ROTHSCHENK

Certificate

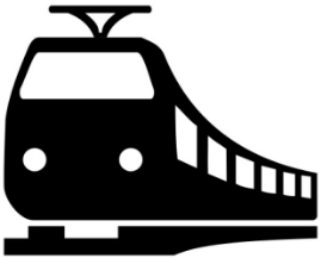
Technical review number: 001/2021
for

X-PAK GLOBAL

Loading calculations for load securing with
Container Lashing System

Rothschenk RedLash

for
Paper Roll Transport up to 24,000 kg / 24 Tons
in a
Standard 40´ ocean dry container



Ocean area A, B, C

The load restraint forces in this certificate are based on the IMO / ILO / UNECE Code of Practice for Packing of Cargo Transport Units as of 2014 and the Load Restraint Guide 2018. The lashing point load capacity in containers built after the year 2000, can be assumed to be 1,500daN (based on the certificate 100/2021 from VTC André Thiele) . The manufacturer of the container can provide information about the actual load values. Since the load capacity of the lashing points in the container can vary depending on the manufacturer, we recommend using the lashing systems based on the G&H GmbH Rothschenk loading instructions. The restraint forces listed in the calculation are based on the acceleration values specified in the Code of Practice in Chapter 5, Table 5.3 and the possible coefficients of friction for different material surfaces. To determine the coefficients of friction that may be applicable to your loads, please refer to the information in the EN 12195-1: 2011-06 table. Vertical movements of the loading units may require additional safety measures to prevent damage to the loading units. When loading, note the maximum payload and the permissible load distributio.

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Loading Instructions:

Safety Instructions:

- Please wear the appropriate protective safety clothing to meet your companies safety requirements.
- The lashing systems should only be used by trained personnel or in accordance with the loading instructions as developed by your supplier.
- The cross straps of the lashing system are under tension. Be aware and avoid injury from the straps and buckles when tensioning or cutting the straps.
- For additional questions please consult your supplier.

Container requirements:

- The container must meet the safety standards as outlined in the CTU-Code.
- The container floor must be undamaged, swept clean and free of oils or grease
- The lashing points in the container must not be bent or damaged in any way.

Load requirements:

- The combined maximum load weight cannot exceed 24,000 kg.

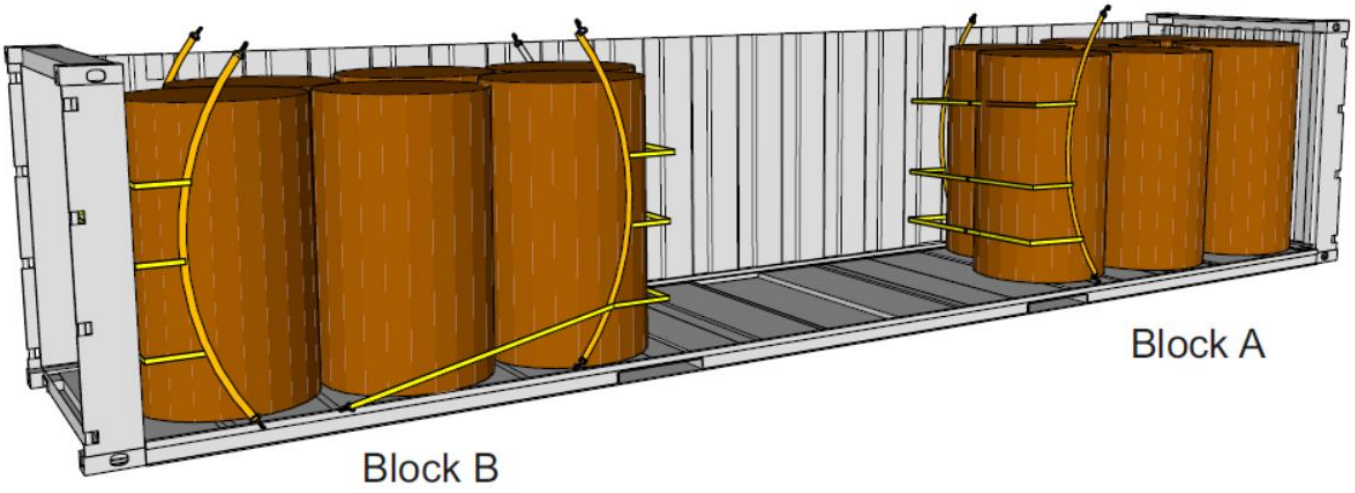
Load instructions:

- All voids between the cargo and the container walls must be filled with an applicable void filler.
- The paper rolls must be placed on rubber anti-slip mats in such a way that the rolls do not have any direct contact to the floor, but only to the mats.
- The hooks on the vertical lashing straps need to be attached to the appropriate container lashing points.
- The paper rolls should be protected with edge protection under the lashing straps to prevent any potential damage to the paper rolls occurring from the pressure of the horizontal straps.

Load Securing Calculation:

Information about the calculation of the load:

- The application of the rubber anti-slip mats calls for using a coefficient of friction of μ = 0,6.
- Basis of calculation:
  - IMO / ILO / UNECE Code of Practice for Packing of Cargo Transport Units as of 2014
  - Australian Load Restraint Guide 2018
  - Maximum load weight: 24,000 kg x 9,81 = F_G= 23,554 daN
  - Divided into two blocks of 12,000 kg each (hereinafter referred to as block A and B)
  - Friction coefficient: μ=0,6
  - Container P= 28.000 kg: End walls F_B = 11,200 daN / Side walls F_B = 16,800 daN
  - Deceleration forces: 1 x Container Lashing: F_B = 9,000 daN
  - Acceleration forces: 1 x Container Lashing: F_B = 6,000 daN
  - Acceleration coefficients:
  - Road transport: c_x = 0,8 / c_y = 0,5 / (c_z = 0,8 for 0,2 G upward movement)
  - Rail transport: c_x = 0,5 / c_y = 0,5 / (c_z = 0,7 for 0,3 G upward movement)
  - Ocean transport: c_x = 0,4 / c_y = 0,8 / (c_z = 0,2 for 0,8 G upward movement)



Road Transport:

Block A:

Restraint for forward direction incl. 0,2 G upward movement.

$c_x = 0,8$ $\mu = 0,6$ $F_G = 23,554$ daN $c_z = 0,8$
Container P= 28.000 kg: end wall / door $F_B = 11,200$ daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 11,772$ daN x $(0,8 – 0,6 \times 0,8)$ $F_{G\,max} = 3,767$ daN

The restraining force of the container wall is sufficient (11,200 daN – 3,767 daN).

Restraint for rearward direction incl. 0,2 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,5 – 0,6 \cdot 0,8)} \qquad F_{G\,max} = 300,000 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 300,000 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Block B:

Restraint for forward direction incl. 0,2 G upward movement.

$c_x = 0,8$ $\mu = 0,6$ F_B Lashing = 9,000 daN $F_G = 11,772$ daN $c_z = 0,8$

Restraint for forward direction incl. 0,2 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{9.000}{(0,8 – 0,6 \cdot 0,8)} \qquad F_{G\,max} = 28,125 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 9,000$ daN, the load force resulting from the load weight may not exceed 28,125 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for rearward direction incl. 0,2 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,5 – 0,6 \cdot 0,8)} \qquad F_{G\,max} = 300,000 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 300,000 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for side movement incl. 0,2 upward movement

$c_x = 0,5$ $\mu = 0,6$ $F_G = 23,554$ daN $c_z = 0,8$
Container P= 28.000 kg: Side walls $F_B = 16,800$ daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 23,554$ daN x $(0,5 – 0,6 \times 0,8)$ $F_{G\,max} = 2,355$ daN

The restraining force of the container wall is sufficient (16,800 daN – 2,355 daN

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Rail Transport:

Block A:

Restraint for forward direction incl. 0,3 G upward movement.

$c_x = 0,5$ $\mu = 0,6$ $F_G = 11,772$ daN $c_z = 0,7$
Container P= 28.000 kg: end wall / door $F_B = 11,200$ daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 11,772$ daN x $(0,5 – 0,6 \times 0,7)$ $F_{G\,max} = 942$ daN

The restraining force of the container wall is sufficient (11,200 daN – 942 daN).

Restraint for rearward direction incl. 0,3 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,5 – 0,6 \cdot 0,7)} \qquad F_{G\,max} = 75,000 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 75,000 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Block B:

Restraint for forward direction incl. 0,3 G upward movement.

$c_x = 0,8$ $\mu = 0,6$ F_B Lashing = 9,000 daN $F_G = 11,772$ daN $c_z = 0,7$

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{9.000}{(0,8 – 0,6 \cdot 0,7)} \qquad F_{G\,max} = 23,684 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 9,000$ daN, the load force resulting from the load weight may not exceed 23,684 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for rearward direction incl. 0,3 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,5 – 0,6 \cdot 0,7)} \qquad F_{G\,max} = 75,000 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 75,000 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for side movement incl. 0,3 upward movement

$c_x = 0,5$ $\mu = 0,6$ $F_G = 23,554$ daN $c_z = 0,7$
Container P= 28.000 kg: Side walls FB = 16,800 daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 23,554$ daN x $(0,5 – 0,6 \times 0,7)$ $F_{G\,max} = 1,884$ daN

The restraining force of the container wall is sufficient (16,800 daN – 1,884 daN).

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Ocean Transport:

Block A:

Restraint for forward direction incl. 0,8 G upward movement.

$c_x = 0,4$ $\mu = 0,6$ $F_G = 11,772$ daN $c_z = 0,2$
Container P= 28.000 kg: end wall / door $F_B = 11,200$ daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 11,772$ daN x $(0,4 – 0,6 \times 0,2)$ $F_{G\,max} = 3,296$ daN

The restraining force of the container wall is sufficient (11,200 daN – 3,296 daN).

Restraint for rearward direction incl. 0,8 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,4 – 0,6 \cdot 0,2)} \quad F_{G\,max} = 21,429 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 21,429 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Block B:

Restraint for forward direction incl. 0,8 G upward movement.

$c_x = 0,4$ $\mu = 0,6$ F_B Lashing = 9,000 daN $F_G = 11,772$ daN $c_z = 0,2$

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{9.000}{(0,4 – 0,6 \cdot 0,2)} \quad F_{G\,max} = 32,143 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 9,000$ daN, the load force resulting from the load weight may not exceed 32,143 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for rearward direction incl. 0,8 G upward movement.

$$F_{G\,max} = \frac{F_B}{(c_x - \mu \cdot c_z)} = \frac{6.000}{(0,4 – 0,6 \cdot 0,2)} \quad F_{G\,max} = 21,428 \text{ daN}$$

With a permitted lashing load capacity in the container of $F_B = 6,000$ daN, the load force resulting from the load weight may not exceed 21,428 daN. The actual load force is $F_G = 11,772$ daN.
The required load securing for the accelerating forces in road transport is therefore met.

Restraint for side movement incl. 0,8 upward movement

$c_x = 0,8$ $\mu = 0,6$ $F_G = 23,554$ daN $c_z = 0,2$
Container P= 28.000 kg: Side walls $F_B = 16,800$ daN

$F_{G\,max} =$ $F_G \times (c_x - \mu \cdot c_z) = 23,554$ daN x $(0,8 – 0,6 \times 0,2)$ $F_{G\,max} = 16,017$ daN

The restraining force of the container wall is sufficient (16,800 daN – 16,017 daN).
The required load securing for deceleration and acceleration forces in ocean transport is therefore met.

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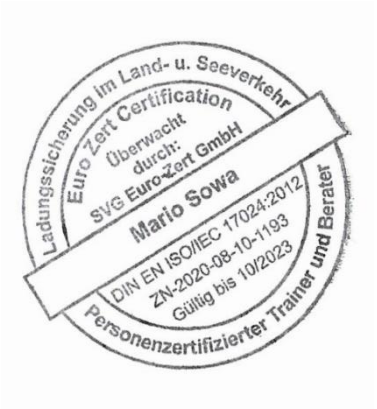
Center of gravity:

The weight distribution is within the permitted range according to the CTU-Code or other local required codes.

In principle, a safety reserve was planned for the lashings in order to take into account possible tilting moments or lashing points with lower strength.



Mario Sowa
Accredited Trainer & Advisor Cargo Securing

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