



Brussels, 21 September 2018.

CONTAINER SECURITY/TRACKING DEVICES

b) Potential opportunities for the use of E-Seals

(Item IX.b on the Agenda)

I. Introduction

1. The importance of 'Seal Integrity for Secure Containers' has been stipulated in Pillar 1 of the SAFE Framework of Standards. Security seals are an integral part of the chain of custody in the international supply chain. Inspecting a seal requires a visual check for signs of tampering, comparison of the seal's identification number with the cargo documentation, and noting the inspection in the appropriate documentation. If the seal is missing, or shows signs of tampering, or shows a different identification number than the cargo documentation, then a number of actions might be necessary.
2. The shipper/consignor or their agent is responsible for securely stuffing the container and for the accurate and complete description of the cargo. Normally, the shipper is also responsible for affixing the cargo security seal immediately upon the conclusion of the stuffing process, and for preparing documentation for the shipment, including the seal number. The SAFE Framework provides that the cargo security seal should be compliant with the definition of high-security mechanical seals in ISO 17712:2013¹.
3. For Customs to have faith in the integrity of the logistics system, it must be certain that the cargo is moving in a manner as recommended by the SAFE framework of Standards. Integrity of cargo is reliant on one thing, i.e. tamper evidence. There should be a robust mechanism to know whether data, or goods have been contaminated, altered, removed or damaged through any unlawful intrusion.
4. It seems that mechanical seals do not fully address the real threats in the supply chain. Hence, businesses and Customs administrations are exploring tamper-proof/tamper-evident solutions in the supply chain.
5. Rapid technological developments, globalization of international trade, as well as increasing inter-dependence of global value chains have also led to advances in

¹ <https://www.iso.org/standard/62464.html>

container security devices and presented new opportunities for their strategic integration within the international supply chain for improving its visibility, integrity, security and facilitation. Some Customs administrations and stakeholders are already exploring new means for cargo security by employing various kind of electronic seals (e-seals).

6. The SAFE Working Group, at its 19th Meeting in February 2018, had established a Mini-Group of interested Members and stakeholders to carry out further work on the use of e-seals with a view to enhancing end-to-end supply chain integrity, within the context of the integrated supply chain management and the SAFE Framework of Standards.

II. E-Seals

7. E-seals combines mechanical security of standard seals with the electronic security. E-seals have unique ID code and read / write user memory capabilities. It brings together manual seal elements with electronic characteristics to enhance seal integrity, store data, and provide real-time communication and information. Some designs use infrared signals and others use direct contact information and communications technologies, but currently radio frequency identification (RFID) is in most common use. Some of the e-seal designs automate the essential functions of seal checking and reporting in order to minimise human intervention. The status of the seal (tampered / not tampered) is immediately detected when it passes through a gate or by manual inspection with a mobile reader in combination with smartphones or tablets.

- **Definitions**

8. According to the current ISO 18185² definition, an e-seal is a *“Read-only, non-reusable freight container seal conforming to the high security seal defined in ISO/PAS 17712 and conforming to electronically evidences tampering or ISO 18185 or revision thereof that intrusion through the container door”*.
9. The WCO has adopted the ‘Recommendation concerning Customs Formalities in connection with the Temporary Admission of Container Security Devices (CSDs)’³. According to the Recommendation, CSD means *“an accessory or a piece of equipment that can be affixed to, on, inside or form part of a container or a load compartment and which is intended to detect tampering or intrusion into the container or load compartment either through either door or through any other side. CSDs include mechanical and electronic seals. The device may or may not be reusable and may or may not have additional functionalities such as monitoring the status of the goods and container tracking”*.

- **Types of e-seals**

10. There are several types of e-seals, for example passive, active and semi-active. Passive e-seals are without battery, whereas active e-seals have battery. Passive seals do not initiate transmissions; they respond when activated by the energy in the signal from a reader. The advantage of a battery-free passive seal is that it can be a simple, inexpensive, and disposable device.

² <https://www.iso.org/standard/41125.html>

³ <http://www.wcoomd.org/-/media/wco/public/global/pdf/about-us/legal-instruments/recommendations/facilitation/transport/recommendation-csd-en.pdf?la=en>

11. Active seals, on the other hand, can initiate transmissions as well as respond to interrogation. They monitor seal integrity on a real-time basis, and most capture the time of tampering and write it to an on-board log. Some can accept global positioning system (GPS) and sensor inputs, and some can also provide live tampering reports as the events happen.
12. Some e-seals can be opened only with a corresponding electronic key received over high-security data links at the destination site. Some others can send data about potential tampering and where it might have occurred via GPS in combination with satellite or cellular networks, before cargo is loaded into a carrier, en route, and after it arrives at its destination.
13. More recently, radio-frequency technologies, including active RFID and passive RFID, have emerged to provide close-range capabilities. The core benefits are that it provides identification without requiring line of sight, can be read at short to very long range and can be encoded with significant amount of data. Passive and active e-seals can also be combined with GPS, satellite and cellular services, such as GSM (Global System for Mobiles), with a possibility to alternate between communications as needed.
14. The simplest type of e-seals contains only a seal ID number. The most common technology for such an e-seal is passive RFID, which requires an appropriate reading device and software. More advanced reusable or permanent active RFID e-seals also include a seal ID number, and a container ID number, and can initiate alarm calls and record time/date of container tampering. Smart e-seal or CSD contains a seal ID number, a container ID number, and additional sensors to indicate the environmental status of container content, an alarm function to inform in real time and satellite communication via GPS/INMARSAT systems.

- **Opportunities**

15. E-seals hold promise, particularly if they can be integrated with an active alarm system and GPS tracking. One advantage of the electronic seal is that it is capable of recording the time of the breach or tamper event, as well as the location, if equipped with GPS technology. E-seals can serve both commercial and security interests by tracking containers from their point of origin, while en route, and to their final destination and point of Customs clearance including different Customs processes such as transit and movement to/from port terminals, special Customs zones, and warehouses without Customs escorts.
16. E-seals enable traders to track goods in transit through the port to inland container depots, container freight stations, and to end-users, thus lowering logistics costs, due to improved predictability and optimization of cargo flows.
17. An e-seal could potentially be an important part of a multi-layered security system that ensures safety and security, provides end-to-end tractability, and protects against theft, pilferage and smuggling. With the various types of e-seals combined with RFID, it is possible to enhance container security, as well as to improve container visibility and transportation efficiency throughout the supply chain.
18. E-seals could also provide the basis and impetus for green lane concepts that are being pursued by some Customs administrations. Data generated by e-seals including geospatial data can support time release study (TRS), as well as some advanced concepts like advanced targeting and predictive analytics using Artificial Intelligence (AI) and Machine learning (ML) in a blockchain environment.

19. Businesses are using e-seals for improving overall supply chain efficiency including through streamlined Customs processes⁴. At the same time, Customs administrations are exploring various opportunities for the use of e-seals for enhanced supply chain integrity. For example :
- i. China is piloting a 'Smart and Secure Seal' (SSS) project to strengthen end-to-end supply chain security, visibility and integrity, as well as enhancing facilitation with data consolidation and track and trace through the supply chain. The key objectives of the project are to efficiently support information exchange (advance electronic information), mutual recognition on controls, and cargo and conveyance surveillance in a timely manner from departure to destination in the domestic and international environments, thus implementing some of the concepts of Pillar 1 of the SAFE Framework, including the integrated supply chain management (ISCM).
 - ii. Uruguay monitors 100% of its transits through e-seals and GPS, 24 hours a day and 365 days a year⁵.
 - iii. India prescribed self-sealing of export containers through the mandatory use of one-time e-seals to facilitate their easy movement and to secure against tampering en route⁶.
 - iv. Belgium initiated a maritime project with respect to the use of e-seals for transports of specified goods to their destination under Customs supervision⁷.
 - v. At the regional level, the East African Community (EAC) has implemented the Regional Electronic Cargo Tracking System (RECTS)⁸ through the use of GPS enabled e-seals for an end-to-end electronic monitoring of transit cargo along the Northern Corridor.
- **Standards for electronic seals**
20. There are three key standards that deals with some aspects of e-seals :
- i. ISO 10374⁹ is a standard for RFID automatic identification of freight containers. It specifies all necessary user requirements: a container identification system, data coding systems, description of data, performance criteria and security features.
 - ii. ISO 18185 is an international standard that provides an unambiguous and unique identification of the container seal, its status and related information. The presentation of this information is provided through a radio-communications interface providing seal identification and a method for determining whether a freight container's seal has been opened. It includes passive and active protocols, enabling both simple low cost and more robust seals. ISO 18185 consists of the following parts, under the general title *Freight containers - Electronic seals*:

⁴ <http://www.rfidjournal.com/articles/view?3257>

⁵ https://www.aduanas.gub.uy/innovaportal/v/8156/3/innova.front/decreto-n%C2%BA-323_011.html

⁶ <http://www.cbic.gov.in/resources/htdocs-cbec/customs/cs-circulars/cs-circulars-2017/circ26-2017cs.pdf> and <http://www.cbic.gov.in/resources/htdocs-cbec/customs/cs-circulars/cs-circulars-2017/circ36-2017cs-revised.pdf>

⁷ <https://finances.belgium.be/sites/default/files/CSC%20Smart-seals.pdf>

⁸ <https://www.trademarka.com/news/regional-electronic-cargo-tracking-system-unveiled/>

⁹ <https://www.iso.org/standard/18435.html>

- Part 1: Communication protocol
- Part 2: Application requirements
- Part 3: Environmental characteristics
- Part 4: Data protection
- Part 5: Physical layer

iii. ISO 23359 is a new body of work for read/write RFID for freight containers.

III. Preliminary outcomes of the SAFE Mini-Group's work

21. The SAFE Mini-Group on E-Seals facilitated by China held its first face-to-face meeting on 4 July 2018. The EU, India, Belgium, Hungary, Belarus, Canada and Cegep de Sherbrooke participated in this meeting. It was noted that this new technology is in its early stages of implementation in the supply chain management and Customs processes.
22. Based on some of the experiences shared by a few Members, the Group noted that E-seal could potentially help increase operational efficiency, improve safety and security, and drive business process innovation. The Group, through preliminary discussions, identified the following key objectives and deliverables:
- i. Develop a study report on the application of e-seals including guidelines, as well as policy and operational recommendations.*
 - ii. Potential update of the relevant provisions of the SAFE Framework of Standards.*
23. The Group also defined its scope of work through a phased approach for the consideration and guidance by the SWG. A broad outline of the envisaged work is appended as Annex I to this document.
24. Furthermore, it was suggested to collect Members and stakeholders' practices and initiatives with the use of e-seals through a simple questionnaire set out at Annex II to this document.
25. This topic will be discussed at the 20th meeting of the SWG that will be held from 17 to 19 October 2018 within the context of the integrated supply chain management. The outcomes of the SWG will be presented at the PTC. PTC Delegates are requested to coordinate with their respective SWG delegates in advance of the meeting and come prepared along with their working experiences for a comprehensive discussion on the different facets of this topic from a wider perspective.

IV. Action Required

26. The PTC is invited to :
- discuss the current and future opportunities and potential uses of e-seals in the supply chain management and Customs business processes from a wider perspective, and provide guidance on the future work based on the preliminary work already initiated done by the SAFE Working Group in this area (Annex I); and

PC0526E1

- encourage Members, economic operators and other stakeholders to share their practices, initiatives/pilots including by responding to the questionnaire (Annex II), as well as contributing to this work.

*
* *

Draft Outline of the scope of work on E-Seals

I. Objectives : The following are the main objectives of the envisaged work in the area of E-Seals :

- a. Develop a study report on the application of e-seals including guidelines, as well as policy and operational recommendations, and
- b. Potential update of the relevant provisions of the SAFE Framework of Standards.

II. Phased approach

- i. Preliminary Report for the consideration by October 2018 SAFE Working Group (SWG),
- ii. Further work including research, consultation of existing international standards e.g. ISO 18185, and collection of Members' practices, pilots and initiatives as per the SWG's guidance : a) Current status, and b) Future considerations,
- iii. Discussion on the 'tamper evidence' issue in existing ISO standards on both e-seals and mechanical seals with a view to develop appropriate recommendations,
- iv. Field Study,
- v. Development of a draft Study Report,
- vi. Draft proposals for a potential update of the relevant provisions of the SAFE Framework of Standards.

III. Methodology

- i. Collection of members' practices, pilots/initiatives (see questionnaire at Annex II),
- ii. Academic research and analysis, and
- iii. Discussions at, and guidance from, WCO working bodies (SWG and Permanent Technical Committee).

IV. Key issues

A. Type of e-seals

- *Passive e-seals,*
- *Active e-seals,*
- *Semi-active e-seals.*

B. Features of E-Seals

- Distinctive characteristics and technical specifications

- *Wide Band Code Division Multiple Access (WCDMA 3G) communication protocol,*
 - *Capacity of the battery,*
 - *Remote setting of data (programming of the e-seal from a distance),*
 - *Authorization from a distance (e.g., the degree of coverage and the signal range of the e-seal),*
 - *Quality (e.g., the weather and impact resistance of the proposed e-seal),*
- Sealing procedures and associated requirements (e.g., auxiliary equipment and infrastructure)

Sealing procedures :

- *Installation and removal e-seals (the reduced manual interventions, the better),*
- *Reading and transfer data / measurement results from e-seals to a Windows and MS Office environment.*

Associated requirements :

- *Monitoring platform,*
 - *Reader (handheld/mobile),*
 - *Interchangeability of data (use of APIs),*
 - *Storage of data (e.g., the storage capacity (internal storage) of data in case of temporary loss of connection to the signal,*
 - *Data security (e.g., the security of the traffic / data transmission).*
- Additional points for evaluation :
 - *accuracy of the sending of the signal and the visualization of the signal,*
 - *readability and practicality of e-seals user manuals and software,*
 - *unique seal number that can be read both electronically and visually; it may be impractical to have electronic readers available at all points,*
 - *ability to record the date and time when the seal was activated or sealed,*
 - *ability to record the date and time when the seal was opened or breached,*
 - *ability to operate within a radio frequency band-width that is approved and publicly available in all locations (in case of an RFID seal),*
 - *ability to be read by universal readers like those typically used to interrogate seals from different manufacturers,*
 - *performance reliability within all anticipated operating environments along the trade route,*
 - *ability to meet the minimum physical security standards of the ISO high-security seal standard,*

- *Ability to issue authorization to unlock container seal with near field communication (NFC) authentication cards.*

C. Business case for migration from paper seals/plastic seals/lead seal/mechanical seals to e-seals including **opportunities, challenges and benefits**

Opportunities:

- *Logistics safety, security and efficiency ,*
- *Track and trace,*
- *Integrated supply chain management (quality, timing),*
- *National and international transits,*
- *Transshipment,*
- *Customs Supervision (movement to warehouse, designated places),*
- *Data exchange (location data, cargo data) and data analytics,*
- *Efficient Inventory management.*

Benefits:

- *Enhanced safety and security of cargo against unlawful intrusion, robbery, drug trafficking and smuggling (to Customs and all economic operators),*
- *Real time information on the status of the means of transport/cargo and its integrity that can help Customs and economic operators to take timely action and prevent illegal behavior,*
- *Increased visibility and efficiency of supply chain and increased productivity of cargo movements,*
- *Reduced cost for Customs clearance and insurance.*

Challenges:

- *Costs and who should or would bear,*
- *Associated technical requirements and equipment,*
- *Data security,*
- *Legal framework,*
- *Ownership.*

D. Current status of the use of E-Seals in different modes of transport of goods by Customs administrations and economic operators, related initiatives and pilots

E. Resources Implications for each mode (financial analysis)

F. Legal and procedural framework (including data storage and security)

V. Recommendations

*
* *

Questionnaire on the use of E-Seals

1. Are e-seals being used by Customs or economic operators in your country for supply chain management, Customs procedures, domestic supervision and international transit?
 2. What kind of e-seals are used (e.g., RFID, reusable/non-reusable, real time tracking, data sharing)?
 3. E-seals are used for which mode of transport?
 4. Any ongoing or planned pilot/initiative?
 5. Point of contact.
 6. Remarks/Additional information.
-