# INTRODUCTION

- Company profile SEC
- Agents and contacts
- About SEC

# CONTAINER PART - GENERAL

- Code of container positions
- Container dimensions and tolerances
- Allowable loads
- Documentation
- Necessary data for quotation

# CONTAINER PART - STOWAGE SYSTEMS

**On Deck:**
- Automatic solution for the bottom layer
- Longitudinal container arrangement
- Compensation of hatch cover movements by use of sliding/elongated foundations

**In Holds:**
- OSHA stowage system
- Transversal stowage system
- Longitudinal stowage system

# CONTAINER PART - FIXED FITTINGS ON DECK

- Foundations
- Lashing plates
- D-rings
- Slewing eyes for lashing bridge

# CONTAINER PART - FIXED FITTINGS IN HOLD

- Flush foundations
- Welding cones
- Guide fittings
- Counter bearings

# CONTAINER PART - LOOSE FITTINGS ON DECK

- Twistlocks
- Turnbuckles
- Lashing bars
- Bin racks & storage bins
- Bridge fittings
CONTAINER PART - LOOSE FITTINGS IN HOLD

Twist stackers
Single stackers
Double stackers
Tension/pressure elements

CONTAINER PART - SPECIAL FEATURES

Fixed & loose lifting equipment
Fixed & loose securing equipment for general cargo
Hatch cover lifting stopper (Panlock-A)
Height adapters
Reefer platforms
ISO-plugs
Removable railing post
ISO/EURO-Adapter pieces

DESIGN & ENGINEERING PART

Cellguide systems
Container blind trestles
Lashing bridges
Cellguide stoppers
Lashing stages
Reefer bridges
Deck stanchions
Consultancy

RORO PART

Lashpots
D-rings
Web lashings
Trailer horses
Wheel chocks

TIMBER PART

Master lashings
Edge controllers
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</table>
Ship’s Equipment Centre Bremen (SEC) is considered to be today’s worldwide leading manufacturer of container lashing equipment.

The basis of this leading position is the perfect combination of in house design and engineering facilities. This combined with unique know how of manufacturing and services has made Ship’s Equipment Centre Bremen as a first class partner for yards and owners.

An enthusiastic team of high skilled experts is operating out of the main office located in Bremen, Germany. A city which provides an infrastructure where the cargo securing technology has quite a history.

As essential support towards an all around service is provided by the international network of agencies and logistics partners. Ship’s Equipment Centre Bremen products are being distributed through world wide stocks kept at the main centres of international shipping activities. This network is essential to make sure that only exclusive Ship’s Equipment Centre products are being supplied. Whether supplied out of New York, Long Beach, Singapore, Shanghai or Europe, each fitting is an original Ship’s Equipment Centre item.

Having the vessels equipped by Ship’s Equipment Centre Bremen means a full range of high quality gear according to International Maritime Organization (IMO) and latest classification rules.

**Products**

The range of products is to be separated into hardware and services. The fittings (hardware) as such being separated into two groups, namely fixed and loose gear.

Fixed fittings:
- Deck and hatch cover foundations
- Lashing points
- In hold installations
- Tank top fittings

Loose fittings:
- Twistlocks, manual and automatic
- Midlocks and stackers
- Lashings
- Supports
- RoRo and timber equipment

This is just to mention a few. The company has over 1500 approved different designs in production.
Among a variety of makers and traders in this segment Ship’s Equipment Centre Bremen is superior with regard to the engineering facilities which are world wide leading and unique in its kind. Whether it regards the integral calculation of entire lashing bridge designs for 14000 TEU giants by FEM-calculation methods or the design of such constructions using latest 3-dimensional CAD systems, Ship’s Equipment Centre Bremen is being known as front runner in this business. Ship’s Equipment Centre Bremen has set certain trends in order to fulfil system integration demands which became essential for large container ship projects.

The complex interaction of the main components such as hatch covers, lashing bridges, deck supports and cargo requires an integral approach which was not known this way before. This is the most significant example for Ship’s Equipment Centre’s technical expertise and its reputation as system integrator for such applications. When receiving an order for the delivery of fixed fittings we will always prepare offset drawings showing the arrangement of foundations, lashing plates etc. for all positions on board. In these drawings the foundations and lashing plates are measured in relation to each other but not in relation to the hull structure.
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<th>COMPANY / ADDRESS</th>
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SEC is considered to be today's leading manufacturer of container lashing equipment. The basis of this leading position is the perfect combination of in-house design and engineering facilities. This combined with unique know-how of manufacturing and services has made SEC a first-class partner for yards and owners. SEC can be a partner from the very start of a container vessel construction project. In addition to the delivery of hardware, a wide variety of services can be offered to help the ship owner find a safe and cost-efficient solution. Whether approached by shipyards or owners, SEC is able to create concepts and turnkey solutions from the beginning. The SEC way of thinking is to build the ship around the cargo. In order to be really prepared for our client's demands SEC keeps its design team for securing systems equipped with all necessary facilities. This means, for example, development of our own lashing calculation software, Finite Element Method (FEM) calculation workstations and, of course, the latest 3D technology in order to meet the highest standards of today's shipbuilding and shipping. The result of such technical services is the range of products that SEC keeps available through its worldwide network of stockists.

Having the vessel equipped by SEC means a full range of high quality gear according to latest IMO and classification rules. All equipment is tested and certified by any kind of institution or classification society involved. Since the SEC office for securing systems is located in Bremen, Germany, SEC is working within an infrastructure where the cargo securing technology has quite a history. The team of SEC Securing Systems in Bremen offers decades of experience, even though the present method of container lashing itself has been for about 25 years. Being and remaining at the top requires a few rules which make all the difference in comparison to trade houses and distributors of lashing gear. SEC develops the products in house. Accordingly, the full range of fittings is made by SEC itself. Whether SEC supplies out of New York, Singapore, Shanghai or Europe, each fitting is an original SEC-item. All raw materials used for the SEC lashing equipment are purchased from class registered production facilities. If requested, SEC is able to prove the origin of each element of the product range. The latest IMO-regulations recommend attention to proper documentation of the cargo securing equipment. SEC can provide original certificates, test reports and even material analysis reports.

SEC much appreciates the latest approach of the IMO towards greater safety and transparency regarding container securing material. Too many accidents have happened as consequence of improper and substandard equipment. This manual will give an impression of the standards which SEC provides but it is almost impossible to refer to all kinds of fittings which SEC has made or which SEC will create.

Therefore this manual focuses on the basis of all SEC products. SEC would like to draw attention to the fact that all kinds of custom-made solutions are possible.
## 1 GENERAL

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<tbody>
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<td>1.1 - 1.3</td>
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<td>Typical damages on containers</td>
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Together with our quotation a detailed specification describing the proposed securing solution will be provided. This also includes sketches showing typical lashing arrangement at midship section with preliminary weight distribution and item drawings for each fitting with all relevant dimensions. Item drawings can be transmitted by telefax or by e-mail (pdf-files).

When receiving an order for the delivery of fixed fittings we will always prepare offset drawings showing the arrangement of foundations, lashing plates etc. for all positions on board. In these drawings the foundations and lashing plates are measured in relation to each other but not in relation to the hull structure.

Offset drawings cannot be approved by classification societies. Their only purpose is to help ship designers to find the correct position for each type of fitting when preparing steel drawings for tank top with reinforcements underneath each fitting for example or for hatch cover designers when preparing outfitting drawings for hatch covers. Placing the order for delivery of loose fittings with us always includes that we will take responsibility for preparation of container securing manual and cargo securing manual.
The container securing manual is a booklet showing the application of loose lashing gear and maximum weight distribution for a certain GM case. Approval of container securing manual is in the responsibility of the corresponding classification society. The cargo securing manual (CSM) according IMO is a booklet which contains all kinds of useful information about securing of cargo on board such as:

- A material list with all fixed and loose securing fittings on board specifying safe working load, proof load, breaking load, material grade, name of maker etc.
- Item drawings for all loose and fixed securing fittings on board
- Handling and maintenance instructions
- A copy of the approved container securing manual
- Acceleration factors and example calculations for securing of non-standardized cargo
- Example calculations for container lashing
- Approval certificates for all fixed and loose securing fittings on board
- ...

Approval of cargo securing manual is in the responsibility of national authorities depending on flag of the vessel. For the reason that most countries do not have their own approval office for cargo securing manuals instead they will be approved by classification societies.
In each harbour the stevedore gang has to be informed how to install the lashings. For this purpose we are offering instruction boards showing the application of lashings and twistlocks. These instruction boards in DIN A 3 size are made of plastic with self-gluing back for easy installation at the longitudinal hatch coaming or other suitable positions.

Even the best securing equipment needs some maintenance from time to time. In order to explain each movement for assembly/disassembly we have prepared a "Maintenance & Repair Video" for our main equipment which is also available on CD ROM on request. Most components of a twistlock, turnbuckle, bridge fitting etc. can be delivered separately. On request we will provide an individual spare parts catalogue for each newbuilding. This spare parts catalogue is listing each securing element with separate article number and drawing of all components. When using this catalogue spare parts can be ordered easily and wrong deliveries will belong to the past.
**Code of container positions**

In accordance with ISO 9711-1 (1990)

**Definition**

- **A**
  - Position of a stack
  - Example 20’ stack

- **B**
  - Position of a container
  - Example 40’ container

**Example 20’ stack**

**Example 40’ container**

**BAY No.**  **ROW No.**

- **BAY 34**
  - 08 - 06 - 04 - 02 - 01 - 03 - 05 - 07
  - PS - STB

- **BAY 50**
  - 08 - 06 - 04 - 02 - 01 - 03 - 05 - 07
  - PS - STB

In accordance with ISO 9711-1 (1990)
## Container sizes

<table>
<thead>
<tr>
<th>CONTAINER SIZE (ft)</th>
<th>CONTAINER SIZE (mm)</th>
<th>OFFSETS (mm)</th>
<th>WEIGHT</th>
<th>REMARKS</th>
</tr>
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<tr>
<td></td>
<td>LENGTH</td>
<td>WIDTH</td>
<td>HEIGHT</td>
<td>LENGTH</td>
</tr>
<tr>
<td>10' x 8' x 8'</td>
<td>2991</td>
<td>2438</td>
<td>2438</td>
<td>2787</td>
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<tr>
<td>20' (1910.5&quot;) x 8' x 8'</td>
<td>6058</td>
<td>2438</td>
<td>5853</td>
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</tr>
<tr>
<td>20' (1910.5&quot;) x 8' x 8'6&quot;</td>
<td>2591</td>
<td>2896</td>
<td>2896</td>
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</tr>
<tr>
<td>40' x 8' x 8'</td>
<td>12192</td>
<td>2438</td>
<td>2591</td>
<td>11985</td>
</tr>
<tr>
<td>40' x 8' x 8'6&quot;</td>
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<td>2591</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>20' x 2500 x 8'6&quot;</td>
<td>6058</td>
<td>2500</td>
<td>2591</td>
<td>5853</td>
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<tr>
<td>20' x 2500 x 9'6&quot;</td>
<td>2896</td>
<td>2591</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>40' x 2500 x 8'6&quot;</td>
<td>12192</td>
<td>2500</td>
<td>2591</td>
<td>11985</td>
</tr>
<tr>
<td>40' x 2500 x 9'6&quot;</td>
<td>2896</td>
<td>2591</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>30' (2911 1/4&quot;) x 8' x 8&quot;</td>
<td>9125</td>
<td>2438</td>
<td>2591</td>
<td>8918</td>
</tr>
<tr>
<td>30' (2911 1/4&quot;) x 8' x 8'6&quot;</td>
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<td>2896</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>30' (2911 1/4&quot;) x 8' x 9'6&quot;</td>
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<td>2896</td>
<td>2896</td>
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<tr>
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<td>2591</td>
<td>13509</td>
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<tr>
<td>45' x 8' x 9'6&quot;</td>
<td>2896</td>
<td>2591</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>48' x 8'6&quot; x 9'6.5&quot;</td>
<td>14630</td>
<td>2591</td>
<td>2908</td>
<td>14427</td>
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<tr>
<td>48' x 8'6&quot; x 9'6&quot;</td>
<td>2438</td>
<td>2896</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>24.5' (242' 1/2&quot;) x 8'6&quot; x 8'6&quot;</td>
<td>7430</td>
<td>2595</td>
<td>2591</td>
<td>7225</td>
</tr>
<tr>
<td>24.5' (242' 1/2&quot;) x 8'6&quot; x 9'6&quot;</td>
<td>2896</td>
<td>2896</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>49' x 8'6&quot; x 9'6&quot;</td>
<td>14935</td>
<td>2595</td>
<td>2591</td>
<td>14728</td>
</tr>
<tr>
<td>49' x 8'6&quot; x 9'6&quot;</td>
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<td>2896</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>53' x 8'6&quot; x 9'6.5&quot;</td>
<td>16154</td>
<td>2591</td>
<td>2908</td>
<td>15891</td>
</tr>
<tr>
<td>35' x 2430 x 2590</td>
<td>10659</td>
<td>2430</td>
<td>2590</td>
<td>30.0</td>
</tr>
<tr>
<td>24' x 8' x 8'</td>
<td>7316</td>
<td>2438</td>
<td>2438</td>
<td>2438</td>
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<tr>
<td>24' x 8' x 8'6&quot;</td>
<td>2438</td>
<td>2591</td>
<td>2591</td>
<td>2591</td>
</tr>
<tr>
<td>20' x 2462 x 9'6&quot;</td>
<td>6058</td>
<td>2462</td>
<td>2896</td>
<td>5853</td>
</tr>
<tr>
<td>40' x 2462 x 9'6&quot;</td>
<td>12192</td>
<td>2500</td>
<td>2591</td>
<td>11985</td>
</tr>
<tr>
<td>40' x 2500 x 8'6&quot;</td>
<td>12192</td>
<td>2500</td>
<td>2591</td>
<td>11985</td>
</tr>
<tr>
<td>40' x 2500 x 9'6&quot;</td>
<td>2896</td>
<td>2591</td>
<td>2896</td>
<td>2896</td>
</tr>
<tr>
<td>45' x 8' x 9'6&quot;</td>
<td>13716</td>
<td>2438</td>
<td>2500</td>
<td>2896</td>
</tr>
<tr>
<td>45' x 2500 x 9'6&quot;</td>
<td>2500</td>
<td>2896</td>
<td>2500</td>
<td>2500</td>
</tr>
</tbody>
</table>

**Tolerances:**
- Width: +0- 5 mm for all containers
- Height: +0- 5 mm for all containers
- Length: +0- 10 mm for 53' -30' containers
- +0- 6 mm for 24.5' -20' containers

Common for all containers is the transverse measure from centre to centre point of the holes of corner fittings = 2259 mm.
## Container dimensions

<table>
<thead>
<tr>
<th>Designation</th>
<th>45°</th>
<th>40°</th>
<th>30°</th>
<th>20°</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1E</td>
<td>1EE</td>
<td>1A</td>
<td>1AA</td>
</tr>
<tr>
<td>Height (ft)</td>
<td>8'6</td>
<td>9'6</td>
<td>8'</td>
<td>8'6&quot;</td>
</tr>
<tr>
<td>H (mm)</td>
<td>2591</td>
<td>2896</td>
<td>2438</td>
<td>2591</td>
</tr>
<tr>
<td>Length (ft)</td>
<td>45'</td>
<td>40'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L (mm)</td>
<td>13716 0/-10</td>
<td>12192 0/-10</td>
<td>9125 0/-10</td>
<td>6058 0/-6</td>
</tr>
<tr>
<td>S (mm)</td>
<td>13509 ±1/-6</td>
<td>11985 ±1/-6</td>
<td>8918 ±1/-6</td>
<td>5853 ±1/-5</td>
</tr>
<tr>
<td>C1 (mm)</td>
<td>101.5 0/-1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width (ft)</td>
<td></td>
<td>8'</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W (mm)</td>
<td></td>
<td>2438 0/-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P (mm)</td>
<td></td>
<td>2259 0/-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C2 (mm)</td>
<td></td>
<td>89 0/-1.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difference D1-D2</td>
<td>≤ 19mm</td>
<td>≤ 19mm</td>
<td>≤ 16mm</td>
<td>≤ 12mm</td>
</tr>
<tr>
<td>max. grossmass kg</td>
<td>30480</td>
<td>30480</td>
<td>25400</td>
<td>24000</td>
</tr>
</tbody>
</table>

*GEEST* CONTAINER

In accordance with ISO 668 (1995)
Container corner castings

Top corner fittings
Type 1 - upper left
(Type 2 mirror inverted - upper right)

In accordance with ISO 1161 (1984)

Bottom corner fittings
Type 3 - bottom left
(Type 4 mirror inverted - bottom right)
Installation tolerances of container foundations (recommendation only)

**Difference of diagonals**
D1 - D2
Should not be more than:

- 20’ Container - 6mm
- 40’ Container - 8mm
- 24.5’ Container - 6mm
- 30’ Container - 6mm
- 45’ Container - 8mm
- 48’ Container - 8mm
- 49’ Container - 8mm

**Height tolerances of container foundations**
Transverse: 1 point is reference, the others ± 3mm
Longitudinally: ± 6mm to reference point
Common container spaces

Width of containers = 2438 according ISO 668 (1995)

The figures shown are the most common ones, but others are possible as well.

Transversal distances of EURO-containers

<table>
<thead>
<tr>
<th>Width of container</th>
<th>Container distances Y centre to centre min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500</td>
<td>265</td>
</tr>
<tr>
<td>2600</td>
<td>365</td>
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</table>

Container spaces

<table>
<thead>
<tr>
<th>Container spaces</th>
<th>Container distances Y centre to centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>203</td>
</tr>
<tr>
<td>38</td>
<td>216</td>
</tr>
<tr>
<td>80</td>
<td>258</td>
</tr>
<tr>
<td>186 (24 based on EURO)</td>
<td>365</td>
</tr>
</tbody>
</table>
Static and dynamic components

Rolling condition

Pitching condition
Permissible forces on containers

RACKING FORCE (kN)

<table>
<thead>
<tr>
<th>Classification Society / ISO 1496-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>door and front wall frame 20’/40’</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>side walls, closed box containers 20’/40’</td>
<td>125</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>150</td>
<td>75</td>
</tr>
<tr>
<td>side walls 20’/40’</td>
<td>150</td>
<td>75</td>
<td>125</td>
<td>150</td>
<td>100</td>
<td>75</td>
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</tbody>
</table>

FORCES IN VERTICAL DIRECTION (kN)

<table>
<thead>
<tr>
<th>Classification Society / ISO 1496-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>top 20’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>118</td>
<td>150</td>
<td>118</td>
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<tr>
<td>tension 40’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bottom 20’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>848</td>
<td>942</td>
<td>848</td>
</tr>
<tr>
<td>tension 40’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>954</td>
<td>1048</td>
<td>1048</td>
</tr>
<tr>
<td>compression at bottom corner 20’</td>
<td>954</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>tension 40’</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>compression at bottom corner 40’</td>
<td>983</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tbody>
</table>

HORIZONTAL SUPPORT FORCE (kN)

<table>
<thead>
<tr>
<th>Classification Society / ISO 1496-1 (1990)</th>
<th>LR</th>
<th>GL</th>
<th>DnV</th>
<th>ABS</th>
<th>BV</th>
<th>ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>top 20’</td>
<td>340</td>
<td>250</td>
<td>200</td>
<td>250</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>tension 40’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>compression 20’</td>
<td>340</td>
<td>250</td>
<td>200</td>
<td>250</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>tension 40’</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>500</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>compression 20’</td>
<td>840</td>
<td>650</td>
<td>500</td>
<td>600</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>tension 40’</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>600</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>compression 20’</td>
<td>840</td>
<td>650</td>
<td>500</td>
<td>600</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>tension 40’</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>600</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>compression 20’</td>
<td>500</td>
<td>500</td>
<td>500</td>
<td>600</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

Lashing loads at corner casting

Acting parallel to front and side face at top and bottom corner fitting.

In accordance with ISO 1161 (1984)
Typical damages on containers

**Racking force:**

The resultant force in the container – end and door frame, as a result of the static and dynamic forces parallel to the deck. In pitching condition the racking force is acting in the container side frames.

Exceeding racking forces can be reduced by use of diagonal lashing units.

**Lifting force:**

The resultant vertical lifting force.

Exceeding lifting forces can be reduced by use of diagonal or vertical lashing units.

**Post load:**

The resultant pressure force in the container corner post.

Exceeding corner post compression cannot be reduced by lashing units, contrary diagonal lashings are even increasing vertical loads. Container weights must be reduced.

**Lashing force:**

The resultant force in the lashing.

Exceeding lashing force can be reduced by using additional lashing units.
### Necessary data for quotation

For a precise quotation and calculation of weight distribution we do need certain information from you. Additionally to below listed data please provide a general arrangement (GA) plan or container arrangement plan in suitable size.

<table>
<thead>
<tr>
<th>Data Required</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length between perpendiculars</td>
<td>$L_{pp}$</td>
</tr>
<tr>
<td>Moulded breadth</td>
<td>$B$</td>
</tr>
<tr>
<td>Depth</td>
<td>$D$</td>
</tr>
<tr>
<td>Service Speed</td>
<td>$v$</td>
</tr>
<tr>
<td>Draught</td>
<td>$d$</td>
</tr>
<tr>
<td>Height of tank top</td>
<td>$h_1$</td>
</tr>
<tr>
<td>Top of H/C above baseline</td>
<td>$h_2$</td>
</tr>
<tr>
<td>Class of vessel</td>
<td></td>
</tr>
<tr>
<td>OSHA compliance required</td>
<td>yes</td>
</tr>
</tbody>
</table>

### Additional data for calculations according LRoS (NK or KR):

- Standard angle of roll (30°) or reduced angle of roll
- Standard GM value (2.5% and 7.5% of $B$) or as specified: ______________
- Breakwater existing: yes | no

### Additional data for calculation according GL:

- Standard acceleration or reduced acceleration or individual acceleration

### Additional data for calculation according DNV:

- Standard GM value (7% of $B$) or as specified: ______________
- Bilge keel existing: yes | no

### Additional data for calculation according BV:

- Standard GM value (7% of $B$) or as specified: ______________
- Standard value for roll axis above baseline (35% of $B$) or as specified: ______________

### Additional data for calculation according ABS:

- GM value to be evaluated over the expected operation range: ______________
- Bilge keel existing: yes | no

### Container data:

- Required stackloads on deck for 20' | 40' | others:
- Required stackloads in hold for 20' | 40' | others:
- Transversal distance between containers on deck: 25 | 38 | 80 mm | or others:
- Transversal distance between containers in holds: 25 | 38 | 80 mm | or others:
- Longitudinal arrangement of 20' containers with 76 mm ISO-gap: symetrically | or asymmetrically

### Container Securing equipment:

**Type of foundations and lashing points on deck:**
- ISO-foundations (H = 110 mm) in combination with lashing plates or dovetail foundations in combination with D-rings or other solution:

**Type of foundations in hold:**
- Cellguides with welding cones at bottom in combination with guide fittings at ISO-gap or flush type twistlock pockets or welding plates ($t = 30$ mm) with ISO-holes
Container part

2 STOWAGE SYSTEMS

2.1 - 2.2 OSHA stowage system in holds
2.3 - 2.6 Transversal stowage system in holds
2.7 - 2.8 Longitudinal stowage system in holds
2.9 - 2.10 Arrangement of sliding foundations
2.11 - 2.12 Automatic solution for bottom tier on deck
2.13 - 2.15 Longitudinal arrangement of containers on deck
Osha stowage system in holds
Description

Since OSHA regulations have to be applied not only for container on deck but also for container securing in holds the mixed stowage system or OSHA stowage system became the most common securing system for 20’ containers within 40’ cellguides.

Under high pressure from shipping companies all major classification societies have revised their regulations for this kind of securing system but nevertheless the stack-weights are strictly limited compared to traditional stow-age systems. The maximum stackweights are depending on the acceleration factors according class rules for the concerned vessel and the number of tiers. Some classification societies are limiting the number of tiers for 20’ containers.

Twist stackers are handled in the same way as semi-automatic-twistlocks which means the twist stackers will be inserted on the quay side and then loaded together with the container on board. Twist stackers do not have any locking function because lifting forces do not occur for this securing solution, their only purpose is to prevent 20’ containers against horizontal sliding. When discharging containers the twist stackers will be transported to the quay side hanging underneath the container and finally stored in bins on flat racks.

The mixed stowage system offers highest flexibility because no horizontal connection between 20’ containers is necessary, each stack stands separately, therefore 20’ containers can be loaded next to a 40’ stack and each stack can be loaded/unloaded individually.

When using twist stackers without flange type IS-1T/LF (page 6.2) the container corners are standing directly on top of each other without 13 mm flange of twist stacker in between. With such type of twist stacker the quantity of stacking cones can be reduced by 50%.
Transversal stowage system in holds
Transversal stowage system in holds

Description

Pressure system

This conventional securing system in the past presented the largest group of securing systems in hold and is split again in two subdivisions:

Pressure System

Only pressure forces will be transmitted from the container block to the supporting points at the longitudinal bulkhead.

Tension/Compression System

The container block is split in two or three separate blocks and both, tension and compression forces will be transmitted into the side structure by use of T/P-Elements.

For the transversal securing system all containers have to be connected by use of double stacking cones in transversal direction. The horizontal forces from the containers which occur in rolling condition will be transmitted from one stack into the next one and at the same time adding up. The resulting force at the outermost stack has to be absorbed at the longitudinal bulkheads. The maximum horizontal force which may be transmitted by the container corner castings is specified in the individual rules of the classification societies (please compare to chapter 1.11).

The required number of supporting points is depending on the acting forces in the container block and the allowable support force specified by class. For this reason it can be necessary in some cases not just to use pressure elements between all tiers but also on top by using bridge fittings and especially designed pressure elements.

Very often the transversal securing system is used for securing of 20’ containers which are stowed in 40’ cellguides at 76 mm ISO gap position but also the transversal securing system is the one and only adequate securing solution for multi purpose container vessels without cellguides in holds.

As an option the pressure elements may be replaced by fixed installed pressure rails which are at the same time protecting the longitudinal bulkhead from damage when loading containers.
Transversal stowage system in holds

hatch cover
split joint
Transversal stowage system in holds

Tension/compression system

In case that fully loaded containers cannot be achieved even if all container levels are supported by pressure elements, it will be necessary to separate the container block. This separation can be realised by using single stacking cones for example in way of ship’s longitudinal axis. The two separate container blocks now have to be connected by means of tension/pressure-elements and corresponding counter bearings to the longitudinal bulkhead.

For larger container vessel with three hatch cover panels it could be an advantage to separate the containers in three blocks. For this reason single stacking cones in combination with pressure adapters should be used in line with the hatch cover split joint. The container block in the middle of the hold will act by pressure force alternately to both sides. The advantage of this system is that the container blocks below each panel can be discharged separately.

When deciding about the type of counter bearing it is important to know which container heights have to be covered because for each combination of 8’6” and 9’6” container height there must be a possibility to insert the tension/pressure-elements.

Main disadvantage of the transversal stowage system is that loading and unloading of containers can only be made tierwise. It is not possible to have a 40’ stack next to a 20’ stack because this would interrupt the transmission of horizontal forces.
Longitudinal stowage system in holds
Anti-rack-spacer system

The basic idea of this system is to connect two 20’ containers in longitudinal direction by use of so called Anti-Rack-Spacers (ARS) in order to simulate a 40’ unit.

The transversal forces at 76 mm ISO-gap will be completely absorbed by the ARS and transferred into the 40’ cellguides. This can only be realised when the 20’ containers can slide in transversal direction on tank top. The required sliding range of 30 mm to each side has been decided in close dependence to the production tolerances of the ARS and the container corner castings. The load of two 20’ containers (2 x 24.0 t = 48.0 t) has to be absorbed by the guide angles.

The stackload for a 20’ stack is limited to a maximum of 120 tons without limiting the number of tiers. The reason is given by the transverse sliding force which has to be higher than the friction force on tank top.

No reinforcements are necessary at the longitudinal bulkhead in way of 76 mm ISO-gap because all horizontal forces will be absorbed by the 40’ cellguides.

The ARS-system has a higher loading flexibility than the transversal stowage system because each row stands separately and a 20’ row can be stowed next to a 40’ container.

As a disadvantage it has to be mentioned that terminal cranes always have to move parallel to the quay for each 20’ container unless the crane is equipped with a double spreader.
Arrangement of sliding foundations
When containers are partly stowed on hatch covers and partly on deck stanchions or on two different panels deformation of hull needs to be compensated by the foundations.

For a typical container vessel torsion of hull causes longitudinal movements at the container foundations. In this case longitudinal sliding foundations can be used to compensate movements of panels but nowadays foundations with elongated ISO-holes are much more common.

Where ever possible the elongated foundations will be arranged on ship side stanchions but when the outline of hatch covers is inclining at forward end the elongated foundations have to be arranged partly on hatch cover panels in order to avoid an accumulation of three sliding foundations for one container stack.

Ships with folding type hatch covers will need transversal sliding foundations under normal circumstances. The necessary sliding range and direction should be determined by hatch cover designers together with the yard.
Semi-automatic solution for bottom tier on deck

**76 mm ISO-gap**

Deck or hatch cover

TL-FA/L  TL-FA/L  TL-FA/L  TL-FA/L

TL-GL/L  TL-GL/L  TL-GL/L  TL-GL/L

**76 mm ISO-gap**

Deck or hatch cover

TL-GA/L  TL-M/L  TL-M/L  TL-GA/L

TL-GA/L  TL-M/L  TL-M/L  TL-GA/L

**76 mm ISO-gap**

Deck or hatch cover

TL-GA/L  TL-M/L  TL-M/L  TL-GA/L

TL-GA/L  TL-M/B  TL-M/B  TL-GA/L

**76 mm ISO-gap**

Deck or hatch cover

TL-GA/L  TL-M/L  TL-M/L  TL-GA/L

TL-GA/L  TL-M/B  TL-M/B  TL-GA/L

**76 mm ISO-gap**

Deck or hatch cover

TL-FA/L  TL-FA/L  TL-FA/L  TL-FA/L

TL-GL/L  TL-FA/G/B  TL-FA/G/B  TL-GL/L
Semi-automatic solution for bottom tier on deck

Locking and unlocking of bottom twistlocks for 20’ containers which are stowed with 76 mm ISO-gap is a permanent problem. OSHA regulations specify that a fall risk begins at 8’ height but on the other side all containers are stowed close together so there is no space where to fall down. It is our understanding of the OSHA regulations that stevedores are still allowed to climb on top of the first tier on deck for locking/unlocking of bottom twistlocks at 76 mm ISO-gap. Nevertheless we have fully automatic solutions for the bottom tier as well.

For example our standard midlock type TL-M/L can be used in the bottom tier when specially shaped foundations are installed in way of 76 mm ISO-gap. In this case a minimum of different fittings is needed for container securing on deck. The midlock in the bottom tier will be unloaded together with the container.

Alternatively especially shaped bottom midlocks type TL-M/B can be used. This type of midlock remains in the foundation when lifting up the containers and it can be used in combination with standard foundations. Special care has to be taken when midlocks or bottom midlocks shall be used in combination with longitudinal sliding foundations. In no case foundations with elongated ISO-holes can be used.

Fully automatic twistlock TL-FA may also be used at bottom tier when specially strengthened foundations are installed. For the reason that flexibility of shipside stanchions is unknown we recommend an application as shown on the left side. TL-FA at 20’ gap position to be inserted up-side down so that they remain on board when unloading containers.

The TL-FA in the bottom tier works perfect in combination with foundations with elongated ISO-holes, but in no case they can be combined with sliding foundations in transversal direction.
Longitudinal arrangement of containers on deck

Asymmetrical arrangement

Symmetrical arrangement
In general there are two solutions for the longitudinal arrangement of containers when 20’ containers shall be stowed with lashing gap in between.

Very often it can be seen that containers are arranged asymmetrically with 5 rows of foundations per 40’ bay only. Despite of the cost saving effect for a minimum quantity of foundations and reinforcements this solution has several disadvantages.

40’ lashing at asymmetrical end has to be made 3-dimensional which can have negative effect on the efficiency of lashings. The lashing plates have to be inclined about 10° or even more in direction of containers. The wider the lashing gap between 20’ containers is, the more difficult it is to cover all lashing positions with unified length of lashing rods. In some cases it might be necessary to install additional lashing plates at asymmetrical end between 20’ and 40’ foundations, if so stevedores have to shift turnbuckles each time when loading 20’ instead of 40’ and opposite.

For this reason we recommend to arrange the containers symmetrically in longitudinal direction resulting in 6 rows of foundation per 40’ bay. This solution brings best results concerning the arrangement of lashing plates and unified length. Even in case of large lashing gap between 20’ containers no additional lashing plates have to be arranged and no shifting of turnbuckles by stevedores is required.

Australian Maritime Safety Authority (AMSA) specifies a minimum gap of 550 mm between 20’ containers regardless of the lashing but at the same time they recommend a clear width of 550 mm between lashing plates. Despite of safety authorities SEC recommends a minimum gap of 750 mm between containers for proper lashing operation.
In case that the vessel is equipped with lashing bridges the symmetrical arrangement of containers in longitudinal direction is even more important.

Shipowner’s requirement for unified length of lashing rods is always extremely difficult to fulfil when the vessel has lashing bridges because a container height difference of at least 2 x 305 mm has to be considered for high cube container loading. It is very difficult to handle extension rods from lashing bridges therefore they should not be used.

The longitudinal gap between lashing bridges and 20’ container end should be minimized as much as possible and 40’ containers always to be arranged symmetrically in order to reduce 3D-effect of lashings.

During torsion of hull the container stack will shift together with the hatch cover panels in relation to the lashing points on lashing bridge creating additional forces in the lashings. This effect is increasing as more as the lashings are inclined in longitudinal direction.
## Container part

### 3 FIXED FITTINGS ON DECK

| 3.1 - 3.2 | Raised foundations |
| 3.3 - 3.4 | Elongated foundations |
| 3.5 - 3.7 | Sliding foundations |
| 3.8      | Dovetail foundations |
| 3.9      | Lashing plates |
| 3.10     | Horn type lashing plates |
| 3.11 - 3.12 | Slewing eyes |
| 3.13     | D-rings |
Raised foundations

Double foundations with combined box structure

SF-C2/203/216/110/U 363/376 x160

SF-C1/110/U160

Welding recommendation

Welding outside Welding inside

Deck or hatch cover

Raised foundations for hatch cover lifting purposes are listed in chapter 7.1

Specification

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard height 110 mm
- Centre marks for easy installation
- Standard distances for double foundations 203/216/258 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile cast steel
Raised foundations

Options and variations for raised foundations

- **Variation of height**
  Min. height 65 mm.
  Attention: These foundations can not be used in combination with semi-automatic twistlocks/midlocks at bottom tier or in combination with lashing plates.
  - Max. height 140 mm.
  - For example for height adjustment between hatch cover surface and deck stanchions.

- **Additional punchmarks** at side plating for easy installation.

- **Special distances** for double foundations for example for EURO containers or special ship's geometry.
  The distance piece has no strength function and only helps to keep correct distance between both parts of foundation.

- **Foundations** are available in built type or casted execution.
  Foundations with unusual dimensions always have to be produced in built type execution.

- **Hardened topplates** (min. 235 HB) for built type foundations by additional heat treatment which exceeds class requirements.

- **Special surface treatment** as specified by customer, for example final paint inside excluding welding area.
Elongated foundations

- Min. breaking loads tension 500kN / shear 420 kN
- Approval from any classification society
- Standard height 110 mm
- Topplate with punchmarks for easy installation
- Standard distances for double foundations 203/216/258 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Special sliding range on request
- Other options and variations please compare with raised foundations
- As a standard we offer elongated foundations with hardened topplates (min. 235 HB) in order to reduce wear down

Sliding range ± 10

Sliding range ± 30

Sliding range ± 50
Elongated foundations

Double foundations with combined box structure

Sliding range
± 10

Sliding range
± 30

Sliding range
± 50

SF-2/216/124-144/110/U 376 x180

SF-2/216/144-144/110/U 376 x180

SF-2/216/124-184/110/U 376 x220

SF-2/216/184-184/110/U 376 x220

SF-2/216/124-224/110/U 376 x260

SF-2/216/224-224/110/U 376 x260
Sliding foundations

Transversal sliding

Range ± 30

**SF-1Q/110**

**SF-3Q/110**

Welding recommendation

Deck or hatch cover

Specification

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard height 110 mm
- Topplate with punchmarks for easy installation
- Standard distances for double foundations 203/216/258 mm

- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Standard sliding range ± 30 mm
Sliding foundations

Longitudinal sliding

Range ± 30

SF-1L/110

SF-2L/216/110/U160

SF-3L/110

SF-2L/216/110

Specification

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard height 110 mm
- Topplate with punchmarks for easy installation
- Standard distances for double foundations 203/216/258 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Standard sliding range ± 30 mm
Options and variations for sliding foundations

- **Sliding foundations with wear plate.**

![Image of sliding foundation with wear plate]

Welding recommendation

![Welding recommendation diagram]

- **Sliding foundations with special sliding range.**

- **Sliding foundations with separate wedge plate for height adjustment on board.**

- **Loose part of sliding foundation hot dip galvanized.**

- **Transversal sliding foundation combined with elongated ISO-hole for transversal and longitudinal shifting.**

![Diagram of transversal sliding foundation]
### Dovetail foundations

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard distances for double foundations 203/216/258 mm
- Guiding angle 55°
- Thickness of bottom plate 8 mm
- Made of casted steel
- Weldable inorganic zinc or epoxy shop primer
- Centre marking for easy installation

---

**Welding recommendation**

Deck or hatch cover

---

**DF-1L/55**

**DF-2L/216/55**

**DF-1L/230/55**
Lashing plates

**Specification**

- Min. breaking load 500 kN
- Approval from any classification society
- Welding chamfer
- Drop forged execution
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Smoothed edges all around
- Centre marking for easy installation

**Welding recommendation**

The angle $\alpha$ depends on the distance between the lashing plate and the container front.

**Typical arrangement of lashing plates for double cross lashing systems**
**Horn type lashing plates**

**Specification**

- Min. breaking load 500 kN
- Approval from any classification society
- Welding chamfer
- Drop forged execution
- Made of high tensile steel

- Weldable inorganic zinc or epoxy shop primer
- Smoothed edges all around
- Centre marking for easy installation

**Welding recommendation**

The angle $\alpha$ depends on the distance between the lashing plate and the container front.

Because of special horn design and oval hole the turnbuckle can either:

- Be laid down horizontally
- Or:
  - Parked upright in diagonal direction.

![Deck or hatch cover diagram](attachment:deck_or_hatch_cover.png)
Slewing eyes

**LAP-1S/C25**

- Min. breaking load 500 kN
- Approval from any classification society
- Welding chamfer
- Drop forged or cast steel execution
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer for welding part
- Movable parts will be delivered in hot dip galvanised execution

**LAP-1S/F**

> Application <
Slewing eyes

Welding and painting recommendation

**LAP-1S/C25**

1.) Single Parts

2.) Welding points for fixing

3.) Welding

4.) Painting of fixed part and assembly

**LAP-1S/F**

1.) Single Parts

2.) Welding points for fixing

3.) Welding

4.) Painting of fixed part and assembly
D-rings

**Specification**

- Min. breaking load 500 kN
- Approval from any classification society
- Welding chamfer
- Drop forged D-ring and welding bow
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer

**Typical arrangement of D-rings**

for double cross lashing systems

**Welding recommendation**

Deck or hatch cover
## Container part

### 4 FIXED FITTINGS IN HOLDS

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Flush type twistlock pockets

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society (except Germanischer Lloyd)
- Standard thickness of topplates 16 or 28 mm depending on thickness of tanktop
- Standard diameter of topplates 160 mm (single type)
- All kinds of chamfer preparation
- Tightness tested
- Standard distances 203/365/258 mm (other distances upon request)
- Thickness of pots 10 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel

ISO - Plugs see chapter 7.7
Flush type twistlock pockets

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard thickness of topplates 16 or 28 mm depending on thickness of tanktop
- Standard diameter of topplates 205 mm (single type)
- All kinds of chamfer preparation
- Tightness tested
- Standard distances 203/365/258 mm (other distances upon request)
- Thickness of pots 10 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel

ISO - Plugs see chapter 7.7
Flush type twistlock pockets

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Standard thickness of topletes 16 or 28 mm depending on thickness of tanktop
- All kinds of chamfer preparation
- Tightness tested
- Standard distances 203/365/258 mm (other distances upon request)
- Thickness of pots 12 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel

ISO - Plugs see chapter 7.7
Flush type twistlock pockets

Chamfer type

II 30° chamfer from above

III without chamfer

IV 45° chamfer from above

VII 40° chamfer from above

VI 45° chamfer from above and smooth transition of thickness

VIII 45° chamfer from below

IX 45° chamfer from below and smooth transition of thickness

"X" and "Y" to be specified by yard
Welding plates

Specification

- Min. breaking load shear 420 kN
- Approval from any classification society
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Punchmarks for easy installation

For transmission of high lateral forces, preferably on tank steps!

Double bottom or tank step
Welding cones

Specification

- Min. breaking load shear 420 kN
- Approval from any classification society
- Drop forged or cast steel execution
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Welding chamfer all around
- Centre marking for easy installation

Welding recommendation

Double bottom or tank step

20'/40' End WC-1/2/100 or: WC-1/2/115

20' GAP GF-...
Guide fittings

Specification

- Min. breaking load shear 420 kN
- Approval from any classification society
- Made of high tensile steel
- Welding chamfer so that welding does not collide with corner casting
- Designed individually for the specified gap between containers
- Special solutions for tank steps
- Weldable inorganic zinc or epoxy shop primer
Guide fittings

Types of guide fittings:

Select the TYPE No.: 1 2 3 4 8 9 / L x B x H (h)

Examples for arrangement of guide fittings:

1

Type 4 = long (280 mm)
Type 2 = short (140 mm)

or:

Type 3 = long (280 mm)
Type 1 = short (140 mm)

or:

Type 3 = long (280 mm)
Type 8 = short (140 mm)

or:

Type 9 = long (280 mm)
Type 8 = short (140 mm)

II

Type 4 = long (280 mm)
Type 2 = short (140 mm)

or:

Type 9 = long (280 mm)
Type 8 = short (140 mm)

or:

Type 9 = long (280 mm)
Type 8 = short (140 mm)
Counter bearings

**Specification**

- Min. breaking load tension/compression 850 kN
- Approval from any classification society
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Installation and testing gauge on request
- For high cube container loading several of these counter bearings can be installed on top of each other
Counterbearings

**Specification**

- Min. breaking load tension/compression 850 kN
- Approval from any classification society
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Tightness tested
- All kinds of chamfer preparation on request, please compare to chapter 4.4
- Bevelling of topplate (relation 1 to 3) for smooth integration into bulkhead as requested by most classification societies can be offered on request

**SB-3/3G/305/499x856x30/III**

**SB-3/2G/305/499x551x30/III**

**SB-3/G/499x246x30/III**

**SB-1/3G/305/220x856x30/III**

**SB-1/2G/305/220x551x30/III**

**SB-1/G/220x246x30/III**
Counter bearings

**Specification**

- Min. breaking load tension/compression 1240 kN
- Approval from any classification society
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Tightness tested
- All kinds of chamfer preparation on request, please compare to chapter 4.4

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**SB-33/(235)/2FT**

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**SB-31/(235)/2FT**

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**SB-33/(235)/1FT**

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**SB-31/(235)/1FT**

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**SB-33/(235)**

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**SB-31/(235)**
## LOOSE FITTINGS ON DECK

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Fully-automatic twistlocks

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approved by ABS, BV, DNV, GL and LRoS
- Fully automatic locking / unlocking function when loading and unloading
- No need to use operation rods for unlocking
- Safe locking against lifting forces during voyage
- Fully complies to OSHA regulations
- Large resting area according GL rules for highest pressure forces
- No restrictions for the application of different lashing systems
- Vertical clearance same as for semi-automatic twistlocks
- Hot dip galvanised with stainless steel components
- Upper cone marked yellow
- Suitable for lifting with twin spreader
- One piece housing made of high tensile cast steel
- Hot dip galvanised with stainless steel components
- Maintenance is not required
- Minimised thickness of flange but still it can be seen from deck level whether a FAT has been inserted between upper tiers or not
Fully-automatic twistlocks

**PATENTED**

**TL-FA/LG**

~ 5.9 kg

---

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approved by ABS, BV, DNV, GL and LRoS
- Fully automatic locking / unlocking function when loading and unloading
- No need to use operation rods for unlocking
- Safe locking against lifting forces during voyage
- Fully complies to OSHA regulations
- Large resting area according GL rules for highest pressure forces
- No restrictions for the application of different lashing systems
- Vertical clearance same as for semi-automatic twistlocks
- Hot dip galvanised with stainless steel components
- Upper cone marked yellow
- Suitable for lifting with twin spreader
- One piece housing made of high tensile cast steel
- Hot dip galvanised with stainless steel components
- Maintenance is not required
- Compared to TL-FA/L this FAT has an enlarged flange area which is flush with the front of the corner casting and with additional yellow colour marking so that it is easier to see if the FATs habe been inserted in all four corners.

---

**Function of pin**

Wrong insert is not possible because the pin interferes with corner casting.

---

- Yellow marked

---
**Fully-automatic twistlocks**

**PATENTED**

### Function of pin

- **TL-FA/G**
  - ~ 6.8 kg

**Patented**

Wrong insert is not possible because the pin interferes with corner casting.

#### Specification

- Min. breaking loads tension 500 kN / shear 420 kN
- Approved by ABS, BV, DNV, GL and LRoS
- Fully automatic locking / unlocking function when loading and unloading
- No need to use operation rods for unlocking
- Safe locking against lifting forces during voyage
- Fully complies to OSHA regulations
- Large resting area according GL rules for highest pressure forces
- No restrictions for the application of different lashing systems
- Vertical clearance same as for semi-automatic twistlocks
- Hot dip galvanised with stainless steel components
- Upper cone marked yellow
- Suitable for lifting with twin spreader
- One piece housing made of high tensile cast steel
- Hot dip galvanised with stainless steel components
- Maintenance is not required
- Preferably to be used for replacement of existing SAT equipment because flange thickness is same so that there is no effect on the lashing length
Semi-automatic twistlocks

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Dual function for manual and semi-automatic mode
- Type TL-GA/L with large resting area according GL rules for highest pressure forces
- Hot dip galvanised with stainless steel components
- Closed housing
- Upper cone marked yellow
- Semi-automatic twistlocks are also available as luxury version with increased diameter of steel wire.
- Cones are always forged for safety reason

---

**TL-A/L**

~ 6.0 kg

**TL-GA/L**

~ 7.3 kg

Cone marked yellow

Wire = Ø 5 mm

Dimensions:
- TL-A/L: 148 mm
- TL-GA/L: 185 mm
Conventional twistlocks

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Pre-locking function of lower cone
- Left hand locking as standard, right hand locking on request
- Type TL-GL/L with large resting area according GL rules for highest pressure forces
- Hot dip galvanised
- Internal locking mechanism made of stainless steel components
Conventional twistlocks

**TL-GL/L**

~ 6.6 kg

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Maximum resting area exceeding class requirements by far
- Designed for highest pressure forces and reduction of wear down or slip/stick effect in combination with elongated ISO-sockets
- To be used preferably at bottom tier
- Pre-locking function of lower cone
- Left hand locking as standard, right hand locking on request
- Hot dip galvanised
- Internal locking mechanism made of stainless steel components
Midlocks

TL-M/L ~ 6.1 kg

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Automatic locking/unlocking at ISO-gap position in combination with semi-automatic twistlocks at opposite container end
- Lashing option in the bottom corner of the upper container
- One piece housing without movable vital parts
- Hot dip galvanised with stainless steel components
- Upper part marked blue
- Can also be used for bottom tier in combination with special shaped foundations

> Application 1 <

> Application 2 <
Automatic bottom locks

**Bottom Midlock**

- TL-M/B
- ~ 7.2 kg

**FAT for Bottom Tier**

- TL-FA/G/B
- ~ 6.6 kg

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- Automatic locking/unlocking at ISO-gap position in combination with conventional twistlocks at opposite container end
- One piece housing without moveable vital parts
- Hot dip galvanised with stainless steel components
- Upper part marked green

> Application <

20’ Container 76 20’ Container
Dovetail twistlocks for point load

**Specification**

- Min. breaking loads tension 500 kN / shear 420 kN
- Approval from any classification society
- 55° side angle of housing
- Left hand locking
- Hot dip galvanised
- Internal locking mechanism made of stainless steel components
Dovetail twistlocks for line load

Specification

- Min. breaking load tension 500 kN / shear 420 kN
- Approval from any classification society
- 55° side angle of housing
- Left hand locking
- Hot dip galvanised
- Internal locking mechanism made of stainless steel components
- Depth of recess 82-86 mm in order not to transmit pressure loads
**Turnbuckles**

**RS-FS**
- Weight: ~11.5 kg
- Min. length for storage: 1160 mm
- Distance pressure point – pressure point:
  - Max. 1500 mm
  - Min. 1070 mm

**Spanner OT-RS-FS**
- Weight: ~2.3 kg

**Specification**
- Min. breaking load tension: 500 kN
- Approval from any classification society
- Hot dip galvanised
- Made of high tensile steel for minimising weight
- Large adjusting range
- Securing nut against self-releasing
- Open design for easy greasing of thread and long life thread lubrication
Turnbuckles

- Min. breaking load tension 500 kN
- Approval from any classification society
- Hot dip galvanised
- Made of high tensile steel for minimising weight
- Large adjusting range
- Patented securing screw against self-releasing at sliding nut

- Open design for easy greasing of thread and long life thread lubrication
- Because of sliding nut principle turnbuckle type RS-FN can be pushed together to minimum storage length directly without any need for rotation. The sliding nut has a securing screw solution for which a patent has been applied for and allows securing against self-releasing at any position of thread by just one short rotation without blocking sliding function

**Specification**

- **RS-FN**
  - ~ 12.4 kg
  - Min. length for storage 1160
- **Spanner OT-RS-FN**
  - ~ 2.4 kg
  - Distance pressure point – pressure point
    - Max. 1500 / min. 1070

May 2011 © Technical alterations reserved
Turnbuckles

**RS-FH/C/900-1400**
- Min. breaking load tension 500 kN
- Approval from any classification society
- Hot dip galvanised
- Minimised weight
- Securing screw against self-releasing
- Closed design with long life thread lubrication
- Made of high tensile steel
- To be used preferably for spare parts deliveries

~ 15.4 kg

**RS-HH**
- Min. breaking load tension 500 kN
- Approval from any classification society
- Hot dip galvanised
- Minimised weight
- Securing screw against self-releasing
- Closed design with long life thread lubrication
- Made of high tensile steel
- To be used preferably for spare parts deliveries

~ 16.0 kg

**Spanner OT-RS-FH/HH**
- Min. breaking load tension 500 kN
- Approval from any classification society
- Hot dip galvanised
- Minimised weight
- Securing screw against self-releasing
- Closed design with long life thread lubrication
- Made of high tensile steel
- To be used preferably for spare parts deliveries

~ 2.5 kg

**RS-FH/O/900-1400**
- Min. breaking load tension 500 kN
- Approval from any classification society
- Hot dip galvanised
- Minimised weight
- Securing screw against self-releasing
- Closed design with long life thread lubrication
- Made of high tensile steel
- To be used preferably for spare parts deliveries

~ 12.9 kg
Under normal conditions the combination of long thread of turnbuckle and multiple knobs at lashing bar guarantees unified lashing length for all container heights. Only in case of unfavourable arrangement of lashing plates it might be necessary to apply additional extension rods at certain stack locations.

- Min. breaking load tension 500 kN
- Approval from any classification society
- Swivel hook at upper end which is self-securing when the lashing bar is hanging in vertical direction.
- Made of high tensile steel
- Type R-KS/... (diagonal lashings) and R-KV/... (vertical lashings) with multiple knobs at lower end for fast pre-adjustment of length minimising necessary number of rotations when tightening the turnbuckles

- Hot dip galvanised

**Specification**

- **R-KS/...**
- **R-KV/...**
- **Extension rod R-KN/...**
Lashing bars

* R-ES/... *

---

**Specification**

- Min. breaking load tension 500 kN
- Approval from any classification society
- Swivel hook at upper end which is self-securing when the lashing bar is hanging in vertical direction.
- Made of high tensile steel
- Hot dip galvanised
- To be used preferably for spare parts deliveries

---

**Extensions rod R-EHS/305**

~ 5.3 kg

---
Operating rods

Telescope type for semi-automatic twistlocks

Telescopic operating rod
OR-AS/3900-10500
~ 9.1 kg

Extension
OR-A/50x2600
~ 2.1 kg

Specification

- Light weight design
- Maximum stiffness
- Made of aluminium tubes
- Free adjustment of length without any tools from top of 2nd tier to top of 4th tier
- In order to reach top of 5th tier the telescopic rod can be extended by additional extension bar 2.60 m

- For top of 1st tier operating rod type OR-A/1800 to be used, please compare to next page
- Advanced head device with seesaw function reducing the pulling force for unlocking of semi-automatic twistlocks
## Specification

- Light weight design
- Maximum stiffness
- Made of aluminium tubes
- Available in different lengths
- Length adjustment by screw connection

- Type OR-A/.. is the standard operating rod for semi-automatic twistlocks while OR-AS/.. is an advanced version with seesaw function reducing the pulling force for unlocking of semi-automatic twistlocks

### OR-A/...

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Tier</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR-A/1800</td>
<td>1.80 m</td>
<td>1/2</td>
<td>~ 1.1 kg</td>
</tr>
<tr>
<td>OR-A/4720</td>
<td>4.72 m</td>
<td>2/3</td>
<td>~ 2.56 kg</td>
</tr>
<tr>
<td>OR-A/7640</td>
<td>7.64 m</td>
<td>3/4</td>
<td>~ 4.24 kg</td>
</tr>
<tr>
<td>OR-A/10300</td>
<td>10.30 m</td>
<td>4/5</td>
<td>~ 5.87 kg</td>
</tr>
<tr>
<td>OR-A/13040</td>
<td>13.04 m</td>
<td>5/6</td>
<td>~ 7.9 kg</td>
</tr>
</tbody>
</table>

### OR-AS/...

<table>
<thead>
<tr>
<th>Type</th>
<th>Length</th>
<th>Tier</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>OR-AS/1800</td>
<td>1.80 m</td>
<td>1/2</td>
<td>~ 1.8 kg</td>
</tr>
<tr>
<td>OR-AS/4720</td>
<td>4.72 m</td>
<td>2/3</td>
<td>~ 3.29 kg</td>
</tr>
<tr>
<td>OR-AS/7640</td>
<td>7.64 m</td>
<td>3/4</td>
<td>~ 5.0 kg</td>
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<tr>
<td>OR-AS/10300</td>
<td>10.30 m</td>
<td>4/5</td>
<td>~ 6.5 kg</td>
</tr>
<tr>
<td>OR-AS/13040</td>
<td>13.04 m</td>
<td>5/6</td>
<td>~ 8.7 kg</td>
</tr>
</tbody>
</table>
Operating rods

for conventional twistlocks

Specification

- Lightweight design
- Maximum stiffness
- Made of aluminium tubes
- Special length on request
- To be used for conventional twistlocks depending on shape of hand lever, i.e. type OR-F/3800 for twistlock TL-L and TL-GL/L and OR-R/3800 for all types of SEC dovetail twistlocks
Specification

- Each flat rack will be approved and delivered with CSC-certificate
- Main dimensions and strength in accordance with ISO-norms
- 20’ flat rack with pockets for forklift trucks
- Flat racks will be delivered with finish paint but hot dip galvanising is available on request.
Storage bins

- Standardised dimensions
- Can be stacked up
- Drainage holes
- Hot dip galvanised
- Colour marking corresponding to the OSHA equipment to be stowed, i.e. yellow marking for fully/semi-automatic twistlocks and blue marking for midlocks
- Wooden grating for bottom is available on request. In this case the stowage capacity per bin is reduced

Stowage capacity for standard bins:

<table>
<thead>
<tr>
<th></th>
<th>wooden grating</th>
<th>without</th>
<th>with</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL-A/L</td>
<td>240 pcs</td>
<td>220 pcs</td>
<td></td>
</tr>
<tr>
<td>TL-GA/L</td>
<td>220 pcs</td>
<td>200 pcs</td>
<td></td>
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<tr>
<td>TL-FA/L</td>
<td>300 pcs</td>
<td>300 pcs</td>
<td></td>
</tr>
<tr>
<td>TL-FA/G</td>
<td>240 pcs</td>
<td>220 pcs</td>
<td></td>
</tr>
<tr>
<td>TL-FA/LG</td>
<td>240 pcs</td>
<td>220 pcs</td>
<td></td>
</tr>
<tr>
<td>TL-M/L</td>
<td>240 pcs</td>
<td>220 pcs</td>
<td></td>
</tr>
<tr>
<td>IS-1T</td>
<td>420 pcs</td>
<td>420 pcs</td>
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<tr>
<td>IS-1T/L</td>
<td>550 pcs</td>
<td>500 pcs</td>
<td></td>
</tr>
<tr>
<td>IS-1T/LG</td>
<td>550 pcs</td>
<td>500 pcs</td>
<td></td>
</tr>
<tr>
<td>IS-1T/LF</td>
<td>1100 pcs</td>
<td>1100 pcs</td>
<td></td>
</tr>
</tbody>
</table>
Bridge fittings

**Specification**

- Min. breaking loads tension / compressions 300 kN
- Approval from any classification society
- Spindle with right-and-left screw thread for fast length adjustment
- Hot dip galvanised
- Long life lubrication
- Type BR-T for tension forces up to 100 kN breaking load to be used preferably on deck in order to limit the movement of stacks towards each other
## Container part

### LOOSE FITTINGS IN HOLDS

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>6.1 - 6.2</td>
<td>Twist stackers</td>
</tr>
<tr>
<td>6.3</td>
<td>Stacking cones</td>
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<td>6.4</td>
<td>Bottom stacking cones</td>
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<tr>
<td>6.5 - 6.6</td>
<td>Anti-Rack-Spacer</td>
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<tr>
<td>6.7</td>
<td>Tension/pressure elements</td>
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<tr>
<td>6.8</td>
<td>Pressure elements</td>
</tr>
<tr>
<td>6.9</td>
<td>Pressure adapters</td>
</tr>
</tbody>
</table>
**Specification**

- Min. breaking load shear 420 kN  
- Approval from any classification society  
- All types are hot dip galvanised with stainless steel components  
- Coning and deconing at the quay side as requested by OSHA  
- Easy one-hand operation  
- Made of casted steel  

- A variety of three different twist stackers with 13 mm resting area is available upon customers preference:  
  - Type IS-1T/L is our standard version in light weight execution with a spring loaded fallout protection  
  - Type IS-1T is our heavy duty version with closed housing and internal spring mechanism  
  - Type IS-1T/LG is a pure after sales product with gravity whip as fallout protection.

**Twist stackers**

- **IS-1T/L**  
  ~ 2.5 kg  

- **IS-1T**  
  ~ 3.6 kg  

- **IS-1T/LG**  
  ~ 2.8 kg
**Twist stackers**

**Specification**

- Min. breaking load shear 420 kN
- Approval from any classification society
- All types are hot dip galvanised with stainless steel components
- Coning and deconing at the quay side as requested by OSHA
- Easy one-hand operation
- Made of casted steel

- Latest invention twist stacker type IS-1T/LF has no resting area any more and containers can be stowed directly on top of each other without vertical gap. The necessary quantity of twist stackers can be reduced by 50% compared to standard twist stackers because height alignment at cellguide ends is no longer required.
- Twist stacker IS-1T/30 has a resting area with 30 mm thickness for height adjustment when used in combination with semi-automatic twistlocks for example for containers which are stowed in deck cellguides at one end only.

**IS-1T/LF**

- ~ 1.4 kg

**IS-1T/30**

- ~ 5.1 kg
Stacking cones

**Specification**

- Min. breaking load shear 420 kN for single stacking cones
- Min. breaking loads tension / compression up to 1200 kN for double stacking cones
- Approval from any classification society
- The transversal distance between the cones of double stackers will be made to measure the required distance between containers. Distances to be used preferably 203, 258 and 365 mm
- Drop forged cones
- Enlarged length of cones (115 mm) in order to reduce longitudinal misalignment of containers
- Hot dip galvanised
Bottom stacking cones

**Specification**

- Min. breaking load shear 420 kN for single stacking cones
- Min. breaking loads tension / compression up to 1200 kN for double stacking cones
- Approval from any classification society
- The transversal distance between the cones of double stackers will be made to measure the required distance between containers. Distances to be used preferably 203, 258 and 365 mm
- To be used in combination with welding plates type WP-1 for example
- Type CS-2/... with one cone flattened to be used for tank step locations
- Drop forged cones
- Enlarged length of cones (115 mm) in order to reduce longitudinal misalignment of containers
- Hot dip galvanised
Anti-Rack-Spacer

Specification

- Min. breaking loads tension / compression 400 kN for intermediate types respectively 200 kN for type BR-3/TP
- Approval from any classification society
- To be used for longitudinal connection of 20' containers within 40' cellguides
- Drop forged execution (except CS-3F/TP/115 which should be used exclusively on 20' tanksteps) for close fit with corner casting as requested by classification societies
- Hot dip galvanised
Anti-Rack-Spacer

**BR-3/TP**
~ 2.6 kg

**IS-3/TP**
~ 4.7 kg

**CS-3F/TP/115**
~ 9.8 kg

PATENTED
**Tension / pressure elements**

**Specification**

- Min. breaking loads tension / compression up to 1200 kN
- Approval from any classification society
- Tension/pressure elements without length adjustment are not allowed according to latest rules of Germanischer Lloyd
- Fully galvanised finish
- Length adjustment by thread or saw fish solution
- Custom-made for individual situation on board
- Made of high tensile steel

> Application <

X to be informed by yard 89
**Pressure elements**

**Specification**
- Min. breaking load compression up to 1200 kN
- Approval from any classification society
- Pressure elements without length adjustment are no longer allowed according to latest rules of Germanischer Lloyd
- Fully galvanised finish
- Length adjustment by thread or saw fish solution
- Custom-made for individual situation on board
- Made of high tensile steel
Pressure adapters

Specification

- Min. breaking load compression up to 1200 kN
- Approval from any classification society
- To be used in combination with single stacking cones type IS-1/115 preferably in holds underneath longitudinal hatch cover joint for separate unloading of container blocks
- The breadth of pressure adapters will be made to measure the required distance between containers. The preferred distance is 258 mm.
- Hot dip galvanised
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<th>SPECIAL FEATURES</th>
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<td>Removable railing post</td>
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<td>7.9 - 7.10</td>
<td>Removable reefer platforms</td>
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</tbody>
</table>
Lifting foundations

**Specification**

- Min. breaking loads tension 960 kN for hatch cover lifting weights up to 45 tons
- Approval from any classification society
- Standard height 110 mm to suit spreader cones
- Thickness of top plating 28 mm
- Topplate with punchmarks for easy installation
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel

**Lifting eyes inclined longitudinally**

*SF-C1LS/EL/110/U160*

**Lifting eyes without inclination**

*SF-C1LS/ER/110/U160*

60° lifting gear with ramshorn hook or similar to be used

**Welding recommendation**

Welding outside

Welding inside

> Application <

Twendeck

Hatch cover

Welding outside

Welding inside

Twendeck

Hatch cover
Securing points for general cargo

LP-B-1H/BL12/200x300x12/III
Min. breaking load 120 kN

DR-1F
Min. breaking load 500 kN

LP-B-C1H/BL36/II
Min. breaking load 360 kN
Casted steel execution

DR-1F/50/IV
Min. breaking load 500 kN

DR-L/45
Min. breaking load 450 kN
Hot dip galvanized
~ 12.2 kg

> Application <

Specification

- Approval from any classification society
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Preparation of welding chamfer for fixed securing points on request
High adapters

**CP-1/TC/305**

- When applied in combination with twistlocks compensation piece type CP-1/TC/305 is capable to transmit lifting forces up to 400 kN breaking load
- Approval from any classification society
- Made of high tensile steel
- Standard height is one foot (305 mm) but other heights can be delivered on request

**CP-1/LT/305**

- ~ 19.4 kg
- ~ 23.9 kg

Compensation pieces or height adapters to be used preferably in holds for levelling of adjacent stacks.

**Specification**

- When applied in combination with twistlocks compensation piece type CP-1/TC/305 is capable to transmit lifting forces up to 400 kN breaking load
- Approval from any classification society
- Made of high tensile steel
- Standard height is one foot (305 mm) but other heights can be delivered on request
**ISO / EURO-adapter pieces**

**Specification**

- Adapter pieces for safe loading of ISO-containers within guide angles with increased width suitable for loading of EURO-containers (2500 mm)
- Coning and deconing to be performed on the quayside as requested by OSHA
- Only the lower corners of an ISO-container have to be equipped with adapter pieces. In total four pieces of DA-CG/30 are needed per 40’ ISO-container.
- Made of cast steel
- Hot dip galvanised with stainless steel components
Spreader and lifting gear

In addition to container lashing gear SEC supplies 20’ and 40’ spreaders. Combined designs for twin loading of married 20’ containers can be delivered. The SEC spreaders are made-to-measure designs. Options such as working platforms, flippers, etc. can easily be added to basic design. In addition to the standard design with manual operation, SEC provides a semi-automatic version. All spreaders are supplied with class lifting gear certificate as standard. This certificate has to be regularly renewed. Furthermore, any other container related lifting gear is available on request. Please apply for details.

Removable lifting eye LGE-50
- Min. breaking load 500 kN
- Approved for lifting purposes
- Hot dip galvanised
- Fits into all foundations with standardized ISO-hole as well as container corner castings
- Weight ~ 12.7 kg

LG-1/20FR

LG-1/20

Description
Hatch cover lifting stopper

**Specification**

- Min. breaking load tension 800 kN
- Approval from any classification society
- Automatic locking of twistlock when closing panels
- The sliding part of foundation always remains in neutral position due to spring loaded ball pen solution
- Fully forged twistlock in hot dip galvanised execution with stainless steel components
- The foundation can be made to measure according to the individual situation on board as far as necessary sliding range, height, steel grade of conic wedges and surface treatment is concerned
Iso-plugs

**Specification**

- As a protection against dirt or when loading grain flush type twistlock pockets can be closed by use of plugs
- Our standard solution is a low cost plastic plug type IP-P
- The luxury version is a metal plug type IP-SR which is hot dip galvanised with rubber sealing
- Also solid rubber version is available

**Application**

- Rubber pad

**Dimensions**

- IP-P: ~ 0.05 kg
- IP-SR: ~ 0.45 kg
Removable railing post

For making safe unprotected sides of hatch covers or similar the existing container foundations can be used when fitting SEC movable railing post.

**Specification**

- Can be used for all foundations with standardised ISO-holes
- Locking function
- Hot dip galvanised
- Light weight design ~ 9.5 kg
Removable reefer platforms

**Specification**

- Light weight design
- Large parts such as ladders and platforms made of aluminium. Remaining parts are hot dip galvanised.
- One man operation
- Foldable
- Available for 2nd, 3rd or even 4th tier

8’6” or 9’6” Container

**OT-RSP /2T**

8’6” or 9’6” Reefer Container

**OT-RSP /3T**

8’6” or 9’6” Container
Removable reefer platforms

Specification

- Removable reefer platform for various application, for example in combination with lashing bridges.
- Light weight design
- Large parts such as platforms made of aluminium. Remaining parts are hot dip galvanised.
- One man operation
- Foldable hand rail
### DESIGN & ENGINEERING PART

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
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<td>SEC consultancy</td>
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<td>SEC design</td>
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<td>8.3-8.4</td>
<td>Lashing bridges</td>
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<tr>
<td>8.5</td>
<td>Reefer stages</td>
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<td>Container deck stanchions</td>
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<tr>
<td>8.8</td>
<td>Cellguides</td>
</tr>
<tr>
<td>8.9</td>
<td>Slim cellguides</td>
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<tr>
<td>8.10</td>
<td>Deck cellguides</td>
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<tr>
<td>8.11</td>
<td>Removable cellguide systems</td>
</tr>
<tr>
<td>8.12</td>
<td>Cellguide stoppers</td>
</tr>
<tr>
<td>8.13</td>
<td>Container blind trestles</td>
</tr>
</tbody>
</table>
When planning a new building it is essential to consider the securing and handling of cargo from the very beginning. As earlier taking care of cargo securing/handling as better is the chance to influence ship’s layout to improve cargo securing/handling. At later design stage many dimensions can not be changed any more and often tremendous disadvantages have to be accepted for cargo securing/handling. No matter if general cargo, timber, RoRo or especially containers are concerned the project engineers of SEC can work out an optimised solution for the cargo. A large range of subjects has to be considered for cargo securing/handling, such as:

- Optimised lashing system for the requested stackloads on deck under consideration of acceleration from classification society depending on ship size and GM value.
- Maximum stackload for 20’ containers which can not be lashed at both ends.
- Maximum number of tiers especially at outermost positions where containers are exposed to wind forces in order to keep the guaranteed TEU capacity.
- Latest requirements from OSHA, AMSA, US Coast Guard, ISO, IMO, national safety authorities etc.
- Optimised arrangement of lashing plates in relation to containers for unrestricted loading of 8’6” and 9’6” containers with unified lashing length.
- Interference of loose lashing gear with hatch cover entry guides, crane pedestals or adjacent stacks.
- Stowage possibilities for special container sizes others than ISO, for example 30’, 45’, 48’, 49’ & EURO containers.
- Best securing solution for containers in hold depending on requested stackloads, loading flexibility and OSHA conformity.
- Design parameter, for example necessary spaces for the arrangement of lashing bridges and removable cellguides, levelling of tank steps in hold, strengthening of longitudinal bulkhead and arrangement of counter bearings for transversal stowage systems.
- Arrangement of sliding foundations for compensation of hatch cover movements with necessary sliding range and direction in cooperation with yard and hatch cover designers.
- Transversal spaces between containers considering deflection of hatches or minimum breadth of guide angles.
- Longitudinal arrangement of containers, for example symmetrical or asymmetrical arrangement of 40’ containers when two 20’ stacks are stowed with lashing gap in between or in combination with other container sizes.
- Advantages/disadvantages of different types of foundations, i. e. raised ISO, dovetail or flush foundations, welding plates or guide fittings.
- Necessary spaces and stowage factors for loose lashing gear.
- Acting forces on bulkheads, container stanchions etc.
A separate department inside SEC takes care about all kinds of container related design parts for ships as shown on the following pages. Our design office is equipped with the latest CAD programs by AUTODESK namely AutoCAD, Mechanical Desktop and Inventor.

Strength analysis is performed by Finite Element Method (FEM) using ANSYS. Drawing transmission by e-mail is possible in all kinds of common file formats, i.e. dxf and dwg. Large files will normally be compressed by WINZIP.

Different levels of design can be offered starting with principle layout drawings to detailed manufacturing drawings with complete outfitting. In order to avoid misunderstandings we would like to precise our definition of different design levels:

1.) Layout Level
Principle Layout shows typical situations i.e. at midship section with the principle arrangement of the concerned design part. These drawings to be used as a base for further design levels. An example could be the principle arrangement of lashing plates at lashing bridge for optimised lashing of containers, interference check with hatch cover panels, parking position of turnbuckles and unified lashing length.

2.) Design Level
a) Typical situation only
Principle Design consists of main steel structure with dimensioning based on the result of our FE calculations but without measuring any details. The principle arrangement of necessary reinforcements at the hull will be indicated but dimensioning of such stiffeners to be done by hull designers. An example is the arrangement and dimensioning of typical container stanchions at ship sides.

b) Complete design
Same as before but for all situations on board which are different, for example the arrangement and dimensioning of main steel structure for all container stanchions on deck.

3.) Manufacturing Level
We will prepare a complete set of manufacturing drawings with detailed measuring including welding details for each individual item ready for production. Manufacturing drawings normally will include complete outfitting with working platforms, railings, ladders, access lids, gratings, light housings and what ever might be necessary. Outfitting with electrical equipment can not be offered. A material list for each item or nesting drawings can be prepared on request.
Lashing bridges

When the requested stackload for 40’ containers is exceeding the limit of approx. 100 tons lashing from hatch cover level might no longer be sufficient. For this reason lashing bridges are installed between 40’ hatches in order to realise more effective support by the lashings. Higher container weights can be realised in the upper tiers while the lashing system can be simplified, i.e. double cross short lashing system (Para-Lash) to be used for 40’ containers from lashing bridge level. Heavy and unhandy long lashing bars should not be used except at some outermost stacklocations. The installation of lashing bridges does not have any effect on 20’ stackloads because 20’ containers still have to be lashed from hatch cover level at midhatch position. The possibility to stow non-standard containers other than 20’/40’ ISO containers is restricted. For example 45’ containers can be loaded on top of two tiers 40’ containers otherwise they would interfere with the lashing bridge structure. Alternatively the length of hatch covers can be increased and additional foundations for 45’ containers to be arranged. It has to be kept in mind when elongating the hatches lashing operation of 40’ containers will become more difficult due to increased gap between lashing bridge and 40’ container end.
Another positive effect of lashing bridges is easy access to reefer containers at second tier. Many subjects have to be considered when designing a lashing bridge:

- At first the layout of transversal hold beam has to be checked together with yard and hatch cover designers considering guiding system of hatch cover panels, arrangement of bearing pads and lifting stoppers, sliding range of hatch covers due to ship’s torsion, installation tolerances, minimum breadth of walkways, strength of lashing bridge etc.

- The longitudinal gap between lashing bridge and container end to be minimised therefore all containers should be arranged symmetrically on hatch covers.

- Also at this stage the arrangement of reefer sockets and parking positions for loose lashing gear has to be considered.

- Next thing is the optimised arrangement of lashing plates on lashing bridge in order to ensure unified length of lashing rods. Preferably fixed lashing plates are used on lashing bridges instead of slewing eyes because of lower costs and no maintenance work. In the case that an average angle of inclination for the lashing plates which covers all lashing combinations and container heights/sizes can not be found slewing eyes can not be avoided.

- Some classification societies are requesting a detailed investigation considering three dimensional lashing, deflection of lashing bridge and shifting of hatch cover panels. These calculations can no longer be performed with standard lashing programs instead FEM to be used.
Description

Fixed installed service stages for reefer containers are a perfect solution for easy surveillance, service and maintenance of reefer containers even at higher tiers. The design is tailor made to accommodate the exact situation on board depending on the requested number of tiers and rows of reefer containers. The lightweight steel structure should be strengthened to absorb bumps from containers and hatch cover panels during operation. Guiding system for hatch covers can be integrated on request.
Lashing stages

Description

Using the transversal hatch coaming as working platform for container lashing is very inconvenient for stevedores especially when there are many installations on top such as ventilation housings, hold down devices etc. For this reason it is recommended to install lashing stages at hatch cover level which will make lashing operation much easier. A perfect solution for the lashing stages is when they cross the whole breadth of vessel with direct access to the container stanchions at both sides of the ship. When the holds are open a removable railing system should be integrated to the lashing stages for safety reason.
Description

The amount of design hours for container deck stanchions can vary quite a lot from pure strength analysis with FEM and dimensioning of main steel structure to manufacturing drawings with complete outfitting such as working platforms, access lids, ladders and railings subject to demand.
The installation of fixed 40’ cellguides is a standard solution for ships which are exclusively designed to carry containers. Vertical guide angles are attached to the transversal bulkheads with entry guides at the upper end in alternating high peak / low peak arrangement to speed up loading time. No loose securing fittings are needed for securing of 40’ containers and various securing solutions can be applied when loading two 20’ containers in a 40’ cell depending on customers preference concerning stackload versus OSHA requirements.
Container vessels which frequently have to carry a large amount of heavily loaded 20' containers sometimes are equipped with slim cellguides which are fitted into the 76 mm ISO gap of a 40’ cellguide system. Slim cellguides are fixed in longitudinal and transversal direction to transmit forces from container loading into the hull structure. No loose securing fittings are needed at all therefore this system fully complies to OSHA regulations but still allows unrestricted stackloads. No need to mention that exclusively 20’ containers can be loaded when slim cellguides are installed. Due to its extreme narrow design slim cellguides are so weak that they normally cannot be made removable.
Description

In order to achieve maximum stackweights with a minimum amount of loose fittings the installation of deck cellguides can be an option. When integrating walkways in the deck cellguides easy access to (reefer) containers is another positive effect. A perfect deck cellguide should reach approx. to the lower third of the uppermost container tier and should be exclusively used for one container size, i.e. 40’ containers. In this case no loose securing fittings are needed at all and maximum stackloads can be achieved. Container tiers which are exceeding the guide angles have to be secured by vertical lashing bars in order to absorb lifting forces and additional diagonal lashings to be arranged if heavy containers to be loaded above entry guide level. Loading of high cube containers has to be restricted due to limited adjustable range of turnbuckles. Securing of 20’ containers within 40’ deck cellguides should be avoided because of many different fittings are needed for fulfilling OSHA regulations.
Description

In case of multi purpose container vessels the loading of other cargoes than containers is disturbed when fixed cellguides are installed. When making the cellguides removable the cargo holds can be used more flexible for other cargoes when parking the cellwall close to the bulkhead. Alternatively the cellguides can be shifted in longitudinal direction to facilitate loading of different container sizes, i.e. 20', 30', 40' or 45'. The cellwall is fully self-sustained with counter bearings at the longitudinal bulkhead. The application of removable cellwalls is limited to a maximum hold breadth of approx. 7 to 8 containers across otherwise the steel weight of the cellwall might exceed the lifting capacity of ship cranes. As an option the removable cellwall can be designed as grain bulkhead.
Description

There are several reasons for integrating vertical stoppers in the cellguides. In the area of inclining hull form with 20’ tanksteps the installation of cellguide stoppers do allow loading of 40’ containers even when there are no 20’ containers available for lowermost position. Vertical stoppers can be integrated at certain level in the cellguides so that non-standardized cargoes can be loaded on tanktop while 40’ containers can be stowed above. In case of large container carriers and especially open top container vessels with more than nine tiers on top of each other the stackloads have to be limited because the corner post compression of the lowermost container might be exceeded. Many different solutions for stoppers have been realised depending on customers preference and situation on board. It should be mentioned that stanchion type stoppers are transmitting vertical loads directly into tanktop structure while all other types of stoppers do require large reinforcements to absorb vertical loads.
Description

Especially for multi purpose vessel which carry containers only in exceptional cases it might be unfavourable to install tank steps in accordance with ISO container dimension at positions where the hull form is inclining. For such vessels container blind trestles are the best choice for maximum container intake and easy securing solution. The blind trestles can be designed in fixed or removable execution.
Fixed Fittings

9.1 - 9.2 Lashing points for trucks / trailer
9.3 - 9.5 Lashing points for cars
9.6 Combined lashpots
9.7 Lashing chains
9.8 Speed winch

Loose Fittings

9.9 Spanners for chains
9.10 Trailer horses
9.11 Wheel chocks
9.12 Web lashings for light vehicles
9.15 Web lashings for heavy vehicles
Lashing points for trucks / trailer

* according to ISO 9367

- Min. breaking load tension 200 kN
- Approval from any classification society
- Standard height 55/62 mm
- Thickness of top plating 16 mm
- Top plate with punchmarks for easy installation
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Counter parts are elephant foot or hook
Lashing points for trucks / trailer

Options and variations for flush lashpots

- Variation of height
- Variation of thickness of top plate
- Variation of size of top plate
- Half type for narrow positions close to bulkheads
- 2-hole type
- Special surface treatment as specified by customer, for example final paint inside excluding welding area
- Variation of chamfer upon request; please compare to chapter 4.4

Options and variations for raised lashpots

- Variation of size
- Half convex type for welding directly against bulkheads or pillars
- Aircraft securing type
Lashing points for cars

Flush Lashpoints

LP-H-F/PL196x6/CUP196x6/III

- Variation of height
- Variation of thickness of top plate
- Variation of size of top plate
- Variation of size of hole

- Variation of chamfer upon request; please compare to chapter 4.4

Specification

- Min. breaking load tension 60 kN
- Approval from any classification society
- Standard height 64 mm
- Thickness of top plating 6 mm
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Count part is hook
Lashing points for cars

**Specification**

- Min. breaking load tension 2 x 30 kN for crinkle bar resp. 100 kN for baby elephant foot
- Approval from any classification society
- Weldable inorganic zinc or epoxy shop primer
- Made of high tensile steel
- Counter parts are car lashing units with hook end
Lashing points for cars

D-Rings

**DR-1/15**

![Image of DR-1/15 D-Ring]

**DR-2/15**

![Image of DR-2/15 D-Ring]

Welding recommendation

![Welding recommendation diagram]

**Specification**

- Min. breaking load tension 150 kN
- Approval from any classification society
- Welding chamfer
- Drop forged D-ring and welding bow
- Made of high tensile steel
- Weldable inorganic zinc or epoxy shop primer
- Counter parts are tumbuckle, hook, shackle or car lashing
**Specification**

- Min. breaking load tension 500 kN
- Approval from any classification society
- Thickness of side plating 12 mm
- Topplate with punchmarks for easy installation
- Standard distance for double foundations 203/258/365 mm
- Weldable inorganic zinc or epoxy shop primer
- Counter parts are twistlock or elephant foot

- Variation of chamfer upon request; please compare to chapter 4.4
**Lashing chains**

Chain size 13
Breaking load: 200 kN
Weight: ~2.9 kg/m

Chain size 11
Breaking load: 150 kN
Weight: ~2.2 kg/m

---

**Specification**

- Min. breaking load tension 20000 daN resp. 15000 daN
- Length on customer’s request
- High tensile steel chain, long link/grade 80
- Spanners and turnbuckles please see next pages
- Painted (orange)
Speed winch

**GE-SW/20/EF**
~ 9.3 kg

**Specification**

- Min. breaking load tension 20000 daN
- Suitable for long-link chain
- Can be operated with standard pneumatic or electrical power tools but also with manual ratchets
- Hot dip galvanised
- Long life lubrication
- Approval from any classification society
- Instead of elephant foot a hook can be applied at lower end
Spanners for chains

**Tension Lever**

C-TL-20
~ 5.3 kg

**Chain Turnbuckle**

RS-C/405-555
~ 3.6 kg

**Specification**

- Min. breaking load tension 20000 daN
- Drop-forged (high tensile steel)
- Counter parts is long-link chain
- Tension lever will be painted (orange)
- Chain turnbuckle will be hot dip galvanised
**Trailer horses**

**GE-TH**

(according to the specifications of leading RoRo carriers) for securing of multi-axle semi-trailers on PCTC vessels

**Specification**

- Min. breaking load 600 kN
- Galvanised steel frame
- Anti-slip shoring
- Weight-controlled rolling gear
- Timber plated crossbeam
- Various load capacities available (25.0 – 60.0 t)
- Weight ~117.0 kg
Wheel chocks

For cars
GE-CC/1
~ 0.7 kg

For trucks/trailer
GE-TC/1
~ 5.2 kg
GE-TC/2
~ 11.0 kg

Specification
- Vulcanized long life rubber
- Skid-proof
- Anti-static
- According to DIN 76051 the specifications of leading RoRo carriers for securing of trucks, trailers and construction vehicles on PCTC vessels
Web lashings for light vehicles

- Min. breaking load tension 1500 daN with overcentre buckle
- Min. breaking load tension 1800 daN with paddle buckle
- High tensile polyester webbing
- Gasoline-, lubricant- and solvent-proof
- Web width = 25 mm
- Steel buckle and hooks; PVC-coated to avoid damages
- According to EN 12195-2
**Web lashing for medium weight vehicles**

*WL50-3HE5.0/500/3000* for securing of medium-weight cargoes on dedicated RoRo vessels

- **Double-J hook**
- **Safe-release ratchet**
- **D-ring + Elephant foot**

Running part ~3000 mm

Fixed part 500 mm

*WL50-3HH5.0/500/3000* for securing of medium-weight cargoes on merchant vessels, trucks and railways

- **Double-J hook**
- **Safe-release ratchet**
- **Double-J hook**

Running part ~3000 mm

Fixed part 500 mm

*WL50-3HH5.0/500/3000+1000* for securing of medium-weight cargoes on merchant vessels, trucks and railways

- **Double-J hook**
- **Extension loop 1000 mm**
- **Safe-release ratchet**
- **Double-J hook**

Running part ~3000 mm

Fixed part 500 mm

**Specification**

- Min. breaking load tension 5000 daN
- High tensile polyester webbing
- Gasoline-, lubricant- and solvent-proof
- Safe-release ratchet (yellow chromatic) on fixed end
- Double-J hook (yellow chromatic) on running end

- Web width = 50 mm
- According to EN 12195-2
- Fixed and with double - J Hook or D-Ring + elephant foot
**Web lashings for medium weight vehicles**

**WL50-3HL5.0/500/3000**

for medium-weight project shipments on multi-purpose and RoRo vessels

- Min. breaking load tension 5000 daN
- High tensile polyester webbing
- Gasoline-, lubricant- and solvent-proof
- Safe-release ratchet and high quality steel hooks (yellow chromatic)
- Extra-large soft eye for variable attachments, e.g. shackles, D-rings, elephant feet etc.
- Web width = 50 mm
- According to EN 12195-2

Optional hardware for attachment

- **Bow shackle**
  B/L = 10000 - 20000 daN

- **D-ring**
  B/L = 12000 - 20000 daN

- **D-ring**
  B/L = 12000 - 20000 daN

- **“Elephant foot”**
  B/L = 6000 - 12000 daN

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Web lashings for heavy vehicles

**Specification**

- Min. breaking load tension 10000 daN
- High tensile polyester webbing
- Gasoline-, lubricant- and solvent-proof
- Safe-release ratchet and high quality steel hooks (yellow chromatic)
- Web width = 75 mm

**WL75-3HH10.0/750/1500**

(according to EN 12195-2)

for marine securing of high and heavy cargoes on RoRo vessels, specialized break-bulk carriers etc.
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Master lashings (single winch system)

Professional securing system for timber deck cargoes
(in compliance with IMO 275E “Code of Safe Practice for Ships Carrying Timber Deck Cargoes”)

Lashing arrangement for unitized/packaged timber

Lashing arrangement for Logs
Master lashing (single winch system)

**Master Lashing**
*ML-1/100/13.3*

Single winch arrangement

**Components of each system**
- 1 x Ratchet Winch
- 1 x Web band 100 % PES, fixed end / 1 reinforced eye / 1 soft eye
- 1 x Web band 100 % PES, loose end / 1 reinforced eye / 1 open end
- 2 x shackles
- 2 x Edge controller (web band protector) – Option

**Fixed fittings**

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*see chapter 3.13  see chapter 3.9*

**Benefits**

- Easy handling and quick installation
- Easy access to tightening devices (ratchet winch) via cargo topside
- Additional personnel protection + safety devices required
- Tailor-made system to match vessel’s specifications, tie down provisions and cargo dimensions

**Specification**

- Min. breaking load tension 13300 daN
- Extremely high tensile band webbing (100 % Polyester)
- Gasoline-, lubricant- and solvent-proof
- High quality steel ratchet winch, galvanization of all parts
- Safe-release feature (stand-off operation)

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Master lashing (double winch system)

Professional securing system for timber deck cargoes
(in compliance with IMO 275E “Code of Safe Practice for Ships Carrying Timber Deck Cargoes”)

Lashing arrangement for unitized/packaged timber

Lashing arrangement for logs
Master lashing (double winch system)

Master Lashing  
*ML-2/100/13.3*

Double winch arrangement

Components of each system

- 2 x Ratchet Winch with 1 steel adapter each  
- 1 x Web band 100 % PES, loose end, variable length  
- 2 x Edge controller (web band protector) – Option

Fixed fittings

- *DR-50*  
- *LAP-1*

see chapter 3.13    
see chapter 3.9

Benefits

- Safe and economical  
- Easy access to tightening devices (ratchet winch)  
- No additional personnel protection + safety devices needed  
- Maximum performance due to variable belt lengths  
- Good flexibility to be adjusted to any lashing point arrangement and / or cargo dimension

Specification

- Min. breaking load tension 13300 daN  
- Extremely high tensile band webbing (100 % Polyester)  
- Gasoline-, lubricant- and solvent-proof  
- High quality steel ratchet winch, galvanization of all parts  
- Safe-release feature (stand-off operation)
Set of IMO-levers

Ratchet handle set with extension “IMO-Lever” for Master Lashing.

- Lightweight design
- IMO-lever hot dip galvanised
- High quality stainless steel ratchet
- One set consists of two ratchets and one extension
- Low budget solution for narrow working space is available on request
Edge controllers

Edge Controller EC-100/1

To prevent web lashings from direct chafing
To spread tension forces in order to protect cargoes and / or tarpaulins

Specification

- Light-weight and strong polyurethane (PUR) material
- Resistant against exposure to UV-rays
- Belt guide with slide-in feature