

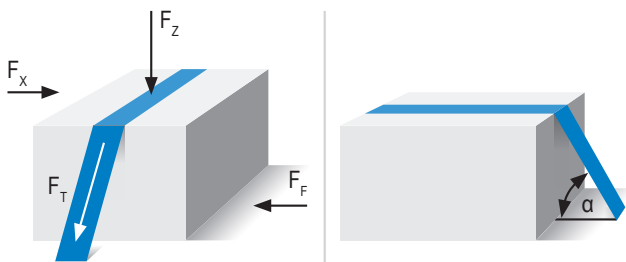
## Load restraint using force locking

The symbols, units and terms used are in compliance with DIN EN 12195:

- $F_{X,Y}$  = Mass force of load towards the front, back and sides
- $F_z$  = Weight (normal force)
- $F_T$  = Tension force lashing device
- $F_F$  = Friction force
- $c_{X,Y}$  = Front, rear or lateral acceleration
- $\mu$  = Friction coefficient
- $\sin \alpha$  = Angle
- STF = Standard tension force lashing strap
- mGVM = Gross vehicle mass

Friction force  $F_F$  can be increased for example by top-over lashing. The load is balanced, meaning the load can not slide if the following applies:

$$\text{Sum } F_F > F_{X,Y} \text{, with sum } F_F = (F_z + F_T) \cdot \mu.$$



Simple calculation of necessary tension force for load securing with top-over-lashing at a 90° angle:

$$\text{Standard tension force } FT = \frac{F_z \cdot (c_{X,Y} - \mu)}{\mu}$$

Calculation for number of straps required:

$$\text{Number of straps} = \frac{F_T}{2 \cdot \text{STF}}$$

**Example:** mGVM 20.000 kg, friction coefficient  $\mu = 0.25$ , load weight 4000 kg, restraint in direction of travel, over-lashing at 90° angle, standard tension force STF = 500 daN:  
 $F_T = 4000 \cdot (0.8 - 0.25) : 0.25 = 8800 \text{ daN}$   
 Number of straps needed =  $8800 \text{ daN} / (2 \cdot 500 \text{ daN}) = 9$

Calculation of necessary tension force for load restraint with top-over lashing at <90° angle ( $\alpha$ ):

$$\text{Number of straps required} = \frac{F_z \cdot (c_{X,Y} - \mu)}{F_T \cdot 2 \cdot \mu \cdot \sin \alpha}$$

**Example:** Friction coefficient  $\mu = 0.25$ , load weight 4000 kg, restraint in direction of travel, over-lashing at 60° angle:

$$11 \text{ Straps} = \frac{4000 \cdot (0.8 - 0.25)}{500 \cdot 2 \cdot 0.25 \cdot \sin 60^\circ}$$

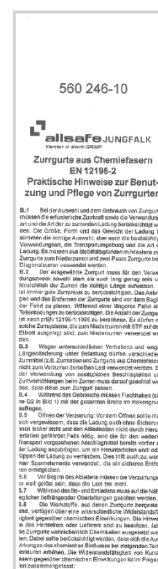
The friction coefficient between load and vehicle floor surface can be increased with force locking. The friction force can be increased with top-over-lashing or equipment that increases friction (e.g. friction mats). With stable loads this should be increased until the load is no longer able to slide, taking accelerating factors into account.

**The standard tension force, not the lashing capacity of the strap, is relevant for the calculation of the number of straps needed!**

To calculate the number of straps required, information about the strap itself and the load is required.

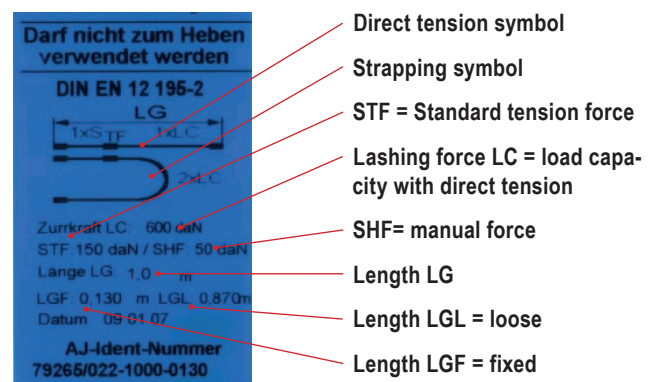
This information can be found on the label.

A standard tension force STF of 500 daN is displayed on the label of the „Ergo long-lever ratchet strap“. To achieve this 500 daN standard tension force (STF) in the ratchet, a manual force (SHF) of 50 daN has to be applied.



In addition to practical instructions, indications of the need to replace components can be found. Potential damage which can occur to the strap can be taken from the label. The strap can be used as long as it does not show signs of the potential damages listed.

To calculate the number of straps required, information about the strap itself and the load is required. This information is always on the label.



Label (blue label)

## ■ ■ ■ Practical examples of friction restraint



### ► Load restraint with straps

When top-over lashing is used, the load is pressed against the floor. The pressure increases the friction force. This prevents the load from sliding.

Top-over-lashing is done with a lashing strap which is stretched over the top of the load. Together with the weight of the load, the lashing strap and the forces it exerts act on the load and the floor. To prevent the load from sliding, the tension forces and the weight of the load have to be coordinated. To increase the friction coefficient, the use of friction mats is recommended.



### ► Ergo long handle ratchets in accordance with DIN EN 12195-2

Product benefits at a glance:

- Easier to use thanks to the ergonomic principle: pulling rather than pushing is easier on the back and delivers more tension with less effort.
- Tensioning force: 500 daN with direct tension, 750 daN with strapping.
- As a comparison, a standard ratchet (e.g. item no. 71056) provides 250 daN with direct tension or 375 daN by strapping.
- The tensioning force increases the friction resistance between the load and platform bed.

## ■ ■ ■ Practical applications of friction/positive locking combined



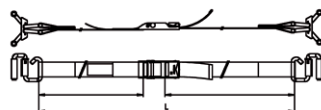
### ► TransSAFE® Net – Load restraint net for individually packaged goods

The new TSN TransSAFE® Net makes restraint of individual goods a breeze. When not in use, a net lift transports the net at the start position under the roof. The net can be stretched quickly and easily over the load from front to back.

The TSN is fixed with a strap that connects the net to the lashing point in the vehicle.

All straps can be handled from the side door or the rear door - awkward climbing around the load space is no longer necessary.

Annoying unraveling of the net is a thing of the past.



### ► TexGrip® – Belt fitting for side walls

Product benefits at a glance:

- Secure fastening for smaller loads on 20 - 30 mm thick side rails, especially suitable for flatbed trucks.
- No anchor points or tracks needed, can be used anywhere.
- Simple handling allows for quick lashing: End fitting provides automatic restraint when locked.
- No damage to board walls thanks to rubber end fittings.
- Load capacity of the strapping 200 daN, length 3.6 m.