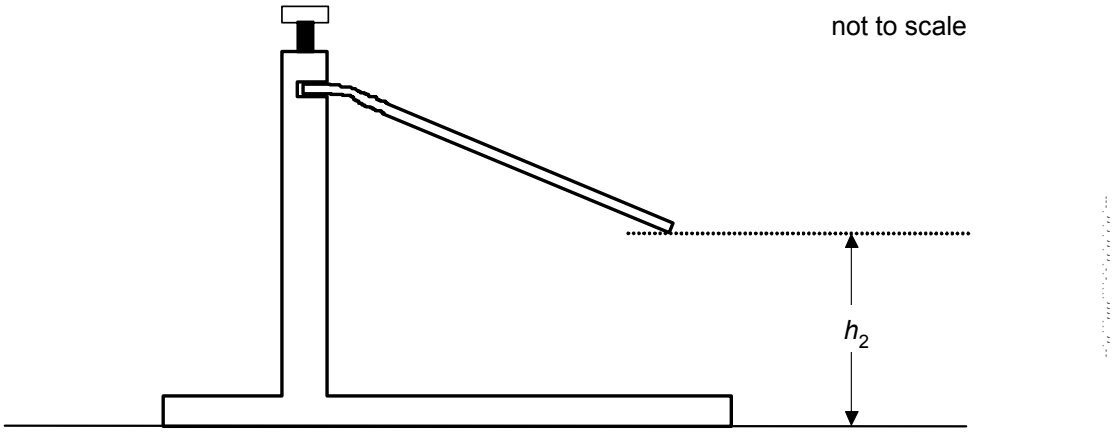


Figure 17 — Card in clamping device after exposure to temperature

Calculate Δh_F: $\Delta h_F = h_1 - h_2$

Repeat the entire procedure with a second card of the same quality, this time with the back side up and calculate Δh_B: $\Delta h_B = h_1 - h_2$.

Determine the maximum deflection Δh i.e. Δh = Maximum($|\Delta h_F|, |\Delta h_B|$)

Check the cards visually for delamination and discoloration.

5.15.3 Test report

The test report shall give the maximum deflection Δh and shall state whether delamination or discoloration occurred on the test-cards.

5.16 Surface distortions and raised areas

Surface distortions and raised areas (except for embossed characters) shall be measured with the same apparatus and procedures as given for Height and surface profile of the magnetic stripe in ISO/IEC 10373-2.

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