



LOAD SECURING OF CLASS 2 RECEPTACLES

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Amendments to 52/13

Section	Change
Entire doc	This document was entirely reviewed and updated with new pictures

Note: Technical changes from the previous edition are not underlined because the entire document has been reviewed.

1 Introduction

Loss of loads can lead to serious accidents. Consequently, it is necessary for the gas industry to provide those that load, with information concerning the requirements that are necessary for transporting individual gas cylinders, bundles of cylinders, pallets of gas cylinders and cryogenic receptacles.

It is essential to make sure that all loads carried on vehicles are adequately secured so that there is no likelihood of them moving or falling off causing danger to the driver or to the public or a release of product to the environment.

The weight, distribution, packing and adjustment of every load should be such that its position is not likely to cause a danger.

2 Scope and purpose

This publication covers load securing of individual gas cylinders, bundles of cylinders, pallets of gas cylinders, pressure drums, cryogenic receptacles and small tank containers which are not permanently connected to the vehicle. It is concerned with product carrying equipment which has to be off-loaded for filling or withdrawal. Recommendations made cover load securing for all types of vehicles including those specially designed and built for the purpose.

Proven load securing systems from several EIGA member companies are presented. The theoretical basis for load securing is not covered in detail.

This publication does not consider the load distribution on the vehicle, e.g. where a load is placed in relation to the axle loading. This varies from vehicle to vehicle and is the responsibility of the one who loads to see that the load distribution is correct and the vehicle is not overloaded.

This publication is intended to provide guidance on acceptable means currently employed within the industrial gases industry. The aim is to present various existing proven systems for guidance.

Transportation of receptacles in passenger cars and vans is excluded (see EIGA Safety Leaflet SL 03, Safe transport of gases).

2.1 Load securing measures

The objective of load security is to prevent the load from slipping, tipping over or falling from the vehicle.

This may be achieved by a number of different methods including technical, informational and motivational.

Technical:

- chains, ropes, straps, tie down points, winches;
- reinforced vehicle sides, arresting beams; and
- boards, stop rails, inflatable cushions.

Informational:

- includes the provision of technical information and data on securing loads. This may make reference to Codes of Practice, standards, manufacturer's booklets and any other proprietary information.

Motivation:

For those involved in vehicle loading and driving, whoever is responsible for loading the vehicles and securing the loads this can be achieved by:

- training;
- leaflets, bulletins;

- illustrations and literature from companies that practice well proven load securing techniques;
- posters, decals; and
- information to customers, freight forwarders and others in which the need for load securing is emphasised.

3 Definitions

For the purpose of this publication, the following definitions apply.

3.1 Publication terminology

3.1.1 Shall

Indicates that the procedure is mandatory. It is used wherever the criterion for conformance to specific recommendations allows no deviation.

3.1.2 Should

Indicates that a procedure is recommended.

3.1.3 May

Indicate that the procedure is optional.

3.1.4 Will

Is used only to indicate the future not a degree of requirement.

3.1.5 Can

Indicates a possibility or ability.

4 General principles

Load securing and ADR

The European Agreement concerning the carriage of Dangerous Goods by Road (ADR) states:

7.5.7 Handling and stowage

7.5.7.1 Where appropriate the vehicle or container shall be fitted with devices to facilitate securing and handling of the dangerous goods. Packages containing dangerous substances and unpackaged dangerous articles shall be secured by suitable means capable of restraining the goods (such as fastening straps, sliding slatboards, adjustable brackets) in the vehicle or container in a manner that will prevent any movement during carriage which would change the orientation of the packages or cause them to be damaged. When dangerous goods are carried with other goods (e.g. heavy machinery or crates), all goods shall be securely fixed or packed in the vehicles or containers so as to prevent the release of dangerous goods. Movement of packages may also be prevented by filling any voids by the use of dunnage or by blocking and bracing. Where restraints such as banding or straps are used, these shall not be over-tightened to cause damage or deformation of the package. The requirements of this paragraph are deemed to be complied with if the cargo is secured in accordance with standard EN 12195-1:2010.

From ADR 2013 the reference to EN12195-1 (Load restraining on road vehicles Safety Calculation of securing forces) is now part of the ADR text.

It is a requirement that whatever load restraint system EIGA members use meets the applicable sections of ADR.

The requirements of ADR may be supplemented by national regulations.

Pressure receptacles are a collective term that includes cylinders, tubes, pressure drums, closed cryogenic receptacles, bundles of cylinders and salvage pressure receptacles.

Class 2 is any pure gas, mixture of gases or mixtures of one or more gases with or without more substances meeting the criteria for class 2.

4.1 Vehicles load limits

Do not exceed the permissible load



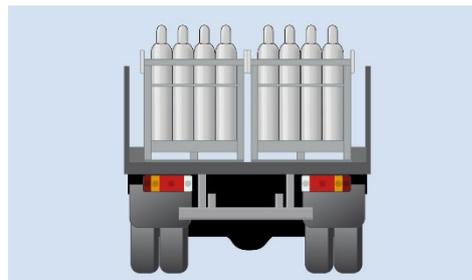
There are two main considerations when a vehicle is loaded. The weight of the vehicle shall not exceed the permissible gross vehicle weight. The permissible axle loads are not exceeded. In some instances, this may mean that not all the load space can be utilised.

Distribute load correctly



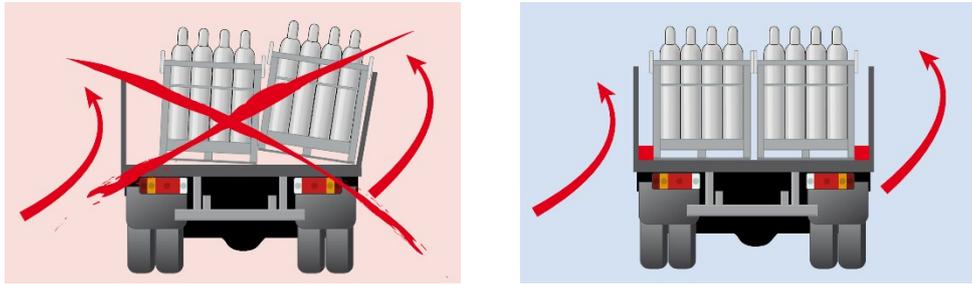
Load distribution diagrams are a valuable aid in determining the most favourable or the permissible distribution of the load. These diagrams vary by vehicle manufacturer and model and a typical example is shown below.

Do not exceed load capacity of the cargo area



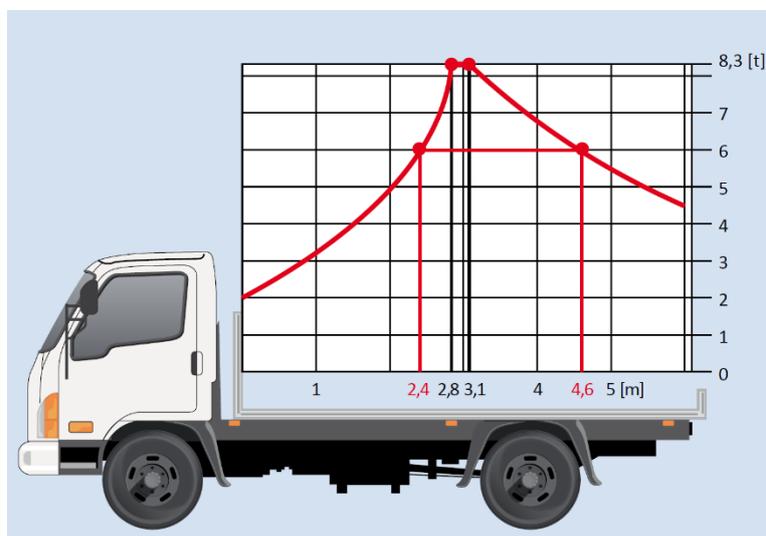
The permissible load rating of the cargo area should be obtained from the vehicle supplier.

Maintain transverse load security



Forces are generated on the load when the vehicle changes direction.

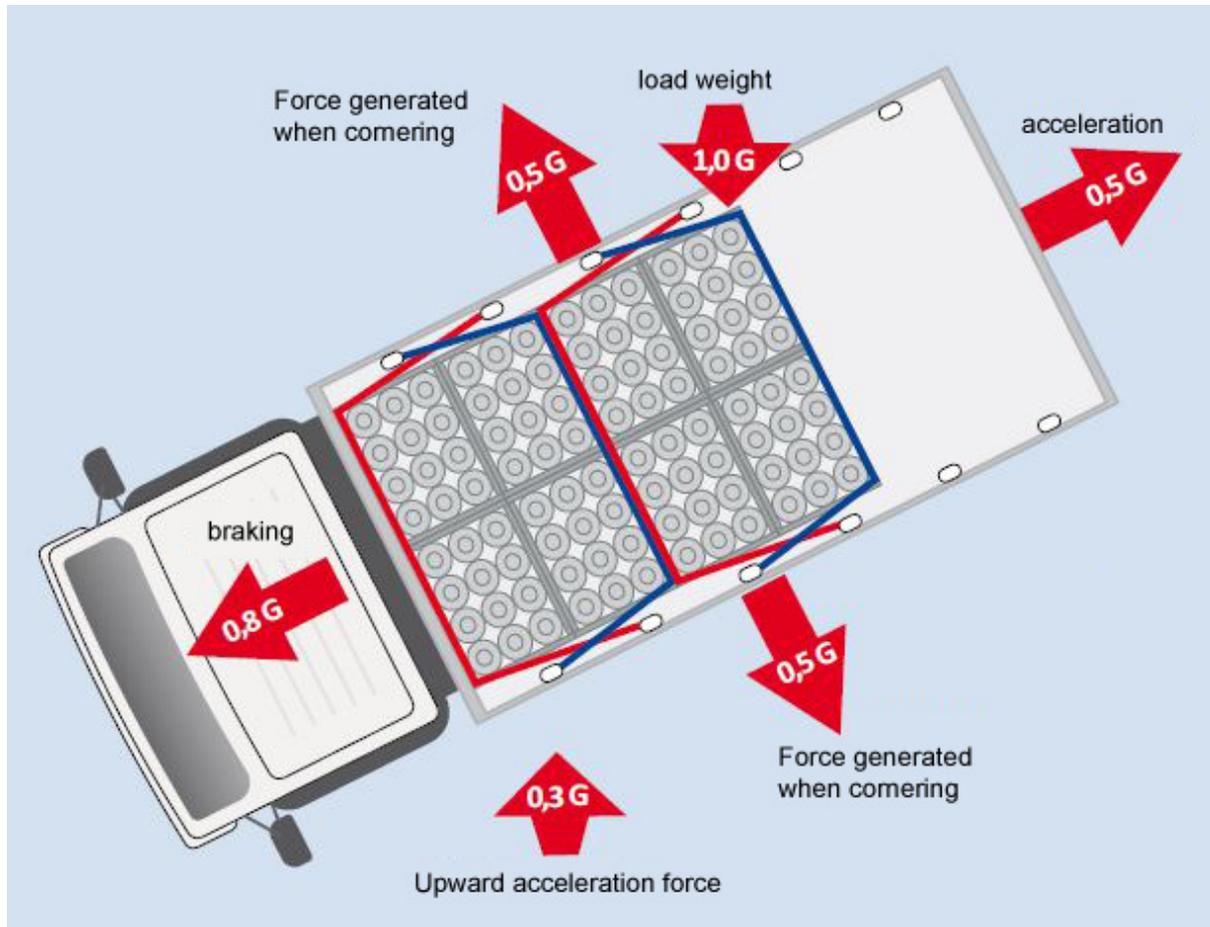
Load distribution diagram



The vehicle manufacturer’s technical data should be checked for the effect of load distribution on the maximum permissible vehicle weight and axle loads.

4.2 Forces affecting load securing

The basic principles upon which load securing is based is that the combined strength of the load restraint system shall be sufficient to withstand a force not less than 0.8 times the total weight of the load forward and half of the weight of the load rearwards and sideways, according to EN 12195 [1]. Vertical movements and movements when braking can occur, but these should be overcome if the above conditions are met.



Note: For tilting loads such as bundles the sideways load applied should be 0.7 rather than 0.5

These principles are valid for normal road use; they are not intended to cover abnormal situations (e.g. road traffic accident) where forces may be substantially increased.

4.3 Load securing

Selection of the best means of securing a load to a vehicle will depend on the type and composition of the load to be carried, pallets, bundles etc.

Bundles and pallets are lashed diagonally and downwards to tie down points on specially constructed vehicles or by using special fastening systems. Suitable devices for use in load security are steel wire or nylon ropes, chains, nylon webbing harnesses etc. In the case of nylon ropes and harnesses, sleeves and corner protectors should be used to avoid damage.

All equipment used for securing loads should be regularly inspected for wear or damage.

Reference should always be made to manufacturers' instruction relating to load securing equipment regarding repair and use.

5 Examples of load securing systems

5.1 Load securing for individual cylinders

5.1.1 General requirements

Gas cylinders should be stowed and secured on the vehicle through suitable means in such a manner as to ensure that it is impossible for them to move during transport. Cylinders should comply with the appropriate standards relating to valve protection. The cargo areas should be kept clean at all times. Under no circumstances should they be contaminated with e.g. oil, grease or tar. Gas cylinders should not be placed on sharp edges (e.g. angle irons). Gas cylinders should neither be thrown nor subjected to impact. Cylinders containing liquefied gases, in particular those with flammable contents, and acetylene should wherever possible be transported upright for reasons of safety.

5.1.2 Transporting of small cylinders

If possible, small cylinders should be transported upright in suitable boxes, crates or pallets in frames permanently attached to the vehicle. Figures 1 and 2 show two load securing systems.



Figure 1



Figure 2

If the marking of the cylinders is not visible the outer package has become an overpack and shall have the word "Overpack" and the UN Number and the labels of the cylinders it contains on the outside, (see figures 3 and 4).



Figure 3



Figure 4

Smaller cylinders are separately packed and secured.

5.1.3 Transporting gas cylinders horizontally

In ADR 7.5.11 there are additional provisions applicable to cylinders (CV10):

"Cylinders shall be laid parallel to or at right angles to the longitudinal axis of the vehicle or container; however, those situated near the forward transverse wall shall be laid at right angles to the said axis. Short cylinders of large diameter (about 30 cm and over) may be stowed longitudinally with their valve-protecting devices directed towards the middle of the vehicle or container. Cylinders which are sufficiently stable or are carried in suitable devices effectively preventing them from overturning may be placed upright. Cylinders which are laid flat shall be securely and appropriately wedged, attached or secured so that they cannot shift."

Always ensure that the cylinders cannot shift longitudinally or transversely. They should also be lashed. Aids for load securing are:

- slip inhibiting bottom and/or intermediate layers;
- wedges or cradles
- boards and adjustable arresting beams;
- stowing cushions (e.g. inflatable);
- tie down straps, ropes, chains.

5.1.4 Transporting gas cylinders upright

If individual cylinders are to be transported upright, the vehicles should be appropriately equipped with:

- reinforced front panel;
- reinforced side panels or detachable frames containing sectional rails which are suitable for securing the cylinders;
- tailgate lift or other suitable cylinder handling devices for lifting and lowering the cylinders to and from the cargo area.

Suitable aids for load securing include:

- tie down straps, ropes, chains; and
- moveable arrestable transverse slats.

To ensure security of all cylinder sizes, two to three sectional rails should be provided at various heights for attachment of the straps. This will enable different sizes of cylinders to be secured relative to their centre of gravity.

Individual cylinder security:



Figure 5



Figure 6

Figures 5 and 6: Flexible load securing of upright cylinders by means of frames on the side panels

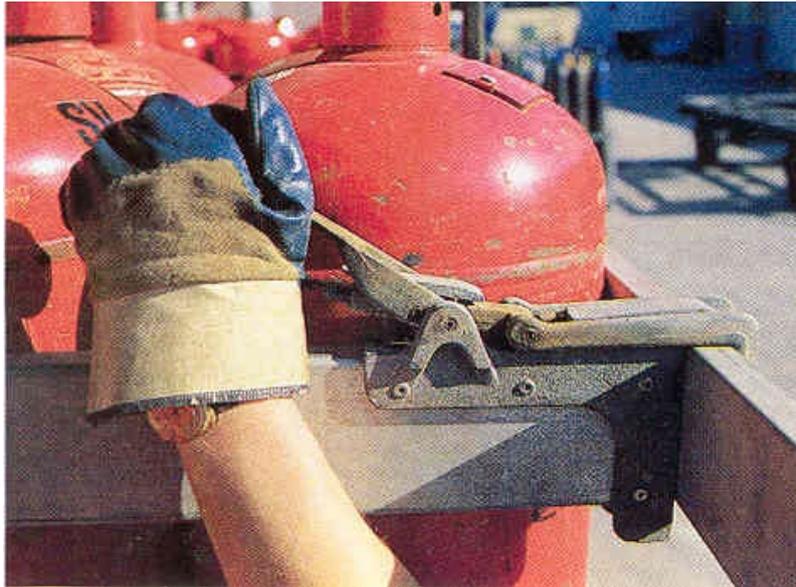


Figure 7: System using a transverse slat with a rapid clamping feature which secures upright cylinders



Figure 8: Upright standing single cylinders in a sea container secured by a clamping feature

5.2 Securing pallets and bundles

Pallets and bundles may be secured on purpose-built vehicles or standard vehicles equipped with supplementary facilities.

In the case of special-purpose vehicles, load securing is based upon the principle of connection between pallets or bundles and a specially designed cargo area. The vehicle equipment and the pallet design are structurally matched to one another. This enables the forces generated on the load to be absorbed. Some vehicles are equipped with securing hooks, which secure the pallets or bundles when changes in direction of forces are encountered.

Load securing that incorporates additional facilities on standard vehicles is less sophisticated, consisting of retaining devices on the cargo area or on the side panels. Similarly to securing individual cylinders, the side panel of the cargo area can be raised. Vehicles' specific tie down systems, possibly incorporating reinforced tie down strap anchors, secure the pallets or bundles against slipping or tipping. Variable stop and tie down points are especially suitable for frequently changing loading conditions. Tie down strap cuffs (e.g. rubber) are a proven means of protecting the straps if they have to be secured around sharp edges. The use of several different methods of additional securing devices is advisable in order to achieve well secured pallets and bundles.



Figure 9: Purpose designed pallet location system



Figure 10



Figure 11

Two systems shown above have locating pintles built into the outer edges of the load platform. The pallet has a mating pocket which when engaged restrains the pallet in all directions. This type of system eliminates the need for additional loader operated securing devices.



Figure 12



Figure 13

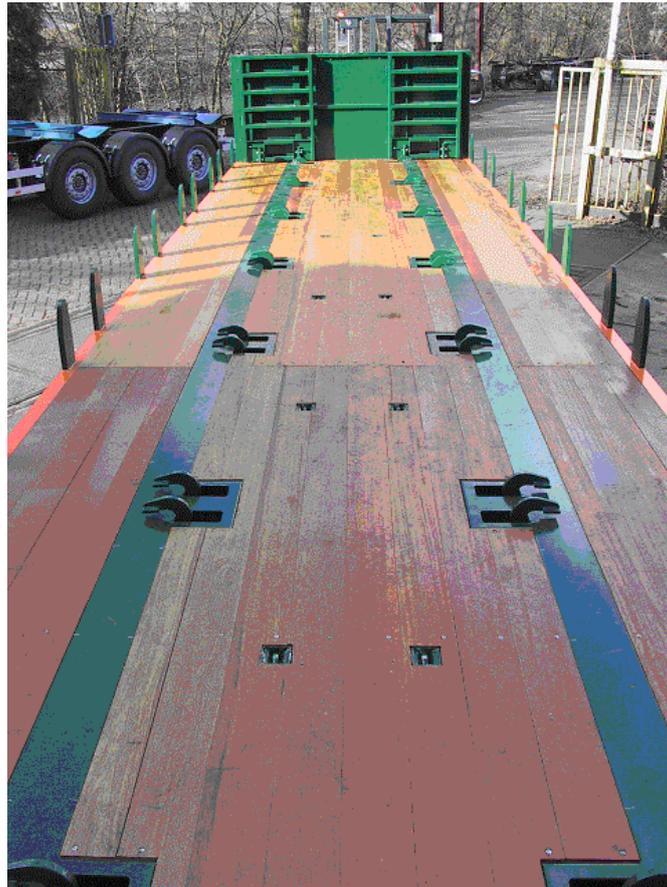


Figure 14

Figures 14, 15 and 16 and 17 show a system which positively positions purpose-built pallets into a recess in the load platform. Pallet security is achieved with a system of hooks which engage the pallet from beneath the load platform. If the hooks are not engaged an in-built safety system immobilises the vehicle.

In this particular system, if the hooks do not engage, the drive axle brake will not release.



Figure 15



Figure 16



Figure 17

The pallets are secured by hooks which are installed in the middle of the platform. A warning lamp shows in the cabin when the hooks are up and the hooks will close when the brakes are released.



Figure 18



Figure 19



Figure 20



Figure 21

This is a system which positively positions purpose-built pallets into recesses of the load platform. Pallet security is achieved with a system of hooks which engage the pallet from beneath the load platform. The hooks are pneumatically operated from the cab.



Figure 22

Covered trucks with ventilation are used for the transport of medical gas cylinders. There exist also specific designed pallets for small cylinders.

5.2.1 Load securing by straps on standard vehicles



Figure 23



Figure 24: Strap fixing point with ratchet attached to the vehicle's frame below the load platform. Transverse straps secure the load.



Figure 25: this type of vehicle side frame with holes for the strap hooks allows load securing with diagonally crossed straps.



Figure 26



Figure 27

Figure 26 and 27: Sharp corners easily destroy the load securing straps, this is why it is important to check them before they are used.



Figure 28: Anchor plates are recessed into the load platform and secured to the vehicle frame.



Figure 29: The securing rails are positioned over the plates and secured there by pin.



Figure 30: The securing rails serve both to secure against load movement as well as act as tie down points.



Figure 31: Securing a pallet to the reinforced side panel of a vehicle with a strap



Figure 32: A Cylinder bundle secured to the reinforced body panel

Note: The pallet truck shall be secured safety for carriage.

5.3 Cryogenic receptacles and small tank containers

Although cryogenic receptacles and small tanks are secured in a similar way to cylinders, bundles or pallets, there are differences because of their size and weight.

They are transported on equipped vehicles, or on pallets, or secured to the vehicle side panels.



Figure 33



Figure 34

Figures 33 and 34: A cryogenic receptacle secured to a vehicle side panel with straps.



Figure 35: Standard cylinder pallet fitted with wooden cradles hung on the pallet back frame. The frame and the cradle can be changed to match the circumference of the cryogenic receptacle.

5.4 Pressure Drums

Pressure drums need to be fixed by wedges and wood if they are not in a protective frame.



Figure 36



Figure 37



Figure 38

Figures 36 to 38: Pressure drums secured by straps, with wooden chocks

6 Information and motivation

6.1 Information

To ensure safe loading of industrial gas consignments adequate information shall be provided to all persons involved, not only to the gas companies' personnel, but also to freight forwarders, warehouses and transport contractors.

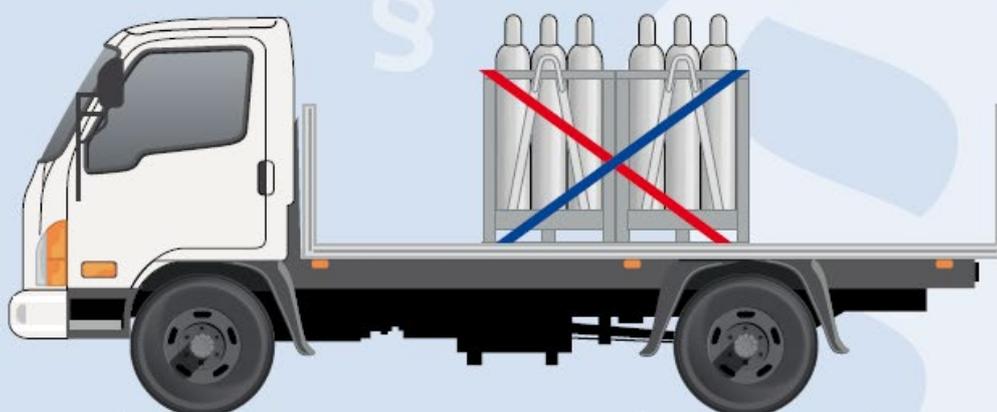
The information should provide details of what to secure, why it has to be secured and how it can be secured.

The information should be clear, concise and include:

- the legal background (regulations, guidance)
- vehicle suitability (load limits)
- loading of the cargo
- methods of securing the various types of goods that are loaded
- load securing principles

As an example most countries have national guidance on load securing, the following document is from the IGV in Germany.

Schriftenreihe:
Normen und Vorschriften



Ladungssicherung bei der Beförderung von Gasen in Druckgefäßen mit Straßenfahrzeugen

IGV IndustrieGaseVerband e.V.

6.2 Motivation

All persons involved including, drivers, independent freight forwards and customers shall be repeatedly encouraged to use load securing techniques. Practical training shall be given to gas company personnel and transport contractors.

Methods of motivation include:

- | | | |
|--------------------------|---|---|
| Training: | - | induction training |
| | - | refresher training |
| Visual opportunities: | - | leaflets |
| | - | posters |
| | - | stickers |
| | - | corporate literature |
| Verbal opportunities: | - | reminders about load securing |
| | - | offer advice about load securing |
| | - | point out deficiencies |
| | - | support correct load securing with praise |
| Practical opportunities: | - | assist in implementing load securing |
| | - | demonstrate correct load securing |
| | - | audits |
| Legal opportunities: | - | call attention to the possible legal and liability consequences of inadequate load securing |

Motivation needs to be a continuous process, not a one-time measure.

7 References

- [1] EN 12195 *Standard for Load restraining on road vehicles*. www.cen.eu