LASHING MEANS AND LASHING POINTS.

Main catalogue version 1 | English

PRODUCT FEATURES.

Explanation of symbols.

	Lifting points with this product characteristic are ideally suited for rotating and turning loads.
	Ball bearing: suitable for rotating and turning. However, not suitable for permanent turning movements under load!
X:1	Design factor (e.g. 4:1) for lifting means (safety against breakage).
	All load-bearing elements are 100 % electromagnetically crack-tested.
	Loadable at all sides: Lifting points which can be loaded in all conceivable directions or which automatically turn into the load direction.
	The retaining spring holds the suspension link/suspension bracket in the adjusted position. This prevents rattling noise and simplifies painting.
360°	The lifting point can be rotated by 360°. However, this is not to be equated with rotating and turning under load!
XXX°	The lifting point has a pivoting area in the suspension link of XXX° (representing the different values).
X	Possible thread types of the respective lifting point. Symbols according to: M, MF, UNC, 8-UN, UNF, BSW, G.
VARIO	The lifting point is available with variable/different thread lengths.
-XX° XXX°C	Operating temperature range of the lifting means without permanent reduction of load capacity.
XXX°C max.	Maximum operating temperature of the lifting means with percentage, product-dependent load capacity reduction.
	The lifting points with this symbol are equipped with the ICE-Bolt.
BLUE-ID	Easy testing and documentation. With the RUD BLUE-ID system (equipped with an RFID chip).
DGUV TEST	Component has been approved by the DGUV (German Social Accident Insurance) and has the corresponding certificate.
DNVGL TEST	With DNVGL approval. The product is suitable for marine and offshore applications.
ASME B30.26	Meets the US standard ASME (American Society of Mechanical Engineers) B30.26.

This overview is for the sole purpose of explaining the symbols used in the catalogue. The actual values or features (here replaced by “X”) can be found on the respective product pages.

CONTENT.

Always a nominal thickness lower than grade 8.
RUD chains made from patented ICE-Material can substitute grade 8 chains of the next highest nominal thickness thanks to their extremely high strength. The decisive advantage: An ICE-Lifting mean or lashing chain is more than 30 percent lighter and the working ergonomics are noticeably improved

OUR CLAIM: MAXIMUM QUALITY, BEST CUSTOMER ORIENTATION.

Innovation, perfection and the motivation to achieve added value for our customers: That is RUD's passion. Being a technological think tank, we repeatedly set standards for load securing and lifting technologies with our lifting and lashing equipment.

Our chain production facilities are among the most modern of their kind. Highly qualified specialists work here, who are never satisfied with the status quo. Because our thinking is focused on meeting customer needs and maximum benefit for the user. The long-term partnership with our customers, their satisfaction and their trust are our focus.

RUD. MADE IN GERMANY.

All RUD products around lifting, moving and securing of loads have something important in common: They are developed and manufactured by us in Germany. In R&D alliances with research institutes, universities, suppliers and customers. With plenty of know-how, high creativity and state-of-the-art technology. This results in products and solutions of outstanding material quality, high robustness and exemplary ergonomics. In a nutshell: Quality made in Germany – made by RUD.

Made in Germany

AT HOME INTERNATIONALLY.

Not only our products, but also RUD's solution and consulting expertise are available to you all over the world. This is ensured by a large number of subsidiaries, associated companies and specialist RUD trade partners. Satisfied users of RUD lifting and lashing solutions can also be found in almost all industrial sectors.

TRADITION MEETS FUTURE.

Time and again, RUD is at the forefront of important developments. Many things considered standard today for lifting and lashing originated from RUD's think tank. In 1953, RUD was the first chain manufacturer to receive the inspection stamp H1 for high-strength chains, in 1972 it was the first to receive approval for grade 8 (H1–8) and in 2007 for round steel chains of the highest grade 12 (D1–12) (ICE). To simplify test processes, we have long equipped many products with RFID transponders as standard and offer a complete hardware and software system for efficient test management. The latest milestone: In 2019, RUD presented the first lifting point that "thinks" and can thus avoid dangerous transverse loads. And there is still a lot do for us to do. Join us into the future.

AWARD-WINNING SERVICE.

Numerous awards prove it: RUD's innovative strength and performance are outstanding – in the industry and beyond.

EFFICIENCY IN LOAD SECURING? GET IN TOUCH.

Head of purchasing, heavy haulage forwarder:

“WHEN SECURING LOADS, COST-EFFICIENCY IS JUST AS IMPORTANT AS RELIABILITY.”

“Our products help to transport heavy and valuable loads every day. Of course, it is always about safety, but also about cost-efficiency. This means that our operating equipment must be precisely suited to our respective tasks, but must also be of uncompromisingly high quality. One of the most important efficiency criteria is a long service life. Another focus is on user-friendliness. In addition: For very special transport projects, we need experienced consultants to select the exact lashing solution. At the end of the day, only a customized solution is truly cost-efficient.”

Technical consultancy, RUD Group:

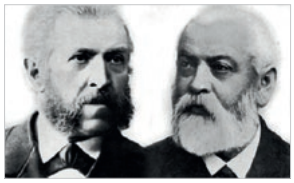
“THE CUSTOMER BENEFIT IS ALWAYS AT THE FOREFRONT FOR US. AND IT IS NEVER ONE-DIMENSIONAL.”

The special feature: In the case of specialised transport challenges, we literally stand by our customers and advise them. Our experts listen carefully to you, offer detailed advice and then develop an individual concept for load securing that perfectly suits the respective task. Another important advantage: Our products are not only extremely reliable and low-wear, they are also exemplary in terms of ergonomics thanks to good ideas and clear weight advantages.“

FIND OUT MORE
ABOUT THE
LOAD SECURING
AT RUD.

RUD MILESTONES.

1875
Establishment of the “Rieger & Dietz Kettenfabrik” by Carl Rieger and Friedrich Dietz in Aalen-Unterkochen.



1945
Beginning of industrial quality chains manufacturing.

1953
RUD is the first chain manufacturer with permittance stamp H1 for high-strength quality chains.

1967
First chain manufacturer with approval for grade 5 (H1–5).

1972
First chain manufacturer with approval for grade 8 (H1–8).

1981
Development of the first lifting points RBG (load ring for bolting) and RBS (load ring for welding).

1985
Expansion of the lifting point program to include the LBS (load ring for welding) and LBG (load ring for bolting).

1990
WBG (load ring thread).

1992
Certification of the quality management system according to DIN/ISO 9001.

Certified as the first chain manufacturer with integrated quality and environmental management system according to ISO 9001/14001.

1994
First chain manufacturer with approval for the VIP-Special grade 8S (H1–8S) with up to 30 % higher WLL than grade 8.

2002
First universal lifting point type PP-S.

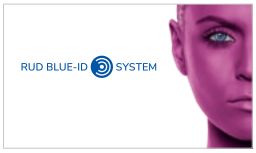
VRS as the first eyebolt with adjustable direction.

2006
Approval for grade 10 (VIP) (H1–10).

2010
W-ABA – first rigid lifting point that can be loaded on all sides.

2016
VLBG-PLUS – with Ø 45 % higher WLL.

2019
RUD BLUE-ID SYSTEM



OPTILASH-CLICK – the click-in lashing point by RUD. Fixed variant: OPTILASH-FIX.

2021
RUD TXP-Texolution-Point – the first textile liftingpoint with tested and guaranteed overall WLL, for the protection of surfaces and loads.

2007
DNVGL approval as manufacturer of round steel link chains and accessories for lifting, lashing and towing according to GL regulations for metallic materials (Certificate WZ 1218 HH 3).

First chain manufacturer with approval for grade 12 (ICE) (D1–12).

2014
RUD is the first lashing and lifting means manufacturer to equip many products with RFID transponders.

Presentation of the ICE-BOLT® – a revolution in bolting technology.

2019
RUD ACP-TURNADO – the first lifting point, whose body rotates automatically in the direction of force.

2022
Innovative 3D lifting means configurator from RUD www.lifting-planner.com.

SIMPLE PRODUCT INSPECTING WITH RFID TECHNOLOGY.

THE RUD BLUE-ID SYSTEM: IDENTIFY. TRANSMIT. MANAGE.

From RFID transponders and readers to a documentation and management software: With the RUD BLUE SYSTEM we offer you a comfortable overall solution for inspecting your equipment. This noticeably relieves your daily workload and saves costs.

The wireless and safe transmission via RFID transponders makes the product identification more convenient than ever. And with our readers and the software solution, documentation and administration also become incredibly easy. Thus, with a single click, all RUD components with RFID tags can be identified contact-free and without errors and transmitted directly to the software or app for further processing of the test data. It could not be more convenient or more secure. Your entire inspecting process will be simpler, faster and more reliable. This gives you more time for your core business.

THE RUD BLUE-ID SYSTEM.

- Lower inspection costs, time and personnel expenditure.
- More process and legal security (avoidance of errors).
- Factory preassigned product information simple, contact-free and fast readout on site.
- Clear marking and identification of the products with RFID technology.
- Offline inspecting possible without Internet access.
- Simple documentation and administration of test data with the cloud based software solution AYE-D.NET.

Serially embedded in defined RUD products.
Can be retrofitted for many other products.

RUD RFID CONNECT IT

If you see this symbol next to the image of an RUD product, you know:
An RFID transponder is installed here.

THE HARDWARE.
FLEXIBLE, ADAPTABLE, RESISTANT.

RFID transponders are already integrated as standard in defined RUD products. In addition, we offer you numerous possibilities to retrofit components safely and permanently with one of our transponders. Each of them is extremely resistant and can withstand even the harshest environmental conditions such as extreme temperatures or chemically aggressive substances.

The RUD ID-POINT®.
The press-fit version.

The RUD ID-STICKER.
The glue version.

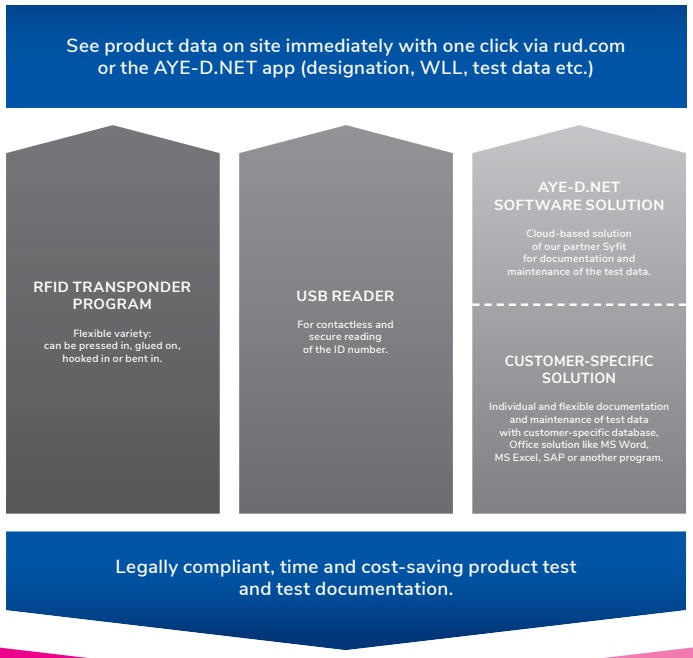
The RUD ID-TAG®.
The hinge version.

The RUD ID-USB-READER.

The RUD ID-LINK®.
The sagging version.

THE SOFTWARE. POWERFUL, MODULAR, EASY TO USE.

As a combination of testing, administration and documentation software, AYE-D.NET opens up numerous possibilities in testing administration and subsequent processes. We offer the cloud-based software tool as a SaaS solution together with our partner Syfit. Alternatively, you can organise the test documentation with existing databases and standard programmes such as Office applications, SAP etc.



PRACTICAL KNOWLEDGE: LOAD SECURING.


RUD
80

CUSTOMER PROXIMITY MEETS HIGH-TECH.

HOW WE PROVIDE LASHING ASSISTANCE.

Creating high-tech is good – but only if it goes hand in hand with consistent customer orientation. That is our attitude at RUD, and we act accordingly. Also when it comes to the topic of load securing, of course.

Technological innovation leadership has been a part of our vision for several decades. Our objective is to combine innovative product design coupled with the highest standards in production engineering and uncompromising quality management. Thanks to this attitude, our products have repeatedly set new standards, set globally recognised benchmarks and often shaped the entire industry.

At the same time, the benefits and added value for you as a customer are always at the forefront of our minds. Therefore, high-tech and innovative strength are resulting in more and more added values for you. What's more, we are also supporting your lashing tasks more and more by using digital tools. And it does so wherever it makes your daily work easier and more convenient as a designer or user. One example is our RUD app "lashing means calculation", which we will present to you on the following page.

THE RUD APP “LASHING MEANS CALCULATION”.

Safe and reliable in practice.
Do you want to learn in a matter of minutes how to optimally lash your current load? You will be on the safe side with our free app. Simply enter the specific parameters such as mass, type of lashing, means of transport, angle and friction values – and you will receive a detailed recommendation for your optimum load securing.

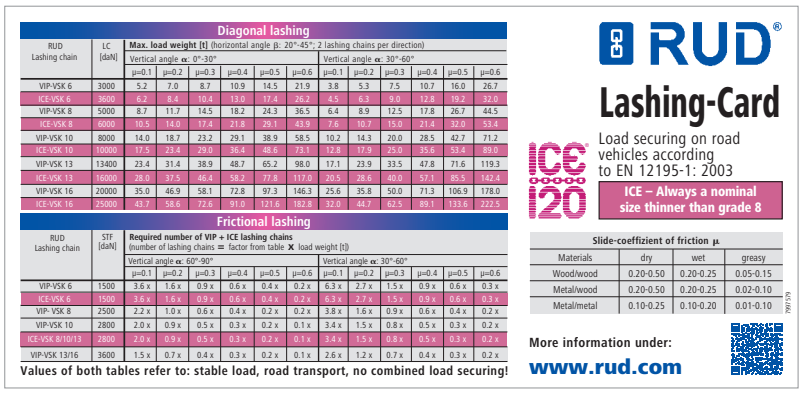
The app includes:
- Diagonal lashing
- Top over lashing
- Combination tie-down lashing/moulding
- Protractor
- Truck, train, vessel
- Angle or length input

Apple iOS

Android

The app is free and available for iOS and Android.

THE RUD LASHING CARD.



Diagonal lashing

RUD Lashing chain	LC [daN]	Max. load weight [t] (horizontal angle β: 20°-45°; 2 lashing chains per direction)											
		Vertical angle α: 0°-30°						Vertical angle α: 30°-60°					
		μ=0.1	μ=0.2	μ=0.3	μ=0.4	μ=0.5	μ=0.6	μ=0.1	μ=0.2	μ=0.3	μ=0.4	μ=0.5	μ=0.6
VIP-VSK 6	3000	5.2	7.0	8.7	10.9	14.5	21.9	3.8	5.3	7.5	10.7	16.0	26.7
ICE-VSK 6	3600	6.2	8.4	10.4	13.0	17.4	26.2	4.5	6.3	9.0	12.8	19.2	32.0
VIP-VSK 8	5000	8.7	11.7	14.5	18.2	24.3	36.5	6.4	8.9	12.5	17.8	26.7	44.5
ICE-VSK 8	6000	10.5	14.0	17.4	21.8	29.1	43.9	7.6	10.7	15.0	21.4	32.0	53.4
VIP-VSK 10	8000	14.0	18.7	23.2	29.1	38.9	58.5	10.2	14.3	20.0	28.5	42.7	71.2
ICE-VSK 10	10000	17.5	23.4	29.0	36.4	48.6	73.1	12.8	17.9	25.0	35.6	53.4	89.0
VIP-VSK 13	13400	23.4	31.4	38.9	48.7	65.2	98.0	17.1	23.9	33.5	47.8	71.6	119.3
ICE-VSK 13	16000	28.0	37.5	46.4	58.2	77.8	117.0	20.5	28.6	40.0	57.1	85.5	142.4
VIP-VSK 16	20000	35.0	46.9	58.1	72.8	97.3	146.3	25.6	35.8	50.0	71.3	106.9	178.0
ICE-VSK 16	25000	43.7	58.6	72.6	91.0	121.6	182.8	32.0	44.7	62.5	89.1	133.6	222.5

Frictional lashing

RUD Lashing chain	STF [daN]	Required number of VIP + ICE lashing chains (number of lashing chains = factor from table X load weight [t])											
		Vertical angle α: 60°-90°						Vertical angle α: 30°-60°					
		μ=0.1	μ=0.2	μ=0.3	μ=0.4	μ=0.5	μ=0.6	μ=0.1	μ=0.2	μ=0.3	μ=0.4	μ=0.5	μ=0.6
VIP-VSK 6	1500	3.6 x	1.6 x	0.9 x	0.6 x	0.4 x	0.2 x	6.3 x	2.7 x	1.5 x	0.9 x	0.6 x	0.3 x
ICE-VSK 6	1500	3.6 x	1.6 x	0.9 x	0.6 x	0.4 x	0.2 x	6.3 x	2.7 x	1.5 x	0.9 x	0.6 x	0.3 x
VIP- VSK 8	2500	2.2 x	1.0 x	0.6 x	0.4 x	0.2 x	0.2 x	3.8 x	1.6 x	0.9 x	0.6 x	0.4 x	0.2 x
VIP-VSK 10	2800	2.0 x	0.9 x	0.5 x	0.3 x	0.2 x	0.1 x	3.4 x	1.5 x	0.8 x	0.5 x	0.3 x	0.2 x
ICE-VSK 8/10/13	2800	2.0 x	0.9 x	0.5 x	0.3 x	0.2 x	0.1 x	3.4 x	1.5 x	0.8 x	0.5 x	0.3 x	0.2 x
VIP-VSK 13/16	3600	1.5 x	0.7 x	0.4 x	0.3 x	0.2 x	0.1 x	2.6 x	1.2 x	0.7 x	0.4 x	0.3 x	0.2 x

Values of both tables refer to: stable load, road transport, no combined load securing!

RUD
Lashing-Card
Load securing on road vehicles according to EN 12195-1: 2003
ICE i20
ICE – Always a nominal size thinner than grade 8

Slide-coeffizient of friction μ

Materials	dry	wet	greasy
Wood/wood	0.20-0.50	0.20-0.25	0.05-0.15
Metal/wood	0.20-0.50	0.20-0.25	0.02-0.10
Metal/metal	0.10-0.25	0.10-0.20	0.01-0.10

More information under:
www.rud.com

Angle measurement and table for tie-down lashing and direct lashing.

Order no. 7996327

CAD DATA FOR RUD LASHING EQUIPMENT.

Data for your own design.
Would you like to use the data of our RUD lashing equipment for the design of your own products? Not a problem: Simply download the necessary data at www.rud.com.

Data for your own design accessible at:
www.rud.com

TO ENSURE NO SLIPPING.

PRACTICAL KNOWLEDGE ON LOAD SECURING IN ROAD TRANSPORT.

Are you responsible for low-loaders, trucks or other transport vehicles? Do you need to occasionallyor even permanently transport all kinds of cargo? Or do you normally use your construction site trucks for excavation and gravel transport and are rarely on the road with a low-loader or only transport general cargo on the flatbed now and then?

In all these cases, the following hints will help you to save yourself accidents, high costs and possibly legal disputes. This is because experience shows that the strength of the lashing materials used is overestimated and the forces that occur during driving are often underestimated. Our aim is to counteract the carelessness and ignorance of physical and also legal contexts with sound basic knowledge.

Source: Police de la Route Liège (B) – Raymond Lausberg

IMPORTANT – NOT JUST FOR DRIVERS AND VEHICLE OWNERS.

Important to know: The StVO and the DGUV “Vehicles” are not only directed at the driver and keeper of the vehicle, but at everyone who is responsible for the proper loading of the vehicles. For every transport operation, the regulations require that the load as well as lashing chains, equipment and other loading devices must be stowed in a roadworthy manner and specially secured against falling and avoidable noise. For you, this means that you must secure the load in such a way that it cannot slip.

Reports in the media, pictures of accidents as well as traffic reports about overturned vehicles or lost loads show that this is not only possible with light loads. We therefore urgently warn against securing loads “by feel”: physics follows its own incorruptible laws. The actual forces acting on the loading area can only be controlled on the basis of concrete calculations.

THE MASS FORCES WITH A 10 TONNE LOAD.

The basic rule is that 0.8 times the load weight pushes in the direction of the driver's cab during full braking (including downhill) and that half of the load weight pushes in the direction of the drop sides during cornering as well as when starting. Expressed in figures using an example, this means: with a load mass of m = 10,000 kg, 8,000 kg ≈ 8,000 daN push towards the driver's cab. When starting and cornering 5,000 kg ≈ 5,000 daN push against the side wall. Corresponding lashing equipment must securely hold these forces. A basic distinction is made between two possible types of lashing: tie-down lashing on the one hand, and direct lashing on the other, which is further subdivided into angled lashing and diagonal lashing. Learn more on the following pages.

USE OUR PRACTICAL CALCULATION EXAMPLES.

We would like to shed more light on the "lashing mathematics" with practice-oriented calculation examples. The calculations are structured in such a way that they are comprehensible even without engineering and technical training and can serve as aids for future own interpretations. More precise and complete calculations can be found in VDI Guideline 2700-2 "Lashing forces" or EN 12195-1.

Remarks regarding the calculation standard EN 12195-1:2010.
EN 12195-1:2010 contradicts the results of many academic and investigations confirmed in practical situations. The status of an approved rules of technology in terms of § 22, Abs. 1 StVO is doubtful and currently not confirmed by legislation. In order to ensure a sufficient level of safety, the following explanations refer to EN 12195-1:2003 or VDI 2700 et seq.

LOAD SECURING HINTS IN HEAVY HAULAGE.

THE TRICK WITH DIVERSION.

One of the biggest challenges in securing heavy loads is to avoid so-called static overdeterminism. The problem in plain language: If you use more than two lashing devices per direction when lashing directly, only two of the lashing devices used will nevertheless absorb the entire force – or at least the majority of it. Theoretically, more than two strands can be supported if all strands fulfil the following boundary conditions:

- Equal strand lengths
- Equal lashing angles
- Equal pre-tensioning
- Same lashing equipment (elongations)

Practitioners know, however, that such load securing is not feasible. You can solve this problem with a trick: divert the lashing chains so that they lead from the load to the vehicle in double strands. The result is four weight-bearing strands in one direction.

A compensation of forces in the double strands must result from the diversion. You can achieve this, for example, by diverting around a round lifting bollard, as shown in the two pictures above. An even better compensation of forces is achieved with the VIP lashing chains with diversion roll.

Because you need other angles for this “double lashing” alongside the common lashing angles α and β and also need to consider boundary conditions specific to the individual case, you cannot calculate this type of load securing in a standard way. Get in touch with us and tell us about your tasks – our specialists will be pleased to advise you.

VIP-HEAVY DUTY LASHING CHAIN WITH DIVERSION ROLL.

- Direct lashing with 4 weigh-bearing strands per direction (statically determined).
- Individual configuration.
- Distribution of high lashing forces on several lashing points of the loading area.
- Direct lashing of up to 475 t load mass.

Chain Ø [mm]	Designation	LC [daN] in single strand	LC [daN] max. achievable	Order no.
20/13	VIP-VSK-20/13	13,400	26,800	8600165
22/16	VIP-VSK-22/16	20,000	40,000	8600166

Subject to technical changes!

MISSING LASHING POINTS?

WHEN ENDLESS CHAINS MAKE SENSE.

Direct lashing can pose further challenges. One of the most common ones is when there are no lashing points on the load. Or the connection dimensions of the existing “lashing points” – often only flame cut holes or drilled holes – do not allow a lashing hook to be properly attached there. The word “properly” means here:

- The safety latch on the lashing hook should close when hooked in.
- The lashing hook may only be loaded in the bottom of the hook, never on the tip of the hook.

Resorting to a shackle to connect the lashing equipment to dimensionally unsuitable lashing points is often problematic, as this exposes the shackle to unauthorised bending stresses. A much more suitable and flexible alternative is the endless chain (see figures). Choose an endless chain with the same Lashing Capacity (LC) as the lashing chain. And because you “double up” the chain, sharp edges on the endless chain are not a problem any more.

You can create a particularly flexible endless chain with the ICE-Multi-shortening claw (see page 42). Simple connect a piece of the ICE-Chain with the ICE-Multi-shortening claw to form a closed chain. The advantages speak for themselves:

- The endless chain can be opened without tools and
- is adjustable in its endless chain diameter.

Typical “direct lashing loads” without a lashing point are, for example, stone blocks or prefabricated concrete parts. Here, a so-called “head lashing” can be done with the help of an endless chain (figure below).

TIE-DOWN LASHING.

Tie-down lashing is the most common type of lashing for road goods transport, since most loads are so wide that securing can only be achieved by vertical or slightly inclined tie-down lashing. The basic idea behind top over lashing is to increase the natural burden by applying pre-tension forces and thus to increase the frictional force which prevents the load from slipping. For tie-down lashing, however, the following pre-conditions must always be heeded:

- High friction must be guaranteed between the load and the load surface as well as between the load units (panel transport). The sliding friction coefficient μ must be known.
- The vertical angle α must be known and should be as close as possible to 90°.
- The load must be able to cope with a higher pre-tension.
- The lashing points must be suitable for the load.
- The most important thing: The amount pre-tension force necessary, which must be applied using the tensioning element, must be known.

Inspecting Ø wear occurrence.

Checking of plastic elongation due to overload.

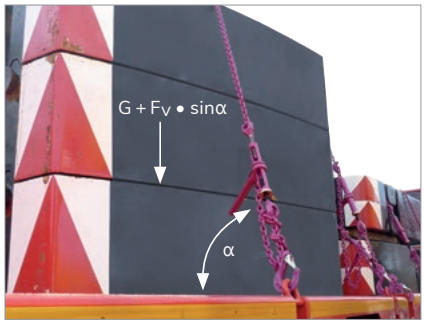
Checking of division elongation due to nominal thickness wear.

LIMITS OF TIE-DOWN LASHING.

The list shows the disadvantages and limits of tie-down lashing: During tie-down lashing, the lashing equipment, the lashing points and the load itself are permanently exposed to a high lashing capacity. In principle, however, tie-down lashing only works if, as mentioned above, there is a sufficiently high coefficient of friction between the loading area and the load. A steel load on a steel loading area, for example, offers very unfavourable conditions, which is why wooden supports, friction-enhancing mats (anti-slip mats) or similar are used to increase friction. Of course, the loading area and the load must be free of oil, dirt and ice.

HOW IS THE SECURING EFFECT BEING GENERATED DURING TIE-DOWN LASHING?

By applying the total tension force F_V using lashing equipment (lashing chains, lashing strap), clamping elements (spindle tensioner/tension gauge ratchet), the friction force F_r is increased. The actual friction force acting, also called the restraining force, is therefore made up of the proportion resulting from the dead weight of the load with G x μ and the part from the vertical force component, which is calculated from the additionally applied tension force F_V x sinα x μ.



Both values together must be greater than the force with which the load tries to move on the loading area, i.e. 0.8 or 0.5 times the load weight:

$$c_{x,y} \times G < G \times \mu + F_V \times \mu \sin\alpha$$

The following formula results for the required total pre-tensioning force F_V:

$$F_V = \frac{G \times (c_{x,y} - \mu)}{\mu \times \sin\alpha}$$

Here means:
G: Weight force in daN ≈ Mass m in kg
cx,y: Acceleration factor
cx: Acceleration factor in direction of travel = 0.8; against direction of travel = 0.5
cy: Acceleration factor across the direction of travel = 0.5
μ: Sliding coefficient of friction
α: Vertical angle (angle between load bed and chain leg)

CALCULATION LENGTH 1.

Load precast concrete element m = 4,000 kg ≈ 4,000 daN = G
Concrete/wooden load bed: μ = 0.3
Vertical angle α = 60°

$$F_V = \frac{G \times (c_{x,y} - \mu)}{\mu \times \sin\alpha}$$

sin60° = 0.866

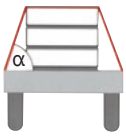
$$F_V = \frac{4{,}000\ \text{daN} \times (0.8 - 0.3)}{0.3 \times 0.866}$$

F_V = 7,698 daN total pre-tension force

From this, the **number of required transformations n** can be calculated:

$$n = \frac{F_V}{S_{TF} \times 1.5}$$

Here means:
STF = **S**tandard **T**ension **F**orce (the pre-tensioning force that can be achieved with a clamping element).



In the example, a lashing chain of the type ICE-Lashing Chain-8 with an STF of 2,800 daN was selected from the table on page 40.

$$n = \frac{7{,}698\ \text{daN}}{2{,}800\ \text{daN} \times 1.5} = 1.8 \text{ selected } 2$$

Two lashing chains of the above type are required in the loop lashing.

PLEASE NOTE:

On the patented ICE/VIP identification tag from from RUD, a differentiation is made between the following details:

LC = Lashing Capacity (permissible lashing capacity in daN; 1 kg≈ 1 daN)

STF = Standard Tension Force (normal, remaining tension force in daN from the tensioning element with a Standard Hand Force (SHF) of 500 N. corresponds to the pre-tensioning force necessary for calculating top over lashing).

DIAGONAL LASHING.

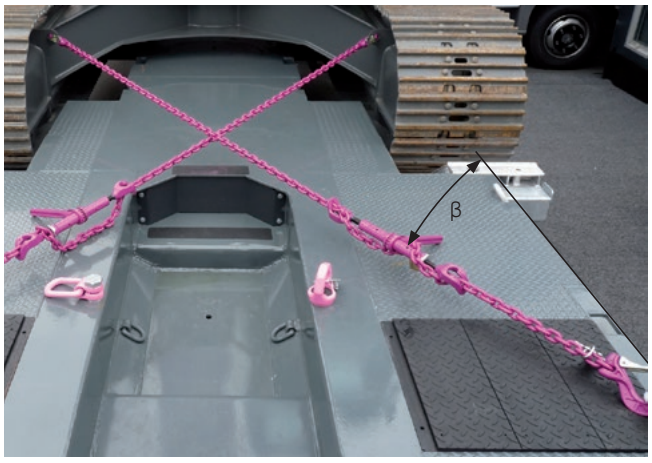
REQUIREMENTS, EFFECTS, ADVANTAGES.

One thing right from the start: You should always prioritise diagonal lashing to tie-down lashing. The reason is that no special static pre-tensioning forces need to be applied. In contrast to tie-down lashing, the lashing equipment/lashing points are only subjected to light pre-tensioning. The lashing equipment are only subjected to higher loads if the forces occur as a result of strong braking, sudden starting or intensive cornering.

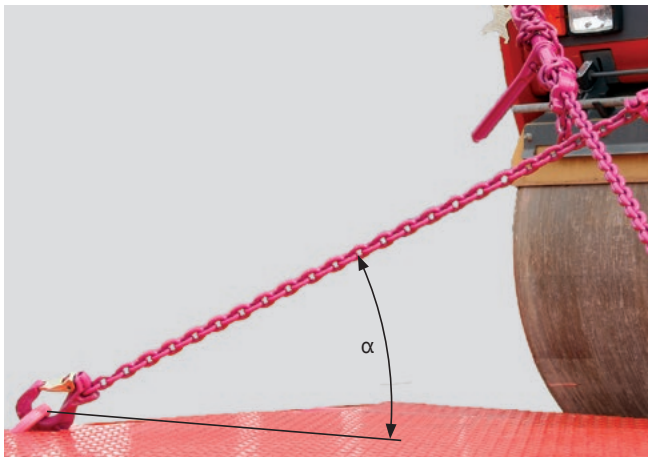
IMPORTANT FEATURES.

It is important some special characteristics are taken into account for diagonal lashing. This concerns the arrangement and positioning of the lashing lines in relation to the respective loading directions. Two angle plans (horizontal and vertical) must be taken into account for diagonal lashing and thus two angles must be defined. The two figures should make a clear definition of the angle to be taken into account easier.

The angles α and β play a decisive role in the calculation. The explanation: The angle β is the horizontal angle between an imaginary straight line from the lashing point towards the driver's cab and the chain strand. The vertical angle α is the angle between the loading area and the chain strand.



Horizontal angle β



Vertical angle α

CALCULATION AID FROM RUD.

RUD chains offer an easy to use calculation aid with protractor, which makes the determination of angles α and β child's play. Using this calculation aid, you can very quickly select the correct lashing chain (see page 15).

It makes sense to keep the angle β between 20° and 45°. If β becomes very small, there will be a very high load on the lashing equipment when cornering. If β becomes very large, there will be a very high load during braking/acceleration. In extreme cases if angle β = 90°, an indefinitely high force would theoretically occur in the lashing equipment. Both illustrate very clearly that extreme crosswise lashing as securing means in the direction of travel, as can often be seen on construction vehicles or rollers, is the most unfavourable type of load securing in the direction of travel.

With an angle α, the optimal power generation of the lashing equipment is given between 0° and 30°. As the angle α increases, so does the load on the lashing equipment, which theoretically increases to infinity with an angle of 90°.

CALCULATION LENGTH 2.

Excavator m = 18000 kg ≈ 18000 daN = G
Vertical angle of the lashing legs: α = 10°
Horizontal angle of the lashing legs: β = 40°
Number of effective lashing chains
in the respective direction: n = 2
Friction coefficient μ dirty/icy
Wooden load bed: μ = 0
The friction coefficient μ of the excavator on the dirty wooden loading area is neglected and not taken into account in the first calculation.

The formula for the necessary lashing equipment with the permissible lashing capacity= LC = lashing capacity is:

$$LC = \frac{G \times c_x}{\cos\alpha \times \cos\beta \times n}$$

cos10° = 0.984
cos40° = 0.766

c_x: Acceleration factor in direction of travel = 0.8;
Opposite direction of travel = 0.5

$$LC = \frac{18{,}000\ daN \times 0.8}{0.984 \times 0.766 \times 2}$$

LC = 9,550 daN

For the excavator weighing 18,000 kg ≈ 18,000 daN and the lashing layout shown, lashing equipment that at least has the permissible lashing capacity of 9,550 daN must be chosen. According to the table on page 40/41, this would be a type ICE-Lashing Chain-10, nominal thickness 10.

CALCULATION LENGTH 3.

Here is the same calculation again as the previous example, but with extremely unfavourable angles α and β, i. e. like with cross-lashing with angles of β = 80° and α = 75°. All other values remain the same.

cos75° = 0.258
cos80° = 0.173

$$LC = \frac{18{,}000\ daN \times 0.8}{0.258 \times 0.173 \times 2}$$

LC = 161,312 daN (!)

This calculation shows in a particularly drastic way how the angles play a decisive role in the calculations and that load securing becomes illusory at unfavourable angles.

If the coefficient of friction μ < 0.5 during diagonal lashing, a recalculation must be carried out for cornering. The formula is as follows:

$$LC = \frac{G \times c_x}{\cos\alpha \times \sin\beta \times n}\ (daN)$$

c_y = Acceleration factor across the direction of travel = 0.5.

This formula differs from the previous ones only by the different factor for cornering 0.5 and the sinβ occurring in the transverse direction.

CALCULATION LENGTH 4.

Here is another example 2, but in favourable weather conditions and with a clean load and loading area and the use of anti-slip material. The friction coefficient μ may affect the calculation of example 2.

In / opposite direction of travel

$$LC = \frac{G \times (c_x - \mu)}{\sin\alpha \times \mu + \cos\alpha \times \cos\beta) \times n}$$

Across the direction of travel

$$LC = \frac{G \times (c_x - \mu)}{\sin\alpha \times \mu + \cos\alpha \times \sin\beta) \times n}$$

G = 18,000 daN
μ = 0.5
cosα = cos10° = 0.984
cosβ = cos40° = 0.766
sinα = sin10° = 0.173

$$LC = \frac{18{,}000\ daN \times (0.8 - 0.5)}{\sin 10° \times 0{,}5 + \cos 10° \times \cos 40°) \times 2}$$

$$LC = \frac{18{,}000\ daN \times (0.8 - 0.5)}{0.173 \times 0.5 + 0.984 \times 0.766) \times 2}$$

= 3,210 daN per lashing strand.

According to the table on page 40/41, this would be a type ICE-Lashing Chain-6, nominal thickness 6.

STANDARDISED MINIMUM REQUIREMENT: EN 12195-3.

In order to be able to absorb high permissible lashing capacities absolutely safely, the Association of German Engineers (VDI) published guidelines for the first time that set clear minimum requirements for quality, permissible lashing capacity, minimum breaking strength, labelling and much more: VDI 2701 “Lashing equipment, load securing on road vehicles”. It had been valid since January 1985 and could be held against the defendant in court as state of the art. With some amendments, it has been incorporated into the European standard EN 12195-3, which has been legally binding since June 2001.

This set of rules means that many conventional lashing chains – especially those with Far Eastern ratchet tensioners with a long lever arm and no anti-rotation device – are no longer acceptable. In addition, most shortening elements (chain killers) do not in any way comply with the requirement that they must not reduce the breaking force.

The pre-tensioning forces (STF Standard Tension Force) achievable by the tensioning elements must be indicated on the prescribed identification tags; they must not exceed the values of 0.5 LC (Lashing Capacity/permissible lashing capacity). The more precise requirements of the standard can be found in the table on page 54/55.

In EN 12195-3, the chain quality grade 8 is listed as the highest grade. For some time now, however, there has been grade 10 and now even grade 12, both of which show considerable improvements in tensile loads, while meeting and even largely exceeding all the requirements of EN 12195-3.

For information on applicable guidelines regarding lashing points, from which obligations for designers can be derived, see page 33.

SELECTING THE CORRECT LASHING CHAIN.

In calculation example 2 (page 23), a lashing chain with nominal thickness 13 of quality class 8 was used with a permissible lashing capacity LC of 9,550 daN. The standard version is 3.5 m long, the chain link diameter is 13 mm, and the permitted lashing capacity LC 10,000 daN. The advantage of the ICE-Lashing chains-Generation becomes particularly clear in this example. With a necessary permitted lashing capacity of 9,550 daN, a ICE-Lashing chain of ICE-Lashing Chain-10 would be sufficient. The ICE standard version is 3.5 m long, but the chain link diameter is only 10 mm. The permissible lashing capacity LC is also 10,000 daN. The standard chain of grade 8 is almost 70 % heavier than that of grade ICE-120.

ICE QUALITY VS. EN STANDARD.

The table on page 54/55 shows, in comparison, which improvements the ICE quality offers in comparison to the EN standard. The higher purchase costs are quickly amortised because the ICE chains are particularly durable and robust as well as faster to handle. During checks, you will be on the safe side with these chains – assuming they are used correctly.

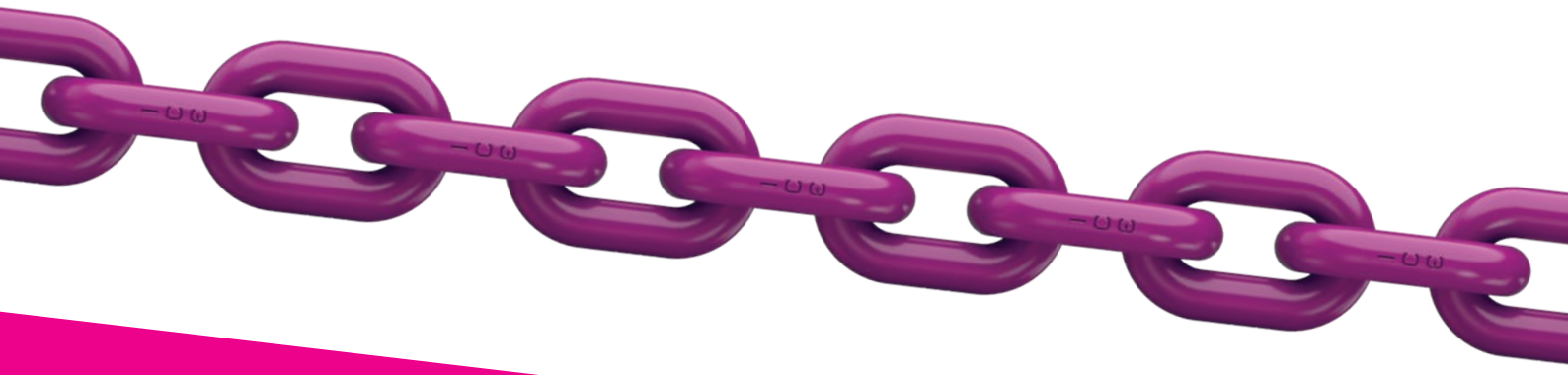
The elastic elongation of lashing chains with the permitted lashing capacity LC (half of the minimum break force) is only 1.1 to 1.6 %. In comparison: For new lashing straps it is < 7 %. This low elongation can be a big advantage for long lashing equipment.

PRE-TENSIONING FORCE AS AN IMPORTANT FACTOR.

Calculation example 1 (page 21) has shown that it is essential to know the level of the pre-tensioning force in order to lash down safely. However, this pre-tensioning force is the big unknown factor. Furthermore, the driver cannot recognise the reduction of pre-tensioning force, caused by the load settling during travel. This repeatedly leads to completely uncontrollable lashing capacity conditions that call into question the effectiveness of the load restraint. Referring to calculation example 1, you would have to use eleven lashing straps in the loop lashing at a required total pre-tensioning force F_V = 7,698 daN – with a STF of 500 daN. With the loop lashing, which theoretically allows a doubling of the pre-tensioning force, it cannot be 100 % guaranteed that the same pre-tensioning force is present on the side opposite the ratchet.

Friction losses at the edge deflections can significantly reduce the pre-tensioning force. This friction losses can be reduce with a corresponding edge protection. However, the safest way to absolutely prevent the losses is either to use two tensioning elements (one tensioning element per side) or to increase the number of lashings by a factor of 1.5 as shown in the formula on page 21.

Thanks to the high achievable pre-tensioning force (STF), lashing chains are ideal for lashing down heavy loads.

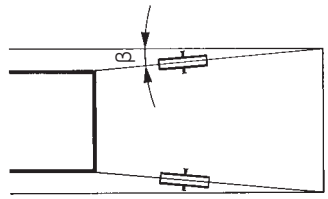


DIAGONAL LASHING.

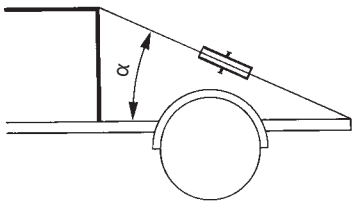
RUD lashing chains	LC [daN]	Max. load weight [t] (horizontal angle β: 20°–45°; 2 lashing chains per direction)											
		Vertical angle α: 0°– 30°						Vertical angle α: 30°– 60°					
		μ = 0.1	μ = 0.2	μ = 0.3	μ = 0.4	μ = 0.5	μ = 0.6	μ = 0.1	μ = 0.2	μ = 0.3	μ = 0.4	μ = 0.5	μ = 0.6
ICE-Lashing Chain-Classic 6	3,600	6.2	8.4	10.4	13.0	17.4	26.2	4.5	6.3	9.0	12.8	19.2	32.0
ICE-Lashing Chain-Classic 8	6,000	10.5	14.0	17.4	21.8	29.1	43.9	7.6	10.7	15.0	21.4	32.0	53.4
ICE-Lashing Chain-Classic 10	10,000	17.5	23.4	29.0	36.4	48.6	73.1	12.8	17.9	25.0	35.6	53.4	89.0
ICE-Lashing Chain-Classic 13	16,000	28.0	37.5	46.4	58.2	77.8	117.0	20.5	28.6	40.0	57.1	85.5	142.4
ICE-Lashing Chain-Classic 16	25,000	43.7	58.6	72.6	91.0	121.6	182.8	32.0	44.7	62.5	89.1	133.6	222.5

The values refer to: stable load, road transport, no combined load securing!

Horizontal angle β



Vertical angle α



TIE-DOWN LASHING.

RUD lashing chains	STF [daN]	Required number of VIP + ICE-Lashing chains in loop lashing (number of lashing chains = factor from table x load weight [t])											
		Vertical angle α: 60°– 90°						Vertical angle β: 30°–60°					
		μ = 0.1	μ = 0.2	μ = 0.3	μ = 0.4	μ = 0.5	μ = 0.6	μ = 0.1	μ = 0.2	μ = 0.3	μ = 0.4	μ = 0.5	μ = 0.6
ICE-Lashing Chain-Classic 6	1,500	3.6 x	1.6 x	0.9 x	0.6 x	0.4 x	0.2 x	6.3 x	2.7 x	1.5 x	0.9 x	0.6 x	0.3 x
ICE-Lashing Chain-Classic 8	2,800	2.0 x	0.9 x	0.5 x	0.3 x	0.2 x	0.1 x	3.4 x	1.5 x	0.8 x	0.5 x	0.3 x	0.2 x
ICE-Lashing Chain-Classic 10	2,800	2.0 x	0.9 x	0.5 x	0.3 x	0.2 x	0.1 x	3.4 x	1.5 x	0.8 x	0.5 x	0.3 x	0.2 x
ICE-Lashing Chain-Classic 13	2,800	2.0 x	0.9 x	0.5 x	0.3 x	0.2 x	0.1 x	3.4 x	1.5 x	0.8 x	0.5 x	0.3 x	0.2 x

The values refer to stable load, road transport, no combined load securing!

GLIDE COEFFICIENTS μ.

Material pairing	dry	wet	greasy
wood/wood	0.20–0.50	0.20–0.25	0.05–0.15
Metal/wood	0.20–0.50	0.20–0.25	0.02–0.10
Metal/metal	0.10–0.25	0.10–0.20	0.01–0.10

THE ICE-LASHING CHAIN BY RUD.

Break force up, weight down.

RUD has always been ahead of its time when it comes to materials for chains. One example is the world-famous RUD ICE chain, which can replace a grade 8 chain of the next largest nominal thickness in direct lashing. As the first manufacturer in the world, RUD received the approval stamp D1 from the German employers' liability insurance association for round steel chains. Thanks to the extremely high strength of the patented material, the continuous nominal thickness increase has been achieved even with diameters of less than 16 mm.

As early as 1994, RUD was the first chain manufacturer to present grade 10 under the name VIP-100 and thereby revolutionised the chain market. The RUD chain with the eye-catching pink powder coating had up to 30 % higher load capacity with the same nominal thickness, meant a considerable weight saving compared to the grade 8 chain and thus a significant improvement in terms of ergonomics.

Quality grade 12 has a breaking force up to 60 % higher than the conventional Grade 8. In lashing technology, this means an increase in LC (= Lashing Capacity) by up to 60 %. The chain generation with the colour ICE pink (traffic lane) owes its name ICE-120 to its enormous low-temperature suitability of –60 °C. The decisive advantage: An ICE-Lashing chain is up to 45 % lighter, the working ergonomics noticeably higher. Tensioning, connection and shortening elements have also been significantly improved in terms of weight and functionality.

We have considerably optimised the following technological properties once more with the ICE-120:

- Elongation to break and ductile strength,
- low temperature toughness as well as
- durability and wear resistance.

Nominal thickness mm	Permissible lashing capacity LC [daN]	
	Grade 8	ICE-120
6	2,200	3,600
8	4,000	6,000
10	6,300	10,000
13	10,000	16,000
16	16,000	25,000

The ICE-Lashing chains replace grade 8 of the next larger nominal thickness.

THE FOR 45 % LESS OWN WEIGHT – YOUR ADVANTAGES:

- Better handling through lightweight design: No impairment of health due to too heavy lifting.
- Up to 60 % higher break force / LC than grade 8.
- Significantly improved toughness and impact energy values (55 J at –60 °C).
- Optimum surface protection through special ICE pink powder coating.
- Higher wear resistance and longer life due to special heat treatment and 30 % higher surface hardness.
- Reduced sensitivity to the penetration of sharp edges.
- Environmental protection: significantly less material and less energy consumption in production.
- Made for extreme temperatures.

THE ICE-CURT RATCHET TENSIONER.

RUD RFID CONNECT IT

One special highlight in the ICE-Lashing chain is the ICE-CURT ratchet tensioner. It offers you plenty of advantages.

- Exceeds the requirements of EN 12195-3.
- It has an extra long clamping path.
- It has a preparation for theft protection by means of a padlock (type ABUS 85/40HB).
- It is equipped with the RUD ID-POINT® (page 11).
- It is easy to clean and grease.
- It has an innovative, practical twist-release guard.
- It is easy to handle – even when wearing gloves.
- It is particularly light and robust thanks to its innovative forged shape.

In short: For the user, the use of ICE-Lashing chains means a considerable weight saving, improved ergonomics, faster attachment and noticeably more safety.

Locking device open.

Locking device closed.

Locking device with anti-theft device.

The ICE-CURT has a magnetic locking device to prevent loosening.

WHAT TO CONSIDER WHEN CHOOSING LASHING CHAINS.

ICE-Lashing chains meet EN 12195-3 and offer much more.

NOT PERMITTED.

Connection link
– Without securing device

Chains
– Lower quality than grade 8
– No manufacturer identification mark
– Long-link chains

Shortening elements
– Without securing device
– Break force reduction of chain

Identification tag
– Does not correspond with the standard
– Missing

Clamping elements
– STF > 50 % LC
– Without manufacturer's identification
– Without anti-rotation device
– Recoil path > 15 cm

RUD ICE-LASHING CHAINS.

ICE-Star-Hook
+ Wear markings
+ Control marking for jaw expansion
+ Robust forged hook latch

ICE chains
+ Grade 12
+ 35 % tougher
+ 30 % harder
+ Up to 60 % more LC
+ Up to 45 % lighter

ICE-Shortener
+ Simple, fast handling
+ Securing by moulding (DIN 5692)

ICE-CURT
+ Practical anti-twist guard
+ Anti-theft guard possible
+ RUD ID-POINT®
+ Sliding on chain strand
+ Simple and fast handling / servicing
+ Long stroke

ICE identification tags
+ Integrated test gauge function

USEFUL INFORMATION ABOUT LASHING POINTS.

FOR DESIGNERS AND MANUFACTURERS.

If you are transporting heavy machines or components, enormous forces can act on the load. The pretensioning force required to keep the load on the load bed are transmitted reliably using direct lashing. The requirement is lashing points on both the load and on the loading area. In other words, correct load securing starts during the design phase and is the responsibility of the design engineer or manufacturer.

PRACTICAL DESIGN PRINCIPLES FOR LASHING POINTS.

- Lashing points should be freely accessible.
- The lashing point shape should allow the folding safety catch of the lashing hook to be closed.
- Lashing points should be adapted to the shape of the lashing hooks and should not require any additional adapter elements such as shackles.
- Lashing points should guarantee the correct load of the connected lashing hook (load at the bottom of the book / no bending load).
- The positioning of the lashing point should allow lashing in the direct strand without lashing redirections over component edges.
- The positioning of the lashing point should make it possible to maintain reasonable lashing angles – reference value α ; $\beta \approx 30°$.
- Lashing points should be clearly recognisable as such and marked with their permissible lashing capacity.
- Lashing points should be available in sufficient umber and tensile force.
- Lashing points should be easily replaceable in the event of damage.
- Lashing points should exhibit pronounced plastic deformation prior to failure due to overloading in order to detect damage.
- The nominal tensile force of a lashing point should be introducible in all expected loading directions. It should best be loadable in all directions.
- Lashing points should have a design factor of 2 against breaking.

USEFUL INFORMATION FOR DESIGNERS: GUIDELINES FOR LOAD SECURING.

The fact that the securing of the load is also a matter for the designer can be found in various laws and technical guidelines. Here we have compiled some of the most important ones.

MACHINE DIRECTIVE 2006/42/EC.

The machine directive 2006/42/EC, which has been binding European law since the end of 2009, requires: “The machine or any of its components must be safe to handle and transport.” This means that it is indispensable for the machine designer to construct the machine in such a way that it is suitable for transport.

§ 22 STVO.

§ 22 StVO sec. 1 (German Road Traffic Act) prescribes that cargo is to be secured and that the recognised rules of sound engineering must be observed. Recognised rules of sound engineering are mainly DIN and EN standards as well as VDI guidelines. § 22 StVO, sec. 1 (German Road Traffic Act) has no special addressee but applies to everyone who deals with the load in a responsible way. This means that standards and guidelines on the subject of load securing must also be taken into account by the designer.

EN 474-1.

Special mention deserves in this context EN 474-1 “Earth-moving machinery-safety – Part 1: General requirements”. It requires earth-moving machinery to have lashing points that are also clearly marked.

VDI 2700-13.

VDI 2700-13 “Load securing on road vehicles – bulky and heavy haulage” becomes even more precise here and demands that, if necessary, a corresponding technical coordination between manufacturer and transport planner must take place already during the design phase.

DGUV REGULATION 70.

Trucks, trailers and semi-trailers with flatbed bodies have long been required to be equipped with anchorages (lashing points) for lashing equipment for securing load. This mandatory requirement is included in the DGUV Regulation 70 (vehicles). With regard to the implementation, reference is made to EN 12640 “Lashing points on commercial vehicles for goods transportation”.

ISO 15818.

ISO 15818 has been in force since 2017. It defines worldwide requirement criteria for lifting and lashing points for end construction machines. All RUD lifting and lashing points meet the standard requirements.

USEFUL INFORMATION FOR DESIGNERS.

ARE LIFTING POINTS SUITABLE FOR LASHING PURPOSES?

Lifting points are often installed for lashing purposes. However, please note that the lifting points originate from lifting technology and are therefore not marked with the permissible tensile force LC (lashing capacity [daN]) but with their WLL [t]. It is also important to know that lashing points and lifting points are subject to different design factors. This is why you will find it easier to meet practical requirements with high-strength, tested and field-proven RUD lashing points. They meet all important requirements of offer maximum quality “Made in Germany”.

RUD LASHING POINTS.

Weldable RUD lashing points are forged, movable ring eyes made of high-quality alloy steel, which are located in bearing blocks that can be easily welded. RUD lashing points with LC specification in daN can also be retrofitted to the vehicle carrier by certified welders. In addition to these weldable lashing points, RUD also offers an extensive range of boltable variants that can be used for load securing.

OUR SERVICE: DATA, CALCULATION PROGRAMS AND MORE.

All geometry data of the RUD lashing points can be downloaded from www.rud.com for your own CAD design. Free load securing calculation programs can be found at www.rud.com and can be downloaded free of charge as an app for iOS and Android in the respective stores.


Goldhofer

TIPS FOR SKIP LOADERS.

OPTIMUM LOAD SECURING WITH ANGLED LASHING.

Optimum load securing is, of course, primarily about the safety of people and the load. In addition, in times of increasing vehicle inspections, the risk of a fine for inadequately secured loads also increases. With RUD products you can protect yourself from this and increase safety for yourself and others in traffic.

For example, trough container lashing only by tie-down lashing – e.g. by Y lashing as shown in the photo – is not sufficient. Due to ice, oil, clay or dirt, a low friction value of approx. μ = 0.1 can occur even when friction-enhancing mats are used.

Your load would not be adequately secured with this. The only safe variant is the diagonal lashing such as the V, X or trapezoidal lashing with a fixed connection at the lashing point and at the suspension pin.

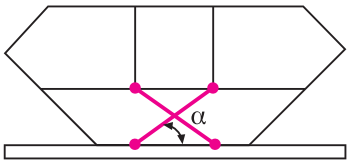
Caution: When passing the chain through the lashing point, as is often seen in practice with the V lashing, the load can slip. However, this means that there must be a turnbuckle on **each** lashing strand; you should invest the somewhat longer tensioning time in favour of safety. The flatter the vertical angle α the higher the container weights you can transport – or a thinner chain can be used.

PREFERABLY NOT LIKE THIS.

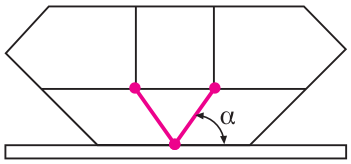
RECOMMENDED LASHING SOLUTION.

WE RECOMMEND THE FOLLOWING APPROACH:

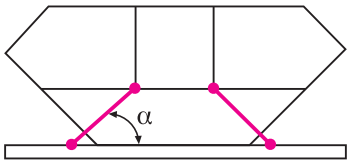
X-lashing



V-lashing



Trapezoidal lashing



EXAMPLE FOR SKIP LOADERS.

Load weight 15 t
α = 60°
Recommendation ICE chain with Ø 10 mm
α = 30°
The ICE chain with Ø 8 mm is adequate here.

The side securing device must have a fixed attachment point.

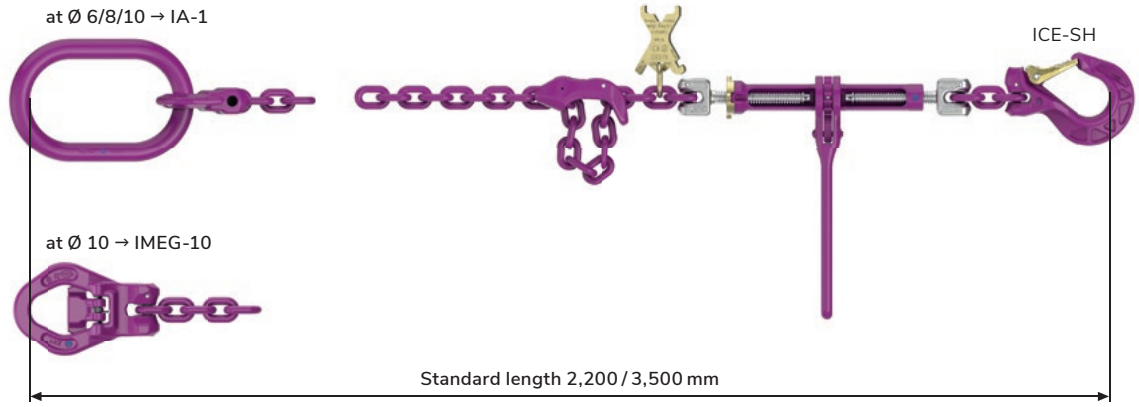
REQUIREMENT:

Tested lashing points suitable for the load must be available on the vehicle.

RUD container lashing chains enable quick, easy and positive lashing of containers in and against the direction of travel.

All components correspond with the lashing standard EN 12195-3.

DESIGN EXAMPLE:



The designs shown are examples of the construction of RUD container lashing chains.

THE CORRECT RUD LASHING CHAIN.

Grade	Chains Ø [mm]	Perm. lashing capacity per strand [daN]	Max. container weight [t] (2 lashing chains per direction; μ = 0.1; side positive; β ≈ 0°)			Order no.
			α≤ 30°	α≤ 45°	α≤ 60°	
12 (ICE-120)	6	3,600	9.6	8.0	6.1	8600260
12 (ICE-120)	8	6,000	16.0	13.5	10.2	8600261
12 (ICE-120)	10	10,000	26.6	22.6	17.0	8600262

LASHING CHAINS.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1

LASHING CHAINS WITH RATCHET TENSIONERS.

RUD ICE-Lashing chains (grade 12) offer noticeable advantages over grade 8 in all respects. Their up to 60 % higher permissible lashing capacity (LC) or comparatively low weight and thus better ergonomics, their high toughness, their durability as well as their increased breaking strength with unchanged elongation at break: All this makes them the economical choice for a wide range of lashing tasks.

RATCHET TENSIONER ICE-CURT-GAKO.

Chains	Designation	Perm. lashing capacity LC [daN]	Achievable pre-tensioning force STF [daN]	Lift [mm]	L-open [mm]	L-closed [mm]	Order no.
6	ICE-CURT-6-GAKO	3,600	1500	140	400	260	7903439
8	ICE-CURT-8-GAKO	6,000	2800	170	520	350	7901125
10	ICE-CURT-10-GAKO	10,000	2800	170	532	362	7901126
13	ICE-CURT-13-GAKO	16,000	2800	300	830	530	7902624
16	ICE-CURT-16-GAKO	25,000	–	350	962	612	7902625

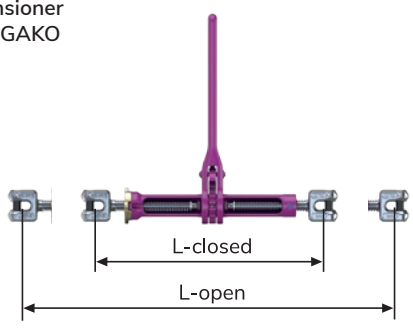
Subject to technical changes!

LASHING CHAIN ICE-LASHING CHAIN-CLASSIC.

Chains	Designation	Perm. lashing capacity LC [daN]	Achievable pre-tensioning force STF [daN]	L-min [mm]	Weight [kg] (Chain + ratchet tensioner)	Order no.
6	ICE-Lashing Chain-Classic-6	3,600	1500	780	4.8 + 2.2	7903443
8	ICE-Lashing Chain-Classic-8	6,000	2800	1040	8.0 + 5.2	7901129
10	ICE-Lashing Chain-Classic-10	10,000	2800	1210	13.0 + 7.1	7901130
13	ICE-Lashing Chain-Classic-13	16,000	2800	1600	21.9 + 13.6	7902626
16	ICE-Lashing Chain-Classic-16	25,000	–	1910	34.5 + 24.3	7902627

Subject to technical changes!

Ratchet tensioner ICE-CURT-GAKO



Lashing chain ICE-Lashing Chain-Classic

INDIVIDUAL COMPONENTS USED.

ISH

IVH

Details on this and other individual components can be found on page 43.

RUD RFID CONNECT IT

All RUD lashing chains are equipped with an RFID transponder as standard for simplified equipment testing and test documentation.

RATCHET TENSIONER ICE-CURT-SL.

Chains	Designation	Perm. lashing capacity LC [daN]	Achievable pre-tensioning force STF [daN]	Lift [mm]	L-open [mm]	L-closed [mm]	Order no.
6	ICE-CURT-6-SL	3,600	1,500	140	470	330	7903441
8	ICE-CURT-8-SL	6,000	2,800	170	623	453	7999435
10	ICE-CURT-10-SL	10,000	2,800	170	671	501	7999436

Subject to technical changes!

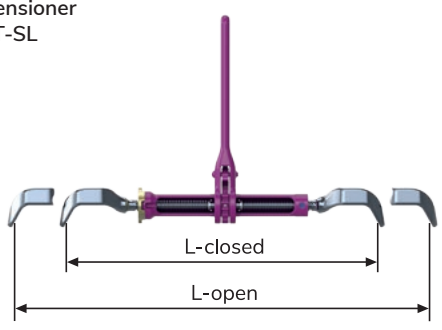
LASHING CHAIN ICE-LASHING CHAIN-ERGO.

Chains	Designation	Perm. lashing capacity LC [daN]	Achievable pre-tensioning force STF [daN]	L-min [mm]	Weight [kg] (Chain + ratchet spanner)	Order no.
6	ICE-Lashing Chain-Ergo-6	3,600	1,500	640	6.5	7903444
8	ICE-Lashing Chain-Ergo-8	6,000	2,800	817	12.6	7900026
10	ICE-Lashing Chain-Ergo-10	10,000	2,800	935	18.1	7900027

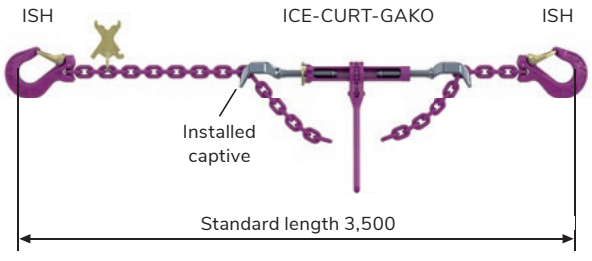
Tensioning element on the chain strand captive sliding.

Subject to technical changes!

Ratchet tensioner
ICE-CURT-SL



Lashing chain ICE-Lashing Chain-Ergo



INDIVIDUAL COMPONENTS USED.

ISH

Details on this and other individual components can be found on page 43.

GK ICE-120

ICE-VSK-Endless chain.

RUD RFID CONNECT IT

Adjustable endless chain diameter

Use with missing or incorrectly sized lashing points. Typical “direct lashing loads” without a lashing point are, for example, stone blocks or prefabricated concrete parts. Here, a so-called “head lashing” can be done with the help of an endless chain.

PRODUCT FEATURES

- To be opened without tools.
- Adjustable endless chain diameter.

Chains	Designation	Perm. lashing capacity LC [daN]	Chain length [mm]	Weight [kg/m]	Order no.
6	IVSK-KK-6	3,600	1,000	1.2	7901307
8	IVSK-KK-8	6,000	1,200	2.5	7901308
10	IVSK-KK-10	10,000	1,200	4.2	7901309
13	IVSK-KK-13	16,000	1,500	8.8	7901310
16	IVSK-KK-16	25,000	1,500	13.4	7901311

Subject to technical changes!

D-stamp
ICE 12 / D1.

- Stamping: ICE marking on the back of each chain link, production number and DGUV approval stamp < 0.5 m

INDIVIDUAL COMPONENTS

2:1 (1) | 4:1 | -60° - 200°C | 300°C max. | DGUV TEST | BLUE-ID

For RUD ICE-Lashing chains.

RUD RFID CONNECT IT

ISH ICE-STAR-HOOK.

Chains	Designation	LC [daN]	D [mm]	F [mm]	Order no.
6	ISH-6	3,600	26	30	7998179
8	ISH-8	6,000	29	36	7995254
10	ISH-10	10,000	37	41	7995255
13	ISH-13	16,000	48	50	7995256
16	ISH-16	25,000	56	58	7995257

Subject to technical changes!

RUD RFID CONNECT IT

(1)

IMEG ICE-DUMPER TRUCK SUSPENSION RING.

Chains	Designation	LC [daN]	Order no.
10	IMEG-10	5,000	7901607

Subject to technical changes!

RUD RFID CONNECT IT

IMVK ICE-MULTI SHORTENING CLAW.

Chains	Designation	LC [daN]	Order no.
6	IMVK-6	3,600	7900985
8	IMVK-8	6,000	7900981
10	IMVK-10	10,000	7900983
13	IMVK-13	16,000	7900984
16	IMVK-16	25,000	7900986

Subject to technical changes!

RUD RFID CONNECT IT

IVH ICE-SHORTENING HOOK.

Chains	Designation	LC [daN]	Order no.
6	IVH-6	3,600	7900129
8	IVH-8	6,000	7900133
10	IVH-10	10,000	7900134
13	IVH-13	16,000	7900136
16	IVH-16	25,000	7900138

Subject to technical changes!

IMK ICE-ROUND STEEL CHAIN ICE-PINK.

Chains	Designation	LC [daN]	Order no.
6	IMK 6x 8	3,600	7998048
8	IMK 8x24	6,000	7996116
10	IMK 10x 30	10,000	7996117
13	IMK 13x39	16,000	7996118
16	IMK 16x48	25,000	7998735

Subject to technical changes!

IVSK-KZA ICE-LASHING CHAIN TAG.

Chains	Designation	Order no. (with STF)	Order no. (without STF)
6	IVSK-KZA 6	7903500	7905320
8	IVSK-KZA 8	7995772	7905321
10	IVSK-KZA 10	7995773	7905322
13	IVSK-KZA 13	7995774	7905323
16	IVSK-KZA 16	–	7903502

Subject to technical changes!

LASHING POINTS.


GERMANY

LPW-U / LPW

Lashing point with LC identification – weldable.

PRODUCT FEATURES

- Lift bail can be pivoted through 180°.
- LC possible up to 90° in load ring plane.
- Clear indication of the minimum lashing capacity in daN.
- Functionally optimised shape of the suspension ring for better support at side loading and protection of the clamping spring.
- Prepared for easy weld-on.
- Phosphated surface.
- The clamping spring achieves noise reduction and keeps the suspension ring in the desired position.
- Distance knobs on the weld-on block for the necessary distance for root welding.

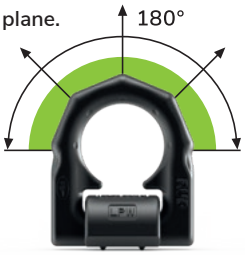
Type	Perm. lashing capacity LC [daN]	Weight (kg/pc.)	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	Welding seam HV + Δa	Order no.
LPW-U 3000	3,000	0.35	65	33	66	38	25	40	14	33	14	HV 5 + 3	7992225
LPW-U 5000	5,000	0.47	75	36	77	45	27	48	14	40	16	HV 7 + 3	7994831
LPW-U 8000	8,000	0.76	83	42	87	51	31	52	16	46	18	HV 8 + 3	7992226
LPW-U 13400	13,400	1.9	117	61	115	67	44	73	22	60	24	HV 12 + 4	7992227
LPW-U 20000	20,000	2.9	126	75	129	67	55	71	26	60	26.5	HV 16 + 4	7992228
LPW 32000 [1]	32,000	6.8	174	95	190	100	69	105	26	90	40	HV 25 + 6	7992229

[1] Without clamping spring.

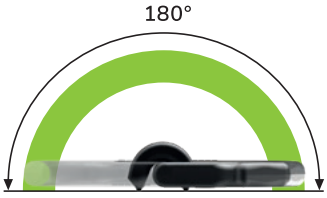
Subject to technical changes!

Clamping spring.

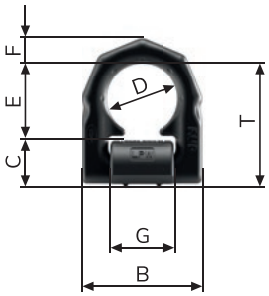
180° LC in the load ring plane.



180° LC in the folding direction.

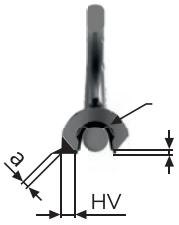


LPW-U / LPW



LPW-U / LPW

LPW-U / LPW



LRBS-FIX

Lashing load ring with LC identification – weldable.

PRODUCT FEATURES

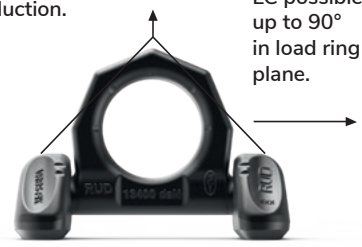
- Bracket can be pivoted through 180°.
- LC possible up to 90° in load ring plane.
- Clear indication of the minimum lashing capacity in daN.
- With all-round welding seam.
- Thanks to the weld arrangement (circular fillet weld), no contact/crevice corrosion can occur.
- For use on loading areas and loads.
- Split force introduction thanks to multiple point fixing.
- The clamping spring achieves noise reduction and keeps the suspension ring in the desired direction.

Type	Perm. lashing capacity LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Welding seam HY + a	Order no.
LRBS-FIX 8000	8,000	0.94	74	60	14	39	48	132	69	HY 3	7999303
LRBS-FIX 13400	13,400	2.2	97	88	20	50	60	167	91	HY 5	7999304
LRBS-FIX 20000	20,000	3.7	108	100	22	60	65	191	100	HY 6	7999305
LRBS-FIX 32000	32,000	8.2	140	130	30	72	90	267	134	HY 9	7993306

Subject to technical changes!

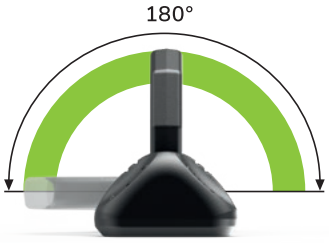
Split force introduction.

LC possible up to 90° in load ring plane.

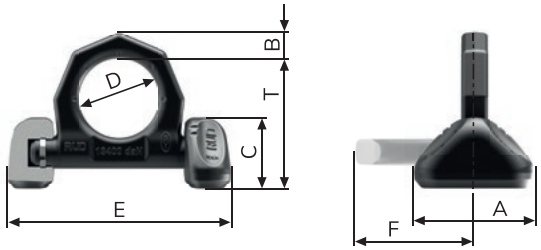


LC angle in load ring plane.

LC angle for side loading.



LRBS-FIX



LRL-FIX forged load ring

LRBK-FIX

Lashing load ring for 90° edges with LC identification – weldable.

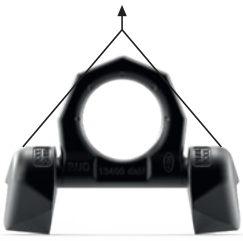
PRODUCT FEATURES

- Lift bail with extended pivoting area, can be pivoted through 270°.
- Optimal for edges – saves half the lashing points.
- Clear indication of the minimum lashing capacity in daN.
- Split force introduction thanks to multiple point fixing.
- LC possible up to 90° in load ring plane.
- Thanks to the weld arrangement (circular fillet weld), no contact/crevice corrosion can occur.
- The clamping spring achieves noise reduction and keeps the suspension ring in the desired direction.
- Simple alignment of ring lug.
- Ring lug remains in position.
- Simple painting.

Type	Perm. lashing capacity LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Welding seam HV + ∆a	Order no.
LRBK-FIX 8000	8,000	1.1	65	32	14	28	48	141	30	HV 4 + 3	7903056
LRBK-FIX 13400	13,400	2.1	84	40	20	35	60	181	34	HV 5 + 3	7903057
LRBK-FIX 20000	20,000	4.4	94	52	22	46	65	212	46	HV 8 + 3	7903058

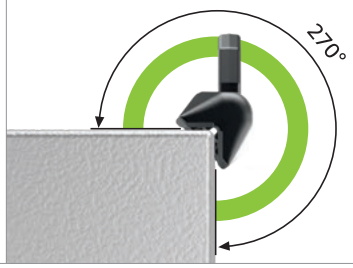
Subject to technical changes!

Patented fixing and clamping.

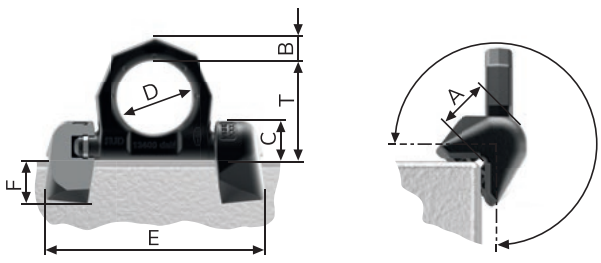


LC angle for side loading.

LC angle for side loading.



LRBK-FIX



LRL-FIX forged load ring

L-ABA

Rigid lashing point with LC identification – weldable.

PRODUCT FEATURES

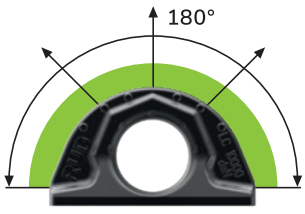
- Lashing point that can be loaded on all sides.
- Ideal for pile drivers, drilling equipment, rollers and earthmoving machinery.
- Clear indication of the minimum lashing capacity in daN.
- Forged from a single piece, no rattling noise or shaking.
- The weld arrangement (circular fillet weld) fulfils the requirements of EN 1090, i.e. the endless weld seam prevents the formation of contact/crevice corrosion (thus suitable for outdoor constructions).

Type	Perm. lashing capacity LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Welding thickness fillet weld HV + Δa	Order no.
L-ABA 2000	2,000	0.2	32	22	12	70	32	12	50	3	7909394
L-ABA 3200	3,200	0.44	41.5	30	16	100	35	16	57	4	7902667
L-ABA 6400	6,400	1.1	59	41	23	137	50	21	80	6	7902668
L-ABA 10000	10,000	2.3	71.5	51	27	172	60	27.5	99	7	790172
L-ABA 20000	20,000	5.3	95	70	38	228	80	35	130	8	7901723

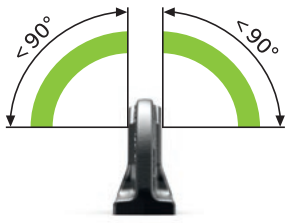
Subject to technical changes!

Clear marking of the minimum LC.

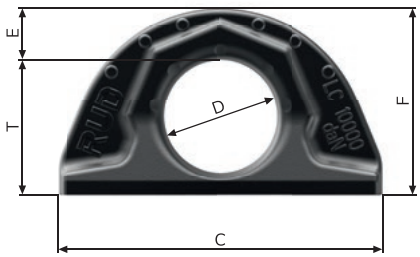
LC angle in load ring plane.



LC angle for side loading.



L-ABA



L-ABA

SLP

Lashing point with LC identification – weldable.

PRODUCT FEATURES

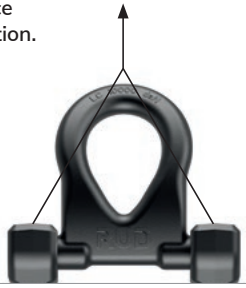
- Pivoting area 270°.
- Clear indication of the minimum lashing capacity in daN.
- Split force introduction thanks to multiple point fixing.
- Optimal for lashing extra-wide loads.
- Prepared for easy weld-on.
- Simple painting by fixing the suspension ring.

Type	Perm. lashing capacity LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	H [mm]	Order no.
SLP	10,000	3.75	115	63	185	100	60	110	25	40	7911358

Subject to technical changes!

Clear marking of the lashing capacity.

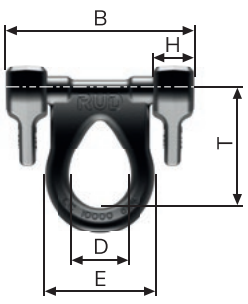
Split force introduction.



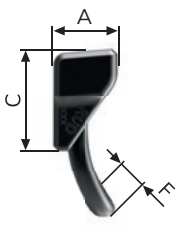
Extended pivoting area 270°.

SLP

SLP



SLP



L-VLBG-PLUS

Lashing load ring with LC identification – boltable.

RUD RFID CONNECT IT

PRODUCT FEATURES

- Rotatable through 360°.
- Lift bail can be pivoted through 180°.
- Clear indication of the minimum lashing capacity in daN.
- Original RUD bolts with special corrosion protection Corrud-DT.
- Captive yet exchangeable special bolt.
- Variable screw lengths available.
- Fast and simple installation.
- The clamping spring achieves noise reduction and keeps the suspension ring in the desired direction.

Type	Perm. lashing force LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H status [mm]	H max [mm]	J [mm]	K [mm]	L status [mm]	L max [mm]	M [mm]	N [mm]	SW	ISK	Torque moment [Nm]	Order no.	
																						Standards	Vario
L-VLBG-PLUS	16,000	6.2	197	77	122	82	70	97	26.5	77	63	223	205	110	140	300	36	87	55	22	800	7904778	8600778

SW = Width across flats
ISK = Inner hexagon

Subject to technical changes!

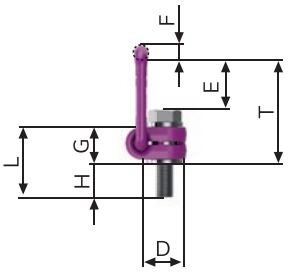
360° rotatable, 180° pivotable.

Clamping spring.

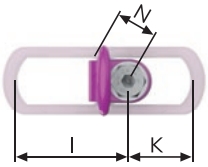
Clear marking of the lashing capacity.

L-VLBG-PLUS

L-VLBG-PLUS



L-VLBG-PLUS



OPTILASH-FIX

Lashing point with LC identification.

PRODUCT FEATURES

- Special offset shape.
- Flat lashing angles possible.
- Can be pulled out of the guiding retainer and used for upright and oversized loads as well.
- Can be loaded on all sides due to optimal lateral guide and support surface.
- Corrosion protecting through phosphatisation.
- Clear indication of the minimum lashing capacity in daN.
- Can be simply replaced with OPTILASH-CLICK in case of damage.

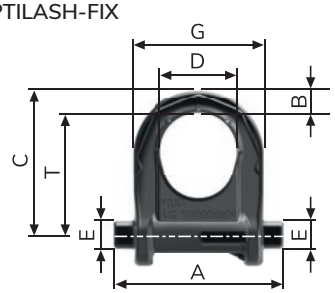
Type	Perm. lashing capacity LC [daN]	Weight [kg/unit]	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	N [mm]	Order no.
OPTILASH-FIX	10,000	1.93	98	136	18	116	60	22	17	104	50	21.5	55	19	7910463

Subject to technical changes!

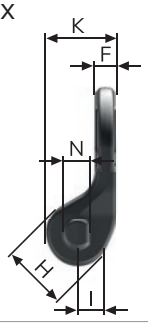
Can be pulled out and used in a guide frame.

Exchange possible with OPTILASH-CLICK.

OPTILASH-FIX



OPTILASH-FIX



OPTILASH-CLICK

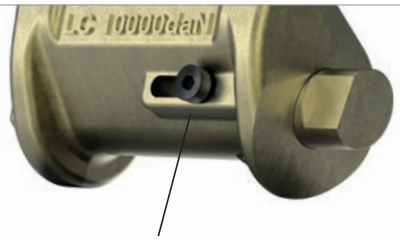
Lashing point with spring bolt with LC identification.

PRODUCT FEATURES

- Special offset shape.
- Flat lashing angles possible.
- Can be pulled out of the guiding retainer and used for upright and oversized loads as well.
- Can be loaded on all sides due to optimal lateral guide and support surface.
- Can be installed in bore or guide in the vehicle frame.
- Can be fitted easily, subsequently, and from outside without tools.
- Installation possible after painting or galvanising of the vehicle frame.
- Clear indication of the minimum lashing capacity in daN.

Type	Perm. lashing capacity LC [daN]	Weight (kg/pc.)	T [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	N [mm]	Order no.
OPTILASH-CLICK	10,000	1.80	98	135	18	116	60	22	17	104	50	21.5	55	19	7910464

Subject to technical changes!

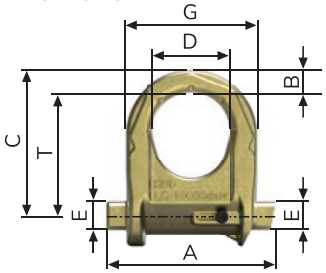


Actuation slider

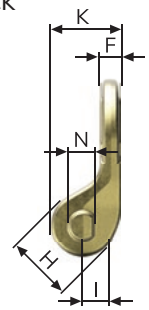
Can be pulled out and used in a guide frame.

Simple exchange.

OPTILASH-CLICK

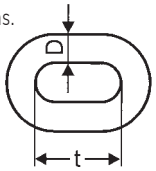


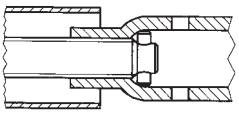
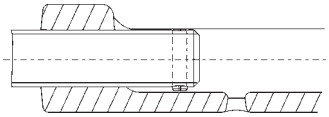
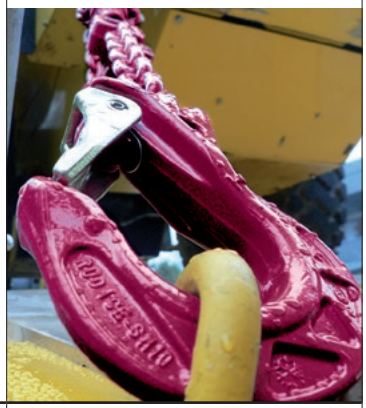
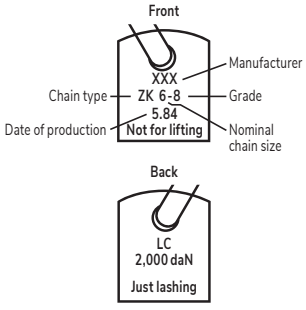
OPTILASH-CLICK



REGULATIONS COMPARISON

for lashing chains using the example of a Ø 8 mm round steel chain.

	KEYWORD	STANDARD BEFORE 2001	EN 12195-3	GRADE ICE-120
1	**Chain grade**	Grade 2 to 8. e.g. LC – perm. lashing capacity from 500 daN to 4,000 daN	EN-818-2 grade 8. Degree 80 – 800 N/mm² e.g. LC = **4,000 daN**	BG-approved special grade with over 60 % higher breaking load. Degree 120 – 1,200 N/mm² e.g. LC = **6,000 daN**
1.1	**Chain dimensioning**	Various division lengths. 	t = 3 x D For long timber transport, division t = 6 x D is permitted.	t = 3 x D = 3 x 8 mm
1.2	**Chain identification**	Any.	+ Manufacturer identification + 8 for quality grade 8	ICE pink powder coating. ICE marking: Each chain link is stamped with ICE and at regular intervals with D1 stamp.
2	**Minimum break force**	No specification. Reductions by up to 40 % were possible due to unsuitable shortening elements. e.g. minimum break force BF = 48 KN instead of 80 KN at quality grade 8	Minimum breaking strength must be achieved in the shortened group. 100 %! e.g. BF = 80 KN.	100 % in shortened group! e.g. BF = 120 KN.
2.1	**Shortening**	Chain killers. Reduction of break force up to 40 %. 	100 % break force must be proven.	ICE-Shortener fulfils 100 %. 
3	**Test load**	Deformation at 1.25 LC on chain and tensioner were common – no requirement.	No deformation at LC x 1.25 – stress duration 1 min.	No deformation at LC x 1.25 – 1 min.
4	**Clamping element**	Turnbuckles, ratchet tensioners with long lever, toggle lever or eccentric clamp with recoil effect > 150 mm no-name products	Only turnbuckles and quick release levers with a recoil path at the end of the tension lever that are smaller than 150 mm. Manufacturer specification stipulated.	ICE-CURT Ratchet tensioner – without recoil. 
4.1	**Guard pre-tensioning**	No specification. Release was possible on vibration.	No unintentional release of pre-tension (use securing chain or similar).	Ratchet tensioner with new magnetically adhering locking device as twist-release guard (see page 29).

	KEYWORD	STANDARD BEFORE 2001	EN 12195-3	GRADE ICE-120
4.2	**Tension force STF** 50 daN 	No specification. Ratchet tensioners with an extremely long lever and unsuitable shortening elements achieve a STF up to 65 % of the break force. e.g. STF = 5,200 daN = 1.3 x LC = 65 % BF! Not permitted!	STF = remaining force in the lashing (pre-tensioning force) after a standard manual force (SHF) of 500 N (50 daN) on the lever of the tensioner. At Ø 6–10 mm: STF_{min} = 0.25 x LC STF_{max} = 0.5 x LC At Ø 13–16 mm: STF_{min} = 0.15 x LC STF_{max} = 0.5 x LC	ICE-Ratchet tensioner – STF Ø 6: 1,500 daN = 0.42 LC Ø 8: 2,800 daN = 0.46 LC Ø 10: 2,800 daN = 0.28 LC Ø 13: 2,800 daN = 0.17 LC
4.3	**Clamping element Anti-rotation device** 	No specification. With turnbuckles and cheap clamps, unintentional loosening or insufficiently or insufficiently screwed-in spindles were common.	Anti-rotation device stipulated. 	Anti-rotation device on ratchet tensioner. 
4.4	**Clamping elements with hook-shaped end pieces**	No specification. Easy fall-out was commonplace. See point 2.1.	Hook guard stipulated. Securing by moulding or locking.	ICE-Shortener with securing by moulding.
5	**Unintentional release of connection and shortening elements**	Inadequate!	There **must** be devices to prevent unintentional release.	Robust guards obligatory. 
6	**Identification of entire lashing chain**	None or corresponding with VDI 2701. 	Information supplemented: ■ Lashing capacity (LC) daN ■ Tension force (STF) daN ■ Name of manufacturer ■ Tracking code of manufacturer ■ Information on standard ■ Note: “Not for lifting ...”	■ ICE-patented identification tag (chain check gauge) fulfils standard specifications and additionally enables easy checking of the chain. ■ Unmistakable identification with the **RUD ID-POINT®** in the clamping element. 

Subject to technical changes!

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The right one for every application: lifting points from RUD are available in countless weldable and screwable variants. Equipped with the powerful ICE-BOLT, they achieve higher WLL and unmatched high safety factors with smaller bolt diameters.

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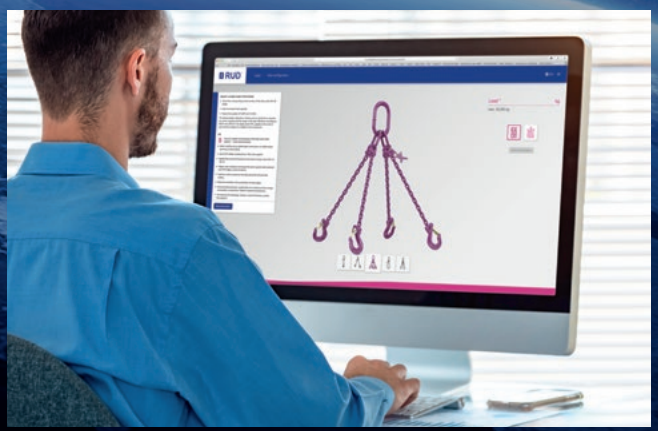

RUD 3D LIFTING MEANS CONFIGURATOR.

With the RUD lifting means configurator you can quickly and safely put together exactly the right chain sling for your lifting task. You can view the finished suspension in 3D, automatically create a parts list and share your configuration via ID.

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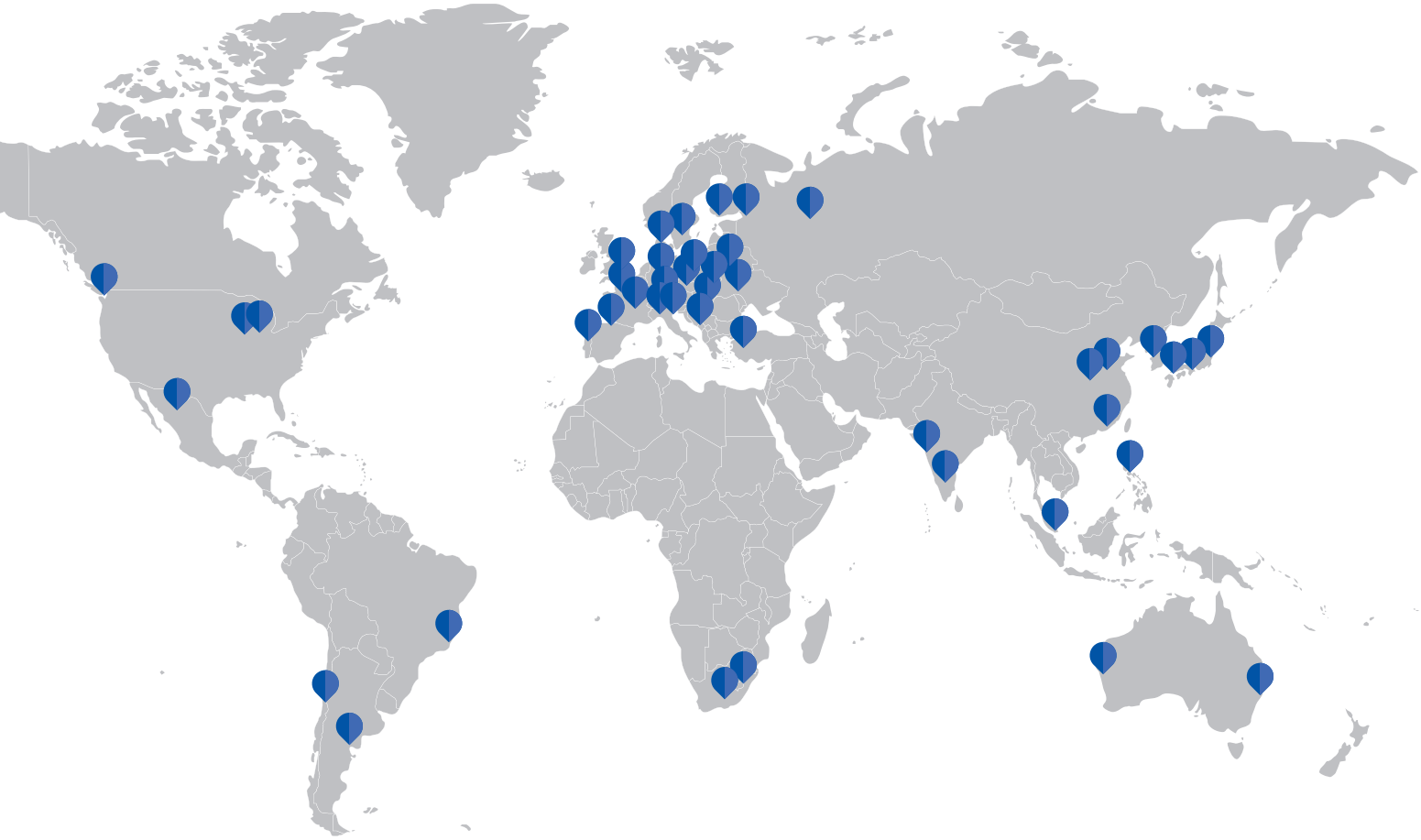
GLOSSARY.

AT HOME INTERNATIONALLY.



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