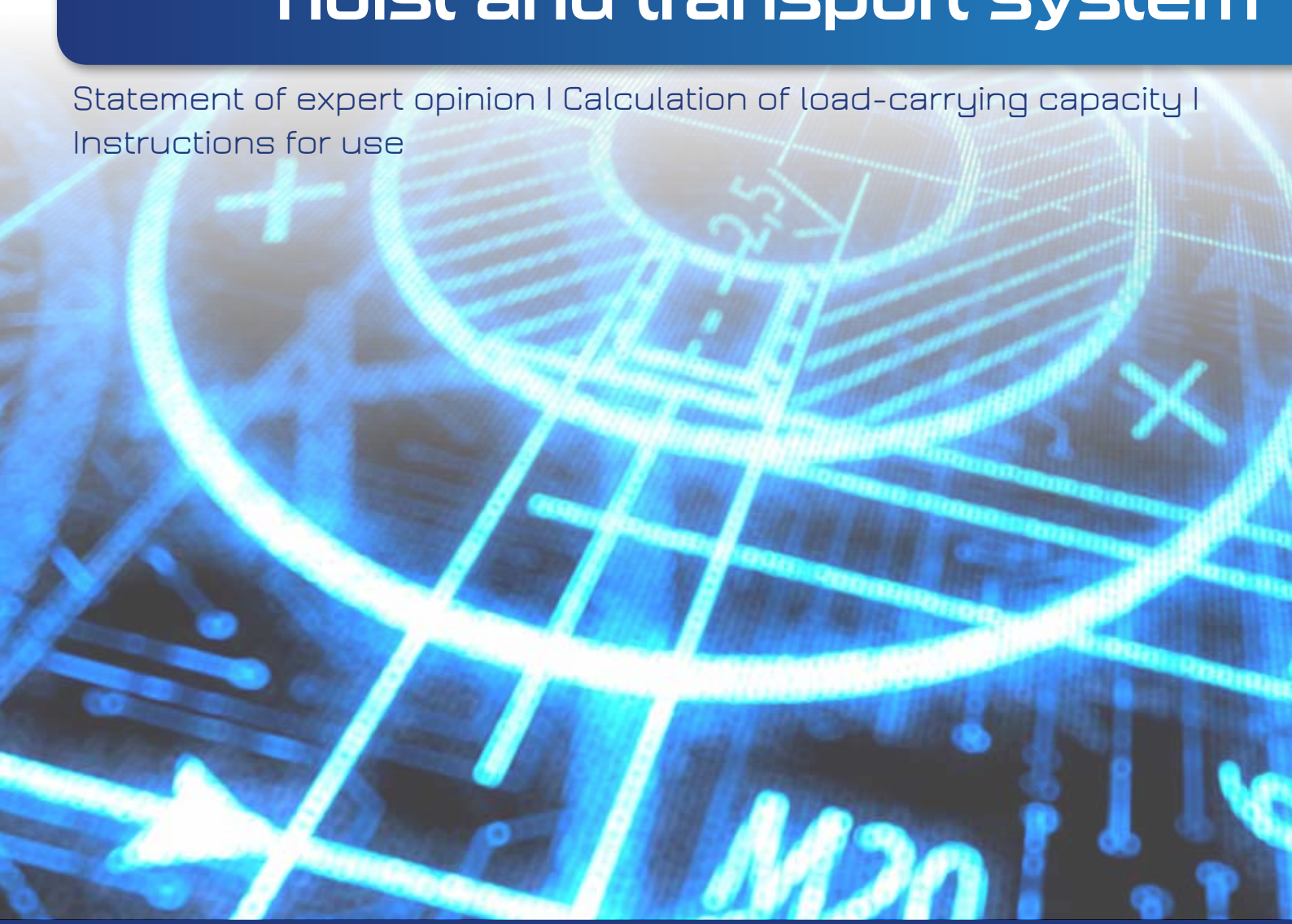
schmid schrauben hainfeld

Schmid RAPID® T-Lift hoist and transport system

Statement of expert opinion I Calculation of load-carrying capacity I Instructions for use



1. Introduction

The RAPID® T-Lift hoist and transport system consists of:

- **RAPID® T-Lift – transport anchor for loads of up to 1.3 t**
- The anchor is used in conjunction with the self-tapping **RAPID® T-Lift – transport anchor screw** ∅ 12 mm × length l according to ETA-12/0373

Complies with EC Machinery Directive 2006/42/EC, annex II 1A (EN ISO 12100:2011-03, VDI/BV-BS 6205:2012-04). The production process is subject to external verification and monitoring.

Documents:
EN 1995-1-1, ETA-12/0373
BGR 500 or UVV-VBG 9a (German accident prevention regulations)

2. Safety information

Before using the RAPID® T-Lift hoist and transport system, read these operating instructions carefully. They must be kept accessible for the User to refer to during operation.

Lifting operations using the described RAPID® T-Lift hoist and transport system may only be carried out by expert personnel (hereinafter referred to as the “User”). Before using the system for the first time, Users must have received theoretical and practical instruction in how to use the system correctly. When used correctly, the RAPID® T-Lift hoist and transport system is designed to ensure maximum safety during operation.
The RAPID® T-Lift transport anchor screw ∅ 12 mm is designed for single use only. This rules out any possibility of previous overloading. The RAPID® T-Lift transport anchor screw is designed for single use and may be loaded on repeated occasions in this position (i.e. repeated lifting operations at the factory and transfer of loads to the worksite are permitted). Used screws must be left in the component or disposed of. The User must know the precise weight of the components to be lifted.
Only RAPID® T-Lift transport anchor screws, calculated in accordance with point 5, may be used.

2. 1. RAPID® T-Lift transport anchor 1.3 t

RAPID® T-Lift transport anchors must be individually inspected by the User before each use. RAPID® T-Lift transport anchors must be inspected annually by qualified persons or by a safety officer from the company using the device. In the process, the degree of wear and tear, and the level of damage must be assessed.

- The ball and coupling link must be visually inspected to make sure there are no cracks.
- The device must be visually inspected to check for any plastic deformations – e.g. buckled chain link, grooves, deformations, pressure marks caused by rigging gear, etc.
- The maximum permissible wear limits must be checked to make sure that they have not been exceeded or fallen short of. If the highest limit dimension “h” is exceeded by 12.5 mm or the lowest limit dimension “m” is fallen short of by 5.5 mm, further use of the RAPID® T-Lift transport anchor is not permitted.
- No modifications or repairs, particularly welding, are permitted.

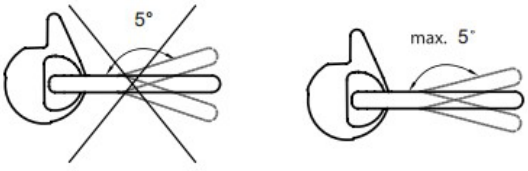


Fig. 1: buckled chain link

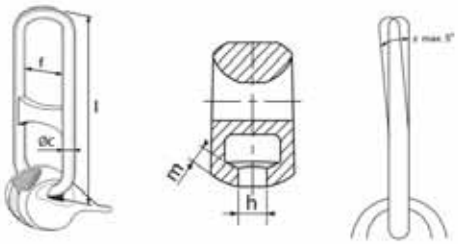


Fig. 2: limit dimensions to be checked annually to ensure further use of the RAPID® T-Lift, and for further informative dimensions

Annual inspection dimensions		
Load group	**m (min.)**	**h (max.)**
1.3 t	5.5 mm	12.5 mm

Table 1: inspection dimensions

Informative dimensions of the RAPID® T-Lift transport anchor					
f	**l**	**Max. elongation of l**	**∅ c**	**Max. wear ∅ c**	**Max. deformation z**
40 mm	189 mm	5% = 9.4 mm	12 mm	10% = 1.2 mm	5°

Table 2: informative dimensions of the RAPID® T-Lift transport anchor 1.3 t

2. 2. Self-tapping RAPID® T-Lift transport anchor screw Ø 12 mm

The RAPID® T-Lift transport anchor screw is designed for single use only in conjunction with RAPID® T-Lift transport anchors. Used screws must be left in the component or disposed of. If re-used, there is a risk that the screw will fail.

Bar-shaped components (beams) must be lifted using at least two transport anchor screws. For platform-shaped parts, at least three transport anchor screws must be used.

Standard screw lengths
- 12 × 120/100
- 12 × 160/144

More dimensions available on request, e.g.:
- 12 × 240/220
- 12 × 350/330
- 12 × 600/300

The screws must not be used in shrinkage cracks or similar.
Use of the RAPID® T-Lift hoist and transport system for lifting and transporting operations involving helicopters is not permitted.

3. Intended use of the RAPID® T-Lift hoist and transport system

The RAPID® T-Lift hoist and transport system is a load suspension device made of high-quality steel, and is designed for reliable and straightforward lifting of timber components made of solid wood, glued laminated timber or timber products with CE labelling (see materials listed in ETA-12/0373). Here, timber components means:

- bar-shaped components
- platform-shaped parts or
- composite structures (e.g. frameworks, prefabricated house walls)

The RAPID® T-Lift transport anchor designed for loads corresponding to the 1.3 t load group may only be used in conjunction with the ETA-12/0373-certified self-tapping RAPID® T-Lift transport hexagonal head anchor screw ∅ 12 mm. The load-carrying capacity of the RAPID® T-Lift hoist and transport system is restricted by the length of the screw thread.

The self-tapping RAPID® T-Lift transport anchor screw ∅ 12 mm must be screwed into softwood without pre-drilling (see ETA-12/0373, e.g. solid timber, veneer wood, glued laminated timber, cross laminated timber, etc.), but can also be partially pre-drilled with max. ∅ 7 mm (guide and orientation drilling) or fully pre-drilled.
Use in hardwood is only permitted by pre-drilling a hole with ∅ 7 mm.

The permitted mounting positions are listed in point 7 a) to c) and must be observed.
The screws must not be used in drying cracks or similar.

4. Handling the RAPID® T-Lift hoist and transport system

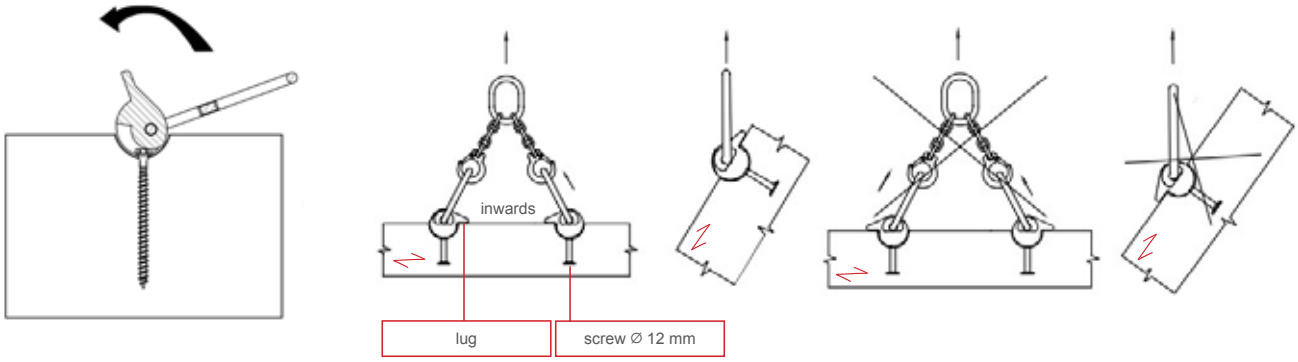


Fig. 3: correctly mount the RAPID® T-Lift transport anchor (i.e. the ball lug must face inwards)

Lifting the load: the load must only be lifted under consideration of the permitted angle of inclination; see point 7 a) to c).
After unloading, the RAPID® T-Lift hoist and transport system must be dismantled and hung up.
The RAPID® T-Lift transport anchor screw can either remain in the wood – screwed right in – or it can be completely unscrewed and removed (NOTE: the screw is designed for single use only).

5. Bases of assessment for lifting with a crane

The RAPID® T-Lift hoist and transport system has been designed for handling timber components. The maximum load-carrying capacity of the RAPID® T-Lift hoist and transport system is 1.3 t.

According to approval ETA-12/0373, RAPID® T-Lift transport anchor screws are intended for use under predominantly static loads only. Due to the infrequent handling of loads, the weights acting on the RAPID® T-Lift hoist and transport system can be considered as predominantly static.

To determine the weights acting on the system, EN 1991 or German standards such as DIN 1055-1 may be taken as a basis.

Due to vibrations that may occur on cranes, a dynamic load can occur. The choice of suitable, absorbing tensile joints such as steel or synthetic ropes reduces the dynamic load. Short chains may not be used. Multiplying the forces acting on the system with the vibration coefficients φ provided in table 3 is recommended.

The recommended vibration coefficients can be influenced by the situation and the prevailing circumstances on site. In this case, corresponding values in accordance with EN 13001-3-1 should be used.

Recommended vibration coefficients		
Lifting device	**Lifting speed**	**Vibration coefficients φ**
Stationary crane, revolving crane or rail crane	≤ 90 m/minute	1.0–1.1
Stationary crane, revolving crane or rail crane	> 90 m/minute	> 1.3
Lifting and transport on even ground	—	> 1.65
Lifting and transport on uneven ground	—	> 2.0

Table 3: recommended vibration coefficients φ

The suspension gear is defined by the quantity of RAPID® T-Lift transport anchor screws used. Statically indeterminate suspension gear basically has more than three strands on which the load is unevenly distributed using suitable measures e.g. compensating cross beams.

Statically indeterminate suspension gear must be designed with consideration for UVV-VBG 9a in such a way that two anchor points can take up the entire load. The loads acting on the anchor points are determined according to the triangle of forces.

Using suitable measures (e.g. compensating cross beams), fastenings with more than three anchor points can be designed as statically determinate. For statically determinate suspension gear, all anchor points must be used to take up the load.

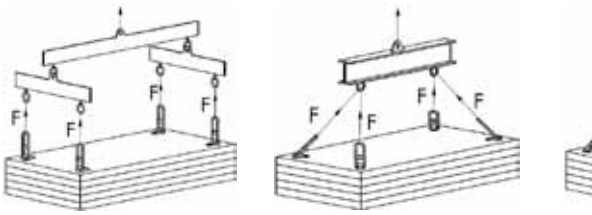


Fig. 4: three examples of statically determinate suspension gear

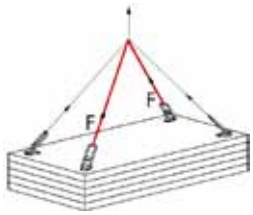


Fig. 5: statically indeterminate suspension gear

6. Bases of assessment for the RAPID® T-Lift transport anchor screw Ø 12 mm – stressed in the axial direction

The minimum distance of RAPID® T-Lift transport anchor screws from each other in the grain direction, and to the end grain wood should be selected as ≥ 300 mm.

The distance to the unloaded edge perpendicular to the grain direction should be selected as 3d (≥ 36 mm). This results in a minimum wood width of 72 mm.
Douglas fir wood requires the minimum distance in the grain direction to be increased by 50%.

Key:

$F_{ax,Rk}$	characteristic withdrawal capacity of the RAPID® T-Lift transport anchor screw in N
d	outer thread diameter in mm
l_{ef}	effective thread length in mm
$F_{ax,Rd}$	axial withdrawal capacity in the measured condition in N
k_{mod}	modification factor
$\gamma_{M,wood}$	partial factor
ρ_k	characteristic density (wood)
$F_{ax,EK}$	characteristic design value of the action on each screw
$F_{ax,Ed}$	design axial force on each screw
l_{ef}	effective thread length in the timber component with threaded tip in mm

The withdrawal capacity of the RAPID® T-Lift transport anchor screw is basically defined by the outer thread diameter d and the screw-in depth or thread length l_{ef}.

Calculation of the characteristic withdrawal capacity in N (C24, ρ_k = 350 kg/m³):

$$\mathbf{F_{ax,Rk} = 11.2\ [N/mm^2] \times d \times l_{ef} = 134.4 \times l_{ef}}$$

This formula applies to screws bolted into an angle of 45° ≤ α ≤ 90° (α is the angle between the axis of the screw and the grain direction).

Note: use with an angle of less than 45° is not recommended due to the high reduction required.

The effective thread length l_{ef} must be at least 4d (= 48 mm).

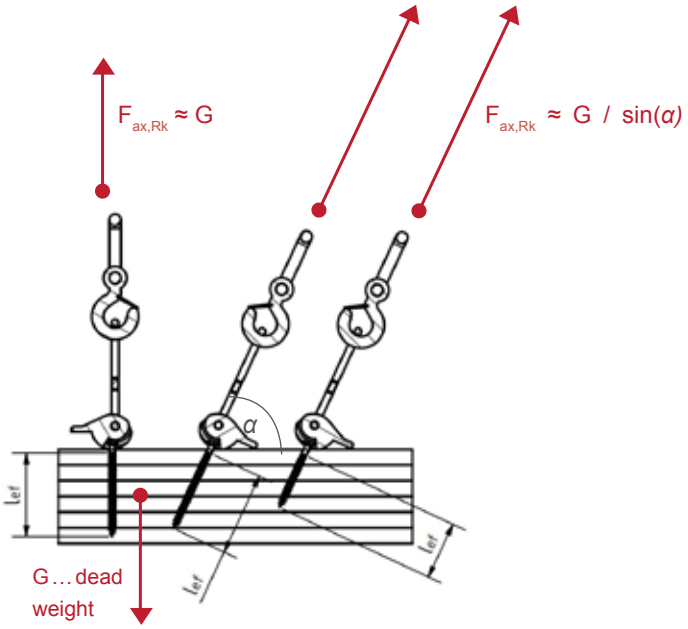


Fig. 6: effective thread length $l_{ef} \geq 4d = 48mm$

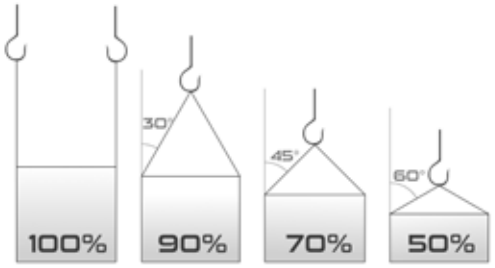


Fig. 7: reduction of the load carrying capacity of the screw in consideration of the hanging angle

Calculation of the design value of withdrawal capacity:

$$F_{ax,Rd} = k_{mod} / \gamma_{M,Holz} \times F_{ax,Rk}$$

k_{mod} = 0.9 (use in dry wood, i.e. usage classes 1 + 2). Additional values for k_{mod} can be found in EN 1995-1-1. The k_{mod}value = 1.1 for LADC “very short” was not applied to increase safety.

$\gamma_{M,wood}$ = 1.3 (in Italy only, this factor should be used with 1.5.)

Calculation of the maximum withdrawal capacity per RAPID® T-Lift transport anchor in N:

$$F_{ax,Rd,max} = 93.05 \times l_{ef}$$

A characteristic density of $\rho_k \geq 350$ kg/m³ applies. For lower densities, the determined load-carrying capacity must be corrected with the factor $f_\rho = (\rho_k / 350)^{0.8}$ (ρ_k in kg/m³). For higher densities, the load-carrying capacity must be increased by the factor f_ρ.

The verification is carried out by comparing the maximum withdrawal capacity $F_{ax,Rd,max}$ with the measured dead weight $F_{ax,Ed}$:

$$F_{ax,Ed} = 1.35 \times F_{ax,Ek} \approx 1{,}35 \times G / \sin(\alpha) \leq F_{ax,Rd} = 93.05 \times l_{ef}$$

RAPID® T-Lift screw withdrawal capacity			
Screw length	**Thread length**	**Load-carrying capacity $F_{ax,Ed}$**	**Load-carrying capacity $F_{ax,Ed}$ (reduced for Italy)**
120 mm	100 mm	6.89 kN ~ 700 kg	5.97 kN ~ 585 kg
160 mm	144 mm	9.92 kN ~ 1,010 kg	8.60 kN ~ 840 kg
240 mm	220 mm	15.16 kN → limited to max.1,300 kg	13.14 kN → limited to max.1,300 kg

Table 4: RAPID® T-Lift transport anchor screw ∅ 12 mm withdrawal capacity in accordance with approval ETA-12/0373 (without a reduction with the vibration coefficients φ)

After conversion, the resulting characteristic withdrawal capacity per RAPID® T-Lift transport anchor in the axial direction of the screw is:

$$F_{ax,Ed} = 93.05 / 1.35 \times l_{ef} = 68.9 \times l_{ef}$$

Note: already from a thread length of 220 mm, the load-carrying capacity of the thread in the timber is higher than the load-carrying capacity of the RAPID® T-Lift transport anchor.

One component must be lifted using at least two RAPID® T-Lift transport anchors. Under axial load (based on EN 1995-1-1), one RAPID® T-Lift transport anchor screw is required for each connection point. According to ETA-12/0373, timber components must have a thickness of at least t ≥ 80 mm and a minimum width of b ≥ 72 mm. For the minimum distances, the values in table 5 must be taken into account.

Minimum distances of RAPID® T-Lift anchor screws		
	∅ 12	**Distance**
From one another in the grain direction	$a_1 \geq 12 \times d$	144 mm
From one another perpendicular to the grain direction	$a_2 \geq 5 \times d$	60 mm
To the unloaded edge perpendicular to the grain direction	$a_{2,c} \geq 3 \times d$	36 mm
To the loaded edge perpendicular to the grain direction	$a_{4,t} \geq 10 \times d$	120 mm
To the loaded edge in the grain direction	$a_{3,t} \geq 15 \times d$	180 mm

Table 5: minimum distances of the RAPID® T-Lift transport anchor screws ∅ 12 mm according to ETA-12/0373

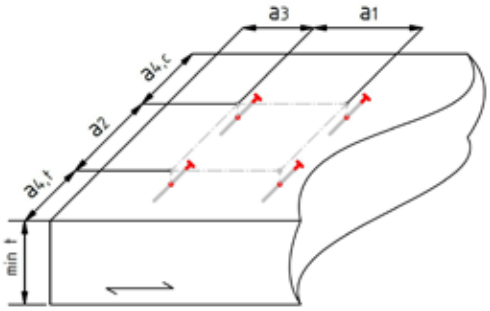


Fig. 8: distances between RAPID® T-Lift transport anchor screws

Lifting a horizontal element (wall, ceiling, etc.):

$a_{4,t}$ (loaded edge, ≥ 10 × d) = 120 mm
$a_{4,c}$ (unloaded edge, ≥ 3 × d) = 36 mm

NOTE concerning figure 9: evidence must be provided by means of a mathematical verification of whether or not an additional screw is required to provide protection against tensile stress (verification in accordance with EN 1995-1-1 and national annex).
During lifting, bending of the RAPID® T-Lift transport anchor screw must be avoided (e.g. by lowering the ball head). Due to the combined load, the connection must also be performed as described in 7.2.

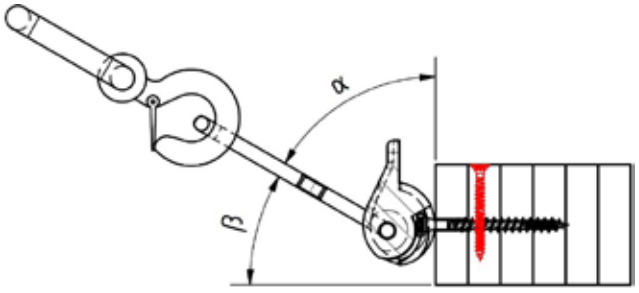


Fig. 9: lifting a horizontal element (α = 0°) or lifting with the screw under diagonal tension

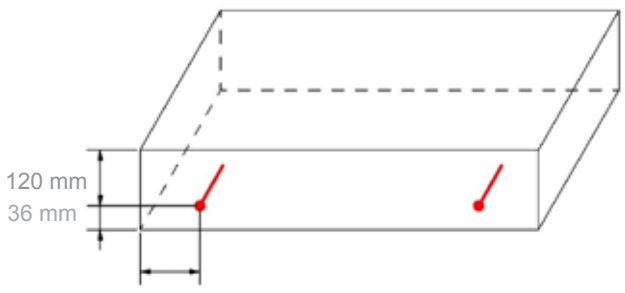


Fig. 10: arrangement of RAPID® T-Lift transport anchor screws on the narrow or side surface (not on the front face)

7. Mounting positions with the various resulting loads

Three different mounting versions of the RAPID® T-Lift transport anchor screw are possible.
These are:

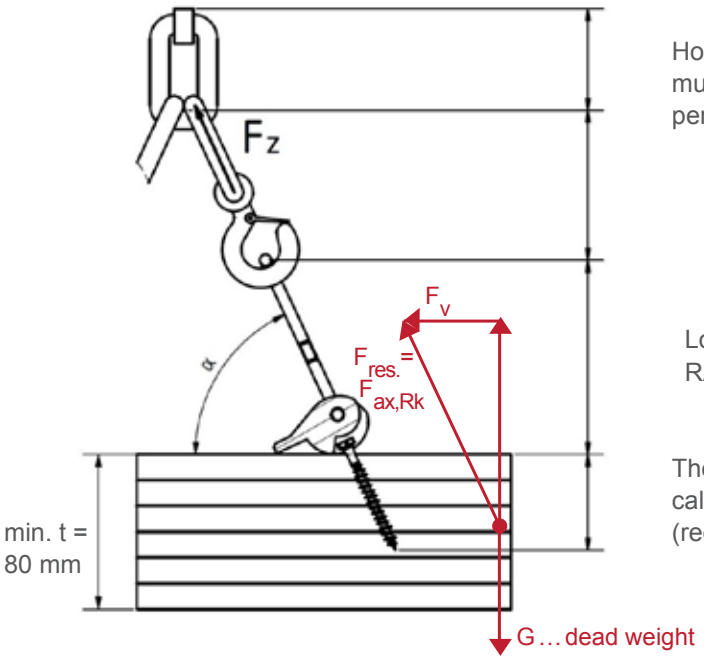
a) Stress on the screw under axial tension
b) Stress on the screw under diagonal tension
c) Diagonal tension stress on the screw with a recess drilled to precisely fit the ball head

7. 1. Stress on the RAPID® T-Lift transport anchor screw under axial tension

If the screw is subjected to withdrawal loading in the screw's axial direction, this is known as axial tensile stress (see fig. 11).

Formula: $F_z \leq F_{ax,Ek} = 68.9 \times l_{ef}$ … applies to screw-in angle α = 45° to 90°

Note: according to ETA-12/0373, the minimum wood thickness is 80 mm. We recommend screwing the thread fully into the wood.



Hoisting and rigging gear must be specified by qualified personnel.

Load suspension device = RAPID® T-Lift transport anchor.

The required screw length must be calculated for the weight to be lifted (reduced by angle α).

Fig. 11: axial tensile stress of the RAPID® T-Lift transport anchor screw

Transport weights per anchor point – thread fully screwed in!															
	Load in kg taking the crane vibration coefficient φ into account														
	φ = 1,0			**φ = 1,1**			**φ = 1,3**			**φ = 1,65**			**φ = 2,0**		
Angle α:	**45°**	**60°**	**90°**	**45°**	**60°**	**90°**	**45°**	**60°**	**90°**	**45°**	**60°**	**90°**	**45°**	**60°**	**90°**
Ø 12 × 120/100	496	608	702	451	553	638	382	468	540	301	368	425	248	304	351
Ø 12 × 160/144	716	876	1.012	651	797	920	550	674	778	433	531	613	358	438	506

Table 6: transport weights taking the crane vibration coefficient φ and the angle α into account

7. 2. Stress on the RAPID® T-Lift transport anchor screw under diagonal tension

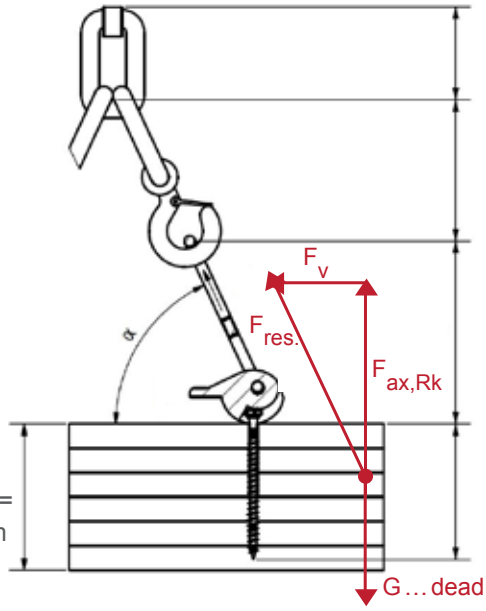
If the RAPID® T-Lift transport anchor screw is simultaneously subjected to withdrawal and shearing loads, this is known as diagonal tension stress (see Fig. 12). The angle of inclination must not be less than 60°.

To calculate the screw's characteristic shear resistance, a single shear, thin steel-to-timber connection in accordance with EN 1995-1-1 is assumed to be the failure mechanism because the wall thickness of the anchor hook is 5.5 mm:

$$F_{v,Rk} = \min \begin{cases} 0{,}4\ f_{h,k}\ t_1\ d \\ 1{,}15\sqrt{2M_{y,Rk}\ f_{h,k}\ d} + \dfrac{F_{ax,Rk}}{4} \end{cases}$$

The verification is carried out using the formula:

$$\left(\frac{F_{ax,Ed}}{F_{ax,Rd}}\right)^2 + \left(\frac{F_{v,Ed}}{F_{v,Rd}}\right)^2 \leq 1$$



Hoisting and rigging gear must be specified by qualified personnel.

Load suspension device = RAPID® T-Lift lifting transport anchor. α ≥ 60 to 90°

Screw-in depth → calculation with effective thread length l_{ef} in mm

Fig. 12: diagonal tension stress (this is not recommended)

- Screw's characteristic yield moment $M_{y,k}$ = 48,600 Nmm
- Partial factor $\gamma_{M,1}$ = 1,1
- Nominal diameter d_1 = 12 mm
- Modification factor for timber and wood-based panels k_{mod} = 0.9
- Partial factor for timber and wood-based panels $\gamma_{M,2}$ = 1.3
- Embedment strength for C24 with ρ_k = 350 kg/m³ is $f_{h,k}$ = 25.26 N/mm²

with a characteristic density of at least ρ_k = 350 kg/m³ for screws fastened vertically into the side wood surface

$$f_{h,\alpha,k} = 0.082 \times (1 - 0.01 \times d) \times \rho_k / (k_{90} \times \sin^2\alpha + \cos^2\alpha)$$

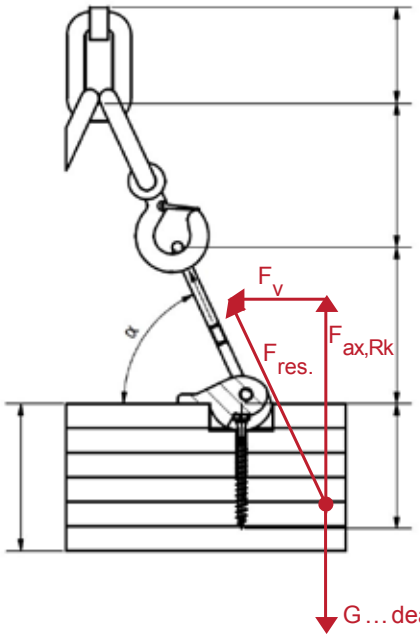
Where, according to EN 1995-1-1, k_{90} is:

$$k_{90} = \begin{cases} 1{,}35 + 0{,}015\,d & \text{for softwoods} \\ 1{,}30 + 0{,}015\,d & \text{for LVL} \\ 0{,}90 + 0{,}015\,d & \text{for hardwoods} \end{cases}$$

7. 3. Diagonal tension stress on the RAPID® T-Lift transport anchor screw with a recess drilled to precisely fit the ball head

When a recess is drilled to precisely fit the ball head, under diagonal tension, the horizontal force is transferred directly to the wood via the ball head. Therefore, the stress exerted on the strew corresponds to axial tensile stress and the screw must be mounted as described in 7.1.

The recess for the ball head must be drilled as shown in figure. 14 in accordance with the dimensions from figure 13 using a centre bit or a similar tool.



Hoisting and rigging gear must be specified by qualified personnel.

Load suspension device = RAPID® T-Lift lifting transport anchor.
α ≥ 45 to 90°

Screw-in depth ➔ calculation with effective thread length l_{ef} (in mm)

min. t = 80 mm

Fig. 13: axial loading on a RAPID® T-Lift transport anchor cut directly into the support

Drill hole d = 70 mm, 30 mm deep, optional initial drill hole for inclining the RAPID® T-Lift transport anchor screw (pre-drilled in the factory).

Tip: pre-mount the RAPID® T-Lift transport anchor screws.

Fig. 14: recess

8. RAPID® T-Lift hoist and transport system markings

8. 1. RAPID® T-Lift transport anchor for loads of up to 1.3 t

A serial number is engraved in the RAPID® T-Lift transport anchor to enable clear identification of the test results during the annual inspection.

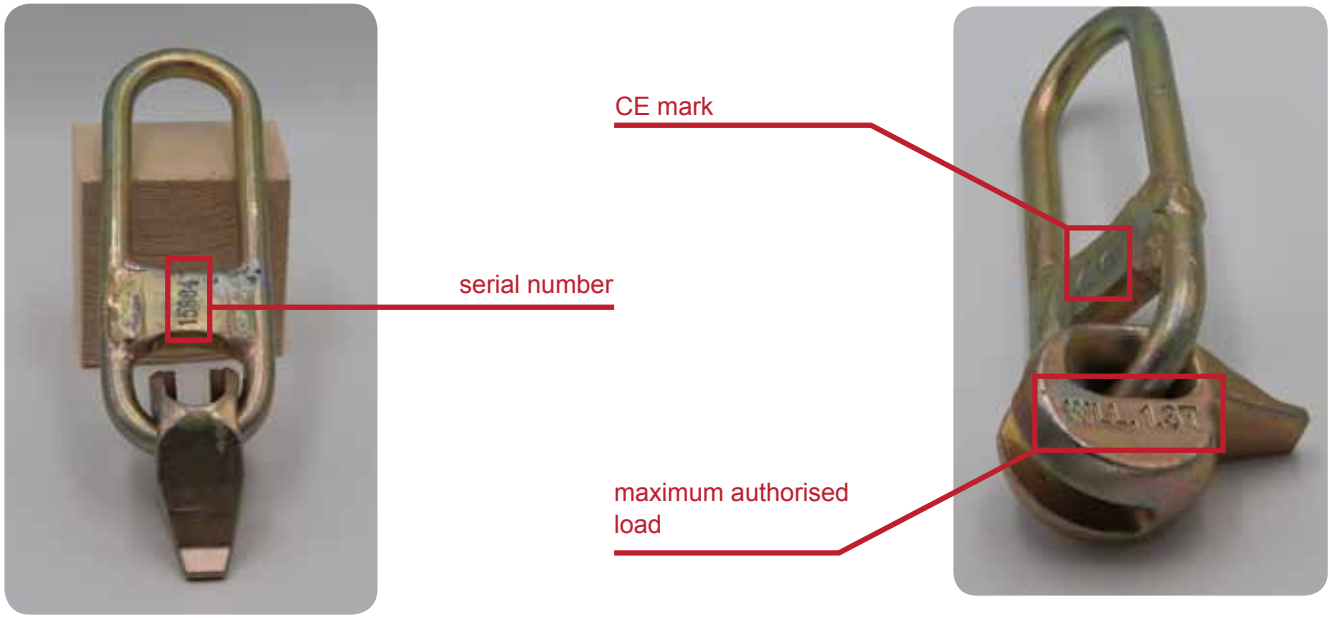


Fig. 15: serial number on the RAPID® T-Lift transport anchor

8. 2. RAPID® T-Lift transport anchor screw ∅ 12 mm

In accordance with ETA-12/0373, the manufacturer's embossing is clearly identifiable on the head of the screw.

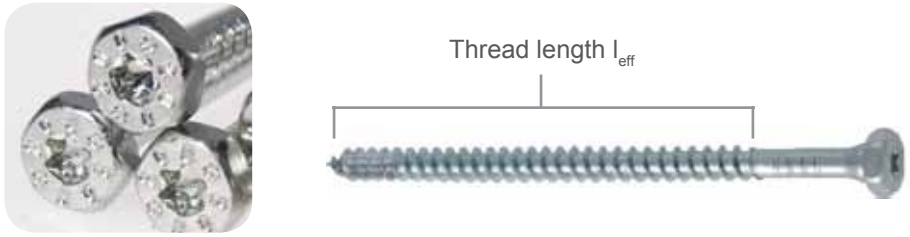


Fig. 16: embossing on the head (with length in mm) and thread length of the RAPID® T-Lift transport anchor screw

Johann Scheibenreiter, Hainfeld, 02/05/2018

schmid schrauben hainfeld

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Service

Our technicians will be delighted to help if you have any questions. Please contact them at info@schrauben.at

Safety

Our screws are approved according to ETA-12/0373.

Structural analysis

Our screws boast above-average mechanical properties for withdrawal and pull-through strengths.

Experience

We have been a specialist in the production of wood screws for over 175 years.

Special hardening

Our elastically resilient, high-strength screws can be bent by up to 45°.

Highest quality

We manufacture to ISO 9001 specifications.

Sustainability

We protect the environment and manufacture to ISO 14001 and ISO 50001 specifications.

Your screws - your brand

We produce screws precisely according to your requirements.

Always able to supply our customers

We keep our warehouse well-stocked with our extensive range of products.

Service-oriented

We are always available for our customers – whether they require calculations, expert advice or empirical values.

ETA-12/0373