Instructions for installation and use

LIFTING SOCKETS

Friedrich Schroeder GmbH & Co. KG

Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

Instructions for installation and use / Lifting sockets

1. General

These instructions for installation and use contain basic information for the design and use of Schroeder lifting socket systems. Data sheets for the individual lifting sockets are also included.

1.1 Usage

Lifting sockets and lifting socket systems are used for lifting, transporting and positioning precast concrete elements. Those elements are generally made from normal-weight concrete using cement as the binder and have an oven-dry density of between 2000 and 2600 kg/m^3. The use of other types of concrete is not ruled out; however, they are not covered by these instructions for installation and use. For lifting from the casting table, the concrete should have a minimum strength of $f_{c,k}$ = 15 N/mm^2.

A lifting socket system consists of the lifting socket itself and the associated lifting accessory. Lifting sockets are normally positioned in the mould prior to concreting, where they are cast in and remain permanently in the concrete element. Once in place, they serve as a point for attaching lifting tackle and have no other function. Only the lifting sockets and lifting accessories from Schroeder – Neuenrade may be used together. Mixing the systems of different manufacturers is not permitted.

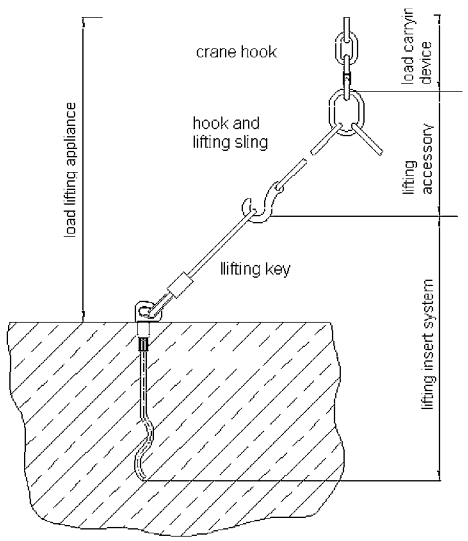


Fig. 1 Definitions: lifting socket, lifting accessory and lifting tackle

As a rule, lifting sockets are used within one transport chain from the casting to the erection of a precast concrete element.
Although the lifting sockets are used more than once in this chain, this is regarded as a one-off use and hence an application in accordance with the intended purpose of the sockets.

If a lifting socket is to be used over a longer period of time, e.g. for later dismantling, or has a permanent function within the structure, then this must be considered at the design stage.

1.2 Technical regulations

Lifting sockets and lifting socket systems, as integral load components, fall under the remit of the European Machinery Directive 2006/42/EC.
As that directive does not specifically refer to concrete elements, VDI/BV-BS Guideline 6205 (Lifting inserts and lifting insert systems for precast concrete elements – Principles, design, applications) is also taken into account.
This guideline was drawn up with the help of Schroeder – Neuenrade. Schroeder lifting sockets comply with the guideline.

The relevant safety regulations of the German employers' liability insurance association for the building industry must be adhered to, especially BGR 500 "Use of lifting accessories".

2. Schroeder lifting socket systems

Schroeder – Neuenrade supplies a multitude of different lifting sockets for different purposes and element dimensions plus the necessary accessories for erection and lifting.

2.1 Threaded lifting sockets

Threaded socket pressed on steel rebar, List 31:

Straight bar | Long wavy-tail bar | Short wavy-tail bar

Fig. 2 List 31

The "straight" and "long wavy tail" versions are suitable for use in walls in the plane of the wall. Compared with the products of its competitors, the Schroeder "long wavy tail" has a much longer anchorage length. Therefore, in narrow walls in particular, e.g. precast concrete garages, it can carry very high axial and inclined pull loads. In thicker walls it is often more economic to use the "short wavy tail" version.

These anchors are also available in heavy-duty versions for use in higher-strength concretes or bulky elements.

Threaded sockets in stainless steel with friction-welded steel rebar

The technically sophisticated solution:

– no bare steel at the base of the socket
– no further corrosion protection measures required
– friction welding is an established means of jointing for engineered structures
– with metric thread
– a **true stainless steel fitting**

Fig. 3

Threaded socket with hole at bottom

Fig. 4
List 30

Fig. 5
List 32 / List 33

A steel reinforcing bar is passed through the hole to anchor the socket. Owing to the flexible anchorage options, these sockets can be used in the most diverse components – walls, slabs, panels, pipes, etc.

Sockets with plates and bolts

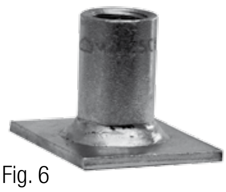


Fig. 6
List 35

Fig. 7
List 38 with end plate

Fig. 8
List 38 without end plate

Owing to their relatively small depth, these sockets are ideal for fitting in slab-type elements perpendicular to the plane of the element.
The end plate increases the anchorage effect.

Schroeder lifting sockets are available with Rd and M threads. To distinguish the threads, M threads have a yellow chromate coating, Rd threads a blue chromate coating. In order that the threads can still be used in the dirty conditions of building sites, they are cut 0.1 mm oversize.

2.2 Lifting socket designations

The threaded sockets are marked with the manufacturer's symbol (the Schroeder "house"), the type of thread (M or Rd), the thread size, the load group and the CE marking. According to the European Machinery Directive, lifting sockets must be marked with their load-carrying capacity. However, this is only sensible when the concrete element and the lifting procedures are taken into account. By specifying the load group, the user can read off the permissible loads under certain conditions in the data sheets of the various lifting sockets.

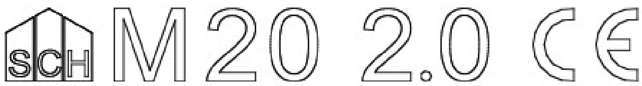


Fig. 9 Information stamped on socket

Coloured tags are available for distinguishing the sockets once they are cast in.

Colour	Thread	Load group	Colour	Thread	Load group
pale yellow	M/Rd 10	0.4	black	M/Rd 24	2.5
orange	M/Rd 12	0.5	light blue	M/Rd 27	3.0
white	M/Rd 14	0.8	green	M/Rd 30	4.0
red	M/Rd 16	1.2	beige	M/Rd 36	6.3
pink	Rd 18	1.6	grey	M/Rd 42	8.0
light green	M/Rd 20	2.0	yellow	M/Rd 52	12.5

Tab. 1 Colour coding

2.3 Lifting accessories – lifting loops for threaded sockets

Fig. 10
GOLIATH lifting loop, List 40.0

Fig. 11
ALPHA lifting loop, List 41

Fig. 12
Lifting loop with crimped threaded spigot, List 42

Fig. 13
Lifting loop for attaching with bolt

The choice of a suitable lifting loop has a significant effect on the load that can be carried by a lifting socket system – permissible load and direction of load. The lifting loop with pressed ferrule, List 42, is only suitable for axial and inclined pull ≤ 45°. The ALPHA (List 41) and GOLIATH (Lists 40.0 and 40.8) lifting loops can be used for axial, inclined and 90° pull.

In the case of inclined pull, the GOLIATH lifting loop has a smaller lever arm compared with the lifting loop with pressed ferrule, List 42. In the case of the ALPHA lifting loop, the design of the forged head means that the lever arm is irrelevant up to an inclined pull ≤ 45°.

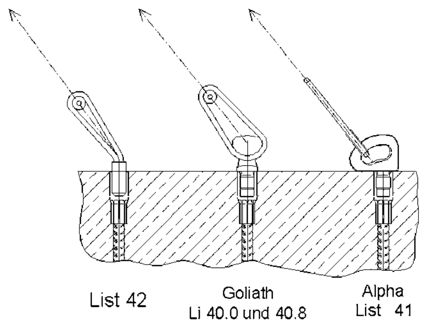


Fig. 14 Lifting loops subjected to inclined pull

Lifting loops must be regarded as wear parts and checked regularly for rope wear (see chapter 6).

2.4 Lifting loop designations

The lifting loops must be marked with the manufacturer's symbol (the Schroeder "house"), the type of thread (M or Rd), the thread size, the permissible load group with a safety factor of 4, a consecutive number and the CE marking.

2.5 Cast-in lifting loops

Cast-in lifting loops are suitable for precast concrete elements in which the side to which lifting tackle is attached is no longer visible in the finished structure and the protruding lifting loops have no adverse effect on the element.

Fig. 15 Cast-in lifting loop, List 36

2.6 Double-wall anchors

Instructions for the installation and use of double-wall anchors can be found in a separate publication.

2.7 Spherical head anchors

Please consult the relevant data sheet for information on spherical head anchors, eyebolts, connection loops and recess formers.

2.8 Miscellaneous, accessories

- Fixing plates in the form of nailing, adhesive or magnetic plates for fixing lifting sockets to the mould, breakpins
- Concrete sealing discs for covering recesses for the above fixing plates
- Seal caps – with and without threads – to prevent concrete entering the socket

2.9 Materials, corrosion protection

Threaded sockets

- Steel tube for precision applications to DIN EN 10305 made from E355+N
- Mild steel or electrogalvanised versions
- Stainless steel to approval Z-30.3-6 (22 April 2014), grades 1.4401, 1.4404 and 1.4571

Lifting loops and cast-in lifting loops

- unalloyed steel wire, $f_{c,k}$ ≥ 1960 N/mm^2
- galvanised
- DIN EN 12385-4: Steel wire ropes – Safety – Part 4: Stranded ropes for general lifting applications
- DIN EN 13411-3: Terminations for steel wire ropes – Safety – Part 3: Ferrules and ferrule-securing

GOLIATH and ALPHA forged heads

- steel 42CrMo4
- quenched and tempered

2.10 GS safety mark

Lifting sockets of Lists 30 and 31 are marked with the GS safety mark of the German employers' liability insurance association for the building industry. Owing to the need to consider potential misuse, reduced load-carrying capacities apply when using lifting sockets according to GS conditions.

Fig. 16 GS safety mark

2.11 Declaration of conformity

Declarations of conformity based on European Machinery Directive 2006/42/EC are available from us for Schroeder lifting socket systems. The products are marked with the CE marking.

2.12 Quality management system and factory production control

- QA system accredited to to DIN ISO 9001:2008
- Monitored and approved stationary testing machine up to 1000 kN tensile force
- Monitored and approved mobile testing machines up to 300 kN tensile force
- Factory production control to DIN EN 1090 – up to execution class EXC4

3. Applications for lifting sockets – storage, installation, lifting, transporting and positioning

3.1 Storage

All lifting sockets must be stored protected from the weather and protected against the effects of aggressive media. They must be stored adequately protected against traffic and in such a way that they present no hazards to persons or vehicles.

3.2 Inspection prior to installation

Prior to being cast in, lifting sockets must be inspected for obvious damage. Damaged sockets may not be used.

Soiling (mud, oil, fat, rust, etc.) that could impair the load-carrying capacity of the socket must be removed. To protect the thread, every socket must be closed off with a seal cap that may only be removed shortly before using the anchor. If sockets are held in position with fixing plates, then the thread must be adequately protected. Seal caps should then be fitted after removing the fixing plates.

If subsequent work is performed on any lifting sockets (e.g. welding, hot-dip galvanising, etc.) without consulting us and without our consent, or if any sockets are not used for their intended purpose, then our warranty shall be void, the declaration of conformity invalid, the corresponding load tables no longer applicable and the user becomes the manufacturer of the product. Lifting sockets may only be installed by suitably trained personnel.

3.3 Installation conditions

Installation

Lifting sockets are generally installed in the mould prior to concreting. Adhesive, magnetic and nailing plates plus plastic breakpins are available for fixing the lifting sockets. Lifting sockets can also be attached to the reinforcement, e.g. with tying wire, but not by means of welding. In exceptional cases, a lifting socket can be pressed into the wet concrete:

- To do this, the concrete must have a sufficiently fluid consistency and must be compacted after pressing in the socket so that an adequate bond is guaranteed.
- No additional or anchorage reinforcement is required. Lifting sockets may only be installed by suitably trained personnel.

Edge distances, centre-to-centre spacings, element thicknesses

Edge distances, centre-to-centre spacings and the form of the element are crucial for the load-carrying capacity of an anchorage. The permissible loads for certain installation situations are given on the data sheets for the individual lifting sockets. The installation dimensions given on those sheets are to be understood as minimum dimensions for exploiting the given permissible loads to the full and can be larger or smaller. Following consultation with us, the permissible loads can be increased or decreased in accordance with engineering principles depending on the particular case. It should be pointed out here that the edge distances and element thicknesses may depend on the concrete cover required.

Minimum reinforcement

The permissible loads were determined with the sockets cast into concrete elements without the structural reinforcement required. Slab-type elements require two layers of B500A Q 188 mesh as structural reinforcement.

Additional reinforcement

The additional reinforcement given on the data sheets for inclined and 90° pull must be installed. The additional reinforcement must press against the socket at the middle of the bend.

Thread [M/Rd]	Additional reinforcement, B500B		
	90° pull stirrup, bent up at 60°		
	d_s	D_{min}	L
	[mm]		
12	8	32	95
14	8	32	125
16	8	32	130
18	10	40	140
20	10	40	170
24	10	40	185
30	14	56	195
36	14	56	200
42	20	140	215
52	20	140	220

Tab. 2 Additional reinforcement for 90° pull – List 31

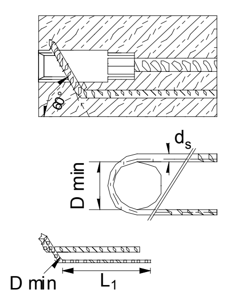


Fig. 17 Additional reinforcement for 90° pull – example, List 31

Thread [M/Rd]	Additional reinforcement, B500B		
	Inclined pull stirrup, straight		
	d_s	D_{min}	L
	[mm]		
12	8	32	130
14	8	32	160
16	8	32	170
18	10	40	185
20	10	40	220
24	10	40	240
30	14	56	265
36	14	56	285
42	20	140	350
52	20	140	370

Tab. 3 Additional reinforcement for inclined pull – List 31

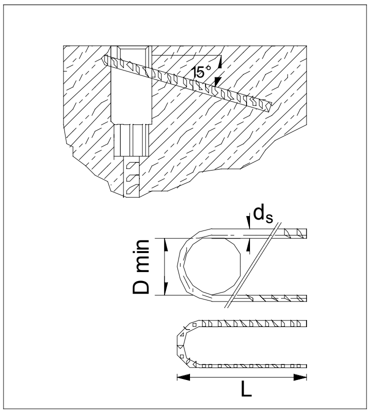


Fig. 18 Additional reinforcement for inclined pull – example, List 31

Installation position relative to centre of gravity

In order to exploit the sockets to the full, they should be installed symmetrically about the centre of gravity. If the concrete element is then lifted with the help of an equalising sling or spreader beam, the loads on the sockets are equal. With the sockets arranged asymmetrically, the concrete element will twist upon lifting, even when using an equalising sling or spreader beam.

Different stress levels develop in the concrete element during the transporting procedure depending on the positions of the sockets.

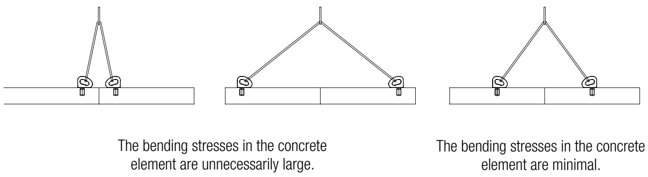


Fig. 19 Possible locations for lifting sockets

3.4 Lifting, transporting and positioning

The lifting sockets, concrete element and lifting gear must be inspected for visible damage prior to lifting. If there are any doubts with respect to the load-carrying capacity of an element or anchorage, then such elements may not be lifted in the way originally intended.

Sockets may be used to carry the full permissible loads given on the data sheets down to a temperature of -20°C. Slings and hooks may only be attached to the concrete element by suitably trained personnel.

Only the appropriate lifting accessories and lifting loops may be used. When using threaded sockets, the lifting loops must be fully screwed in and afterwards may not be unscrewed more than a half turn to match the loading direction. If necessary, the thread should be cleaned prior to screwing in the loop.

The manufacturer of the precast concrete element must provide instructions for transport and erection which explain the conditions for lifting, transporting and positioning the element. These instructions must be handed to the haulage contractor and the building site.

Definition of loading directions, transport positions

We normally distinguish between four different loading directions:

1. **Axial pull F_V**:
   Acts in the direction of the longitudinal axis of the lifting socket.

2. **Inclined pull F_S**:
   Simultaneous loading by an axial pull and a 90° pull which acts at an angle to the longitudinal axis of the lifting socket in the plane of the element.

3. **90° pull perpendicular to plane of element F_Q**:
   A load or load component parallel with the surface of the element and perpendicular to the plane of the element.

4. **Angled 90° pull $F_{Q,S}$**:
   A load or load component perpendicular to the longitudinal axis of the socket, at an angle to the plane of the component and parallel with the surface of the component.
   This load occurs, for example, when lifting a concrete element from the horizontal position without a spreader beam.
   Only half the weight of the wall applies here;
   $_{perm} F_{Q,S} = {}_{perm} F_Q$.

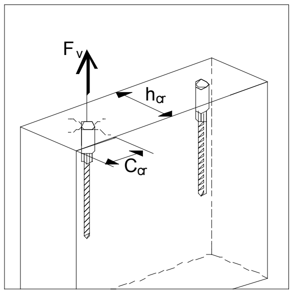


Fig. 20 Axial pull F_V

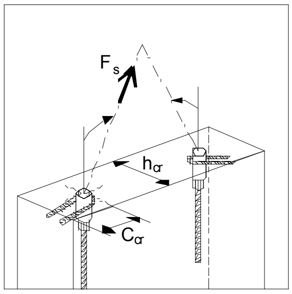


Fig. 21 Inclined pull F_S

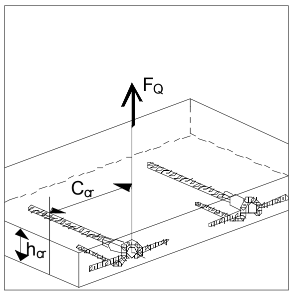


Fig. 22 90° pull F_Q perpendicular

Statically determinate and indeterminate suspension arrangements

Only in a statically determinate system can every lifting point be used to carry the load. A suspension arrangement is statically determinate when the load at every single lifting point can be determined unambiguously. One- and two-point suspensions are always statically determinate.

Three-point suspensions in which all three points lie in a straight line are only statically determinate when using an equalising sling. If an equalising sling is not used, the designer must assume that only one lifting socket carries the whole load. If three-point suspensions are used to transport slab-type elements and the three lifting points do not lie in a straight line,

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

then the suspension is statically determinate even without the use of an equalising sling and all three lifting sockets can be considered in the design.

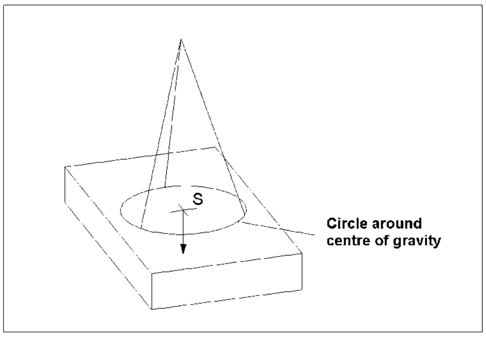


Fig. 23 Statically determinate three-point suspension:
The anchors must be arranged symmetrically about the centre of gravity so that each socket carries an equal load and the slab can be lifted without twisting.

Four-point suspensions are only statically determinate with an equalising sling/spreader beam. If slab-type elements are transported with a four-point suspension but without an equalising sling/spreader beam, then the concrete element will wobble during lifting and only two sockets will be carrying the load. Introducing an equalising sling/spreader beam makes the system statically determinate and all four sockets will carry the load.

Statically determinate four-point suspensions with an equalising sling/ spreader beam where all four sockets carry the load

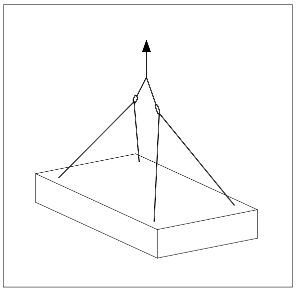


Fig. 24 Lifting sling with equalising fittings

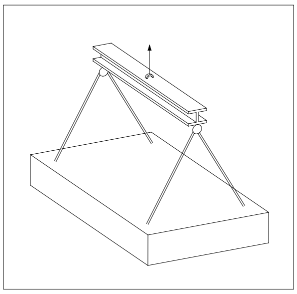


Fig. 25 Lifting sling with spreader beam

Statically indeterminate suspensions where only two sockets carry the load

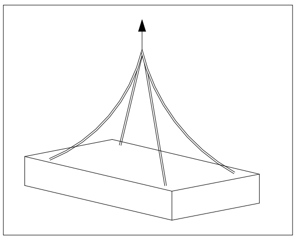


Fig. 26 Lifting sling without equalising fittings

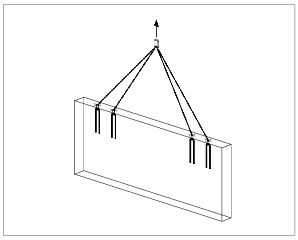


Fig. 27 Lifting sling without equalising fittings

4. Design of lifting sockets

4.1 Explanation of failure mechanisms

Lifting sockets for concrete components must be designed with sufficient safety against failure of the steel and concrete. Owing to the comparatively low strength of the concrete upon striking the mould, the analysis of concrete failure is frequently critical.

Examples of concrete failure under axial pull

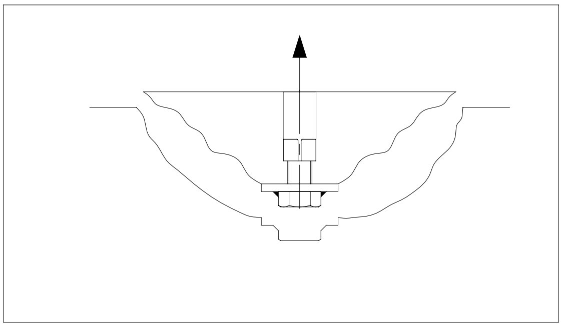


Fig. 28 Concrete breakout

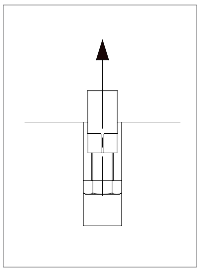


Fig. 29 Pull-out

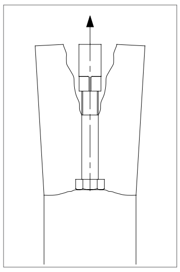


Fig. 30 Splitting

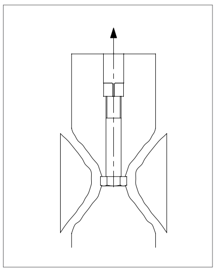


Fig. 31 Local concrete breakout (blow-out)

Examples of concrete failure under 90° pull

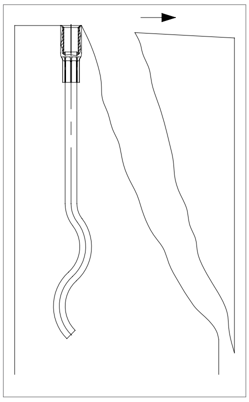


Fig. 32 Concrete edge failure

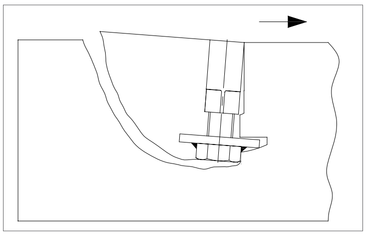


Fig. 33 Reverse concrete edge failure

Examples of steel failure

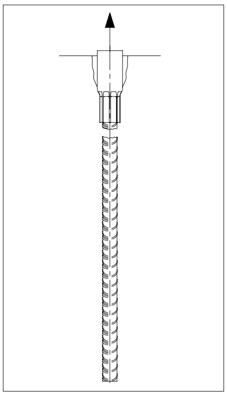


Fig. 34
Tension failure

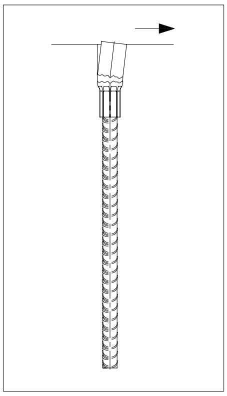


Fig. 35
Shear failure

4.2 Analyses and safety concept
A global safety factor should be applied when checking lifting sockets and lifting socket systems. It is important to verify that the applied loads E do not exceed the permissible resistances R_{perm} (permissible loads). This analysis must include all possible actions, loading directions, failure modes and foreseeable misuse.

To comply with the GS safety mark conditions of the German employers' liability insurance association for the building industry, foreseeable misuse must always be considered, but with a reduced safety factor $\gamma = 2.0$ on the resistance side, e.g. 90° pull when raising a panel. This means that the permissible loads a lifting socket can carry are considerably reduced.

According to VDI/BV-BS Guideline 6205 (Lifting inserts and lifting insert systems for precast concrete elements), foreseeable misuse does not have to be considered in the design if such misuse can be ruled out through adequate supervision or technical facilities based on the transport and erection instructions of the concrete element manufacturer.

We recommend using VDI/BV-BS Guideline 6205.

4.3 Actions
As a rule, the following actions must be considered when designing lifting sockets. Circumstances specific to the particular application must be assessed and considered on the basis of engineering principles.

Self-weight of concrete element:
This depends on the dimensions of the element and the density of the concrete.

$\mathbf{F_G = V \times \rho}$

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

Mould adhesion and friction:
The adhesion of the mould upon lifting the element essentially depends on the surface characteristics of the mould.
The following figures can be taken as a guide (see VDI/BV-BS 6205):

	q_{adh} [kN/m^2]
Steel mould with release oil	1
Painted timber mould	2
Rough timber mould	3

Tab. 4 Mould adhesion

Moulds with surface textures require special consideration.

Note: According to VDI/BV-BS 6205 – Part 3 – 6.5.1.3, the values in the table are only valid when suitable measures are taken to reduce the adhesion of the mould, e.g. casting on tilting tables or operating vibration equipment during striking.

If there are any doubts about the global figures given in Tab. 4, tests might need to be carried out to establish the mould adhesion.

The load is calculated with

$\mathbf{F_{adh} = q_{adh} \times A_f}$

F_{adh} [kN] = load due to mould adhesion
q_{adh} [kN/m^2] = basic mould adhesion figure
A_f [m^2] = area of contact between concrete element and mould

Dynamic loads – dynamic factor
Different dynamic factors apply depending on the transport and lifting gear and these must be considered in the design.

The following dynamic factors must be taken into account:

Lifting and transporting	Dynamic factor ψ_{dyn}
Tower crane, gantry crane, mobile crane	1.3 – 1.7
Lifting and transporting on even surfaces	2 – 3
Lifting and transporting on uneven surfaces	> 4

Tab. 5 Dynamic factor ψ_{dyn}

The load to be lifted must be multiplied by the dynamic factor.

Increase in rope tension under inclined pull
As the angle β increases, so the resultant force acting on the lifting socket, lifting accessory and lifting tackle also increases.

The following applies:
$\mathbf{F_S = F_V \times z = F_V \times 1/\cos \beta}$

Inclined pull angle β	Inclined pull factor z
0°	1.00
15°	1.04
30°	1.15
45°	1.41

Tab. 6 Increase in load due to inclined pull

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

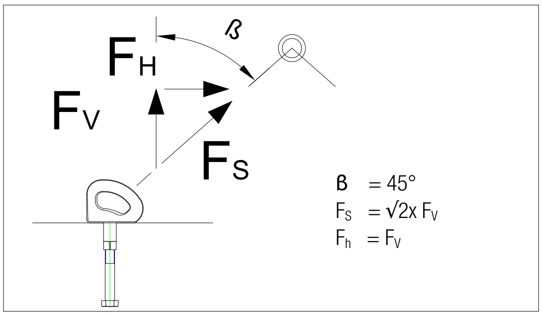


Fig. 36 Rope tension under inclined pull

4.4 Resistances

The permissible loads/resistances of the various lifting sockets are given in the associated data sheets. These are generally based on tests carried out on cast-in sockets.

The permissible loads are assigned to specific installation situations (edge distances, centre-to-centre spacings, element dimensions, concrete strengths) and loading directions. If an application does not match the boundary conditions of the tables, it must first be assessed in detail according to engineering principles. The permissible loads can often be derived from the figures in the tables. Permissible loads must be reduced in the case of less favourable installation situations, but can be increased for more favourable situations. A less favourable installation situation is one with smaller edge distances, centre-to-centre spacings and element dimensions as well as a lower concrete strength. If permissible loads for the particular application cannot be derived from the tables, then it is possible to determine the permissible loads through calculations or by performing appropriate tests.

Just ask us – we'd be delighted to help you.

According to VDI/BV-BS Guideline 6205, method B, the permissible loads on lifting sockets have a factor of safety
$\gamma_{conc} = 2.5$ against concrete failure and $\gamma_{steel} = 3.0$ against steel failure.

Where the lifting sockets used are not subjected to factory production control and constant monitoring, then $\gamma_{conc} = 3.0$ applies. In this case the permissible loads on the data sheets must be multiplied by the factor 0.84.

Details can be found on the data sheets for the lifting sockets.
Lifting loops have a factor of safety
$\gamma_{steel} = 4.0$ against steel failure.

4.5 Examples of applications

4.5.1 Lifting a slab-type element cast horizontally out of the mould – lifting sockets in plane of slab

Depending on the circumstances during striking, load case 1, which takes into account the mould adhesion, or load case 2, which considers the hoisting load factor, will be critical. The larger of the two load cases applies; considering both load components together is not necessary. Sockets perpendicular to plane of element (Figs. 24 and 25).

Load case 1 $E_1 = (F_G + F_{adh}) \times z/n \leq {}_{perm}F_S$ or ${}_{perm}F_V$
Load case 2 $E_2 = (F_G \times \psi_{dyn}) \times z/n \leq {}_{perm}F_S$ or ${}_{perm}F_V$

F_G = self-weight of concrete element
F_{adh} = load due to mould adhesion
E = load per socket
z = inclined pull factor
n = number of loadbearing sockets
ψ_{dyn} = dynamic factor

4.5.2 Lifting a slab-type element cast horizontally out of the mould – lifting sockets in end face

As one edge of the concrete element is still in contact with the mould during lifting, only half the load needs to be considered. Depending on the circumstances during striking, load case 1, which takes into account the mould adhesion, or load case 2, which considers the hoisting load factor, will be critical. The larger of the two load cases applies; considering both load components together is not necessary. Sockets in end face of element (Fig. 22).

Load case 1 $E_1 = (0.5 \times F_G + F_{adh})\ n \leq {}_{perm}F_Q$
Load case 2 $E_2 = (0.5 \times F_G \times \psi_{dyn})\ n \leq {}_{perm}F_Q$

F_G = self-weight of concrete element
F_{adh} = load due to mould adhesion
E = load per socket
z = inclined pull factor
n = number of loadbearing sockets
ψ_{dyn} = dynamic factor

Upon raising the element, the result is, initially, a 90° pull (see Fig. 22) or angled 90° pull load perpendicular to the axis of the socket.

The loading direction changes to an axial pull (Fig. 20) as the slab-type element is raised further.

4.5.3 Transporting a wall under inclined pull

The self-weight of the wall, the inclined pull factor and the hoisting load factor must be considered (Fig. 1).

E $= F_G \times z \times \psi_{dyn} /n \leq {}_{perm}F_s$

F_G = self-weight of concrete element
E = load per socket
z = inclined pull factor
n = number of loadbearing sockets
ψ_{dyn} = dynamic factor

4.5.4 Transporting a wall under axial pull

The self-weight of the wall and the hoisting load factor must be considered.
E $= F_G \times \psi_{dyn}/n \leq {}_{perm}F_V$

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

5. Risks and misuse

Despite the high level of safety that applies to the production and design of our lifting sockets, misuse of the sockets or mistakes by users can lead to failures that can result in serious injuries and/or economic losses.

A number of potential misuses and mistakes are listed in the table below. This list does not claim to be exhaustive.

Risks	Preventive measures
Installing damaged lifting sockets in a concrete structure	Visual inspection prior to installation
Overloading lifting sockets during production because actions were not considered or not considered adequately or resistances were overestimated, e.g. wrong concrete strength, wrong mould adhesion, wrong hoisting load factor, wrong loading direction, lack of additional reinforcement, incorrect installation	Agreement between designer and manufacturer of precast concrete element, factory production control, training of personnel in precasting works
Overloading lifting sockets during transport and erection because actions were not considered or not considered adequately or resistances were overestimated, e.g. wrong concrete strength, wrong hoisting load factor, wrong loading direction, lack of additional reinforcement	Instructions for transporting and erecting the precast concrete element must be handed to haulage contractor and building site, trained personnel, site supervision
Mechanical risks to personnel when attaching ropes and slings, transporting and positioning a precast concrete element	Personal protective equipment, training of personnel
Use of damaged or worn wire rope loops	Visual inspection, rope wear (see chapter 6)
Lifting loops not fully screwed in	Training of personnel
Wrong lifting loop, e.g. loop with pressed ferrule, List 42, instead of ALPHA or GOLIATH for 90° pull	Instructions for transporting and erecting the precast concrete element must be handed to haulage contractor and building site, trained personnel, site supervision
Inclined or 90° pull in wrong direction relative to anchorage reinforcement or lack of anchorage reinforcement	Instructions for transporting and erecting the precast concrete element must be handed to haulage contractor and building site, trained personnel, site supervision, labelling on concrete element

6. Rope wear and inspections of wire ropes based on DIN EN 13414-2:2009-2

Thorough inspections and rejection criteria

According to the the German Operational Safety Act, wire ropes for lifting must be inspected thoroughly by a specialist. Inspections must be carried out at least once a year, but more frequently when the operating conditions render this necessary. Records must be kept of these inspections.

Specialists

Lifting accessories may only be checked by persons who have been suitably trained and and whose specialist knowledge and practical experience qualify them to carry out the necessary tests and examinations according to the appropriate instructions.

Rejection criteria

The criteria can be found in EN 13414-2:2009-2. Wire rope loops should be rejected when one or more of the conditions given below apply, are reached or exceeded:

- Illegible and/or missing labelling
- Damaged upper and lower terminals; distorted and worn hooks, crushed thimbles, etc.
- Damaged rope terminations; wear, distortion and or cracking of ferrules or pull-out of splice, sinking.
- Broken wires: ≤ 6 randomly distributed broken outer wires over a length of 6 x d;
  ≤ 14 randomly distributed broken wires over a length of 30 x d;
  ≤ 3 adjacent broken outer wires in one strand
- Rope distortion; kinking, crushing, birdcaging, core protrusion or other damage that distorts the rope structure.
- Rope wear; 10% of nominal root diameter
- Thread damage
- Corrosion; pitting of the wires, loss of flexibility
- Heat damage discernible through discolouration of the wires

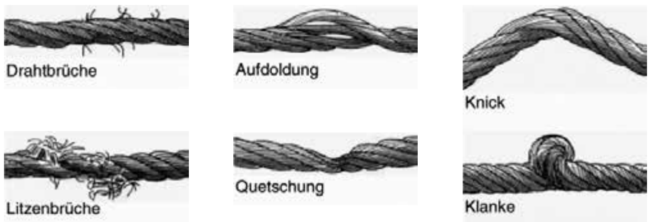


Fig. 37 Rope damage

Fig. 38 Damaged thread

Fig. 39 Sinking

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

7. Load tables

7.1 List 30: Lifting socket with flat end and cross-hole

Load group	Type	Typical mounting situation		Permissible loads				
				Axial pull $_{perm}F_V$	**90° pull** $_{perm}F_Q$	**Inclined pull** $_{perm}F_S$ **ß ≤ 45°**		
		Element thickness h_{cr}	Edge distance c_{cr}	Alpha Goliath List 42	Alpha Goliath	List 42	Goliath	Alpha
	[M/Rd]	[cm]		[kN]				
Concrete strength f_{ck} ≥ 15 N/mm²								
0.4	10 x 50	8.0	14.0	8	3.7	4	7	8
0.5	12 x 60	8.0	14.0	11	4.1	6	8	13
0.8	14 x 70	8.0	18.0	12	5.3	8	10	14
1.2	16 x 79	10.0	18.0	17	6.2	13	13	16
2.0	20 x 99	12.0	25.0	30	12.0	20	21	30
2.5	24 x 112	12.0	30.0	37	12.8	25	25	31
3.0	27 x 131	16.0	35.0	48	19.7	30	31	42
4.0	30 x 156	16.0	35.0	48	20.8	40	40	44
Concrete strength f_{ck} ≥ 25 N/mm²								
0.4	10 x 50	8.0	14.0	9	4.8	4	7	8
0.5	12 x 60	8.0	14.0	12	5.3	6	13	16
0.8	14 x 70	8.0	18.0	12	6.8	8	14	18
1.2	16 x 79	10.0	18.0	18	8.0	13	16	21
2.0	20 x 99	12.0	25.0	36	15.6	20	27	35
2.5	24 x 112	12.0	30.0	40	16.6	25	31	41
3.0	27 x 131	16.0	35.0	52	25.4	30	35	47
4.0	30 x 156	16.0	35.0	52	26.8	40	41	55

7.2 List 31: Lifting socket with steel rebar Straight bar

Load group	Type	Typical mounting situation: Element thickness h_{cr}	Typical mounting situation: Edge distance c_{cr}	Permissible loads: Axial pull $_{perm}F_V$ Alpha Goliath List 42	Permissible loads: 90° pull $_{perm}F_Q$ Alpha Goliath	Permissible loads: Inclined pull $_{perm}F_S$ ß ≤ 45° Alpha Goliath List 42
	[M/Rd]	[cm]		[kN]		
Concrete strength f_{ck} ≥ 15 N/mm²						
0.5	12 x 200	6	14	9.0	3.5	6.0
0.8	14 x 230	6	18	10.0	3.5	6.0
1.2	16 x 270	8	18	14.0	4.0	7.0
1.6	18 x 300	10	20	28.0	8.0	11.0
2.0	20 x 350	10	25	28.0	10.0	11.0
2.5	24 x 400	10	30	40.0	10.0	17.0
4.0	30 x 500	14	35	57.0	22.0	31.0
6.3	36 x 650	14	40	80.0	22.0	35.0
8.0	42 x 850	16	50	110.0	22.0	57.0
12.5	52 x 900	20	60	160.0	42.0	62.0
Concrete strength f_{ck} ≥ 25 N/mm²						
0.5	12 x 200	6	14	11.0	4.5	8.0
0.8	14 x 230	6	18	13.0	4.5	8.0
1.2	16 x 270	8	18	19.0	5.0	8.0
1.6	18 x 300	10	20	34.0	10.0	14.0
2.0	20 x 350	10	25	34.0	13.0	14.0
2.5	24 x 400	10	30	45.0	13.0	21.0
4.0	30 x 500	14	35	65.0	29.0	40.0
6.3	36 x 650	14	40	100.0	29.0	45.0
8.0	42 x 850	16	50	130.0	29.0	74.0
12.5	52 x 900	20	60	180.0	54.0	81.0

7.3 List 31: Lifting socket with steel rebar Long wavy-tail bar

Load group	Type	Typical mounting situation: Element thickness h_{cr}	Typical mounting situation: Edge distance c_{cr}	Permissible loads: Axial pull $_{perm}F_V$ Alpha Goliath List 42	Permissible loads: 90° pull $_{perm}F_Q$ Alpha Goliath	Permissible loads: Inclined pull $_{perm}F_S$ ß ≤ 45° Alpha Goliath List 42
	[M/Rd]	[cm]		[kN]		
Concrete strength f_{ck} ≥ 15 N/mm²						
0.5	12 x 300	6	14	10.0	3.5	13.0
0.8	14 x 310	6	18	11.0	3.5	14.0
1.2	16 x 320	8	18	16.0	4.0	16.0
1.6	18 x 360	10	20	28.0	8.0	18.0
2.0	20 x 400	10	25	30.0	10.0	20.0
2.5	24 x 450	10	30	40.0	10.0	23.0
4.0	30 x 600	14	35	57.0	22.0	44.0
6.3	36 x 750	14	40	90.0	22.0	49.0
8.0	42 x 850	16	50	122.0	22.0	61.0
12.5	52 x 900	20	60	180.0	42.0	75.0
Concrete strength f_{ck} ≥ 25 N/mm²						
0.5	12 x 300	6	14	11.0	4.5	16.0
0.8	14 x 310	6	18	14.0	4.5	18.0
1.2	16 x 320	8	18	21.0	5.0	20.0
1.6	18 x 360	10	20	34.0	10.0	24.0
2.0	20 x 400	10	25	34.0	13.0	25.0
2.5	24 x 450	10	30	45.0	13.0	28.0
4.0	30 x 600	14	35	65.0	29.0	57.0
6.3	36 x 750	14	40	100.0	29.0	65.0
8.0	42 x 850	16	50	130.0	29.0	78.0
12.5	52 x 900	20	60	180.0	54.0	98.0

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

7.4 List 31: Lifting socket with steel rebar
Short wavy-tail bar

Load group	Type	Typical mounting situation		Permissible loads		
		Element thickness h_{cr}	Edge distance c_{cr}	Axial pull $_{perm}F_V$	90° pull $_{perm}F_Q$	Inclined pull $_{perm}F_S$ ß ≤ 45°
				Alpha Goliath List 42	Alpha Goliath	Alpha Goliath List 42
	[M/Rd]	[cm]		[kN]		
Concrete strength f_{ck} ≥ 15 N/mm²						
0.5	12 x 150	6	14	5.0	2.0	6.0
0.8	14 x 180	6	18	8.0	2.4	6.0
1.2	16 x 230	8	18	14.0	7.4	7.0
1.6	18 x 260	10	20	20.0	9.0	10.0
2.0	20 x 260	10	25	20.0	9.0	11.0
2.5	24 x 300	10	30	23.0	9.0	17.0
4.0	30 x 420	14	35	36.0	20.0	31.0
6.3	36 x 460	14	40	59.0	20.0	35.0
8.0	42 x 500	16	50	70.0	20.0	57.0
12.5	52 x 550	20	60	100.0	38.0	62.0
Concrete strength f_{ck} ≥ 25 N/mm²						
0.5	12 x 150	6	14	7.0	2.6	8.0
0.8	14 x 180	6	18	11.0	3.1	8.0
1.2	16 x 230	8	18	18.0	9.6	8.0
1.6	18 x 260	10	20	26.0	11.6	14.0
2.0	20 x 260	10	25	26.0	11.6	14.0
2.5	24 x 300	10	30	30.0	11.6	21.0
4.0	30 x 420	14	35	47.0	25.8	40.0
6.3	36 x 460	14	40	76.0	25.8	45.0
8.0	42 x 500	16	50	90.0	25.8	74.0
12.5	52 x 550	20	60	130.0	49.0	81.0

7.5 List 32: Tubular socket with cross-hole

Load group	Type	Typical mounting situation		Permissible loads				
				Axial pull $_{perm}F_V$	90° pull $_{perm}F_Q$	Inclined pull $_{perm}F_S$ ß ≤ 45°		
		Element thickness h_{cr}	Edge distance c_{cr}	Alpha Goliath List 42	Alpha Goliath	List 42	Goliath	Alpha
	[M/Rd]	[cm]		[kN]				
Concrete strength $f_{ck} \geq 15$ N/mm²								
0.5	12 x 40	8.0	14.0	11	4.1	6	8	13
0.8	14 x 47	8.0	18.0	12	5.3	8	10	14
1.2	16 x 54	10.0	18.0	17	6.2	13	13	16
1.6	18 x 65	12.0	25.0	18	7.0	14	14	17
2.0	20 x 69	12.0	25.0	30	12.0	20	21	30
2.5	24 x 78	12.0	30.0	37	12.8	25	25	31
4.0	30 x 103	16.0	35.0	48	20.8	40	40	44
6.3	36 x 125	16.0	40.0	63	20.8	63	63	63
8.0	42 x 145	20.0	50.0	80	20.8	80	80	80
12.5	52 x 195	20.0	60.0	125	35.0	125	125	125
Concrete strength $f_{ck} \geq 25$ N/mm²								
0.5	12 x 40	8.0	14.0	12	5.3	6	13	16
0.8	14 x 47	8.0	18.0	12	6.8	8	14	18
1.2	16 x 54	10.0	18.0	18	8.0	13	16	21
1.6	18 x 65	12.0	25.0	19	9.0	14	17	22
2.0	20 x 69	12.0	25.0	36	15.6	20	27	35
2.5	24 x 78	12.0	30.0	40	16.6	25	31	41
4.0	30 x 103	16.0	35.0	52	26.8	40	41	55
6.3	36 x 125	16.0	40.0	76	26.8	63	63	63
8.0	42 x 145	20.0	50.0	102	26.8	80	80	80
12.5	52 x 195	20.0	60.0	140	45.0	125	125	125

7.6 List 33: Solid socket with cross-hole

Load group	Type	Typical mounting situation		Permissible loads				
				Axial pull $_{perm}F_V$	90° pull $_{perm}F_Q$	Inclined pull $_{perm}F_S$ ß ≤ 45°		
		Element thickness h_{cr}	Edge distance c_{cr}	Alpha Goliath List 42	Alpha Goliath	List 42	Goliath	Alpha
	[M/Rd]	[cm]		[kN]				
Concrete strength $f_{ck} \geq 15$ N/mm²								
0.4	10 x 42	8.0	14.0	8	3.7	4	7	8
0.5	12 x 49	8.0	14.0	11	4.1	6	8	13
1.2	16 x 57	10.0	18.0	17	6.2	13	13	16
2.0	20 x 68	12.0	25.0	30	12.0	20	21	30
2.5	24 x 80	12.0	30.0	37	12.8	25	25	31
4.0	30 x 103	16.0	35.0	48	20.8	40	40	44
Concrete strength $f_{ck} \geq 25$ N/mm²								
0.4	10 x 42	8.0	14.0	9	4.8	4	7	8
0.5	12 x 49	8.0	14.0	12	5.3	6	13	16
1.2	16 x 57	10.0	18.0	18	8.0	13	16	21
2.0	20 x 68	12.0	25.0	36	15.6	20	27	35
2.5	24 x 80	12.0	30.0	40	16.6	25	31	41
4.0	30 x 103	16.0	35.0	52	26.8	40	41	55

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

7.7 List 35: Threaded socket with welded end plate

Load group	Type	Typical mounting situation		Permissible loads
		Element thickness h_{cr}	Edge distance c_{cr}	**Axial pull** $_{perm}F_V$ **Inclined pull** $_{perm}F_S$ **β ≤ 45°**
	[M/Rd]	[cm]		[kN]

Concrete strength f_{ck} ≥ 15 N/mm²				
0.5	12 x 30	8	18	5.0
0.8	14 x 33	9	18	8.0
1.2	16 x 35	9	25	12.0
2.0	20 x 47	11	30	20.0
2.5	24 x 54	12.5	40	25.0
4.0	30 x 72	15	50	40.0
6.3	36 x 84	16.5	65	63.0
8.0	42 x 100	18	65	80.0
12.5	52 x 120	21.5	75	125.0

Concrete strength f_{ck} ≥ 25 N/mm²				
0.5	12 x 30	8	18	6.5
0.8	14 x 33	9	18	10.3
1.2	16 x 35	9	25	15.5
2.0	20 x 47	11	30	25.8
2.5	24 x 54	12.5	40	32.3
4.0	30 x 72	15	50	51.6
6.3	36 x 84	16.5	65	81.3
8.0	42 x 100	18	65	103.3
12.5	52 x 120	21.5	75	161.4

7.8 List 36: Cast-in lifting loop

Load group	Min. centre-to-centre spacing	Min. edge distance	Embedment depth	Min. element thickness h_{cr}			
				Fitted parallel with element surface		Fitted perpendicular to element surface	
	a_{cr}	c_{cr}	L_2	C 12/15	C 20/25	C 12/15	C 20/25
	[cm]						
0.8	55	27	14	7	5	13.5	13.5
1.2	62	31	16	9	6	14	14
1.6	70	35	17	12	8	17	17
2.0	85	46	19	15	10	18	18
2.5	90	45	22	16	11	18	18
4.0	100	50	25	22	15	22	22
5.2	105	53	27	29	20	30	22
6.3	15	57	29	32	22	35	28
8.0	130	65	33	40	28	40	28
10.0	145	73	37	44	31	44	31
12.5	160	80	42	56	39	55	40
16.0	185	93	48	62	43	62	43
20.0	210	105	55	68	48	68	48
25.0	240	120	63	75	53	75	53

7.9 List 38: Lifting socket with bolt

Load group	Type	Typical mounting situation: Element thickness h_{cr}	Typical mounting situation: Edge distance c_{cr}	Permissible loads for installation perpendicular to plane of slab: Axial pull $_{perm}F_V$ / Inclined pull $\beta \leq 45°$ $_{perm}F_S$
	[M/Rd]	[cm]	[cm]	[kN]
Concrete strength $f_{ck} \geq 15$ N/mm²				
0.5	12 x 55	8	9	5.1
	12 x 100	12	15	8.6
	12 x 150	17	23	8.6
1.2	16 x 75	10	12	8.2
	16 x 140	20	20	12.8
	16 x 220	24	25	12.8
2.0	20 x 90	15	25	10.6
	20 x 150	20	30	20.0
	20 x 180	20	35	20.0
	20 x 270	29	40	20.0
2.5	24 x 200	22	30	28.8
4.0	30 x 240	26	35	48.3
6.3	36 x 300	32	45	68.8
Concrete strength $f_{ck} \geq 25$ N/mm²				
0.5	12 x 55	8	9	6.6
	12 x 100	12	15	11.1
	12 x 150	17	23	11.1
1.2	16 x 75	10	12	10.6
	16 x 140	20	20	16.5
	16 x 220	24	25	16.5
2.0	20 x 90	15	25	13.7
	20 x 150	20	30	25.8
	20 x 180	20	35	25.8
	20 x 270	29	40	25.8
2.5	24 x 200	22	30	37.2
4.0	30 x 240	26	35	62.4
6.3	36 x 300	32	45	88.8

7.10 List 38: Lifting socket with bolt and end plate

Concrete strength $f_{ck} \geq 15$ N/mm²				
0.5	12 x 55	8	9	7.6
1.2	16 x 75	10	12	11.9
2.0	20 x 90	15	25	15.6
2.5	24 x 110	22	30	27.4
4.0	30 x 140	26	35	31.4
Concrete strength $f_{ck} \geq 25$ N/mm²				
0.5	12 x 55	8	9	9.8
1.2	16 x 75	10	12	15.4
2.0	20 x 90	15	25	20.1
2.5	24 x 110	22	30	35.3
4.0	30 x 140	26	35	40.5

7.11 List 40.0: GOLIATH lifting loop circle shape

Load group	Dimensions [mm]							approx. weight each	Loading capacity with safety factor of 4: Axial pull $_{perm}F_V$ Inclined pull $_{perm}F_S$	90° pull $_{perm}F_Q$
	d [mm]	Order No.	D	L	s	g	k	[kg]	[kN]	[kN]
0.4	M 10	**k40100m**	24	150	8	15	60	0.33	13	6.5
0.5	M/Rd 12	**k40120m/r**	24	150	8	20	60	0.32	17	8.5
0.8	M/Rd 14	**k40140m/r**	24	150	8	20	60	0.33	18	9
1.2	M/Rd 16	**k40160m/r**	24	170	9	20	60	0.40	23	11.5
1.6	Rd 18	**k40180r**	44	210	12	25	102	1.32	37	18.5
2.0	M/Rd 20	**k40200m/r**	44	210	12	25	102	1.34	44	22
2.5	M/Rd 24	**k40240m/r**	44	270	14	30	102	1.74	55	27.5
3.0	M/Rd 27	**k40270m/r**	44	290	16	32	102	2.16	64	32
4.0	M/Rd 30	**k40300m/r**	44	290	16	35	102	2.12	72	36
6.3	M/Rd 36	**k40360m/r**	75	400	20	50	170	6.79	100	50

7.12 List 40.8: GOLIATH lifting loop figure-of-eight shape

Load group	Dimensions [mm]							approx. weight each	Loading capacity with safety factor of 4: Axial pull $_{perm}F_V$ Inclined pull $_{perm}F_S$	90° pull $_{perm}F_Q$
	d [mm]	Order No.	D	L	s	g	k	[kg]	[kN]	[kN]
0.4	M 10	**k40108m**	24	335	8	15	60	0.40	13	6.5
0.5	M/Rd 12	**k40128m/r**	24	335	8	20	60	0.40	17	8.5
0.8	M/Rd 14	**k40148m/r**	24	335	8	20	60	0.40	18	9
1.2	M/Rd 16	**k40168m/r**	24	385	9	20	60	0.50	23	11.5
1.6	M/Rd 18	**k40188r**	44	470	12	25	102	1.55	37	18.5
2.0	M/Rd 20	**k40208m/r**	44	470	12	25	102	1.57	44	22
2.5	M/Rd 24	**k40248m/r**	44	550	14	30	102	2.10	55	27.5
3.0	M/Rd 27	**k40278m/r**	44	590	16	32	102	2.60	64	32
4.0	M/Rd 30	**k40308m/r**	44	590	16	35	102	2.60	72	36
6.3	M/Rd 36	**k40368m/r**	75	780	20	50	170	7.68	102	50
8.0	M/Rd 42	**k40308m/r**	75	860	22	60	180	8.99	110	55
12.5	M/Rd 52	**k40368m/r**	75	1080	28	70	190	15.20	175	87.5

Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

7.13 List 41: ALPHA lifting loop

Load group	Metric thread		Knuckle thread with metric pitch		Dimensions [mm]					approx. weight each	Loading capacity with safety factor of 4	
											Axial pull $_{perm}F_V$ **Inclined pull** $_{perm}F_S$	**90° pull** $_{perm}F_Q$
	d [mm]	**Order No.**	d [mm]	**Order No.**	B	H	g	L	S	[kg]	[kN]	
0.4	M 10	**k4110m**			55	42	22	260	8	0.45	13	6.5
0.5	M 12	**k4112m**	Rd 12	**k4112r**	55	42	24	260	8	0.45	17	8.5
0.8	M 14	**k4114m**	Rd 14	**k4114r**	55	42	25	260	8	0.47	18	9
1.2	M 16	**k4116m**	Rd 16	**k4116r**	55	42	28	320	10	0.65	23	11.5
1.6			Rd 18	**k4118r**	89	69	32	380	12	1.45	37	18.5
2.0	M 20	**k4120m**	Rd 20	**k4120r**	89	69	34	380	12	1.50	44	22
2.5	M 24	**k4124m**	Rd 24	**k4124r**	89	69	39	430	14	1.65	55	27.5
3.0	M 27	**k4127m**			89	69	42	490	16	2.50	64	32
4.0	M 30	**k4130m**	Rd 30	**k4130r**	89	69	46	490	16	2.50	72	36

7.14 List 42: Lifting loop with crimped threaded spigot

Load group	Metric thread		Knuckle thread with metric pitch		Dimensions [mm]			approx. weight each	Loading capacity with safety factor of 4 **Axial pull** $_{perm}F_V$
	d [mm]	**Order No.**	d [mm]	**Order No.**	g	L	s	[kg]	[kg]
0.5	M 12	**k4212m**	Rd 12	**k4212r**	22	130	6	0.06	900
0.8	M 14	**k4214m**	Rd 14	**k4214r**	25	150	7	0.10	1400
1.2	M 16	**k4216m**	Rd 16	**k4216r**	27	170	8	0.13	1700
1.6			Rd 18	**k4218r**	34	190	9	0.19	2400
2.0	M 20	**k4220m**	Rd 20	**k4220r**	35	210	10	0.26	3100
2.5	M 24	**k4224m**	Rd 24	**k4224r**	43	260	12	0.43	3900
3.0	M 27	**k4227m**			48	280	13	0.67	4900
4.0	M 30	**k4230m**	Rd 30	**k4230r**	56	340	16	1.05	5000
6.3	M 36	**k4236m**	Rd 36	**k4236r**	68	380	18	1.52	7900
8.0	M 42	**k4242m**	Rd 42	**k4242r**	80	420	20	2.18	10 200
12.5	M 52	**k4252m**	Rd 52	**k4252r**	97	550	26	4.75	17 500

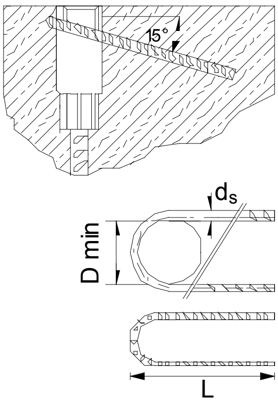
7.15 List 42: Lifting loop with crimped threaded spigot and hole for bolt

Load group	Thread Ø	**Order No.**	Rope Ø	Total length	Loading capacity with safety factor of 4 **Axial pull** $_{perm}F_V$
	M		s	L	
	[mm]		[mm]	[mm]	[kg]
0.5	12	**k420500**	7	200	1400
1.2	16	**k421200**	10	250	3100
2.5	24	**k422500**	16	350	5000

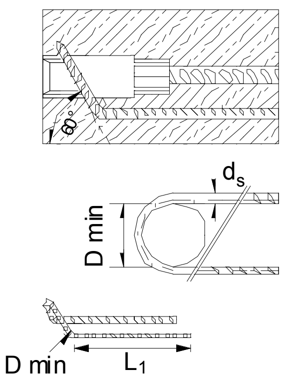
7.16 Additional reinforcement

The permissible loads in the load tables of Lists 30, 31, 32, 33, 35 and 38 are only valid when using the following additional reinforcement:

Additional reinforcement*, B500B [mm]			
Thread [M/Rd]	**Inclined pull**		
	d_s	D_{min}	L
12	8	32	130
14	8	32	160
16	8	32	170
18	10	40	185
20	10	40	220
24	10	40	240
30	14	56	265
36	14	56	285
42	20	140	350
52	20	140	370



Additional reinforcement*, B500B [mm]			
Thread [M/Rd]	**90° pull**		
	d_s	D_{min}	L_1
12	8	32	95
14	8	32	125
16	8	32	130
18	10	40	140
20	10	40	170
24	10	40	185
30	14	56	195
36	14	56	200
42	20	140	215
52	20	140	220



Friedrich Schroeder GmbH & Co. KG
Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088 | info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

Friedrich Schroeder GmbH & Co. KG

Hönnestr. 24 | 58809 Neuenrade | Germany | Tel: +49 2394 91800 | Fax: +49 2394 918088
info@schroeder-neuenrade.de | www.schroeder-neuenrade.de

SCH

Made in Germany

09/2015