

SECT.	SHORT NAME	CATEGORY	REQUIREMENT
2	Continuity of Knowledge	Key Security Features	The seal shall maintain continuity of knowledge over the containment status of the sealed object.
3	Components	Dimensions	The passive loop sealing system shall consist of a seal body, sealing wire, and seal reader (seal recording / verification station optional)
3.1	Body Captures Wire	Key Security Features	The seal body shall enable reliable and irreversible connection of the sealing wire ends in a tamper indicating manner
3.1	No active electronic circuits	Easily Verifiable and Identifiable in Field	The seal body shall not incorporate any active electronic circuits able to detect, record, and report tampering with the sealing wire or the seal body itself
3.2	Sealing wire fitment	Dimensions	The sealing wire shall fit through the parts of the objects to be sealed.
3.2	Sealing wire ends	Key Security Features	Both ends of the sealing wire shall be irreversibly connected within the seal body thus forming a sealing loop
3.3	Identity Verification by Seal Reader	Easily Verifiable and Identifiable in Field	The seal reader shall enable field verification of the seal body identity
4.1	No tools	Easy To Operate	The seal shall be closed manually without any tools
4.1	Closing force	Easy To Operate	Maximum closing force shall not exceed 75 newtons.
4.1	Automatic Seal Wire Capture	Key Security Features	The sealing wire shall be automatically captured inside the seal body when the latter is fully closed.
4.1	No knots	Easy To Operate	No knots or crimps shall be necessary (the seal body acts as a crimp).
4.1	Adjustable Wire Length	Easy To Operate	The wire length shall be easily adjustable to the desired value prior to closing
4.1	Clearly indicate Closure	Easily Verifiable and Identifiable in Field	Closing shall be clearly indicated by a tactile and, optionally, audible or visual feedback
4.1	Seal Body ID	Easily Verifiable and Identifiable in Field	The seal body shall be identified with a string of alphanumeric characters (a "serial number") applied to one or more body surfaces
4.2	Easy Handling in Field	Easily Verifiable and Identifiable in Field	The sealing wire shall allow easy handling in the field both when being fitted through the objects to be sealed and when the seal body is being attached
4.2	Seal Wire Diameter	Dimensions	One diameter of sealing wire shall be <1.5mm
5.1	Indicate Open & Close attempts	Easily Verifiable and Identifiable in Field	The seal body shall conclusively indicate any attempt to open and reclose it
5.1	Unique ID	Key Security Features	The seal body shall have unique identification features making its duplication (cloning) practically impossible with state-of-art techniques

<b>5.2</b>	Sealing Wire Indicates Splices	Easily Verifiable and Identifiable in Field	The sealing wire shall conclusively indicate any attempt to cut and splice it
<b>5.2</b>	Multistrand Wire	Dimensions	If a multistrand stainless steel cable is used, the number of its strands shall be 19 strands or greater
<b>6.1</b>	Seal Body Visual Verification	Easily Verifiable and Identifiable in Field	The seal body integrity verification shall be performed by visual inspection
<b>6.2</b>	Seal Wire Visual Verification	Easily Verifiable and Identifiable in Field	The sealing wire integrity, both outside and inside the seal body, shall be conclusively verifiable by visual inspection without cutting the seal body; objectively measuring the integrity of the seal wire is an asset.
<b>7.1.1</b>	Max Dimensions Requirement	Dimensions	REQUIREMENT: If this design objective is not technologically achievable for the material(s) selected, the shape and dimensions should be as close as possible to the CAPS shape and dimensions, but NOT larger than 30mm in diameter and 15mm in height
<b>7.1.1</b>	Max Dimensions Objective	Dimensions	OBJECTIVE: The seal body should be dimensionally compatible with the CAPS seal body to allow one-to-one replacement: not larger than 27mm in diameter and 12mm in height
<b>7.1.2</b>	Wire Diameter Gripped in Body	Key Security Features	The wire diameter shall allow reliable grip within the seal body
<b>7.2</b>	Max Seal Body Weight	Dimensions	The seal body weight shall not exceed 25 g
<b>7.3.1</b>	No damage - dropped	Reliable	The seal body shall receive no damage if dropped onto a concrete surface from the height of about 1.2 m (a requirement from MIL-STD 810 Rev. G)
<b>7.3.1</b>	No damage - stepped on	Reliable	The seal body shall not be destroyed or deformed when a person wearing protective shoes steps on it
<b>7.3.1</b>	Mechanical Tests	Reliable	The seal body shall pass mechanical tests described in SG Testing Annex
<b>7.3.1</b>	Scratch Resistance	Reliable	The seal body shall have sufficient scratch and abrasion resistance to maintain unambiguous verifiability of the unique pattern(s) over the entire seal lifecycle
<b>7.3.2</b>	Sealing Wire Tensile Strength	Dimensions	The sealing wire shall have tensile strength of no less than the tensile strength of the stainless steel wire authorised for the CAPS seal (1570 N/mm <sup>2</sup> )
<b>7.3.2</b>	Seal Body Capture Force	Dimensions	The sealing wire captured inside the seal body shall not be pulled out under the constant load up to at least 30 kg

<b>7.4.1</b>	Operating Temperatures	Reliable	The seal body and the sealing wire shall maintain their tamper indicating properties and remain unambiguously verifiable after prolonged (up to 3 years) exposure to temperatures from –50 to +150 °C
<b>7.4.2</b>	Normal Closure Temp Limits	Easy To Operate	The seal shall allow normal closing from –40 to +50 °C
<b>7.5</b>	Chemical Resistance	Reliable	The seal shall maintain its tamper indicating properties and remain unambiguously verifiable after prolonged (up to 3 years) exposure to corrosive environments typically present at nuclear facilities worldwide
<b>7.6</b>	Radiation Hardness	Reliable	The seal shall maintain its tamper indicating properties and remain unambiguously verifiable after receiving neutron/gamma doses specified in [1], “Special Applications”
<b>8</b>	No Sharp Edges	Easy To Operate	The seal body shall not have any sharp edges or corners able to cut or otherwise damage protective gloves, clothes, or human skin
<b>8</b>	No Fracturing of Seal Body	Easy To Operate	The seal body shall not fracture into sharp pieces able to pierce or cut protective gloves, clothes, or human skin
<b>9</b>	Transport	Easy To Operate	The seal body and the sealing wire shall conform to all international and domestic regulations governing transportation, installation, and use of equipment
<b>9</b>	No Unallowed Substances	Easy To Operate	In particular, the seal body and the sealing wire shall not contain any substances not allowed at the facilities where the seals are to be applied

Reference:

[1] Qualification Test of IAEA Safeguards Equipment, SG-PR-12145, ver. 1, 2014-03-28