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Freight containers – Electronic seals – Part 2: Application requirements

Récipients de fret - Joints électroniques - Partie 2: Conditions d'application

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Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

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

International Standard ISO 18185, Part 2 was prepared by Technical Committee 104, Freight Containers, Subcommittee SC 4, Identification and communication, Working Group WG2, Automatic Identification Equipment (AEI) for containers and container related equipment.

Attention is drawn to the possibility that some of the elements of this part of ISO 18185 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 18185 consists of the following parts, under the general title *Freight containers— Electronic seals*:

- *Part 1: Communication protocol*
- *Part 2: Application requirements*
- *Part 3: Environmental characteristics*
- *Part 4: Data protection*
- *Part 6: Messages sets for transfer between seal reader and host computer*
- *Part 7: Physical layer*

Introduction

This International Standard was prepared by ISO Technical Committee 104/Subcommittee 4/Working Group 2, using the drafting conventions of ISO/IEC Directives, Part 2.

This standard provides a system for the identification and presentation of information about freight container electronic seals. The identification system provides an unambiguous unique identification of the container seal, and its status.

The presentation of this information is provided through a radio-communications interface providing seal identification and a method to determine whether a freight container's seal has been opened.

Freight containers – Electronic seals – Part 2: Application requirements

1 Scope

This International Standard specifies a freight container seal identification system, with an associated system for verifying the accuracy of use, having:

- A seal status identification system;
- A battery status indicator;
- A unique seal identifier including the identification of the manufacturer;
- Seal (tag) type

This International Standard shall be used in conjunction with the other Parts of ISO 18185.

2 Normative references

The following referenced documents are indispensable 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 8601, *Data elements and interchange formats - Information interchange - Representation of dates and times*

ISO 10374*, RF automatic identification*

ISO/TS 14816, *Road transport and traffic telematics -- Automatic vehicle and equipment identification – Numbering and data structure*

ISO 17712, *Freight containers – Mechanical seals*

ISO 18185-1, *Freight containers — Electronic seals — Part 1: Communication protocol*

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

ISO 18185-7, *Freight containers — Electronic seals — Part 7: Physical layer*

ISO/IEC 19762, Part 1, *Information Technology, Automatic Identification and Data Capture Techniques – Harmonized vocabulary – Part 1: General terms relating to Automatic Identification and Data Capture (AIDC)*

ISO/IEC 19762, Part 3, *Information Technology, Automatic Identification and Data Capture Techniques – Harmonized vocabulary – Part 3: Radio-Frequency Identification (RFID)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762, Parts 1 and 3, ISO 17712, and the following apply.

3.1
electronic seal
e-seal
read-only, non-reusable freight container seal conforming to the high security seal defined in ISO 17712 and conforming to ISO 18185 or revision thereof that electronically evidences tampering or intrusion through the container doors

NOTE The electronic seal is read-only in all aspects except being able to electronically record date and time of sealing (as described in Clause 4.2), date and time of opening (as described in Clause 4.3).

3.2
seal identification
Seal ID
unique identification of each manufactured seal incorporating serial number (i.e., Tag ID), and manufacturer ID; the combination of which shall be called seal ID

3.3
interrogator identification
Interrogator ID
code used to identify the source address during every communication session originated by the interrogator

3.4
localization
capability in any operational scenario to associate an e-seal to the container on to which it is affixed

4 Seal application requirements

The seal shall be uniquely identified by the tag manufacturer ID and the tag ID (serial number) combination. This combination shall be called seal ID and shall be used in all point-to-point communication to uniquely identify a source (seal to interrogator) and destination address (interrogator to seal).

4.1 Data description

Unique identification of each manufactured seal tag incorporating all necessary information such as seal tag ID, manufacturer ID and seal tag type.

The *seal ID* is permanently programmed into the seal during manufacturing and cannot be modified.

Seal Tag ID: the ID field (serial number) for the seal. The seal number is assigned by the user or the manufacturer and is programmed by the manufacturer. Further, the ID shall be marked on the exterior (casing) of the seal. Until the seal is closed and sealed it will not respond.

Seal Tag type: The manufacturer is responsible for determination of seal tag type, compliance with the high security seal requirements in ISO 17712, and programming (See also 4.7). Further, the seal tag type shall be permanently programmed into the seal and marked on the exterior (casing) of the seal. Reading of the seal tag type shall be remotely possible under the same conditions and parameters as reading of the seal ID.

Battery life: The battery in the seal shall have a minimum life sufficient to remain in inventory for a period of two years, followed by a trip of up to 60 days' duration. The seal shall provide an indication of whether there is sufficient battery power to last for a trip of duration of 60 days with a minimum of 1000 interrogations per trip. Additionally, the manufacturer shall, according to user's specifications, provide for the visual identification of the seal's "use by date" (represented in numeric ISO format, as defined in ISO 8601).

The Seal Status bit: the status bit that indicates the seal having been opened or sealed.

The Seal Tag Manufacture ID: this is the manufacturer identification of the tag. This identification is assigned in accordance with ISO/TS 14816.

The Seal Tag Manufacturer ID of the seal is programmed by the RF Component Manufacturer.

4.2 Date and time of sealing

The seal shall give indication of the date and time when it was sealed in the format CCYYMMDDHHMM (UTC), as defined in ISO 8601. The accuracy of the time compared to actual UTC shall be no worse than ±5 seconds per day, as defined in ISO 18185-1.

4.3 Date and time of opening

The seal shall give indication of the date and time when it was opened in the format CCYYMMDDHHMM (UTC), as defined in ISO 8601. The accuracy of the time compared to actual UTC shall be no worse than ±5 seconds per day, as defined in ISO 18185-1.

4.4 RF regulations

The device shall work according to the local radio regulations and ISO 18185-7.

4.5 Reading devices

The seals shall have the ability to be interrogated by an international standards based reading device.

4.6 Environmental characteristics

The seals shall perform reliably in operating environments as defined in ISO 18185-3.

4.7 Mechanical characteristics

The seals shall have minimum mechanical characteristics in accordance with the high security provisions of ISO 17712.

4.8 Reading reliability and accuracy

The reliability and accuracy of reading the seals shall in any operational scenario be no less than 99,99% and 99,998% respectively.

4.9 Localization and seal verification scenarios

Performance requirements for electronic seals will be presented in the context of seal verification scenarios. Each scenario will motivate technical requirements like read ranges, travel speeds, and others. Container terminals, container stuffing locations, border crossings and other facilities are expected to utilize combinations of the described scenarios based on their specific local needs.

All scenarios are assumed to share a common three-step process for seal verification:

1. Determination of the container's identity.

2. Determination of identity, type, and status of the electronic seal on that container.

3. Determination whether the seal on that container is the correct seal.

Steps 1 and 3 describe functions that are outside of the scope of this standard. Regarding step 2, current technology does not support localization in all the below described scenarios. In situations, where localization is not possible, a reading confirming that the e-seals have not been tampered with or are missing shall be sufficient. If the reading detects that one or more seals have been tampered with or are missing, those e-seals and the containers on which they are affixed will be subject to exception management as established by the user of the technology.

4.9.1 Container handling and moving equipment scenarios

This set of scenarios deals with electronic seal verification while containers are being handled. Handling equipment covered by this scenario includes top loaders, side loaders, reach stackers, straddle carriers (collectively, "mobile equipment"), as well as rubber tired gantry cranes (RTG), rail mounted gantry cranes (RMGC), and quay cranes. The minimum container travel speed for seal verification for all container handling scenarios is 0km/h (0mph). Upcoming generations of quay cranes are anticipated to move containers at speeds of up to 12m/sec. The maximum container travel speed while seal verification takes place is consequently defined as 12m/sec (44km/h, 27mph).

Automatic identification devices and/or antennas may be mounted on spreaders on both mobile equipment and cranes. However, in those situations where such devices, instead of being mounted on spreaders, are mounted on the equipment itself, the read distance requirements will differ between mobile equipment and cranes. These latter scenarios are described in more detail in paragraphs 4.9.1.2 – 4.9.1.3 below.

4.9.1.1 With spreader mounted devices

Where feasible, automatic identification devices or antennas may be mounted on spreaders (or other components that directly connect to the container) and must be sufficiently fabricated and/or installed for appropriate levels of water resistance and ongoing shock and vibration.

4.9.1.2 Without spreader mounted devices - Cranes

On quay cranes or gantry cranes, where the mounting of automatic identification devices or antennas on spreaders (or other components that directly connect to the container) is not feasible or deemed undesirable, the devices may instead be mounted on the crane legs. In these situations, the system level coverage will depend on user requirements and shall be capable of a minimum of 35m (115ft).

4.9.1.3 Without spreader mounted devices - Mobile equipment

In the case of mobile equipment, where the mounting of automatic identification devices or antennas on spreaders (or other components that directly connect to the container) is not feasible or deemed undesirable, the devices may instead be mounted on the equipment itself. In these situations, the system level coverage will depend on user requirements and shall be capable of a minimum of 10m (33ft).

4.9.1.4 Moves with multiple containers simultaneously

Container handling equipment that moves single 40ft containers or two 20ft containers is often capable of moving more than one 40ft or two 20ft containers simultaneously. Any combination of container orientations is possible (e.g., doors left, right, both doors out or butted together).

Such multiple container moves are defined as having the same minimum and maximum speeds as discussed above in Section 4.9.1. Read distances would be dependent upon whether the container handling equipment has spreader mounted devices or not as discussed in paragraphs 4.9.1.1, 4.9.1.2 and 4.9.1.3.

4.9.2 Restricted lane scenarios

This set of scenarios deals with electronic seal verification while containers travel in restricted lanes. Containers could be pulled by road or yard trucks or travel on rail cars. Some kind of physical restriction assures movement in only one direction (e.g., forwards/backwards but not sideways) within a confined or defined space (e.g. lane or rail track).

4.9.2.1 Single-lane gates or portals

This scenario covers all situations where container traffic is reduced to a single lane. This includes truck gates, structured pre-gates, OCR portals, and yard portals. Structures on either or both sides of the lane exist to restrict movement and for permanent installation of automatic identification devices or antennas.

Lanes are assumed to be 3m to 6m wide and containers are assumed to travel at speeds ranging from 0km/h (0mph) to 50km/h (31mph).

4.9.2.2 Multiple-lane gates or portals

This scenario covers all situations where containers travel in multiple parallel lanes. This includes truck gates, structured pre-gates, OCR portals, and yard portals. Structures between lanes exist to restrict movement and for permanent installation of antennas or automatic identification devices. Containers in adjacent lanes may travel in opposite directions.

Lanes are assumed to be 3m to 6m wide and containers are assumed to travel at speeds ranging from 0km/h (0mph) to 50km/h (31mph).

4.9.2.3 Single track train gates or portals

This scenario covers single-track rail gates. Structures on either side, both sides, or above the track exist or can be created for permanent installation of antennas or automatic identification devices. Containers on rail cars travel at speeds of up to 50km/h (31mph) and can be stacked up to two containers high. Lanes are assumed to be 3m to 6m wide.

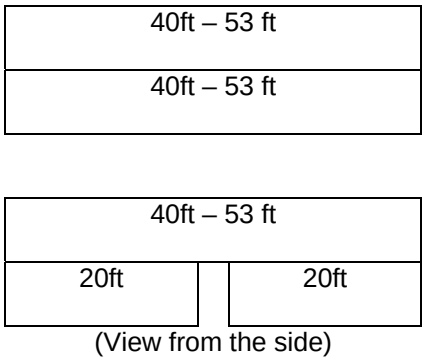
4.9.2.4 Multiple track train gates or portals

This scenario covers rail gates with multiple parallel tracks. Structures on either side, between or above tracks exist or can be created for permanent installation of antennas or automatic identification devices.

Containers on rail cars travel at speeds of up to 50km/h (31mph) and can be stacked up to two containers high. Lanes are assumed to be 3m to 6m wide.

4.9.2.5 Containers on rail cars

Containers can be stacked up to two high on rail cars but only the bottom containers can be 20ft containers (e.g., four 20ft containers will not be loaded onto a single rail car)



(View from the side)

In the case well cars are used to transport containers, the bottom 2.04m of the bottom containers may be covered by the steel of the well car. The well car steel cover can reach as high as 2.04m on the left and right sides of the rail car.

4.9.3 Short-range handheld scenarios

In addition to automated seal verification with fixed equipment as described in the previous scenarios, seal verification may be done with handheld devices. Examples for the use of hand-held devices are exception handling as well as locations that lack fixed infrastructure.

The short-range handheld scenario assumes a person is able to walk up very close to the container door(s) to which the seal(s) are affixed. The hand-held device must be ergonomically viable and seal verification must support situations where the person stands still or is walking at speeds of up to 5km/h (3mph). The hand-held device shall read electronic seals at a range of 3 m (10 ft) or less.

4.9.4 Long-range handheld scenarios

Situations may arise where seal verification must be done using a hand-held device over long distances. In this case, the long-range handheld scenario assumes a person is unable to be close to the container door. An example for the use of long-range hand-held devices is the use by crane operators for containers under the hook. The hand-held device shall be ergonomically viable and seal identification shall support situations where the container stands still or moves at speed of up to 12m/sec (44km/h, 27mph). The distance between the hand-held device and the container is limited to no more than 50m (164ft).

Bibliography

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[4] ISO 17363, *Supply chain applications of radio frequency identification (RFID) - Freight containers*

[5] ISO 18185-4, *Freight containers — Electronic seals — Part 4: Data protection*

[6] ISO 18185-6, *Freight containers — Electronic seals — Part 6: Messages sets for transfer between seal reader and host computer*