USER MANUALS

Basics

In addition to this basic information, please observe the notes on the purpose and safe use of the individual categories of products.

Plan of action
Every lift should be planned before starting. Plan to suitably and economically match the extent and complication of the task.

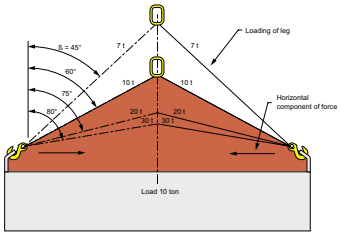
Not all lifting actions require written documentation of the process.

In order to guarantee safety when using load lifting apparatus, the 20 questions in the overview below must all be answered before lifting.

Our catalogue of questions includes only the minimum requirements which must be supplemented by the user, if necessary.

Question	Examples
Is a qualified person taking responsibility?	Crane driver, loading foreman, safety engineer
Are the communication arrangements clear?	Hand signals, radio communication
Is the load lifting apparatus in good condition?	Regular inspection, visual checks before use
Is the load lifting apparatus suited for the lifting task?	Webbing slings are damaged by sharp edges
Is all load lifting apparatus properly marked?	Lifting capacity tag, labels, stamps
Is the lifting capacity of all load lifting apparatus known?	Lifting capacity shown on the sling
Is the lifting capacity of the load lifting apparatus adequate?	Consider the slinging angle
Is the weight of the load known?	Shown on the load or in the accompanying documents
Where is the load's centre of gravity?	Centre of gravity indicated in the drawing
What are the slinging angles?	Slinging angles must be considered when selecting the sling
Is loading symmetrical on the sling legs?	Unequal slinging angles indicate unequal loading
Are slings protected against sharp edges?	The edge radius must be greater than the sling diameter
Is the load bearing hook positioned above the centre of gravity of the load?	The load will swing if the crane hook is not above the centre of gravity
Is the selected type of slinging suitable for the load?	Single leg slings are not suited for long, slender loads
Is load control assured?	Load movement may be controlled with a tagline
Are all persons out of the danger zone?	Do not move suspended loads over persons
Are there further risks / hazards?	Staff crossing the transportation route
Is the load held firmly and safely?	Rigging or load may shift
Any unusual influencing factors to be considered?	Additional wind loads, obstacles, power lines or similar
Any special requirements?	Loads must be turned

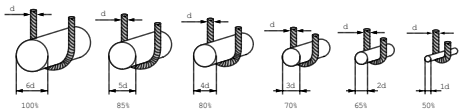
General notes
Slinging angles
Slinging angles have a significant effect on rigging.
The greater the angle ß, the greater the load on the particular leg.



Slinging angles > 60° are prohibited!

The load must be capable of taking the horizontal forces!

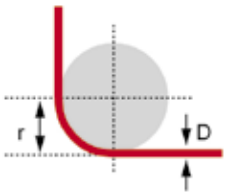
Bending radius D/d
It is imperative with a basket hitch to take the sling diameter/bending radius ratio into account when selecting the sling.



D/d should never be < 1:1

Also account for this factor at all connecting points. (Shackle/wire rope sling, etc.)

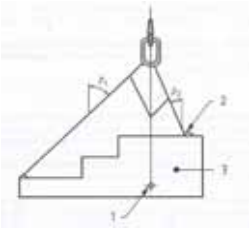
Sharp edges
Slings must be protected against sharp edges.
Never run slings over unprotected sharp edges!
An edge is sharp if its radius is smaller than the diameter of the sling!



Qualified persons
Many factors must be considered when lifting. Assign only trained staff to working with load lifting equipment.

Only trained staff have the necessary knowledge to account for special factors such as use in the presence of lyes, acids or other aggressive media, temperature effects, carrying capacity of substrates, wind loads, impact loads, etc.

Centre of gravity
The centre of gravity of the load must always be directly beneath the crane hook!



1 = Centre of gravity of the load
2 = Suspension point
3 = Load
ß 1-2 = Slinging angle

Unequal slinging angles may indicate unequal loading of the slings. Unless symmetrical loading of the legs is assured, it must be assumed that one leg bears all the load.

Suspension point
The points connecting the load and the sling must be dimensioned to handle the slinging forces.

Observe welding or assembly instructions!

Connecting elements
All the links between the components of the rigging, between load and sling and between the sling and the lifting gear must be able to move freely. All anchoring points must be suited to safely absorb and hold the load forces in the relevant direction.

Load-bearing parts may not be stressed by bending or gravitational forces, in addition to their load.

All load-bearing elements may only be stressed as designed.

Load control
Loads must be rigged to remain secure and stable during the entire lifting procedure. Shock loads must be avoided. Tearing loads loose by lifting is prohibited. Certex recommends the use of a tag line for controlled movement of the load.

Shock loads must absolutely be avoided!

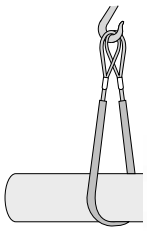
Rigging
The rigger is responsible for selecting the proper rigging for transportation. The following must be considered:

- Weight of the load
- Centre of gravity of the load
- Slinging angles
- Secure connections at the suspension points
- Features of the load (sharp edges, temperature, etc.)
- Properties and load-bearing capacity of the slings
- Stress on the load due to the type of rigging
- Environmental impacts

The load must be securely supported and stable at all times.

Basket hitch
Long, slender loads must not be rigged using single leg slings. When basket hitching with multi-leg slings, ensure that the legs of the slings cannot slip when under load.

Slings must not slip



Slender loa unstable in si slings

Choker hitch
Reduce the lifting capacity of slings to 80% when choker hitching.

WLL.: 80%

Inspection and maintenance
All load lifting apparatus must be checked for visible defects prior to use, to guarantee its safe condition. All load lifting apparatus must also be tested at least once a year.
Refer to notes and instructions provided in relevant operating manuals and applicable guidelines and regulations in this respect.

Damaged slings must be removed from service immediately to prevent further use.

Only qualified persons may be authorised to test slings.

All **load lifting machines** which are ready for commissioning at delivery were subjected to a static load test prior to delivery:
Manually operated load lifting machines were tested at 1.5 times their lifting capacity.
Powered load lifting machines were tested at 1.25 times their lifting capacity.

CERTEX **load lifting apparatus** in terms of the Machinery Directive are designed to pass a static test at 1.5 times their lifting capacity.

Your CERTEX advisers will gladly assist you with further information and advice.

Safe Use and Purpose of Steel Wire Ropes

Designated use:
Crane ropes for lifting of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for first use, operation, maintenance and testing.
Any other use, especially exceeding the specified lifting capacity and operation or assembly by untrained persons is deemed improper.

Selection
Selection of running wire ropes. The selected wire rope must be strong enough. Applicable directives, standards and regulations must be observed. Certex recommends selection in accordance with ISO 4308-1 "Cranes and Lifting appliances – Selection of wire rope". Other, local regulations and manufacturers' information may also need to be taken into account. Apart from the strength of ropes, various wire rope types and designs have different properties which offer many additional criteria for selection. The selection of a wire rope implies examining the positive and negative properties of the different designs for each application in order to find the most suitable rope. A specialist may find a discarded wire rope very useful in this respect. We will gladly assist you in finding the optimal rope for your application.

The following information is not binding and does not substitute the applicable standards, directives and regulations.

Strength
A rope selection factor (C) must be found to select a rope of adequate strength pursuant to ISO 4308-1 for a specific purpose within a group of mechanisms.

$C=\sqrt{Zp/K' \times Ro}$

C = Rope selection factor
K' = Minimum breaking load factor (see ISO 2408)
Ro = Minimum tensile strength of the wire used in the rope
Zp = Minimum coefficient of utilisation (see table)

Minimum coefficient of utillisation (Zp)

Mechanism group	M1	M2	M3	M4	M5	M6	M7	M8
Zp cable drives	3.15	3.35	3.55	4.00	4.50	5.60	7.10	9.00
Zp Pendant and stay ropes	2.50	2.50	3.00	3.50	4.00	4.50	5.00	5.00

Mechanism group and minimum coefficient of utilisation ZP

Values for mobile cranes acc. to ISO 4308-2 on request

Minimum breaking load factor (K')
The minimum breaking load factor for different rope constructions is given in EN 12385-4 or ISO 2408.
K' may also be calculated as follows:

K' = Minimum breaking load factor
f = Fill factor
k = Stranding loss factor

$K' = f \times k/4$

The table below gives K' values for different rope designs. Depending on the mechanism group, the nominal strength of the wire (1960 N/mm² in this case) and the rope tension, this may be used to determine the minimum wire rope diameter of the specific rope design.

Rope type	Fill factor F	Stranding factor k	Min. breaking load factor K'
Verostar	0.620	0.860	0.419
Veropro 8	0.670	0.850	0.447
Veropower 6	0.720	0.850	0.481
Veropower 8	0.750	0.870	0.512
Stratoplast	0.617	0.860	0.417
Turboplast	0.665	0.850	0.444
Stratolift	0.661	0.860	0.446
Turbolift	0.734	0.830	0.478
CTE	0.620	0.751	0.366
6x36 IWRC	0.580	0.782	0.356

The above data are for information only.

Rope type	Fill factor F	Stranding factor k	Min. breaking load factor K'
6x36FC	0.500	0.840	0.330
8x19S IWRC	0.574	0.751	0.356

The above data are for information only.

Contact your CERTEX branch for detailed information

Minimum rope diameter
Finding the minimum rope diameter in acc. with ISO 4308-1

$d\ min = C\sqrt{S}$

d min = Minimum rope diameter
C = Rope selection factor
S = Max. rope tension, in Newtons

Minimum breaking load
Acc. to ISO4308-1

$F\ min = SxZp$

S = Max. rope tension in Newtons
Zp = Minimum coefficient of utilisation acc. to table

Design
In addition to the strength, the selected wire rope must also be suited to the specific application. Different rope designs have very divergent properties.

Never replace one rope design with another without expert advice.

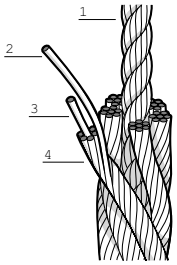
Special conditions of use
Provide as much information as possible when ordering wire ropes. Fundamental information is given in the crane book. Further data on issues such as working temperature, use in aggressive media etc. are of paramount importance for selection and safe operation of your wire ropes and equipment.

Temperatures
Wire ropes with fibre cores and/or aluminium mechanical splices must not be used where working temperatures exceed 100 degrees Celsius. Wire ropes can be used down to - 60ºC.

Working temperature	100-200 ºC	200-300 ºC	300-400 ºC	+ 400 ºC
Reduction in lifting capacity	10%	25%	35%	100%

Never use wire ropes in temperatures above 400°C.

Rope elements
Wire ropes consist of single wires twisted to form strands. These strands are then twisted about a rope core. The dimensions of the single wires, their position, number, form and design of the rope core determine the main properties of a wire rope design.
1.) Rope core
2.) Wire
3.) Strand core
4.) Strand

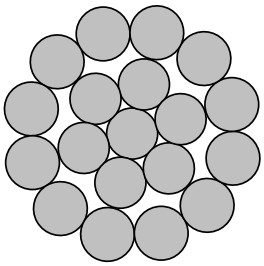


Steel wire rope

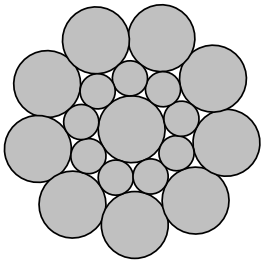
Rope core
Rope cores are at the centre of the rope and significantly affect its properties. Steel cores and plastic sheathed cores normally enhance the stability of the wire rope. By selecting a suitable rope core, damage caused by high radial forces such as those occurring during multilayer coiling may be counteracted.

Strand construction

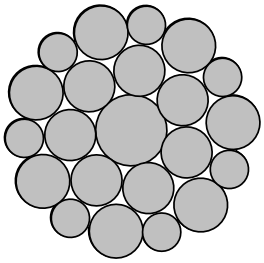
Strands consist of one or more layers of rope wires twisted around a core. This core may comprise one or more wires, but also fibres. The design of the strand significantly affects the physical properties of the completed rope.



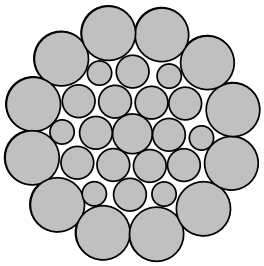
Standard



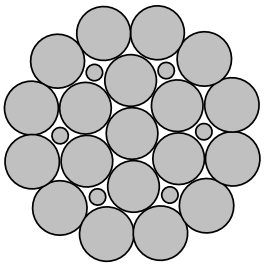
Seale (S)



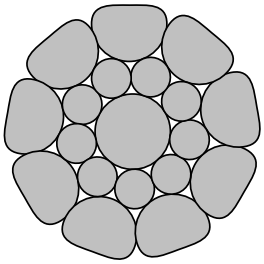
Warrington (W)



Warrington-Seale (WS)



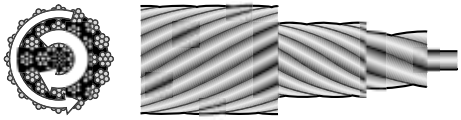
Filler wire (F)



Compacted strand

Rope construction

The rope core and the strands are twisted to form the finished wire rope. Wire ropes comprise single and multilayer round strand ropes. Single layer round strand ropes usually have 6 or 8 strands.

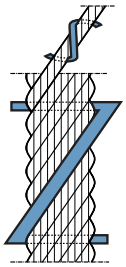


Multilayer wire rope designs would normally be rotation-resistant or "rotation-free", for example 19x7 or 35x7.

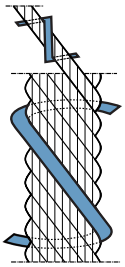
The multilayer structure of this rope design allows manufacture of ropes with a very low twisting moment across a certain range of loads since the twisting forces in different layers are mutually opposing.

Type and direction of lay

The suitable lay type and direction depends on the cable drive design. Right-hand and left-hand lay ropes are often used in a system to cancel out the twisting effect of two single layer rope constructions. Only ropes with the same lay type and direction should be combined in a cable drive. The following lay types and directions are common:

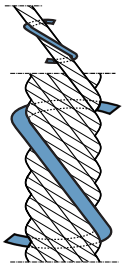


Ordinary right hand lay (sZ)



Ordinary left hand lay (zS)

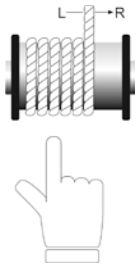
Right Lang's lay (zZ)



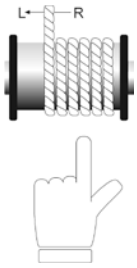
Left Lang's lay (sS)

Small letters designate the lay of a single wire in the strand.
Capital letters designate the lay of the strand.

Selecting the appropriate direction of lay
Rope runs over the top of the rope drum.

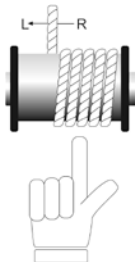


Overwind and anchor point left= right hand lay rope

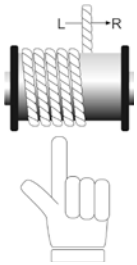


Overwind and anchor point right= left hand lay rope

Rope runs over the bottom of the drum.



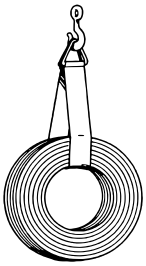
Underwind and anchor point left= right hand lay rope



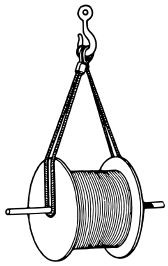
Underwind and anchor point right= left hand lay rope

Storage and transport of wire ropes
Ropes must be stored in a clean, well-ventilated, dry and protected area.
Wire ropes must be stored at room temperature. In case of longer storage, the rope must be checked regularly for corrosion and protected through appropriate re-lubrication, if necessary.

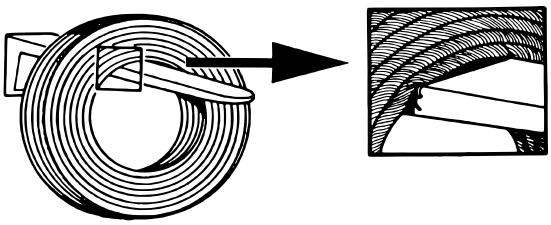
The rope must be protected against mechanical damage during storage and transport. Avoid incorrect transport.



Right



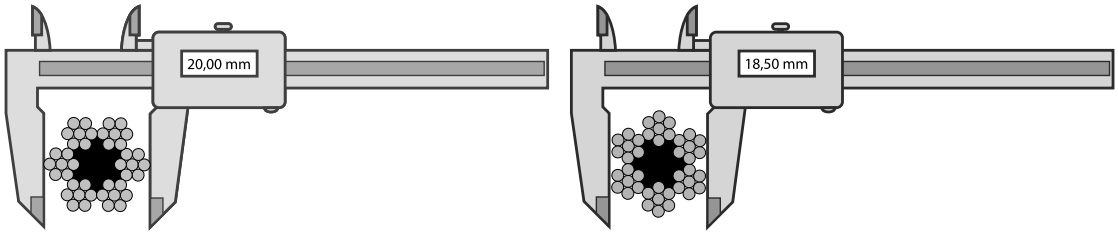
Right



Wrong
Forklift forks often damage ropes!

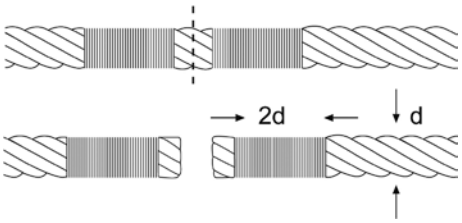
Mark wire ropes permanently and uniquely, to avoid confusion.

Measuring wire ropes
Check the rope diameter (see diagram) and the rope terminations for visible defects before putting the wire ropes into use. Check all the technical data in the markings and the corresponding certificates.



Right **Wrong**

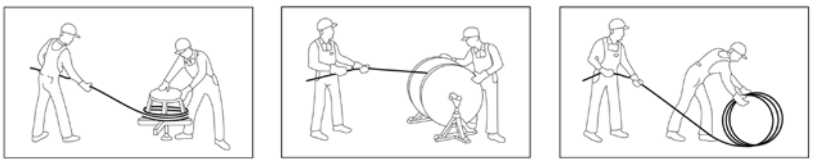
Cutting wire ropes to length
Before cutting, steel wire ropes must be prevented from untwisting (see sketch). At least 2 seizings must be applied on both sides of the cut in case of multilayer wire ropes or parallel twisted ropes:



We recommend using a cut-off grinder for cutting.
Please strictly observe the relevant safety regulations.
Wear protective gear!

Unreeling wire ropes

Avoid damaging or twisting the wire rope when unreeling

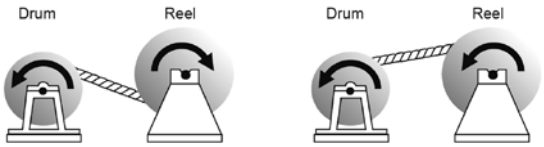


Correct handling of wire ropes will extend their service life.

We recommend the use of split grips/pulling eyes with a flexible connection to prevent torsion in the old rope from being transferred to the new rope. Ensure safe and firm connections!

Rope installation
Reverse bending must be avoided when the wire rope is spooled from the delivery reel. The ropes must be adequately pre-tensioned when winding onto the rope drum to ensure proper reeling and safe operation of the cable drive.
Only qualified persons may install the wire ropes. Proper assembly and perfect condition of the wire ropes must be checked before re-starting.

New wire ropes must be run in at small partial loads.

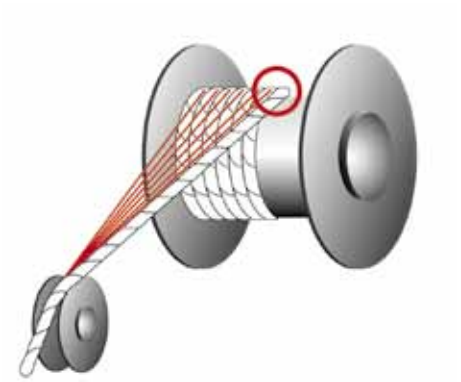


Fleet angle
Fleet angles may cause increased wear or strain on wire ropes. With coiling onto a smooth drum, the fleet angle should be 0.5 to 2.5 degrees. If the rope is damaged by adjacent windings, the service life may be improved by using compacted or lang lay ropes.

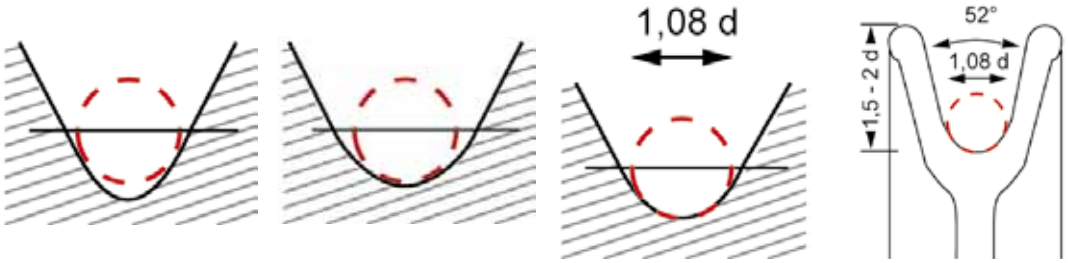
The fleet angle on drums should likewise not exceed 2.5 degrees.
With multilayer or parallel twisted rope constructions, the angle should not exceed 1.5 degrees.

Ensure that the running wire rope cannot run off the flange of the sheave or drum.

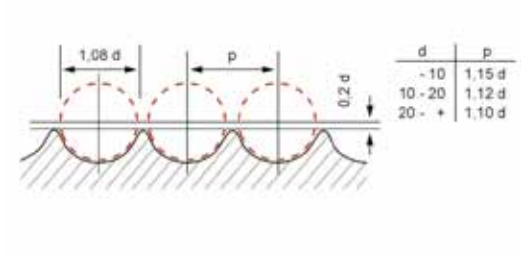
The points where the rope enters the equipment at a fleet angle need special attention in the course of monitoring the wire ropes in use.



Drum grooves
The design and condition of the drum grooves in rope sheaves or on rope drums are decisive criteria governing the rope's service life.



Wire rope sheaves
Rope sheaves should support the rope along approx. 1/3 of its circumference.
Certex recommends a groove diameter of 1.08 x d
(d = nominal rope diameter).



d	p
- 10	1,15 d
10 - 20	1,12 d
20 - +	1,10 d

Rope drums
The dimensions and design of grooves on drums for single layer windings.

Check the condition of the drum grooves and the mobility of all rope sheaves before every rope change.

Hardness of steel wires and rope sheaves

Nominal strength of the rope wires	Values acc. to API 9 A	Hardness approx.	
N/mm²		Brinell	Rockwell C
2160	EEIPS	480/500	52
1960	EIPS	470/480	51
1770	IPS	445/470	49
1570	PS	405/425	45

Recommended hardness of drum grooves made of alloyed or Mn steel = 250 to 300 Brinell

Rope sheaves and drum diameter
We recommend calculation of the required rope and drum diameters based on the establishment of the minimum rope diameter as described above.

$D_1 \geq xh_1 \times txd_{min}$
$D_2 \geq xh_2 \times txd_{min}$

D_1 = Min. drum diameter
D_2 = Min. rope sheave diameter
dmin = Minimum rope diameter
h1 = Selection factor acc. to Table
h2 = Selection factor acc. to Table
t = Rope factor acc. to Table

Mechanism group	Drum factor h1	Rope sheave factor h2
M1	11.20	12.50
M2	12.50	14.00
M3	14.00	16.00
M4	16.00	18.00
M5	18.00	20.00
M6	20.00	22.40
M7	22.40	25.00
M8	25.00	28.00

No. of outer strands in the rope	Rope factor t
3 to 6	1.25
6 to 10	1.00
8-10 with plastic sheathed core	0.95

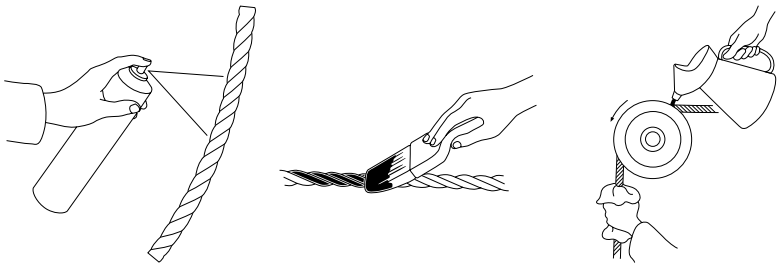
** twist-resistant rope construction*

No. of outer strands in the rope	Rope factor t
10 and more outer strands*	1.00

** twist-resistant rope construction*

Lubrication of wire ropes
Running wire ropes must be lubricated regularly when in operation. Regular treatment with suitable lubricants may significantly increase rope service life.

Contact CERTEX for further advice and help on lubrication.



Discard condition of wire ropes
(where applicable, local guidelines should also be consulted in addition to these notes)

Corrosion
Wire rope corrosion may be counteracted by galvanising, lubricating or by selecting a rope construction with large wire diameters.

Wear
Contact between the rope and other elements of the cable drive abrades the individual wires. Contact between individual wires inside the rope likewise causes internal abrasion in the rope. This abrasion reduces rope strength and ultimately leads to its scrapping. Selection of an appropriate rope construction may be decisive in increasing rope service life.

Example:
A 22 mm wire rope of rope construction 6 x 36 WS has 14 outer wires per strand, each measuring 1.28 mm in diameter. The outer wires of a rope with the same rope construction diameter of 6 x 19 S each measure 1.83 mm in diameter, thereby significantly improving on the abrasion properties.

Diameter changes
Single layer round strand wire ropes having a diameter reduced by more than 10% should be discarded.
Rotation-free / rotation-resistant wire ropes with a diameter reduced by more than 3% should be discarded.

Damaged wire ropes
Wire ropes with deformations or changes in the rope structure must be discarded.
Wire ropes with damaged strands or wire deformations must be discarded.
Bird caging, tangled loops, protruding rope cores or other visible damage due, for instance, to heat, are likewise reasons for scrapping.
Wire ropes with damaged rope terminations must be discarded.

Wire breakage
Wire ropes exhibiting individual wire breakages exceeding the max. permissible number as per Tables 1 and 2 must be discarded. Refer to DIN 15020, ISO 4309 or the wire rope manufacturer's documentation for further information.

Maximum permissible number of visible wire breakages for single layer and double-parallel twisted wire ropes in cable drives with steel rope sheaves.

Table 1

RCN Code	No. of load-bearing wires in the outer strands [a] (n)	No. of visible wire breakages [b] Ordinary lay ropes in M1-M4 or unknown [d]		No. of visible wire breakages [b] Lang lay ropes in all mechanism classes		For rope sections in multilayer coiling [c]	
		On a length 6 x d [e]	On a length 30 x d [e]	On a length 6 x d [e]	On a length 30 x d [e]	On a length 6 x d [e]	On a length 30 x d [e]
01	n < 50	2	4	1	2	4	8
02	51 - 75	3	6	2	3	6	12
03	76 - 100	4	8	2	4	8	16
04	101 - 120	5	10	2	5	10	20
05	121 - 140	6	11	3	6	12	22
06	141 - 160	6	13	3	6	12	26
07	161 - 180	7	14	4	7	14	28
08	181 - 200	8	16	4	8	16	32
09	201 - 220	9	18	4	9	18	36
10	221 - 240	10	19	5	10	20	38
11	241 - 260	10	21	5	10	20	42
12	261 - 280	11	22	6	11	22	44
13	281 - 300	12	24	6	12	24	48
	> 300	0.04n	0.08n	0.02n	0.04n	0.08n	0.16n

a Filler wires do not count as load-bearing wires.
b A broken wire has 2 ends.
c This value is applicable to areas possibly damaged by fleet angles and ropes touching on multilayer rope drums.
d Double the given number of wire breakages is applicable to Group M5 to M8 cranes.
e d = Nominal wire rope diameter.

Number of max. permissible, visible wire breakages for rotation-resistant or rotation-free wire ropes in cable drives with steel rope sheaves.

Table 2

RCN Code	Rope construction or no. of load-bearing* wires in the outer strands [a](n)	No. of visible wire breakages [b]		No. of visible wire breakages [b]	
		On a length 6 x d[d]	On a length 30 x d[d]	On a length 6 x d[d]	On a length 30 x d[d]
21	4-strand rope or n < 100	2	4	2	4
	3- or 4-strand ropes n > 100	2	4	4	8
	11 or more outer strands				
23-1	76 - 100	2	4	4	8
23-2	101 - 120	2	4	5	10
23-3	121 - 140	2	4	6	11
24	141 - 160	3	6	6	13
25	161 - 180	4	7	7	14
26	181 - 200	4	8	8	16
27	201 - 220	4	9	9	18
28	221 - 240	5	10	10	19
29	241 - 260	5	10	10	21
30	261 - 280	6	11	11	22
31	281 - 300	6	12	12	24

RCN Code	Rope construction or no. of load-bearing* wires in the outer strands [a](n)	No. of visible wire breakages [b]		No. of visible wire breakages [b]	
		On a length 6 x d[d]	On a length 30 x d[d]	On a length 6 x d[d]	On a length 30 x d[d]
	n > 300	6	12	12	24

a Filler wires do not count as load-bearing wires.
b A broken wire has 2 ends.
c This value is applicable to areas possibly damaged by fleet angles and ropes touching on multilayer rope drums.
d d = Nominal wire rope diameter.

Special constructions with larger outer wire diameters deviating from the standard might be classified deviating from Table 1. Contact the manufacturer in this regard. For Seale-type wire ropes, where the number of outer wires in strands does not exceed 19, the rope should be classified two rows above the actually applicable row in Table 1.

The number of wire breakages may be applicable (to the most-stressed rope section) in the case of steel grooves or plastic drum grooves and multilayer coiling but they are not applicable to plastic drum grooves and single layer coiling.
Interior damage and concealed interior wire breakages deserve special consideration in this case.

Typical Steel Wire Rope Damage

Typical steel wire rope damage
Discard the wire rope in accordance with current regulations or according to the manufacturers recommendations.

Only a qualified and experienced person should be responsible for discard.

The pictures show typical examples of wire rope deterioration.

WARNING! Failure to take adequate precautions could result in injury.

Mechanical damage caused by contact of the running rope with a sharp edge

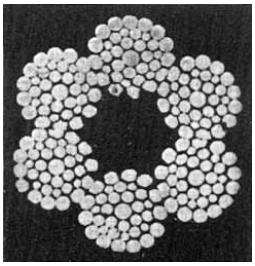
Local abrasion due to contact with the crane structure

Parallel wear pattern in the cyclical bending area, ending in wire breakage. Caused by grooves in rope sheaves that are too small or too big.

Two parallel rows of wire breakages caused by too small grooves in the rope sheaves.

Strong abrasion due to excessive pressure between rope and rope sheave.

Heavy abrasion on Langs lay ropes



Heavy corrosion

Wire breakages after exceeding the maximum number of bending cycles

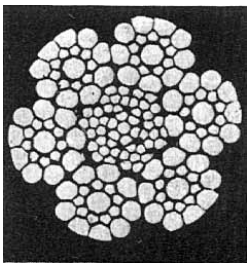
Wire damage due to strand contact

Destruction of the rope core through extreme stress.

Loosening of individual wires caused by shock loading or twisting

Local abrasion and de-formation

Bird caging after shock load or twisting of multi-layer round strand ropes



Corrosion of the rope core, the surface of the outer rope wires remains largely undamaged.

Safe Use and Purpose of Wire Rope Slings

Designated use

Detachable links for rigging and lifting of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for first use, operation, maintenance and testing.
Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Applied standards

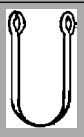
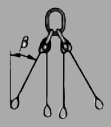
European Machinery Directive (98/37 EC) for all EU member states for compliance with the CEN standard
European standard EN 13414 - 1-3

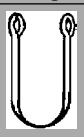
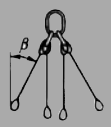
Guidelines for use

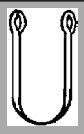
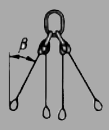
BGR 500: Use of load lifting apparatus for lifting operations
ZH 1/325: Information sheet on the use of wire rope slings
BGI 556: / ZH 1/103 a Safety Certificate of Apprenticeship for riggers
BGR 151: Use of wire rope slings

Basic rules

Prior to use, select the appropriate wire rope slings according to the planned rigging and the requisite lifting capacity (see Lifting capacity table).

	Single leg			2 legs		3- and 4 legs	
							
Dia.	Direct	Basket	Choker				
Factor	1	2	0.8	1.4	1	2.1	1.5
mm	Lifting capacity in tons						
8	0.70	1.40	0.56	0.95	0.70	1.50	1.05
10	1.05	2.10	0.84	1.50	1.05	2.25	1.60
12	1.55	3.10	1.20	2.12	1.55	3.30	2.30
13	1.80	3.60	1.44	2.50	1.80	3.85	2.70
14	2.12	4.24	1.70	3.00	2.12	4.35	3.15
16	2.70	5.40	2.10	3.85	2.70	5.65	4.20
18	3.40	6.80	2.70	4.80	3.40	7.20	5.20
20	4.35	8.70	3.50	6.00	4.35	9.00	6.50
22	5.20	10.40	4.00	7.20	5.20	11.00	7.80
24	6.30	12.80	5.00	8.80	6.30	13.50	9.40
26	7.20	14.40	5.80	10.00	7.20	15.00	11.00
28	8.40	16.80	6.70	11.80	8.40	18.00	12.50
32	11.00	22.00	8.50	15.00	11.00	23.50	16.50
36	14.00	28.00	11.20	19.00	14.00	29.00	21.00
40	17.00	34.00	13.60	23.50	17.00	36.00	26.00

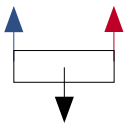
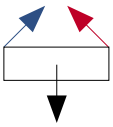
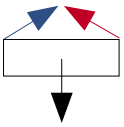
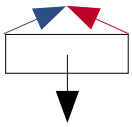
	Single leg			2 legs		3- and 4 legs	
							
Dia.	Direct	Basket	Choker				
Factor	1	2	0.8	1.4	1	2.1	1.5
mm	Lifting capacity in tons						
8	0.75	1.50	0.60	1.05	0.75	1.55	1.10
10	1.15	2.30	0.92	1.60	1.15	2.40	1.70
12	1.70	3.40	1.36	2.30	1.70	3.55	2.50
13	2.00	4.00	1.60	2.80	2.00	4.15	3.00
14	2.25	4.50	1.80	3.15	2.25	4.80	3.40
16	3.00	6.00	2.40	4.20	3.00	6.30	4.50
18	3.70	7.40	2.95	5.20	3.70	7.80	5.65
20	4.60	9.20	3.68	6.50	4.60	9.80	6.90

	Single leg			2 legs		3- and 4 legs	
							
Dia.	Direct	Basket	Choker				
Factor	1	2	0.8	1.4	1	2.1	1.5
mm	Lifting capacity in tons						
22	5.65	11.30	4.52	7.80	5.65	11.80	8.40
24	6.70	13.40	5.36	9.40	6.70	14.00	10.00
26	7.80	15.60	6.24	11.00	7.80	16.50	11.50
28	9.00	18.00	7.20	12.50	9.00	19.00	13.50
32	11.80	23.60	9.44	16.50	11.80	25.00	17.50
36	15.00	3000	12.00	21.00	15.00	31.50	22.50
40	18.50	37.00	14.80	26.00	18.50	39.00	28.00

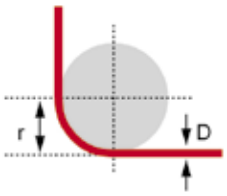
The centre of gravity of the load must be known in order to correctly calculate the length and lifting capacity of the slings. If the centre of gravity is in the middle, the required length of the slings is calculated from the load dimensions and the chosen rigging method. If the centre of gravity is off the geometric centre, the single leg sling lengths must be individually matched.
Important: always position the crane hook above the centre of gravity!

Attention: Observe the slinging angle (ß)! The greater the slinging angle, the smaller the lifting capacity.

Slinging angles > 60° are not permitted!

Slinging angle	0° (to max. 6°)	up to 45°	45° to 60°	over 60°
				
Parallelogram of forces	 ß=0°	ß = 45°	ß = 60°	ß= 80°
	Total lifting capacity = 100% of the individual lifting capacity x 2	Total lifting capacity = 70% of the individual lifting capac-ity x 2	Total lifting capacity = 50% of the individual lifting capacity x 2	Total lifting capacity = 17% of the individual lifting capacity x 2
				Use prohibited!

Instructions for use



- Wire rope slings must be without visible defects.
- Wire rope slings may not be knotted.
- Wire rope slings may not be pulled across sharp edges.
- Edge protection must be used for loads with sharp edges. An edge is considered sharp already if the edge radius (r) is smaller than the diameter of the sling (D).
- Rope end fittings (wire rope compression sleeves, splices etc.) must not be placed around the edges of the load or into the hook of the crane.
- Wire rope slings may not be distorted through twisting.
- No potentially damaging loads may be placed on wire rope slings.
- Wire rope slings must be rigged to prevent the load from falling.
- Rigging with basket hitch is not permitted. This excludes rigging of long, rod-shaped loads, provided tipping of the load, slipping of the slings and ejection of the load or parts thereof is prevented.

- Fittings must move freely after assembly.
- Wire rope slings must be rigged such that the opening angle of the end eye at the linking point does not exceed 20°.

Limitations of use

The lifting capacity must be reduced to 80% of nominal when using a choker hitch.

The use of slings in acidic environments is not recommended. Please contact the manufacturer for information.

The following table shows the permissible temperatures at which wire rope slings may be used, taking into account the type of rope termination.

Rope termination	Wire rope with	Surface temperature of the rope °C	Lifting capacity %
Aluminium compression sleeve	Fibre core	- 60 to + 100	100
	Steel core	- 60 to + 150	100
Splice	Fibre core	- 60 to + 100	100
	Steel core	- 60 to + 250	100
		+ 250 to + 400	75
Superloop	Fibre core	- 60 to + 100	100
	Steel core	- 60 to + 250	100
		+ 250 to + 400	75

Selecting the sling

Slings must be marked by the manufacturer. Marking must be permanent and legible and show the following:

- Lifting capacity
- Effective length
- Manufacturer
- Standard
- Year of Manufacture

Inspection, maintenance and care
Wire rope slings must be stored safe from the weather and aggressive substances. Wire rope slings may not be repaired.

Wire rope slings must be checked by an expert at least once a year. Additional checks may be required in the interim, depending on operating conditions.
Wire rope slings must be monitored for visible defects when in use. Wire rope slings must be removed from service if they have the following defects:

- Bends and kinks (tangled loops)
- Broken strand
- Loose outer layer along the free length
- Pinching along the free length
- Pinching in the bearing surface of the eye, with more than 4 wire breakages in stranded ropes and more than 10 breakages on cable laid ropes
- Corrosion scars
- Damaged or heavily worn rope joint or termination
- Load hooks bent open
- Wire breakages as in the following table:

Type of rope	Number of visible wire breakages at discard condition over a length of		
	3 d	6 d	30 d
Stranded rope	4	5	16
Cable laid rope	10	15	40

Damaged rigging must be identified without delay and removed from service!

General notes on hazards
Loads falling after failure of slings pose a direct or indirect hazard to the safety and health of persons in the danger zone during lifting.

Where is the danger zone?
- Underneath the load
- Next to the load when lifting starts
- At elevated workplaces
- In the swing area of the load being lifted
- Between simultaneously lifted loads
- When hands remain between the load and rigging before lifting begins (crush hazard)

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Safe Use and Purpose of Wire Rope Clamps

Designated use

Detachable fasteners for rigging and lifting of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Check the wire rope clamps before use. Ensure that:-
- all markings are clearly legible
- the wire rope clamps do not exhibit any cracks, notches or other material defects
- the selected wire rope clip is of the correct size
- the wire rope clip has neither been repaired nor modified in any way.

Fitting wire rope clamps

The wire rope clip must match the size of the wire rope. Refer to the relevant tables for details.

Always fit the saddle of the wire rope clamp to the load bearing side of the wire rope loop and the U-bolt of the clamp over the loose end (see Fig. 1-3).

Dimension the length of the looped back end of the rope such that a sufficient number of wire rope clamps can be fitted in the prescribed manner.

As shown in Fig. 1, fit the first clamp over the folded back rope the width of a saddle from the end of the rope.

Then tighten the nut with the prescribed torque.

The second wire rope clamp is fitted directly adjacent to the thimble. It must, however, be positioned such that tightening does not damage the outer wires of the rope (Fig. 2). Tighten the nut but not yet with the prescribed torque.

The other clamps are now fitted spaced at least 1.5 to max. 3 clamp widths (see Fig. 3).
Now tension the two rope strands slightly and evenly tighten the nuts at the prescribed torque

Wire rope diameter	Minimum no. of clamps	Torque Nm
5	3	2
6.5	3	3.5
8	4	6
10	4	9
12	4	20
13	4	33
14	4	33
16	4	49
9	5	68
22	5	107
26	5	147
30	6	212
34	6	296
40	6	363

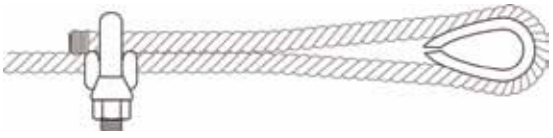


fig 1

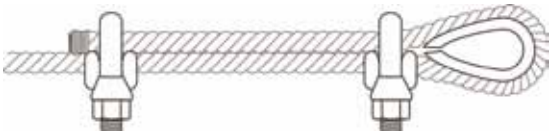


fig 2

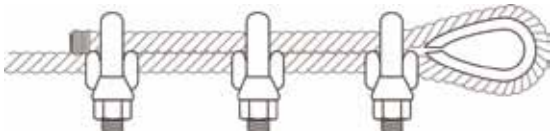


fig 3

The nuts must be checked and re-tightened at the required torque whilst fitting and each time before use. The clamps must be re-torqued after the rope was stressed for the first time.

Notes

The torque must be checked at regular intervals. The torque must be checked every 10 000, 20 000 and 50 000 load cycles with heavy, medium and light loads respectively.

If the load cycles cannot be reliably counted, then the torque must be checked at fixed intervals, e.g. every 3 months, every 6 months or once a year.
Refer to the table for prescribed torques and the minimum number of wire rope clamps to be used for a specific wire rope size.

The effectiveness of a wire rope termination depends essentially on the selection of the appropriate clamps and their correct positioning and careful fastening. The rope end may slip through the wire rope clamps if the nuts are not adequately torqued or if too few clamps are used.
Several factors may impair the secure connection between clamps and wire rope:

- Although the nut may be tight on the thread, it may not be tight enough on the saddle.
- Contamination of the threads with dirt or oil, or corrosion may impede proper tightening of the nut.

Wire rope clamps similar to EN13411-5 are suited for static loads and once-off lifting, applying an appropriate safety factor. This may only be performed by specialised staff, however.

Wire rope clamps may not be used on:
- hoisting ropes in mines
- crane ropes in steelworks and rolling mills
- permanent wire rope attachments in wire rope drives
- rope termination fittings used with lifting apparatus

Tackles designed for special applications are an exception here, however. The products must be checked regularly, at least in accordance with the standards of the country where they are used. This is necessary because the products in use may be deformed by wear and tear, incorrect use etc., potentially changing the characteristics of the material. The products should be checked by qualified staff at least every six months. More frequent checking is required if the products are subjected to unfavourable operating conditions.

Notes
The torque must be checked at regular intervals. The torque must be checked every 10 000, 20 000 and 50 000 load cycles with heavy, medium and light loads respectively.

If the load cycles cannot be reliably counted, then the torque must be checked at fixed intervals, e.g. every 3 months, every 6 months or once a year.
Refer to the table for prescribed torques and the minimum number of wire rope clamps to be used for a specific wire rope size.

The effectiveness of a wire rope termination depends essentially on the selection of the appropriate clamps and their correct positioning and careful fastening. The rope end may slip through the wire rope clamps if the nuts are not adequately torqued or if too few clamps are used.
Several factors may impair the secure connection between clamps and wire rope:

- Although the nut may be tight on the thread, it may not be tight enough on the saddle.
- Contamination of the threads with dirt or oil, or corrosion may impede proper tightening of the nut.

Wire rope clamps similar to EN13411-5 are suited for static loads and once-off lifting, applying an appropriate safety factor. This may only be performed by specialised staff, however.

Wire rope clamps may not be used on:
- hoisting ropes in mines
- crane ropes in steelworks and rolling mills
- permanent wire rope attachments in wire rope drives
- rope termination fittings used with lifting apparatus

Tackles designed for special applications are an exception here, however. The products must be checked regularly, at least in accordance with the standards of the country where they are used. This is necessary because the products in use may be deformed by wear and tear, incorrect use etc., potentially changing the characteristics of the material. The products should be checked by qualified staff at least every six months. More frequent checking is required if the products are subjected to unfavourable operating conditions.

Safe Use and Purpose of Chain Slings

Designated use

Detachable fasteners for lifting and rigging of loads, with up to 20 000 load cycles, when used in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for commissioning, operation, maintenance and testing.
Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Notes on general use

- Do not attach loads to twisted chain legs.
- Use only special chain shortening links where necessary.
- Knotting of chains is prohibited.
- Protect the chain by padding (timber scantling/edge protection) when lifting sharp-edged loads.
- Carry the load on the bed of the hook, not its tip.
- Hook empty load hooks into the master link during transportation.
- Ensure that the master link moves freely in the crane hook.
- Replace damaged accessories.
- Never overload chains, observe slinging angles; when in doubt, always select a stronger chain.
- Authorise only qualified persons to use or maintain chain slings.
- Heat treatment and welding work on chain slings may only be performed by the manufacturer.

Attention: Improper use may endanger life and health.

Applied standards

DIN EN 818-XX "Chain sling grade 8"
DIN EN 1677
DIN 685 Part 5 "Round steel link chains, utilisation"

Guidelines for use:

BGR 500 "Load lifting apparatus for lifting operations"
BGI 556 "Safety Certificate of Apprenticeship for riggers"

Basic rules

a) Visual inspection of the chain sling before first use
Before using a chain sling for the first time, ensure that:

- the chain sling is exactly what was ordered.
- the test certificate or manufacturer's certificate is at hand.
- the identification and lifting capacity information on the chain sling correspond with the information in the test certificate or manufacturer's certificate.
- all the chain sling details are entered in the register.

Always before use:
visually check the chain sling for obvious damage or signs of wear. (Refer to Care and Maintenance)

Damaged chain slings must be removed from service immediately to prevent further use!

b) Handling the load
Preparation

Check whether special instructions are given for load handling.

Before starting to lift, ensure that the load moves freely and is not anchored or otherwise attached.

Load mass

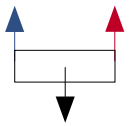
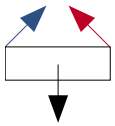
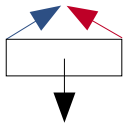
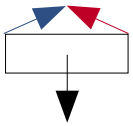
To select the appropriate sling, establish the weight of the load by weighing, by calculation or by reference to the shipping documents. Never just estimate the weight of the load!

The centre of gravity of the load must be known in order to correctly calculate the length and lifting capacity of the slings. If the centre of gravity is in the middle, the required length of the slings is calculated from the load dimensions and the selected slinging method. If the centre of gravity is off the geometric centre, the single-leg sling lengths must be individually matched.

Always position the crane hook above the centre of gravity of the load.

Observe the slinging angle ß! The greater the slinging angle, the smaller the lifting capacity.

Slinging angles > 60° are not permitted!

Slinging angle	0° (to max. 6°)	up to 45°	45° to 60°	over 60°
				
Parallelogram of forces	 ß=0°	ß = 45°	ß = 60°	ß= 80°

	Single leg		Two legs				3 and 4 legs		3 and 4 legs	
Slinging angle ß	**0**	**0**	**0 - 45°**		**0 - 60°**		**0 - 45°**		**0 - 60°**	
Load factor	**1**	**1**	**1.4**		**1**		**2.1**		**1.5**	
Nominal chain thickness	**G 8**	**G 10**	**G 8**	**G 10**	**G 8**	**G 10**	**G 8**	**G 10**	**G 8**	**G 10**
6	1120	1400	1600	2000	1120	1400	2360	2940	1700	2100
7	1500	1900	2120	2650	1500	1900	3150	4200	2240	2850
8	2000	2500	2800	3550	2000	2500	4250	5300	3000	3750
10	3150	4000	4250	5600	3150	4000	6700	8400	4750	6000
13	5300	6700	7500	9500	5300	6700	11200	14000	8000	10000
16	8000	10000	11200	14000	8000	10000	17000	21200	11800	15000
18	10000	12500	14000	17500	10000	12500	21200	26000	15000	18500
19	11200	14000	16000	20000	11200	14000	23600	30000	17000	21000
20	12500	15000	17000	21250	12500	15000	26500	33000	19000	23000
22	15000	19000	21200	26500	15000	19000	31500	40000	22400	28500
23	16000	21000	22400	29500	16000	21000	35500	44000	24000	31500
26	21200	27000	30000	38000	21200	27000	45000	57000	31800	40500
32	31500	40000	45000	56000	31500	40000	67000	85000	47250	60000

Centre of gravity of the load
The position of the load's centre of gravity must be determined in relation to the possible suspension points of the chain sling. To lift the load without it twisting or toppling, observe the following:

- With single-leg chain slings and endless basket chain slings, the suspension point should be vertically above the centre of gravity.
- With two-legged chain slings, the suspension points should be above and on two sides of the centre of gravity.
- With three- and four-legged chain slings, the suspension points should be uniformly distributed at one level around the centre of gravity. This arrangement should preferably be uniform and the suspension points should be positioned above the centre of gravity.

Use in hostile environments
Ambient temperature.

Remaining lifting capacity in %, as a function of chain temperature:

Ambient temperature	Lifting capacity
- 40°C to + 200°C	100%
+ 200°C to + 300°C	90%
+ 300°C to + 400°C	75%

Grade 8 chain slings may only be used up to a max. temperature of 400 degrees. Grade 10 chain usage temperatures acc. to manufacturer's specifications.

Please consult your CERTEX adviser if you need to use chain slings at temperatures below - 40°C.

Effects of acids
Grade 8 chain slings should neither be used in acids nor be exposed to acid vapours. Take note that certain production processes release acids or acid vapours.

Please contact your Certex adviser for information on the safe use of chain slings in aggressive environments.

Chain slings may neither be hot-dip galvanised nor subjected to any other galvanising treatment without the manufacturer's approval.

Care and maintenance
Visual inspection
Chain slings are exposed during use to conditions which may reduce their safe working ability. Ensure, therefore, that the chain slings are in a safe working condition.

The chain slings must immediately be removed from service for maintenance and repairs, if the following defects occur:

a) Illegible markings (identification and / or lifting capacity specifications) on the chain sling
b) Deformation of links on the hook or load sides
c) Stretched chain
d) Restricted movement of the chain links
e) Wear
f) Cuts, indentations, grooves, incipient cracks, excessive corrosion, bent or twisted links or other faults
g) Signs of widening hooks, i.e. noticeably wider jaw opening or other deformations in the hook end

Inspection
An inspection should be carried out annually by an expert. Additional inspections may be required in the interim, depending on the operating conditions.

Inspection results must be retained.

Chain slings must be thoroughly cleaned, i.e. oil, dirt and rust must be removed prior to inspection. Any cleaning method is allowed that does not affect the basic material. Processes which might result in hydrogen embrittlement, overheating, material ablation or movement should be avoided, as well as processes which may hide cracks or surface damage.

The chain sling should be checked for wear, deformation or external damages along its entire length.

Storage
Chain slings that are not in use should be stored in a frame designated for the purpose. Do not leave chain slings lying on the floor after use, since they may be damaged there.
Hook the chain hook into the master link when leaving the empty chain slings hooked on the crane.

Clean, dry and protect chain slings from corrosion if they are not expected to be in use for a longer period (e.g. lubricate lightly).

Safe Use and Purpose of Textile Slings

Designated use

Detachable links for rigging and lifting of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for first use, operation, maintenance and testing.
Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Applied standards

- European Machinery Directive (89/392 EEC) for all EU member states for compliance with the CEN standard
- European Standard EN 1492-1 "Flat woven webbing slings made of man-made fibres for general purpose use" and EN 1492-2 "Round slings made of man-made fibres, for general purpose use"

Guidelines for use

- BGR 500: "Use of load lifting apparatus for lifting operations"
- ZH 1/324 "Data sheet on the use of webbing slings made of synthetic fibres"
- BGI 556: / ZH 1/103 a "Safety Certificate of Apprenticeship for riggers"

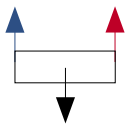
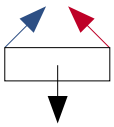
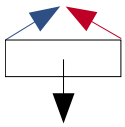
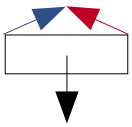
Basic rules

To select the appropriate slings, establish the weight of the load by weighing, by calculation or by reference to the shipping documents. Never just estimate the weight of the load!

The centre of gravity of the load must be known in order to correctly calculate the length and lifting capacity of the slings. If the centre of gravity is in the middle, the required length of the slings is calculated from the load dimensions and the chosen rigging method. If the centre of gravity is off the geometric centre, the single leg sling lengths must be individually matched.

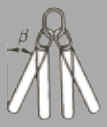
Always position the crane hook above the centre of gravity.

Observe the slinging angle (ß)! The greater the slinging angle, the smaller the lifting capacity. Slinging angle > 60 ° prohibited!

Slinging angle	0° (to max. 6°)	up to 45°	45° to 60°	over 60°
				
Parallelogram of forces	 ß=0°	ß = 45°	ß = 60°	ß= 80°
	Total lifting capacity = 100% of the individual lifting capacity x 2	Total lifting capacity = 70% of the individual lifting capacity x 2	Total lifting capacity = 50% of the individual lifting capacity x 2	Total lifting capacity = 17% of the individual lifting capacity x 2
				Use prohibited!

Selecting the textile sling
Colour coding is identical today throughout Europe, for quick information in addition to the label. In case of dirt, the tonnage stripes are useful for immediate establishment of the lifting capacity. This prevents confusion when working fast.

Colour coding for 1.000 kg to 8.000 kg lifting capacity is given in EN 1492 Part 1 and Part 2.

	Direct	Basket	Choker	Basket hitch		2-leg sling		3- and 4 leg sling	
									
Slinging angle				**0 - 45°**	**45° - 60°**	**0 - 45°**	**45° - 60°**	**0 - 45°**	**45° - 60°**
Factor	**1**	**2**	**0,8**	**1,4**	**1**	**1,4**	**1**	**2,1**	**1,5**
Colour	**Lifting capacity kg**								
Violet	1.000	2.000	800	1.400	1.000	1.400	1.000	2.100	1.500
Green	2.000	4.000	1.600	2.800	2.000	2.800	2.000	4.200	3.000
Yellow	3.000	6.000	2.400	4.200	3.000	4.200	3.000	6.300	4.500
Grey	4.000	8.000	3.200	5.600	4.000	5.600	4.000	8.400	6.000
Red	5.000	10.000	4.000	7.000	5.000	7.000	5.000	10.500	7.500
Brown	6.000	12.000	4.800	8.400	6.000	8.400	6.000	12.000	9.000
Blue	8.000	16.000	6.400	11.200	8.000	11.200	8.000	16.800	12.000
Orange	10.000	20.000	8.000	14.000	10.000	14.000	10.000	21.000	15.000

Webbing slings and round slings from 10 000 kg and up are colour coded in orange acc. to Euro Standard (CEN).

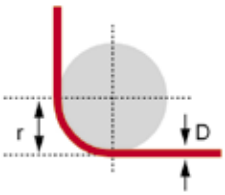
Properties
Webbing slings and round slings comprise of the materials as shown below. They are labelled differently, depending on the chemical resistance of the material:

Colour code - label	Resistance	Elongation		Working temperature
		Roundslings	Webbing slings	
Polyester (PES)	acid- and solvent-resistant	1 - 1.5%	3 - 5%	* -40 to + 100°C
Polyamide (PA)	lye- and abrasion-resistant	3%	5 - 7%	* -40 to + 100°C
Polypropylene (PP)	highly resistant to chemicals	2.5 - 3%	4 - 6%	* -40 to + 800°C

** This temperature range may change after exposure to chemical substances. In this case, please consult with the manufacturer!*

Slings must bear the manufacturer's label. This label must durably and legibly provide details on lifting capacity, effective length, manufacturer, material, standard, year of manufacture and tracking code.

Basic rules for rigging loads with textile slings



- Ensure that the crane hook is positioned above the centre of gravity of the load.
- Webbing slings and round slings may not be knotted or twisted.
- Round slings may not be extended by knotting or joining in any way. Use a round sling coupling link to extend round slings.
- Webbing slings and round slings must be used at their full width.
- Do not simultaneously use webbing slings / round slings made of different materials.
- The end eyes of webbing slings must not be too short, to avoid exceeding a 20° opening angle of the eye when rigging to a crane hook, for instance.
With short eyes, the use of reducing rigging is recommended.
- Webbing slings and round slings may not be run across sharp edges or rough surfaces unless adequately protected. An edge is considered sharp already if the edge radius (r) is smaller than the diameter of the sling (D).

To protect the textile sling, use edge protection devices, protective tubes and PU fixed coating, etc. for sharp edges and/or rough surfaces.

Inspection and maintenance

Maintenance and care
- Never use textile slings unless they are labelled fully and clearly legible.
- Store clean, dry and well-ventilated.
- Protect against intense UV radiation, heat and aggressive substances.
- Clean webbing slings and round slings with clean water (without added chemicals).
- Hang products that are wet after use out to dry.
- Never heat or otherwise attempt to dry slings.

Checking
- Have textile slings examined for visible defects at least once a year by a specialist before or during use (BGR 500).
- Also check fittings, connecting elements and marking!
- In case of damage or particular incidents which may affect the lifting capacity, remove the sling from service for examination by an expert.

Signs of flaws and damage
- Chafe marks on the surface
- Longitudinal and lateral cuts, cuts on the edges of webbing slings, round sling tubes, stitches or eyes
- Chemical exposure
- Damaged or deformed fittings
- Damaged protection devices against abrasion or chafing

Discard condition (webbing slings and round slings no longer allowed to be used)
- Damage to the webbing or its edge and high count of yarn breaks, e.g. > 10% of the total number at the point most damaged.
- Heavy deformation due to heat, e.g. caused by inner and outer friction
- Damaged load-bearing seams
- Damage caused by aggressive substances
- Damage to the sheath or its stitching on slings made of endless man-made fibres
- No or illegible marking
- Deformation, incipient cracks, breakages or other damage to fittings.

Damaged slings must be identified and removed from service without delay!

General notes on hazards
Loads falling after failure of slings pose a direct or indirect hazard to the safety and health of persons in the danger zone during lifting.

Where is the danger zone?
- Underneath the load
- Next to the load when lifting starts
- At elevated workplaces
- In the swing area of the load being lifted
- Between simultaneously lifted loads
- When hands remain between the load and rigging before lifting begins (crush hazard)

Safe Use and Purpose of Shackles

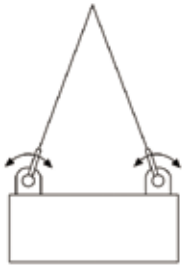
Use and maintenance of shackles in accordance with EN 13889. It is imperative to read these instructions before use.

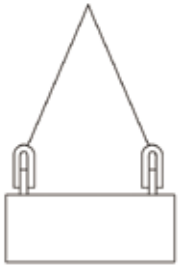
Designated use:
Detachable links for rigging and lifting of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions for first use, operation, maintenance and testing.
Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Shackles must be selected according to the required lifting capacity and the technical specifications.
The permissible lifting capacity must under no circumstances be exceeded.
Shackles must be checked as follows before use:
- Shackle body and pin are matched in terms of size, design and lifting capacity.
- Marking, incl. specified lifting capacity, is clearly legible.
- Neither shackle body nor pin show signs of damage.
- Wear, threads, cracks, corrosion, deformation

The shackle may not be used unless it is without defects.
The shackle pin must be tightened firmly before taking up a load.
The pin collar must be tight against the shackle eye and the full thread length must be screwed in.
Shackle components may only be replaced with original supplier spares.
Shackles may not be subjected to lateral forces. The stress must be along the centre line.

Different use is subject to approval by the manufacturer. The slinging angle must be considered when using shackles in multi-leg slings.





The stress in the single leg sling and on its shackle increases as the slinging angle increases.
Slinging angles > 60° are not permitted.

Bow shackles are used for linking multi-leg slings to crane hooks. The slings must In this case be positioned in the shackle body and the pin in the crane hook.

The load must be secured well. Especially the load's centre of gravity must be considered here.

No shock loads.

Spacers may be used on the pin to prevent lop-sided stress. Welding on spacers or deforming the shackle is prohibited.

Loosening of the pin due to movement of the load or slings must be prevented.

Shackles may not rest on edges or be subjected to bending stress.

Shackles with bolts, nuts and safety pins are used for permanent connections.

Do not use with unstable loading.

Shackles must not be modified. Only the manufacturer is allowed to work on shackles (e.g. heat treatment, welding, mechanical work, galvanising, coating or similar).

Permissible working temperature - 20°C to + 200°C.

Shackles may not be exposed to acids or other chemicals without the consent of the manufacturer.

An expert should assess the risk and reduce the permitted lifting capacity for applications posing special hazards (offshore application, transportation of molten or corrosive substances, nuclear materials or persons).

Shackles must be checked for visible defects prior to use.

Shackles must be regularly checked by experts.

The interval for checking should not exceed 6 months and can be shorter in case of special stresses.

Non-compliance with these instructions will render warranties null and void.

These instructions for use must be stored together with the shackles and must be available to the operator at all times.

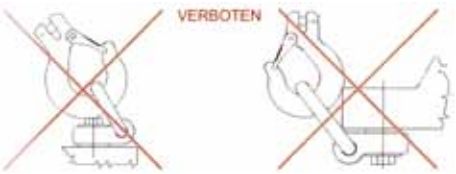
Operating Instructions for Suspension Points

General usage principles

Loads falling as a result of failure and/or incorrect use of rigging or its individual components pose a hazard to persons in the danger zone during lifting. These operating instructions contain notes on safe use and handling of suspension points. Specialists should instruct the assigned persons before they use the suspension points. Suspension points may neither be used in acids nor be exposed to acid vapours. The coefficient is 2.5 for static tests and the operating coefficient for the rated lifting capacity is 4.

Assembly instructions

The suspension points must be clearly identifiable on the load (e.g. by colour marking). Their positioning on the load must provide for a flat bearing surface for transmission of the forces.



The suspension points must be positioned on the load such that:
- they are easily accessible for unobstructed hooking and unhooking of slings
- no hazards (e.g. crushing, shearing, snagging or bumping) are created which jeopardise or obstruct the rigger and/or transport of the load
- the lifting forces can be transmitted to the basic material of the load without deformation
- no impermissible stresses are created, e.g. through off-centre force transmission, thus preventing unbalanced load distribution i.r.o. the centre of gravity (EN 818-6)
- the number and arrangement of the suspension points are chosen so as to prevent the load from inadvertently shifting during transport
- the rigging is not impeded by other parts of the structure
- damage, e.g. due to sharp edges, is prevented

When under load, the suspension point may not be rotated or used to turn loads.

Attention: ensure correct assembly and positioning of the suspension lug. It must face the direction of pull and move freely. The load lifting device may not rest on edges or on the suspension point.

If a bolt is fitted at a later stage, the bush marking must face upward. Insert the bolt from the top, applying slight pressure.

Tighten the bolt with a wrench until the contact surfaces mate. Check correct bolt and thread size and thread depth. With a blind bore, the thread depth must be at least 1.1 times the screw-in length.
We recommend the following minimum bolt length:
in steel 1 x d
in cast iron 1.25 x d and at least 1.5 x d with cast iron strength < 200 MPa
in aluminium alloys 2 x d
in aluminium-magnesium alloys 2.5 x d

Only crack tested bolts with strength class 10.9 may be used. Liability is strictly excluded in the event of accidents or warranty claims if bolts other than those supplied by the manufacturer are used. Only thread sizes as shown on the part may be used. Non-metric threads are prohibited. It is mandatory in these cases to request such types from the manufacturer / supplier. Approval is subject to prior inspection.

Lifting capacity at other temperatures and torquing of bolts
For the property class 10.9 bolts, the lifting capacities must comply with the specifications in Table 1 below. For nominal bolt sizes and dimensions, the torques must be as per Table 2.

Table 1

Ambient temperatures	Strength class 10.9 WLL
minus 40° - minus 20°C	minus 25%
minus 20° - plus 100°C	no subtraction
over 100°C - plus 200°C	minus 15%
over 200°C - plus 250°C	minus 20%
over 250°C - plus 350°C	minus 25%
over 350°C	no longer allowed

Table 2

Nominal size	Torques Nm	Diameter S
FP 0.5 M10x40 mm	40	34
FP 0.8 M12x45 mm	65	34
FP 1.5 M16x55 mm	180	34
FP 2.5 M20x70 mm	250	34
FP 4-S M24x80 mm	300	34
FP 4 M24x80 mm	300	58
FP 5 M27x80 mm	400	58
FP 6 M30x90 mm	500	58
FP 8 M36x100 mm	600	58

The corresponding lifting capacities are given on the suspension point and in tables and graphs in the technical data sheet, for each corresponding nominal size. They may not be exceeded.
With asymmetrical load distribution, the lifting capacities of single-leg rigging at 0° slinging angle (= lifting capacity given on the suspension point) are applicable also to 2- to 4-leg rigging.

Inspection and maintenance
Suspension points must be inspected by a qualified person after installation and at least once a year. Prior to use by a rigger, for instance, the suspension points must be checked for tightness of the bolts and for incipient cracks, deformations or severe corrosion.

List of possible checking criteria:
- Suspension point in order
- Bolts tightly in place
- Observe and do not exceed given lifting capacity
- Observe correct bolts and thread-in length
- Immediate prohibition of use in case of mechanical damage to the thread, the suspension lug or the suspension point, or of corrosion, incipient cracks or restricted rotation (hard to turn or jerky).

Current test specifications apply.

Operating Instructions for Swivel Lifting Eyes

General

Loads falling as a result of failure and/or incorrect use of rigging or its individual components pose a hazard to persons in the danger zone during lifting. These operating instructions are for the safe use and handling of swivel lifting eyes. Before use, persons using swivel lifting eyes must be instructed on their handling and use by an expert. Swivel lifting eyes may not be used in acids or exposed to acid vapours.

Fitment instructions

The swivel lifting eyes must be clearly identified on the load (e.g. by colour marking). They must be positioned on the load to provide a flat bearing surface for transmission of forces. These bearing surfaces must match the full diameter of the swivel body at least (correspondingly larger for weldable swivel lifting eyes) and the threaded hole must be at right angles to the bearing surface. The threaded bore must be countersunk. The number and arrangement of the swivel lifting eyes on the load must be selected such that the load is safely carried with no risk of accidental shifting in transport. The eye of the swivel lifting eye must swivel freely in the direction of the transmitted force.
The swivelling range of the eye and thus the range of force transmission is 180°. The swivel lifting eyes must be positioned on the load such that:
- they are easily accessible for unobstructed hooking and unhooking of slings
- they create no hazards (e.g. crushing, shearing, snagging or bumping) endangering the rigger and/or obstructing transport
- the lifting forces can be transmitted to the bulk of the load without deformation
- no impermissible stresses are created, e.g. through off-centre force transmission, thus preventing unbalanced load distribution around the centre of gravity (EN 818-6)
- the slings are not obstructed by other structural parts or damaged by resting on sharp edges, for instance.

The following is also applicable to threaded swivel lifting eyes:
Check correct bolt and thread size and threaded depth of the bolted connection. With blind bores, the depth of the threaded bore must be at least 1.1 times the screw-in length.
We recommend a minimum screw-in length of (d = thread size, e.g. M24):

Steel 1 x d
Cast iron 1.25 x d and at least 1.5 x d with cast iron of strength < 200 MPa
Aluminium alloys 2 x d
Light metals with low strength 2.5 x d

With once-off transportation, hand tighten with a wrench, e.g. jaw wrench in acc. with DIN 895 or DIN 894, until the contact surfaces mate. If the suspension point remains on the load permanently or if it is used for turning and swivelling of loads, torque as tabulated in these operating instructions.

The following is, in addition, applicable to weldable swivel lifting eyes:
- Welding may only be done by DIN EN 287-1 certified welders.
- The material of the welded swivel body is 23 MnNiMoCr 54, (1.6758) in acc. with DIN 17115 or equivalent.
- With gas shielded arc welding pursuant to ISO 4063-135 (MAG), a wire electrode 1.0 acc. to EN 440-G 46 2 M G4Si1 suffices.
- With manual arc welding in acc. with IS0 4063-111, welding filler EN 499-E 38 2 RR 12 Ø2.5 is adequate for the root run.
- The weld must fill the entire cross section; weld transitions must be free from notches.

Lifting capacity and working temperature

Lifting capacity is marked on the suspension points and given for each nominal size in tables and graphs in the technical data sheet. These lifting capacities must not be exceeded.
With asymmetrical load distribution, the lifting capacity of single-leg rigging at 90° slinging angle is applicable to 2- to 4-leg rigging. This corresponds to the lifting capacity given on the suspension point.

Working temperature	WLL
- 40°C to + 200°C	no reduction
+ 200°C to + 300°C	less 10%
+ 300°C to + 400°C	less 25%
over 400°C	not permissible

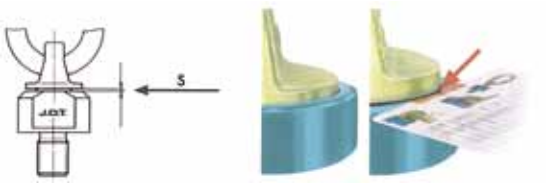
After using at over 200 °C, the lifting capacity must be permanently reduced as per the above table. Bearing wear may be accelerated and must be monitored by the user (see below for detecting wear).

Inspection and maintenance
Proper use of the suspension points must be checked regularly (e.g. tightness of bolts, heavy corrosion, deformation, etc.), e.g. by the rigger. An expert must check the suspension points at least once a year or, depending on conditions of use, at shorter intervals. The operator must consider the results of the risk assessment as per the Ordinance on Industrial Safety and Health.

List of possible checking criteria:
- Bolts tightly in place
- Observe and do not exceed given lifting capacity
- Observe proper screw-in length
- Immediate prohibition of use in case of mechanical damage to the thread, the eye, the swivel body or of corrosion, incipient cracks or restricted rotation (hard to turn or jerky).

Wear measurement before discard condition

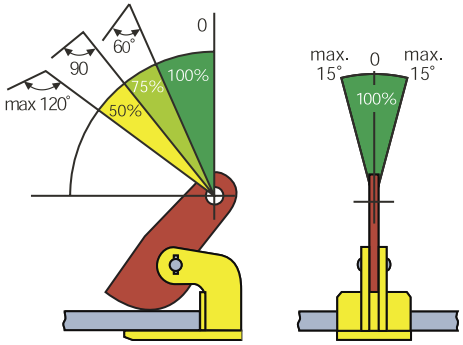
Nominal size	Max. play >s<
0.5 – 1.4 t	1.5 mm
2.0 – 2.5 t	1.5 mm
3.0 – 6.7 t	2.4 mm
8.0 – 10.0 t	3.2 mm
15.0 t	4.0 mm
20.0 – 30.0 t	4.5 mm



Using the new lifting capacity table, the discard condition is easy to establish.

Safe Use and Purpose of Terrier Lifting Clamps

Part 1: Clamps for horizontal transport



General
Terrier safety lifting clamps are made of high-grade steels and comply with the 2006/42/EC EC Machinery Directive.

Functional description
FHX, FHSX, FHX-V, TDH and TNMH horizontal clamps are used exclusively for horizontal transportation of steel plates and steel plate stacks, comprising body, cam and cam shafts. The cam has a dual function as a crane lifting eye and to secure the product in transport. Like the FH(S)(X), the THSK horizontal clamp is used exclusively for lifting and transport of horizontal steel plates and steel plate stacks. The THSK has a height adjustable body and cam. The cam serves also as a crane lifting eye and its function is the same as that of the FH(S)(X) clamp described above.

Designated use

FHS, FHSX, FHX-V and TNMH
Terrier FHS, FHSX, FHX-V and TNMH horizontal clamps are specially developed load carriers used exclusively for lifting and horizontal transport of rigid steel plates/structures with flat, even lifting positions. The horizontal clamps must always be used in pairs.
NB: The clamp is used exclusively for lifting and horizontal transportation of steel plates.

TDH
Terrier TDH horizontal clamps are specially developed load carriers used exclusively for lifting and horizontal transportation of bending and shaped steel plates with even, flat attachment points. The horizontal clamps must always be used in pairs.

THSK
Terrier THSK safety horizontal clamps are also used exclusively for transportation of horizontal steel plates/stacks with even, flat attachment points. THSK clamps may be used in pairs or, with lifting beams, also in sets. THSK safety clamps may also be used in upright position underneath a lifting beam. One or more plates may be lifted per lifting operation, provided they do not bend.

When using several clamps, all clamps must be loaded equally.

Safety notes

Always be aware of your personal safety and the safety of others! Carefully read the Instructions for Use before using the product!

To guarantee your own safety and the safety of our products, the clamp should be checked, tested and overhauled, if necessary, at least once a year by Certex Lifting & Service GmbH or another specialised firm. Also refer to Chapter 8 – Overhauling. Please contact CERTEX further information.

Avoiding life-threatening situations
- Never use untested clamps or clamps with an expired testing date.

- Absolutely maintain the prescribed safety distance! Standing under suspended loads is prohibited.

- Never use damaged clamps.

- Clamps showing signs of damage must be repaired by Certex Lifting & Service GmbH or another specialised firm immediately.

- Unless indicated otherwise, the clamps are intended exclusively for the transportation of single plates and not for stacks.

- Do not transport steel plates which exceed the safe clamp loading capacity (lifting capacity) – see specifications on the clamp, certificate or in the table.

- Do not transport steel plates that are thicker or thinner than the jaw opening (see specifications on the clamp, certificate or in the table).

- When using several facing clamp pairs at the same time, provide sufficiently long slings or chains to ensure that the 60º slinging angle between the vertical and the sling leg is not exceeded.

- When using a number of adjacent horizontal clamps, use a lifting beam and sufficiently long slings or chains to ensure that the crane lifting eyes of the clamps are never pulled sideways.

- Select the attachment point such that the clamp does not grip a conical section of the load.

- Remove all dirt, grease, corrosion, mill scale etc. from the plate, including attachment point.

- Position the clamps for optimum balance of the load as it is lifted.

- Do not exceed the permissible surface hardness of 37 HrC (345 Hb, 1166 N/mm^2) of the load.

- All clamps are designed exclusively for use at temperatures between - 40°C and +100°C.

Warning

- Never subject the cam to a lateral load.

- The clamp may be damaged by falling or by striking objects due to uncontrolled swinging of the load hook. In this case, check the clamp for possible damage before using it again.

- Horizontal clamps are not suited for permanent clamping.

- Maintenance to the clamp should be at monthly intervals (see Maintenance/Inspection).

- Modifications to the clamp, e.g. by welding, grinding etc., may jeopardise the function and safety of the product. This will void the warranty and no liability is accepted.

- Use only original Terrier spares and accessories.

Additional safety notes on the use of FH(X), FHS(X), TDH and THSK horizontal clamps

The load on the clamp may not result in a lateral slinging angle in excess of 15º (see drawing below). A 60º slinging angle was assumed as a basis for calculation of the clamp design. The lifting capacity must be reduced as per the drawing below for larger slinging angles. With choker rigging, the maximum slinging angle is 60º and the reduced lifting capacity is 50% of the maximum permissible.
Standard clamps are designed for temperatures ranging from - 40°C to +100ºC.

Lifting

When using the clamp, ensure that the permissible lifting capacity is not exceeded (see specifications on the clamp).

Fastening the horizontal clamp at the suspension point:

- with a safety lock, directly on the load hook.
- using anchor or chain shackles.
- using slings or chains, possibly also with anchor or chain shackles.
- ensure that all load lifting attachments are tested and suited for the load.

Ensure that the fastening links and locks allow the clamp to move freely in the hook.

- Check the clamp for visible damage.
- Check that the cam opens and closes easily.
- Check the gripping jaws for dirt. Clean with a wire brush, if necessary.
- Remove all dirt, grease, mill scale etc. from the attachment point.
- Open the clamp. Push the jaw opening fully over the plate, making sure that the clamp is positioned so as to balance the load in transport.
- Lift gently at first to allow the cams to grip well and check the clamp for rotation or tilt.
- Refer to the aforementioned instructions in case the clamp rotates or tips.
- Ensure that the load is held safely and stable.

Maintenance
Check the condition of the clamp once a month (see Dismantling/Assembly).

Do not use the clamp if:

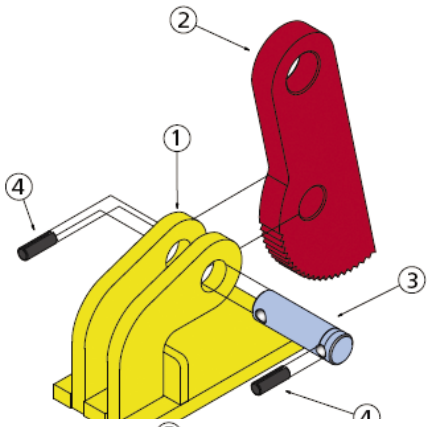
- the body is cracked or deformed, especially at the corners of the jaw.
- the cams are deformed.
- the teeth on the cam are blunt.
- the pins are deformed.
- the locking pins are missing.
- the markings on the clamp are illegible.

Depending on the identified defects:
Dismantle and clean the clamp (see Dismantling/Assembly) or have the clamp overhauled and tested by Certex or another specialised firm (see Overhauling).

Guidelines on Assembly/Dismantling of FHX, FHSX, FHX-V and TDH horizontal cla
Dismantle FHX, FHSX, FHX-V and TDH horizontal clamps as follows for cleaning and maintenance:

- Remove locking pin (4) and cam shaft (3).
- Remove cam (2).
- Clean the parts with a commercial degreasing agent.
- Grease the cam shaft (3) with bearing grease.
- Remove any metal burs with a file.

The clamp is reassembled in reverse sequence.
Always renew the locking pins and use only original Terrier spares.

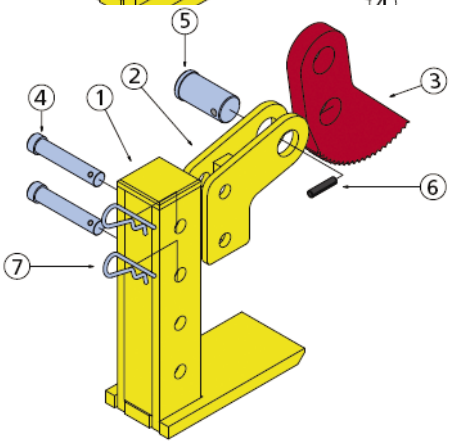


Guidelines on Assembly/Dismantling of THSK horizontal clamps
Dismantle the THSK horizontal clamp for cleaning and maintenance as follows:

- Use a punch to remove the locking pin (6) from the cam shaft (5).
- Push the cam shaft from its bearing and remove the toothed segment (3).
- After removing the pin spring (7) and the two pins (4), remove both side plates (2) from the clamp (1).

The clamp is reassembled in reverse order.
Always renew the locking pins.

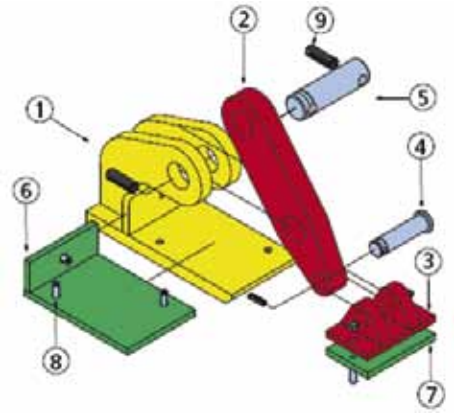
After maintenance and/or repairs, the clamp must be tested on a tension testing machine.



Guidelines on Assembly/Dismantling of TNMH horizontal clamps
Dismantle TNMH horizontal clamps for cleaning and maintenance as follows:

- Remove locking pin (9) and cam shafts (4+5).
- Remove cam (2).
- Clean the parts with a commercial degreasing agent.
- Grease the cam shafts (4+5) with bearing grease.
- Remove any metal burs with a file.

The clamp is reassembled in reverse order.
Always renew the locking pins and use only original Terrier spares.



Checking
The clamp must be checked, tested and examined by Certex or another specialised firm at least once a year or if damaged (prescribed by law).

Disposal
The clamp may be disposed of in accordance with the local regulations.

Troubleshooting checklist

Fault	Possible cause	Remedy
Load slips	Load dirty	Clean
	Cam dirty	Clean
	Cam blunt	Replace
	Jaw bent	Replace
Cam hard to move	Cam overloaded	Discard
Body is bent	Cam overloaded	Discard
Crane eye oval	Cam overloaded	Discard
Cam shaft bent	Cam overloaded	Discard
Adjusting pins bent	Cam overloaded	Discard
Missing locking pins	Assembly error	Fit locking pins
Clamp hard to open / close	Clamp worn	Discard
	Clamp dirty	Clean

5 year warranty
The manufacturer gives end users a 5 year warranty on its horizontal clamps. This warranty is valid only for the original end user of the horizontal clamps and provided that the lifting device is examined, tested and maintained over the full warranty period and in accordance with the manufacturer's and seller's instructions. The warranty period is 5 years from the date of purchase. The warranty is subject to the provisions and conditions contained in this document.

Conditions and provisions
The warranty covers only manufacturing defects becoming evident during normal use. The warranty excludes wear to components such as toothed segments, springs, etc. If a defect is identified within the warranty period, the horizontal clamp will be replaced or repaired at the manufacturer's discretion.

The warranty excludes clamps with defects caused by:- normal wear and tear
- overload
- incompetent or careless use
- damages
- non-observance of the prescribed procedures and measures
- lifting of any loads other than those specified on the clamp or in the operating instructions
- modifications/changes to the Terrier clamp
- improper use of the clamp and non-observance of the instructions given in the relevant operating instructions
- maintenance and/or repairs not performed by a certified Terrier dealer

The manufacturer accepts no liability for collateral damage or damages caused by the use of the horizontal clamp or caused by breach of the warranty.

Safety inspection
All inspections and repairs must be recorded in the Inspection schedule.
This applies to your own inspections as well as inspections carried out by a certified Terrier dealer. The Maintenance schedule must always accompany the clamp handed in for inspection or maintenance.

Damage to the horizontal clamp
Proceed as follows in case of identified wear or damage:

1. Remove the clamp from service (record the date).
2. Try to establish the cause of the defect, e.g. (refer to Chapter 1 for the complete list):

- Overload
- Improper use (the clamp is not suited for pulling or dragging of objects)
- Incompetent use
- Rough or careless use

The warranty does not cover the above types of damage! This procedure must nevertheless be followed to guarantee your personal safety and the safety of your colleagues/co-workers.

3. Submit the horizontal clamp together with the Maintenance schedule at a certified repair specialist.
4. Take the clamp into operation again after inspection/repairs. Record the date of re-commissioning in the Maintenance schedule.

Inspection schedule

Months	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Years		1			2			3			4			5	
Inspections carried out by your own Safety Officer	Blue	Blue		Blue	Blue		Blue	Blue		Blue	Blue		Blue	Blue	
Maintenance by a certified Terrier repair specialist			Green						Green						
Inspection by a certified Terrier repair specialist						Orange						Orange			

Part 2: Clamps for vertical transport

General
Terrier safety lifting clamps are made of high-grade steels in compliance with the 2006/42/EC EC Machinery Directive.

Functional description
Terrier safety lifting clamps are renowned by dint of their special built-in safety mechanism comprising a latch, a tension spring and a tensioning lever. When operating the tensioning lever, the innovative safety mechanism applies constant pretensioning of the cam onto the steel plate. This prevents the load from slipping when it is lifted. When lifting starts, the weight of the load increases the clamping pressure of the jaws. The clamp prevents the plate from accidentally slipping when the load is put down.

Further information on the use of the TSU-R clamp

The TSU-R clamp was developed especially for lifting of stainless steel plates. To prevent corrosion by carbon contamination, the vertical clamp is manufactured from stainless steel components and the body and tensioning lever are nickel-plated. This prevents contamination by carbon residues of the attachment points and obviates subsequent cleaning.

Designated use
Terrier safety vertical clamps are specially developed load carriers used exclusively for lifting and transportation of steel plates/ structures having even and flat attachment points.

TSMP / TSEMP/ STSMP
The greater freedom of movement of the MP head renders the TSMP, TSEMP, STSMP lifting clamps particularly suitable for tipping of steel plates/structures.

TS(H) / TSE(H)
Due to the specially developed “hard” cam and “hard” pin, the TS-H, TSE-H clamps are particularly suited for lifting and transporting steel plates/structures with a maximum surface hardness of 45 HrC (429 HB, 1450 N/mm^2).

The TSHP has three pins to firmly hold the load, rendering it highly suitable for transporting flat bulb bar steel (Holland Profile).

Designated use of the clamp means lifting and transportation of steel plates from:
- vertical position
- horizontal position.

The lifting capacity is reduced when lifting from other than vertical positions (see Loading capacity diagram).

TSU / TSEU / STSU / TSU-R / TSHPU
are suited for lifting from any position.
The TSU-R was specially designed for transporting stainless steel plates/structures with even, flat attachment positions. Using the clamp for carbon-containing metals and also for stainless steel plates creates a risk of carbon contamination!

Designated use of the clamp means lifting and transportation of steel plates from:
- vertical position
- horizontal position
- lateral position

The lifting capacity is reduced when lifting from other than vertical positions (see Loading capacity diagram).

Safety notes
Always be aware of your personal safety and the safety of others! Carefully read the Instructions for Use before using the product!

To ensure your own safety and the safety of our products, the clamp should be checked, tested and. if necessary, overhauled, by Certex Lifting & Service GmbH or another specialised firm at least once a year (see also Overhauling).

Please contact CERTEX for further information.

Avoiding life-threatening situations
(see examples)
- Never use untested clamps or clamps with an expired testing date.

- Absolutely maintain the prescribed safety distance! Standing under suspended loads is prohibited.

- Never use damaged clamps. Clamps showing signs of damage must be repaired by CERTEX another specialised firm immediately.

- The clamps are designated exclusively for transporting single plates and not stacks.

- Do not transport steel plates which exceed the safe clamp loading capacity (lifting capacity) – see specifications on the clamp, the certificate, in the table or in the Load capacity diagram).

- Do not transport steel plates that are thicker or thinner than the jaw opening (see specifications on the clamp, the certificate or in the table).

- Be careful when lifting from a non-vertical position! Observe the reduced lifting capacity (see Lifting capacity diagram).

- When using clamp pairs, provide sufficiently long slings or chains to ensure that the 60º slinging angle between the vertical and the sling leg is not exceeded.

- Ensure that the load is equally distributed when using clamps in pairs.

- Select the attachment point such that the clamp does not grip a conical section of the load.

- Remove all dirt, grease, corrosion, mill scale etc. from the plate, including attachment point.

- Do not exceed the permissible surface hardness of 37 HrC (345 Hb, 1166 N/mm^2) of the load.

- A maximum surface hardness of 30 HrC (283 Hb, 945 N/mm^2) is applicable to the TSU-R clamp.

All clamps are designed exclusively for use at temperatures between - 40°C and +100°C.

Warning
- Avoid pulling the crane lifting eye of the TS / STS / TSE clamps sideways.

- With the MP clamps, avoid stressing the MP head sideways.

- The clamp may be damaged by falling or by striking objects due to uncontrolled swinging of the load hook. In this case, check the clamp for possible damage before using it again.

- Vertical clamps are not suited for permanent clamping.

- Maintenance to the clamp should be at monthly intervals (see Maintenance/Inspection).

Modifications to the clamp, e.g. by welding, grinding etc., may jeopardise the function and safety of the product. This will void the warranty and no liability is accepted.

- Use only original spare parts and accessories.

- Improper use of the clamp and/or non-observance of the operating instructions and safety notes may jeopardise the operator or third parties.

Notes on the use of the TSU-R clamp
- The clamp may only be used for lifting stainless steel plates/structures.

- Although the clamp is highly resistant to wear and tear, it should be handled with the utmost care. Avoid stressing through impact, falling etc.

Lifting
Ensure that the permissible lifting capacity is not exceeded in use.
Fastening the horizontal clamp at the suspension point:

- with a safety lock, directly on the load hook

- using anchor or chain shackles

- using slings or chains, possibly also with anchor or chain shackles

- Ensure that all load lifting attachments are tested and suited for the load. Ensure that the fastening links and locks allow the clamp to move freely in the hook.

- Check the clamp for visible damage.

- Check that the tensioning lever opens and closes the clamp easily.

- Check the gripping jaws for dirt. Clean with a wire brush, if necessary. Use a brass brush to clean the TSU- R vertical clamp!

- Remove all dirt, grease, mill scale etc. from the attachment point.

- Use the tensioning lever to open the clamp.

- Push the jaws over the plate as far as they will go, making sure that the clamp is positioned so as to balance the load in transport.

- Turn back the tensioning lever fully to close the clamp.

- Start lifting slowly to allow the cams to grip securely. Check that the clamp has a firm grip.

- If the load slips: see Chapter – Lifting.

- If the load continues to slip: see Chapter – Maintenance.

- Ensure that the load is in a safe and stable position before releasing the vertical clamp.

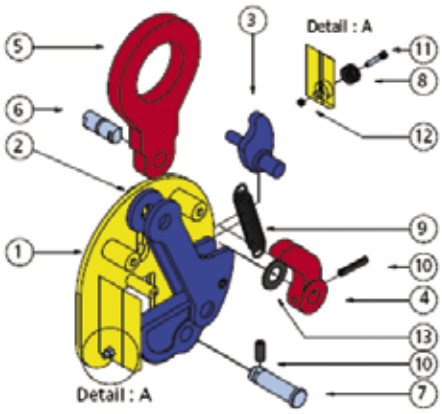
Maintenance
- Check the condition of the clamp once a month (see Chapter 17 - Dismantling/Assembly).

Do not use the clamp if:

- the body is cracked or deformed, especially in the corners of the jaw.
- the crane lifting eye or the link is deformed.
- the teeth on the cam are blunt.
- the spring is worn or broken.
- the tensioning lever functionality is restricted.
- the shafts are deformed.
- the locking pins are missing.
- the keyway is dirty.
- the markings on the clamp are illegible.

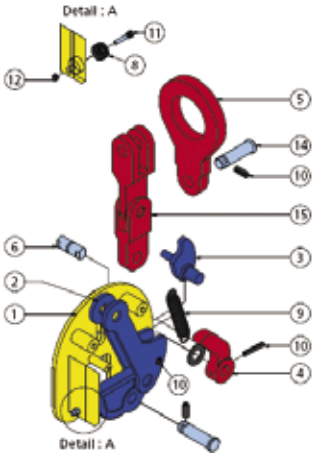
Depending on the identified defects:
Dismantle and clean the clamp (see Chapter 7 – Dismantling/Assembly) or have the clamp overhauled and tested by CERTEX or another specialised firm (see Chapter 8 - Overhauling).

Guidelines on Assembly/Dismantling of TS, STS, TSE, TSHP vertical clamps



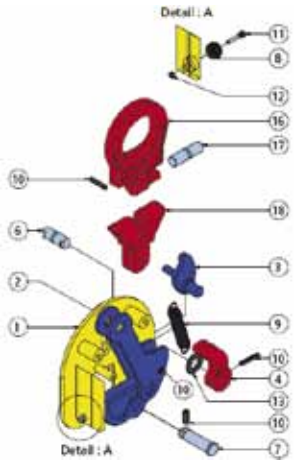
- Open clamp fully.
- Remove tension spring (9). With the 0,75 TS, 1 TS, 1,5 , 2 , 3 TSE, first remove the locking pin (10) from the cam shaft.
- Remove the locking pin (10) and cam pin (7).
- Push in the crane lifting eye (5) until the pin (6) can slide through the assembly aperture.
- Remove crane lifting eye (5) and cam shaft (2).
- Dismantle the tensioning lever (4) by removing the locking pin (10) and remove the tensioning pin (3) from the clamp.
- Remove the stop (8) using an Allen key and ring spanner.
- Clean the parts with a commercial degreasing agent.
- Grease all shafts with bearing grease.
- Oil the spring, if necessary.
- Reassemble the clamp in reverse order
- Always renew the locking pins (10).
- Always replace the stop bolt (11) and nut (12).
- Use only original spare parts.
- Remove any metal burs with a file.

Guidelines on Assembly/Dismantling of TSMP, TSEMP, STSMP vertical clamps



- Open clamp fully.
- Remove tension spring (9). With the 0,75 TSMP, 1TSMP, 1,5 ,2 ,3 TSEMP, first remove the locking pin (10) from the cam shaft.
- Remove the locking pin (10) and cam pin (7).
- Remove the locking pin (10) and pivot pin (14).
- Remove the crane lifting eye (5).
- Push in the clevis (15) until the pin (6) of the crane lifting eye can be removed through the assembly aperture.
- Remove the clevis (15) and cam shaft (2).
- Dismantle the tensioning lever (4) by removing the locking pin (10) and remove the tensioning pin (3) from the clamp.
- Remove the stop (8) using an Allen key and ring spanner.
- Clean the parts using a commercial degreasing agent.
- Grease all shafts with bearing grease.
- Oil the spring, if necessary.
- Reassemble the clamp in reverse order.
- Insert new original locking pins (10) using a hammer, combination pliers and pin punch.
- Always renew the stop bolt (11) and nut (12).
- Use only original spare parts.
- Remove any metal burs with a file.

Guidelines on Assembly/Dismantling of TNMH lifting clamps



- Open clamp fully.
- Remove tension spring (9). With the 0,75 TSU, 1 TSU, 1 TSEU, 1,5, 2 and 3 TS(E)U, first remove the locking pin (10).
- Remove locking pin (10) and cam pin (7).
- Dismantle the locking pin (10) from the link (18) and remove the link pin (17).
- Remove the crane lifting eye (16).
- Push in the link (18) until pin (6) of the crane lifting eye can be removed through the assembly aperture.
- Remove the link (18) and cam shaft (2).
- Dismantling the tensioning lever (4): Remove locking pin (10) and remove the tensioning pin (3) from the clamp.
- Remove the stop (8) using an Allen key and ring spanner.
- Clean the parts with a commercial degreasing agent.
- Grease all shafts with bearing grease.
- Oil the spring, if necessary.
- Reassemble the clamp in reverse order.
- Always renew original locking pins (10).
- Always renew the stop bolt (11) and nut (12).
- Use only original spare parts.
- Remove any metal burs with a file.

Checking

The clamp must be checked, tested and examined by CERTEX or another specialised firm at least once a year or if damaged (prescribed by law).

Disposal

The clamp may be disposed of in accordance with the local regulations.

Troubleshooting checklist

Malfunction	Possible cause	Remedy
Load slipping	Load dirty	Clean
	Stop and/or cam dirty	Clean
	Stop and/or cam blunt	Replace
	Jaw opening bent	Replace
Crane lifting eye hard to move	Crane lifting eye overloaded	Discard
Clevis sticking	Clevis overloaded	Discard
Body is bent	Clamp overloaded	Discard
Crane lifting eye oval	Clamp overloaded	Discard
Spring damaged	Spring worn	Discard
Shaft/pin bent	Clamp overloaded	Discard
Locking pins missing	Incorrectly assembled	Fit locking pins
Clamp difficult to open / close	Keyway dirty	Clean
	Clamp overloaded	Discard
	Clamp dirty	Clean
	Clamp worn	Discard

5 year warranty

The manufacturer gives end users a 5 year warranty on its horizontal clamps. This warranty is valid only for the original end user of the horizontal clamps and provided that the lifting device is examined, tested and maintained over the full warranty period and in accordance with the manufacturer's and seller's instructions. The warranty period is 5 years from the date of purchase. The warranty is subject to the provisions and conditions contained in this document.

Conditions and provisions
The warranty covers only manufacturing defects becoming evident during normal use. The warranty excludes wear to components such as toothed segments, springs, etc. If a defect is identified within the warranty period, the lifting clamp will be replaced or repaired at the manufacturer's discretion.

The warranty excludes clamps with defects caused by:
- normal wear and tear
- overload
- incompetent or careless use
- damages
- non-observance of the prescribed procedures and measures
- lifting of any loads other than those specified on the clamp or in the operating instructions
- modifications/changes to the clamp
- improper use of the clamp and non-observance of the instructions given in the relevant operating instructions
- maintenance and/or repairs not performed by a certified dealer

The manufacturer accepts no liability for collateral damage or damages caused by the use of the lifting clamp or caused by breach of the warranty.

Safety inspection
All inspections and repairs must be recorded in the Inspection schedule.
This applies to your own inspections as well as inspections carried out by a certified dealer. The Maintenance schedule must always accompany a clamp handed in for inspection or maintenance.

Damage to the lifting clamp
Proceed as follows in case of identified wear or damage:

1. Remove the clamp from service (record the date).
2. Try to establish the cause of the defect, e.g. (refer to Chapter 1 for the complete list):

- Overload
- Improper use (the clamp is not suited for pulling or dragging of objects)
- Incompetent use
- Rough or careless use

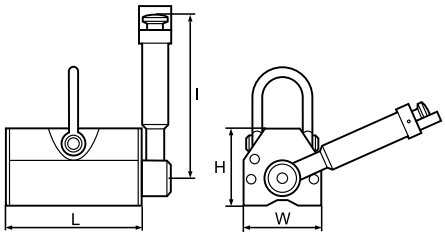
The warranty does not cover the above types of damage! This procedure must nevertheless be followed to guarantee your personal safety and the safety of your colleagues/co-workers.

3. Submit the lifting clamp together with the maintenance schedule at a certified repair specialist.
4. Take the clamp into operation again after inspection/repairs. Record the date of re-commissioning in the Maintenance schedule.

Inspection schedule

Months	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
Years		1			2			3			4			5	
Inspections carried out by your own Safety Officer	Blue	Blue		Blue	Blue		Blue	Blue		Blue	Blue		Blue	Blue	
Maintenance by a certified Terrier repair specialist			Green						Green						
Inspection by a certified Terrier repair specialist						Orange						Orange			

Safe Use and Purpose of Certex Permanent Load Lifting Magnets



Note: Read these operating instructions carefully before using the product. Please contact Certex Lifting & Service GmbH for any further information on safe use.

Check the supplied magnet for completeness and possible damages.

Permanent magnets are easy to use and their design is safe and user-friendly. This is why load lifting magnets are widely used as load lifting devices in many sectors of industry, in shipyards or for handling of cargo.

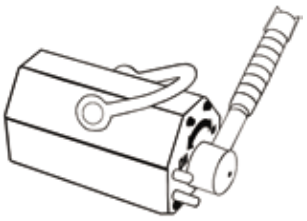
Using magnets can improve working conditions and increase effectiveness.

Designated use
Permanent magnets are used to lift and move metal blocks and cylindrical workpieces.

Design
The NdFeB magnets have a strong permanent magnetic field. The magnetic field is activated and deactivated by a manually operated lever. The lifting eye fitted on the magnet serves for connecting to a suitable lifting apparatus. The V-groove on the underside of the magnet enables safe lifting of round workpieces.

Dimensions

Lifting capacity	100 kg	300 kg	600 kg	1 t	2 t
W mm	62	92	122	176	234
L mm	92	162	232	258	378
H mm	67	91	117	163	212
I mm	126	155	196	285	426
Max. manual force in kg	< 80	< 80	< 80	< 80	< 80
Weight in kg	3	10	24	50	125



Use
Remove rust, chips or other dirt from the surfaces before use. Position the magnet centrally above the centre of gravity of the workpiece. After placing the magnet, swing the lever from OFF to ON. Ensure that the safety lock of the lever is latched before you lift the load.

Never exceed the lifting capacity of the magnet. No persons may be present under loads suspended from load lifting magnets. The ambient temperature and the temperature of the lifted workpiece must be between – 40° and + 80° Celsius. Shock loads and strong vibrations are prohibited.

When lifting round workpieces, the surface of the load must mate with both sides of the V-groove along its length. With cylindrical workpieces, the lifting capacity of the magnet is always reduced to 30%.

After lifting and setting down the load again, press the button to open the safety lock and swing the lever from ON to OFF. The magnet is now deactivated and will release the workpiece.

Factors influencing the lifting capacity of load lifting magnets

Before using the magnet, the effective lifting capacity, given the workpiece shape, material thickness and air gap must be established. Please use the following table of maximum lifting capacity for this purpose, as a function of these factors.

Lifting capacity in kg for low-carbon steel S 235 JR (St. 37)

Lifting capacity	Material thickness mm	Clean and flat polished surface, air gap approx. 0.1 mm		Rusty/hot-rolled surface, air gap approx. 0.2 mm		Irregular and rough surface, air gap approx. 0.4 mm		Very rough surface, air gap > 0,5 mm
		Sheet metal, plates	Round material	Sheet metal, plates	Round material	Sheet metal, plates	Round material	
WLL 100 kg	45	100	30	85	25	70	20	Please ask your supplier
	40	95	28	80	23	65	19	
	30	85	25	70	20	60	17	
	20	75	22	60	18	50	15	
	10	50	15	40	13	35	10	
	5	25	8	20	5	15	5	
WLL 300 kg	40	300	90	250	75	200	60	
	30	270	80	225	68	185	55	
	20	250	75	200	63	175	50	
	10	150	45	125	38	100	30	
	5	75	23	60	19	50	15	
WLL 600 kg	40	600	180	500	150	400	120	
	30	540	160	450	135	375	105	
	20	500	150	425	125	350	100	
	10	300	90	250	75	200	60	
	5	150	45	125	38	100	30	
WLL 1000 kg	50	1000	300	850	250	700	200	
	40	950	285	800	240	660	190	
	30	900	270	750	225	630	180	
	20	850	255	700	210	600	170	
	10	750	225	625	180	525	150	
	5	500	150	425	125	350	100	
WLL 2000 kg	60	2000	600	1700	500	1400	400	
	50	1900	570	1600	475	1300	380	
	40	1800	540	1500	450	1250	360	
	30	1700	510	1400	425	1200	340	
	20	1500	450	1250	375	1000	300	
	10	1000	300	850	255	700	200	

Supplementary to the aforementioned lifting capacities, the effect of carbon content of the steel must also be considered. The following factors must be applied when determining the permissible lifting load:

1.00 for low-carbon steel
0.95 for steel with medium carbon content
0.90 for steel with high carbon content
0.75 for low-alloy steel types
0.50 for cast iron parts

Notes on maintenance and safety
Do not damage the contact surfaces during the use and transport of magnets. Lubricate the surface lightly after use.

Check the safety lock of the lever regularly. Ensure that it moves freely and that the safety bolt closes properly.

Only operate the lever after the load lifting magnet has been positioned on a magnetic workpiece.

Only qualified and trained persons may use the magnet and carry out maintenance.

Modifications to load lifting magnets jeopardise safety and are prohibited.

Every load lifting magnet must be checked by a qualified person at least once a year. All the components must be checked in addition to the load test, to ensure adequate safety.

The magnet must be scrapped to prevent further use if its enclosure or moving parts are damaged.

Safe Use and Purpose of Lashings

Lashing methods

1. Direct lashing

This lashing method is preferred to the tie-down system. With this lashing method, both the pretensioned force of lashing and the permissible stress in the lashing are at work.

2. Tie-down

With the tie-down system, the lashing presses the load to be secured down onto the loading area. The securing force in this case is the pretensioned force (STF) of the lashings.
The tie-down system should only be used for lighter loads or together with anti-slide mats and lashings with a high pretensioning force.

Factors

The following factors should be considered when dimensioning load restraining:
- Mass and properties of the load
- Friction μ
- Lashing angle ß
- Pretensioning force or permissible tensile force of the lashings
- Vehicle data
- Acceleration values

Tie-down method - recommended number of lashings

Pretensioning force	Lashing angle	Friction	Weight of load					Friction	Weight of load				
STF in daN	ß< degrees	μ	2 t	4 t	6 t	8 t	10 t	μ	2 t	4 t	6 t	8 t	10 t
150	35	0.6	8	17	xx	xx	xx	0.3	29	xx	xx	xx	xx
150	60	0.6	5	11	xx	xx	xx	0.3	19	xx	xx	xx	xx
150	90	0.6	5	9	xx	xx	xx	0.3	17	xx	xx	xx	xx
300	35	0.6	4	8	12	17	21	0.3	14	29	43	xx	xx
300	60	0.6	3	5	8	11	14	0.3	10	19	29	xx	xx
300	90	0.6	2	5	7	9	12	0.3	8	17	25	xx	xx
450	35	0.6	3	6	8	11	14	0.3	10	19	29	39	48
450	60	0.6	2	4	5	7	9	0.3	6	13	19	26	32
450	90	0.6	2	3	5	6	8	0.3	6	11	17	22	28

Remark

At least 2 lashings must be used at all times.
The table allows for only 50% of the specified STF for the side opposite the tensioning device.
The number of required lashings is reduced by 25% if the pretensioning force on both sides of the lashing is verifiably equal to the STF.

Friction coefficients μ

The existing friction plays an important role with load restraining.
We generally recommend the use of friction mats with the tie-down method.

Material	dry	wet
Wood/wood	0.20-0.50	0.20-0.25
Metal/wood	0.20-0.50	0.20-0.25
Metal/metal	0.10-0.25	0.10-0.20
Concrete/wood	0.30-0.60	0.30-0.50

Safe Use and Purpose of Textile Lashings

Designated use

Detachable links for fastening and restraining of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially use by untrained persons, is deemed improper.

General

Lashing straps made of man-made fibres are manufactured in one- and two-piece types.
One-piece lashing straps are used to strap the load. They normally comprise a woven textile strap and a tensioning device.
Two-piece lashing straps consist of two woven textile straps. One is fitted with a tensioning device and both have an end fitting.

Important notes

1. All loads must be adequately restrained before starting on a trip. The required number of lashings must be calculated according to prEN 12195-1: 1995.
2. Staff tasked with restraining the load must be trained.
3. The lashings must be suited for the specific load and intended use.
4. The lashings must be in perfect condition.
5. Any partial unloading must be taken into account.
6. At least 2 lashings must be used at all times when using the “tie-down” system.
7. 2 pairs of lashings must be used for “diagonal lashing”.
8. Before removing the lashings, ensure that the load is stable without them.
9. Lashings may not be knotted.
10. Lashings with different elastic elongation may not be used on the same load (e.g. lashing chains and lashing straps).
11. Do not run lashings over unprotected sharp edges.
12. Lashing straps may not be used for lifting.
13. Lashing straps must be cleaned after exposure to aggressive substances.
14. Do not overload lashings.
15. Do not subject tensioning devices and end fittings to bending.

Discard condition of lashing straps

Lashing straps must be removed from service if they show any of the following signs of damage:

- Cracks, cuts, notches and breakages in load-bearing fibres and seams of the belt straps.
- Belt straps with deformation due to heat or aggressive substances.
- Tensioning devices and end fittings with deformations, cracks, heavy wear and tear or corrosion.
- No label or illegible label.

Safe Use and Purpose of Lashing Chains in acc. with EN

12195-3

Designated use
Detachable devices for fastening and restraining of loads in accordance with their technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially by untrained persons, is deemed improper.

When selecting and using lashing chains, the required lashing force, intended application and type of load to be lashed must be considered.

Task only qualified and instructed persons with the use and repair of lashing chains.

Selection is determined by the size, shape and weight of the load as well as the intended use and the transport conditions.

Refer also to VDI 2702 and DIN EN 12195-1 for information on calculation, selection and dimensioning of lashings.

Do not use long-link chains for general lashing.

The lashing chain must be strong and long enough for the intended purpose.

Plan the lashing and also removing the chains again before starting to lash. Remove slings before lashing.

Any partial unloading must be taken into account. Calculate the number of lashing chains to be used in acc. with DIN EN 12195-1.

Due to different behaviour and change in length under load, never use different lashing means (e.g. chains and straps) for lashing the same load.

Additional connections and lashing devices must match the lashing chain.

Removing the lashings: before opening, ensure that the load is stable even without lashings and that persons tasked with offloading are not in danger.

If necessary, to prevent toppling, rig slings intended for further transport already before lashings are removed.

Release the lashing chains for the load to stand freely before offloading. Look out for low overhead lines and other obstructions during loading and offloading.

Lashing chains must be removed from service and returned to the manufacturer for repair if they show any signs of damage.

The following signs are indicative of damage:
1. on round steel chains: surface cracks, > 3% elongation, wear of 10% or more of nominal thickness, visible deformation.
2. on linking parts and tensioning devices: deformations, cracks, serious indications of wear, signs of corrosion.

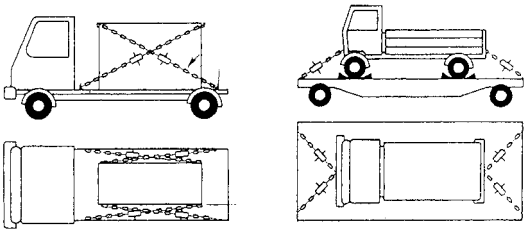
Ensure that the lashing chain is not damaged by sharp edges.

Use only lashing chains with legible marking tags.

Lashing chains must not be overloaded: the max. manual force allowed is 50 daN. Mechanical aids such as rods or levers etc. may not be used unless they are part of the tensioning device.

Lashing chains that are knotted or linked with bolts and screws may not be used.

The lashing chains and edges of the load must be protected against abrasion and damage. Use suitable edge protectors.



Operating Instructions for Load Lifting Attachment/s (LLA/s)

General notes on all LLAs

1. Read these operating instructions carefully and ensure that the information is accessible to all persons authorised to operate LLAs.

2. Certex LLAs may be used exclusively as designated in these operating instructions. Improper use may be hazardous and cause damage. These instructions must be deemed recommendations insofar as they are not directly applicable to a supplied LLA.

3. For use only by assigned and instructed persons and in compliance with the applicable regulations pursuant to BGR 500, Chapter 2.8 and DIN EN 13155.

4. The LLA must be meticulously checked visually for damages, completeness, wear and tear, tight fit of all moving parts and functional safety every time before first use. Hard to move components are a sign of overloading. If full usability of an LLA is in doubt, it must be removed from service immediately to be checked by an expert.

5. Never exceed the maximum lifting capacity of the LLA. No persons may be present in the danger zone near a load.

6. LLAs are not certified for transporting persons (exception: manbaskets). LLAs without name plates or with illegible lifting capacity specification may not be used. Transporting of fluids or bulk goods, use outside the temperature range of – 20°C to + 100°C and exposure to chemicals such as acids, lyes and vapours is prohibited.

7. Rig only symmetrical loads. The centre of gravity of the load must be positioned precisely under the crane hook and the hitching points precisely below the load lifting points of the LLA. Ensure that the load is distributed equally for LLAs with several load lifting points. Maximum permissible deviation from horizontal is 6°. Never use LLAs for pulling loads (e.g. off a truck or from storage).

8. Ensure that hitching points and rigging are dimensioned to take the weight of the load and direction of pull. Observe permissible spread angles. Preferably rig as “direct” or “choker”. With “basket” type rigging, the load might slip out. Lash loads, if necessary.

9. Ensure that the safety latches of all load carrying apparatus are closed. The suspension eye of the load lifting attachment must have sufficient space in the crane hook to move freely. Hooks may not be loaded at their tip. A shortening hook must be used with oversized crane hooks.

10. Pulling other than vertical with the LLA is prohibited, do not tear loads away, do not pull against a resistance, prevent loads from toppling when turning them. Ensure that the load does not swing and knock against objects when moving the LLA. Accelerate and slow down gently - no sudden lifting or shifting. Max. lifting rate: 10 m/min. '

11. Be careful when operating and moving the LLA. Use the handles; keep your hands away from moving parts (especially from the scissor mechanism of the grippers). To prevent crushing and abrasion, create adequate clearance to move the load. When setting down the load, make sure that it cannot topple, slip or roll away. Do not leave the load unattended or suspended for longer than necessary.

12. Avoid strained body postures. Stand as upright as possible, remove obstacles and protect yourself by wearing a helmet, safety goggles, gloves etc. Talk to us if you must adopt an ergonomically unfavourable posture to operate the LLA.

13. Store LLAs in a stable manner when not in use. They must not topple with a 10° angle of inclination in any direction. Secure suspension racks or storage trestles or racks, manufactured if necessary, are suitable options. We would gladly provide you with a quotation in this respect. Do not store the LLA in very moist, salty, corrosive, alkaline or explosive atmospheres.

14. All load lifting machines ready for commissioning on delivery were subjected to a static load test prior to delivery:
Manually operated load lifting machines were tested at 1.5 times their lifting capacity.
Powered load lifting machines were tested at 1.25 times their lifting capacity.

Certex load lifting attachments falling under the Machinery Directive are designed to pass a static test at 1.5 times their rated lifting capacity.

Notes on maintenance and testing

LLA design in acc. with DIN EN 13155 (max. 20 000 load cycles under full load) or in acc. with DIN 15018 for more load cycles. The LLAs have thereafter reached the end of their service life.

Examination before first operation

CERTEX LLAs have passed final inspection in the factory, were tested and are ready for use. They must nevertheless be tested under BGR 500 by an expert at the operating company before first use and any defects must be remedied.

Regular inspections

LLAs must be checked by an expert at least once a year and also after special incidents such as overloading or damage and after repair. Accessories must be tested for compliance with the applicable regulations.
Attention: Shorter inspection intervals or different lifting capacity ratings may be necessary in case of highly dynamic loads or frequent use. LLAs must be monitored for visible defects when in use. The operator is responsible for requesting inspections.

Inspections prior to every use
Check the exterior condition of the LLA for deformation, heavy corrosion and other wear and tear. All moving parts such as hooks, bolts, shackles, screw connections, splints, springs, shafts, sheaves, force transfers and the like must be checked for mechanical damage, deformation, missing or faulty safety devices and for cross section reductions of 5% or more. Check that the nameplate is fitted and legible.

Repairs
CERTEX LLAs may only be checked and repaired by specialists. Heat treatment and welding is not permitted. A load lifting test must be performed at nominal load after any repairs. Certex GmbH accepts no liability for damages arising from conversions and modifications of its supplied apparatus and from the use of non-original parts.

Non-observance of the above may void any claims against Certex GmbH under product liability or warranties.

Please also observe the component-specific notes on the different LLA groups!

Component-specific notes on the different LLA groups

Rigid and adjustable lifting beams

Designated use
Detachable load lifting apparatus for lifting and horizontal transport of loads in accordance with its technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Lifting beams are beams loaded in bending with usually a central suspension arrangement for the crane hook (on the crane side) and two or more suspension points for load attachment (on the load side). They serve to distribute forces from the hook of the crane to the load suspension points, to prevent buckling forces and to protect lifted loads. With symmetrical rigging to two load lifting points, each point carries 50% of the load. If the suspension points are adjustable, they can be arranged such that the crane hook suspension point is not at the geometric centre but rather above an asymmetric centre of gravity of a load. Ensure in this case that the suspension points closest to the crane hook (and therefore also the attached slings) carry more load than those further away. A torsion-free design is necessary for H lifting beams with asymmetric loads! Please consult the manufacturer.
Use only the load lifting points provided. Any oblique tension on the load side is prohibited. The spacing between the suspension points of adjustable lifting beams may not be changed during lifting.
The permissible load per suspension point must be observed in the case of several suspension points (e.g. on lifting beams for transporting flexible rods). These lifting beams are normally unable to carry all of the load just on the outer load lifting points. Refer to the data sheet or the drawing for permissible loads per suspension point.

With **lifting beams with a suspension assembly that can be shortened** (using chain shorteners, for instance), the slings can be arranged such that the crane hook eye is positioned off the geometric centre and thus above a centre of gravity of the load which is asymmetrical. Ensure in this case that the suspension points closest to the crane hook (and therefore also the attached slings) carry more load than those further away.

Spreader beams and spreader frames are stressed mainly in compression, not bending, and they are therefore designed for static loads. It is strictly prohibited to fit additional suspension points to the beam or to use load lifting points other than those provided.
With adjustable lifting beam suspension, ensure that the max. permissible slinging angle is not exceeded, even at maximum working length. It is therefore prohibited to bore additional holes to change the adjustment range or to shorten the suspension slings (for a lower clear height, for instance).
Low profile lifting beams or lifting beams with adjustable crane hook suspension points may hang on the crane hook highly unstable and/or skew when not under load. This requires particularly alert crane operators.

Lifting beams for forklifts extend the range of applications for forklifts and may change the basic balance conditions. You should therefore check if the forklift is suited for the transport required before use.

The LLA must be **secured against slipping off** again after the forklift forks have engaged in the pockets on the LLA. This is normally achieved using a chain which is wrapped around the mast and which can be shortened to fit tightly, or using locking levers pressing against the forklift forks. Ensure, in this case, that the pin presses fully against the fork and tighten the locking handle.

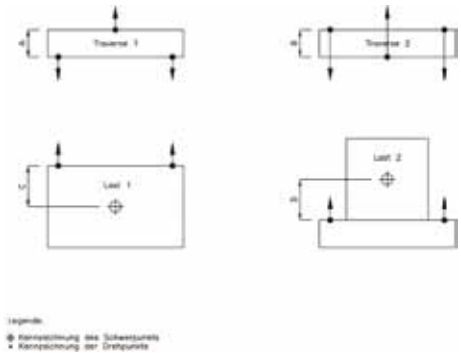
Position the LLA above the centre of gravity of the load and rig using suitable slings. Lift carefully and check level suspension.

Always drive slowly when moving loads with the forklift! Bear in mind the balancing conditions and the forces arising when braking and negotiating uneven floors.

Observe the load diagram of the forklift.

Never exceed the individual lifting capacity of the suspension points!
Lifting beams may only be used with vertically hanging slings!

Stability height of load lifting attachments and load



Be particularly cautious if the centre of gravity of the load lies higher than the load hitching point:

The load lifting attachment has a “rigid height”. This is the dimension from the seat on the crane hook to the next pivoting point above or below (e.g. the shackle bolt for attaching the load). The load similarly has such a rigid height. This is the distance between the suspension point of the sling to the centre of gravity of the load. The stability height of the combination lifting beam and load must be positive.

Lifting beam 1 has a positive stability height, lifting beam 2 has a negative stability height.
Load 1 has a positive stability height, load 2 has a negative stability height.
Although only the two-dimensional case is shown, the principle may be applied to all horizontal axes of rotation. The result of the combinations is as follows:

Lifting beam 1 + Load 1: is always stable.
Lifting beam 1 + Load 2: is stable if A>D.
Lifting beam 2 + Load 1: is stable if C>B.
Lifting beam 2 + Load 2: is always unstable.

Coil hooks

Detachable load lifting apparatus for lifting and horizontal transport of loads in accordance with its technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Coil hooks are permitted only to transport objects with their centre of gravity below the supporting fork during transport. They are available with or without counterweight, with or without safety nose and with a full or ¾ tine.

A **counterweight** facilitates horizontal orientation of the **empty** hook to facilitate its positioning. Preferably use **coil hooks without counterweights** only for low lifting capacities and short tine lengths, since these LLAs are light-weight and can easily be balanced by hand.

A safety nose prevents the load from slipping in case of improper use or if the load starts swinging. Certex recommends using safety noses. Not using a safety nose should be considered only under special circumstances.

¾ tines are used in confined spaces or if highly diverse coil widths are to be transported with the same coil hook. Ensure in this case that the tine length is at least 0.75 times the coil width. Coil hooks with ¾ tines are designed without a safety nose.

The centre of gravity of the load must always lie below the crane hook attachment point, offset slightly towards the back of the hook. This ensures that the tip of the coil hook tine is tilted slightly upward (at least 5°). This is permissible in order to secure the load.

Transporting coils with the centre of gravity in front of the suspension point (towards the tip of the tine) tips the tine downward and is always prohibited (even with a safety nose).

Transporting coils with the centre of gravity far behind the suspension point (towards the back of the hook) is safe, since the load is supported by the back of the C hook.

Ensure that a tine tip projecting from the coil does not get hooked on other objects.

Narrow, unsecured slit strips pose a hazard since they might topple from the tine in transport. Check in each case whether transporting is permissible. For a solution, a coil hook may be fitted with a load securing device.

Coil tipping devices are suitable for turning coils and slit strips from the vertical to the horizontal coil axis position. The following should be noted in addition when working with a coil tipping device:

- Turning is dangerous and particular caution must be exercised.
- Turning from vertical to horizontal (putting down) is not permitted.
- The width of the coil or strip must be at least half the length of the tine!
- The nose of the tipping hook must remain fully in contact during the entire turning exercise.
- The tipping hook must remain in contact both horizontally and vertically during turning.

Loading forks

Designated use
Detachable load lifting apparatus for lifting and horizontal transport of loads in accordance with its technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

The **centre of gravity** must be considered in all types of loading forks!
The distance of the centre of gravity of the load to the back of the loading fork must be small enough to allow the fork tips to point **at least 5° upward from horizontal** when under load. Although handling might be complicated if the centre of gravity of the load is located nearer to the back of the loading forks, safety remains assured. The load must rest securely on the forks and be secured against sliding off sideways. Provided the load is secured, the loading fork may also be used with horizontal forks.

Loading forks with a counterweight have a **fixed crane hook attachment.** If possible, the centre of gravity of the load should be positioned below this suspension point and offset slightly to the back.

Loading forks with adjustable suspension points have an **adjustable crane hook attachment.** The suspension point may, within limits, be positioned above the centre of gravity of the load and offset slightly to the front.

Loading forks with automatic compensation for own weight have a self-adjusting crane hook suspension point. When not under load, spring tension pushes the crane hook eye back and over the centre of gravity of the loading fork, for the loading fork forks to hang horizontal. Under load, the spring tension is overcome and the suspension point moves forward up to a stop. The suspension point can therefore only assume positions "A" (back) or "B" (front). The designation "automatic weight compensation" is misleading in the sense that the suspension point does not automatically come to rest above the centre of gravity of the load but only changes end stops. The position of the centre of gravity of the load is thus fixed by design and it is necessary here also for the forks to point slightly upwards under load.
Note in particular that loading forks with automatic weight compensation need a **minimum load for suspension point transition!** Unless specified otherwise, this minimum load to move the suspension point forward is about **20%** of the lifting capacity.

Adjustable forks may only be adjusted symmetrical to the centre. Forks and **loading height adjustments** must be secured again with bolts with cotters after adjustment.

Do not lift damaged pallets. Only work close to the floor. The load must be additionally secured with a net or cage when working with loading forks at greater height or on building sites.

Grabs

Designated use
Detachable load lifting apparatus for lifting and horizontal transport of loads in accordance with its technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

a) Positive fitting grabs
Positive fitting grabs hold the load around its sides or under it. The load must be dimensionally stable to withstand the pressure of the grabbing jaws. Especially when using grabs, the load must always hang horizontally. Long loads may therefore not be lifted with only one grab, since they may swing and potentially slide out of the grab.
Grabs are designed with several points of hinging. Keep your hands away from these hinged points during operation – always only use the handles. If there are no handles, handle the grab as near to the top of the suspension point as possible.
To prevent uncontrolled closing of the grab, always set down and fully relieve the grab from its load, then unlatch the catch hook. The **spindle grab,** which can be closed when suspended above the load and therefore has no device for holding it open, is the exception. After locking and before lifting, check for positive fitting contact between grab and load.

The manufacturer's specification of gripping width must be complied with in terms of minimum and maximum size. Manufacturing tolerances and elastic deformations of the grab have been taken into account.

Never use a positive fitting grab as a friction locking grab!

b) Friction locking grabs
The following must also be observed i.r.o. friction locking grabs:

Friction locking grabs may only be used for workpieces with vertical surfaces on which the grab's friction pad can fully engage. The safety factor to prevent the load from slipping must be 2. Adequately secure gripping force is a function of jaw pressure and the coefficient of friction between grab jaws and workpiece. Note that the security of the grip depends only on the friction value and the grab position, not the weight of the load. A scissor grab in this respect exerts higher closing pressure on a workpiece when the jaws are open wider than with its jaws more closed. It is thus possible that a large, heavy workpiece is held securely whilst a small, light workpiece may "slip out". Unless specified otherwise, we assume a friction coefficient between materials of □ = 0.5.

The gripped object must be **dimensionally stable.** The friction coefficient specified by the manufacturer is the minimum permissible. The workpiece surface and the grab jaws must be checked for moisture, oil dust, etc., which reduce friction.

Especially when working with friction locking grabs, ensure that the load does not swing or collide during lifting and transport.

Turning grabs
Turning grabs come as positive fitting or friction locking designs. The **centre of gravity of the load** must be on the axis of rotation to avoid large restoring forces! These may cause the load to topple and drop, which may result in the permissible stress on the grab being exceeded. Note, in particular, that the centre of gravity changes as a **container is emptied**. A serious risk of injury exists!

If the centre of gravity of the handled load is not on the axis of rotation, then a turning grab with dampening gears must be used.

Jib for forklifts

Designated use
Detachable load lifting apparatus for lifting and horizontal transport of loads in accordance with its technical specifications and conditions of use. This also includes compliance with the manufacturer's instructions governing first use, operation, maintenance and testing. Any other use, especially lifting of persons, lifting of loads over persons, exceeding the specified lifting capacity and operation by untrained staff is deemed improper.

Jibs extend the range of application of forklifts. Loads may be lifted and dropped off again at larger distances and also at greater heights. This inevitably changes the **balance conditions of the forklift.** Before using a forklift boom, therefore, check if the forklift is suited for the required task. It may, for instance, be necessary to use a 3 ton forklift to safely transport a 500 kg load.

The LLA must **absolutely be secured against slipping out** after the forklift forks have been inserted in the LLA pockets. This is normally achieved using a chain which is wrapped around the mast and which can be shortened to fit tightly, or using locking levers pressing against the forklift forks. Ensure, in this case, that the pin presses fully against the fork and tighten the locking handle well.

Position the lifting hook above the centre of gravity of the load and rig the load using suitable slings to prevent uncontrolled side-ways sliding when lifting. Lift carefully and check level suspension.

Always drive slowly when moving loads with the forklift! Bear in mind the balancing conditions and the forces arising when braking and negotiating uneven floors.

Observe the load diagram on the forklift jib

Assembly Instructions Pursuant to EC-RL 2006/42/EC Annex VI

The following must be taken into account when assembling machine parts or load bearing devices with the purpose of assembling these parts and other components to create a complete machine, without endangering the safety and health of persons:

Assembly work, installation and commissioning of powered machines may only be carried out by qualified and authorised persons.

Assembly tasks must be performed professionally in compliance with relevant codes of practice.

The following must be properly performed prior to assembly:
- Read associated documentation carefully
- Exclude hazards due to, for instance:
  - Environmental impact
  - Electrical power
  - Moving parts
  - Falling when working at heights
  - Actuation of control devices
  - Assuring that the complete machine and all its individual components are capable of handling the forces arising

During assembly
- Wear protective equipment
- Use only suitable tools
- Ensure stable positioning of the machine
- Do not exceed the machine’s load-bearing capacity
- Take applicable safety factors into account
- Ensure adequate stability under all operating conditions, also in transport and when dismantling
- Avoid additional stress due to tensile or shearing forces or pressure
- Use prescribed torques
- If bolts and nuts are used, at least 3 turns of the thread should protrude from the nut

Welding required during assembly may only be carried out on incomplete machines or load-bearing equipment designated for that purpose, if:
- the relevant welding instructions are at hand and complied with
- the work is performed and checked by suitably trained specialised staff

Threaded sling attachment points may only be stressed at rated capacity if the entire threaded length is screwed into suitably strong material.

Linked sling elements must move freely.

When releasing the ends of wire ropes wound on reels or coiled, these ends may recoil and cause injuries or damage. Appropriate measures must be taken before releasing to avoid recoil.

After assembly
- Incomplete machines and load-bearing devices may only be used as designated, even after assembly.