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Freight containers — NFC or/and QR code seals

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 4, *Identification and communication*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document proposes a specification for freight container NFC or/and QR code seals, including clear and unique identification and status of NFC or/and QR code seals. It is intended to greatly improve container transportation security and transparency with the advantages of low cost, easy to promote and apply.

The main body of implementation of this document is users, producers and information platform operators of container NFC or/and QR code seals, including cargo owners, shipping companies, logistics companies, agents, customs, inspection and quarantine, port tally, NFC or/and QR code seal manufacturers and information management platform operators.

The anticipated effects and benefits are as follows.

— To facilitate quick access to the Internet for container sealing information.

— To improve the safety of freight container transportation and reduce theft, smuggling and illegal immigration.

— To improve the transparency of freight container transportation and facilitate the accountabilities partition in multimodal transport of containers.

— To facilitate the supervision by such national institutions as customs, and inspection and quarantine bureaus.

— To facilitate the manufacturers' upgrading of products and expanding of the NFC or/and QR code seal market.

Freight containers — NFC or/and QR code seals

1 Scope

This document specifies the system composition, data format (storage data of the seal, interaction data and format between seal and APP, interaction data and format between smartphone APP and information platform, data exchanged between platforms), technical requirements, data communication requirements and operational requirements for freight container NFC seals, QR code seals, NFC and QR code seals.

This document applies to the design, manufacture and application of freight container NFC seals, QR code seals, NFC and QR code seals.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 6709, *Standard representation of geographic point location by coordinates*

ISO 17712, *Freight containers — Mechanical seals*

ISO 18185-3, *Freight containers — Electronic seals — Part 3: Environmental characteristics*

ISO/IEC 7816-6, *Identification cards -Integrated circuit cards-Part 6: Interindustry data elements for interchange*

ISO/IEC 14443-2:2020, *Cards and security devices for personal identification — Contactless proximity objects — Part 2: Radio frequency power and signal interface*

ISO/IEC 14443-3, *Cards and security devices for personal identification — Contactless proximity objects — Part 3: Initialization and anticollision*

ISO/IEC 18004:2015, *Information technology — Automatic identification and data capture techniques — QR Code bar code symbology specification*

ISO/IEC 18092, *Information technology — Telecommunications and information exchange between systems - Near Field Communication - Interface and Protocol (NFCIP-1)*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
NFC seal
non-reusable, anti-counterfeiting electronic seal embedded NFC tag with a globally unique identifier (UID) that records seal ID and manufacturer information

Note 1 to entry: Its mechanical part shall comply with ISO 17712 related requirements for freight container seals. It can provide evidence of tampering or intrusion through the container doors by appearance or information management system.

3.2
QR code seal
non-reusable mechanical seal printed on the surface containing seal ID, manufacturer information and produce date, to form a globally unique QR code

Note 1 to entry: It shall comply with ISO 17712 requirements for freight container seals. It can provide physical evidence of tampering or intrusion of the container door.

3.3
NFC and QR code seal
electronic NFC seal with a QR code printed on the surface

Note 1 to entry: The information in it includes the NFC UID, seal ID, seal manufacturer information, etc.

3.4
NFC read/write device
process device for NFC reading and writing, location uploading, picture shooting, and access to internet, such as smartphones, which has an operating system and running space where software can be installed

3.5
QR code read device
process device for QR code reading, location uploading, picture shooting, and access to internet, such as smartphones, which has an operating system and running space where software can be installed

4 Freight container — NFC or/and QR code seals

4.1 General requirements

4.1.1 The type, technical requirements, test methods and external identification of the mechanical part of the container NFC or/and QR code seal shall comply with ISO 17712.

4.1.2 The environmental requirements for NFC seal shall comply with ISO 18185-3.

4.1.3 The data character encoding method, symbol format, size characteristics, error correction rules, reference decoding algorithm and production quality requirements of QR code seal, etc., shall comply with ISO/IEC 18004.

4.2 Data format and content of NFC seal

The data of NFC seal shall include chip UID, NFC seal ID, seal manufacturer ID and container number. NFC seal ID and seal manufacturer ID shall be written onto an NFC seal during production and set to be read-only. The container number can be written by the sealing operator. The data format and content of the NFC seal are shown in Table 1.

Table 1 — Data format and content of NFC seal

Field name	Identifier	Type	Size	Description
Chip UID	ChipID	Hexadecimal	8 bytes	Required. The unique identification serial number for the chip built in the NFC seal. It shall comply with the UID-related regulations in ISO/IEC 7816-6.
NFC seal ID	SealID	Character string	14 bytes	Required. The external identifier for the NFC seal. It shall comply with ISO 17712.
Seal manufacturer ID	ManufacturerID	Character string	18 bytes	Required. For identification of seal manufacturer.
Container number	ContainerNo	Character string	11 bytes	Optional. It can conform to ISO 6346.

4.3 Data format and content of QR code seal

The data content of the QR code seal is printed on the surface of the seal in the form of a QR code, and the data content should include the seal ID, manufacturer ID and produce date. The data format and content of the QR code seal are shown in Table 2.

Table 2 — Data format and content of the QR code seal

Field name	Identifier	Type	Size	Description
QR code seal ID	sealID	Character string	14 bytes	Required. The external identifier for the NFC seal. It shall comply with ISO 17712.
Seal manufacturer ID	manufacturerID	Character string	18 bytes	Required. For identification of seal manufacturer.
Manufacturing time	produceDate	Character string	14 bytes	Required. Manufacturing time of the QR code seal. The format shall be "YYYYMMDDHHMMSS".

4.4 Data format and content of NFC and QR code seal

The requirements of data content, format of the NFC and QR code seal are consistent with the terms of 4.2, with the addition of printing a QR code on the surface of the seal. The content of the QR code shall include the NFC chip UID, seal ID and manufacturer ID. The data format and content are shown in Table 3.

Table 3 — QR code data format and content of NFC with QR code seal

Field name	Identifier	Type	Size	Description
Chip UID	chipID	Hexadecimal	8 bytes	Required. The unique identifier serial number of the chip inside the NFC seal. It shall comply with the relevant UID regulations in ISO/IEC 7816-6.
Seal ID	sealID	Character string	14 bytes	Required. External identifier of the seal. It shall comply with ISO 17712.
Seal manufacturer ID	manufacturerID	Character string	18 bytes	Required. Used to identify the seal manufacturer.

4.5 Requirements for the communication interface between NFC seal and NFC read/write device

4.5.1 The operating frequency, signal interface, bit rate, modulation principle, bit coding, etc., of the NFC seal shall comply with the requirements of ISO/IEC 14443-2.

4.5.2 The read and write operations between NFC read/write device and NFC seal, such as communication initialization, anti-collision, instruction selection and pause, block instruction reading and writing, shall comply with the regulations in ISO/IEC 14443-3.

4.6 Requirements of QR code printing and reading

4.6.1 The QR code printed on the surface of the seal shall be such that the pattern is clear, on a flat surface and not bent.

4.6.2 The reading environment of the QR code seal should be such that the QR code symbol is evenly illuminated, has accurate focus and is not covered or defaced.

4.6.3 The time for the QR code reading device to complete one information reading shall not be longer than 2 s.

4.6.4 The single reading rate of the QR code shall not be less than 99,9 %.

5 NFC or/and QR code seal system for freight containers

5.1 System components

5.1.1 Online container NFC or/and QR code seal system

It consists of a seal, read/write device and an information management platform. See Figure 1 for its structural diagram. The data interaction between NFC or/and QR code seal and the information management platform is achieved through the NFC read and write device.

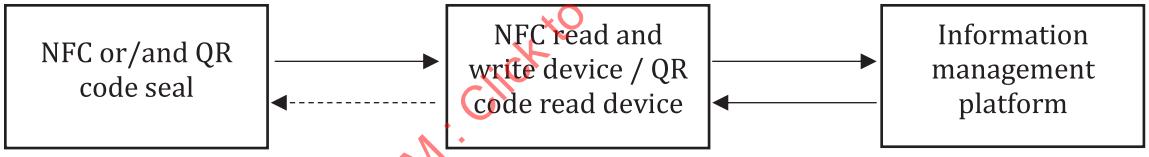

Figure 1 — Structure of an online container NFC or/and QR code seal system

5.1.2 Offline NFC and QR code seal authenticity verification system

It consists of an NFC and QR code seal, read and write device. See Figure 2 for its structural diagram.

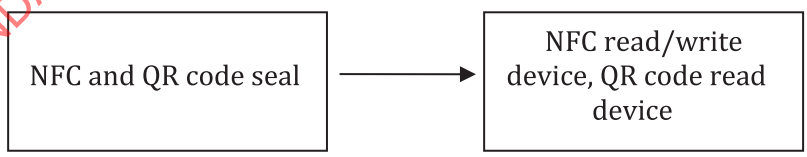

Figure 2 — Structure of an offline NFC and QR code seal authenticity verification system

5.2 General requirements

5.2.1 The container NFC or/and QR code seal system shall be equipped to read and write NFC seal or read QR code seal, record the time, place, operator, and operating image or video, and transmit such information to the platform automatically.

5.2.2 The NFC or/and QR code seal system shall have the function of abnormal report.

5.2.3 The container NFC or/and QR code seal system shall have the function of providing information query services to authorized users, who can conduct enquiry through the information management platform, NFC read/write device, and QR code read device.

5.2.4 The container NFC or/and QR code seal system shall be able to provide a standard enquiry interfaces to third-party platform.

6 NFC read/write device and QR code read device

6.1 General requirements

6.1.1 When reading or writing the NFC seal information, NFC read/write device shall comply with the regulations in ISO/IEC 18092.

6.1.2 The NFC read/write device shall be able to read the NFC seal, and write the container number onto the corresponding NFC seal and set to be read-only.

6.1.3 The NFC read/write device or the QR code read device shall be able to access the Internet and log in to the platform for safety certification and authorization.

6.1.4 The NFC read/write device or QR code read device shall be able to position and acquire the Internet time automatically during operation.

6.1.5 The single reading rate of the NFC seal shall not be less than 99,9 %.

6.2 Content and format of data interaction

The content and format of data interaction between NFC read/write device or QR code read device and the information management platform are shown in Table 4.

Table 4 — Content and format of data interaction between NFC read/write device or QR code read device and information management platform

Identifier	Type	Size	Description
devID	Character string	32 bytes	Optional. Device ID of the NFC read/write device or the QR code read device.
chipID	Hexadecimal	8 bytes	Required. NFC Chip UID.
sealID	Character string	14 bytes	Required. The seal ID.
manufacturerID	Character string	18 bytes	Required. Seal manufacturer ID.
containerNo	Character string	11 bytes	Optional. Container number.
produceDate	Character string	14 bytes	Required. Manufacturing time of the QR code seal. The format shall be “YYYYMMDDHHMMSS”.
carrier	Character string	128 bytes	Optional. Carrier.
sealDate	Character string	14 bytes	Required. The seal operation time. The format shall be YYYYMMDDHHMMSS".

Table 4 *(continued)*

Identifier	Type	Size	Description
sealLoca	Character string	21 bytes	Optional. The geographic location of the seals shall be expressed in latitude and longitude, with the former followed by the latter. The format of latitude is dd.ddddd. The latitude ranges from -90 to 90, with the negatives standing for southern latitudes. The format of longitude is ddd.ddddd. The longitude ranges from -180 to 180, with the negatives representing western longitudes. It shall conform with ISO 6709.
sealOper	Character string	36 bytes	Required. The seal operator.
sealPic	Hexadecimal	2M bytes	Optional. The picture of the seal.
sealStatus	Character string	1 byte	Required. The seal status. 0: unused; 1: sealed; 2: checked; 3: unsealed; 4: abnormal; other undefined status.
sealDestr	Character string	512 bytes	Required. Description of the abnormal seals.

7 Information management platform

7.1 General requirements

7.1.1 The platform shall set and store the status of NFC or/and QR code seals according to the operation, including unused, sealed, inspected, unsealed and abnormal.

7.1.2 The platform shall have the function of storing and comparing NFC or/and QR code seal status information to ensure the uniqueness and integrity.

7.1.3 The platform shall be able to feed back the operation steps of the NFC or/and QR code seal to the NFC read/write device or QR code read device according to the status of the seal.

7.1.4 Platforms shall be able to exchange basic information between each other, including NFC or/and QR code seals' information (including: chip UID or produce date, seal ID, produce date, container number) and NFC or/and QR code seal status information (including: unused, sealed, inspected, unsealed and abnormal).

7.1.5 The sharing of basic information between platforms can be invoked through the API interface and realized in the form of broadcast.

7.2 Content and format of the data interaction interface

The content and format of the data interaction interface between the platform and the NFC read/write device or the QR code read device are shown in Table 4. The interface content and format of the data interaction between the information management platform and other platforms are shown in Table 5.