



Secure freight quickly and easily and transport it reliably

Curtain up for correct load securing

Load securing should be simple if it is to be applied correctly. However, there are rules and guidelines that everyone must apply for their own protection. This brochure gives you an overview, and shows the most important things you need to know. You will also learn how Schmitz Cargobull can make your work easier.

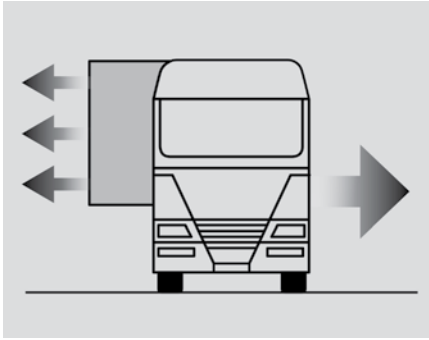
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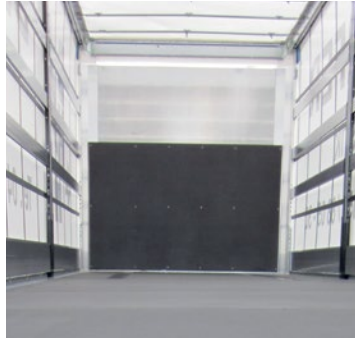
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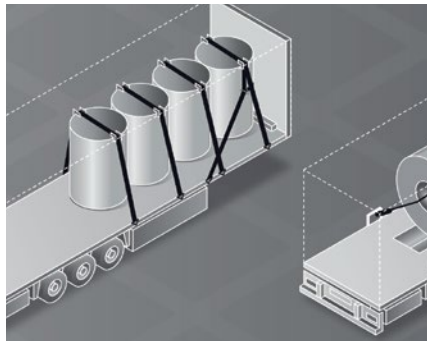
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	<small>(P is the value)</small>		
Vehicle body in compliance with			
loading height up to	200 mm	800 mm	max. height
front wall	18000 daN	15000 daN	13500 daN
rear wall	---	---	8100 daN
side walls	---	10800 daN	10800 daN
Certificate	Number of laths per section		

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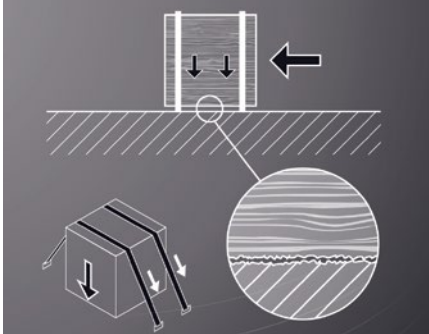
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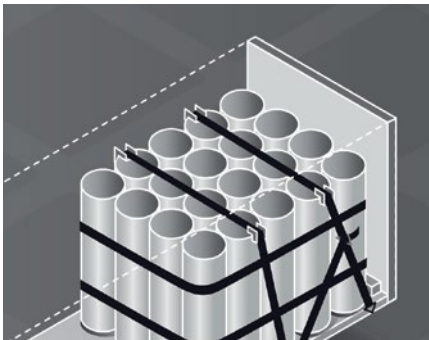
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It doesn't work without you

According to the Federal Motor Transport Authority, German trucks transported a total of more than 2.85 billion tonnes of goods in 2023. On around 286 million journeys, drivers also had to pay attention to securing the load.



Load securing must be simple

Schmitz Cargobull is part of the "road freight transport" system, just like the drivers. We all play a big part in making this system work.



Load securing protects your life and that of all other road users

With this brochure, we would like to remind you of something that your busy day-to-day work may sometimes mask: The awareness that load securing not only protects the load of your articulated lorry, but also human lives in an emergency. Especially your own, but also that of other road users.

Utilising and protecting laws



Load securing within freight transport is a topic on which the legislator and employer liability insurance associations set requirements from their respective perspectives in order to ensure that freight transport does not cause damage to the load, the vehicle, the driver or other traffic. In this respect, while the laws governing load security require time and commitment, they ultimately keep us all safe.

Occupational Health and Safety Act (ArbSchG)

Load securing is also important in terms of occupational safety. The vehicle is work equipment and is therefore subject to occupational health and safety regulations. The Occupational Health and Safety Act refers in detail to the accident prevention regulations (UVV) of the employers' liability insurance associations.

The personal legal consequences of inadequate load securing can be serious.

The legal framework for load securing:

Possible legal consequences of inadequate load securing*

	Civil law		Public law	Criminal law
	Contractual	Non-contractual claims or unauthorised action		
Standard	Section 425 HGB Liability for damage to goods and default	Section 7 Para. 1 StVG Liability of the registered keeper of the vehicle	Section 49 Para. 1 No. 21 StVO Infringement i.a.w. section 22 StVO Loading	Section 222 StGB Manslaughter
	Art. 17 Para. 4 c CMR Liability of the carrier	Section 823 BGB Liability for damages due to unlawful acts	Section 49 Para. 1 No. 22 StVO Infringement i.a.w. section 23 StVO Other obligations of the driver	Section 229 StGB Negligent bodily harm
	Section 412 HGB Diligence of the carrier		Section 69 a Para. 5 No. 3 StVZO Infringement i.a.w. section 31 Para. 2 StVZO Responsibility for operation of the vehicles	Section 315 b StGB Dangerous interference with road traffic
Possible legal consequences	Compensation	Damages, compensation for pain and suffering	Fine, driving ban, entry in the central traffic register	Fine, prison sentence, driving ban, driving licence revocation

* Listing without guarantee and without claim to completeness.

Your responsibilities



The German Road Traffic Regulations (StVO) and the German Commercial Code (HGB) as well as the German Occupational Health and Safety Act (ArbSchG) and the accident prevention regulations (UVV) of the Employers' Liability Insurance Association assign you as the driver, vehicle operator and freight carrier responsibility for correctly securing the load for transport on the articulated lorry.

Why you?

Because you drive the load to its destination and are in close contact with it during transport, which means you are best placed to know the necessary securing measures required. You also know your vehicle best. It is also assumed that you have a vested interest in good load securing, as your well-being depends on whether you have taken all the necessary securing measures. It goes without saying that your semi-trailer must be securely constructed and equipped (Section 22 Para. 1 and 37 Para. 4 UVV) so that you can secure the load correctly. For this reason, the obligations of the vehicle owner are also mentioned in regulations Section 30, 31 StVZO and in Section 22 StVO.

It is simply safer to abide by these laws.

German Commercial Code

(Section 412 HGB)

Paragraph 1: Unless circumstances or customary practice dictate otherwise, the sender must load, stow and secure (load) and unload the goods safely for transport. The carrier shall ensure safe loading.

Accident prevention

(Section 22 UVV)

Paragraph 1: Vehicle superstructures must be designed in such a way that when used as intended (...) the load is secured against slipping, rolling, falling (...) (...). If load securing is not guaranteed by the vehicle body alone, load securing aids must be provided. (...).

(Section 37 UVV)

Paragraph 4: The load must be stowed and, if necessary, secured in such a way that there is no danger to persons under normal traffic conditions.

Highway Code

(Section 22 StVO)

Paragraph 1: The load, including load securing devices (...) must be stowed and secured in such a way that they do not slip, (...) fall or generate avoidable noise, even in the event of emergency braking or sudden swerving movements. The recognised rules of technology must be observed.

(Section 23 StVO)

Paragraph 1: The driver is responsible for ensuring that his vision and hearing are not impaired by (...) the load (...). He must ensure that the vehicle (...) and the load (...) are in accordance with the regulations and that the road safety of the vehicle (...) is not impaired by the load (...).

Physical forces - stronger than you think

Physical forces are constantly at work and determine our lives, consciously or unconsciously. Whether gravity, centrifugal force or frictional forces - the laws of nature do not stop after the loading of your trailer. There are always situations in road traffic in which you and your

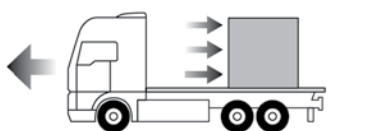


load feel the effect of these physical forces. Our experience with physical forces usually relates to their effect on our own bodies. When it comes to load securing, however, we are dealing with much greater forces.

Acceleration

The approach

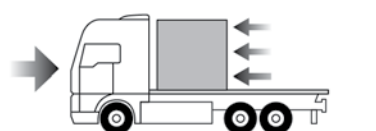
Acceleration is the increase in speed within a certain period of time. It causes the load to want to slide backwards.



Braking

Reverse acceleration

Deceleration - braking - is also a change in speed. It causes the load to move towards the driver's cab.



Curve travel

Lateral acceleration

Even if you drive round a bend at exactly the same speed, you will feel a change in direction: lateral acceleration. It causes the load to change in the direction of the side wall.

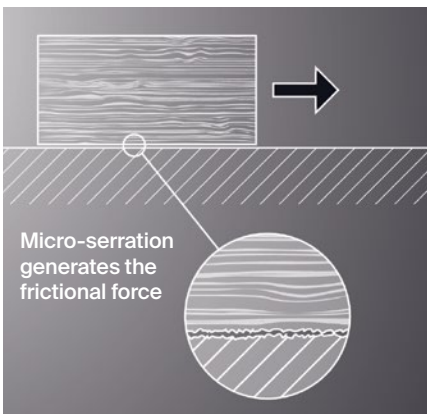


The other side - these forces work for you

Weight force, mass force and frictional force act on the load to help keep it where it was placed during the journey. However, these forces are typically not strong enough to cancel out the forces generated by the acceleration of the vehicle, braking or changing of direction when cornering. They move the load from its original position. This is why a counterforce is required, which - with the same strength - ensures that the load is secured. The ratio between the normal force (weight force or contact force) and the frictional force, known as the friction pairing, is defined by the coefficient of sliding friction.



The primary objective of load safety must be to ensure that the load retains its position in every situation.



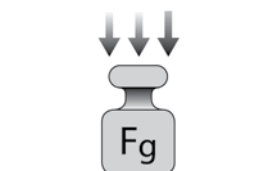
Friction

the delay

Every surface - even if it appears smooth - has irregularities, small "mountains and valleys". If two surfaces are pressed against each other, they get stuck and make relative movement more difficult. This resistance is expressed in the coefficient of friction. The lower the value, the lower the resistance. At rest, this resistance is greater than when the objects are already in motion. In load securing, the dynamic coefficient of friction is always taken as the basis, as it cannot be assumed that the load is at rest due to vibrations when travelling.

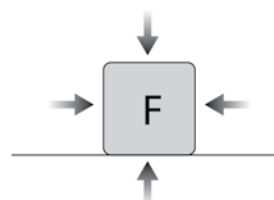
The weight force

presses the load vertically onto the loading surface.



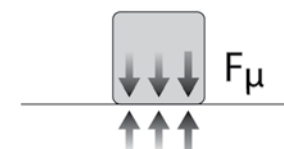
The mass force

(inertia force) aims to hold the load in its current position/movement and counteracts vehicle acceleration, braking and changes in direction.



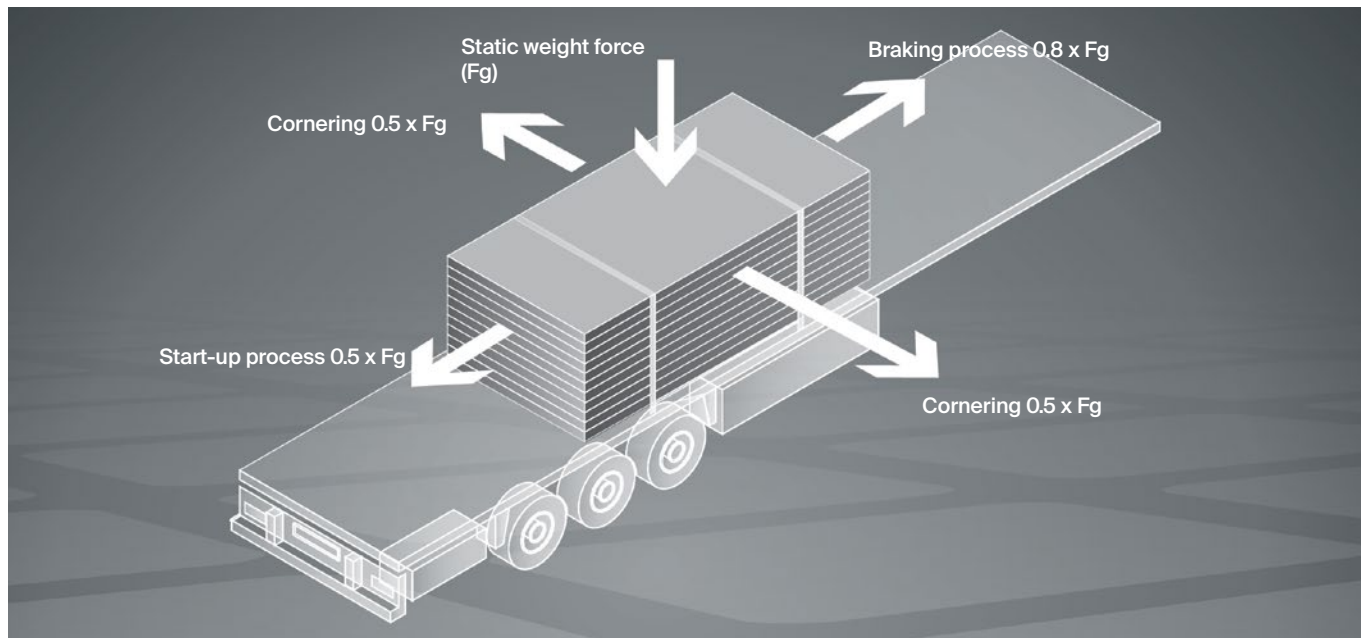
The frictional force

prevents or reduces the displacement of the load. Its effect is influenced by the surfaces of the load and the loading surface.



Assess the forces correctly

Ideally, you have the opportunity to carefully prepare the load securing by recording all weights and dimensions. However, it is often necessary to make an assessment on site in order to quickly arrive at suitable measures.



Acceleration and friction in figures

What forces should I expect?

The diagram shows the magnitude of the forces that normally occur during transport. Multiply the weight force (Fg)* of the load by the corresponding acceleration factor and you will obtain the force that the load wants to move away from the trailer.

The formula for estimation:

▶ Example braking deceleration:

▶ What force acts against it?

Use this formula to ensure that the load remains in its position:

Weight force x acceleration factor = force acting on the load

T that the counterforce for securing must be at least the same value.

The acceleration factor of the load beim during braking is 0.8 (see diagram)

Load 1,000 daN x 0.8 = 800 daN.

This means that the load is pushed forwards towards the driver's cab with 800 daN (corresponds to approx. 800 kilograms) during braking.

With a coefficient of friction of $\mu = 0.3$, the following counterforce is to be expected:

Load 1,000 daN x 0.3 = 300 daN

This means 300 daN (corresponds to approx. 300 kilograms) act as a counterforce to the movement of the load.

Conclusion:

800 daN acceleration force minus 300 daN counterforce is: 500 daN

This means

that load securing is required that can withstand at least 500 daN (corresponds to approx. 500 kilograms), either by increasing the friction (lashing down) or by blocking (support on the body).

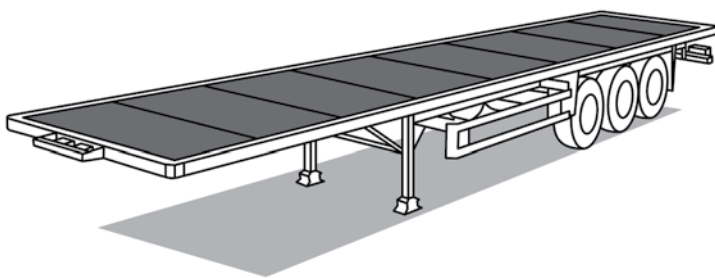
Friction in figures: The values for practice

Example:

A pallet is standing on the trailer floor; movement can occur between the floor and the pallet, but also between the pallet and the load, and also between the individual parts of the load. The weakest point is used for the assessment. The table below right shows the dynamic coefficients of friction. It is assumed that the load is always moving a little due to vibrations when travelling, so that the initial adhesion does not play a role. If in doubt, use a lower coefficient of friction, for example $\mu = 0.2$ for an unswept loading surface.



A coated anti-slip floor with a sliding friction coefficient of $\mu = 0.6$ simplifies load securing and saves on consumable anti-slip mats.



The coefficients of friction of the most common material combinations vary greatly, so it is important to always have at least some key data in mind. If in doubt, you should use the lower value. This also applies to the assessment of where so-called friction joints are present, i.e. connection points between materials.

Familiarise yourself with the numerical values of the forces in order to be able to determine the necessary securing forces and measures for the load on site.

Dynamic coefficient of friction in μ for different material pairings*

Sawn timber

Sawn timber - laminated wood/plywood	0,45
Sawn timber - corrugated aluminium	0,40
Sawn timber - sheet steel	0,30
Sawn timber - sheet steel	0,30

Planed wood - laminated wood/plywood	0,30
Planed wood - corrugated aluminium	0,25
Planed wood - sheet steel	0,20

Plastic pallet

Plastic pallet - laminated wood/plywood	0,20
	0,15

Plastic pallet - sheet steel

Steel and metal

Steel box - laminated wood/plywood 0,45

Steel box - corrugated aluminium 0,30

Steel box - sheet steel 0,20

Concrete

Rough concrete - sawn timber slats 0,70

Smooth concrete - Lumber slats 0,55

Paper rolls - Laminated wood/plywood 0,25 - 0,4

Beverages

Stainless steel kegs - Euro pallet 0,40 - 0,50

PU-coated kegs - Euro pallet 0,50 - 0,70

Horizontal kegs - barrel pallets 0,70 - 0,80

Reusable plastic beverage crates - Euro pallet 0,20 - 0,35

Foil-wrapped non-returnable containers - Euro pallet 0,20 - 0,50

Cardboard packaging 0,25 - 0,50

Anti-slip mat

Rubber 0,60

* Surface dry or wet and clean, free of oil, ice, grease.

** If special materials are used for increased friction, such as anti-slip mats, a certificate for the coefficient of friction μ is required.

The recognised rules of technology

The recognised rules of technology can also be relied upon from a legal perspective.


In addition to the conditions for correct load securing under civil and road traffic law, there are further concretisations - for example by DIN EN 12642 Code XL as well as by the VDI, Daimler AG or industry associations - which provide detailed specifications for the transport of the respective loads. The Road Traffic Regulations stipulate that the recognised rules of technology must be observed when securing loads, including these sources.



The technical regulations as concretisation of the laws

Conspicuous yellow stickers on the front and rear walls of the vehicle indicate the body's ability to absorb forces. This applies, for example, to the necessary slats in the body in order to fulfil the requirements of the various certificates.

Figure on the right: Sticker as proof of certified structural strength in accordance with DIN EN 12642 Code XL.

SCHMITZ CARGOBULL 		EN 12642-XL P (27000 kg)	
Vehicle body in compliance with		(P is the value)	
Loading height up to	200 mm	800 mm	max. height
Front wall	18000 daN	15000 daN	13500 daN
Rear wall	---	---	8100 daN
Side walls	---	10800 daN	10800 daN
Certificate		Number of laths per section	
XL		2 aluminium / wood	
Beverages		4 aluminium / wood	
Beverages with dropsides		2 aluminium / wood	
Daimler 9.5		4 aluminium / wood	

Schmitz Cargobull Safety Roof increases body stability

Schmitz Cargobull curtainsiders are generally equipped with the Schmitz Cargobull Safety Roof, which can be opened at the front or rear for craneable goods. When closed, the roof contributes to the superstructure stability in accordance with DIN EN 12642 Code XL.



The rules become concrete

The more specific the "recognised rules technology" required in Section 22 StVO become, the clearer it is that the load securing requirements of the various organisations overlap and complement each other. It is therefore possible to obtain semi-trailers that comply with VDI Guideline 2700, DL Guideline 9.5 and DIN EN 12642 Code XL at the same time.



Get trained so that you can use the rules of technology to your advantage in your day-to-day work.

Individual requirements by organisation

VDI 2700

In its VDI 2700 series of guidelines, the Association of German Engineers has published recognised rules of technology on numerous cargo securing topics, each of which is regulated in a single sheet. There are VDI 2700 sheets on lashing forces (2), load distribution plan (4), general cargo (6), combined transport (7), paper rolls (9), reinforcing steel (11), beverages (12), coils (19) and other topics. The series is constantly being expanded.

DL Guideline 9.5

The purpose of Daimler guideline 9.5 is to ensure trouble-free transport to and from Daimler AG plants and contains binding methods for securing loads. The guideline is based on the statutory regulations on load securing (StVO/StVZO and HGB).

The vehicle equipment for correct load securing includes a bulkhead tested with 0.5 x payload, a rear door tested with 0.3 x payload and 2 pairs of espagnolette locks, reinforced roof and side tarpaulins with 24 Tyride buckles and at least 3 pairs of reinforced stanchions as well as 4 rows of wooden or aluminium top slats and a pallet stop. Daimler guideline 9.5 is increasingly being used for all transports in the automotive sector.

DIN EN 12642

The European standard DIN EN 12642 applies in all EU member states as well as Norway and Switzerland and describes the minimum requirements for the bodies of commercial vehicles over 3.5 tonnes. It includes a rigid front wall (0.5 x payload), rear wall (0.3 x payload) and side walls (0.4 x payload), which must not bulge by more than 30 centimetres - for example due to a particularly sharp bend - before

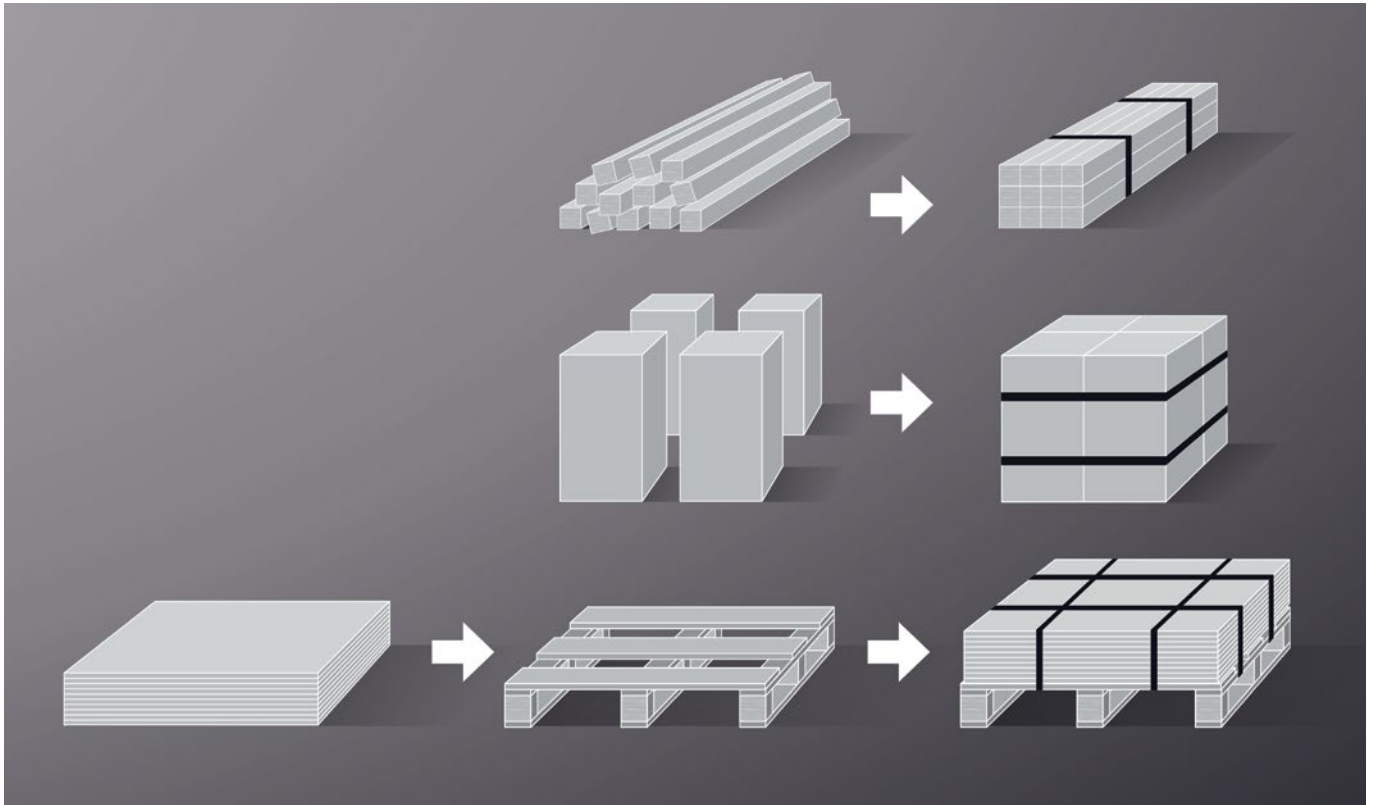
returning to their original state against the vehicle frame. A continuous lashing hole in the outer frame as well as reinforced versions of the tarpaulins and stanchions and at least 2 rows of wooden or aluminium laths are still part of the equipment. The Code XL marking indicates the particularly high stability of the vehicle body in contrast to the Code L marking, which characterises bodies with lower stability.

Code XL with the addition "suitable for beverage transport" designates a vehicle body that meets the special requirements for the transport of well pallets or drums. The vehicle body is characterised by reinforced side tarpaulins with 24 buckles positioned closer together and a reinforced roof tarpaulin with spar reinforcement. Reinforced beverage stanchions and 4 rows of aluminium top slats are also part of the beverage equipment.

VDI 2700 Sheet 6 General Cargo

Sheet 6 - Mixed loading of general cargo

In addition to the methods of load securing, the guidelines describe the characteristics of the vehicle superstructures and the aids for the transport of general cargo. A special feature of general cargo is that it is usually not standardised, especially in groupage transport.



For this reason, grouping the packages into larger load units is particularly important. This means that individual parts are tied together and ideally provided with a load carrier such as a pallet or container.

When stacking load units vertically, attention must be paid to the compressive strength of the individual layers. Overall, the proper load distribution of the respective vehicle must be observed. The vehicle superstructures or the means of transport should also comply with the DIN EN 12642 Code XL standards for swap bodies. This DIN standard is fulfilled by all Schmitz Cargobull curtainsiders ex works.

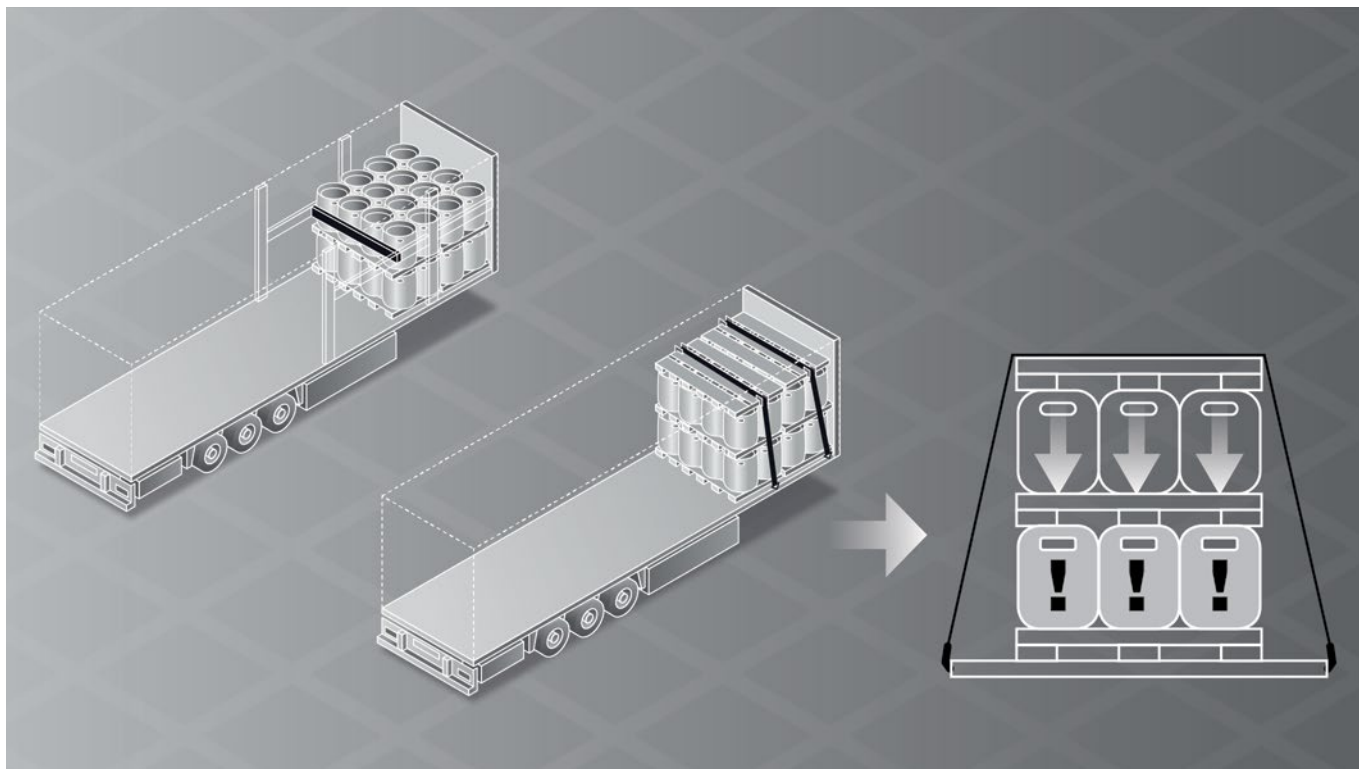
Recognising the characteristics of each transport task is the first step.

For application examples for general cargo transport, see page 34.

VDI 2700 Sheet 12 b beverage transport

Sheet 12 - Load securing of beverage products

Sheet 12 deals with the load securing of beverage products and accessories (e.g. refrigerated machines, dispensing systems) on vehicles with standard bodies and particularly rigid bodies in accordance with DIN EN 12642 Code XL. In the latter case, additional load securing measures

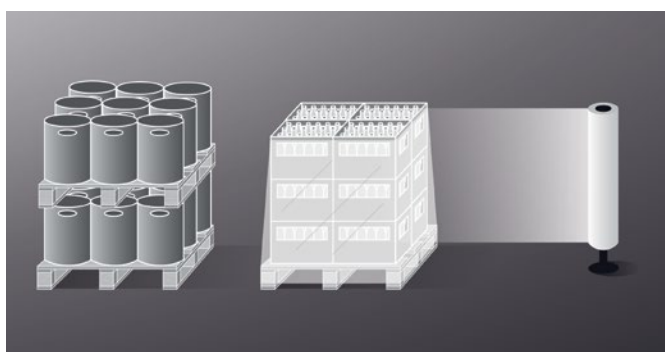


Principle illustration above:

For partial unloading, secure to the rear with cross beams or locking bars, or by lashing down. When lashing down, it is essential to observe the compressive load capacity of the lower loading unit.

can be dispensed with if a form-fit complete load is present. In this case, the body can absorb all forces.

Vehicles with a beverage certificate have reinforced curtains and side stops on the frame, which make it easier to secure beverage crates as a form-fitting load.



Graphic left:

2 layers of drums should be separated from each other by pallets. Crates or other containers should ideally be connected by film to form compact loading units.



Picture left:

Form-fitting load made of banded drum material.

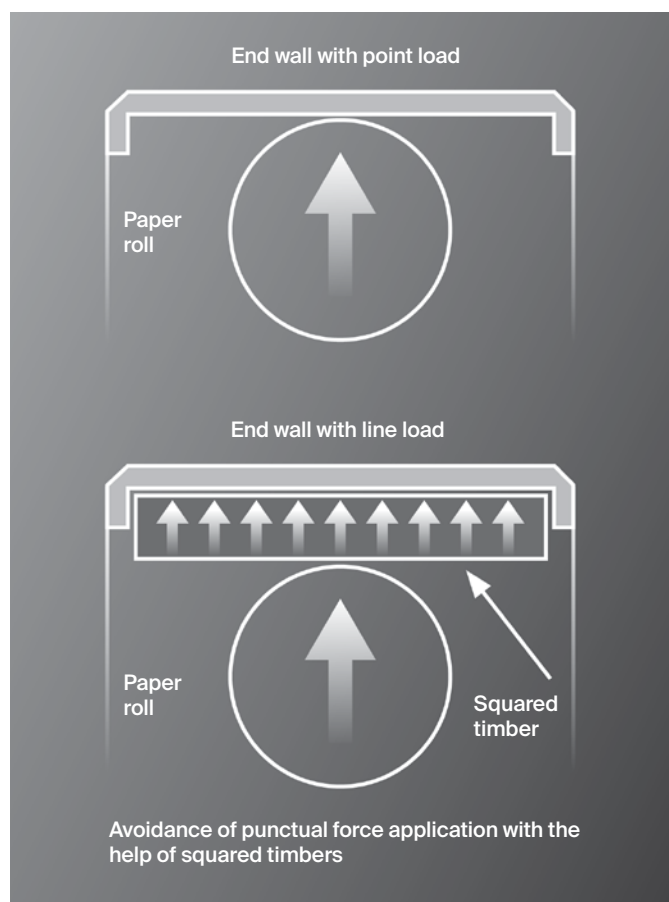
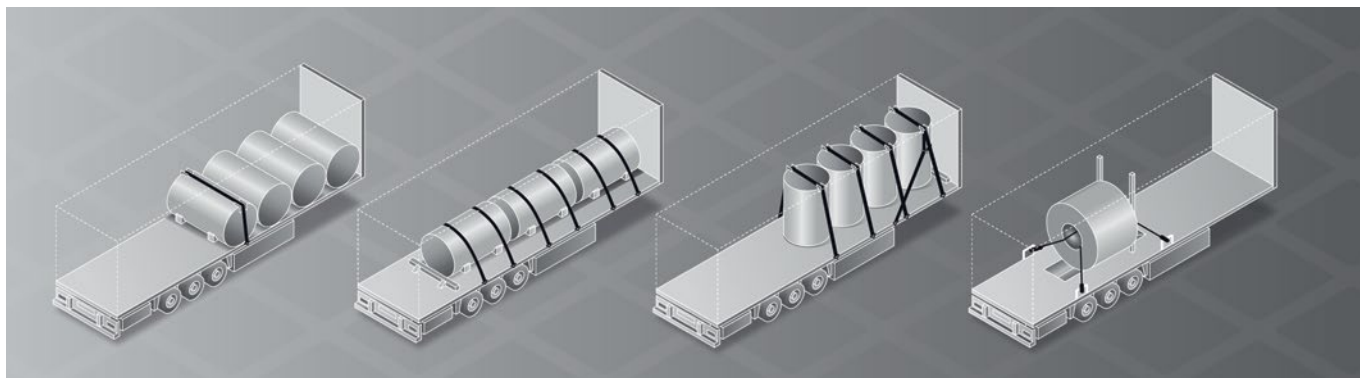
Creating stable loading units for beverage transport

For examples of beverage transport applications, see page 32.

VDI 2700 Sheet 9+19 paper and steel transport

Sheet 9 - Load securing of hard-wound paper rolls

Sheet 9 only deals with the transport of paper rolls on pure road vehicles, without intermodal transport, i.e. loading of trailers onto trains or ships - separate regulations, for example for railways, must be observed for this.



This guideline also refers exclusively to hard-wound paper rolls and does not cover palletised format paper or softwound rolls such as hygiene paper. The coefficients of friction for paper rolls are between $\mu = 0.25$ and 0.4 , depending on the material combination, so that despite the high weight, additional protection must always be provided, at least with anti-slip materials. Only anti-slip material that is approved for transporting paper rolls should be used. This can also be a complete anti-slip floor, for example, which has a sufficiently high coefficient of friction overall. This guideline describes in great detail the conditions for different roller arrangements: Stand-alone castors, straight in combination or offset and horizontally arranged. In the case of horizontal castors, both slipping and rolling must be taken into account.

Sheet 19 - Load securing for coiled steel strip, sheet metal and moulded steel

Due to the very high weights of steel goods on the vehicle chassis, this guideline deals with the subject of load distribution and securing in great detail. Illustrations of principles, tables and calculation formulae for the storage and stability of the load, as well as a list of the definitions of sheet metal and moulded steel with the different commercial forms and packaging, show the complexity in this area. It should always be noted that point or linear application of force to the vehicle must be avoided, and squared lumber may have to be used to distribute the load. The most important load securing aids are stanchions and heavy-duty lashing points with lashing chains.

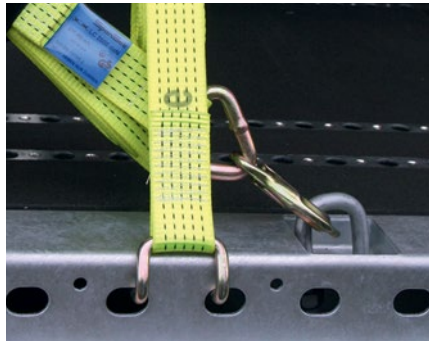
With heavy weights, small details can have a big impact.

For application examples for paper transport, see page 26.
For application examples for coil transport, see page 28.

Lashing equipment and eyelets - the right equipment for every purpose



Various end fittings are possible on the straps. Here is a pointed hook that engages in a retractable lashing eye on the outer frame.



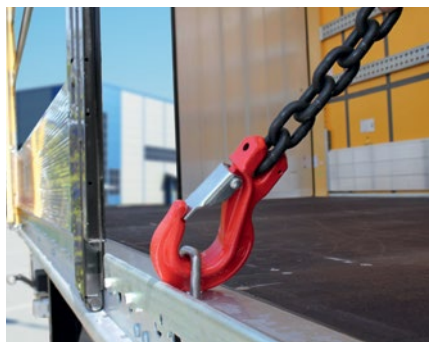
The design of the hooks and lashing eyes or lashing holes must be matched to each other.



The sliding lashing system fitted between the roof bars enables customised load securing. Sliding retainers accommodate load securing straps. This means they can be moved to any position in the load compartment.



Flush with the floor, this allows lashing down of up to 4 tonnes from the surface



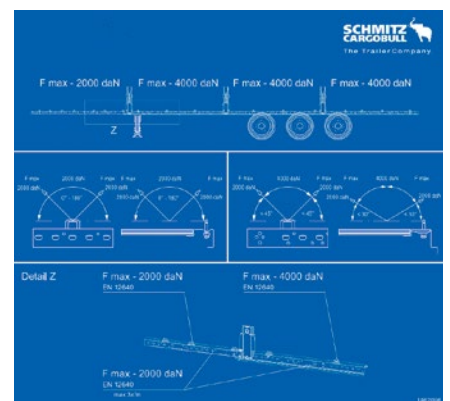
Lashing chains for heavy loads belong on appropriately designed lashing eyes, here a 5-tonne eyelet.



When not in use or loaded, the load securing straps are simply moved or pulled through the retainers under the roof, leaving the load compartment free. This means they can be moved to any position in the load compartment.

Overview of approved lashing equipment according to standard DIN EN 12195:

Lashing equipment	Clamping device	Clamping element	Connecting element
Lashing strap	Webbing	Ratchet Winch Clamp lock	Lashing hook End link Oval link
Lashing chain	Round steel chain	Spindle clamp Turnbuckle Chain hoist	Hook Shackle End link Shortening element
Lashing wire rope	Wire rope	Winch Chain hoist	Hook Shackle End link Combination link



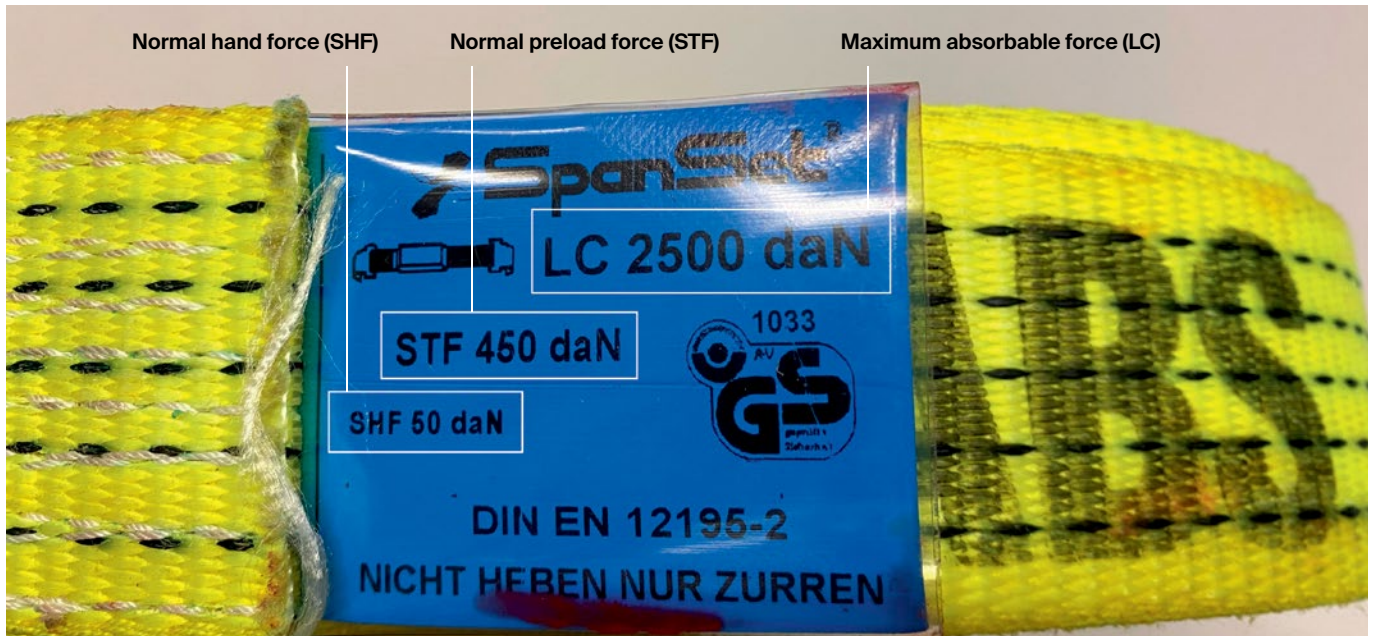
Be sure to observe the **vehicle manufacturer's specifications** regarding the load capacity of the lashing points.

The lashing strap

The lashing strap label provides information about the maximum tensile load and the material used.

Identifying the correct work equipment

The markings on lashing equipment are standardised. There is a label on the straps that provides information about their properties. The load capacity information is given in daN (deca-Newton), which can be equated with kilograms for simplicity's sake (it corresponds to the weight force acting on a mass of 1 kilogram).



Estimate the required number of belts.

When lashing down, the total STF values of all belts should at least correspond to the weight of the load in kilograms. With low coefficients of sliding friction, the required pre-tensioning force can be several times the weight of the load.

Only use valid lashing materials.

All straps must bear a label stating the load capacity and must comply with the standard DIN EN 12195, Part 2, "Lashing straps made of man-made fibres".

An identification code, the date of manufacture, the length of the strap and the maximum elongation are also specified. The colours of the labels (not the webbing) indicate the material:

- Blue = polyester (PES)
- Brown = polypropylene (PP)
- Green = polyamide (PA)
- White = other materials



Hersteller Rückverfolgbarkeitscode

Prüfnummer einer Prüfstelle im BG-Prüfzert

SHF Handkraft

STF Vorspannkraft bei Handkraft maßgeblich für Niederzurren

LC zulässige Zurrkraft maßgeblich für Direktzurren

Kräfte gelten für geraden Zug

Dehnung unter LC in %

Normal manual force (SHF)

This force must be applied to the tensioning device (ratchet) in order to achieve the normal pre-tensioning force.

Normal pre-tensioning force (STF)

This force is generated by the tensioning device in the belt, operated by hand only - without any aids such as an extension of the lever. How much of this acts on the load when lashing down depends on the angle at which the belt is tensioned, see page 19.

Maximum load capacity (LC)

This is the maximum value that can be applied to the belt in a straight pull, for example when lashing directly. If the belt is used as a sling, this value is doubled.

Available at anytime

Load securing can only be as good as the condition of the securing equipment.

Handling the lashing equipment

Load securing should be quick. The necessary equipment must be available quickly and in perfect condition. The best place to store it is in a designated area where all lashing equipment is stowed. This also allows the necessary checks to be carried out at any time to sort out worn or damaged equipment.



Ideal for lashing equipment and other load securing materials: storage and pallet boxes in various formats create storage space independent of the loading area.



In addition to tools, the **plastic tool box** also has space for load securing equipment.



EcoPack is the aerodynamically shaped storage box for the Ecogeneration vehicles and optimises fuel savings. The large storage space offers room for pallets, spare wheels, etc.



The **INOX BOX** made of stainless steel is burglar-resistant and protects the contents against unauthorised access.

Practical tips:

Check the surface of the loading floor. Sand contamination can lead to a reduction in frictional resistance. If in doubt: sweep!

Or use a non-slip material such as anti-slip mats.

When lashing down, make sure that you do not damage the load. If the load gives way (cardboard or similar), pretensioning force is also lost.

Distribute lashing equipment evenly over the load to be secured.

Do not use lashing straps above the maximum tensile load.

Do not twist or knot lashing straps.

Never tension lashing straps over sharp edges. Always use edge protection.

Re-tension after a certain journey time.

Avoid lashing angles of less than 30 degrees.

Observe the ban on unauthorised extensions of the ratchet lever.

Check the lashing equipment for wear or damage before each use. Lashing straps without a test plate should not be used.

Securing by force closure

Pressure increases the frictional resistance.

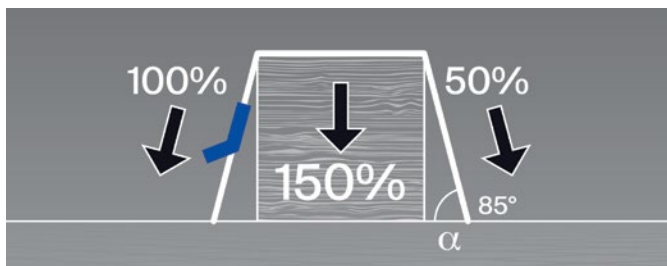


Tie-down lashing - the pre-tensioning force

When lashing down a load, the lashing equipment does not secure it directly, but works by increasing the contact pressure. The load is therefore secured against slipping solely by the frictional force. For example, two lashing straps are placed over a piece of cargo. The straps are hooked into lashing points on the loading area and pre-tensioned with a tensioning element, such as a ratchet.

Increased friction - increased securing

When lashing down a load, the lashing equipment does not secure it directly, but works by increasing the contact pressure. The load is therefore secured against slipping solely by the frictional force. For example, two lashing straps are placed over a piece of cargo. The straps are hooked into lashing points on the loading area and pre-tensioned with a tensioning element, such as a ratchet.



The clamping force generated at the ratchet is only half effective on the opposite side due to the friction at the deflection points of the belt. The resulting contact pressure must therefore be set at 1.5 times the tensioning force, and only if the belt is at an angle of almost 90 degrees.

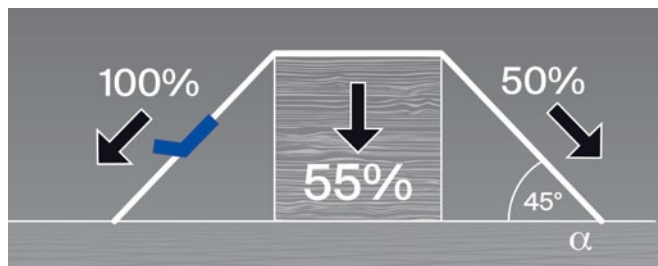
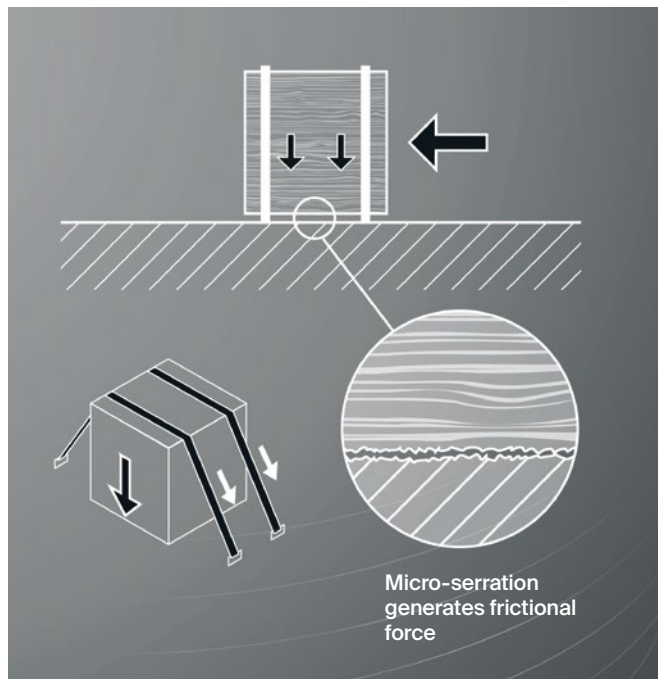
Lashing down at the right angle

Force fit or form fit

There are two basic principles for securing loads: Securing by positive locking and securing by frictional locking. Force-locking load securing is based on intensifying the frictional force between the load and the loading surface. For this purpose, the pressure on the load is increased with the aid of lashing equipment, i.e. the load is pressed more firmly onto the loading surface and thus retains its position. Formfit load securing is based on a limitation of the cargo space, i.e. each piece of cargo lies without a gap against another or against the load space limitation, for example against the front or rear wall, or against the side walls.

When is load securing by tie-down lashing useful?

It is not without reason that securing by tie-down lashing is the most frequently used form of load securing - provided that the necessary pre-tensioning forces can be realised. However, remember that this type of load securing only works with low weights.

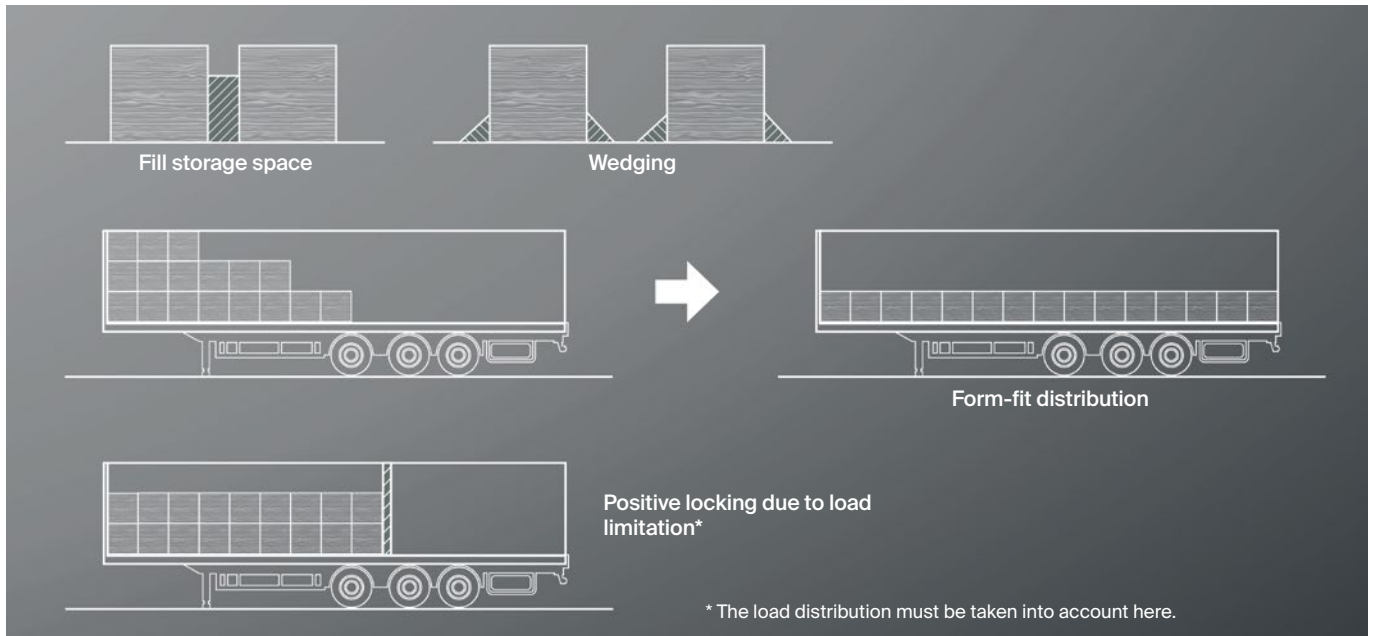


The smaller the lashing angle, the lower the resulting contact pressure. In this example, the clamping force would have to be significantly increased to compensate for the loss.

Secured by positive locking

Blocking the movement of the load through the body

An optimum method of securing the load is to place the load parts tightly against the front wall, rear wall or side walls (pallet stop edge) during loading, without creating gaps between the individual parts. This requires a sufficiently stable construction of the walls.



The individual parts of the load must be stable in themselves, otherwise they would not be able to withstand the forces acting on them - acceleration, braking, cornering. The friction between the load floor and the loading surface must also be sufficient.

Gaps in the load

Gaps between the individual parts can never be completely avoided, but they must not be more than a few centimetres in total, otherwise they are not form-fitting. In this case, the gaps must be filled accordingly or the load must be secured by lashing it down.

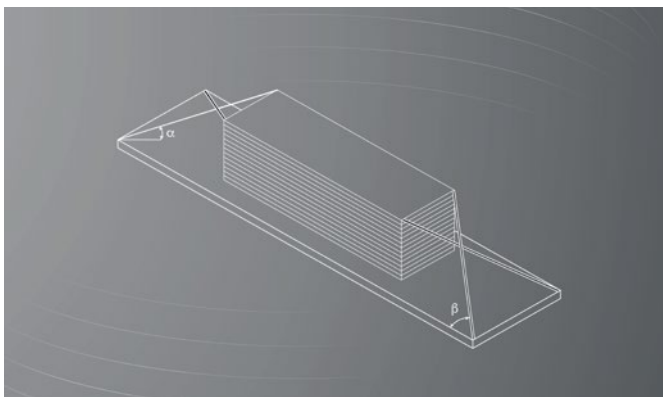
A stable body is the prerequisite for securing the load by positive locking.

SCHMITZ CARGOBULL		EN 12642-XL P (27000 kg)		
Vehicle body in compliance with		(P is the value)		
Loading height up to	200 mm	800 mm	max. height	
Front wall	18000 daN	15000 daN	13500 daN	
Rear wall	---	---	8100 daN	
Side walls	---	10800 daN	10800 daN	
Certificate		Number of laths per section		
XL		2 aluminium / wood		
Beverages		4 aluminium / wood		
Beverages with dropsides		2 aluminium / wood		
Daimler 9.5		4 aluminium / wood		

Only superstructures in accordance with DIN EN 12642 can absorb load securing forces.

The properties of a certified body can be read off the corresponding **stickers**.

Aids for positive locking



When lashing diagonally, the belts absorb forces in all directions.

The right means for every purpose

Each trailer offers different requirements for achieving a tight fit even if the type of load - such as pallets with bagged goods or overpacks that are too weak - does not normally allow this. These aids include, for example, perforated rails in the vehicle floor, recessed rails for pallet rollers (e.g. Joloda), stanchions or crossbeams. Reinforced tarpaulins stabilise the load against forces acting from the side, such as the Schmitz Cargobull SPEED CURTAIN - a tarpaulin with integrated stanchions - or the Schmitz Cargobull POWER CURTAIN - a tarpaulin reinforced with aramid straps and steel wires. The POWER CURTAIN PLUS, with planks inserted vertically into the curtain, offers particular stability against lateral forces - e.g. from tyres or unstructured loads. Of course, it is also possible to block the load using the special trailer structure or straps.

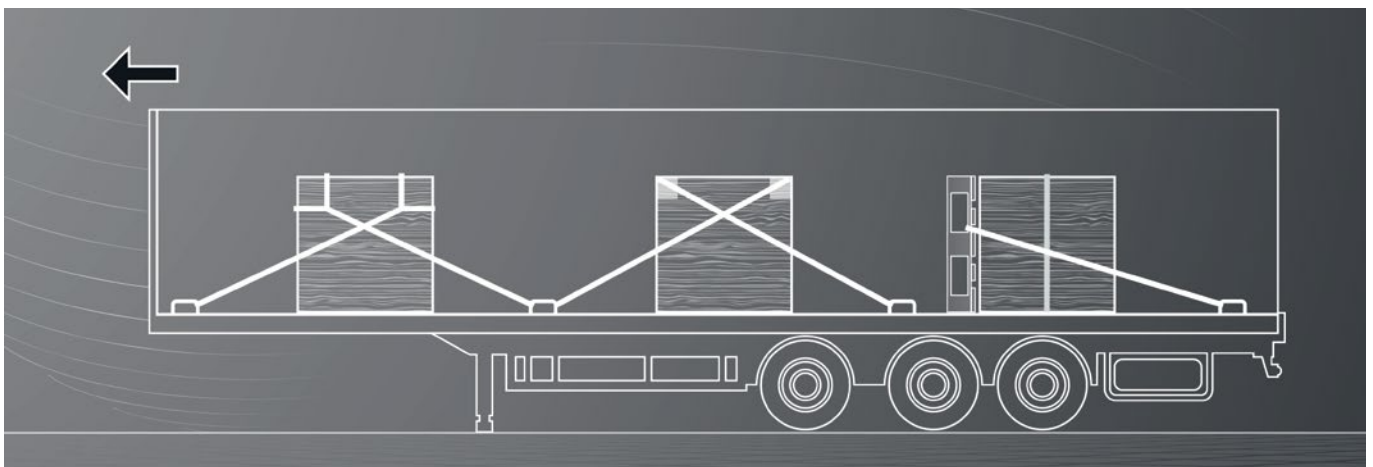
Direct lashing - diagonal, diagonal, with loops

Direct lashing means that the load is held in position directly by the lashing equipment. It is a form-fit securing method that is similar in function to the load space limitation.

With diagonal lashing, at least eight lashing devices, two at each corner of the load, are braced directly to the loading surface at an angle of 90 degrees. Diagonal lashing always requires at least 4 lashings, which are tensioned diagonally (not at right angles) from the corners of the load to the loading surface. This secures the 4 corners of the load.

A combination of these two types of direct lashing is particularly suitable for securing heavy loads. The head sling secures the load to the front. Therefore, the lateral and rearward inertia forces must be counteracted by additional head slings or by lashing down.

Illustration below: Belts must be guided in such a way that they cannot slip down. This is possible by using a head sling, attachment points on the load or even an upright pallet.



Aids for positive locking

The right means for every purpose

When does it make sense to secure the load with a tight fit?

It is generally advisable - if at all possible - to position the load directly on one of the 4 walls of the trailer. Here, the stable vehicle body secures the load, provided that gaps in the load can be avoided.



When does it make sense to secure the load using direct lashing?

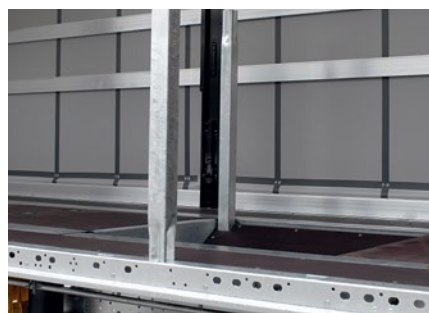
If there are lashing points on the load, it makes sense to secure the load with diagonal lashing. Side slings or a combination of side and end slings are excellent for securing the load against slipping.



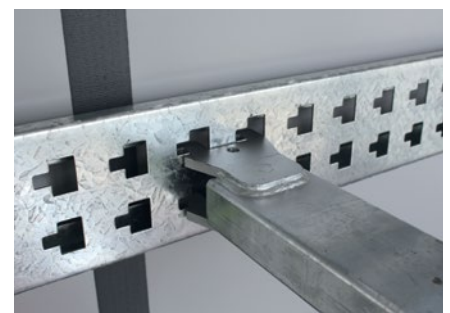
The two curtain systems **SPEED CURTAIN** and **POWER CURTAIN** are particularly effective for form-fit complete loads, as no additional load securing elements are required. For partial loads, tension belts or securing beams are used (see also page 30-31)



For particularly heavy loads such as steel coils, plug-in stanchions with struts can ensure positive locking.



Stanchions that can be inserted into the floor enable form-fit loading despite gaps in the load arrangement, e.g. in the case of partial unloading.



Horizontal load beams can be inserted into perforated stainless steel slats for securing to the front or rear.

Practical tips:

Dangers lurk when opening the rear door. If you do not place an additional crossbar between the door and the load, the load can move towards you.

Partition walls or pallets set up against the direction of force also provide form-fit securing.

Look for the certificate that proves the trailer's superstructure strength for the different levels - Code L, Code XL, beverage transport.

Check whether the body of your trailer can absorb the percentage of the maximum payload as force: Front wall 50 per cent, side wall 40 per cent each, rear wall 30 per cent.

When lashing diagonally, ensure that your load has suitable attachment points.

Combined load securing

The frictional and positive locking

When is combined load securing useful?

When transporting paper rolls, heavy concrete parts, large crates, special components, high goods and similar loads.



Wedges positively secure a paper roll, **lashing straps** increase the contact pressure.



Form-fit secured to the side and to the front and lashed down.



Load secured positively to the front with securing beams and supports, which are secured with **diagonally tensioned belts**.

Die richtige Kombination von Ladungssicherungsmaßnahmen ist nicht nur eine technische, sondern auch eine ökonomische Notwendigkeit.

The simple way

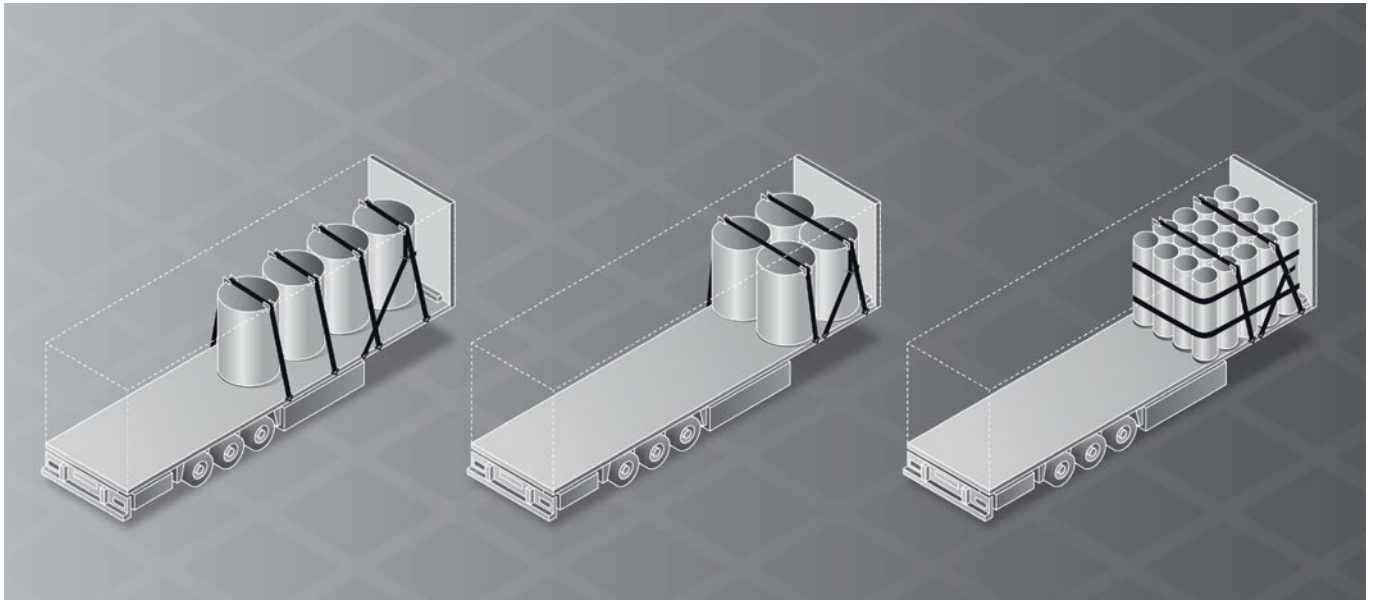
As a rule, the combination of form-fit and force-fit load securing is the simplest and most advantageous method, as the elements of both methods complement each other. The decisive factor is that the time required and labour intensity are low and yet guarantee optimum safety. This also applies in particular to high loads - here the combination of form-fit securing with tie-down lashing is the best method against the risk of tipping. The ideal combinations for practical and intelligent load securing include the joint use of wedges and lashing straps, head slings with tie-down lashings or head slings in conjunction with empty pallets.

When the centre of gravity moves upwards

Securing loads that are not stable

Stability

If the height of the load is significantly greater than its sides or diameter, its stability is not guaranteed or at least impaired. In this case, it may tip over, making additional securing necessary.



Even if a load is lashed down so that it cannot slip, there is a risk of it tipping over.

Tips for practical use:

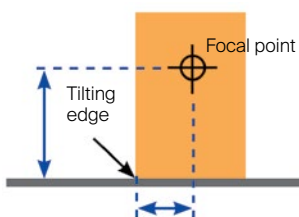
This simple calculation provides a way of estimating the stability:

The distance D (tilting edge to centre of gravity) is divided by the height of the centre of gravity H. If the result is less than the following values, specific measures should be taken to ensure stability.

At least 0.8 (to the front)

At least 0.7 (to the side)

At least 0.5 (to the rear)



Securing against tilting

Once the load has been secured against sliding by means of frictional or positive locking, the second step is to secure it against tipping. The lashing used for this secures the load against tipping with its tensile force, not with the pre-tensioning force. If friction-locking tie-down lashing is used for securing against sliding, this lashing equipment can work against sliding and tipping at the same time.

Bundling

Goods that are not stable and of the same size can be positively locked together with a lashing strap to form a unit. This has a positive effect on the ratio of height to base area. This unit now only needs to be secured in the conventional way, see sketch above.

Special vehicles

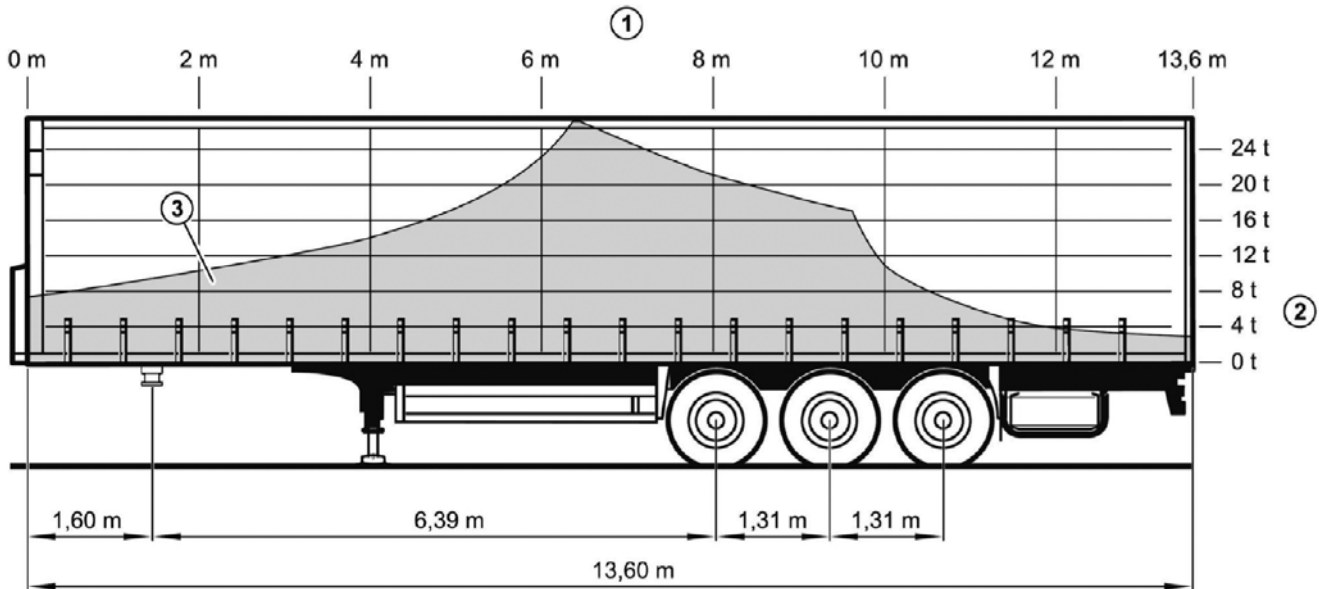
Vehicles specially adapted to the cargo are used to transport unstable loads, such as stacked drinks crates or drums. The reinforced body and devices to ensure positive locking ensure tipping safety. They make the use of lashing straps unnecessary. For beverage crates on well pallets, the lateral tight fit is created with swivelling top slats.

How to load correctly

The load distribution

Stability

All load securing measures are determined by the different types of load. This includes compliance with the German Road Traffic Regulations (StVO). It requires a load distribution that does not impair traffic or operational safety.



Transport can only be safe if the load conforms to the load distribution plan.

Practical tips:

With a fully loaded vehicle, you can achieve even load distribution if a Euro pallet weighs no more than 750 kilograms.

If a heavy load cannot be positioned on the bulkhead due to the load distribution, use the existing insert stanchions or perforated rails for form-fit securing.

Special securing devices such as a head sling also secure a load that is not form-fitted to the bulkhead.

A securing block or an additional partition wall that forms a positive fit at the front is also helpful.

The dangers of incorrect load distribution

If the load is too far back on the trailer, the fifth-wheel pressure on the tractor unit may be too low. This aspect is important for the driving safety of the tractor unit, because if the load on the drive axle is too low, the tyres have less grip. If the load is too far forward, the drive axle may be overloaded, even if the permissible gross weight is not exceeded. Good knowledge of the load distribution plan makes it easier to comply with the legal and technical specifications for axle loads.

Special loads

For special loads with high point loads, such as steel coils, there are precisely defined loading positions with corresponding troughs and supports.

From the operating instructions for curtainsider vehicles:

Commercial vehicles may only be loaded with their maximum permissible payload if the overall centre of gravity of the load is in a very specific area. However, even loads below the maximum payload may only be positioned in certain areas of the loading area. Otherwise there is a risk of exceeding or falling short of the axle load.

If the overall centre of gravity of the load is within this range, the so-called load distribution curve, it is ensured that the axle loads are adhered to. Using the load distribution curve, you can see from the load distribution plan at what distance from the front wall the semi-trailer may be loaded and with what load.

Paper transport

High point loads

The measures presented so far are an indication of the most important aspects of load securing. In practice, of course, each individual case must be considered separately. For example, there are many special transport operations for which specific standards have now been developed. Some of these solutions are shown here.



Horizontal paper roll lengthways to the direction of travel. Lashed down with 2 belts and secured at the front with securing wedges



Additional securing of the paper roll to the front and rear.



Joloda rails with perforated grid and sturdy aluminium covers are easy to clean and make handling and securing the load easier.

Aids in paper transport

Transporting hard-wound paper rolls

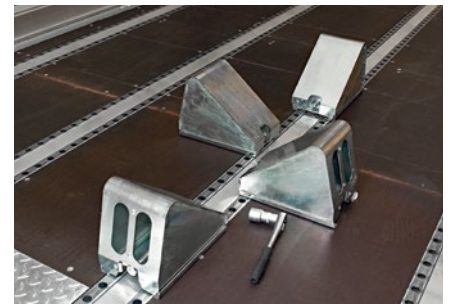
Wedges are important aids for securing horizontal paper rolls to prevent them from rolling away. All support surfaces must be fitted with anti-slip mats specially designed for transporting paper. The tipping over of standing paper rolls can be prevented by direct lashing with a so-called head lashing.



Paper roll transport with positive and non-positive locking.
The head flap of the upright roll also secures against tipping.



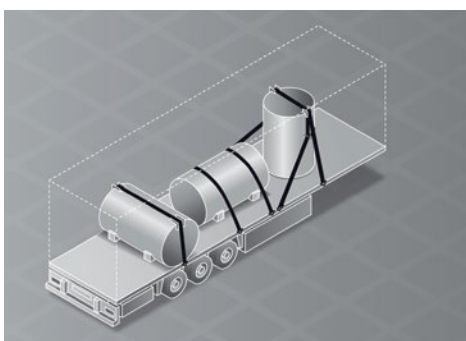
Positive locking of the castor
using special wedges in conjunction with anti-slip mats.



Safety wedges
can be inserted into the perforated rails in 4 directions and positioned precisely.



Storage boxes
- here integrated into the front wall - ensure that the necessary parts are available at all times.



The weight-optimised metal wedges
secure rolls lying at a 90-degree angle lengthways or crossways to the direction of travel. Stationary castors are lashed down.

Coil transport

Heavy point loading on the chassis

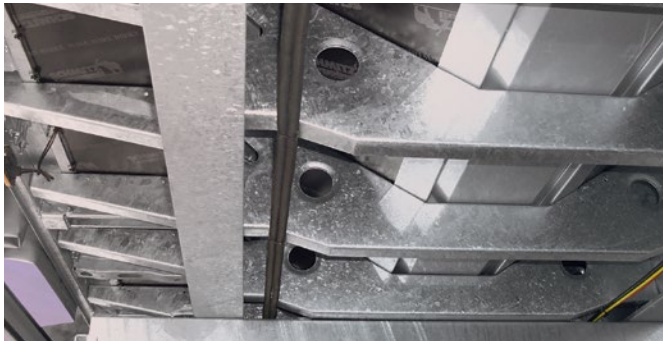
The transport of heavy steel coils is not feasible without special trailer equipment. First and foremost, the chassis must be designed for the high point load. A recessed trough then automatically defines the correct position for loading.



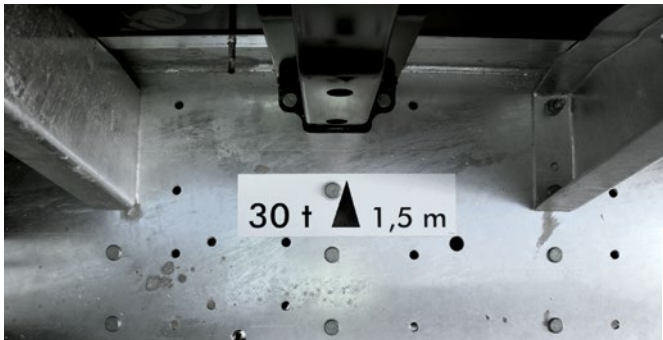
Form-fit securing of a steel coil
by means of a special trough, plug-in stanchions
and chains anchored in heavy-duty lashing eyes.

Even at first glance, all other measures are larger than the
standard load securing equipment: plug-in stanchions in the
body, tensioning chains and heavy-duty lashing eyes.

Steel and coil transport



Chassis with integrated coil trough.



Marking of the load centre of gravity on the longitudinal member.

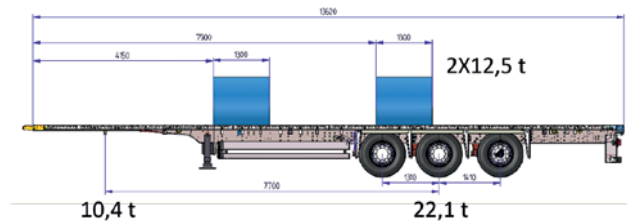
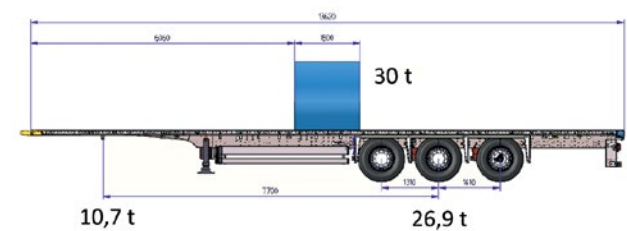
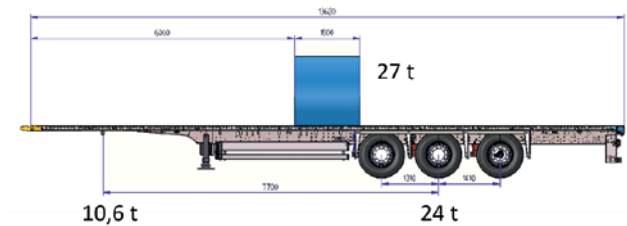
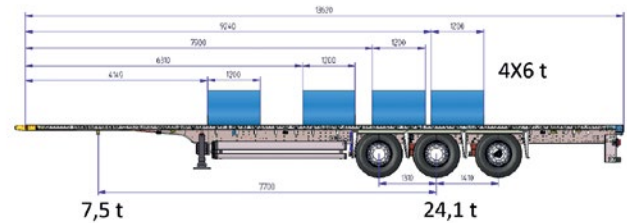
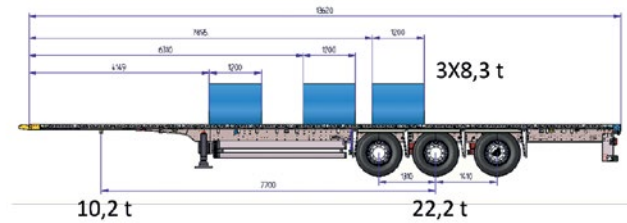


For transporting profiles and bar material: additional stanchions and steel support slats with horizontal beams.

Transport with special equipment

The necessary design details for coil transport cannot always be retrofitted. These are special vehicles that are configured accordingly ex works. It should be noted that the geometry of the coil trough must be compatible with the dimensions of the load.

Moulded steel such as sheets and profiles can also be secured with the standard securing devices for general cargo, provided that load units are created by strapping with steel straps - ideally on pallets.



The correct position of the coils on the trailer is crucial for safe transport. The manufacturer's specifications must be observed.

Fast load securing

With SPEED CURTAIN and POWER CURTAIN

To simplify load securing and accelerate the handling speed for form-fit loads, Schmitz Cargobull offers special curtain systems with SPEED CURTAIN and POWER CURTAIN with certified body strength in accordance with DIN EN 12642 Code XL with beverage certificate and DL guideline 9.5.



Vertical supports, which are anchored in the floor and roof, can be freely positioned to secure the pallet cages and pallets in the SPEED CURTAIN body in a form-fit manner.

DL Directive 9.5, making both systems a fully-fledged replacement for conventional curtainsider trailers. SPEED CURTAIN and POWER CURTAIN, which can dispense with the slats in the body, offer fast access to the freight and shorter handling times.



POWER CURTAIN: Rear load securing for partial loads with the **integrated tarpaulin loops**. The loops have a securing force of up to 7,500 daN for partial loads (2,500 daN per row).



Positive-locking partial loads are secured in the SPEED CURTAIN with **horizontal securing beams**.



In addition to lashing straps, the form-fit load can also be secured at therear with **tarpaulins or nets** in the POWER CURTAIN.

Tyre transport



Fast load securing with POWER CURTAIN PLUS

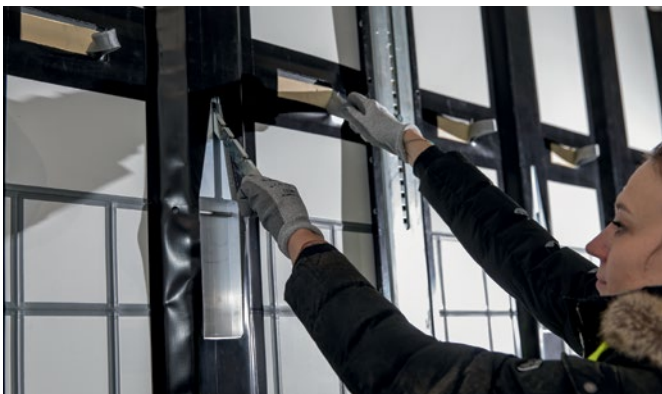
The transport of non-rigid goods and tyres in particular presents a particular challenge for load securing, because forces act on the side surfaces that cannot be met with the DIN EN 12642 Code XL certificates and the extensions for beverages or automotive.



Highly resilient with certification:
guided at the top and braced at the bottom - the vertical support bars made of lightweight hollow chamber metal profiles stabilise the side tarpaulin.



Without additional aids:
Form-fit loading of tyres and other non-dimensionally stable goods.



Fixed at the top: A simple lever mechanism stabilises the supporting bar on the roof profile and the stop bar.

Here, the additionally certified POWER CURTAIN PLUS from Schmitz Cargobull offers a particularly efficient solution that can dispense with additional load securing elements such as slats and diagonally tensioned lashing straps. Supporting bars inserted into the side tarpaulin are wedged at the top and bottom during loading so that the tarpaulin can absorb the lateral forces over its entire surface.



Fixed at the bottom: Slide-out metal profiles utilise the continuous palletstop of the outer frame to keep the supporting bar stable at the bottom.



For certified tyre transport in conventional bodies, the equipment is extended by 6 rows of top slats and 2 rows of steel slats on each side in accordance with the DIN EN 12642 Code XL certificate. This provides strong lateral support. One tensioning strap cross per stanchion bay ensures stability. Additional support is provided by lateral steel slats with a narrow hole pattern. Cross beams suspended here create a form-fit partial load. Quick, effective and simple.

Beverage transport

Bottles and kegs in different sizes

The requirements for beverage transport are high. There are different sizes and containers for bottles and barrels. However, gaps to the loading space limits must be avoided. If you want to load all these variants flexibly, you need to be prepared with the appropriate equipment. In case of doubt, form-fit securing must be supplemented by erecting pallets and lashing down.



Barrelled goods, banded and unbanded, can be transported safely without lashing down if the appropriate equipment is used.



Horizontal load-securing beams limit the load for partial loads. The double slats inserted at the bottom provide a high, lateral stop for palletised freight.



Two pallets can be stacked one on top of the other for banded drums. Two pallets with beverage crates require double-decker equipment on top of each other.

To increase the handling speed in beverage transport, the containers are loaded onto pallets in a form-fit manner. The SPEED CURTAIN and POWER CURTAIN systems from Schmitz Cargobull offer significantly greater convenience and therefore also more speed during loading and unloading, especially for complete loads. No further load securing is required and the stabilised side tarpaulins can hold the freight against lateral forces even without slats and stanchions (in the SPEED CURTAIN).

Beverage transport in crates

Loading without gaps

Vehicles with a body certified to DIN EN 12642 Code XL can absorb all forces through the body. The prerequisite is that the pallets are loaded without gaps. To compensate for gaps, spacer slats and securing systems are used, which are anchored between the roof and floor. Vehicles that also have a beverage certificate offer greater body strength thanks to aluminium and steel slats as well as equipment details that make work easier, such as stop rails and spacer slats for well crates.



Cross beams in front of and behind the load prevent partial loads from sliding lengthways.

Both pictures above:
Slat with hinged spacer for transporting well boxes.



Picture left:
Beverage crates loaded in a form-fitting manner can be transported safely without lashing them down if they are equipped accordingly.

General cargo

Pallet transport

It is important to create a tight fit using suitable aids for the frequently different loads in general cargo transport. Creating load units with standardised dimensions on pallets is one of the most important measures. Stanchions, vertical supports and locking beams that can be freely distributed in the loading area are perfect.



Examples of the use of vertical supports for load securing for pallets and general cargo.

Horizontally inserted top laths provide the lateral form fit for palletised octabins. Locking beams secure in the longitudinal direction.



Example of an easy-to-secure load unit.

Shop on second level

Picture below:

Double-decker systems create a second loading level in the trailer. Diagonal belts on the side and diagonal struts in the roof stabilise the body for the additional loads.

With double-decker system

In order to make optimum use of the cargo space, double-decker systems are used to create a second level for palletised goods. Depending on the design, the load capacity of this second level is up to 6 tonnes or 10 tonnes. The safety stickers on the cross beams provide precise information on the load capacity of the elements. The second level separates the loads from each other and makes it easier to partially unload them if necessary. However, it also means that the load must be secured



Example of a **form-fit load with alternating levels**. The double-decker height can be individually defined between the stanchions in some systems.

in a form-fit manner on each level separately. Cross beams, which can consist of the system's load-bearing beams, are also used for this purpose. The support beams have a stop edge to secure the sides of the pallets. Additional slats provide the necessary safety.



Load securing with **crossbars**



Note on the load capacity on the crossmember

Image right:

Two horizontal aluminium beams - suspended in the black steel slats - support a row of pallets. Additional steel slats with a perforated grid make it possible to secure partial loads with cross beams.



Edge stop of the steel slat for the pallet

Automotive transport

Automotive pallet cages

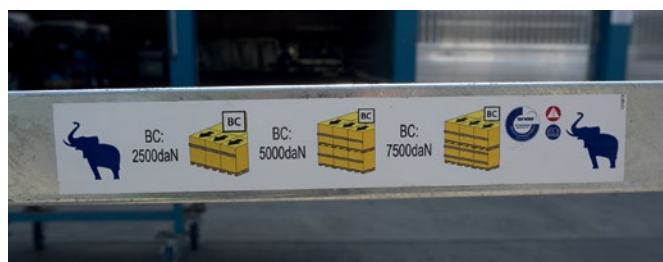
The certificate in accordance with the Daimler 9.5 guideline is used for most automotive transports. It provides for a stop edge on the outer frame, and the use of metal slats instead of wooden slats. This enables the form-fit transport of pallet cages without additional lateral securing measures.



Stacks of three lattice boxes are considered standard. This requires a MEGA vehicle with an interior height of 3 metres. After the loading process, it is therefore extremely important that the body does not exceed the legal maximum height of 4 metres during the journey. Horizontal load securing beams are used to secure form-fitting partial loads for pallet cages and pallets.



Mesh boxes are the standard transport units for automotive transport. The POWER CURTAIN simplifies load securing here too. Partial loads are secured with lashing straps.



In conventional bodies, aluminium beams are used to secure the load.

Hazardous and chemical transport

The requirements in the chemical industry

are high and characterised by additional safety regulations. In addition to ADR equipment for the transport of hazardous goods, the means of securing loads should be up to date. An anti-slip floor and a flexible load securing system are the best prerequisites for safely transporting a wide variety of loads.



Steel slats with a close-meshed grid for attaching crossbars and belts allow any desired division. Aluminium slats can be used to form a stable side wall.

The following also applies to the transport of hazardous goods: the load must be positively secured, i.e. it must be loaded in such a way that it can no longer move, regardless of whether an emergency stop or a sudden evasive manoeuvre takes place. Furthermore, the load as such must be dimensionally stable and resistant to tipping.



Octabin
Some loads are not suitable for lashing down because the packaging would not withstand the pressure. In the case of octabins, for example, form-fit securing must be realised on all sides.



Form-fit securing for flexible big bags:
lower side slat made of aluminium and tarpaulin with lashing straps.

Sustainable transport solutions from Schmitz Cargobull

The new transport solutions from Schmitz Cargobull are sustainable, resource-saving and efficient, enabling us to respond to the challenges of the future. However, the previous principles for proper load securing remain in place and the measures shown here can still be applied directly. Handling remains familiar and simple.



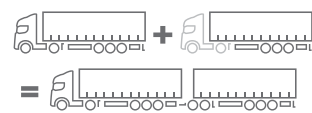
For the EcoFLEX and EcoVARIOS models, the full loading height at the rear can be quickly and easily created for volume transport if required.

The EcoDuo combines two standard trailers and deliberately avoids exotic special solutions. This means that the freight can be secured in each individual trailer as before.



With the EcoGeneration, all equipment options are available, especially for load securing, and the POWER CURTAIN can also be used for simplified load securing of palletised goods. Familiar technologies are used to lower the roof, which are otherwise used to adjust the height of high-volume vehicles or to raise the roof on one side during loading.

Reduce CO2 with the EcoGeneration S.CS curtainsider semi-trailers.
The aerodynamic rear of the three curtainsider semi-trailers EcoFLEX, EcoVARIOS and EcoFIX reduces the air resistance of the entire trailer combination and saves up to 10% fuel and CO2 in practical use. This applies in particular to use on motorways and long distances.



EcoDuo - the concept for 25% CO2 savings

Two regular standard semitrailers are combined with a dolly unit to form an articulated lorry. This unit is pulled by a tractor unit with a total weight of up to 70 tonnes. This concept is suitable for long distances and motorways and saves fuel, working time and resources for a second tractor unit.



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