Guidelines on securing of assorted steel products on roll-trailers
## Contents

1 INTRODUCTION ..................................................................................................................3

2 STEEL PLATES WITH ROUGH SURFACES SHIPPED DURING SUMMER CONDITIONS .................3
   2.1 PREPARATIONS BEFORE DELIVERY TO PORT ................................................................ 4
   2.2 PREPARATIONS IN PORT AND LOADING ONTO ROLL-TRAILERS ..................................4
   2.3 SECURING OF STEEL PLATES ....................................................................................... 6

3 STEEL PLATES WITH SMOOTH SURFACES OR SURFACES COVERED BY ICE OR SNOW .............8
   3.1 PREPARATIONS BEFORE DELIVERY TO PORT .............................................................. 9
   3.2 PREPARATIONS IN PORT AND LOADING ONTO ROLL-TRAILERS ................................. 9
   3.3 SECURING OF STEEL PLATES ....................................................................................... 11

4 STEEL PIPES .....................................................................................................................13
   4.1 PREPARATIONS BEFORE DELIVERY TO PORT .............................................................. 13
   4.2 PREPARATIONS AND LOADING ONTO ROLL-TRAILERS ............................................. 13
   4.3 SECURING OF STEEL PIPES ....................................................................................... 15
1 Introduction

This guideline has been prepared by MariTerm AB for Höegh Autoliners AS and aims to provide general advice for best practices on the securing of mixed, assorted steel products on roll-trailers during unrestricted sea transport in Höegh Autoliners vessels.

In general, loading and securing of mixed steel products on roll-trailers is a time consuming process that requires good planning. Thus it is desirable to have the whole shipment arriving as early as possible to the place of reloading, in order to allow sufficient time for sorting and stowing the different products as favourable as possible and to properly secure the cargo to the roll-trailers. Good planning is a key factor for an efficient loading procedure.

The advice in this guideline should not rule out good seamanship.

1.1 Summer and winter conditions

In these guidelines, separate instructions have been given for loading and securing of steel products for two different types of weather conditions: summer and winter conditions.

The decision on which condition to apply shall only be based on the weather conditions during loading. The conditions during the sea transport or the subsequent unloading from the vessel need not to be considered.

Winter conditions apply when there are clear accumulations of ice, snow or frost on the roll-trailers loading surface or the goods. Winter conditions shall also be considered to apply when there is a risk that these circumstances may occur during a later stage of the loading.

If there is no risk for snow, ice or frost during loading, summer conditions apply.

2 Steel plates with rough surfaces shipped during summer conditions

This section describes proper sorting, stowage and securing onto roll-trailers of steel plates with rough surfaces. This type of plates or slabs has not been treated to have a smooth surface finish, nor have they been treated with any type of protective coating. Thus they can be considered to have good friction against each other and against wooden dunnage.

In case winter conditions apply, i.e. the plates are or risk being covered by ice or snow during loading, all plates shall be considered to have smooth, low friction surfaces and shall be handled in accordance with chapter 3 of this guideline.
Examples of mild steel plates with rough surfaces.

2.1 Preparations before delivery to port

Before delivery, the steel plates should be sorted based on length and width into groups of plates with similar shape. The plates should foremost be sorted based on width, but extreme variations in length should be avoided. The height of a group of plates without intermediate transvers battens should not exceed 10 cm.

Plates that are to be shipped to the same consignee shall be grouped together.

As long as there are no extreme variations of width among the plates in each group, the narrowest plates shall be placed at the bottom of the stow.

When transported from a storage facility, the plates should, if possible, be covered during transport in order to avoid accumulation of ice, snow, rain water or dirt.

2.2 Preparations in port and loading onto roll-trailers

As far as possible, groups of plates with similar dimensions shall be loaded together. This produces even ends and sides of the stows on the roll-trailers and makes it easier to secure the plates properly. Sorting by width shall be prioritized over sorting by length.
Example of groups of plates with similar dimensions having been loaded together.

The cargo should be loaded so that its centre of gravity is located as near as possible to the roll-trailers centre, both in the longitudinal and transverse direction.

The groups of steel plates shall be separated by transverse wooden battens. The battens placed directly on top of the roll-trailer flooring shall have a minimum cross section of 100 x 100 mm and shall span the full width of the roll trailer. Battens placed between the different groups of plates shall have a minimum cross section of 75 x 75 mm.

The longitudinal spacing of the battens shall be such that no plate is allowed to deflect more than 10 mm in vertical direction.

Transverse battens used to separate the groups of steel plates shall be place directly on top of each other to avoid buckling of the plates.

The transverse battens between the different layers have been placed directly on top of each other in order to avoid buckling of the plates.

In order to allow for a reasonable securing arrangement, the cargo weight on each roll-trailer shall be limited to 40 tons.
2.3 Securing of steel plates

Stacks of steel plates on roll-trailers shall be secured with half loop lashings to prevent transverse movement and spring lashings to prevent longitudinal movement. The half loop lashings shall be applied at several different levels.

Example of half loop lashings in the transverse direction.  
Example of spring lashing in the longitudinal direction.

The equipment used should be chain lashings with breaking strength MBL at least 10 tons and MSL at least 5 tons.

Höegh standard chain lashing with MBL 10 ton and MSL 5 ton.

Corner protectors should be used between the lashings and the cargo in order to prevent the edges of the steel plates from being damaged by the chain lashings as well as bending of chain links. Either hard plastic corner profiles or wooden corners can be used.

Chain links may bend over sharp edges  
With corner protections this problem is significantly reduced

All lashings shall be placed so that it is possible to retighten them if needed during the voyage.
2.3.1 Securing in the transverse direction

The following principles should be applied when securing in the transverse direction:

- When the stow of cargo consists of multiple layers of groups of steel plates, pairs of half loop lashings have to be applied at several different levels.

- Several layers of plates can be loop-lashed together. However, the total height of the layers that are secured together should not be more than 50 cm.

- The number of half loop lashings is to be determined based on the weight of the layers of cargo they encircle as well as the weight of any layers stowed on top of it, see dimensioning table below.

<table>
<thead>
<tr>
<th>Friction factor</th>
<th>Secured cargo weight for each half loop lashing pair (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rough steel plates during summer conditions, ( \mu=0.3 )</td>
<td>16.3 ton</td>
</tr>
</tbody>
</table>

- In case groups are loaded in several sections after each other in the longitudinal direction, each section shall be secured with at least 2 pairs of half loop lashings.

Example of cargo in multiple layers. Three of the half loop lashing pairs encircle the two bottom layers and two pairs of half loop lashings encircle the three top layers.
2.3.2 Securing in the longitudinal direction

The following principles should be applied when securing in the longitudinal direction:

- Spring lashings are to be used to secure the plates in the longitudinal direction.

- In case it is not possible to apply the spring lashings so that they are in direct contact with all layers, the primary focus should be to secure the top layers. In any case, cargo representing at least 50% of the total weight should be in direct contact by a spring lashing in each longitudinal direction.

- The number of spring lashings in each direction is to be determined based on the dimensioning table below.

<table>
<thead>
<tr>
<th>Friction factor</th>
<th>Secured cargo weight for each spring lashing (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rough steel plates during summer conditions, $\mu=0.3$</td>
<td>42 ton</td>
</tr>
</tbody>
</table>

3 Steel plates with smooth surfaces or surfaces covered by ice or snow (winter conditions)

This section describes proper sorting, stowage and securing onto roll-trailers of steel plates with smooth surfaces. These are plates that have been treated to have a fine, high quality finish and thus have a low friction against each other and against wooden dunnage.

Plates with a high quality finish are typically packaged together in bundles and covered in protective material.

This chapter shall also be applied for any types of plates if winter conditions prevail during loading and the plates are covered by snow or ice.

Example of stainless steel plates with smooth surfaces.

Example of plates with smooth surfaces in bundles.
3.1 Preparations before delivery to port

Groups of smooth surface plates with identical size may be placed on pallets and packaged into bundles by means of steel straps. The total height of steel plates in each bundle should in general not exceed 20 cm.

![Example of properly packaged bundles of steel plates](image1)

![Example of poorly packaged bundles of steel plates, not to be accepted.](image2)

For shipments which consist of individual steel plates with smooth or icy surface of varying size, the plates should be sorted based on length and width into groups of plates with similar shape before delivery to port. The plates should foremost be sorted based on width, but extreme variations in length should be avoided. During these circumstances, each plate shall be separated by wooden or rubber dunnage.

Plates that are to be shipped to the same consignee shall be grouped together.

In case the plates are covered by snow and ice, they should be swept to remove snow and ice in order to ensure as good friction as possible and to avoid excessive settling of the stows during transport as the snow melts.

If transported from a storage facility, the plates should, if possible, be covered during transport in order to avoid accumulation of ice, snow, rain water or dirt.

3.2 Preparations in port and loading onto roll-trailers

As far as possible, groups of plates with similar dimensions shall be loaded together. This produces even ends and sides of the stows on the roll-trailers and makes it easier to secure the plates properly. Sorting by width shall be prioritized over sorting by length.
Example of groups of plates with similar dimensions having been loaded together.

The cargo should be loaded so that its centre of gravity is located as near as possible to the roll-trailers centre, both in the longitudinal and transverse direction. All voids between the cargo units shall be avoided or filled with suitable dunnage.

In case of individually stowed plates with varying size, the steel plates shall be separated by transverse wooden battens or rubber mats. The battens placed directly on top of the roll-trailer flooring shall have a minimum cross section of 100 x 100 mm and shall span the full width of the roll trailer. Battens placed between the different groups of plates shall have a minimum cross section of 75 x 75 mm.

The longitudinal spacing of the battens shall be such that no plate is allowed to deflect more than 10 mm in vertical direction.

Transverse battens used to separate the steel plates shall be place directly on top of each other to avoid buckling of the plates.

The transverse battens between the different layers have been placed directly on top of each other in order to avoid buckling of the plates.

In order to allow for a reasonable securing arrangement, the cargo weight on each roll-trailer should be limited to 40 tons.
3.3 Securing of steel plates

Stacks of steel plates on roll-trailers shall be secured with half loop lashings to prevent transverse movement and spring lashings to prevent longitudinal movement. The half loop lashings shall be applied at several different levels.

![Examples of half loop and spring lashings](image)

Example of half loop lashings in the transverse direction.  
Example of spring lashing in the longitudinal direction.

The equipment used should be chain lashings with breaking strength MBL at least 10 tons and MSL at least 5 tons.

![Höegh standard chain lashing](image)

Höegh standard chain lashing with MBL 10 ton and MSL 5 ton.

Corner protectors should be used between the lashings and the cargo in order to prevent the edges of the steel plates from being damaged by the chain lashings as well as bending of chain links. Either hard plastic corner profiles or wooden corners can be used.

All lashings shall be placed so that it is possible to retighten them if needed during the voyage.
3.3.1 Securing in the transverse direction

The following principles should be applied when securing in the transverse direction:

- When the stow of cargo consists of multiple layers of bundles of plates or individual plates, pairs of half loop lashings have to be applied at several different levels.

- Several layers of plates can be loop-lashed together. However, the total height of the layers that are secured together should not be more than 50 cm.

- The number of half loop lashings is to be determined based on the weight of the layers of cargo they encircle as well as the weight of any layers stowed on top of it, see dimensioning table below.

<table>
<thead>
<tr>
<th>Friction factor</th>
<th>Secured cargo weight for each half loop lashing pair (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth steel plates or winter conditions, $\mu=0.2$</td>
<td>12.8 ton</td>
</tr>
</tbody>
</table>

- In case bundles are loaded in several sections after each other in the longitudinal direction, each section shall be secured with at least 2 pairs of half loop lashings.

3.3.2 Securing in the longitudinal direction

The following principles should be applied when securing in the longitudinal direction:

- Spring lashings are to be used to secure the plates in the longitudinal direction.

- In case it is not possible to apply the spring lashings so that they are in direct contact with all layers, the primary focus should be to secure the top layers. In any case, cargo representing at least 50% of the total weight should be covered by a spring lashing in each longitudinal direction.

- The number of spring lashings in each direction is to be determined based on the dimensioning table below.

<table>
<thead>
<tr>
<th>Friction factor</th>
<th>Secured cargo weight for each spring lashing (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smooth steel plates or winter conditions, $\mu=0.2$</td>
<td>37 ton</td>
</tr>
</tbody>
</table>
4 Steel pipes

4.1 Preparations before delivery to port

Before delivery, the steel pipes should be sorted based on length and diameter into groups of pipes with similar shape. The plates should foremost be sorted based on diameter, but extreme variations in length should be avoided.

Pipes with smaller diameter, up to some 10 cm, should be strapped together in bundles measuring some 25 x 25 cm. The bundles should as far as practical consist of pipes with similar length and diameter.

Pipes that are to be shipped to the same consignee shall be grouped together.

If transported from an indoor storage facility, the pipes should, if possible, in the winter season be covered during transport in order to avoid accumulation of ice and snow.

4.2 Preparations and loading onto roll-trailers

Upon arrival to port, the groups or bundles of steel pipes should be sorted based on length and diameter, so that groups of pipes with similar shape can be loaded together onto the roll-trailers.

In case of winter conditions, the pipes should be swept to remove snow and ice in order to ensure as good friction as possible and to avoid excessive settling of the stows during transport as the snow melts.

The cargo should be loaded so that its centre of gravity is located as near as possible to the roll-trailers centre, both in the longitudinal and transverse direction.

Each layer of individual pipes or bundles of pipes should be separated by transverse battens spanning the full width of the load. Each layer should consist of pipes with equal diameter or in case of bundles, with equal height.

At the outermost pipes in each layer, wedges should be fitted to the transverse battens to prevent rolling and stabilize the stow. The wedges shall have a height of at least 1/6 of the pipe or bundles diameter but do not need to be higher than 20 cm. Alternatively, battens with rounded indentations can be used.
Larger pipes, with diameters of some 100 cm and upwards, in an upper layer may be loaded in saddle crated by two pipes in the bottom layer, see picture below. Lashings must be used to ensure that the pipe remains in the saddle during transport. The pipes in the lower layer shall be secured against rolling by the means of wedges. Dunnage should be used between the pipes to avoid damages.

As far as possible, groups of pipes with similar length shall be loaded together. This produces even ends of the stows on the roll-trailers and makes it easier to secure the pipes properly in the longitudinal direction. If the pipes are of very varying lengths, at least one end should be made even.

In order to allow for a reasonable securing arrangement, the cargo weight on each roll-trailer should be limited to 40 tons.
4.3 Securing of steel pipes

Stacks of steel pipes on roll-trailers shall be secured with half loop lashings to prevent transverse movement and spring lashings or straight lashings to prevent longitudinal movement.

The equipment used should be either web lashings or chain lashings with breaking strength MBL at least 10 tons and MSL at least 5 tons. It is not allowed to mix different type of equipment on the same load.

If chain lashings are used, rubber or synthetic fibre dunnage mats should be used between the lashings and the cargo to avoid cargo damages. Dunnage mats should also be to protect the cargo from the hooks if direct lashings are used.

All lashings shall be placed so that it is possible to retighten them if needed during the voyage.

If the cargo is covered by ice or snow, winter conditions apply and a maximum friction of $\mu=0.2$ shall be considered when deciding on the number of lashings to use.

4.3.1 Securing in the transverse direction

The half loop lashings used to secure the cargo in the transverse direction shall be applied at several different levels. Each half loop lashing should not encircle more than two layers.

If the cargo consists of multi-layer bundles of pipes held together by steel straps, as shown in the illustration below, each layer of bundles should be separated with transverse battens spanning the full width of the cargo and each layer should be loop lashed separately.
Example of bundles of pipes, where each layer of bundles has been loop lashed separately and the layers have been separated with transverse battens which span the full width of the cargo.

When larger pipes are saddle loaded, all lashings used to prevent transverse movement should be applied as half loop lashings around all three pipes.

The number of half loop lashings is to be determined based on the weight of the layer of cargo they cover as well as the weight of any layer stowed on top of it, see dimensioning table below.

<table>
<thead>
<tr>
<th>Friction factor based on weather conditions</th>
<th>Secured cargo weight for each half loop lashing pair (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter, ( \mu = 0.2 )</td>
<td>12.8 ton</td>
</tr>
<tr>
<td>Summer, ( \mu = 0.3 )</td>
<td>16.3 ton</td>
</tr>
</tbody>
</table>

### 4.3.2 Securing in the longitudinal direction

In case the stow has even ends, the spring lashings can be drawn around empty pallets or wooden boards, placed at each end of the stow. If the stow have uneven ends, the spring lashings can be drawn around vertical battens to ensure that each bundle has at least some support in the longitudinal direction. In any case, at least 50% of the cargo weight should be secured in the longitudinal direction.
Even ended bundles of steel pipes secured with a spring lashing drawn around a wooden pallet. Bundles of steel pipes with uneven ends, secured with a spring lashing drawn around vertical battens.

In case of larger pipes which are loaded not more than two pipes abreast, straight lashings can be used to secure the pipes in the longitudinal direction, as has been done in the example of a saddle loaded pipe above. In such case, each pipe must be secured with at least on straight lashing in both forward and backward direction. The angle between the straight lashings and the platform floor should not exceed 30 degrees.

The number of lashings needed to secure the cargo in each longitudinal direction is to be determined by the use of the dimensioning table below:

<table>
<thead>
<tr>
<th>Friction factor based on weather conditions</th>
<th>Secured cargo weight for each spring lashing (MSL 5 ton)</th>
<th>Secured cargo weight for each straight lashing (MSL 5 ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter, $\mu=0.2$</td>
<td>37 ton</td>
<td>11.4 ton</td>
</tr>
<tr>
<td>Summer, $\mu=0.3$</td>
<td>42 ton</td>
<td>12.2 ton</td>
</tr>
</tbody>
</table>