Tiger

Hebezeuge der Spitzenklasse

ENGLISH

Translation of the Original

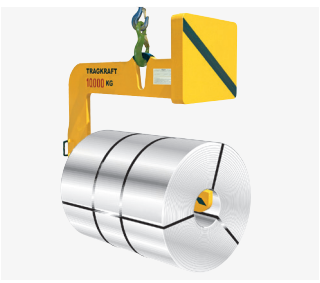
General Operating Instructions for Load Suspension Devices

Use for crane and stacker operation

GRIPPERS & LIFTING CLAMPS

LOAD BEAMS & CRANE BEAMS

C-HOOKS & COIL HOOKS



LOADING FORKS & CRANE FORKS

CRANE CAGES & TRANSPORT RACKS

STACKER BEAMS

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1. Definition of a load suspension device (according to the Machinery directive 2006/42 EC)

A non-hoist module or component which ensures the gripping of the load and is attached between the machine and the load or to the load itself and intended to become an integral part of the load and separately put into circulation.

Fasteners and their components are also regarded as load suspension devices.

2. Design bases

- Machinery directive 2006/42 EC

• DIN EN 13155	Cranes - Safety - Non-fixed lifting attachments
• DIN EN ISO 12100	S- Safety of machinery General principles for design - Risk assessment and risk reduction (ISO 12100:2010)
• DIN 15003	Lifting appliances - load suspension devices, loads and forces - Definitions
• DGUV Rule 100-500	Operation of load suspension devices in hoist operation
• DIN 15026	Lifting appliances; Marking of points of hazard
• VDI 3578	Attachment for forklift trucks
• DGUV rule 68 (formerly BGV D27)	Industrial trucks

3. Machine description (technical product data)

Manufacturer:	Kurschildgen GmbH Hebezeugbau
Load Suspension Devices:	delivery note / nameplate
Series:	delivery note / nameplate
Type designation :	delivery note / nameplate
Carrying capacity:	delivery note / nameplate
Gripping range:	delivery note / nameplate
Working width:	delivery note / nameplate
Turning radius/immersion depth:	delivery note
Tightening moment/Manual force of the handwheel: (only for grippers with slipping clutch)	delivery note / manual-wheel plate
Setting value of the slipping clutch:	delivery note/ manual-wheel plate
Max. load center displacement to the rotation axis: (only for grippers with a slewing gear)	delivery note
Load center of gravity (LSP):	delivery note / nameplate
Dead weight:	delivery note / nameplate
Serial no.:	delivery note / nameplate
Year of construction:	delivery note / nameplate

4. General information

The operating instructions are a necessary part of the delivery scope for each load suspension device (LSD). The manufacturer must provide them together with the declaration of conformity.

The operating instructions must be read and kept carefully. The plant operator must make sure that the operating instructions can be reached and read easily on the site of use. Missing operating instructions may be obtained from the manufacturer.

Only persons authorized by the plant operator and familiar with this work may use the LSD independently. The existence of operating instructions does not release the user from his individual duty to review. Also, the operating instructions cannot be a substitution for the necessary individual training of the user.

Basically, the regulation DGUV Regulation 100-500 of the trade association and other technical directives (e.g. EN standards, other rules or regulations of the trade association) must be observed and complied with. If the DGUV Regulation 100-500 is not available, it may be downloaded at **www.tigerhebezeuge.de.**

The delivered LSD was manufactured according to the load force and geometric specifications of the goods to be gripped as specified by the customer. The manufacturer emphasizes that he does not provide a warranty for the proper installation of the LSD into the total plant.

The LSD must only be used for vertical lifting at a uniform load distribution. When using LSDs with several load hooks, make sure that the load is distributed uniformly.

Inclined pulls with the LSD are not allowed.

LSDs must be stored in a stable manner. To this effect, the manufacturer may offer support stands, support feet and support structures.

Fig. 4-1 Support feet

Fig. 4-2 Support stands

Fig. 4-3 Stacker crossbeam incl. support feet

Fig. 4-4 C-hook support structure

The crane hook must be above the load centre of gravity and the vertical alignment of the load centre of gravity (LCG).

When moving the LSDs, make sure that there are no reciprocating movements or strikes to objects and parts of the building. Also, a low movement speed must be used.

Pulling against resistances such as goods which are close to each other and contact (e.g. big bags) must be avoided since the friction of the goods close to each other may cause higher load values than the admissible carrying capacity.

Staying under the suspended load as well as in the danger area is prohibited!

A transport with load suspension devices holding the loads by magnetic, suction or frictional forces must not be effected above persons unless additional safety measures have been taken, including a.o.: prohibition for persons to stay in the danger area, blocking of the danger area and gripping from below the loadways (e.g. protection by a guard net).

Load hooks must not be loaded at the top!

All hardware and accessories must be properly selected according to the carrying capacity and the type of fastening. Never use load suspension devices with a mechanical damage, deformations or an exceeded admissible reduction in the cross section. This applies to all eyelets, bolts,

bows, shackles, hooks, chains etc. The admissible reductions in the cross sections may be referred to in the DGUV Regulation 100-500 of the trade association or in additional manufacturer specifications, if necessary.

All hardware must move freely. All socket pins must be secured.

The maximum application temperatures for all LSDs are -20° to +80 °C, except for frictionally engaged grippers whose application temperature is 0° to +80° C. A special release from the manufacturer is required for the use in other temperature ranges.

The specified carrying capacity must not be exceeded.

If this information does not apply to the delivered LSD directly, it must be understood as a recommendation. A proper handling of load suspension devices avoids damage to persons and property.

The LSD must only be used for the purpose as described in the operating instructions (intended use). A non-intended use may result in considerable damage to persons and property.

5. Legend to the safety information on the LSD

Never stay under suspended loads - death or severe injuries may result.

Possibly imminent danger resulting from squeezing – severe or light injuries may result.

6. Grippers for crane operation

Normally, grippers are load suspension devices for handling the load by clamping/gripping on a certain point of the load/good to be gripped.

Grippers have a lock to keep the gripper in its open (locked) position and place it on the good to be gripped. An activation of the lock for starting a gripping process can only be made after the gripper is placed on the good to be gripped and is not loaded. It is only then that the lock can be released and/or loosened and the goods to be gripped can be gripped and lifted by a lifting movement of the crane.

Once the load is positioned and the gripper has been released of the material to be gripped (starting position of the gripper) the locking lever will be engaged automatically. Here, the proper closing position of the lock must be observed.

The spindle gripper is an exception. This gripper has no lock and can take the good to be gripped by an activation of the spindle drive without being put down and released. Grabs can be of a frictionally engagement and positive engagement type. Basically, they must be operated from the provided spots (handles or other spots marked black). The operator must avoid all squeezing points. Persons must never stay under a load and in the dangerous area of the load. The gripper must only be used for the specified and described load.

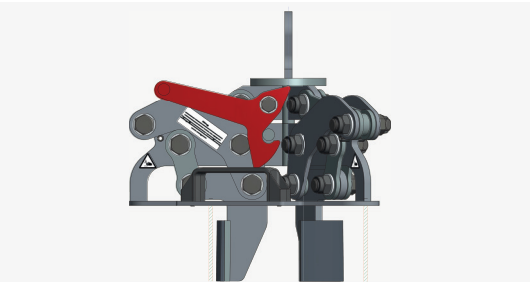

Fig. 5-1 Internal gripper in its locked position

Fig. 5-2 Internal gripper with Demag Manu coupling retainer

Fig. 5-3 Coil gripper with automatic cycle mechanism

Grippers can also be equipped with a Demag Manu coupling retainer or with an automatic cycle mechanism.

The handling of a gripper with a gripping device can be facilitated considerably if an automatic cycle mechanism performs the closing and the opening of the gripper instead of the locking lever (pawl). The Tiger® automatic cycle mechanism works without any external energy and is therefore independent of the location.

The automatic locking and unlocking of the gripper which is only performed by the lowering and lifting process allows load movements in elevations and depths which are difficult to access.

For example, loads to be lifted can be stacked to any height or removed from a stack without any manual interventions. Please note that the gripper must have a support for the procedure of the cycle automatic system and may be supported on the goods to be gripped.

6.1. Frictionally engaged grippers for transport

The frictionally engaged Tiger® grippers include internal grippers, coils grippers, carton grippers, parallel grippers, block grabs and internal grippers of a compact 3-gripping claw design. These grippers can also be designed as positively engaged grippers.

Fig. 6-1 Internal gripper

Fig. 6-2 Spindle gripper

Fig. 6-3 Carton gripper

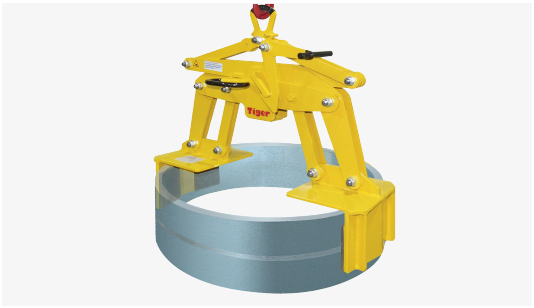

Fig. 6-4 Parallel gripper

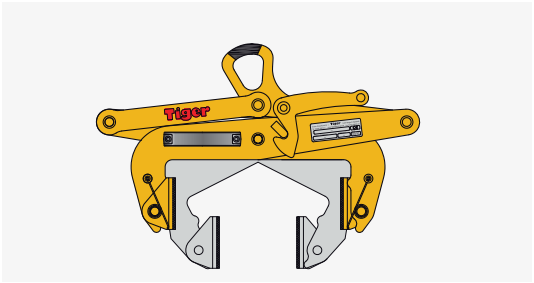

Fig. 6-5 Block grab

Fig. 6-6 Internal gripper of compact 3-gripping claw design.

Frictionally engaged grippers hold the load exclusively by pressing the gripper jaws to the goods to be gripped. To this effect, the grippers obtain the required pressing force from the design geometry and the load weight. Spindle grippers are an exception and obtain the required pressing force by a deactivation of a spindle drive with a crank handle. Here, the coefficients of friction must be observed. When transporting loads with grippers, please note that load collisions may open the gripper. Therefore, collisions must strictly be avoided in lifting processes with grippers. If collisions cannot be excluded, the gripper must be equipped with an additional safety device.

Make sure that a high friction factor exists between the gripping surface and the friction lining of the gripper claw so that a high holding force exists. Also, observe the geometric gripping position of the gripper.

The gripping surfaces must be parallel to each other and **absolutely dry as well as clean (no oil, grease and dust)**! All contaminations on the gripping surface and on the friction linings must have been eliminated for any time of the lifting process. Frictionally engaged grippers must have a safety factor of 2 to prevent the load from sliding off. Make additionally sure that the gripping surfaces are vertical and parallel to the vertical axis of the gripper unless this has been designed differently for the application. The working ranges of a gripper as specified by the manufacturer must never be out of range. The goods to be gripped must be suitable for lifting by frictionally engaged grippers and pressure-stable and must not be deformed during the lifting process.

Grippers not suitable for lifting by frictionally engaged grippers are loads / goods to be gripped having surfaces running acutely to the crane hook. Due to their geometry, their coefficient of friction may be reduced. All frictionally engaged grippers are to be designed as positively engaged grippers. In this case check whether the positive engagement complies with the design!

6.1.1. Internal grippers

General part

The 2, 3 and 4-arm internal grippers are intended for accepting cylindrical or parallel-walled opened hollow parts or loads with vertical drill holes. This internal gripper has been designed such that the leverage provides an optimum pressing force so that the product can be lifted and transported by the frictional engagement of the gripping claws.

Intended use

The internal gripper is designed for transporting opened and parallel-walled hollow parts or loads with vertical drill holes by a crane. The gripper must only be operated on the handles provided for that. When accepting the load, make sure that the load support to which the gripper is to be placed is in a horizontal position. In case of a frictionally engaged acceptance of loads the defined friction coefficients must be complied with (refer to the operating instructions Item 6.2.). The product and the gripping claws must always be **dry and free from grease, oil and lubricants.**

When lifting a load, check the correct position of the gripping claws to the product.

Furthermore, make sure that the interlock is in correct (closed) position prior to a no-load stroke.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

6.1.2. Spindle gripper

Refer to the special section 6.5. Spindle gripper.

6.1.3. Carton gripper

General part

The carton grippers are designed for gripping cartons and wooden boxes. This carton gripper has been designed such that the leverage provides an optimum pressing force so that the product can be lifted and transported by a frictional engagement of the gripping claws.

Intended use

The LSD must only be operated on the handles provided for that. When suspending loads, make sure that the product support is in its horizontal position and the gripping arms move together uniformly. In addition, check whether the gripping claws can be applied to the product. Adjustable gripping arms must be adapted to the product by socket pins (refer to the drawing). Furthermore, make sure that the locking device is in its correct position prior to a no-load stroke. The PK-_AS carton gripper must first be set to the required width dimension in its down position and fixed by a clamping lever. In case of a no-load transport the clamping lever must always be fixed and must never be released during transport. Contrary to that, loads must only be transported with a released clamping lever; otherwise, the gripper will not achieve the required clamping effect.

The product and the gripping claws must always be **dry and free from grease, oil and lubricants.** Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

⚠ Do not open the clamping lever on the LSD during a no-load transport; otherwise, the gripper may move jerkily and thus cause accidents!

6.1.4. Parallel gripper

General part

The parallel grippers are designed for gripping a load with parallel or round surfaces. Here, the gripping claws move parallel to the product. The parallel gripper has been designed such that the leverage provides an optimum pressing force so that the product can be lifted and transported by a frictional engagement of the gripping claws.

Intended use

The LSD must only be operated on the handles provided for that. When lifting a load, check the correct position of the gripping claws to the product and check the correct position of the interlock during a no-load stroke. When suspending loads, make sure that the product support is in its horizontal position

and the gripping arms move together uniformly. In addition, check whether the gripping claws can be applied to the product. Special attention must be paid to prism jaws where the contact of all jaw surfaces with the material to be gripped must be ensured. Furthermore, make sure that the locking device is in its correct position prior to a no-load stroke. The product and the gripping claws must always be dry and free from grease, oil and lubricants. Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

6.1.5. Block grab

General part

The block grabs are designed for gripping rectangular goods or vertical round goods. For this case the gripping forces have been designed as prisms. The block grab has been designed such that the leverage provides an optimum pressing force so that the product can be lifted and transported by a frictional engagement of the gripping claws.

Intended use

The LSD must only be operated on the handles provided for that. When suspending loads, make sure that the product support is in its horizontal position and supported on the product. The gripping arms must move together uniformly, changing the immersion depth by the swivelling movement of the gripping claws. In addition, check whether the gripping claws can be applied to the product. Special attention must be paid to prism jaws where the contact of all jaw surfaces with the material to be gripped must be ensured.

Adjustable gripping arms must be adapted to the product by socket pins (refer to the drawing). Furthermore, make sure that the locking device is in its correct position prior to a no-load stroke.

The product and the gripping claws must always be **dry and free from grease, oil and lubricants.** Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

6.1.6. Internal grippers of compact 3-gripping claw design

General part

The internal gripper with automatic cycle mechanism is designed for gripping the load of a hollow part or a load with drills. This internal gripper has been designed for minimum space requirements. The pressing force generates a positive micro-engagement which ensures an optimal transport of parts.

Intended use

This gripper must only be operated on a guiding globe. The goods to be gripped are always gripped centrally and out-leverage by the positive micro-locking is not possible. Thus, the 3-gripping claw design for this gripper provides a high degree of safety. The gripper obtains the required claw pressure from the design geometry and the load weight. To ensure a safe transport, the surface hardness of the goods to gripped must not exceed a HRB (hardness number) value of 90. Due to the automatic cycle mechanism the operator must not consider a locking or the like.

Optionally, this gripper can also be designed with frictional engagement instead of a positive micro-engagement.

Dangers / residual risks

⚠ If the maximum admissible surface hardness is exceeded, the positive micro-locking may not be established so that a proper gripping process is not ensured. Danger of accidents!

6.2. Coefficients of friction for frictionally engaged grippers

Strictly observe the following coefficients of friction for frictional engagement

For standard block grippers:	not smaller than 0.65
For standard carton grippers:	not smaller than 0.80
For standard internal grippers:	not smaller than 0.65
For series standard spindle grippers:	
For STD-SK series standard	not smaller than 0.35
For STD-K-SK series standard	not smaller than 0.50
For standard parallel grippers:	not smaller than 0.65

6.3. Positively engaged grippers for transporting/emptying

The positively engaged Tiger® grippers include box grippers, KLT grippers, universal grippers, coil grippers, fork C-hooks, round stock grabbers, support bolts with spherical retainers, support bolts with eccentric retainers and internal grippers with integrated actuating handle.

Fig. 9-1 Box gripper

Fig. 9-2 Box gripper for emptying

Fig. 9-3 Fork C-hook CST-WTA

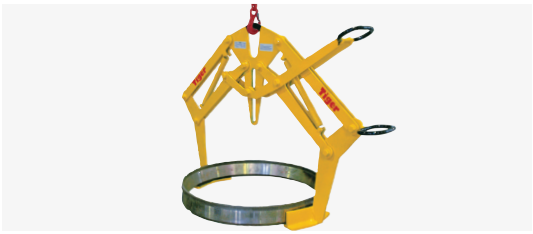

Fig. 9-4 Universal gripper

Fig. 9-5 Coil gripper

Fig. 9-6 KLT gripper

Fig. 9-7 Fork C-hook C-KLT

Fig. 9-8 Fork C-hook C-KLT-HR

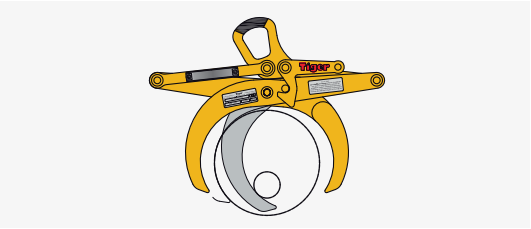

Fig. 9-9 Round stock grabber

Fig. 9-10 Support bolt with eccentric retainer

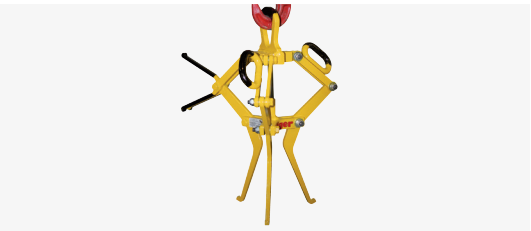

Fig. 9-11 Internal gripper with integrated actuating handle

Fig. 9-12 Spindle gripper

Positively engaged grippers are designed such that the gripping arms surround or grip underneath the goods to be gripped. The pressing force must agree with its positively engaged pawl. In this case always check whether the positive engagement complies with the design. A gripper designed for positively engaged operation must never be used as a frictionally engaged gripper. The load will inevitably slide off the gripper!

6.3.1. Box grabs (for steel containers)

General part

This is a load suspension device for storing boxes for crane operation. Depending on the type, gripping is made from the inside or outside.

Intended use

When accepting the product, check the positive engagement for a compliance with the design prior to each load stroke and for the correct position of the locking prior to each no-load stroke.

The steel container and the gripping claws must always be **dry and free from grease, oil and lubricants.** Lubricants on the container must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

Dangers / residual risks

⚠ Lifting the load with a positive engagement not complying with the design is prohibited. Danger of accidents!

⚠ Lifting an oily container which is not free of grease is prohibited. The gripping claws must always be dry and free from grease, oil and lubricants. Danger of accidents!

6.3.2. Fork C-hook CST-WTA (for steel containers)

General part

The use of fork C-hooks allows storage boxes to be transported and emptied by a handwheel.

Intended use

The fork C-hook CST-WTA must only be operated by the handwheel and has a compensation of its own weight. In a loadless condition the fork C-hook hangs vertically. During the lifting process the fork C-hook to a safety inclination of approx. 5°. If this is not the case due to a displaced load centre of gravity, relocate the stop socket bolt such that the fork C-hook tilts to its safety inclination in case of a load. The fork C-hook is designed such that the load centre of gravity of the container including the maximum contents level lies below the rotation axis.

Otherwise, there is a danger of overturn! Check the correct locking of the lock and the safety inclination prior to each transport of the load.

ATTENTION: The self-compensation function in crane operation requires a minimum load of approx. 30-45 kg. In case of reduced loads the operator must compensate the force a little by the handwheel. Check the correct locking of the lock and the safety inclination prior to each transport of the load.

Dangers / residual risks

⚠ If the load centre of gravity is not correctly at the level of load centre of gravity of the loaded box (the load centre of gravity is below the rotation axis), overturn is possible during the emptying process. Danger of accidents!

⚠ If the locking plate is not engaged correctly, the storage box may slip out. Danger of accidents!

6.3.3. Universal grippers

General part

The Tiger® universal grippers are lifting appliances for a variety of applications. They can lift almost all goods.

However, this requires that a positive engagement with the product can be made and the size of the product is within the specified gripping range and/or diameter of the gripper.

Intended use

Position the universal gripper in its opened position above the product and lower it slowly until the product support is correctly positioned on the product. Now, press the actuating lever upward. The product has now been gripped. In this case check the compliance of the positive engagement with the design. Lift the universal gripper slowly by moving the crane. Make sure that the gripping claws are correctly applied to the product. During the transport the two operating levers must not be actuated simultaneously. Danger of accidents! Furthermore, make sure that the interlock is in correct position prior to a no-load stroke.

Dangers / residual risks

⚠ Transporting a load with a positive engagement not complying with the design is prohibited. Danger of accidents!

6.3.4. Coil grippers

General part

These grippers have been designed such that coils standing or lying over a positive engagement can be transported, depending on the type.

Intended use

The LSD must only be operated on the handles provided for that. When lifting a load, check the correct position of the gripping claws to the product and check the correct position of the interlock during a no-load stroke. Always check the compliance of the positive engagement with the design when lifting a load.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Lifting a load with a positive engagement not complying with the design is prohibited. Danger of accidents!

6.3.5. KLT gripper (for plastic containers)

General part

The box grippers are designed for transporting small load carriers (KLT) with a uniform distribution of their contents by a crane.

Intended use

The KLT grippers are operated on the handrail and entered into the vertical lift chambers of the KLT containers with the 4 gripping tips. The gripping hooks form a positive engagement during the lifting of a load.

The plastic container can be released by one hand. To this effect, press the crossbar (movable cross tube) and the handrail (rigid cross tube) together. Thus, the gripping hooks release the positively engaged position in the lifting wells and the box gripper can be lifted from the plastic containers by a crane.

This gripper must only be operated on a guiding globe.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ During the transport of the container the handle (rigid cross tube) and the cross rod (movable cross tube) must not be compressed. Otherwise, the gripper may open. Danger of accidents!

6.3.6. Fork C-hook C-KLT and C-LKLT_HR (for plastic containers)

General part

The fork C-hooks C-KLT and C-KLT-HR are designed for transporting small-load carrier systems (KLT containers). In their no-load condition the fork C-hooks do not hang vertically. For taking up the containers the operator must keep the fork-C hook vertically. When loaded, the fork-C hooks point their tips upright at a safety inclination of 5°. The fork-C hook C-KLT_HR is equipped with a swivable fork and a hand wheel for emptying small-load carriers.

Intended use

The LSD must only be operated on the handles provided for that. If the fork C-hook hook C-KLT or C-KLT_HR fails to reach its safety inclination due to a displaced load centre of gravity, the KLT container may slip. In this case transport of the load is prohibited. Check during each transport of a load whether the positive engagement complies with the design. The fork C-hook "C-KLT_HR" with a turning handwheel is moved with its forks into the guiding grooves of the KLT container. It is secured by its security claw and lifted. During the lifting process the fork C-hook with a turning handwheel moves to a safety inclination of approx. 5° together with the small load carrier. The load in the small load carrier must be uniformly distributed. The turning process which is subsequently possible is performed with the turning handwheel. The container is emptied along its long side, releasing the turning movement for the turning handwheel by loosening the locking bolt. The integrated grid lock on the turning handwheel can be used for different container positions.

Danger / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Transporting a load with a positive engagement not complying with the design is prohibited. Danger of accidents!

⚠ If the load centre of gravity is not correctly at the level of load centre of gravity of the loaded box (the loadcentre of gravity is below the rotation axis), overturn is possible during the emptying process. Danger of accidents.

⚠ If the locking plate is not engaged correctly, the container may slip out. Danger of accidents!

6.3.7. Box turning gripper

General part

The box-turning gripper is designed for a transport by a crane and a subsequent emptying of steel sheet boxes.

The load centre of gravity of the filled box must be at the level of the rotation axis of the gripper to ensure a safe and convenient operation. This type of grippers is always designed for one box height only.

Intended use

The LSD must only be operated on the handles provided for that. For accepting the product, the gripper must be placed on the box in its correct position. If the locking bolt is loosened, the gripper will close during the crane run and the gripping arms will move together and the box is gripped positively. The gripping position of the gripper is secured by an index bolt. Thus, the gripper cannot open auto-matically. This ensures a safe handling.

As a standard, emptying is via the box width on the box itself by a handwheel or a slewing gear.

All gripper functions can be performed manually without any problems. If the load centre of gravity of the goods to be gripped is above the rotary axis of the gripper, the load may suddenly be tilted.

Attention: shortly before lowering the box the locking bolt must be actuated and held until the complete lowering to the bottom so that the gripping arms can open without any limitation.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Loosen the locking bolt to open the gripper in its lowered position. Danger of accidents!

⚠ If the load centre of gravity is not correctly at the level of load centre of gravity of the loaded box (the load centre of gravity is below the rotation axis), overturn is possible during the emptying process. Danger of accidents!

6.3.8. Round stock grabber

General part

Round stock grabbers are designed for transporting round stock or bundled goods. The round stock grabber has been designed such that the leverage provides an optimum pressing force so that the product can be lifted and transported by a frictional engagement of the gripping claws.

Intended use

The LSD must only be operated on the handles provided for that. By a accepting a load make sure that the gripper is used in the middle of the axis direction of the good to be gripped (in the load centre of gravity) and it is below the crane suspension. The product load centre of gravity must therefore be in the middle of gripping arms and aligned with the crane suspension.

Due to the large clamping range of the round stock grabber the grabber needs sufficient space and a smooth basis during the acceptance and positioning of the product. Approximately the first 10% of the gripping range are covered by placing the grabber on the product, loosening of the locking lever and initiating the gripping process. This means that the gripping jaws have no floor contact in this area. In the other gripping area they slide over the floor during the closing process.

The product and the gripping claws must always be **dry and free from grease, oil and lubricants.** Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case. Check during each transport of a load whether the positive engagement complies with the design.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that.

⚠ If the products are greasy and the load center of gravity is displaced, the product may slide out of the gripper. Danger of accidents!

⚠ Due to the design, the materials to be gripped is only carried and not clamped during transport. The process requires careful operation. Danger of accidents!

6.3.9. Supporting bolts with a spherical retainer and an eccentric

General part

The support bolts with a spherical retainer (TBK) or a swivelling retaining eccentric (TBE) and the integrated actuating handle are designed for safely lifting loads with small or long continuous or countersunk drill holes whose middle axis coincides with axis of the load centre of gravity. Depending on the product, the goods to be gripped may hang out during the lifting movement.

Intended use

The LSD must only be operated on the handles provided for that. Check the position of the interlock and thus whether the positive engagement complies with the design prior to each lifting process. In case of the supporting bolt with a spherical retainer system the 3 mm radius of the goods to be gripped in the contact range of the retaining sphere must never be exceeded. Danger of accidents! After the lifting process the supporting bolt with its spherical retainer system (TBK) may show visible impressions in the acceptance area of the sphere.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ If the maximum drill diameter is exceeded, the positive engagement complying with the design is no longer ensured. Danger of accidents!

6.3.10. Internal gripper with an integrated actuating handle

General part

The 3-arm internal gripper with an integrated actuating handle for transporting hollows parts or products with drills can be manually operated without any problems.

Intended use

The LSD must only be operated on the handles provided for that. The gripper can be fastened from a hanging position. Lowering to the ground is not necessary. The gripper is opened and closed manually. The handles of the tong are actuated by one hand to each other so that the gripping arms move together. In this position, the gripper is entered into the drill hole by a lowering through the crane and released in the required immersion depth. The gripper arms spread automatically and have to form a positive engagement which complies with the design. This must be checked prior to the lifting process.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Transporting a load in positive engagement not complying with the design is prohibited. Danger of accidents!

6.3.11. Spindle gripper

Refer to the special section 6.5. Spindle gripper.

6.4. Frictionally and positively engaged turning grippers for transporting/turning

The Tiger® turning grippers include spindle grippers, box turning grippers and coil turning grippers.

Fig. 13-1 Spindle gripper with a turning mechanism

Fig. 13-2 Coil turning gripper

6.4.1. Spindle gripper

Refer to the special section 6.5. Spindle gripper.

6.4.2. Coil turning gripper

General part

This load suspension device is a positively engaged coil turning gripper. The coil turning gripper is positioned with its plates on the coil. These grippers must have the load centre of gravity of the goods to be gripped at the height of the turning axis of the turning gripper to ensure safe and convenient operation. This type of grippers is designed for one coil width only.

Intended use

The LSD must only be operated on the handles provided for that. For accepting the product, the gripper must be placed on the coil in its correct position. The loosening of the locking lever and the subsequent crane travel cause the gripping arms to close the coil, thus forming a positive engagement. The pressing force by the deadweight prevents the gripper from opening automatically. This ensures a safe handling. The coils are then turned manually on the coil. All gripper functions can be performed manually without any problems. Check the correct position of the locking plate during each no-load stroke.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

6.5. Spindle gripper

Spindle grippers are gripping specialists for transporting (type ST) and turning (type STD) products. Basically, operation is the same for all spindle grippers. Opening and closing of the gripping jaws is performed manually by a handwheel and a spindle drive. This type is suitable for lifting processes where the pressing jaws have to be moved to the goods to be gripped variably, parallel and without a displacement of height (a support point is not required). Here, the spindle is used to exert the highest possible pressing pressure to the product to be lifted to achieve frictional engagement. The gripper obtains the necessary pressing force of the gripping jaws from the spindle geometry design and the manual force of the handwheel. The suitability of the respective friction lining of the gripping jaws must be matched to the corresponding surface of the gripping goods!

As a standard, all frictionally engaged spindle grippers are equipped with a torque limiter and a reverse-lock to prevent the gripping jaws from being opened accidentally.

The required torque is achieved during tensioning (pressing force of the gripping jaws) as soon as the slipping clutch is disengaged. Opening and closing the gripping jaws of the gripper is by operating the handwheel on the spindle. The frictional engaged gripper is equipped with a reverse-lock to prevent a accidental opening. The lock is automatically activated when the jaws are tensioned. The jaws cannot be released until the ratchet is moved upwards and engaged. Tensioning the jaws again activates the reverse-lock automatically. The product can be turned manually on the product itself, by a turning mechanism (gearbox) or by a turning handwheel. The frictionally engaged design of the ST-SK series is suitable for a transport of loads with a round or square outer geometry of up to approx. 200 kg. The frictionally engaged design of the STD-SK series is suitable for a transport and turning of loads with a round or square outer geometry up to approx. 200 kg. In addition, the ST-SK_R, STD-SK_R or the ST-K-SK, STD-K-SK series spindle gripper with an increased pressing force must be used. The spindle grippers can also be designed as positively engaged grippers. They can optionally be equipped with a torque limiter or a reverse-lock.

6.5.1. ST type spindle gripper (without turning function) / STD (with turning function)

General part

The spindle grippers with a handwheel for gripping the outside of loads with a symmetric load distribution and with or without a turning function are designed both as positively and frictionally engaged grippers.

Intended use

The LSD must only be operated on the handles provided for that. In case of positively engaged grippers check whether the positive engagement complies with the design prior to each load stroke.

This type is suitable for lifting processes where the pressing jaws have to be moved to the goods to be gripped variably, parallel and without a displacement of height (a support point is not required). Here, the handwheel is used to exert the highest possible pressing pressure to the product by the handwheel and via the spindle to achieve frictional engagement. The product and the gripping claws must always be dry and free from grease, oil and lubricants. Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

The gripper receives its required claw pressure from the designed spindle geometry and the manual force on the handwheel or the specified torque. The product can be lifted safely only in combination with a suitable friction lining.

Opening and closing the gripper is by cranking the spindle.

Attention!

Actuate the handwheel only after the product has been positioned. Danger of accidents!

Special attention must be paid to prism jaws where the contact of all jaw surfaces with the material to be gripped must be ensured.

To check the required torque at the handwheel by the operator, a hexagonal support is integrated in the handwheel fastener for placing a torque wrench there.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Actuating the handwheel under suspended load. Danger of accidents!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

⚠ Lifting a load in positive engagement not complying with the design is prohibited. Danger of accidents!

Fig. 15-1 STD type spindle gripper

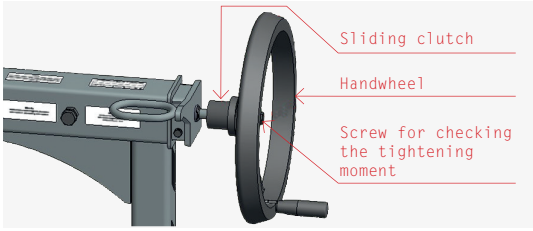

Fig. 15-2 STD type component explanation

6.5.2. ST-I type internal spindle gripper(frictionally engaged) / ST-IU (positively engaged)

General part

The internal spindle gripper with its handwheel for internally gripping loads with a symmetric load distribution are designed both as positively and frictionally engaged grippers.

Intended use

The LSD must only be operated on the handles provided for that. The internal spindle gripper ST-IU can grip rings and tubes within the internal diameter and below the product in a positively engaged manner. The chamfered retaining plate (positive engagement shoulder) is moved in between the goods to be gripped and its support surface by the spindle movement. Check prior to each load stroke whether the positive engagement complies with the design.

ST-I type internal spindle gripper

This type accepts the product in a drill hole as a hollow space. Clamping is from the inside to the outside. Here, the handwheel is used to exert the highest possible pressing pressure to the product by the handwheel and via the spindle to achieve frictional engagement.

The product and the gripping claws must always be **dry and free from grease, oil and lubricants.** Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case.

The gripper receives its required claw pressure from the designed spindle geometry and the manual force on the handwheel or the specified torque. The product can be lifted safely only in combination with a suitable friction lining.

Opening and closing the gripper is by cranking the spindle.

Attention!

Actuate the handwheel **only** after the product has been positioned. Danger of accidents!

To check the required torque at the handwheel by the operator, a hexagonal support is integrated in the handwheel fastener for placing a torque wrench there.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Actuating the handwheel under suspended load. Danger of accidents!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

⚠ Lifting a load in positive engagement not complying with the design is prohibited. Danger of accidents!

Fig. 15-3 ST-IU type Spindle gripper

6.5.3. STK-type spindle gripper (without turning function) / STD-K (with turning function)

General part

The spindle grippers with a handwheel for gripping the outside of loads with a symmetric load distribution and with or without a turning function are designed both as positively and frictionally engaged grippers. This spindle gripper has been designed such that the frictional engagement increases the pressing force exerted on the product by laterally positioned slides to ensure a safe transport of the load.

Intended use

The LSD must only be operated on the handles provided for that. In case of positively engaged grippers check whether the positive engagement complies with the design prior to each load stroke. These types automatically clamp the product over the weight to be lifted so that it is only necessary to tighten the spindle finger-tight. In case of frictionally engaged grippers the handwheel must be actuated until the sliding clutch is disengaged. The goods to be gripped are lifted in dependence of the function of the load. The suitability of the friction lining was matched to the respective surface of the goods to be gripped. This type is suitable for lifting processes where the pressing jaws must be moved to the product variably, parallel and without any displacement of height. It is only necessary to tighten the spindle finger-tight. The prisms on the goods to be gripped will automatically tighten by a parallel inclination as a function of the load. The product and the gripping claws must always be dry and free from grease, oil and lubricants. Lubricants on the product must be avoided strictly. If not, a 100% gripping effect is no longer ensured, and the load must never be lifted in this case. Opening and closing the gripper is by cranking the spindle.

Attention!

The handwheel may only be actuated when the product has been lowered to the bottom and the gripping arms have completely been retracted to the starting position by the tension spring. Danger of accidents!

To check the required torque at the handwheel by the operator, a hexagonal support is integrated in the handwheel fastener for placing a torque wrench there. Special attention must be paid to prism jaws where the contact of all jaw surfaces with the material to be gripped must be ensured.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Actuating the handwheel under suspended load is prohibited. Danger of accidents!

⚠ The product may slide out of the gripper if the specified coefficients of friction (refer to sect. 6.2) are not complied with. Danger of accidents!

⚠ Lifting a load in positive engagement not complying with the design is prohibited. Danger of accidents!

Fig. 16-1 STD-K type spindle gripper

7. Lifting beams for crane and stacker operation

7.1. General information

Normally, crane lifting beams are rigid or adjustable steel structures used as load suspension devices. On the crane and on the load side the lifting beam has a fixed and centred crane suspension (optionally with chain suspensions) and different suspension points on the load side, respectively. This depends on the type of the lifting beam.

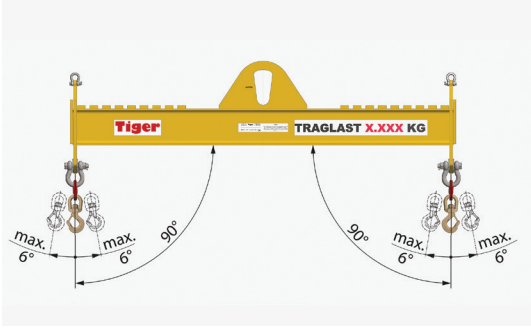

Fig. 16-2 Max. inclination of the slings

Whenever a load is lifted, the crane hook must always be above the load centre of gravity. If the crane hook is not above the load centre of gravity, the entire system will tilt during the lifting process until the centre of gravity is below the crane hook. The higher

the lifting beam builds, the lower must the system incline to take the position of the load centre of gravity below the crane hook. Since the lifting beam and its load is never suspended absolutely horizontally, inadmissible inclination has been defined. According to EN 13155, max. 6° are allowed.

Please note that there are load cases where an inclination of 6° already results in a critical fastening and is subject to an individual assessment. An object with a small base and high centre of gravity can be tilted more easily than an object with a broad base and low centre of gravity

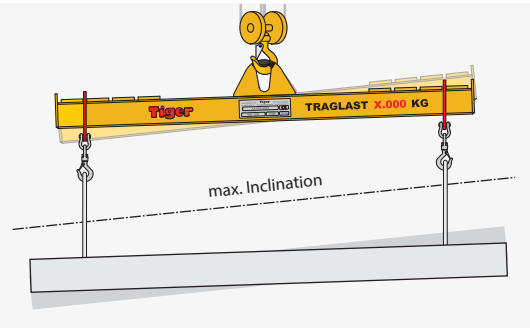

Fig.17-1 Max. inclination of the lifting beam

Since the height of the centre of gravity increases relatively to the width of the base, a point is reached where the object tilts if it is not supported by external measures. At this point the object is regarded as unstable; the higher the required support, the more unstable the object is. A similar situation exists for a suspended load. There are inevitable forces trying to tilt the load (e.g. wind, acceleration, braking). Therefore, it is important that the load is sufficiently stable during the fastening of the load to withstand these tilting forces. To this effect, the following examples (Fig. 17-2 and Fig. 17-3) must be observed and complied with. When fastening, always observe the height centre of gravity of the load and assess it critically! Each lifting beam has a "fixed overall height".

The fixed overall height is the dimension from the crane hook contact to the next hinge point below (positive stability height) or above (negative stability height) which cannot change geometrically. For example, a shackle bolt is always a hinge point. Basically, the crossbeams are designed are for loads with a uniform load distribution. The fastening points on the load should always be symmetrical to the load centre of gravity of the load (selected). In this case the adjustable fastening points on the beam (Fig. 17-3) (in most cases two, several fastening points are permitted in pairs) must be arranged symmetrically to the crane eye. In case of two fastening points on the beam each fastening point carries 50 % of the load weight. An asymmetrical adjustment of the fastening points on the beam is possible. Here, the admissible load of an individual fastening point of the crossbeam must not be exceeded. A process of an asymmetrically adjusted beam in a loadless condition requires very careful operation.

Load combinations

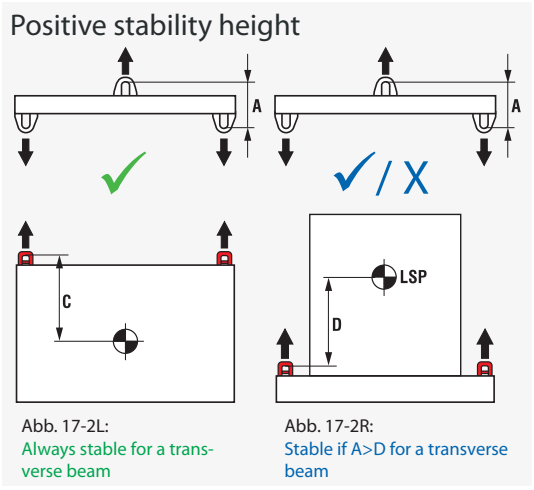

Abb. 17-2L:
Always stable for a transverse beam

Abb. 17-2R:
Stable if A>D for a transverse beam

Fig. 17-2 Pos. stability height of a transverse beam

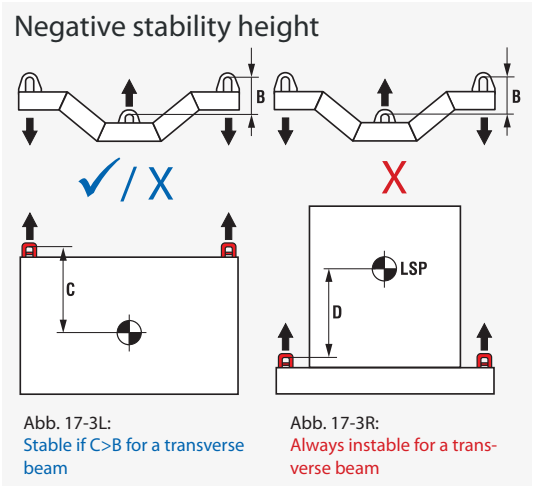

Abb. 17-3L:
Stable if C>B for a transverse beam

Abb. 17-3R:
Always instable for a transverse beam

Fig. 17-3 Neg. stability height of a transverse beam

Fig. 17-2L It is absolutely safe if a positive stability height is given and the load centre of gravity (LCG) is lower than the fastening points of the load.

Fig. 17-2R If a positive stability height is given and the LCG is higher than the low fastening points, the fixed overall height of the beam, dimension A, must be greater than the distance of the load fastening points to the LCG, dimension D, to create and guarantee a stable fastening situation.

Fig. 17-3L If a negative stability height is given and the LCG is below the load fastening points, the distance from the LCG to the load fastening points (dimension C) must be greater than the fixed overall height (dimension B) to create and guarantee a stable fastening situation.

Fig. 17-3R If there is a negative stability height as well as an LCG above the load fastening points, fastening/use is prohibited since the beam tends to tilt in this situation (tilting strike).

„The load must be kept in more than one vertical plane to be stable in the direction of both horizontal axes. (from DIN EN 13155)

Please refer to the manufacturer in case of uncertainty.

7.2. Girder-type beams

General part

Normally, girder-type beams have a fixed suspension in the middle for the crane hook and 2 or more fastening points for lifting/transporting uniform loads. In case of girder-type beams with two fastening points each fastening point carries 50 % of the load weight. In case of more than 2 fastening points the admissible load must be observed for each fastening point.

Intended use

The centre of gravity of the product must always be aligned with the crane lug.

Fastening must always be performed at right angles to the girder-type beam and symmetrically to the crane suspension.

Asymmetric adjustment of the adjusting elements on the girder-type beams is possible. Here, the admissible load of the fastening point must not be exceeded.

Dangers / residual risks

⚠ Overload of the fastening points by an asymmetric load.

⚠ Exceeding the admissible inclination of 6°.

⚠ Make adjustments only in a lowered condition since the beam could tilt. Danger of accidents!

Fig. 18-1 Girder-type beams with a fixed hook distance

Fig. 18-2 Girder-type beams with an adjustable hook distance

7.2.1. Laminated-hook and side-hook lifting beams

General part

Laminated hook or long-hook lifting beams are welded steel structures with a rigid crane suspension in the middle and two lamellae on the front for accepting shafts or winding spindles. The laminated-hook lifting beams can be designed with fixed or adjustable laminated hooks.

Intended use

The LSD must only be operated on the handles provided for that. In case of adjustable laminated hook lifting beams make sure that an adjustment is always symmetrical to the crane suspension. Therefore, always check the correct position of the socket pin.

Fig. 18-3 Laminated-hook lifting beam with a fixed hook distance

Fig. 18-4 Laminated-hook lifting beam with an adjustable hook distance

The support shafts or winding spindles or laminated hooks must be absolutely dry, as well as free of oil and lubricants. The lifting beam should be in its horizontal position during transport; otherwise, the load may slide off. The product must be secured against slipping to the sides. For reasons of safety the required protection of the support shafts or the winding spindles to the laminated hooks must be ensured.

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Make adjustments only in a lowered condition since the beam could tilt. Danger of accidents!

⚠ Sliding by greasy support shafts or excess of the admissible inclination of 6°. Danger of accidents!

7.2.2. Side-hook lifting beams

General part

Side-hook lifting beams are welded steel structures with a rigid and centred crane suspension and two side hooks on the end for suspending loads. The side-hook lifting beams can be designed with fixed or adjustable side hooks.

Intended use

The LSD must only be operated on the handles provided for that. In case of adjustable side-hook lifting beams make sure that an adjustment is always symmetrical to the crane suspension. Therefore, always check the correct position of the socket pin. An asymmetrical adjustment of the side hooks on the beam is not permitted. The load must be suspended to a minimum of 4 side-load hooks. In case of deflection-capable long materials the side-load hook intervals must be reduced.

Fig. 19-1 Side-hook lifting beam with a fixed hook distance

Fig. 19-2 Side-hook lifting beam with an adjustable hook distance

When fasting loads on the side hooks, make sure that the load suspension device does not exceed an angle of 90°.

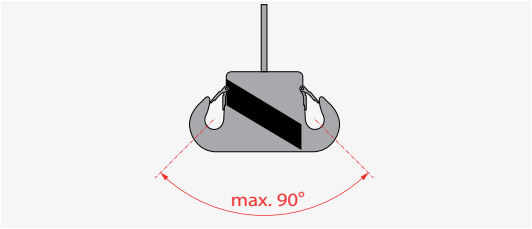

Fig. 19-3 Max. load angle

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Make adjustments only in a lowered condition since the beam could tilt. Danger of accidents!

⚠ The side hooks are overloaded if the max. fastening angle of 90° is exceeded.

7.2.3. Spreader beams / shoring beams

General part

The spreader beams are the ideal beams for lifting and transporting loads where the fastened chain suspensions must be vertical. The load can be accepted and transported without any effect from pressure forces. The installed chain suspension makes sure that the beam swings less.

Intended use

The spreader beam is equipped with two swivel hooks whose distance can be adjusted by telescoping the spreader beam which is blocked by a socket pin.

The shoring beams are an ideal application extension for lifting processes with 2-length chain suspensions. The installation of the chain suspensions has a vertical load run for the load chains. Make sure that the chain length is the same on both sides up to the fastening point on the spreader beam. The load can be accepted and transported without any effect from pressure forces. A shoring beam is always designed for chain size only. The length of the shoring beam (chain spread distance) can be adjusted by telescoping the beams and fixing the socket pin. The adjustment is made in the grid. Never remove the socket pins unless the LSD has been lowered. Danger of accidents!

In case of adjustable hook distances make sure that the inclination angle of the chain suspension never exceeds 60°.

Fig. 20-1 Spreading beam

Fig. 20-2 Shoring beam

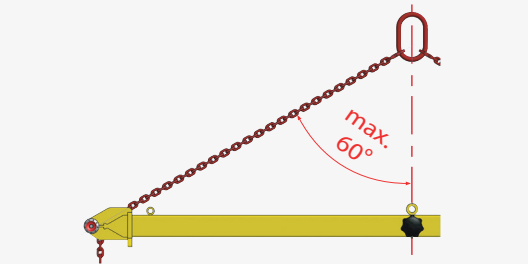

Fig. 20-3 Chain suspension inclination angle

Dangers / residual risks

⚠ Overload of the lifting beam and the suspension devices when the inclination angle of 60° is exceeded.

⚠ Overload through asymmetrical load because of unequal chain lengths.

⚠ Make adjustments only in a lowered condition since the beam could tilt. Danger of accidents!

7.3. Low-design and negative-design beams

General part

Low-design beams are always used where no sufficient clearance to ceilings or only minimum design height for the LSD is available.

Intended use

Low-design beams are very unstable in a loadless condition and may hang inclined in the crane hook.

Fig 20-4 Low-design girder-type beam

Fig. 20-5 Negative BIG-BAG design

Extremely careful crane operation is therefore required. Negative-design beams must be operated by the operator in a no-load condition since they do not hang on the crane hook in a stable manner, tend to swing and would tilt in an extreme case. The load centre of gravity must here significantly be below the fastening points.

Dangers / residual risks

⚠ A lifting beam can tilt if it is not guided. Danger of accidents!

7.4. Lifting beam with an adjustable crane suspension

General part

The girder-type crossbeams with an adjustable crane suspension are designed for loads whose fastening points are not symmetrically positioned to the load centre of gravity. In this case the adjustable crane suspension must be adjusted in the load centre of gravity.

Here, the admissible load of the individual fastening point of the beam must not be exceeded.

An asymmetric alignment of the fastening points (swivel hooks) to the middle of the crossbeam is allowed conditionally only.

Also, the admissible load of an individual fastening point of the crossbeam must not be exceeded.

Intended use

In case of load suspension devices with adjustable suspensions the suspension must be adjusted such that both the load and the load suspension device hang on the crane hook at the admissible inclination. This normally means that the load suspension device and the load are aligned horizontally after lifting. If the beam is delivered with an off-centre adjustment of the crane suspension for loads with a centre of gravity displacement, please note that the fastening point closer to the crane hook must have a higher load than the fastening point a larger distance to the crane hook. The maximum carrying capacities of the fastening points must be observed. In a no-load condition these beams hang askew if the crane eye is displaced. The beam must be placed to the ground for adjusting the crane suspension. Adjustment can be made by shifting, manually by a spindle drive or by an electric drive. In case of an adjustment by a spindle drive or an electrical drive the beam must only be without any load. It is not necessary to place it to the ground.

If a manual adjustment is made by shifting, the cross-beam must be placed on the ground and then fixed by two clamping levers.

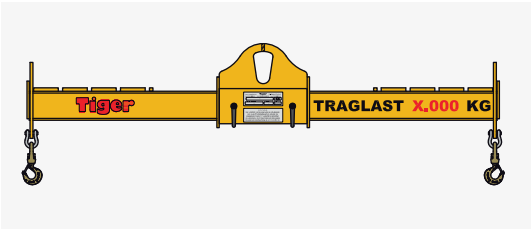

Fig. 21-1 Adjustment by manual shifting

Fig. 21-2 Adjustment by a spindle drive

Fig. 21-3 Adjustment by an electrical drive

Fig. 21-4 Adjustment by a perforated plate

Adjustment by manual shifting

If the crane eye is to be adjusted by a clamping lever, it is adjusted manually and fixed by a clamping lever. The beam must be placed to ground completely for this adjustment.

Adjustment by a spindle drive

If the crane eye is to be adjusted by a spindle drive, the beam must in a no-load condition. It is not necessary to lower the beam to the ground.

Adjustment by an electrical drive

If the crane eye is to be adjusted by an electrical drive, the beam must also be in a no-load condition. Also, it is not necessary to place the beam to the ground.

Adjustment by a perforated plate

If the crane eye is to be adjusted by perforated plate, it is adjusted by a disassembly/assembly of the shackle (refer to item 11.1.2). The beam must be placed to ground completely for this adjustment.

Dangers / residual risks

⚠ An adjustment of the crane eye of a crossbeam under full load is prohibited. Danger of accidents!

7.5. Transverse beams

General part

Transverse beams are load suspension devices with a crane suspension attached in the middle. The transverse beam can not only be used for lifting and transporting different loads, but the adjustable transverse beams can also be used as a single lifting beam.

Intended use

Transverse beams are welded girders/sections in the shape of an "H" or a cross. Normally, a transverse beam has a fixed and centred crane suspension (optionally chain suspension as well), four fastening points and is designed for the lifting/transporting uniform loads. Transverse beams can be manufactured with fixed or adjustable hook distances. In case of adjustable hook distances make sure that the adjustment is always symmetrical between the humps provided for that, to the crane suspension. In case of adjustable side-hook lifting beams make sure that an adjustment is always symmetrical to the crane eye. Here, the admissible load of the crossbeam must not be exceeded. Asymmetrical adjustment of the adjusting elements of the crossbeams is possible. However, the TAV-Q-AQ series transverse beams with a chain suspension must be used only.

Fig. 22-1 Transverse beam with a fixed hook distance

Fig. 22-2 Transverse beam with an adjustable hook distance

Dangers / residual risks

⚠ Make adjustments only in a lowered condition since the beam could tilt. Danger of accidents!

⚠ An asymmetrical adjustment of the fastening points or crossbeams is prohibited because of a danger of overload and/or accident! Here, the TAV-Q-AQ crossbeams are an exception.

7.5.1. BIG-BAG beams

General part

Big-bag beams are girders / sections arranged crosswise or in the shape of an H. They have a fixed and centred crane suspension and four load fastening points for lifting / transporting especially big bags (synthetic woven bags). The loops of the big bags are fastened to the load fastening points. Big-bag lifting beams must also be operated by the operator during movements due to their load centre position in a no-load condition.

Intended use

When lifting, make sure that all 4 loops are safely accepted by the fastening points and the safety catches of the load hooks have been engaged. Lifting with fewer than 4 fastening points is not allowed! When lifting big-bags which are close to each other, please note that there may be a constellation in which the beam is overloaded since the friction to the adjacent big bags must be overcome and is generated in addition to the load weight.

Negative-design BIG-BAG beams are also available. Due to this negative design the beam does not hang stable in the crane hook and will tilt aside in a no-load condition. The lifting process must be performed carefully, and the load centre of gravity must significantly be below the suspension points.

Fig. 22-3 BIG-BAG beam

Fig. 22-4 Crossed beam

Fig. 22-5 Adjustable crossed beam

Fig. 23-1 Negative design BIG-BAG

Dangers / residual risks

- ⚠ Transport with fewer than four suspended loops.
- ⚠ Transport with unsecured loops.
- ⚠ Transport without safety pins
- ⚠ Move the crossbeam manually in a no-load condition; otherwise, danger of tilting.

7.5.2. Frame spreader beams

General part

Frame spreader beams are plugged-in or welded girders / sections having the shape of a rectangle. Normally, a frame-spreader beam consists of a 4-strand chain suspension and swivel hooks arranged on the corners of the beam / profiles. The crossbeam must be used for a transport of load with a uniform load distribution. This design has a positive impact on the load since the fastening points of the load are only loaded vertically. The 4-strand chain suspension provides a higher transport stability.

Intended use

The spreader frame beams can be manufactured with fixed or exchangeable hook distances. When using exchangeable hook distances, make sure that the inclination angle of the chain suspension never exceeds 60°.

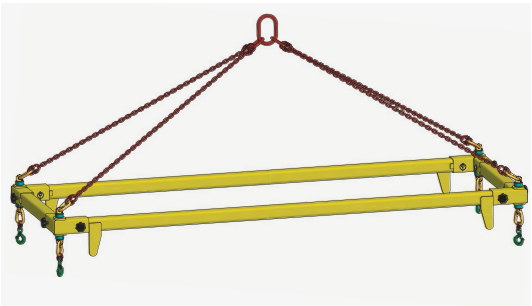

Fig. 23-2 Frame beam with chain suspension

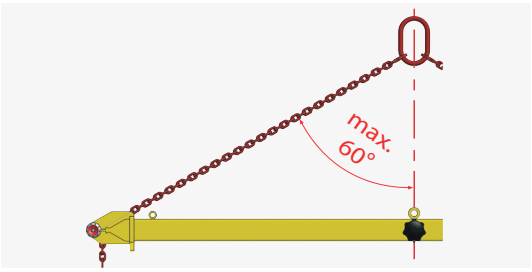

Fig. 23-3 Chain suspension inclination angle

Dangers / residual risks

- ⚠ Overload of the lifting beam and the suspension devices when the inclination angle of 60° is exceeded.
- ⚠ Overload of asymmetrical load because of unequal chain lengths.

7.5.3. 3-arm crossbeams

General part

3-arm beams are welded beams/sections in the shape of an "Y" where all arms normally have an spread angle of 120°. Normally, 3-arm beams have a fixed and centred crane suspension as well as three load fastening points for preferably lifting and/or transporting round and uniform loads. The 3-arm beams can be manufactured with fixed or adjustable hook distances. In case of adjustable hook distances make sure that the adjustment is always symmetrical to the crane suspension.

Intended use

When adjusting the load hook and/or adjustment elements, make always sure that this is done symmetrically.

Dangers / residual risks

- ⚠ Overload of the lifting beam by an asymmetric adjustment/load.

Fig. 23-4 3-arm beam with a fixed distance

Fig. 23-5 3-arm-beam with an adjustable distance

7.5.4. Crane cages/load racks for material transport

General part

Crane cages are ideal load suspension devices for lifting and transporting loaded euro pallets and industrial pallets. They can be loaded quickly by manual pallet trucks and ensure a safe transport of pallets by a crane. Other goods to be stacked and transported can be transported by the crane cage as quickly and safely.

Intended use

The crane cage must be parked on a plane and stable ground for loading and unloading. The doors, ramp and locking device may only be opended while the crane cage is in stable parking position! Pallets and other goods to be transported must always be positioned in the centre due to the centre of gravity. The load must always be secured to the pallet. If crane cages without side plates are used, the load must additionally be secured in the crane cage and must not protrude from it (neither during a possible displacement of the pallet). Loads with an edge distance of >100 mm must additionally be secured by e.g. anti-skid mats. Due to its functional design the crane cage is an ideal load suspension device for transporting material by a crane. The operator must start the lifting process and transport of the load only after he has made sure that the load is secured and the crane cage has been locked correctly. The load suspension device may only be used for transporting corresponding loads and never for the transport of persons. Any misappropriate use must be avoided.

Dangers / residual risks

⚠ Transport of persons prohibited!

⚠ Transport of unsecured products prohibited. Danger of accidents!

⚠ Danger of injuries when the flap opens!

Fig. 24-1 Transport cage with side plate

Fig. 24-2 Transport cage without side plates

7.5.5. Gas cylinder lifter

General part

A standard equipment of the gas cylinder lifter includes a suspension eye for a transport by crane. The gas cylinders are secured by retaining chains.

Intended use

The LSD must only be operated on the handles provided for that. The retaining chains are secured by a safety bolt to prevent the gas cylinders from falling down. Check the correct safety position of the chain and the safety bolt prior to each stroke. The optionally available carriage for smooth floors with two rigid castors and two steering castors is an ideal supplement for handling the gas cylinders in workplaces where the destination of the gas cylinder transport by a crane cannot be reached. In this case, observe the tilting moment in case of a change of direction(s) (pulling after pushing and vice-versa): Depending on the cylinder, they try to incline in an uncontrolled manner. Be careful. Counteraction is necessary here. Danger of accidents!

Fig. 24-3 Gas cylinder lifter

Fig. 24-4 Optionally with a carriage

Dangers / residual risks

⚠ Danger of squeezing if the LSD is not operated in the places provided for that!

⚠ Transport of persons prohibited!

⚠ A transport with unsecured gas cylinders is prohibited. Danger of accidents!

⚠ Danger of tilting by an inclined pull.

⚠ Danger of tilting when placing the cylinder on the carriage.

⚠ Please note that the gas cylinder lifter must never be left in a carriage due to its geometry. Every inclined pull must be avoided! Danger of tilting.

⚠ Attention!
It is not allowed to store or to park the gas bottles permanently in the gas cylinder lifter!

Fig. 25-1 Stacker with girder-type beam

Fig. 25-2 Stacker with transverse beam

7.6. Lifting beams for stacker operation

General part

Basically, all lifting beams can also be designed for stacker operation. Stacker beams are beams which are pushed over the prongs of the stacker by attached pockets and are then locked. Locking must be on one side.

Intended use

Each stacker has its defined carrying capacity for different radius/extension lengths (refer to the carrying load diagram of the stacker). The use of a beam may change the defined carrying capacity of the radius/extension lengths. Then, the residual carrying capacity of the stacker must be determined and complied with, considering the use of the beam. Also, the deadweight of the beam must be observed.

Please contact the LSD manufacturer for an accurate determination of the actual carrying capacity of a stacker beam in any case.

Avoid shock loads with the stacker as well as reciprocating movements of the load during movements. A proper travel speed must be selected. In this case, the product must be transported near to the floor.

In case of beams with several fastening points a symmetric load distribution must be observed. The admissible carrying capacities of the individual fastening points must be considered and complied with.

Dangers / residual risks

⚠ A transport with clamping levers not fixed is prohibited. Danger of accidents!

⚠ Non-compliance with the carrying capacities of the stacker.

8. C-hooks for crane operation

General part

C-hooks are C-shaped load suspension devices for lifting loads with openings (e.g. coils, pipes, split strips etc.). Depending on the application, they can be used with or without counterweights.

Intended use

C-hooks without a counterweight are normally suspended in the crane hook in an inclined manner. For threading the C-hook into the good to be accepted (e.g. a coil) it is necessary that the C-hook be brought to a horizontal position manually. The higher the deadweight of the C-hook be-comes due to higher loads the more difficult and inconvenient operation will be.

To improve the operation and the convenience the counterweight may be attached. This makes sure that the C-hook has a horizontal position in a loadless condition and can be moved or threaded into the good to be accepted more easily.

Furthermore, C-hooks can be equipped with 3/4 prongs and 4/4 prongs. The local space conditions are decisive for that. If sufficient space exists, select a C-hook with a 4/4 prong. In case of confined space a C-hook with a 3/4 prong is recommended. The load and transport situation is identical for both types. A transport of coil widths greater than the rated length of the 4/4 prong is prohibited.

In case of C-hooks the load centre of gravity of the goods to be gripped must always be below the support edge of the prong. When taking up the good to be gripped, make sure that the proper positioning of the good to be gripped has an inclination of at least 5° of

the prong upwards. This is required for reasons of safety to prevent the load from sliding off the prong during transport. This safety inclination is not necessary for the transport of metal sheet coils.

Narrow and unsecured split strips must not or conditionally be transported in this way even if the centre of gravity position is right. Here, the danger exists that the front split strip or the front split strips slide off the hook when the crane system is moved or the hook makes a reciprocating movement. Decisions have to be made individually as far as split strips can or may be transported. To this effect, the C-hook can be equipped with a safety device (e.g. safety nose).

A transport of coils with a centre of gravity in front of the crane suspension (in the prong tip direction) will lead to an inclination of the prong in a negative direction (downwards) and is prohibited in any case. Strong swinging movements and hitting obstacles must be avoided in any case.

Dangers / residual risks

⚠ Non-compliance with the safety inclination.

⚠ Non-compliance with the load centre of gravity.

⚠ Falling product due to a strong swinging movement

Fig. 26-1 C-hook without counterweight

Fig. 26-2 C-hook with counterweight

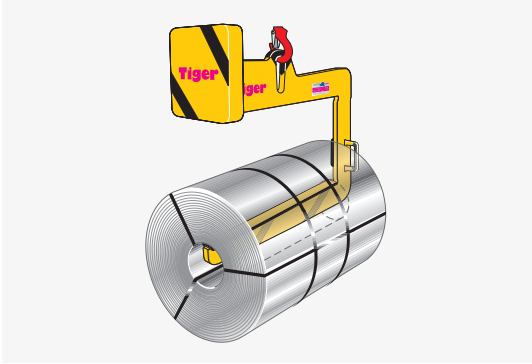

Fig. 26-3 C-hook with counterweight

Fig. 26-4 C-hook with manual weight compensation

Fig. 26-5 C-hook with weight compensation

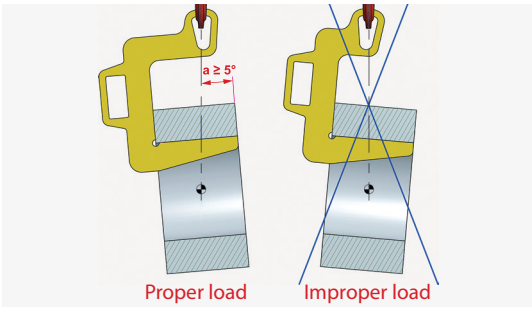

Fig. 26-6 Load

A C-hook with manual weight compensation must accept the load such that the supporting arm takes an upward safety inclination of 5°. Weight compensation is performed manually by adjusting the crane suspension. This adjustment strictly requires that the C-hook be placed to the ground. Attention! Danger of tilting.

C-hooks with an automatic weight compensation adjust automatically to a specified load centre of gravity. However, the self-compensation function requires a minimum load of approx. 25% of the rated load of the C-hook.

The C-hook should have this safety inclination during the transport of the load. It is noticed that this is not the case and the inclination does not exist, the lifting and transporting process is no longer ensured. In this case it is mandatory that the load not be transported!

8.1. Coil tilting hooks

General part

Coil tilting hooks not only allow the transport of coils. The special feature of the coil tilting hooks is the fact that lying coils can be put up right and coils hanging on crane may be placed to the ground. Thus, the coil tilting hook is the ideal load suspension device for handling coils effectively.

Intended use

Attention! When putting coils upright and to the ground, very careful operation is required. Therefore, the coil must be secured against rolling to the sides. The rolling movement and simultaneous lateral movement of the crane allow the coil to be put in a horizontal position very slowly.

The coils must individually be set in an upright position from the floor or pallet only.

Fig. 27-1 Coil tilting hooks

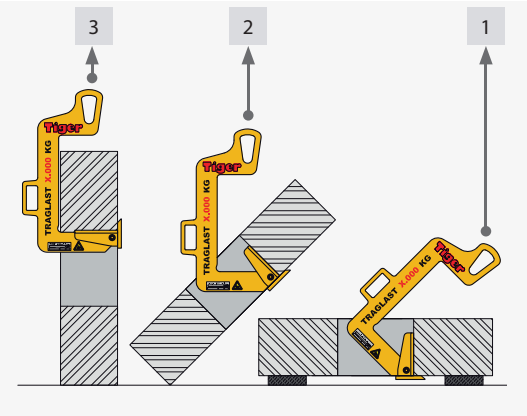

Fig. 27-2 Positions of the coil tilting hooks

Dangers / residual risks

⚠ Secure the coil against rolling to the sides. Danger of accidents!

8.2. C-hooks with a load lifting magnet

General part

C-hooks with load lifting magnet for crane operation are special suspension devices for putting steel plates and steel discs upright and transporting them.

Fig. 27-3 C-hook with load lifting magnet

Fig. 27-4 Position: upright

Fig. 27-5 Position: lying

Intended use

To cover different disc diameters, the position of the load lifting magnet can be fixed by a socket pin and adjusted gradually. The load lifting magnet must be adjusted to the middle of workpiece. The steel disc is additionally held on the lower C-hook with 2 bolts serving as a support prism. The crane suspension must be adjusted to the respective LCG for the different disc thicknesses. Simply swivelling the lever activates and/ or deactivates the load lifting magnet. A safety device locks the lever in its MAG phase to exclude each unintended demagnetization (DEMAG).

Attention: Supporting bolts (red) must be fit tightly to the front surfaces of the disc (blue). Then, throw the lever on the load lifting magnet and re-hook the crane hook into the second crane suspension. (see Fig. 27-6).

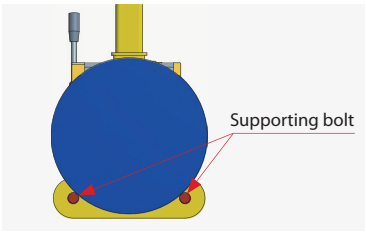

Fig. 27-6 Retaining position

Dangers / residual risks

⚠ No transport with a load magnet adjusted

too low. Danger of accidents!

⚠ The load magnet must not be adjusted on the ÄC-hook while it is hanging. Danger of accidents!

9. Crane forks

General part

Normally crane forks are suitable for the transport of palletized goods which can safely be retained by the prongs due to their dimensions

Intended use

In case of crane forks with manual weight compensation the load centre of gravity (LCG) must be found manually by using the gradual grid adjustment. For an adjustment, the crane fork must be put down safely. Always check the correct position of the oval ring. Crane forks with automatic deadweight compensation adjust automatically to a specified load centre of gravity. This type does not require that the crane fork be put down.

Fig. 28-1 Crane fork with a automatic weight compensation

Fig. 28-2 Crane fork with a manual weight compensation

However, the automatic compensation function requires a minimum load of approx. 25% of the rated crane fork load.

In case of crane forks with a fixed crane suspension the load centre of gravity is specified and must be complied with. Crane forks with a fixed crane suspension can be designed with a counterweight for better and more convenient operation. The load centre of gravity must never be exceeded at any time. Crane forks can be delivered with adjustable or fixed prongs as well as an adjustable or fixed loading height.

In case of crane forks with adjustable prongs a symmetric adjustment of the prongs to the centre as well as the protection of the prongs after adjustment must be observed. In case of an adjustable loading height a protection by a safety bolt must also be observed after adjustment. In case of a proper positioning of the load the prongs of the crane fork must have an upward safety inclination of approx. 5°, see Fig. 28-4. Otherwise, the lifting process must not be performed.

During operation outside the area close to the ground or on construction sites the load must be secured by the delivered chain which must be tensioned tightly. If necessary, loads must be fastened to prevent the load from being lost. Staying under the suspended load as well as in the danger area is prohibited!

Normally, crane forks are stable and do not require additional security. Crane forks with a counterweight may tilt. To this effect, the manufacturer may offer support frames. Crane forks with automatic weight compensation strictly require that the pallet be positioned up to the stop (vertical profile); otherwise, the automatic function cannot be ensured properly.

Dangers / residual risks

⚠ Non-compliance with the safety inclination.

⚠ Non-compliance with the load centre of gravity.

⚠ Falling of the product by a strong swinging movement.

⚠ If the crane eye, prongs or the internal height is adjusted, the crane fork must be placed to the ground safely. Otherwise, danger of accident!

Fig. 28-3 Crane fork with counter-weight compensation

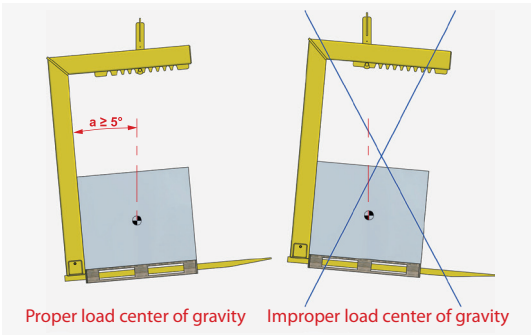

Fig. 28-4 Load

10. Information on the CE mark and risk assessment

The CE declaration and the operating instructions are only valid if the associated LSD can be identified and assigned unambiguously. This assignment is specified on the name plate of the manufacturer. A modification to or a corruption of the manufacturer specifications is not allowed. In case of ambiguities the manufacturer must be consulted or contacted. Normally, the use of an LSD is not limited to defined working processes which are always the same. Therefore, the manufacturer cannot judge the actual application on site. The operating instructions are therefore of a general type and only refer directly to the technology of the delivered LSD.

The load suspension device is integrated into an existing hoist system or crane system. The manufacturer does not know the exact application. Therefore, the declaration of conformity and the operating instructions are strictly limited to the delivered LSD. If the LSD corresponds to other applications and affects special operational procedures, it may be necessary to perform an additional in-house risk assessment, involving the LSD. The plant operator or the new marketing company is responsible for performing a risk assessment of his/its own according to the machine directive and for publishing his/its own operating instructions for the entire process. The LSD must only be used for the purpose as specified in the operating instructions (intended use). A non-intended use may result in considerable damage to persons and property. The manufacturer emphasizes that he does not provide a warranty for the proper installation of the LSD into the total plant. The delivered LSD was manufactured according to the load force and geometric specifications of the goods to be gripped as specified by the customer. Modifications made to the LSD may cause the LSD to comply no longer with the requirements of miscellaneous directives or standards. Here, they must be examined and complied with.

11. Mounting / test / maintenance / repair

11.1. Mounting

11.1.1. Mounting the adjusting elements "V-kp" on the TAV and TAV-H beams

The adjusting elements are delivered as a complete assembly together with the crossbeam. They have only to be positioned on the beam between the humps (Fig. 29-1).

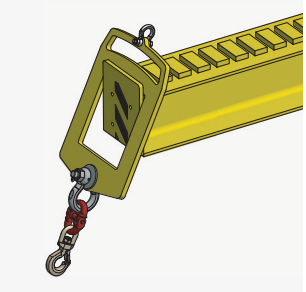

Fig. 29-1 Example of an adjusting element

11.1.2. Mounting the HC/C shackle type

The threaded bolt must be inserted into the shackle, fixed by the nut and additionally be secured by a cotter pin. A shackle must never be put into operation without the safety cotter pin ().

Fig. 29-2 Example of a shackle

11.1.3. Mounting the VBG coupling links

The two bows of the coupling link must be hooked into the connecting components (e.g. into the shackle, chain etc.) and then positioned such that they are aligned. Now, centrally position the bush in this alignment and drive in the bolt until it engages (Fig. 29-3).

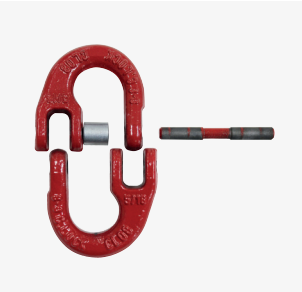

Fig. 29-3 Example of a coupling link

11.1.4. Mounting the eye-type load hook of the TA beam

Loosen the hexagon screw and the lock nut DIN 985 to remove and exchange the hook. When assembling it again, make sure that the locknut DIN 985 is replaced (Fig. 30-1).

Fig. 30-1 Example of an eye-type load hook

11.1.5. Mounting the substitute traps

Opening and pulling out the rivet allows the trap to be removed. Now, correctly position the new trap including the spring and rivet it properly (Fig. 30-2).

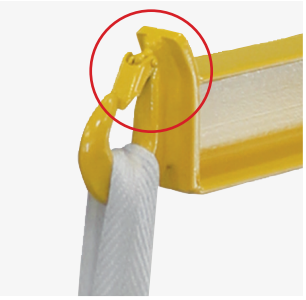

Fig. 30-2 Example of a substitute trap

11.2. Test

11.2.1. Test in the manufacturer's premises

The load suspension device was subjected to an internal production control in the manufacturer's plant.

11.2.2. Test prior to the first commissioning

The load suspension devices must be reviewed by an expert prior to the first commissioning in the operator's premises according to the DGUV Regulation 100-500. Possible defects (e.g. transport damage) must be eliminated.

The tests prior to the first commissioning are mainly visual and functional tests. They must cover the test of the condition of the components and equipment, the proper assembly and the completeness and efficiency of the safety devices.

Furthermore, a check must be made as to whether or not the nameplate with following data exists:

- Manufacturer's characteristic data
- Carrying capacity
- Deadweight
- Serial number
- CE mark

The test can then be documented in the test sheet (refer to the appendix) by the tester.

An expert is a person who has sufficient knowledge in the field of load suspension devices due to his/her professional training and experience and is familiar with the relevant governmental job safety provisions, regulations for the prevention of accidents, guidelines and generally accepted engineering standards (e.g. DIN EN standards) such that he/she can assess a safe condition of load suspension devices.

11.2.3. Test prior to each application

The load suspension device should be subjected to a visual test prior to each application by the user/operator. These tests are mainly visual and functional tests. They must cover the test of the condition of the components and equipment as well as the proper assembly and the completeness and efficiency of the safety devices. Also, checks must be performed for contaminations which influence or limit the operation of the load suspension device.

In case of frictionally engaged grippers a check of the friction linings for absence of grease is mandatory.

11.2.4. Regular test

The plant operator must make sure that load suspension devices are reviewed by an expert at intervals of no more than one year. Depending on the applications of the load suspension devices, tests at shorter intervals than one year may be required. For example, this applies to an especially frequent application, increased wear, in case of corrosion or if heat effects have to be taken into account.

The regular tests are mainly visual and functional tests. They include a check of the condition of the components and devices (check for cracks, deformations, high corrosion and wear), a proper

corrosion and wear), a proper assembly as well as the completeness and efficiency of the safety devices. Also, checks must be performed for contaminations which influence or limit the operation of the load suspension device.

All movable parts such as hooks, bolts, shackles, chain links, screwed connections, cotter pins, springs, axles, rollers, cable pulleys, gas dampers etc. must be checked for completeness, functional safety, wear and movability. In case of a wear of movable parts the maximum cross section reduction as specified in the DGUV Regulation 100-500 of the trade association must be considered. Friction linings may be worn up to the wearing limit provided that the linings were worn uniformly (refer to the wearing limits for the values). Furthermore, a check is to be made as to whether the nameplate as well as the identification of the load suspension device exists. The test can then be documented in the test sheet (refer to the appendix) by the tester.

11.2.5. Extraordinary tests

Extraordinary tests according to the DGUV Regulation 100-500 must be performed for load suspension devices after damage and special incidents which may impact the carrying capacity. Accessories must be tested according the relevant regulations of DGUV Regulation 100-500 of the trade association.

They have to cover the condition of the components and equipment (test for cracks, deformations etc.), the intended assembly as well as the completeness and effectiveness of the safety devices.

All movable parts such as hooks, bolts, shackles, chain links, screwed connections, cotter pins, springs, axles, rollers, cable pulleys, gas dampers etc. must be checked for completeness, functional safety, wear and movability. The max. reduction of the cross section as specified in the DGUV Regulation 100-500 of the trade association must be considered for the wear of movable parts. Friction linings may be worn up to the wearing limit. provided that the linings were worn uniformly (refer to the wearing limits for the values).

11.2.6. Wearing limits for friction linings

Wearing material	Thickness	Max.wear
	mm	mm
Jurid 421 brake tape	2,0	0,6
	3,0	0,9
	4,0	1,2
	5,0	1,5
	6,0	1,8
	8,0	2,4
	10,0	3,0
Secutex SPL (with insert of perforated sheet) screwed	10,0	1,5
	15,0	5,0
Secutex SP (without insert of perforated sheet) bonded	10,0	3,0
	15,0	4,5
STAR-LP 333-3	3,0	0,5
STAR-LP 333-4	4,0	0,5
STAR-X-3,3	3,3	0,5
STAR-X-4,5	4,5	0,5
STARPUR-6	6,0	2,0

11.2.7. Deformation and wear limits of carrying elements

A deformation of Tiger® construction hooks (no standard hooks) and/or form-fit workpiece retainers.

In case of load suspension devices visual inspection and a check for a deformation in the hook mouth (gross extension in the hook opening) will suffice. If a deformation of the measured length or a deviation from the desired condition is more than 5.0%, the corresponding component must be replaced. In case of the C-hook the distance of the measuring point for a check (KMP) (refer to the delivered documentation, drawing sheet M) must be checked. A distance deviation of up to 1% of the supporting arm length (carrying/supporting mandrel) is admissible.

Wear

Wear of the supporting components are only allowed within a defined range where functional safety of the component is not adversely affected. Supporting components with a reduction in the cross section from 10% must be replaced!

11.3. Maintenance

Tiger® load suspension devices are largely free of maintenance except for the spindle gripper. Here, the bearing surfaces of the cars and the threaded spindle of the gripper must always be clean and lubricated. If required, they must be re-lubricated.

11.4. Repair

LSDs must not be repaired without a consultation with the manufacturer. If repair must be performed after the consultation of the manufacturer by the plant operator, a test record must be prepared.

Modifications to the LSD must not be performed. Modifications made to the LSD may cause the LSD to comply no longer with the requirements of miscellaneous directives or standards.

12. Notes

Non-compliance with the above-mentioned information may result in a lost claim within the scope of product liability or warranty.

13. Drawings

Refer to the enclosed drawing.

14. Spare parts

Basically, all load suspension devices are spare parts and are therefore not listed specially!

Refer to the enclosed drawing for the spare parts.

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TEST SHEET

Test prior to the first commissioning: Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
1. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
2. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
3. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
4. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
5. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
6. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
7. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
8. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
9. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp

10. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
11. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
12. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
13. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
14. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
15. Regular test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp

1. Extraordinary test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Laboratory/stamp
2. Extraordinary test on: ..... Defects: (no) / (yes) acc. to the record	Signature of the expert	Test laboratory/stamp

Tiger
Hebezeuge der Spitzenklasse

Notes

Notes

Notes

www.tigerhebezeuge-shop.de/lastaufnahmemittel

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