



Content

1. Loading methods	3
2. Tight-fitting cargo against the headboard.....	5
3. Loose-fitting cargo against the headboard.....	6
4. Divided packages	
4.1 Tight-fitting package 1 against the headboard	7
4.2 Loose-fitting package 2	8
5. Tight fit with stanchions - Bottom package.....	9
6. Loading with loose fit.....	10
7. Responsibilities of the driver	11
8. Responsibilities of the vehicle owner.....	12

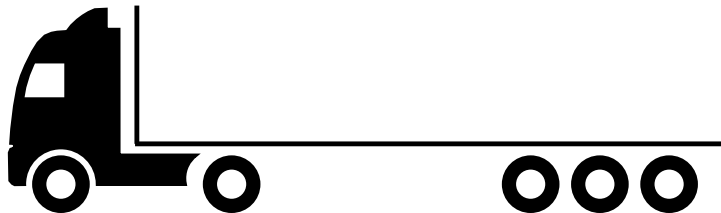
1. Loading methods

Note: For all calculations and indications, e.g. regarding the required lashing means, it is assumed that the loading weight does not exceed 25,000 kg. Specific trials have led to the conclusion that the loading of sawn wood packages with a loading weight of 25,000 kg can only be carried out securely and effectively when anti-skid mats are deployed:

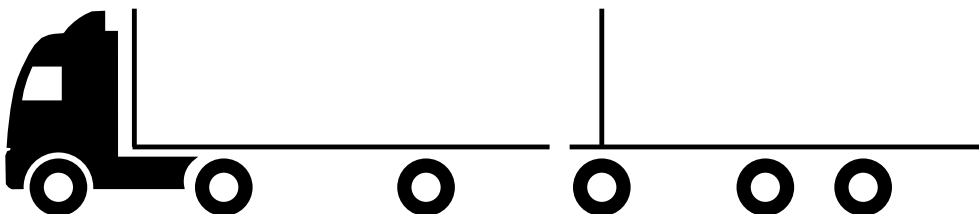
When using anti-skid mats (material pairing of wood on wood = 0.4), the assumed friction coefficient is increased to 0.6. Due to this higher coefficient of kinetic friction the number of required lashings can be significantly reduced.

Assuming that the freight vehicles are equipped with lashing systems that have an STF value of STF 350 to 500 daN per lashing strap, the correct and safe securing of the cargo can only be ensured when the friction coefficient is 0.6. Consequentially, the increased friction acts as a securing force and reduces the number of required lashing straps. The reduced number of lashings ensures that the loading and securing of the cargo is carried out within an acceptable time frame.

It is assumed that the transport vehicle consists of a articulated truck with 2 axles and a standard trailer with 3 axles with a loading space length of 13.60 m.



The same values can be assumed when wood packages are loaded on an articulated truck consisting of a tractor unit with 2 axles and a trailer with 3 axles. The only difference is the headboard stability as this combination has 2 headboards (1x on the machine wagon and 1x on the trailer).



The following illustrates how many lashings are required. The sketches represent the respective loading methods.

An angle (loading goods - vehicle body) 90° can always be assumed. Only for rider packages the angle is ca. 45°. This has been taken into account when calculating the number of lashings. Calculations for the sides and the back are not required since a friction coefficient of 0.6 can be assumed due to the deployment of anti-skid mats. The coefficient is higher than the required value of 0.5 according to VDI [Association of German Engineers].

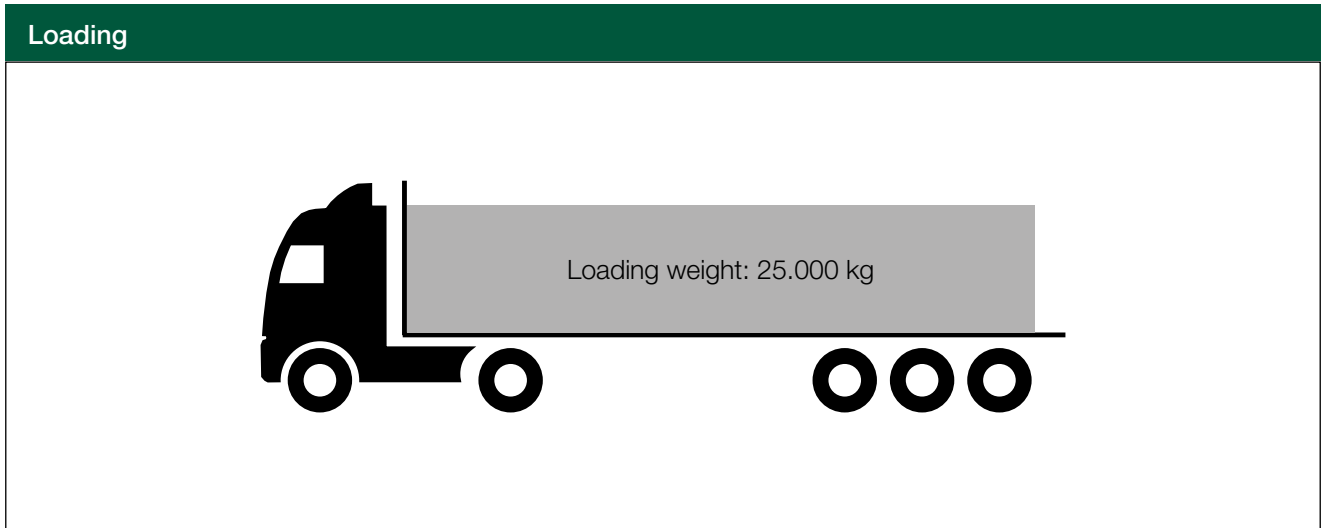
Nonetheless, lashings must be attached to the sides and towards the back as a tight fit against the side walls and the tailgate cannot always be ensured; a tight fit against the loading space walls is not always possible, and therefore it must be ensured that the cargo does not slide across the loading surface. This method is referred to as fixation. Additionally, the stability of the side walls and the tailgate must be examined when tight-fitting cargo is loaded. These walls can have varying sizes or may not even exist in some cases. This primarily depends on the build type (e.g. certificate according to EN 12642). In order to ensure a simple loading process it was determined by the forwarder and shipping agent (Binderholz Oberrot | Baruth GmbH) to forgo the examination and inquiry into the stability of the superstructures.

Driving tests were conducted, and it was determined that the following methods are both safe as well as economically reasonable.

Note on using the following tables

The number in the lower part of the table is the amount of necessary straps. Please differentiate according to STF value. The value is written on the blue label of the lashing strap. The lowest value is to be assumed if this indication is missing. The max value would then be STF 350 daN even when dealing with a long-lever ratchet. You may only calculate the factor 2 if you are using corner protectors. The general conditions for the lashing-down method must be observed.

2. Tight-fitting cargo against the headboard

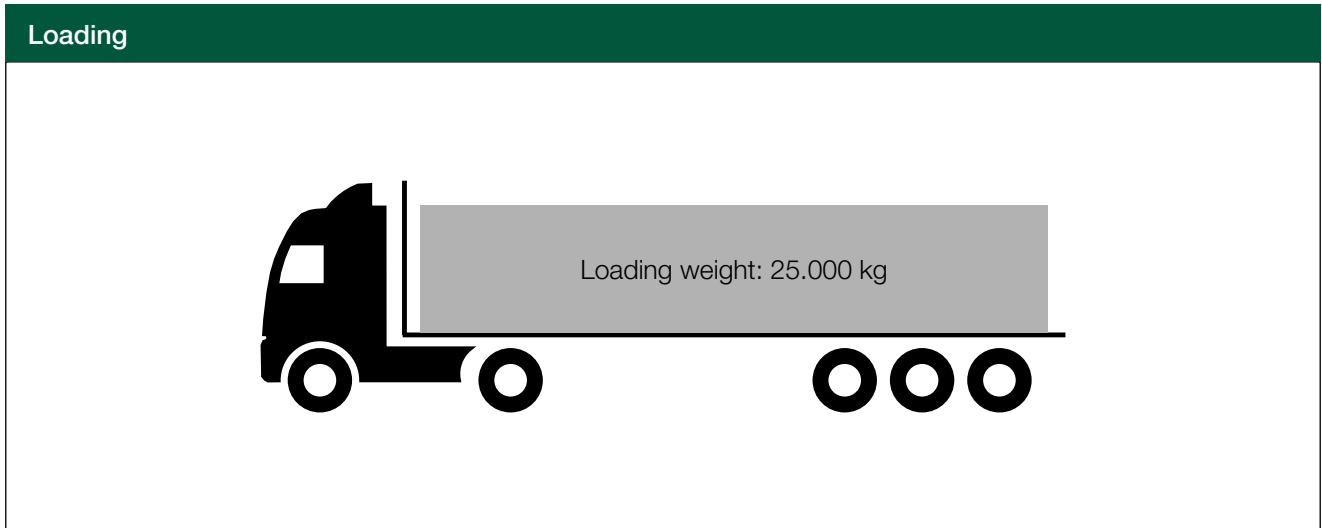


Conditions
<ul style="list-style-type: none"> • tight-fitting • with anti-skid mats • without corner protection (K factor 1.5) • with corner protection (K factor 2.0) • lashing strap with STF 500 daN • lashing strap with STF 350 daN

Comments
<p>(Theoretically) no other cargo securing measure is required on account of the tight fit against the headboard (5000 daN) and the friction force of 0.6 towards the front. However, the cargo must be secured to the sides. It is therefore determined that 1 lashing strap is to be attached per loading meter, alternatively 1 strap at each lashing point and at least 10 lashing straps. The STF designation (fixation) is irrelevant in this regard.</p>

Number of lashing straps			
STF 350	STF 350	STF 500	STF 500
Factor 1,5 = 525 daN	Factor 2 = 700 daN	Factor 1,5	Factor 2
Preload force in STF	Preload force in STF		
> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter

3. Loose fitting cargo against the headboard

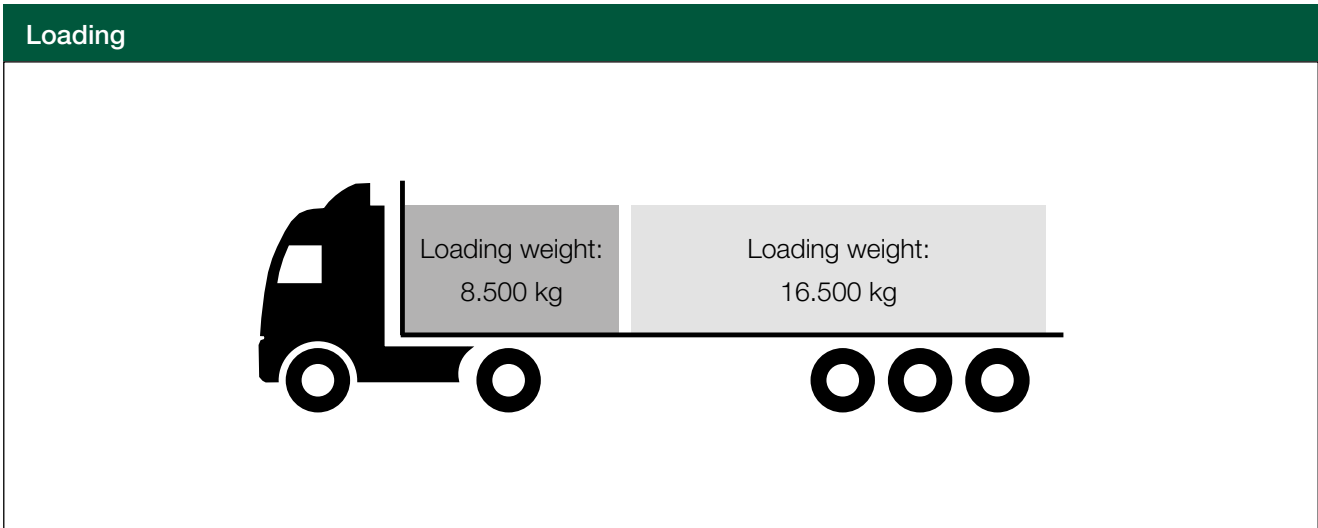


Conditions
<ul style="list-style-type: none"> • loose-fitting • with anti-skid mats • without corner protection (K factor 1.5) • with corner protection (K factor 2.0) • lashing strap with STF 500 daN • lashing strap with STF 350 daN

Comments

Number of lashing straps			
STF 350	STF 350	STF 500	STF 500
Factor 1,5	Factor 2	Factor 1,5	Factor 2
Preload force in STF	Preload force in STF		
> 16	> 12	> 11	> 8

4.1 Divided packages – Tight-fitting package 1 against the headboard

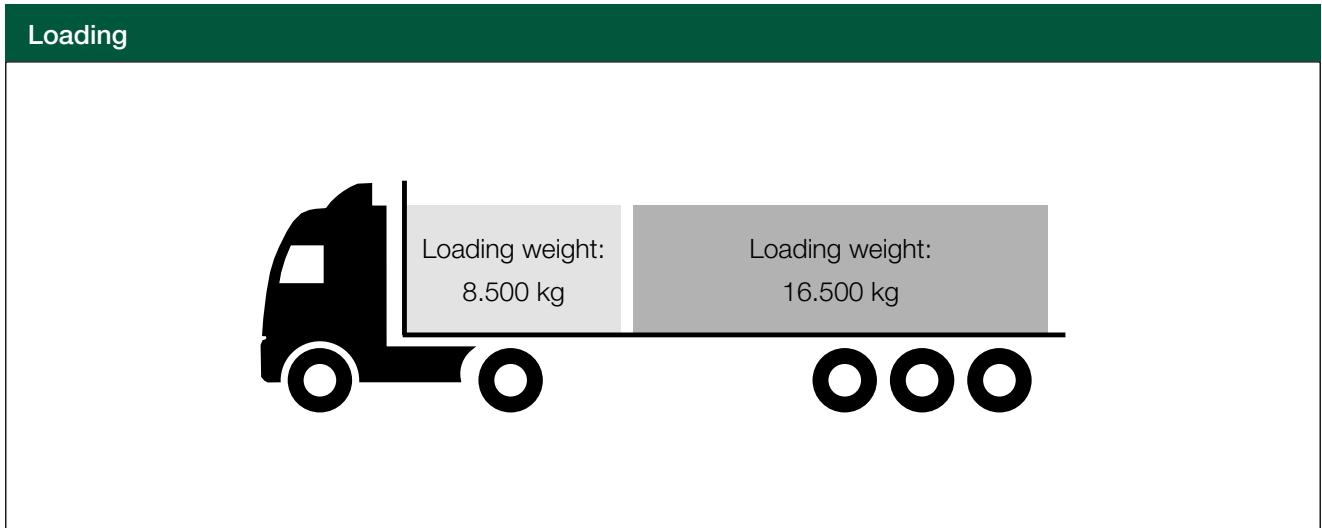


Conditions
<ul style="list-style-type: none"> • tight fit (only applies for the 1st package = 8,500 kg loading weight) • with anti-skid mats • without corner protection (K factor 1.5) • with corner protection (K factor 2.0) • lashing strap with STF 500 daN • lashing strap with STF 350 daN

Comments

Number of lashing straps			
STF 350	STF 350	STF 500	STF 500
Factor 1,5 = 525 daN	Factor 2 = 700 daN	Factor 1,5	Factor 2
Preload force in STF	Preload force in STF		
> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter

4.2 Divided packages – Loose-fitting package 2

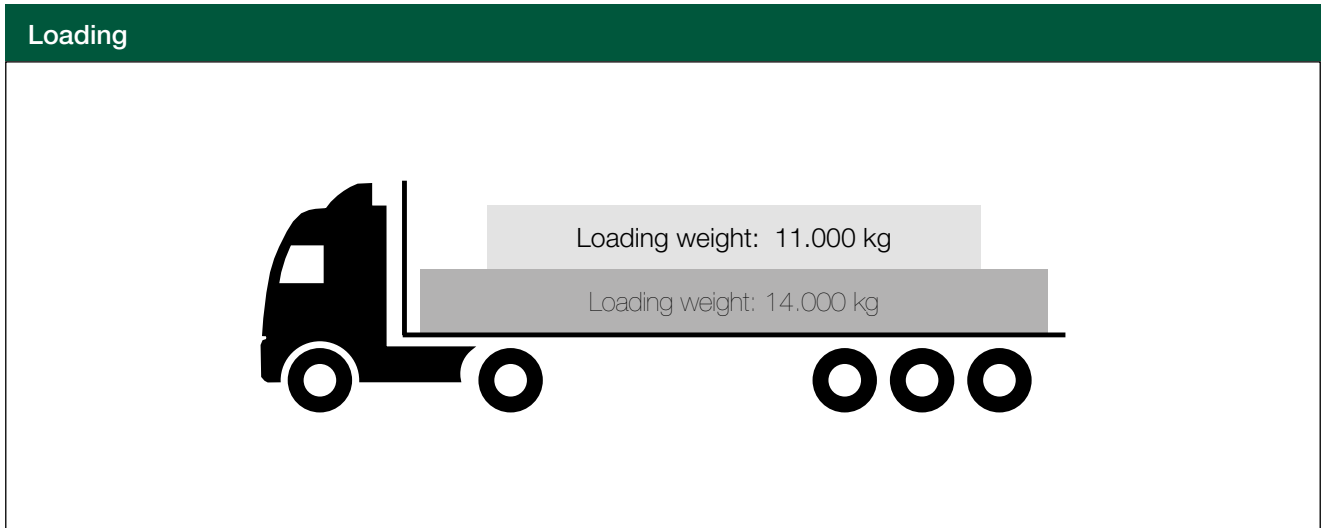


Conditions
<ul style="list-style-type: none"> • with loose fit (only applies to the 2nd package = 16,500 kg loading weight) • with anti-skid mats • without corner protection (K factor 1.5) • with corner protection (K factor 2.0) • lashing strap with STF 500 daN • lashing strap with STF 350 daN

Comments

Number of lashing straps			
STF 350	STF 350	STF 500	STF 500
Factor 1,5 = 525 daN	Factor 2 = 700 daN	Factor 1,5	Factor 2
Preload force in STF	Preload force in STF		
> 8	> 6	> 6	> 4

5. Tight fit with stanchions - Bottom package

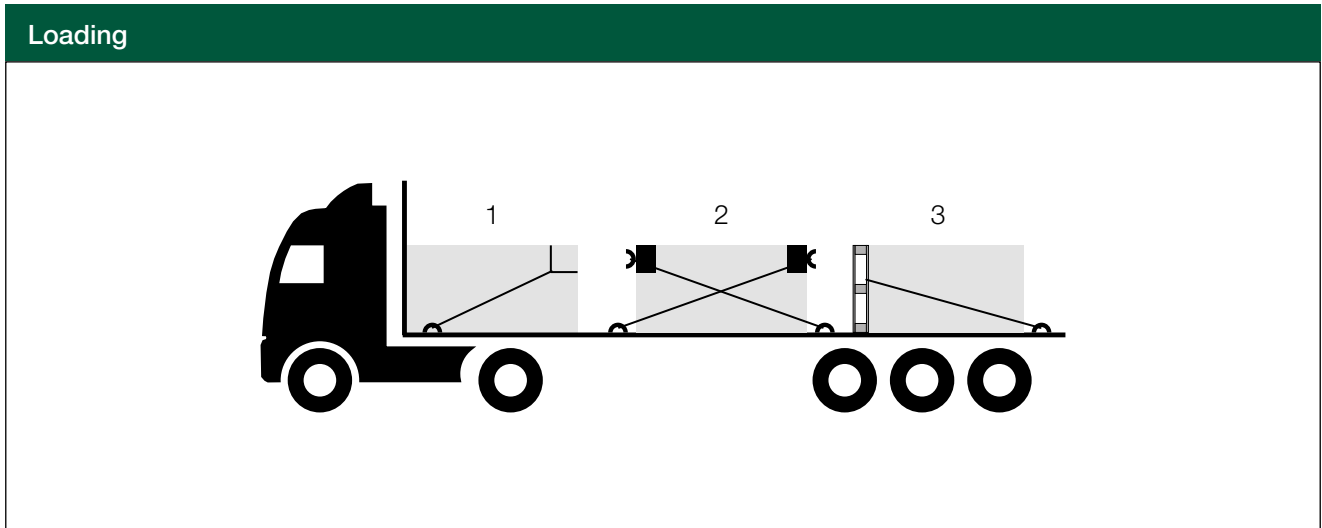


Conditions
<ul style="list-style-type: none"> • with anti-skid mats • without corner protection (K factor 1.5) • with corner protection (K factor 2.0) • lashing strap with STF 500 daN • lashing strap with STF 350 daN

Comments
<p>Comments regarding stanchions (stability of 4000 daN assumed): The stanchions grip the entire cargo.</p>

Number of lashing straps			
STF 350	STF 350	STF 500	STF 500
Factor 1,5 = 525 daN	Factor 2 = 700 daN	Factor 1,5	Factor 2
Preload force in STF	Preload force in STF		
> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter	> 1 strap per loading meter

6. Loading with loose fit



Conditions

- Package 1: with hoisting sling
- Package 2: with edge angles
- Package 3: with pallet

Comments

- The cargo above must be additionally secured to the side and towards the back!
- The strap of the head sling must always be held in position!
- The head sling secures the cargo against backward or forward movement. Since this is much more effective than lashing down fewer lashing straps are required to secure the cargo.

7. Responsibilities of the driver

The driver is the person who usually implements the cargo securing measures. However, he is also the first contact person for the police or other regulatory bodies when a load has been secured insufficiently or when an accident occurs on account of insufficiently secured cargo. His responsibilities for properly securing cargo are regulated in §§ 22 and 23 of the StVO [Traffic Regulations].

The Higher Regional Court Koblenz in its decision from September 6, 1991 has decreed that the driver must generally observe the guideline VDI 2700 as an „objectified expert report“. This means that the driver must secure the cargo on the basis of the guideline VDI 2700. Consequentially, the driver is required to familiarize himself with the accepted and practiced cargo securing measures.

Three obligations of the driver are additionally derived from the legal ruling:

- The obligation to inspect the securing of the cargo and load distribution before commencing the transport.
- The obligation to inspect and subsequently fix the securing of the cargo during transport.
- The obligation to adapt one's driving behavior to the cargo.

According to § 23 of the StVO the driver is also obligated to check the securing of the cargo when the vehicle has been loaded by another person. In case of inadequate storage, he must decline the transport.

Possible legal consequences for the driver (public law)

1. Routine traffic check:

- Continued transport is forbidden until the cargo has been secured properly.
- Traffic violation report including a fine and penalty points in Flensburg.

2. Traffic accident due to insufficiently secured cargo:

In case of mere material damage: Traffic violation report with fine and penalty points in Flensburg.

If persons are injured or killed: Criminal charge with fine or prison sentence.

(Source: Alfred Lampen: Ladungssicherung - Der Leitfaden für die Praxis, [Securing of Cargo - The Practical Guideline], Publisher Günter Hendrich, 2001, p. 9)

8. Responsibility of the vehicle owner

The vehicle owner is responsible for the proper condition and the proper equipping of the vehicle. This also applies to equipping the vehicle with cargo securing means. These obligations arise from §§ 30 and 31 of the StVZO [Road Traffic Licensing Regulation].

The Higher Regional Court Koblenz in its decision from July 18, 1989 has decreed that the owner must generally observe the guideline VDI 2700. This means that the vehicle owner must, among other things, ensure that the vehicle is sufficiently equipped with load securing means so that the driver and possibly the shipper can secure the cargo in accordance with guideline VDI 2700.

Two obligations for the vehicle owner are derived from this:

- Provision and equipping of a suitable vehicle (§§ 30, 31 of the StVZO).
- Deployment of suitable vehicle drivers (§ 31 of the StVZO).

The vehicle owner must provide a vehicle that is suitable for the respective cargo. In addition to this he must also inquire about the transport goods and the proper securing of these goods.

Furthermore, he must inform the driver about the specific dangers of the cargo. He may only deploy drivers who are capable of working independently - and capable of properly securing cargo.

Possible legal consequences for the driver (public law)

1. Routine traffic check:

- Continued transport is forbidden until the cargo has been secured properly.
- Traffic violation report including a fine and penalty points in Flensburg.

2. Traffic accident due to insufficiently secured cargo:

In case of mere material damage:	Traffic violation report with fine and penalty points in Flensburg.
If persons are injured or killed:	Criminal charge with fine or prison sentence.

Source: Alfred Lampen: Ladungssicherung - Der Leitfaden für die Praxis, [Securing of Cargo - The Practical Guideline], Publisher Günter Hendrich, 2001, p. 10)