TECHNICAL MANUAL

Peikko Lifting Systems

General information for all Lifting Systems

Version PEIKKO GROUP 12/2022

peikko®

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Chapter headers explanation:

Chapters are marked by a unique header to explain suitability of information for target group.

DESIGNERS	PRECAST PLANTS	USERS
Designers: Information is intended for designers, civil and structural engineers.	Precast plants: Information is itended for fabricators and companies manufacturing, transporting and mounting precast elements.	Users: Information is intended for persons responsible for selection and ordering of particular lifting elements.

DESIGNERS	PRECAST PLANTS	USERS
	Gray color in header means that particular information is not targeted directly to group indicated in gray color.	

About Peikko Lifting Systems

1. Product properties

DESIGNERS | PRECAST PLANTS | USERS

The Peikko Lifting Systems product range enables the user to handle different lifting application. All Peikko Lifting Systems consist of two components: the Peikko Technical Manual (General and specific) and the Peikko product. The General Information is valid for all Peikko Lifting Systems and the specific Peikko Manual for the individual system. The Peikko products are useable only in combination with the Technical Manuals. Both yield into a complete product that follows the safety and health requirements of the machinery directive (2006/42/EC).

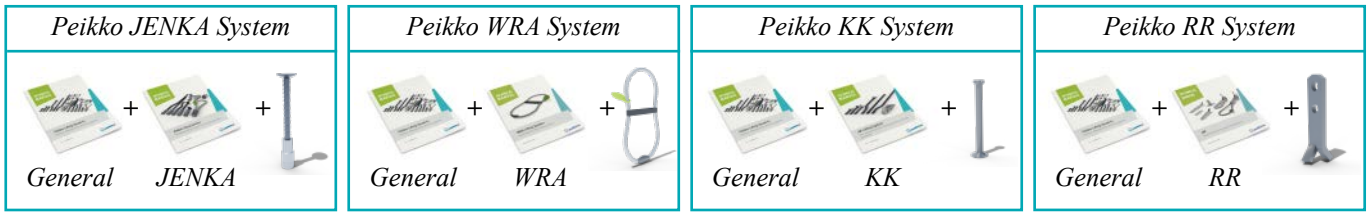


Figure 1. Peikko Lifting Systems Overview.

1.1 General Information

DESIGNERS | PRECAST PLANTS | USERS

The Peikko Lifting Systems are lifting insert systems designed for lifting and handling precast concrete elements. They meet the requirements of the European machinery directive (2006/42/EC) related to the steel load capacity of the lifting systems mentioned in the directive. The EN13155 (harmonized standard “Crane – Safety – Non-fixed load lifting attachment”) together with VDI/BV-BS 6205 requirements (national German rule “Lifting inserts and lifting insert systems for precast concrete elements”) ensure that lifting systems that are cast into concrete can be used safely and have sufficient resistance against concrete failure. The interpretation of these regulations is precisely explained in the Peikko Whitepaper for Lifting Systems.

All Peikko Lifting Systems are intended for temporarily fastening to Lifting Keys to enable concrete elements to be transported and lifted. Applications that require permanent load, affect the stability of a building or require attaching of the safety equipment are not included in this range of applications.

This General Information for Peikko Lifting Systems gives a general overview about the conditions and limitations under which a safe use is possible. It guides the user to design and use Lifting systems correctly and in line with the safety and health requirements according to machinery directive (2006/42/EC). The General Information in this document is applicable for all Peikko Lifting Systems. All system specific product related Peikko Technical Manuals are only valid and can only be used when the information included in this document is known and considered during application.

1.1.1 Unit geometry and spacing

Use of Peikko Lifting systems requires a specific element geometry. The load capacities given in this section of the manual are based on specific dimensions as well as edge and axial distances. The safety factors can only be ensured as described if the geometric specifications are complied with. Peikko’s engineering service offers customized solutions to make special applications possible.

1.1.2 Resistances and design concept

The resistance of the Peikko Lifting Systems is determined by a design concept that refers to the following standards and regulations.

- Machinery directive 2006/42/EC
- EN1992-1-1
- EN13155
- VDI/BV-BS6205

The load capacities depend very much on how and in which combination the items will be used. For Peikko Lifting Inserts all Peikko Lifting Keys can be used at an angular pull of β = 0 – 45° and some at a lateral pull of 90°.
The safe working load capacities (R_{zul}) are based on specific dimensions and edge distances as given in the specific product manual. Before selecting an insert, take note of the design assumptions in this manual. **The minimum compressive strength of the concrete at the moment of load application is 15MPa and for KKD 35 MPa.**

min. 15 MPa
For KKD min. 35 MPa

The Peikko Lifting Systems are available in standardized load classes as shown in *Figure 2*.

JENKA [t]	KK [t]	RR [t]	WRA [t]
0.5			
			0.8
1.2	1.3		1.2
			1.6
2.0			2.0
2.5	2.5	2.5	2.5
4.0			4.0
	5.0	5.0	5.2
6.3			6.3
8.0	7.5		8.0
	10.0	10.0	10.0
12.5			12.5
	15.0		16.0
	20.0		20.0
		26.0	25.0
	32.0		

Figure 2. Peikko standard load classes.

1.1.3 Reinforcement

The use of the Peikko Lifting Systems requires a minimum level of reinforcement in the concrete elements. The reinforcement that is defined by structural design can be considered by taking into account the existing cross section. The required reinforcement level can be attained by using single reinforcing bars or a wire mesh with an equivalent or greater cross section (mm^2/m or cm^2/m). If the designed reinforcement must be removed or cut to install the Peikko Lifting Insert, this area must be repaired by adding a similar cross section of reinforcement (single bars or wire mesh) with sufficient overlapping length.

WARNING!
Always check that sufficient reinforcement is designed and installed. Too little reinforcement can result in severe accidents and collapsing elements.

The reinforcement described in this section supports only the load impact of the lifting system on the concrete element. The structural designer must bear in mind that the element may bend as a result of the transportation process. Additional reinforcement may be needed to prevent the element from cracking. This must be defined separately. Surface reinforcement (mm^2/m) must be considered and installed cross-wise for each element direction.

1.2 Application condition

DESIGNERS	PRECAST PLANTS	USERS

1.2.1 Loading, lifetime, and environmental conditions

All Peikko Lifting Systems are designed for use in precast elements for transportation and with temporarily-fastening Lifting Keys, shackles or crane hooks.

Multiple lifts can be completed before the final installation. The lifting system must not be installed or used in crane counter weights. Lifting systems for such applications must be made from stainless steel.

The lifetime of lifting systems begins with stocking and stretches to the final installation of the precast element on the construction site. This might be hours, days, or sometimes weeks or months. During this time, it is essential to protect any opening against dirt, pollution, and water. This can be achieved by covering plugs or by storing elements in dry conditions under a roof or other shelter.

All precast concrete elements in which Peikko's lifting systems can be used must be made from normal concrete according to EN206. The minimum compressive strength must be 15MPa in normal cases and 35 MPa for KKD Inserts.. Exceptions for lower concrete strength and grade require individual confirmation.

min. 15 MPa
For KKD: min. 35 MPa

The products described in this technical manual are not intended for use in lightweight concrete, lightweight aggregate concrete with an open structure, or autoclaved aerated concrete. Light concrete requires separate verification of proper conditions and must not be used without detailed specifications.

All Peikko lifting systems must be installed and used in clean, dry surroundings and environmental conditions. Environmental pollution should always be minimized. Normal humidity does not affect durability during stocking. Dampness resulting from the concreting procedure is permissible and does not affect usability. Lifting components must be stored and protected in dry conditions, preferably under a roof. *Figure 3* shows a suitable storage location.

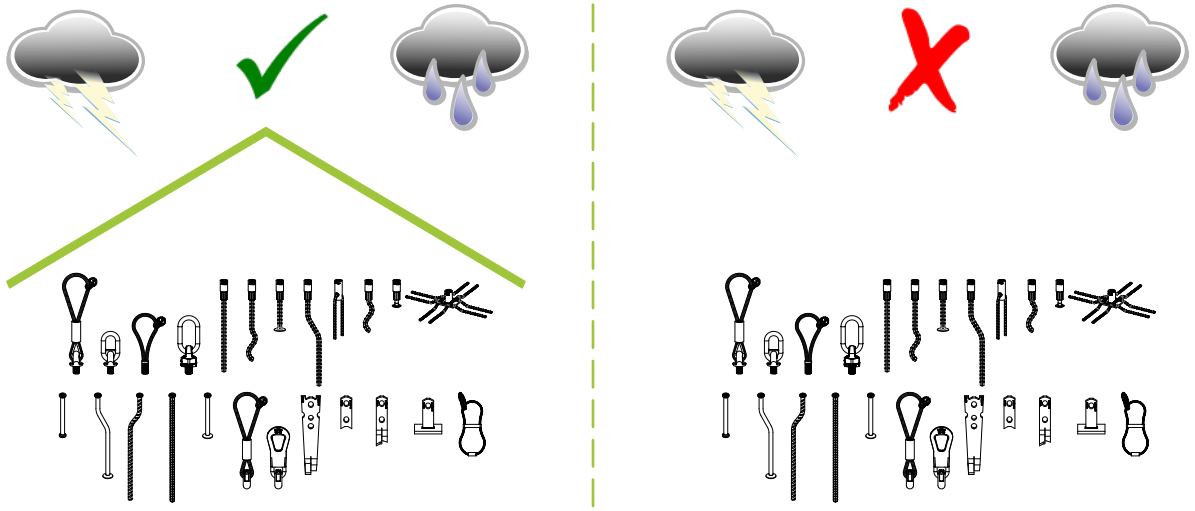


Figure 3. How to store.

WARNING!

Peikko Lifting Keys are subject to corrosion when they are unprotected and exposed to outdoor weather conditions such as large temperature variations, snow, ice, humidity, acidic atmosphere, or salt and sea water impact. These conditions may cause damages and shorten the standing time, which increases costs.

Peikko Lifting Keys must be used by experienced and trained personnel. This reduces the risk of severe damages and injury. Always execute every lifting process according to the instructions.

All Peikko Lifting Keys provided by Peikko are intended for lifting processes. Never use Peikko Lifting Keys for lashing or for fixing loads onto trucks as this may cause damage to the Peikko Lifting Keys, leading to a reduced service life.

The following are mandatory instructions for safe working. They must be strictly complied with whenever lifting systems are in use.

WARNING!

- Connect Peikko Lifting Keys completely and correctly with the Lifting Insert.
- Operate manually. Do not use any tools such as bars or claws.
- During the attachment process the Peikko Lifting Key should move freely without requiring force. If the Peikko Lifting Key is blocked, check for damage and the presence of obstructions.
- Visually inspect all items before use.
- Check and clean all surfaces on the Peikko Lifting Keys and the possible recess of Peikko Lifting Inserts before use. It is highly recommended that the installation accessories are lubricated for easier removal and to avoid concrete pollution. Pollution can prevent the Peikko Lifting Key from fitting to the Lifting Insert, which has an immediate impact on the safety level and may result in danger of death.
- Inspect all Peikko Lifting Keys regularly for safety purposes.
- Use Peikko Lifting Keys only in appropriate environmental conditions.
- Keep in mind the local regulations for safe lifting and hoisting at all times and consider the design assumptions described in this manual.

1.2.2 Interaction with Lifting Keys

Ensure that all Peikko Lifting Systems are used correctly during each interaction. Please read, understand, and use the instructions for Peikko Lifting Keys. This is the only way to ensure that loads are transferred properly.
All Peikko Lifting Keys are designed for use either with one hand or with both hands. When using Peikko Lifting Keys, bear in mind the designed method and load transfer. Items with a thread transfer loads over the entire thread length into the casted insert. All Peikko Lifting Keys are designed to enable full load transfer.

WARNING!
Cutting, filing and reworking Peikko Lifting Keys is strictly prohibited.

1.2.2.1 JENKA Lifting Keys

Peikko offers different JENKA Lifting Keys for different load applications. Before and during use, it is important that an appropriate JENKA Lifting Key is chosen. Lifting Keys JL, JLW and TLP can be used in all directions but TLL Lifting Key can only be used for axial and diagonal loads up to a maximum of 45°. *Figure 4* shows the permissible load directions for JENKA Lifting Keys.

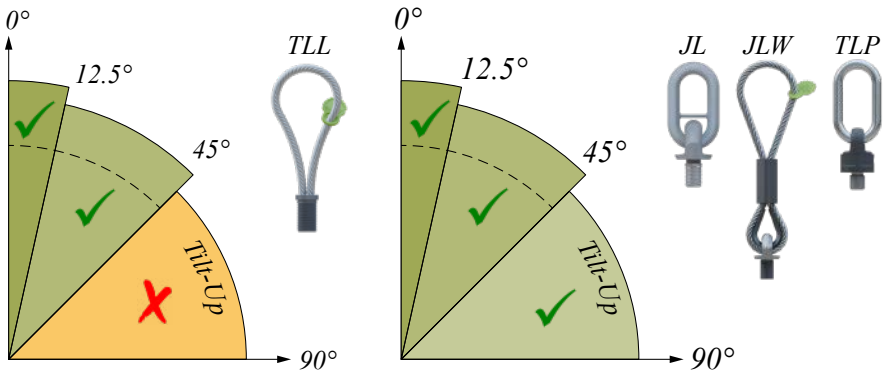


Figure 4. Permissible load directions.

Technically, the difference between JENKA Lifting Keys TLL and JL or JLW is that for TLL the Narrow Nail Plate creates a recess to fit the Lifting Key in as for JL and JLW the NP P recess plate creates an opening in the concrete for the pressure plate. This opening supports the load impact to Lifting Keys JL and JLW, gives better performance, and reduces the risk of damaging the Lifting Key during the use. The impact of the horizontal loads from JENKA Lifting Keys JL and JLW onto the concrete is shown in principle in *Figure 5* together with the correct application.

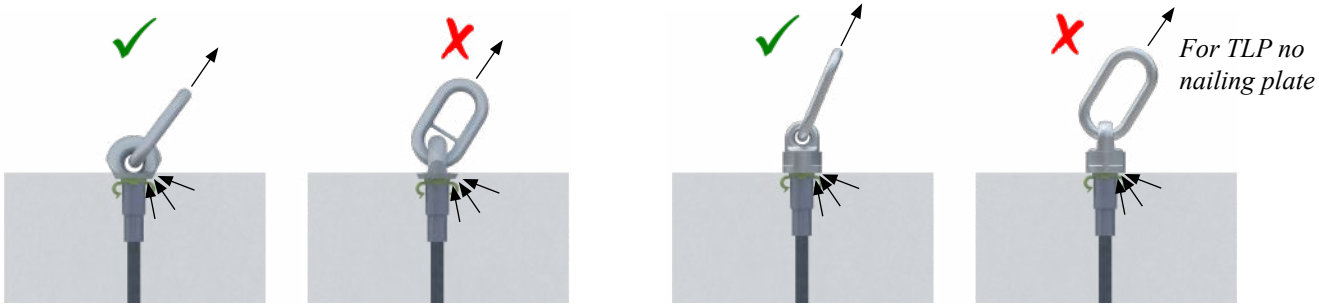


Figure 5. Correct direction of JENKA JL, JLW, and TLP Lifting Keys.

WARNING!
When using TLP Lifting Key the Lifting Insert needs to be assembled flush to the element surface – no nailing plates should be used.

1.2.2.2 KK Lifting Keys

For KK Lifting System Peikko offers KKL Lifting Keys, which are designed for all load directions. *Figure 6* shows the permissible load directions for KKL Lifting Keys.

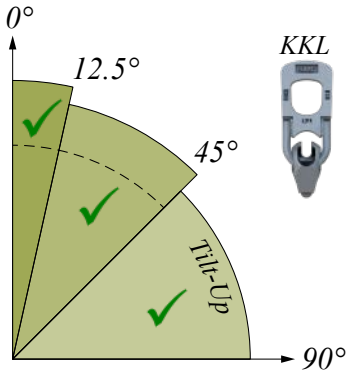


Figure 6. Permissible load directions.

KKL Lifting Key works together with the opening created in the concrete by the Recess Items KK FR or KK FM for the spherical KKL Lifting Key part. This supports the load impact on KKL Lifting Key, gives better performance and reduces the risk of damaging the lifting system's parts during use. The impact of horizontal loads from the KKL Lifting Key onto concrete is shown in principle in *Figure 7*.

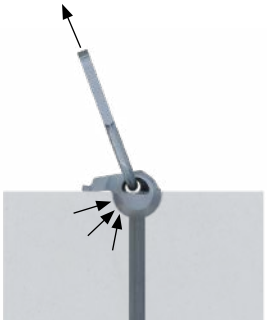


Figure 7. Impact of horizontal loads.

1.2.2.3 RR Lifting Keys

For RR Lifting System Peikko offers RR Lifting Keys that are designed for all load directions. *Figure 8* shows the permissible load directions for RR Lifting Keys.

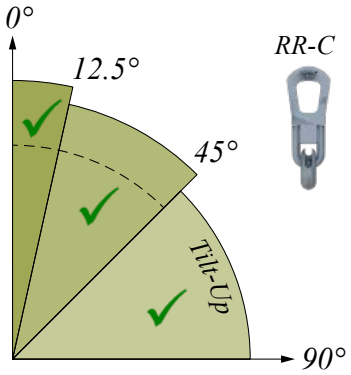


Figure 8. Permissible load directions.

Technically, RR Lifting Key works together with the opening created by RR-RF and RR-PF Recess Items in the concrete for RR Lifting Key part. This supports the load impact to RR Lifting Key, gives better performance and reduces the risk of damaging the Lifting System parts during use. The impact of horizontal loads from RR Lifting Keys to concrete is shown in principle in *Figure 9*.

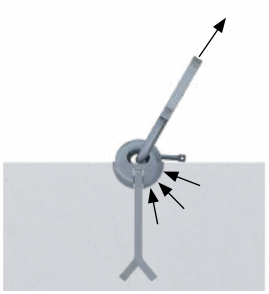


Figure 9. Impact of horizontal loads.

1.2.2.4 WRA Lifting Keys

Peikko offers different WRA Lifting Inserts that are protruding out of the concrete element. WRA Lifting Inserts are not designed for all load directions. They can only be used for axial and diagonal loads up to a maximum of 45° (up to WRA-25,0Z) or up to a maximum of 30° (from WRA-28,0Z up to WRA-99,0Z). *Figure 10* shows the permissible load directions for WRA Lifting Inserts.

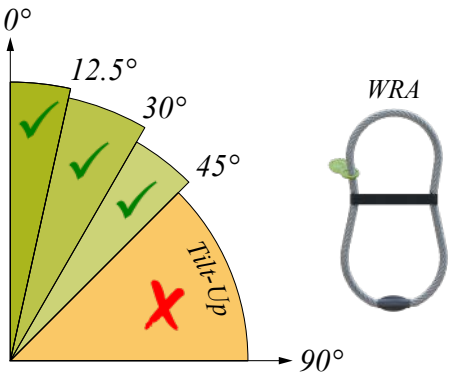


Figure 10. Permissible load directions.

1.2.3 System compatibility of Peikko Lifting Systems

Peikko Lifting Systems include various product series for transporting precast concrete elements. As described under the product properties, Peikko lifting systems consist of Peikko Lifting Inserts and Peikko Lifting Keys. Always use the Lifting Key and the Lifting Insert from the same product series. Combination of different product series such as JENKA, RR, KK is currently not possible.

Lifting Keys are subject to exchanging and forwarding actions during multiple lifting processes. Clarify compatibility prior to using any lifting keys in combination with Peikko Lifting Inserts.

WARNING!
Incompatible lifting keys may cause accidents and severe injuries.

The correct lifting and handling guidelines must always be available when hoisting. This information must be supplied by the company owner to all personnel concerned.

Peikko Lifting Inserts can be used with other Lifting Keys. Prior to use, compatibility must be certified and approved by Peikko.

1.2.3.1 JENKA Lifting System Compatibility

Peikko's special Rd thread is a mix of the standard Rd thread and a metric thread according to DIN 13. It has metric screw pitches but a round thread geometry of thread flanks that contain a double angle of 60° and 30°. For that reason it can be used with standard metric thread as well as with Peikko's special Rd thread. It is not possible to use standard Rd thread according to DIN405:1997 or standard metric fine thread according DIN13:1999. *Figure 11* shows the applicable thread combinations.

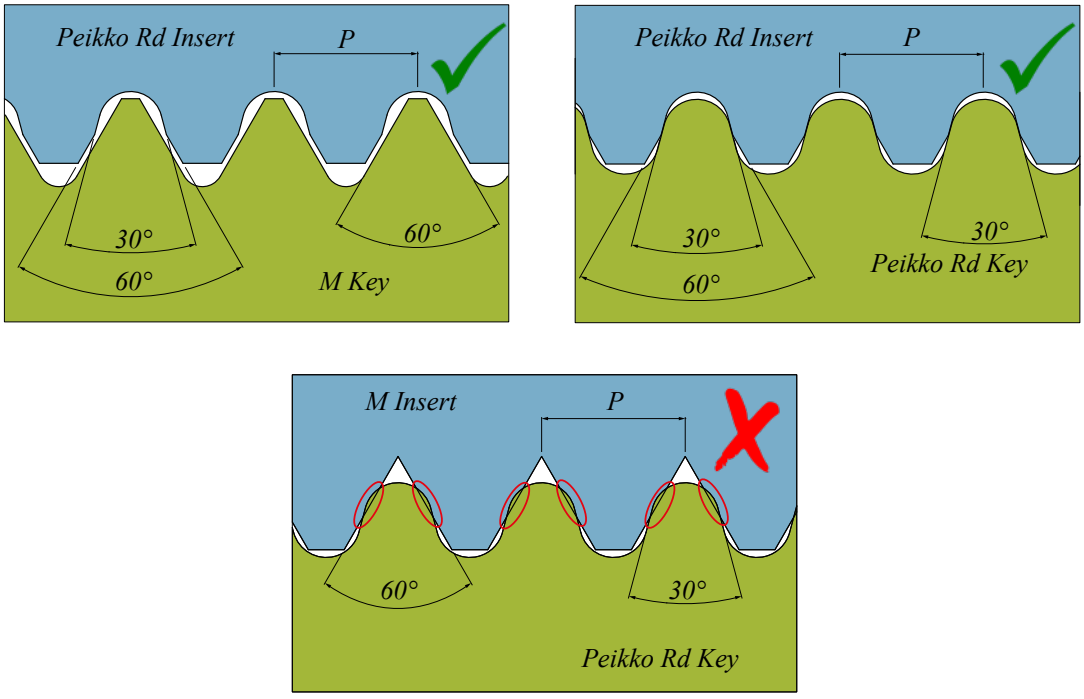


Figure 11. JENKA thread combinations.

Peikko JENKA Lifting Inserts are compatible with the following lifting keys:

- JENKA Lifting Keys such as JL, JLW, or TLL with special round thread (Rd thread)
- JENKA Lifting Keys such as JL, JLW, TLP or TLL with metric thread (M thread)
- Other lifting keys with thread that are certified and approved by Peikko prior to use

Peikko Lifting Inserts are always delivered with Peikko Rd thread, which enables full compatibility with Rd threaded and M threaded Lifting Keys.

1.2.3.2 KK Lifting System Compatibility

Peikko KK Lifting Inserts are compatible with the following lifting keys:

- KK Lifting Keys such as KKL and modifications of KKL placed on the market by Peikko
- Other lifting keys that are certified and approved by Peikko prior to use

1.2.3.3 RR Lifting System Compatibility

Peikko RR Lifting System Inserts are compatible with the following Lifting Keys:

- RR Lifting Keys such as RR-C and modifications placed on the market by Peikko
- Other Lifting Keys that are certified and approved by Peikko prior to use

1.2.3.4 WRA Lifting System Compatibility

Peikko WRA Lifting Inserts can be used with ordinary lifting accessories. Peikko WRA Lifting System inserts are compatible with the following lifting keys:

- Standard hoisting hooks for the use with chain or wire ropes
- Standard hoisting shackles (bolt diameter $>3.5\times ds$ for loads up to 100 kN)
  (bolt diameter $>4\times ds$ for loads bigger than 100 kN)

1.3 Limitations for application

DESIGNERS	PRECAST PLANTS	USERS

Use of the Peikko Lifting Systems is limited to specific application condition. This section describes the known (but not limited to) conditions, instructions, and hints for safe use.

1.3.1 Corrosion, chemical impacts and galvanizing

Corrosion may occur on exposed metal products when architectural precast elements are etched or acid washed. The amount of corrosion will depend on the acidity of the wash and/or the type of chemicals used. Similar effects may occur when using products in a chemical and industrial environment and in coastal zones that have a salty atmosphere.

For lifting systems that are permanently exposed to weather, chemical conditions, and seawater atmosphere the usability of products might be affected by corrosion. Ensure that black or electro galvanized lifting systems are prevented from corrosion during storage, transport, and installation. For extreme conditions we recommend inserts made of stainless steel.

Permanent corrosion protection is technically not given. Casted products must be protected from environmental influence. Peikko accessories can be used for protection purposes.

All Peikko lifting systems are delivered in usable condition. No further surface treatment (e.g. galvanizing, painting) is needed. Such treatments may result in unexpected embrittlement of the product.

WARNING!
Never galvanize or coat Peikko products in any way.

All parts of lifting systems are subject to ultraviolet radiation. Prior to use, ensure that the products are not affected by material aging caused by ultraviolet radiation. Material aging effects occur on products that are kept in storage for extended periods or that have suffered the effects of bad weather.

All Peikko Lifting Inserts are either black, electro galvanized, hot dipped galvanized or made from stainless steel. Choose the correct surface finish prior to installation depending on your application (seawater conditions, changing weather conditions, etc.).

1.3.2 Weather conditions

During winter season the users are often challenged to keep the Peikko Lifting Inserts free of ice and snow. There are very efficient and simple techniques for protecting lifting systems from winter conditions. The following chapters show the recommended solutions for the individual systems. By following our recommendations, the openings of Peikko Lifting Systems are protected and keeping dust, dirt and water away.

Peikko Lifting Systems have been tested for use all year round, guaranteeing safe and reliable handling during all stages of lifting and transportation. After final usage of Peikko Lifting Products that remain installed, further use is explicitly prohibited. Sealing with mortar is recommended to avoid corrosion and to ensure the durability of the element.

For the JENKA Lifting System the NP P and NNP nailing plates as well as CPP cover plugs (see *Figure 12*) can be used to protect the casted inserts from bad weather conditions.

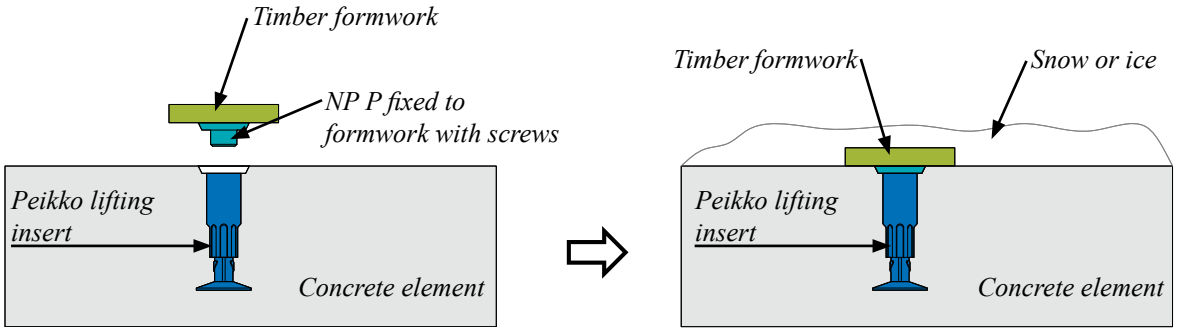


Figure 12. Winter protection of lifting systems.

For the KK Lifting System the KK FR recess and for the RR Lifting System the RR-RF recess (see *Figure 13*) can be used to protect the casted inserts from bad weather conditions.

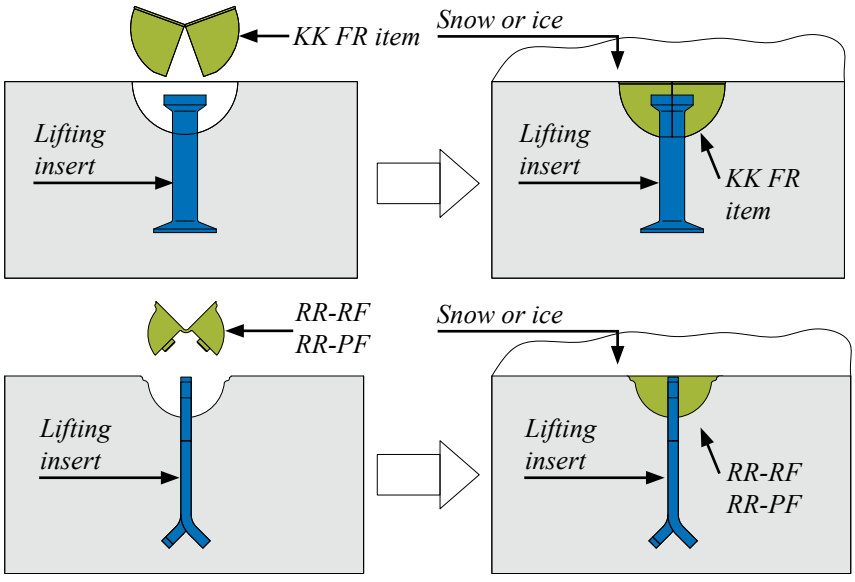


Figure 13. Winter protection of lifting systems.

1.3.3 Personnel and safety requirements

Peikko products must be used by trained, qualified, experienced, and properly supervised workers adhering to the safety standards in this manual.

WARNING!
If untrained personnel use lifting systems, there is a risk of incorrect use, which may lead to items falling and could cause severe injury or death.

The user must evaluate the product application to determine the safe working load and control all field conditions to prevent applied loads from exceeding the product's safe working load. If it is not possible to define the loads acting on the insert by calculation (e.g., highly structured elements), then inserts must be installed in such a way that every insert is able to carry the unit's entire weight.

The Peikko items are installed either by wire fixing, nailing, drilling, or any other type of tooling. During these procedures, the operator is subject to different exposures (e.g., noise, dirt, dust, vibration, thermic influence, oil, and grease). The use of personal safety equipment is recommended.

Documentation is subject to regular updates. Prior to use, check Peikko's website for updated documentation. When updated documentation is published, this version expires with immediate effect.

1.3.4 Modifications on products

Peikko cannot control field conditions or field workmanship; therefore it cannot provide a guarantee for any Peikko product that has been altered in any way after it has left the manufacturing facility. This includes welding, bending, and filing.

WARNING!
Never weld any of Peikko's lifting products.

1.3.5 Material properties and quality

Peikko has its own plants worldwide, enabling it to offer special and customized steel grades for lifting items in addition to standard grades. Products can be customized on demand to individual configurations such as higher impact strengths for low temperatures. A proper consultation is required to identify special considerations during application.

2. Design criteria

DESIGNERS | PRECAST PLANTS | USERS

Regulations such as VDI/BV-BS 6205 (national German rule, “Lifting inserts and lifting insert systems for precast concrete elements”) govern lifting systems. According to the definition, the Lifting Systems consist of a Lifting Insert, permanently anchored in the precast element, and the corresponding Lifting Key, which hooks temporarily onto the embedded Lifting Insert. *Figure 14* shows this definition in an overview of the Lifting System parts.

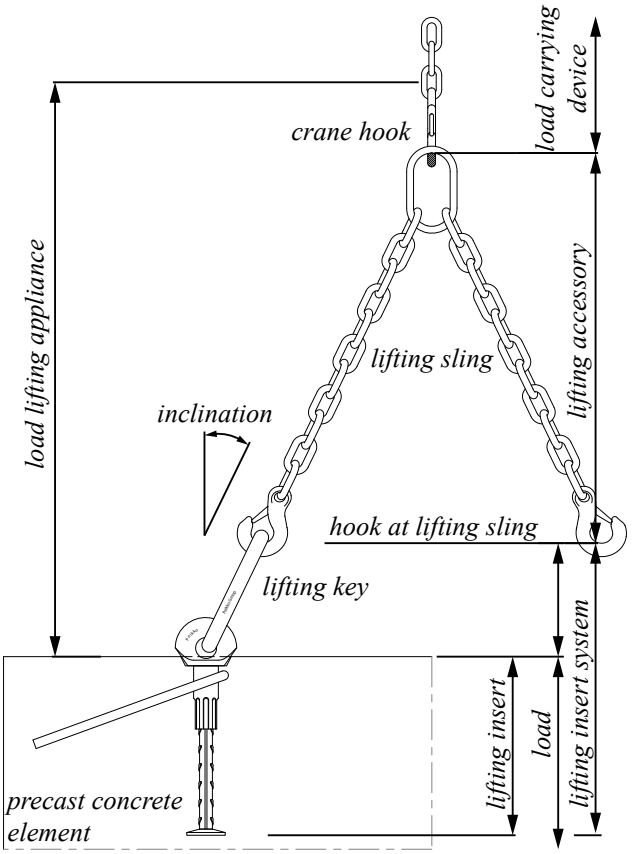


Figure 14. Definition of a lifting system according to VDI/BV-BS6205.

Item that are parts of lifting accessories or load carrying device shown in *Figure 14* are not documented here.
The structural behavior of lifting systems depends on multiple factors. These design assumptions and impacts are given in the following sections.

2.1 Temporary conditions and concrete strength

DESIGNERS	PRECAST PLANTS	USERS

When lifting systems are being used, temporary conditions at the precast plant or on site during the early hardening stage of the concrete must be taken into account.

The concrete must have a compressive strength of at least 15 MPa, for KKD 35 MPa, prior to any lifting operation. Always check for exceptions and the correct value from the System specific Technical Manual.

min. 15 MPa
for KKD min. 35 MPa

During temporary conditions, the concrete often limits safe working loads.

PLEASE NOTE

Consider the environmental and temperature conditions. A series of concrete cubes can help to determine the development of the concrete's strength.

2.2 Safety and factors

DESIGNERS	PRECAST PLANTS	USERS

The insert's static safety factors account for at least 3-fold protection against steel failure, as well as at least 2.5-fold protection against concrete failure depending on the concrete strength. All Lifting Keys account for at least 4-fold protection against steel failure.

2.3 Number of inserts and lifting systems

DESIGNERS	PRECAST PLANTS	USERS

During transportation, various defined and undefined balancing conditions may exist, depending on the chosen load lifting system.

For defined balance conditions (statically determined system), the insert loads can be calculated very precisely. This is the case when we use two suspension gears, three suspension gears (with symmetrical insert distribution), or four suspension gears with a compensation seesaw. *Figure 15* shows examples of such transportation systems.

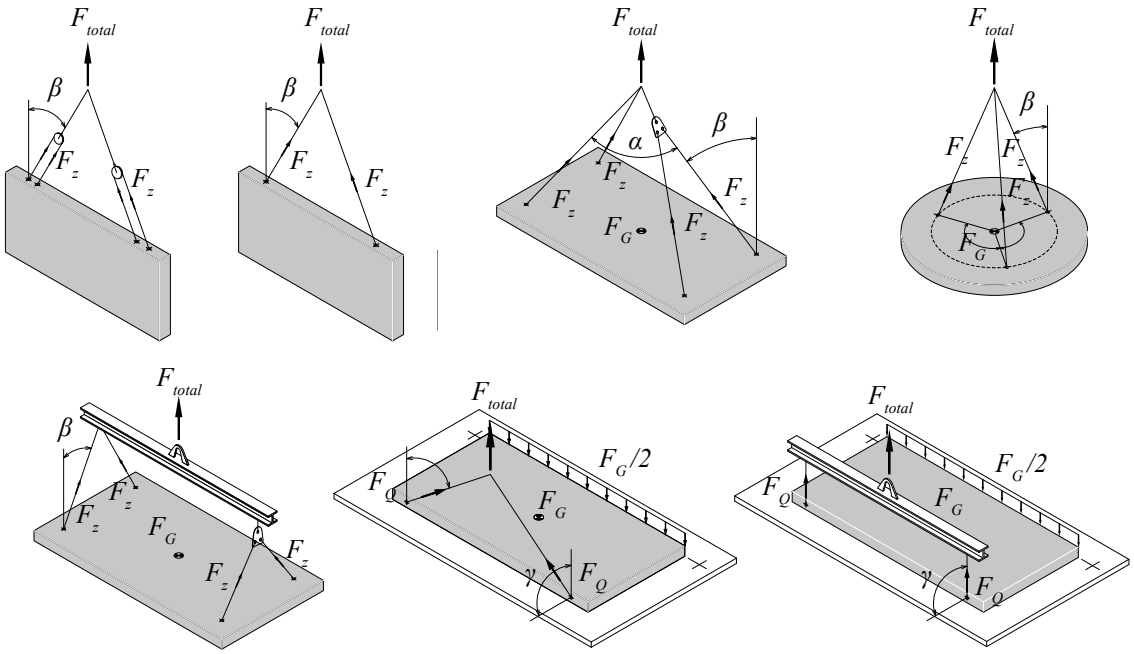


Figure 15. Balanced lifting conditions.

For undefined balance conditions, the lifting insert loads cannot be calculated exactly. This is the case when more than two lifting inserts are used, such as for wall elements with three lines installed or four suspension gears without compensation. In such a case, a maximum of two lifting inserts can be load bearing. *Figure 16* shows examples of such transportation systems.

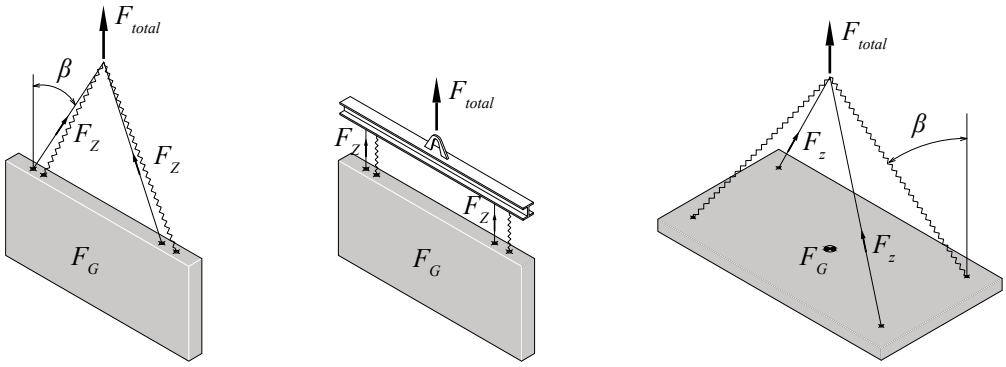


Figure 16. Imbalanced lifting condition.

For unclear lifting situations in which only the element's weight is known, it is recommended for safety reasons that **each insert is designed for the entire element weight.**

Using tolerance-compensating equipment such as (but not limited to) seesaws or lifting beams allows precise load distribution among the inserts. Before installation and lifting, ensure that all factors have been taken into consideration regarding the lifting actions.

PLEASE NOTE

Always specify which load distribution and which conditions and equipment must be considered for safe lifting.

Asymmetrical element design requires consideration of asymmetrical insert installations. Before installing lifting systems into asymmetrical elements or asymmetrically, calculate the insert loads relative to the center of gravity. *Figure 17* shows such an application.

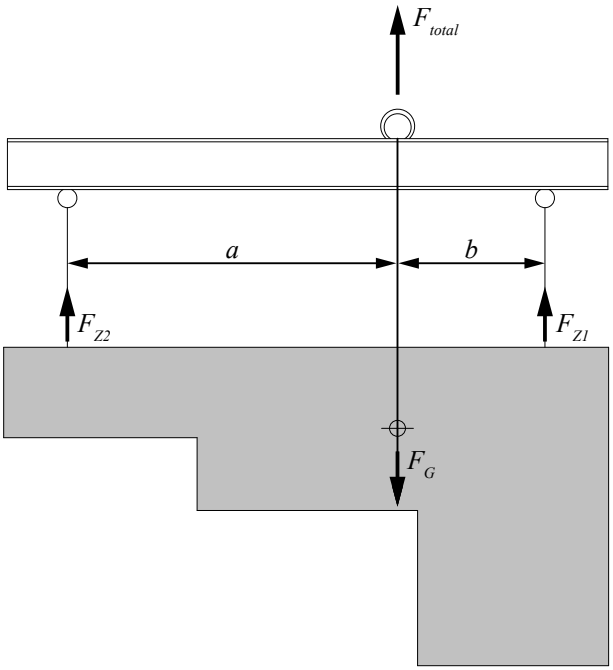


Figure 17. Asymmetrical insert layout.

Prior to installation and use, the position of the insert must be considered. It must always be higher than the center of gravity to prevent the element from tipping over as shown in *Figure 18*.

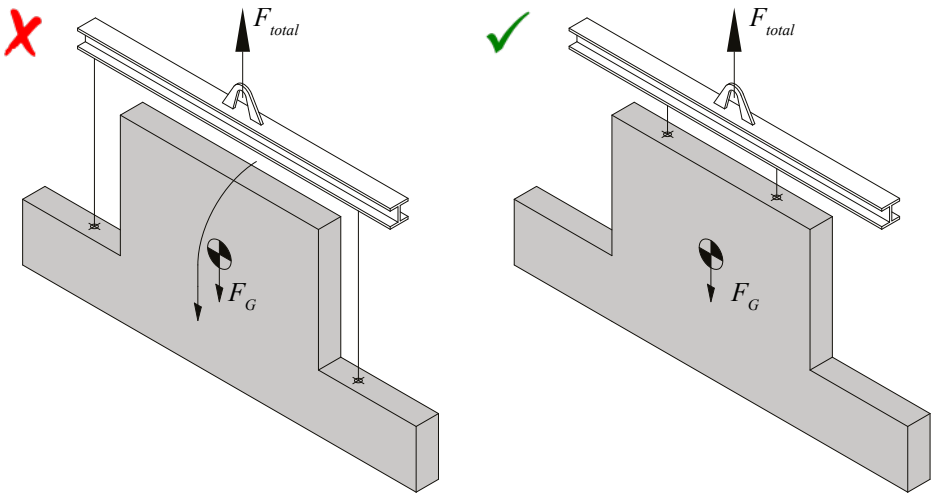


Figure 18. Lifting points lower than the center of gravity.

PLEASE NOTE
Elements that tip over can cause severe injury to the user's limbs. Always ensure that the center of gravity is known and the inserts are correctly positioned before attaching elements to the hoisting equipment.

2.4 Acceleration forces

DESIGNERS	PRECAST PLANTS	USERS

The lifting insert system must withstand hoist and acceleration forces such as gravity, acceleration, drive loads, and up and down lifts, and must transmit those loads into the unit. The hoisting load coefficient is usually called the "dynamic factor", and it is chosen depending on the hoist class of the crane (according to EN 13001-2) or the transportation method. Notwithstanding the hoisting load, the coefficient can be defined based on evaluations or user experience for vehicles such as excavators or forklifts. Transportation with an excavator over uneven ground leads to a multiplication of the actual unit weight through acceleration forces. Reference values for the dynamic factor are given in *Table 2*.

PLEASE NOTE
The individual hoisting coefficient must be considered for the entire chain of transportation between the precast plant and final installation.

Depending on the individual hoisting class ($H1$ to $H4$) for cranes, the minimum hoisting coefficient (HC) for cranes can be taken from *Figure 19*, which shows the development of the hoisting coefficient related to hoisting speed (according EN 13001-2), where Φ_2 = dynamic coefficient and v_h = hoisting speed. Reference values for hoisting equipment are introduced in *Table 2*.

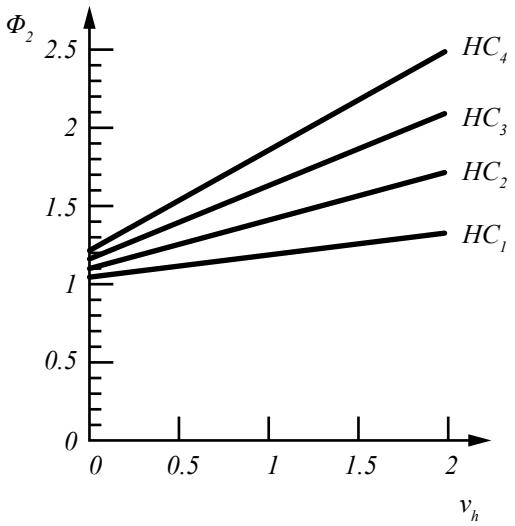


Figure 19. Hoisting coefficient development from EN 13001-2.

2.5 Mold adhesion

DESIGNERS	PRECAST PLANTS	USERS

While lifting concrete units out of the mold, we observe an adhesion force between the element and the formwork. This adhesion force must be assumed when defining the lifting system. The adhesion force can increase the force required to several times the actual unit weight. This increase in the force depends on the mold surface and the contact area between the concrete unit and the mold. Applying lubrication and separating agents reduces the required forces. Separately removable construction groups of formwork (side formwork or front-end formwork) must be removed before lifting. The adhesion forces can be determined by multiplying the contact area with the reference values for mold adhesion. Please bear in mind that mold adhesion may vary depending on the surface structure of the mold. Reference values for mold adhesion are given in *Table 1* ("Selecting a lifting system").

The tilt-up procedure for wall elements can be simplified using wooden wedges to lower the adhesion forces. *Figure 20* shows how this can be executed.

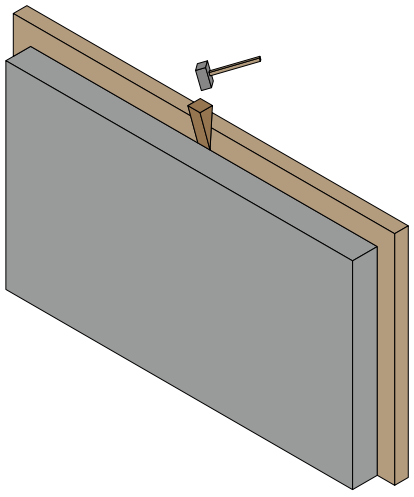


Figure 20. Lowering of the adhesion forces.

For slabs with a regular distribution of lifting inserts, it could be helpful to first lift up two of the four installed inserts. This lowers adhesion forces all over the contact area with the formwork. Thanks to this, there will be no adhesion forces and the lifting can take place on all four inserts.

2.6 Element weight

DESIGNERS	PRECAST PLANTS	USERS

According to EN 1991-1-1, the normal reinforced concrete element weight is defined as a specific weight of 25 kN/m^3. The use of reinforced heavy concrete requires specific weights of at least 27 kN/m^3. Lightweight aggregate concrete with an open structure and autoclaved aerated concrete can vary in weight from 9 kN/m^3 to 20 kN/m^3, depending on the aggregates used. The individual specific weight must be determined by the user.

For heavily reinforced structures such as bridges or massive concrete foundations, the weight of the reinforcement must be considered separately. Openings should be considered for efficient calculation and optimal selection of the lifting system.

2.7 Load directions

DESIGNERS	PRECAST PLANTS	USERS

During the chain of transportation, various processes such as tilt-up, loading, hoisting, rotation, and installation may take place. The selected lifting system must withstand all such conditions and be able to remain safe, even under multiple load directions.

It is clear that a rotation process involves much different conditions than hoisting with a tower crane. For this reason, the user must consider the load directions that may occur when the selected lifting system is used. In principle, four different load directions can be defined (see *Figure 21*):

- **Axial tension:** occurs during lifting with a beam in the longitudinal direction of the insert axis. This is the most economical lifting direction, requiring the smallest insert size. There is no load increase caused by inclination.
- **Diagonal tension:** occurs during lifting with a chain under an angle of inclination longitudinal to the insert axis. This is the most commonly used lifting direction, requiring no special equipment except a lifting chain. It causes load increase due to the inclination angle.
- **Lateral tension:** occurs during lifting with a beam perpendicular to the longitudinal direction of the insert axis. This is the preferred method of demolding elements and lifting them from the horizontal to the vertical direction. This is only possible with certain unit thicknesses due to the perpendicular load impact on the unit thickness.
- **Diagonal lateral tension:** occurs during lifting with a chain perpendicular to and under an angle of inclination longitudinal to the insert axis. This is very similar to lateral tension, but carried out with a chain instead of a beam. This is only possible with certain unit thicknesses due to the almost perpendicular load impact on the unit thickness.

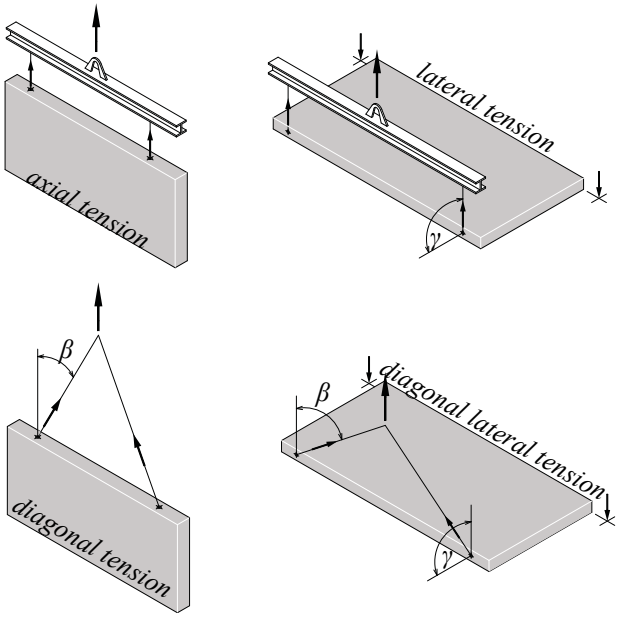


Figure 21. Load directions during hoisting.

The load increase depends on the chain inclination, which is defined by the angle "β" to the vertical. For Peikko's Lifting Systems, the maximum angle to the vertical is 45°. Greater angles are not permissible due to excess load increase.

The relationship of the inclination angle "β" to the load increase and the spread angle of the chain "α" is shown in *Figure 22*. This shows the load distribution on double-strand lifting equipment when hoisting at different angles.

In practice, this means that the angle of inclination has a significant impact on the dimensioning of the transportation system. Transportation with diagonal tension requires additional reinforcement when the inclination angle "β" is > 12.5°.

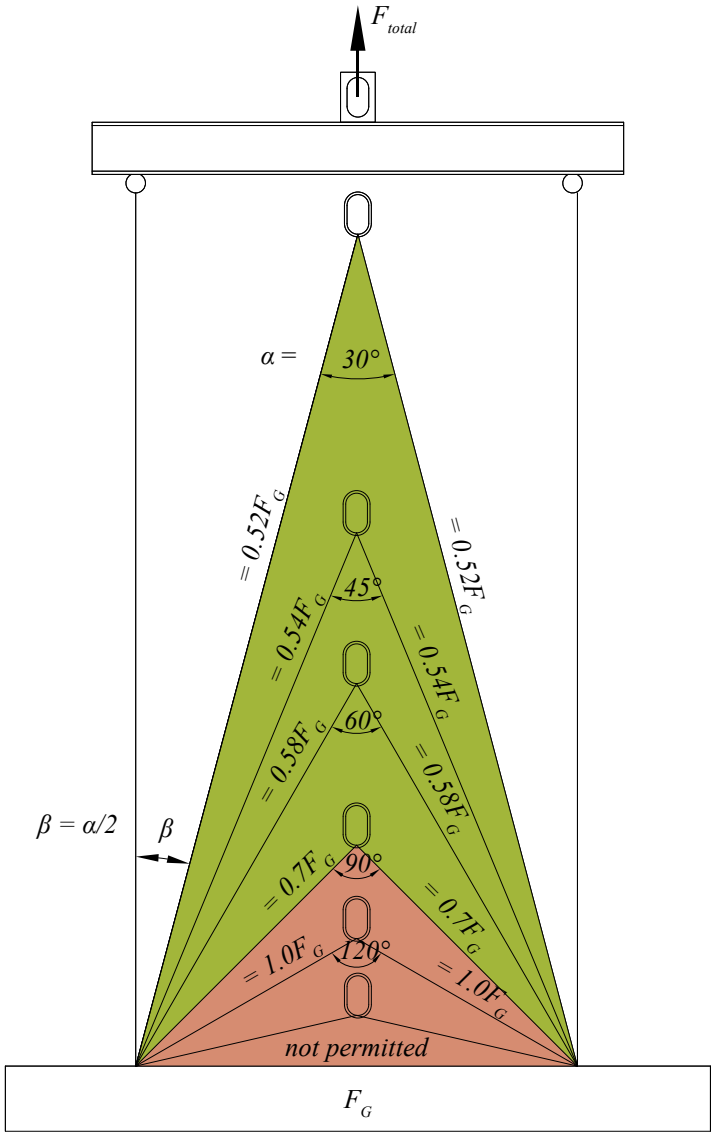


Figure 22. Load increase during hoisting.

Precast concrete elements are very often produced horizontally on casting tables. After concrete hardening, elements such as walls must be lifted from a horizontal position to a vertical position. In many situations, no special tilt-up equipment, such as tilt-up tables or special tilt up machinery, is available. In such cases, the insert installed in the front end assumes only half of the loads during the tilt up process.

This is that half of the element's weight remains on the casting table and half is taken by the installed lifting system. For this type of lifting procedure (lateral tension or diagonal lateral tension), the lifting system must be provided with additional reinforcement. Additional reinforcement can be left out when the inclination angle "γ" is < 15° and a tilt-up table is used (see *Figure 23*).

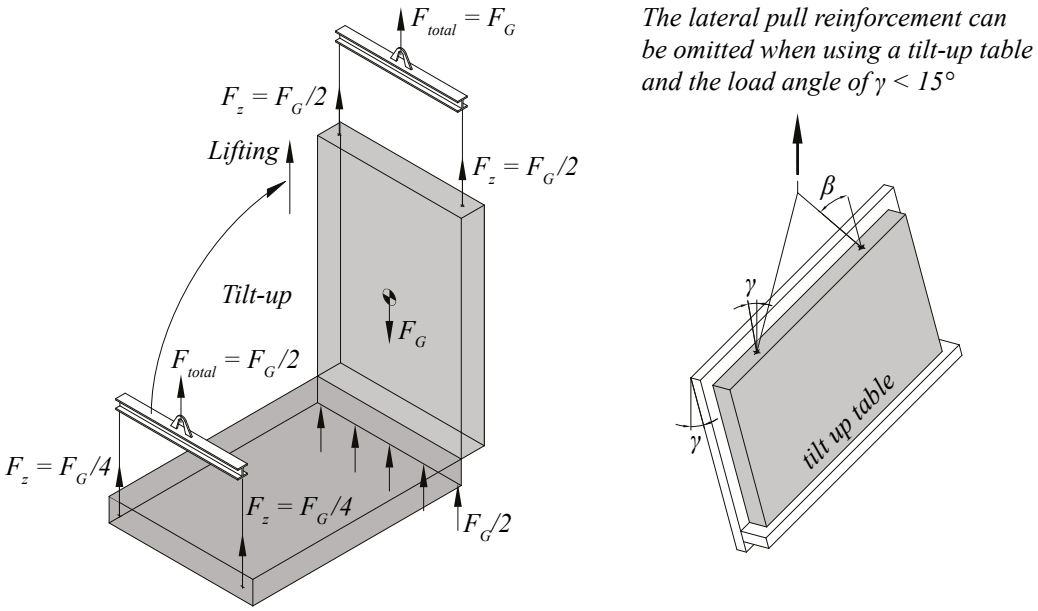


Figure 23. Hoisting procedure from horizontal to vertical.

2.8 Load transfer to concrete

DESIGNERS	PRECAST PLANTS	USERS

Lifting systems anchor the load into the concrete with different methods of load impact. This can happen by

- Bond stress
- Geometry (wave, forged foot)
- Inclusion of concrete.

Before installing any lifting system, please ensure that it is suitable for your application and unit geometry. Often the concrete strength limits the application and lifting takes place under undefined conditions.

The engineer must design concrete elements with very precisely positioned lifting systems. The design must consider the deflection of the concrete element caused by lifting and load impact. Additional reinforcement may be needed to handle these impacts.

Selecting Lifting Systems

DESIGNERS | PRECAST PLANTS | USERS

The selection of the lifting system is one important factor in ensuring a safe transportation process.

The user must check the following:

- Is the element known (size, weight, geometry)?
- Is the center of gravity known or must it be defined?
- What is the transportation process after production and who is responsible for it?
- Which equipment is available for transportation to ensure that design assumptions are realized?

Loads are determined for the most challenging case of the transportation process. This guides the entire design of the lifting system. Engineers' calculations must remain below the resistances of the lifting system given in this documentation. The rule "stress (E) < resistance (R_{zul})" must always be satisfied.

The lifting system must be decided upon depending on the application, taking account of the following factors:

- Unit weight (F_G)
- Mold adhesion (F_{adh})
- Acceleration forces (Ψ_{dyn})
- Force directions from insert loads (z)
- Manipulation within the entire transport chain
- Influence of multiple slings (n)
- Unit geometry

All of these factors must be considered when selecting a lifting system. The determination of the resulting force acting on the insert is calculated according to the following formulae.

The unit weight is given by

$$F_G = V \times \rho_G \qquad \textit{Equation 1}$$

F_G = weight of the precast element [kN]
V = volume of the precast element [m^3]
ρ_G = density of the concrete [kN/m^3]

The mold adhesion and form friction are assumed to work simultaneously when lifting elements out of formwork. Reference values for mold adhesion are given in *Table 1*. It should be determined as given by

$$F_{adh} = q_{adh} \times A_f \qquad \textit{Equation 2}$$

F_{adh} = action due to adhesion and form friction [kN]
q_{adh} = basic value of combined adhesion and form friction [kN/m^2]
A_f = contact area between concrete and formwork [m^2]

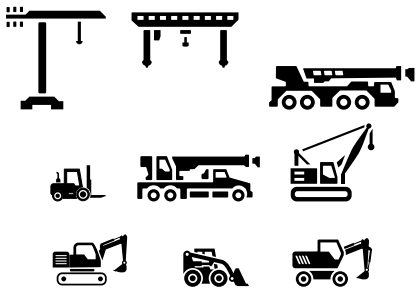
Table 1. Reference values for mold adhesion according to VDI/BV-BS6205.

Formwork and condition	q_{adh} [kN/m^2]
Oiled steel mold, oiled plastic coated plywood	≥ 1.0
Varnished wooden mold with panel boards	≥ 2.0
Rough wooden mold	≥ 3.0

The acceleration forces will be considered by a dynamic factor called ψ_{dyn}. This factor increases the static loads to consider dynamic influence. *Table 2* shows example hoisting coefficients for different hoisting equipment.

Table 2. Coefficient for different hoisting equipment according to VDI/BV-BS6205.

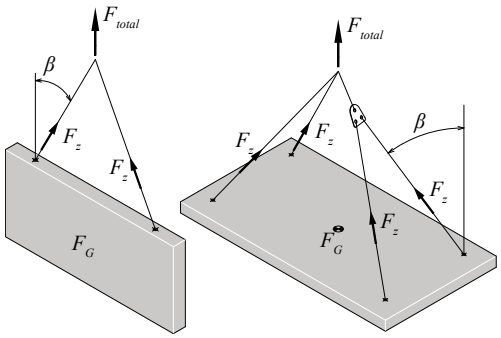
Hoist equipment (class)	Dynamic factor Ψ_{dyn}
Tower crane, portal crane, mobile crane	1.30
Lifting and moving on flat terrain	2.50
Lifting and moving on rough terrain	> 4.0



By lifting elements with a chain, there is a load increase resulting from the angle of inclination. This load increase factor is given for calculation purposes in *Table 3*.

Table 3. z-factors for combined tension and shear (diagonal pull).

Inclination angle β	Cos β	Diagonal tension z-factor (1/cos β)
0.0°	1.00	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



The manipulation within the entire transport chain must be considered and the most challenging case must guide the design. During manipulation, the following load conditions may occur:

- Erection in combination with adhesion and form friction.
- Erection.
- Lifting and handling under combined tension and shear.

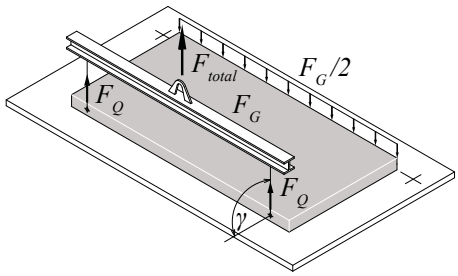
Load due to erection in combination with adhesion and form friction may occur when the element is lifted out of the formwork. It is assumed that the element (*Equation 3*) rest one-sided on the formwork. The load is calculated as follows:

$$F_Q = (F_G/2 + F_{adh}) \times z/n \qquad \text{Equation 3}$$

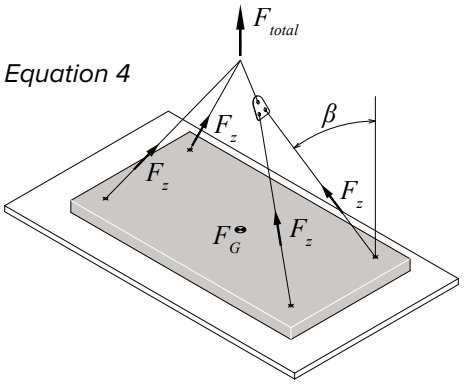
$$F_Q = F_z = (F_G + F_{adh}) \times z/n \qquad \text{Equation 4}$$

F_Q = load acting on the lifting insert [kN]
F_G = weight of the precast element [kN]
F_{adh} = action due to adhesion and from friction [kN]
z = factor for combined tension and shear, $z = 1/\cos \beta$
n = number of load bearing lifting inserts

Equation 3

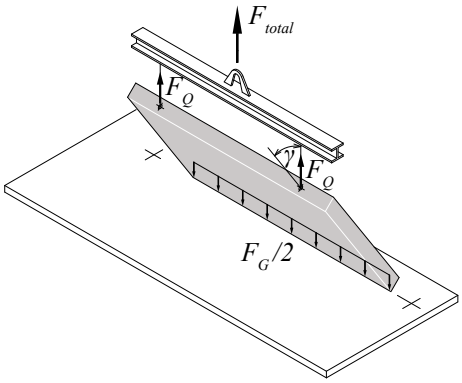


Equation 4



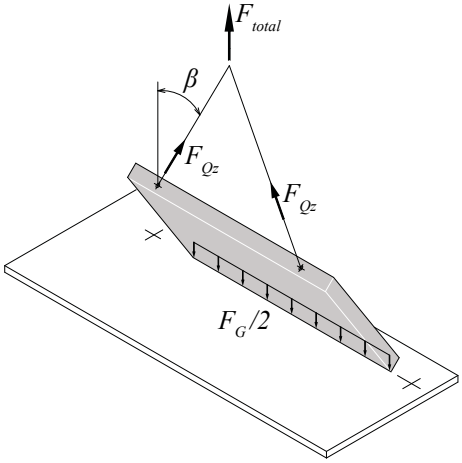
The erection process assumes that the element rests one-sided on the formwork or has been tilted up and adhesion forces are no longer present. Consider whether a beam or a chain will be used before calculation. The load is calculated as follows:

$$F_Q = (F_G/2) \times \Psi_{dyn}/n \qquad \textit{Equation 5}$$



F_Q = shear load acting on the lifting insert (shear) directed perpendicular to the longitudinal axis of the concrete component, e.g., during lifting from the horizontal position with a beam [kN]
F_G = weight of the precast element [kN]
Ψ_{dyn} = dynamic factor
n = number of load bearing lifting inserts

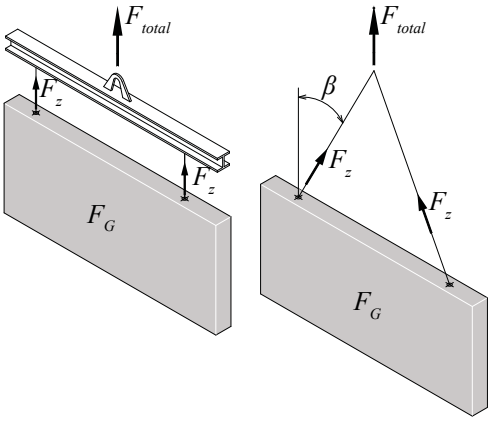
$$F_{QZ} = (F_G/2) \times \Psi_{dyn} \times z/n \qquad \textit{Equation 6}$$



F_{QZ} = shear load acting on the lifting insert (shear) directed perpendicular to the longitudinal axis of the concrete component, e.g., during lifting from the horizontal position [kN]
F_G = weight of the precast element [kN]
Ψ_{dyn} = dynamic factor
n = number of load carrying lifting inserts
z = factor for combined tension and shear, z = 1/cos β

The most common lifting procedure is lifting with a chain. This is also known as lifting and handling under combined tension and shear. The calculation procedure for this lifting is as follows:

$$F_Z = F_G \times \Psi_{dyn} \times z/n \qquad \textit{Equation 7}$$



F_Z = load acting on the lifting insert in direction of the sling axis [kN]
F_G = weight of the precast element [kN]
Ψ_{dyn} = dynamic factor
n = number of load carrying lifting inserts
z = factor for combined tension and shear, z = 1/cos β

After determining the actions, the permissible safe working load (SWL) as given in section 1 must be compared with the actions. The following formula is always valid and requires that the actions ("E") never exceed the resistance ("R_{zul}").

$$E \leq R_{zul} \qquad \textit{Equation 8}$$

E = action [kN]
R_{zul} = permissible load (resistance) [kN]

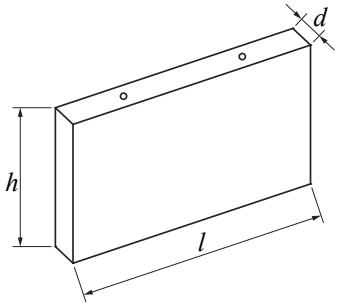
If the safe working load is at least as large as the action, the lifting system can be used in accordance with the geometrical requirements.

Annex A – Calculation examples Peikko Lifting Systems

DESIGNERS	PRECAST PLANTS	USERS

Example 1: Transporting a wall element

- Tilt-up process with a tilt-up table possible, lateral pull possible, but a vertical storage position preferred.
- Spreader beam available at the precast plant. Only chains available on the construction site with a spread angle of a maximum of 30°.
- Hoisting factor of 1.3 (tower hoist crane, heavy duty mobile crane, truck crane).
- Peikko standard lifting inserts to be utilized.
- Mold adhesion comes from the steel formwork.



Unit geometry and conditions during production
Concrete compressive strength at first loading of 25 N/mm². Reinforcement to be defined but minimum #188 mm²/m

l = 4.0 m h = 2.50 m d = 0.25 m

Unit weight:
$F_G = 4.0\ m \times 2.50\ m \times 0.25\ m \times 25.0\ kN/m^3 = 62.5\ kN$

$F_G = V \times \rho_G$ (*Equation 1*)

Mold adhesion:
$F_{adh} = 4.0\ m \times 2.5\ m \times 1.0\ kN/m^2 = 10.0\ kN$

$F_{adh} = q_{adh} \times A_f$ (*Equation 2*)

Load case 1: Unit weight + dynamics + diagonal pull.
$F_Z = 62.5\ kN \times 1.3 \times 1.15 / 2 = 93.43\ kN / 2 = 46.72\ kN/insert$

$F_Z = F_G \times \Psi_{dyn} \times z/n$ (*Equation 7*)

Load case 2: Unit weight + adhesion + tilt-up with diagonal pull.
$F_Q = F_{QZ} = (62.5\ kN /2 + 10.0\ kN) \times 1.15 / 2 = 23.72\ kN/insert$
Here only half load applies due to one sided support by mold.

$F_Q = (F_G/2 + F_{adh}) \times z/n$ (*Equation 3*)

Load case 3: Unit weight + dynamics + tilt-up with diagonal pull.
$F_Q = F_{QZ} = 62.5\ kN / 2 \times 1.3 \times 1.15 / 2 = 23.36\ kN/insert$

$F_{QZ} = (F_G / 2) \times \Psi_{dyn} \times z/n$ (*Equation 6*)

- ⇨ Load case 1 causes the highest load and determines the design for diagonal lifting.
- ⇨ Load case 2 determines the design for tilt-up actions.

JENKA Lifting insert selection:

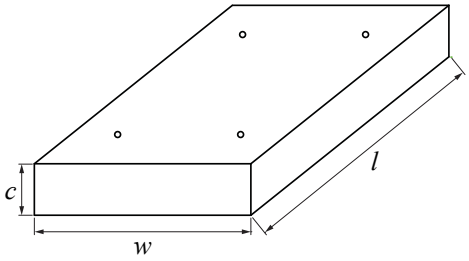
See JENKA Technical Manual

- SRA36, WAL36 or TF36 with
  load for load case 1 ⇨ $F_Z = 46.72\ kN/insert < 63\ kN$
  load for load case 2 ⇨ $F_{QZ} = 23.72\ kN/insert < 31.5\ kN$
  For individual capacity R_{zul}
- Minimum spacing
  800 mm + 2 × 400 mm = 1600 mm < 4000 mm.
  Spacing required ($b + 2 \times a$)
- Minimum thickness 200 mm < 250 mm.
  Thickness required (d)
- Minimum reinforcement
  # 188mm²/m + Ø12×450 (diagonal rebar for 30°) + lateral rebar Ø14×690 (for tilt-up actions and diagonal lifting double rebar recommended).
  Reinforcement required

KK Lifting insert selection:	See KK Technical Manual
• KK5.0×240 or KKR5.0×580 with load for load case 1 ⇨ $F_Z = 46.72\ kN/insert < 50\ kN$ load for load case 2 ⇨ $F_{QZ} = 23.72\ kN/insert < 29.5\ kN$	For individual capacity R_{zul}
• Minimum spacing 760 mm + 2 × 380 mm = 1520 mm < 4000 mm.	Spacing required ($b + 2 \times a$)
• Minimum thickness 180 mm < 250 mm.	Thickness required (d)
• Minimum reinforcement KK5.0×240 is #188 mm²/m + 6Ø10×650 (stirrup) + 2Ø14 (top rebar) + Ø10×420 (diagonal rebar for 30°) + lateral rebar Ø20×1000 (for tilt-up actions and diagonal lifting double rebar recommended). KKR5.0×480 is #188 mm²/m + Ø10×420 (diagonal rebar for 30°) + lateral rebar Ø20×1000 (for tilt-up actions combined with diagonal lifting double rebar recommended).	Reinforcement required
RR Lifting insert selection:	See RR Technical Manual
• RR-SA-5.0-240 / RR-HA-5.0-120 / RR-EA-5.0-290 load for load case 1 ⇨ $F_Z = 46.72\ kN/insert < 50\ kN$ RR-SA-5.0-240 / RR-EA-5.0-290 load for load case 2 ⇨ $F_{QZ} = 23.72\ kN/insert < 25.0\ kN$ for RR-SA thickness of 250 mm not sufficient and for RR-EA resistance of 18.6 kN not sufficient ⇨ tilt-up table required, RR-HA not permissible due to tilt-up activity	For individual capacity R_{zul}
• Minimum spacing for RR-SA-5.0-240: 840 mm + 2 × 420 mm = 1680 mm < 4000 mm. RR-EA-5.0-290: 1000 mm + 2 × 500 mm = 2000 mm < 4000 mm. RR-HA-5.0-120: 750 mm + 2 × 375 mm = 1500 mm < 4000 mm.	Spacing required ($b + 2 \times a$)
• Minimum thickness RR-SA-5.0-240: 230 mm < 250 mm. RR-EA-5.0-290: 160 mm < 250 mm. RR-HA-5.0-120: 120 mm < 250 mm.	Thickness required (d)
• Minimum reinforcement RR-SA-5.0-240: #188 mm²/m + 2Ø10×700 (stirrup) + Ø10×420 (diagonal rebar for 30°). RR-EA-5.0-290: #188 mm²/m + 2Ø10×700 (stirrup) + Ø10×420 (diagonal rebar for 30°). RR-HA-5.0-120: #188 mm²/m + 1Ø16×750 (anchoring bar) + Ø10×420 (diagonal rebar for 30°).	Reinforcement required
WRA Lifting insert selection:	See WRA Technical Manual
• WRA-5,2Z with load for load case 1 ⇨ $F_Z = 46.72\ kN/insert < 52\ kN$ load for load case 2 ⇨ $F_{QZ} = 23.72\ kN/insert.$ for WRA-5,2Z lateral lifting not permissible ⇨ tilt-up table required.	For individual capacity R_{zul} Not permissible
• Minimum spacing. 800mm + 2 × 400 mm = 1600 mm < 4000 mm.	Spacing required ($b + 2 \times a$)
• Minimum thickness 290 mm > 250 mm is insufficient.	Thickness required (d)
• Minimum reinforcement #257 mm²/m.	Reinforcement required
• WRA-5,2Z can't be used as the element thickness is insufficient.	

Example 2: Transporting a slab

- Tilt-up process directly from the production table. No lateral pull on the inserts.
- Only chains available at the precast plant and on the construction site with a maximum 30° spread angle.
- Hoisting factor of 1.3 (tower hoist crane, heavy duty mobile crane, truck crane).
- Peikko standard lifting inserts to be utilized.
- Mold adhesion comes from the steel formwork.



Unit geometry and conditions during production:
Concrete compressive strength at first loading of 25 N/mm^2.
Reinforcement to be defined but minimum #188 mm^2/m

w = 1.80 m l = 3.0 m c = 0.18 m

Unit weight:
$F_G = 3.0 \times 1.80 \times 0.18 \times 25.0\ kN/m^3 = 24.3\ kN$

$F_G = V \times \rho_G$ (*Equation 1*)

Mold adhesion:
$F_{adh} = 3.0\ m \times 1.8\ m \times 1\ kN/m^2 = 5.4\ kN$

$F_{adh} = q_{adh} \times A_f$ (*Equation 2*)

Load case 1: Unit weight + dynamics + diagonal pull.
$F_Z = 24.3\ kN \times 1.3 \times 1.15 / 2 = 36.3\ kN / 2 = 18.2\ kN/insert$

$F_Z = F_G \times \Psi_{dyn} \times z/n$ (*Equation 7*)

Load case 2: Unit weight + adhesion + diagonal pull.
$F_Z = F_Q = (24.3\ kN + 5.4\ kN) \times 1.15 / 2 = 17.1\ kN/insert$

$F_Q = F_Z = (F_G + F_{adh}) \times z/n$ (*Equation 4*)

- ⇨ Load case 1 causes the highest load and determines the design.
- ⇨ Only chains available ⇨ just 2 inserts share the load.

JENKA Lifting insert selection:

See JENKA Technical Manual

- BSA20, PSA20 or PLA20
  load for load case 1 ⇨ $F_Z = 18.2\ kN/insert < 20\ kN$
  load for load case 2 ⇨ $F_Z = 17.1\ kN/insert < 20\ kN$

For individual capacity R_{zul}

- Minimum spacing
  BSA20+PSA20: 600 mm + 2 x 300 mm = 1200 mm < 1800 mm
  PLA20: 360 mm + 2 × 180 mm = 720 mm < 1800 mm

Spacing required ($b + 2 \times a$)

- Minimum thickness
  BSA20: 180 mm > 120 mm. PSA20: 180 mm > 100 mm
  PLA20: 180 mm > 145 mm

Thickness required (d)

- Minimum reinforcement
  BSA20 and PLA20: #188 mm^2/m + Ø8×300 (diagonal rebar)
  PSA20 #188 mm^2/m + Ø8×300 (diagonal rebar) + 2Ø8×640 (plate rebars).

Reinforcement required

KK Lifting insert selection:	See KK Technical Manual
• KK2.5×85 load for load case 1 ⇨ $F_Z = 18.2\ kN/insert < 25\ kN$ load for load case 2 ⇨ $F_Z = 17.1\ kN/insert < 25\ kN$	For individual capacity R_{zul}
• Minimum spacing. 280 mm + 2 × 140 mm = 560 mm < 1800 mm	Spacing required ($b + 2 \times a$)
• Minimum thickness 180 mm > 125 mm	Thickness required (d)
• Minimum reinforcement #188 mm²/m + Ø8×300 (diagonal rebar for 30°).	Reinforcement required
RR Lifting insert selection:	See RR Technical Manual
• RR-PA-2.5-80 load for load case 1 ⇨ $F_Z = 18.2\ kN/insert < 25.0\ kN$ load for load case 2 ⇨ $F_Z = 17.1\ kN/insert < 25.0\ kN$	For individual capacity R_{zul}
• Minimum spacing for 320 mm + 2 × 160 mm = 640 mm < 1800 mm	Spacing required ($b + 2 \times a$)
• Minimum thickness 180 mm > 110 mm	Thickness required (d)
• Minimum reinforcement #188 mm²/m + 2×2Ø10x300 (bars) + Ø8×300 (diagonal rebar).	Reinforcement required
WRA Lifting insert selection:	See WRA Technical Manual
• WRA-2.0Z with load for load case 1 ⇨ $F_Z = 18.2\ kN/insert < 20\ kN$ load for load case 2 ⇨ $F_Z = 17.1\ kN/insert < 20\ kN$	For individual capacity R_{zul}
• Minimum spacing 570 mm + 2 × 285 mm = 1140 mm < 1800 mm	Spacing required ($b + 2 \times a$)
• Minimum thickness 180 mm < 230 mm is insufficient	Thickness required (d)
• Minimum reinforcement #188 mm²/m WRA-2.0Z cant be used as the element thickness is insufficient.	Reinforcement required

Annex B – Declarations of Conformity

DESIGNERS	PRECAST PLANTS	USERS

NOTE: Declarations of conformity of all Peikko Lifting systems can be found on our webpage www.peikko.com

ENG / DE

EU Declaration of conformity according to Machine Directive 2006/42/EC, attachment II 1A
EG Konformitätserklärung gemäß EG Maschinenrichtlinie 2006/42/EG, Anhang II 1A

The manufacturer / Der Hersteller

Peikko Group Corporation
Voimakatu 3
15101 Lahti, FINLAND

declares that following products / erklärt, dass folgende Produkte

Product name / Produktbezeichnung	JENKA Lifting System / JENKA Transportankersystem
Lifting Insert / Transportanker	SRA / WAL / WAS / BSA / PSA / CSA / TF / SRASW/ PLA
Material and surface / Material und Oberfläche	galvanized / verzinkt, stainless steel / Edelstahl, untreated / unbehandelt, hot dipped galvanized /feuerverzinkt
Lifting Key / Lastaufnahmemittel	TLL / JL / JLW / TLP
Thread size/ Gewindegröße	12 – 52

comply due to conception and construction with the following cited regulations. / aufgrund Konzipierung und Bauart den Bestimmungen der nachfolgend aufgeführten Richtlinien entsprechen.

EU Machine Directive 2006/42/EC - EG Maschinenrichtlinie 2006/42/EG

Considered harmonized standards / Angewandte harmonisierte Normen

EN ISO 12100:2011-03 Safety of machinery-Generals principles for design – Risk assessment and risk reduction / EN ISO 12100:2011-03 Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze Risikobeurteilung – Risikominderung

Other considered standards or specifications / Sonstige angewandte Normen oder Spezifikationen

VDI/BV-BS 6205:2012-04 Lifting inserts and lifting systems for precast concrete elements / VDI/BV-BS 6205:2012-04 Transportanker und Transportankersysteme für Betonfertigteile
DGUV Regel 100-101 Sicherheitsregeln für Transportanker und –systeme von Betonfertigteilen
DGUV Regel 109-017 Betreiben von Lastaufnahmemitteln und Anschlagmitteln im Hebezeugbetrieb

Responsible commissioner for preparation and management of technical documentation is / Verantwortlicher Bevollmächtigter zur Erstellung und Führung der technischen Dokumentation ist

Mr. Sebastian Gonschior,
R&D Engineer, Peikko Group Corporation

Lahti 15.11.2022

Mr. Žygimantas Kačinskas
Quality Manager
Peikko Group Corporation

peikko®

ENG / DE

CE

EU Declaration of conformity according to Machine Directive 2006/42/EC, attachment II 1A
EG Konformitätserklärung gemäß EG Maschinenrichtlinie 2006/42/EG, Anhang II 1A

The manufacturer / Der Hersteller

Peikko Group Corporation
Voimakatu 3
15101 Lahti, FINLAND

declares that following products / erklärt, dass folgende Produkte

Product name / Produktbezeichnung	KK Lifting System / KK Transportankersystem
Lifting Insert / Transportanker	KK, KK SW, KKD, KKE, KKR, KKR SW
Material and surface / Material und Oberfläche	galvanized / verzinkt, stainless steel / Edelstahl, untreated / unbehandelt, hot dipped galvanized /feuerverzinkt
Lifting Key / Lastaufnahmemittel	KKL
in the version/ in den Ausführungen	K1,3 – K32,0

comply due to conception and construction with the following cited regulations. / aufgrund Konzipierung und Bauart den Bestimmungen der nachfolgend aufgeführten Richtlinien entsprechen.

EU Machine Directive 2006/42/EC - EG Maschinenrichtlinie 2006/42/EG

Considered harmonized standards / Angewandte harmonisierte Normen

EN ISO 12100:2011-03 Safety of machinery-Generals principles for design – Risk assessment and risk reduction / EN ISO 12100:2011-03 Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze Risikobeurteilung – Risikominderung

Other considered standards or specifications / Sonstige angewandte Normen oder Spezifikationen

VDI/BV-BS 6205:2012-04 Lifting inserts and lifting systems for precast concrete elements / VDI/BV-BS 6205:2012-04 Transportanker und Transportankersysteme für Betonfertigteile

DGUV Regel 100-101 Sicherheitsregeln für Transportanker und –systeme von Betonfertigteilen

DGUV Regel 109-017 Betreiben von Lastaufnahmemitteln und Anschlagmitteln im Hebezeugbetrieb

Responsible commissioner for preparation and management of technical documentation is / Verantwortlicher Bevollmächtigter zur Erstellung und Führung der technischen Dokumentation ist

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PEIKKO GROUP OY

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E-Mail: lifting.systems@peikko.com

CE	**EU Declaration of conformity according to Machine Directive 2006/42/EC, attachment II 1A** **EG Konformitätserklärung gemäß EG Maschinenrichtlinie 2006/42/EG, Anhang II 1A**

The manufacturer / der Hersteller **Peikko Group Oy, Voimakatu 3, FI-15101 Lahti, FINLAND**

with production plants / mit Produktionsstätten

Peikko Deutschland GmbH Brinker Weg 15 D-34513 Waldeck GERMANY	Peikko Construction Accessories (Zhangjiagang) Co., Ltd, No. 9 Fuxin Rd., Zhangjiagang Economic Development Zone, JiangSu Province, CHINA	Peikko Finland Oy Voimakatu 3 FI-15101 Lahti FINLAND	Peikko Russia ООО "Пейкко" 197348 Санкт-Петербург Коломяжский пр. 10, лит. Ф RUSSIA

Declares that following lifting devices acc to article 2 d) Erklärt folgende Lastaufnahmemittel nach Artikel 2 d) mit der

Product name / Produktbezeichnung:	Peikko RR System
Lifting Insert / Transportanker	SA / HA / EA / PA / FA /
With surface treatment / mit Oberflächenbehandlung	galvanized (verzinkt) / untreated (unbehandelt) / hot dipped galvanized (feuerverzinkt)
Lifting Key / Lastaufnahmemittel	RR-C / RR-CW
In the version/ in den Ausführungen:	RR-0,7 – RR-26,0

Complies due to conception and construction the regulations of the following cited regulations

Aufgrund Konzipierung und Bauart den Bestimmungen der nachfolgend aufgeführten Richtlinien entspricht

EU Machine Directive 2006/42/EC - EG Maschinenrichtlinie 2006/42/EG

Considered harmonized standards / Angewandte harmonisierte Normen

EN ISO 12100:2011-03 Safety of machinery-Generals principles for design – Risk assessment and risk reduction / Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze Risikobeurteilung –Risikominderung
EN 13155:2009-09 Cranes-Safety-Non fixed load lifting attachments / Krane-Sicherheit-Lose Lastaufnahmemittel

Other considered standards or specifications / Sonstige angewandte Normen oder Spezifikationen

DGUV Regel 100-101 safety regulations for transport anchors and- systems of precast elements / Sicherheitsregeln für Transportanker und –Systeme von Betonfertigteilen
DGUV Regel 100-500 use of work equipment chapter 2.8 / Betreiben von Arbeitsmitteln Kapitel 2.8
VDI/BV-BS 6205:2012-04 Lifting inserts and lifting insert systems for precast concrete elements, principles, design, application / Transportanker und Transportankersysteme für Betonfertigteile, Grundlagen, Bemessung, Anwendung

Responsible commissioner for preparation and management of technical documentation is / Verantwortlicher Bevollmächtigter zur Erstellung und Führung der technischen Dokumentation ist

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Lahti 23.03.2016

Mr. Teppo Lassila
Quality Manager
Peikko Group Oy

PEIKKO GROUP OY

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R&D Engineer
Peikko Group Oy

Peikko Group Oy
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FI-15101 Lahti
www.peikko.com
E-Mail: lifting.systems@peikko.com

CE	**EU Declaration of conformity according to Machine Directive 2006/42/EC, attachment II 1A** **EG Konformitätserklärung gemäß EG Maschinenrichtlinie 2006/42/EG, Anhang II 1A**

The manufacturer / der Hersteller **Peikko Group Oy, Voimakatu 3, FI-15101 Lahti, FINLAND**

with production plants / mit Produktionsstätten

Peikko Deutschland GmbH Brinker Weg 15 D-34513 Waldeck GERMANY	Peikko Construction Accessories (Zhangjiagang) Co., Ltd, No. 9 Fuxin Rd., Zhangjiagang Economic Development Zone, JiangSu Province, CHINA	Peikko Finland Oy Voimakatu 3 FI-15101 Lahti FINLAND	Peikko Russia ООО "Пейкко" 197348 Санкт-Петербург Коломяжский пр. 10, лит. Ф RUSSIA

Declares that following lifting devices acc to article 2 d) Erklärt folgende Lastaufnahmemittel nach Artikel 2 d) mit der

Product name / Produktbezeichnung:	Peikko WRA System
Lifting Insert / Transportanker	WRA / WRA-Z
With surface treatment / mit Oberflächenbehandlung	galvanized (verzinkt)
In the version/ in den Ausführungen:	WRA0,8 – WRA25,0 WRA0,8Z – WRA25,0Z

Complies due to conception and construction the regulations of the following cited regulations

Aufgrund Konzipierung und Bauart den Bestimmungen der nachfolgend aufgeführten Richtlinien entspricht

EU Machine Directive 2006/42/EC - EG Maschinenrichtlinie 2006/42/EG

Considered harmonized standards / Angewandte harmonisierte Normen

EN ISO 12100:2011-03 Safety of machinery-Generals principles for design – Risk assessment and risk reduction / Sicherheit von Maschinen – Allgemeine Gestaltungsleitsätze Risikobeurteilung –Risikominderung
EN 13155:2009-09 Cranes-Safety-Non fixed load lifting attachments / Krane-Sicherheit-Lose Lastaufnahmemittel

Other considered standards or specifications / Sonstige angewandte Normen oder Spezifikationen

DGUV Regel 100-101 safety regulations for transport anchors and- systems of precast elements / Sicherheitsregeln für Transportanker und –Systeme von Betonfertigteilen
DGUV Regel 100-500 use of work equipment chapter 2.8 / Betreiben von Arbeitsmitteln Kapitel 2.8
VDI/BV-BS 6205:2012-04 Lifting inserts and lifting insert systems for precast concrete elements, principles, design, application / Transportanker und Transportankersysteme für Betonfertigteile, Grundlagen, Bemessung, Anwendung

Responsible commissioner for preparation and management of technical documentation is / Verantwortlicher Bevollmächtigter zur Erstellung und Führung der technischen Dokumentation ist

Mr. Sebastian Gonschior
R&D Engineer, Peikko Group Oy

Lahti 23.03.2016

Mr. Teppo Lassila
Quality Manager
Peikko Group Oy

PEIKKO GROUP OY

Mr. Sebastian Gonschior
R&D Engineer
Peikko Group Oy

Annex C – General inspection criteria for Peikko Lifting Keys

DESIGNERS	PRECAST PLANTS	USERS

For safety reasons, all Lifting Keys must be maintained. Never use damaged or corroded lifting system parts. All reusable Lifting Keys must be inspected regularly by the user to determine if they may be used at the rated safe working load or must be taken out of use. The frequency of inspections depends upon factors such as (but not limited to) the amount of use, period of service, and environment. Inspections must take place at least annually. It is the responsibility of the user to schedule hardware inspections for wear and to take products out of use when wear is identified.

Description of the inspections criteria for Peikko Lifting Keys

The use of Peikko Lifting Keys requires the consideration of local safety and accident prevention regulations. When no additional information given in the regulation the user must follow the inspection instructions described in here.

The use of Peikko Lifting Keys is only permitted when a competent person has inspected them. The inspection is to be executed according to the subsequent criteria **and the inspection interval must be according to local regulations, but at least between one and three years.** Before inspection, clean the Peikko Lifting Keys thoroughly.

Chains and chain-like non-fixed Peikko Lifting Keys (RRC+KKL+JL+JLW+TLP):

- Inspection by a competent person.
- Visual check at least once per year for external damage such as
  - Bent chain links.
  - Twisted chain links.
  - Indents.
  - Plastic elongation due to overloading.
  - Readability of the marking.
  - Ratio elongation due to wear out.
  - Wear out of diameter (due to permanent use).
- Crack absence inspection at least every third year.
- Additional inspection after unexpected incidents.
- No visible cracks, micro-cracks or deformations.
- No necking or material tapering.
- No welding in any location.
- The tolerances provided by manufacturer must be complied with.
- Checking of wear out criteria of load bearing parts.

Ferrule with external thread (TLL):

- Movement of the internal rope layer vs the swaged ferrule with external thread.
- No plain surface present at the front.
- No micro cracks in the thread ground.

Peikko Lifting Keys containing wire rope (TLL+JLW):

- No bending or kinks permissible.
- No breaking of strands.
- No loosening of the external layer on the free length of the wire.
- No squeezing in the free length of the rope.
- No damage or heavy wear to the rope end connection.
- Not more than four wires in the support area of the loop.
- More significant wire breakages make further use impossible.

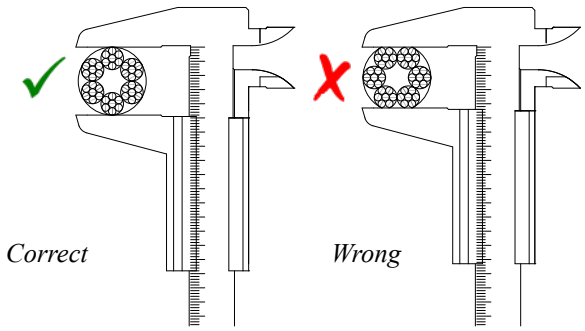


Figure 24. Rope measurement at TLL and JLW.

Table 4. Number of broken wires according to DGUV100-500.

Rope construction	Amount of visible rope damage on a length of		
	3 × ds	6 × ds	30 × ds
Stranded rope	4	6	16

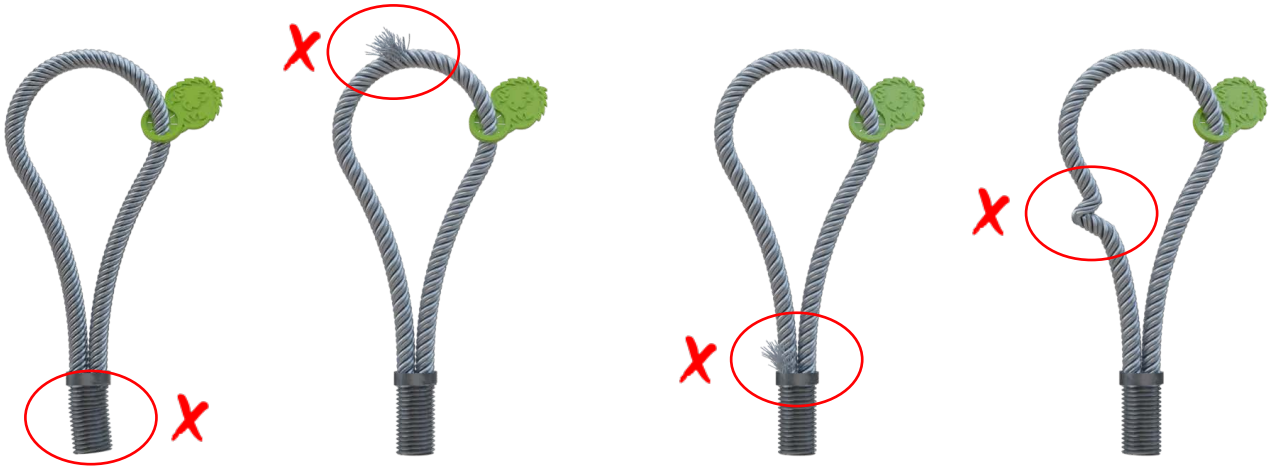


Figure 25. Possible rope damage types.

Documentation:

- Business order (internal company procedure)
- Chain record card for Peikko Lifting Keys Overall inspection protocol of the tested items
- Single inspection protocol of the tested item
- Testing label or marking visible on the item

Peikko recommends the documentation of the inspections by recording the inspection results of all items with serial numbers on record cards as shown in *Figure 26*.

Chain record card
DGUV 209-063
(previous BGI 879-2)
Release: September 2015

☐ **Hoist chain**

☐ **Chain sling with welded in master and end links**
For assembled chain sling made from parts a chain record card according DGUV 209-062 must be used

peikko group
CONCRETE CONNECTIONS

Peikko Group Corp.
Voimakatu 3
FI-15101 Lahti
www.peikko.com

Name of the chain

Order No.	Chain No.	Capacity SWL			
		Hoist chain	Chain sling		
			1-strand	____-strands/legs	
Grade	Nominal thickness			β ≤ 45°	β ≤ 60°
	mm	t	t	t	t
Length	Weight	Manufacturer symbol*)	Inspection certificate		Delivery from:
m	kg		No.	Date	
Next inspection date					Taken into use on:
					Taken out of use on:

Figure 26. Record card for lifting systems.

C1: Peikko JENKA System Lifting Keys inspection criteria

DESIGNERS	PRECAST PLANTS	USERS

No further use is permitted if any of the above mentioned factors are present. Changes to the construction and repairs (especially welding) of Peikko TLL JENKA Lifting Keys are prohibited.

Inspection of the following regions of TLL JENKA Lifting Keys is recommended

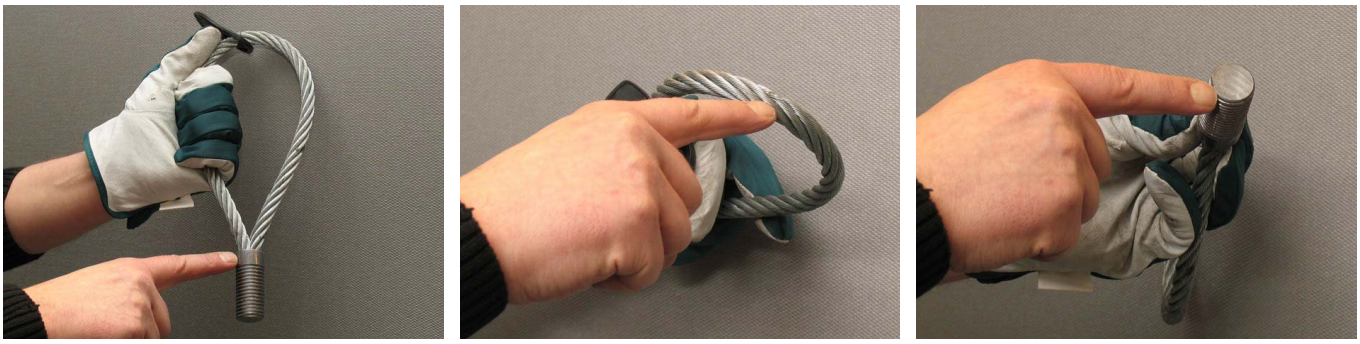


Figure 27. Swaged ferrule where rope comes out / cross section of rope in the loop / plain surface on the front.

Typical damages of Lifting Keys leading to immediate discard

Figure 28. Damaged rope / thread damage / movement of strand layers.

Figure 29. Deformed ferrule / broken strand / corrosion rope and ferrule.

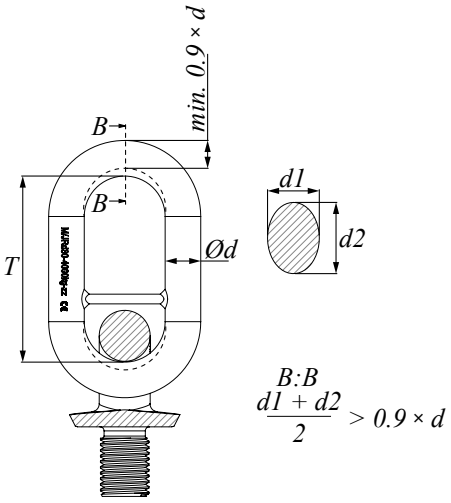
ANNEX C

JENKA JL and JLW Lifting Key

Table 5 below shows the dimension of JENKA JL Lifting Keys at the delivery stage.

Table 5. Wear out tolerances of JENKA JL Lifting Key.

Type	T	$T_{max} = 1.05 \times T$	$Ød$	$Ød_{min} = 0.9 \times Ød$
	[mm]	[mm]	[mm]	[mm]
RD/M12	115	121	13	11.7
RD/M16	115	121	13	11.7
RD/M20	115	121	16	14.4
RD/M24	115	121	16	14.4
RD/M30	115	121	22	19.8
RD/M36	115	121	22	19.8
RD/M42	139	146	26	23.4
RD/M52	139	146	26	23.4

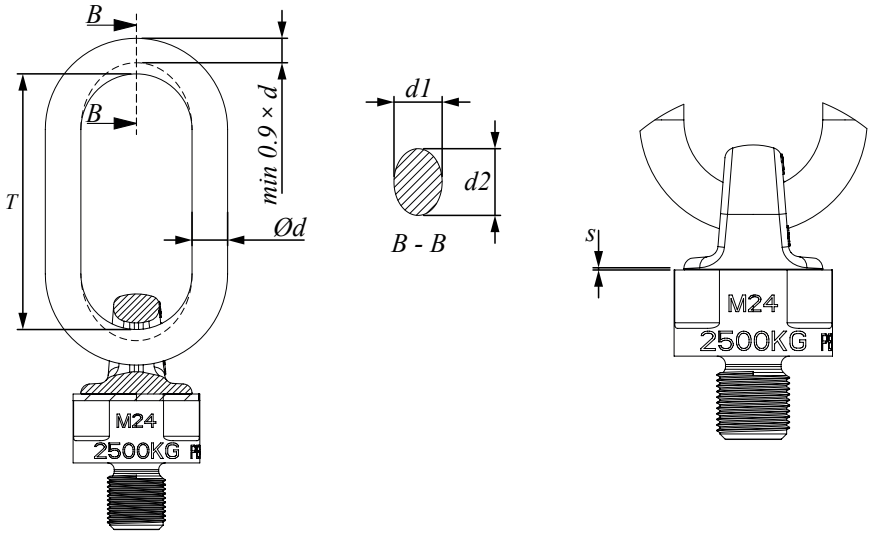


TLP JENKA Lifting Key

Table 6 below shows the dimension of JENKA TLP Lifting Keys at the delivery stage.

Table 6. Wear out tolerances of JENKA TLP Lifting Keys.

Item No. TLP	M [mm]	T [mm]	T_{max} = 1.05 × T [mm]	$Ød$ [mm]	$Ød_{min}$ = 0.9 × $Ød$ [mm]	Max Gap s
16	M16	55	57.8	13	11.7	1.5
20	M20	70	73.5	16	14.4	1.5
24	M24	85	89.2	18	16.2	2.0
30	M30	100	105	22	19.8	2.5
36	M36	100	105	22	19.8	3.0



No further use is permitted if the measures in *Table 5* and in *Table 6* are reached. Changes to the construction and repairs (especially welding) of Peikko Lifting Keys are prohibited.

Inspection of the following regions of JENKA JL, JLW and TLP Lifting Keys is recommended

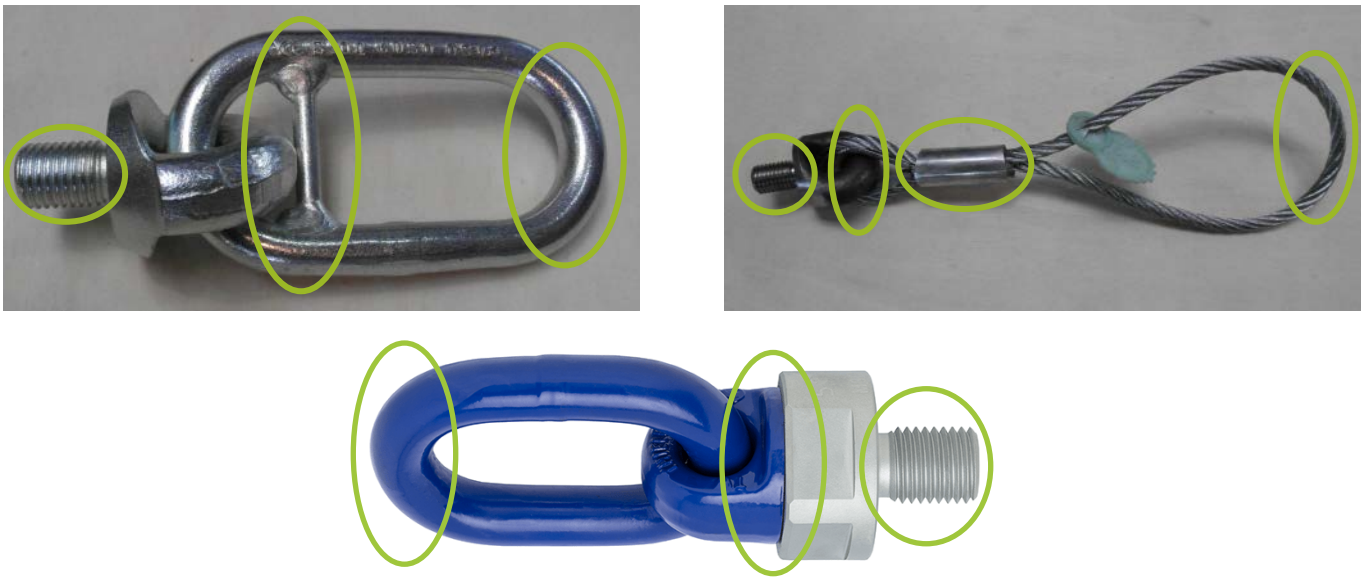


Figure 30. Inspection areas (Threaded bolt / lifting ring or loop).

Typical damage to JL, JLW and TLP leading to immediate discard

Figure 31. Crack in the thread ground / thread damage /crack in the welding.

Figure 32. Damaged rope / broken strand / deformed lifting ring.

C2: Peikko KK System Lifting Keys inspection criteria

DESIGNERS	PRECAST PLANTS	USERS

Table 7 below shows the dimensions of Lifting Key KKL at the delivery stage.

Table 7. Safe working loads and measures.

Item No	Load class	Dimensions						
		a [mm]	***b*** [mm]	***c*** [mm]	***d*** [mm]	***e*** [mm]	***f*** [mm]	***g*** [mm]
KKL 1.3	1.3	47	75	71	12	20	33	160
KKL 2.5	2.5	58	91	86	14	25	41	198
KKL 5	4.0- 5.0	68	118	88	16	37	57	240
KKL 10	7.5-10.0	85	160	115	25	50	73	338
KKL 20	15.0-20.0	110	190	134	40	74	109	435
KKL 32	32.0	165	272	189	40	100	153	573

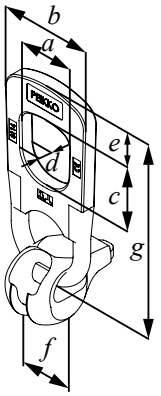
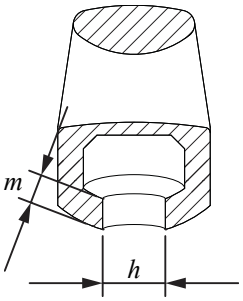


Table 8. Wear out tolerances of KK Lifting Key clutch.

Load class	Maximum ***h*** [mm]	Minimum ***m*** [mm]	Item No
1.3	13.0	5.5	KKL 1.3
2.5	18.0	7.5	KKL 2.5
4.0–5.0	25.0	9.0	KKL 5
7.5–10.0	33.0	12.5	KKL 10
15.0–20.0	46.0	19.0	KKL 20
32.0	58.0	25.5	KKL 32



Inspection of the following regions of KKL Lifting Keys is recommended

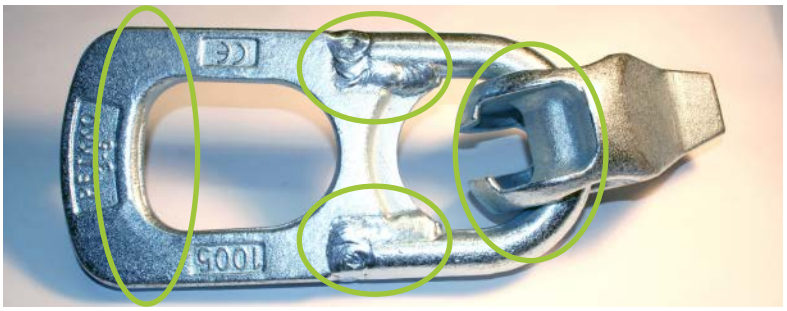


Figure 33. Top region of handle / lifting eye at welding region / casted spherical ball.

Typical damage to KK Lifting Keys leading to immediate discard

Figure 34. Worn out handle / worn out clutch.

Figure 35. Plastic deformed lifting handle.

Figure 36. Deformed spherical ball / fatigue with cracking.

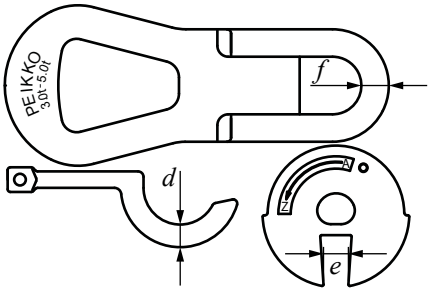
C3: Peikko RR System Lifting Keys inspection criteria

DESIGNERS	PRECAST PLANTS	USERS

RR Lifting Key dimensions at delivery stage are shown in *Table 9*.

Table 9. Wear out tolerances of RR-C Lifting Key.

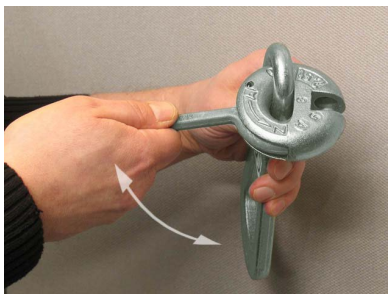
RR-C/RR-CW	Head		Bar		Ring	
Load class	*e* [mm]	*Max. e* [mm]	*f* [mm]	*Min. f* [mm]	*d* [mm]	*Min. d* [mm]
2.5	12.0	13.0	14.0	13.0	13.0	12.0
5.0	18.0	19.5	20.0	19.0	16.5	15.5
10.0	22.0	23.5	25.0	24.0	23.5	22.5
26.0	34.0	37.0	40.0	38.5	32.0	30.5



No further use is permitted if the measures in *Table 9* are reached. Changes to the construction and repairs (especially welding) of RR-C Lifting Keys are prohibited.

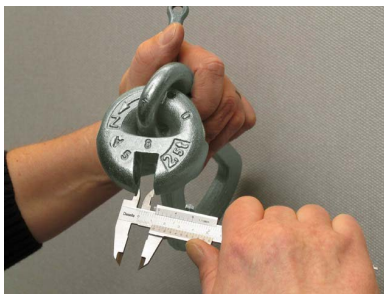
Inspection of the following regions of RR-C Lifting Keys is recommended

Movability of latch



Bolt diameter

Size of opening



Chain link diameter

Welding damages

Figure 37. Regions to check at RR Lifting Keys.

Revision History

Version: PEIKKO GROUP 12/2022. Revision: 002

- Updated product names, resitances and figures.

Version: PEIKKO GROUP 05/2022. Revision: 001

- First publication.

Resources

DESIGN TOOLS

Use our powerful software every day to make your work faster, easier, and more reliable. Peikko design tools include design software, 3D components for modeling programs, installation instructions, technical manuals, and product approvals of Peikko's products.

peikko.com/design-tools

TECHNICAL SUPPORT

Our technical support teams around the world are available to assist you with all of your questions regarding design, installation etc.

peikko.com/technical-support

APPROVALS

Approvals, certificates, and documents related to CE-marking (DoP, DoC) can be found on our websites under each products' product page.

peikko.com/products

EPDS AND MANAGEMENT SYSTEM CERTIFICATES

Environmental Product Declarations and management system certificates can be found at the quality section of our websites.

peikko.com/qehs