INTERNATIONAL STANDARD

ISO 3874

Fifth edition
1997-12-15

AMENDMENT 1
2000-11-15

Corrected and reprinted
2001-09-01

Series 1 freight containers — Handling and securing

AMENDMENT 1:

Twistlocks, latchlocks, stacking fittings and lashing rod systems for securing of containers

Conteneurs de la série 1 — Manutention et fixation

AMENDEMENT 1:

Verrous tournants, verrous à loquet, dispositifs de gerbage et systèmes de barres de saisissage pour la fixation des conteneurs

Reference number
ISO 3874:1997/Amd.1:2000(E)

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Printed in Switzerland

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

Amendment 1 to International Standard ISO 3874:1997 was prepared by Technical Committee ISO/TC 104, *Freight containers*, Subcommittee SC 1, *General purpose containers*.

Series 1 freight containers — Handling and securing

AMENDMENT 1:
Twistlocks, latchlocks, stacking fittings and lashing rod systems for securing of containers

Page iii, Foreword

Replace the last sentence with the following:

"Annexes A to D form a normative part of this International Standard. Annex E is for information only."

Page 29, annex A, Bibliography

Change this annex to annex E.

Add the following annexes A to D before the bibliography.

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 transport modes (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 empty containers.

A.2 Definitions

For the purposes of this annex, the following definitions apply to twistlocks.

A.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

A.2.2
eyehole
hole in the top cone of a twistlock to identify the proper orientation of the twistlock

A.2.3
handle tail
upbent part of the handle to identify the proper orientation of the twistlock in a stack of containers

A.2.4
fixed base
rigid part of a collar which allows manual pre-locking of the bottom part of a twistlock

A.2.5
triggering device
manually operated device which sets a twistlock

A.2.6
intermediate plate
part of a twistlock that carries the compression force between stacked containers

A.2.7
single-purpose twistlock
twistlock of asymmetrical design complying with the standard orientation

NOTE It can be used only in one of the two following alternatives:

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

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

A.2.8
double twistlock
twistlock fitted with both top cone and bottom cone

A.2.9
dual-purpose twistlock
twistlock that, having the same orientation, can be pre-locked either in a top corner fitting or in a bottom corner fitting

A.2.10
single lock
locking function of a twistlock in either the top cone or bottom cone

A.2.11
double lock
locking function of a twistlock in both the top cone and bottom cone

A.3 Types and description of securing twistlocks

A.3.1 Manual twistlocks

A.3.1.1 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 with an eyehole which can be rotated in relation to a fixed base;

— an intermediate plate with collars and a fixed base;

— a handle with 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.

Key

1 Unlocked
2 Locked

a) Fully open position **b) Fully closed position**

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

A.3.1.2 Manual twistlock, with double locks, three positions

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

a) a top cone with an eyehole and a bottom cone rigidly connected together by a shaft;

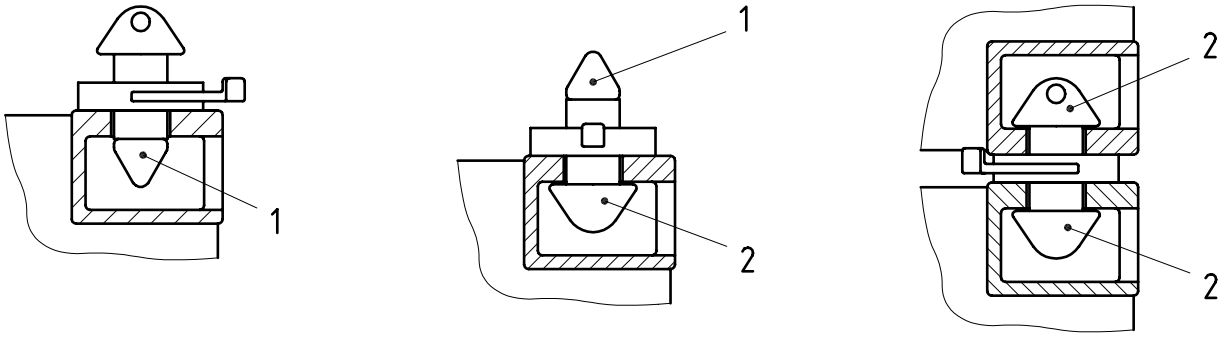
b) an intermediate plate with collars;

c) a handle with a tail pointing upwards, attached to the shaft, moving in the horizontal plane and having three positions; see Figure A.2:

— **first position**: bottom cone fully open in order to engage the twistlock to the top corner fitting;

— **second position**: top cone fully open and bottom cone closed in order to secure the twistlock to the top corner fitting and engage the twistlock to the bottom corner fitting of the next container;

— **third position**: both top and bottom cones fully closed.



Key

1 Unlocked

2 Locked

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

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

A.3.2 Semi-automatic twistlock

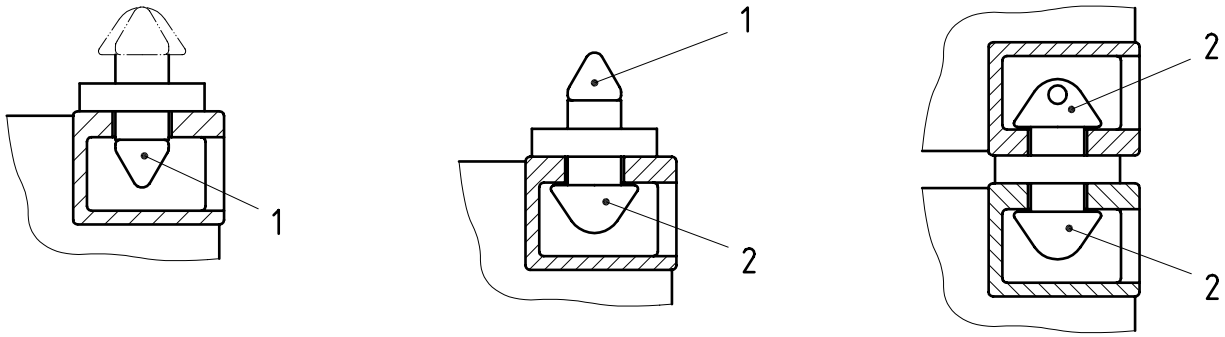
A semi-automatic twistlock can be of both single purpose and dual purpose. It consists of the following:

— a top cone with an eyehole 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 either 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 device for unlocking the twistlock.



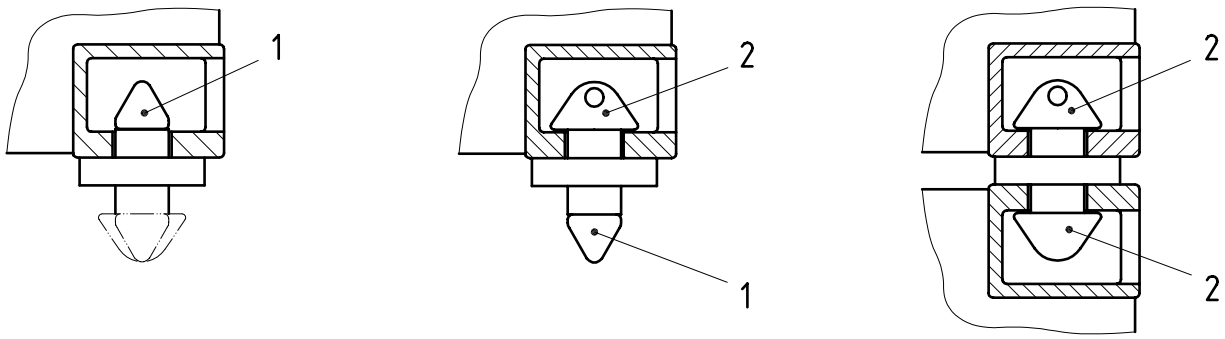
Key

1 Unlocked

2 Locked

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

Figure A.3 — Semi-automatic twistlock, fitted to the upper corner fitting



Key

1 Unlocked

2 Locked

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

Figure A.4 — Semi-automatic twistlock, fitted to the bottom corner fitting

A.4 Functional requirements and dimensions of twistlocks

A.4.1 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 in the top cone shall identify the top cone and facilitate the handling of the twistlock.

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

A.4.2 Manual twistlocks

A manual twistlock shall be oriented so that the cone with an eyehole is pointing upwards.

The handles shall always work in the horizontal plane and shall be fitted with a tail which shall be pointing upwards.

The unified direction of handle locking shall be clockwise, seen from above, to ensure safe locking.

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

A.4.3 Semi-automatic twistlocks

A semi-automatic twistlock shall be oriented so that the cone with an eyehole 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 handle shall be fitted with a tail pointing upwards and 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 a positive locking mechanism which ensures that the twistlock will not be dislodged from the corner fitting during loading and unloading of containers.

A.5 Dimensions

A.5.1 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.5.2 Intermediate plate

The thickness of the intermediate plate shall be $30\ ^{0}_{-5}$ mm. See Figure A.6.

The load carrying area (flange surface bearing area) of the intermediate plate shall be at least 4 500 mm^2. The twistlock shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

A.5.3 Handle

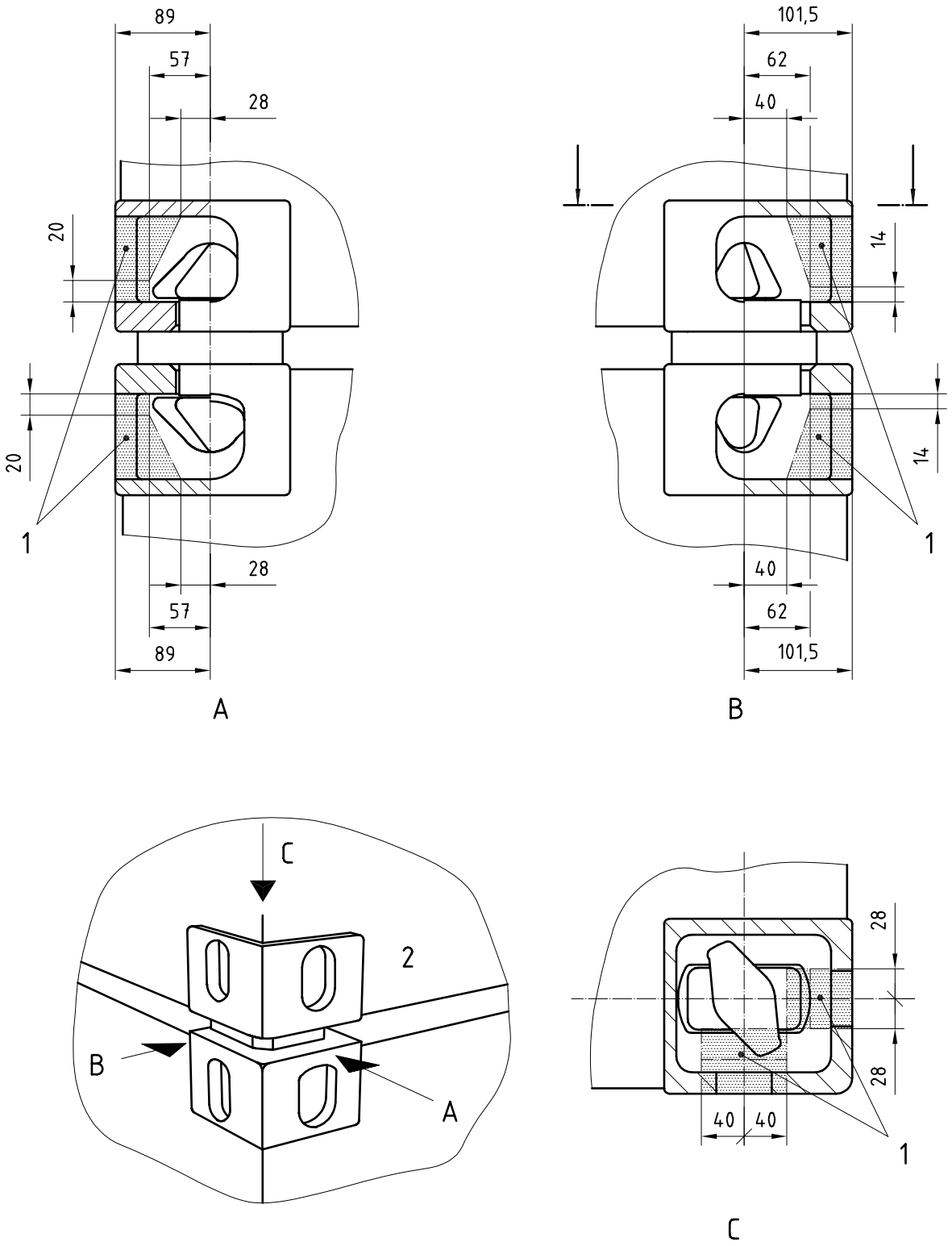
The length of the handle, measured from the centreline of the locks to the end, shall be a maximum of 160 mm.

The bent-up tail of the handle shall have a length of 25 mm $\pm$ 2 mm. See Figure A.7.

A.5.4 Collars

In order to fit into corner fitting apertures in accordance with ISO 1161, the collar shall have the dimensions shown in Figure A.8.

Dimensions in millimetres



Key

1) Restricted area
2) Container end

Figure A.5 — Restricted part of corner fitting cavity

Dimensions in millimetres

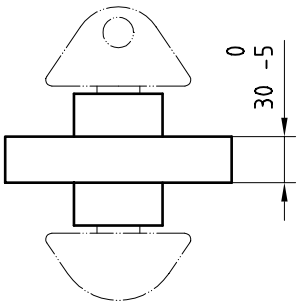


Figure A.6 — Intermediate plate

Dimensions in millimetres

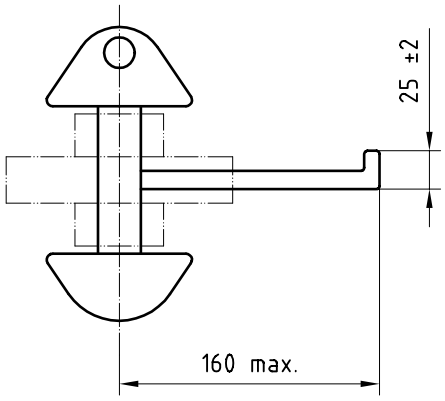


Figure A.7 — Length of the handle

Dimensions in millimetres

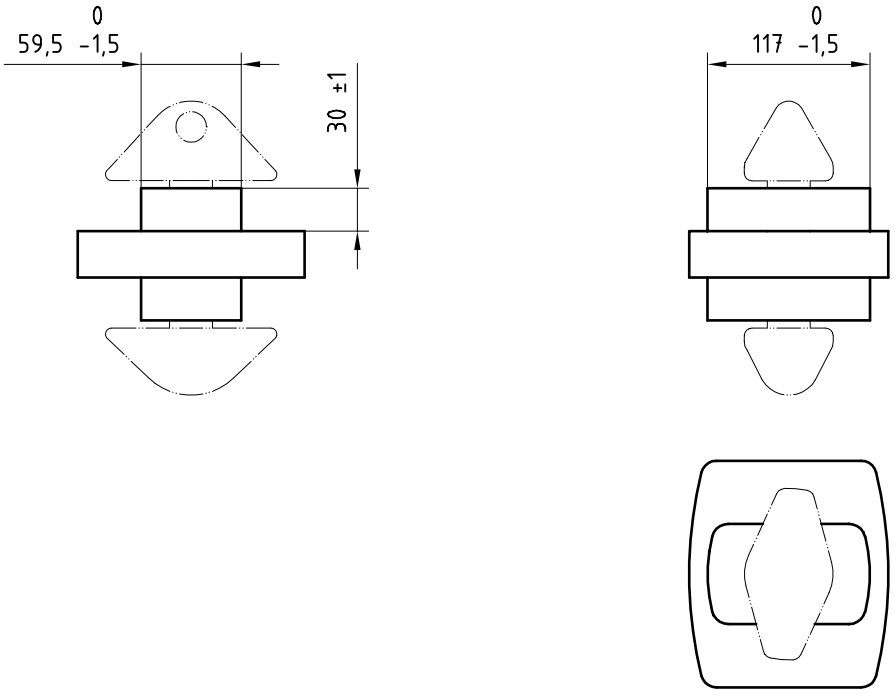
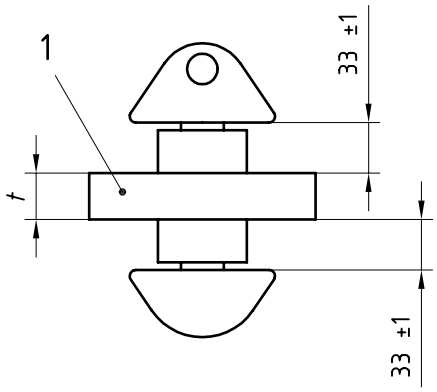


Figure A.8 — Dimensions of collars

A.5.5 Distance between top lock and bottom locks

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.9.

Dimensions in millimetres



Key

1 Intermediate plate

t is the thickness of the intermediate plate.

Figure A.9 — Distance between top and bottom locks

A.6 Material and design performance

The performance and reliability of twistlocks are functions of design and choice of material. Moving parts, especially springs holding the handle in position shall be designed so that their function does not cease because of stress, corrosion and dirt. For safety reasons it is also important that there are distinct stop positions.

A.7 Strength requirements

A.7.1 Tensile strength

Twistlocks shall withstand a tensile force of 150 kN without any permanent deformation. To verify the tensile strength requirement, test the twistlocks in accordance with A.8.1. The force shall act between the locking cones or the top locking cone and the fixed base.

Twistlocks used for lifting shall withstand a tensile force of at least 178 kN without any permanent deformation.

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

A.7.2 Compression strength

A.7.2.1 Compression strength of intermediate plate

The intermediate plate of the twistlock shall withstand a compression force of 850 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the compression strength requirement, test the twistlock in accordance with A.8.2.1. 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.7.2.2 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. To verify the compression strength requirement, test the cone of the twistlock in accordance with A.8.2.2. The function of the twistlock shall not be affected by the test.

A.7.3 Shear strength

The collars of the twistlock shall withstand a shearing force of 300 kN longitudinally and 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.

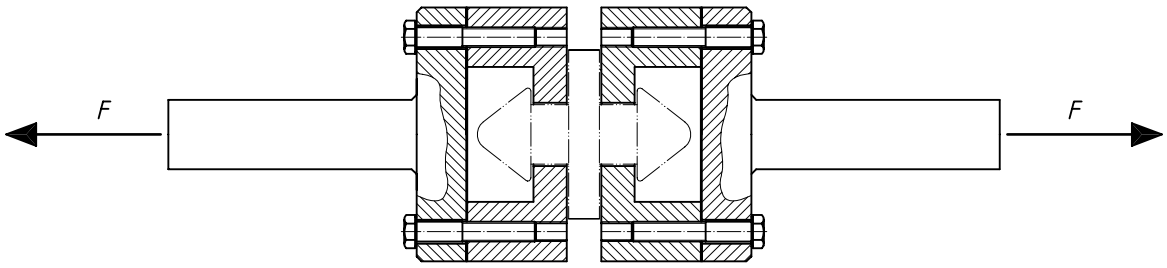
To verify the shear strength requirements, test the collar of the twistlock in accordance with A.8.3.

A.8 Test methods

A.8.1 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.10.

The test force shall be held for 5 min.



F is the test force.

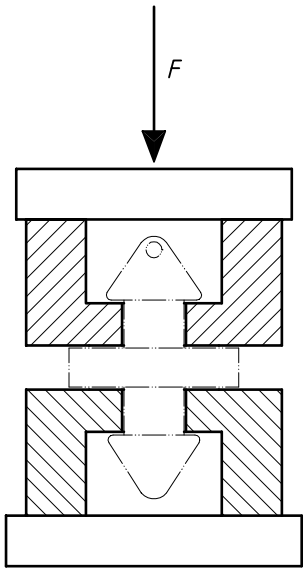
Figure A.10 — Tensile test

A.8.2 Compression test

A.8.2.1 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 A.11.

The test force shall be applied for 5 min.



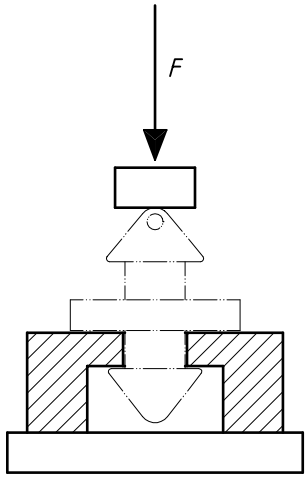
F is the test force.

Figure A.11 — Compression test on intermediate plate

A.8.2.2 Compression strength of cones

When performing the compression test on the top cone or the bottom cone, the cone 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 A.12.

The test force shall be applied for 5 min.



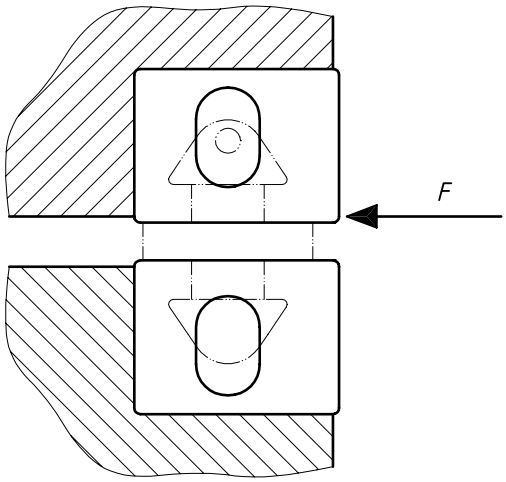
F is the test force.

Figure A.12 — Compression test on top or bottom cone

A.8.3 Shear strength test

For the shear strength test, the twistlock 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.13.

The twistlock shall be tested in both the longitudinal and transverse directions. The test force shall be applied for 5 min.



F is the test force.

Figure A.13 — Shear test

Annex B
(normative)

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

B.1 General

Latchlocks locate and secure containers

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

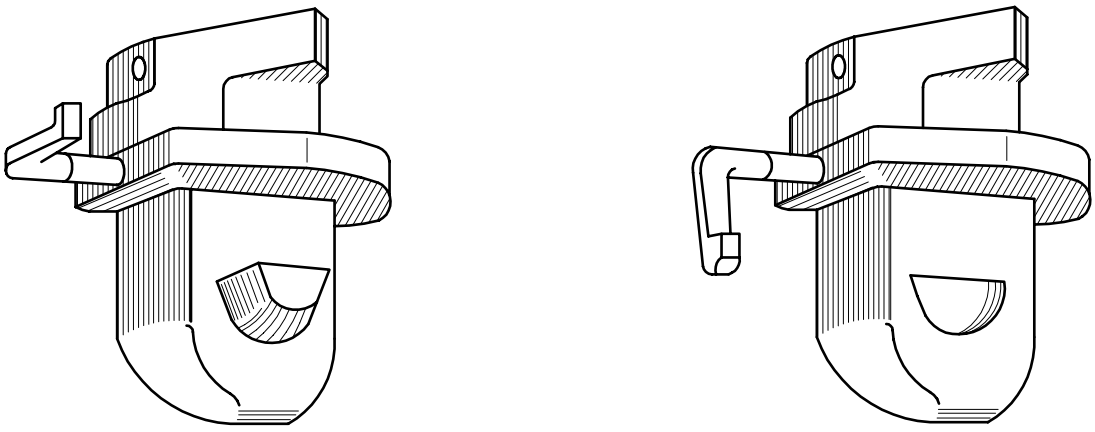
— or to the transport modes (they are then acting through the corner fitting and the securing sockets of the carrying vehicles).

Latchlocks are also used to connect and lift empty containers.

B.2 Definitions

For the purposes of this annex, the following definitions apply to latchlocks.

B.2.1
latchlock
a device locking containers, to each other within a stack, or to the transport mode, and securing containers by the protrusion of a latch(es), engaging in a corner fitting of a container or in a securing socket. See Figure B.1



a) Locked **b) Unlocked**

Figure B.1 — Semi-automatic latchlock, single lock

B.2.2
semi-automatic latchlock
latchlock in which the top cone and/or bottom cone are/is activated by a mechanism and automatically locked

B.2.3
top cone
top body of a latchlock with or without a locking device, always engaging a bottom corner fitting

B.2.4
bottom cone
bottom body of a latchlock with or without a locking device, always engaging a top corner fitting or in a securing socket

B.2.5
latch
locking device of a latchlock, moved horizontally or swung out from a cone

B.2.6
handle
device attached to a latchlock, activating the mechanism and therefore the latch

B.2.7
collar
part of latchlock which fits into the top or bottom apertures of a corner fitting and restrains connected containers from horizontal movements

B.2.8
eye hole
hole in the top cone of a latchlock

B.2.9
fixed base
rigid part of a cone which allows manual pre-locking to a corner fitting of a container

B.2.10
intermediate plate
part of latchlock that carries the compression force between stacked containers

B.2.11
single-purpose latchlock
latchlock of asymmetrical design complying with the standard orientation

NOTE It can be used only in one of two following alternatives:

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

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

B.2.12
double latchlock
latchlock fitted with both top cone and bottom cone

B.2.13
dual-purpose latchlock
latchlock that, having the same orientation, can be pre-locked either in a top corner or in a bottom corner fitting or in a securing socket

B.2.14
single lock
latchlock with locking function in either the top cone or the bottom cone only

B.2.15
double lock
latchlock with locking functions in both the top cone and bottom cone

B.3 Types and description of semi-automatic latchlocks

A semi-automatic latchlock can be of both single and dual purpose.

A single-purpose latchlock consists of the following:

a) a top cone with an eye hole and a bottom cone with a latch, connected to a mechanism;

b) an intermediate plate with collars;

c) an internal mechanism automatically locking the latch when the bottom cone engages into a top corner fitting, see Figure B.2.

A dual-purpose latchlock consists of the following:

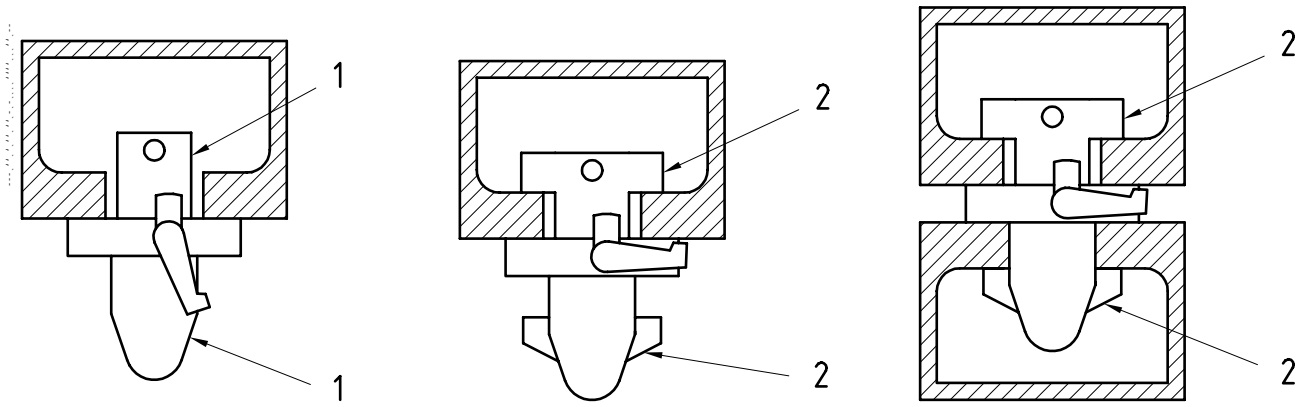
a) a top cone with an eye hole and a bottom cone, rigidly connected, each being fitted with a latch connected to an interval mechanism;

b) an intermediate plate with collars;

c) an internal mechanism which automatically locks the latches when

— either a container is landed onto the bottom latchlock locked into a top corner fitting (see Figure B.3),

— or the latchlock, locked into the bottom corner fitting of a container, is engaged into a corner fitting.

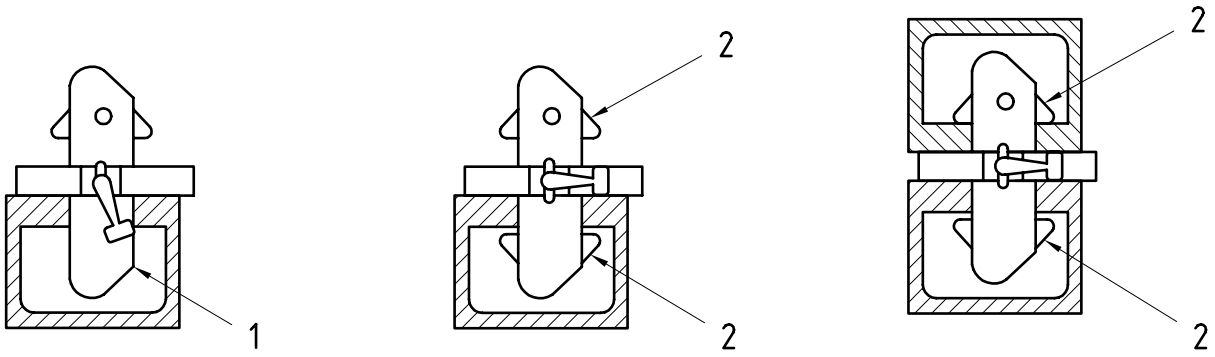


a) First position **b) Second position** **c) Third position**

Key

1 Unlocked
2 Locked

Figure B.2 — Semi-automatic latchlock, fitted to the bottom corner fitting



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

Key

1 Unlocked
2 Locked

Figure B.3 — Semi-automatic latchlock, fitted to the upper corner fitting (dual-purpose only)

B.4 Functional requirements of latchlocks

B.4.1 General requirements

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

The collar shall restrain connected containers against horizontal movements.

The eyehole in the top cone shall identify the top cone and facilitate the handling of the latchlock.

The handle shall allow movement of a latch(es) and therefore locking and unlocking of the latchlock.

The positive locking mechanism shall ensure that the latchlock is not accidentally dislodged from the corner fitting during loading, unloading and transport of containers.

B.4.2 Semi-automatic latchlocks

A semi-automatic latchlock shall be oriented so that the cone with an eyehole is pointing upwards.

A semi-automatic latchlock shall be fitted with a means to clearly identify the locking of both cones.

For semi-automatic latchlocks fitted with a handle working in a vertical plane, the locking of the latch(es) shall be indicated by the handle in its horizontal position.

In the case of a semi-automatic latchlock with a handle working in a horizontal plane, the handle shall be fitted with a tail pointing upwards, and closing of the container shall be indicated by the handle in its leftmost position.

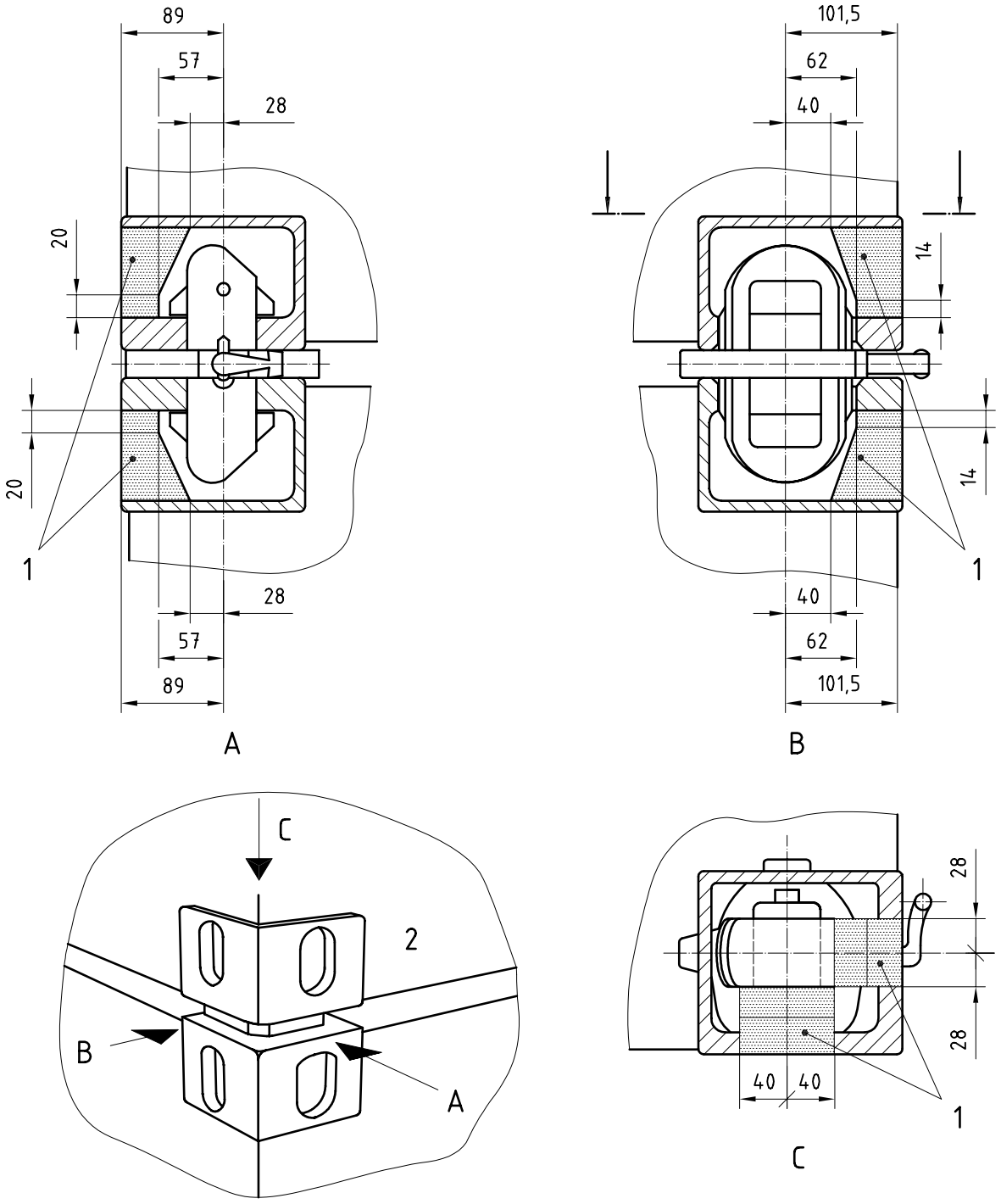
B.5 Dimensions

B.5.1 Top cone and bottom cone

The top cone and the bottom cone or respective latches shall be designed so that, in a fully locked position, the load carrying area is greater than 800 mm^2 in total when locked at both sides of a corner fitting aperture, or greater than 600 mm^2 when locked at one side of a corner fitting aperture. The top cone and bottom cone shall not

protrude into the part of the corner fitting cavity, defined in Figure B.4, which is required for other lashing equipment.

Dimensions in millimetres



Key

1 Restricted area

2 Container end

Figure B.4 — Restricted part of corner fitting cavity

B.5.2 Intermediate plate

The thickness of the intermediate plate shall be $30\ ^{0}_{-5}$ mm.

The compression load carrying area (flange surface bearing area) of the intermediate plate shall be at least 4 500 mm^2. The latchlock shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

B.5.3 Handle

In the case of a handle working in a vertical plane, the length of the shank part of the handle, measured from the centreline of the locks to the inside of the bent handle, and the length of the bent handle from the centre of the shank to the end shall be in accordance with Figure B.5.

Dimensions in millimetres

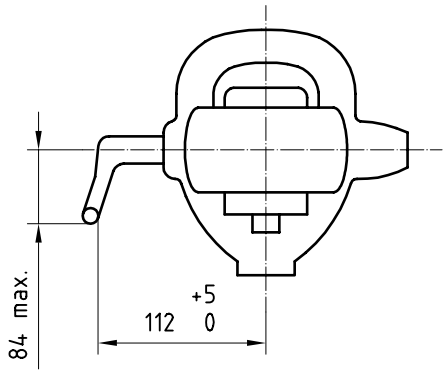


Figure B.5 — Length of the handle working in a vertical plane

In the case of a handle working in a horizontal plane, the length of the handle, measured from the centre of the locks to the end, and the bent-up tail of the handle shall be in accordance with Figure B.6.

Dimensions in millimetres

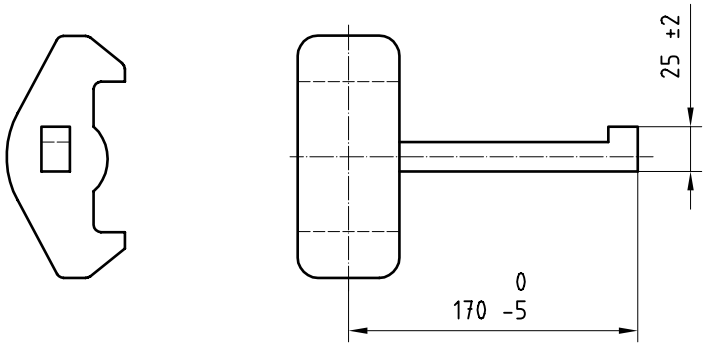


Figure B.6 — Length of handle working in a horizontal plane

B.5.4 Collars

The collars 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.7.

Dimensions in millimetres

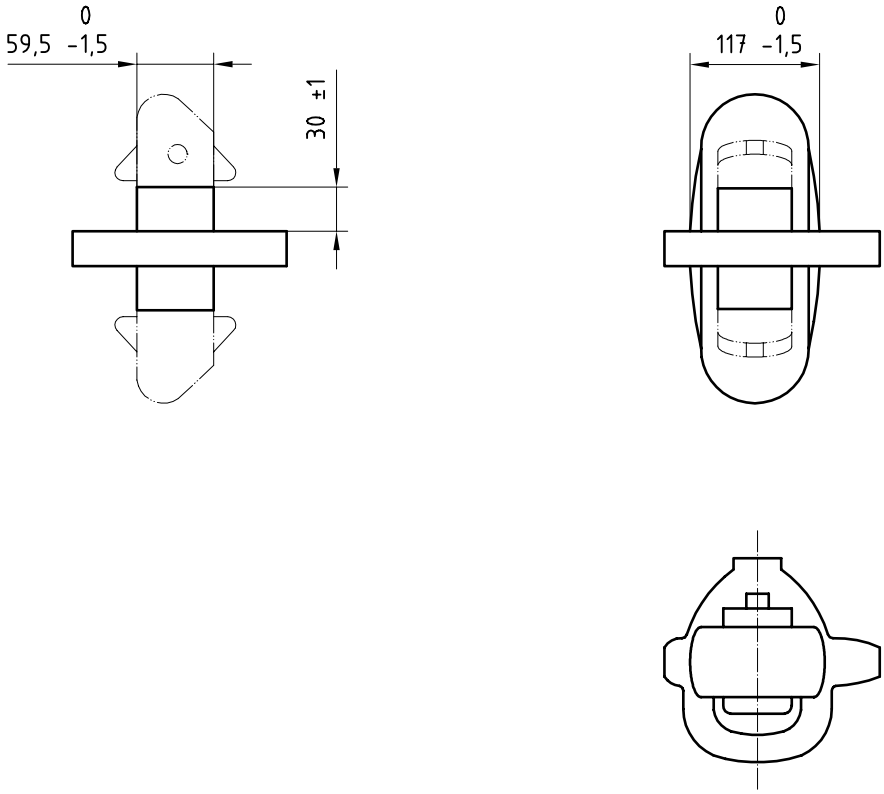


Figure B.7 — Dimensions of collars

B.5.5 Distance between top lock and bottom lock

The distance between the top and bottom locks shall be as shown in Figure B.8.

Dimensions in millimetres

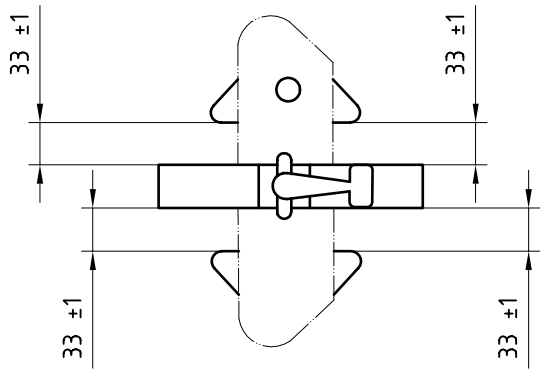


Figure B.8 — Distance between top and bottom latches

B.6 Material and design performance

The performance and reliability of latchlocks are functions of the design and choice of material. Springs holding the handle in position shall be designed so that their function does not cease because of stress, corrosion or dirt. For safety reasons it is also important that there are distinct stop positions.

B.7 Strength requirements

B.7.1 Tensile strength

The latchlock shall withstand a tensile force of 150 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the tensile strength requirement, test the latchlock in accordance with B.8.1. The force shall act between the locking cones or the top locking cone and the fixed base.

Latchlocks used for lifting shall withstand a tensile force of at least 178 kN without any permanent deformation or other abnormalities which would render it unsuitable for use.

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

B.7.2 Compression strength

B.7.2.1 Compression strength of intermediate plate

The intermediate plate of the latchlock shall withstand a compression force of 850 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the compression strength requirement, test the latchlock in accordance with B.8.2.1 The function of the latchlock shall not be affected by the test. The compression force shall be applied in a testing machine via two steel plates with holes equivalent to those in corner fittings in accordance with ISO 1161.

B.7.2.2 Compression strength of cones

The cones of the latchlock 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 latchlock shall not be affected by the test.

The compression force shall be applied to the top cone or to the bottom cone, in a testing machine by one plain 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 latchlock in accordance with B.8.2.2. The function of the latchlock shall not be affected by the test.

B.7.3 Shear strength

The collar of the latchlock shall withstand a shearing force of 300 kN longitudinally and 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.

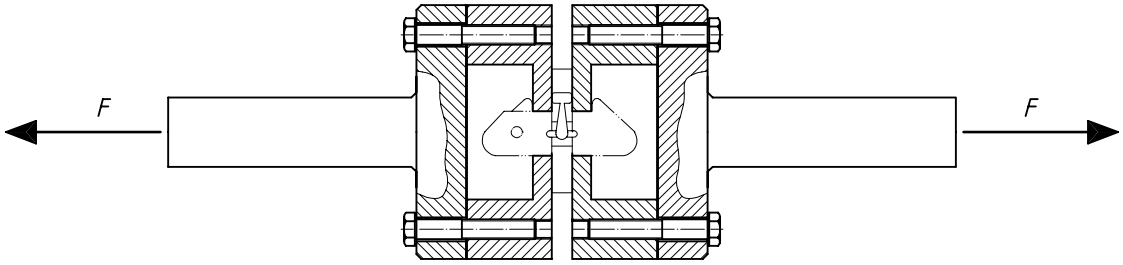
To verify the shear strength requirements, test the stacking fitting in accordance with B.8.3.

B.8 Test methods

B.8.1 Tensile test

The tensile test force shall be applied to the latchlock by a tensile test machine and two fittings with dimensions equivalent to corner fittings in accordance with ISO 1161. See Figure B.9.

The test force shall be applied for 5 min.



F is the test force.

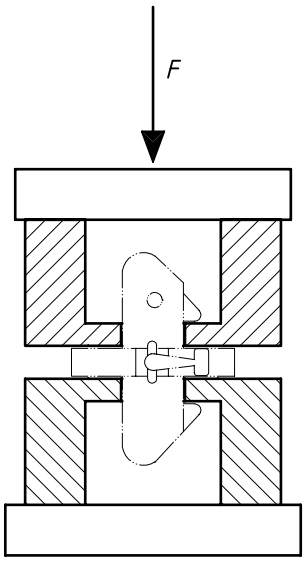
Figure B.9 — Tensile test

B.8.2 Compression test

B.8.2.1 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.10.

The test force shall be applied for 5 min.



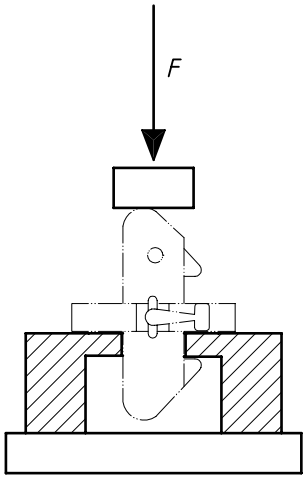
F is the test force.

Figure B.10 — Compression test on intermediate plate

B.8.2.2 Compression strength of cones

When performing the compression test to the top or the bottom cone, the cones shall be compressed in a testing machine by a flat steel plate and a steel plate with a hole equivalent to those in corner fittings in accordance with ISO 1161. See Figure B.11.

The test force shall be applied for 5 min.



F is the test force.

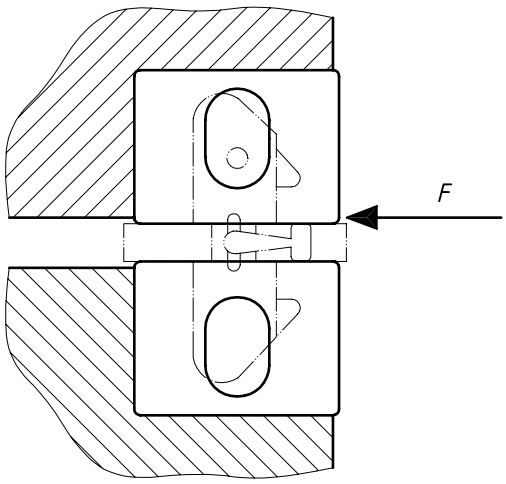
Figure B.11 — Compression test on top or bottom cone

B.8.3 Shear strength test

For the shear strength test, the latchlock shall be placed in locked position in a testing rig with holes equivalent to those in corner fittings in accordance with ISO 1161. See Figure B.12.

The latchlock shall be tested both in longitudinal and transverse directions.

The test force shall be applied for 5 min.



F is the test force.

Figure B.12 — Shear test

Annex C
(normative)

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

C.1 General

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

C.2 Definitions

For the purposes of this annex, the following definitions apply to stacking fittings.

C.2.1
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

C.2.2
intermediate plate
part of a stacking fitting that carries the compression force between stacked containers

C.2.3
single cone
stacking fitting fitted with one top cone and one bottom cone

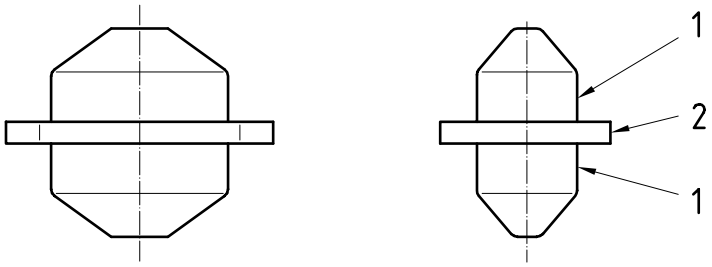
C.2.4
double cones
stacking fitting fitted with two top cones and two bottom cones

NOTE They can be of transverse or longitudinal type.

C.3 Types and description of stacking fittings

C.3.1 Single-cone stacking fitting

A single-cone stacking fitting consists of two cones opposite to each other, attached to an intermediate plate. See Figure C.1.



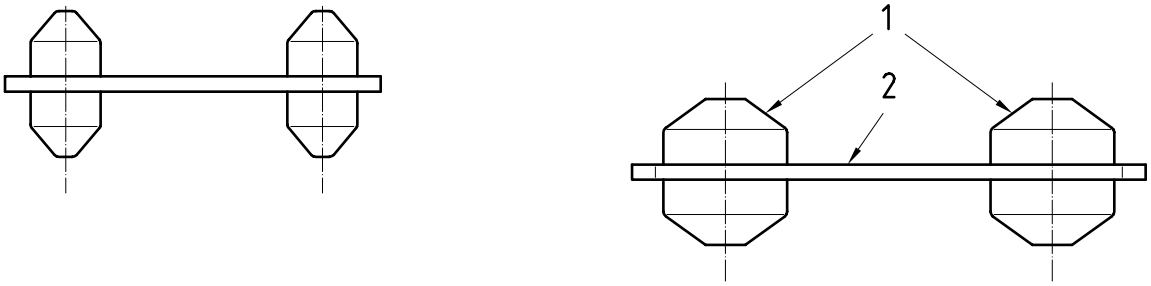
Key

1 Cone
2 Intermediate plate

Figure C.1 — Single-cone stacking fitting

C.3.2 Double-cone stacking fitting

A double-cone stacking 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 or longitudinal type. The transverse type secures containers which have sides parallel to each other. The longitudinal type secures containers having their ends parallel to each other. See Figure C.2.



a) Transverse type **b) Longitudinal type**

Key

1 Cone
2 Intermediate plate

Figure C.2 — Double-cone stacking fittings

C.4 Functional requirements and dimensions of stacking fittings

C.4.1 General requirements

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

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

C.4.2 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. See Figure C.3 which specifies the restricted area.

C.4.3 Intermediate plate

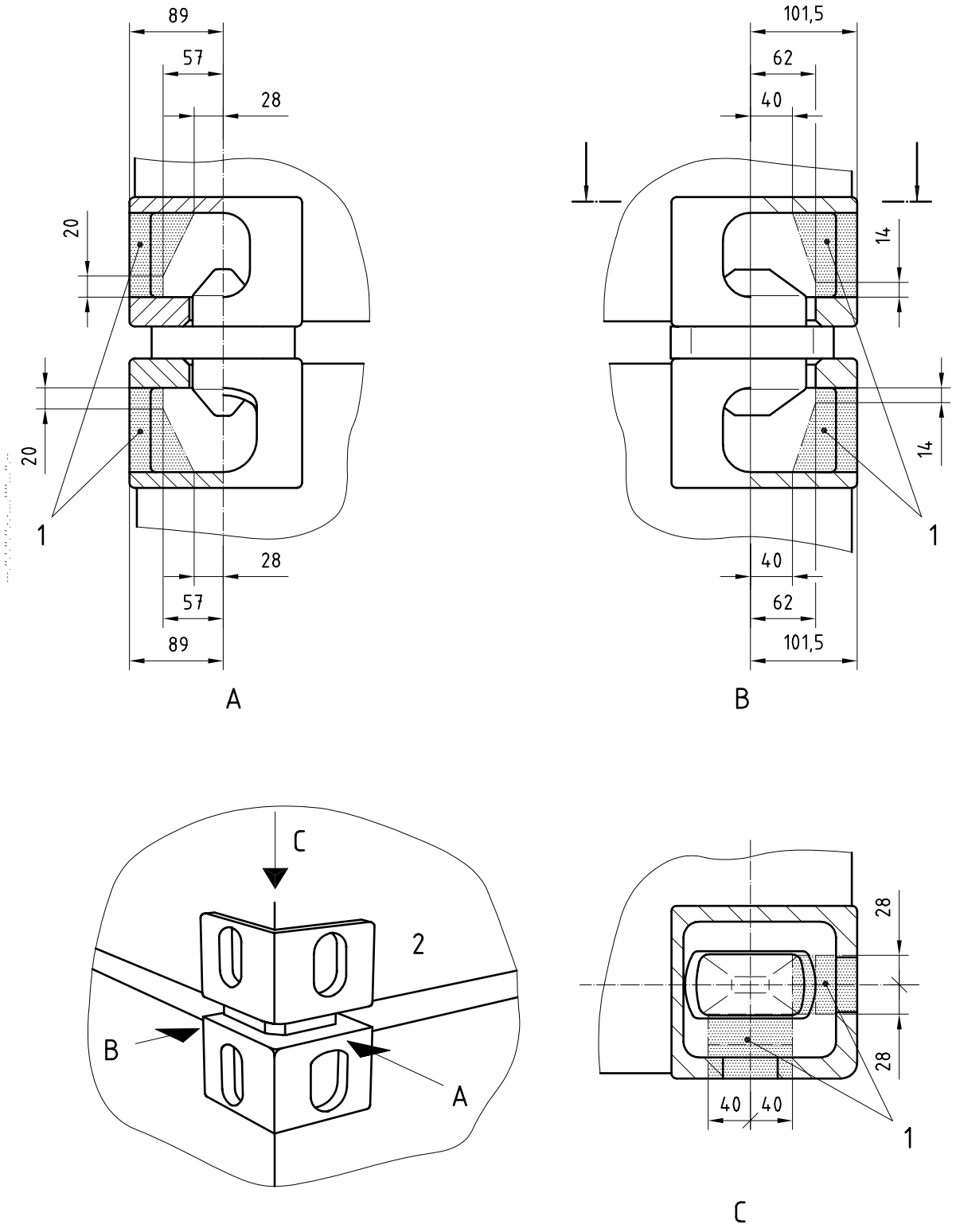
The thickness of the intermediate plate shall be minimum 12 mm. In particular, in a stack of containers all intermediate plates should have the same thickness.

The compression load carrying area (flange surface bearing area) of the intermediate plate shall be at least 4 500 mm^2. The intermediate plate shall be so designed as to have the maximum load transfer area towards the walls of the corner fittings.

C.4.4 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 C.4.

Dimensions in millimetres



Key

1 Restricted area

2 Container end

Figure C.3 — Restricted part of a corner fitting cavity

Dimensions in millimetres

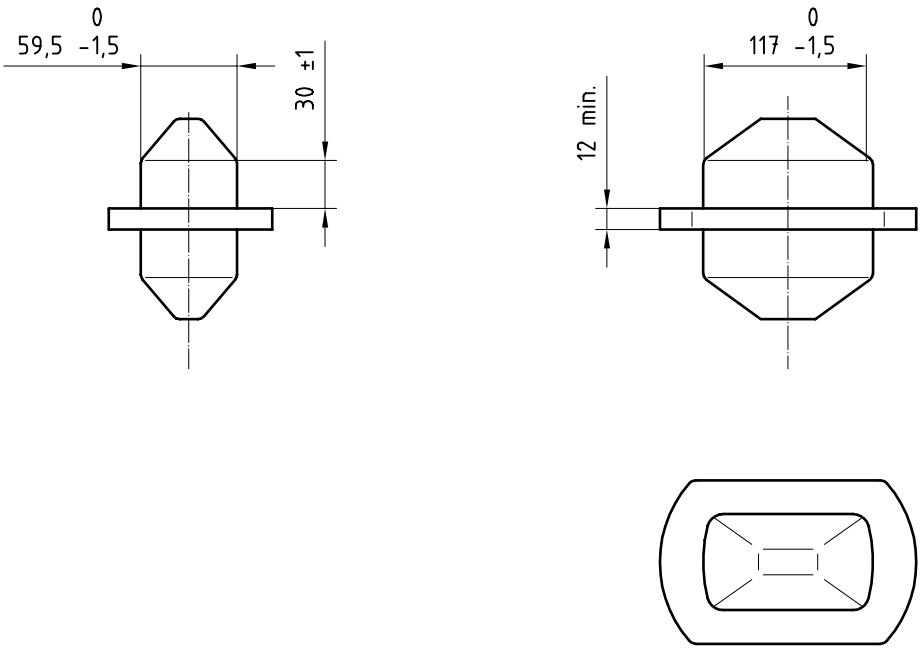


Figure C.4 — Dimensions of cone

C.4.5 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.

The distance between the cones on longitudinal double-cone stacking fittings shall be 280 mm ± 5 mm, as shown in Figure C.5.

Dimensions in millimetres

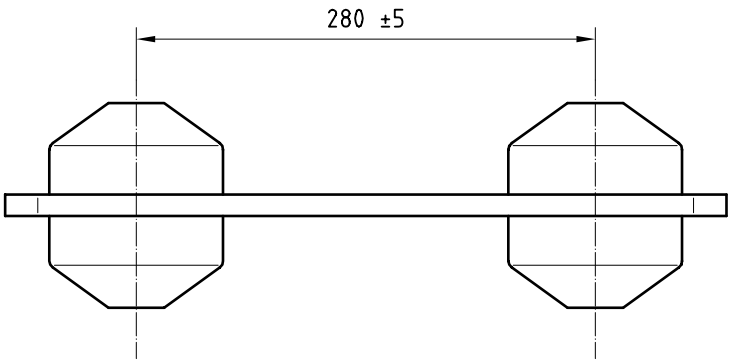


Figure C.5 — Distance between cones

C.5 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.

C.6 Strength requirements

C.6.1 Compression strength of intermediate plate

The intermediate plate of single- and double-cone stacking fittings shall withstand a compression force of 850 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 C.7.1. 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.

C.6.2 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 C.7.2.

C.6.3 Shear strength

The stacking fitting shall withstand a shearing force of 300 kN longitudinally and 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 C.7.3.

C.6.4 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 300 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 C.7.4. The force shall act between the cones, see Figure C.9.

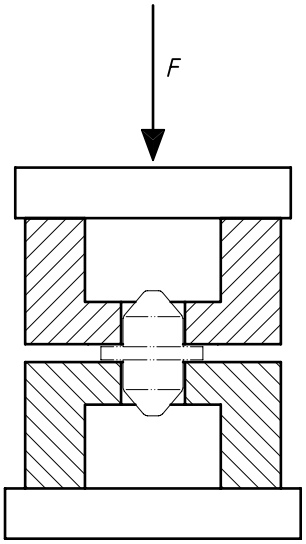
The force shall be applied by means of a device, longitudinal or transverse depending of type, simulating four corner fittings in accordance with ISO 1161.

C.7 Test methods

C.7.1 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 C.6.

The test force shall be applied for 5 min.



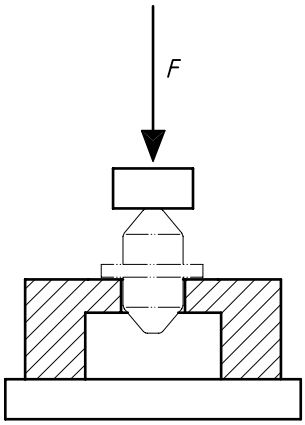
F is the test force.

Figure C.6 — Compression test on intermediate plate

C.7.2 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 C.7.

The test load shall be applied for 5 min.



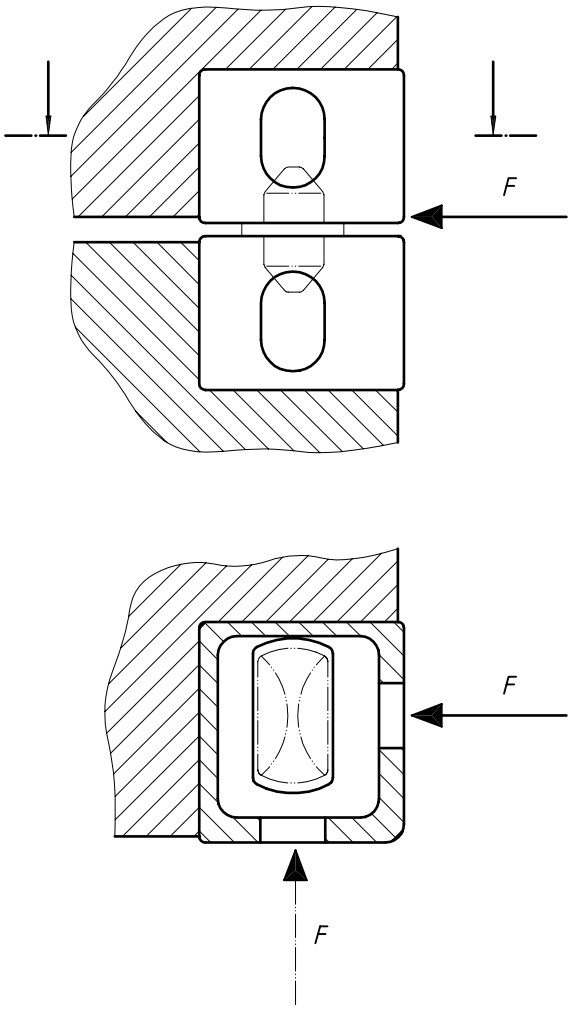
F is the test force.

Figure C.7 — Compression test on top cone on bottom cone

C.7.3 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 C.8.

The stacking fitting shall be tested in both the longitudinal and transverse directions. The test force shall be applied for 5 min.



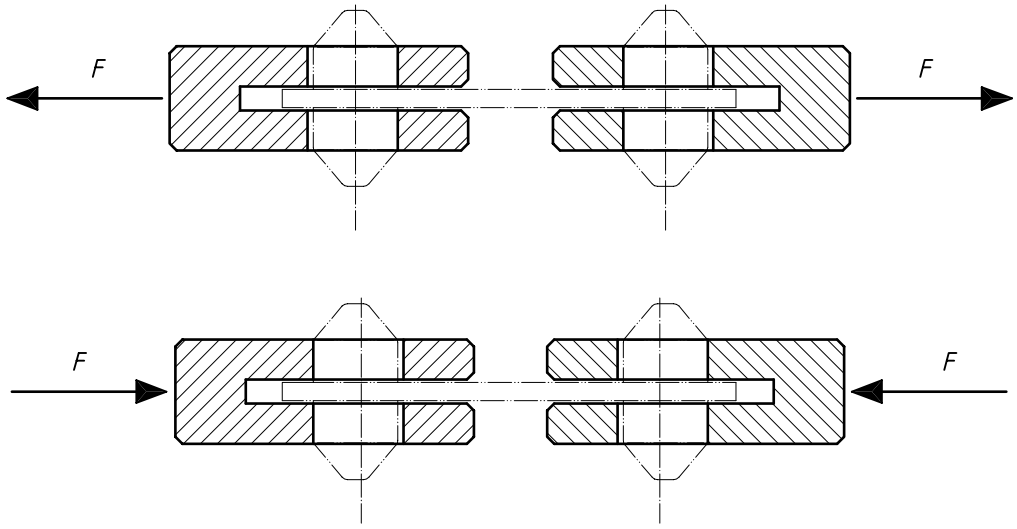
F is the test force.

Figure C.8 — Shear test

C.7.4 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 1121. See Figure C.9.

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



F is the test force.

Figure C.9 — Tensile and compression test

Annex D
(normative)

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

D.1 General

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

D.2 Definitions

For the purposes of this annex, the following definitions apply to lashing rods.

D.2.1
lashing rod
rod with a top which fits into a corner fitting or to a connecting part (i.e. a hook) which in turn fits into a corner fitting, and a bottom part which fits into a tensioning device (i.e. a turnbuckle)

See Figures D.1 to D.5.

D.2.2
securing hook
securing fitting which fits into a corner fitting and to which a lashing rod can be attached

See Figures D.1 and D.5.

D.2.3
plug hook
fixed part of a lashing rod which fits into a corner fitting

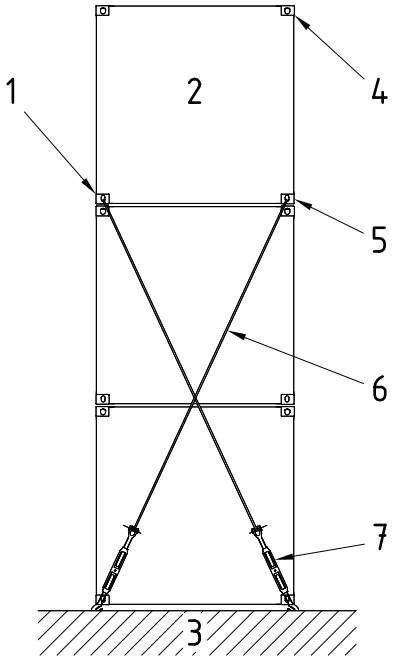
See Figure D.3.

D.2.4
hinge hook
articulated part of a lashing rod which fits into a corner fitting

See Figure D.4.

D.2.5
tensioning device
device in which one end fits into the bottom part of a lashing rod and in the other end fits onto the transport mode (i.e. a pad eye)

See Figure D.1.



Key

1 Securing hook
2 Container
3 Ship structure
4 Top corner fitting
5 Bottom corner fitting
6 Lashing rod
7 Tensioning device

Figure D.1 — Lashing rod system

D.3 Functional requirements and dimensions

D.3.1 Lashing rod

A lashing rod shall be designed so as to

— be directly connected to the corner fitting of a container or to a device that fits into the corner fitting (securing hook),

— 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 transport mode.

See Figures D.2 to D.4.

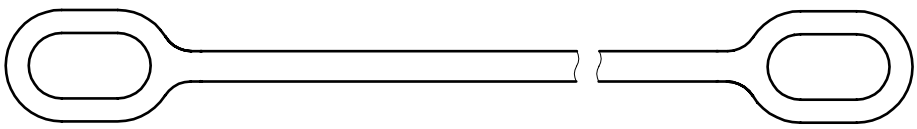


Figure D.2 — Lashing rod

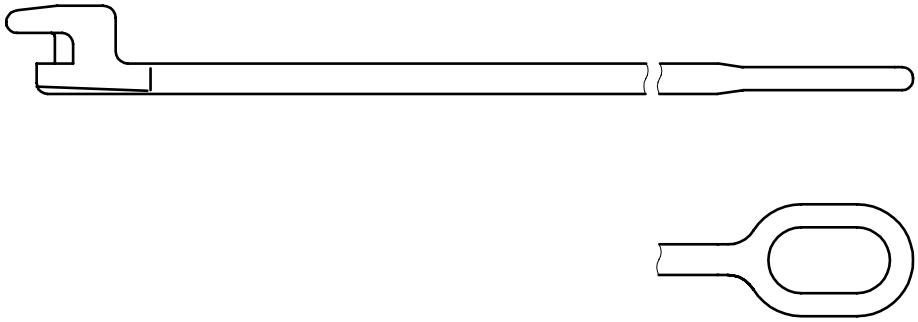


Figure D.3 — Lashing rod, plug hook

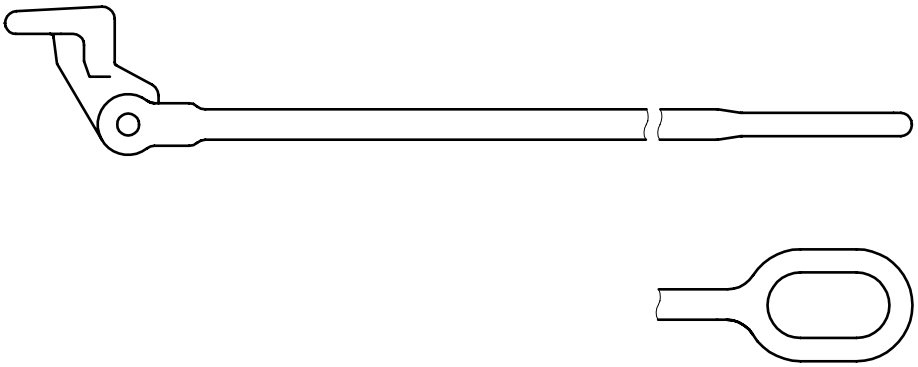


Figure D.4 — Lashing rod, hinged hook

D.3.2 Securing hook

A securing hook shall be designed so as to be connected to the corner fitting of a container and to a lashing rod. See Figure D.5.

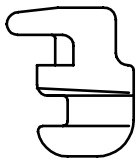


Figure D.5 — Securing hook

D.3.3 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 device which locks the tensioning device, i.e. locking nuts. See Figure D.6. The tensioning device should be kept neither slack nor over-tensioned.

NOTE Over-tensioning of these devices can damage containers.

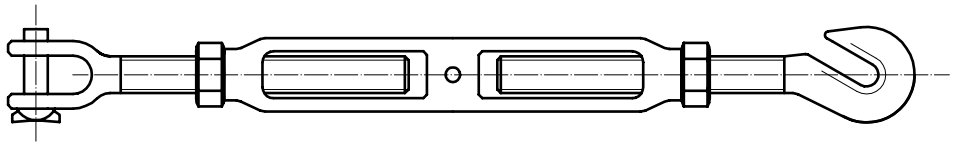


Figure D.6 — Typical example of a tensioning device, turnbuckle with locking nuts

D.3.4 Top end of lashing rod or securing hook

The top end of a rod or a securing hook shall be designed so that it does not protrude into the part of the corner fitting cavity, defined in Figure D.7, which is required for other lashing equipment.

D.3.5 Bottom end of lashing rod

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

D.3.6 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 transport mode.

D.4 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.

D.5 Tensile strength of lashing rod

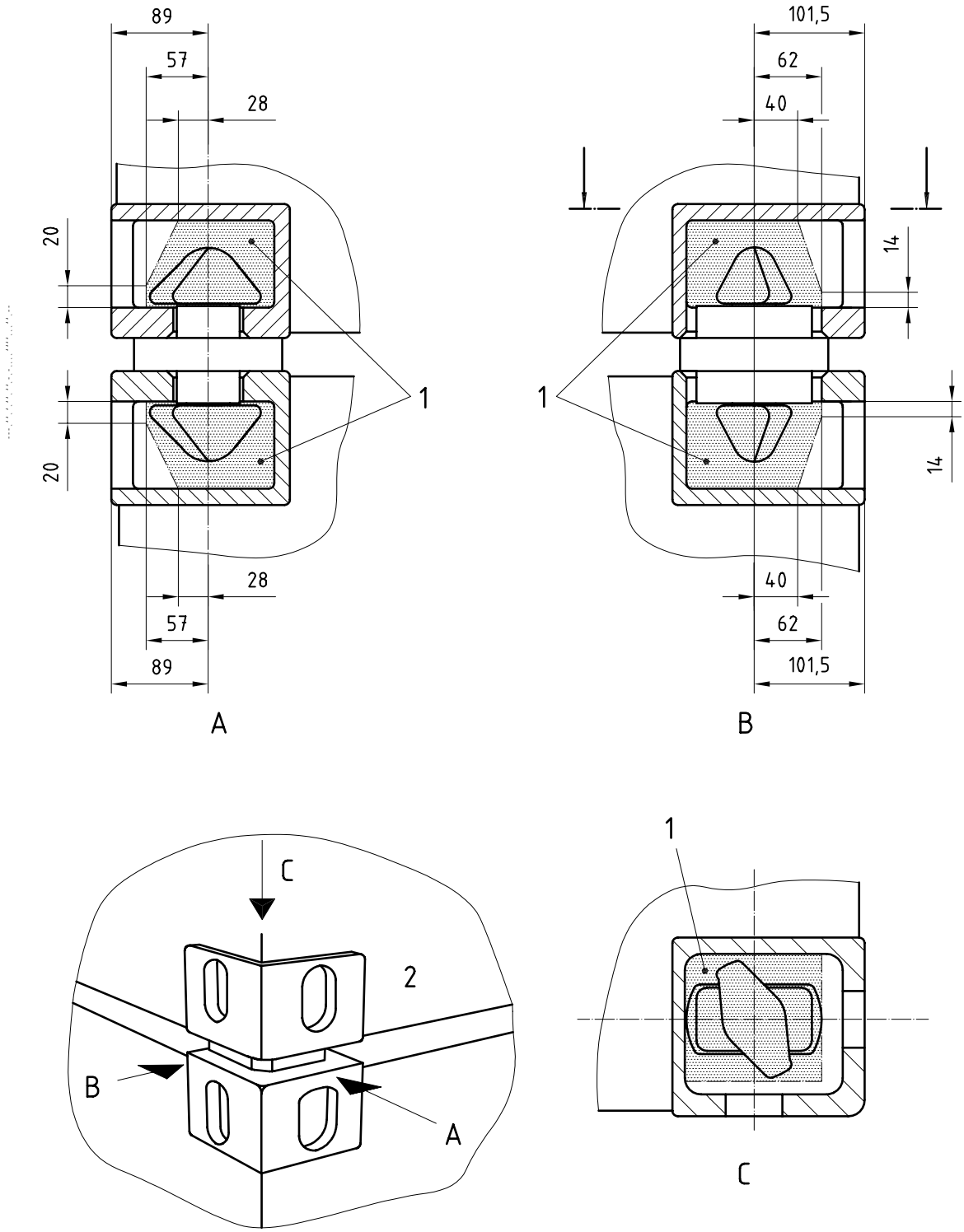
A lashing rod shall withstand a tensile force of 270 kN without any permanent deformation or other abnormalities which would render it unsuitable for use. To verify the tensile strength requirement, test the rods in accordance with D.7.1. The force shall act between the corner fitting and a similar connection that the tensioning device is equipped with. If the lashing rod is designed to be connected to a corner fitting by a securing hook, this securing hook shall be included in the tensile test.

D.6 Tensile strength of tensioning device

A tensioning device shall withstand a tensile force of 270 kN 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 D.7.2. The force shall act between the connectioning devices.

Dimensions in millimetres



Key

1 Restricted area

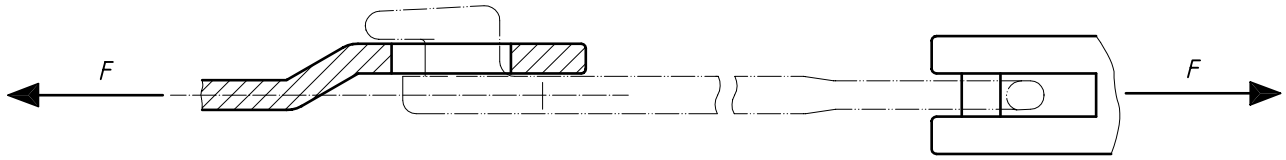
2 Container end

Figure D.7 — Restricted part of corner fitting cavity

D.7 Test methods

D.7.1 Tensile test on lashing rod

The lashing rod shall be subjected to a tensile force of 270 kN for 5 min, without permanent deformation or other abnormalities which would render it unsuitable for use. The elongation shall be measured after these 5 min and the force shall then be increased until rupture occurs. The breaking force shall be recorded. See Figure D.8.

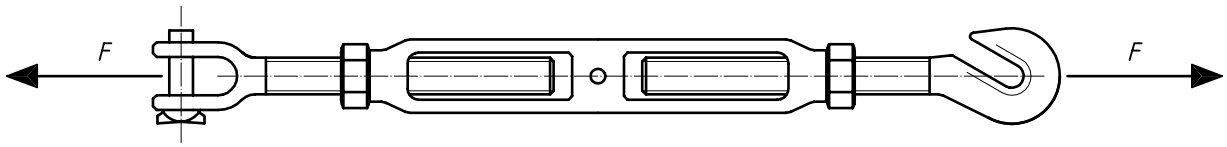


F is the test force.

Figure D.8 — Tensile test on lashing rod

D.7.2 Tensile test on tensioning device

The tensioning device shall be subjected to a tensile force of 270 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 D.9.



F is the test force.

Figure D.9 — Tensile test on tensioning device

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