



# **General Installation Instructions for Peikko Transport Anchors**



ISO 9001  
ISO 14001

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# DIRECTORY

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# 1. General Information

The Installation and Application Manual for usage of Peikko Transport Anchors „General Installation Instructions for Peikko Transport Anchors“ (GII) contains important instructions of Peikko Transport Anchors. In principle, the manual only applies to the specific components of the selected transport anchor system.

A transport anchor system consists of a permanently installed transport anchor and its corresponding lifting device. The general concepts of a transport anchor system are shown in detail in figure 1. All transport anchors must adhere to the safety regulations „Sicherheitsregeln für Transportanker und -systeme von Betonfertigteilen“ (BGR106). The application of lifting devices is outlined in BGR500 „Betreiben von Lastaufnahmemitteln im Hebezeugbetrieb“. According to the regulations in BGR106, only compatible anchors and lifting devices can be used together. The use of Peikko Transport Anchors with lifting devices of other manufacturers is not permissible.

The Peikko Transport Anchor System fills all requirements of the aforementioned regulations. Precision integration of the system components is achieved via clear identification markings. All transport anchors and lifting devices are permanently marked with the manufacturer and load class. Additionally the colour coding system integrated with JENKA Transport Anchors makes identifying built in anchors easy and safe.

It is the responsibility of the user to utilize the most up to date version of the installation and usage manual. Manuals lose their validity with newer publications. Responsibility of keeping the most current documents also lies upon the user.

## 2. Peikko Transport Systems

Various Peikko transport systems are available to the user.

Figure 2 JENKA Transport Anchor and Lifting Device

Figure 3 Peikko KK Anchor System

Figure 4 Peikko RR Anchor System

Figure 1: Definition of transport anchor systems

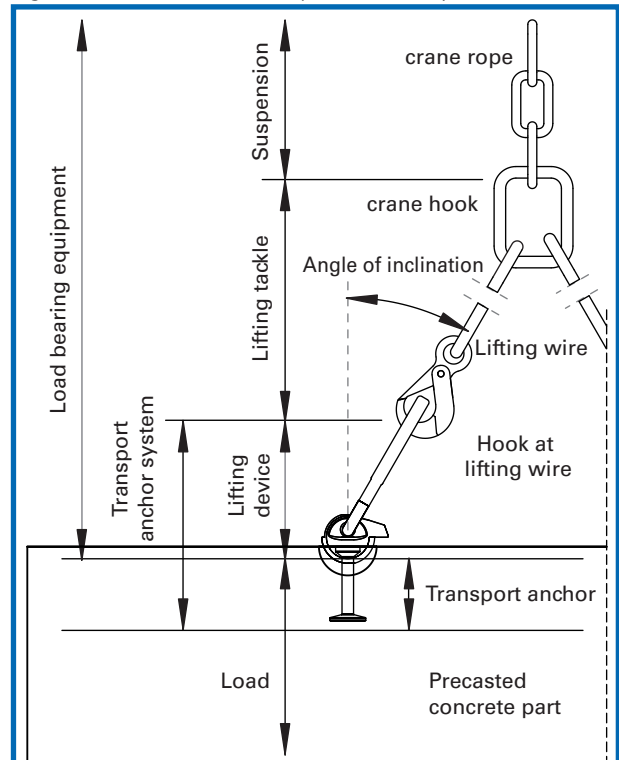


Figure 2: JENKA Transport Anchor

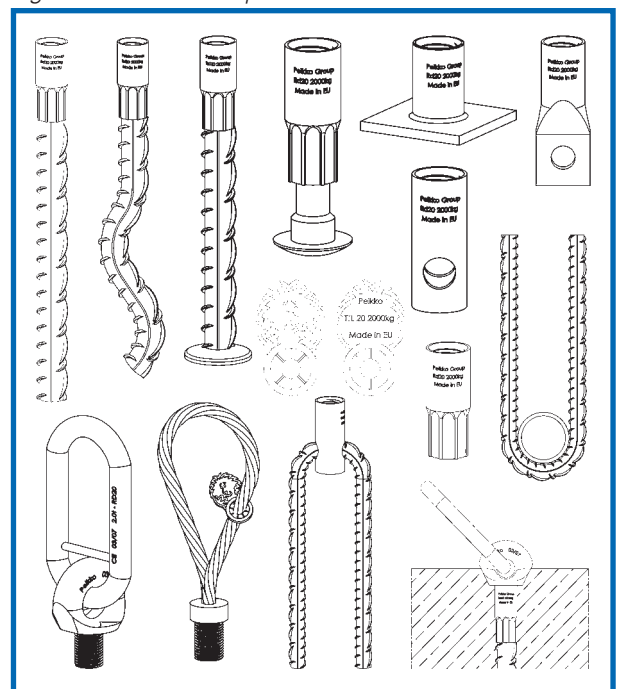
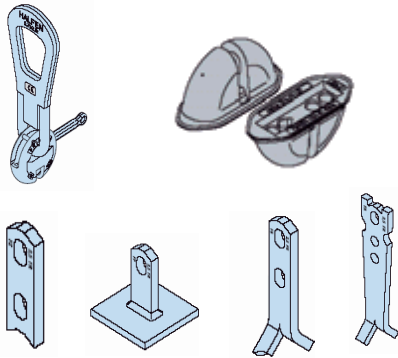


Figure 3: Peikko KK Anchor System



# Peikko Transport Anchor System

Figure 4: Peikko RR Anchor System



## 3. Installation of Transport Anchor Systems

Peikko Transport Anchors are designed for the transport and assembly of precast concrete construction components. Long term loads upon the system, such as utilization for the stability of a building is prohibited. For this installation, approvals are required in relation to the construction site through the German Institute for Construction Technology (Deutsches Institut für Bautechnik DIBt). Instructions for construction, dimensions, and operations of precast concrete construction components are to be taken from the German Standards such as DIN 1045-1.

Multiple uses of a transport anchor for transport from the place of manufacture to place of installation is not seen as repeated use. Peikko Transport Anchors should only see repeated use if allowed by its respective installation and usage manual. For situations of repeated use, the anchors must adhere to the approvals „Products, Connections, and Construction Components of Stainless Steel“ [Erzeugnisse, Verbindungsmittel und Bauteile aus nichtrostenden Stählen (DIBt Berlin Zul. Nr. Z-30.3-6)]. The buyer is responsible for following this regulation prior to application.

Peikko JENKA Transport Anchors can be assembled deep or flush with proper fittings. For the protection of open threads there are plastic stoppers which create a protective seal. JENKA Transport Anchors come in various forms in order to make the optimal anchor available. The range of operations for Peikko JENKA anchors is provided in a special installation and usage manual. The JENKA Lifting System contains the JENKA TLL lifting loop and the JENKA Lifter.

Peikko KK Anchors are usually installed in slabs or wider elements. The associated lifting device in this case is the Peikko KK Lifting Clutch. Peikko RR Anchors are used in combination with special ring clutches, a further transport system for prefabricated construction..

## 4. Selecting a Transport Anchor System

### 4.1 Interacting Factors

Fundamentally a transport anchor system is chosen relative to safety and economic considerations concerning production and transport of prefabricated concrete construction components. The acting forces and force directions must be set in opposition to the pull force of the transport anchor. Particular interacting factors to be acknowledged:

- Weight of the element
- Mould adhesion
- Hoisting capacity factors
- Occurring axial, angular, and lateral pull
- Positioning and number of transport anchors
- Concrete strength at the moment of first load.

### 4.2 Determination of the weight force $F_G$

The force of gravity  $F_G$  of the element is calculated by multiplying the volume of the element  $m^3$  with the specific weight (density) of the implemented concrete. For steel prefabricated concrete elements a density of  $\rho = 25 \text{ kN/m}^3$  is generally used. For heavily reinforced elements or the installation of large steel parts, the weight of the element should receive special consideration. For simplification, a mass of 1000 Kg with 10 kN may be installed (1000 kg  $\approx$  10 kN).

### 4.3 Mould Adhesion $H_A$

Depending on the chosen mould and the geometry of the construction component, possible suction, adhesive, and frictional forces could occur and impact the total load of the component. These forces can be reduced by using oil on the mould, or other lubricants and release agents. Nevertheless it is still possible that additional forces will exceed the

weight of the component. For strong structured components such as TT Ceiling Slabs, forces could easily add to double the components weight. Separately removable mould pieces, such as frontal and side pieces, should be removed prior to lifting of the component. These will then no longer be calculated in mould adhesion  $H_A$ . A table is made available for the different types of moulds and their reference values for calculating the mould adhesion factors.





Table 1: Mould Adhesion Factor  $h$

Kind of mould	$h$ [kN/m <sup>2</sup> ]
Rough timber mould	3
Oiled timber mould	2
Oiled steel mould	1

## 4.4 Acceleration Factor $f$

During lifting and transport of steel concrete construction components, the actual load on the anchor is elevated by dynamic forces. The chosen transport anchor must take on the occurring operating torque, as well as lifting and acceleration forces. The lifting force factor  $f$  is chosen dependant upon the lifting class of the crane following DIN 15018 (see table 2). The worst case is always considered for situations involving transport and installation.

Table 2: Acceleration Factor  $f$

Hoisting conditions		Lifting force factor
Stationary crane, hoist velocity $\geq 90$		1.10 to 1.30
Stationary crane, hoist velocity $\geq 90$		1.20 to 1.60
Stationary crane, hoist velocity $\geq 90$		1.20 to 1.60
Hoisting and transport on planar or non planar ground / e.g. with excavator		1.60 to 3.00

## 4.5 Quantity and Arrangement of Transport Anchors

All transport anchors are to be placed symmetric to the centre of gravity of the construction component. Any other placement will cause an uneven load upon the anchors. The load upon the system

is determined by the distance from the centre of gravity. This must be calculated for each individual case.

The number of transport anchors also determines the selected suspension. Generally either a single or double cable suspension is seen as a statically defined loading condition. A 3-cable suspension is only the case when the anchors are not in line with each other, and are placed centrally around the centre of gravity. For more than 3 transport anchors, a statically undefined load condition is the case unless appropriate measures are taken to divide the load equally upon each point (such as with a controlled suspension system, see figures 5 and 6)

In situations of statically undefined load conditions (ex. Lifting of a simple 4 cable suspension without suspension control), the loads must be calculated so that the entire load of the system can be safely held by only two anchors (see BGR500). Various transport situations must be considered in the calculations for number of anchors and their placement.

Figure 5: Statically Defined Load Condition

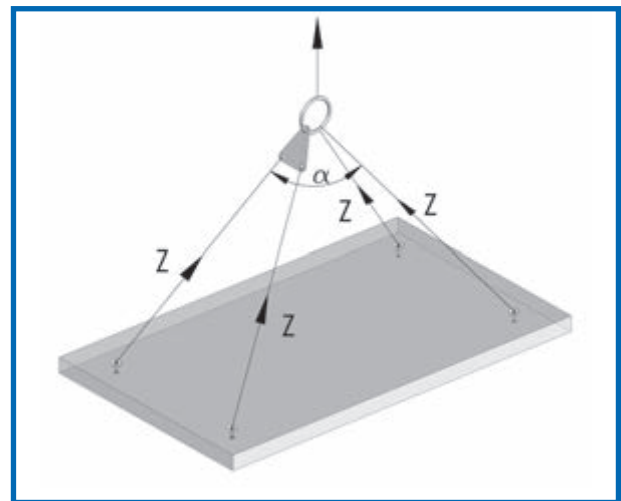
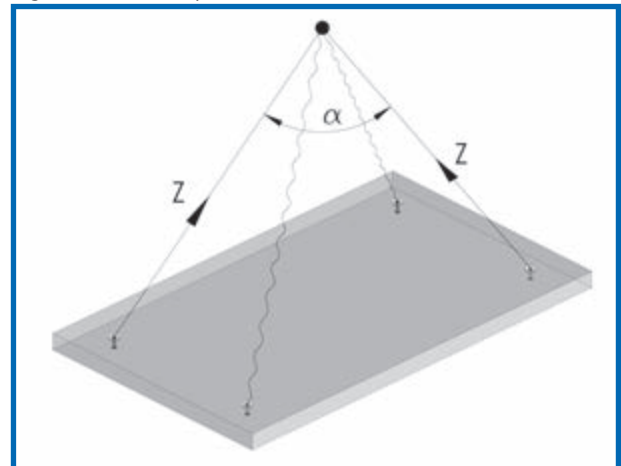


Figure 6: Statically Undefined Load Condition



# Peikko Transport Anchor System

## 4.6 Axial-, Angular, and Lateral Pull

Fundamentally, 3 types of transport anchor loads can occur.

1. Axial pull takes place when the load is on the horizontal axis (fig. 7)
2. Angular pull takes place when the transport anchor lifts on the horizontal axis with a tilt angle of  $\beta \geq 12,5^\circ$ . (fig. 7) Unless otherwise stated in specific instructions, this situation always requires additional reinforcement for angular pull.
3. Lateral pull takes place for a transport anchor strained under a tilt angle  $\gamma$ . (fig. 8) A tilt angle  $\gamma = 90^\circ$  would be the most extreme case and occurs when a fabricated component lies on the ground and must be erected. In this situation angular pull can also be implemented (fig. 9). This special case is considered lateral pull. Unless otherwise stated in its specific installation instructions, for the case of  $\gamma \geq 15^\circ$ , additional reinforcement in the form of lateral reinforcement stirrups must always be installed (fig. 10). Additional angular pull reinforcement is then not required.

Figure 7: Axial, Angular, and Lateral Pull

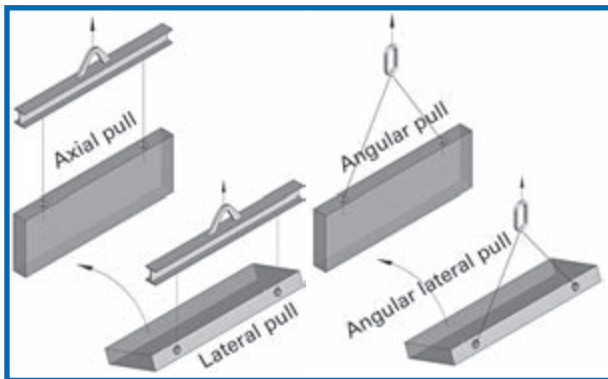


Figure 8: Lateral Pull Angle  $\gamma$

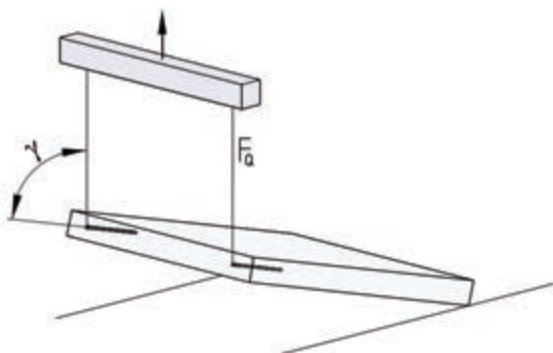


Figure 9: Angular Lateral Pull

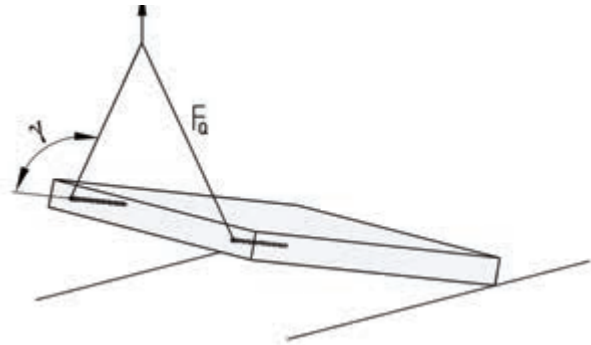
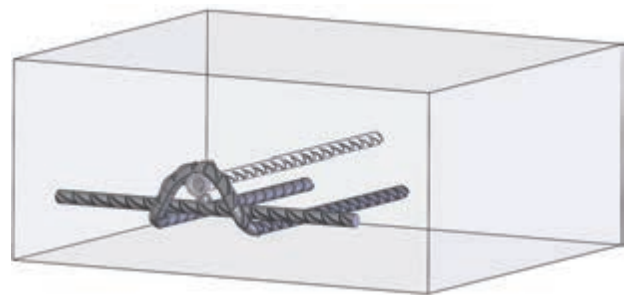


Figure 10: Example of Lateral Pull Reinforcement



## 4.7 Load Increase Through Angular Pull

The resulting force on the transport anchor, the lifting device, and the suspension cables, are all increased in angular pull. To compensate for load increase, the angular pull factor  $z$  is implemented. A tilt angle of  $\beta > 60^\circ$  is not allowed due to the excessive load increase (see BGR 500).

Table 3: Angular Pull Factor  $z$

Angle of inclination $\beta$	$\cos \beta$	Angular tension factor ( $1/\cos \beta$ )
0,0°	1	1,00
15,0°	0,97	1,04
22,5°	0,92	1,08
30,0°	0,87	1,15
37,5°	0,79	1,26
45,0°	0,71	1,41

## 4.8 Procedure for Selecting a Transport Anchor

- A Surface area of the construction component [m<sup>2</sup>] (on the mould)
- V Volume of the construction component [m<sup>3</sup>]
- ρ Density of the concrete [kN/m<sup>3</sup>]
- F<sub>G</sub> Weight of the concrete component [kN]
- F<sub>Z</sub> Axial force on the transport anchor
- F<sub>S</sub> Angular force on the transport anchor
- F<sub>Q</sub> Lateral force on the transport anchor
- H<sub>A</sub> Mould adhesion force
- z Angular pull factor (1/cosβ)
- n Number of load bearing anchors
- f Impact load factor
- h Mould adhesion factor m<sup>2</sup>

All circumstances of transport are to be considered. The constraints on calculation should be established and documented among the manufacturer of the component, the carrier, and the construction company.

Selecting a transport anchor is possible with the following steps:

1. Determination of the components weight:  

$$F_G \text{ [kN]} = V \text{ [m}^3\text{]} \times \rho \text{ [kN/m}^3\text{]}$$
2. Determination of the mould adhesion force:  

$$H_A \text{ [kN]} = h \text{ [kN/m}^2\text{]} \times A \text{ [m}^2\text{]}$$
3. Determining the impact load factor, number of anchors, and load on each anchor under the necessary lifting and transport circumstances (for this example, lateral pull). For pure axial pull, an angular pull factor of 1 is to be used.
  - a) Example for a case of lifting with mould adhesion, where the component is not placed unilaterally:  

$$F_q \text{ [kN]} = (F_G + H_A \text{ [kN]}) \times z / n \leq \text{zul. } F_q$$
 (see table in specific installation instructions)
  - b) Example for a case of lifting and refection of a component lying unilaterally:  

$$F_q \text{ [kN]} = (F_G / 2 \text{ [kN]}) \times f / n \leq \text{zul. } F_q$$
 (see table in specific installation instructions)
  - c) Example for the case of transport with angular pull:  

$$F_s \text{ [kN]} = F_G \text{ [kN]} \times f \times z / n \leq \text{zul. } F_q$$
 (see table in specific installation instructions)

All interacting factors on the force of the transport anchors must be taken into consideration. Constraints defined by the user will define the force upon the transport anchors. With the values found in the tables of the selected individual transport anchor installation instructions insures that the forces F<sub>s</sub> or F<sub>q</sub> are always less as the allowed values for transport anchors. If it is not possible to calculate the forces of the anchor exactly, then it is necessary to measure the forces so that the entire load can be held by one transport anchor.

### 4.8.1. Example of a Typical Application

Concrete construction component: Wall element  
 b = 5 m, h = 2,4 m, d = 0,3 m

Further constraints: Normal quality steel. Oiled wooden mould (h=2, table 1). Minimum concrete strength prior to first lift of 15 N/mm<sup>2</sup>. The wall slab is manufactured lying on its face and must be lifted from its mould with 90° lateral pull and the use of a lifting beam (slab is always upon the moulding table during erection). Further transport is established with a two cable suspension (assumes two anchors implemented) and a maximum of 30° angular pull. The deployed crane has a maximal lifting speed of 90 m/min meaning an impact load factor of f = 1,3 comes into effect. Desired transport anchor system: Peikko JENKA Anchor SRA.

#### Weight F<sub>G</sub> of the component:

$$V = b \times h \times d = 5 \text{ m} \times 2 \text{ m} \times 0,3 \text{ m} = 3 \text{ m}^3$$

$$F_G = V \times \rho = 3 \text{ m}^3 \times 25 \text{ kN/m}^3 = 75 \text{ kN}$$

#### Mould adhesion force H<sub>A</sub>:

Upon the adhesive surface of the mould:

$$A = b \times h = 5 \text{ m} \times 2 \text{ m} = 10 \text{ m}^2$$

$$H_A = h \times A = 2 \text{ kN/m}^2 \times 10 \text{ m}^2 = 20 \text{ kN}$$

#### Lateral pull by remove of the mould and erection with 2 anchors and a lifting beam:

$$F_q = ((F_G / 2) + H_A) / n$$

$$= ((75 \text{ kN} / 2) + 20) / 2 = 28,75 \text{ kN}$$

#### Lateral pull force by remove of the mould and erection with 2 anchors and a lifting beam

(Lifting scenario with impact load factor):

$$F_q = (F_G / 2) \times f / n$$

$$= ((75 \text{ kN} / 2) \times 1,3 / 2) = 24,375 \text{ kN}$$

#### Angular pull force with angular pull of 30° and transport with 2 anchors:

$$F_s = (F_G \times f \times z) / n$$

$$= 75 \text{ kN} \times 1,3 \times 1,15 / 2 = 56,06 \text{ kN}$$

# Peikko Transport Anchor System

Decisive in the selection of necessary anchors is the situation of 30° lateral pull, in which the larger portion of force is placed on the anchor. The requirements of all three lifting situations are filled with the JENKA SRA36 (load capacity 63 kN). The allowed forces  $F_s$  and  $F_q$  (see table 1 in the Installation instructions for JENKA Systems) are not exceeded. Necessary minimum reinforcement with lateral pull stirrups must follow the JENKA installation instructions precisely.

**Attention:** For all further laying and erection, the lateral pull reinforcement must be accounted for. A clear identification must be placed in sight on the outside surface of the component, otherwise the reinforcement must compensate for both directions of force.

## 5. Concrete Strength

The use of Peikko Transport Anchors Systems demands that at the first moment of force, independent of the type of concrete component, the minimum concrete strength must attain a concrete strength of 15 N/mm<sup>2</sup> prior to application of force. Concrete compressive strength less than 15 N/mm<sup>2</sup> leads to a reduction in load capacity of the concrete (see BGR 106, section 4.2.2). The use of normal concrete is assumed. The installation of Peikko Transport Anchors in light concrete demands a separate check of constraints on the system by our technical team, you can contact our technical department at [www.peikko.com](http://www.peikko.com)

## 6. Reinforcement

Unless specifically stated in the individual usage installation manuals, minimum reinforcement must comply with the regulations outlined in DIN 1045-1. Calculations may take into account the minimum reinforcement required by the transport system as well as the fundamental reinforcement of the construction component. Steel bar reinforcement and mesh reinforcement are to be considered equivalent.

**Reference: Necessary minimum reinforcement for the transport anchors only compensates for local applications of force. The user is responsible for the application of force throughout the entire component.**

## 7. Restrictions of Application

Each installed lifting device is in accordance with BGR 500 "Lastaufnahmeeinrichtungen im Hebezeugbetrieb" (lifting arrangement for lifting device operations), and requires regular inspection. Only appropriate lifting devices and transport anchors are to be used.

Peikko lifting devices (ex. JENKA TLL) may not be installed contrary to its respective usage instructions. Subsequent welding or repair to lifting devices or transport anchors is generally impermissible. Peikko Transport Anchors are not designed for continuous repeated operation..

## 8. Corrosion Protection

A galvanized plating offers temporary resistance to corrosion satisfactory for storage, transport, and placing of a precast concrete component. A permanent corrosion protection is not given through galvanization. The sealing of openings using concrete and mortar should follow placement of the precast concrete component following the regulations outlined in DIN 1045-1.

For longer storage in open air or high moisture climates, unprotected transport anchors can undergo corrosion that will eventually effect load capacity. For precast components continuously used outdoors, in an industry environment, or near open water (high moisture environment and salty air), it is advised to use galvanized transport anchors, or anchors made of stainless steel.



## 9. Identification Markings

The BGR106 „Sicherheitsregeln für Transportanker und -systeme von Betonfertigteilen“ demands identification markings for the transport anchor. Peikko Transport Anchors fulfil these requirements with imprints upon the anchors, lifting devices, and with identification rings. For installation conditions, JENKA anchors implement identification rings JENKA JID or JENKA JDR.

Additionally JENKA Transport Anchors implement a colour coding system for identification of anchors. All components of the same load class are coded with the same colour (see table 4).

Table 4: Color Code System

Load class	Colour code
500	Orange
800	White
1200	Red
1600	Pink
2000	Lightgreen
2500	Anthracite
4000	Green
6300	Blue
8000	Silver
12500	Yellow
15000	Orange
20000	White

The following articles and components are included in the color code system.

Figure 13: JENKA Nail Plate NPP

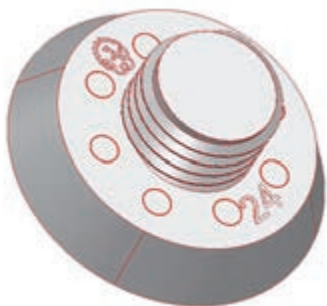


Figure 14: JENKA Narrow Nail Plate NNP

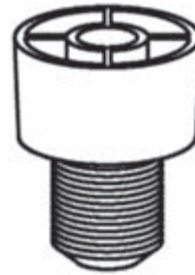


Figure 15: JENKA Identification Ring JID



Figure 16: Peikko Load Identification Tag, ex. for JENKA TLL

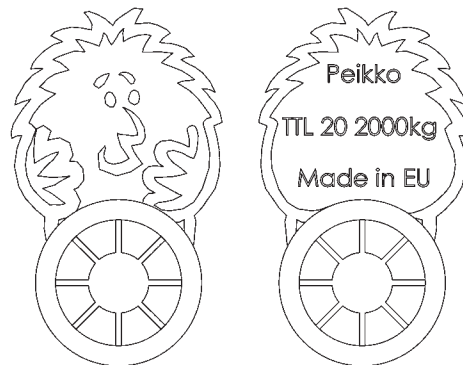
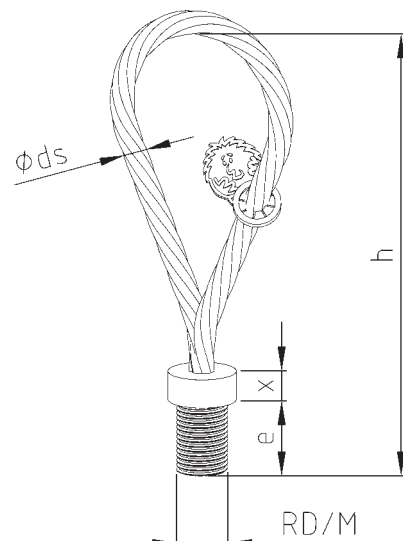


Figure 17: JENKA TLL with Load Identification Tag





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