TECHNICAL REPORT

ISO/TR 15069

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1997-12-15

Series 1 freight containers — Handling and securing — Rationale for ISO 3874 Annex A

Conteneurs de la série 1 — Manutention et fixation — Complément à l'annexe A de l'ISO 3874

Foreword

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The main task of ISO technical committees is to prepare International Standards. In exceptional circumstances a technical committee or subcommittee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee or subcommitted data of a different kind from that which is normally published as an International Standard ("state-of-the-art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 15069, which is a Technical Report of type 3, was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 1, *General purpose containers*.

Annex A of this Technical Report is for information only.

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Introduction

The methods of handling and securing series 1 freight containers built and tested to comply with the latest editions of the ISO 1496 series are specified in ISO 3874. ISO 3874 also defines basic principles and procedures to ensure safe operation of containers in all modes of surface transport.

This document is published in the form of a Technical Report because it is intended to provide a concise background to the requirements specified in ISO 3874:–, Annex A.

Series 1 freight containers — Handling and securing — Rationale for ISO 3874 Annex A

1 Scope

This Technical Report gives the background to the requirements specified in ISO 3874:–, Annex A.

2 Normative references

The following standards contain provisions which, through reference in this text, consitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All International Standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 668:1995, *Series 1 freight containers — Classification, dimensions and ratings.*

ISO 830:—[1], *Freight containers — Vocabulary.*

ISO 1161:1984, *Series 1 freight containers — Corner fittings — Specification.*

ISO 1496-1:1990, *Series 1 freight containers — Specification and testing — Part 1: General cargo containers for general purpose.*

ISO 1496-2:1996, *Series 1 freight containers — Specification and testing — Part 2: Thermal containers.*

ISO 1496-3:1995, *Series 1 freight containers — Specification and testing — Part 3: Tank containers for liquids, gases and pressurized dry bulk.*

ISO 1496-4:1991, *Series 1 freight containers — Specification and testing — Part 4: Non-pressurized containers for dry bulk.*

ISO 1496-5:1991, *Series 1 freight containers — Specification and testing — Part 5: Platform and platform- based containers.*

ISO 3874:—[2], *Series 1 freight containers — Handling and securing.*

BS 5273:1985, *Specification for lifting twistlocks.*

SIS 842105:1972, *Containers — Engaging members.*

JIS Z 1617:1979, *Standard for lifting twistlocks.*

1) To be published. (Revision of ISO 830:1981)
2) To be published. (Revision of ISO 3874:1988)

3 Definitions

For the purpose of this Technical Report, the definitions in ISO 830 and ISO 3874 apply.

4 Twistlocks

4.1 Types of twistlock

4.1.1 **Semi-automatic twistlocks** (sometimes referred to as automatic twistlocks)

A semi-automatic twistlock is a twistlock that locks automatically when containers are loaded in a stack, but needs a manual operation to be fitted to either top or bottom corner fitting of a container before stacking. A manual operation is also needed when unlocking semi-automatic twistlocks.

4.1.2 Dual purpose twistlock

Twistlock which can be fitted either under a container connected to a lifting equipment or on top of a container in a container stack. Dual purpose twistlocks are often designated as dual function in the literature.

4.1.3 Manual twistlock (double-lock, two positions)

These twistlocks are regarded as an old type of equipment which gives an unsafe practice.

A manual twistlock with double lock, two positions, consists of:

- a top cone with an eyehole and a bottom cone rigidly connected together by a shaft;
- an intermediate plate with collars;
- a handle with a tail pointing upwards attached to the shaft;
- the handle travels in the horizontal plane and is limited by two end stops, fully closed or fully open, see figure 1.

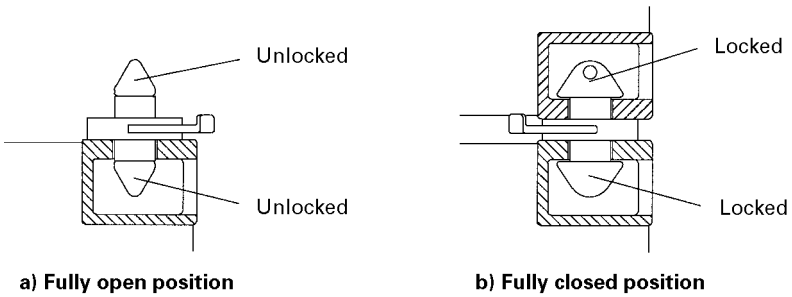

Figure 1 — Manual twistlock, with double-locks, two positions

4.2 Dimensions

4.2.1 Top and bottom cones

The top and bottom cones shall be designed so that the load-carrying area, in a fully locked position, in an ISO 1161 corner fitting, is larger than 800 mm^2.

The load-carrying area 800 mm^2 is taken from ISO 1161, minimum bearing area, BS 5237 and SIS 842105.

JIS Z 1617, has no requirement on load-carrying area, but the twistlock itself has the same dimensions as those given in ISO 1161, BS 5237 and SIS 842105.

4.2.2 Intermediate plate

The thickness of the intermediate plate 30 mm is taken from measurements made on 47 different twistlocks where most of them had a thickness of 28 mm to 29 mm.

The compression load-carrying area (flange surface-bearing area) of the intermediate plate is specified to be at least 4500 mm^2 and the twistlocks are to be designed so that they have the maximum load transfer area towards the walls of the corner fittings. The reason for this value was that compression tests on both top and bottom corner fittings were carried out with twistlocks, with a load-carrying area of 4300 mm^2, up to a load of 840 kN without any significant deformation of the corner fittngs and only very few twistlocks of those who have been measured had areas smaller than 4500 mm^2.

4.2.3 Handle

The length of the handle measured from the centre line of the locks to the end is specified to be 170^{0}_{-5} mm.

The maximum value is derived from the distance between two 6 m (20 ft) containers placed in a 12 m (40 ft) container area. The minimum value is derived from the dimensions of a corner fitting. It should be observed that “Russian stowage” is not acceptable according to ISO 3874.

4.2.4 Collar

The collars are to fit into the top and bottom corner fitting apertures as in ISO 1161. The dimensions and tolerances were chosen in order to get a small play and still not have problems during operation. This has been done in order to take into consideration the dimensional tolerances of the corner fitting location as described in ISO 668.

4.2.5 Distance between top and bottom lock

The distance between top and bottom locks is specified to be the actual thickness of the intermediate plate plus two times (33 ± 1) mm.

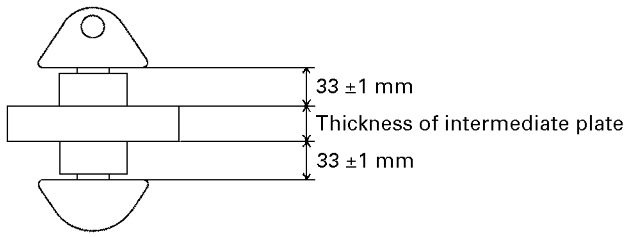

Figure 2 — Distance between top and bottom locks

As the intermediate plate can have a dimension between 25 mm and 30 mm, the distance between the locks (cones) must vary with this thickness if the play in the corner fittings of stacked containers shall remain the same.

4.3 Strength requirements

4.3.1 Tensile strength

The twistlocks shall withstand a tensile force of 150 kN. An earlier value of 350 kN has been judged too high considering the required strength of the corner fittings according to ISO 1161, which have to be tested to the value 150 kN (taken from ISO 1161 and the ISO 1496 series). Tensile tests show anyhow that the corner fittings are much stronger than this. Tests on twistlocks have been conducted with standard corner fittings up to 578 kN and the corner fittings have only been slightly deformed on the inside. The external dimensions of the corner fittings have not been affected very much.

Consideration have been given to the fact that a damaged corner fitting normally leads to scrapping of containers and that it therefore is better if the twistlock breaks before the corner fitting.

The classification societies have higher requirements for breaking strength:

American Bureau (ABS), 335 kN
Bureau Veritas (BV), 400 kN
Det Norske Veritas (DnV), 400 kN
Germanische Lloyd (GL), 500 kN
Lloyds Register of Shipping (LR) 400 kN.

4.3.2 Compression strength

The twistlocks are intended to withstand a compression force of 850 kN without any permanent deformation and the function of the twistlock must not be affected by the test. The value is derived from the requirements in the ISO 1496 series stacking test.

The United Kingdom has proposed a compression test with the top cone housed in a bottom corner fitting and the load applied directly on the top cone to simulate misalignment. Undoubtedly, this occurs often in real life and the twistlock must withstand those compression forces. The classification societies have no requirements for compression strength.

4.3.3 Shear strength

The collars of the twistlocks are designed to withstand a shearing force of 300 kN longitudinally and 150 kN transversely.

During transport at sea the longitudinal accelerations are low, but when a container is loaded on a railway wagon or a truck the longitudinal accelerations are considerably higher. According to ISO 3874 they may reach 2*g* in railway traffic. In CEN standardization work they are set to 1*g* under the premise that hump shunting is forbidden.

Transversely, transport at sea gives the highest accelerations 0,6*g* to 0,7*g*, rail and road give only 0,3*g* to 0,5*g*.

Account was also taken of the fact that normally only two of the four corner fittings take up the force when a container is submitted to racking.

The classification societies have higher requirements for shearing strength in all directions:

American Bureau (ABS), 250 kN
Bureau Veritas (BV), 300 kN
Det Norske Veritas (DnV),300 kN
Germanische Lloyd (GL),420 kN
Lloyds Register of Shipping (LR) 300 kN.