Calculating the number of webbing straps required to secure a load for road transport

Introduction

The British Standard BS EN 12195-1:2010 provides an equation to calculate the number of webbing straps required to secure a load for road transport by frictional lashing. This equation assumes that the load is inherently stable and is loaded so that the weight is distributed evenly, as far as is possible, across the width of the load bed. A load that is offset should not be secured by frictional lashing.

Frictional lashing works by increasing the downward force acting on the load. Straps over a low load in the centre of the load bed may be at such a shallow angle that there is minimal downward force; either the height of the load should be raised by using packing, or another securing method used.

The European Standard equation

The equation for calculating the number of lashings required, n, is:

$$n \geq \frac{(c_{x,y} - \mu \times c_z)mg}{2 \times \mu \times sin\alpha \times F_T} \times f$$

At first sight this looks complicated, but many of the values are known.

- If the load is loaded away from the headboard, without blocking, chocks, or an intermediate headboard, then $c_{x,y}$ is 0.8. If it is loaded to the headboard, $c_{x,y}$ is 0.5
- The coefficient of friction, μ, between the load and the load bed can normally be assumed to be 0.2, unless there is metal-to-metal contact, in which case it will be lower. High-friction floor surfaces and friction matting will raise the coefficient of friction
- C_z is 1 for road transport
- The mass of the load, m (in kilograms), is multiplied by g (9.81 m/s^2)
- The angle α is the angle between the strap and the load bed (the α of a vertical strap would be 90°)
- F_T is the tension force of the strap. This is often shown on the strap label, or can be obtained from the manufacturer. It is usually quoted in decaNewtons (daN) and should be multiplied by 10 when used in this equation (no conversion is necessary if it is already quoted in Newtons)
- The final value is the safety factor, f, which is 1.25

These values, put into the equation, should produce the number of straps required to safely secure the load.

If the number of straps appears to be impractical, there are a number of possible reasons:

- The load is not loaded or blocked to the headboard (doing so reduces the number of straps required)
- The coefficient of friction is too low. Friction matting between the load and the load bed may reduce the number of straps required
- The tension force in the strap is too low. Straps with higher tension forces could be used
- The angle of the straps is too shallow. The height of the load can be increased using packing to increase the angle of the straps

If the number of straps required still appears to be impractical, it is likely that webbing straps are not a suitable means of securing for that particular load and an additional or replacement method should be considered.

Example calculation

A load with a mass of 2 tonnes (2000kg) is transported on a flatbed, loaded away from the headboard with no blocking. The coefficient of friction between the load and the load bed is assumed to be 0.2. The angle of the straps relative to the trailer bed is 70°. The tension force of the strap is 350 daN (3500 N).

$$n \geq \frac{(0.8 - 0.2 \times 1)2000 \times 9.81}{2 \times 0.2 \times sin70 \times 3500} \times 1.25$$

$$n \geq \frac{11772}{1315.6} \times 1.25$$

In this case, n = 11 straps.

However, loading the same load to the headboard results in n = 6 straps, and loading to the headboard and using friction matting to raise μ to 0.4 results in n = 2 straps.