

# Transport and installation instructions

**BETONBAU group**

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## Table of Contents

<b>1</b>	<b>  General.....</b>	<b>4</b>
1.1	General information on applicable procedures/rules .....	4
1.2	Lifting insert system.....	5
1.3	Requirements for the operating personnel.....	6
<b>2</b>	<b>  Transport .....</b>	<b>7</b>
2.1	Vehicle requirements.....	7
2.2	Load securing requirements .....	7
<b>3</b>	<b>  Station equipment.....</b>	<b>14</b>
3.1	Requirements for the location of transformers during transport .....	14
3.2	Customer-made equipment outside the BETONBAU manufacturing plant.....	14
<b>4</b>	<b>  Station placing .....</b>	<b>14</b>
4.1	General notices .....	14
4.2	Use of lifting accessories.....	16
4.3	Inspection of the internal space .....	17
4.4	Transport with/without a roof .....	17
4.4.1	Handling of the roof .....	18
4.4.2	Temporary roof storage .....	18
4.4.3	Roof reassembly .....	19
4.5	Other necessary modifications .....	19
4.6	Methods of load slinging.....	20
4.6.1	Standard lifting accessories.....	20
4.6.2	Supporting beams .....	20
4.6.3	Spreader beams.....	21
4.7	Foundation structures.....	22



**For transport from the BETONBAU manufacturing plant to the construction site / installation site.**





List of figures

*Fig. 1: Marking of means for gripping loads* ..... 4

*Fig. 2: Use of lifting insert systems* ..... 5

*Fig. 3: Examples of lifting insert systems* ..... 6

*Fig. 4: Forces acting on the load and an example of a load distribution diagram* ..... 7

*Fig. 5: Means of securing the load and sling points on the vehicle*..... 7

*Fig. 6: Example of lifting insert placement for lifting and securing the load*..... 8

*Fig. 7: Lifting inserts for lifting and securing the loads separately (left) and combined (right)* . 8

*Fig. 8: Deformation caused by a prohibited lifting method*..... 9

*Fig. 9: Direct diagonal slinging*..... 10

*Fig. 10: Sling points on the outer face of longitudinal walls* ..... 10

*Fig. 11: Direct diagonal slinging - outside the wall projection* ..... 11

*Fig. 12: Friction slinging (left) and passing the lifting accessories through (on the right)* ..... 11

*Fig. 13: Sling points on the outer face of transverse walls* ..... 12

*Fig. 14: Sling points on the outer face of longitudinal walls* ..... 12

*Fig. 15: Use of lifting inserts for securing the load in the case of UF-series walk-in stations* 13

*Fig. 16 Blocking with wedges or prisms* ..... 13

*Fig. 17: Examples of transformer securing in a substation*..... 14

*Fig. 18: Angle  $\beta$  of inclination of the lifting accessories* ..... 15

*Fig. 19: Installation with and without a roof* ..... 16

*Fig. 20: Coefficients reducing the axial load bearing capacity of lifting inserts* ..... 16

*Fig. 21: Examples of correctly screwed lifting accessories*..... 17

*Fig. 22: Angles for securing during transport* ..... 17

*Fig. 23: Lifting the concrete cell with textile straps* ..... 18

*Fig. 24 Examples of permissible pull direction* ..... 18

*Fig. 25 Example of roof storage*..... 19

*Fig. 26 Transport angles (left) and plumbing elements (right)* ..... 19

*Fig. 27 Slinging steel chain with a balancing segment* ..... 20

*Fig. 28 Supporting beam (H-beam)*..... 21

*Fig. 29 Permissible pull directions*..... 21

*Fig. 30 Spreader beams* ..... 22



## 1 | General

### 1.1 | General information on applicable procedures/rules

Only workers who meet the requirements of legal and other regulations to ensure occupational health and safety and who have undergone a training course with practical training under the supervision of a qualified person of the operator of the equipment may carry out the tying of loads. According to NV 193/2022 Coll., these are authorised persons for loads slinging (according to ČSN ISO 12480-1 - Slinger). The installation outside the Czech Republic is subject to local regulations.

Before using lifting insert systems, all load influences such as permissible lifting insert load bearing capacity, diagonal pull, transverse pull, dynamic coefficient, balancing spreader beams, use of beams, etc. must be taken into account. During installation, the relevant requirements of the operating instructions for the individual suspension and handling equipment must be observed.

The relevant regulations apply for the installation in the Czech Republic, e.g.:

- Act No. 262/2006 Coll., Labour Code,
- Act No. 250/2021 Coll., on occupational safety in connection with the operation of reserved technical equipment,
- Gov. Decree No. 193/2022 Coll., on reserved technical lifting equipment and requirements for ensuring their safety,
- Gov. Decree No. 378/2001 Coll., laying down more detailed requirements for the safe operation and use of machinery, technical equipment, devices and tools,
- ČSN ISO 12480-1 - Cranes - Safe use - Part 1: General

Chains, slings and other means for gripping loads in the Czech Republic must comply with e.g.:

- Government Decree No. 176/2008 Coll., on technical requirements for machinery (marking, manufacturer's information, maximum load bearing capacity),
- Manufacturer's operating instructions
- Technical rules ČBS 06 - Lifting inserts (translation of German VDI/BV-BS 6205)

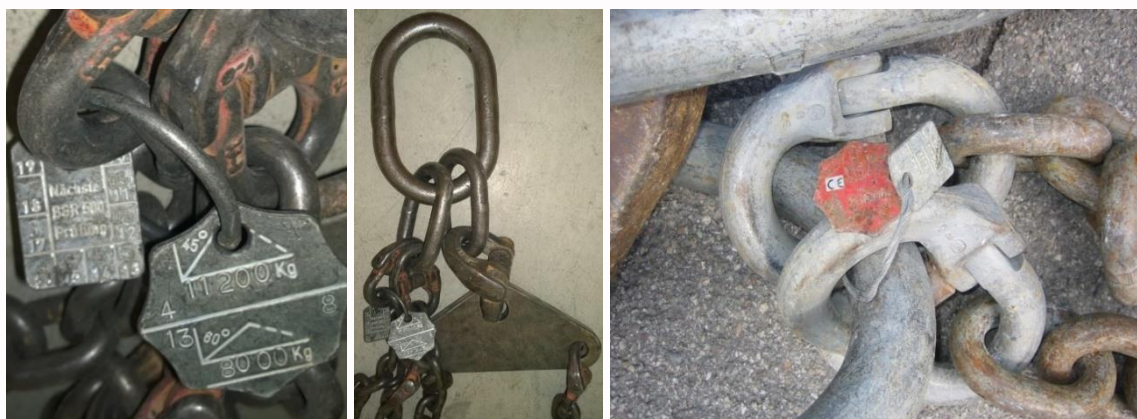


Fig. 1: Marking of means for gripping loads

These safety rules represent the applicable set of requirements for the use of lifting insert systems and means for gripping loads. BETONBAU products can only be handled safely during lifting, transport and installation if these rules are observed.

## 1.2 | Lifting insert system

The lifting insert system consists of a lifting insert embedded in concrete, a bar anchor and the appropriate lifting accessories for gripping the load. The manufacturer's use and installation instructions are also included. Lifting insert systems from one manufacturer must not be combined with systems from other manufacturers. This means that the lifting accessory and the lifting insert must be considered as a single unit.

Adequate and safe operation of the lifting insert system can only be guaranteed if mutually compatible threaded parts of the system are used. Only undamaged lifting inserts and lifting accessories may be used for handling loads. Defective lifting inserts or lifting accessories with visible deformations, previous damage, severe corrosion or damaged threads must not be used.

Improper lifting and placing of concrete parts can lead to e.g. lifting inserts being pulled out, formation and development of cracks in concrete, damage to surface finishes, deformation of openings and construction fillings (doors, ventilation elements).

In order to eliminate the possibility of confusion of system components from different manufacturers, BETONBAU has set the rule that for lifting inserts with rounded threads up to the size of RD 30 the product range from Philipp is used, and for RD 36 mm the product range from Pfeifer is used, see below.

- Manufacturer - Philipp, thread sizes: RD 16; RD 18; RD 24; RD 30
- Manufacturer - Pfeifer, thread sizes: RD 36; RD 42; RD 52; RD 56

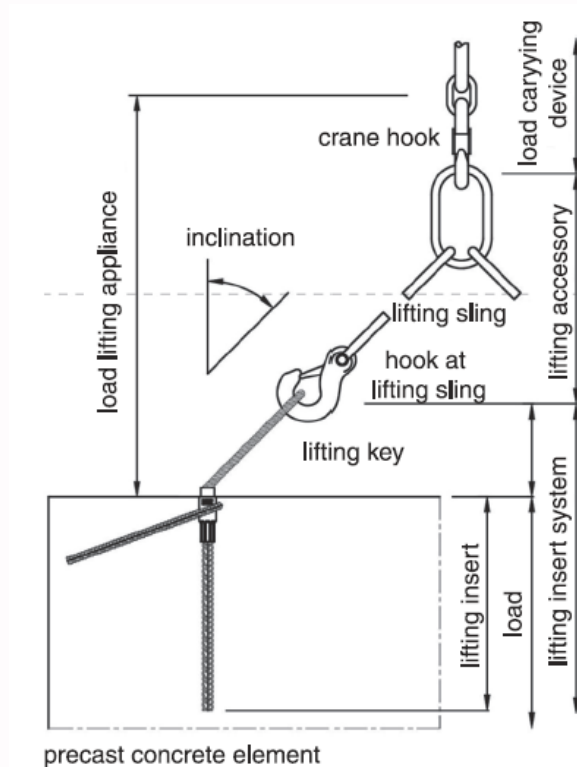


Fig. 2: Use of lifting insert systems

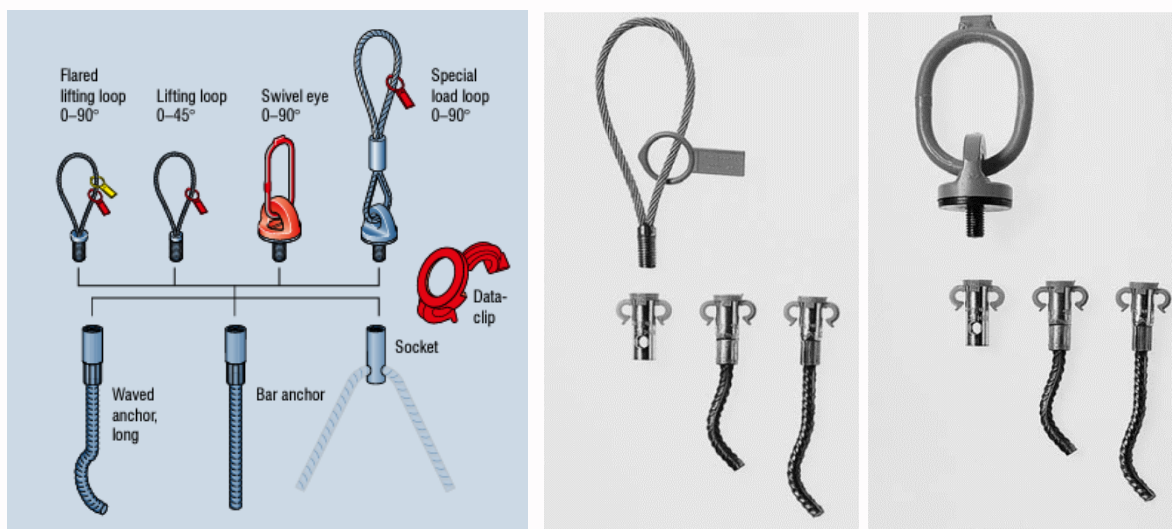


Fig. 3: Examples of lifting insert systems

When handling, all conditions specified in the BETONBAU production documentation and in the technical documentation of the specific lifting insert system as amended must be observed by all means.

Other thread shapes (special thread, fine thread or left-hand thread, etc.) are also used for non-standard cases. The means used for gripping the loads shall be suitable for the thread system concerned. The lifting insert systems installed by BETONBAU are specified in the production documents.

According to TP ČBS 06, the use of lifting inserts and lifting insert systems is intended for one-off fixing of a concrete prefabricated component. The definition of 'one-off use' includes multiple suspension within the transport chain from production to installation of the finished part.

In the case of lifting inserts for repeated use (e.g. moving of stations), the threaded bushings must comply with the requirements of General Construction Technical Approval Z-30.3-6 "Products, components and fasteners made of stainless steel" of the German Institute for Construction Technology (DIBt).

Before attaching the means for gripping loads, the responsible worker must check that the lifting inserts are not damaged by corrosion, that they are movable well, that the concrete cell to be transported does not demonstrate cracks in concrete, etc. In case of any doubt, the lifting inserts must not be used.

Regular inspections of all types of lifting accessories are carried out in accordance with the Gov. Decree No. 378/2001 Coll., according to the Safe Working System for Lifting Equipment and the manufacturer's instructions - visual inspection by a slinger before each use and a professional inspection once every 12 months by an authorised person or, in case of doubt, by a lifting equipment inspection technician. Damaged lifting accessories shall not be used by the slinger to suspend loads.

### 1.3 | Requirements for the operating personnel

According to TP ČBS 06, Gov. Decree 193/2022 Coll. or e.g. ČSN ISO 12480-1 - Cranes, attachment to lifting inserts must be carried out by appropriately trained and authorised personnel. The operator must have sufficient technical knowledge and be instructed in the use of the specified lifting inserts and products.



## 2 | Transport

### 2.1 | Vehicle requirements

These instructions address road transport issues as well. If the concrete cell is to be transported by a means of transport other than a truck, a case-by-case assessment is always required.

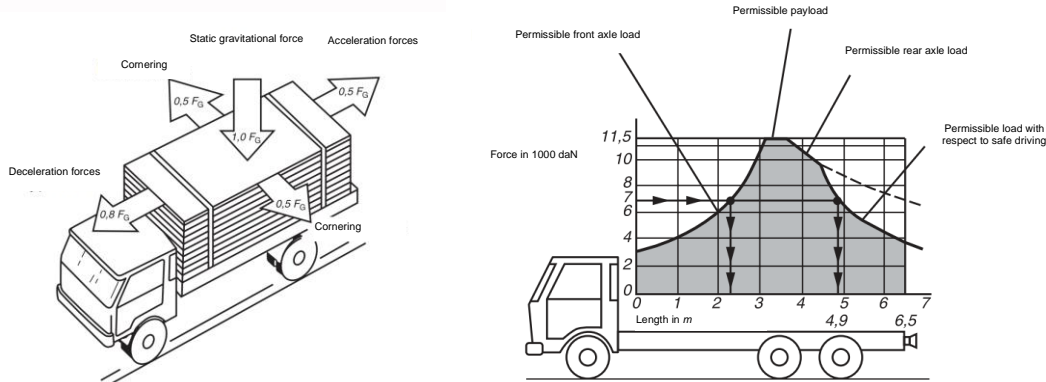


Fig. 4: Forces acting on the load and an example of a load distribution diagram

Concrete cells may only be transported by vehicles that are suitable and approved for the weight and load to be transported. If the permissible weights and/or dimensions are exceeded, a valid transport permit issued by the competent authorities must be presented. Without this permit loading is not possible. The vehicle must be equipped with fixed sling points according to ČSN EN 12640.

### 2.2 | Load securing requirements

The slipping of the concrete cell on the transport vehicle must be prevented by inserting certified anti-slip mats with a coefficient of friction value of at least  $\mu=0.6$  (determined on the basis of tensile tests to determine dynamic friction). It is essential to ensure that the product is placed only on these mats and does not touch the loading surface of the transport vehicle at any point. The transport securing of the concrete cell must comply with the requirements of ČSN EN 12195-1.



Fig. 5: Means of securing the load and sling points on the vehicle

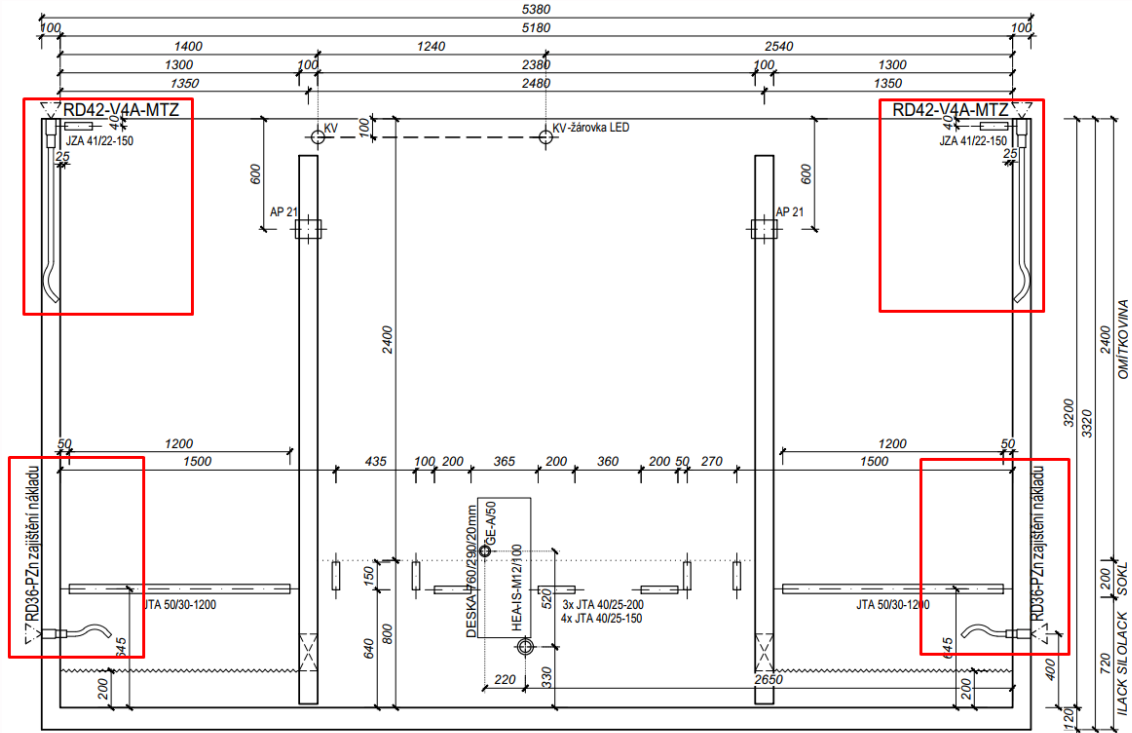


Fig. 6: Example of lifting insert placement for lifting and securing the load



BETONBAU uses separate lifting inserts to lift and secure the concrete cells on the vehicle. Short wave lifting inserts for securing the load are inserted horizontally into the face of the stations, long wave lifting inserts are inserted vertically on the top face of the walls.

In some cases, e.g. for compact stations, shaft structures and catch basins, horizontally installed long wave lifting inserts can also be used to secure the load for lifting.



Fig. 7: Lifting inserts for lifting and securing the loads separately (left) and combined (right)

It follows from the aforementioned, that it is always obligatory to check the production documentation to verify which lifting inserts are intended for lifting the product and which are intended for securing during transport. Short wave lifting inserts intended only for securing during transport are marked as such in the production documentation (Fig. 6).

**Lifting the product by the short wave lifting insert is not permissible and may lead to overloading and subsequent lifting insert failure (Fig. 8)!**





*Fig. 8: Deformation caused by a prohibited lifting method*

Due to the dimensions of the product and the forces generated during the transport of the load, direct diagonal slinging to the transport vehicle is required (*Fig. 9*). The lifting accessories must not be sagging or stretched. The tensioning force of the lifting accessory must not be exceeded!

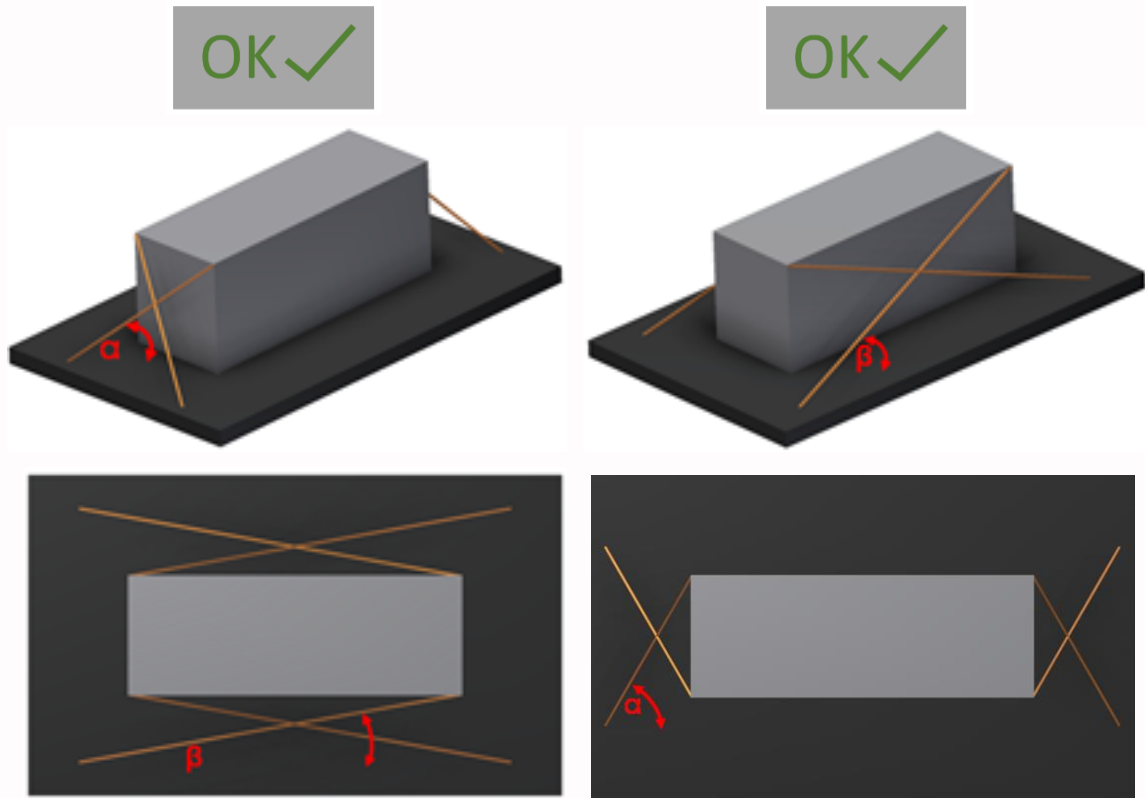


Fig. 9: Direct diagonal slinging

It is very important to pay attention to the direction of slinging with respect to the location of the sling points on the concrete cell. These can be located on the transverse walls (i.e. parallel to the longitudinal axis of the vehicle) or on the longitudinal walls (i.e. perpendicular to the direction of travel). In both cases, it is necessary to ensure that the lifting accessories do not extend beyond the projection of the outline of the wall on which the sling points are located. The correct design is shown in Fig. 10 on the left. The method of slinging illustrated in Fig. 10 on the right results in a load on the lifting inserts that is not contemplated and can lead to acute lifting insert failure. Also in Fig. 11, Fig. 13 and Fig. 14.

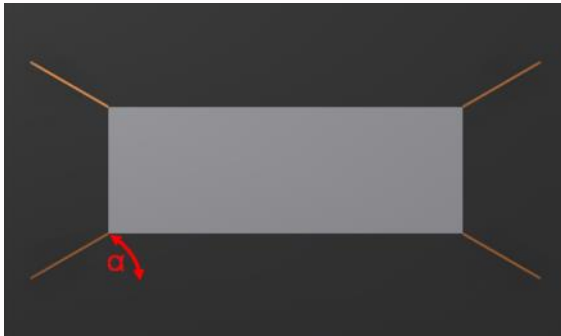


Fig. 10: Sling points on the outer face of longitudinal walls





NO X



NO X

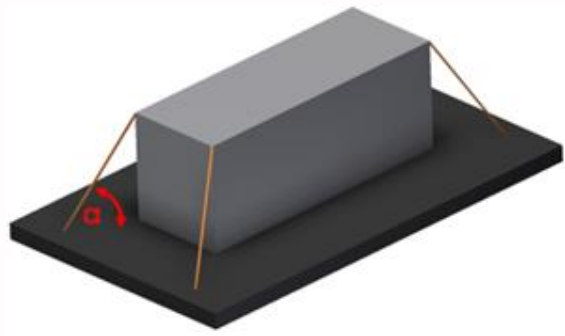


Fig. 11: Direct diagonal slinging - outside the wall projection

Friction slinging to the means of transport is not permitted. Damage may occur to the finish of the product being transported (Fig. 12 on the left). In addition, it is not permitted to pass the lifting accessories through the sling points on the concrete cell (Fig. 12 on the right).

NO X



NO X



Fig. 12: Friction slinging (left) and passing the lifting accessories through (on the right)



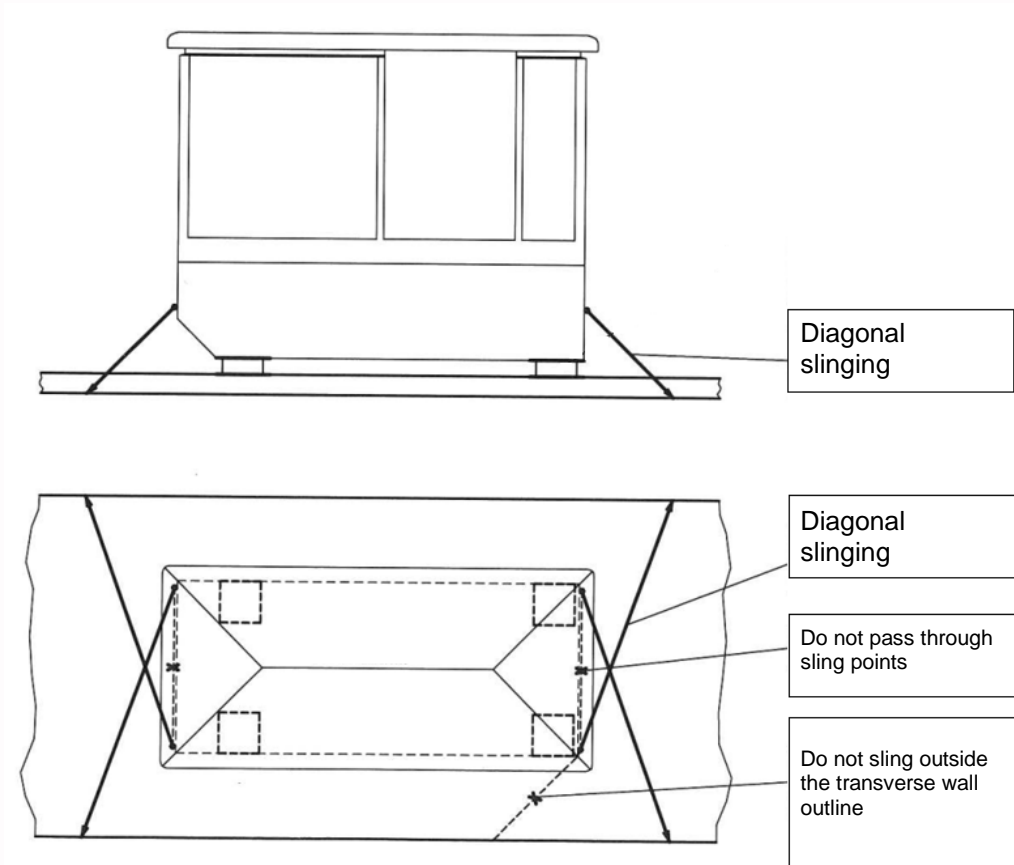


Fig. 13: Sling points on the outer face of transverse walls

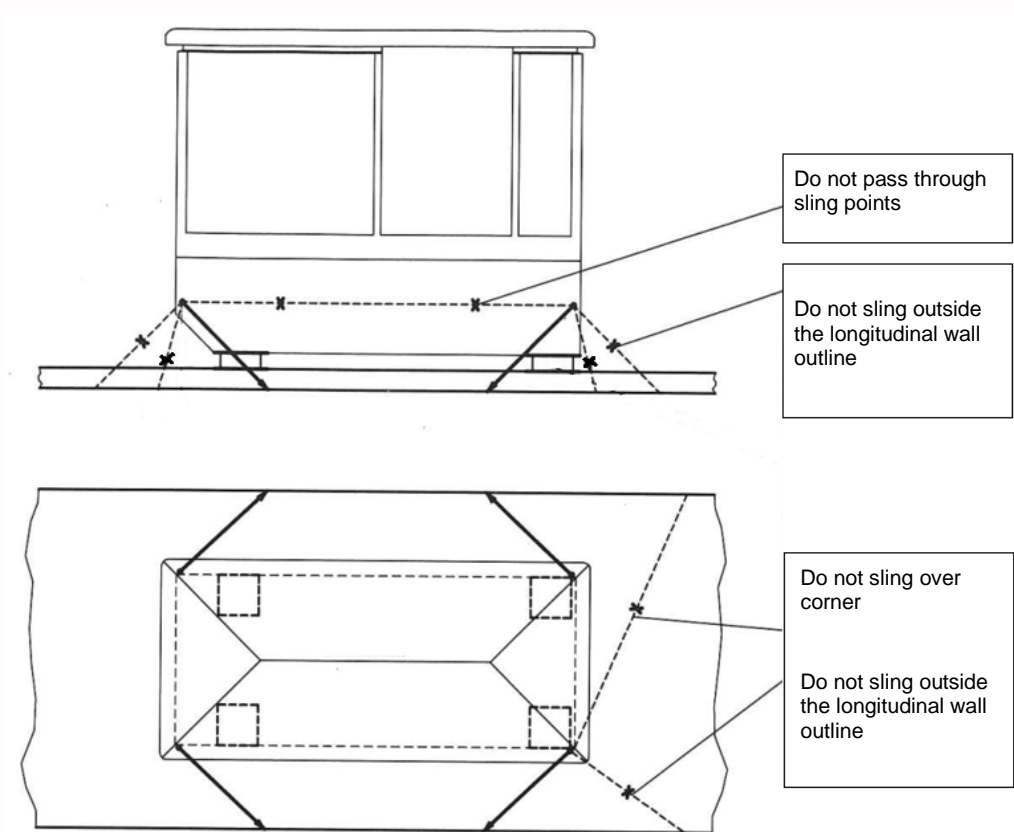


Fig. 14: Sling points on the outer face of longitudinal walls



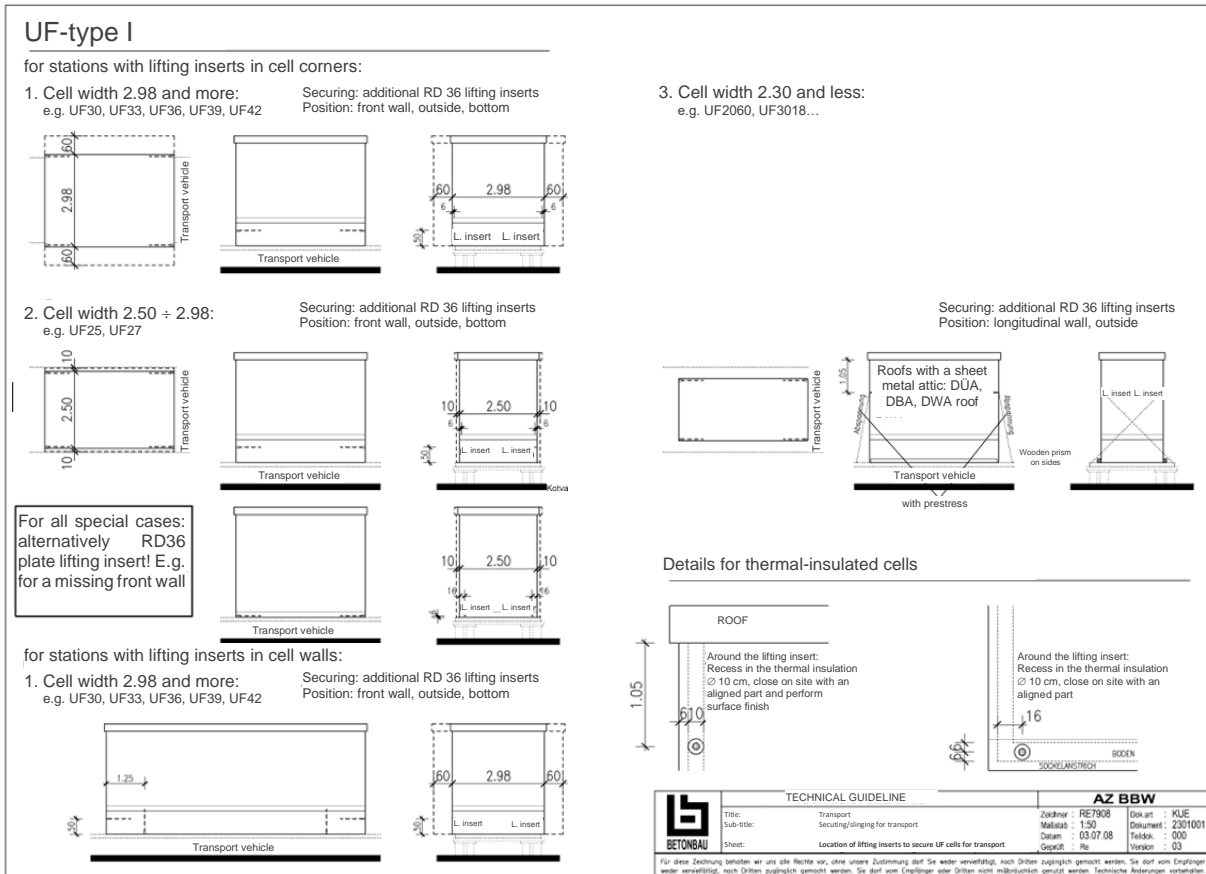


Fig. 15: Use of lifting inserts for securing the load in the case of UF-series walk-in stations

The requirements for the load bearing capacity of the lifting accessories and sling points increase with the increasing weight of the concrete cell and the type of slip-resistant mats used. In addition to direct diagonal slinging of the goods being transported, blocking can also be considered, either by leaning against a sufficiently strong front wall of the trailer (if it is capable of doing so) or by using the technical means of the transport vehicle.



Fig. 16 Blocking with wedges or prisms



### 3 | Station equipment

#### 3.1 | Requirements for the location of transformers during transport

Transformers must always be dismantled. In exceptional cases, transport with a transformer can be carried out after consultation with BETONBAU and proper securing.

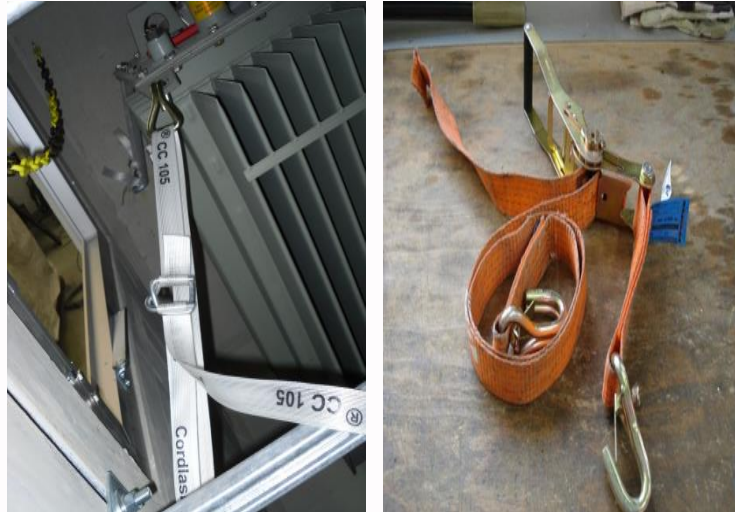


Fig. 17: Examples of transformer securing in a substation

Securing must be carried out in accordance with the separate instructions for securing transformers for transport in BETONBAU stations.

#### 3.2 | Customer-made equipment outside the BETONBAU manufacturing plant

When temporarily storing concrete cells for further equipment, it is also necessary to observe the requirements for placing and storage resulting from the type or individual statics, in particular the requirements for placing on grade beams. In any case, the concrete cell must be levelled both horizontally and vertically when it being placed.

Before further modifications, it is necessary to check that the new total weight does not exceed the load bearing capacity of the installed lifting inserts in all subsequent installation conditions with regard to the direction of pull, number of lifting inserts, etc. The centre of gravity of the building shall not be significantly altered by further modifications. All newly added parts must be secured by the contractor against slipping, tipping or movement in accordance with the load securing standard of ČSN EN 12195-1.

The supporting structure of the building must not be altered, e.g. by additional cut-outs, removal of supporting elements, etc.

### 4 | Station placing

#### 4.1 | General notices

The design of the lifting insert system is based on the manufacturers' installation instructions and the instructions specifically designed for BETONBAU applications. Lifting parallel to the central plane / longitudinal axis of the component with an angle of inclination of the lifting accessories  $\beta$  less than  $12.5^\circ$  (reduction factor of the effect of the inclined pull  $z < 1.04$ ) is considered as standard. Due to the high weight and dimensions of the structure, these must be lifted and moved very carefully at a maximum lifting speed of 45 m/min. Therefore a dynamic

coefficient of  $\Psi_{\text{dyn}} = 1.2$  is taken into account. For compact stations and other special designs, an inclined pull of  $\beta = 90^\circ$  can also be taken into account.

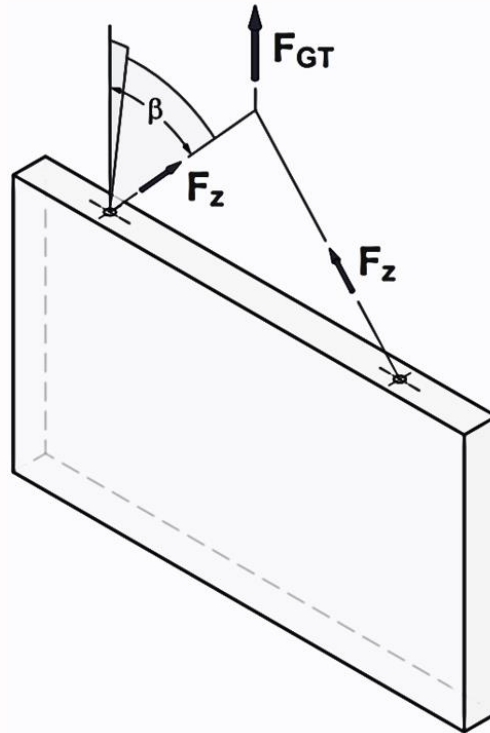


Fig. 18: Angle  $\beta$  of inclination of the lifting accessories

It follows from the aforementioned that the maximum angle  $\beta$  of inclination during installation is achieved by using the lifting accessories of the appropriate length. The required lengths with respect to the diagonal distances of the lifting inserts are given in the document **Determination of lifting sling lengths for UF-type stations**. Failure to observe these rules may result in overloading of the lifting insert system and acute lifting insert failure!

When the structure is moved using a mobile crane, it is lifted by 4 strands of lifting accessories concentrated in one place - the crane hook. This results in both a permissible angle of inclination (up to  $12.5^\circ$ ) of the lifting accessories in the central plane of the longitudinal walls and a prohibited inclined transverse pull perpendicular to this plane. This can be avoided in two ways. Either by moving the body with the roof, which in this case acts as a spreader to capture transverse pulls, or by means of spreader beams (see Fig. 19). When using the H-beam, inclined pulls do not occur.

**Transverse pull outside the central plane of the wall is strictly prohibited.**



Fig. 19: Installation with and without a roof

**NOTE:** Any exceedance of the above parameters leads to a reduction in the load bearing capacity of the lifting inserts. In the case of an inclined pull in the central plane below a lifting accessory angle  $\geq 12,5^\circ$ , no additional reinforcement is installed to capture the inclined pull.

If necessary, measures can be taken to reduce the weight (dismantling of equipment) - after consultation with BETONBAU.

Lifting technology	Dynamic coefficient $\psi_{dyn}$	Inclination angle $\beta$	Inclined pull effect $z$
Tower / gantry / mobile crane	1.3	0.0°	1.00
		15.0°	1.04
Lifting and transport on a flat surface	2.5	22.5°	1.08
		30.0°	1.15
Lifting and transport on an uneven surface	$\geq 4.0$	37.5°	1.26
		45.0°	1.41

Fig. 20: Coefficients reducing the axial load bearing capacity of lifting inserts

#### 4.2 | Use of lifting accessories

The lifting accessories must be screwed into the lifting insert embedded in concrete in the entire length of the thread. In the case of Pfeifer lifting slings, once they are fully screwed into the lifting insert, they are subsequently loosened by half a turn to a maximum of one full turn and the sling eye shall be aligned in the direction of pull.

In the case of lifting accessories with a swivel eye for diagonal and transverse pulls (e.g. Philipp: Wirbelstar and Pfeifer: Swivel Hanger, Special Hanger, Super Hanger) the swivel plate must be perpendicular to the axis of the lifting insert and must be fully screwed in (must be adjacent to the concrete).







Fig. 21: Examples of correctly screwed lifting accessories

#### 4.3 | Inspection of the internal space

Before any relocation/transportation of the concrete cell, it is necessary to check that there are no loose or moving parts of the equipment inside. These must be removed or secured against slipping, tipping or movement in accordance with generally applicable load securing regulations.

#### 4.4 | Transport with/without a roof

Before the concrete cell is lifted by crane, its firm structural connection to the roof slab must be ensured. This is ensured by a steel bolted joint consisting of a steel angle, lifting insert C-profiles embedded in concrete with teeth and corresponding hammer head bolts.



Fig. 22: Angles for securing during transport

When lifting, it is necessary to ensure that the concrete cell is suspended horizontally. This is achieved by adjusting the length of the lifting accessories (chains, slings, straps, etc.). The slowest lifting speed of the crane must be used for lifting (maximum lifting speed 45 m/min). The lifting must be smooth without jerking or bumping.

Maximum force often occurs during an emergency stop or sudden stop when the boom is rotating.





Fig. 23: Lifting the concrete cell with textile straps

#### 4.4.1 | Handling of the roof

Lifting and moving of a concrete basin roof or concrete roof slab shall be carried out in a similar manner to sections 4.1 to 4.3. Before lifting the roof slab, all detachable connections to the concrete cell must be removed - e.g. grounding straps, cables, load securing angles, light fittings, drainpipes, etc. In addition to that, all fastening material between the walls and the roof must also be removed. Statically conditioned welded joints between the concrete cell and the roof slab may only be released after consultation with BETONBAU.

For practical reasons, the transport securing angles shall be left attached to the roof slab as a guiding aid for the subsequent roof reassembly



Fig. 24 Examples of permissible pull direction

#### 4.4.2 | Temporary roof storage

To store the roof in a temporary location, a horizontal loading surface with supporting beams must be provided to prevent forming of cracks and damage. For roofs with installed plumbing elements, e.g. DBA, DÜA, DRO, etc., care must be taken to ensure that they are not damaged.

Basic principles for roof laying:

- the substrate MUST be flat and load-bearing
- the supporting beams MUST be axially aligned with the lifting inserts

- the supporting beams **MUST** be higher than the height of the transport angles / lighting etc.

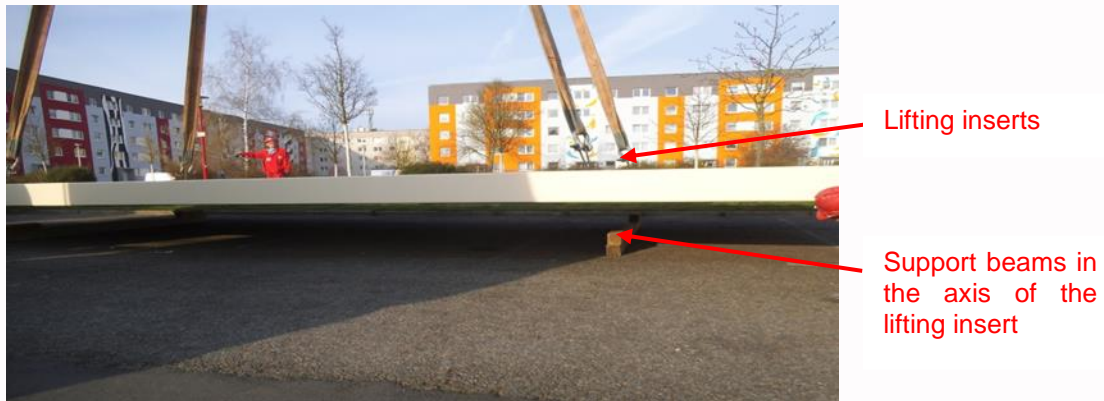


Fig. 25 Example of roof storage

#### 4.4.3 | Roof reassembly

Before the roof is installed, it is necessary to check that the rubber mats are glued to the top face of the concrete cell walls. These minimize local loads from unevenness and the transmission of horizontal forces. Alternatively, the joint shall be filled with mortar. These and other adjustments to the horizontal joint are generally described in the technical instructions, production documentation or structural calculation. All loose connections are then connected.

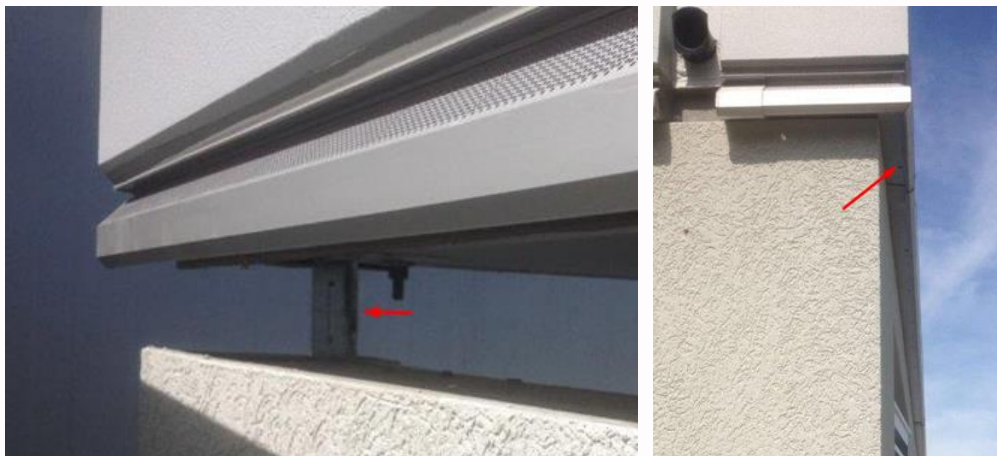


Fig. 26 Transport angles (left) and plumbing elements (right)

#### 4.5 | Other necessary modifications

Lifting inserts and relevant round openings in the reinforced concrete roof slab shall be sealed by resealing with suitable sealing strips or sealing plugs and sealant. Alternatively, the roof flashing must be installed and properly sealed.

Washed river aggregate (pebble gravel) is spread evenly over the entire surface of the basin roofs in a maximum layer thickness of 50 mm. The cleanliness and placement of the drainpipe coarse debris filter should be checked to ensure proper drainage of water from the roof.





## 4.6 | Methods of load slinging

### 4.6.1 | Standard lifting accessories

When moving a concrete cell without a supporting beam, lifting accessories of minimum length according to Table "VP002 - Determination of lifting sling lengths for UF-type stations" must be used. The pair of slings or chains must be equipped with a balancing segment for even load distribution.

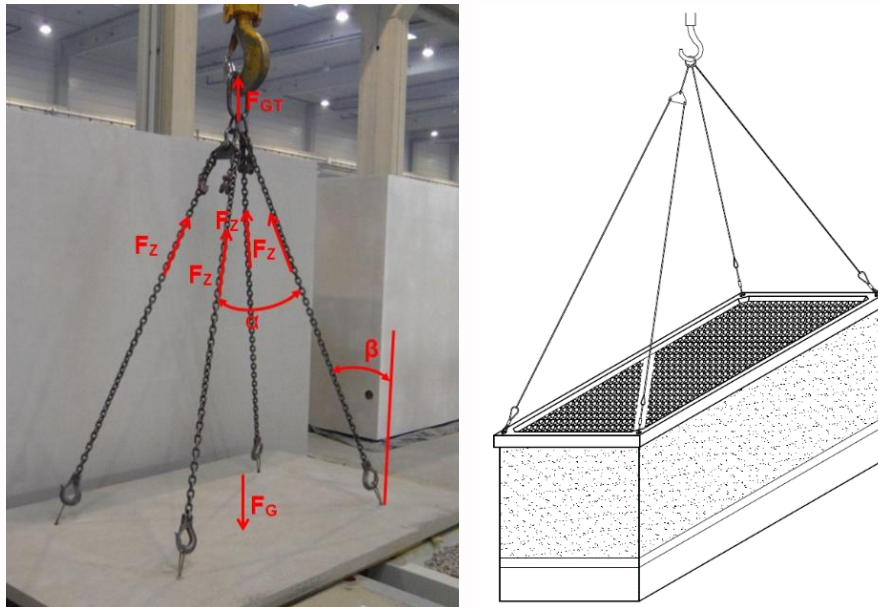


Fig. 27 Slinging steel chain with a balancing segment

( $\alpha$  - spreading angle ( $2\beta$ ),  $\beta$  - inclination angle of the lifting accessory,  $F_G$  - dead weight in kN (10 kN ~ 1000 kg),  $F_Z$  - force in the lifting accessory,  $F_{GT}$  - total transport load)

### 4.6.2 | Supporting beams

When designing the location of the lifting insert system, particular care is taken to ensure that the lifting inserts for pulling the concrete product out of the mould are placed at an even distance from the centre of gravity (of the concrete cell/roof). It is imperative that this assumption is fulfilled, otherwise the concrete body may get stuck against the steel core and subsequently damaged.

The concrete cell is also equipped with an additional set of lifting inserts that are used when the cell is turned upside down. The centre of gravity then varies depending on the current mounting condition. It occurs in a different position after the body is turned over. It shifts after the internal partitions are installed and after the technology is installed. When lifting the load, it is therefore necessary to ensure that the crane hook is always above the centre of gravity of the load. This is achieved by expertly adjusting the support beam.

The entire supporting beam - body system will tilt during lifting until the centre of gravity is below the crane hook. The higher the support beam is above the vertical position of the centre of gravity, the less the system must tilt to stabilise. Since the beam with the load is never suspended absolutely horizontally, a permissible inclination of max.  $6^\circ$  was determined in accordance with ČSN EN 13155.

Another case where the centre of gravity of the load must be taken into account is its vertical position in relation to the vertical position of the lifting inserts. The danger arises especially when the vertical position of the centre of gravity is higher than the lifting insert. The system may completely tip over.





The centre of gravity of loads must therefore always be taken into account when lifting!



Fig. 28 Supporting beam (H-beam)

### 4.6.3 / Spreader beams

When moving open concrete cells (e.g. without a roof / catch basin), a spreader beam (or spreader) or H-beam must be used. The beam must be adjusted to the width of the station so that there is no diagonal pull outside the central plane of the wall.

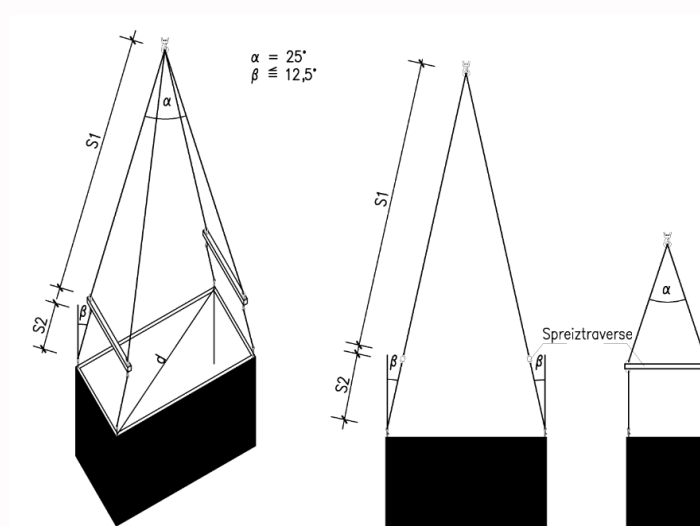


Fig. 29 Permissible pull directions





Fig. 30 Spreader beams

#### 4.7 | Foundation structures

The design of the foundations must take into account a wide range of factors and must be carried out in such a way as to ensure the safety and stability of the upper part of the structure. For each job, the requirements for the subsoil parameters are defined. The conformity of the requirements with the actual local geological conditions must be verified by a competent person of the client.

Concrete cells can have wall-to-wall foundations, depending on the subsoil parameters, either in a compacted gravel bed or on a reinforced concrete slab. The gravel bed consists of two layers, the lower one with a grain size of 8-16 mm (thickness of 100 mm) and a top levelling layer with a grain size of 4-8 mm (thickness of 50 mm). The flatness of the surface of this layer shall not be more than  $\pm 5$  mm. The levelling layer must also be made above the reinforced concrete slab (fine gravel / mortar bed) or above the grade beams (mortar bed).

The construction pit shall be constructed in accordance with the specifications shown on the construction readiness drawing. The given dimensions are minimum and must be observed, especially because of the possible movement around the concrete cell during its placing.

The client is responsible for the proper execution of the excavation.



**BETONBAU assumes no liability for improper or negligent handling and securing of the load during transport/installation.**

