

DEKRA VDI Symposium Oct. 23 – 24, 2013

Transportation of technical gases

Semitrailer with central separation of the loading platform and wire ropes at the side



The AIR LIQUIDE Group

Air Liquide is the global market leader in gases for the industry, medicine and environment protection and with 50,000 employees present in 80 states.

Oxygen, nitrogen, hydrogen and inert gases are in the centre of the activities of Liquide since the foundation in 1902.



Air Liquide is **focused on the following industrial sectors:**

Basic material industry (chemistry, petro chemistry, refinery, steel/metal industry) use big quantities of gas.

It is supplied by line networks / pipes of which Air Liquide France Industry has the largest network: almost 1,600 km in France.



Companies of the processing industry use gases in a very great deal of sectors (food industry, water treatment, metal processing, glass production, chemical industry, pharmaceutical industry, transversal flame cutting of metal parts, ...).



These gases are delivered fluid in bottles and stored or produced directly on-side at the customer.



The AIR LIQUIDE Group

Craftsmen use gases in small portions in bottles.

Labs are provided with cleanest gases and gas mixtures on request/demand. In doing so, purity and quality are warranted on high level.

Semiconductor industry: For the production of semiconductors and photo voltaic facilities there are special gases of very high purity available.

Innovative technologies are necessary to the decrease of emissions, reduction of energy consumption in the industry, recycling of natural resources and the development of energy carriers of tomorrow as hydrogen, bio fuels or photovoltaic ... oxygen for hospitals, home care or to protect against nosocomial infections ... Air Liquide links numerous products with different technologies, to develop for his customers applications and services.



The AIR LIQUIDE Group

Air Liquide investigates in all possibilities which can offer life protection and follows herewith a path of sustainable development.

In the year 2012 the group sales amounts to 15.3 milliard Euros.

Guidelines for safety, quality and environment protection / principles for action:

To reach the „Vision Zero“ (zero accidents) has highest priority.

Our process of continuous improvement is based on the analyses of accidents dangerous situations and hazardous incidents, risk evaluation an exchange of experiences.

Environmental protection at our premises and at the sites of our customers:

We assure that our installations and products meet the requirements and rules.

Summary

- **Problems which occur when using tie-down lashing for cargo securing.**
 - Do the web lashings (belts) always hold the pretension force?
 - Troublesome working conditions for the drivers when tie down using web lashings.
 - Retention of the cargo during emergency braking.

- **Securing of cargo on semi trailers using plug-in stanchions and side walls.**

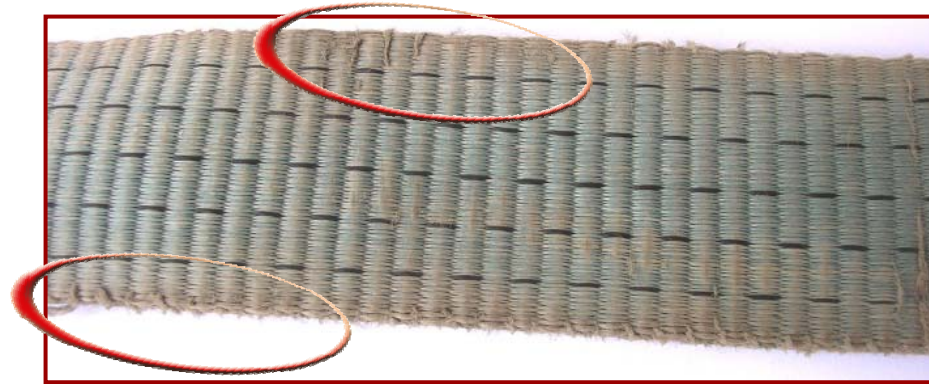
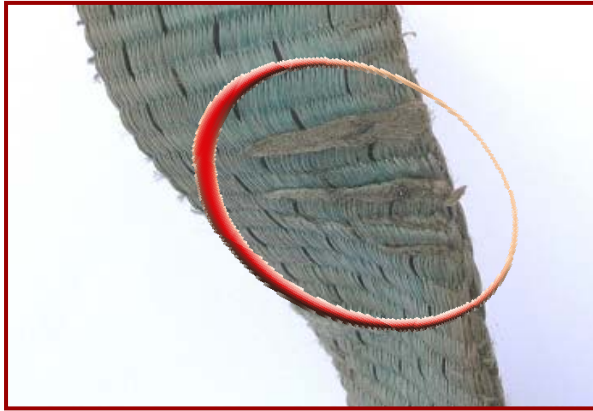
- **Advantages of semi trailers with central partition wall.**
 - Securing of cargo units with the body structure.
 - Less troublesomeness for the driver.
 - Easy loading and unloading with observation of a well load distribution on the cargo platform.

Web lashings

- **On semi trailers with plug-in stanchions and side walls the cargo is only secured in longitudinal direction by tie-down lashing.**
 - The web lashings have a lashing capacity (LC) of 2,500 daN, and the pretension force is 500 daN.

- **Securing by web lashings:**
 - The pretension force of 500 daN may differ during the tour, because in road transportation unforeseeable influences act to the cargo and web lashings (acceleration, deceleration, driving in curves, pot holes, bumps in the road).
 - Is the degree of abrasion of the web lashings acceptable? How is an effective check-up possible?
 - Do the characteristics of the web lashings change under the influence of the weather conditions?
 - Are the web lashings and ratchets always in good condition?

Condition of web lashings



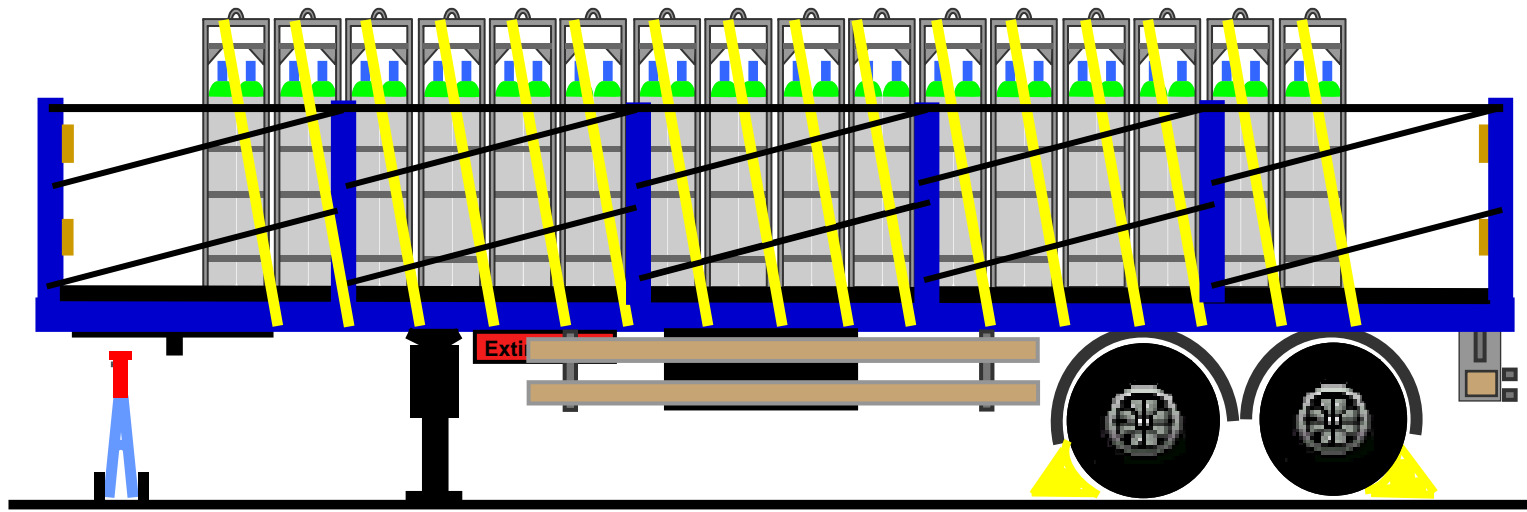
- Tests with worn-out web lashings had shown that a pretension force of 3,500 daN can be decreased down to one third of this value.



Worn-out web lashings = Uncertainty

Troublesomeness of tie-down lashing for the drivers

- According to the type of semitrailer the figure of web lashings may differ between 17 and 21.
 - Reduction of troublesomeness and effort for the application of the web lashings top-over the cargo (height 3.40 m) and **Risks of diseases of the human musculoskeletal system.**
 - Troublesomeness during handling of web lashings and ratchets.



Behaviour of the cargo

- Web lashings do not withstand the loads during emergency brakes.



- Additional measures must be implemented.

Semitrailer with plug-in stanchions and side walls

- Web lashings are used for cargo securing.

Semitrailer with plug-in stanchions

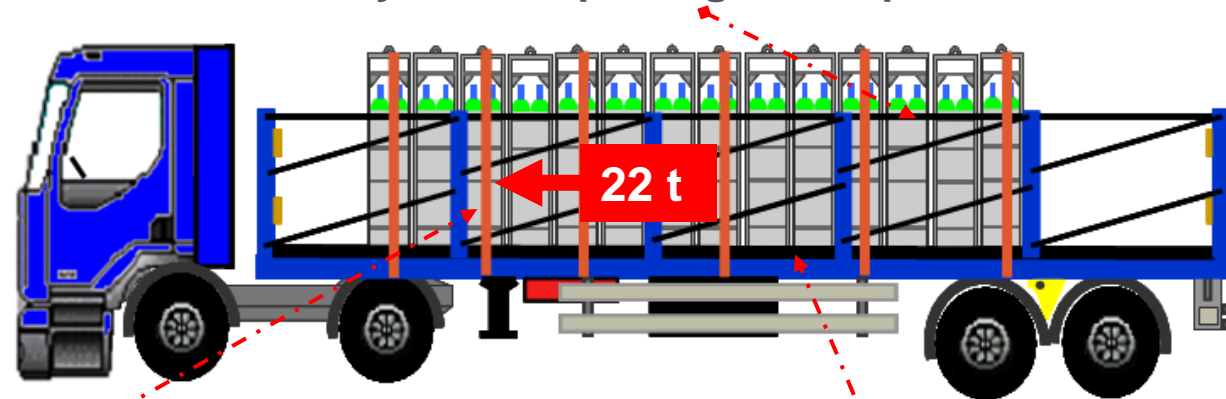


Semitrailer with side walls



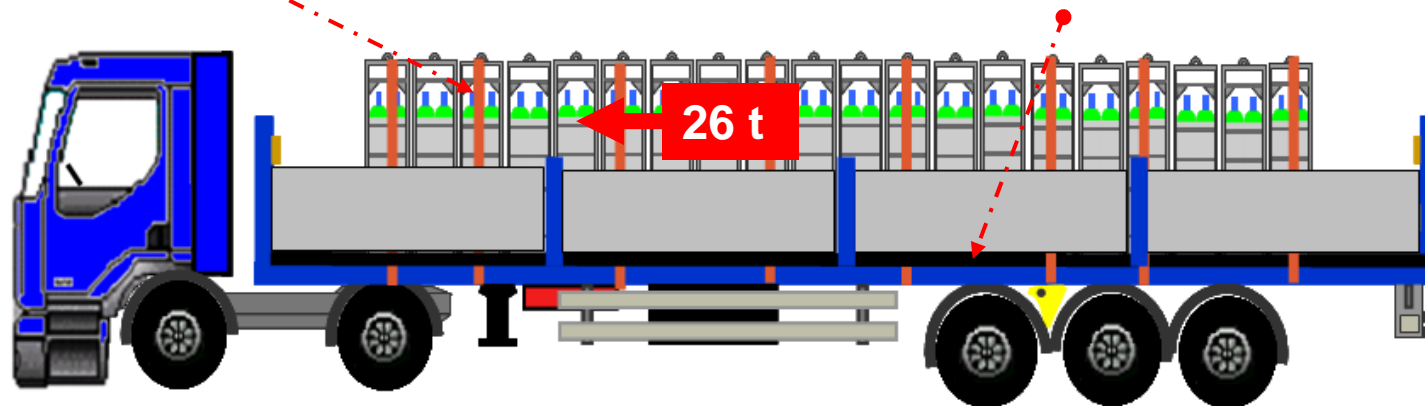
Securing of cargo units on vehicles with stanchions or side walls

2. Laterally at the top using wire ropes



1. Longitudinally using web lashings

3. Laterally at the bottom using an end-to end bar welded on the vehicle structure



New semitrailers with two or three axles and centric partition



■ Improvement of the retaining of the cargo units (cages, frames):

- After an impact onto the front.
- In lateral movement.

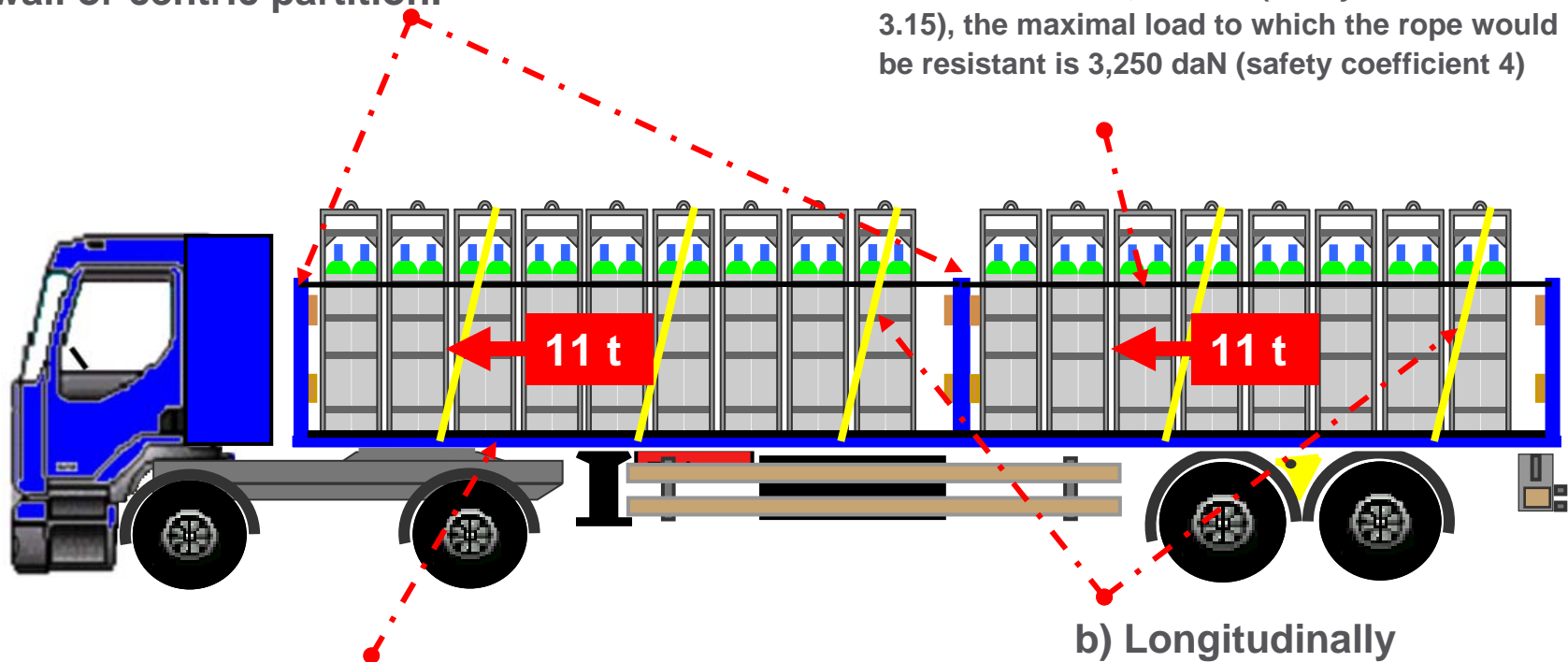
- Securing of the cargo units on semitrailers with two or three axles not only by using web lashings but also with the structure of the body.



Securing of cargo units on semitrailer with 2 axles and centric partition

1. a) In longitudinal direction with reclining of the cargo unit on the front wall or centric partition.

2. Laterally on top using a wire rope in a height of 1,200 mm. The rope resists a tension force of 4,140 daN (safety coefficient 3.15), the maximal load to which the rope would be resistant is 3,250 daN (safety coefficient 4)



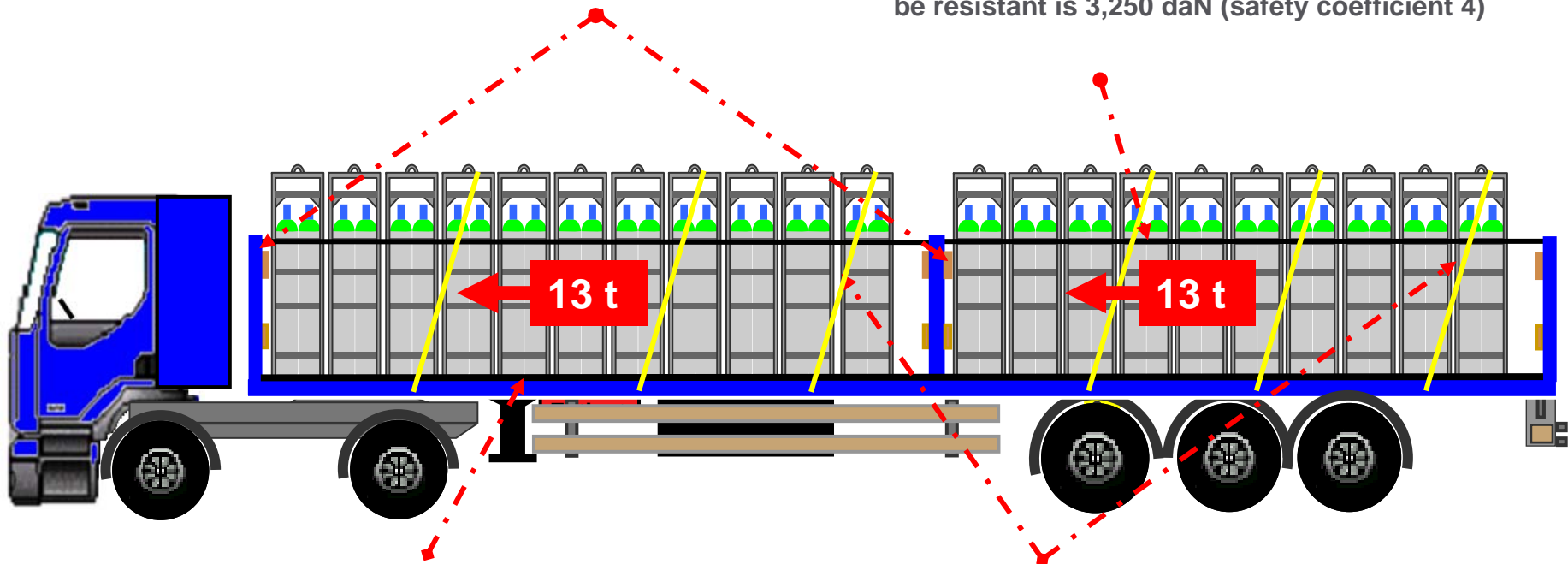
3. Laterally at the bottom using an end-to-end bar welded on the vehicle structure.

b) Longitudinally using web lashings

Securing of cargo units on semitrailer with 3 axles and centric partition

1. a) In longitudinal direction with reclining of the cargo unit on the front wall or centric partition.

2. Laterally on top using a wire rope in a height of 1,200 mm. The rope resists a tension force of 4,140 daN (safety coefficient 3.15), the maximal load to which the rope would be resistant is 3,250 daN (safety coefficient 4)



3. Laterally at the bottom using an end-to-end bar welded on the vehicle structure.

b) Longitudinally using web lashings

Semi trailers with two or three axles and centric partition

- **To secure the retention of the cargo units (cages, frames):**
 - After an impact onto the front.
 - In lateral movement.

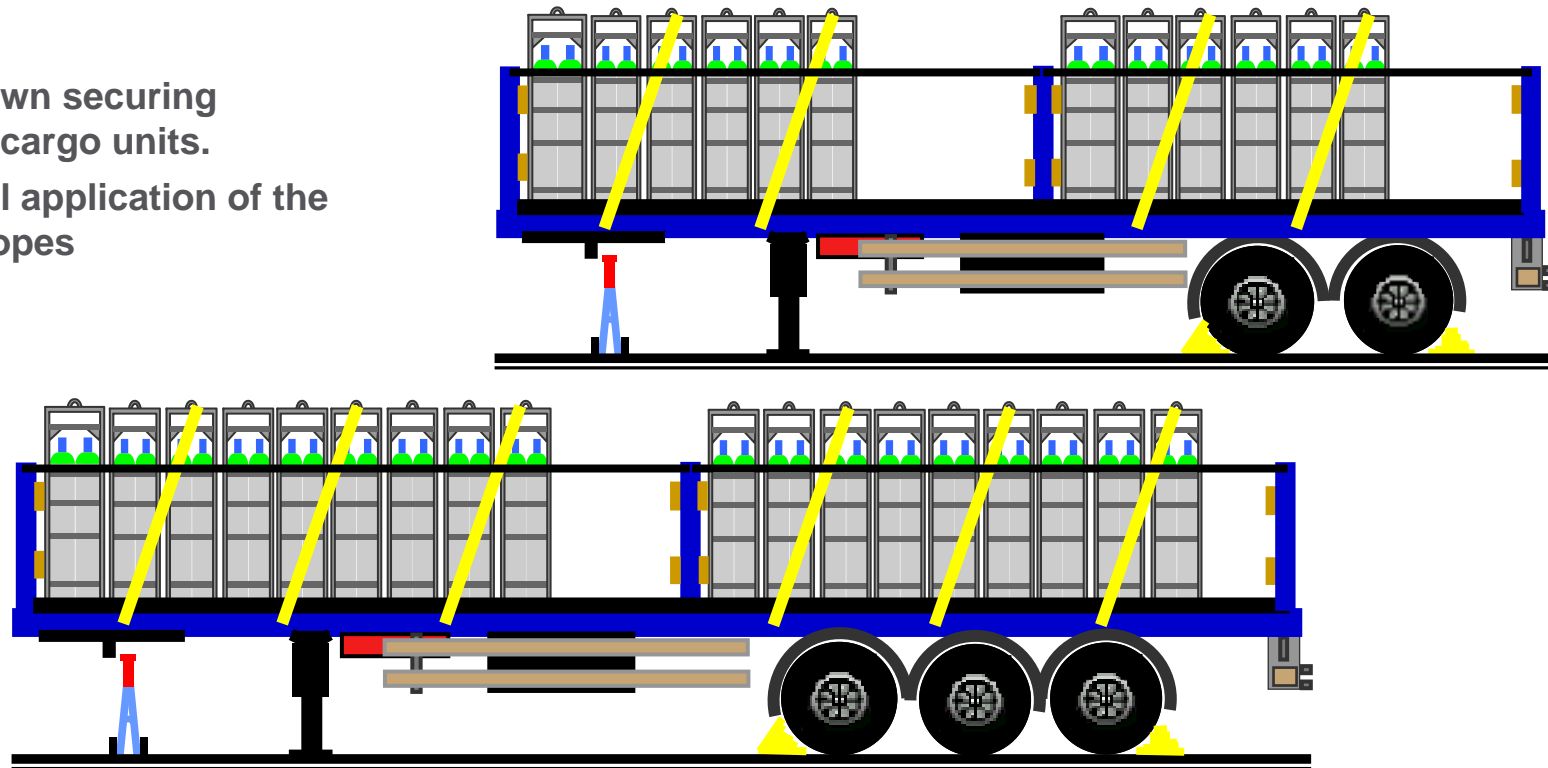
- **Reduction of troublesomeness for the driver:**
 - In application of web lashings top over the cargo (height 3.40 m).
 - In down-out handling of side walls and plug-in stanchions.
 - **17 to 21 web lashings** on semitrailers with side walls and plug-in stanchions, **6 web lashings only for semitrailers with centric partitions.**
 - **Thereby reduction of the risk of diseases of the human musculoskeletal system.**
 - In tie-down the web lashings using ratchets.

- **Easy loading and unloading with well load distribution on the cargo platform.**

Semi trailers with two or three axles and centric partition

1. The loading starts at the rear part with the cargo reclining against the centric partition,
2. Afterwards the frontal part of the cargo is reclined against the front wall,
3. Subsequently **always alternating the rear part and the frontal part is loaded**, whereby a frontal tilting of the semitrailer is avoided and this way results, if the vehicle is not completely laden, in a **well load distribution on the cargo platform**.

- Tie-down securing of the cargo units.
- Lateral application of the wire ropes



Semi trailers with two or three axles and centric partition

- **A study of INRS (Institut National de Recherche et de Sécurité) ascertained the tension forces in the web lashings:**
 - 3,598 daN at 0.8 g
 - 1,140 daN at 0,5 g

For us this is a confirmation to produce semitrailers with centric partition on which the cargo units are supported in longitudinal direction by the front wall and the partition and with a body structure designed to resist 2 g in longitudinal direction and 1 g laterally.

Semi trailers with two or three axles and centric partition

- Dynamic driving tests carried out by DEKRA GmbH – Bielefeld, did enable the check-up of the technical measures used according to EN 12195-1.



Semi trailers with two or three axles and centric partition

- **Film of dynamic driving tests
as of February 7:
2013-03-K2-05.mpg**



Many thanks for your attention ...

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