LIFTING GUIDE

GUNNEBO
LIFTING

Safe lifting - every time

Lifting operations call for a very high level of safety. The lifting equipment and the way it is used are crucial to your safety on site. For this reason, it is important to choose a responsible supplier. Gunnebo Lifting is a leading manufacturer of lifting equipment. When it comes to quality we leave nothing to chance. That is something you can rely on.

Edition 2, eng.

Contents

GUNNEBO LIFTING

Introduction

This manual is your pocket guide to the use of lifting equipment. It covers equipment made of synthetic fibre, steel wire rope and chain with associated master links, hooks and couplings.

It consists of four colour-coded sections which can be read individually when required:

- Lifting equipment in general
- Choosing lifting equipment
- When lifting
- Maintenance

Gunnebo does not, however, in any way claim that this manual covers all kinds of lifting equipment or all lifting situations.

The ant and the elephant

There are many illustrations in this manual. To make it more comprehensible we have chosen to depict lifting operations with the help of two creatures: the Ant, representing the diligent and orderly working man and the Elephant, representing the strength needed when lifting heavy loads.

The two work as a team. Sometimes they show what you should not do - in red - but more often they show what you should do - in green.

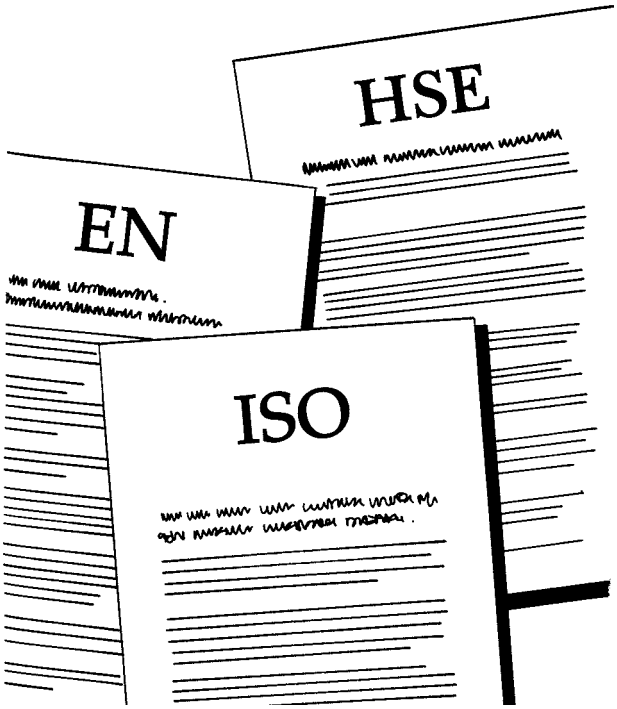
Standards, laws and regulations

Several organisations are involved in the development of standards, legislation and inspection procedures in the field of lifting. We recommend that you obtain relevant information from your national Health & Safety Authority.

ISO, International Standardisation Organisation, develops world-wide standards.
www.iso.org

CEN, Comité Européen de Normalisation, develops European standards.
www.cenorm.org

ASTM, American Standardisation Organizations.
www.astm.org



Expressions and terms

Lifting equipment is everything used to connect a load to the crane hook, i. e. wire rope slings, chain slings, roundslings, webbing slings, lifting beams etc.

WLL (working load limit) is the maximum mass that the lifting equipment is authorized to sustain in general lifting service.

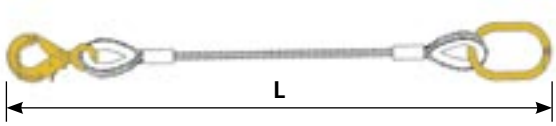
BF (breaking force) is the maximum force reached during the static tensile test.

SF (safety factor) is the relationship between breaking force and WLL. Note! The safety factors for chain, steel wire rope and soft slings differs.

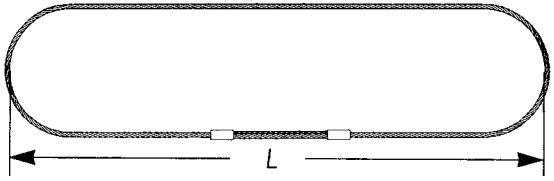
MPF (Manufacturing proof force) is the force to which lifting equipment or components are tested prior to delivery, by the manufacturer.

Total ultimate elongation is the elongation of a chain at the moment of breaking, in percent, of the original length. It is a measure of toughness.

Effective length is the length between the load-bearing points of an unloaded lifting sling or chain sling.



Effective length of a one-legged lifting sling with two components.

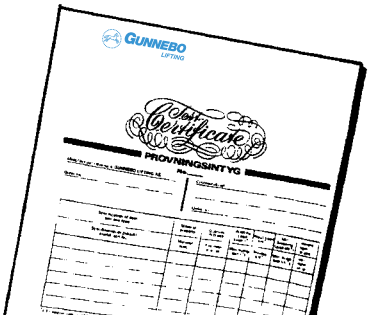


For endless slings both the effective length and the circumference are stated.

Safety and responsibility

Be aware of the applicable safety regulations for lifting in general. Responsibilities also rest with the supplier/ manufacturer, who must:

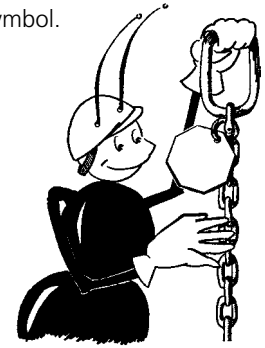
- take responsibility for damage and personal injury caused by inferior equipment (so-called product responsibility).
- provide instructions for safe usage.
- mark the equipment with the maximum permitted load and the manufacturer's designation.
- provide test certificate of proof loading and/or declaration of conformity for equipment when called upon to do so.
- use a reliable quality assurance system (ISO 9001:2000).



Product responsibility
New and more demanding laws on product responsibility have been adopted in the EU. If an injured person is able to prove his/her injury, a defect in the lifting equipment and a connection between the injury and the defect, the manufacturer (or importer) will be held responsible. For this reason, it is important that the manufacturer/importer is adequately insured.

Marking
Lifting assemblies must be supplied with an resistant ID-tag including following information:
- W.L.L and range of angles
- CE marking
- Individual identification mark
- Grade
- Manufacturer's name or symbol.
- Number of legs.

Steel wire rope slings can be marked on the ferrules, while soft lifting slings should have an ID-label.



Safety and responsibility

The demands on suppliers for quality assurance systems, approved according to ISO 9001:2000 are growing even stronger. The ISO 9001 system ensures that the supplier has documented routines for all activities which may influence on customer related quality. A third part auditor continuously assesses the conformity of the quality system.

By close co-operation with our suppliers we ensure guaranteed that the raw material complies with our high demands.

We work continuously to improve our existing range of products and develop new innovative products in order to solve all possible kinds of lifting situations.

Our Quality Assurance system, accredited to ISO 9001:2001, covers all processes from design to delivered product, e.g. design, development, marketing, production and distribution.

Components of lifting equipment

Chain

Chain is divided into types depending on shape of the link - short link (KL), medium length link(HL) and long link (LL, HLC) chain. Chains are also made in different strength grades. Grade 8, 10 (8+) chain is the most common in lifting equipment.The sole exception is chain used in very hot environments, where grade 3 chain is required to prevent the heat treatment from being affected.

Only use short link chain for lifting operations.

Chain Grade	Surface treatment	Type	Nom. Min breaking strain (N/mm^2)	Load factors			Typical Applications
				Max Load factors	Proof Force	Breaking Force	
2	Galvanized (Z) Polished (B)	KL	240	1	2,4	4,5	Agriculture, anchorage General consumer use
		HL	240	1	2,4	5,2	
		LL	240	1	2,4	5,8	
3	Painted red (R)	KL	360	1	2,4	4,5	For use in hot environments (KL)
		HL	360	1	2,5	5,2	
		LL	360	1	2,4	5,5	
5	Painted blue (A)	HL	500	1	2,4	4,5	Lashing bundling, lumbering
		LL	500	1	2,5	5,2	
8	Painted yellow (U) painted black (B) Galvanized (Z)	KL	800	1	2,5	4,0	Chain sling EN818-2 / EN818-4
		KLF	800	1	2,5	5,0	Lifting equipment (KL),
		HL	800	1	2,5	5,0	Container lashing (HL, HLC).
		ML	800	1	2,5	5,0	towing, fishing and lumbering.
		LL	800	1	2,5	5,0	(KL, ML, LL).
10(8+)	Painted blue (A)	KL	1000	1	2,5	4,0	Chain sling EN818-2 / 818-4 with increased lifting capacity

Lifting equipment in general

Extreme temperatures
The capacity of grade 8 and grade 10 (8+) chain is reduced by temperature according to the following table:

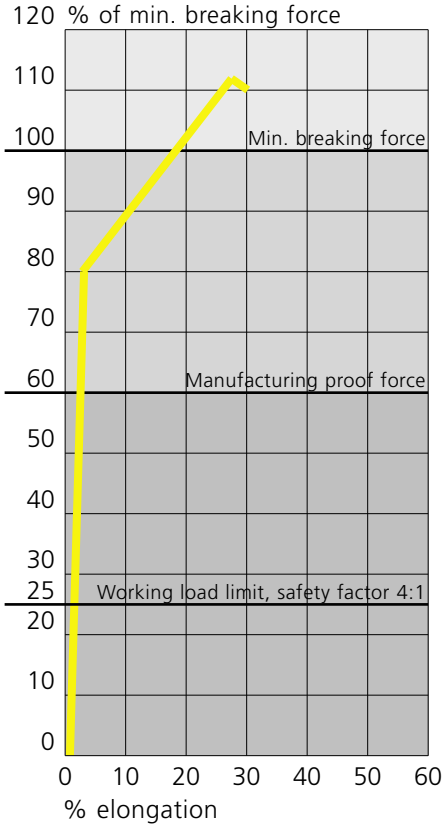
Chain sling temperature	Reduction in max. load
-40°C to +200°C	0%
+200°C to +300°C	10%
+300°C to 400°C	25%

The safety factor of grade 8 and grade 10(8+) chain is 4:1, i.e. the max. load must not exceed one quarter of the stipulated minimum breaking force. The safety factor of grade 3 chain is 4,5:1.

All chain produced by Gunnebo Lifting is proof loaded with a force more than double the maximum load, as shown in table, page 15.

Grade 8 chain for lifting is manufactured to EN 818 and ISO 3076.

Stress/elongation diagram
Chain grade 8, and grade 10 (8+) type KL



Steel wire rope

The most common designs of steel wire rope used in lifting equipment are:

114-wire rope (6 x 19) with a fibre core (diameter: approx. 3 to 8 mm)

216-wire rope (6 x 36) with a fibre core (diameter: approx. 6 to 60 mm)

133-wire rope (7 x 19)with a steel core, intended for hot environments.

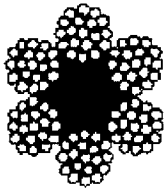
265-wire rope (6 x 36) with a steel core, intended for hot environments.

144-wire rope (6 x 24) for use in shipping and disposable slings.

The nominal breaking strain of individual wires in ropes must be 1770 N/mm^2. The minimum wire fill-factor of ropes must be 0.40.

216-wire Warrington-Seale, fibre core

Filling factor F = 50%



Lifting equipment of steel wire rope is manufactured according to EN13414-1

The working load limit can be decided either from standard tables or when the angle to the vertical and the centre of gravity is known through trigonometric calculations.

The following formula can be used for calculating the maximum load in cases where a wire design can't be found in the standard tables. The calculation yields the maximum load on each leg rounded off to the nearest hundred kgs, when the lifting angle is 0°

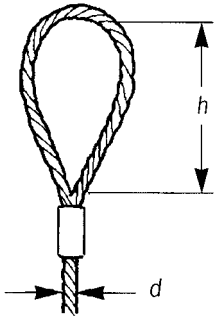
$$WLL = \frac{F_{min} \times K_T}{Z_p \times g}$$

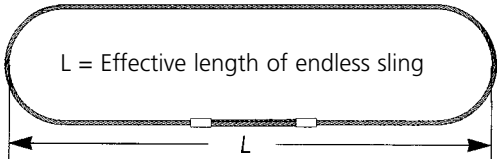
Where:
F_{min}=The minimum breaking load of the rope in kN
K_T = allowed factor for the efficiency of the termination
K_L= is the leg factor related to the number of legs and the angle to the vertical.
Z_P = 5 (Safety Factor)
g=9,81

Lifting equipment in general

Location of the mechanical splices or ferrules.
The length (h) of the eye on a steel wire rope must be at least 15 x d.

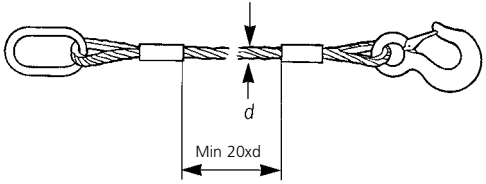
d = rope diameter





The distance between the ferrules on a endless sling must not be less than 3 x the length of the ferrule.

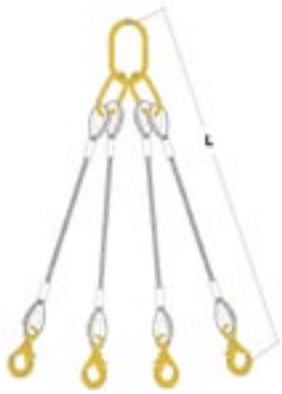
The distance between the two ferrules on lifting slings must not be less than 20 x d.



For spliced lifting slings the minimum length of plain rope shall be at least 15 x d.

Multiple legs
Multilegged lifting slings may consist of two, three or four legs. A master link joins the legs at the top. The legs of 3- and 4-legged slings are connected into intermediate links.

Note that multilegged slings should be equipped with thimbles when used with supplementary lifting equipment.



Soft lifting equipment

Roundslings
Roundslings consist of an endless load-bearing sling made of polyester fibre, protected from dirt and wear with a single- or double-layered cover of polyester fabric. There are two types of covers: sideseam with double cover which give a stiffer roundsling and the seamless for softer version.

Endless Webbing slings
These webbing slings consist of a woven polyester webbing sewn into an endless loop. They can be used in the same way as roundslings but are limited to lower working loads.

Webbing slings with eyes and roundslings strops.
A webbing sling is a woven webbing with sewn eyeloops at both ends. It is often used to even out and soften the pressure on the load. Roundsling strops may have loops too, but the stronger design with a fibre core and cover make them suitable for heavier lifts.

To know
One single cover heavy duty tube for the roundsling is actually stronger than a double cover tube with two thin layers. Our tests show that the quality of the tube is of utmost importance for the lifetime of the product.
We refute the argument that when the first layer on a double cover sling is damaged you can still use the sling because there is a risk that sharp objects have entered in between the layers and may cause hidden damages. Another advantage with the single cover roundsling is the protected label which also makes the sling stiffer so it can be passed through narrow spaces.

Lifting equipment in general

Material properties
Polyester is resistant to acids but not to alkalis, e.g. ammonia and caustic soda.

- The melting point is 260°C, but polyester lifting equipment must not be used with loads or ambient temperatures hotter than 100°C.
- The strength is not affected by water. Water absorption is negligible.
- Note that friction and sharp edges can quickly wear and cut polyester.
- Lifting equipment in polyester has a blue identification tag.

Polypropylen

- The melting point is 165°C.
- Polypropylene must not be used with loads hotter than 80°C.
- Lifting equipment in polyproplene has a brown identification tag.

Safety factor
Roundslings and webbing slings = 7:1 according to EN-standards.

Lifting components

The grade of the lifting components must match the grade of the chain (usually grade 8 or grade 10 (8+). The size designation usually refers to the size of the chain with the same strength, e.g.:
G-10-8 = Coupling link, type G, suitable for 10 mm chain, grade 8 (max. load 3.2 tonnes)

Master Links

Master links can be drop forged or forged and welded from round steel. There are two basic designs:
- single master link, for one- and two-legged lifting slings
- master link, with sub links for three- and four-legged lifting slings.

Master Link, M
For use with G-link

Master Link MF/ MFX
For use with Berglok, G-link or

Master Link MG
All-in-one top link

Master Link MTC
For use with G-link

Master Link MT
For use with Berglok or G-link

Master Link MGD
All-in-one top link

Lifting equipment in general

Couplings

Examples of the most common mechanical couplings are shown below. For chain there are several alternative connection systems: G-coupling link, Berglok, The SK-system and direct connection to clevis-type hooks.

Coupling link, G

Berglok chain coupler, BL

A foolproof assembly system in combination with matching links and hooks.

Half link, SKT

For use with matching SK-system components.

Roundsling coupling, SKR

For use with matching SK-system components.

Clevis shackle GSA

For connection in chain

Dee shackle SA

Bow shackle

C-grab, CG

For use with master link MF.

C-grab, CGD

For use with master link MF.

C-lok , CL

For use with master link MF.

Hooks

For steel wire rope and chain (G-couplinglink/Berglok)

Safety hook, BK/OBK

Will not open when under direct load and prevents the hook from cathing when lifting.

Sling hook, EKN

With latch to prevent unintentional unloading.

Sling hook, EK

Suitable when latching hooks can not be used.

Foundry hook, OKE

With a wide opening to accept large diameter.

Grabhook, OG

Not for use with Berglok. No load derating. Supporting bridge prevents chain deformation.

Swivel safety hook, BKL/BKLK

With a swiveling eye to enable rotation.

Swivel latch hook, LKN/LKNK

With a swiveling eye to enable rotation.

Lifting equipment in general

GUNNEBO LIFTING

Clevis-type hooks for direct connection to chain

Safety hook, BKG/GBK

Will not open when under direct load and prevents the hook from cathing when lifting.

Sling hook, GKN/EGKN

With latch to prevent unintentional unloading.

Sling hook GK/EGK

Suitable when latching hooks can not be used.

Clevis swivel safety hook, BKH

Especially for chain hoists. With ball bearing to enable rotation.

Grab hook, GG

Shortening hook with supporting bridge to prevent deformation of the load bearing link. No load derating.

Clevis egg-link, CEL

Masterlink for direct connection with chain.

SK-System

Sling hook SKN/ESKN

Master Link, closed SKG. Open SKO.

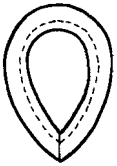
Rollerbearing swivel, SKLI

Used to insulate the lifted load to enable safe welding. Max. 1000 V. Lubricated, sealed and fully rotational even at maximum load.

Steel rope components for lifting equipment

Steel rope clamp

Thimble



Clamping thimble

Along with ferrules, the most common components, for assembling steel wire rope slings.

Lifting equipment in general

Crimping ferrule

Straight Talurit ferrule

Crimping ferrule

Conical TK ferrule (also available with inspection hole, TKH clamp)

Crimping ferrule

Straight ultragrip

Crimping ferrule

Conical K ferrule

Special lifting equipment

Many lifting equipments and components are made for specific load types, e.g.:

- Custom-made lifting beam
- Pallet forks
- Steel plate clamps
- Drum lifters etc.

Check-list for safe lifting

- Confirm the weight of the load
- Choose a safe and suitable lifting method
- Consider all the angles
- Choose suitable equipment
- Attach the load and check:
  - the centre of gravity
  - if there is a risk of rotation
  - if there is a risk of sliding
  - that the load will keep together
- Position yourself - keep your back clear
- Test-lift until the load just clears the ground, then check the load distribution.
- Never drag the load with equipment
- Take note of the max. load. Never overload

Types of lifting equipment

Check the list below every time you are facing a new lifting situation.

Checklist

- Make a good estimate of the lifting and transportation requirements.
- Find out the weight of the load.
- Choose appropriate lifting equipment.
- Decide the best way to attach the lifting equipment to the load, considering its centre of gravity and configuration.
- Choose appropriate lifting equipment with sufficient capacity. Note that the sling leg loadings rise as the angle between the sling legs increases.

Lifting equipment differences

The fields of application for the three main types of lifting equipment (chain, steel wire rope and soft lifting equipment) overlap. For this reason, you may often choose the type you are most familiar with, but there are differences in properties you should be aware of:

Chain

- Wear resistant, best durability.
- Flexible.
- A wide range of components to choose from.
- Heat resistant (see p. 16).
- Shortening possibility
- easy to store

Steel wire rope

- Lighter and often less expensive than chain.
- Usually hot-dip galvanised for best rust protection.
- Suitable for extremely heavy loads.

Soft lifting equipment

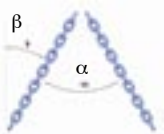
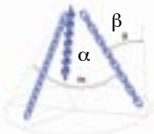
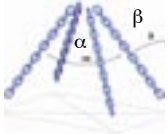
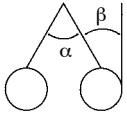
- Simple and inexpensive.
- Suitable for fragile goods.
- Flexible, suitable for choke-hitching load.
- Easy identification of max. load by colour.
- easy to store

Load table for grade 10(8+) chain slings

GrabiQ

In the case of asymmetric loading
- 2-legged sling calculated as the corresponding 1-leg sling.
- 3- and 4-legged sling calculated as the corresponding 1-leg sling (If it is certain that 2-legs are equally carrying the major part of the load it can be calculated as the corresponding 2-legged sling.

Working load limits in tonnes

Chain dim. (mm)	1-leg 	2-leg 		3-legged 	4-legged 	2-legged choke hitch 	
Chain	_____	β 0-45° α 0-90°	β 45-60° α 90-120°	β 0-45° α 0-90°	β 45-60° α 90-120°	β 0-45° α 0-90°	45-60° 90-120°
6	1,5	2,1	1,5	3,1	2,2	1,6	1,2
8	2,5	3,5	2,5	5,2	3,7	2,7	2,0
10	4,0	5,6	4,0	8,4	6,0	4,4	3,2
13	6,7	9,4	6,7	14,0	10,0	7,4	5,4
16	10,0	14,0	10,0	21,0	15,0	11,0	8,0

The above apply to normal usage and equally loaded legs.

Load table for grade 8 chain slings

Working Load Limits in tonnes
for chain slings grade 8, according to EN 818-4

In the case of asymmetric loading
- 2-legged sling calculated as the corresponding 1-leg sling.
- 3- and 4-legged sling calculated as the corresponding 1-leg sling (If it is certain that 2-legs are equally carrying the major part of the load it can be calculated as the corresponding 2-legged sling.

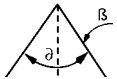
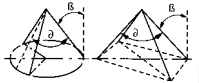
Chain dim. (mm)	1-leg	2-leg		3-legged	4-legged	Choked endless sling
						
Chain		0-45° 0-90°	45-60° 90-120°	0-45° 0-90°	45-60° 90-120°	
6	1,12	1,6	1,12	2,36	1,7	1,8
7	1,5	2,12	1,5	3,15	2,24	2,5
8	2,0	2,8	2,0	4,25	3,0	3,15
10	3,15	4,25	3,15	6,7	4,75	5,0
13	5,3	7,5	5,3	11,2	8,0	8,5
16	8,0	11,2	8,0	17,0	11,8	12,5
19	11,2	16,0	11,2	23,6	17,0	18,0
22	15,0	21,2	15,0	31,5	22,4	23,6
26	21,2	30,0	21,2	45,0	31,5	33,5
32	31,5	45,0	31,5	67,0	47,5	50,0

The above loads apply to normal usage and equally loaded legs.

Load table for steel wire rope

The table below shows the maximum permitted load for the most common steel rope slings, tensile grade 1770 N/mm^2 and 1960 N/mm^2, according to EN13414-1

Working load limit in tonnes

Wire dim. mm.							
	1-legged	1-legged	2-legged		3- & 4-legged		endless
			α 0-45°	α 90-120°	α 0-90°	α 90-120°	
			β 0-45°	β 45-60°	β 0-45°	β 45-60°	
8	0,70	0,56	0,95	0,70	1,50	1,05	1,40
9	0,85	0,68	1,20	0,85	1,80	1,30	1,70
10	1,05	0,84	1,50	1,05	2,25	1,60	2,10
11	1,30	1,04	1,80	1,30	2,70	1,95	2,60
12	1,55	1,24	2,12	1,55	3,30	2,30	3,10
13	1,80	1,44	2,50	1,80	3,85	2,70	3,60
14	2,12	1,69	3,00	2,12	4,35	3,15	4,24
16	2,70	2,16	3,85	2,70	5,65	4,20	5,40
18	3,40	2,72	4,80	3,40	7,20	5,20	6,80
20	4,35	3,48	6,00	4,35	9,00	6,50	8,70
22	5,20	4,16	7,20	5,20	11,00	7,80	10,40
24	6,30	5,04	8,80	6,30	13,50	9,40	12,60
26	7,20	5,76	10,00	7,20	15,00	11,00	14,40
28	8,40	6,72	11,80	8,40	18,00	12,50	16,80
32	11,0	8,8	15,0	11,0	23,5	16,5	22,0
36	14,0	11,2	19,0	14,0	29,0	21,0	28,0
40	17,0	13,6	23,5	17,0	36,0	26,0	34,0
44	21,0	16,8	29,0	21,0	44,0	31,5	42,0
48	25,0	20,0	35,0	25,0	52,0	37,0	50,0
52	29,0	23,2	40,0	29,0	62,0	44,0	58,0
56	33,5	26,8	47,0	33,5	71,0	50,0	67,0
60	39,0	31,2	54,0	39,0	81,0	58,0	78,0

Parallell choke hitch	endless choke hitch
2,80	1,10
3,40	1,40
4,20	1,70
5,20	2,12
6,20	2,50
7,20	2,90
8,48	3,30
10,80	4,35
13,60	5,65
17,40	6,90
20,80	8,40
25,20	10,00
28,80	11,80
33,60	13,50
44,0	18,0
56,0	22,5
68,0	28,0
84,0	33,5
100,0	40,0
116,0	47,0
134,0	54,0
156,0	63,0

Choosing equip ment

Steel rope slings

When planning a lift where technical data on weight , centre of gravity etc. are known, trigonometrics may be used for calculating the maximum load on the lifting equipment. Basis for the calculation is the column for 1-legged slings, or the following formula:

$$WLL = \frac{F_{min} \times K_T}{Z_p \times g}$$

Where

F_{min}=The minimum breaking load of the rope in kN

K_T = allowed factor for the efficiency of the termination

K_L= is the leg factor related to the number of legs and the angle to the vertical.

Z_P = 5 (Safety Factor)

g=9,81

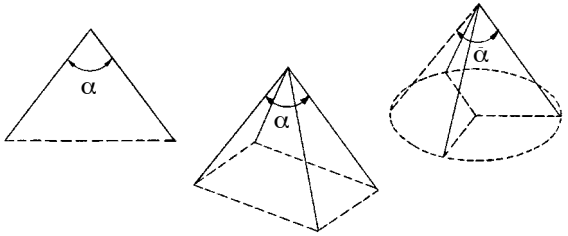
The calculation yields the max. load on each leg when the lifting angle is 0°, rounded off to the nearest hundred kgs.

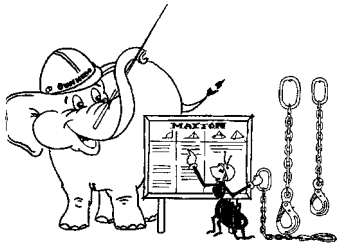
Max. load for multilegged equipment

If the table is not used, the max. load must be calculated. The result of the above formula, representing the max. load on a 1-legged sling, shall be multiplied by a factor according to the following table:

Lifting angle α	Factor K_L	
	Number of legs	
	2	3-4
0-90°	1,4	2,1
90-120°	1,0	1,5

The lifting angle is measured according to the following figures:

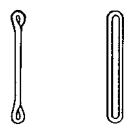
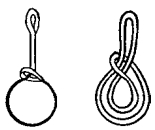
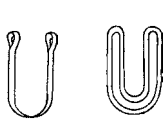
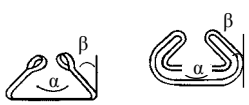




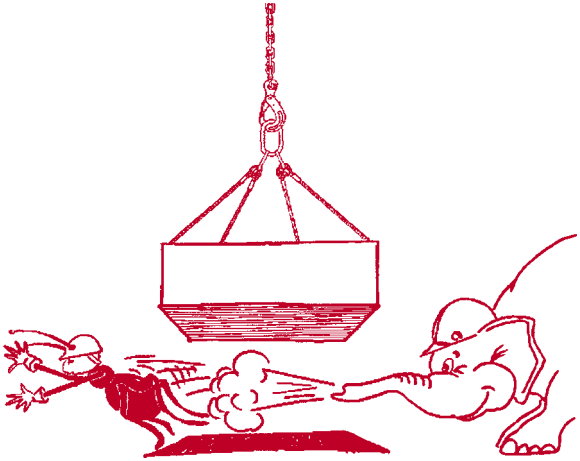
Never excee the stated max. load at the lifting angle involved. Always check the rated capacity of the equipment before lifting, not after the catastrophe.

Load table for soft lifting products

WLL in tonnes according to EN 1492

		Maximum load	in tonnes	
Straight lifting	**Choke hitch**	**basket hitch**	**45° basket hitch β0-45° α0-90°**	**90° basket hitch β45-60° α90-120°**
				
0,5	0,4	1,0	0,7	0,5
1,0	0,8	2,0	1,4	1,0
2,0	1,6	4,0	2,8	2,0
3,0	2,4	6,0	4,2	3,0
4,0	3,2	8,0	5,6	4,0
5,0	4,0	10,0	7,0	5,0
6,0	4,8	12,0	8,4	6,0
8,0	6,4	16,0	11,2	8,0
10,0	8,0	20,0	14,0	10,0
12,0	9,6	24,0	16,8	12,0
15,0	12,0	30,0	21,0	15,0
20,0	16,0	40,0	28,0	20,0
25,0	20,0	50,0	35,0	25,0
30,0	24,0	60,0	42,0	30,0
35,0	28,0	70,0	49,0	35,0
40,0	32,0	80,0	56,0	40,0
50,0	40,0	100,0	70,0	50,0

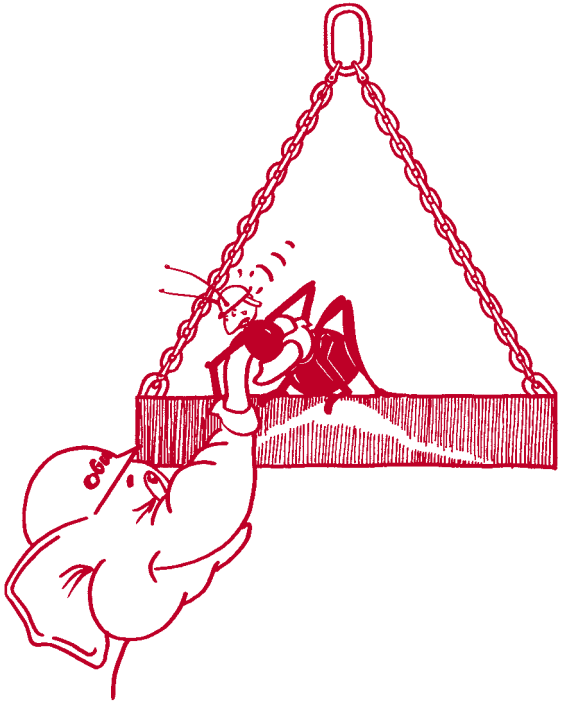
When lifting



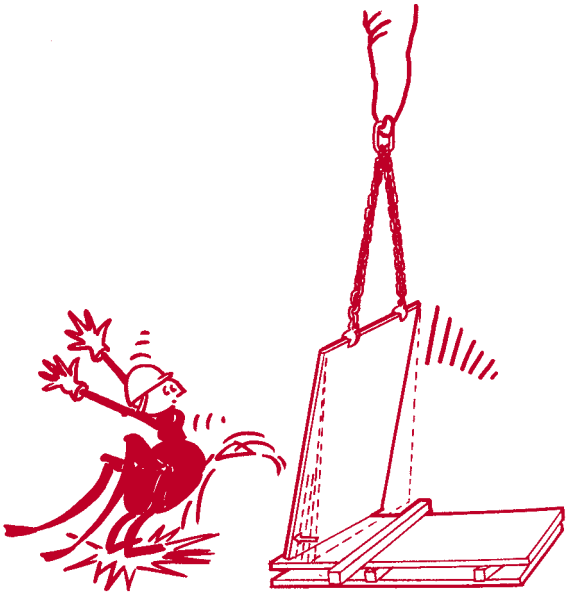
Never stand under the suspended load. People within the working area of the lifting equipment must not be exposed to danger when the load is lifted or moved.

General

Do not ride on the load.



When lifting



Be careful where you stand in relation to the load when lifting. The load might slip and cause injury. Keep your back clear.

General

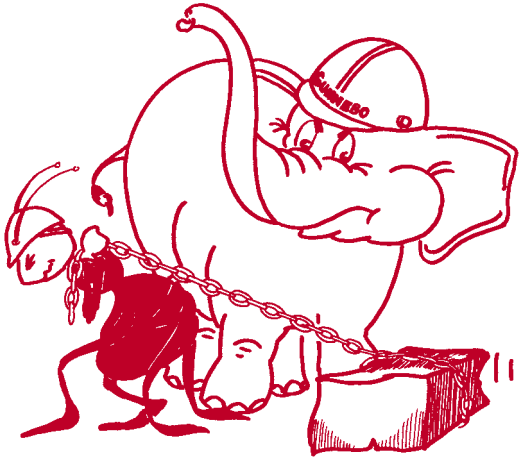
Lift vertically. Otherwise the load will swing horizontally when clearing the ground.

When lifting

General

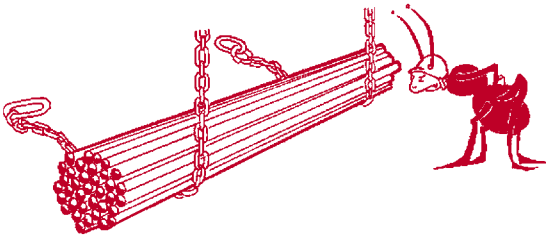
Avoid snatch loading. Do not expose the equipment to unnecessary strain, for example sudden jerks.

Never use lifting equipment for dragging goods.

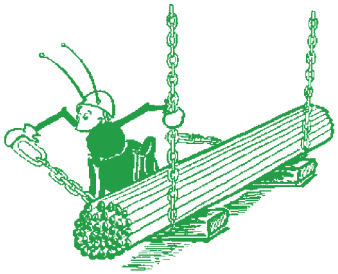


When lifting

Treat chain with care. Do not pull it clear from under the load without using spacers. The chain can easily become damaged and a weakened chain might break next time you use it.

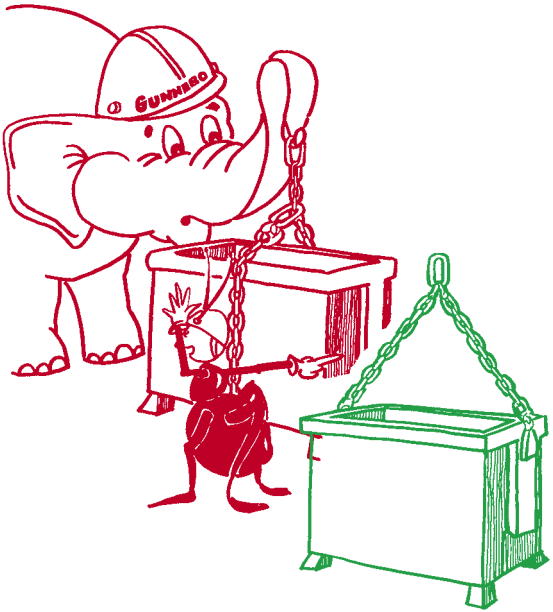


Always position the load in a way that makes it possible to remove the lifting equipment without using force.



General

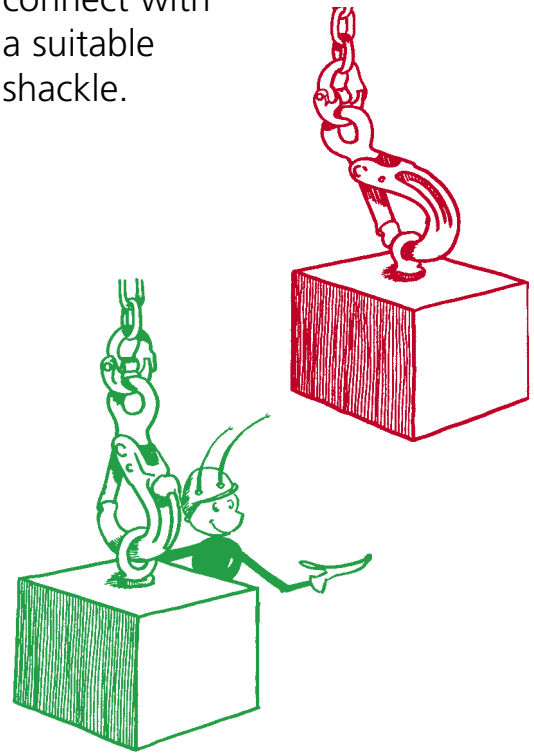
Avoid choke-hitching, as loads can tip over.

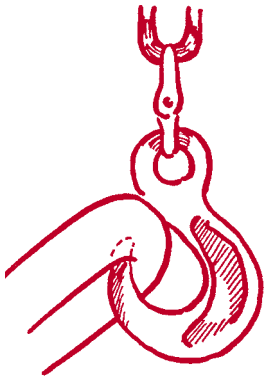


When lifting

General

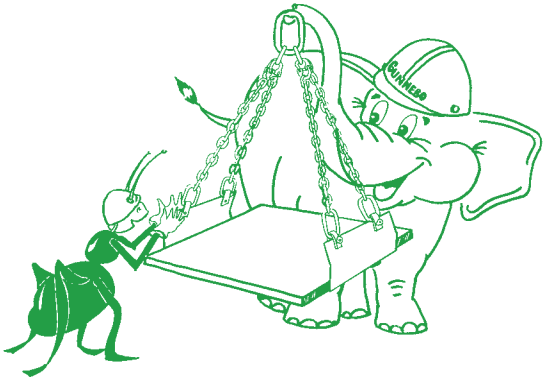
Never point load the hook. Use an eyebolt with a larger eye or connect with a suitable shackle.





Never force a master link on to a hook. Use a hook with a larger opening.

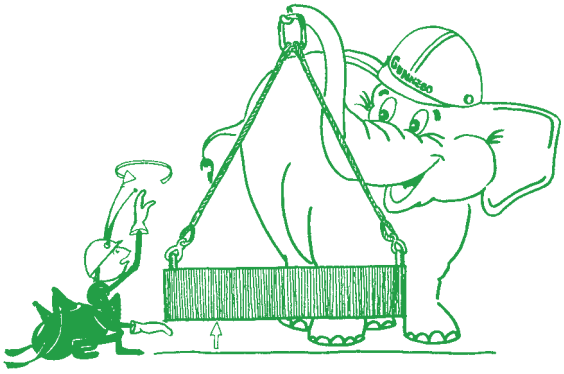
When lifting



Use sheet-metal clamps
when lifting sheet-metal packs.
Avoid point loading of hooks.

General

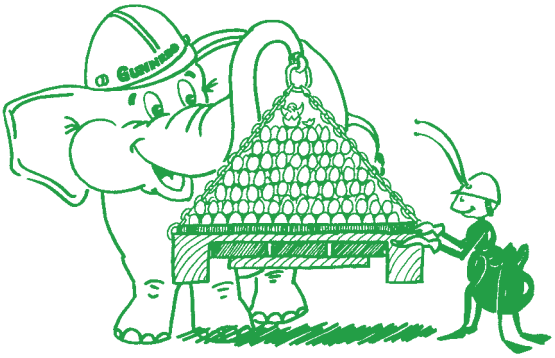
Test-lift by carefully lifting the load just clear of the ground. Check the load security and angles before continuing.

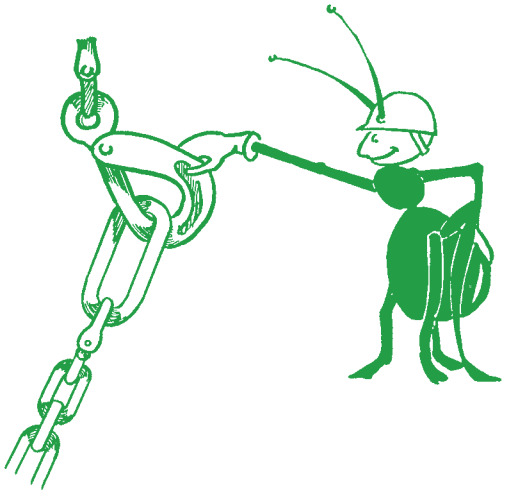


When lifting

General

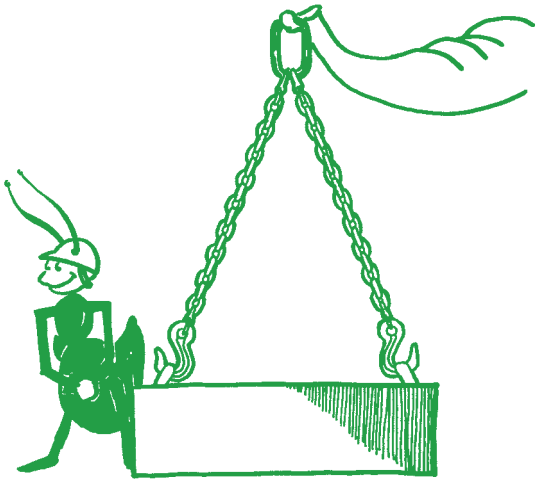
Handle the load with care. Raise and lower it gently and avoid jerks.





Grip the hook by its sides with your fingertips only, never with your entire hand, otherwise your fingers might be crushed.

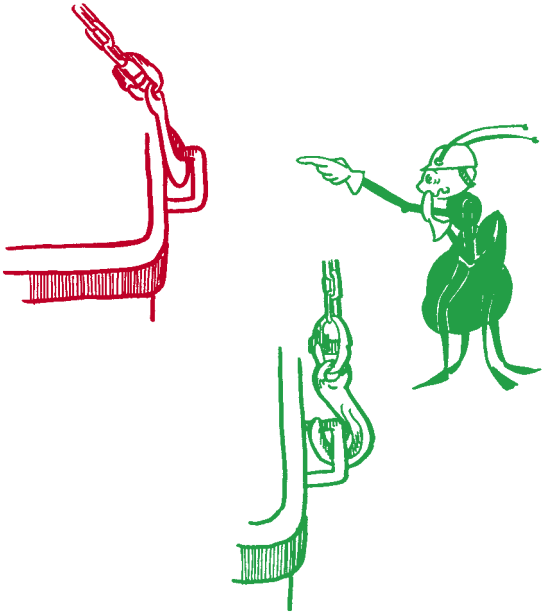
When lifting



When connecting to lifting eyes, make sure that the hooks/eyes are turned the right way (facing outwards). A rotating lifting point (RLP) automatically adjust itself to the right position.

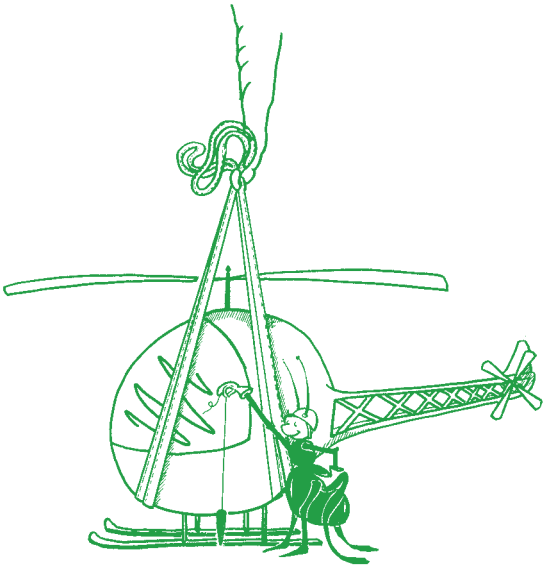
General

Do not side load the hook.

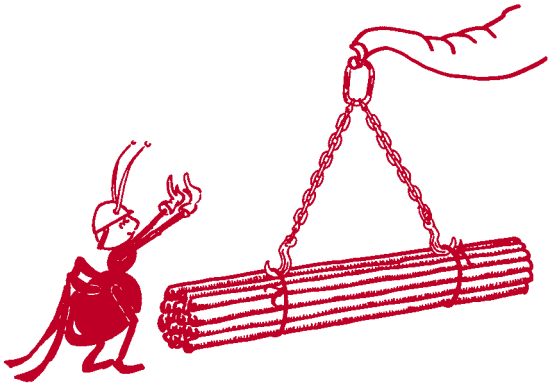


When lifting

Make sure that the load is distributed as evenly as possible.

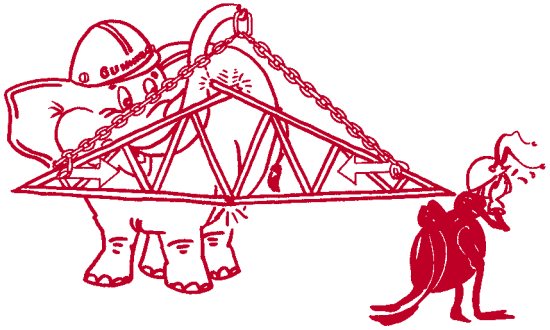


General



Never lift with ropes or bands used for wrapping. They are only intended for keeping the goods together, not for lifting.

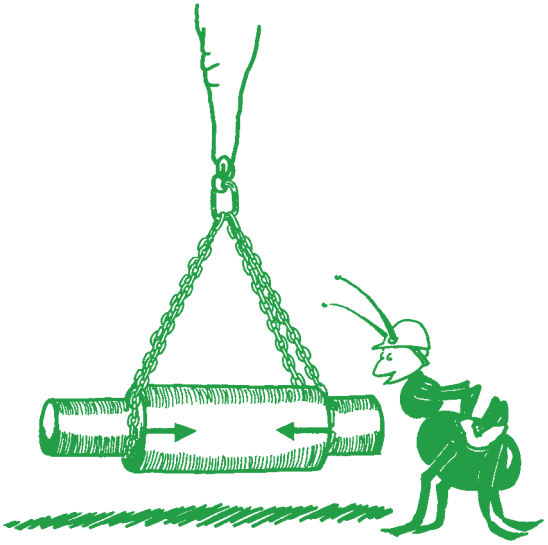
When lifting



Note that the pressure increases as the lifting angle grows. Use the pressure correctly.

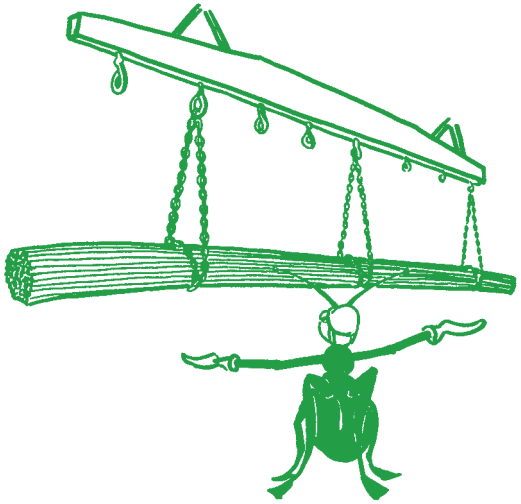
General

Correct usage of pressure.

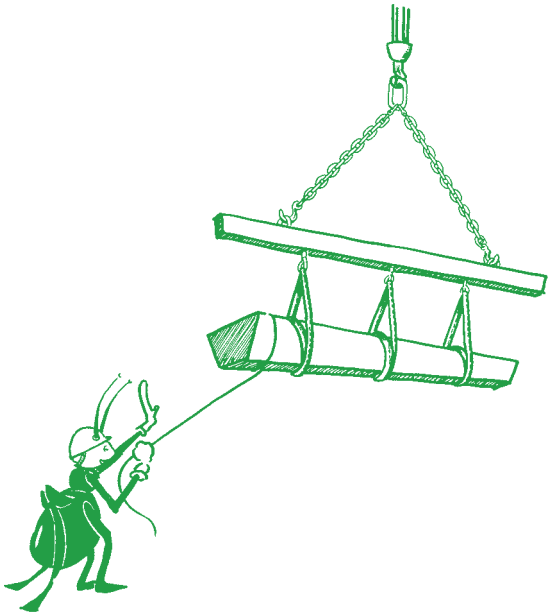


When lifting

Use a spreader beam. When using basket slings, make an extra turn around the load to get a firm hold.

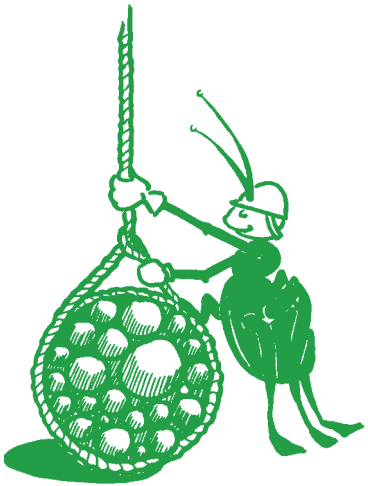


General



Use a steering rope to control rotation when lifting long goods.

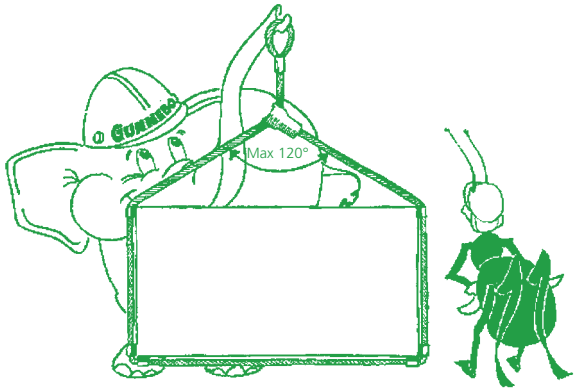
When lifting



Loads consisting of separate parts should be secured by wrapping the lifting sling(s) around twice to prevent the load from falling apart.

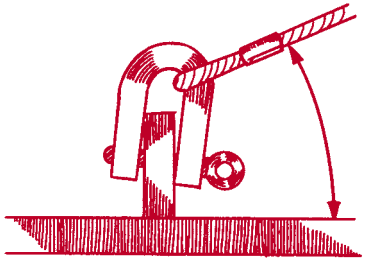
General

The internal angle of a multi-legged lifting sling should never exceed 120°, or 60° to the vertical. Use edge protection if there are sharp edges. When choke hitching, reduce the WLL by 20%.

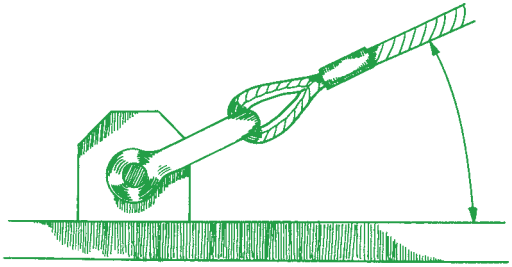


When lifting

General



Incorrect alignment causes excessive strain on this shackle when lifting or pulling.

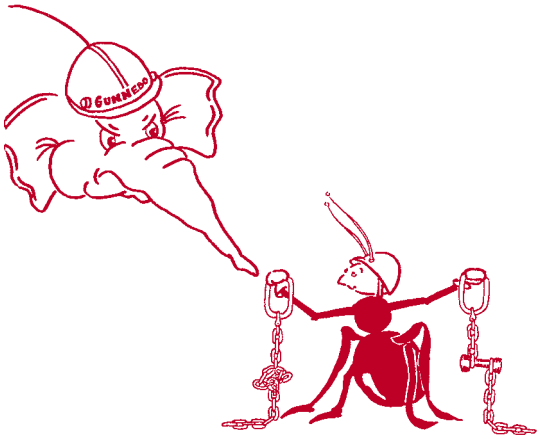


correct alignment.

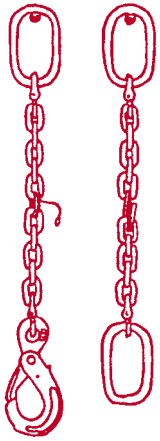
When lifting

Chain

Never repair chains with bolts.
Never twist chains.



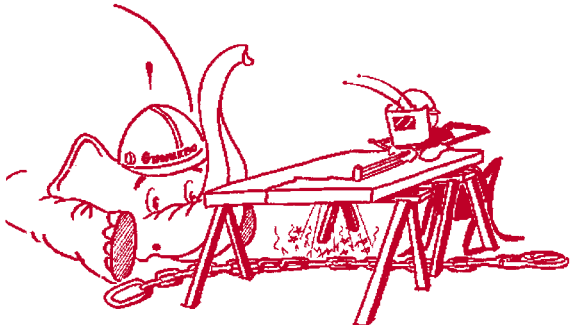
A chain is never stronger than its weakest link. Do not repair broken chains with wires, bolts or by welding. Replace the entire damaged chain length.

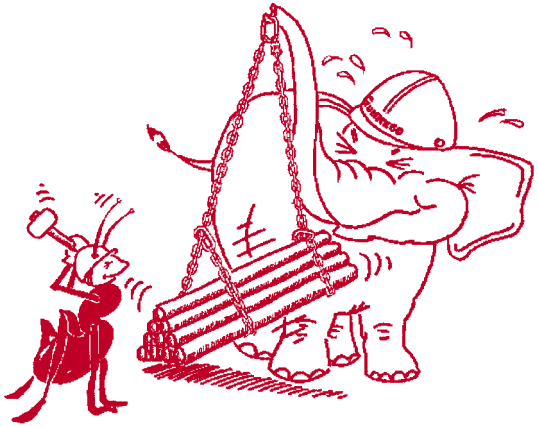


When lifting

Chain

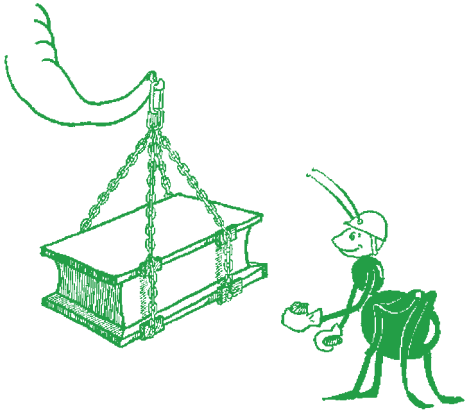
When welding or cutting, make sure that the lifting equipment is not affected by the heat involved, as it can damage the heat treatment of the chain.





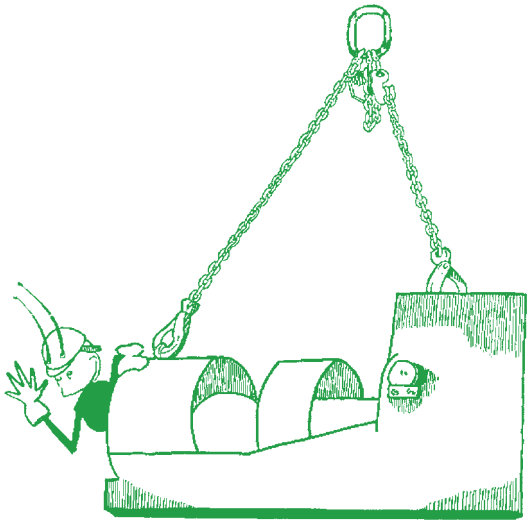
Do not handle chain violently, especially when under load.

When lifting Chain



Use edge protection to prevent sharp edges from damaging the lifting equipment. A rule of thumb is that the radius of the edge >2 x chain diameter. When lifting with chain directly on lugs we recommend that the lug diameter >3 x the pitch of the chain. With a lug diameter which is less than stipulated above, the WLL must be reduced with 50%.

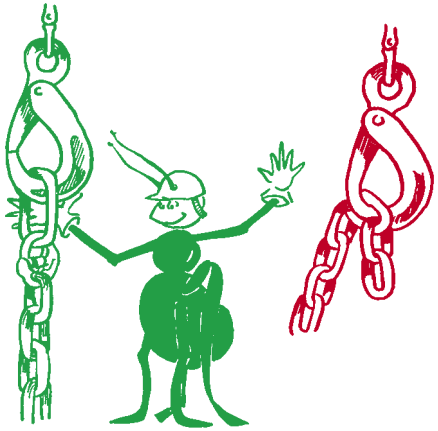
Use shortening hooks when lifting asymmetric loads.
Avoid lopsided lifting.



When lifting

Chain

Do not connect directly to the chain by forcing a link on to the hook. Always use a master link.



Never lift with a twisted chain.

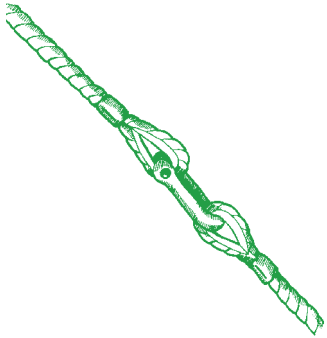
Severe environment

Chain and components in grade 8 and grade 10 (8+) must not be used in alkaline (> pH10) or acidic conditions (< pH6).

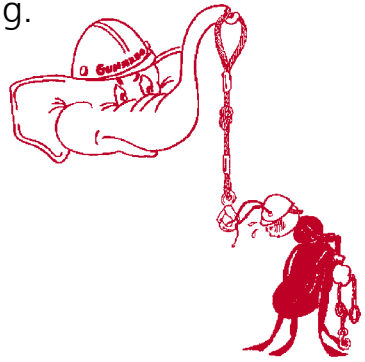
Comprehensive and regular examination must be carried out when used in severe or corrosive inducing environments, if using in an uncertain situation, contact the manufacturer.

When lifting Steel wire rope

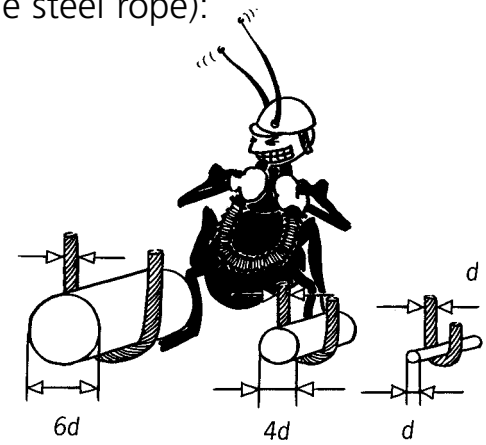
Never join wire rope slings by knotting, always use a shackle.



Never shorten steel rope by knotting.



The strength of steel wire rope is reduced by bending. The derating is related to the diameter of the bend as follows (d = diameter of the steel rope):

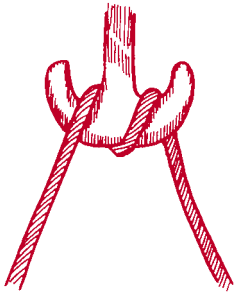


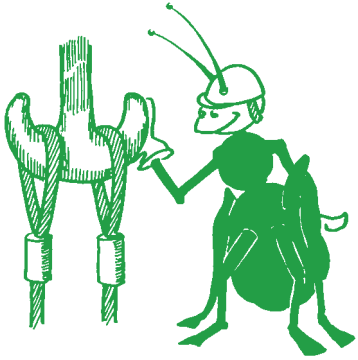
6d = 100%
5d = 85%
4d = 80%
3d = 70%
2d = 65%
1d = 50%

When lifting Steel wire rope

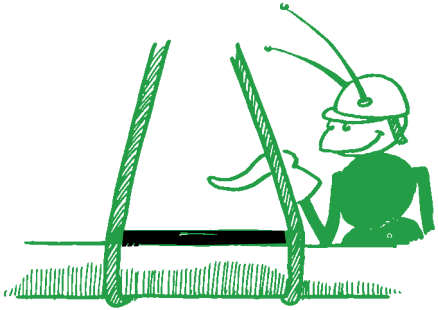
Use protective gloves when handling steel wire rope.

Do not wind the rope around a ramshorn hook to prevent slipping. The bending will be too sharp and cause damage to the rope.





When lifting Steel wire rope

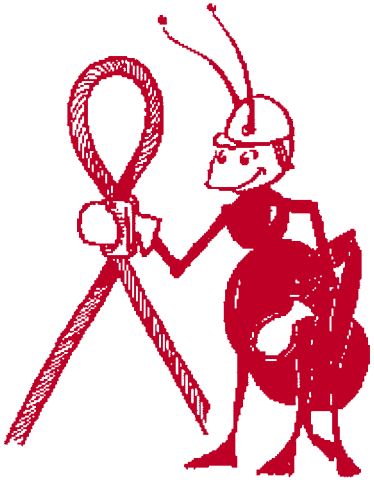


Use a suitable spacer to prevent the ropes from sliding. Avoid sharp bending of the rope. The load can slip if the lifting points slide. Sharp bending damages the rope.

Bending like this will immediately destroy the rope. Use lifting slings with hooks instead.

When lifting Steel wire rope

A two-legged lifting sling with a single ferrule fitted like this can be lethal. The tearing force at the clamp grows with the lifting angle.

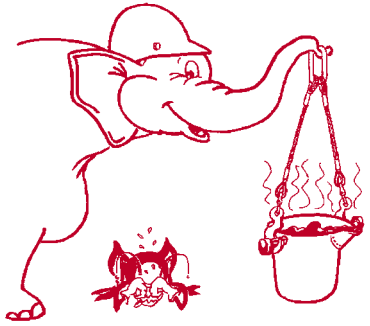


Do not expose steel wire rope to excessive heat or cold.

Rope with fibre core: max. 100°C. Rope with steel core and aluminium ferrule: max. 150°C. Rope with steel core and steel ferrule/or hand spliced: max. 150°C = 100%, max. 200°C = 90% of WLL, max. 400°C = 60% of WLL.

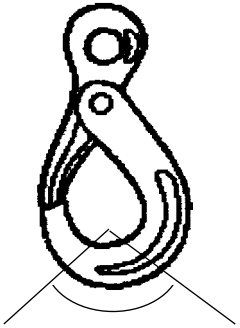
Do not use at temperatures below –40°C without consulting the manufacturer.

According to EN 13414-2



When lifting Steel wire rope

When lifting with several lifting equipments in a hook, the lifting angle must not exceed 90°.



Use edge protection to prevent sharp edges from damaging the lifting equipment.

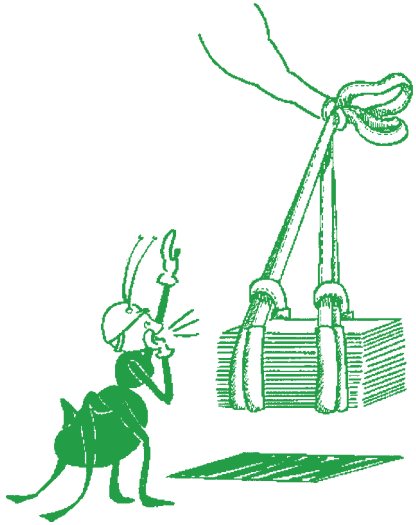
When lifting Soft equipment

Use hooks with rounded edges and an inner radius not less than the webbing width.

Recommended contact areas for polyester roundsling (SF 7:1)

Tonnes	Min. tap diameter	Min. width
1	23 mm	35 mm
2	32 mm	40 mm
3	35 mm	47 mm
4	38 mm	50 mm
5	42 mm	53 mm
6	46 mm	60 mm
8	50 mm	67 mm
10	56 mm	75 mm
12	58 mm	80 mm
15	70 mm	96 mm
20	78 mm	104 mm
25	84 mm	112 mm
30	90 mm	120 mm
35	96 mm	128 mm
40	102 mm	136 mm
50	120 mm	160 mm

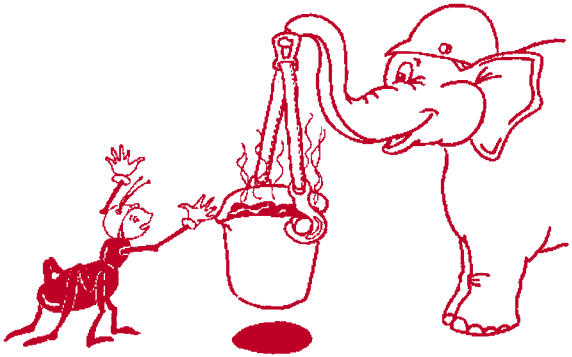
Note If smaller lug dimensions are used it will effect the safety due to that the roundsling may be damaged.



Lift vertically and use protective sleeving and/or edge protection to keep the equipment from directly contacting sharp corners and edges.

When lifting Soft equipment

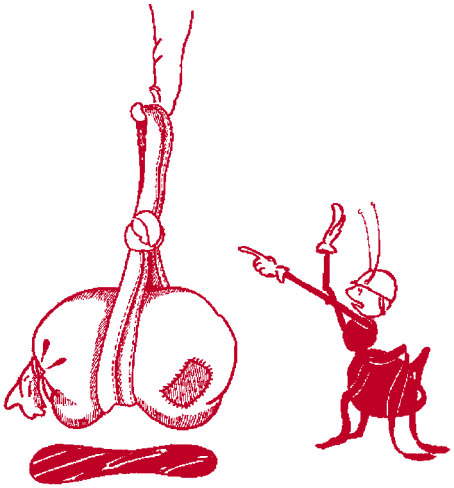
Polyester lifting strops and slings are made of synthetic fibre and must not be used with loads or ambient conditions exceeding 100°C. Hot materials require the use of steel rope or chain.



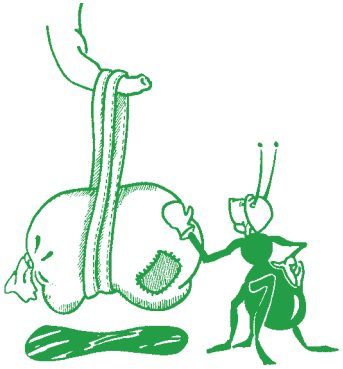
Keep soft lifting equipment away from alkalis such as caustic soda and ammonia. The colour fades and the slings disintegrate.

When lifting Soft equipment

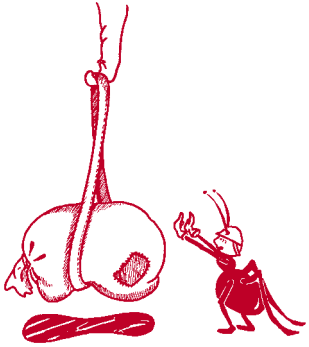
Do not shorten soft lifting slings by knotting. They quickly weaken. Avoid overloading.



Note that the maximum load of roundslings in connection with choke or basket hitching assumes vertical legs (see table on p. 42-43).



If the load is placed inside the roundsling, the max load should be calculated as straight lifting (see table on p. 42-43).



Regular inspection

Lifting equipment must be checked on a continual basis and be inspected in accordance with standards and industrial safety legislation. The responsibility for carrying this out rests with the site management.

Regular inspection includes functional checks, as well as the adjustments and maintenance that may be required from time to time.

Inspections must be carried out by people possessing sufficient knowledge of design, use and maintenance of lifting equipment.

Damaged or worn equipment must be reported to the site management, who in turn, must arrange for the equipment to be taken out of use and then be repaired or replaced.

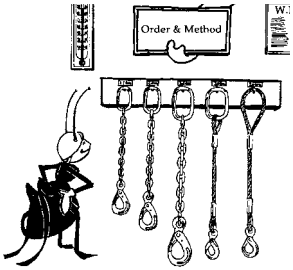
Lifting equipment having been stored for a period of time must be inspected before being taken back into use.

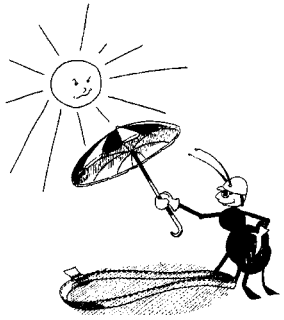
In addition to regular inspection, which must be thoroughly recorded, everyone working with lifting equipment must be on guard and inspect the equipment before every use.

Storage

Dragging or dropping the equipment can cause damage and should be avoided.

Arrange for appropriate storage, preferably at an even temperature. Good storage preserves the equipment and helps you find what you need faster. Chain and steel wire rope stored for long periods should be rust protected.





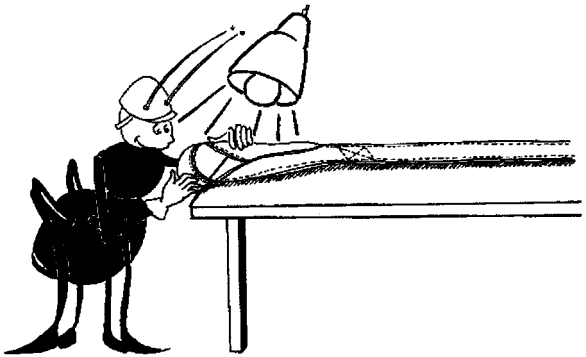
Soft slings and strops should not be exposed to bright sunlight for any long periods of time. Choose a storage location accordingly.

Inspection

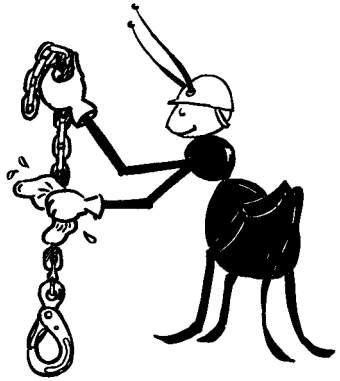
Lifting equipment must be inspected regularly. Good lighting without shadows is necessary during inspection.

Check
Check / inspect the equipment regularly. Make sure that repairs are made when needed.
When inspecting soft lifting slings or strops: put the equipment, stretched to its full length, on a table.

Turn eyes on the equipment inside out and inspect for wear or damage. Inspect webbing one side at a time. When inspecting endless slings it is recommended to run them around a revolving pin, or similar.

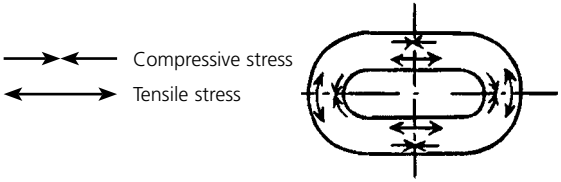


Before inspecting a chain it must be thoroughly cleaned of dirt and oil. All cleaning methods that do not damage the basic material are acceptable. No methods that cause hydrogen embrittlement or overheating are allowed, nor methods that remove basic material or move material in a way that might hide cracks or other visible damage.



Chain

The illustration below, showing the distribution of strain in a link, can be of guidance for decisions on chain wear and damage.



The stress distribution in the link is very favourable.

Tensile stresses are the most important to chain strength. They are concentrated to the most protected areas of the link: the outside of the short side and the inside of the long side.

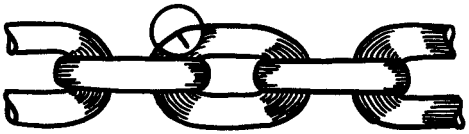
The relatively harmless compressive stresses are distributed the opposite way around, i.e. where link wear is at its maximum. Here the link can wear down significantly without any major effect on chain strength.

Keeping strain distribution in mind, we shall take a look at some examples of wear and damage on the following pages.

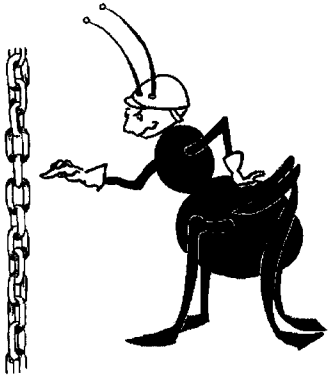
Maintenance

Cracks / gouges

Chain showing cracks and gouges must be discarded. Transverse cracks are the most serious.



Deformation



When a twisted chain is overloaded the resultant twist becomes permanent. The chain must be replaced.

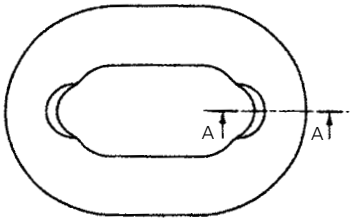
Chain containing bent links must be replaced.

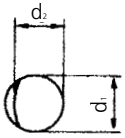
Maintenance

Wear

Inter-link wear, as measured by taking the diameter indicated (d_1) and one at right angles, (d_2) is acceptable until the mean of these diameters has been reduced to 90% of the nominal diameter (d_n) (see figure) provided.

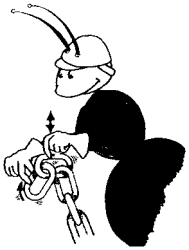
$$\frac{d_1+d_2}{2} > 0{,}9d_n$$



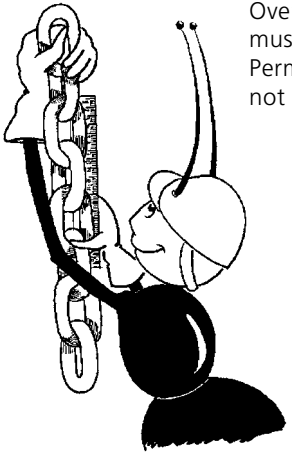


A-A

The chain must be slackened and the adjoining links pushed back to allow inspection of the contact surfaces of each link.

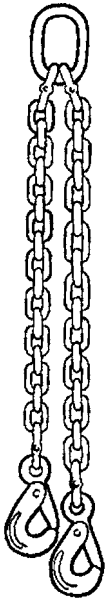


Elongation



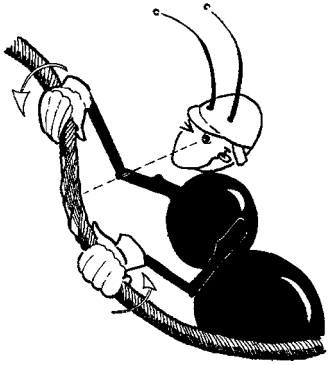
Overloaded equipment must be discarded. Permanent elongation is not permitted.

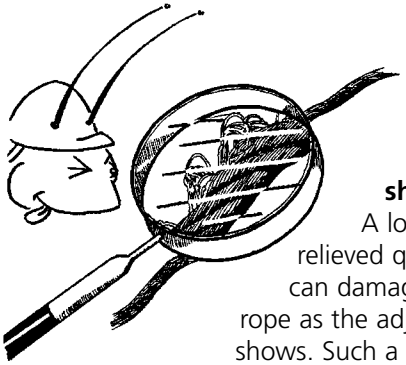
If the lengths of the legs of a multilegged chain sling are unequal, overload should be suspected.



Steel wire rope

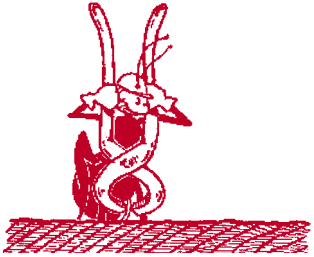
Rust
Remember that even galvanised steel wire rope may rust. Bend the rope to expose the inner strands and core to inspection.





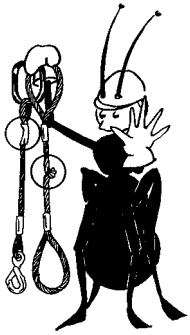
Effects of shock loading
A load applied or relieved quickly (shock) can damage a steelwire rope as the adjacent picture shows. Such a rope must be discarded.

Broken wires
Broken wires weaken the rope and causes injury.

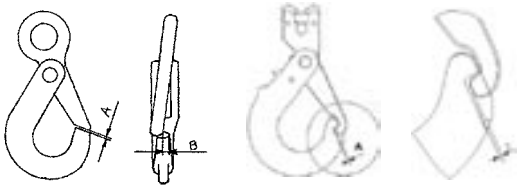


The correct way to remove a broken wire is to bend it back and forth until it breaks. Do not use pliers.

Ropes with kinks, crushing, excesive broken wires or damaged ferrules must be taken out of service.



Components



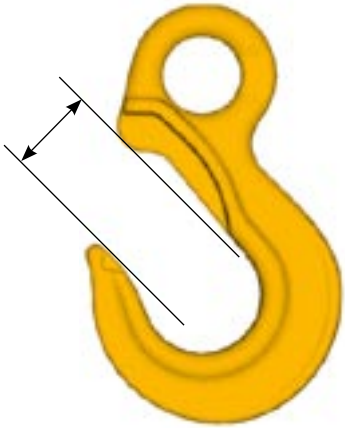
This table indicates the maximum permissible clearance between hook and latch in horizontal and vertical direction.

Size	Maximum A mm	Maximum B mm
BK/OBK-6-8	2,2	3,5
BK/OBK-7/8-8	2,7	4,5
BK/OBK-10-8	3,0	6,0
BK/OBK-13-8	3,3	7,0
BK/OBK-16-8	4,0	9,0
BK/OBK-18/20-8	5,0	10,0
BK/OBK-22-8	6,0	11,0
BK-26-8	6,5	12,0
BK-28-8	7,0	13,0

For griplatch hooks (OBK/GBK) the maximum clearence is defined as the difference between measure A with uploaded spring and meassure A when latch is pressed against the hook, note clearence B is not applicate for griplatch hooks.

Check the function of hook latches, locking pins/ collars on coupling links etc.

- Check hooks thoroughly for widened apertures, which indicate abnormal loading.



- The increase in hook aperture must not exceed 10%.
- No elongation is permitted for coupling components, such as G-links, master links and Berglok links.
- Wear must not exceed 10%.
- Examine all lifting components thoroughly for transversal cracks, wear and other damage.

Soft lifting equipment

Discard the equipment if a load bearing cord is broken. Repair protective sleeving when needed. Cut discarded slings and straps immediately.

Round slings

The sleeving has been torn apart by dragged along a rough surface. The load bearing cord is intact. Let the manufacturer repair the sling or discard it.

A cut as a result of sharp edges combined with heavy loads in movement. A load bearing cord is broken. Discard the sling.

Webbing slings and straps

The warp is split as a result of lopsided loading. The strength is not affected unless the warp is broken. The equipment can be repaired by the manufacturer or be discarded.

Cross or longitudinal cuts or chafe damage to edges. Remove from service

A hardened, shiny surface is a sign of damage caused by severe friction. Webbing can easily slide, causing friction, when the lifting angle is wide. Folding the webbing at the damage makes it easier to see the extent of it. If the damage is wider than 5% of the webbing width the equipment must be discarded.

Keeping a register

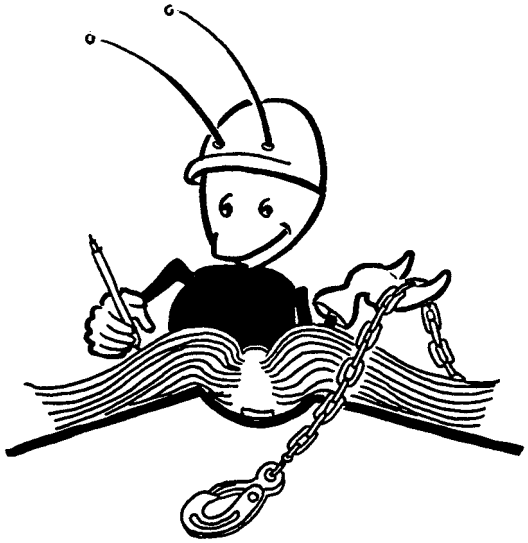
Keeping a proper register is important to safe lifting. The register must describe the equipment and list its identity markings.

Intervals for inspection and testing should be determined and entered into the register.

The condition of the equipment and all test results must be recorded after every inspection.

The reason for, and a description of, every repair must also be recorded.

The register is intended as a continuous description, ensuring that the equipment is properly inspected, tested and maintained and that it is currently in a good condition for use.



Inspection planning

1. Master links
Material wear must not exceed 10%. Permanent elongation is not permitted. File away small, sharp cuts and burrs. Note: In case of bad deformation the link must be discarded.

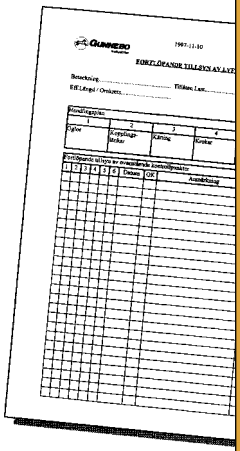
2. Coupling links
Material wear must not exceed 10%. Permanent elongation is not permitted. File away small sharp cuts and burrs. Failure to pivot is a sign of previous overload. Make sure that the load pin is locked in position and that the locking pins (BL) securely lock the load pin.

3. Chain
Material wear must not exceed 10%. Wear is defined as the reduction in average diameter of the chain material, measured in two transversal directions.
Permanent chain elongation is not permitted. File away small sharp cuts and burrs.

4. Hooks
Material wear must not exceed 10%. The maximum permissible increase in hook opening due to wear is 10%. File away small sharp cuts and burrs.

5. Steel wire rope
Steel wire rope with kinks, excessive broken wires or damaged ferrules must be discarded. Concentrated wire breakage on one strand should not exceed 3 wires. On a distance of 6x diameter, max 6 breakage or on a distance of 30x diameter, maximum 14 breakage.Note that steel wire rope should be opened up to expose the inner strands and core to inspection.

6. Round slings / webbing slings and straps
Roundslings: When holes in the protective sleeving expose the loadbearing fibres to dirt, the sling should be discarded. If there are holes in the sleeving and broken load-bearing cords, the sling must be discarded.
Roundslings must also be examined by hand for lumps, indicating fibre breakage.
Webbing slings and strops:
If there is damage from friction, the equipment must be discarded. If eye sleeving is worn out: discard or repair. If edge damage exceeds 5% of the webbing width, the equipment must be discarded. Check that the seams are intact.



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