INTERNATIONAL STANDARD

ISO/IEC 24789-2

First edition
2011-11-15

Identification cards — Card service life —

Part 2: Methods of evaluation

Cartes d'identification — Durée de vie des cartes —

Partie 2: Méthodes d'évaluation

Reference number
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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 24789-2 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 17, *Cards and personal identification*.

ISO/IEC 24789 consists of the following parts, under the general title *Identification cards — Card service life*:

— *Part 1: Application profiles and requirements*

— *Part 2: Methods of evaluation*

Introduction

This part of ISO/IEC 24789 comprises methods of evaluation of identification (ID) card service life.

These methods of evaluation complement the application profiles and requirements defined in ISO/IEC 24789-1, which are intended to be used by card issuers, card manufacturers and card component suppliers to represent the comparative rigour of various ID card service life applications. They provide a means for ranking and comparing the main factors affecting ID card service life in a manner that is amenable to evaluation using the methods defined or referenced in this part of ISO/IEC 24789.

Identification cards — Card service life —

Part 2:
Methods of evaluation

1 Scope

This part of ISO/IEC 24789 specifies methods of evaluation for ID-1 identification card service life in the applications referred to in ISO/IEC 24789-1. It contains no additional or changed requirements for the ID-1 card properties defined in other applicable standards.

NOTE 1 At the time of publishing this first edition, there is limited data to show direct equivalence to any measure of actual field use conditions. It will not be possible to establish any such equivalence until and unless a degree of quantitative correlation has been established for the ID card construction in question.

NOTE 2 For the convenience of certain users, non-S.I. equivalents are given for some quantity values where these are in common use in the ID card industry. These equivalents appear in parentheses and are for information only.

2 Normative references

The following referenced documents are indispensible for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 24789-1, *Identification cards — Card service life — Part 1: Application profiles and requirements*

ISO/IEC 7810, *Identification cards — Physical characteristics*

ISO/IEC 7811-2, *Identification cards — Recording technique — Part 2: Magnetic stripe — Low coercivity*

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

ISO/IEC 7811-8, *Identification cards — Recording technique — Part 8: Magnetic stripe — Coercivity of 51,7 kA/m (650 Oe)*

ISO/IEC 10373-1, *Identification cards — Test methods — Part 1: General characteristics*

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

ISO/IEC 14443-1, *Identification cards — Contactless integrated circuit cards — Proximity cards — Part 1: Physical characteristics*

ISO 105-B02, *Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test*

ISO 3310-1, *Test sieves — Technical requirements and testing — Part 1: Test sieves of metal wire cloth*

IEC 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

IEC 60454-2, *Pressure-sensitive adhesive tapes for electrical purposes — Part 2: Methods of test*

CIE Publication 116-1995, *Industrial Colour-Difference Evaluation*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms, definitions, symbols and abbreviations given in ISO/IEC 7810, ISO/IEC 10373-1, ISO/IEC 10373-2, ISO/IEC 24789-1 and the following apply.

3.1.1
card fracture
crack or break in a card whose depth is at least one third of the card thickness

3.2 Abbreviated terms

ICM integrated circuit(s) module

ICC integrated circuit(s) card

4 Default items applicable to the evaluation methods

4.1 Test environment

Unless otherwise specified, evaluation shall take place in an environment having a temperature 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 evaluation method, the identification cards to be evaluated shall be conditioned to the default test environment for a period of 24 h before evaluation.

4.3 Selection of evaluation methods

Methods of evaluation shall be applied as required by the application profile of the card defined in ISO/IEC 24789-1.

4.4 Default tolerance

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

4.5 Total measurement uncertainty

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

5 Methods of evaluation for card service life (CSL)

5.1 Xenon arc light exposure

The purpose of this test is two-fold:

a) The procedure can be used as a preconditioning step before, or as a test step in, a sequential test. Cards will be exposed to Xenon arc to accelerate aging of the plastic materials. This aging typically causes plastics to lose ductility and become more susceptible to mechanical failures.

b) The test can also be used as a means for determining discoloration of card materials due to UV degradation. The test will allow for simulation of outdoor exposure (no window glass filter) and indoor exposure (use of window glass filter).

5.1.1 Apparatus

Xenon Arc Test Chamber conforming to ISO 105-B02 and constructed with:

— Xenon arc lamp;

— IR (daylight) filter to cut out wavelengths greater than 800 nm;

— window glass filter (when applicable);

— black body temperature control.

5.1.2 Procedure

Mount the cards in the test chamber with the card surface of interest exposed.

Close the chamber to prevent leakage. Expose the cards to the Xenon arc for 24 h under the following test conditions:

a) black-standard temperature of 50 °C ± 5 °C (122 °F ± 9 °F) as measured with a black-standard thermometer as defined in ISO 105-B02;

b) illumination intensity:

— without window filter – “Outdoor” exposure
0,65 w/m^2 using a control point[1)] of 420 nm
550 w/m^2 using a control point[2)] of 290 nm to 800 nm;

— with window filter – “Indoor” exposure
0,65 w/m^2 using a control point of 420 nm
550 w/m^2 using a control point of 290 nm to 800 nm.

Allow the cards to cool to room temperature and remove them from the test chamber.

If used as a preconditioning test, continue with the remaining test procedures.

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1) Test equipment using a 420 nm control point is made by QSun (models Xe-1 and Xe-3). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these products. Other manufacturers using this control point may be used as long as they meet the requirements of ISO 105-B02.

2) Test equipment using a 290 nm to 800 nm control point is made by Atlas (all Suntest models). This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these products. Other manufacturers using this control point may be used as long as they meet the requirements of ISO 105-B02.

5.1.3 Evaluation report

Unless specified otherwise by the base standard:

a) record the number of hours of Xenon arc light exposure, the illumination intensity and any filters used;

b) record any colour change observations and method of evaluation:

- visual;
- colour difference ΔE^*_{Lab} or ΔE^*_{Lch} measured using CIE 1994 as defined in CIE Publication 116-1995 (or later version) L*a*b* or L*C*h* with standard illuminant D65 and 10° observer;
- (optionally) reflection density changes (ISO 5-3 and ISO 5-4).

c) record whether or not the cards remain testably functional following application of the procedure and report the version of the colour difference measurement method used.

5.2 Surface abrasion

The purpose of this method is to provide controlled abrasion of the card surface.

5.2.1 Apparatus

- Abraser with vacuum pick up or equivalent[3)];
- 2 abrasive Wheels (Taber CS -10F or equivalent);
- resurfacing disks (Taber S-11 or equivalent);
- dry soft cleaning cloth;
- hole punch or equivalent;
- 500 g total load per wheel (250 g additional - no counter weight wheels).

5.2.2 Procedure

Prepare two sample cards that have all the desired information and features by punching or cutting a notch in the card as shown in Figure 1.

Resurface the abrasive wheels for 50 cycles before beginning the procedure and then again after every 250 cycles. Clean the cards and turntable thoroughly, using a dry soft cloth, to remove all debris. Avoid direct finger contact with the test cards and abrasion wheels.

Mount the two cards side by side on the turntable without any compliant pad so that the abrasive wheels pass over the desired areas. The abrasive wheels must not bounce during the procedure. Place the abrasive wheels on the card and the vacuum nozzle 6,4 mm (0.25 in) above the cards.

3) The abraser apparatus and abrasive wheels may be obtained from Taber Industries, 455 Bryant Street, North Tonawanda, New York 14120. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these products. Equivalent products may be used if they can be shown to lead to the same results.

Preset the specified number of cycles and start the abraser and vacuum. Stop the procedure after the specified number of cycles or until wear through of the card feature is observed. The procedure may be stopped after 5,000 cycles have occurred without wear through. Stopping the procedure periodically to observe the point of wear-through is recommended.

Dimensions in millimetres (inches)
not to scale

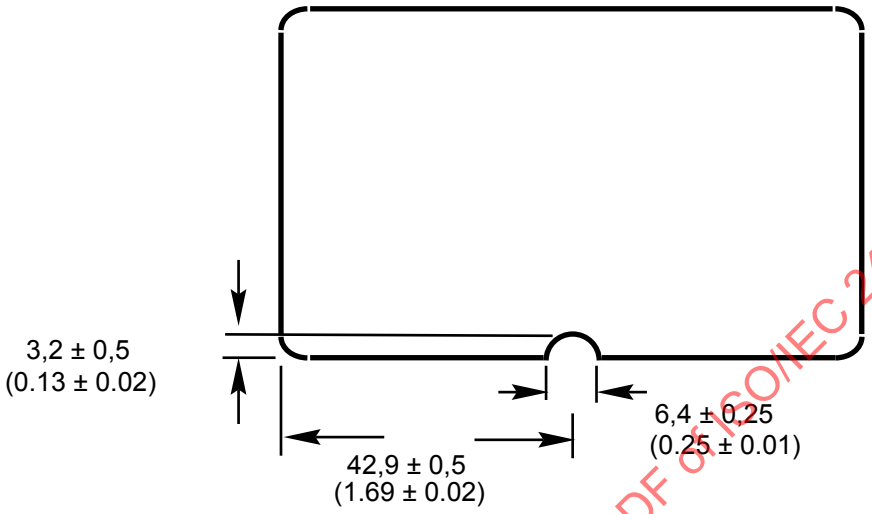


Figure 1 — Test card notch location

5.2.3 Evaluation report

Unless specified otherwise by the base standard, compare the wear-through of the card to a control card or the number of cycles to the specified requirement.

5.3 Magnetic stripe abrasion

The purpose of this method is to provide a controlled abrasion of the magnetic stripe surface.

5.3.1 Apparatus

— Abraser with vacuum pick up or equivalent[4)]

— filler card (card of the same thickness as the card to be abraded);

— 2 abrasive wheels (Taber CS -10F or equivalent);

— resurfacing disks (Taber S-11 or equivalent);

— 500 g total load per wheel (250 g additional - no counter weight wheels);

— dry soft cleaning cloth;

4) The abraser apparatus and abrasive wheels may be obtained from Taber Industries, 455 Bryant Street, North Tonawanda, New York 14120. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these products. Equivalent products may be used if they can be shown to lead to the same results.

— hole punch or equivalent;

— magnetic stripe read test equipment with the following characteristics:

  — ISO/IEC 10373-2 compliant;

  — capable of reporting average signal amplitude (U_A) on middle third of Track 2 (see ISO/IEC 7811-2, ISO/IEC 7811-6 or ISO/IEC 7811-8).

5.3.2 Procedure

Prepare the card by encoding on Track 2 with a recording density of 8 ftpmm (200 ftpi), with a relative tolerance of ± 10 %, at a recording current of I_{min}, in accordance with ISO/IEC 7811-2, ISO/IEC 7811-6 or ISO/IEC 7811-8 and ISO/IEC 10373-2).

NOTE 1 If the magnetic stripe material is required to comply with any established standard, the compliance tests must be conducted and the results acceptable prior to this procedure.

Punch a hole in the card as shown in Figure 2.

Measure the average signal amplitude $U_{Ainitial}$ in the read area shown in Figure 2.

Resurface the abrasive wheels for 50 cycles before testing begins and after every 100 cycles. Clean the cards and turntable using a dry soft cloth after the abrasive wheels are resurfaced. Avoid direct finger contact with the cards and abrasion wheels. Complete the procedure for each card to the stopping point before recommencing it with another card.

Mount the card on the turntable without any compliant pad. Add a filler card of the same thickness as the card on the specimen plate so that the abrasive wheels do not bounce when the procedure is in progress. Place the abrasive wheels (with the additional loads) on the card and the vacuum nozzle 6,4 mm (0.25 in) above the cards.

Preset the abraser for 50 cycles and start the abraser and vacuum. Ensure that the abrasive wheels do not bounce during the test.

Remove the card and clean the magnetic stripe thoroughly, using a clean soft cloth, to remove debris.

NOTE 2 Particular care should be taken to ensure that the stripe is completely free from debris in order to avoid causing damage to the magnetic head used to measure the signal amplitude.

Re-measure average signal amplitude (U_A) in the read area shown in Figure 2.

Repeat the sequence of 50 abraser cycles followed by measurement of the average signal amplitude (U_A) in the read area shown in Figure 2 until a value of U_A is achieved such that $U_A \leq 0{,}70\ U_{A\ initial}$. The procedure may be stopped after 5 000 Taber cycles have occurred without achieving $U_A \leq 0{,}70\ U_{A\ initial}$.

Dimensions in millimetres (inches)
not to scale

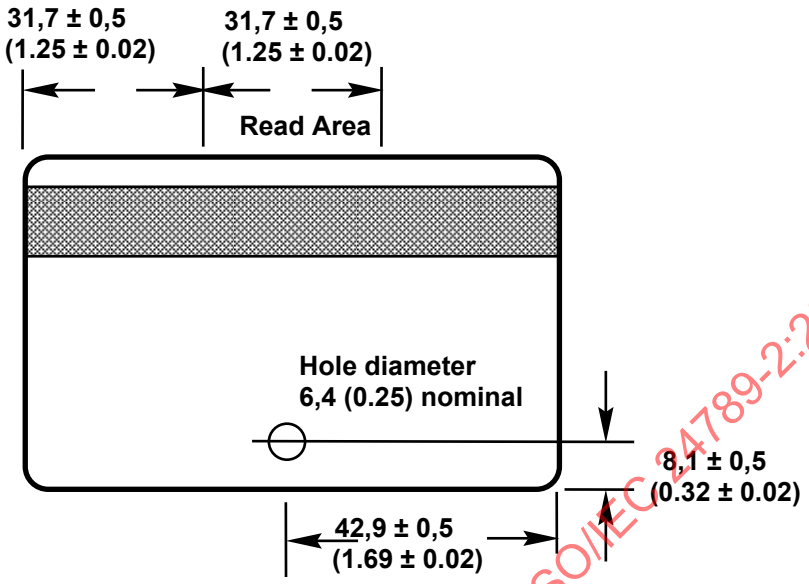


Figure 2 — Magnetic stripe read area and hole location

5.3.3 Evaluation report

Unless specified otherwise by the base standard, report the average number of abraser cycles (to the nearest 50 cycles) that was required to produce $U_A \leq 0{,}70\ U_{A\ initial}$.

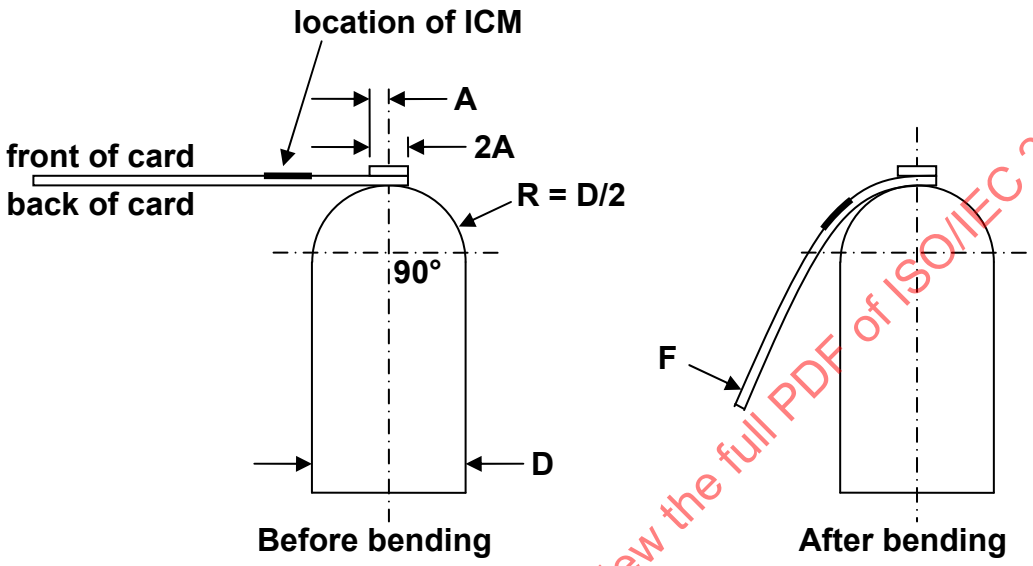
NOTE Graphical results (average signal amplitude vs. abraser cycles) have been shown to be useful in showing abrasion characteristics.

5.4 ICM adhesion

The purpose of this method is to establish that sufficient bond strength exists between the card and the ICM of an IC Card with contacts.

5.4.1 Apparatus

Dimensions in millimetres (inches)
not to scale



D = 50 (1.97)
A= 2,00 (0.08)
The apparatus comprises a half-cylinder on the rectangular block (not a hemisphere on a cylinder)

Figure 3 — IC-module test apparatus

5.4.2 Procedure

Place the short edge of the ICC nearest the ICM into the jaws of the test apparatus.

Slowly bend the card round the apparatus as shown in Figure 3. The bending time shall be 2 s to 3 s.

Hold the card in this position for 5 s ± 2 s before releasing it to “spring back” freely.

5.4.3 Evaluation report

Perform a visual check of the ICM adhesion and report the result as required by the base standard.

5.5 Plasticised vinyl storage

This purpose of this method is to evaluate card resistance to the potentially damaging effects of plasticisers.

5.5.1 Apparatus

— Two rigid inert sheets having dimensions that exceed the maximum length and width of the cards to be evaluated. Glass or chrome plated steel are acceptable materials;

— batch of 5 cards for evaluation;

— soft PVC foils[5)] containing 20 % ± 5 % of DOP plasticizer cut to, at least, cover the entire card surface;

— weight capable, when placed on top of one of the rigid inert sheets listed above, of applying a uniform pressure of 2,5 kPa ± 0,13 kPa (0.36 PSI ± 0.02 PSI) to the surface of a card placed completely beneath the plate.

— environmental chamber.

5.5.2 Procedure

Starting from the rigid inert sheet, alternately place PVC foils and cards to form a stack. All cards sides must be in contact with the surface of a PVC foil. Foils of about 450 µm should be used, or a stack of foils giving the same thickness.

Use foils only once.

Cover the stack with weight and place all elements as shown in Figure 4 in an environmental chamber set to a temperature of 50 °C ± 3 °C for 48 h.

Not to scale

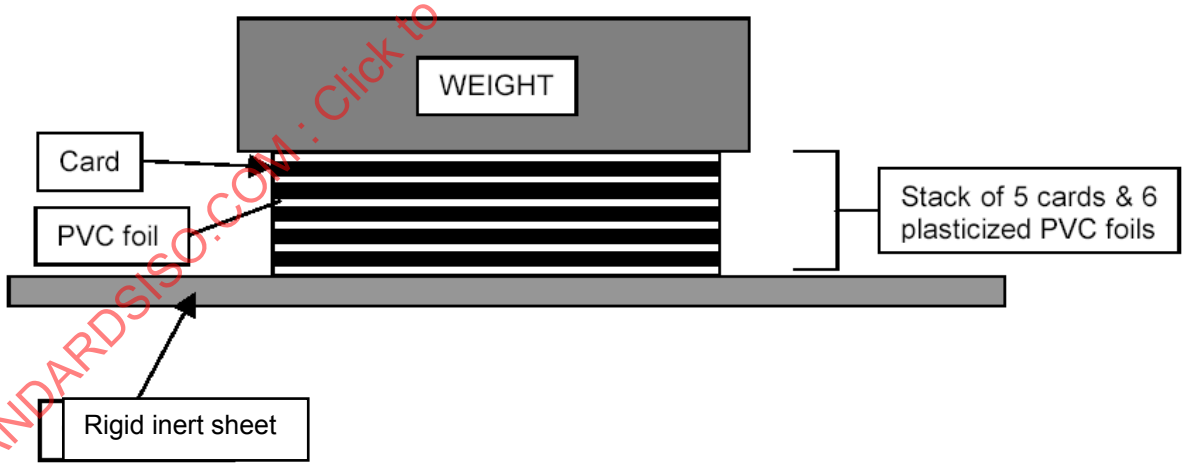


Figure 4 — Cards stacked for loading into the environmental chamber

NOTE Several stacks can be composed with all available cards involved in the test procedure and then all placed in the environmental chamber

Remove stack from chamber and place in the test environment (Subclause 4.1) and immediately remove the weight from the stack. Allow stack to cool for 2 hours. Separate the plasticized vinyl sheets from the cards.

5) Suitable foils are available from SKK Folien GmbH Sales, Postfach 1168, D-79207 Denzlingen. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of this product.

5.6 Wear and soil test

The purpose of this method is to evaluate the effect of abrasion of the entire face of the card.

NOTE Most appropriate for cards having surface features such as holograms, surface printing, magnetic stripes, signature panels, etc.

5.6.1 Apparatus

— 160 µm or 180 µm sieve;

— metal sieve (analytical sieve 63 µm, Ø 200 mm, height 50 mm, according to ISO 3310-1) with cover, or pan bottom (Ø 200 mm, height 50 mm) with cover;

— vibrating device able to vibrate the metal sieve or pan bottom along an axis perpendicular to the floor(s) of the sieve and approximately parallel to the local gravitational field, with an amplitude of 1,5 mm ± 0,2 mm (0.059 in ± 0.008 in) at a frequency of 45 Hz to 60 Hz;

— 270 g (indicative mass) of polished solid glass pearls having a diameter of 7,0 mm ± 0,2 mm (0.275 in ± 0.008 in);

— soiling mixture ingredients as follows:

  — 8,0 g ± 0,4 g peat, untreated, unfertilised;

  — 2,0 g ± 0,1 g quartz sand[6] 40 – 100 mesh ASTM;

  — 0,500 g ± 0,025 g charcoal activated, grade: for analysis, e.g. Merck no. 102186;

  — 9,00 g ± 0,45 g rac-Glycerol 1-monooleate, grade: technical, e.g. Aldrich/Fluka no. 49960,

— 200 µm +/- 20 µm thick PVC foil disk with an outer diameter 0 mm to 5 mm smaller than the inner diameter of the sieve or pan;

— miscellaneous items for cleaning glass pearls:

  — any commercially available dishwashing detergent;

  — a colander,

— double-sided thin adhesive tape having an adhesive that does not contaminate the card surface after removal of the tape;

— weighing device having a precision of 0,05 g.

5.6.2 Procedure

Prepare the soiling mixture as follows:

a) Grind reasonably dry peat dust (sphagnum) in an impact mill for 5 min.

b) Pass the ground peat dust through the sieve (160 µm or 180 µm).

NOTE 1 Choosing either of these sizes rather than the other will not affect the results of the test

6) The quartz sand required for this test may be obtained from FOGRA, Postfach 800469, 81604 Munich, Germany, email info@fogra.org. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of this product.

c) Dry the sieved peat dust in a ventilated oven at 100°C until weight loss is less than 0.5 percent over a 1 hour period.

d) Mix thoroughly with a blade agitator (paddle mixer):

— 8,0 g ± 0,4 g dried sieved untreated unfertilized peat dust,

— 2,0 g ± 0,1 g quartz sand 40 – 100 mesh ASTM,

— 0,500 g ± 0,025 g charcoal activated, grade: for analysis, e.g. Merck no. 102186.

e) Add 9,00 g ± 0,45 g glycerine mono-oleate, Fluka no. 49960, drop by drop under continuous stirring and continue stirring until mixture is homogenous.

f) Store the prepared mixture in a non-plastic impermeable container. It is stable for a minimum of 60 days (in default conditions).

Using double sided adhesive tape, affix 3 cards, at least 3,0 mm mm from each other and the sieve or pan wall, to the PVC foil disk.

Place the PVC foil into the sieve or pan bottom as shown in Figure 5.

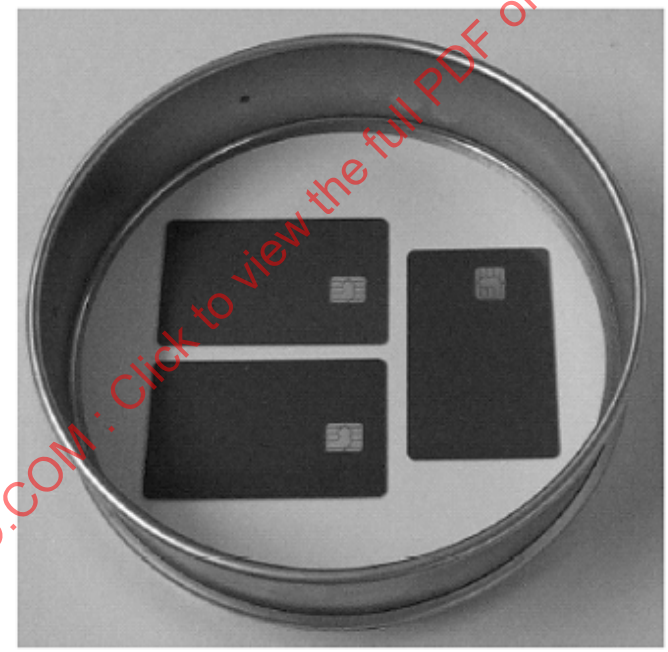


Figure 5 — Showing cards and foil positioned in sieve

Add 270 ± 1 g of glass pearls to the sieve or pan.

Distribute 1,5 g of soiling mixture in various spots in the sieve to keep the soiling mixture from clumping in one location, as shown in Figure 6.

Figure 6 — Showing pearls and soiling mixture added

With its cover in place, secure the sieve to the vibrating device.

Set the amplitude to 1,5 mm and vibrate for 15 min.

Remove the round PVC foil, cards and pearls from the sieve or pan bottom.

Carefully clean the cards with dishwashing soap and a soft cloth. Wash the cards to remove as much of the soiling mixture as possible without damaging the card surface.

Dry the cards with a soft, clean towel and then place the cards on a ventilated rack in the test environment (Subclause 4.1) conditions for 24 hours.

NOTE 2 It is recommended to clean the pearls with a dishwashing detergent in a colander under tap water and to let them dry at room temperature or under heat at for example 50 °C. The sieve or pan bottom may be cleaned with dishwashing detergent under tap water before drying with a soft cloth. When cleaning the sieves (pans) it may be less work to remove as much soiling mixture as possible with a dry cloth or paper towel before using detergent and water. The PVC foil disk should be discarded and a new one used for subsequent tests.

Report whether a sieve or a pan bottom was used.

Observe whether or not the cards exhibit an even surface abrasion.

NOTE 3 If this is not the case then the test results may be invalid.

5.7 Temperature and humidity aging

This method exposes the card to elevated temperature and humidity. It can be used in conjunction with other methods to evaluate the effect of aging on specified properties of the card. It shall not be used as a stand alone method.

5.7.1 Apparatus

— Environmental chamber as specified in IEC 60068-2-78;

— test card holder - constructed in such a way that permits exposure of the humid air to both surfaces of the card and sufficient to support cards without restricting their movement.

NOTE Redbrand hardware cloth (#11443; 1/4x1/4 – 23 gauge) or stainless steel welded wire cloth (#9322T5 – McMaster Carr) has shown to provide proper card support.

5.7.2 Procedure

Pre-condition the sample card under the test environment specified in 4.1.

Place the sample card on the test card holder in the environmental chamber at a temperature of 50 C ± 3 C and a relative humidity of 93 % ± 5 % for a time period *t*, where the duration of time period *t* is determined by the evaluation regime.

Following the time exposure, return the sample card to the test environment and retain it in this environment for 24 h ± 4 h before checking its functionality.

5.8 Temperature shock

This method exposes the sample card to rapid changes of temperature (positive & negative). It can be used in conjunction with other methods to establish the effect of thermal shock on specified properties of the card. It shall not be used as a stand alone method.

5.8.1 Apparatus

— Two temperature chambers;

— test card holder - constructed in such a way that permits exposure of the humid air to both surfaces of the card and sufficient to support cards without restricting their movement.

NOTE Redbrand hardware cloth (#11443; 1/4x1/4 – 23 gauge) or stainless steel welded wire cloth (#9322T5 – McMaster Carr) has shown to provide proper card support.

5.8.2 Procedure

Pre-condition the sample card under the default conditions specified in Clause 4.

Perform the following procedure in the test environment.

Set and stabilise the first thermal chamber at a temperature of -35 °C ± 3 °C and the second thermal chamber at a temperature of +50 °C ± 3 °C.

Repeat the following four steps for *n* cycles (see Figure 7), where *n* is specified in the evaluation regime of the card:

a) Place the sample card on the test card holder in the first thermal chamber and leave it in the chamber for 15 min.

b) Move the sample card, on the test card holder, to the second thermal chamber with a transfer time of 15 s or less.

c) Leave the card in the second chamber for 15 min.

d) Move the sample card, on the test card holder, to the first thermal chamber with a transfer time of 15 s or less.

Unless specified otherwise on completion of 10 cycles, return the sample card to the test environment described in Clause 4 and retain it in this environment for at least 4 h.

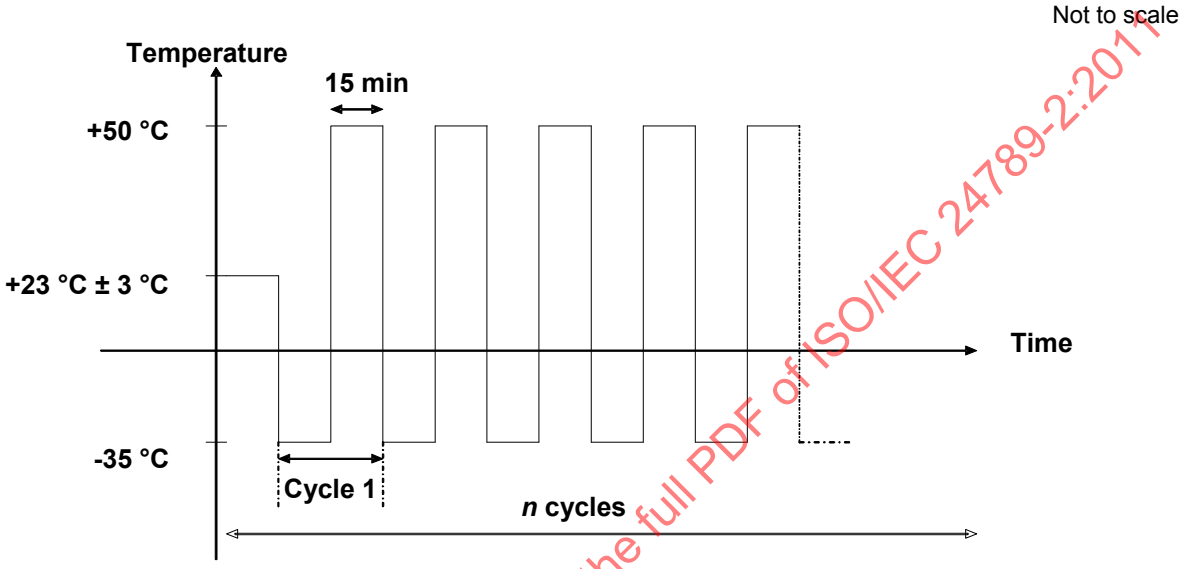


Figure 7 — Temperature shock cycles

5.9 Temperature and humidity cycling

The purpose of this method is to apply thermal stress to the sample card with a change between cold temperature, medium temperature and high temperature combined with low and high relative humidity. It can be used in conjunction with other methods to establish the effect of thermal cycling on specified properties of the card. It shall not be used as a stand alone method.

5.9.1 Apparatus

— Environmental chamber or chambers as specified in IEC 60068-2-78;

— test card holder - constructed in such a way that permits exposure of the humid air to both surfaces of the card and sufficient to support cards without restricting their movement.

NOTE Redbrand hardware cloth (#11443; 1/4x1/4 – 23 gauge) or stainless steel welded wire cloth (#9322T5 – McMaster Carr) has shown to provide proper card support.

5.9.2 Procedure

Pre-condition the sample card under the test environment specified in 4.1.

Perform the following sequence, as illustrated by Figure 8.

a) Set and stabilise the environmental chamber at a temperature of -35 °C ± 3 °C.

b) Place the sample card on the test card holder in the environmental chamber and leave it in the chamber for 30 min.

c) Remove the sample card, on the test card holder, to test environment with a transfer time of 1 minute or less

d) Leave the sample card in the test environment for at least 30 min.

e) Meanwhile, set and stabilise the environmental chamber at a temperature of +50 °C ± 3 °C and a relative humidity of 20 % or less.

f) Move the sample card, on the test card holder, into the environmental chamber with a transfer time of 1 minute or less.

g) Leave the sample card in the environmental chamber for 6,5 h.

h) Remove the sample card, on the test card holder, to the test environment with a transfer time of 1 minute or less.

i) Leave the sample card in the test environment for at least 30 min.

j) Meanwhile, set and stabilise the environmental chamber at a temperature of -35 °C ± 3 °C.

k) Move the sample card, on the test card holder, into the environmental chamber with a transfer time of 1 minute or less.

l) Leave the sample card in the environmental chamber for 30 min.

m) Remove the sample card, on the test card holder, to test environment with a transfer time of 1 minute or less.

n) Leave the sample card in the test environment for at least 30 min.

o) Meanwhile, set and stabilise the environmental chamber at a temperature of +50 °C ± 3 °C and a relative humidity of 85 % or more.

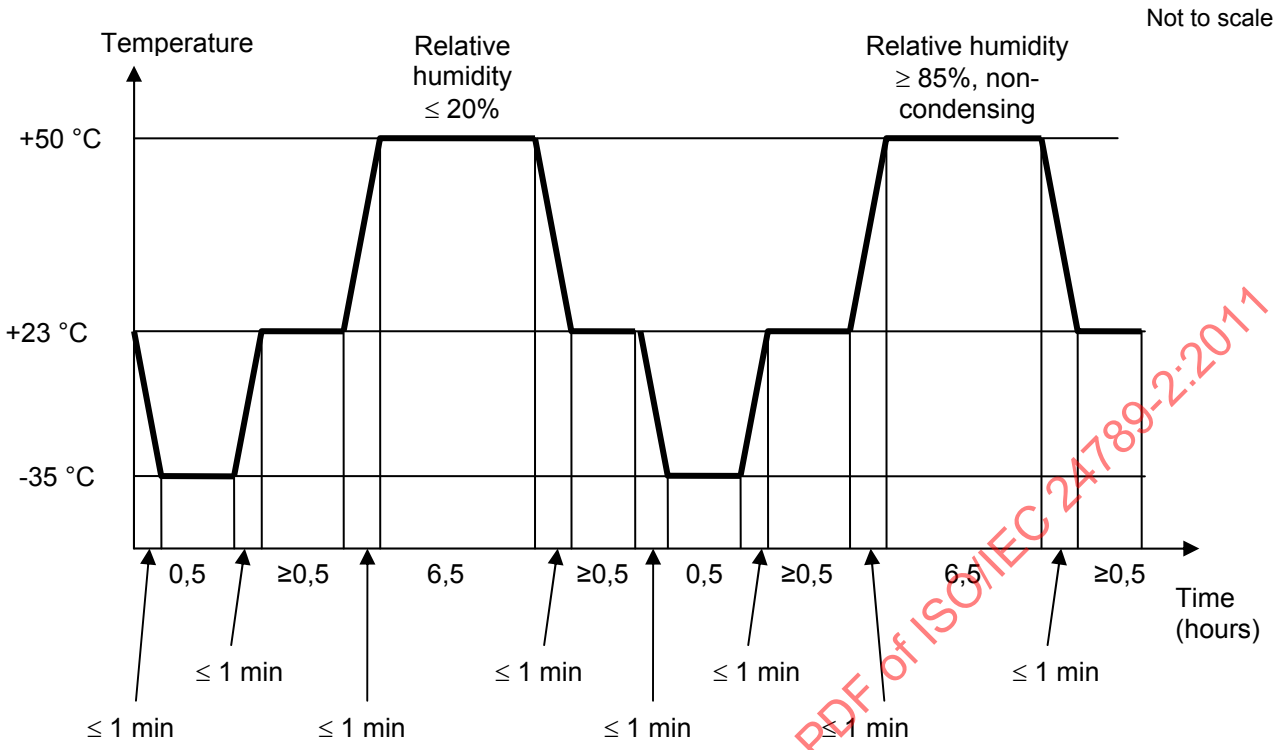
p) Move the sample card, on the test card holder, into the environmental chamber with a transfer time of 1 minute or less.

q) Leave the sample card in the environmental chamber for 6,5 h.

r) Remove the sample card, on the test card holder, to the test with a transfer time of 1 minute or less.

NOTE A standard laboratory oven, placed in the default test environment, will achieve the humidity conditions specified in step e) of this procedure.

Retain the sample card in the default test environment described in 4.1 for at least 24 h.



NOTE The intervals identified by "≥ 0,5" hours may last longer than 0,5 hours, e.g. 15 hours to accommodate working time regulations.

Figure 8 — Thermal cycle profile

5.10 ID-1 card flexure

This method can be used as a means for determining fatigue resistance of a card body.

5.10.1 Apparatus

The flexure apparatus described in ISO/IEC 10373-1 (Dynamic Bending Stress) shall be used for this method with the following modification:

The apparatus shall be run at a flexure frequency of 1,0 Hz.

5.10.2 Procedure - card fatigue testing

Pre-condition the sample card(s) according default storage conditions for a minimum of 24 hours before flexing. The procedure shall be conducted under the default environmental conditions given in Clause 4.

Set the apparatus to flex the card in the orientation desired. Set the flexure frequency to 1,0 Hz.

Mount card in the flexure apparatus and begin flexing the card.

NOTE 1 Card axes A and B are defined in the Dynamic bending stress procedure contained in ISO/IEC 10373-1.

NOTE 2 Results can vary depending on which side of the card is under extension (side up). Thus, it is recommended to carry out the procedure on separate cards with each side under extension (side up).

Do not permit the card under evaluation to remain under mechanical stress for more than 5 min when not being flexed. The movable jaw shall be positioned in the un-flexed position when stopped. Cards shall be removed from the apparatus if flexing is stopped for more than 5 min. Flexing shall be restarted within 24 h of removal.

During flexing, pay close attention when cards begin to fracture since fractures can progress rapidly.

Unless otherwise specified, the stopping point is reached when a single fracture of at least 13 mm (0.5 inch) long or a combination of 5 fractures or fewer that total at least 13 mm (0.5 inch) is observed.

The procedure may be stopped after 100 000 cycles have occurred without card fracture unless otherwise stated.

5.10.3 Report

Report the following:

— number of cycles to stopping point to the nearest 1 000 cycles;

— length and axis of fracture;

— description of which card side the fracture occurred;

— full description of card design features (printing, IC, photo, magnetic stripe, embossing, etc.).

5.11 Temperature and humidity aging followed by peel strength testing

The purpose of this method is to determine the peel strength between card layers after exposing the cards to thermal and humidity aging.

5.11.1 Apparatus

— Environmental chamber and card holder as specified in 5.7.1;

— test equipment for evaluating peel strength as defined in ISO/IEC 10373-1.

5.11.2 Procedure

Pre-condition, expose and re-condition the card as defined in 5.7.2.

Run the peel strength test method as defined in ISO/IEC 10373-1.

5.11.3 Report

The 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.

If it was not possible to separate any card layers, this should be noted in the report and a chart recording is not required

5.12 Cross-cut test

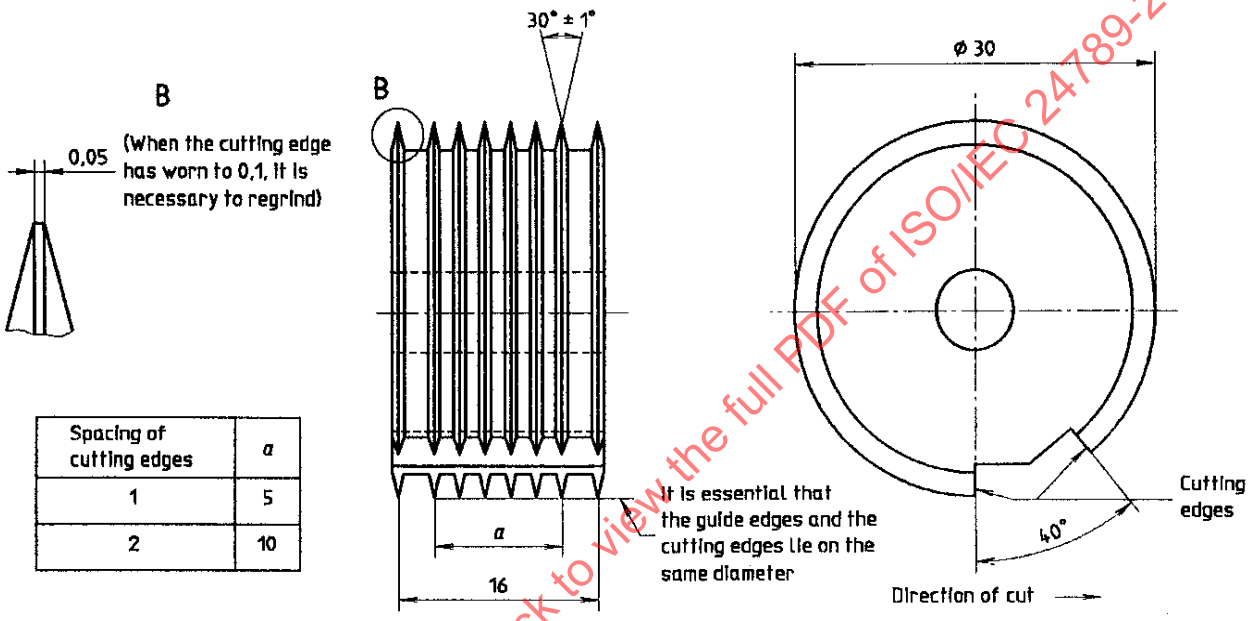
The purpose of this method is to probe the adhesion of surface and near surface features to deeper layers.

5.12.1 Apparatus

a) A single-blade cutting tool with 20° to 30° edge and other dimensions as specified in Figure 9;

b) a soft brush.

c) transparent pressure-sensitive adhesive tape, 25 mm wide, with an adhesion strength of (10 ± 1) N per 25 mm width when tested in accordance with IEC 60454-2.



Spacing of cutting edges	a
1	5
2	10

Figure 9 — Multi-blade cutting tool

5.12.2 Procedure

The default conditions given in Clause 4 apply.

Precondition the cards under evaluation to the default test environment.

Before making any cuts, inspect the cutting edge of the blade and maintain its condition by sharpening or re-placement. Set the blade spacing to make six parallel cuts 1 mm apart.

Place the card on a flat, rigid supporting surface.

With uniform pressure and cutting rate, make six parallel cuts in the first direction of the lattice pattern.

Repeat this operation, making further six parallel cuts, crossing the original cuts at 90° so that the lattice pattern illustrated in Table 1 is formed.

Repeat the pattern of cuts in at least three different places on the card surface, making sure that surface features known to have less initial adhesion and/or most affected by age and usage (e.g. by embrittlement) are included.