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**Identification cards — Test methods —**

**Part 1:**  
General characteristics tests

*Cartes d'identification — Méthodes d'essai —  
Partie 1: Essais des caractéristiques générales*

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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. 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 10373-1 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*

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# Identification cards — Test methods —

## Part 1: General characteristics tests

### 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 common to one or more card technologies. Other parts of ISO/IEC 10373 define technology-specific test methods.

### 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 5-2:1991, *Photography - Density measurements - Part 2: Geometric conditions for transmission density.*

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

ISO 1817:1985, *Rubber, vulcanized - Determination of the effect of liquids.*

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

ISO/IEC 7810:1995, *Identification cards - Physical characteristics.*

ISO/IEC 7811-1:1995, *Identification cards - Recording technique - Part 1: Embossing.*

ISO/IEC 7811-2:1995, *Identification cards - Recording technique - Part 2: Magnetic stripe.*

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

ISO/IEC 7813:1995, *Identification cards - Financial transaction cards.*

ISO/IEC 7816-1:1998, *Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics.*

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

ISO/IEC 10536-1:1992, *Identification cards - Contactless integrated circuit(s) cards - Part 1: Physical characteristics.*

ISO/IEC 11694-3:1995, *Identification cards - Optical memory cards - Linear recording method - Part 3: Optical properties and characteristics.*

### 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<sup>1</sup> 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

##### **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

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<sup>1</sup> 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****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

**3.12****flammability**

ability of a card, once ignited, to maintain and propagate a flame

**3.13****<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:

$$T = \Phi_t / \Phi_j$$

where

$T$  is the transmittance factor

$\Phi_t$  is the transmitted <optical> flux

$\Phi_j$  is the aperture flux

[ISO 5-2:1991]

**3.14****opacity****<optical> transmission density** **$D_T$** 

logarithm to the base 10 of the reciprocal of the transmittance factor:

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

[ISO 5-2:1991]

**3.15****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

**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  $23^\circ\text{C} \pm 3^\circ\text{C}$  ( $73^\circ\text{F} \pm 5^\circ\text{F}$ ) 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

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	All cards	Card is embossed	Card has Mag stripe	Card has IC <sup>a</sup>	Card has CIC <sup>b</sup>	Card has OMA <sup>c</sup>
5.1 Card Warpage – overall	✓	✓	✓	✓	✓	✓
5.2 Dimensions of cards	✓	✓	✓	✓	✓	✓
5.3 Peel strength	✓	✓	✓	✓	✓	✓
5.4 Resistance to chemicals	✓	✓	✓	✓	✓	✓
5.5 Card stability and warpage with temperature and humidity	✓	✓	✓	✓	✓	✓
5.6 Adhesion or blocking	✓	✓	✓	✓	✓	✓
5.7 Bending stiffness	✓	✓	✓	✓	✓	✓
5.8 Dynamic bending stress (bending properties)				✓	✓	✓
5.9 Dynamic torsional stress (torsion)				✓	✓	✓
5.10 Flammability (see NOTE)						
5.11 Opacity	✓	✓	✓	✓	✓	✓
5.12 Ultraviolet light				✓	✓	✓
5.13 X-rays				✓	✓	✓
5.14 Electromagnetic fields				✓	✓	✓
5.15 Embossing relief height of characters		✓				
NOTE - The flammability test is performed only when the application specifically requires it.						
<sup>a</sup> IC = integrated circuit <sup>b</sup> CIC = contactless integrated circuit <sup>c</sup> OMA = Optical memory area (of an optical memory card)						

## 4.4 Default tolerance

Unless otherwise specified, a default tolerance of  $\pm 5\%$  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 Card warpage

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

#### 5.1.1 Apparatus

A profile projector or similar measuring device with a minimum accuracy of 0,01 mm (0.0004 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

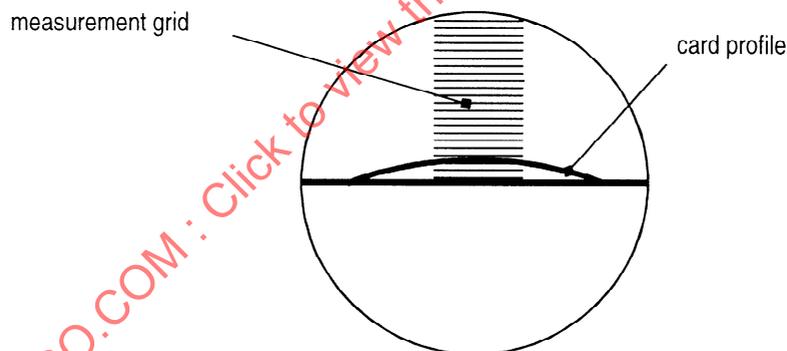


Figure 1 — Projector apparatus view of warpage measurement

#### 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 (see ISO/IEC 7810 :1995).

#### 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).

### 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.

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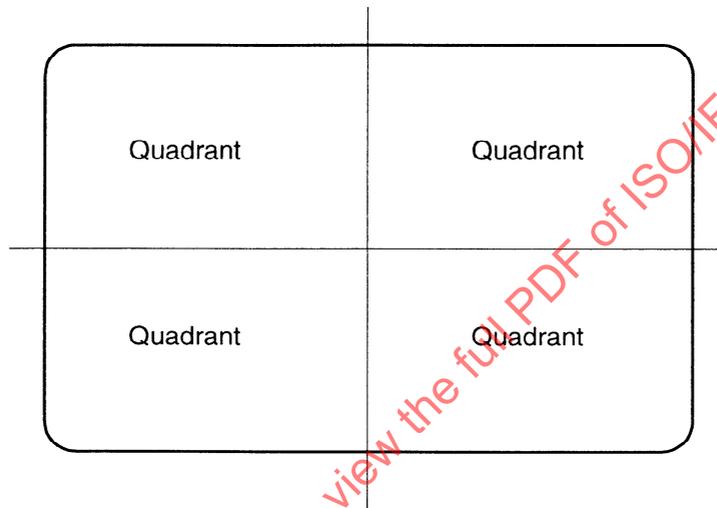


Figure 2 — Assignment of quadrants

### 5.2.2 Height and width of card measurement

#### 5.2.2.1 Apparatus

The following items are required:

- a level horizontal rigid surface of a roughness not greater than 3,2  $\mu\text{m}$  according to ISO 1302:1992;
- a measuring device with a precision of 2,5  $\mu\text{m}$ ;
- a load of 2,2 N  $\pm$  0,2 N (0.495 lbf  $\pm$  0.045 lbf).

#### 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.

#### 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<sup>2</sup> between card layers (see ISO/IEC 7810:1995).

#### 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

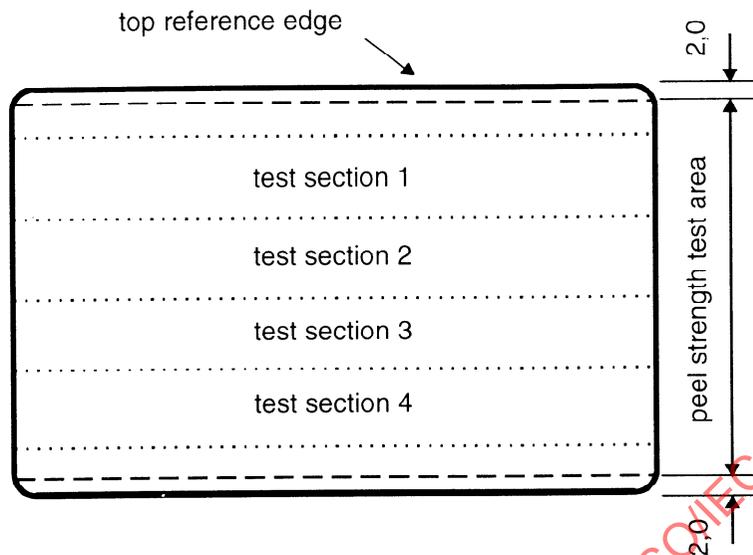
Pre-condition the sample card according to 4.2 before testing and conduct the test under the test environment defined in 4.1.

Cut the card, or score through the layer, to produce sections of width 10 mm ± 0,1 mm (0.39 in ± 0.04 in) as shown in figure 3.

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<sup>2</sup> Note that ISO/IEC 7810:1995 defines 'delamination resistance' in terms of a quantity called 'peel strength' that, although similar in principle to that measured here, is not directly comparable. The anomaly will be corrected at the next revision of ISO/IEC 7810. A revised requirement of 0,35 N/mm (2.0 lb/in), measured according to this method, is anticipated.

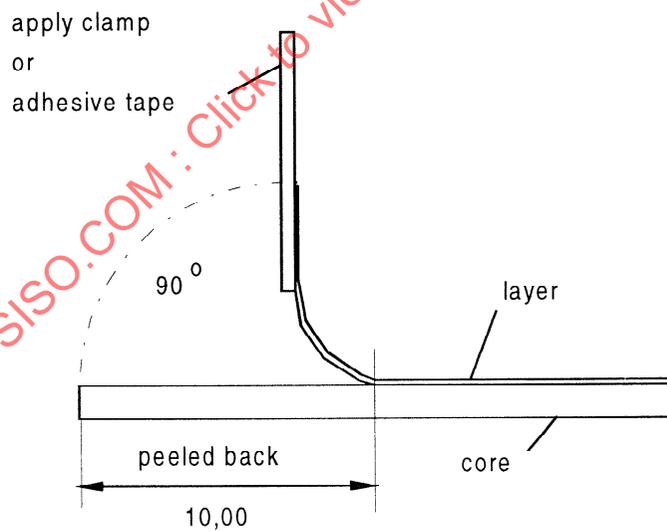
not to scale  
dimensions in millimetres



**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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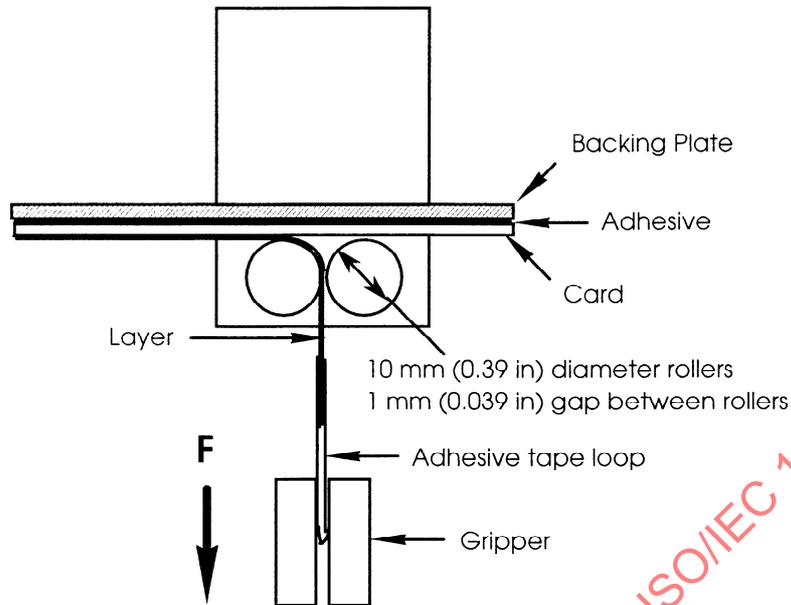


Figure 5 — Specimen mounted in tensile tester

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

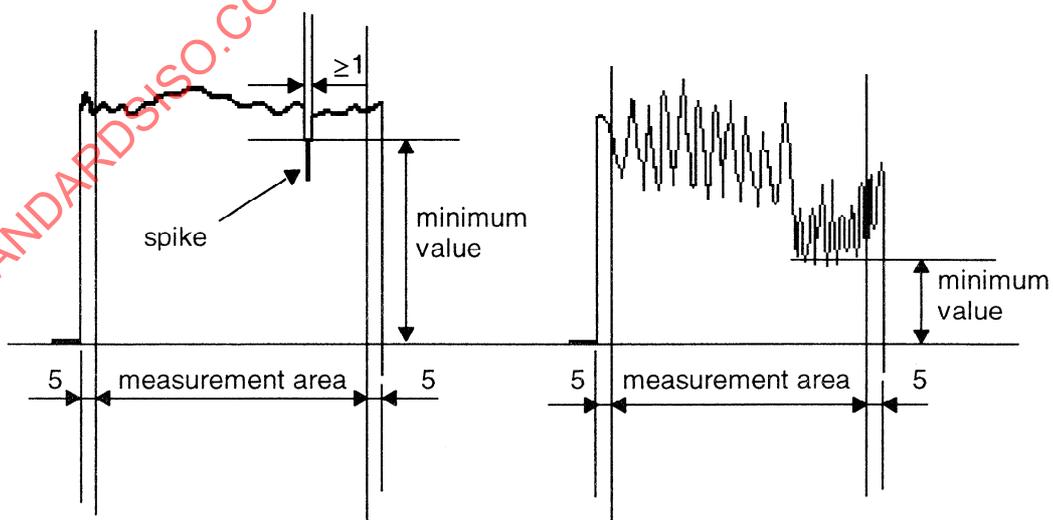


Figure 6 — Examples of peel strength chart recordings

### 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 minimum 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 (see ISO/IEC 7810:1995, ISO/IEC 7811-2:1995, ISO/IEC 7811-6:1996 and ISO/IEC 11694-3:1995).

#### 5.4.1 Reagents

##### 5.4.1.1 Solutions for short term contamination test

- a) aqueous solution of sodium chloride ( $\text{NaCl}$ , 98% minimum assay);
- b) aqueous solution of acetic acid ( $\text{CH}_3\text{COOH}$ , 99% minimum assay);
- c) aqueous solution of sodium carbonate ( $\text{Na}_2\text{CO}_3$ , 99% minimum assay);
- d) aqueous solution of ethyl alcohol ( $\text{CH}_3\text{CH}_2\text{OH}$ , grain alcohol, 93% minimum assay);
- e) aqueous solution of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , 98% minimum assay);
- f) Fuel B (according to ISO 1817:1985);
- g) aqueous solution of ethylene glycol ( $\text{HOCH}_2\text{CH}_2\text{OH}$ , 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 the 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<sup>3</sup> at 20 ft/mm (500 fpi) using a test recording current of  $I_{\text{min}}$ , read and note the signal amplitude.

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 removal from the solution, wash the card in distilled water and dry it with absorbent tissue.

<sup>3</sup> Due to an error, the base standard may specify incorrect test recording conditions.

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 vertically 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

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 (see ISO/IEC 7810:1995).

#### 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.

$-35^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $-31^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ) ;

$+50^{\circ}\text{C} \pm 3^{\circ}\text{C}$  ( $+122^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ) and  $95\% \pm 5\%$  relative humidity.

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 measured values of the sample card dimensions and card warpage.

### 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 (see ISO/IEC 7810:1995).

### 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  $2,5 \text{ kPa} \pm 0,13 \text{ kPa}$  ( $0.362 \text{ psi} \pm 0.018 \text{ psi}$ ) over the top card surface.

Expose the stacked cards to an environment maintained at a temperature of  $40^\circ\text{C} \pm 3^\circ\text{C}$  ( $104^\circ\text{F} \pm 5^\circ\text{F}$ ) 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 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 ;
- discoloration 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 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 (see ISO/IEC 7810:1995)<sup>4</sup>.

#### 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.

Mount the sample card in the apparatus described below such that it is clamped along the entire left side, front surface upwards.

Measure  $h_1$  (see figure 7).

Apply a load 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.

After one minute, measure  $h_3$  (see figure 9).

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<sup>4</sup> This method is applicable to ID-2 and ID-3 in addition to ID-1.

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 dimensions in millimetres

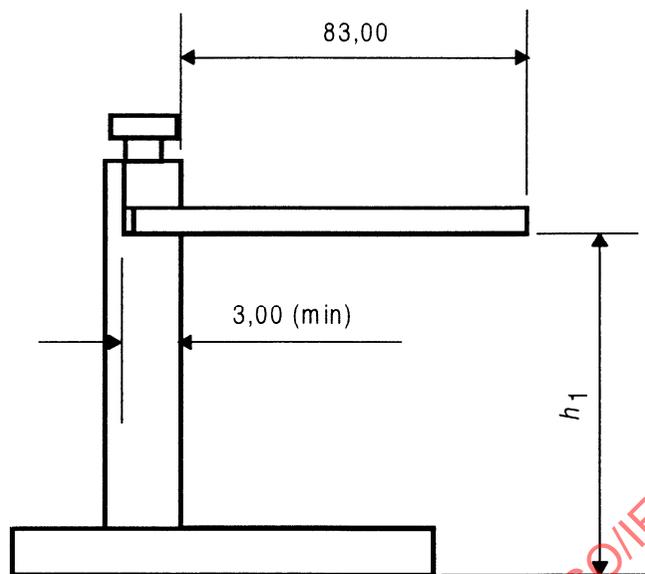


Figure 7 — Card in clamping device before loading

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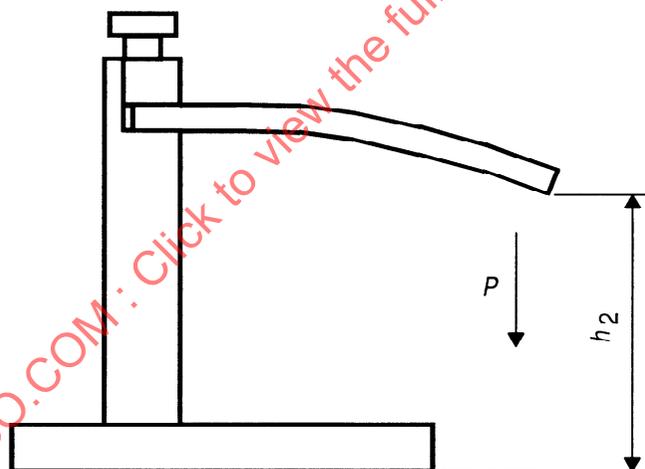


Figure 8 — Card in clamping device during loading

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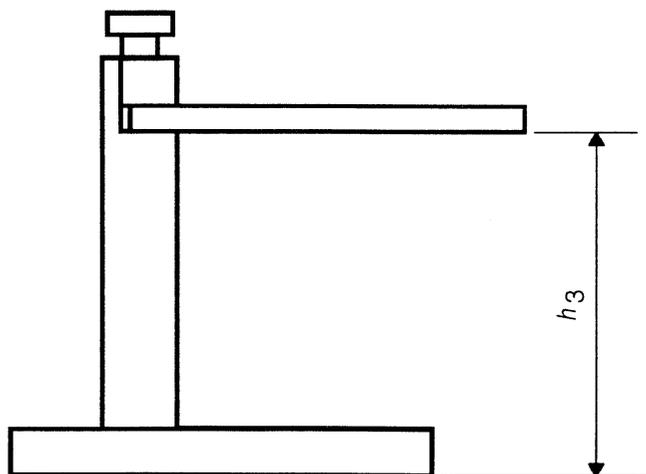


Figure 9 — Card in clamping device after unloading

### 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 (bending properties)

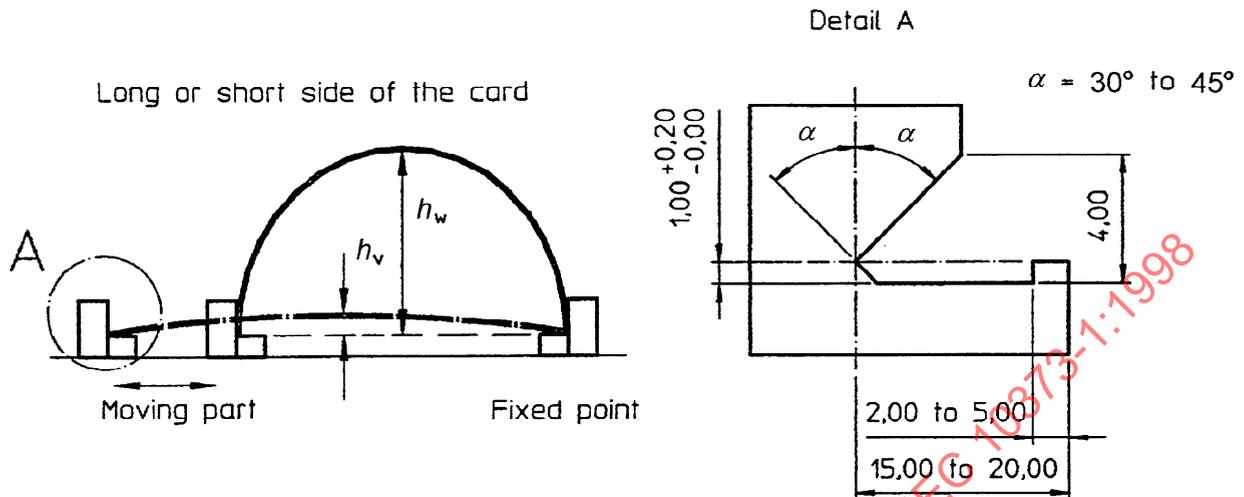
The purpose of this test is to determine any adverse mechanical or functional effects of bending stress in a card test sample (see ISO/IEC 7816-1:1998 and ISO/IEC 10536-1:1992).

#### 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 maximum deflection  $h_w$  can be set to within a tolerance of +0 mm, -1,00 mm, (+0 in, -0.04 in) by adjusting the stroke of the moving part. The minimum deflection  $h_v$  is set by the starting position.

not to scale  
dimensions in millimetres



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

NOTE 2 -  $\alpha$  of  $30^\circ$  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.

Set the stroke of the apparatus to achieve a minimum deflection  $h_v$  of  $2,00 \text{ mm} \pm 0,50 \text{ mm}$  ( $0.079 \text{ in} \pm 0.020 \text{ in}$ ).

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.

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.

Set the stroke of the apparatus to achieve a minimum deflection  $h_v$  of  $1,00 \text{ mm} \pm 0,50 \text{ mm}$  ( $0.040 \text{ in} \pm 0.020 \text{ in}$ ).

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.

Not to scale

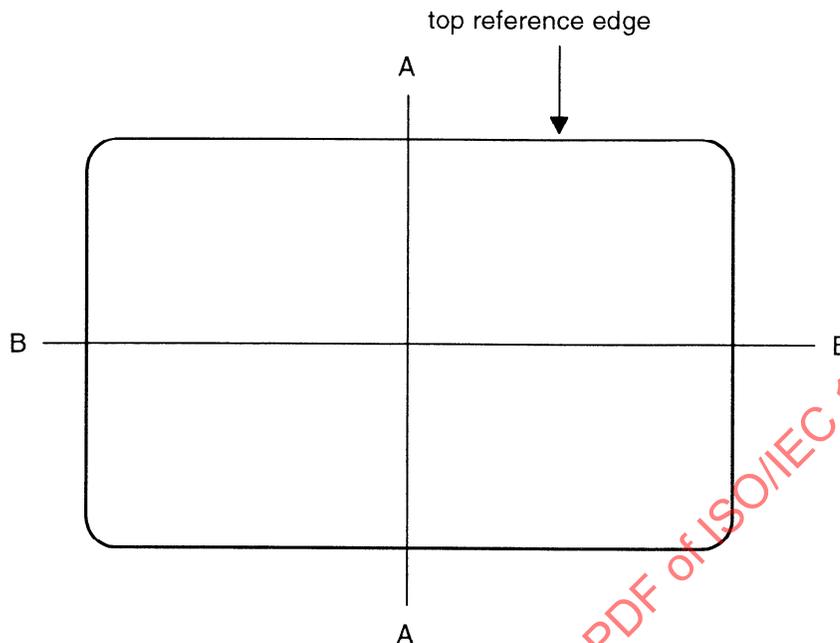


Figure 11 — Definition of axes

### 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 (torsion)

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 (see ISO/IEC 7816-1 :1998 and ISO/IEC 10536-1 :1992).

#### 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.