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Sixth edition
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Series 1 freight containers — Handling and securing

Conteneurs de la série 1 — Manutention et fixation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 on 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 the following URL: www.iso.org/iso/foreword.html.

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

This sixth edition cancels and replaces the fifth edition (ISO 3874:1997), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the terminology has been aligned to match those that are used in the CTU Code and the “load distribution” guidance figure has been removed in Clause 4;

— Clause 9 and the associated figures have been updated to reflect the current practice and equipment used;

— Annex A has been updated to include securing devices in the current common usage including, fully automatic twistlocks, midlocks, multi-purpose twistlocks, and automatic container locks;

— the dimensions for all locks have been reviewed and revised, where appropriate, to reflect current practice;

— the dimensions for locks not previously included have been added;

— the strength requirement for all locks has been reviewed and revised to reflect current practice and maximum vessel sizes;

— the test requirements have been reviewed and revised as above to match ISO 17905 and class requirements;

— the old Annex B has been removed, reflecting lack of common usage;

— Annex C, now Annex B, has been updated, as well as strength and test requirements, to reflect the current practice and equipment used;

— Annex D, now Annex C, has been updated, as well as strength and test requirements, to reflect the current practice and equipment used;

— Annex D types and requirements have been added in accordance with ISO 17905;

— Annex E has been added in accordance with ISO 17905;

— ISO 1161:1984, Annex C, included as Annex F, has been updated to include ISO 1161:1984/Amd. 1:2007 45 ft containers.

It also incorporates the Amendments ISO 3874:1997/Amd. 1:2000, ISO 3874:1997/Amd. 2:2002, ISO 3874:1997/Amd. 3:2005 and ISO 3874:1997/Amd. 4:2007.

Series 1 freight containers — Handling and securing

1 Scope

This document specifies the methods of handling and securing series 1 freight containers built and tested to comply with ISO 1496 (all parts).

Methods of handling and securing are described for both loaded and empty containers. The conditions for lifting different types of loaded and empty containers are laid down in Clause 6.

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 668, *Series 1 freight containers — Classification, dimensions and ratings*

ISO 830, *Freight containers — Vocabulary*

ISO 1496 (all parts), *Series 1 freight containers — Specification and testing*

ISO 1161, *Series 1 freight containers — Corner and intermediate fittings — Specification*

IMO/ILO/UNECE *Code of Practice for Packing of Cargo Transport Units*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 830 and the following 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 http://www.electropedia.org/

3.1 General

3.1.1
empty container
container in the tare condition

3.1.2
packed container
container in a condition other than the tare condition

3.1.3
asymmetry of the centre of gravity
longitudinal and/or lateral horizontal differences between the centre of gravity of any container [*empty* (3.1.1) or *packed* (3.1.2), with or without fittings and appliances] and the geometric centre of the diagonals of the centres of the four bottom corner fittings

3.1.4
mobile centre of gravity
centre of gravity of a container packed with liquid, bulk, hanging or similar cargo which is liable to move under dynamic conditions

3.1.5
securing device
device used to secure containers

Note 1 to entry: Securing devices can be divided into three types, namely securing fittings, lashing fittings and buttress fittings, each type divided into fixed fittings and portable fittings and defined as follows:

— **portable fittings** — securing devices not welded to the hull;

— **fixed fittings** — securing devices welded to the hull;

— **securing fittings** — securing devices used between the containers and between the container and the deck, hatch cover as well as bilge, to prevent the container from longitudinal, traverse and vertical movements relative to the hull during the transportation,

— **lashing fittings** — securing devices used to lash the container on the hatch cover, deck or lashing bridge,

— **buttress fittings** — securing devices used to eliminate the clearance between the container and the longitudinal bulkhead and transfer the transverse force to the longitudinal bulkhead.

3.2 Twist locks

3.2.1
collar
part of a twistlock which fits into the top or bottom apertures of a corner fitting and restrains connected containers from horizontal movements

3.2.2
cone
part of a twistlock that fits into the top or bottom aperture of a corner fitting or a securing socket and restrains connected containers from vertical movements

3.2.3
eyehole
(if so fitted) hole in a cone to identify the orientation of the twistlock according to the manufacturer's specifications

Note 1 to entry: Some manufacturers use "lightening holes", which should not be confused with eyeholes

3.2.4
handle tail
(if so fitted) bent up part of the handle to identify the orientation of the twistlock in a stack of containers

3.2.5
fixed base
rigid part of a *collar* (3.2.1) which allows the manual pre-locking of the bottom part of a twistlock

3.2.6
triggering device
manually operated device which sets a twistlock

3.2.7
intermediate plate
part of a twistlock that carries the compression force between stacked containers

3.2.8
single twistlock
twistlock fitted with either top *cone* (3.2.2) or bottom cone and the function is achieved by the cone twisting

3.2.9
double twistlock
twistlock fitted with both top *cone* (3.2.2) and bottom cone and the function is achieved by both cones twisting

3.2.10
single lock
locking function of a twistlock in either the top *cone* (3.2.2) or bottom cone, where the cone does not twist

3.2.11
double lock
locking function of a twistlock in both the top *cone* (3.2.2) and bottom cone, where neither cone twists

3.2.12
single-function twistlock
twistlock of asymmetrical design complying with the standard orientation

Note 1 to entry: It can be used only in one of the two following alternatives:

— in the top corner fitting of the container on which another container will be stacked (alternative A);

— in the bottom corner fitting of a container which is going to be stacked on top of another container (alternative B).

3.2.13
dual-function twistlock
twistlock that, having the same orientation, can be pre-locked either in a top corner fitting or in a bottom corner fitting

3.2.14
single purpose twistlock
twistlock that is only used for locking

3.2.15
multi-purpose twistlock
twistlock that fulfils the function of a twistlock and have additional functionality which can include lifting capability

3.2.16
multi-purpose automatic twistlock
MAT
twistlock that fulfils the function of a *FAT* (3.2.20) and will have additional functionality which can include lifting capability

3.2.17
midlock
locking device that does not require any locking or unlocking operation when containers are loaded or discharged

Note 1 to entry: Midlocks are used in conjunction with *semi-automatic twistlocks* (3.2.19) as long as they are compatible: One end of container is fitted with midlocks whilst the other end has semi-automatic twistlocks.

Note 2 to entry: A midlock opens only when the container is lifted and the semi-automatic twistlocks at the other end of the container are free to open.

Note 3 to entry: Midlocks are typically used in the middle position for 20 ft containers stowed in a 40 ft bay.

3.2.18
manual twistlock
twistlock that requires manual locking and unlocking

3.2.19
semi-automatic twistlock
SAT
twistlock that locks automatically and requires manual unlocking

3.2.20
fully automatic twistlock
FAT
twistlock that locks and unlocks automatically

3.2.21
automatic container lock
automatic twistlock that has no rotating parts

3.3 Stacking fittings

3.3.1
cone
part of a stacking fitting which fits into the top or bottom aperture of a corner fitting or a securing socket and restrains connected containers from horizontal movements

3.3.2
intermediate plate
part of a stacking fitting that is subject to the compression force between stacked containers and holds the *cones* (3.3.1) in place

3.3.3
single stacking cone
stacking fitting fitted with one top *cone* (3.3.1) and one bottom cone

3.3.4
double stacking cones
stacking fitting fitted with two top *cones* (3.3.1) and two bottom cones

Note 1 to entry: Only for underdeck use.

3.3.5
flangeless hanging stackers
stacking fittings for use in hold cell guides for 20 ft containers in mixed stowage

Note 1 to entry: These are placed between 20 ft containers and between 20 ft with 40 ft on top, one per container end.

3.3.6
flanged hanging stackers
hanging stacker fitted with a flange

Note 1 to entry: This means that 4 pieces per container shall be used (see B.2.3).

3.4 Lashing rods

3.4.1
lashing rod
rod with a top which fits into a corner fitting and a bottom part which fits into a *tensioning device* (3.4.4)

Note 1 to entry: An example of a tensioning device is a turnbuckle.

Note 2 to entry: Lashing rods may be used for internal or external lashing systems and are not interchangeable between systems. See Figure C.1.

3.4.2
plug hook
fixed part of a *lashing rod* (3.4.1) which fits into a corner fitting

Note 1 to entry: See Figure C.3.

3.4.3
hinge hook
articulated part of a *lashing rod* (3.4.1) which fits into a corner fitting

Note 1 to entry: See Figure C.2.

3.4.4
tensioning device
device in which one end fits into the bottom part of a *lashing rod* (3.4.1) and the other end fits onto the means of transport

EXAMPLE Into a pad eye.

Note 1 to entry: See Figure C.4.

4 Basic requirements

4.1 General

4.1.1 Users of this document should use caution regarding conditions which may place loads on the containers or on the handling or securing devices. These include deterioration of the container or devices, loosening and over-tightening of devices, slackness of cargo within containers, eccentric loading and excessive environmental conditions such as high wind, ice, wave action, etc.

NOTE Slackness is a general term which includes shifting of cartons, shifting and settlement of bulk cargoes, liquids having a free surface, etc.

4.1.2 The container and any equipment which may be used in its operation shall be adequately maintained.

4.1.3 Doors, lids, closures, removable or foldable parts and any loose or portable equipment shall be properly secured.

4.1.4 All personnel engaged in handling and securing operations shall have received proper instructions, especially with regard to safety matters.

4.1.5 It is necessary to know whether the container is empty or packed; unless otherwise ascertained, a container shall be treated as packed.

4.1.6 Strong winds and other environmental conditions can have an effect on handling equipment and additional care shall be taken when operating in such conditions.

4.2 Packing and emptying

4.2.1 When a cargo is packed and secured where necessary, this shall be carried out in accordance with good and recommended practices so that the cargo does not impose on the container forces in excess of those for which it has been designed and so that the fundamental requirements specified in 4.2.2 to 4.2.4 are complied with.

4.2.2 The equipment used for packing and emptying the container shall only impose loads which are not in excess of those for which the container was designed.

4.2.3 The total mass of all items packed into the container, including dunnage, securing equipment and similar equipment, shall not exceed the maximum permitted payload, i.e. the maximum permissible operating gross mass minus the tare.

4.2.4 The cargo shall be distributed throughout the container to ensure that the centre of gravity is kept as central and as low as possible

— to avoid excessive tilting,

— to avoid overstressing either the container or the handling equipment,

— to avoid unacceptable vehicle axle loading,

— to avoid lack of vehicle stability, and

— to avoid unacceptable load concentrations.

Asymmetry of the centre of gravity for the packed container varies with the distribution of load within the container; designers of containers and handling equipment should take this fact into account (see 4.3).

4.3 Stowage and securing of cargo

The cargo shall be packed and secured in accordance with the guidance given in the IMO/ILO/UNECE Code of Practice for Packing of Cargo Transport Units.

NOTE For CTU Code, see Clause 2.

5 Handling

5.1 Handling by specified lifting methods (see Clause 6)

5.1.1 Care shall be taken to ensure that the equipment used is suitable for the load and is safely attached to the container and that the container is free to be handled.

5.1.2 In the case of a single-point lift, special attention should be paid to the risk of the container tilting owing to asymmetry of the centre of gravity.

5.1.3 Care shall be taken when lifting a container whose centre of gravity is mobile or asymmetric, e.g. a tank container, a bulk container, a container with a liquid bulk bag, a container with hanging cargo or a thermal container with a refrigerating unit.

5.2 Handling by unspecified lifting methods

Containers may be handled by methods other than those specified in Clause 6 but only after careful evaluation of the equipment by means of which the container is to be handled and of the methods of operation envisaged, with respect to international container standards.

6 Specified lifting methods

6.1 General

6.1.1 The lifting methods specified in 6.2 to 6.10 are summarized in Table 1.

6.1.2 The headings "Allowed" and "Not allowed" used in Tables 3 to 5 and Tables 7 to 12 refer to the specified lifting methods applied to differing types and sizes of containers and take into account the stresses on containers of differing types of design, their loads, where applicable, and the safety of the operation. There could be exceptions in cases when combinations of container types, sizes, loads, designs and operating conditions could not be taken into account in Tables 3 to 5 and Tables 7 to 12. Such situations should be carefully evaluated by those competent to do so in order to decide whether a safe and satisfactory operation can be ensured. An explanation of the size designations referred to in Tables 3 to 12 is given in Table 2.

Table 1 — Summary of specified lifting methods

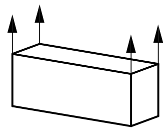
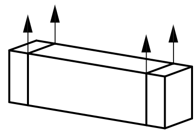
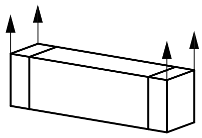
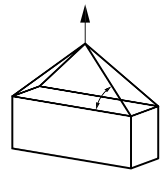
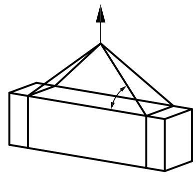
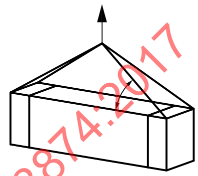
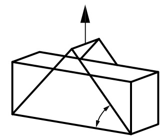
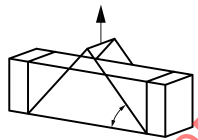
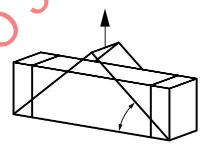
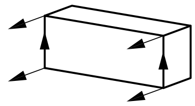
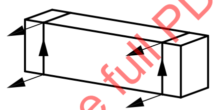
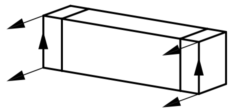
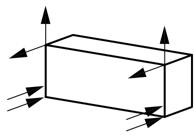
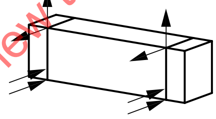
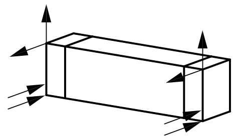
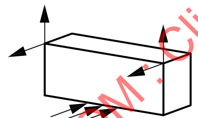
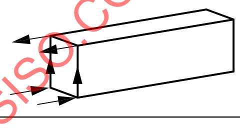
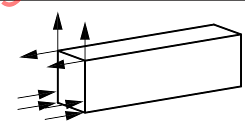
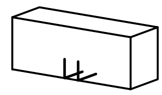
Subclause	Description	Container types A, B, C and D	Container type E at 40 ft position	Container type E at 45 ft position
6.2	Top lift spreader			
6.3	Top lift sling			
6.4	Bottom lift sling			
6.5	Side lift: Method 1			
6.6	Side lift: Method 2			
6.7	Side lift: Method 3		Not applicable to type E (45 ft) containers	Not applicable to type E (45 ft) containers
6.8	End lift: Method 1		Not applicable to type E (45 ft) containers	Not applicable to type E (45 ft) containers
6.9	End lift: Method 2		Not applicable to type E (45 ft) containers	Not applicable to type E (45 ft) containers
6.10	Fork-lift		Not applicable to type E (45 ft) containers	Not applicable to type E (45 ft) containers

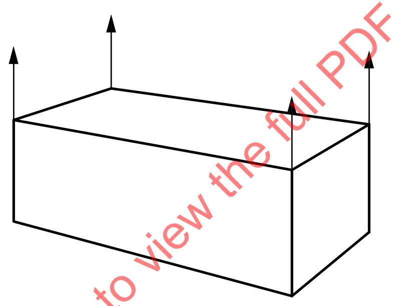
Table 2 — Size designations referred to in Tables 3 to 12

Nominal length		External height			
m	Ft	<2 438 mm (8 ft, 0 in)	2 438 mm (8 ft, 0 in)	2 591 mm (8 ft, 6 in)	2 896 mm (9 ft, 6 in)
13 716	45	—	—	1EE	1EEE
12	40	1AX	1A	1AA	1AAA
9	30	1BX	1B	1BB	1BBB
6	20	1CX	1C	1CC	—
3	10	1DX	1D	—	—

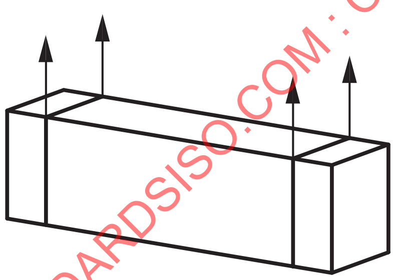
NOTE All units have a nominal width of 2 438 mm (8 ft 0 in).

6.2 Top lift spreaders

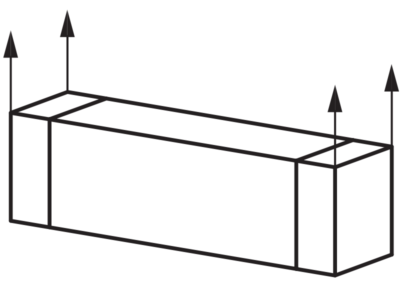
6.2.1 See Figure 1.



a) Lifting containers other than type E



b) Lifting type E containers — 40 ft position



c) Lifting type E containers — 45 ft position

Figure 1 — Lifting by means of a top lift spreader

6.2.2 The container is lifted by means of a spreader designed to lift containers by the top apertures of the four top corner fittings, the lifting forces being applied vertically.

6.2.3 Lifting devices shall be properly engaged. Gathering devices should only impinge on corner fittings and corner posts.

6.2.4 The applicability of top lift spreaders is given in Table 3.

6.2.5 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

6.2.6 The vertical tandem coupling of containers that are specifically designed as in 6.2.5 for lifting purposes, using twistlocks or other loose gear, is acceptable if forces of not greater than 75 kN act vertically through each corner fitting, and the twistlocks or other loose gear are certified for lifting. Twistlocks or other loose gear shall be periodically examined.

NOTE 1 The value of 75 kN prescribes the minimum structural capability of the lock/corner fitting combination. The 75 kN value includes an arbitrary constant wind load of 26 kN (corresponding wind speed of 100 km/h), regardless of the size of the containers. As an example, the balance of the 75 kN value equates to two 1 AAA containers with a combined tare of 22 kN and a maximum payload of 27 kN. A practical upper limit of three vertically-coupled containers is also envisaged.

NOTE 2 The certification process envisaged is to use a safety factor of at least four based on the ultimate tensile strength of the material.

Table 3 — Applicability of top lift spreaders

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU															
															Thermal		RE, RT, RS															
															Tank for liquids and gases		TN, RT, TG															
															Bulk: non-pressurized/hopper pressurized		BK															
															Platform		PL						a				a			a		a
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

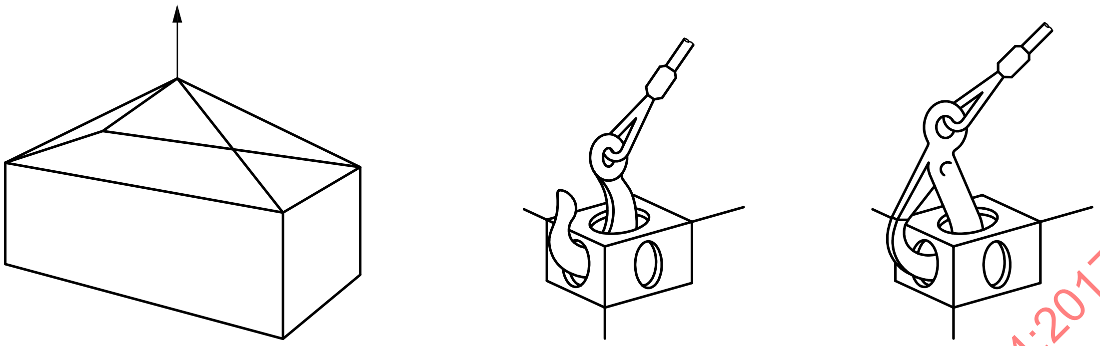
Allowed

Not allowed (or not applicable)

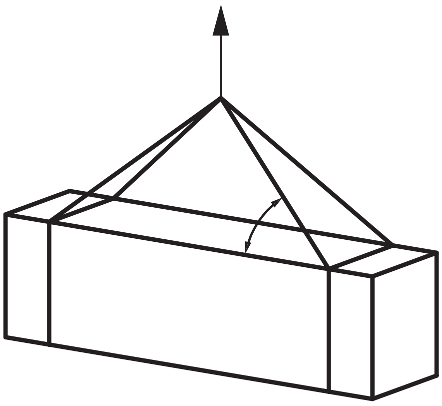
a Top lift possible with extensions only.

6.3 Top lift sling

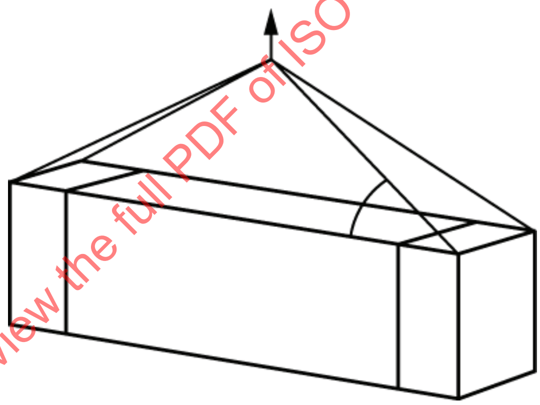
6.3.1 See Figure 2.



a) Lifting containers other than type E



b) Lifting type E containers — 40 ft position



c) Lifting type E containers — 45 ft position

Figure 2 — Lifting by means of a top lift sling

6.3.2 The container is lifted by all four top corner fittings with forces applied other than vertically.

6.3.3 Lifting devices shall be properly engaged. Hooks shall always be placed in an inward to outward direction.

6.3.4 The applicability of top lift slings is given in Table 4.

6.3.5 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

Table 4 — Applicability of top slings

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN														b	
															Open top		UT														b	b
															Bulk: non-pressurized/box		BU														b	b
a	a	a	a	a		a	a	a		a	a		a		Thermal		RE, RT, RS														b	
															Tank for liquids and gases		TN, RT, TG														b	b
															Bulk: non-pressurized/hopper pressurized		BK														b	b
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed

Not allowed (or not applicable)

a Centre of gravity can be eccentric.

b For 1D and 1DX containers, the lifting forces is applied at an angle not less than 60º to the horizontal (see Figure 3).

Centre of gravity can be mobile for liquid bulk or hanging goods cargoes.

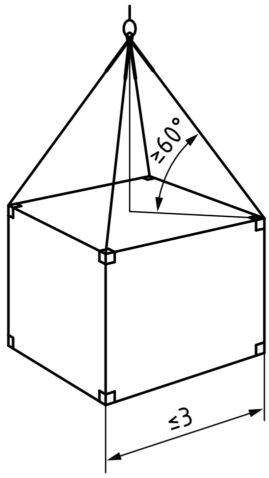


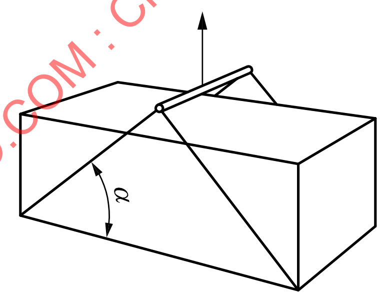
Figure 3 — Application of lifting forces (1D and 1DX containers)

6.4 Bottom lift sling

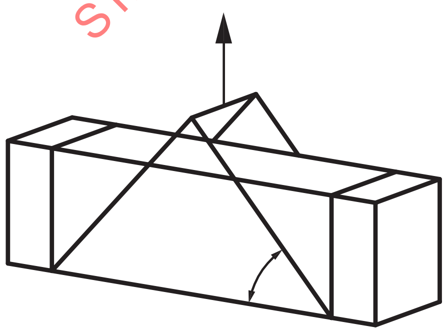
6.4.1 See Figure 4.

6.4.2 The container is lifted from side apertures of four bottom corner fittings by means of slings. The bottom sling attachment shall bear on the corner fittings only and should be such to exert lifting forces not more than 38 mm away from the outer face of the corner fittings (see Figure 5).

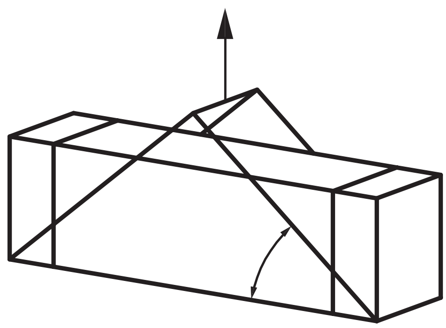
6.4.3 Lifting devices shall be properly engaged.



a) Lifting containers other than type E



b) Lifting type E containers — 40 ft position



c) Lifting type E containers — 45 ft position

Figure 4 — Lifting by means of a bottom lift sling

Dimensions in millimetres

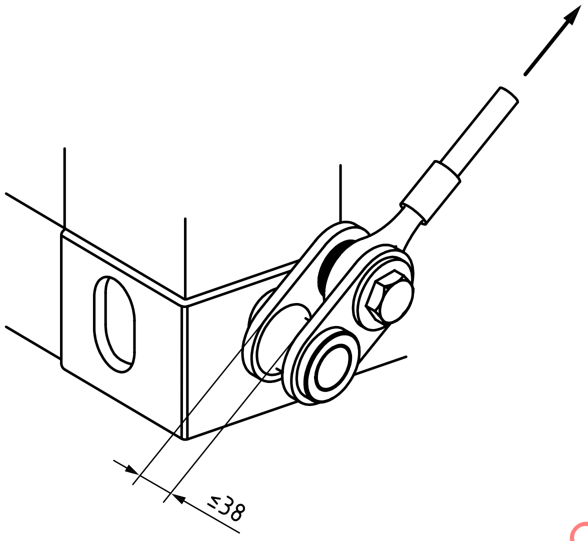


Figure 5 — Bottom sling attachment

6.4.4 The applicability of bottom lift slings is given in Table 5.

6.4.5 Folding platform-based containers (codes PL and PC; see ISO 6346), when empty and in the folded condition, may be handled in interlocked piles. The total mass of the pile shall not exceed the maximum gross mass (rating) according to ISO 668.

6.4.6 For loaded containers, the lifting angle, α, shown in Figure 4 a), shall not be less than the minimum values shown in Table 6.

Table 5 — Applicability of bottom lift slings

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
[a]	[a]	[a]	[a]	[a]		[a]	[a]	[a]		[a]	[a]		[a]		Thermal		RE, RT, RS	[a] [b]	[a] [b]	[a] [b]	[a] [b]	[a] [b]		[a] [b]	[a] [b]	[a] [b]		[a] [b]	[a] [b]		[a] [b]	
															Tank for liquids and gases		TN, RT, TG															
															Bulk: non-pressurized/hopper pressurized		BK															
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed

Not allowed (or not applicable)

[a] Centre of gravity may be eccentric.

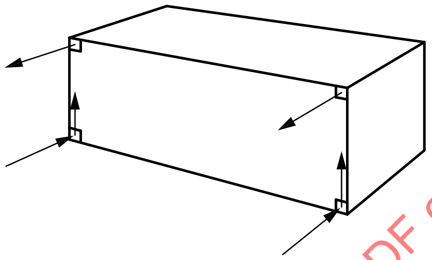
[b] Centre of gravity may be mobile, e.g. liquid, bulk or hanging load.

Table 6 — Lifting angles for loaded containers

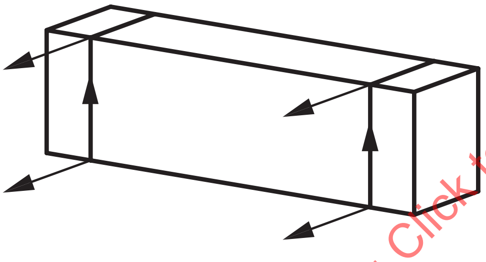
Container size designation	Lifting angle, α, min
1AAA ; 1AA ; 1A ; 1AX ; 1EEE ; 1EE	30°
1BBB; 1BB; 1B; 1BX	37°
1CC; 1C; 1CX	45°
1D; 1DX	60°

6.5 Side lift: Method 1

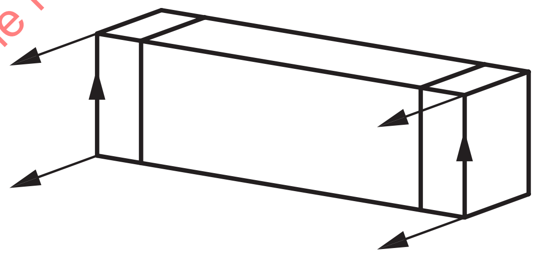
6.5.1 See Figure 6.



a) Lifting containers other than type E



b) Lifting type E containers — 40 ft position



c) Lifting type E containers — 45 ft position

Figure 6 — Lifting by means of a side lift (method 1)

6.5.2 The container is lifted by means of a side lift frame designed to lift a container by the two bottom corner fittings of one side and to restrain it by the two top corner fittings of the same side.

6.5.3 Lifting and restraining devices shall be properly engaged.

6.5.4 The applicability of side lift (method 1) is given in Table 7.

Table 7 — Applicability of side lift (method 1)

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU											b	b	b	b	b
a	a	a	a	a		a	a	a		a	a		a		Thermal		RE, RT, RS											b	b		b	
															Tank for liquids and gases		TN, RT, TG											b	b	b	b	b
															Bulk: non-pressurized/hopper pressurized		BK											b	b	b	b	b
															Platform		PL															
																Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
															Platform-based	Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed (white cell)

Not allowed (or not applicable) (shaded cell)

a Centre of gravity may be eccentric.

b Centre of gravity may be mobile, e.g. liquid, bulk or hanging load.

6.6 Side lift: Method 2

6.6.1 See Figure 7.

6.6.2 The container is lifted by means of a side lift frame designed to lift a container by the two top corner fittings of one side and to take the reaction forces on the bottom corner fittings of the same side or on suitable corner post areas above those corner fittings (see Figure 8).

6.6.3 Lifting devices shall be properly engaged.

6.6.4 The applicability of side lift (method 2) is given in Table 8.

Table 8 — Applicability of side lift (method 2)

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU											b	b	b	b	b
a	a	a	a	a		a	a	a		a	a		a		Thermal		RE, RT, RS											b	b		b	
															Tank for liquids and gases		TN, RT, TG											b	b	b	b	b
															Bulk: non-pressurized/hopper pressurized		BK											b	b	b	b	b
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

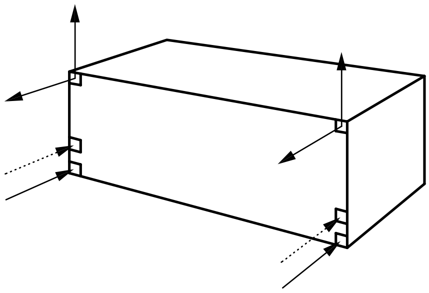
Allowed

Not allowed (or not applicable)

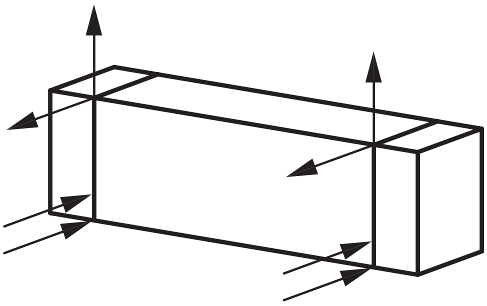
a Centre of gravity may be eccentric.

b Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

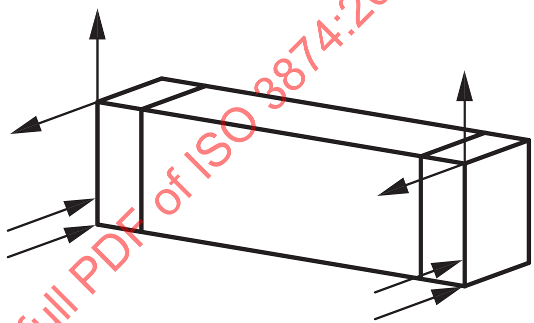
NOTE When using this method, care should be taken to ensure that under dynamic conditions the container is not subjected to undue deflection or damage.



a) Lifting containers other than type E



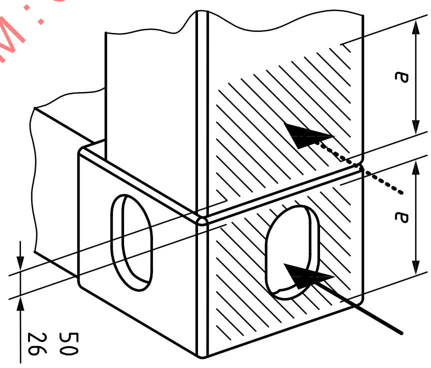
b) Lifting type E containers — 40 ft position



c) Lifting type E containers — 45 ft position

Figure 7 — Lifting by means of side lift (method 2)

Dimensions in millimetres



NOTE Dimension, *a*, is shown to indicate that the two bearing areas have similar or equal heights.

Figure 8 — Arrangement of bottom corner fittings and corner post areas

6.7 Side lift: Method 3

6.7.1 See Figure 9.

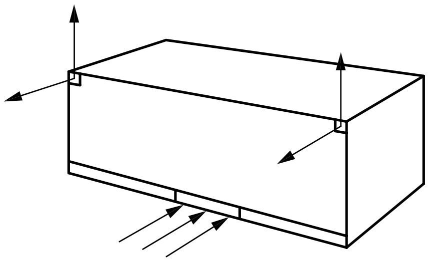


Figure 9 — Lifting by means of side lift (method 3)

6.7.2 The container is lifted by means of a side lift frame designed to lift a container by the two top corner fittings of one side and to take the reaction forces at the bottom side rail of the same side by means of a pad of sufficient size and located so as to prevent deformation and damage to the container.

Side Lift (method 3) is not allowed for EE and EEE containers.

WARNING 1 — Under no circumstances shall the bearing pad be applied to the underside of the container side panel.

WARNING 2 — Under no circumstances shall the lifting forces be applied to the underside of the bottom side rail.

6.7.3 Lifting devices shall be properly engaged.

6.7.4 The applicability of side lift (method 3) is given in Table 9.

Table 9 — Applicability of side lift (method 3)

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU															
		a	a	a		a	a	a		a	a		a		Thermal		RE, RT, RS															
															Tank for liquids and gases		TN, RT, TG															
															Bulk: non-pressurized/hopper pressurized		BK															
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed

Not allowed (or not applicable)

[a] Centre of gravity may be eccentric.

Side lift (method 3) is not allowed for EE and EEE containers.

NOTE The use of piggybackers has never been recognized by ISO and may cause damage due to excessive stresses to containers operated in such a way.

6.8 End lift: Method 1

6.8.1 See Figure 10.

6.8.2 The container is lifted by means of an end lift frame designed to lift a container by the two bottom corner fittings of one end and to restrain it by the two top corner fittings of the same end.

End lift (method 1) is not allowed for EE and EEE containers.

6.8.3 Lifting and restraining devices shall be properly engaged.

6.8.4 The applicability of end lift (method 1) is given in Table 10.

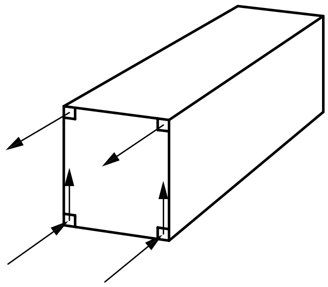


Figure 10 — Lifting by means of an end lift (method 1)

Table 10 — Applicability of end lift (method 1)

Container type		ISO 6346	Empty container															Loaded container														
			EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX	EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
General purpose		GP, VN	■	■	■	■	■	■	■	■	■	■	□	□	■	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Open top		UT	■	■	■	■	■	■	■	■	■	■	□	□	■	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bulk: non-pressurized/box		BU	■	■	■	■	■	■	■	■	■	■	□	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Thermal		RE, RT, RS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Tank for liquids and gases		TN, RT, TG	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bulk: non-pressurized/hopper pressurized		BK	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Platform		PL	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Platform-based	Complete and fixed ends	PF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Fixed free-standing posts	PF	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Complete and folding ends, erected condition	PC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Folding free-standing posts, erected condition	PC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Complete and folding ends, folded condition	PC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Folding free-standing posts, folded condition	PC	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Platform-based with complete superstructure and open-sided		PS	■	■	■	■	■	■	■	■	■	■	□	□	■	□	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

□ Allowed

■ Not allowed (or not applicable)

When using this method, consider that, under dynamic conditions, the container may be subject to undue deflection or damage.

6.9 End lift: Method 2

6.9.1 See Figure 11.

6.9.2 The container is lifted by means of an end lift frame designed to lift a container by the two top corner fittings of one end and to take the reaction forces on the bottom corner fittings of the same end or on suitable corner post areas above those corner fittings (see Figure 12).

End lift (method 2) is not allowed for EE sand EEE containers.

6.9.3 Lifting devices shall be properly engaged.

6.9.4 The applicability of end lift (method 2) is given in Table 11.

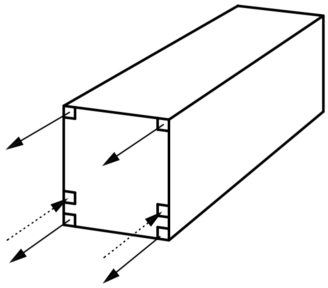
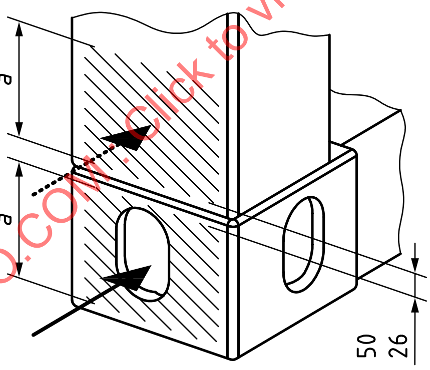


Figure 11 — Lifting by means of an end lift (method 2)

Dimensions in millimetres



NOTE Dimension a is shown to indicate that the two bearing areas have similar or equal heights.

Figure 12 — Arrangement of bottom corner fittings and corner post areas

Table 11 — Applicability of end lift (method 2)

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU															
															Thermal		RE, RT, RS															
															Tank for liquids and gases		TN, RT, TG															
															Bulk: non-pressurized/hopper pressurized		BK															
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed

Not allowed(or not applicable)

When using this method consider that, under dynamic conditions, the container may be subject to undue deflection and consequent damage.

6.10 Fork lifts

6.10.1 See Figure 13.

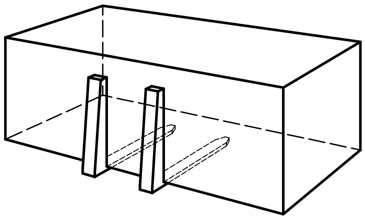


Figure 13 — Lifting by means of forks

6.10.2 The container, if provided with fork-lift pockets as specified in ISO 1496-1, is lifted by means of forks.

WARNING — Under no circumstances shall containers with or without fork-lift pockets be lifted by forks under the base.

6.10.3 Forks should ideally extend the whole width of the container, but under no circumstances should they extend less than 1 825 mm into the fork-lift pockets.

WARNING — When 1CC, 1C and 1CX containers are fitted with a second (inner) set of fork-lift pockets, these pockets shall be used for empty handling only.

6.10.4 The applicability of fork lifts is given in Table 12.

Table 12 — Applicability of fork lifts

Empty container															Container type		ISO 6346	Loaded container														
EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX				EEE	EE	AAA	AA	A	AX	BBB	BB	B	BX	CC	C	CX	D	DX
															General purpose		GP, VN															
															Open top		UT															
															Bulk: non-pressurized/box		BU											b	b	b	b	b
										a	a		a		Thermal		RE, RT, RS											b	b		b	
															Tank for liquids and gases		TN, RT, TG															
															Bulk: non-pressurized/hopper pressurized		BK															
															Platform		PL															
															Platform-based	Complete and fixed ends	PF															
																Fixed free-standing posts	PF															
																Complete and folding ends, erected condition	PC															
																Folding free-standing posts, erected condition	PC															
																Complete and folding ends, folded condition	PC															
																Folding free-standing posts, folded condition	PC															
															Platform-based with complete superstructure and open-sided		PS															

Allowed

Not allowed (or not applicable)

a Centre of gravity may be eccentric.

b Centre of gravity may be mobile, e.g. liquid, bulk or hanging loads.

When 1CC, 1C and 1CX containers are fitted with a second (inner) set of fork-lift pockets, these pockets shall be used for empty handling only.

7 Landing and supporting

7.1 To avoid damage, containers shall be landed carefully.

WARNING — Containers shall not be dragged or pushed over any surface.

7.2 On the ground, a firm, flat, drained surface shall be provided, clear of obstructions and projections, in order to avoid damage to bottom rails, cross members, sills and floors.

WARNING — On the ground, containers shall be supported by their four bottom corner fittings only.

7.3 On carrying vehicles, containers shall be supported by their corner fittings only, or by the intermediate load transferring areas in the base structure only.

8 Stacking on the ground

8.1 When stacking containers, adequate contact between the top and bottom corner fittings should be ensured.

8.2 Special consideration should be given to wind conditions which might lead to sliding and tipping of containers; larger and empty containers are more likely to be affected by wind. The critical wind speed is lower for multiple rows than for a single row (stack). Wind effects can be reduced by

— limiting the stacking height,

— block stacking,

— securing of containers to the ground,

— block stacking with packed containers in the uppermost tier, and

— using stacking fittings or lashings, in particular in exposed rows.

Containers should be stacked so that the longitudinal axis is in line with the predominant wind direction. In the case of a storm warning, the containers at the corners of the block should be secured. The need for such countermeasures should be considered at wind speeds in excess of 15 m/s.

NOTE 15 m/s = 29 knot = Beaufort 7.

For a block of multiple rows of similar containers and for a given wind speed, displacement is likely to occur in the sequence shown in Figure 14.

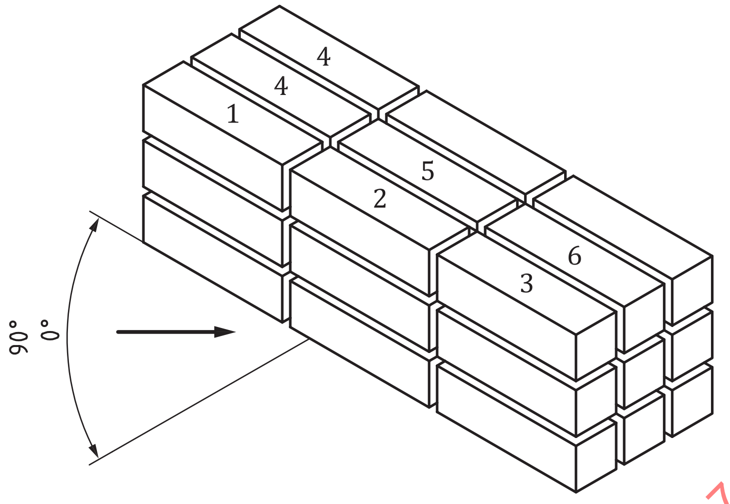


Figure 14 — Wind effects on block stowage of containers

9 Securing during transport

9.1 General

9.1.1 In order to prevent any movement of containers relative to the ship or the carrying vehicle, which might lead to injury to personnel or damage, the containers shall be secured during transport, except as envisaged in 9.3.2.

9.1.2 Containers should be restrained from horizontal movement by their bottom fittings as the main strength of a container is derived through its bottom frame.

9.1.3 Methods used for securing containers to a vehicle or ship should ensure that the strength of containers and their ability to withstand securing forces applied are not exceeded.

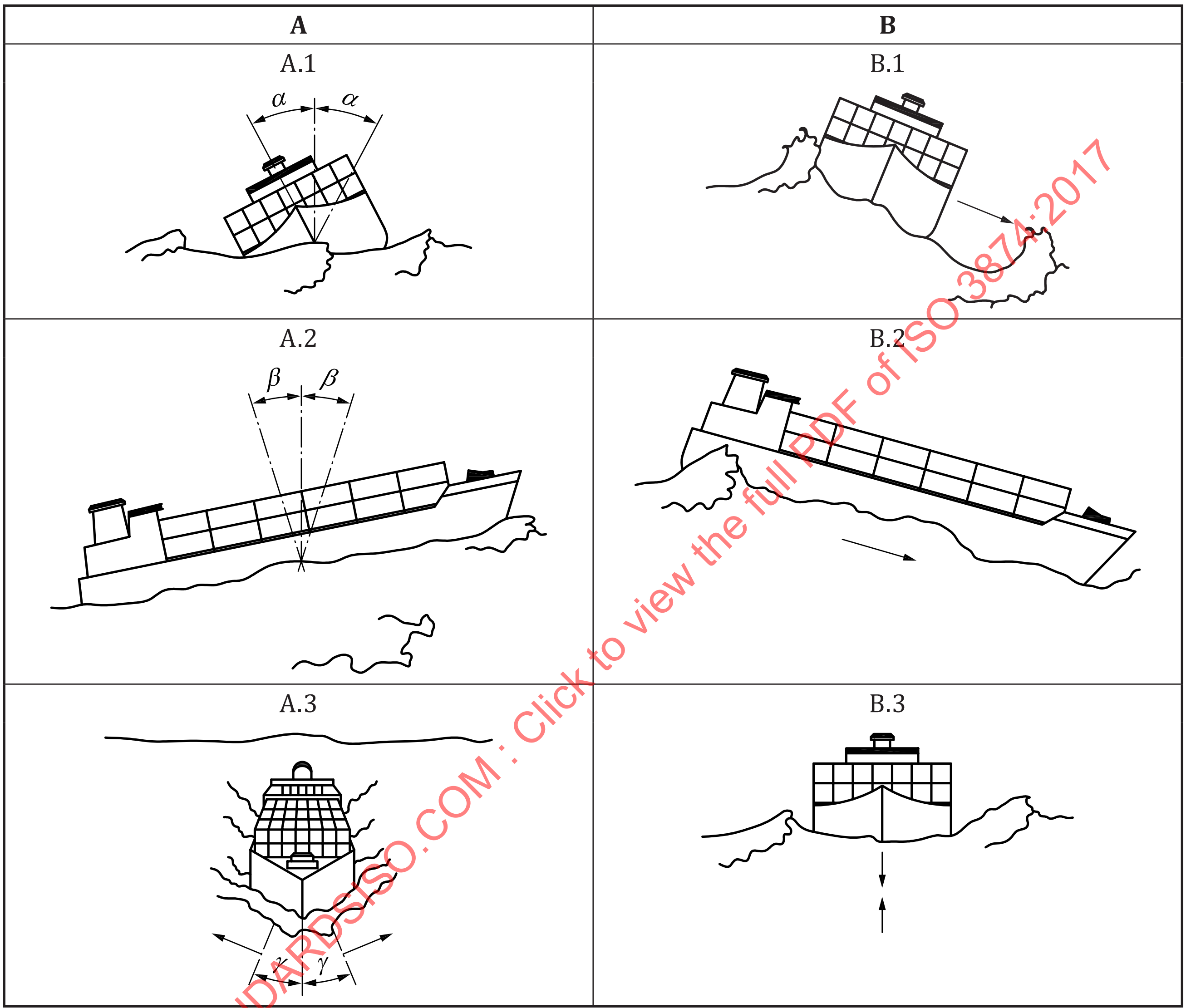
9.1.4 The correct positioning of all securing devices should be checked before loading containers onto or unloading them from ships or carrying vehicles.

9.1.5 The correct application of such devices should be checked before and during transport.

9.2 Securing on board a ship

9.2.1 Forces on board a ship

On board a ship at sea, containers are subjected to forces arising from ship motion, wind and boarding seas (see Figure 15).



Key

A rotational motion
A.1 roll
A.2 pitch
A.3 yaw

B linear motion
B.1 sway
B.2 surge
B.3 heave

Figure 15 — Examples of motions of a ship at sea

9.2.2 Effects on container

9.2.2.1 Racking

Racking is the deformation of the container end or side frames as a result of transverse component static and dynamic forces applied to it.

The principal racking force arises when a stack of containers is subjected to rolling which results in transverse forces being borne by the lower containers in the stack; wind can add to these forces.

Should the forces anticipated from this cause exceed the container racking strength, the affected containers shall be given support; this is usually only necessary with transverse racking (see Figure 16).

9.2.2.2 Tipping

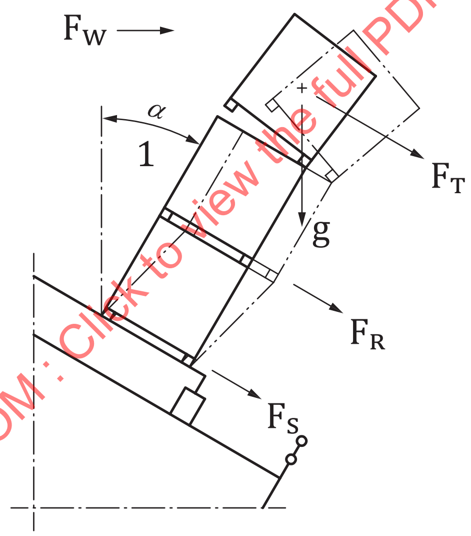
Tipping is the tendency for a container or stack to pivot on a bottom edge when subjected to a transverse force such as by rolling or wind; a vertical securing element is required to resist it (see Figure 16).

9.2.2.3 Sliding

Sliding is the horizontal movement of a container relative to its bearing surface; it can be prevented by the use of positioning fittings, although small movements within their tolerances may still occur (see Figure 16).

9.2.2.4 Collapse

Collapse is the failure of a corner post resulting from excessive compressive load; the force applied by securing devices may increase compression load (see Figure 17).



Key

1 roll

F_T tipping force

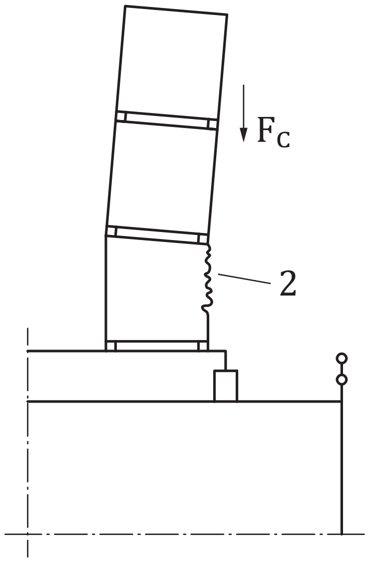
F_W wind force

F_R racking force

F_S sliding force

g gravitational force

Figure 16 — Racking, tipping and sliding



Key

2 collapse

F_C compression force

Figure 17 — Compression and collapse

9.2.2.5 Structural failure

Structural failure is the separation or permanent deformation of the structural components of a container due to excessive force. It can be caused by improper use of securing devices or excess compression force, or loose cargo.

9.2.3 Ship design, stowage and securing of containers

9.2.3.1 Ships intended to carry containers are provided with structures, and fixed and portable fittings for use below and/or above deck, which, when properly used in conjunction with planned stowage, take the factors described in 9.2.1 and 9.2.2 into consideration.

9.2.3.2 A cellular container ship is fitted with vertical guides designed to position and hold containers in vertical stacks below and sometimes above deck. For examples of on-deck cell guides, see Figure 18.

Figure 18 — Example of on-deck cell guides

9.2.3.3 Arrangements to secure containers on deck are based on either of the following two concepts:

— providing restraint of sufficient strength to secure all containers when packed to their permitted gross mass without exceeding the container strength;

— providing securing equipment of a certain strength and then selecting and stowing containers, the resulting mass of which does not induce forces exceeding the nominal strength of the securing devices (or the containers).

9.2.3.4 The methods for securing containers below deck in non-cellular container ships are similar to those defined in 9.2.3.3 for use on deck, particularly those to prevent sliding.

9.2.4 Types of securing equipment

9.2.4.1 General

For examples of container-carrying ships, see Figure 19.

Refer to Tables D.1, D.2 and D.3 for the various types of securing equipment in use.

When cellular guides are not provided, various basic types of equipment are used such as

— buttresses,

— deck sockets (see Figure 20 and Figure 21),

— rods and tensioning devices, e.g. turnbuckles (see Figure 20 and Figure 21), and

— twistlocks (see Figure 20 and Figure 21).

Combinations of these are frequently used.

9.2.4.2 Buttresses

Buttresses are portable securing devices used to eliminate the clearance between the container and the longitudinal bulkhead and to transfer the transverse force to the longitudinal bulkhead [see Figure 21 j)].

9.2.4.3 Rods

Rods are used both to hold containers down against tipping and/or to provide support against racking forces (see Figure 20 and Figure 21).

They are used in conjunction with a suitable variety of twistlocks, which both locate containers and secure them against sliding. Elasticity of rods is low and the correct tension should be applied to avoid over-tensioning and possible structural failure of the container, the fittings or the attachment points on the vehicle or ship (see Figure 20 and Figure 21).

9.2.4.4 Twistlocks

Twistlocks locate and secure containers to each other, within a stack, or to the transport mode. They act through the corner fittings. (see Figure 20 and Figure 21).

It is important to be able to identify on a twistlock, even in poor visibility, which is the correct way up or whether or not it is locked. All manual twistlocks in use on board a ship shall lock by turning in the same direction.

9.2.4.5 Stacking cones

Single or double-stacking cones are used to ensure that containers are located and restrained from sliding in the horizontal plane. (see Figure 20 and Figure 21).

9.2.4.6 Bridge fittings

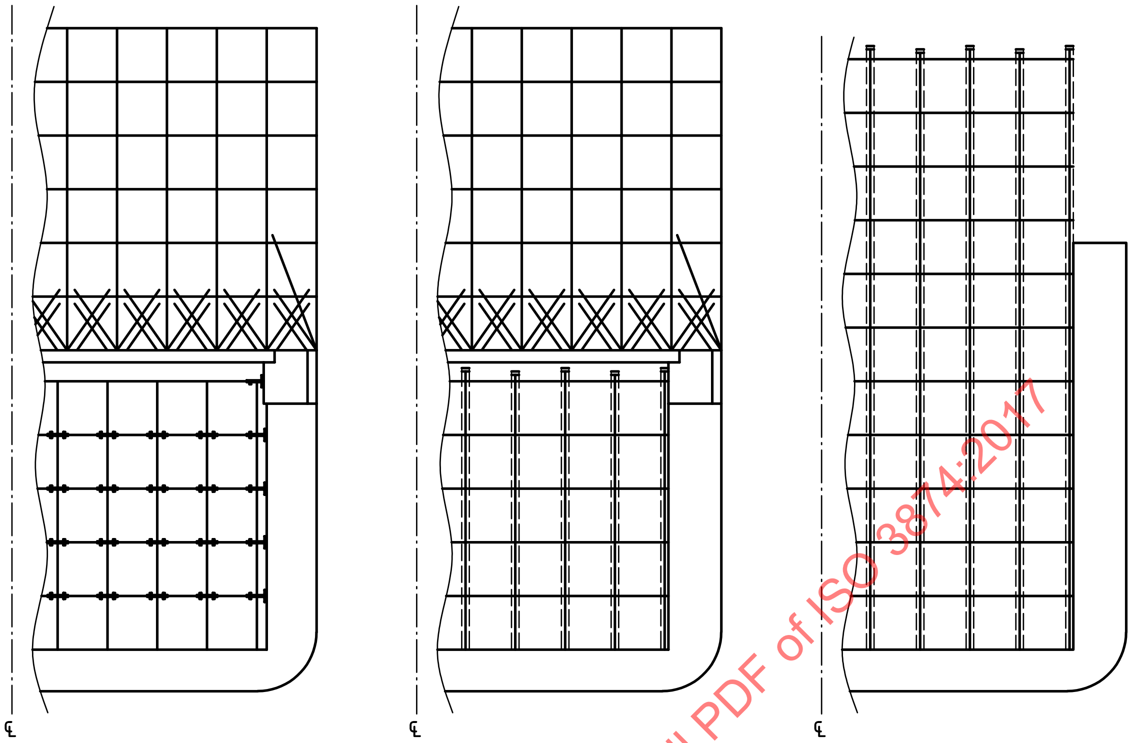
Bridge fittings are designed to hold adjacent containers together by the upper corner fittings. (see Figure 20 and Figure 21).

NOTE This document reflects lashing gear in use on modern vessels and current and anticipated future lashing modes. Thus, items such as chains and wires, not in widespread use, are not mentioned although they can still be supplied by lashing gear manufacturers.

9.2.4.7 Tensioning devices

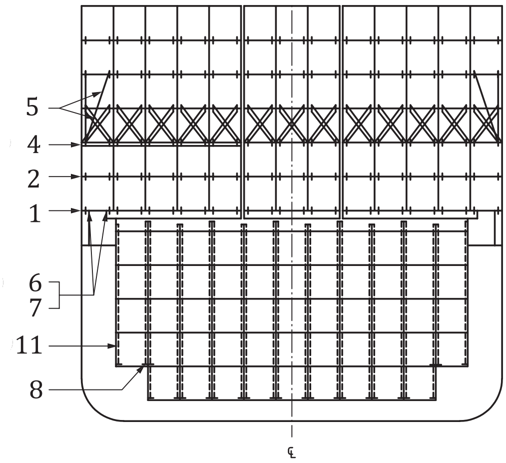
The most common tensioning devices in general usage are turnbuckles.

Turnbuckles are usually necessary to provide sufficient strength to support containers fully against racking forces. (see Figure 20 and Figure 21).

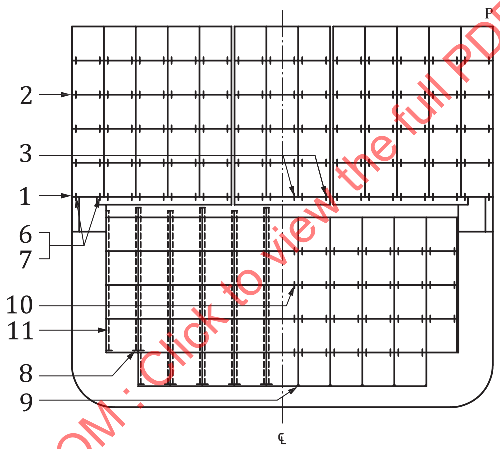


a) Cargo hold without cell guides b) Cargo hold with cell guides c) Cargo hold — Hatchless

Figure 19 — Examples of container-carrying ships



a) 40 ft container



b) 20 ft container

Key

1 bottom twistlocks
2 twistlocks
3 midlocks
4 lashing bridge
5 turnbuckles /lashing rods
6 twistlock foundation
7 lashing eyes
8 weld on cones
9 guide fittings
10 stacking cones
11 cell guides

Figure 20 — Example of typical securing, lashing and handling equipment (see also Figure 21)

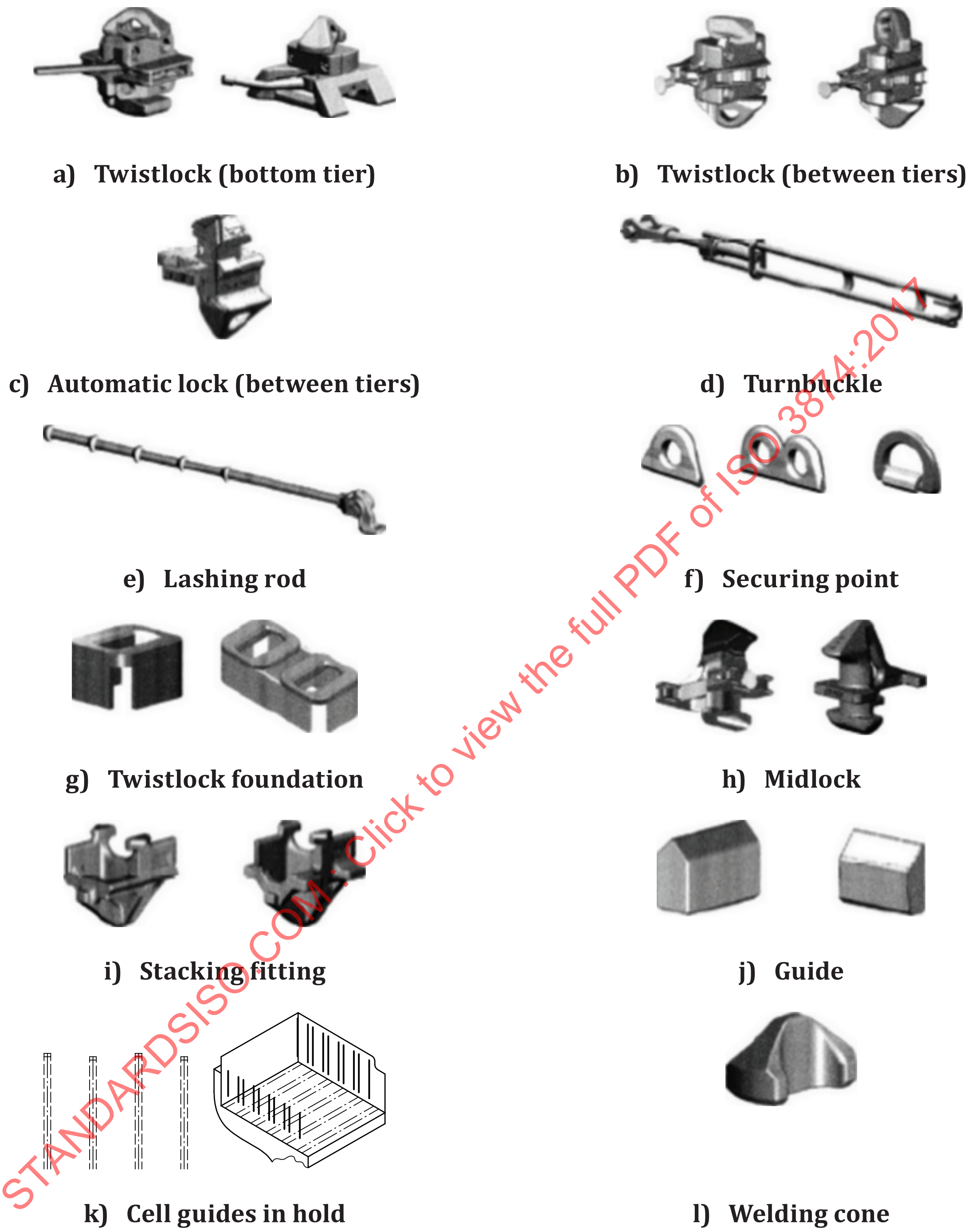


Figure 21 — Examples of securing and lashing equipment

9.3 Securing of container for road and rail transport

9.3.1 General

When being transported by road or rail, containers are subjected to forces and vibrations arising from braking, shunting, cornering, acceleration, road surface and wind.

Securing methods should take these factors and those factors identified in 9.1 into account.

For road and rail transport, the container shall not project beyond the front or rear of the carrying vehicle.

9.3.2 Terminal trailer operation

Terminal operation in this context is container movement on terminal trailers at low speed over short distances within designated areas.

For such an operation, tie-down devices are not required but the container shall be correctly located on the trailer and prevented from moving horizontally; that is generally achieved by gathering guides or similar devices (see Figure 22).

9.3.3 Public road operation

To ensure safe operation over public roads, the container shall be supported on the road vehicle by all four bottom corner fittings only or by the intermediate load transfer areas in the base structure only. The container shall also be secured to the road vehicle by all four bottom corner fittings (see Figure 23).

The most usual method of securement is by twistlocks (see Figure 24), which may be either fixed or retractable and, in some cases, adjustable in height. Alternative methods are securing cones (see Figure 25) or securing guides (see Figure 26) to give location and to resist horizontal forces with pins through the side or end apertures to resist upward vertical forces.

Refer to Annex F for more detailed guidance on securing containers to vehicles.

Dimensions in millimetres

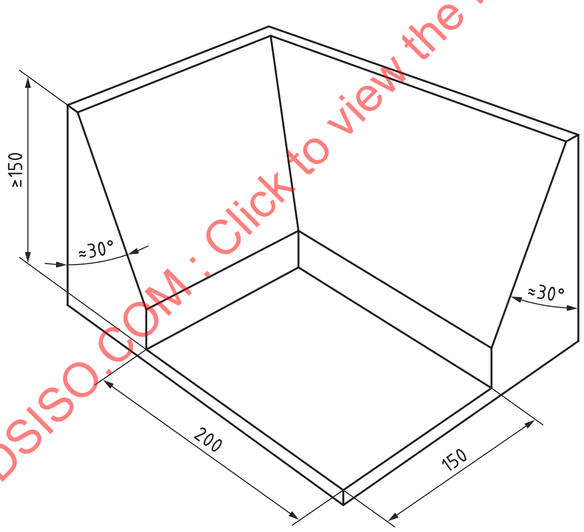


Figure 22 — Example of gathering guide

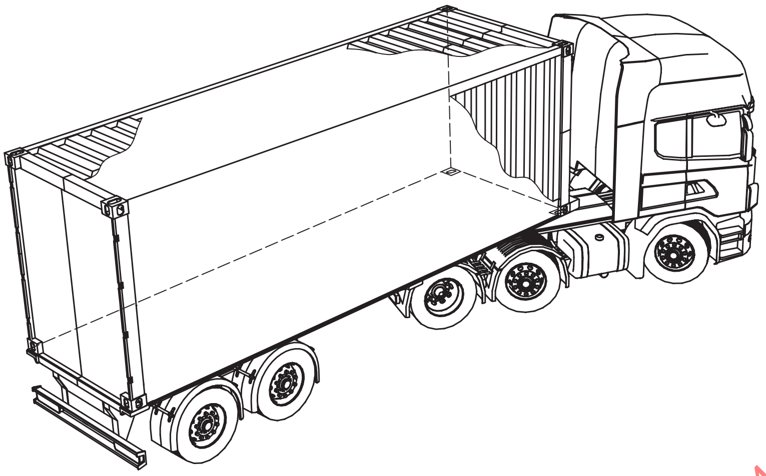


Figure 23 — Tractor/semi-trailer with twistlock chassis

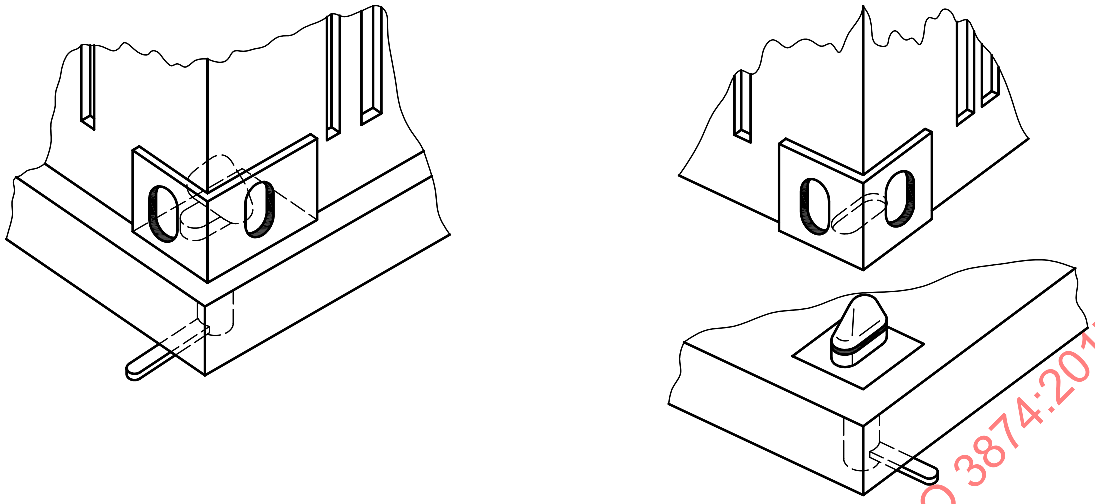
To ensure safe operation,

— the position of the securing devices shall be readily apparent,

— to prevent damage to container bottom rails, any intermediate securing devices shall be retracted or removed,

— before the vehicle is moved, the securing of the container shall be checked, and

— before the container is lifted, any locking device shall be released.



a) Locked

b) Unlocked

Figure 24 — Twistlock (retractable)

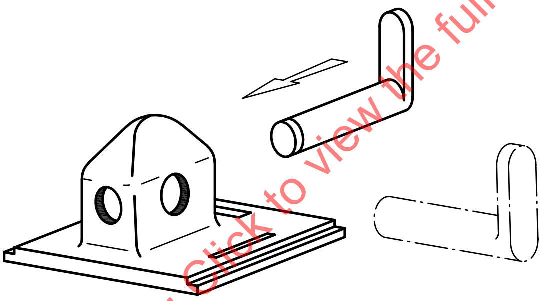


Figure 25 — Securing cone with pinlock

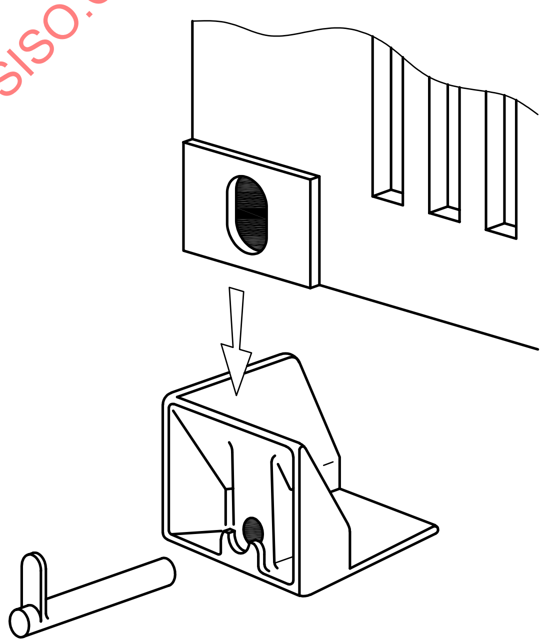


Figure 26 — Securing guide with pinlock

9.3.4 Rail vehicle operation

To ensure safe operation by rail, the container shall be supported on the rail vehicle by all four bottom corner fittings only or by the intermediate load transfer areas in the base structure only. The container should also be secured to the rail vehicle by all four bottom corner fittings either by twistlocks or by other means which will ensure compliance with 9.1. An example of a securing fitting used for transport by rail is shown in Figure 27.

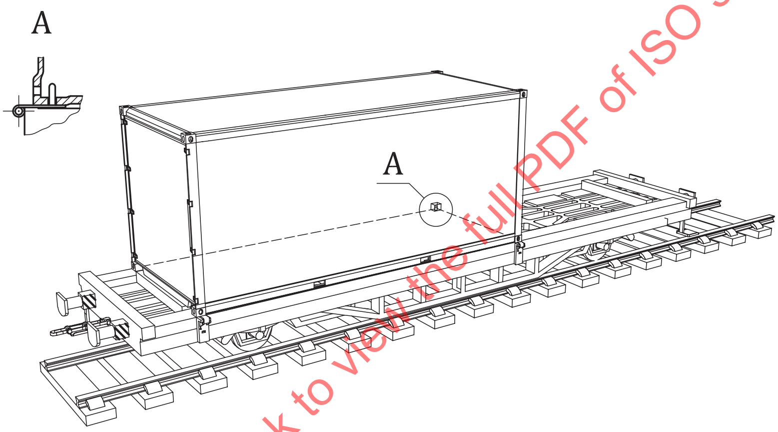
To ensure safe operation,

— the position of the securing devices shall be readily apparent,

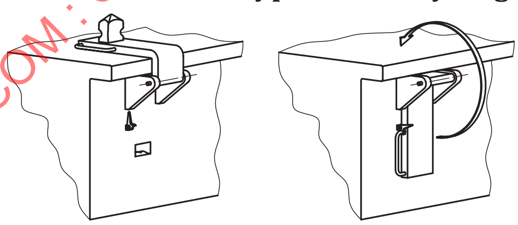
— to prevent damage to container bottom rails, any intermediate securing devices shall be retracted or removed,

— before the vehicle is moved, the securing of the container shall be checked, and

— before the container is lifted, any locking device shall be released.



a) Overall view of a typical railway wagon



b) Detail of securing fitting

Figure 27 — Example of railway vehicle with securing fittings in common use

9.3.5 Double stack rail car operations

To ensure safe operation of containers on double stack rail car vehicles, the lower containers shall be supported by all four bottom corner or intermediate fittings. If fixed locating cones are used to keep the lower tier containers in place during transit, the locating cones shall interface with corner or intermediate fittings at the 40 ft position only. The bottom container shall be secured to the rail vehicle through the bottom corner or intermediate fittings either by twistlocks or by other means which will ensure compliance with 9.1.

The upper container shall be secured to the lower container through the bottom corner or intermediate fittings either by twistlocks or other means which will ensure compliance with 9.1. It is noted that these rail cars should always be shoved to rest during operations, i.e. “shunting”, should not be allowed.

An example of a securing fitting used for transport by rail and of a double stack rail vehicle is shown in Figure 28.

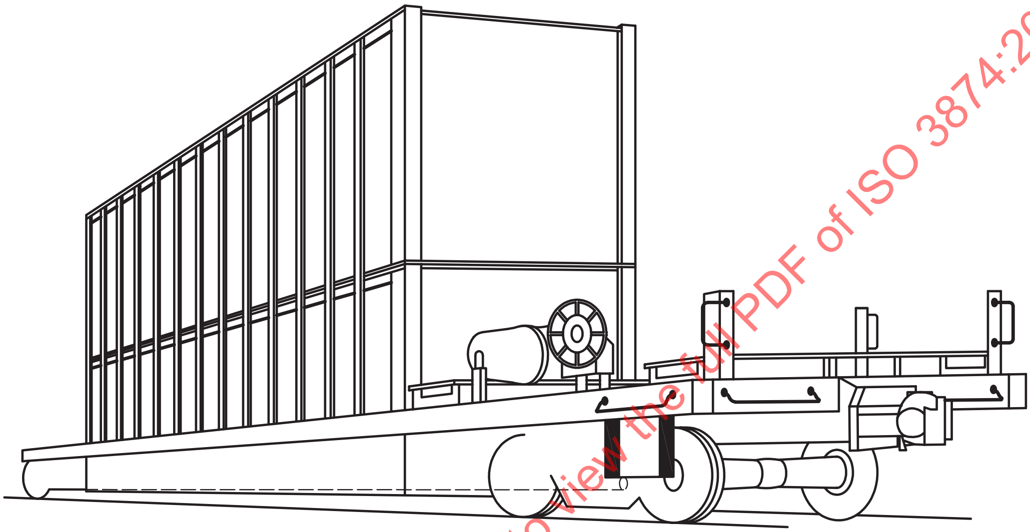
To ensure safe operation,

— the position of the securing devices shall be readily apparent,

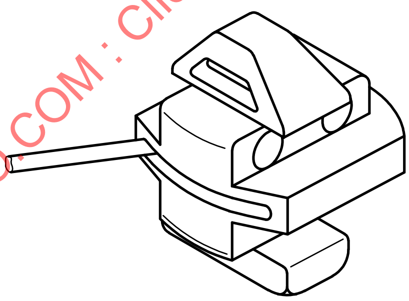
— to prevent damage to container bottom rails, any intermediate securing devices shall be retracted or removed,

— before the vehicle is moved, the securing of the container shall be checked, and

— before the container is lifted, all locking device shall be released.



a) Overall view of a typical double stack rail car



b) Example of securing fitting

Figure 28 — Example of a double stack rail car with securing fittings in common use

Annex A
(normative)

Twistlocks for securing of containers — Function, dimensions, strength requirements and testing

A.1 General

Twistlocks locate and secure containers

— either to each other within a stack (they are then acting through the corner fittings), or

— to the means of transport (they are then acting through the bottom corner fittings and the securing sockets of the carrying vehicle).

Twistlocks are also used to connect and lift containers. Twistlocks used for lifting are subject to a special inspection regime.

A.2 Types and description of securing twistlocks

A.2.1 Manual twistlocks

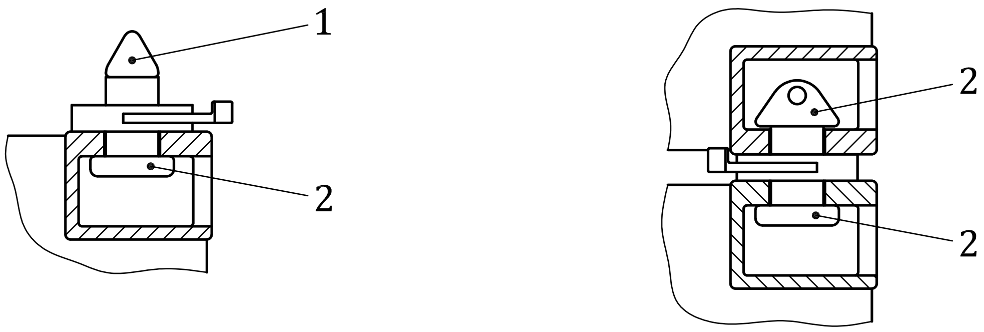
A.2.1.1 Manual twistlock with a fixed base and a single lock, two positions

A manual twistlock with a fixed base consists of the following:

— a top cone, which may have an eyehole, that can be rotated in relation to a fixed base;

— an intermediate plate, if so fitted, with collars and a fixed base;

— a handle, which may have a tail pointing upwards, attached to the shaft, moving in the horizontal plane and having two stop positions, one end fully closed and one end fully open; see Figure A.1.



a) **Fully opened position** b) **Fully closed position**

Key

1 unlocked

2 locked

Figure A.1 — Manual twistlock with a fixed base and a single lock, two positions

A.2.1.2 Manual twistlock, with double locks, three positions

A manual twistlock with double locks, three positions, consists of the following:

— a top cone, which may have an eyehole, and a bottom cone rigidly connected together by a shaft;

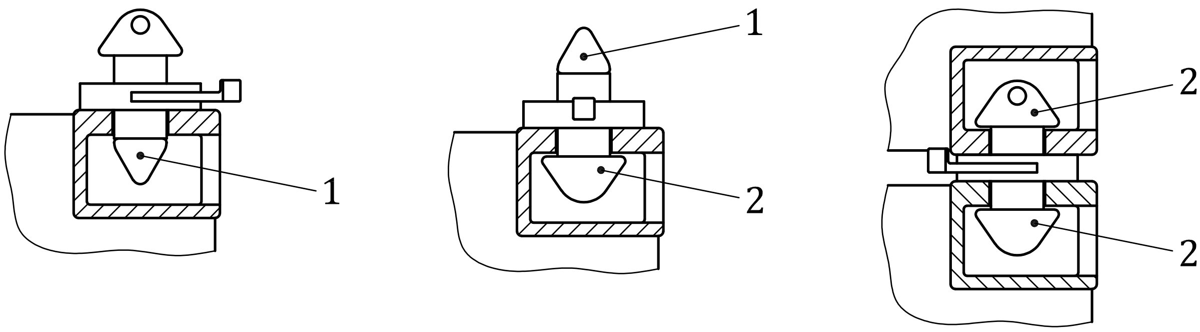
— an intermediate plate with collars;

— a handle, which may have a tail pointing upwards, attached to the shaft, moving in the horizontal plane and having three positions (see Figure A.2):

  — **first position**: upper cone inserted and in locked position in hoisted container, lower cone in unlocked position to allow engagement of upper corner fitting on a base container;

  — **second position**: lower cone inserted and in locked position in upper corner fitting of a base container, upper cone in fully open position to receive lower corner fitting of a container loaded on top of base container;

  — **third position**: lower cone in upper corner fitting of base container in locked position and upper cone in lower corner fitting of upper container in locked position.



a) **First position** b) **Second position** c) **Third position**

Key

1 unlocked

2 locked

Figure A.2 — Manual twistlock with double locks, three positions, pre-mounted to the top corner fitting

A.2.2 Semi-automatic twistlocks

A semi-automatic twistlock can be of both single function and dual function. It consists of the following:

— a top cone with a clear indicator for direction and a bottom cone, rigidly connected by a mechanism;

— an intermediate plate with collars;

— an internal mechanism automatically closing the cones either when a container is landed onto the twistlock (see Figure A.3), or when the bottom cone fits into the top corner fitting of a container (see Figure A.4);

— a mechanism for unlocking the twistlock.

A.2.3 Fully automatic twistlocks (FAT)

A fully automatic twistlock can be both single function and dual function. It consists of the following:

— a top cone with a clear indicator for direction and a bottom cone, connected by a mechanism;

— may be fitted with an intermediate plate;

— collars;

— an internal mechanism automatically closing the cones when a container is landed and the bottom cone fits into the top corner fitting of a container;

— a design that prevents disengagement of containers during dynamic movement of a vessel;

— an internal mechanism automatically opening the cones when a spreader is engaged and the container is lifted vertically.

A.2.4 Automatic container locks (AL)

An automatic lock is single purpose only. It consists of the following:

— a top cone with a clear indicator for direction and a rigidly connected bottom cone;

— an intermediate plate if required for proper functioning;

— structure to deal with shear loads;

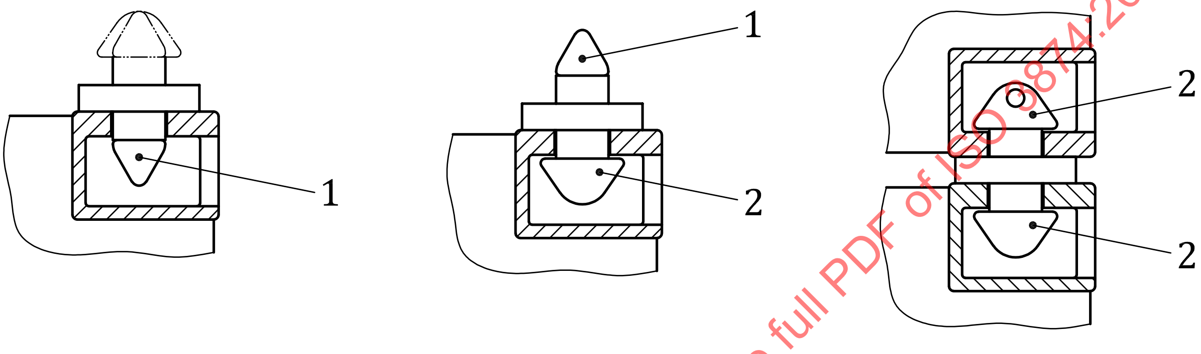
— a design feature that allows automatic positioning of the cone when a container is landed and the bottom cone fits into the top corner fitting of a container;

— a design that prevents disengagement of containers during dynamic movement of a vessel;

— a design that automatically permits disengagement when the container is lifted vertically;

1) deviations to this subsection are permitted provided that the functional requirements of a fully automatic twistlock are met;

2) deviations to this subsection are permitted provided that the functional requirements of an automatic lock are met.



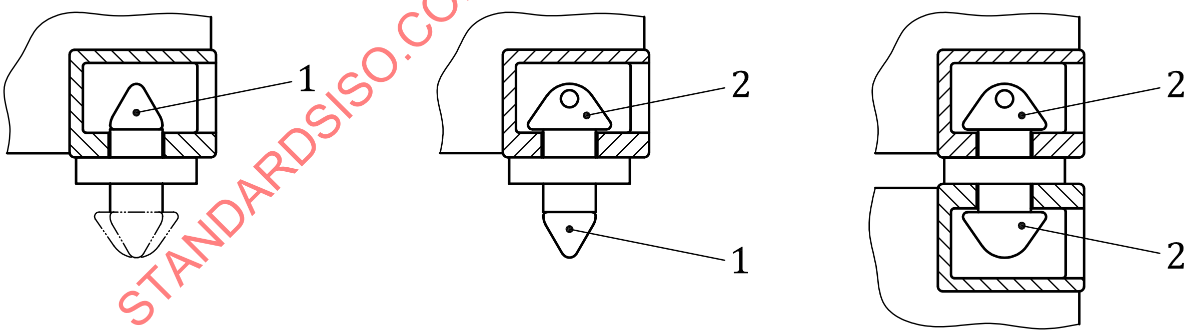
a) First position **b) Second position** **c) Third position**

Key

1 unlocked

2 locked

Figure A.3 — Automatic/semi-automatic twistlock, fitted to the upper corner fitting



a) First position **b) Second position** **c) Third position**

Key

1 unlocked

2 locked

Figure A.4 — Automatic/semi-automatic twistlock, fitted to the bottom corner fitting

A.2.5 Midlocks

A midlock has an engagement mechanism which ensures that the lock will not be dislodged from the corner fitting during loading and unloading of containers. It requires no manual intervention for locking or unlocking.

A.3 Functional requirements and dimensions of twistlocks

A.3.1 General requirements

The top cone and bottom cone shall restrain connected containers against vertical movements.

The collar shall restrain connected containers against horizontal movements.

The eyehole, if so fitted, in the top cone shall identify the top cone and facilitate the handling of the twistlock. Otherwise, there shall be clear indication on the top cone as to direction.

The tail of the handle, if so fitted, on a manual twistlock shall identify the correct orientation of the twistlock in a container stack.

The twistlock shall not accidentally dislodge from a corner fitting during container loading or unloading operations.

A.3.2 Manual twistlocks

A manual twistlock shall be oriented so that the cone with an eyehole, if so fitted, or other top identification is pointing upwards.

The handles shall always work in the horizontal plane. All manual twistlocks are required to close to the left hand side to ensure safe locking.

All manual twistlocks, also those with three defined positions, shall have an engagement mechanism which ensures that the twistlock will not be dislodged from the corner fitting during loading, unloading and transport of containers.

This type of twistlock is considered as a bottom twistlock.

A.3.3 Semi-automatic twistlocks

A semi-automatic twistlock shall be oriented so that the cone with an eyehole, if so fitted, or other top identification is pointing upwards.

A semi-automatic twistlock shall be fitted with a means of identifying clearly the closing of both cones.

For semi-automatic twistlocks fitted with a handle, working in a horizontal plane, the closing of the cones shall be indicated by the handle in its leftmost position.

For semi-automatic twistlocks fitted with a pull wire, the closing of the cones shall be indicated by the full retraction of the wire.

For semi-automatic twistlocks fitted with other triggering devices, the closing of the cones shall be shown by an indicator designed to ensure consistency with the requirements expressed above.

A semi-automatic twistlock shall have an engagement mechanism which ensures that the twistlock will not be dislodged from the corner fitting during loading and unloading of containers.

A.3.4 Automatic twistlocks and automatic container locks

Automatic twistlocks and container locks shall be oriented so that the cone with an eyehole, if so fitted, or other top identification is pointing upwards.

Where required for correct operation, automatic twistlocks and container locks shall be labelled so as to clearly identify the required orientation.

Automatic twistlocks and container locks shall have an engagement mechanism or design which ensures that the lock will not be dislodged from the corner fitting during loading and unloading of containers.

No manual operation, except installing and removing the lock to and from the bottom corner fitting of containers, is needed during loading and discharging of containers.

Containers shall remain locked together and secured to the vessel, if used as a bottom lock, under dynamic movement conditions.

A.4 Dimensions for manual and semi-automatic twistlocks

A.4.1 Top cone and bottom cone

The top cone and the bottom cone shall be designed so that, in fully locked position, the load carrying area is larger than 800 mm^2. The top cone and bottom cone shall not protrude into the part of the corner fitting cavity defined in Figure A.5, which is required for other lashing equipment.

A.4.2 Intermediate plate

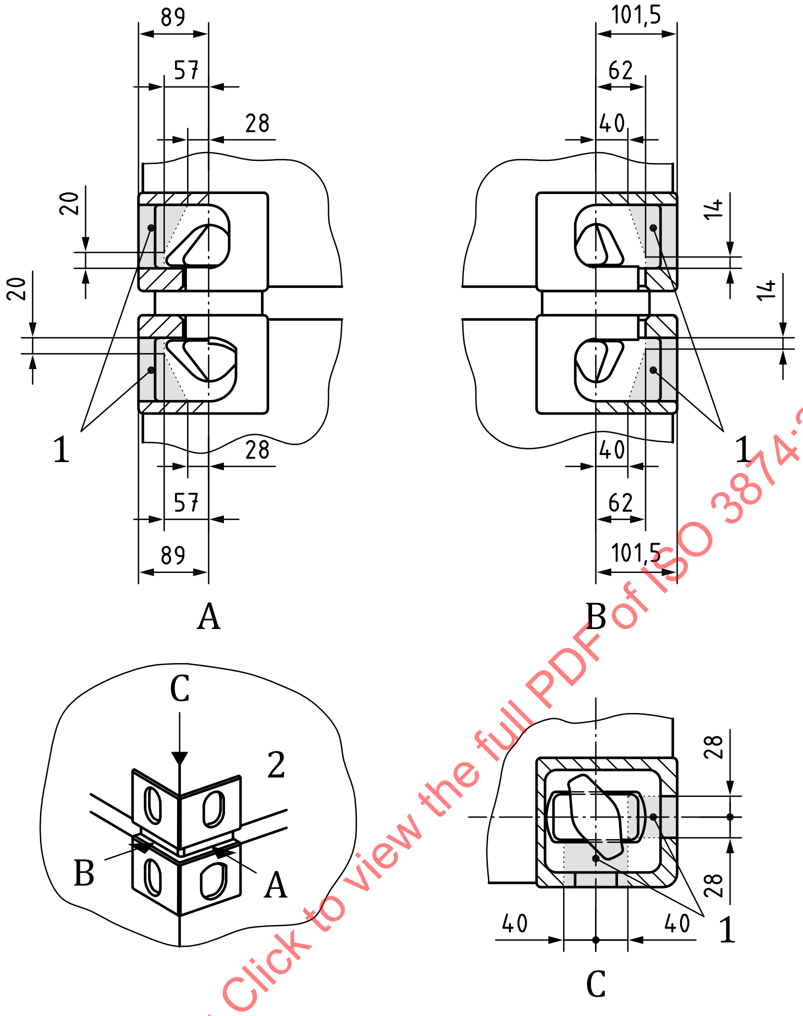
The load carrying area (flange surface bearing area) of the intermediate plate shall be sufficient to withstand the maximum loads anticipated and to minimize wear. The twistlock shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

The recommended thickness of the intermediate plate is 28 mm but may be less as required. All twistlocks used onboard a vessel shall have the same thickness of intermediate plate.

A.4.3 Collars

In order to fit into corner fitting apertures in accordance with ISO 1161, the collar shall have the dimensions shown in Figure A.6.

Dimension in millimetres



Key

1 restricted area

2 container end

Figure A.5 — Restricted part of corner fitting cavity

Dimensions in millimetres

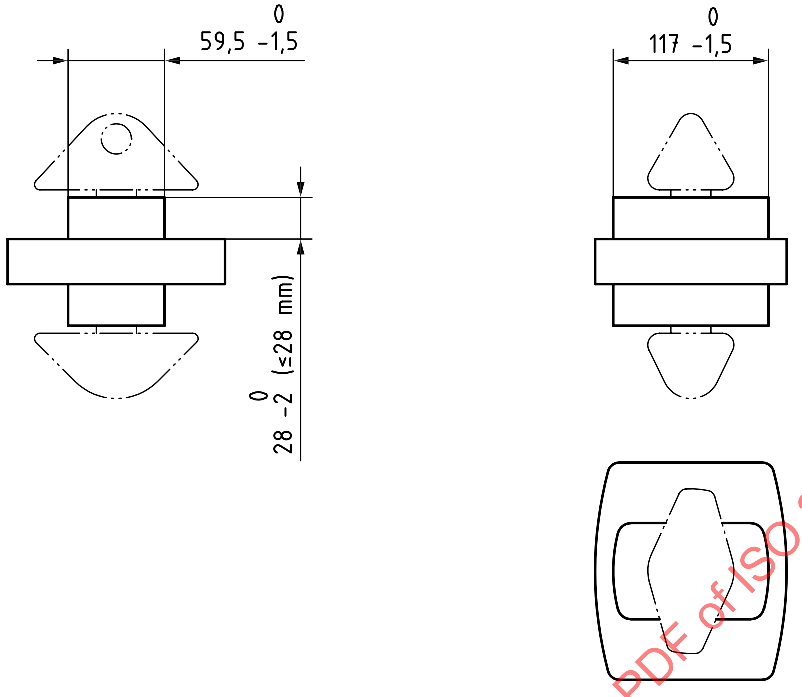
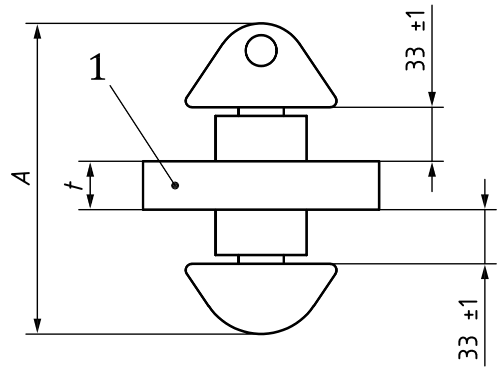


Figure A.6 — Dimensions of collars

A.4.4 Distance between top lock and bottom locks

The distance, A, between the top and bottom locks shall be the actual thickness of the intermediate plate plus two times (33 ± 1) mm. See Figure A.7.

Dimensions in millimetres



Key

1 intermediate plate

t thickness of the intermediate plate

Figure A.7 — Distance between top and bottom locks

A.5 Dimensions for automatic twistlocks

A.5.1 Top cone and bottom cone

The top cone and the bottom cone shall be designed so that when used to secure containers together the contact area on each lobe or arm of a cone is sufficient to prevent rotation in dynamic circumstances and to preclude damage. The top cone and bottom cone shall not protrude into the part of the corner fitting cavity defined in Figure A.5, which is required for other lashing equipment.

A.5.2 Intermediate plate (if so fitted)

The load transfer area of the intermediate plate shall be so designed as to ensure correct operation and shall be sufficient to withstand the maximum load anticipated and to minimize wear. The twistlock shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

The recommended thickness of the intermediate plate is 28 mm but may be less as required. All twistlocks used onboard a vessel shall have the same thickness of intermediate plate.

A.5.3 Collars

In order to fit into corner fitting apertures in accordance with ISO 1161, the collar shall have the dimensions shown in Figure A.7.

A.5.4 Distance between top lock and bottom locks (automatic twistlocks)

The distance between the top and bottom locks shall be the actual thickness of the intermediate plate plus two times (33 ± 1) mm. See Figure A.7.

A.6 Dimensions for container locks

A.6.1 Top cone and bottom cone

The top cone and the bottom cone shall be designed so that when used to secure containers together, the contact area on each arm or lobe of the cone is sufficient to prevent rotation in dynamic circumstances and preclude damage. The top cone and bottom cone shall not protrude into the part of the corner fitting cavity defined in Figure A.5, which is required for other lashing equipment.

A.6.2 Intermediate plate

The load transfer area of the intermediate plate shall be so designed as to ensure correct operation and shall be sufficient to withstand the maximum load anticipated and to minimize wear. The twistlock shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

The recommended thickness of the intermediate plate is 28 mm but may be less as required. All twistlocks used onboard a vessel shall have the same thickness of intermediate plate.

A.6.3 Locating and shear load structure

A container lock shall be designed with a structure to deal with shear loads and that shall fit into corner fitting apertures in accordance with ISO 1161.

A.7 Material and design performance

The performance and reliability of twistlocks are functions of design and choice of material. Twistlocks shall be designed so that their function does not cease because of stress, corrosion or dirt between prescribed maintenance periods. For safety reasons, it is also important that there are distinct stop positions for manual and semi-automatic twistlocks.

A.8 Strength requirements for manual and semi-automatic twistlocks

NOTE Unless stated otherwise, all loads are SWL.

A.8.1 Tensile strength

Twistlocks, including twistlocks used for lifting, shall withstand a tensile force equivalent to the value in Annex E, without any permanent deformation. To verify the tensile strength requirement, the twistlocks should be tested in accordance with A.10.1. The force shall act between the locking cones or the top locking cone and the fixed base.

The tensile force shall be applied by means of two corner fittings or two equivalent devices in accordance with ISO 1161.

A.8.2 Compression strength

A.8.2.1 Compression strength of intermediate plate

The intermediate plate of the twistlock shall withstand a minimum compression force of 1 000 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the compression strength requirement, the twistlock should be tested in accordance with A.10.2. The function of the twistlock shall not be affected by the test. The compression force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

A.8.2.2 Compression strength of cones

The cones of the twistlocks shall withstand a compression force of 150 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. The function of the twistlock shall not be affected by the test.

The compression force shall be applied to the top cone or to the bottom cone, in a test machine by one plain steel plate and one steel plate with a hole equivalent to that in corner fittings in accordance with ISO 1161. The function of the twistlock shall not be affected by the test.

A.8.3 Shear strength

The collars of the twistlock shall withstand a shearing force equivalent to the value in Annex E transversally without any permanent deformation or other abnormalities which would render it unsuitable for use.

The force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

To verify the shear strength requirements, the collar of the twistlock should be tested in accordance with A.10.3.

A.9 Strength requirements for automatic twistlocks and container locks

A.9.1 Tensile strength

Automatic twistlocks and container locks shall withstand a proof tensile force equivalent to the value in Annex E without any permanent deformation.

Automatic twistlocks and container locks shall not break at a tensile force less than the value in Annex E.

To verify the tensile strength requirement, the twistlocks should be tested in accordance with A.10.1.

A.9.2 Compression strength

A.9.2.1 Compression strength of intermediate plate

The intermediate plate of the lock, if so fitted, shall withstand a minimum compression force of 1 000 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the compression strength requirement, the lock should be tested in accordance with A.10.2. The function of the lock shall not be affected by the test. The compression force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

A.9.2.2 Compression strength of cones

The cones of the locks shall withstand a compression force of 150 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. The function of the twistlock shall not be affected by the test.

The compression force shall be applied to the top cone or to the bottom cone in a test machine by one plain steel plate and one steel plate with a hole equivalent to that in corner fittings in accordance with ISO 1161. The function of the lock shall not be affected by the test.

A.9.3 Shear strength

The collars of the lock or a corresponding structure designed to deal with shear forces shall withstand a shearing force equivalent to the value in Annex E transversally without any permanent deformation or other abnormalities which would render it unsuitable for use.

The force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

To verify the shear strength requirements, the collar of the twistlock should be tested in accordance with A.10.3.

A.10 Test methods

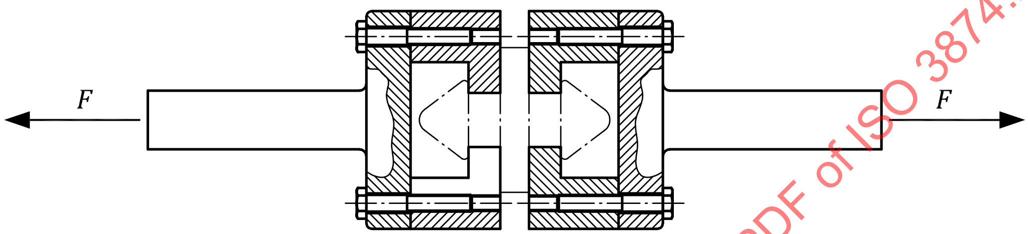
A.10.1 Tensile test

When performing the tensile test, the tensile force shall be applied to the twistlock by a tensile test machine and two fittings with dimensions equivalent to the corner fittings specified in ISO 1161 (see Figure A.8).

NOTE A different test jig is required for automatic twistlocks and container locks, although the procedure is the same.

For automatic twistlocks and automatic container locks, the test rig shall also prevent transverse, longitudinal and rotational movements of the lock under test.

For proof load testing, the test force shall be held for 5 min.



Key

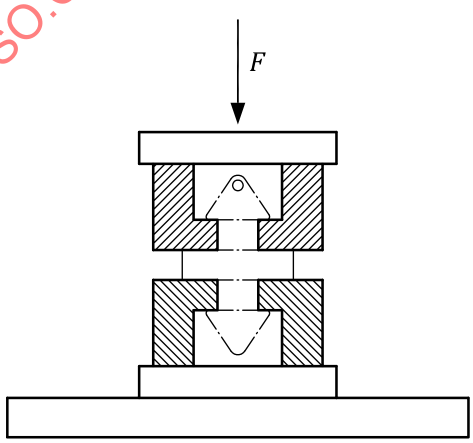
F test force

Figure A.8 — Tensile test

A.10.2 Compression strength of intermediate plate (if so fitted)

When performing the compression test, the intermediate plate shall be compressed in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161 (see Figure A.9).

The test force shall be applied for 5 min.



Key

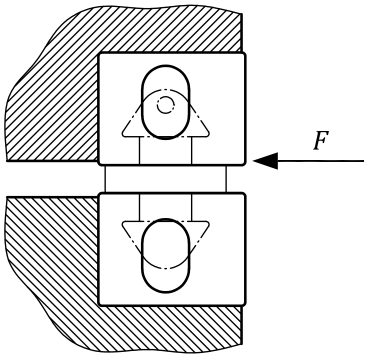
F test force

Figure A.9 — Compression test on intermediate plate

A.10.3 Shear strength test

For the shear strength test, the lock shall be placed in locked position in a test rig with holes equivalent to those in corner fittings in accordance with ISO 1161 (see Figure A.10).

The test force shall be applied for 5 min.



Key

F test force

Figure A.10 — Shear test

A.10.4 Function testing of automatic twistlocks and container locks

A.10.4.1 General

Automatic twistlocks and container locks are to be tested with a test set-up that simulates the conditions that may be experienced in extreme weather conditions at sea on container stacks and during loading and unloading operations.

When container stacks heel, the locks on one side of a container will be under compression and the locks on the other side under tension. In addition to these forces, there is also a transverse shearing force. Under test conditions, all forces should be applied simultaneously.

The test rig should simulate the top and bottom frames of two containers with the attached corner fittings manufactured from the same material used in normal production. The minimum width of the corner fitting apertures in which the locks are located is to be in accordance with the dimensions given in ISO 1161. The maximum variance between centres may be up to 9,5 mm as noted below. This should be taken into account for testing purposes.

The function test should be carried out taking into consideration the most critical combination of tolerances of container and fittings (see Figure A.11). For the function test, a difference between top and bottom fittings of 9,5 mm in the most onerous direction is to be applied.

The function test should be carried out in such a manner as to simulate vessel heeling to both port and starboard separately.

Taking the dimensions and tolerances from ISO 668 and ISO 1161, Figure A.11 shows the range of dimensions between the centrelines and inner edges of the top aperture. The values marked in red indicate the nominal dimensions. It is to be noted that there is a 1 mm difference between the calculated centre lines (2 260 mm) and the value of *P* shown in ISO 668:2013, Table A.1 (2 259 mm). The reason for this difference is due to the translation from imperial to metric units.

The top pair of corner fittings shown indicates the dimensions between when the container is at its minimum width, and the bottom pair shows those dimensions when it is at its maximum width. Taking account of the tolerance attributed to the positioning of the top aperture from the outside face, there is an 8 mm variation between possible alignments of the top apertures. When considering the alignment of the inner faces of the top aperture and taking account of the tolerance attributed to the width of the top aperture, the difference increases to 9,5 mm.

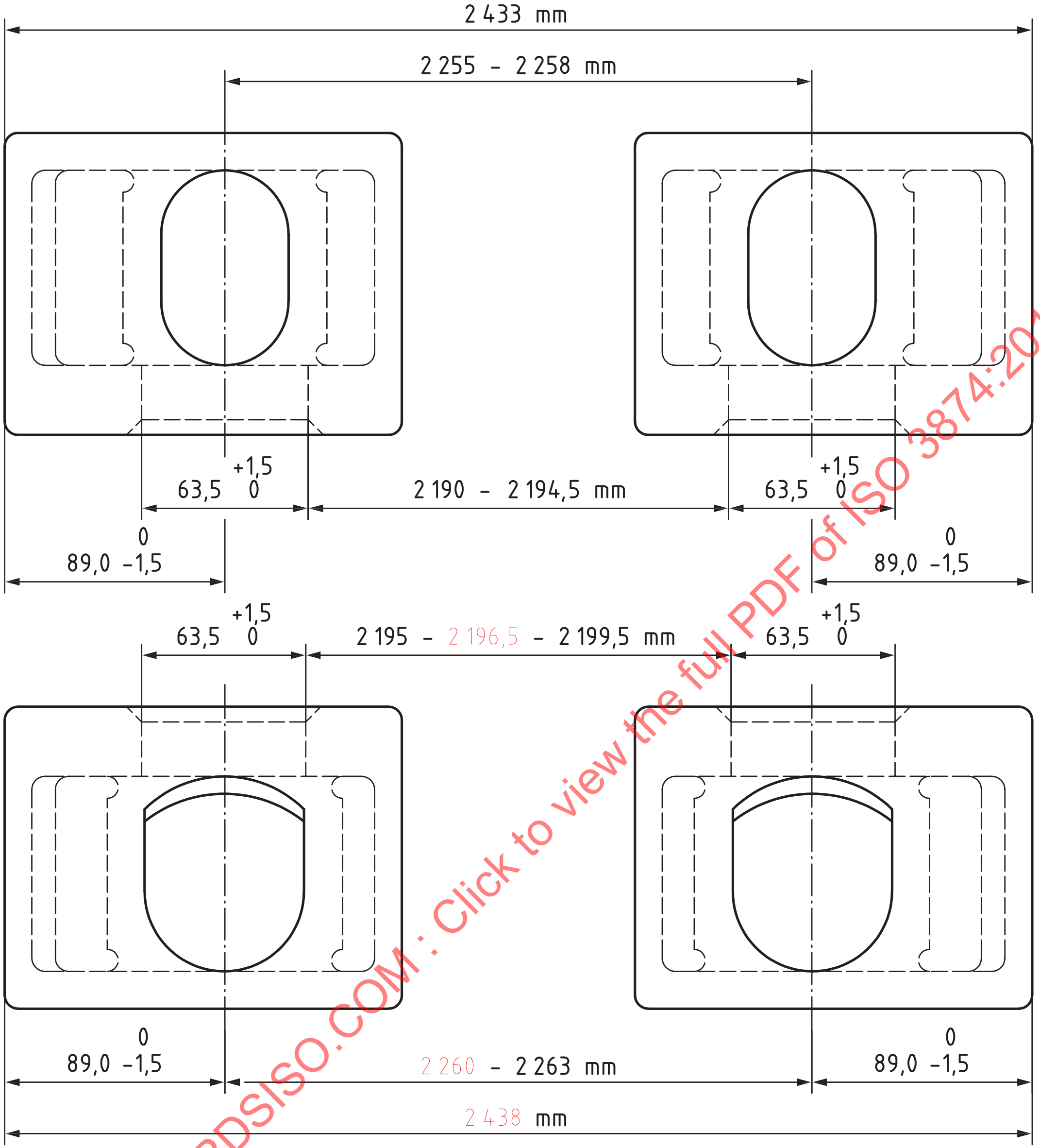


Figure A.11 — Corner fitting tolerances

A.10.4.2 Testing of automatic twistlocks and container locks to simulate (so-called) "slamming" and "whipping"

Automatic twistlocks and container locks shall be tested with a test set-up that simulates the varying angular dynamic forces that may be experienced especially by empty containers in stacks from vessels "slamming" and/or "whipping" under wave action. Tests should simulate the action of a vessel rolling or heeling while subject to a strong vertical impact. Locks shall not disengage from either top or bottom corner fittings during the test.

A.10.5 Testing of midlocks

The test methods and forces used for testing are the same for midlocks as they are for twistlocks.

Annex B
(normative)

Stacking fittings for securing of containers — Function, dimensions, strength requirements and testing

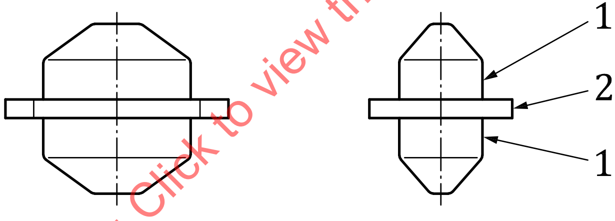
B.1 General

Stacking fittings, or stacking cones, or stackers, locate and secure containers horizontally either to each other, within a stack, or to the means of transport. They shall act through the container corner fittings or through sockets on the means of transport. Stacking fittings are always used together with other lashing and securing devices.

B.2 Types and description of stacking fittings

B.2.1 Single stacking cone fitting

A single stacking cone fitting consists of two cones opposite to each other, attached to an intermediate plate (see Figure B.1).



Key

1 cone

2 intermediate plate

Figure B.1 — Single stacking cone fitting

B.2.2 Double stacking cone fitting

A double stacking cone fitting consists of two cones opposite each other, attached to the ends of an intermediate plate. They are designed to connect and secure containers to each other and are of transverse type. The transverse type secures containers which have sides parallel to each other (see Figure B.2).

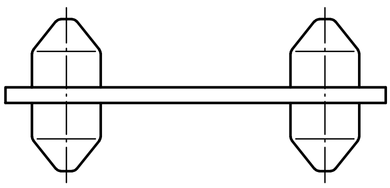


Figure B.2 — Double stacking cone fittings — Transverse type

B.2.3 Hanging stacker or terminal stacker

Hanging stackers are used to connect containers in holds when 20 ft containers are carried in 40 ft cell guides and are locked into the bottom corner fittings of containers above.

Flanged hanging stackers shall be placed in all four corner fittings to ensure horizontal and transverse alignment (see Figure B.3).

Flangeless hanging stackers allow containers to be stowed more compactly by slightly reducing height. Only two flangeless hanging stackers need to be fitted since horizontal and transverse alignment is not affected by flange thickness (see Figure B.4).

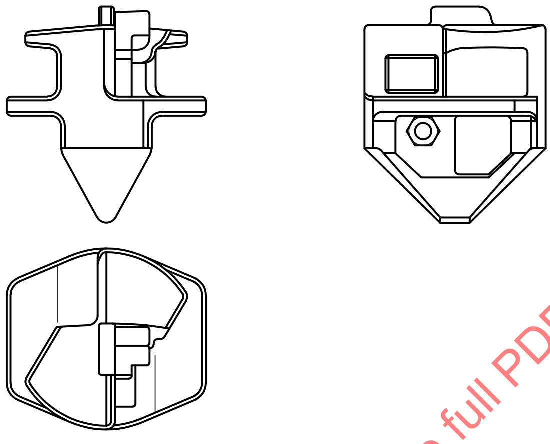


Figure B.3 — Flanged hanging stacker

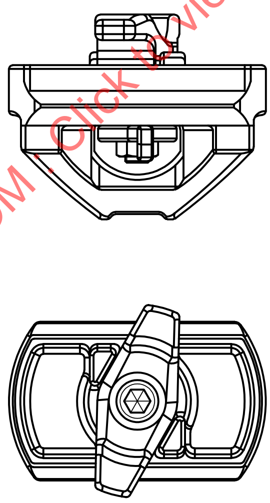


Figure B.4 — Flangeless hanging stacker

B.3 Functional requirements and dimensions of stacking fittings

B.3.1 General requirements

The fitting shall restrain connected containers in holds against horizontal movements.

The intermediate plate of double stacking cone fittings shall secure containers to each other to ensure loads are shared between stacks. Double-cone stacking fittings can only be used when the top corner fittings of the container layers are on the same level.

B.3.2 Top and bottom cones

The top and bottom cones shall be designed so that they do not protrude into that area of the corner fitting which is required for other lashing equipment. Figure B.5 specifies the restricted area.

B.3.3 Intermediate plate (if so fitted)

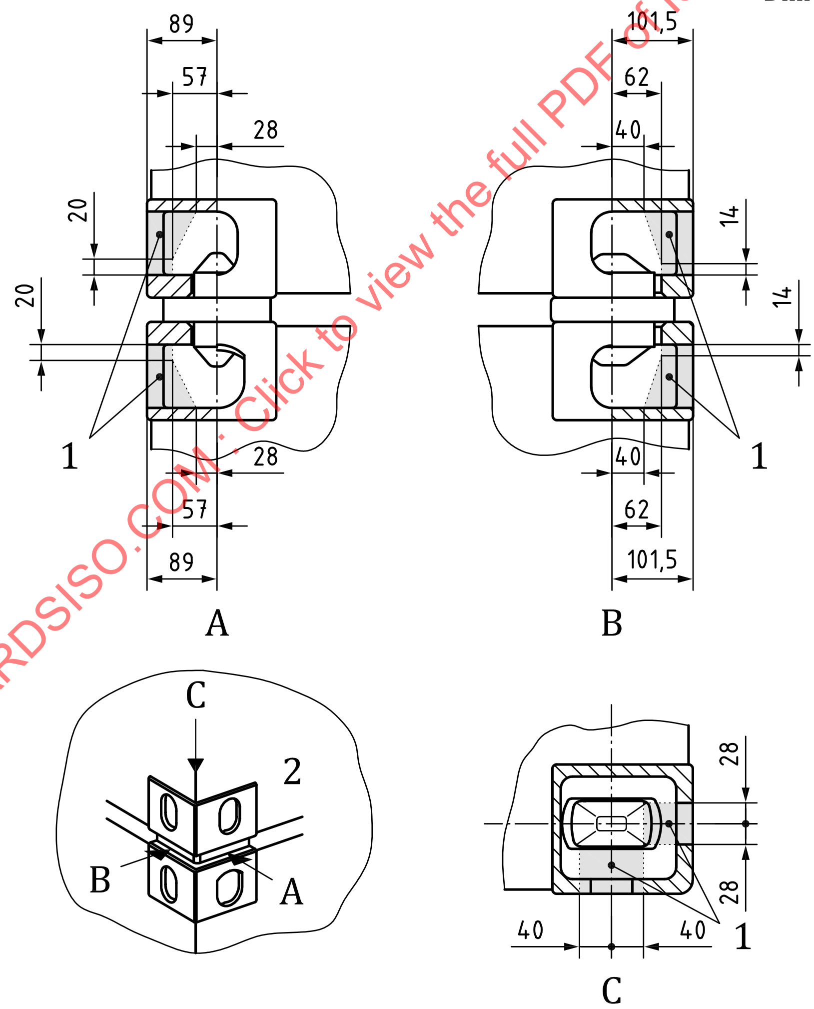
The thickness of the intermediate plate shall be minimum 12 mm. In particular, in a stack of containers all intermediate plates should have the same thickness.

The compression load transfer area of the intermediate plate shall be so designed as to ensure correct operation but not less than 600 mm^2. The intermediate plate shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

B.3.4 Cones

The cones shall fit into the top and bottom of corner fitting apertures in accordance with ISO 1161, and shall have the dimensions shown in Figure B.6.

Dimensions in millimetres



Key

1 restricted area

2 container end

Figure B.5 — Restricted part of a corner fitting cavity

Dimensions in millimetres

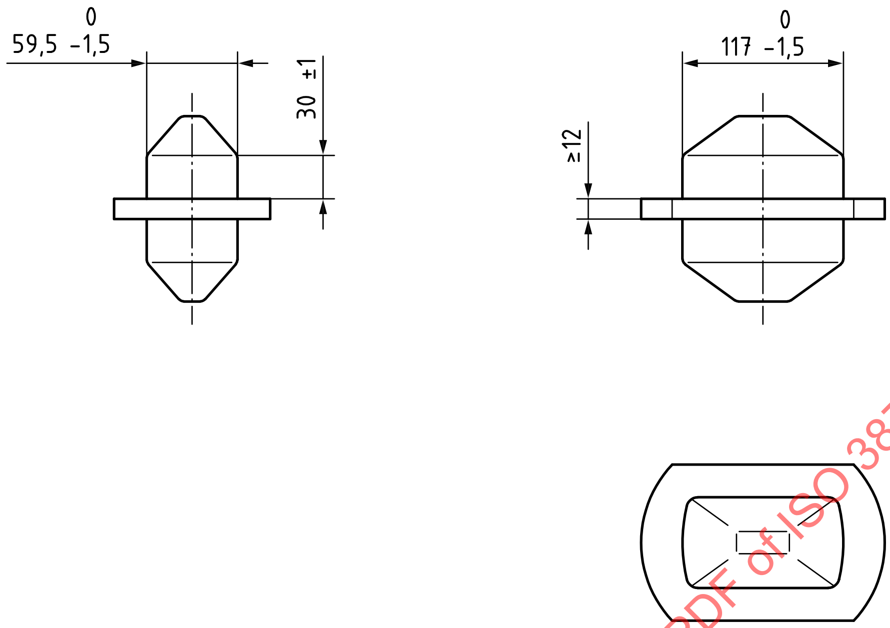


Figure B.6 — Dimensions of cones

B.3.5 Distance between cones

The distance between the cones on a transverse double-cone stacking fitting shall be in accordance with the container spacing of the ship where it is to be used. On a particular ship, the distance between the cones shall be the same and in accordance with the spacing selected for this ship.

B.4 Material and design performance

The performance and reliability of stacking fittings are functions of the design and choice of material. Stacking fittings shall be designed so that their function does not cease because of stress, corrosion or dirt.

B.5 Strength requirements

B.5.1 Compression strength of intermediate plate

The intermediate plate of single and double stacking fittings shall withstand a compression force of 1 000 kN without any permanent deformation or other abnormalities which would render it unsuitable for use.

To verify the compression strength requirement, test the stacking fitting in accordance with B.6.1. The compression force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

B.5.2 Compression strength of cones

The cones of single- and double-cone stacking fittings shall withstand a compression force of 150 kN without any permanent deformation or other abnormalities which would render it unsuitable for use.

The compression force shall be applied to the top cone in a testing machine by one flat steel plate and one steel plate with a hole equivalent to those in corner fittings in accordance with ISO 1161.

To verify the compression strength requirement, test the stacking fitting in accordance with B.6.2.

B.5.3 Shear strength

The stacking fitting shall withstand a shearing force equivalent to the value in Annex E transversally without any permanent deformation or other abnormalities which would render it unsuitable for use.

The force shall be applied in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

To verify the shear strength requirements, test the stacking fitting in accordance with B.6.3.

B.5.4 Tensile and compression strength of intermediate plate

The intermediate plate of a double-cone stacking fitting shall withstand a tensile and a compression force (horizontal) of 560 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the strength requirement, test the stacking fitting in accordance with B.6.4. The force shall act between the cones (see Figure B.10).

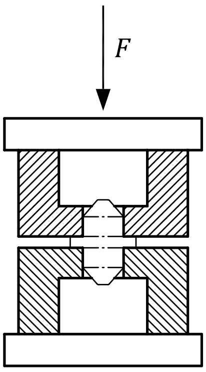
The force shall be applied by means of a device simulating four corner fittings in accordance with ISO 1161.

B.6 Test methods

B.6.1 Compression strength of intermediate plate

When performing the compression test, the intermediate plate shall be compressed in a testing machine by two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161 (see Figure B.7).

The test force shall be applied for 5 min.



Key

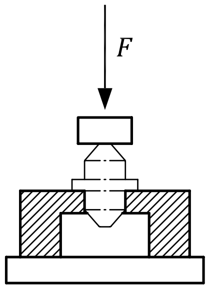
F test force

Figure B.7 — Compression test on intermediate plate

B.6.2 Compression strength of cones

When performing the compression test to the top cone or the bottom cone, it shall be compressed in a testing machine by a flat steel plate and a steel plate with holes equivalent to those in corner fittings in accordance with ISO 1161 (see Figure B.8).

The test load shall be applied for 5 min.



Key

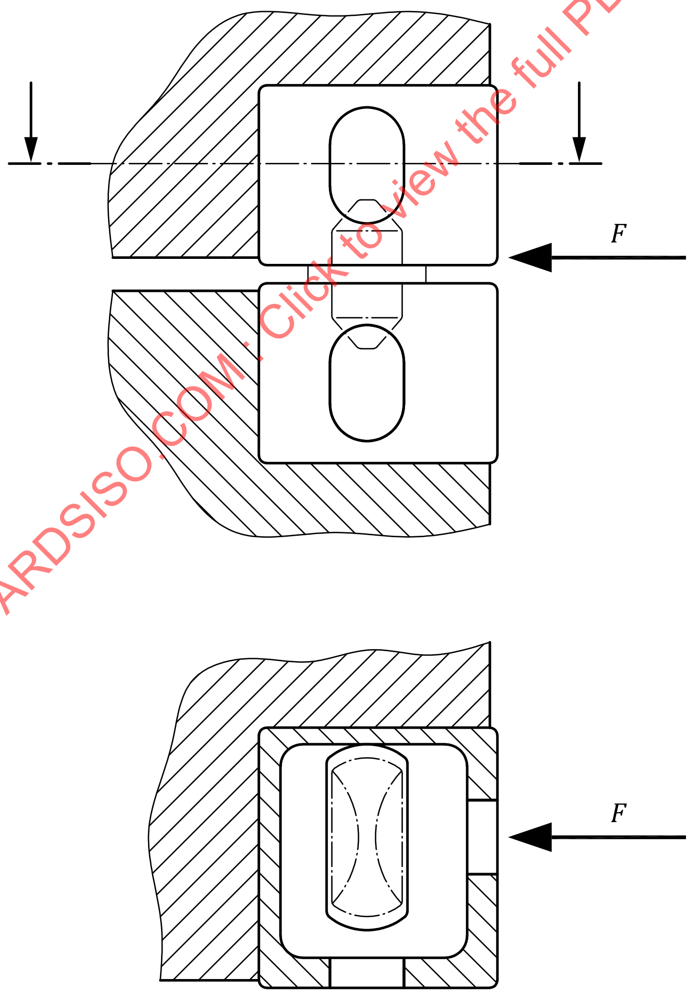
F test force

Figure B.8 — Compression test on top cone or bottom cone

B.6.3 Shear strength test

For the shear strength test, the stacking fitting shall be placed in the test rig with holes equivalent to those in corner fittings in accordance with ISO 1161 (see Figure B.9).

The stacking fitting shall be tested the transverse direction. The test force shall be applied for 5 min.



Key

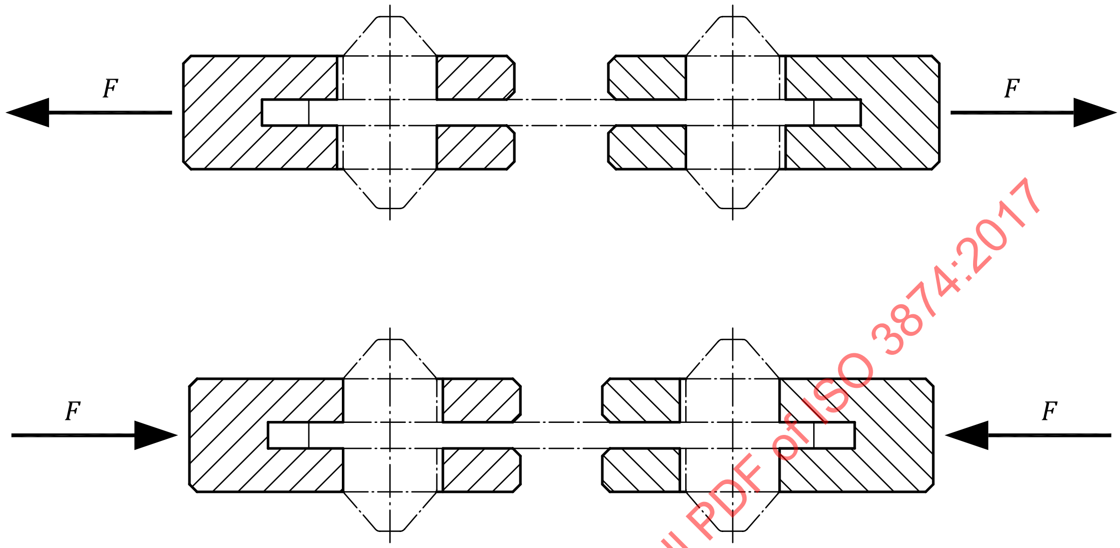
F test force

Figure B.9 — Shear test

B.6.4 Tensile and compression test, racking resistance test

The force shall be applied to the double-cone stacking fitting in a tensile test machine by four fittings with dimensions equivalent to corner fittings in accordance with ISO 1161 (see Figure B.10).

The test force shall be applied for 5 min in each direction.



Key

F test force

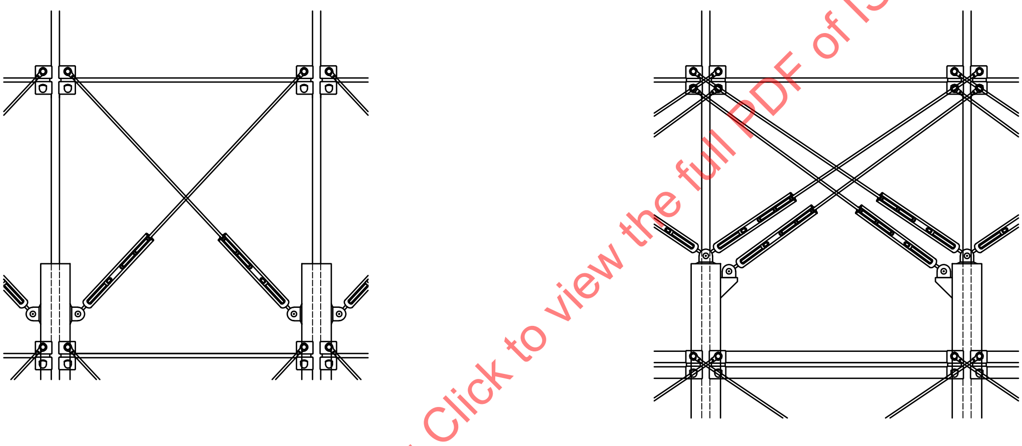
Figure B.10 — Tensile and compression test

Annex C
(normative)

Lashing rod systems, including tensioning devices, for securing of containers — Function, dimensions, strength requirements and testing

C.1 General

Lashing rods and tensioning devices secure tiers of containers, within a stack, to the means of transport. They act through the container fittings to the means of transport. They are always used together with other securing devices such as stacking fittings and twistlocks.



a) Internal b) External

Figure C.1 — Internal and external lashing systems

C.2 Functional requirements and dimensions

C.2.1 Lashing rod

A lashing rod shall be designed so as to

— be directly connected to the corner fitting of a container,

— be connected to a tensioning device, and

— have an appropriate length so that, together with the tensioning device, it fits between the corner fittings and the means of transport mode.

See Figure C.2 and Figure C.3.

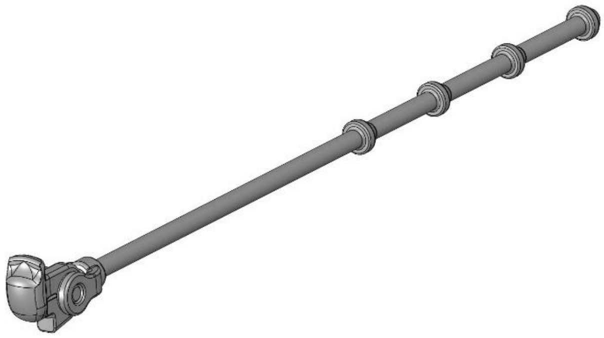


Figure C.2 — Lashing rod, hinged

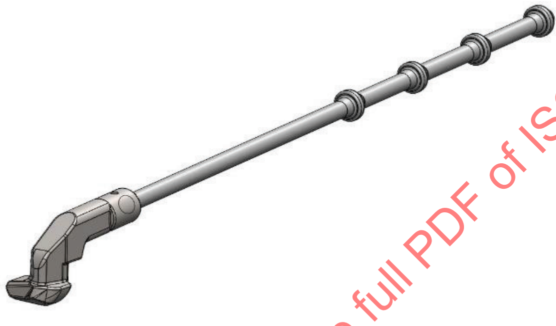


Figure C.3 — Lashing rod with plug

C.2.2 Tensioning device

A tensioning device shall be designed so as to be connected to the bottom part of a lashing rod and at the other end to the transport mode. It shall be of sufficient length so that, together with the lashing rod, it fits between the corner fittings and the transport mode. It shall be equipped with a mechanism which locks the tensioning device, i.e. locking nuts (see Figure C.4).

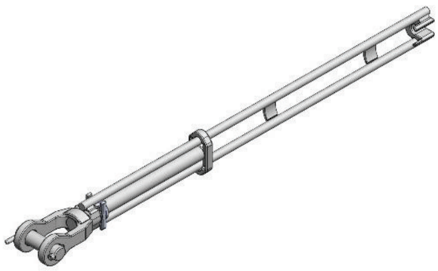


Figure C.4 — Typical example of a tensioning device

C.2.3 Top end of lashing rod

The top end of a rod shall be designed so that it does not protrude into the part of the corner fitting cavity, as defined in Figure C.5, which is required for other lashing equipment.

C.2.4 Bottom end of lashing rod

The bottom end of the rod shall be designed so that it fits to a tensioning device.

C.2.5 Other parts of lashing rod and tensioning device

Other parts of lashing rods and tensioning devices shall be designed so that they fit together or to the means of transport.

C.3 Material and design performance

The performance and reliability of lashing rods are functions of the design and choice of material. They shall be designed so that their function does not cease because of fatigue, corrosion or dirt.

C.4 Tensile strength of lashing rod

A lashing rod shall withstand a tensile force of 245 kN SWL[1)] without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the tensile strength requirement, test the rods in accordance with C.6.1. The force shall act between the corner fitting and a similar connection that the tensioning device is equipped with.

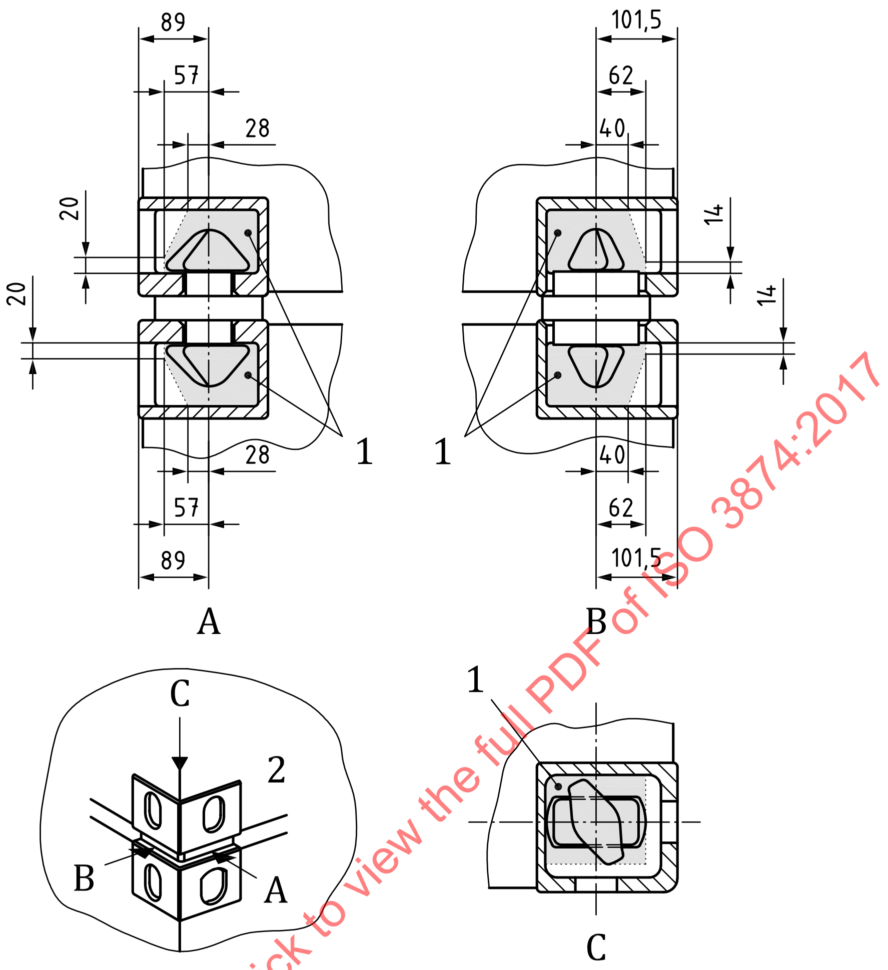
C.5 Tensile strength of tensioning device

A tensioning device shall withstand a tensile force of 245 kN SWL[1)] without any permanent deformation or other abnormalities which would render it unsuitable for use.

To verify the tensile strength requirement, test the tensioning device in accordance with C.6.2. The force shall act between the connecting devices.

1) The value of the tensile force can be reduced for specific lashing arrangements as approved in the Vessel Lashing Plan.

Dimensions in millimetres



Key

1 restricted area

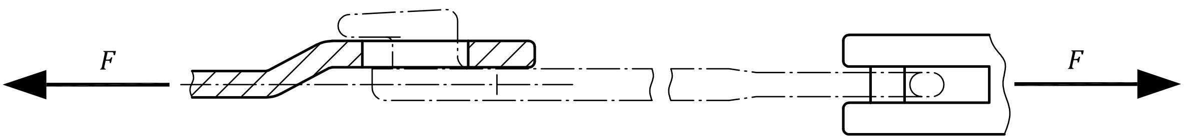
2 container end

Figure C.5 — Restricted part of corner fitting cavity

C.6 Test methods

C.6.1 Tensile test on lashing rod

The lashing rod shall be subjected to a tensile force of 245 kN[1] for 5 min, without permanent deformation or other abnormalities which would render it unsuitable for use. The elongation shall be measured after 5 min and the force shall then be increased until rupture occurs. The breaking force shall be recorded (see Figure C.6).



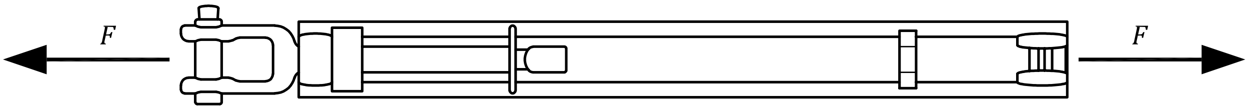
Key

F test force

Figure C.6 — Tensile test on lashing rod

C.6.2 Tensile test on tensioning device

The tensioning device shall be subjected to a tensile force of 245 kN for 5 min and the force shall then be increased until rupture occurs. The force shall be applied through suitable fittings. The breaking force shall be recorded. See Figure C.7.



Key

F test force

Figure C.7 — Tensile test on tensioning device

Annex D
(informative)

Container securing fittings

D.1 General

To ensure industry consistency, securing fittings tables are extracted from ISO 17905.

D.2 Securing fittings

The structural types of securing fittings are given in Table D.1.

Table D.1 — Structural types of securing fittings

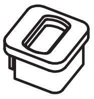
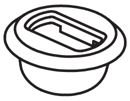
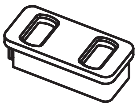
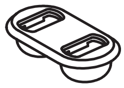
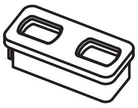
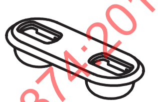
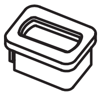
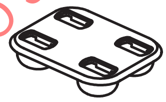
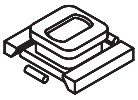
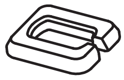
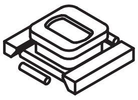
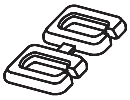
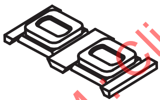
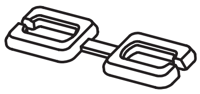
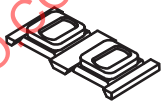
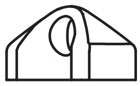
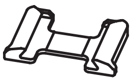
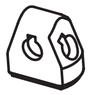
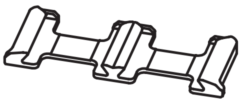
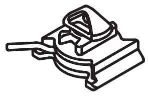
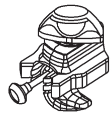
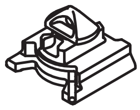
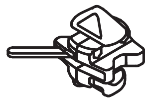
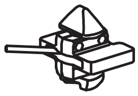
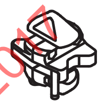
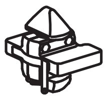
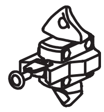
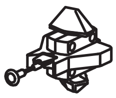
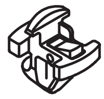
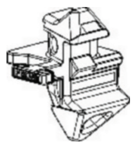
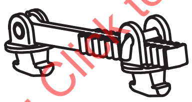
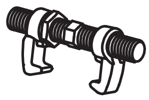
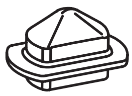
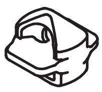
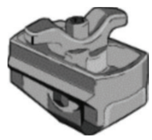
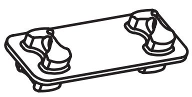
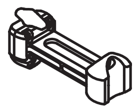
Type	Code	Name	Illustration	Code	Name	Illustration
Fixed fittings	A11	Raised socket		C11	Flush socket	
	A12	Raised transverse double socket		C12	Transverse double flush socket	
	A13	Raised longitudinal double socket		C13	Longitudinal double flush socket	
	A21	Raised elongated socket		C14	Quadruple flush socket	
	A31	Longitudi-nal sliding socket		D11	Doubling plate	
	A32	Transverse sliding socket		D12	Transverse double doubling plate	
	A33	Transverse sliding double socket		D13	Longitudinal double doubling plate	
	A34	Longitudinal sliding double socket		E11	Welding cone	
	B11	Dovetail foundation		E12	Welding cone with hole for securing bolt	
	B12	Double dovetail foundation				

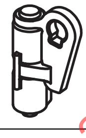
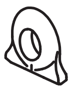
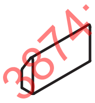
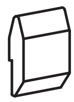
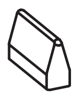
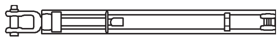
Table D.1 *(continued)*

Type	Code	Name	Illustration	Code	Name	Illustration
Portable fittings	F11-L	Left hand dovetail twistlock		F14	Fully automatic twistlock	
	F11-R	Right hand dovetail twistlock		F21-L	Left hand manual twistlock	
	F12-L	Left hand manual bottom twistlock		F21-R	Right hand manual twistlock	
	F12-R	Right hand manual bottom twistlock		F22	Semi-automatic twistlock	
	F13	Semi-automatic bottom twistlock		F31	Midlock	
	F32	Automatic container lock				
	G12	Rack adjusting bridge fitting		G11	Bridge fitting	
	H11	Bottom single stacking cone		H31	Flanged hanging stacker	
	H21	Single stacking cone		H32	Flangeless hanging stacker	
	H22	Double stacking cone		H33	Hanging double stacker	

D.3 Lashing fittings

The structural types of lashing fittings are given in Table D.2.

Table D.2 — Structural types of lashing fittings

Type	Code	Name	Illustration	Code	Name	Illustration
Fixed fitting	I11	D-ring		J22	Slewing lashing plate	
	J11	Lashing plate		K11	Single-sid-ed guide fit-ting	
	J12	Double lashing plate		K12	Guide fitting for platform	
	J21	Limit lashing plate		K13	Double-sided guide fitting	
Portable fitting	L12	Tensioning device		M11	Hinged lashing rod	
	M14	Plug lashing rod		M21	Extension lashing rod