TECHNICAL REPORT

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Second edition
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Series 1 freight containers — Handling and securing — Rationale for ISO 3874:2017, Annexes A to E

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

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Contents

Page

Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 1, *General purpose containers*.

This second edition cancels and replaces the first edition (ISO/TR 15069:1997), which has been technically revised. The main changes compared to the previous edition are as follows:

— old subclause 4.1 has been removed, as definitions are contained in ISO 3874;

— the header of subclause 4.2 has been amended to the more specific “Dimensions for manual and semi-automatic twistlocks”;

— new sub-clauses 4.3, 4.4.1 and 4.4.2 have been added.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The methods of handling and securing series 1 freight containers built and tested in accordance with the latest editions of the ISO 1496 series are specified in ISO 3874.

This document is published in the form of a Technical Report with the intention of providing the technical and operational background to the requirements specified in ISO 3874:2017, Annexes A to E.

Dimensions, tolerances and strength requirements noted in ISO 3874 and this document were validated against the approved Container Securing Manual for the largest vessels afloat at the time namely the Maersk Line "Triple E" class.

Noting that ISO 17905:2015 was published early in the period of revision, it was decided, in order to avoid conflicting data, to adopt the strength requirements therein directly in this version of ISO 3874. Items not in common use were removed from the tables before inclusion in ISO 3874.

Series 1 freight containers — Handling and securing — Rationale for ISO 3874:2017, Annexes A to E

1 Scope

This document gives the background to the requirements specified in ISO 3874:2017, Annexes A to E.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 830, *Freight containers — Vocabulary*

ISO 3874:2017, *Series 1 freight containers — Handling and securing*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 830 and ISO 3874:2017 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Twistlocks

4.1 General

New definitions were introduced in ISO 3874:2017 based on the terms commonly used by the manufacturer's representatives in the expert working group to describe the products currently on the market: Fully automatic twistlocks (FAT), Automatic Container Locks (AL) and Midlocks.

All types of lock as defined in ISO 3874 are referred to by the more general term "twistlock" in this document.

4.2 Dimensions for manual and semi-automatic twistlocks

4.2.1 Top and bottom cones

The top and bottom cones have been 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 3874, BS 5237 and SIS 842105.

4.2.2 Intermediate plate

The thickness of the intermediate plate has varied between 25 mm and 30 mm in previous editions but now settled at a universal value of 28 mm. In the 2017 edition, it has been recognized that thinner intermediate plates have been approved and are in use with the provison that all intermediate plates on the same vessel are the same thickness.

The compression load-carrying area (flange surface-bearing area) of the intermediate plate was previously specified to be at least 4 500 mm^2. This requirement has been removed from the 2017 edition since there are many different designs approved and in common use that have smaller flange surface-bearing areas.

4.2.3 Handle

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

4.2.4 Collar

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

The length of the collar is specified at 117 mm whereas calculating the required dimension according to the tolerances specified in ISO 668 can indicate a required dimension of 114 mm. This pertains to stacking cones only and the argument for the smaller dimension has validity for 40 ft. containers. However, cones are not generally used on 40 ft. containers (with some known exceptions). Thus, 117 mm has been determined as a critical dimension for the collar when used for 20 ft. containers because of the cumulative effect, for example, in a 9 high stack, which can allow the top tiers of containers to move longitudinally.

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 to ensure free rotation of the cones when inserted into an ISO 1161 corner fitting top or bottom aperture.

4.3 Dimensions for automatic locks — All types

4.3.1 Top cone and bottom cone

No bearing area has been specified in the 2017 edition for automatic twistlocks because of the different principle of operation and subsequent design. This is because the forces transferred between corner fittings on containers stacked on vessels have been calculated to be less than those required previously for twistlocks, which can have been utilized for lifting in addition to securing. Note that all automatic locks act as a system rather than individually. A new test requirement has been included to prove the function of automatic locks as a system.

4.3.2 Locating and shear load structure

The requirement for all automatic locks to have a structure to deal with transverse shear loads has been included as not all automatic locks have a conventional collar design. It was agreed that longitudinal shear forces were not significant and that transverse shear forces need to be countered in the lock design.

4.4 Strength requirements

4.4.1 Strength requirements for manual and semi-automatic twistlocks

4.4.1.1 Tensile strength

An earlier value of 350 kN was judged as too high considering the required strength of the corner fittings according to ISO 1161 and, thus, the value was set at 150 kN.

Values for tensile strength have been included in the 2017 edition as published in ISO 17905:2015 in order to avoid conflict.

4.4.1.2 Compression strength of intermediate plates

Twistlock intermediate plates were required previously to withstand a compression force of 850 kN without any permanent deformation and the function of the twistlock not being affected by the test. This has been increased to 1 000 kN in the 2017 edition although it should be noted that manufacturers routinely test beyond this.

The United Kingdom previously 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. A second compression test has been included in the 2017 edition to simulate this with a force of 150 kN.

4.4.1.3 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 2g in railway traffic. In CEN standardization work, they are set to 1g under the premise that hump shunting is forbidden.

Transport at sea gives the highest transverse accelerations 0,6g to 0,8g. Rail and road give only 0,3g to 0,5g. Account was also taken of the fact that normally only two of the four corner fittings take up the force when a container is subjected to racking.

4.4.2 Strength requirements for automatic twistlocks and container locks

4.4.2.1 Tensile strength

Values for tensile strength have been included in the 2017 edition as published in ISO 17905:2015 in order to avoid conflict.

4.4.2.2 Compression strength

4.4.2.2.1 Compression strength of intermediate plate

The intermediate plate of the lock, if so fitted, should withstand a compression force of 1 000 kN without any permanent deformation or other abnormalities which would render it unsuitable for use.

4.4.2.2.2 Compression strength of cones

The cones of the locks are expected to withstand a compression force of 150 kN without any permanent deformation or other abnormalities which would render the lock unsuitable for use.