Cargo Securing Guidelines for Road Transport
U. S. Steel Košice, s.r.o.

U. S. Steel Košice

Guidelines for drivers

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Katedra cestnej a mestskej dopravy

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1 GENERAL GUIDELINES FOR LOADING AND SECURING A CARGO

1.1 APPLICATION OF THE GUIDELINES

These guidelines apply for all road vehicles carrying the steel sheets (bundles, coils, coil strips) and pipes from U.S. Steel Kosice s.r.o. (USSK) to our customers. Given the diversity of cargo carried, guidelines contain cargo securing principles for individual types of load. Guidelines are based on current cargo securing standards and measured results of selected cargoes. Cargo securing instructions are based on the estimated parameters as e.g. cargo weight, dimensions, friction factors, lashing angles, tensioning forces, lashing forces, use of anti-slip mats and the like.

These guidelines are minimum requirements to protect our goods. They do not indemnify the carrier from his responsibility to take additional measures as he may deem necessary mainly in case of difficult loadings, difficult weather conditions (ice, snow, icing...).

1.1.1 DRIVER BEHAVIOR

Drivers must follow work safety regulations in USSK. Drivers must wear personal protective equipment (PPE) according instructions in way-bills!

The driver is obliged to wear PPE during the whole loading or unloading of the vehicle.

Vehicle must be weighted at the entrance gate into USSK! Furnishing of the vehicle on loading site, tarpaulins removal, manipulation with sideboards and cargo securing is performed by the driver. Driver checks stowage of load on a loading platform during the whole loading.

1.2 VEHICLE REQUIREMENTS

1.2.1 HEADBOARD

The vehicle must be fitted with a headboard between the cabin and the loading platform to protect the vehicle personnel in case of load shifts forwards. Headboard has to be functional without cracks in bearing weld seams.

Vehicle without lashing points with damaged headboard!

We recommend vehicle superstructures certified according to the standard EN 12642 Code XL for our goods!

Vehicle body marking according to EN 12642

1.2.2 LOADING PLATFORM

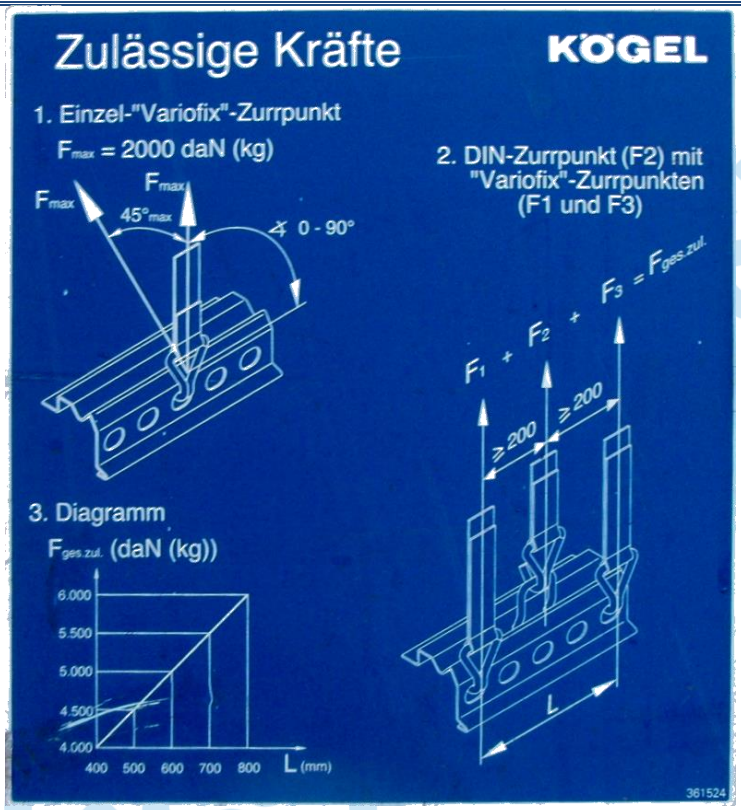
The surface of the loading platform should be even and closed (no missing or broken boards). The cargo should not become wet from below. In case of semi-trailer with a coil-well this must be without any missing or broken coil-well covers. The loading platform should be dry and clean before loading.

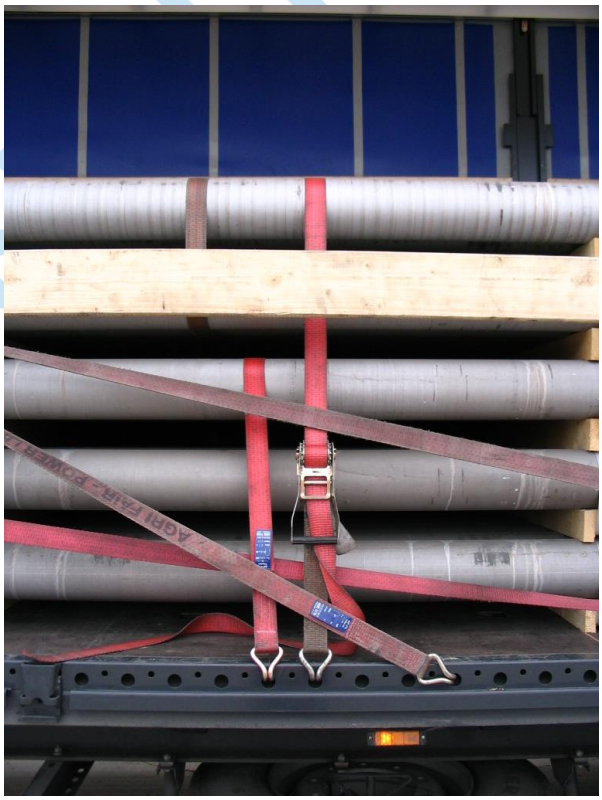
Loading platform must have anti-skid floor (not metal floor)!

1.2.3 LASHING POINTS

Lashing points should be an integral part of the vehicle construction. Usual semi-trailer must be equipped by minimum 12 pairs of lashing points (24 lashing points) with minimum safe working load of 2000 daN.

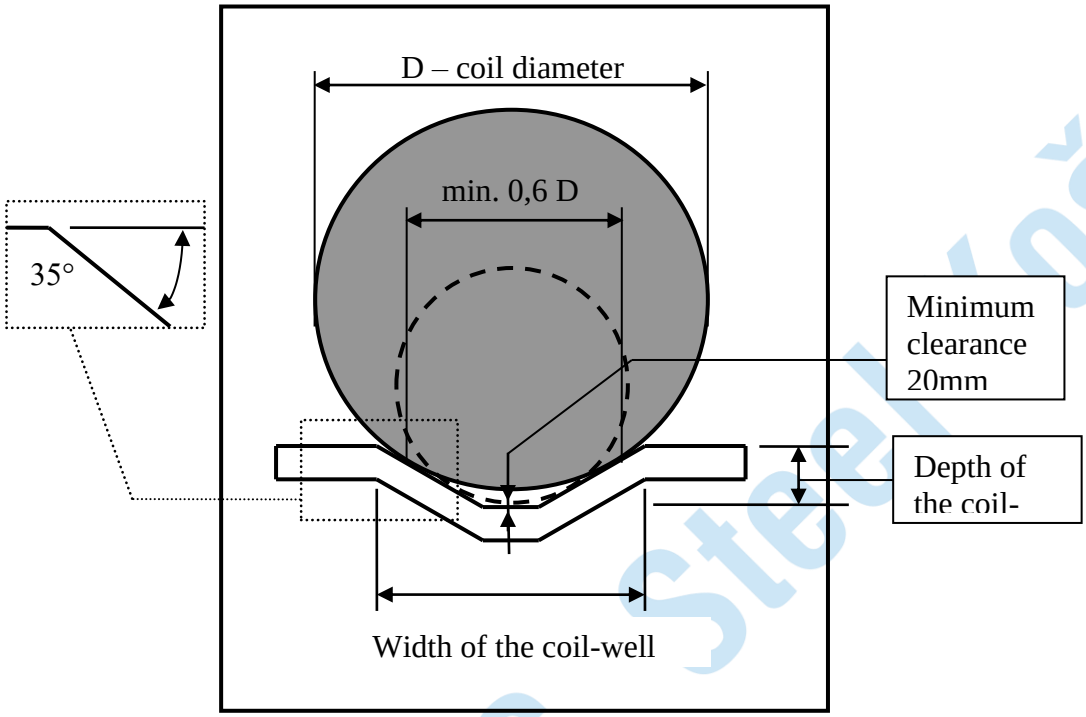
We recommend vehicles with multi-hole lashing system for our goods or at least 20 pairs of lashing poins.



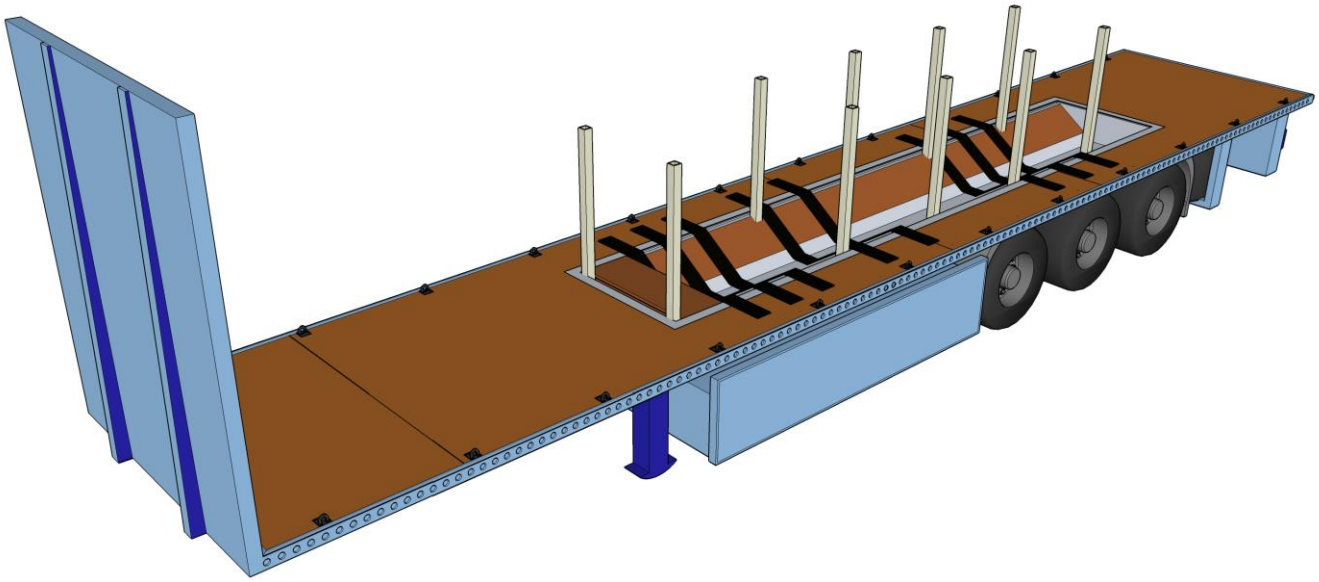


1.2.4 SEMI-TRAILERS FITTED WITH A COIL-WELL

- Minimum angle of slopes shall be 35°.
- Minimum span between supporting surfaces shall be 0,6 D.
- Minimum clearance under coil loaded in coil-well is 20 mm.
- Vehicle must be equipped with stanchions plugged into the cases in a coil-well. Coil must be placed against the stanchions. If coil might be damaged by stanchions use protective material.
- Use of anti-slip mats between the coil and the coil-well is obligatory by every type of surface of the coil-well.
- Coil might not be laying on the bottom (minimum clearance 20 mm) and/or top edges of the coil-well, always must be laying on coil-well slopes.



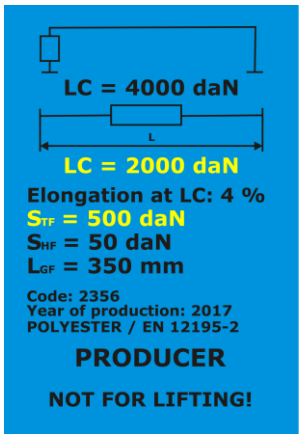
Maximum coil diameter loaded in coil-well is 1800 mm!

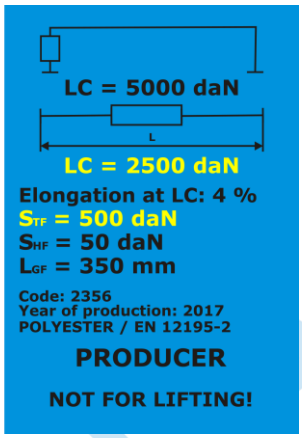


1.3 LASHING STRAPS

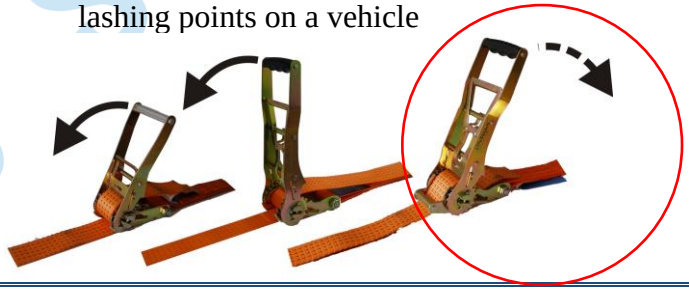
Vehicle must be equipped with sufficient number of lashing straps!

- Minimum **20 pcs** for tractor + semi-trailer and vehicle + trailer combinations with a lashing capacity LC = min. 2000 daN. Particular types of loading may require more straps.
- Minimum **10 pcs** for vehicle with a payload over 3,5 tonnes to 12 tonnes with a lashing capacity LC = min. 2000 daN, Particular types of loading may require more straps.
- Minimum **6 pcs** for a vehicle with a payload not more than 3,5 tonnes with a lashing capacity LC = min. 2000 daN, Particular types of loading may require more straps.
- Sufficient number of straps protective equipment (corner protectors, sleeves etc.) against sharp edges.
- Lashing straps must be certified according to the standard EN 12195-2.
- **Lashing capacity LC = min. 2000 daN !** (2500 daN recommended) and **standard tension force S_{TF} = min. 500 daN**





- length of lashing straps must be sufficient for applied lashing method
- lashing straps must be visually inspected before each use
- lashing straps end fittings must be suitable for lashing points on a vehicle



We require long handle ergo ratchets – S_{TF} = 500 daN for our load!

1.3.1 CONDITIONS OF USAGE

- Use only damage-free lashing straps with readable identification tag indicating lashing capacity (LC) and standard tension force (S_{TF}).
- Identification tags should be protected from sharp edges or even the load itself if possible.
- Lashing straps mustn't be knotted.
- Lashing straps mustn't lead over sharp edges or rough surfaces without equivalent protection.
- Lashing straps must never be used for lifting loads or for any other purpose for which they are not intended.
- Lashing hooks must not be loaded at their tips unless the hooks are specially designed for this purpose.
- To avoid stress on tensioning devices and fasteners, do not lay them across edges, otherwise they may fracture.
- Lashing straps must not be used again after the fracture, deformation of connective elements or tensioning elements.

- Driver is obligated to check the tension in lashings short after the start and, if he is aware of loosening, also during the carriage in necessary periods.
- Change of temperature during the carriage can affect the tension forces in lashing straps therefore check the tension after entry to warm area.
- Driver is responsible for functional lashing straps.

1.4 ANTI-SLIP MATS

- material – rubber granulate
- minimum friction factor 0,5
- minimum thickness 8 mm
- always to be used between the load and vehicle´s floor

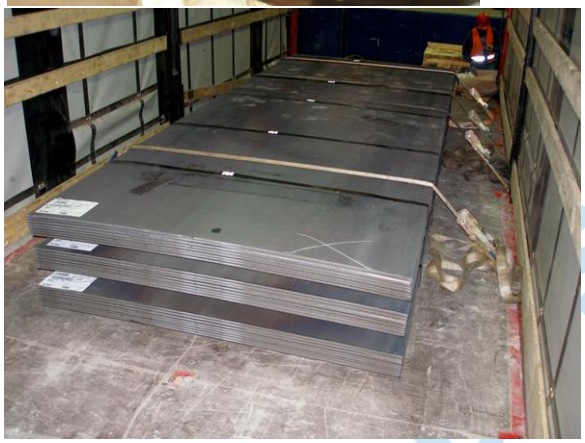
1.5 BASIC RULES FOR CARGO SECURING IN USSK

1. Never carry the unsecured load even for short distances!

24 tones of coil strips carried according driver "for short distance" unsecured!

Semi-trailer was not equipped with lashing points!!!

2. Cargo must be always secured forwards! Top-over lashing is not suitable for securing forwards!



Bales of sheets of 12 tones unsecured forwards!

3. Never place steel products on metal floor this is also valid for coil-well!

By contact surface steel – metal platform always use anti-slip mats. By contact surface steel (wedge bed, steel pallet) – wood/plywood floor always use anti-slip mats.

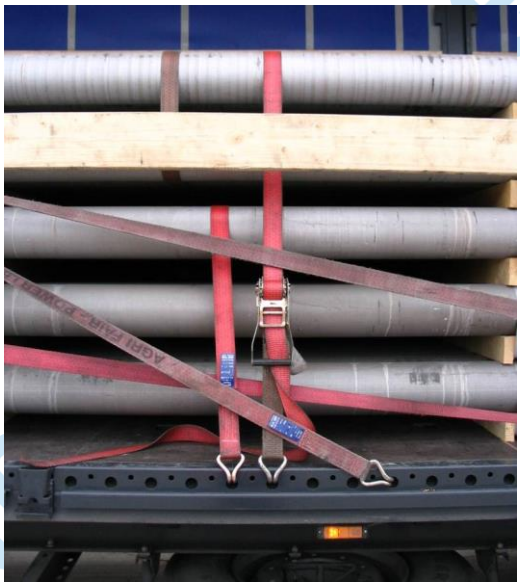
4. Use lashing straps of minimum lashing capacity LC = 2000 daN, standard tension force S_{TF} = 500 daN (long ratchets) and sufficient number!

5. For cargo securing use lashing points designed for this purpose. If the load displacement doesn't allow doing that, lash the lashings to the vehicle or superstructure chassis! But watch out of sharp edges!

Control officers in Germany do not allow lashing to vehicle/superstructure chassis. They can define the vehicle as inappropriate for carriage. They can order to load the cargo on another vehicle. We recommend vehicles with multi hole lashing system or at least 20 pairs of lashing points for our goods.

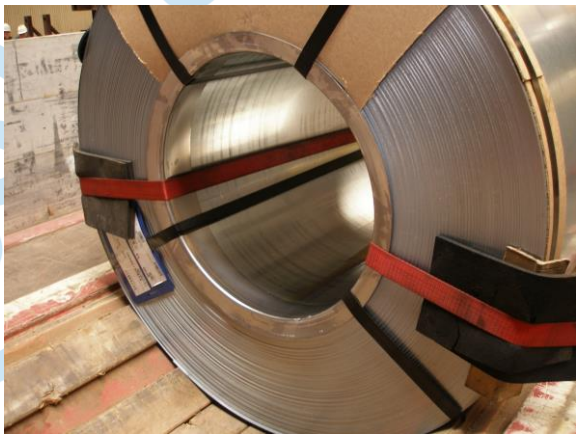
6. It is necessary for vehicles carrying steel products to be equipped with lashing points of sufficient strength and number!

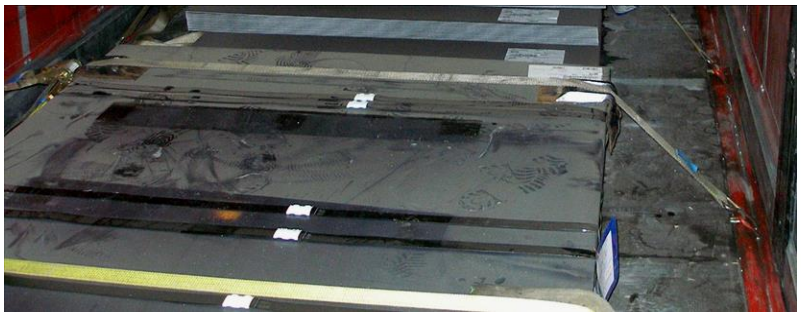
Usual semi-trailer must be equipped with 20 pairs of lashing points with minimum safe working load of 2000 daN. By vehicles without any lashing points it is not possible to secure the load safely and efficient!

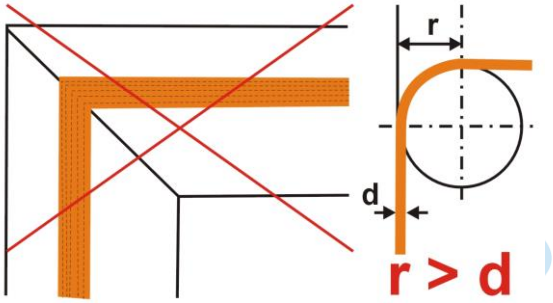


We recommend vehicles with multi hole lashing system or at least 20 pairs of lashing points for our goods.

7. Be aware of sharp edges, loose steel products have sharp edges and can cut the lashing straps, use protective material (corner protectors, sleeves...)!







8. Never load the lashing point in the same direction!

In one lashing point can be maximum 3 lashing straps but each in different direction of loading that is e.g. during braking is force transferred to lashing point by only one lashing straps.

We recommend vehicles with multi hole lashing system for our goods.

9. Anti-slip mats (ASM) decrease the number of additional securing equipment!

Always use ASM correctly. When using ASM cargo must be placed in a way that there are no contact points with loading platform and the whole cargo mass is transferred to loading platform through ASM.

2 SHEETS IN BUNDLES

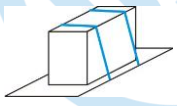
2.1 LOADING AND SECURING

Placing of bundles in longitudinal direction without gaps, blocking to the headboard, if necessary (e.g. load distribution) use of e.g. pallets to fill the distance between headboard and the first bundle or spring lashing.

It is reasonable (e.g. distance between lashing points or load displacement) to place the bundles in units and secure the whole unit forwards, rearwards and sideways. **In case of gaps between units each unit must be secured individually forwards** (practise: German authorities ordered to fill each gap!). If the bundles are loaded in layers and some layer is not secured forwards it must be secured by spring lashing.

Never carry the cargo unsecured forwards!

SHEETS BUNDLES UNSECURED FORWARDS PENETRATED HEADBOARD DURING HEAVY BREAKING!

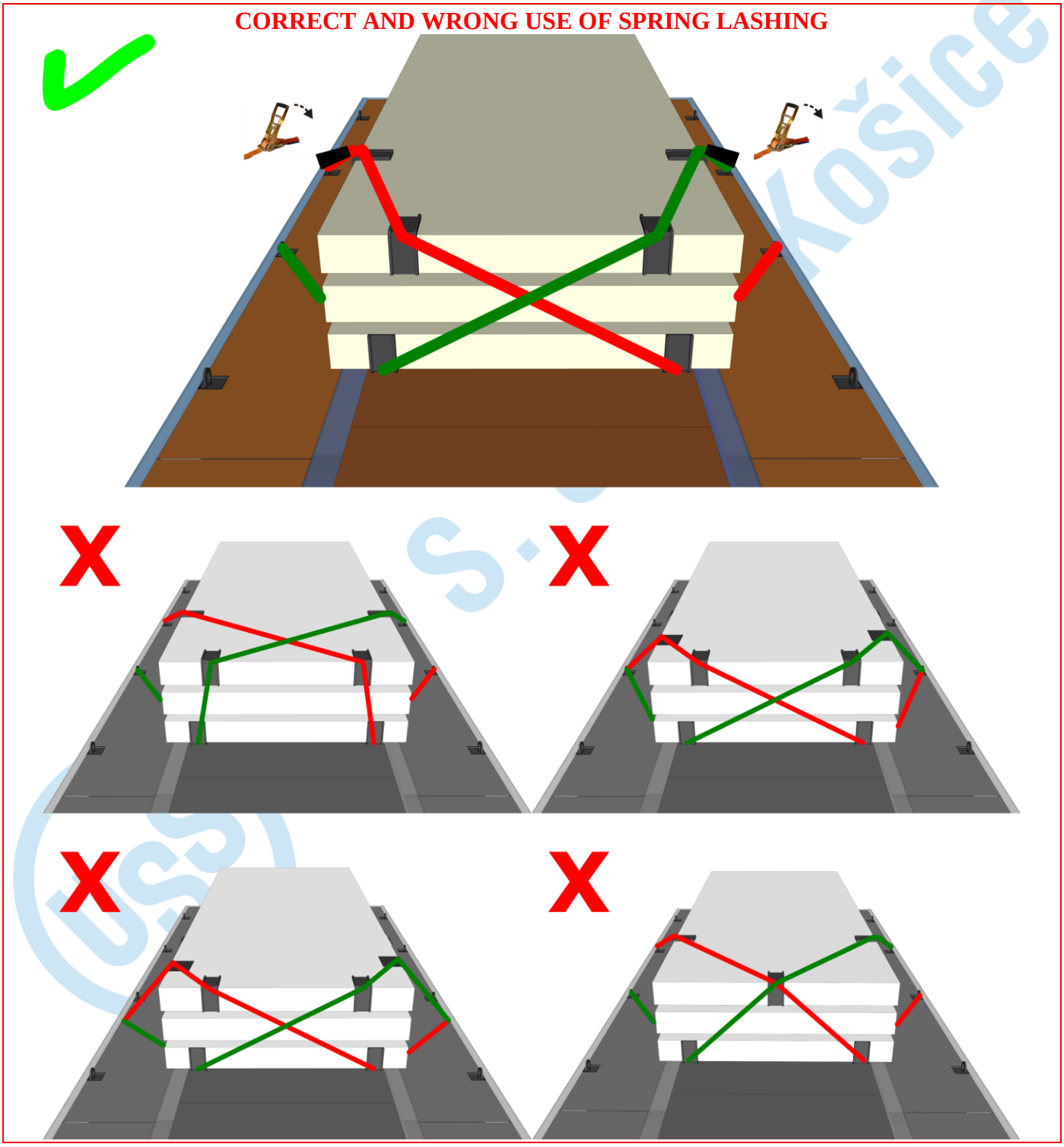


Top-over lashing never secures the load forwards by reasonable number of lashings!

2.1.1 SPRING LASHING FOR SECURING FORWARDS/REARWARDS

VARIANT SL1 – Bundles in one or several layers to prevent longitudinal movement

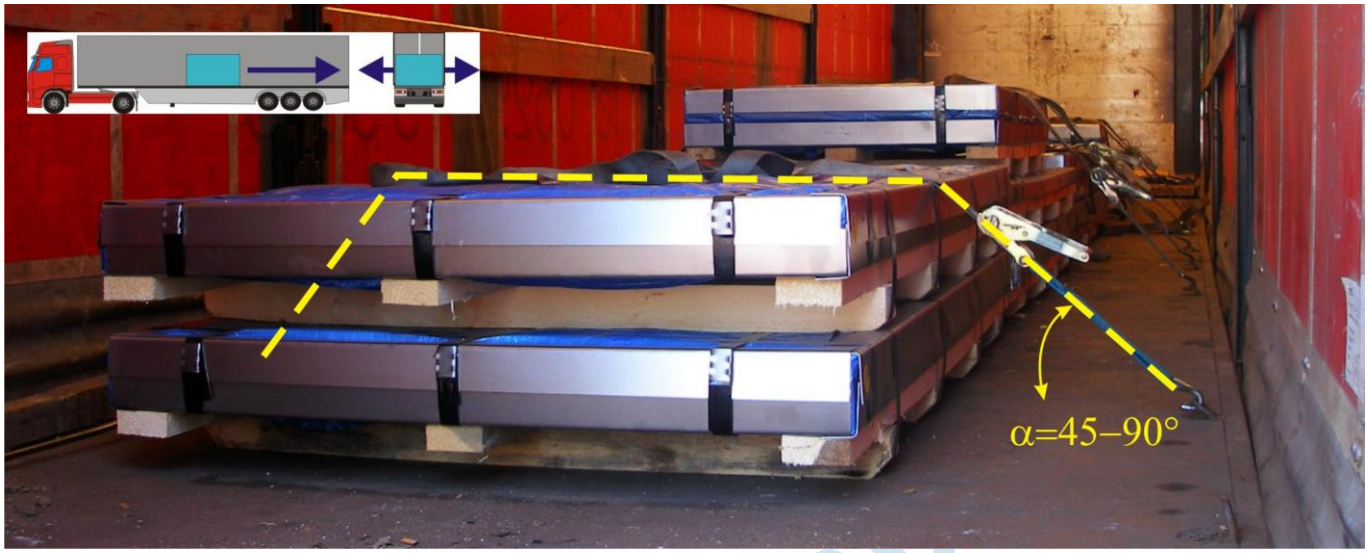
In case of bundles in more layers consider lashing of layers separately (not only the whole cargo). When using spring lashing, tensioners shall be used in the upper strap lines.



VARIANT SL2 – One or two bundles in one layer in combination with top-over lashing to prevent spring lashing to slip off

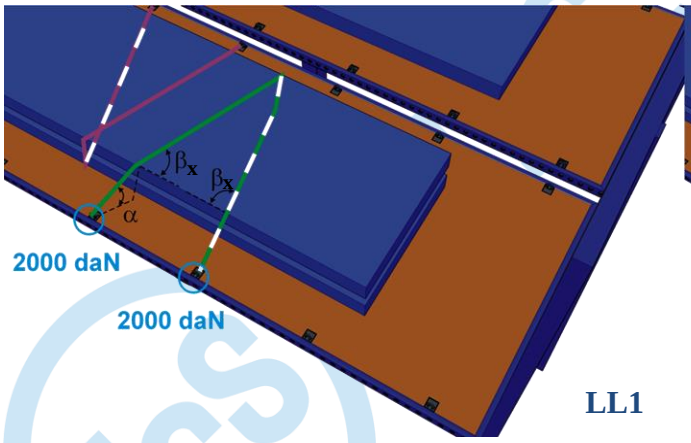
2.1.2 TOP-OVER LASHING FOR SECURING SIDEWAYS/REARWARDS

Use for bundles already secured forwards!

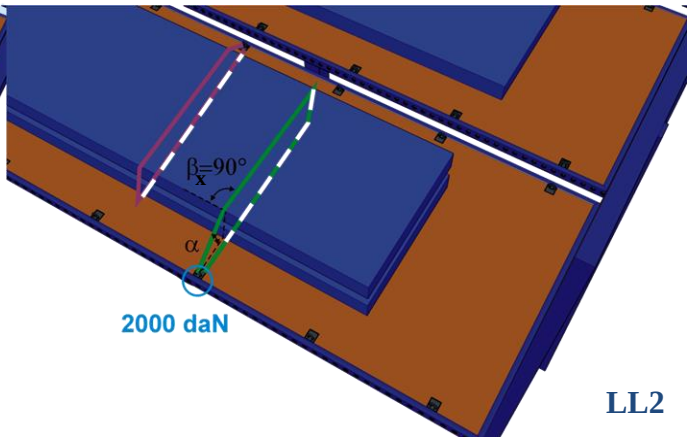


2.1.3 LOOP LASHING FOR CARGO SECURING SIDEWAYS

Loop lashing – 2 variants – use for long bundles over 4 m in length and also for shorter bundles where great number of top-over lashings is necessary.



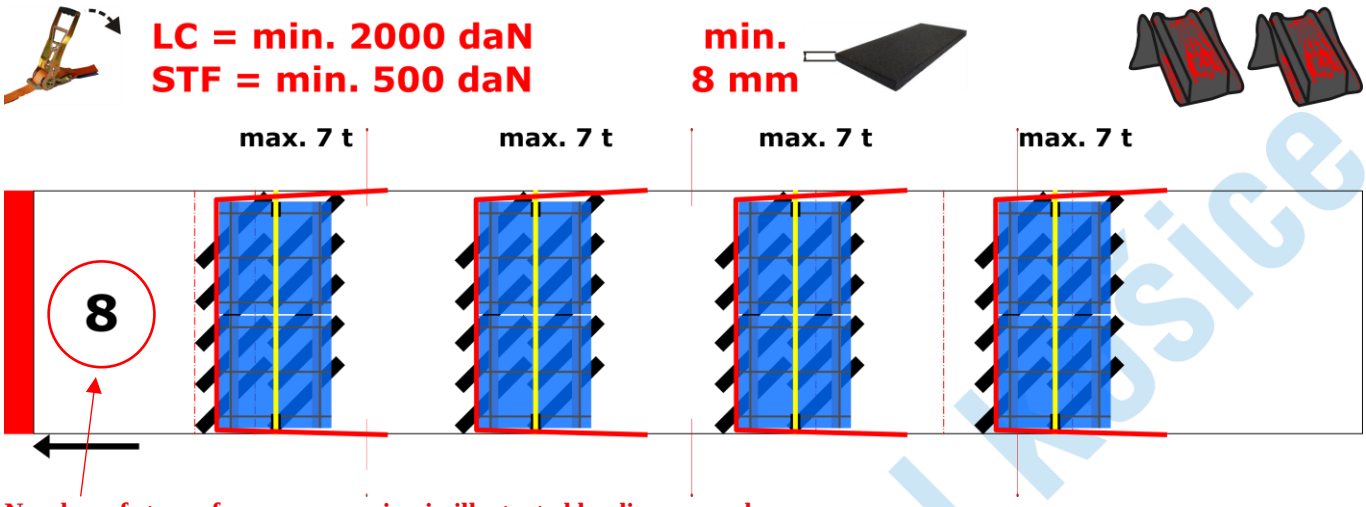
LL1



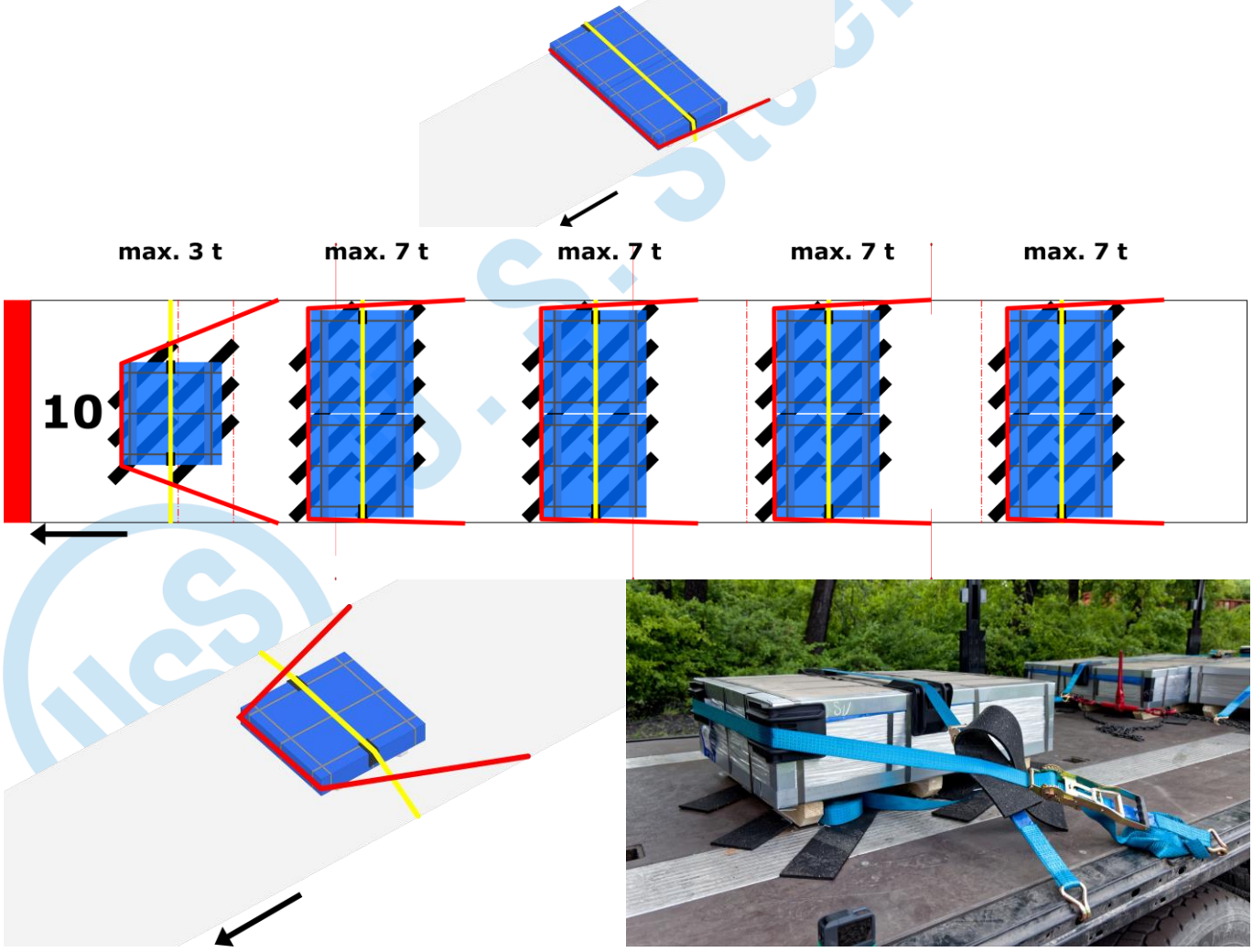
LL2

2.2 SHEETS BUNDLES – SECURING EXAMPLES

2.2.1 SECURING EXAMPLES OF COLD-ROLLED SHEETS IN SMALL BUNDLES IN DZ ZU AND OV

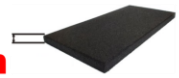


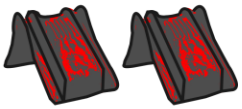
Number of straps for cargo securing in illustrated loading example.

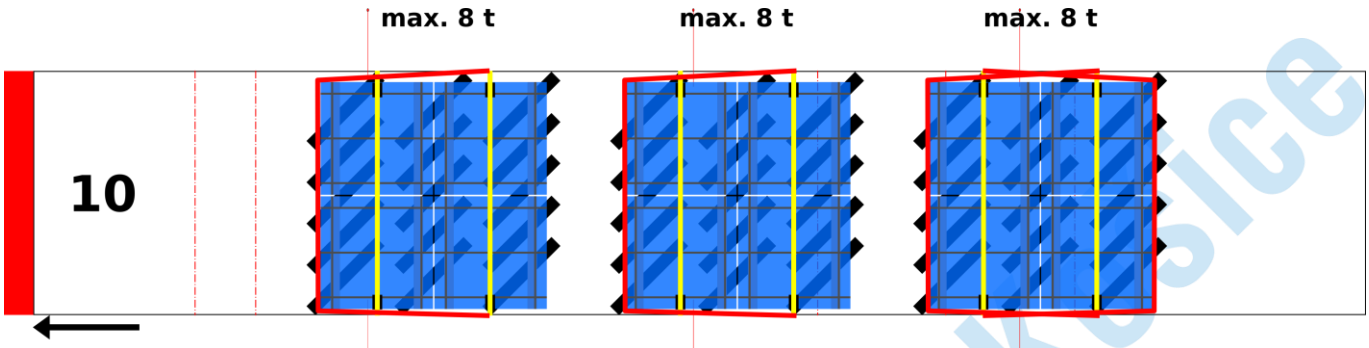


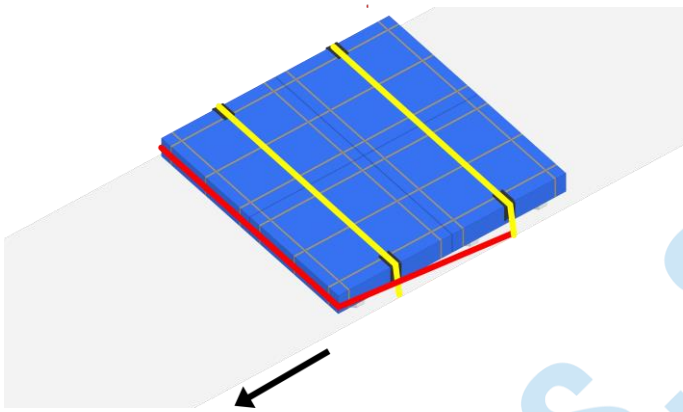
LC = min. 2000 daN
STF = min. 500 daN

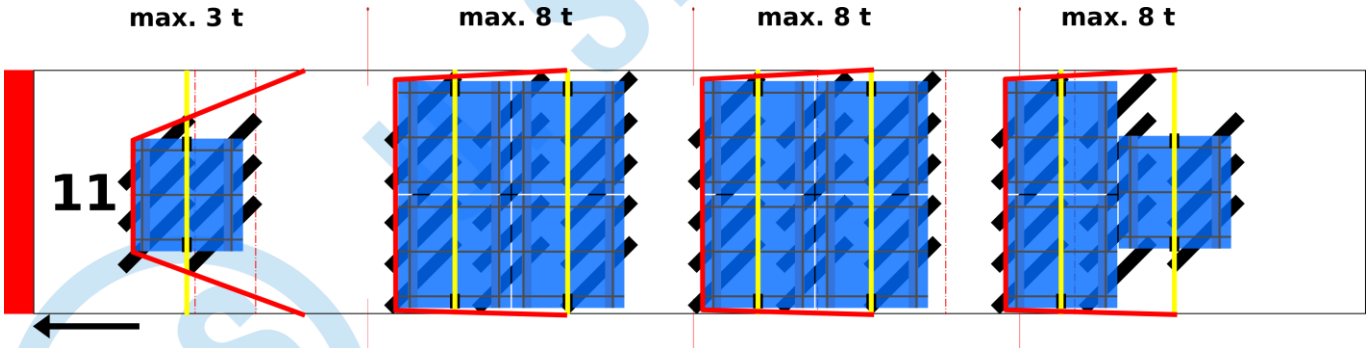
min. 8 mm

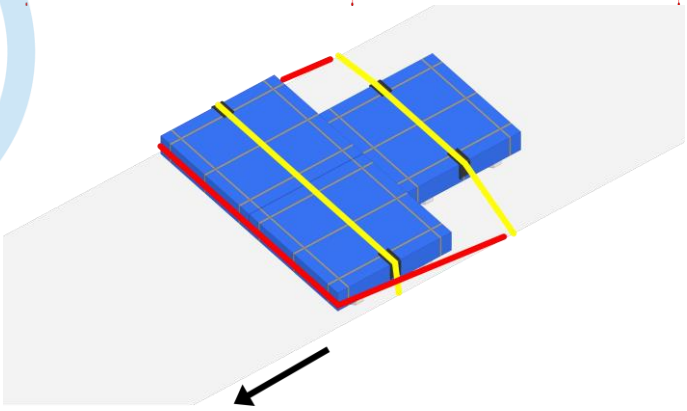




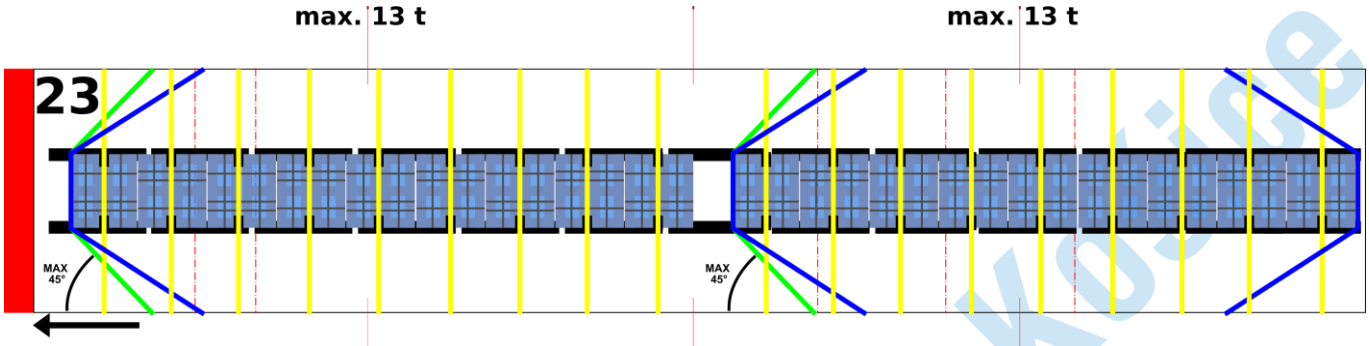


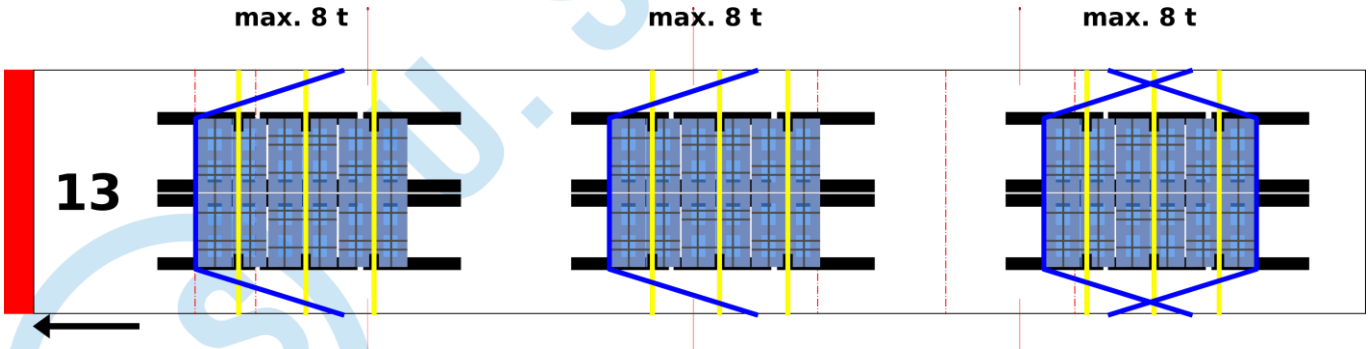




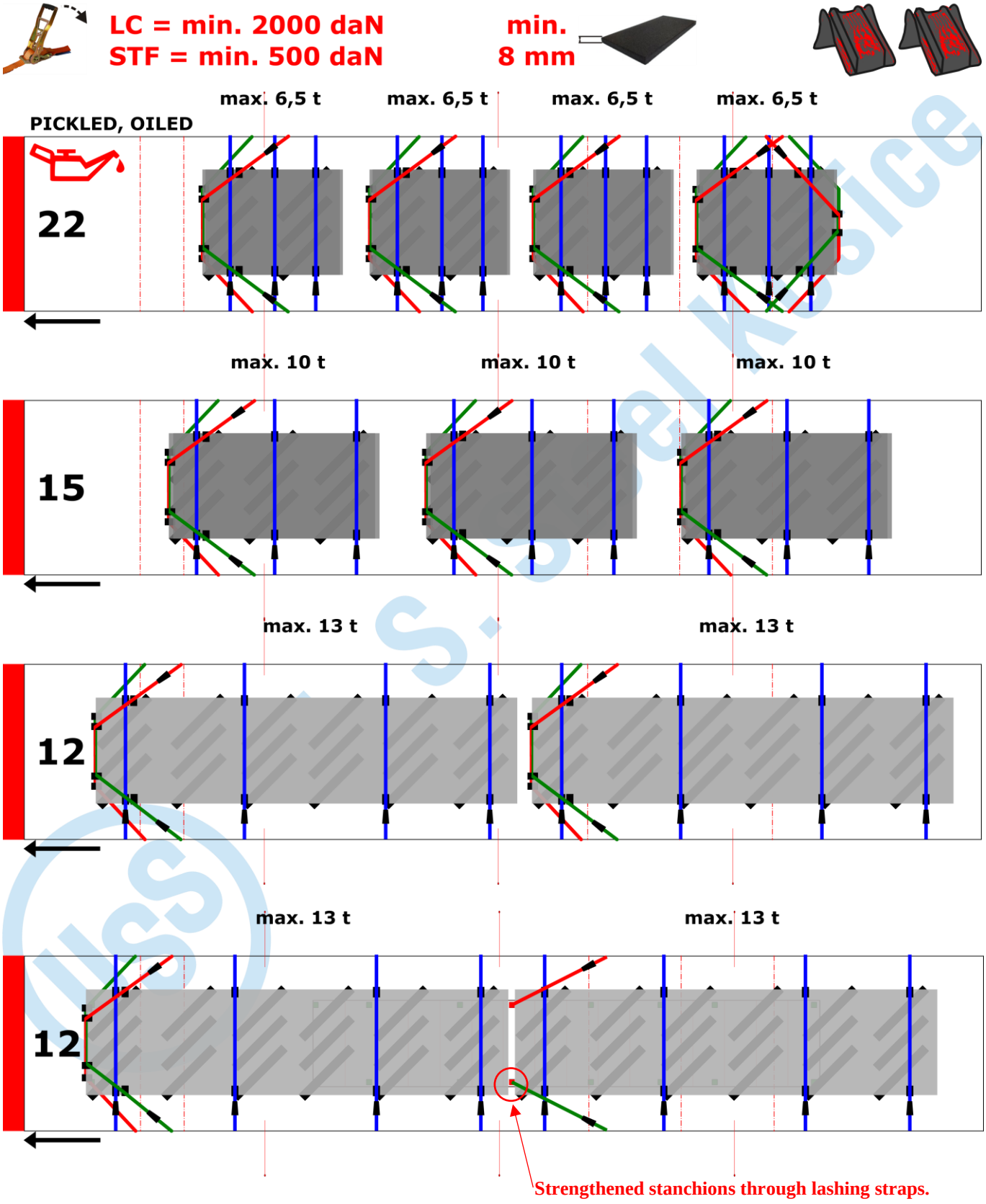


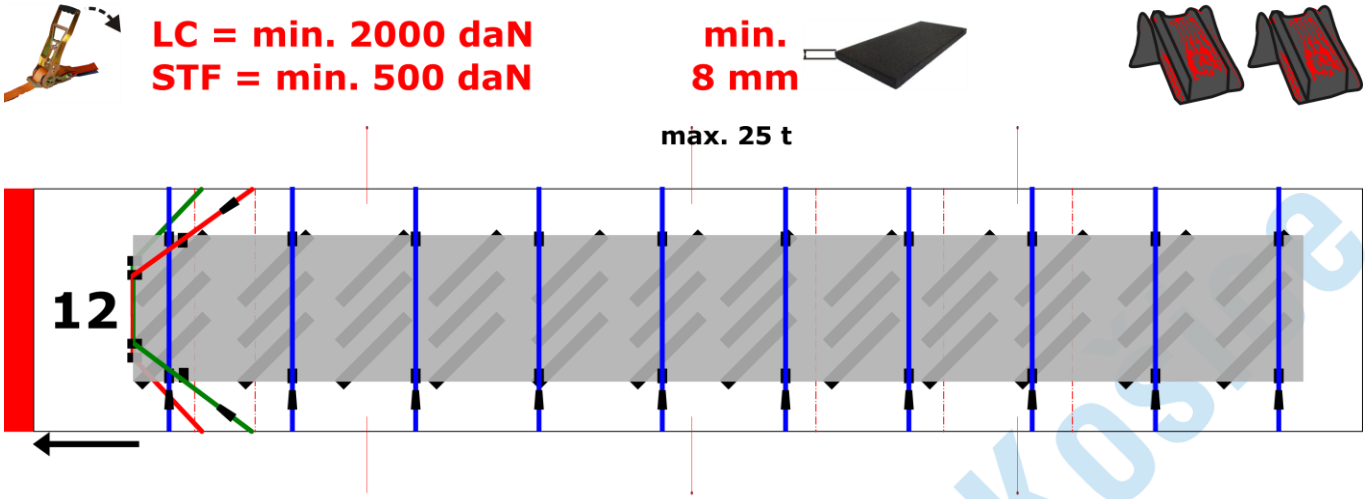
2.2.2 SECURING EXAMPLES OF COLD-ROLLED SHEETS IN SMALL BUNDLES IN CO-OPERATING COMPANIES



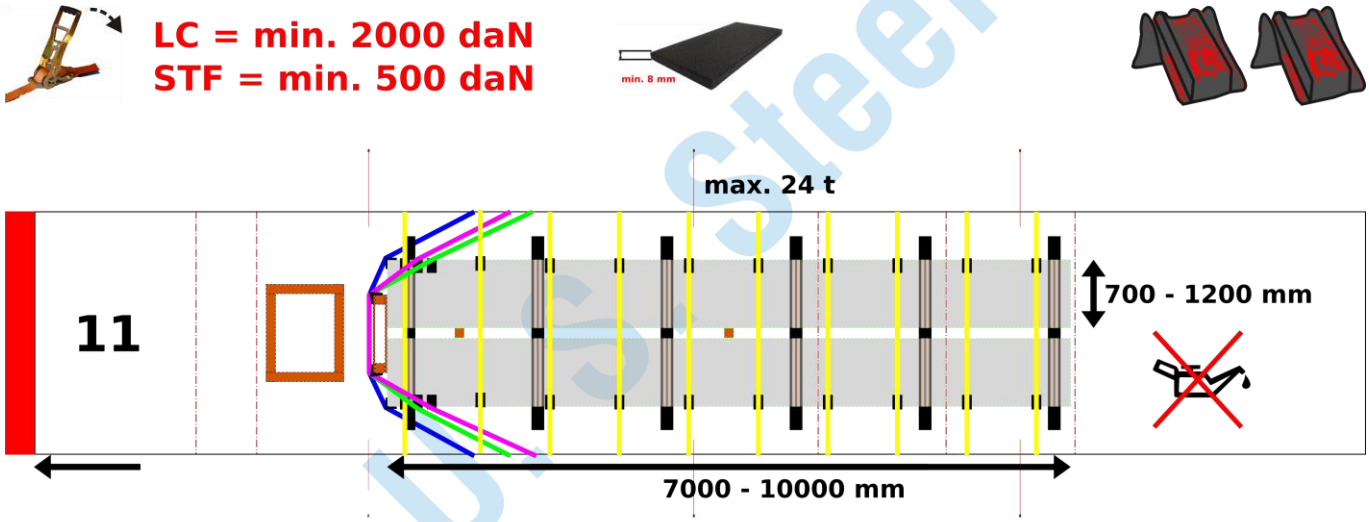


2.2.3 SECURING EXAMPLES OF HOT/COLD-ROLLED SHEETS IN BUNDLES IN DZ TVA, DZ SVA, DZ ZU A OV





2.2.4 SECURING EXAMPLES OF HOT/COLD-ROLLED SHEETS IN BUNDLES IN CO-OPERATING COMPANIES



3 TIN PLATES ON WOODEN OR STEEL PALLETS WINDING AXIS VERTICAL UP TO 12 TONNES

3.1 LOADING

Place coils on a loading platform in a way to achieve correct load/axle load distribution. Always use anti-slip mats with minimum thickness of 8 mm under the pallets.

WRONG SECURING OF COIL, COIL NOT SECURED FORWARDS/ REARWARDS AT ALL AND NOT PROPERLY SECURED SIDEWAYS!

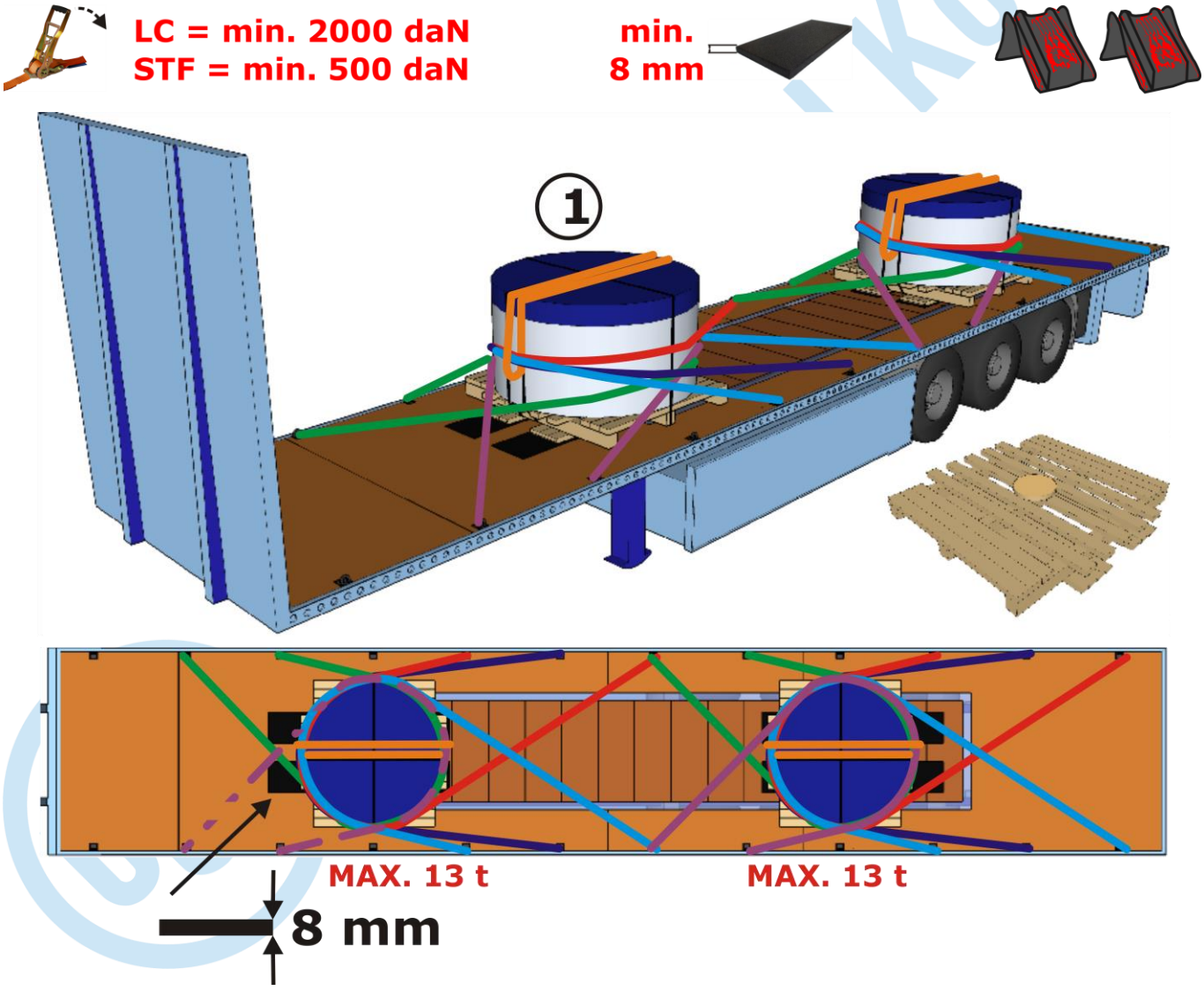
STEEL PALLETS

Always use anti-slip mats with a minimum thickness of 8 mm under the steel / wood pallets!

COIL SHIFT DURING BRAKEING, NOT PROPERLY SECURED!

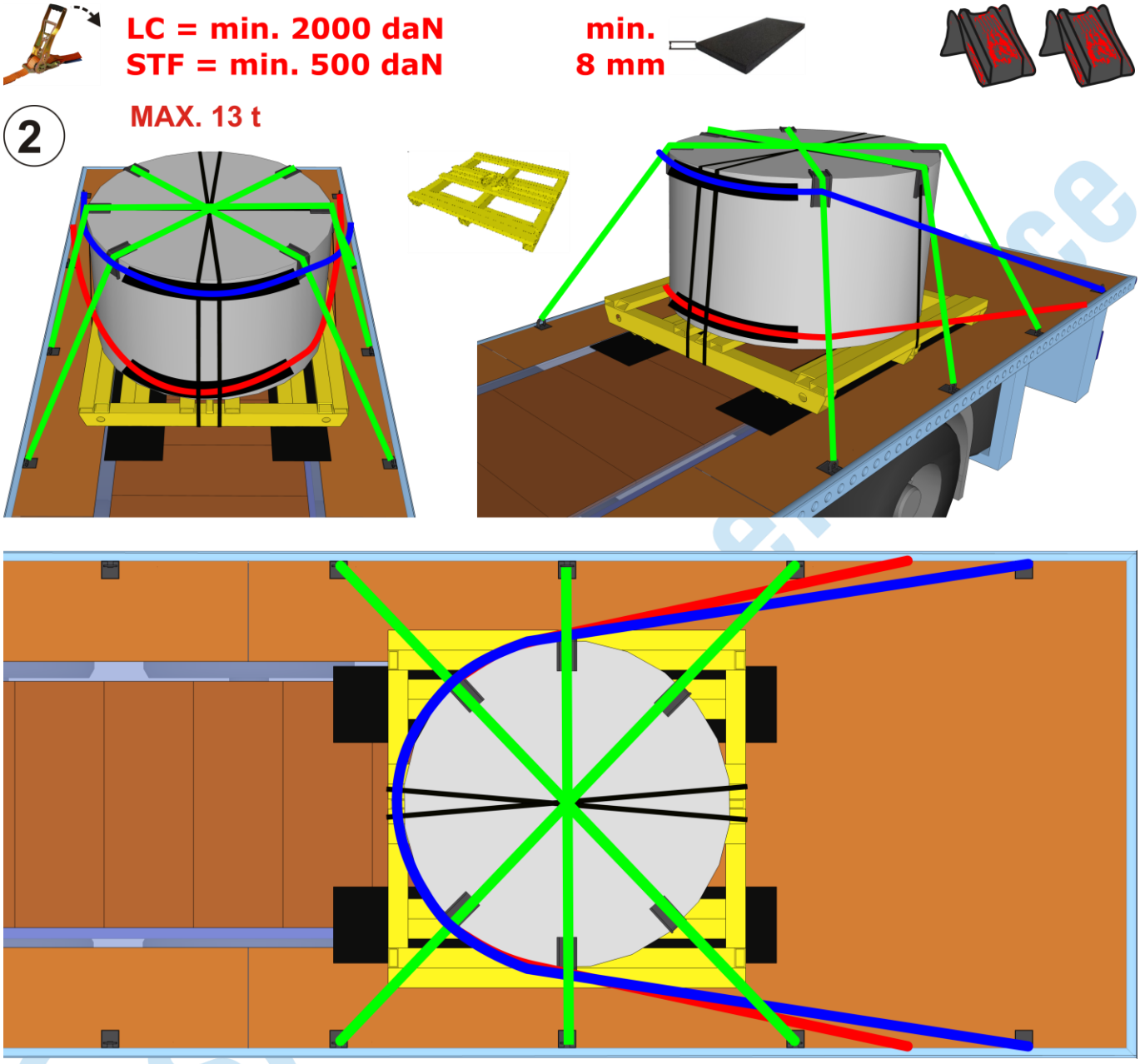
COIL FALLEN OUT FROM SEMI-TRAILER, NOT PROPERLY SECURED!

3.2 CARGO SECURING EXAMPLES OF COLD-ROLLED TIN PLATES ON PALLETS IN DZ ZU A OV



Lashing angles α = max. 35°, βx for lashings forwards = max. 40°, βx,y for lashing rearwards/sideways = max. 60°

1. Cargo securing of unblocked coil up to 13 tonnes placed on rubber anti-slip mats by 3 round spring lashings SL2 against forward movement (red, ligh blue and dark blue strap), 2 round spring lashings SL2 against rearward movement (green and pink strap) and 1 holding strap to hold securing straps (orange strap). The combination of lashings forwards/rearwards also secure a cargo sideways.



2. Cargo securing of unblocked coil up to 13 tonnes placed on rubber anti-slip mats by 2 spring lashings SL2 against forward movement and 3 crossed top-over lashings sideways/rearwards. Blue strap leads over one green strap against falling down.

4 COILS AND COIL-STRIPS ON WOODEN/PLASTIC BATTENS WINDING AXIS VERTICAL (EYE-TO-THE-SKY)

4.1 LOADING

Loading in one row with gaps between units or create groups from more units. Smaller coils than half of the platform width can be stowed next to each other.

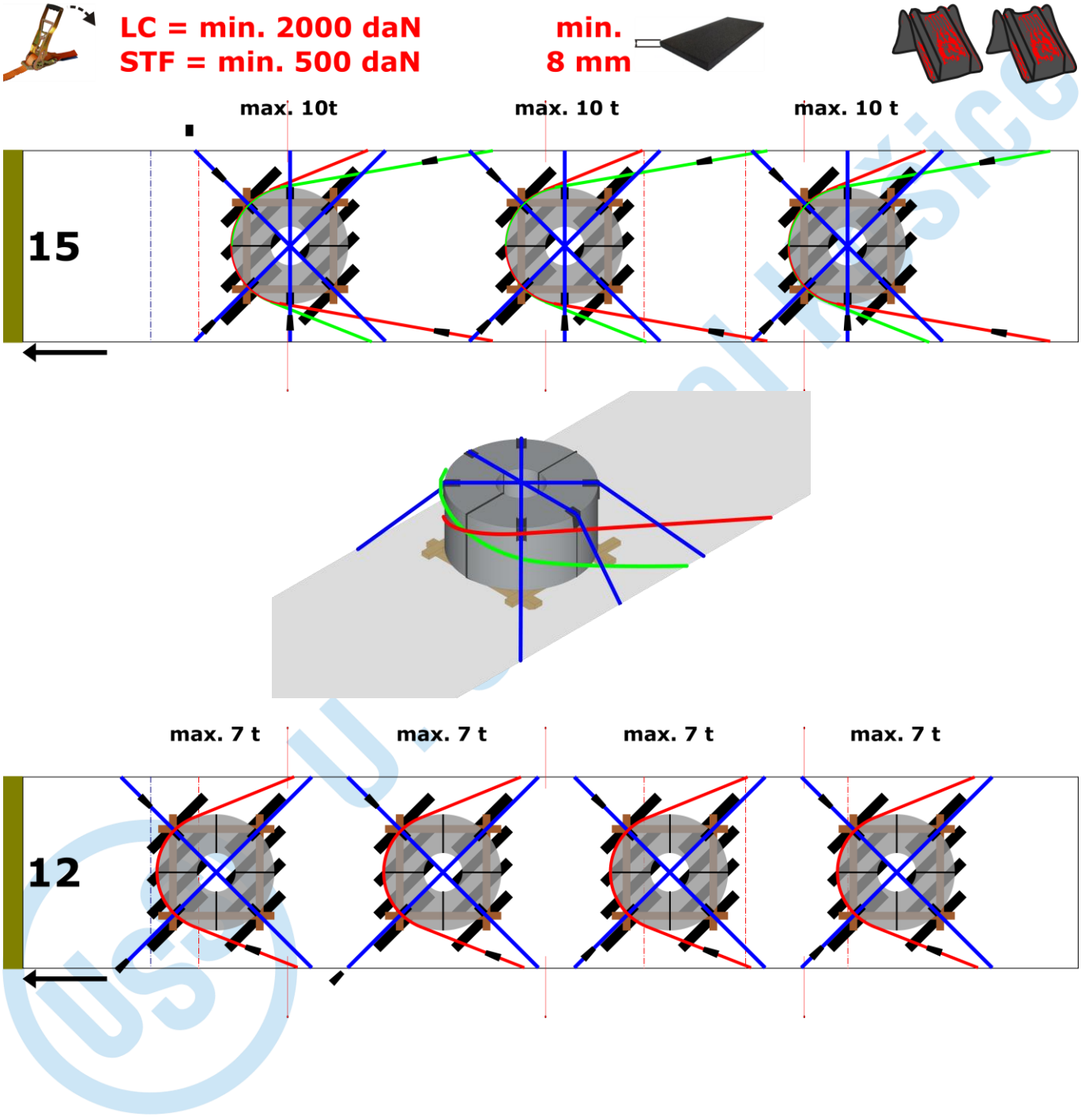
4.2 CARGO SECURING

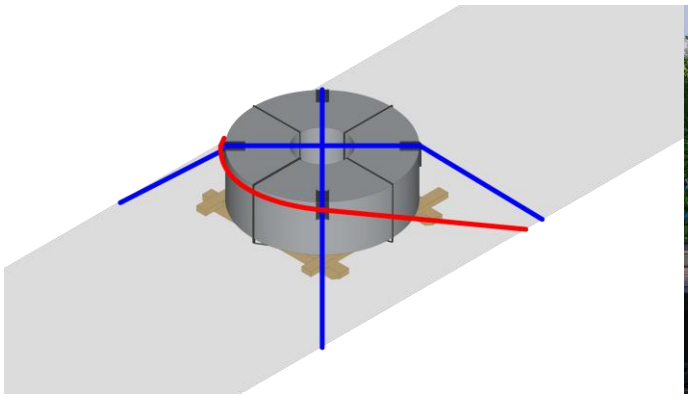
All coils/coil-strips are placed on wooden or plastic battens winding axis vertical. All coils/coil-strips need to be secured using spring lashing against forward movement. Top over lashing is not securing against forward movement of cargo!

Lighter coils can be grouped together without gaps secured sideways/rearwards by top-over lashing but forwards always by spring lashings if coil group is not blocked by headboard, stanchions, pallets. If load is not placed against headboard use always blocking or spring lashing.

For securing sideways or rearwards a top-over lashing or crossed top-over lashing can be used. Unstable coils on wooden or plastic battens must be secured against tilting by spring/top-over lashing or blocking.

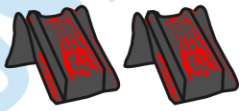
4.3 SECURING EXAMPLES OF COILS WITH WINDING AXIS VERTICAL ON WOODEN BATTENS UP TO 10 TONNES AND PLASTIC BATTENS UP TO 7 TONNES

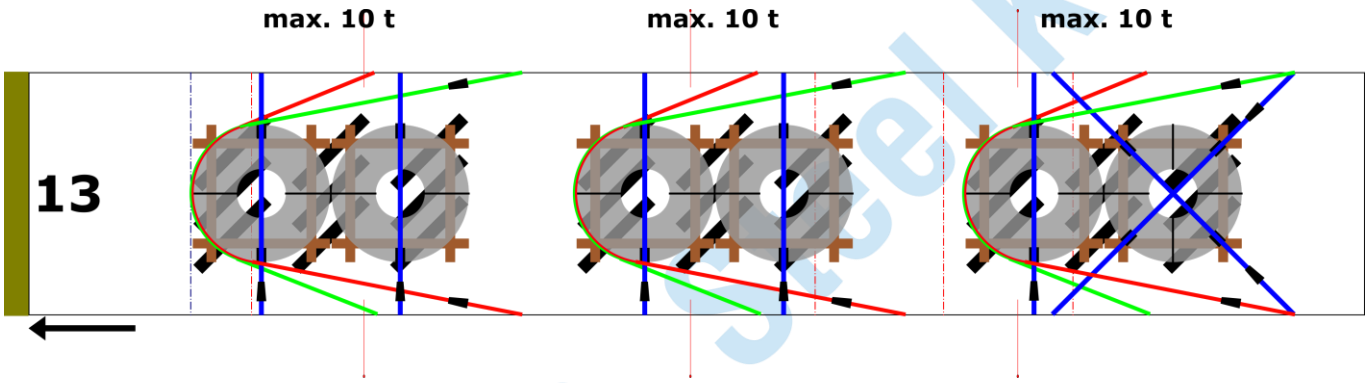


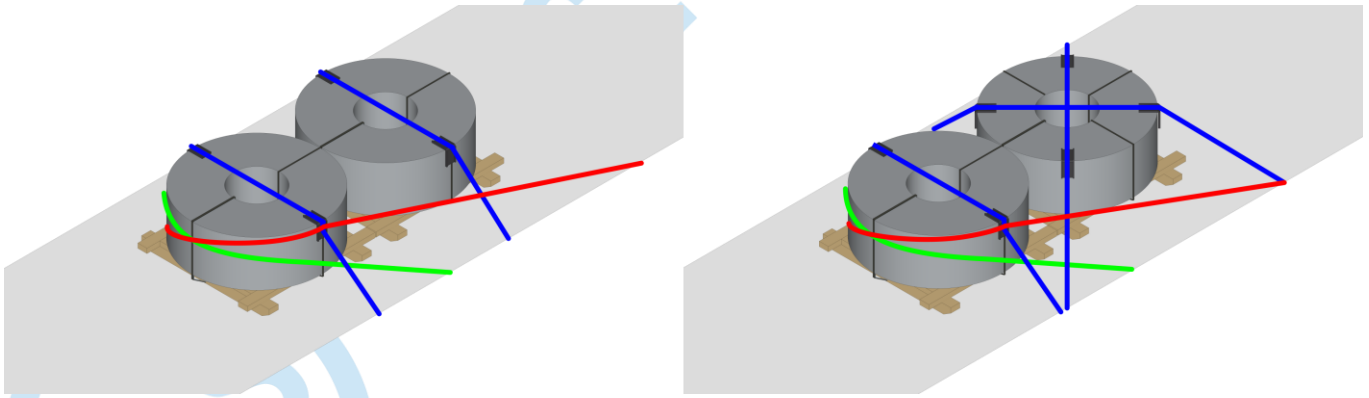


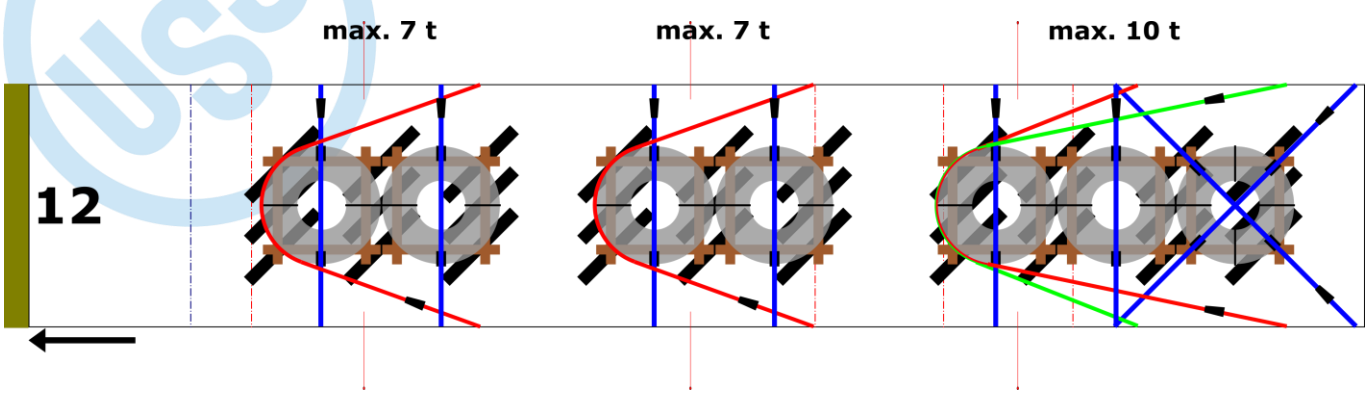
LC = min. 2000 daN
STF = min. 500 daN

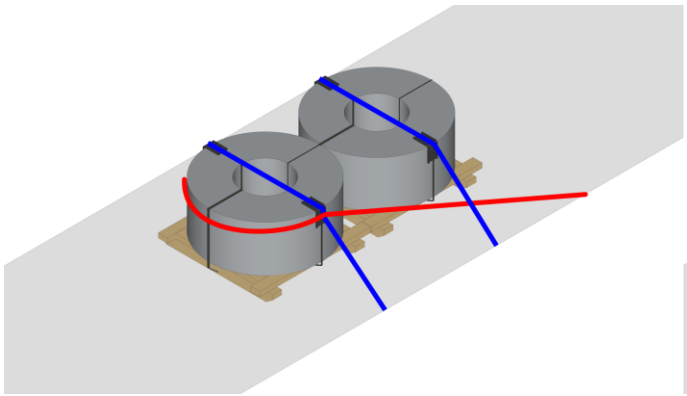
min. 8 mm

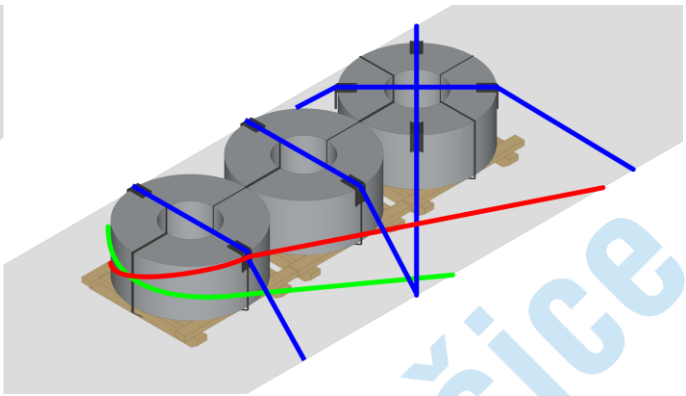






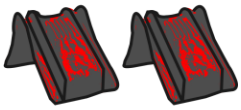


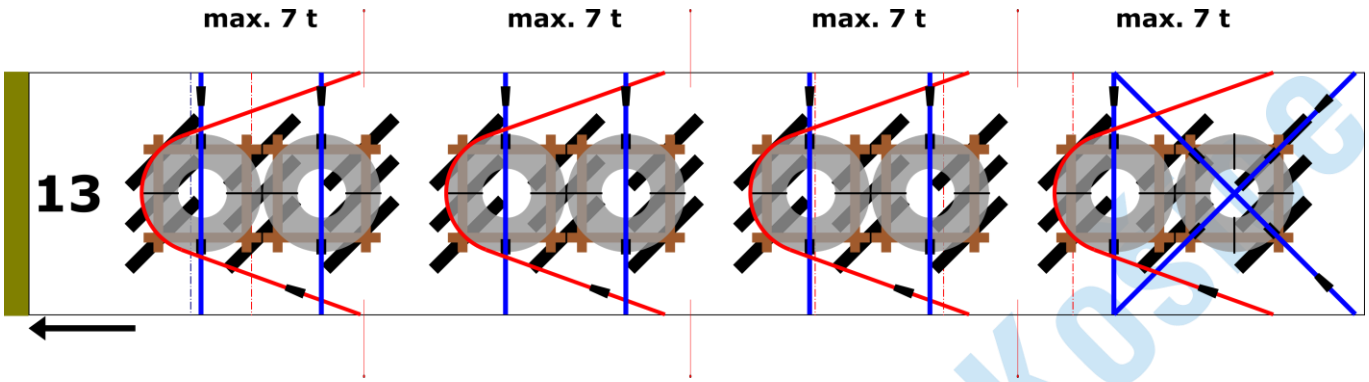


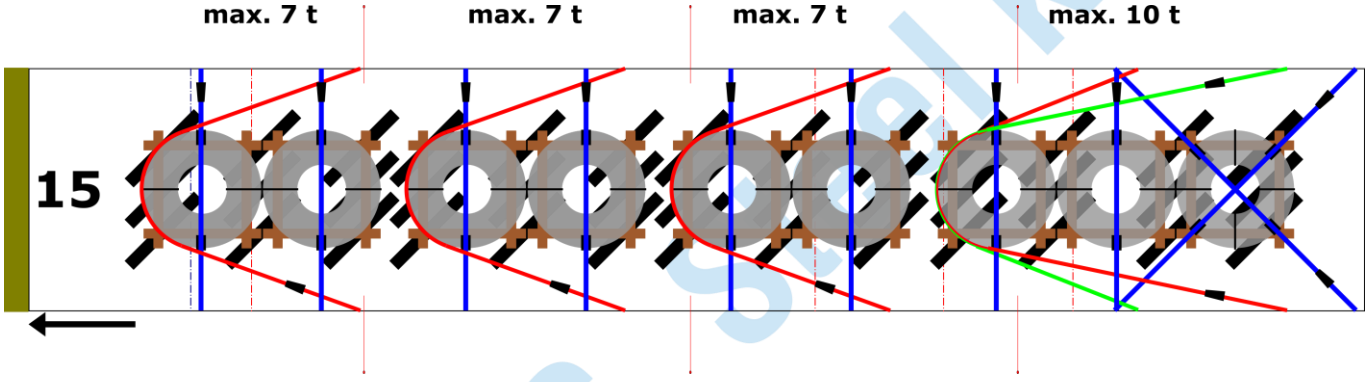


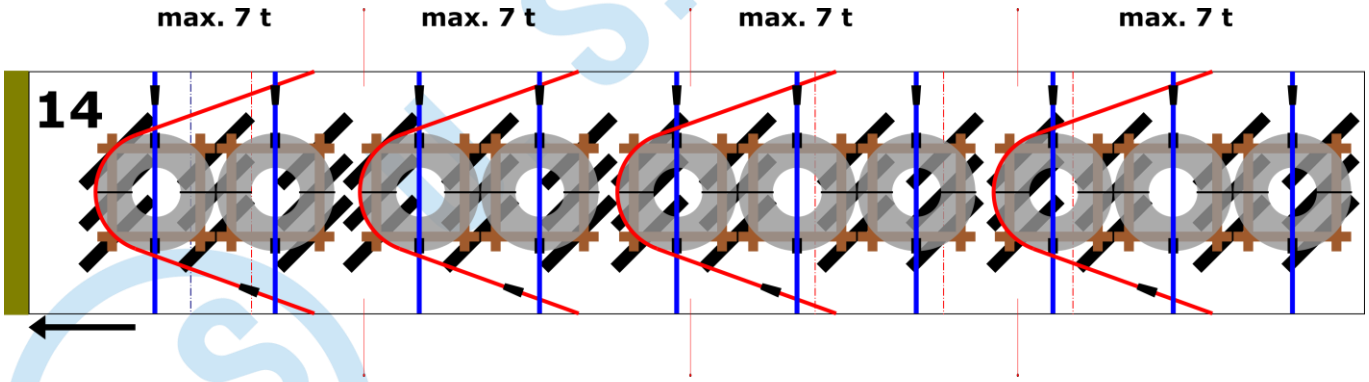
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm



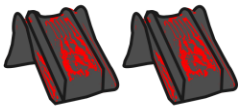


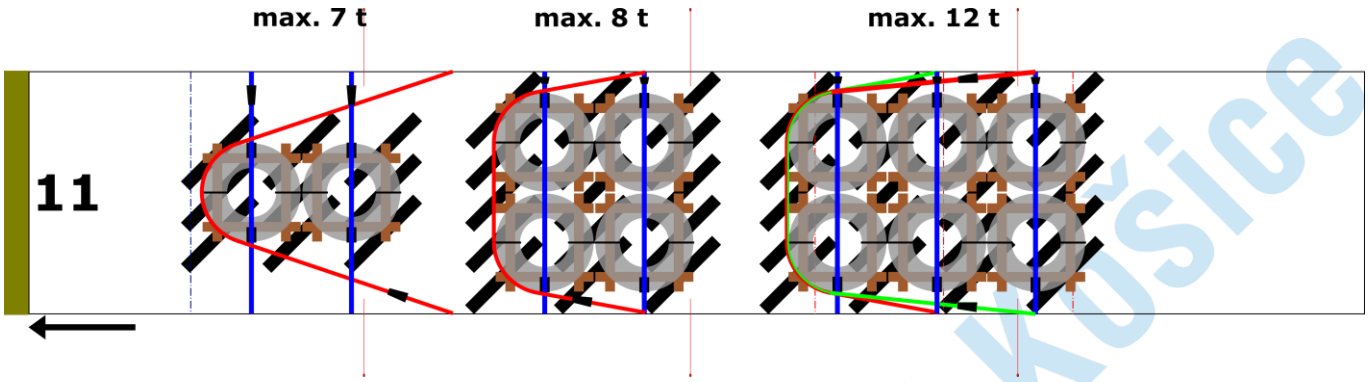


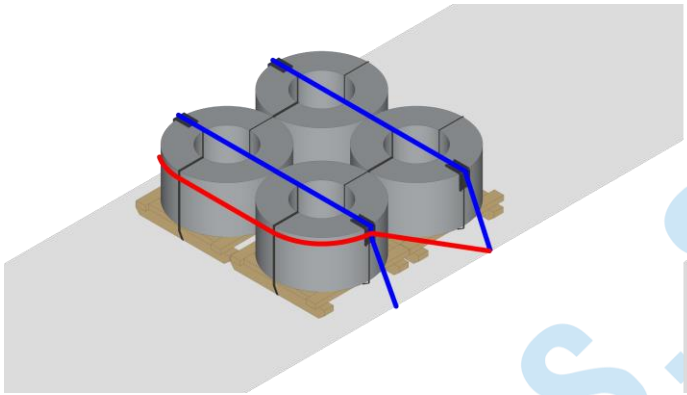


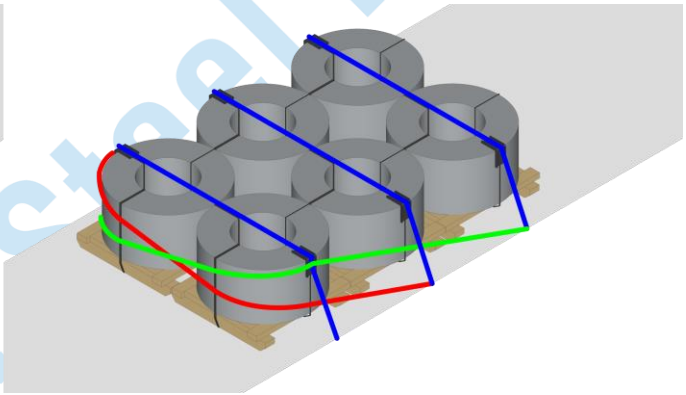
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm









4.4 UNSTABLE COILS

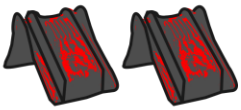
!!!WARNING!!!

Unstable coils must be secured against sliding and tilting by additional top-over lashing! For valid quantity of additional top-over lashings straps ask loading staff!

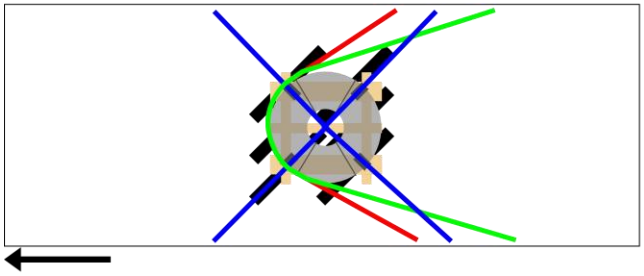
4.4.1 UNSTABLE COILS WITH WINDING AXIS VERTICAL ON WOODEN BATTENS UP TO 10 TONNES AND PLASTIC BATTENS UP TO 7 TONNES

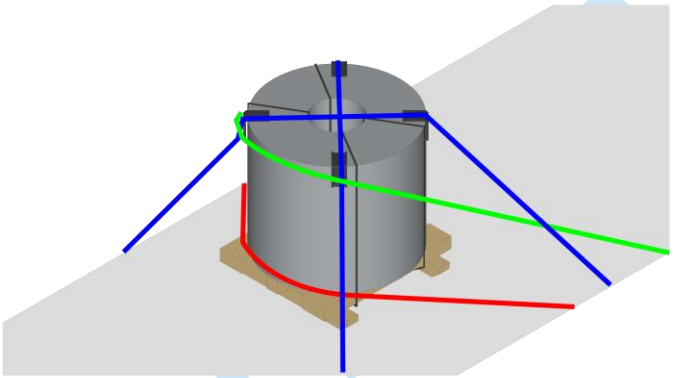
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm

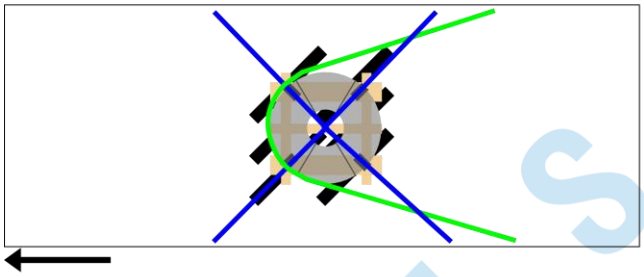


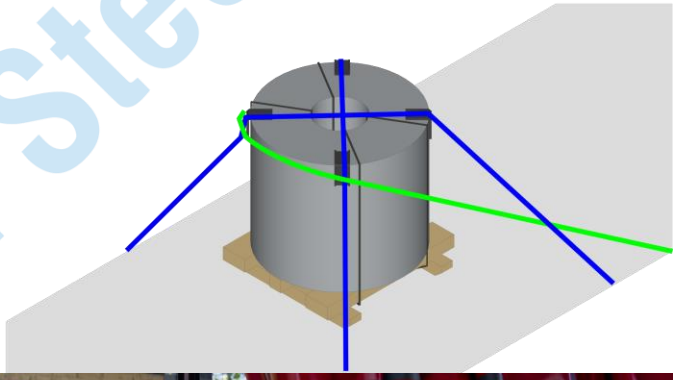
max. 7 t





max. 4.5 t





5 COILS AND COIL-STRIPS ON WOODEN SLEDGES WITH WINDING AXIS PARALEL TO LONGITUDINAL VEHICLE AXIS UP TO 10 TONNES OR LOADED WINDING AXIS TRANSVERSE TO LONGITUDINAL VEHICLE AXIS UP TO 10 TONNES

5.1 LOADING

Coils to be loaded in the vehicle with respect to the axle loads. Always use rubber anti-slip mats between coils and the vehicle floor. Create groups if possible. If it is not possible secure each unit separately. Coils on short sledges can be unstable. If it is possible never load with rolling direction in driving direction!

5.2 CARGO SECURING

Securing of coils on wooden sledges depends on stowage of coils on loading platform. Spring lashing through the coil eye is suitable for securing of coils.

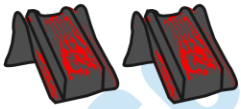
NOT PROPERLY SECURED COILS (8363 KG FRONT ONE AND 5328 KG REAR ONE) BY ONLY TOP-OVER LASHINGS, NOT PROPERLY SECURED FORWARDS. BETWEEN COILS AND LOADING PLATFORM IS NOT USED RUBBER ANTI-SLIP MATS!

5.3 SECURING EXAMPLES OF COILS IN WOODEN SLEDGES WINDING AXIS PARALEL TO LONGITUDINAL VEHICLE AXIS UP TO 10 TONNES

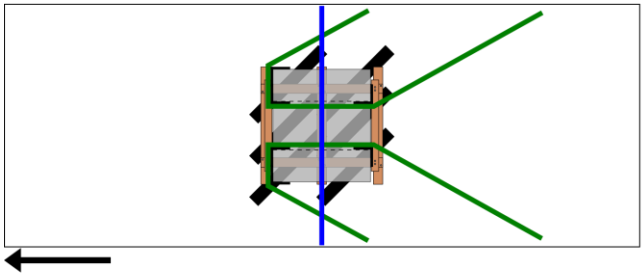
5.3.1 COILS IN WOODEN SLEDGES FOR ROAD TRANSPORT UP TO 6 TONNES

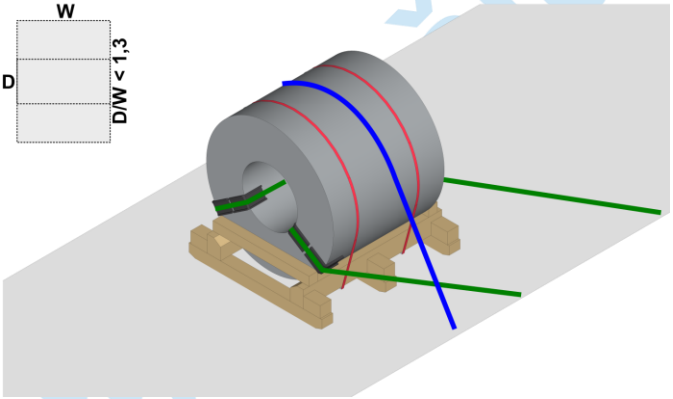
LC = min. 2000 daN
STF = min. 500 daN

min.
8 mm



max. 6 t

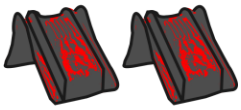




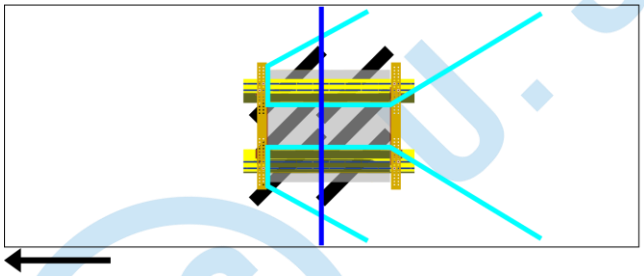
5.3.2 COILS IN STEEL PALLETS UP TO 6 TONNES

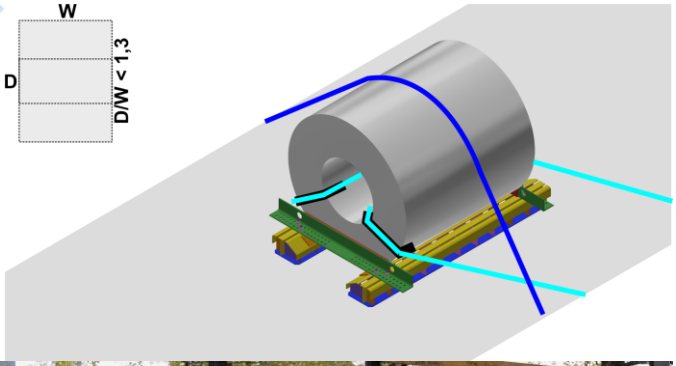
LC = min. 2000 daN
STF = min. 500 daN

min.
8 mm



max. 6 t

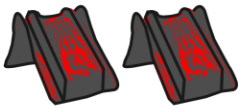




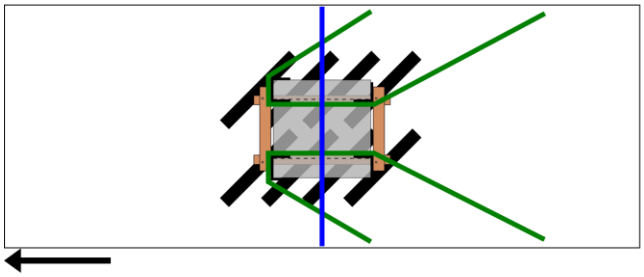
5.3.3 COILS IN RAILWAYS SLEDGES UP TO 10 TONNES

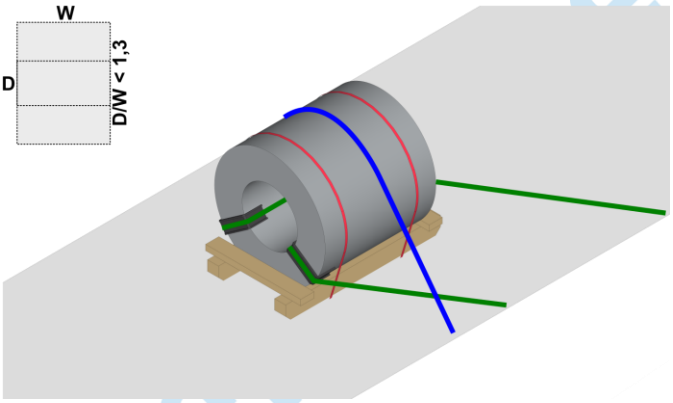
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm

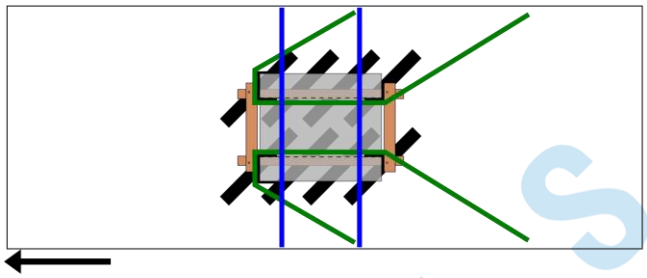


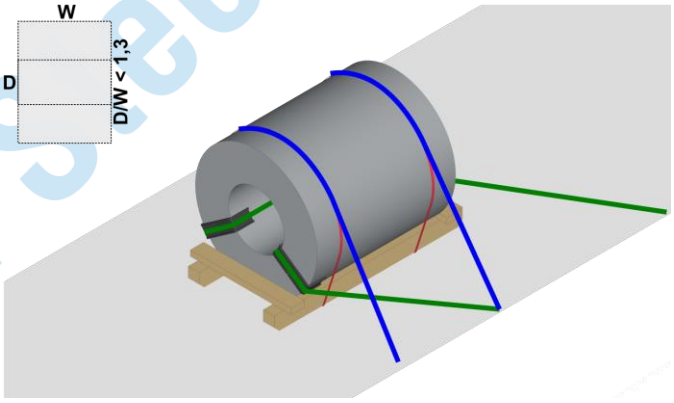
max. 6 t



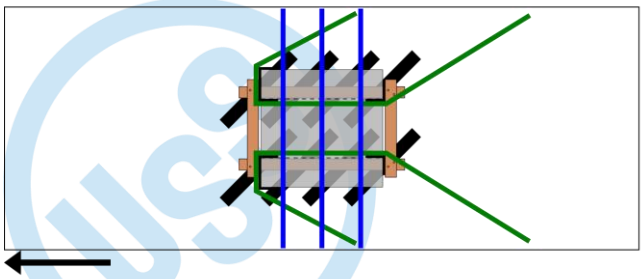


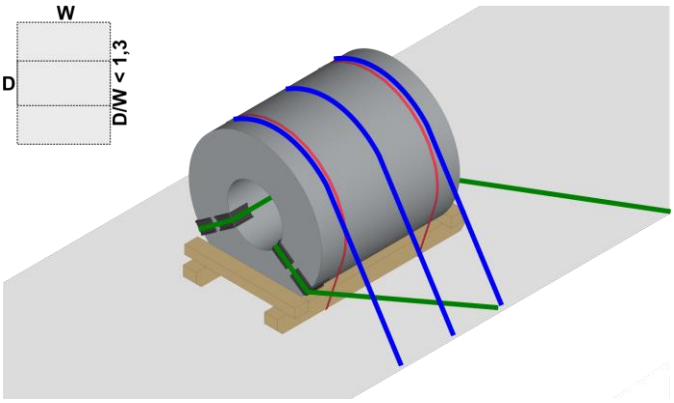
max. 8 t





max. 10 t

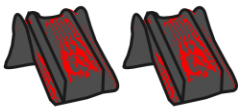




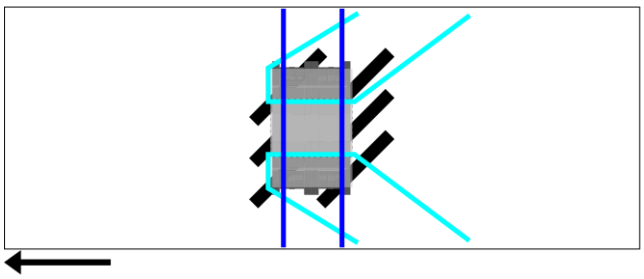
5.3.4 COILS ON PLASTIC PADS UP TO 10 TONNES

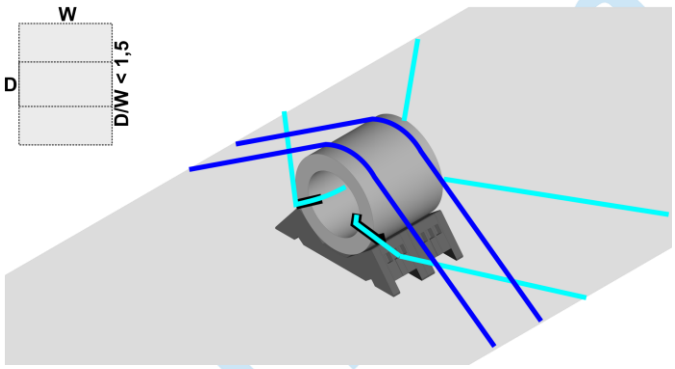
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm

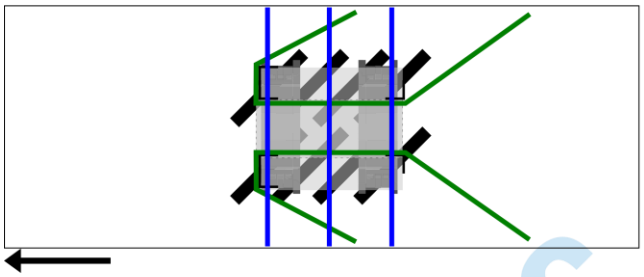


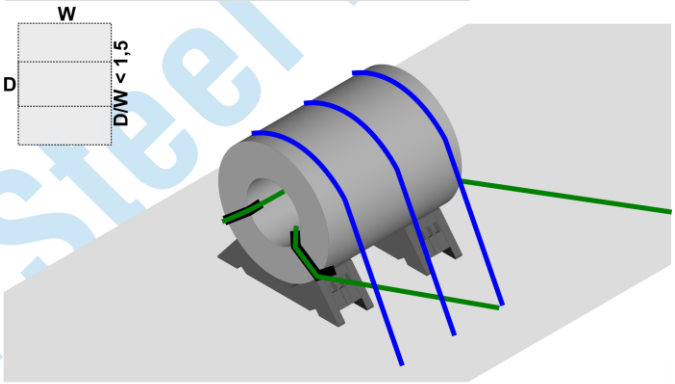
max. 6 t





max. 10 t



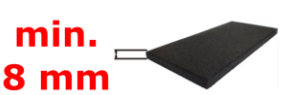


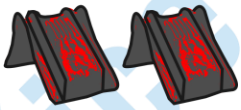
5.4 SECURING EXAMPLES OF COILS IN WOODEN SLEDGES WINDING AXIS TRANSVERSE TO LONGITUDINAL VEHICLE AXIS UP TO 10 TONNES (ROLL DIRETION OF COIL TO THE DRIVING DIRECTION)

5.4.1 COILS IN RAILWAYS SLEDGES UP TO 10 TONNES

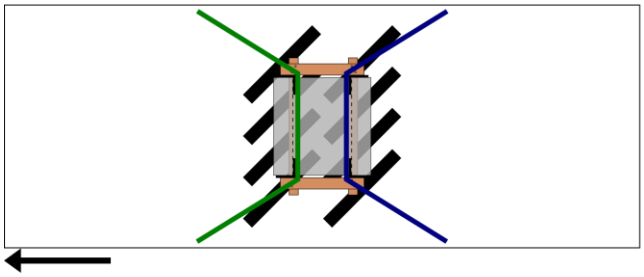
LC = min. 2000 daN
STF = min. 500 daN

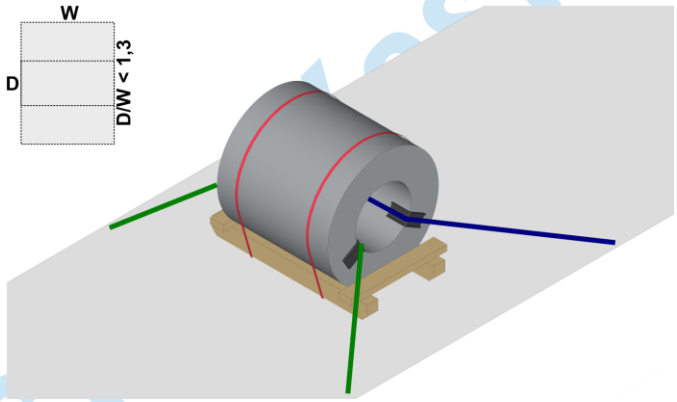
min.
8 mm



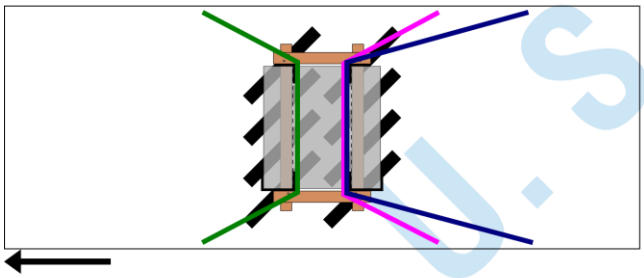


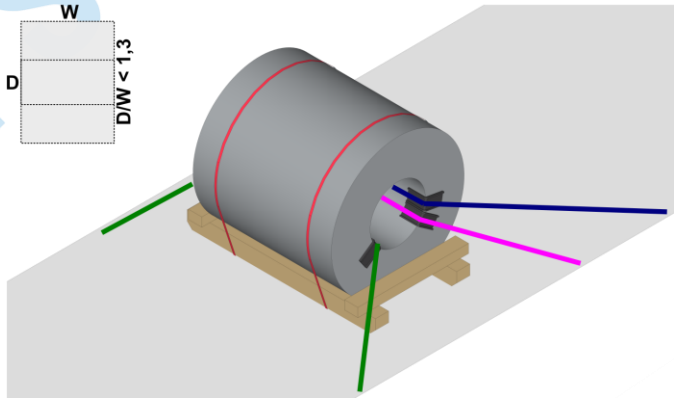
max. 6 t





max. 10 t



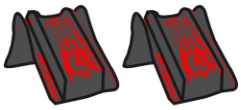


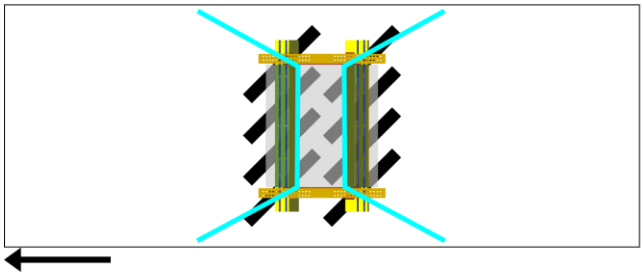
5.4.2 COILS IN STEEL PALLETS UP TO 6 TONNES

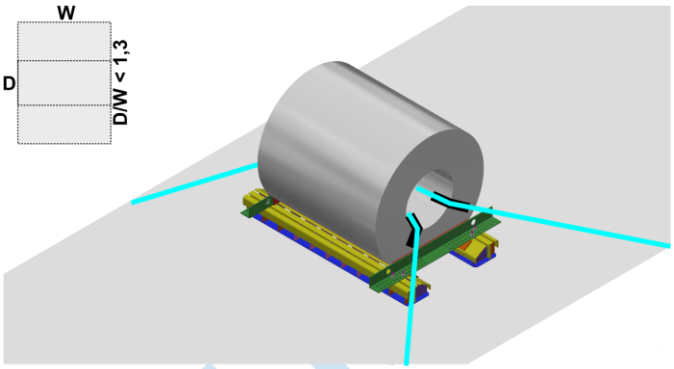
LC = min. 2000 daN
STF = min. 500 daN

max. 6 t

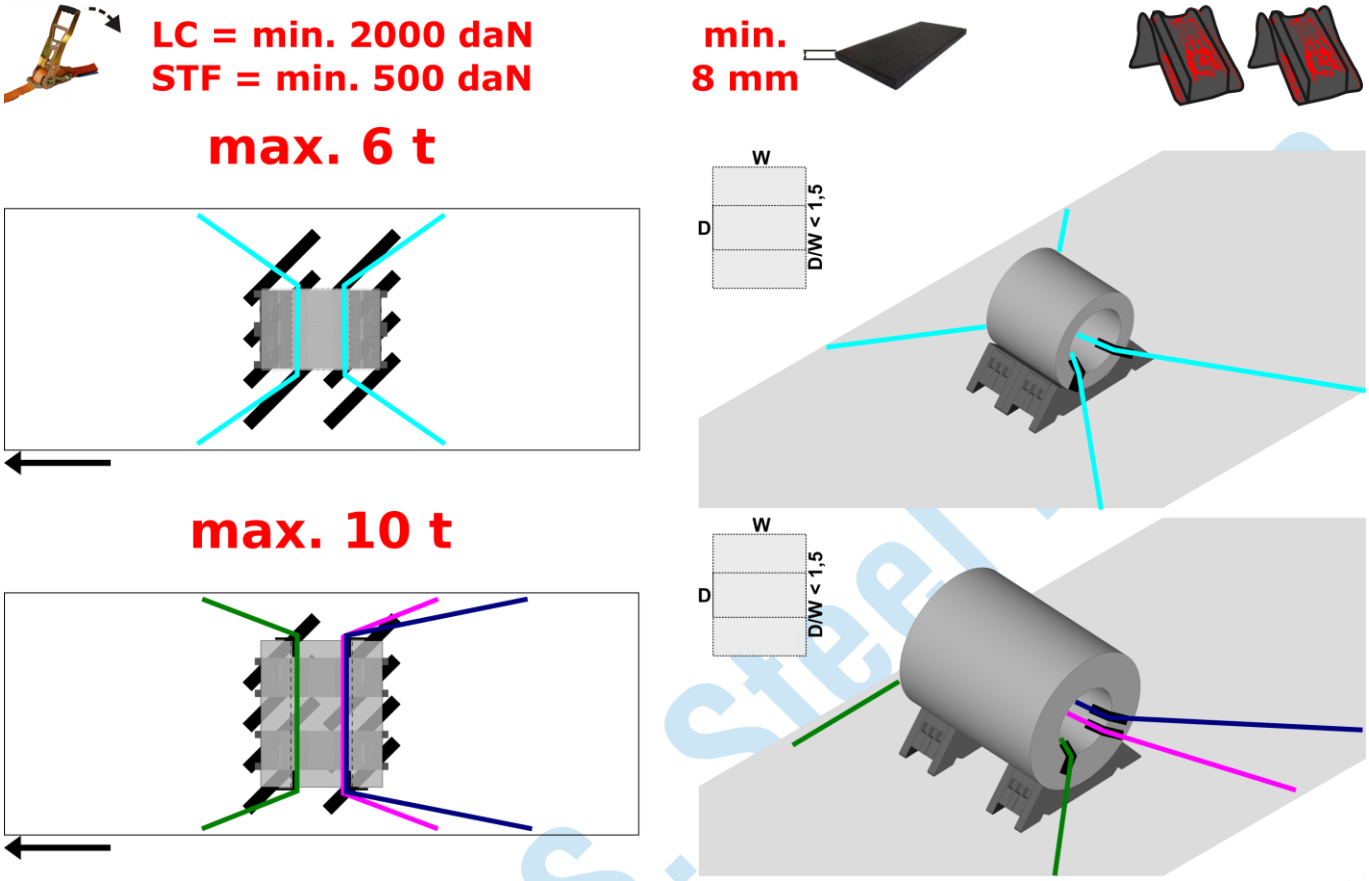
min. 8 mm







5.4.3 COILS ON PLASTIC PADS UP TO 10 TONNES



5.5 UNSTABLE COILS

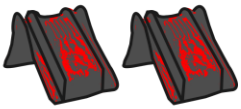
!!!WARNING!!!

Unstable coils must be secured against sliding and tilting by additional top-over lashing! For valid quantity of additional top-over lashings straps ask loading staff!

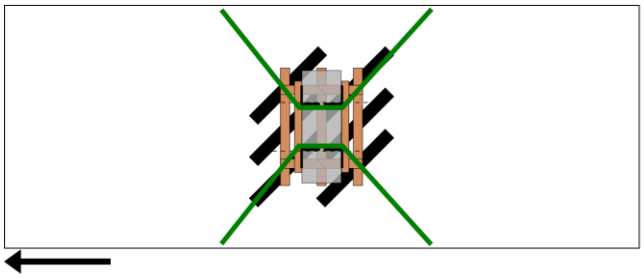
5.5.1 UNSTABLE COILS IN WOODEN SLEDGES FOR ROAD TRANSPORT UP TO 6 TONNES

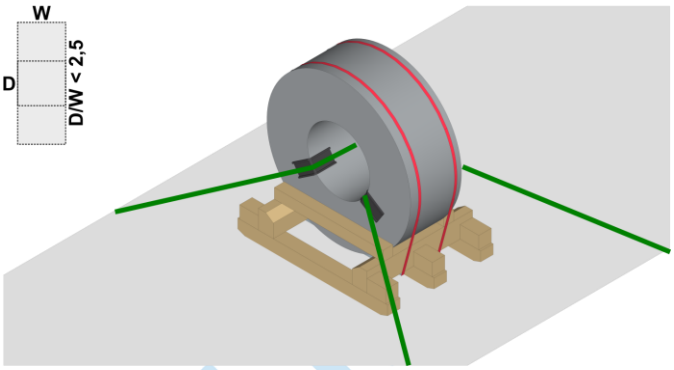
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm

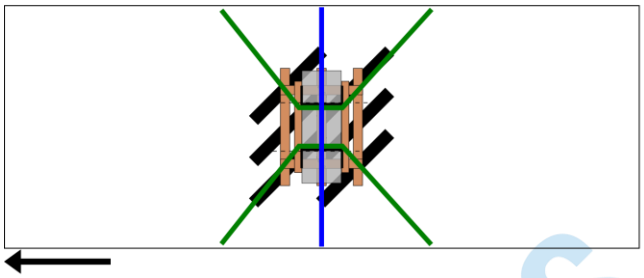


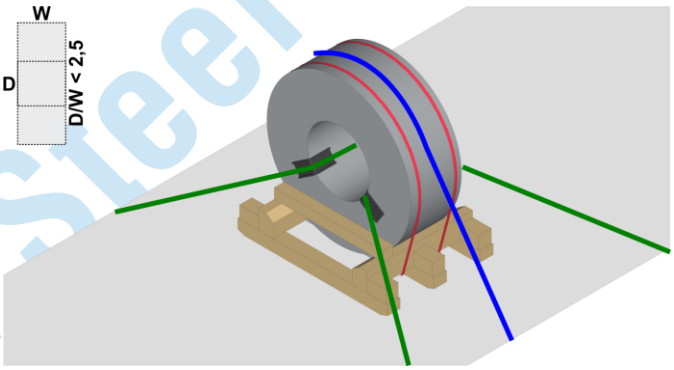
max. 3,2 t



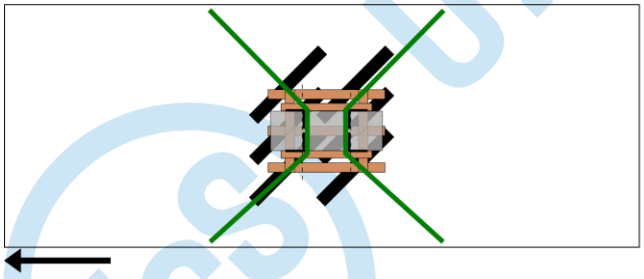


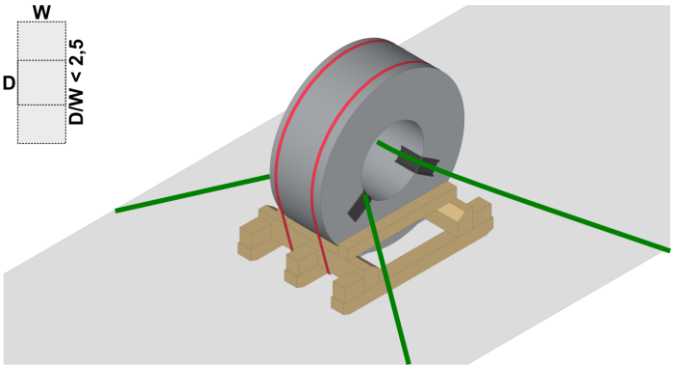
max. 4,5 t





max. 4,5 t

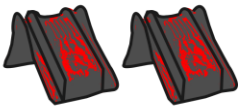




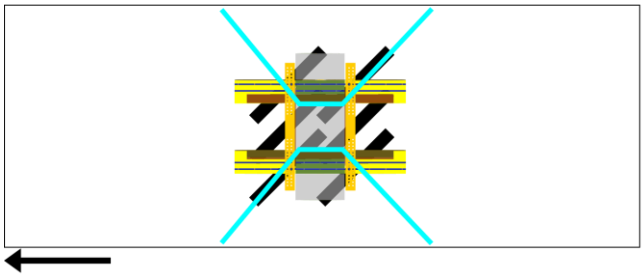
5.5.2 UNSTABLE COILS IN STEEL PALLETS UP TO 6 TONNES

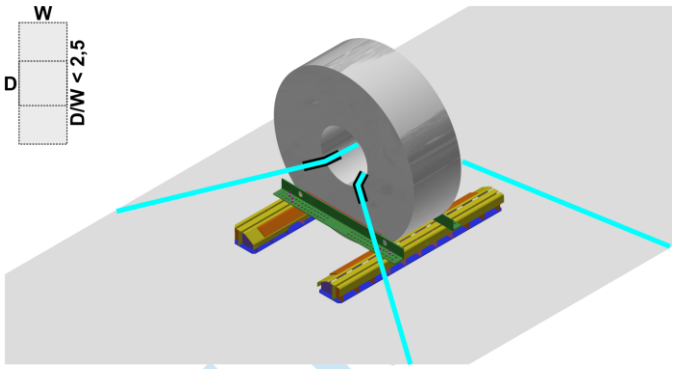
LC = min. 2000 daN
STF = min. 500 daN

min. 8 mm

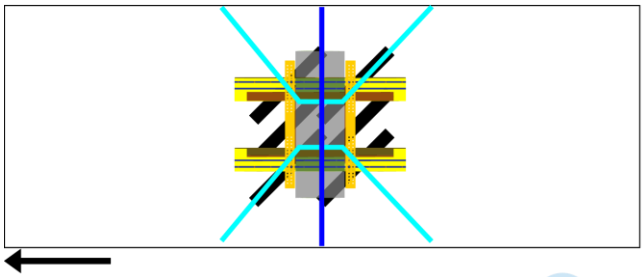


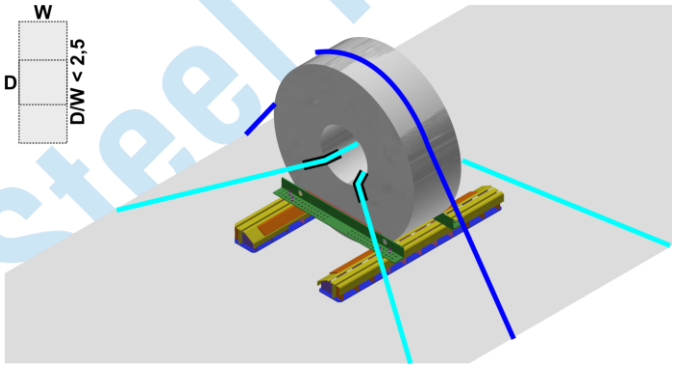
max. 3,2 t



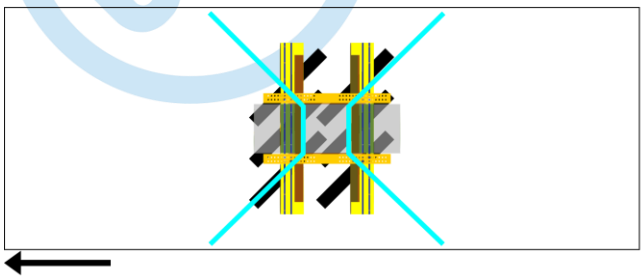


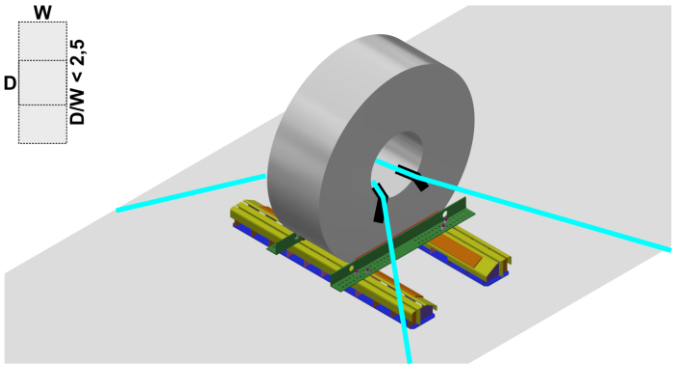
max. 4,5 t





max. 4,5 t





6 COILS LOADED IN A COIL-WELL WITH WINDING AXIS PARALEL TO LONGITUDINAL VEHICLE AXIS UP TO 20 TONNES

Maximum coil diameter in coil-well 1800 mm!

6.1 LOADING AND CARGO SECURING

Coils are loaded by a crane into a coil-well. Coil-well is fitted with stanchion pockets for stanchions to block coils in forward direction wherever possible. Coil-well covers can be used to block other coils. In case that covers are of sufficient strength no lashing is necessary forwards. We do not recommend using more than one cover between two coils because they can tilt up during coil movement and blocking is inefficient.

Always block coils with stanchions where possible!

⚠

Unstable coils always block forwards with suitable stanchions and secure against tilting rearwards!

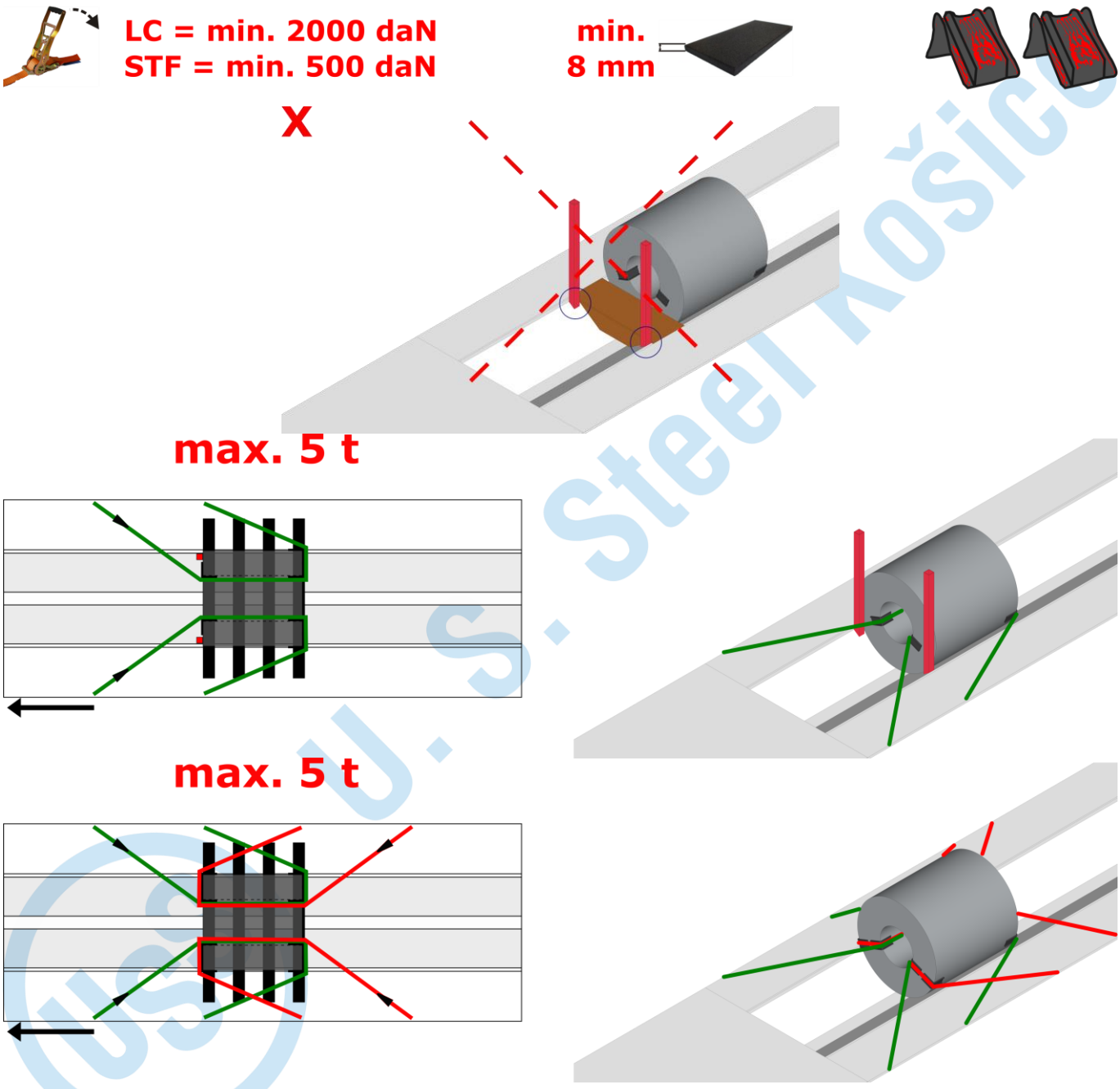
Load coils in one row and fill up the gaps with coil-well covers (maximum 1 coil-well cover can be used between coils). Coils must be placed on rubber anti-slip mats!
Stronger lashing points than 2000 daN, are recommend if fitted.

Not proper use of coil-well covers between neighbouring coils – covers can tilt up during coil movement

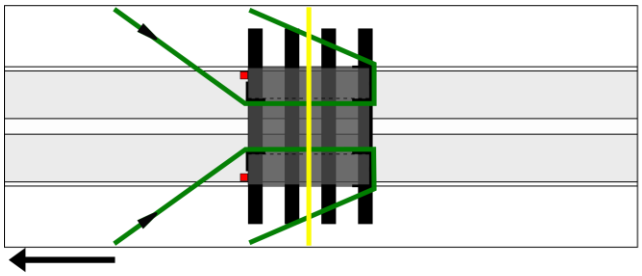
stable coil blocked by stanchions forwards and lashed by spring lashing through coil eye rearwards where straps are connected to stronger lashing points

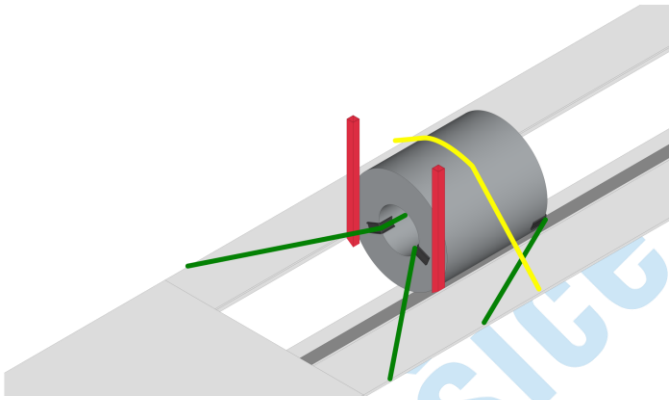
6.2 SECURING EXAMPLES OF COILS IN A COIL-WELL UP TO 10 TONNES

Applicable for coils where diameter/width < 1,52.

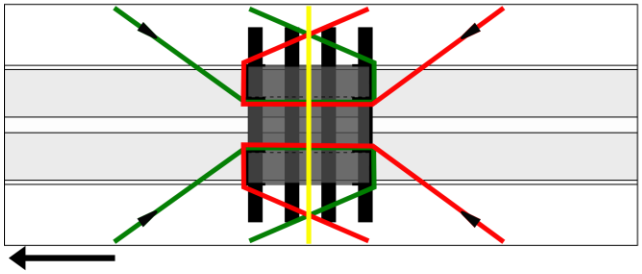


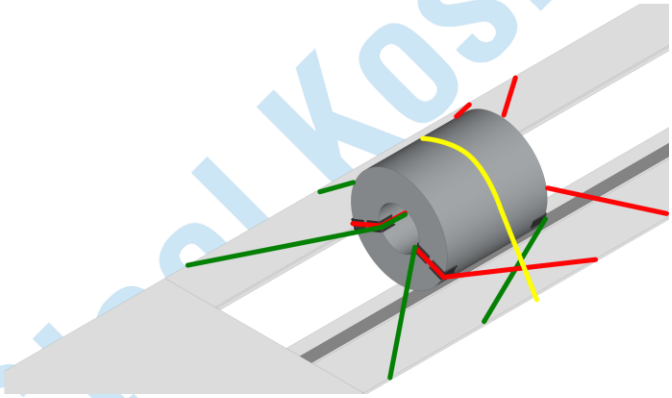
max. 10 t



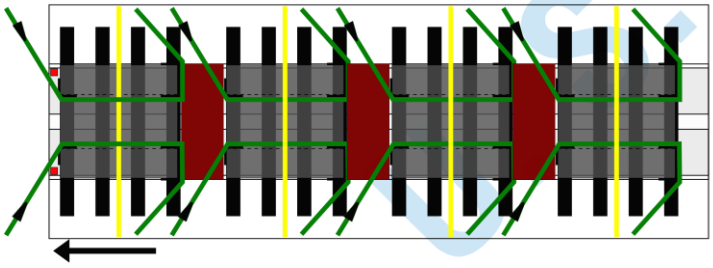


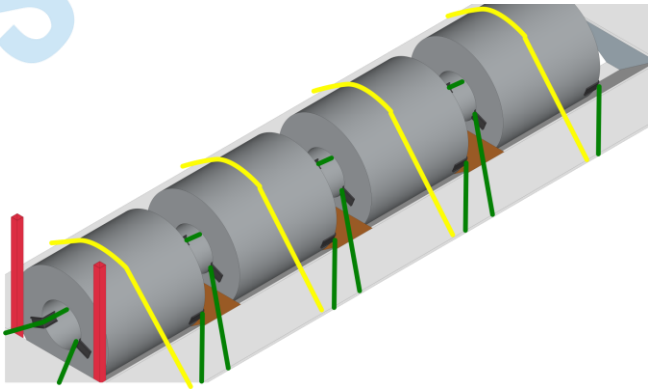
max. 10 t



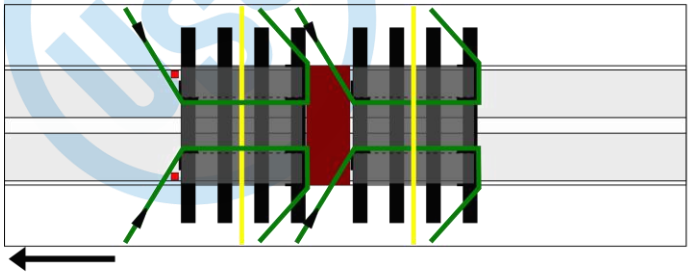


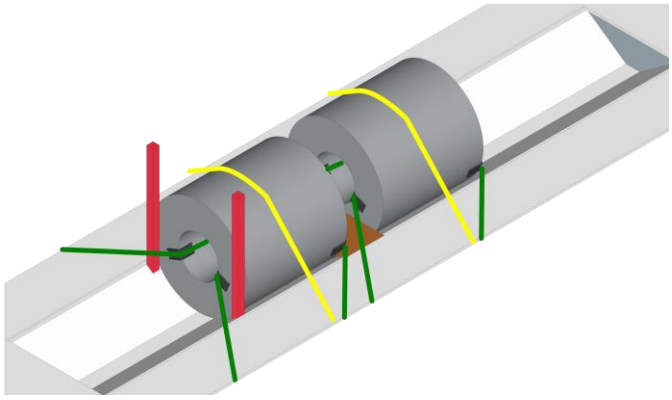
max. 4 x 6 t





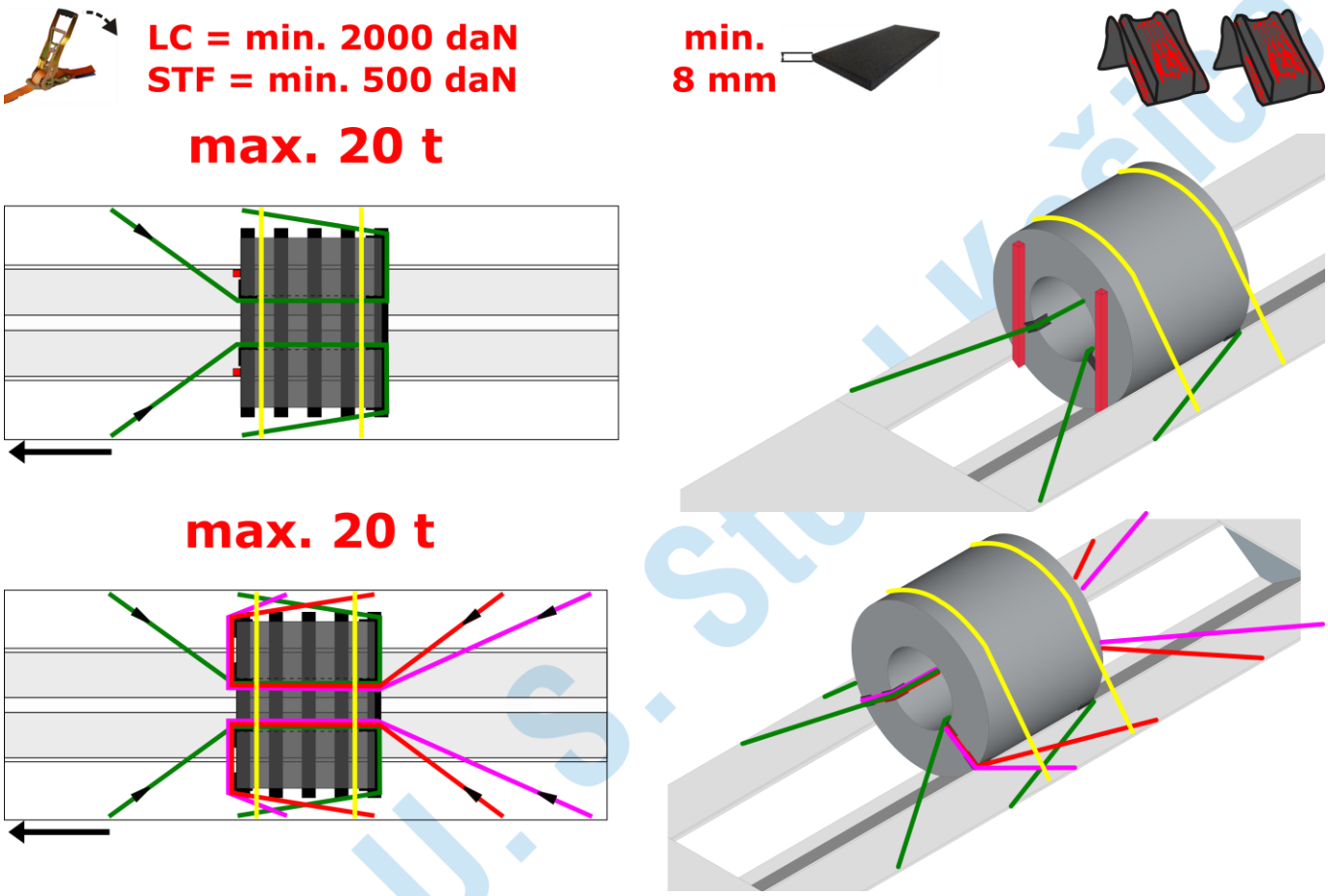
max. 2 x 10 t





6.3 SECURING EXAMPLES OF COILS IN A COIL-WELL WITH MASS 10 - 20 TONNES

Applicable for coils where diameter/width < 1,52.



6.4 SECURING OF UNSTABLE COILS BLOCKED BY STANCHIONS FORWARDS AGAINST TILTING REARWARDS

!!!WARNING!!!

Unstable coils must be secured against sliding and tilting by additional top-over lashing! For valid quantity of additional top-over lashings straps ask loading staff!

6.4.1 UNSTABLE NARROW COILS IN COIL-WELL UP TO 24 TONNES

The fixing method applies to the narrow coil bundles shown in the figure above and cannot be generalised to other narrow coils and loadings. Place anti-slip mats horizontally between the coils and the coil-well. Fill the spaces between the bundles with 2 coil-well covers (not covers with steel profiles, which can make damages to the coils) or wooden prisms. For fixing in the forward direction, use 3 spring lashings, two of which are crossed over the top cover and stanchions and the the third spring lashing over the stanchions and the top coil-well cover.

For fixing to the rear, fix the bottom coil-well cover with a single spring lashing and the top cover with 2 crossed spring lashings. Lash the middle bundles with 4-5 top-over lashings.

7 SPIRAL-WELDED STEEL PIPES

7.1 LOADING

Pipes are loaded on wooden battens. At the beginning and at the end of the loading platform two battens are placed with pipes overhang about 350-400 mm. Besides it is necessary to place another 2 battens between them of equal distance. Battens are fitted with nailed wedges. Battens between layers have wedges nailed from both sides.

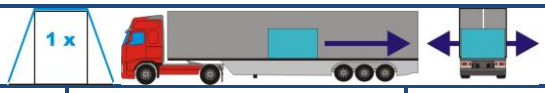
If there are no gaps between the pipes in one layer the outer pipes are secured by wedges only. If there are gaps between the pipes in one layer each pipe must be secured by wedges from both sides. Place the first layer of pipes on wooden battens. After the loading of the first layer place the battens with nailed wedges from both sides in such a way that they secure the pipes in upper and lower layer. Place next layer of pipes on this battens. This procedure repeats in regard to number of pipes to be loaded. By loading secure the pipes against rolling by wedges.

⚠ Pipes must be loaded firstly against the headboard but if load distribution doesn't allow this it is necessary to use protective wooden grid!

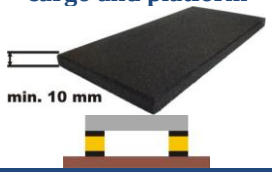
7.2 CARGO SECURING

It is difficult to achieve proper and efficient securing of pipes. It is important that well secured wedges prevent pipes from rolling also during unloading when lashings holding the pipes during carriage are loosened. It is important to use sufficiently strong wooden battens to prevent breaking and loosening of the stability of the whole stack of pipes.

Mass of secured cargo by 1 top-over lashing against sliding sideways/rearwards



Ratchet type	Standard tension force in lashing strap S_{TF}	Steel/wood, wood/plywood clean	Rubber anti-slip mats between cargo and platform
	300 daN	1926 kg	4000 kg
	350 daN	2247 kg	
	400 daN	2568 kg	
	500 daN	3210 kg	
	750 daN	4815 kg	
	1000 daN	6420 kg	

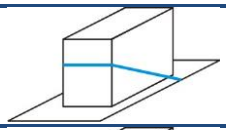
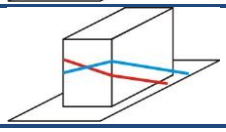


For other lashing angles see tables in annex	TAB 15	
Friction factor	$\mu = 0,4$	$\mu > 0,5$
Lashing angles	α = 60-90°	

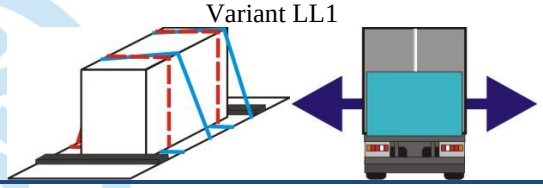
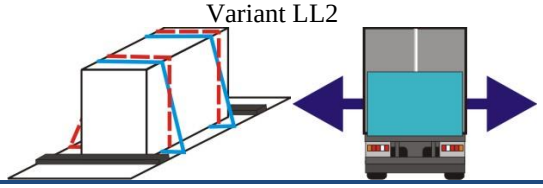
In case of cargo mass of 26 tonnes 26/3,21 = 9 lashing straps with long handle ratchets with tension force of 500 daN are necessary to secure the whole cargo against sliding sideways.

It is necessary to consider additional pressure from lashings on outer pipes. By 9 lashings and force 500 daN additional pressure on outer pipes is 4,5 tonnes. If drivers use extension bars for ratchets then force above 1000 daN is possible and additional pressure of 9 tonnes (+ pipes mass) on outer pipes which can damage wooden battens if the pipes in layers are not placed exactly on each other.

Mass of secured cargo by round spring lashing SL2

No. of lashing straps	Securing forwards		Securing rearwards
	steel/wood, wood/plywood clean	rubber anti-slip mats in each sliding layer	steel/wood, wood/plywood clean
	6,5 t	8,6 t	-
	13 t	17,3 t	26 t
3	19,5 t	26 t	
4	26 t		
For other lashing angles see tables in annex	TAB12	TAB 14	TAB 13
Friction factor	μ.fμ = 0,4	μ.fμ = 0,5	μ.fμ = 0,4
Lashing angles	α = max. 30°, β_x = max. 5°		

Cargo mass secured by pairs of loop lashing sideways for two variants of loop lashing – but always a minimum of 3 pairs of loop lashings

No. of pairs of loop lashings	Variant LL1	Variant LL2
		
	steel/wood, wood/plywood clean	steel/wood, wood/plywood clean
2	27 t	21,1 t
3	27 t	27 t
For other lashing angles see tables in annex	TAB6	TAB6
	μ.fμ = 0,4	μ.fμ = 0,4
	α_1=max.90°, α_2=max.20°, β_y=0-20°	α_1=max. 90°, α_2=max.20°, β_y=0°, β_x=90°

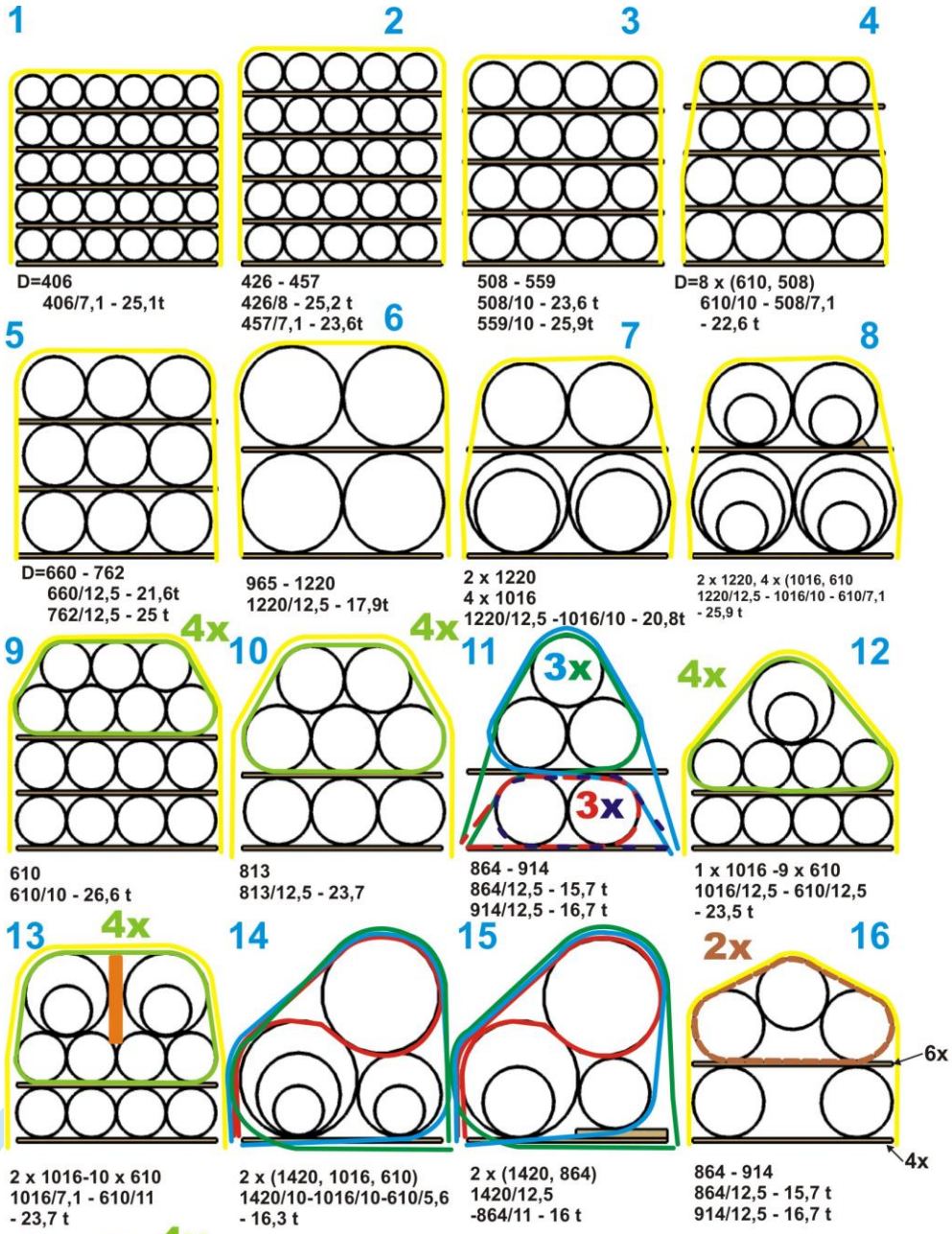
	1...top line over the cargo 2...bottom line under the cargo	1...top line over the cargo 2...bottom line under the cargo

Use of front protective grid is necessary when:

- Pipes are not directly placed against headboard and mainly pipes loaded in each other.
- Protective grid can be substituted by cargo securing net of sufficient strength.
- For certain loadings spring lashing with pallets can be used occasionally.

For loadings where it is not possible to loop lash the layers of the cargo use loop lashing of the whole cargo by minimum 6 lashing straps for securing sideways.

7.3 SELECTED LOADING COMBINATIONS OF PIPES IN USSK (MASS IS VALID FOR 12 METERS PIPES)



Outer pipe diameter	Wall thickness (mm)								MIN	MAX
	5	5,6	6,3	7,1	8	10	11	12,5		
	Weight of 12 m pipe (kg)									
406	594	664,8	746,4	838,8	943,2	1173,6	1284	1456,8	594	1456,8
426	634,8				1008				634,8	1008
457	668,4	747,6	840	945,6	1063,2	1322,4	1452	1644	668,4	1644
508		832,8	934,8	1052,4	1183,2	1476	1620	1836	832,8	1836
559		916,8	1030,8	1159,2	1308	1620	1788	2016	916,8	2016
610		1002	1125,6	1272	1428	1776	1944	2208	1002	2208
660			1224	1368	1548	1920	2112	2400	1224	2400
711			1308	1476	1668	2076	2280	2580	1308	2580
762			1404	1584	1788	2220	2448	2772	1404	2772
813			1500	1692	1908	2376	2616	2964	1500	2964
864			1596	1800	2028	2532	2772	3144	1596	3144
914			1692	1908	2148	2676	2940	3336	1692	3336
1016				2124	2388	2976	3276	3708	2124	3708
1220					2868	3576	3936	4464	2868	4464
1420					3348	4176	4584	5208	3348	5208

Eccentrically loading (stowage 14, 15)

Eccentrically loading of pipes is always secured by loop lashings sideways. Minimum 3 pairs of loop lashings shall be used for the whole cargo and 3 loops for top pipe against movement to one side.

Loading of pipes of diameter 864/914 mm (stowage 11)

Cargo securing sideways shall be done by 3 pairs of loop lashings for bottom layer and 3 pairs of loop lashings for top layer of pipes.

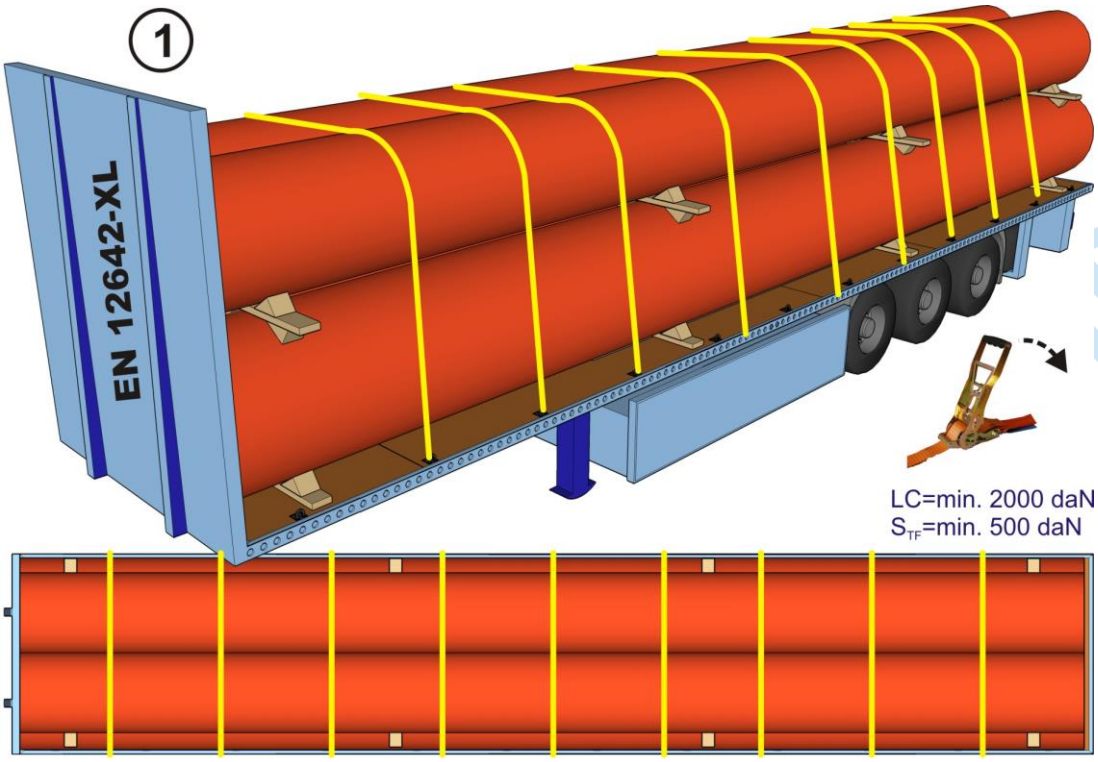
Pipes loaded in pipes bed (stowage 9, 10, 12, 13)

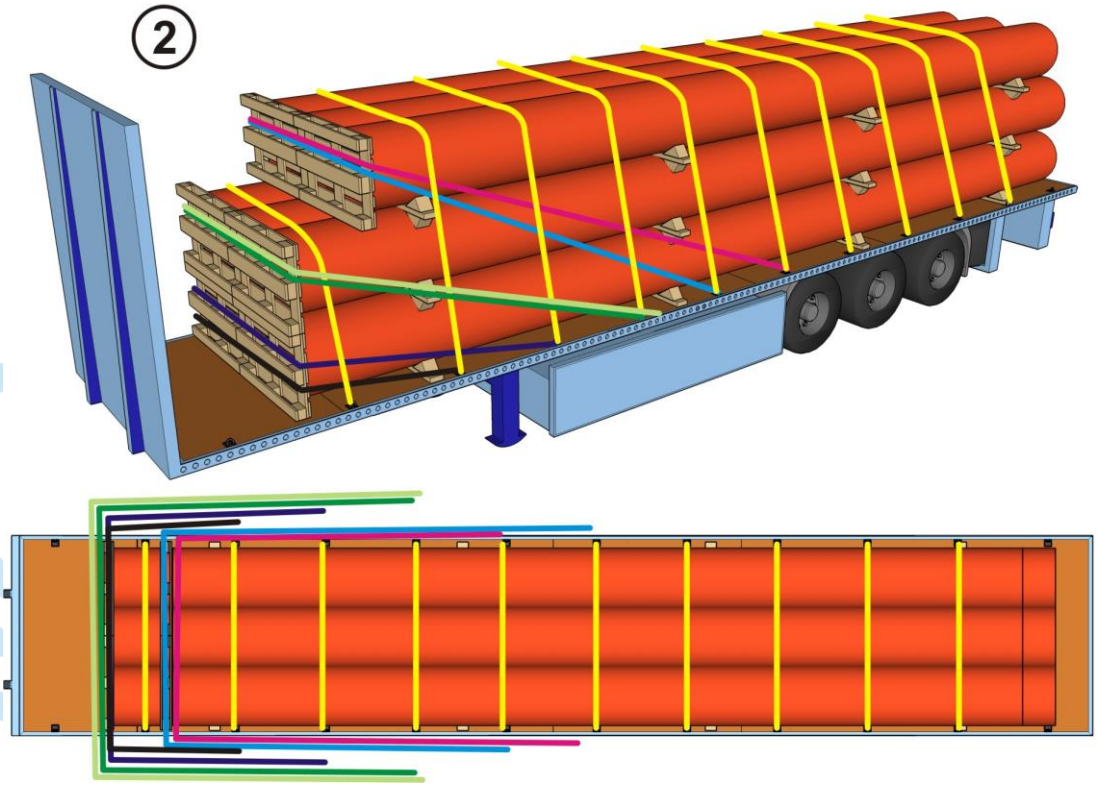
Pipes loaded in pipes bed shall be secured by 4 round turn lashings with bottom layer close to wooden battens to release the pressure on outer wedges which is increasing with the application of top-over lashings. For loading combination 13 the gap between two pipes must be filled. In case that pipes are loaded in pipes bed then contact surface is steel-steel therefore use of rubber anti-slip mats is necessary on such surface.

Pipes loaded broader and top pipe loaded in pipes bed (stowage 16, 17)

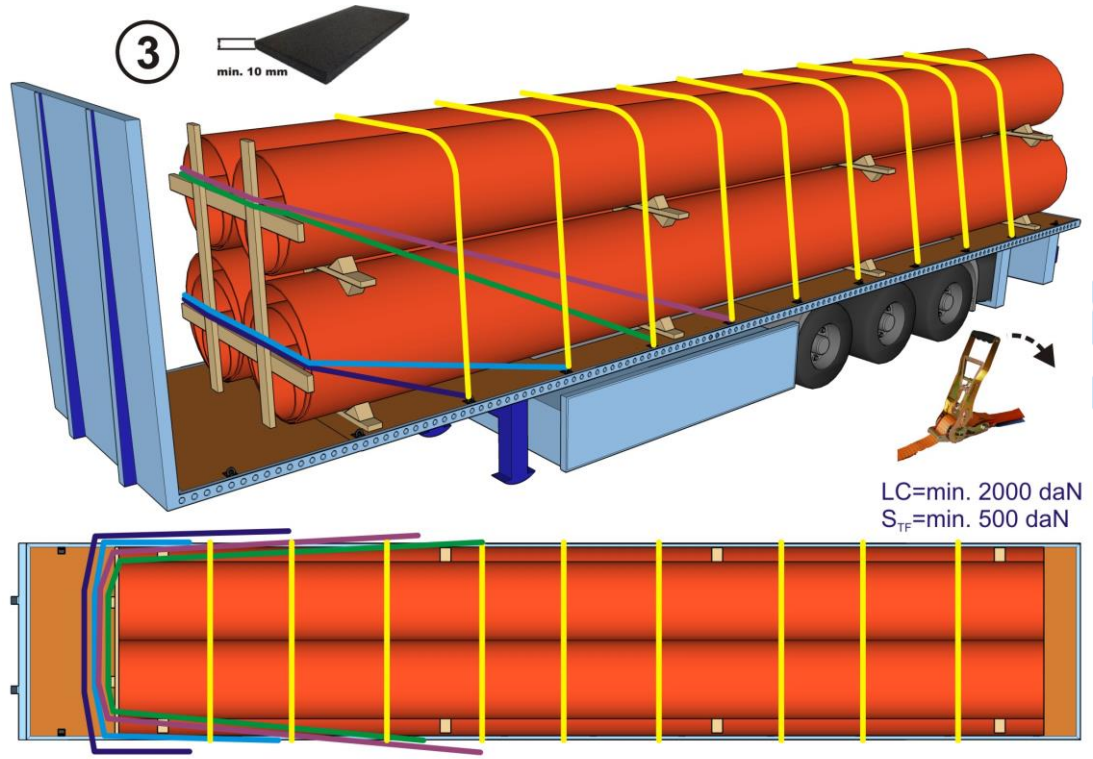
Pipes loaded in upper layer are loaded on 6 wooden battens and pipes in bottom layer on 4 wooden battens. Top 3 pipes must be lashed by 2 round turn lashings with min. 8 mm chains (LC=4000daN) (stowage 16) or 4 lashing straps and wooden support of top middle layer by 2 vertical wooden blocks 100x100 mm nailed to outer horizontal wooden battens. These two wooden blocks must be of accurate length to exactly fill the gap between the platform and top middle pipe. Without such securing top middle pipe can fall down and push out the vehicle sides.

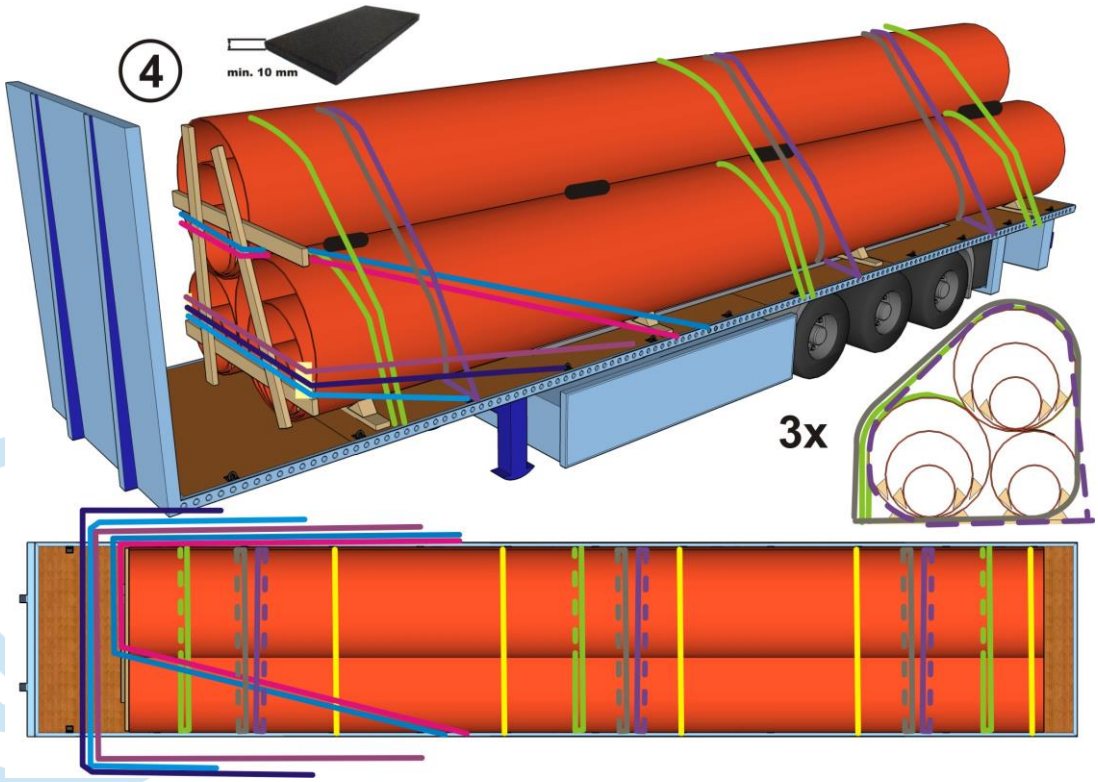
7.4 SECURING EXAMPLES OF SELECTED LOADING COMBINATIONS OF PIPES





1. Pipes blocked by headboard of sufficient strength (EN 12642 XL) forwards and secured sideways by top-over lashings (yellow straps).
2. Pipes of different length not blocked forwards secured by round spring lashings with pallets where wooden blocks can be inserted under straps. No. of spring lashings is according individual mass of the layers. Cargo is secured sideways by top-over lashings.





3. Cargo securing of pipes loaded into each other by 4 spring lashings SL2 (8 lines) with wooden grid. Two spring lashings of bottom/top layer have the same length. Cargo is secured sideways by top-over lashings. Pipes inside each other are always placed on rubber anti-slip mats and wedged against transverse rolling.
4. Securing of eccentrically loading of pipes by spring lashings SL2 (8-10 lines) in combination with wooden grid forwards. Securing sideways is done by 3 pairs of loop lashings LL1/LL2 for the whole cargo and by 3 loops of top pipes against movement to one side. Rubber anti-slip mats are used between steel/steel surface.