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CUSTOMS CONVENTION ON THE INTERNATIONAL TRANSPORT OF GOODS UNDER COVER OF TIR CARNETS (TIR CONVENTION, 1975)

Application of the Convention
Technical provisions
ISO standard on mechanical seals for freight containers

Transmitted by the International Organization for Standardization (ISO)

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Foreword

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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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of normative document:

— an ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

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An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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

ISO/PAS 17712 was prepared by Technical Committee ISO/TC 104, *Freight containers*. It is issued initially as a Publicly Available Specification (PAS) due to the immediate need for clarification and guidance with regard to security seals used in conjunction with freight container transportation. It has been prepared based on existing material available from national customs organizations, national testing bodies and the World Customs Organization.

Freight containers — Mechanical seals

1. SCOPE

This Publicly Available Specification (PAS) establishes uniform procedures for the classification, acceptance, and withdrawal of acceptance of mechanical freight container seals. It provides a single source of information on mechanical seals which are acceptable for securing freight containers in international commerce.
This Publicly Available Specification is not applicable to special-purpose seals, such as fibre-optic and sophisticated electronic seals.

2. TERMS AND DEFINITIONS

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

2.1
security seal
passive, one-time locking device that is used to provide a reliable indicator of tampering (unauthorized removal or attempted removal) or entry

NOTE In addition, by virtue of its construction, the security seal provides limited resistance to an intentional or unintentional attempt to open it and enter the freight container that is sealed with the seal. Security seals require inspection to indicate whether tampering has occurred or entry has been attempted.

2.2
high security seal
security seal that is constructed and manufactured of material such as metal or metal cable with the intent to delay intrusion

NOTE High security seals generally must be removed with quality bolt cutters or cable cutters. They require inspection to indicate whether tampering has occurred or entry has been attempted.

2.3
indicative seal
seal that is constructed and manufactured of material that can easily be broken by hand or by using a simple snipping tool or shear

NOTE Indicative seals require inspection to indicate whether tampering has occurred or entry has been attempted.

3. MECHANICAL SEAL TYPES AND REQUIREMENTS

3.1 TYPES OF MECHANICAL SEAL

3.1.1 Wire seals

Wire seals consist of a length of wire secured in a loop by some type of seizing device.
EXAMPLES Crimp wire, fold wire and cup wire seals.

3.1.2 Padlock seals

Padlock seals consist of a locking body with a bail attached.
EXAMPLES Wire shackle padlock (metal or plastic body), plastic padlock and keyless padlock seals.

3.1.3 Strap seals

Strap seals consist of a metal or plastic strap secured in a loop by inserting one end into or through a protected (covered) locking mechanism on the other end.

3.1.4 Cable seals

Cable seals consist of a cable and a locking mechanism. On a one-piece seal, the locking or seizing mechanism is permanently attached to one end of the cable. A two-piece cable seal has a separate locking mechanism which slips onto the cable or prefabricated cable end.

3.1.5 Bolt seals

Bolt seals consist of a metal rod, threaded or unthreaded, flexible or rigid, with a formed head, secured with a separate locking mechanism.

3.1.6 Cinch or pull-up seals

Cinch or pull-up seals are indicative seals consisting of a thin strip of material, serrated or non-serrated, with a locking mechanism attached to one end. The free end is pulled through a hole in the locking mechanism and drawn up to the necessary tightness. Cinch or pull-up type seals may have multiple lock positions. These seals are generally made of synthetic materials such as nylon or plastic. They should not be compared to simple electrical ties.

3.1.7 Twist seals

Twist seals are made of steel rod or heavy-gauge wire of various diameters, which is inserted through the locking fixture and twisted around itself by use of a tool.

3.1.8 Scored seals

Scored seals consist of a metal strip which is scored perpendicular to the length of the strip. The strip is passed through the locking fixture and bent at the score mark. Removal of the seal requires bending at the score mark which results in breakage of the seal.

3.1.9 Label seals

Label seals are frangible seals consisting of a paper or plastic backing with adhesive. The combination of backing and adhesive are chosen to cause the seal to tear when removal is attempted.

3.1.10 Barrier seals

Barrier seals are designed to provide a significant barrier to container entry. A barrier seal may, for example, enclose a portion of the inner locking rods on a container. Barrier seals may be designed to be reusable.

3.2 GENERAL REQUIREMENTS

3.2.1 Security and high security seals shall be strong and durable so as to prevent accidental breakage, early deterioration (due to weather conditions, chemical action, etc.) or undetectable tampering under normal usage.

3.2.2 Seals shall be capable of being affixed easily and quickly.

3.2.3 Seals shall be identified by unique marks (such as a logotype) and numbers that are readily legible; markings intended for unique identification of the seal shall be considered permanent. Any modification of markings shall require irreversible physical, chemical, heat or other destruction of the security seal.

3.2.4 Seals shall be designed and constructed so as not to permit removal or undoing without breaking, or tampering without leaving readily apparent traces.

3.2.5 Seals, with the exception of barrier seals, shall be designed so as not to permit use more than once.

3.2.6 Seals shall be made as difficult as possible to copy or counterfeit.

3.3 IDENTIFICATION MARKS

3.3.1 Seals intended for use on freight containers moving under customs laws as instruments of international trade shall be separately approved and marked as determined by the relevant customs organization or competent authority.

3.3.2 If the seal is to be purchased and used by customs, the seal or fastening, as appropriate, shall be marked to show that it is a customs seal by application of unique words or markings designated by the appropriate customs organization and a unique identification number.

3.3.3 If the seal is to be used by private industry (i.e. a shipper, manufacturer or carrier), it shall be clearly and legibly marked with a unique identification number. It may also be marked with a company name or logo.

3.4 EVIDENCE OF TAMPERING

3.4.1 Different seal types evidence tampering in different ways, but one common test for tampering, regardless of seal type, is easy opening of the seal under hand pressure.

3.4.2 Cable and wire seals can also evidence tampering by a frayed appearance at the point where the wire or cable meets the locking portion of the seal.

3.4.3 Bolt, rod and padlock-type seals can evidence tampering by scratches or nicks on the body of the seal, indicating attempted prying or picking of the lock mechanism. Threaded bolts can be bent after installation to upset the threads and prevent undetected removal of the locking mechanism. The use of a plastic coating on these types of seals can promote the detection of tampering.

3.4.4 Other types of seal can evidence tampering by scratches or nicks adjacent to the locking mechanism or deformation of the locking mechanism.

3.5 CUSTOMS ACCEPTANCE

3.5.1 Seals shall be manufactured under a controlled process, as evidenced by a suitable, externally audited manufacturing and testing processes quality control process, for example by ISO 9000 series certification.

3.5.2 Seals will be considered as acceptable for use and/or purchase as soon as the manufacturer attests that the seals have been tested and meet or exceed the standards provided in Clause 4 and that they also meet the other requirements of this Publicly Available Specification. They will continue to be considered acceptable until such time as it is demonstrated that they do not meet the standards or they are withdrawn from the marketplace by the manufacturer. A manufacturer should notify the appropriate customs authority whenever a seal is so withdrawn.

3.5.3 A manufacturer may attest to the qualification of a specific seal, or to an entire product line of seals as of a certain date. Any addition of a seal to a group of seals attested to as a group would require specific acceptance of that seal by customs.

3.5.4 All testing of seals deemed necessary before customs acceptance will be done by the manufacturer or by a private laboratory, and not by customs. However, customs reserves the right to test, or to have tested, seals that have been accepted by customs.

3.5.5 Only seals classed as high security or security seals based on the test protocols set forth in Clause 4 shall be acceptable for use as customs seals.

3.6 TEST FIXTURE CONFIGURATION

The general type of seal and its configuration shall be used to configure the appropriate test fixture. Seals shall be classified as high security, security or indicative based on their certified performance under the tests described in Clause 4.

4. TESTING

4.1 TENSILE TEST

A pull test shall be conducted to determine the strength of a seal's locking mechanism. The test fixture shall apply a uniform load to the seal in a manner that simulates reversal of the motion used to lock the seal. The load shall be slowly applied until the seal forcibly opens or is otherwise broken.

The seal shall be classified based on the tensile force recorded at the time of failure of the seal based on the criteria set forth in Table 1.

Table 1 — Tensile test seal classification requirements

Load to failure kN[a]	**Seal classification**
10,0[b]	High security seal
2,27	Security seal
< 2,27	Indicative seal

a 1 J = 0,737 562 1 ft-lbf
1 N = 0,224 808 9 lbf
1 kg-f = 2,204 585 5 lbf
1 N·m = 0,737 562 1 ft-lbf

b A value of 7,5 kN is acceptable for those seals specifically designed to fail at a location that is plainly visible and precludes reassembly of the seal such that the failure would not be apparent.

4.2 SHEAR TEST

4.2.1 A shear test shall be conducted to test the ability of a seal to withstand cutting with shearing blades, as might be implemented with bolt cutters. The cutting blades used in the test fixture shall be sufficiently well aligned that seals are cut and not merely deformed as might occur with a thin, flexible seal and misaligned blades. The compressive load shall be applied slowly until the seal is severed.

4.2.2 The seal shall be classified based on the compressive load recorded at the time of failure of the seal based on the loads set forth in Table 2.

Table 2 — Shear test seal classification requirements

Load to failure kg-f[a]	**Seal classification**
341	High security seal
227	Security seal
< 227	Indicative seal

[a] 1 J = 0,737 562 1 ft-lbf
1 N = 0,224 808 9 lbf
1 kg-f = 2,204 585 5 lbf
1 N·m = 0,737 562 1 ft-lbf

4.3 BENDING TEST

4.3.1 The bending test is run to determine the resistance of a seal to failure under bending loads. How the test is run shall be based on the subclassification of the seal as either flexible or rigid. Flexible seals shall be tested for their ability to resist repeated bending loads without failure. Rigid seals shall be tested to determine their resistance to deformation by bending.

4.3.2 For flexible seals, fix the locking end and flex the material adjacent to this fixed end repeatedly through an arc of 180° until failure. Record the number of cycles through this 180° arch and base classification of the seal on the number of cycles shown in Table 3.

4.3.3 For single-shaft rigid seals, fix the locking end and then fit a tube or other suitable lever over the remaining portion of the seal. Apply a load on the lever so as to bend the seal 90°. Record the load required to bend the seal and the distance above the fixed end of the seal (the moment arm) that the load is applied. Base classification of the seal on the maximum bending moment recorded and that shown in Table 3.

4.3.4 For rigid seals with two shafts such as in a padlock, fix the locking end and then fit a bar or rod through the opening between the two shafts. Rotate the rod or bar until it is in contact with both shafts. Continue to rotate the bar in the same direction an additional 90°. Record the torsional force needed to achieve the 90° rotation or to cause failure of the locking mechanism if that occurs prior to achieving the 90° rotation. Base classification of the seal on the maximum bending moment recorded and that shown in Table 3.

Table 3 — Bending test seal classification requirements

Cycles to failure (flexible seals)	**Bending moment to failure** (rigid seals) N·m[a]	**Seal classification**
501	50	High security seal
251	22	Security seal
< 251	< 22	Indicative seal
[a] 1 N·m = 0,737 562 1 ft-lbf		

4.4 IMPACT TEST

4.4.1 The impact test shall be run to determine the resistance of the seal to an impact load at 18 °C and – 27 °C. The test fixture shall be devised so the impact load is applied at the locking mechanism of the seal in the direction opposite the direction used in locking the seal. The impact load shall be applied five times at a load equivalent to 13,56 J. Subsequent impact test sequences shall be run at a load that is 13,56 J higher than the previous five impact loads. Impacts shall be run until the seal fails or successfully withstands five impacts at 40,68 J. A second seal shall be tested at the second temperature.

4.4.2 If the seal fails prior to completion of the five impact cycles, it shall be classed based on the next lower set of values. The value at which the seal fails shall be recorded and used to determine the seal's classification. The values set forth in Table 4 shall be the basis for this determination.

Table 4 — Impact test seal classification requirements

Low temperature impact load J[a]	**High temperature impact load** J[a]	**Seal classification**
40,68	40,68	High security seal
27,12	27,12	Security seal
< 27,12	< 27,12	Indicative seal

[a] 1 J = 0,737 562 1 ft-lbf
1 N = 0,224 808 9 lbf
1 kg-f = 2,204 585 5 lbf
1 N·m = 0,737 562 1 ft-lbf