

# The Egyptian machine readable passport and ID card

## Evaluation of their compliance to ICAO and ISO/IEC standards

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In 1996 the first Egyptian machine readable ID card was issued, followed in 2008 by a machine readable passport. Since then, there has not been any scientific research to evaluate the conformance of the documents to the requirements laid down in ISO/IEC 7810-2003 and ICAO-Doc 9303 Part 1, Volume 1 respectively. Therefore, in this article Ahmed Mahmoud Yosri Ahmed investigates to which extend both documents comply.

In 2008 the first Egyptian machine readable passport (MRP) was issued. The previous passport was personalised with handwriting, and the content of the data page was easily forged. Generally, the physical and informative security strength levels were very poor. The current Egyptian MRP was designed in compliance with ICAO Doc 9303, Part 1, Volume 1: Passports with Machine Readable Data Stored in Optical Character Recognition Format<sup>1</sup>. Its components were been determined according to the ICAO specifications. Although upgrading the Egyptian passport to a machine readable one can be considered a huge step forward, the current MRP is still not the latest passport type. Many countries have already issued e Passports, and others are planning to issue smart card e-Passports in the near future.

In 1996 Egypt issued its first machine readable ID card. The previous card was made of ordinary paper and contained handwritten personal data. The holder's portrait was a paper one, fixed onto the ID by a metal eyelet. The personal data on the former ID document were easily forged, and its physical strength profiles were very poor. The country's current ID card has been designed to comply with the international specifications of ISO/IEC 7810:2003 Identification cards - Physical characteristics<sup>2</sup>. All its physical,

security and data components have been identified according to these international standards. The current laser personalised ID card is not the latest card type however, and does not contain an integrated circuit chip (ICC) or contactless RFID chip. In 2009, the European Network and Information Security Agency (ENISA) announced in its official publications that ten European countries had already issued e-ID cards, and that another 12 were planning the issue of such a card<sup>3</sup>.

### Disadvantages

The current passport and ID card have a number of disadvantages:

- The OCR and the 2D barcode on the data page of the passport, and the 2D barcode on the ID card are not suited for recording biometric features, such as 3D scanning and voice or iris recognition. The storage capacity is not sufficient.
- The OCR and the 2D barcode are static data carriers: the information can't be changed, and therefore they can't be used for any visas or seals. Also, if any of the laser burned information, such as the holder's profession, needs changing, a new document must be issued.

There is a plan to upgrade the current ID card to an e-ID card with a larger storage capacity on a microchip or RFID chip. Such a card could simultaneously serve as a health insurance card, an ATM card, a driving licence, etc., next to its main function as an ID card.

### Research methodology and targets

Both the passport and the ID card research was conducted using analytical comparative methodology. Three targets were identified for the passport research. These are:

1. valuating the conformance of the MRP with the requirements specified in ICAO Doc 9303, Part1, Volume 1;
2. standardising the necessary adaptation of the current MRP features, so that they fully comply with the ICAO standard requirements;
3. standardising the inevitable informative reconfiguration of the current MRP, upgrading it to an e-Passport.



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Table 1 - Security components requirements

To secure	Security components	
	Mandatory security components	Optional security components
Paper substrate	<ul style="list-style-type: none"> <li>- UV dull paper, two-tone watermark, high ink absorbency profile and chemical sensitisers.</li> <li>✓ The MRP conforms; its paper contains embossing, linear watermarks, bleachers and solvents sensitisers.</li> </ul>	<ul style="list-style-type: none"> <li>- Visible UV fibres and embedded or window security thread.</li> <li>✓ The MRP conforms</li> <li>- Invisible UV fibres.</li> <li>✗ The MRP does not conform.</li> </ul>
Background printing (static data)	<ul style="list-style-type: none"> <li>- Totally linear and rainbow linear backgrounds (no CMYK overlapping halftone dots are allowed)</li> <li>- Two-colour guilloche background</li> <li>- Anti-scan patterns</li> <li>- Microprinted text</li> <li>- Security background of the biographical data page is printed in a design different from that of the visa pages</li> <li>✓ The MRP conforms.</li> </ul>	<ul style="list-style-type: none"> <li>- Latent (intaglio) image</li> <li>- Duplex linear printing</li> <li>- Relief (3D) designs</li> <li>✓ The MRP conforms</li> <li>- Intaglio (rotogravure) printing</li> <li>- See-through register</li> <li>- Deliberate microtext spelling error</li> <li>- Different security background design for every visa page</li> <li>- Tactile features</li> <li>✗ The MRP does not conform; it is completely printed using the dry-offset printing technology.</li> </ul>
Background spot inks	<ul style="list-style-type: none"> <li>- UV fluorescent ink (visible or invisible) on the biographical page and all visa pages.</li> <li>✓ The MRP conforms; it has invisible reddish fluorescent ink on its data page and invisible lemon-coloured fluorescent ink on all visa pages.</li> </ul>	<ul style="list-style-type: none"> <li>- Colour-shifting inks (CSI)</li> <li>- Metallic inks</li> <li>- Metameric inks</li> <li>- Infrared fluorescent inks</li> <li>- Thermochromic inks</li> <li>- Photochromic inks</li> <li>- Phosphorescent inks</li> <li>- Tagged inks</li> <li>✗ The MRP does not conform.</li> </ul>
Numbering	<ul style="list-style-type: none"> <li>- All the visa pages must be digitally personalised with the MRP number (except the inner side of the front cover if used as a data page).</li> <li>✓ The MRP conforms</li> </ul>	<ul style="list-style-type: none"> <li>- The type font of the passport number must be non-standard (uncommon).</li> <li>✓ The MRP conforms</li> </ul>
Additional security features	<ul style="list-style-type: none"> <li>- Binding the data page with the whole MRP booklet using a secure binding technique.</li> <li>✓ The MRP conforms; its data page is thread sewn with back-sewn lock stitch.</li> </ul>	<ul style="list-style-type: none"> <li>- Locating the data page inside the MRP, two sides transparent heat sealed laminate;</li> <li>- Collation marks (anti-substitution) on the fore-edge of every visa page.</li> <li>✗ The MRP does not conform.</li> <li>- Multi-colour and/or fluorescent sewing thread;</li> <li>- Page numbers integrated into security background design on every visa page.</li> <li>✓ The MRP conforms; its sewing thread is a rainbow-coloured fluorescent thread.</li> </ul>

zone III. The data page is positioned on the inside of the front cover, but zone IV has been shifted to page 3.

#### Holder's portrait requirements

The MRP shall incorporate a mandatory portrait of the holder, either digitally printed in colour or laser burned in grey tones. The portrait shall not be larger than 45.0 mm x 35.0 mm and no smaller than 32.0 mm x 26.0 mm, vertically centred in zone V.

✓ The MRP conforms. The holder's portrait measures 45.0 mm x 34.0 mm and is printed with a D2T2 printer.

- The crown-to-chin portion of the full-face frontal pose shall be 70 to 80% of the longest dimension defined in zone V.

✗ The MRP does not conform.

- The quality of the holder's portrait should at least have a resolution of 288 to 384 dpi. The security background of zone V must not interfere with the proper viewing of the holder's portrait.

✓ The MRP conforms.

#### Security components requirements

See table 1 on this page.



1. laser burning personalisation
2. invisible UVI
3. zigzag micro text
4. anti-scan linear background
5. laser burned ID holder's portrait
6. dry offset linear portrait

7. personalised MLI
8. laser burned factory patch number
9. invisible UVI
10. 2D metallised kinegram in rainbow shades
11. microtext
12. laser burned 2D barcode

**Figure 3**  
Front (left) and back  
(right) of the Egyptian  
ID card.

### Research results ID Card

Listed below are the requirements of ISO/IEC 7810:2003 Identification cards - Physical characteristics. A ✓ or an ✗ indicates whether or not the Egyptian ID card meets those requirements.

#### Dimensions requirements

For the dimension requirements, a distinction is made between unused and returned ID-1 cards. An unused card is a card which has not been subjected to any personalisation or testing operation. A returned card has been issued to the card holder and returned for the purpose of testing. The width of unused cards must be between 85.47 and 85.72 mm, the width of returned cards between 85.47 and 85.90 mm. The height of unused cards must be between 53.92 and 54.03 mm, the height of returned cards between 53.92 and 54.18 mm. The card corners' radius for both unused and returned cards must be between 2.88 and 3.48 mm, and the thickness for both cards must be between 0.68 and 0.84 mm.

- ✓ *The ID card conforms to the size of ID-1. The unused ID dimensions are 85.48 x 53.95 mm and the returned card dimensions are 85.5 x 53.98 mm with a 3 mm card corners' radius and a 0.84 mm thickness. (Note that the nominal thickness of the five layers of the ID card body measures 0.845 mm, before being thermally stamped together.)*

- The raised area(s) thickness of the ID card must not exceed the standard thickness profile by more than 0.1 mm.
- The ID card does not conform. The multiple laser image (MLI) exceeds the required card thickness by 0.12 mm.

#### Card construction and edges requirements

The body of the ID card may be solid (one laminated or unlaminated layer) or may consist of multibonded layers (usually thermally stamped layers) with edge burrs of less than 0.08 mm above the card surface.

- ✓ *The ID card conforms. The body consists of five thermally stamped PC layers (see figure 4).*

#### Card material requirements

The various physical properties of the card body's material must not be affected by its integrated plasticisers or by other plastic cards.

- ✓ *The ID card conforms.*

#### Bending stiffness requirements

The bending stiffness of the ID card shall be such that deformations in normal use can be removed by the recording or printing device without impairing the function of the card. The deformation which occurs when the card is subjected to 0.7 N force load shall be 35 mm maximum and 13 mm minimum, and the card shall return to within 1.5 mm of its original flat condition within one minute after the load is removed.

- ✓ *The ID card conforms.*

#### Toxicity requirements

The ID card must not present any toxic hazard during its normal usage.

- ✓ *The ID card conforms. The Egyptian ID card has been in circulation for 15 years now without any registered toxic hazard.*

#### Chemical resistance requirements

The dimensions and the warpage distance of the ID card must still be inside the standard tolerance ranges specified in ISO/IEC 7810 and not show any separation



of card components after being submerged for 1 minute in high concentration of diluted acid or alkaline solutions, or after being submerged for 24 hours in a standard concentration acid or alkaline artificial sweat solution.

✓ *The ID card conforms.*

#### Dimensional stability requirements

The dimensions and warpage distance of the ID card must stay inside their standard tolerance ranges after exposure to temperatures ranging from  $-35\text{ }^{\circ}\text{C}$  to  $50\text{ }^{\circ}\text{C}$  and a relative humidity of 5% to 95% for any period.

✓ *The ID card conforms although it was tested under 20% to 80% relative humidity.*

#### Light deterioration resistance requirements

The change averages of the optical properties profiles of the ID card body material(s) and the card printing or personalisation inks must stay inside their standard tolerances after the standard daylight and UV light exposure tests.

✓ *The ID card conforms. Its daylight and UV light resistance profiles are fair and reach step 4 on the textile blue scale.*

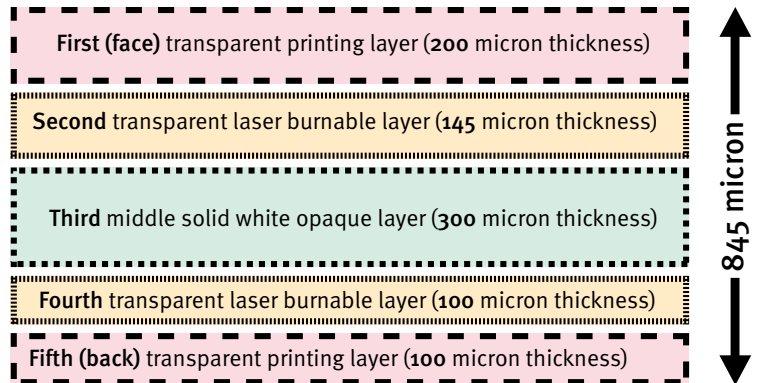
### Physical aspects of the Egyptian passport and ID card

#### Passport

*The inside of the front cover of the current MRP is the data page, digitally personalised by D2T2 colour printing technology (dye diffusion thermal transfer). The data on this page is encoded twice: first in the two-line OCR, which work as the basic machine readable device, and then in a 2D barcode. Both can be electronically scanned and then decoded by special software.*

#### ID card

*The body of the ID card is made of five heat-stamped polycarbonate (PC) layers: a laser burnable, engravable plastic material. The variable data of the ID card has been laser burned into the second and fourth layer of its body. Most of the data on the ID card is encoded in a 2D barcode on the back side. This 2D barcode is virtually integrated into the fourth layer of the ID card body using laser burning technology. To compare the human readable data with the machine readable data on an ID card, its 2D barcode lines are electronically scanned and subsequently decoded by special computer software. This dual decoding mechanism is held on portable terminals (readers).*



**Figure 4**

*The five thermally stamped PC layers.*

#### Mechanical durability and peel strength requirements

Durability of the ID card is not specified in ISO/IEC 7810. It is based on the requirements of the issuing authority. The adhesion strength between the layers of ID card must possess a minimum peel strength of 0.35 N/mm.

✓ *The ID card conforms. The Egyptian digital ID card conforms. The ID card possesses a peel strength of 0.4 N/mm. Main mechanical durability profiles:*

- tensile strength = 80 MP
- elongation ratio = 140%,
- elasticity (Young's modulus) = 2.1 Gpa
- compression strength = 95 Mpa
- impact strength (sharp pressure head) = 750 j/m.

#### Opacity requirements

The ID card body shall have an optical transmission density greater than 1.3 for the range of 450 nm to 950 nm, and greater than 1.1 for the range of 950 nm to 1000 nm.

✓ *The ID card conforms.*

#### Overall warpage requirements

The maximum distance from a flat rigid plate to any portion of the convex surface must be less than 1.5 mm, including its body thickness.

✓ *The ID card conforms.*

#### Heat resistance requirements

The deflection of the digital machine readable ID card body must be less than 10 mm and the ID card must not show any delamination or discolouration after exposure to a temperature of  $50\text{ }^{\circ}\text{C}$  and a relative humidity less than 60%.

✓ *The ID card conforms. It starts to deflect at  $150\text{ }^{\circ}\text{C}$  and its melting temperature is  $260\text{ }^{\circ}\text{C}$ .*

#### Body components contamination and interaction requirements

The card material and any material added, integrated or adhered to the card must not contaminate its holder's fingers or its readers. Furthermore, it must not contain unacceptable amounts of toxic heavy metals, such as cadmium, cobalt, arsenic, mercury and antimony.

✓ *The ID card conforms.*

## Results evaluation and recommendation

### Passport

The Egyptian MRP conforms to ICAO Doc 9303 Part1, Volume 1 in 81 requirements (59 mandatory and 22 optional requirements). It does not conform to 25 requirements (2 mandatory and 23 optional requirements). Therefore, the conformance of the Egyptian MRP to ICAO Doc 9303 Part1, Volume 1 has proved excellent by a compliance ratio of 59 : 61 = 96.7%.

This research recommends:

- that to be in full mandatory conformance with the ICAO standards, the current Egyptian MRP must comply with the two mandatory requirements of ICAO Doc 9303 Part1, Volume 1 that are not met;
- that to be in a full optional conformance with the ICAO standards, the current Egyptian MRP must comply with the 23 optional requirements of ICAO Doc 9303 Part1, Volume 1 that are not met;
- upgrading the current MRP to an e Passport, by replacing its 2D barcode with a changeable encoded data carrier with a larger storage capacity, such as a microchip/ICC and/or an integrated contactless chip (RFID chip). This e-Passport should be loadable with both analogue (self-adhesive) and digital visas and also with both ink and digital airports seals.

### ID card

The Egyptian ID card conforms to the ISO/IEC 7810:2003 in 31 mandatory requirements, and in only one case does it not comply. The conformance of the Egyptian ID card to ISO/IEC 7810:2003 has proved excellent by a compliance ratio of 30:31 = 96.8%.

This research recommends:

- that to be in full mandatory conformance with the ISO/IEC 7810 requirements, the thickness of the MLI on the front of the Egyptian ID card must be decreased to less than 0.94 mm;
- upgrading the current ID card to an e-ID card, by replacing its 2D barcode with a changeable encoded data carrier, such as a microchip/ICC and/or an integrated contactless chip (RFID chip).

1 International Civil Aviation Organisation, Doc 9303: Machine Readable Travel Documents; Part1: Machine Readable Passports; Volume1: Passports with Machine Readable Data Stored in Optical Character Recognition Format, 2006.

2 International Organization for Standardization/International Electrotechnical Commission: ISO/IEC 7810:2003: Identification cards - Physical Characteristics, 2008.

3 Naumann, I. & Hogben, G. Privacy Features of European eID Cards. European Network and Information Security Agency (ENISA), ENISA position paper ([www.enisa.europa.eu](http://www.enisa.europa.eu)).

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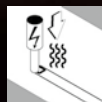
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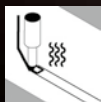
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