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eb-2015-00048

Document Date: 01/27/2015

To: INCITS Members

Reply To: [Deborah J. Spittle](#)

Subject: 1st Public Review and Comments Register for the Approval of:
INCITS 440:201x, Information technology -Card Durability / Service Life

Due Date: The 1st public review is from February 6, 2015 to March 23, 2015.

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American National Standard
for Information Technology -

INCITS 440:201x, Card Durability / Service Life
(Revision of INCITS 440:2008)

Secretariat

Information Technology Industry Council

Post Eden Prairie - Working Paper

Meeting Date: 19August2014

American National Standard

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Published by

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Printed in the United States of America

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Foreword

The purpose of this Card Durability/Service Life Standard is to provide a uniform means of predicting the service life of an ID card for a specific application.

This standard shall be used to determine the suitability of a card for a particular application.

This standard was developed by Task Group B10 of Accredited Standards Committee INCITS during 2011 – 2012. The standards approval process started in 2012. This document includes annexes that are informative and are not considered part of the standard. This document also contains “NOTES” which are intended to provide helpful information to the reader but are not considered part of the test method requirement. (See ISO/IEC JTC 1 Directives – Part 3 Drafting and Presentation for the use of NOTES.)

Requests for interpretation, suggestions for improvements or addenda, or defect reports are welcome. They should be sent to the INCITS Secretariat, Information Technology Industry Council, 1250 Eye Street, NW, Suite 200, Washington, DC 20005-3922.

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Card Durability / Service Life

1 SCOPE

This American National Standard defines a method to determine a card application class for the intended card use. Once the service life application is determined, the standard defines test methods and requirements for the card application.

An identification (ID) card is defined as a card identifying its holder and issuer which may carry data required as input for the intended use of the card. Identification cards include, but are not limited to: fishing licenses, driver's licenses, access control cards, credit cards bankcards, student ID cards, government ID cards and military ID cards.

This standard is to be used by card end users, card issuers, card manufacturers, card component suppliers, and card personalization equipment manufacturers to make predictive comparisons of performance of ID cards. This standard should be useful for comparing the relative durability of newly issued cards and to predict service life. Failure to conform to specified criteria noted within this document shall be negotiated between the involved parties.

2 NORMATIVE REFERENCES

The following references contain provisions that constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All references are subject to revision and interested parties are encouraged to investigate the most recent editions of the references listed below.

Copies of the following documents can be obtained from ANSI: approved ANSI standards, approved and draft international standards (ISO, IEC, CEN/CEN/CENELEC), and approved foreign standards (including BSI, JIS and DIN). For further information, contact ANSI Customer Service Department at 212-642-4900 (phone), 212-302-1286 (fax) or via the World Wide Web at <http://www.ansi.org>. Additional availability contact information is provided below as needed.

Document	Title	Subclause Referenced
ANSI INCITS 322	<i>Card Durability Test Methods</i> ¹⁾	3
CIE Publication 116-1995	Industrial Colour Difference Calculation	5.1, 5.3, 5.4
ISO/IEC 7810	<i>Identification cards - Physical characteristics</i> ¹⁾	3
ISO/IEC 10373-1	<i>Identification cards - Test Methods</i> ¹⁾ <i>Part 1: General Characteristics</i>	A1
ISO 11664-4:2008	<i>Colorimetry -- Part 4: CIE 1976 L*a*b* Colour space</i> ²⁾	5.1, 5.3, 5.4

¹⁾ Available from American National Standard Institute, 11 West 42nd Street, New York, NY 10036

²⁾ The Industrial Color-Difference Technical Committee (TC 1-29) of the CIE recommended this new color difference equation, CIE94.

3 DEFINITIONS (Glossary of terms)

For the purpose of this Standard, the terms and definitions given in ANSI INCITS 322, ISO/IEC 7810 and the following apply.

- 3.1 Card Durability:** The capability of maintaining the serviceability of a card over a specified period of time, excluding abuse.
- 3.2 Card Durability Category:** A grouping of 10 card categories, numbered D1 through D10, with D10 being most durable. Additional durability categories (D11, D12, etc...) may be added as needed.
- 3.3 Edge of Card:** Card edge that was die-cut or molded to meet ID-1 dimensions.
- 3.4 ID-1 Card:** The size of a card specified in ISO/IEC 7810.

4 Card Durability Category Profile

There are many factors that influence how durable a card structure needs to be for reliable service. The major influencing factors are:

- Redundancy: The ability to complete the transaction by an alternative method or card, e.g., a second credit card if the first is rejected.
- Replacement: How inconvenient or complex is the process to replace the card, e.g., renewing a library card on site versus resubmitting a license or passport application?
- Usage per Year: How often does the cardholder remove the card from storage and use the card (handle the card)? A frequently used card will need greater durability.
- Expected Card Life: The longer a card is expected to be in service, the greater its durability requirements.
- Allowable Annual Post Issuance Functional Failures: The lower the allowable annual post issuance functional failures, the greater the card durability requirements.

Since card durability is related to all of the above factors, the Card Durability Category Profile was developed. This table allows a card issuer to input the factors that will influence card life. Once all the factors are taken into consideration, a card durability category can be determined.

Once the card issuer knows the durability category needed for their application, they can look up the appropriate tests and criteria that are needed for the cards.

CARD DURABILITY FACTOR POINT VALUES

Usage per year		Redundancy		Replacement		Expected Card Life		Allowable Annual Post Issuance Functional Failures	
Pts	Description	Pts	Description	Pts	Description	Pts	Description	Pts	Description
0.0	1	0.0	Redundant	0.0	Trivial	0.0	1	0.0	1.00%
5.4	12	5.0	Somewhat Redundant	2.5	Inconvenient	3.6	2	0.5	0.50%
11.8	52	10.0	Non-Redundant (security Identification)	5.0	Complex	10.7	4	4.1	0.25%
20.3	365					17.9	6	13.6	0.10%
29.3	2920					25.0	8	20.3	0.05%
								23.8	0.03%

The card durability category is determined by adding the point values from the five factors and looking up the durability category (D 1 through D10) in the following table.

Note: While the current standard only goes to category D10, there may be applications that have total points greater than 90. In these cases, the reader of the standard should use category D10 requirements until future revisions of this standard, having durability category requirements greater than D10, are published.

There is no limit to the number of points that may be assigned for Usage, Expected Card Life and Functional Failures. The tables above are examples. Other values shall be calculated using the following equations.

Equation for Usage:

Greater than 3.5/yr: $\text{Points}(\text{usage}) = 4.35 * \ln(\text{usage}) - 5.38$
 Less than or equal 3.5/yr: $\text{Points}(\text{usage}) = 0$

Equation for Expected Card Life:

Greater than 1 year: $\text{Points}(\text{Life}) = 3.57 * \text{Life} - 3.57$
 Less than or equal 1 year: $\text{Points}(\text{Life}) = 0$

Equation for Allowable Post Issuance Functional Failures:

Less than 1% failures: $\text{Points}(\% \text{Failures}) = 30.333 * e^{-8.052(\% \text{failures})}$
 Greater than or equal to 1% failures: $\text{Points}(\% \text{Failures}) = 0$

CATEGORY	POINTS
D1	$0 \leq X \leq 9$
D2	$9 < X \leq 18$
D3	$18 < X \leq 27$
D4	$27 < X \leq 36$

D5	36 < X ≤ 45
D6	45 ≤ X ≤ 54
D7	54 < X ≤ 63
D8	63 < X ≤ 72
D9	72 < X ≤ 81
D10	81 < X ≤ 90

The following table provides examples that illustrate the use of the Card Durability Category for five different card applications. Actual values will vary depending on the customer's specific application.

	Library Card		Gift Card		Credit Card		Student Campus Card		Driver's License	
	Value	Pts.	Value	Pts.	Value	Pts.	Value	Pts.	Value	Pts.
Usage (# per year)	12	5.4	5	1.6	1,000	24.7	3,650	30.3	52	11.8
Redundancy	Redundant	0.0	Redundant	0.0	Redundant	0.0	Somewhat Redundant	5.0	Non-redundant	10.0
Replacement	Trivial	0.0	Trivial	0.0	Inconvenient	2.5	Inconvenient	2.5	Complex	5.0
Expected Card Life (years)	5	14.3	3	7.1	5	14.3	4	10.7	6	17.9
Allowable Post Issuance Functional Failures (%)	1	0.0	0.2	6.1	0.1	13.6	0.2	6.1	0.001	30.1

Total		19.7		14.8		55.1		54.6		74.8
-------	--	------	--	------	--	------	--	------	--	------

Durability Category		D3		D2		D7		D7		D9
---------------------	--	----	--	----	--	----	--	----	--	----

5 Durability Requirements

The following tables list tests and requirements for each card durability profile.

It should also be noted that the user of this standard has the option to increase or decrease the requirement categories for any of the listed tests, based upon their individual application. This allows the possibility of having several Card Durability Categories for the same card.

For example, a credit card issuer may desire a higher level of durability for magnetic stripes, while they may tolerate a lower level of durability for Xenon arc color change. Therefore, they have the option of asking for Category D8 requirements for magnetic stripe related tests, but Category D4 requirements for Xenon tests.

5.1 Durability Requirements – Card Body

ANSI/INCITS 322 Method	Unit	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Card Flex A ^a	Minimum cycles to stopping point	3,600	5,300	7,800	11,300	16,600	24,300	35,500	52,000	76,100	100,000
Card Flex B ^a	Minimum cycles to stopping point	1,800	2,700	3,900	5,700	8,300	12,100	17,800	26,000	38,000	50,000
Stress & Plasticizer Exposure Axis A & B ^a	Minimum hours to stopping point	No Req.	No Req.	No Req.	No Req.	No Req.	24	36	48	72	96
Linear Dimensional Change at Elevated Temperature Axis A & B	Maximum % shrinkage	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	1.0%	1.0%	1.0%	1.0%
Card Body Indoor Xenon Arc ^{b, c, d}	Maximum ΔE_{1994} ^{e, f}	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	15.0	12.5	10.0	7.5
Card Body Outdoor Xenon Arc ^{b, c, d}	Maximum ΔE_{1994} ^{e, f}	No Req.	No Req.	No Req.	20.0	17.5	15.0	12.5	10.0	7.5	5.0

^a Cards shall be run with the “face” of card up (face in extension) until the stopping points are reached. A different set of cards shall be tested with the “face” of card down (face in compression) until the stopping points are reached. Testing on each face orientation shall meet the requirements listed.

^b Test to be performed without the window glass filter.

^c Color change of unprinted card areas are to be included in this evaluation.

^d Final card structure shall be measured, i.e. if an overlamine patch is present on the final structure, it shall be present on the structure for this test.

^e Constants for ΔE_{1994} calculations shall be:

$K_L=1$; $K_C=1$; and $K_H=1$ (default values);

$K_1=.045$ and $K_2 = .015$ (graphics arts)

^f Measurement to use white base standard, D65 illuminate, 10 degree observer angle and polarized filter.

5.2 Durability Requirements – 90 Degree Peel

Card interlayer adhesion requirements are dependent upon:

1. Where the layers are on the card.
 - a. Card edges are more susceptible to abrasive and tangential forces than areas away from the edges. Edges therefore require greater adhesion.
2. The thickness of the removed layers (combined layer thickness). Thicker layers separate from one another more readily and therefore require greater adhesion to prevent delamination.
3. The size of any special features (with lower adhesion values).
 - a. Some card features (such as color shift inks) have unavoidable low adhesive/cohesive strengths.
 - b. The low adhesion does not eliminate the features from use, but card design must be considered to avoid delamination issues.
 - c. Smaller features can have lower peel values as long as the bonds surrounding the inks are high enough to reinforce the structure.

In order to determine the 90-degree peel requirement, calculate the applicable durability class as per section 4 of this document. Use the following table to determine the base requirements for the card. The base requirements are for:

1. Card edges.
2. Relatively thick layers >40 µm (> 0.0016 in) being separated from the remainder of the card.
3. Large contiguous areas of construction that have relatively constant peel values.

ANSI/INCITS 322 Method 90-degree Peel Base Requirements									
N/mm									
Category D1	Category D2	Category D3	Category D4	Category D5	Category D6	Category D7	Category D8	Category D9	Category D10
No Req.	No Req.	0.33 (1.9 lb _f /in) minimum	0.35 (2.0 lb _f /in) minimum	0.37 (2.1 lb _f /in) minimum	0.40 (2.3 lb _f /in) minimum	0.42 (2.4 lb _f /in) minimum	0.44 (2.5 lb _f /in) minimum	0.46 (2.6 lb _f /in) minimum	0.48 (2.7 lb _f /in) minimum

The base requirements shall be modified, depending upon:

1. The location of the area being tested.
2. The thickness of the combined layers being removed. The card must have 90-degree peel tests completed to determine this.
3. If applicable, the area(s) of card feature(s) that have lower peel strength than the surrounding areas of the card.

In order to determine the 90 degree peel requirements for the tested card:

1. Find the Card Application Profile Category and associated base peel requirement (as per above).
2. Measure the thickness of the removed layer(s) from the tested card.
3. If applicable, calculate the contiguous area of any special feature areas with low adhesion values.
4. Determine the correction factor for the card area(s) of interest from the correction factor tables.
5. The base peel requirement is multiplied by the correction factor to get the requirement for the area of the card being tested. The same card may have more than one requirement, depending upon the card construction.

(Refer to Annex B for 90 degree peel requirement calculation examples)

90-degree Peel Requirement Correction Factors for Associated Card Designs (imperial units)			
Area of interest	Area of contiguous low peel strength feature - a (in ²)	Removed layer thickness - t (inches)	Peel requirement correction factor (refer to annex B examples)
Edge of card	Any	t > 0.0016	1.000
		0.0016 ≥ t ≥ 0.0008	0.800
		t < 0.0008	0.640
Card Interior	No low peel strength feature or a > 0.60	t > 0.0016	0.800
		0.0016 ≥ t ≥ 0.0008	0.640
		t < 0.0008	0.512
Card Interior	0.60 ≥ a > 0.15	t > 0.0016	0.640
		0.0016 ≥ t ≥ 0.0008	0.512
		t < 0.0008	0.410
Card Interior	0.15 ≥ a > 0.075	t > 0.0016	0.512
		0.0016 ≥ t ≥ 0.0008	0.410
		t < 0.0008	0.328
Card Interior	a ≤ 0.075	t > 0.0016	0.410
		0.0016 ≥ t ≥ 0.0008	0.328
		t < 0.0008	0.262

90-degree Peel Requirement Correction Factors for Associated Card Designs (metric units)			
Area of interest	Area of contiguous low peel strength feature - a (mm ²)	Removed layer thickness - t (µm)	Peel requirement correction factor (refer to annex B examples)
Edge of card	Any	t > 40	1.000
		40 ≥ t ≥ 20	0.800
		t < 20	0.640
Card Interior	No low peel strength feature or a > 400	t > 40	0.800
		40 ≥ t ≥ 20	0.640
		t < 20	0.512
Card Interior	400 ≥ a > 100	t > 40	0.640
		40 ≥ t ≥ 20	0.512
		t < 20	0.410
Card Interior	100 ≥ a > 50	t > 40	0.512
		40 ≥ t ≥ 20	0.410
		t < 20	0.328
Card Interior	a ≤ 50	t > 40	0.410
		40 ≥ t ≥ 20	0.328
		t < 20	0.262

5.3 Durability Requirements - Cards with Surface Printing/Security Devices

ANSI/INCITS 322 Method	Units	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Delamination Cross Hatch Tape	Minimum Tape Test Grade	No Req.	No Req.	No Req.	3	3	4	4	4	5	5
Surface Abrasion^g	Minimum Cycles to Stopping Point	0	100	150	200	250	350	500	1000	1750	2500
Indoor Xenon Arc^{b, d}	Maximum ΔE_{1994} ^{e, f}	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	25.0	22.0	20.0
Outdoor Xenon Arc^{b, d}	Maximum ΔE_{1994} ^{e, f}	No Req.	No Req.	No Req.	No Req.	No Req.	25.0	22.0	20.0	17.0	15.0

^b Test to be performed without the window glass filter.

^d Final card structure shall be measured, i.e. if an overlamine patch is present on the final structure, it shall be present on the structure for this test.

^e Constants for ΔE_{1994} calculations shall be:

$K_L=1$; $K_C=1$; and $K_H=1$ (default values);

$K_1=.045$ and $K_2 = .015$ (graphics arts)

^f Measurement to use white base standard, D65 illuminate, 10 degree observer angle and polarized filter.

^g Signature panels, stamped holograms, etc may not meet the requirement listed above by design and may require deviation

5.4 Durability Requirements - Cards with Machine Readable Features

ANSI/INCITS 322 Method	Unit	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10
Mag Stripe Abrasion	Minimum cycles to stopping point	No Req.	No Req.	50	100	150	200	250	300	350	400
Bar Code Abrasion	Minimum Cycles to Stopping Point	No Req.	No Req.	50	100	150	200	250	300	350	400
Indoor Xenon Arc^{b, d}	Maximum $\Delta E_{1994}^{e, f}$	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	No Req.	25	22	20
Outdoor Xenon Arc^{b, d}	Maximum $\Delta E_{1994}^{e, f}$	No Req.	No Req.	No Req.	No Req.	No Req.	25	22	20	17	15
IC Card with Contacts Micromodule Adhesion	Minimum Force (N)	No Req.	No Req.	5	10	17	25	37	50	62	75

^b Test to be performed without the window glass filter.

^d Final card structure shall be measured, i.e. if an overlamine patch is present on the final structure, it shall be present on the structure for this test.

^e Constants for ΔE_{1994} calculations shall be:

$K_L=1$; $K_C=1$; and $K_H=1$ (default values);

$K_1=.045$ and $K_2 = .015$ (graphics arts)

^f Measurement to use white base standard, D65 illuminate, 10 degree observer angle and polarized filter.

Annex A
(Informative)

Bibliography

- ASTM E6 – 86¹ *Standard Definitions of Terms Relating to Methods of Mechanical Testing*
- AAMVA DL/ID *American Association of Motor Vehicle Administrators National Standard for the Driver License/Identification Card*

¹Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959

Annex B

90 degree Peel Requirement Calculation Examples

Example 1 - Credit card; peel strip includes a long card body edge

1. Credit card category from examples table is D7.
2. The base peel value from the table is 0.42 N/mm (2.4 lb_f/in)
3. The overlay thickness of the card (assuming it can be removed) is 46 µm (0.0018 in).
4. The peel test strip includes a long card body edge.
5. The correction factor for this example is 1.0.
6. The peel requirement for this layer/location shall be 0.42 N/mm (2.4 lb_f/in)

Example 2 - Credit card; peel test strip does not include a long card body edge

1. Credit card category from examples table is D7.
2. The base peel value from the table is 0.42 N/mm (2.4 lb_f/in)
3. The overlay thickness of the card (assuming it can be removed) is 46 µm (0.0018 in).
4. The peel strip does not include a long card body edge.
5. The correction factor for this example is 0.8
6. The peel requirement for this layer/location shall be 0.34 N/mm (1.9 lb_f/in)

Example 3 - Drivers' License with 33 micron (0.0013 in) patch laminate (typically called 1 mil patch)

1. Drivers' license card category from examples table is D9.
2. The base peel value from the table is 0.46 N/mm (2.6 lb_f/in)
3. The patch thickness card (assuming it can be removed) is 33 µm (0.0013 in).
4. The peel strip is from the card body interior (patches are not applied edge-to-edge).
5. The correction factor for this example is 0.64
6. The peel requirement for this layer/location shall be 0.29N/mm (1.7 lb_f/in)

Example 4 – Student Campus Card (no patch laminate); peel strip includes a long card body edge

1. Student campus card category from examples table is D7.
2. The base peel value from the table is 0.42 N/mm (2.4 lb_f/in)
3. The overlay thickness of the card (assuming it can be removed) is 46 µm (0.0018 in).
4. The peel test strip includes a long card edge.
5. The correction factor for this example is 1.0.
6. The peel requirement for this layer/location shall be 0.42 N/mm (2.4 lb_f/in)

Example 5 – Student Campus Card (with 15 micron (0.0006 in) patch laminate (typically called half-mil patch)

1. Student campus card category from examples table is D7.
2. The base peel value from the table is 0.42 N/mm (2.4 lb_f/in)
3. The patch thickness card (assuming it can be removed) is 15 µm (0.0006 in).
4. The peel strip is from the card body interior (patches are not applied edge-to-edge).
5. The correction factor for this example is 0.512
6. The peel requirement for this layer/location shall be 0.21N/mm (1.2 lb_f/in)

Note: Card durability categories listed above are examples to show how to calculate peel requirements. Card durability categories and resulting peel requirements will differ, depending upon the user's application.

