

## Loading recommendations for paper coils standing upright

### Requirements for vehicle and floor

Depending on the specific cargo, the right vehicle has to be used with a corresponding superstructure and devices for securing the load. The floor must be swept clean and as dry as possible. The load rating of the cargo floor must be sufficient and, as necessary, proven.

### Lashing points for securing the load

Lashing points on vehicles must comply with DIN EN 12640. A sufficient number of lashing points must be available. The lashing points must be laid out in a manner that they can withstand the stress (traction force). The manufacturer's instructions must be followed.

### Displacement of the load, friction force, securing the load

The friction force counteracts any displacement of the load. It depends on the weight force of the load and on the sliding friction coefficient of the material combination, e.g. paper coil and perforated floor plates of the truck:

as per VDI 2700 sheet 9 =  $\mu$  0.3

Standing paper coils are usually loaded with a positive fit up against the front end wall. Lashing straps are also used and lashed down with preload force of at least 500 daN using longhandled ratchets.

Please note that in most cases, the load will not be adequately secured with the sliding friction coefficient stated above of  $\mu$  0.3.

**Please also note** that even when taking account of the load rating of the front end wall with a total positive fit with no gaps, the paper coils still have to be strapped down when using **Regupol® Anti-Slip Mats** even if theoretically no additional securing is necessary. After all, consideration also has to be given to dynamic vertical movements and the risk of the paper coils tipping over.

This loading recommendation is a typical example for the efficacy of **Regupol® Anti-Slip Mats** and the way that their use can reduce the number of necessary lashing straps.



The anti-slip mats must be at least 150 mm wide and 3 mm thick. The length of the mat depends on the diameter of the coils. The anti-slip mats are positioned under the paper coils so that approx. 1 cm of mat can still be seen from the outside.



Example for calculating how to secure a load of upright paper coils without taking account of the load rating of the front end wall.

$$\text{Preload force: } F_T = \frac{(c_x - \mu_D)}{\mu_D \cdot \sin_a} \cdot \frac{F_G}{K}$$

$$c_x = 0,8$$

$$\mu_D = 0,3 \text{ (without anti-slip mat)}$$

$$\sin_a = 1$$

$$F_G = 20.000 \text{ daN}$$

$$K = 1,5$$

$$\text{Preload force: } F_T = \frac{(0,8 - 0,3)}{0,3 \cdot 1} \cdot \frac{20.000}{1,5}$$

$$F_T = 22.213 \text{ daN}$$

For a preload force of 500 daN per lashing strap, altogether **45 lashing straps** are needed here without anti-slip mats.

When anti-slip mats are used to increase the sliding friction coefficient to  $\mu$  0.6, this **reduces the number of lashing straps to 9**.

## Loading recommendations for steel bars and pipes

### Requirements for vehicle and floor

The main methods used for securing cargo are positive fit, blocking, top-over lashing and direct lashing. With positive fit loading (e.g. front end wall, sideboards, etc.), the load-bearing capacity must be ensured. The front end wall should have a load rating of at least 5,000 daN. The floor must be swept clean and as dry as possible.

### Lashing points for securing the load

Lashing points on vehicles must comply with DIN EN 12640. A sufficient number of lashing points must be available. The lashing points must be laid out in a manner that they can withstand the stress (traction force). The manufacturer's instructions must be followed.

### Lashings

The lashings must meet the requirements of DIN EN 12195, part 2. Edge protectors (such as **Regupol® Webbing Protectors**) should be used to protect the lashings and / or the cargo from damage.

### Displacement of the load, friction force, securing the load

The friction force counteracts any displacement of the load. It depends on the weight force of the load and on the sliding friction coefficient of the material combination. In most cases, a sliding friction coefficient of at least  $0.6 \mu$  can be achieved by using **Regupol® Anti-Slip Mats**. Packages of steel bars, for example, can be formed with several bundles. Packages of steel bars or pipes should be secured with a positive fit to prevent them from sliding forwards. This can be done by securing them to the front end wall, spacers or a cross batten (artificial front end wall). Power absorption must be hereby taken into account.

**Important note:** The permitted payload and load distribution must be observed. The lashing should be checked during transport and tightened as needed.

### Correct use of **Regupol®** Anti-Slip Mats

The materials should preferably be placed on **Regupol® Anti-Slip Mats**. The anti-slip mats should be selected based on the surface pressure exerted and the sliding friction coefficient



This loading recommendation is a typical example for using **Regupol® RHM Squared Timbers**.



(at least  $0.6 \mu_0$ ). Overloading the mats may prematurely damage them. In order to counteract this, there are different **Regupol® Anti-Slip Mats** with different maximum loads. The anti-slip mats (and their thickness) should be chosen and used to ensure that the cargo does not come into contact with the load floor (disassociation). Generally, according to sheet 15 of VDI 2700, the mats' size should be chosen to ensure that surface pressure of the load does not deform them by more than 30%. **Regupol® Anti-Slip Mats** should be placed under and between stacked goods to prevent slippage. Squared timber are often used as spacers (e.g. during loading and unloading) when there is more than one package. A **Regupol®** anti-slip mat should be fitted under and over the squared timber to prevent the spacers from slipping. Squared timber must have a rectangular, not squared, cross-section. **Regupol® RHM Squared Timbers** are already fitted with **Regupol® Anti-Slip Mats** to prevent a key cause of accidents (fitting anti-slip mats under and over the squared timber by hand). The packages are to be lashed down in accordance with VDI 2700 guidelines.

## Loading recommendations for coils or slit strips on pallets, free-standing

### Requirements for vehicle and floor

The floor must be swept clean and as dry as possible. The load rating of the cargo floor must be sufficient and, as necessary, proven.

### Lashing points for securing the load

Lashing points on vehicles must comply with DIN EN 12640. A sufficient number of lashing points must be available. The lashing points must be laid out in a manner that they can withstand the stress (traction force). The manufacturer's instructions must be followed.

### Lashings

The lashings must meet the requirements of DIN EN 12195, part 2. The lashings must have an  $S_{TF}$  (standard tension force) of at least 350 daN for top-over lashing. Depending on the weight of the loading units, lashings with long lever ratchets should be used. The lashings must have an LC (lashing capacity) of at least 2,500 daN for diagonal lashing. Edge protectors (such as **Regupol® Webbing Protectors**) should be used to protect the lashings and / or the cargo from damage.

### Displacement of the load, friction force, securing the load

The friction force counteracts any displacement of the load. It depends on the weight force of the load and on the sliding friction coefficient of the material combination. In most cases, a sliding friction coefficient of at least  $0.6 \mu$  can be achieved by using **Regupol® Anti-Slip Mats**. Coils or slit strips on pallets must be suitably packaged for transport in order to secure the loading unit. The stability (risk of tipping or of not tipping) of these loading units should be taken into consideration (see VDI 2700 "Securing of loads on road vehicles"). All loading units should be exclusively on non-slip mats. Loading units should preferably be loaded with a positive fit or up against spacers (load balancing). Depending on the loading unit, the lashings should be secured diagonally and / or top-over. A top loop secures the lashes from falling.

**Important note:** The permitted payload and load distribution must be observed. The lashing should be checked during transport and tightened as needed.

### Correct use of **Regupol®** Anti-Slip Mats

The materials should preferably be placed on **Regupol® Anti-Slip Mats**. The anti-slip mats should be selected based on the surface pressure exerted and the sliding friction coefficient (at least  $0.6 \mu_p$ ). Overloading the mats may prematurely damage them. In order to counteract this, there are different **Regupol® Anti-Slip Mats** with different maximum loads. The anti-slip mats (and their thickness) should be chosen and used to ensure that the cargo does not come into contact with the load floor (disassociation). Generally, according to sheet 15 of VDI 2700, the mats' size should be chosen to ensure that surface pressure of the load does not deform them by more than 30%.

## Loading recommendations for coils or bundles in coil well

### Requirements for vehicle and floor

Vehicles with coil wells should be used for the transport of non-palleted coils and bundles. The floor must be swept clean and as dry as possible. The load rating of the cargo floor must be sufficient and, as necessary, proven.

### Lashing points for securing the load

Lashing points on vehicles must comply with DIN EN 12640. A sufficient number of lashing points must be available. The lashing points must be laid out in a manner that they can withstand a traction force of at least 5,000 daN. The manufacturer's instructions must be followed.

### Lashings

The lashings must meet the requirements of DIN EN 12195, part 2. The lashings must have an  $S_{TF}$  (standard tension force) of at least 350 daN for top-over lashing. The lashings must have an LC (lashing capacity) of at least 2,500 daN for diagonal lashing. Edge protectors (such as **Regupol® Webbing Protectors**) should be used to protect the lashings and / or the cargo from damage.

### Displacement of the load, friction force, securing the load

The friction force counteracts any displacement of the load. It depends on the weight force of the load and on the sliding friction coefficient of the material combination. In most cases, a sliding friction coefficient of at least  $0.6 \mu$  can be achieved by using **Regupol® Anti-Slip Mats**. Coils or slit strips can be loaded separately or in conjunction with the coil well. Coils or bundles should be secured with a positive fit (against two sideboards) to prevent them from sliding forwards. Coils or bundles should be secured to prevent them from rolling out the back or the sides. E.g.: they should be secured with diagonal lashings or blocked backwards with positive fit against sideboards and spacers as well as top-over lashings. Depending on the coils or bundles, a top loop secures the lashes from falling. The materials should be loaded centrally or symmetrically to the longitudinal axis of the vehicle.

**Important note:** The permitted payload and load distribution must be observed. The lashing should be checked during transport and tightened as needed.

### Correct use of **Regupol®** Anti-Slip Mats

The materials should preferably be placed on **Regupol® Anti-Slip Mats**. The anti-slip mats should be selected based on the surface pressure exerted and the sliding friction coefficient (at least  $0.6 \mu_D$ ). Overloading the mats may prematurely damage them. In order to counteract this, there are different **Regupol® Anti-Slip Mats** with different maximum loads. The anti-slip mats (and their thickness) should be chosen and used to ensure that the cargo does not come into contact with the load floor (disassociation). Generally, according to sheet 15 of VDI 2700, the mats' size should be chosen to ensure that surface pressure of the load does not deform them by more than 30%.