

# Instructions for use

e+s deep linear shoring



thyssenkrupp

Date: September 2020

## Information about the instructions for use

These instructions enable the safe and efficient use of e+s deep linear shoring. The instructions are part of the system and shall be kept in close proximity of the shoring site, accessible to the personnel at all times.

The personnel must read and understand these instructions thoroughly before starting to work. Prerequisite for safe work is observance of all safety precautions and work instructions specified in these instructions.

In addition, local occupational health and safety regulations and general safety regulations for the area of use of the system apply.

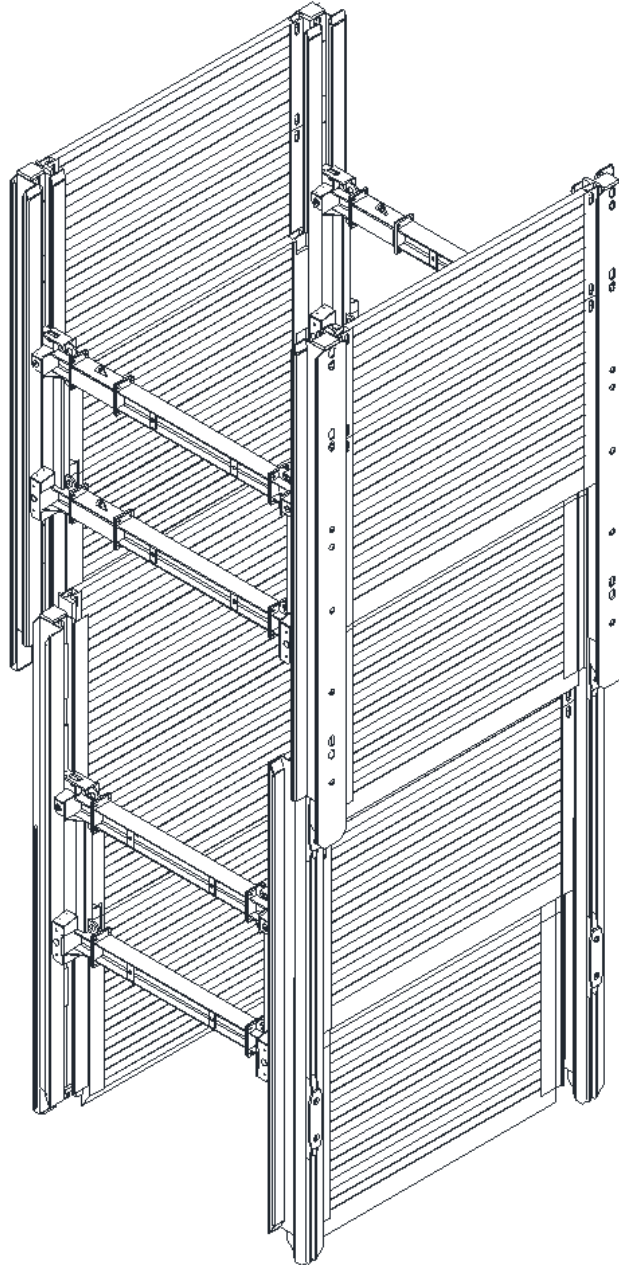
All safety-related dimensions conform with German safety and accident prevention regulations and German standards. The respective state-specific regulations are to be checked and applied before the works start.

## Contents

1	System overview	2
2	Occupational safety and general information in accordance with DIN EN 13331-1/-2	3
2.1	Symbols in these instructions	3
2.2	Dangers	4
2.3	General safety information and measures for reduction of risks	4
2.4	Protection against falls and falling parts	5
2.5	Storage, transportation and lifting operations	5
2.6	Criteria for the inspection, repair and withdrawal of worn or damaged components	6
2.7	The following, as amended, apply in particular:	7
2.8	Personal protective equipment (PPE)	7
2.9	Technical data of the shoring elements	7
3	Deep linear shoring	8
3.1	Installation instructions deep linear shoring with linear shoring supports of equal length	8
3.2	Assembly instructions deep linear shoring with linear shoring supports of equal length	11
3.3	Installation instructions deep linear shoring with linear shoring supports of different length	19
3.4	Assembly instructions deep linear shoring with linear shoring supports of different length	22
3.5	Installation instructions deep linear shoring with head end shoring	30
3.6	Assembly instructions deep linear shoring with head end shoring	34
3.7	Instructions for removing deep linear shoring	43
4	Statics questionnaire	46

# 1 System overview

## Deep linear shoring



Module length	2.25 m - 6.50 m
Slide rail length	6.13 m - 7.13 m
Panel height	1.32 m / 2.32 m
Pipe culvert height	variable

### Designation for slide rail system X according to EN 13331-1:

e. g.: RD - X - FR - F - 6.13 - 0.90 / max. - 1.35 / max.

## 2 Occupational safety and general information in accordance with DIN EN 13331-1/-2

### 2.1 Symbols in these instructions

#### Safety information

The following occupational safety symbols are on all occupational safety information which indicates a danger to the life and limb of personnel and are identified by a pictogram, a signal word and a signal color.

You can find explanations of the dangerous situations at the relevant points in the documentation.

Observe this information at all times!

Observe the applicable local safety and accident prevention regulations at all times!

All the following dimensions conform with German safety regulations.

#### DANGER



##### Type and source of danger

This symbol warns of an immediate danger to the life and health of personnel.

Failure to observe these warnings results in serious repercussions for health, culminating in life-threatening injuries and extensive property damage.

*Action which must be refrained from so that the danger does not occur*

#### WARNING



##### Type and source of danger

This symbol warns of an imminent danger to the life and health of personnel, and of environmental and property damage.

Failure to observe these warnings may result in serious repercussions for health, culminating in life-threatening injuries and/or extensive environmental and property damage.

*Action which must be refrained from so that the danger does not occur*

#### CAUTION



##### Type and source of danger

This symbol warns of an imminent danger to the health of personnel and of environmental and property damage.

Failure to observe these warnings may result in moderate or slight repercussions for health, culminating in injuries and/or extensive environmental and property damage.

*Action which must be refrained from so that the danger does not occur*

#### NOTE



##### Type and source of machine and/or system damage

This symbol warns of a dangerous situation and serves to indicate a note on the handling of the trench shoring.

Failure to observe these warnings may result in extensive property damage.

*Action which must be refrained from so that the damage does not occur*

#### Tips and recommendations



*This symbol highlights useful tips and recommendations, as well as information for efficient and fault-free operation. Action which must be refrained from so that the danger does not occur*

#### Other markings

The following markings are used to highlight instructions, results, lists, references and other elements in these instructions:

Marking	Explanation
1., 2., 3. ...	Step-by-step instructions
	Results of actions
•	Lists with no fixed order

## 2.2 Dangers

When working on and in excavations and trenches, the following dangers with the potential to cause serious injuries or death arise, among others:

- Being buried under volumes of soil or gravel which slip
- Being buried as a result of failure of the shoring
- Personnel falling
- Being affected by falling or tipping parts
- Tripping, slipping, falling
- Forced postures in confined working spaces
- Crushing of hand and feet during loading and unloading, transportation, assembly and disassembly, and installation and removal of the shoring elements

## 2.3 General safety information and measures for reduction of risks

Please note that an appropriate risk assessment must be generated for the specified work step before assembly, installation and removal and disassembly of the shoring system.

Compliance with the technical specifications and safety information in these use instructions is required at all times.

### DANGER



#### **Risk of death or injury owing to insufficient safety measures on the construction site and for adjacent installations / trades!**

Insufficient safety measures on the construction site and for adjacent installations / trades result in a risk of death or injury, as well as a risk of property damage to the shoring!

- Attention must be paid to overhead lines during transportation and during installation and removal of the shoring.
- On sloping or uneven ground, the shoring must set up at as close to a right angle to the slope as possible.
- The use instructions must be present of the construction site.
- When using the shoring system, the maximum permitted loads as specified in these use instructions may not be exceeded.
- Shoring systems may only be used in ground which is not susceptible to slippage; water table drawdown measures must be taken where applicable.
- The stability of the shoring must be ensured in all installation and removal, assembly and disassembly states.
- The shoring must be installed in a horizontal position.
- Only put up shoring units on solid and even surfaces and secure against falling where applicable – possible factors which may affect stability, e.g. site incline, wind loads, vibrations from traffic loads and/or work tools, soil condition, etc., must be taken into account.
- Take traffic safety measures us trenches are established in the vicinity of public roads or if the establishment affects traffic. Consult with the relevant authorities.
- The shoring must reach to the bottom of the trench. In minimum stiff, cohesive soils, the shoring for construction operations which will be finished in a few days may end up to 0.50 m above the bottom of the trench if there are no exceptional influences and no earth pressure is to be absorbed from building loads.
- Throughout the construction phase, the front area must be secured through frictional connection and/or battered in accordance with the national regulations.
- Shoring elements placed on top of one another must be frictionally connected to one another at all points provided for in the design.
- Cavities should be filled immediately in a force-fitting manner.
- In order to ensure the safe execution of works, material transportation, and in particular the rescue of injured personnel, minimum working area widths in accordance with DIN 4124 must be complied with (minimum working area width for excavations/trenches  $\geq 0.6$  m); the appropriate national regulations must be applied where applicable.
- All parts of the shoring must always be inspected after heavy rainfall, in the event of significant changes to the loading, at the onset of a thaw, after a long interruption in the works, after extraordinary stresses (e.g. owing to impacts or vibrations) or after blasts.
- Removal of the shoring must be done in conjunction with backfilling.



**TIP**

- The safety of vehicles and persons on site must be ensured by means of cones, warning tape or security personnel specially deployed for this purpose.
- The construction site must be sufficiently marked as such using warning signs, for example.

**2.4 Protection against falls and falling parts****⚠ DANGER****Risk of death or injury owing to falls or falling parts!**

Falls or falling parts result in a risk of death or injury, as well as a risk of property damage to the machine and/or system! The following measures must be implemented, depending on the construction site.

- Transitions are required for trenches with a width of > 0.80 m; the transitions must be at least 0.50 m wide.
- At a trench depth of > 1.00 m, the transitions must be equipped with a three-part side guard on both sides to protect against falling.
- At a trench depth of > 1.25 m, steps or ladders must be used for access.
- In order to protect against falling parts or against excavated soil slipping back in, the shoring must have an overhang over the top edge of the trench – at trench depths of 2.0 m this must be min. 5 cm, at trench depths of greater than 2.0 m it must be min. 10 cm.
- The front sides of the trenches or excavations must either be secured using appropriate shoring systems or, depending on the soil condition, battered accordingly.
- At the top edge, a protective strip which is at least 0.60 m wide must be kept free from loads and in particular from construction machinery and vehicles.
- Fall protection systems must be installed in excavations and trenches with a possible fall height of greater than 2 m.
- For activities for which the installation of effective fall protection is generally not possible (e.g. during installation of the shoring, during excavation, during cable laying or during backfilling), this must be reviewed and justified within the risk assessment.

**2.5 Storage, transportation and lifting operations****Storage****⚠ DANGER****Risk of death or injury owing to incorrect storage!**

Incorrect storage results in a risk of death or injury, as well as a risk of property damage to the machine and/or system!

- The shoring elements may only be stored on solid, even ground.
- In the event that shoring panels are stored in stacks, the maximum permitted stack height must be observed – rule of thumb: max. stack height [m] = 4 x width of the narrow side [m].
- Care must be taken to ensure that the shoring panels are aligned perpendicular with one another during storage and transportation; support staves and non-slip mats or similar must be used where applicable in order to ensure safe storage and safe transportation.
- The prescribed safety distances from trench and excavation walls (see 2.3) must always be complied with for storage.

## Transportation and lifting operations

### DANGER



#### **Risk of death or injury owing to suspended, hauled or towed loads!**

Loads may swing out and fall during lifting operations. Hauled or towed loads may tip over. There is a risk of death or injury, as well as a risk of property damage to the shoring!

- Assembly of the guide frame may only be done in a horizontal position. Assembly in vertical alignment is EXPRESSLY prohibited!
- For transportation, the use of cranes or hydraulic excavators using hoisting operation is preferred; during transportation with forklifts, attention must be paid to the fact that the ground on a construction site is frequently uneven. This may lead to the load slipping or falling – additional safety measures are required where applicable for transportation with forklifts.
- Hydraulic excavators using hoisting operation must be equipped with an overload warning system and a line-break safety device; the overload warning system must be switched on in hoisting operation.
- The lifting gear, load handling attachment and sling must be chosen according to the load; the dynamic loads, e.g. when pulling boxes (removal), must also be taken into account here in addition to the static loads.
- All lifting gear, load-handling attachments and slings must be tested and approved.
- Do not pull shoring elements through the trench (exception: dragboxes).
- When using slings, the use of edge protection is required if the sling is routed against sharp edges.
- Only load hooks with safety catches may be used in order to prevent unintentional unhooking of the load during lifting, pulling or transportation; in the event that the safety catch does close owing to the design, the use of hackles or round slings as connectors is required.
- The shoring elements may only be attached and transported using the intended attachment points.
- The loads must be attached such that the shoring elements are in a horizontal position; pendulum movements must be reduced to a minimum during transportation; diagonal pulls are not permitted.
- The angle of inclination between the sling and the notional vertical at the attachment point may not exceed 60°.
- Transportation must be done as close to the ground as possible.
- Never carry the load over personnel.
- Attached loads must be guided with guide lines/guide rods; always walk behind the load and do not walk backwards.
- The accompanying persons for guiding the load and slingers must always remain within the machine operator's field of vision off the track and outside the danger area.
- Accompanying persons for guiding the load and slingers must have safe footing; never stand between a suspended load and a fixed abutment (risk of crushing!).
- Care must be taken to ensure that fingers are always free during lifting, guiding and set down; never guide loads using the sling.
- The applicable national rules and regulations must be observed and complied with.

## 2.6 Criteria for the inspection, repair and withdrawal of worn or damaged components

- Shoring elements must be subjected to functional testing and a visual inspection for obvious defects, e.g. on struts, top layers of the panels, welding seams, stabilizers, attachment points, by supervisors before each use.
- If defects which reduce the load capacity are found, in particular damaged struts, cracked welding seams or excessively deformed, cracked or worn out attachment points, the shoring elements may only be used again after professional repairs by the manufacturer.
- Furthermore, missing parts such as nuts, screws, connectors, bolts and stabilizers, or broken parts such as spindles, bolts and spreader systems result in withdrawal of individual system elements.
- Defecting parts must be replaced or repaired before use. The elements may only be used again after approval by the manufacturer.
- In the event of significantly deformed or warped parts or in the event of holes, e.g. in the panel body, the manufacturer must always be consulted before the shoring element is used.

- Small repairs may be carried out by the user himself where applicable – however this may only be done in consultation with the manufacturer.
- Only original parts from the manufacturer may be used.
- The manufacturer provides no warranty for repairs which are improperly performed and for the use of parts which are not original parts.
- Before each (repeated) use and after reassembly of the shoring elements or after exceptional disturbances (see chapter 2.2), the tightness of all screw connections must be checked and they must be tightened where necessary.
- If there is any doubt about the usability of the shoring elements, and in the event of defects and damage, the manufacturer must be contacted.
- Soil which has adhered to the shoring elements must be cleaned off after use.
- In order to increase the service life, regular renewal of the paint (rust protection, top coat) is recommended.

## 2.7 The following, as amended, apply in particular:

Regulations issued by the BG [German Employers' Liability Insurance Association] – Civil Engineering Technical Committee

- DIN 4124 "Excavations and trenches"
- DIN EN 13331 Part 1 – Product specifications, Part 2 – Assessment by calculation or test
- General safety information and the Industrial Safety Regulation

Our products bear the "tested for safety" GS mark.

## 2.8 Personal protective equipment (PPE)

Personal protective equipment serves to protect personnel against health and safety risk while working.

In principle, the necessary personal protective equipment for the activities is the result of your risk assessment.

We recommend the following PPE for loading and unloading activities, assembly and disassembly, transportation/lifting operations, maintenance and repair, and for activities in the area with shoring:

### PROTECTIVE CLOTHING



Protective clothing is tight-fitting workwear which tears easily, with tight sleeves and with no protruding parts.

### SAFETY HELMET



Safety helmets protect the head against falling objects, swinging loads and impacts against fixed objects.

### PROTECTIVE GLOVES



Protective gloves protect the hands against friction, abrasions, deeper injuries.

### SAFETY SHOES



Safety shoes protect the feet against crushing, falling parts and slipping on slippery surfaces. Furthermore, S3 safety shoes are puncture-resistant and thus protect against injuries to the feet resulting from nails, metal chips, etc.

## 2.9 Technical data of the shoring elements

The technical data of the shoring elements used can be found in the current version of the technical manual. The technical manual is available at <https://www.thyssenkrupp-infrastructure.com>

## 3 Deep linear shoring

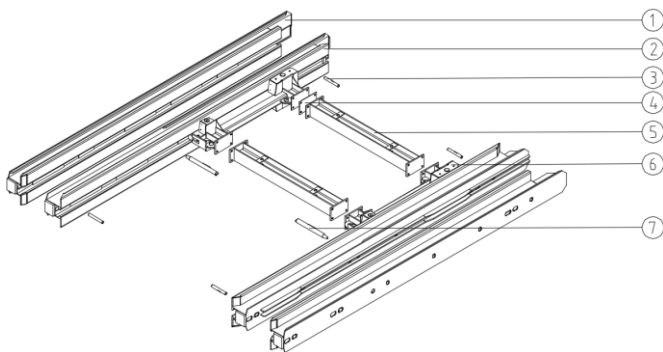
### 3.1 Installation instructions deep linear shoring with linear shoring supports of equal length

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

The guide frame is completely pre-assembled on a sufficiently large surface that is as even as possible.

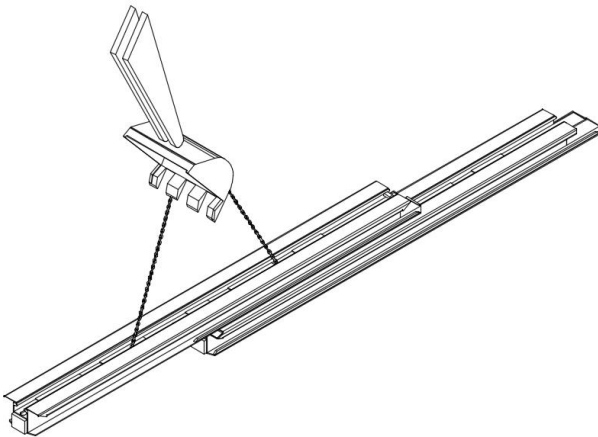
To facilitate installation - especially on uneven ground - all components must be placed on squared timber.

#### 1. Guide frame system overview



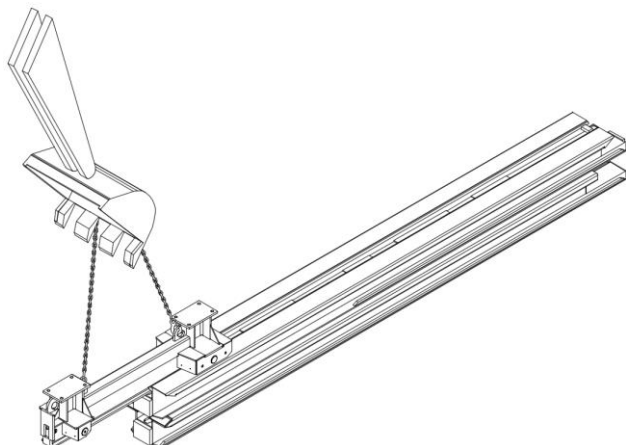
- (1) Support "Deep linear shoring" outside
- (2) Support "Deep linear shoring" inside (with guide rails welded on at rear)
- (3) Locking pin
- (4) Distance plate
- (5) Spacers or combinations
- (6) Linear shoring strut cart
- (7) Locking pin slide rail

#### 2. Beam installation



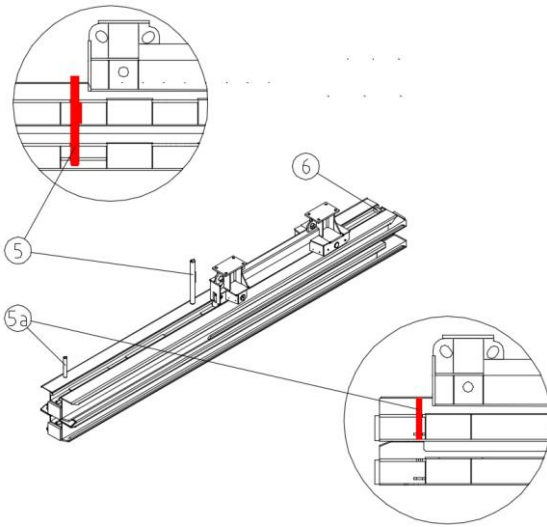
The outside support must be positioned on suitable terrain. The inside beam is then inserted using a lifting device and suitable lifting sling (GS approval). Make sure that both supports are flush with each other in the area of the impact plate.

#### 3. Strut cart installation



One strut cart each is inserted into the inside supports with the pendulum roller first using lifting gear and suitable lifting slings (GS approval).

#### 4. Securing the strut cart

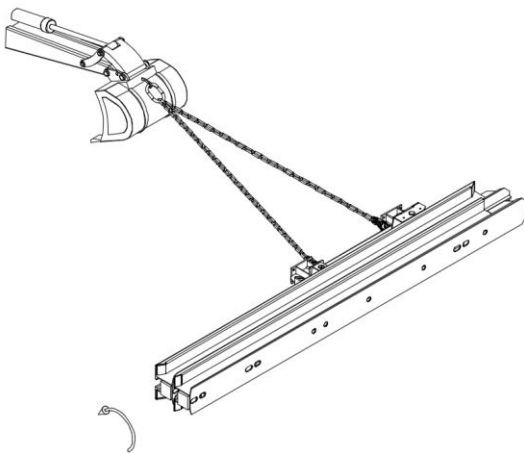


To fix the two supports, the long locking pin  $\varnothing 60 \times 650$  mm (5) is inserted. The locking pin  $\varnothing 30 \times 300$  mm (5a) is used to secure the strut cart against unintentional removal from the slide rail during the installation phase.

After insertion of the pins these must be turned by  $180^\circ$ .

In the lower area of the inside support, a fixed stop (6) serves to fix the strut cart downwards.

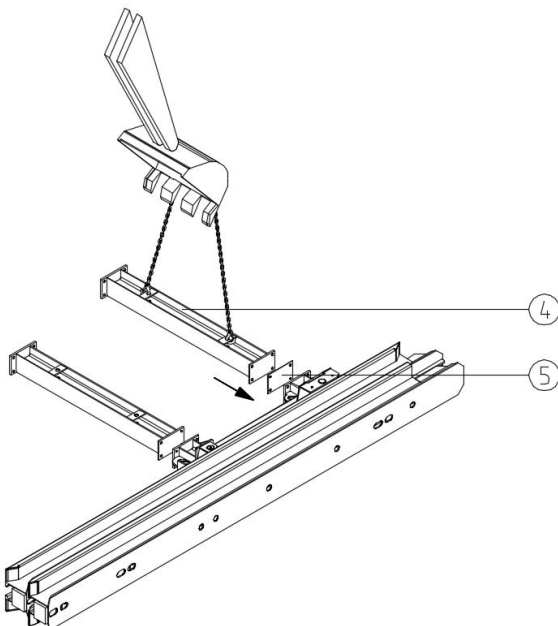
#### 5. Turning of the linear shoring support



Before the spacers can be installed, the linear shoring supports must be rotated by  $90^\circ$ .

The turned linear shoring support must be secured against tipping over.

#### 6. Pre-assembly of the spacer combination

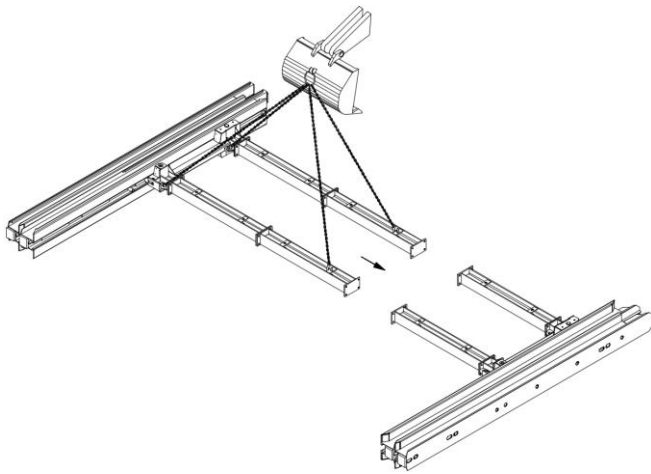


The pre-assembled spacer combinations (4) required for the desired trench width are aligned with the mounting plates of a strut cart and screwed with the required number of screws according to the parts list. The screws are only slightly tightened for easier alignment of the spacers for the following installation steps.

Insert the distance plate (5) between the spacer pointing towards the tip of the beam and the stop panel.

The frame provided with a combination of spacers must be secured against tipping over, e. g. by means of a lifting device.

## 7. Installation of the complete guide frame

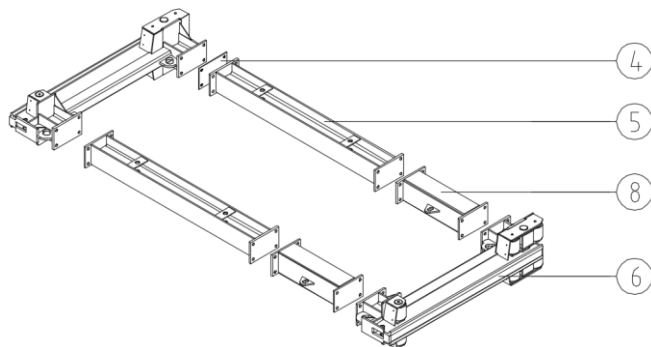


The complete guide frame must be installed in a lying position.

Both strut carts inserted into the beams must be pre-assembled with approximately the same extension bar length. After pre-assembly, both supports are laid flat to each other on the side of the ground so that the extension bars can be screwed together.

Two fully mounted guide frames are required to create a shoring field. An additional guide frame must be provided for each additional shoring field.

## 8. System overview strut carts for outside beams



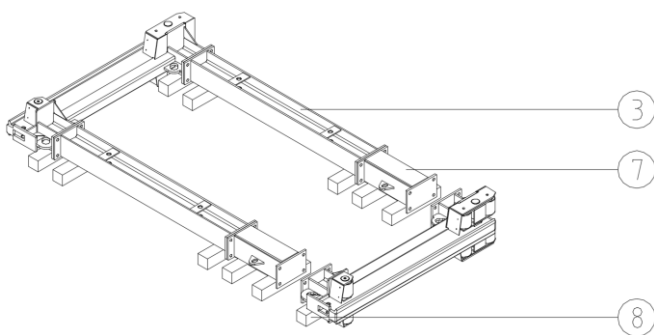
(4) Distance plate

(5) Extension bars or combinations

(6) Strut cart

(8) Compensation spacers; length 840 mm

## 9. Installation of the strut carts



The strut carts must be mounted in lying position. It is recommended that any unevenness in the terrain be corrected by placing squared timber underneath.

The strut cart for the outside support is installed by screwing the corresponding extension bars (5) together. An additional 840 mm long compensating spacer (8) is required for the strut cart of the outside supports.

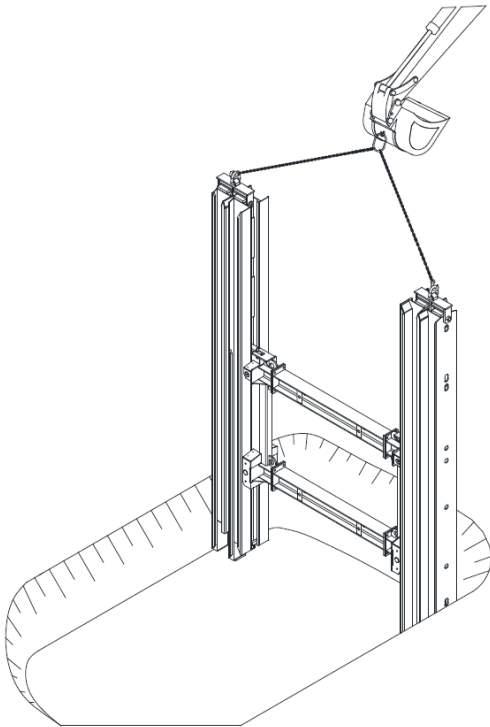
The screws are only tightened hand-tight to facilitate alignment of the extension bars. Only when the strut cart is completely installed are all screw connections fully tightened.



### 3.2 Assembly instructions deep linear shoring with linear shoring supports of equal length

Before starting the work, it is obligatory to observe all safety precautions from section “Occupational health and safety and general remarks according to DIN EN 13331-1/-2” (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

#### 1. Setting the 1st guide frame



After the trench alignment has been measured, advance excavation for the 1st shoring field takes place in accordance with the instructions of the site management.

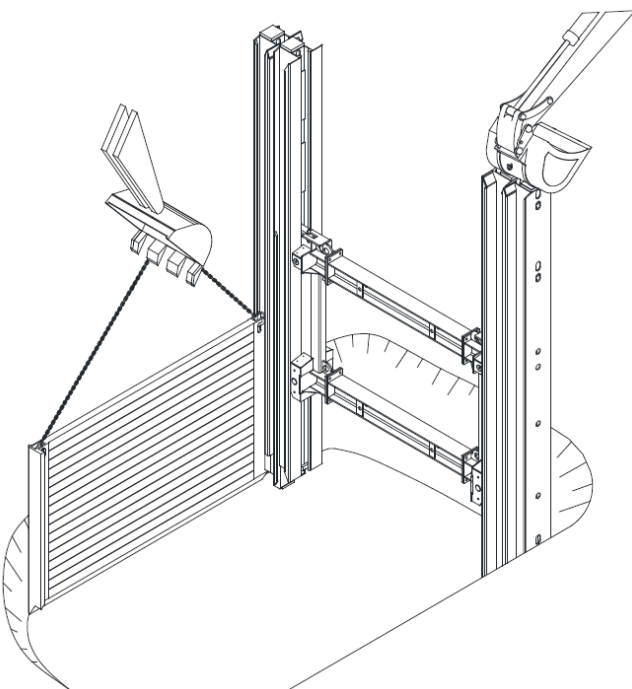
Trench width  $b_a$ : required clear trench width  
 $b_c$  + approx. 1.30 m

Shoring field length: module length + approx. 0.70 m  
 (and / or length of the panels + approx. 1.00 m)

The first outside guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench.

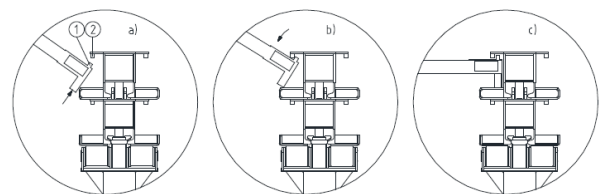
In order to make it easier to set the frame, e+s pulling adapters are to be used. The strut cart is secured at the top by a locking pin in the guide frame (see installation instructions). If necessary, the frame should be locked vertically (e. g. using a second lifting gear).

#### 2. Inserting the outside base panels (outside shoring field)

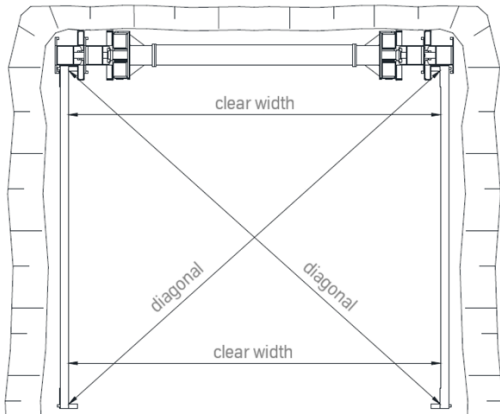


The outside base panels are swiveled into the support profile using lifting gear (see image a, b, c). Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2). After being swiveled in, the shoring panels are adjusted to the bottom of the trench.

Before lowering the linear shoring frame, it is essential to remove all locating pins located beneath the strut cart.

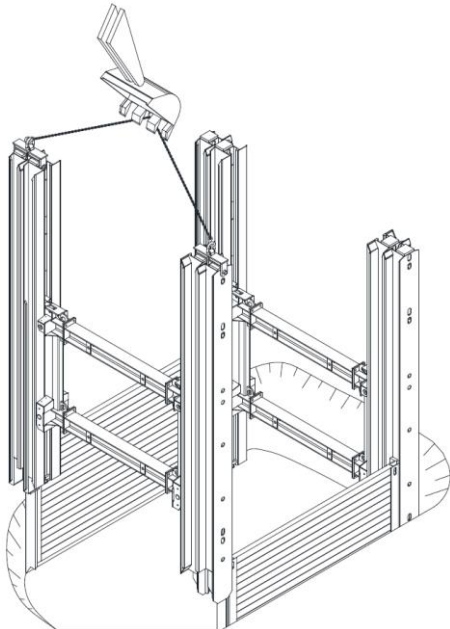


### 3. Alignment of the shoring panels



The alignment of the first shoring field is decisive for the creation of an exact shoring field running parallel to the trench axis. For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

### 4. Setting the 2nd guide frame

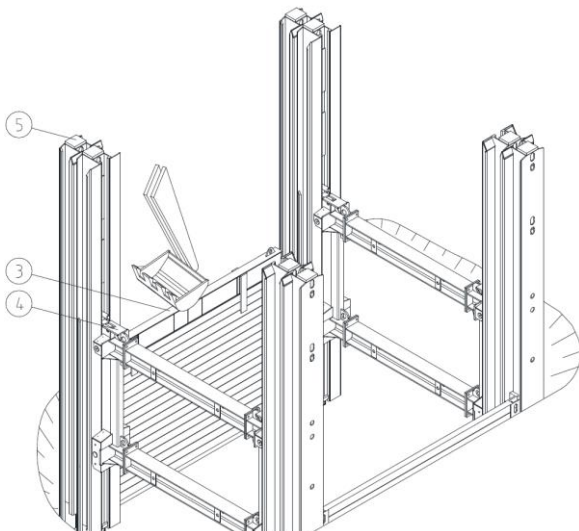


The second guide frame is guided over the free-standing guide profiles of the base panels and adjusted to the bottom of the trench.

After adjusting the shoring field should be aligned again as described in work step 3, as this makes it easier to install and remove the subsequent shoring fields.

To ensure that the shoring is guided correctly, the cavity between trench wall and shoring panel must be filled with suitable material during lowering.

### 5. Lowering the shoring field (outside shoring field)

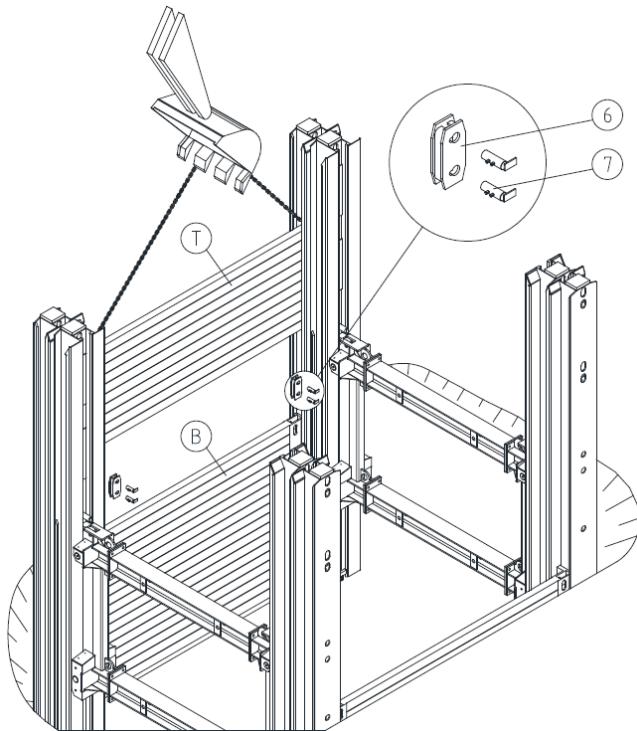


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

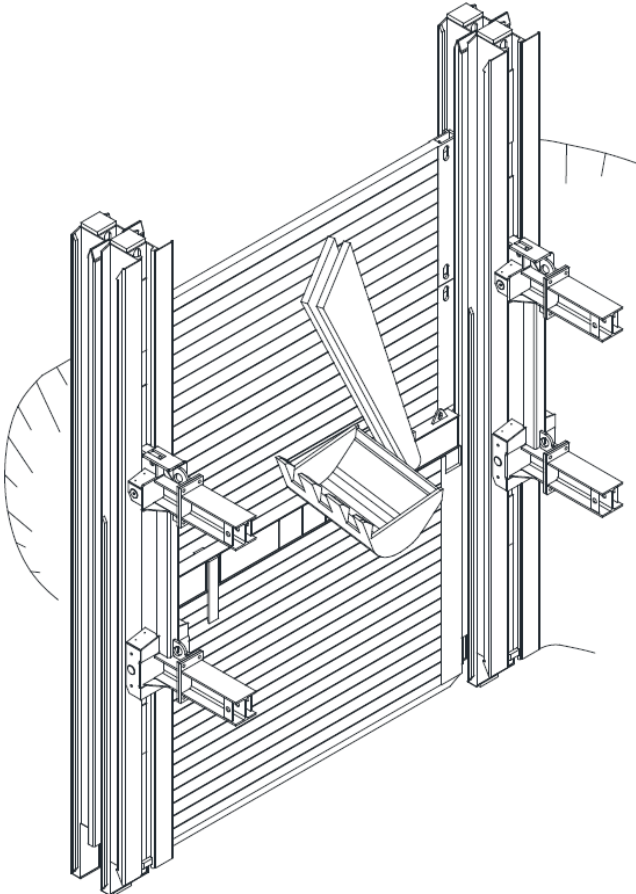
## 6. Inserting the outside top panels (outside shoring field)



Depending on the required trench depth, after lowering the outside base panels to the temporary bottom of the trench, the outside top panels are inserted into the shoring supports.

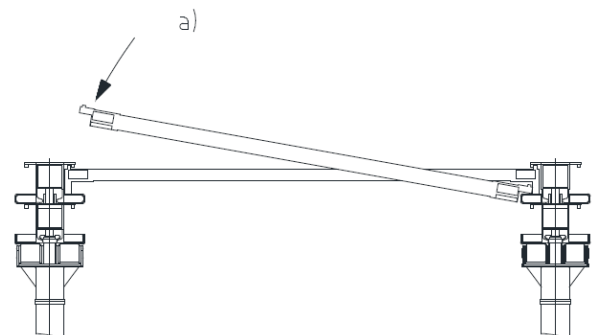
Base and top panels are to be connected by stanchions (6) and pins (7).

## 7. Inserting the inside base panels (outside shoring field)

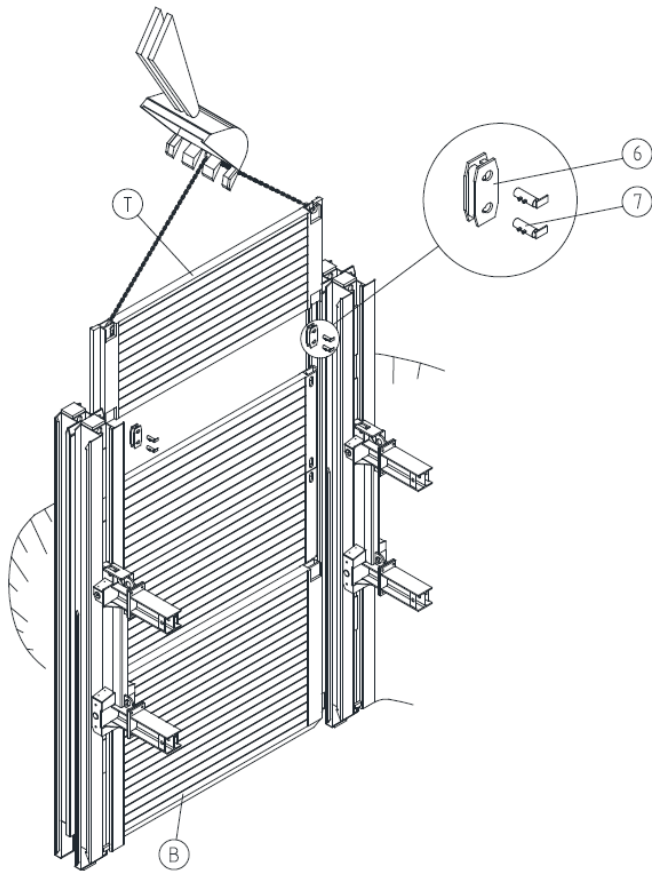


The inside base panel is swiveled between the guide frames as shown in image a), guided in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside base panels, the guide frames and the strut carts.

When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



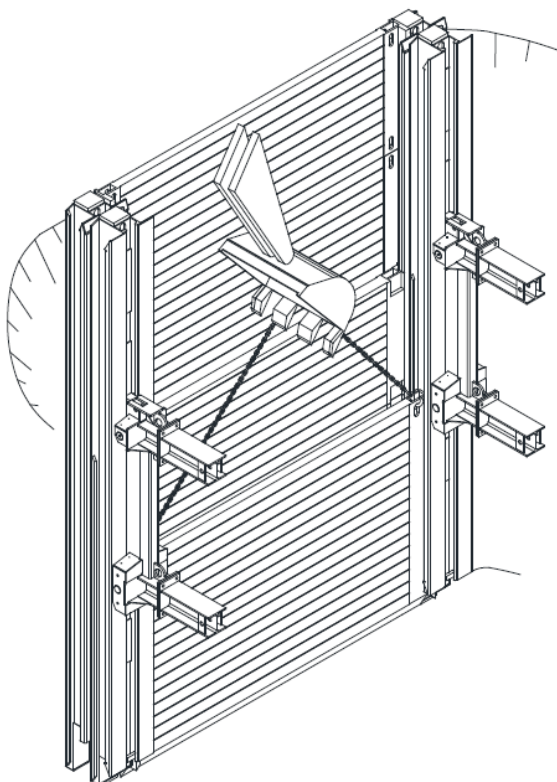
## 8. Inserting the inside top panels (outside shoring field)



Further height adjustment of the shoring wall is possible by inserting the inside top panels (T). The installation is carried out in the same way as work step 6.

Base (B) and top panels are to be connected by stan- chions (6) and pins (7). The pins must be turned by 180° after insertion.

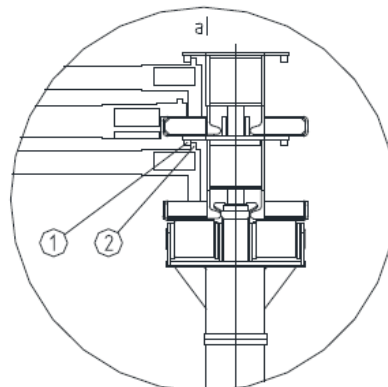
## 9. Inserting the outside base panels (inside shoring field)



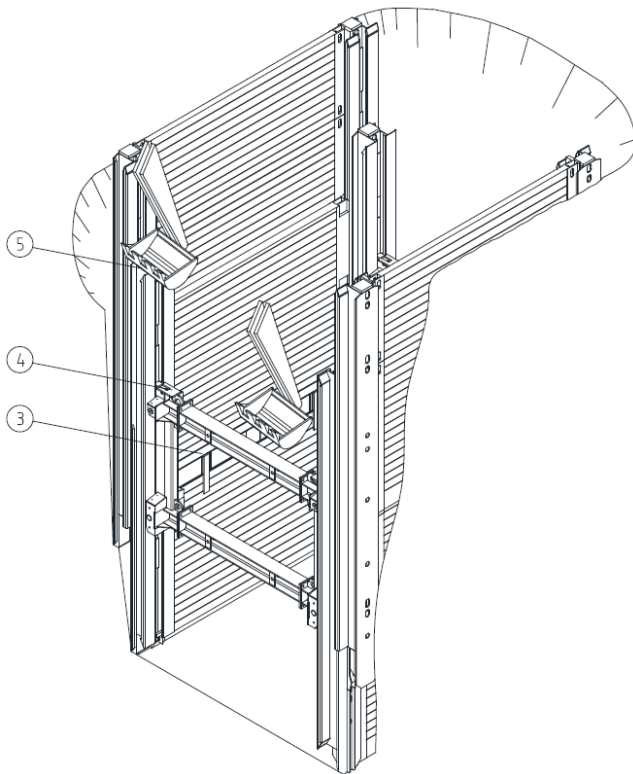
The shoring panels of the inside shoring field must only be installed after the shoring panels of the outside shoring field have been lowered completely to the temporary sole.

The outside base panels are inserted into the support pro- file of the inside guide frames from above using lifting gear (see image a)). Ensure that the square on the rear of the shoring panels (2) engages behind the square in the linear shoring support (1).

After being inserted, the shoring panels are adjusted to the bottom of the trench.



## 10. Lowering the shoring field (inside shoring field)

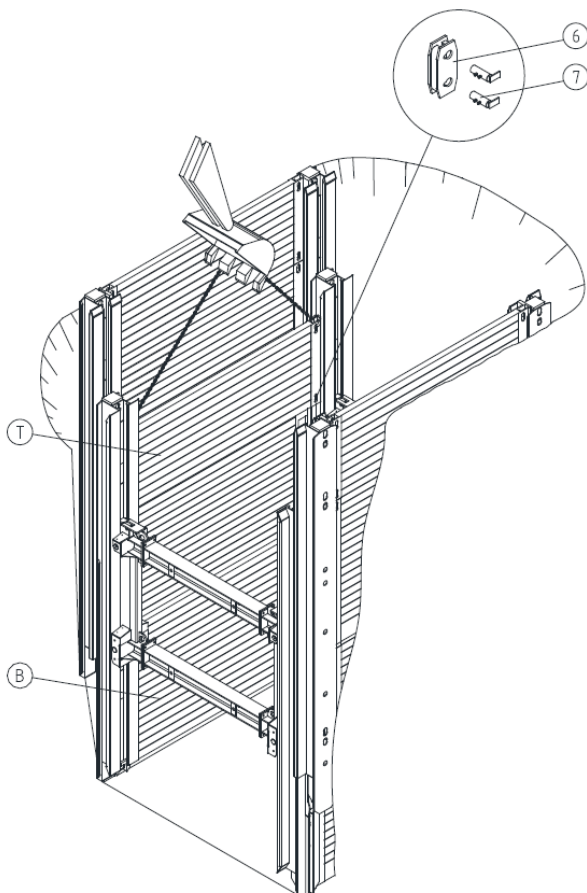


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

## 11. Inserting the outside base panels (outside shoring field)

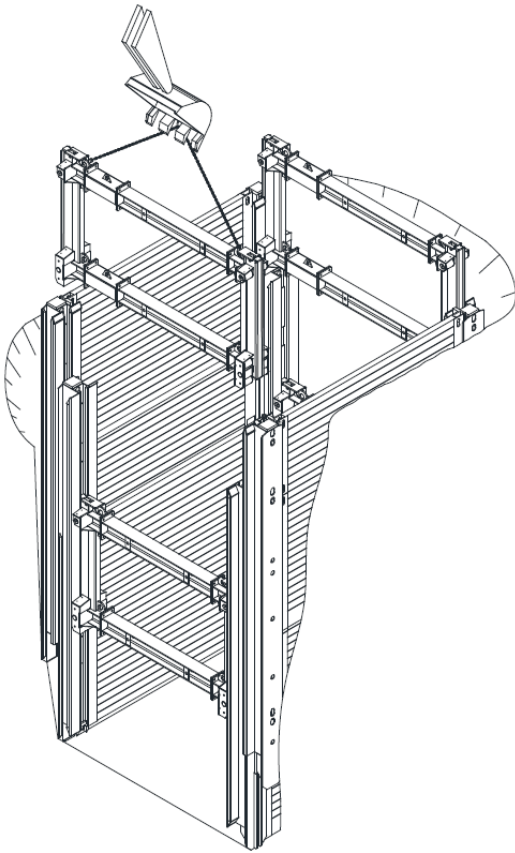


Depending on the required trench depth, after lowering the outside base panels to the temporary bottom of the trench, the outside top panels are inserted into the shoring supports.

Base and top panels are to be connected by stanchions (6) and pins (7).



## 12. Inserting the outside strut cart frame (outside shoring field)

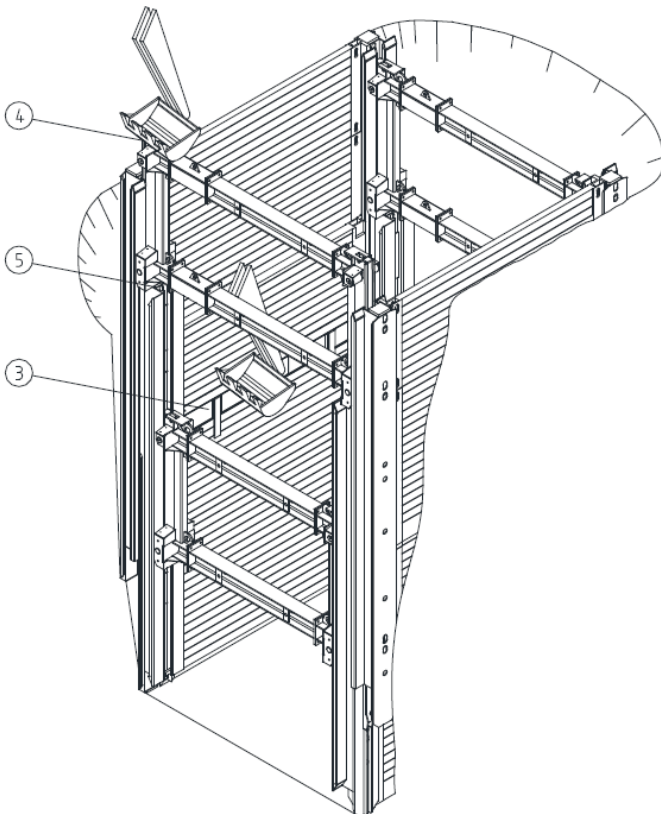


The inside guide frames are first lowered so far that the outside strut cart frames can be inserted from above. When lowering the inside system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

The outside strut carts are inserted into the outside linear shoring supports with the pendulum roller first using lifting gear and suitable lifting slings (GS approval). Then the strut cart must be secured by inserting the upper locking pins.

Care must be taken to ensure that the shoring beams are in contact on the inside and on the outside.

## 13. Lowering the shoring field (inside shoring field)



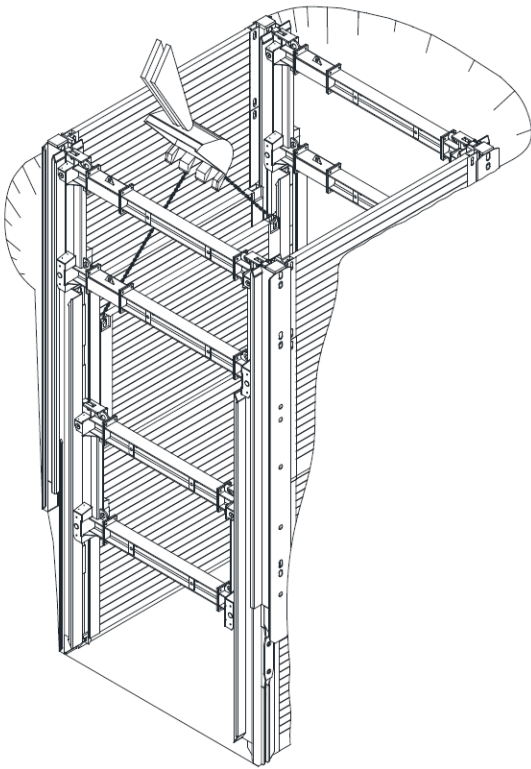
Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the inside system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

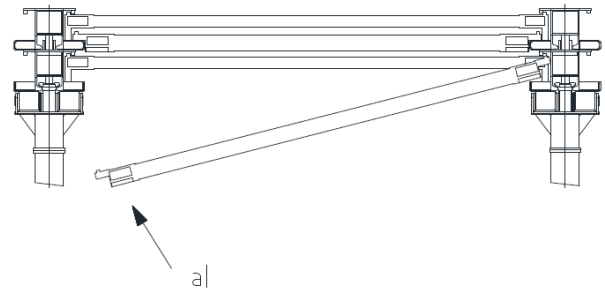


#### 14. Inserting the inside base and top panels (inside shoring field)

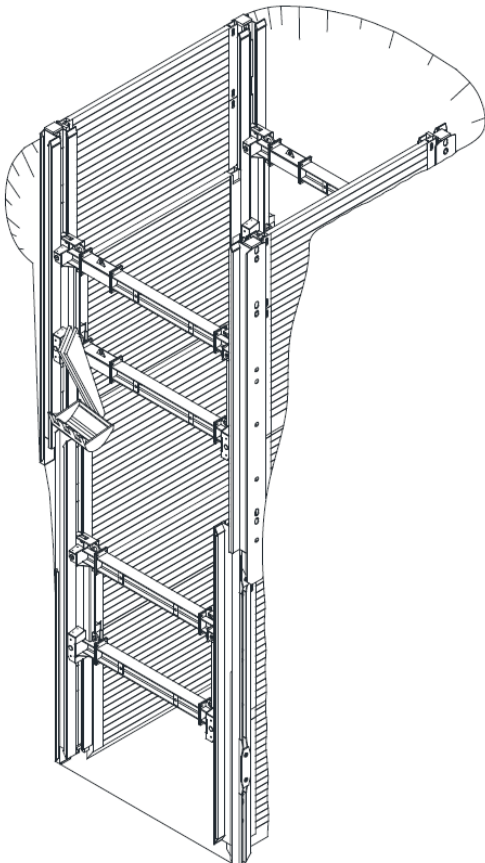


The inside base and top panels are swiveled between the guide frames as shown in image a), guided in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside shoring panels, the guide frames and the strut carts.

When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



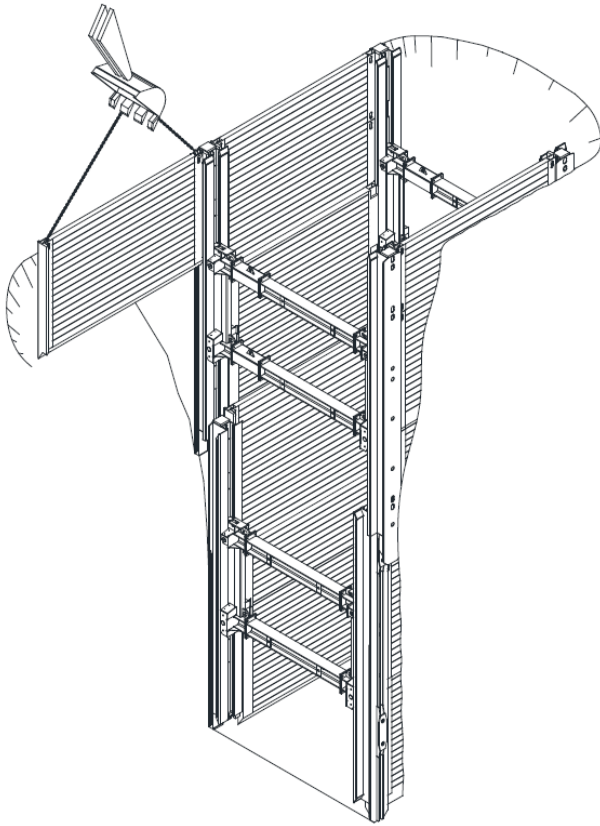
#### 15. Lowering to final depth (inside shoring field)



If the strut cart of the outside shoring field is positioned in accordance with the static requirements, it must be secured in its position with locating pins. For all subsequent lowering steps, only elements of the inside shoring field are lowered to the final installation depth.

When lowering the inside shoring field, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.

## 16. Setting the next shoring field (outside shoring field)

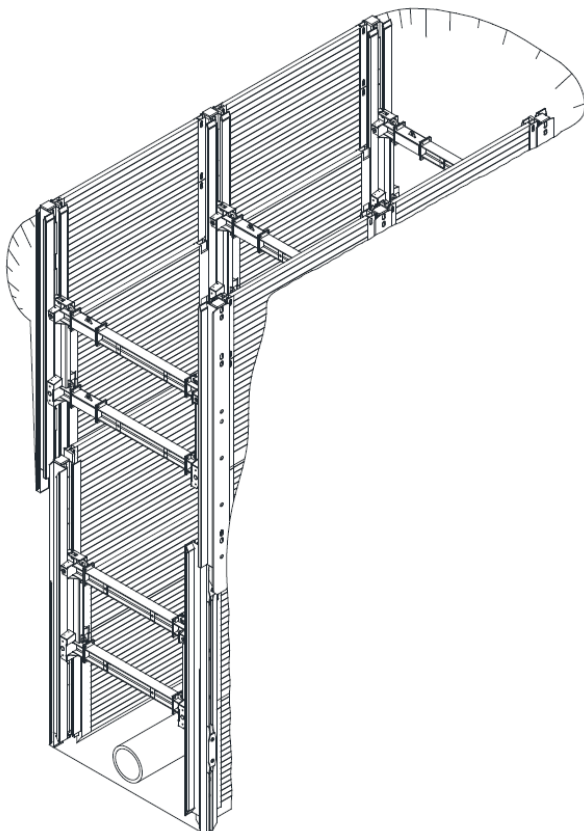


The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned and fixed vertically in accordance with the static requirements. The installation is carried out according to the described points 2 to 15.

The other fields are aligned with the precisely installed first field. When inserting the shoring panels, the clear trench width and diagonal dimension (point 3) should be checked for each subsequent field.

Before each use of the shoring elements, all screw connections must be checked for tightness and retightened if necessary.

## 17. Pipe laying



Once the shoring has been lowered completely and without gaps to the bottom of the trench to the required length, pipe laying can begin.

The strut carts must be positioned and fixed vertically with pins in accordance with the static requirements.

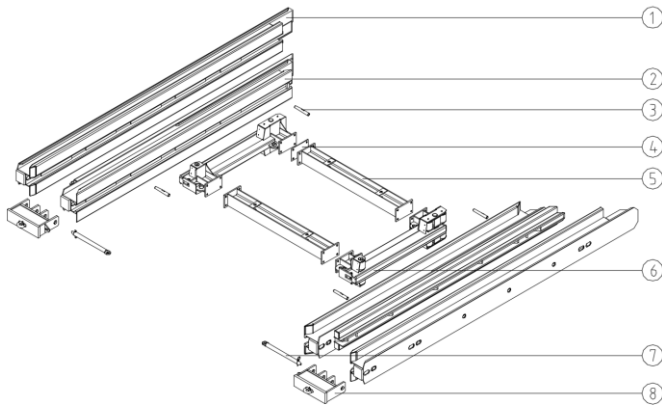
### 3.3 Installation instructions deep linear shoring with linear shoring supports of different length

Before starting the work, it is obligatory to observe all safety precautions from section “Occupational health and safety and general remarks according to DIN EN 13331-1/-2” (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

The guide frame is completely pre-assembled on a sufficiently large surface that is as even as possible.

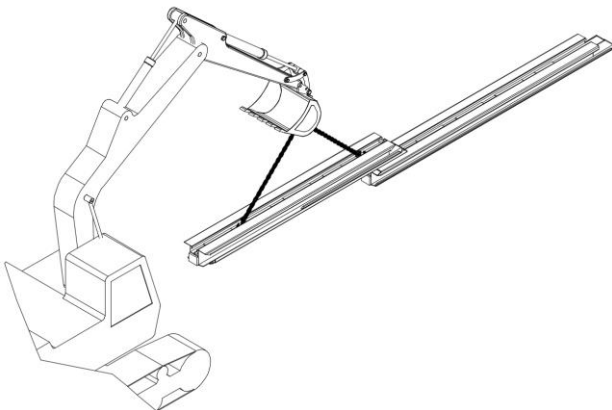
To facilitate installation - especially on uneven ground - all components must be placed on squared timber.

#### 1. System overview guide frame



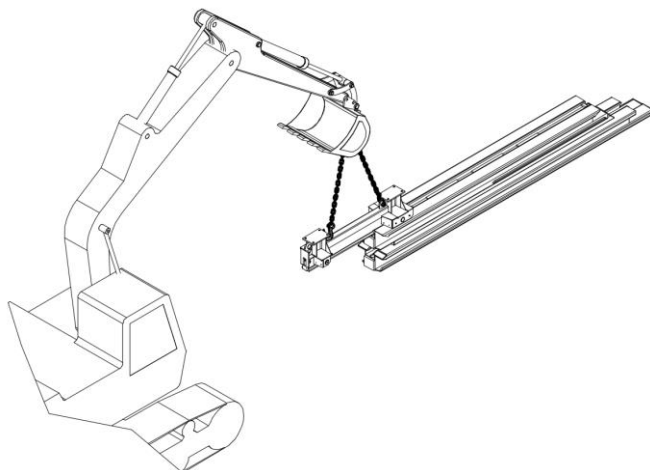
- (1) Beam “Deep linear shoring” outside
- (2) Beam “Deep linear shoring” inside (with guide rails welded on at rear)
- (3) Locking pin slide rail
- (4) Distance plate
- (5) Extension bars or combinations
- (6) Linear shoring strut cart
- (7) Pin pulling adapter
- (8) Pressure adapter “Deep linear shoring”

#### 2. Beam installation



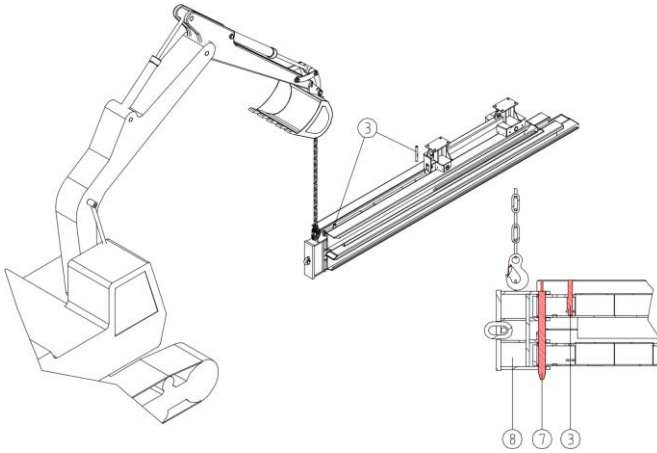
The outside beam must be positioned on suitable terrain. The inside beam is then inserted using a lifting device and suitable lifting sling (GS approval). Make sure that both beams are flush with each other in the area of the impact plate.

#### 3. Strut cart installation



One strut cart each is inserted into the inside beams with the pendulum roller first using lifting gear and suitable lift-slings (GS approval).

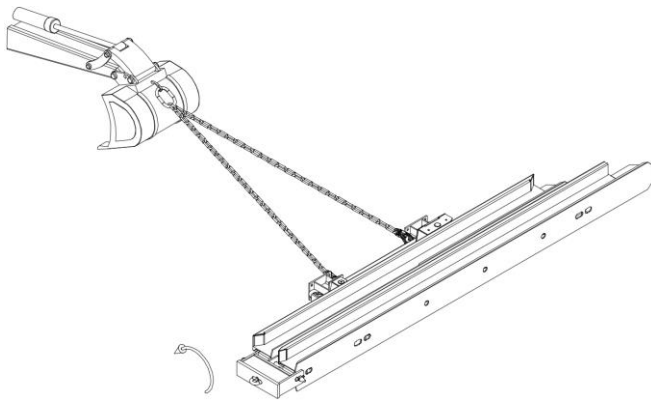
#### 4. Installation of the pressure adapters



The pressure adapter (8) must be moved up to the linear shoring supports by means of a lifting device and secured with a locking pin and spring cotter (7). The locking pin (3) is inserted to secure the strut cart. It is used to secure the strut cart against unintentional removal from the slide rail carrier during the installation phase.

After insertion of the pin (3) it must be turned by 180°. In the lower area of the inside beam, a fixed stop serves to fix the strut cart downwards.

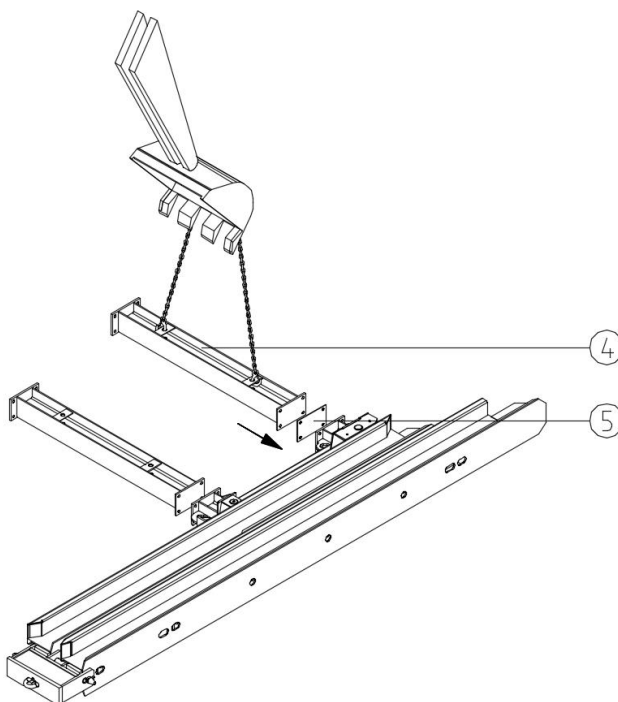
#### 5. Turning of the linear shoring support



Before the extension bars can be installed, the linear shoring supports must be rotated by 90°.

The turned linear shoring support must be secured against tipping over.

#### 6. Pre-assembly of the spacer combination

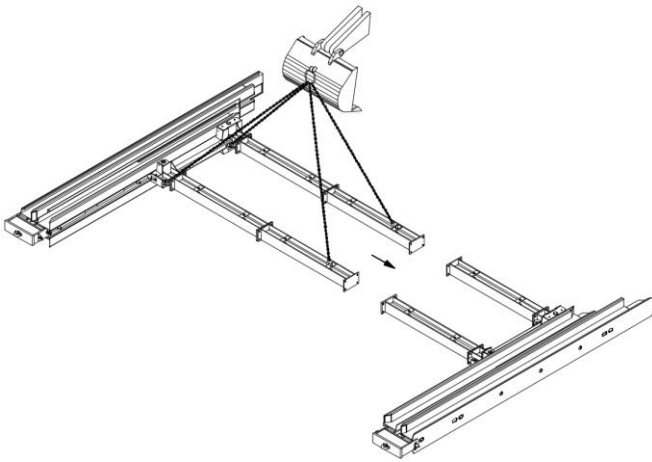


The pre-assembled extension bar combinations (4) required for the desired trench width are aligned with the mounting plates of a strut cart and screwed with the required number of screws according to the parts list. The screws are only slightly tightened for easier alignment of the spacers for the following installation steps.

Insert the distance plate (5) between the spacer pointing towards the tip of the beam and the stop panel.

The frame provided with a combination of spacers must be secured against tipping over, e. g. by means of a lifting device.

## 7. Installation of the complete guide frame

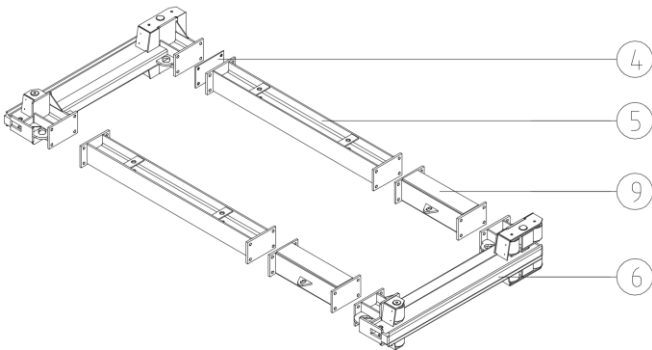


The complete guide frame must be installed in a lying position.

Both strut carts inserted into the beams must be pre-assembled with approximately the same extension bar length. After pre-assembly, both beams are laid flat to each other on the side of the ground so that the spacers can be screwed together.

Two fully mounted guide frames are required to create a shoring field. An additional guide frame must be provided for each additional shoring field.

## 8. System overview strut carts for outside beams



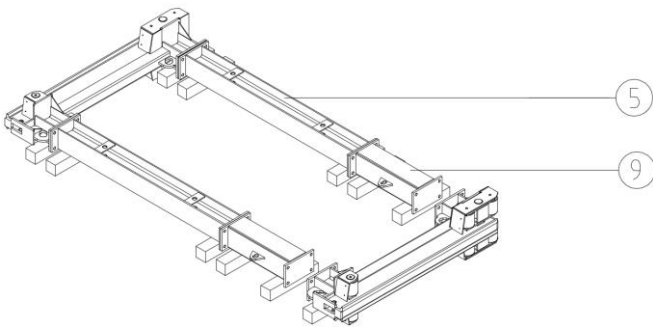
(4) Distance plate

(5) Extension bar or combinations

(6) Linear shoring strut cart

(9) Compensation spacers; length 840 mm

## 9. Installation of the strut carts



The strut carts must be mounted in lying position. It is recommended that any unevenness in the terrain be corrected by placing squared timber underneath.

The strut cart for the outside beam is installed by screwing the corresponding extension bars (5) together. An additional 840 mm long compensating spacer (9) is required for the strut cart of the outside beams.

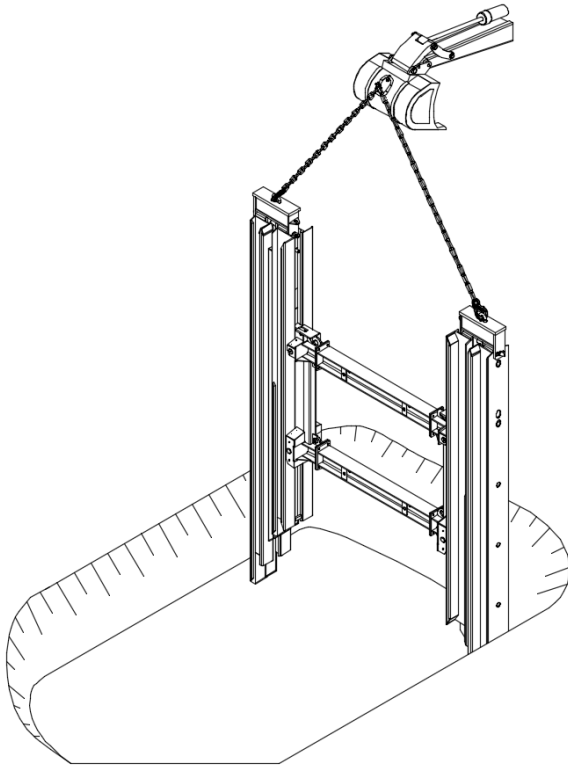
The screws are only tightened hand-tight to facilitate alignment of the spacers. Only when the strut cart is completely installed are all screw connections fully tightened.



### 3.4 Assembly instructions deep linear shoring with linear shoring supports of different length

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

#### 1. Setting the 1st guide frame



After the trench alignment has been measured, advance excavation for the 1st shoring field takes place in accordance with the instructions of the site management.

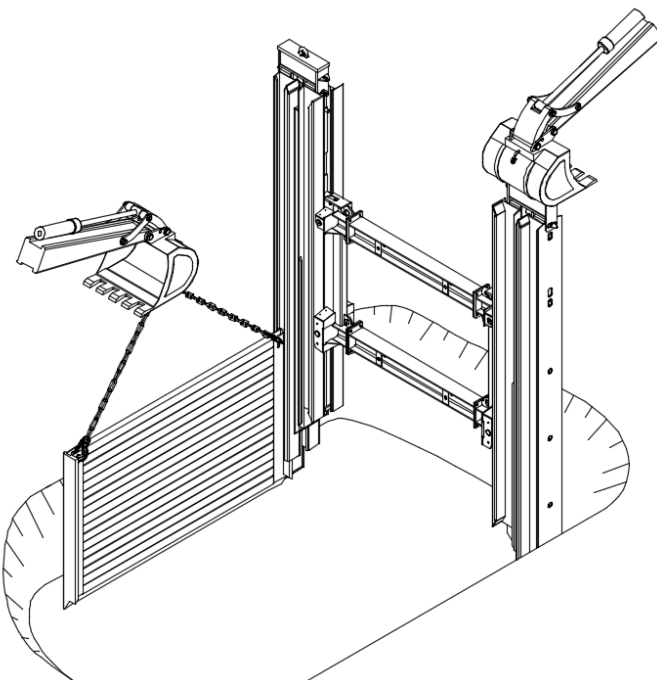
Trench width  $b_a$ : required clear trench width  
 $b_c$  + approx. 1.50 m

Shoring field length: module length + approx. 0.70 m  
 (and / or length of the panels + approx. 1.00 m)

The first outside guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench.

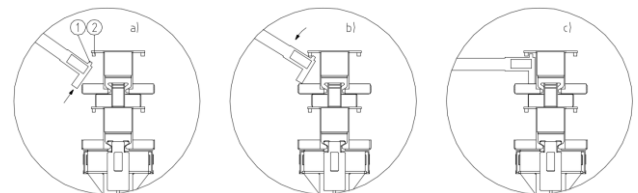
In order to make it easier to set the frame, e+s pressure adapters are to be used. The strut cart is secured at the top by a locking pin in the guide frame (see installation instructions). If necessary, the frame should be locked vertically (e. g. using a second lifting gear).

#### 2. Inserting the outside base panels (outside shoring field)



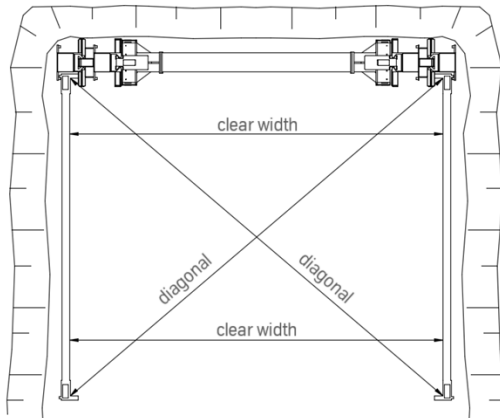
The outside base panels are swiveled into the support profile using lifting gear (see image a, b, c). Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2). After being swiveled in, the shoring panels are adjusted to the bottom of the trench.

Before lowering the linear shoring frame, it is essential to remove all locating pins located beneath the strut cart.



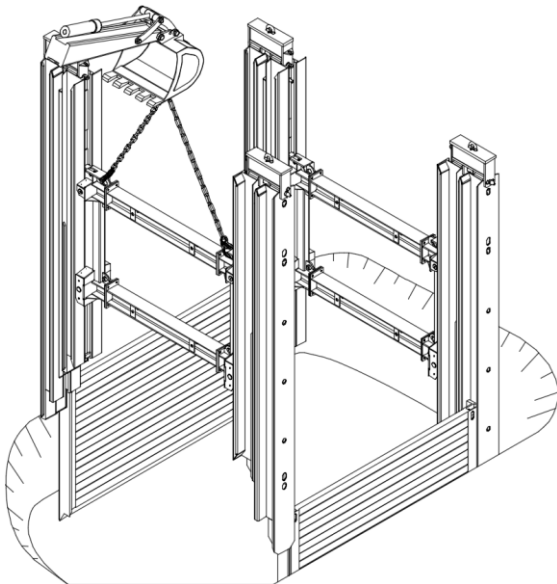


### 3. Alignment of the shoring panels



The alignment of the first shoring field is decisive for the creation of an exact shoring field running parallel to the trench axis. For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

### 4. Setting the 2nd guide frame

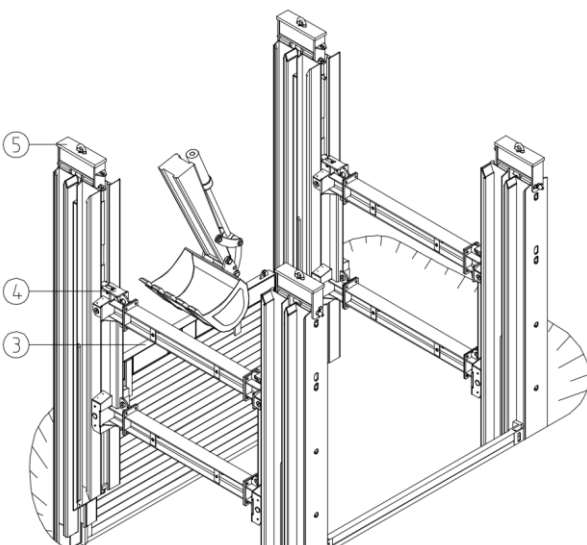


The second guide frame is guided over the free-standing guide profiles of the base panels and adjusted to the bottom of the trench.

After adjusting the shoring field should be aligned again as described in work step 3, as this makes it easier to install and remove the subsequent shoring fields.

To ensure that the shoring is guided correctly, the cavity between trench wall and shoring panel must be filled with suitable material during lowering.

### 5. Lowering the shoring field (outside shoring field)



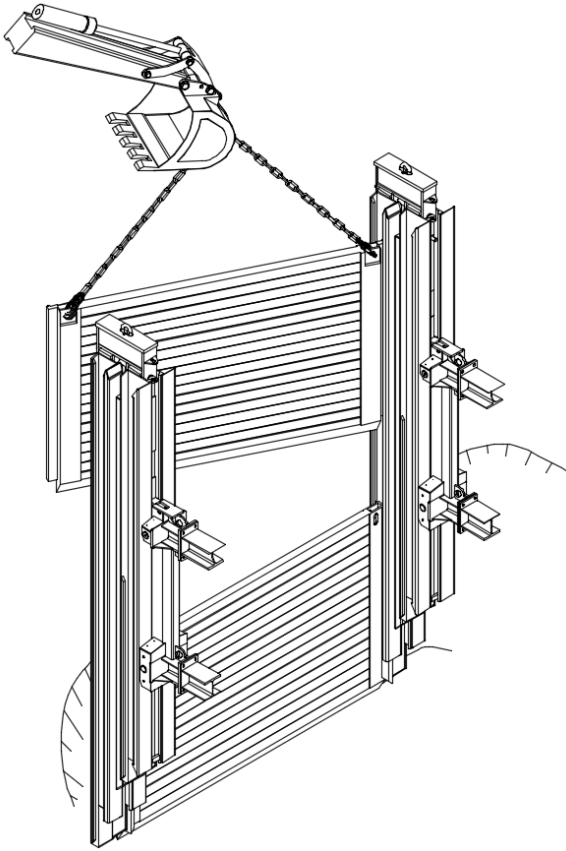
Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the previously installed pressure adapters (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

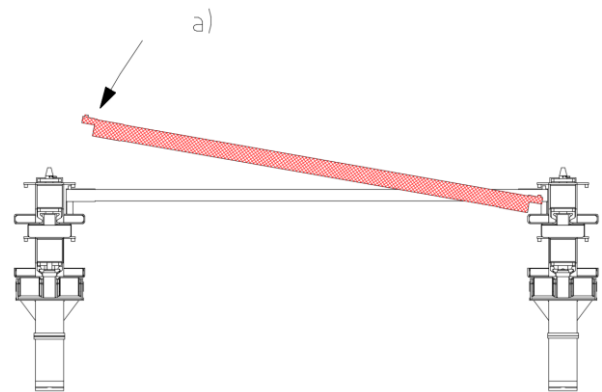
Depending on the required trench depth, after lowering the outside base panels to the temporary bottom of the trench, the outside top panels are inserted into the shoring supports.

## 6. Inserting the inside base panels (outside shoring field)

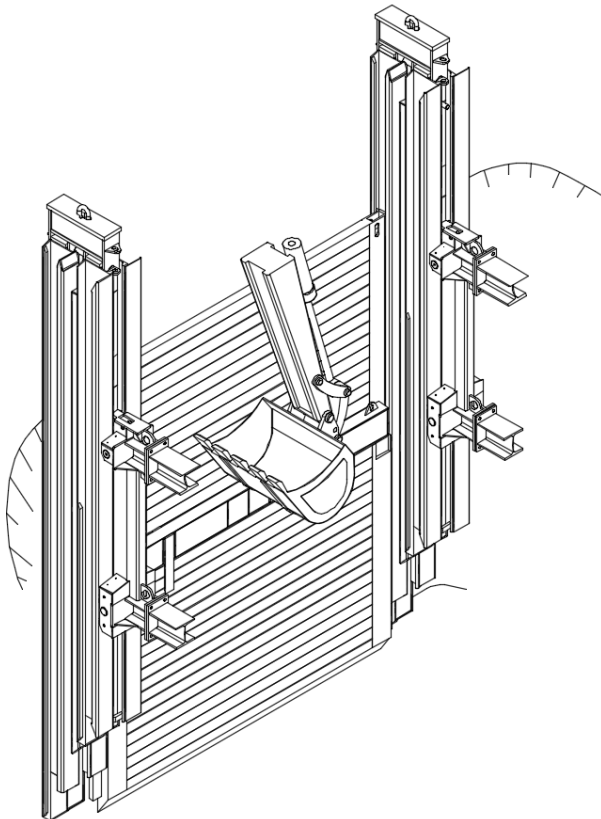


The inside base panel is swiveled between the guide frames as shown in image a), guided in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside base panels, the guide frames and the strut carts.

When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



## 7. Lowering the shoring field (outside shoring field)

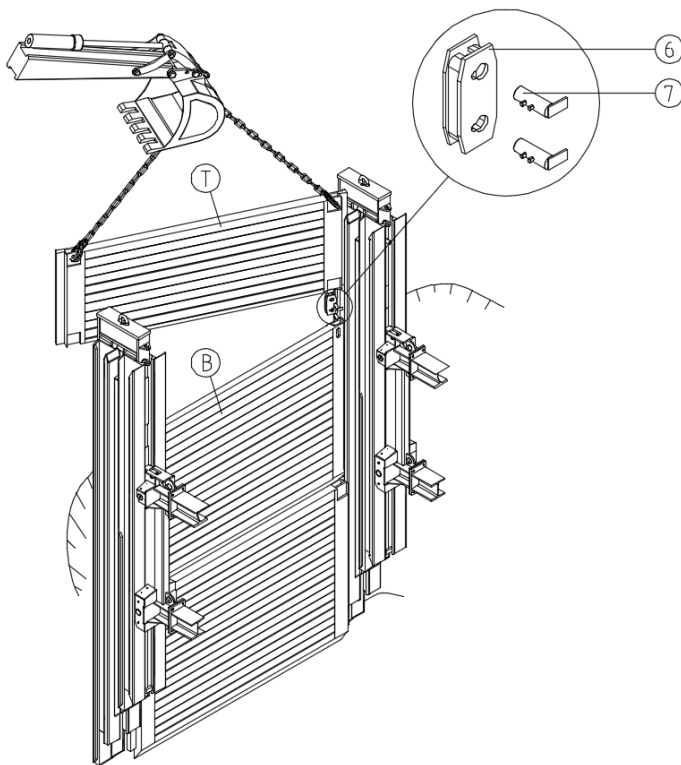


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management.

Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams being used in particular in the case of the shoring panels, the pre-assembled pressure panels in the case of the strut carts and the previously installed pressure adapters in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering. When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

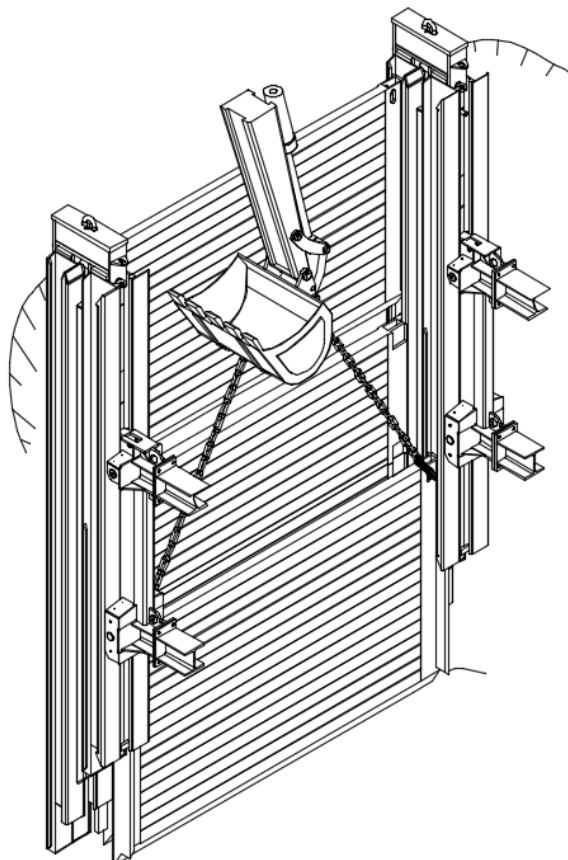
## 8. Inserting the inside top panels (outside shoring field)



Further height adjustment of the shoring wall is possible by inserting the inside top panels (T). The installation is carried out in the same way as work step 6.

Base (B) and top panels are to be connected by stan-chions (6) and pins (7). The pins must be turned by 180° after insertion.

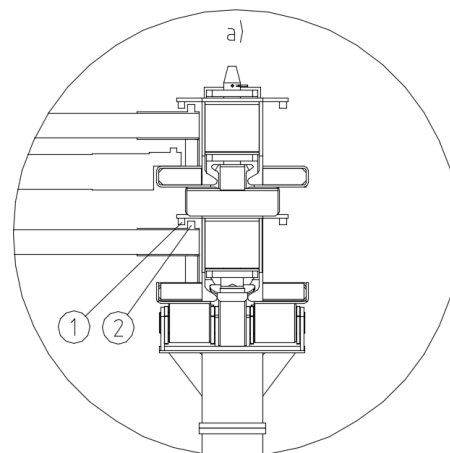
## 9. Inserting the outside base panels (inside shoring field)



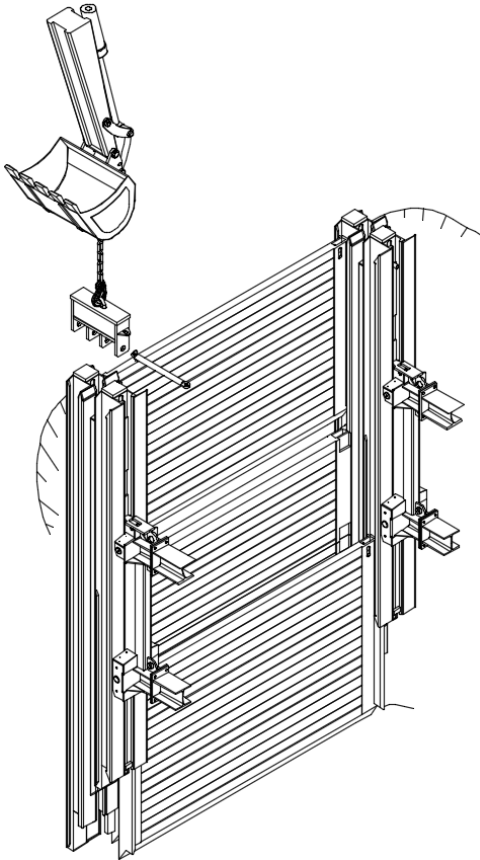
The shoring panels of the inside shoring field must only be installed after the shoring panels of the outside shoring field have been lowered completely to the temporary sole.

The outside base panels are inserted into the support profile of the inside guide frames from above using lifting gear (see image a)). Ensure that the square on the rear of the shoring panels (2) engages behind the square in the linear shoring support (1).

After being inserted, the shoring panels are adjusted to the bottom of the trench.

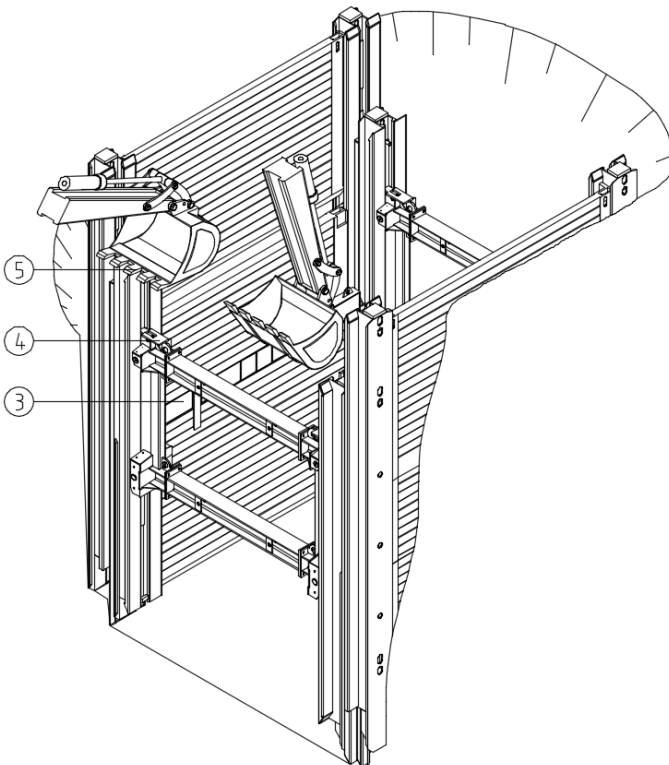


## 10. Removing the pressure adapters



Before lowering the inside shoring field, the pressure adapters must be removed. For this purpose they are secured in advance with a suitable lifting device. Now the spring cotters on the pin can be removed and the locking pins can be pulled out. The pressure adapters can now be removed with the lifting device.

## 11. Lowering the shoring field (inside shoring field)

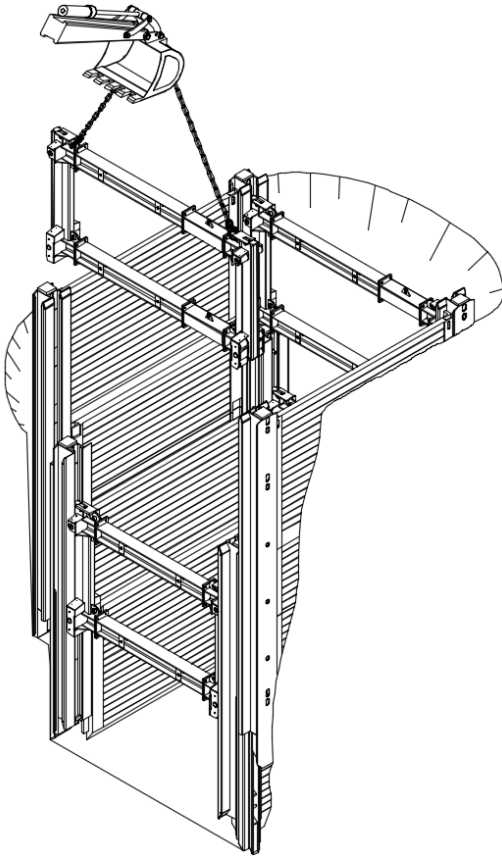


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

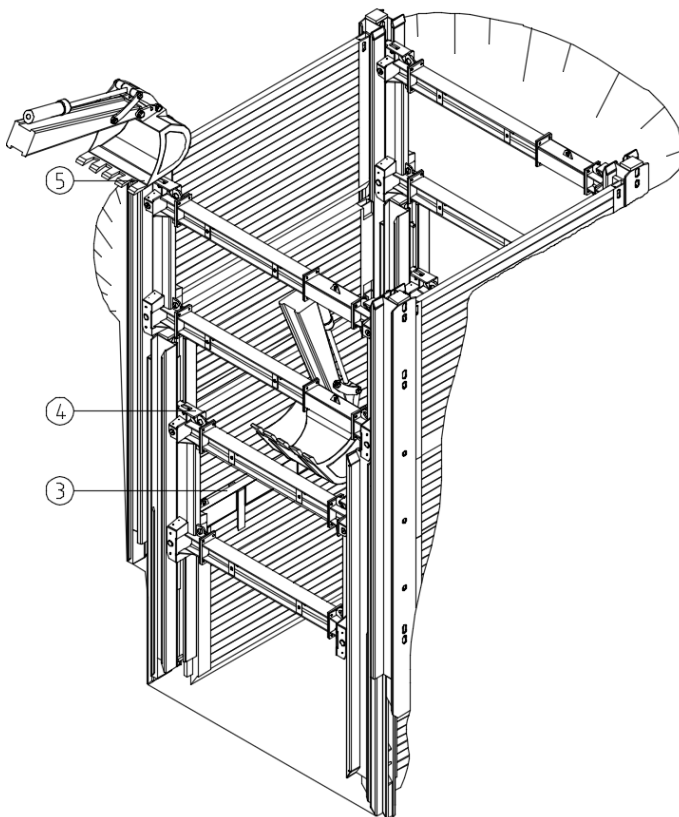
## 12. Inserting the outside strut cart frame (outside shoring field)



The inside guide frames are first lowered so far that the outside strut cart frames can be inserted from above. When lowering the inside system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

The outside strut carts are inserted into the outside linear shoring supports with the pendulum roller first using lifting gear and suitable lifting slings (GS approval). Afterwards the strut cart must be secured by inserting the upper locking pins.

## 13. Lowering the shoring field (inside shoring field)



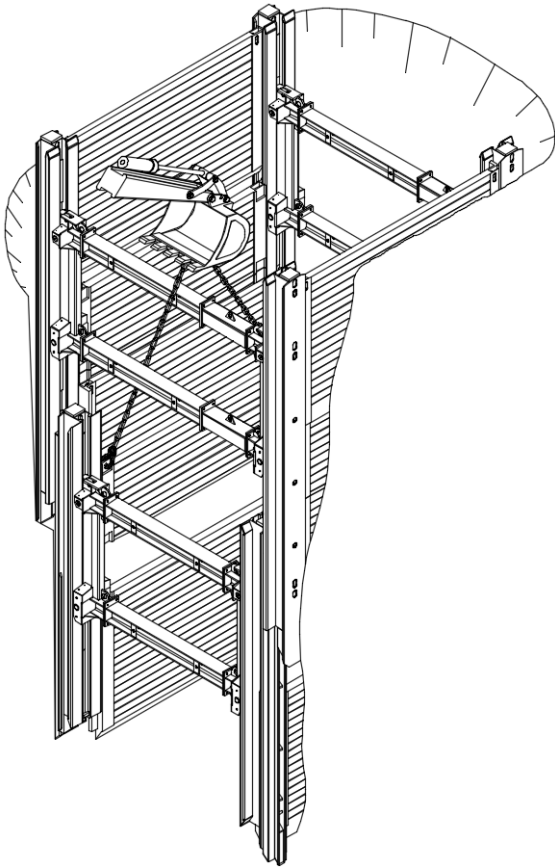
Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

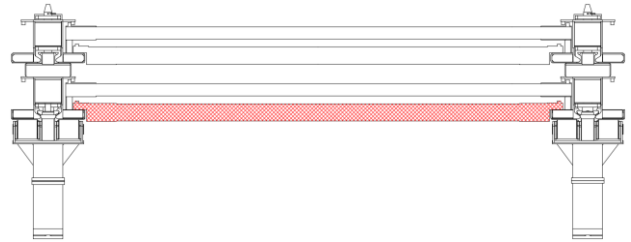
When lowering the inside system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).



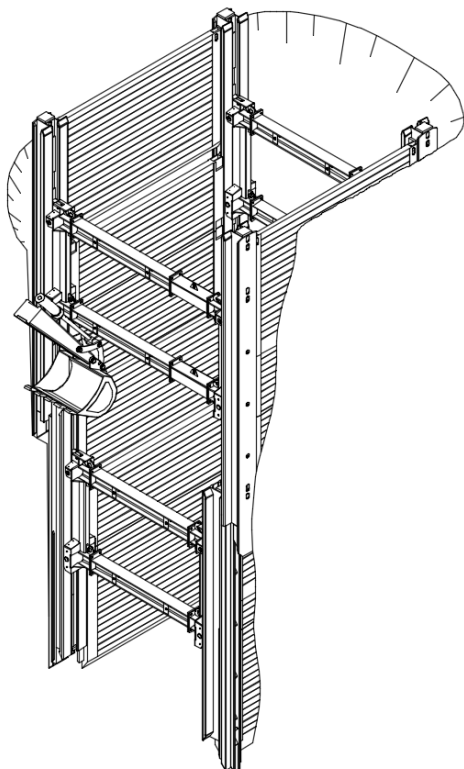
#### 14. Inserting the inside base and top panels (inside shoring field)



The inside base and top panels are guided from above in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside shoring panels, the guide frames and the strut carts. When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



#### 15. Lowering to final depth (inside shoring field)

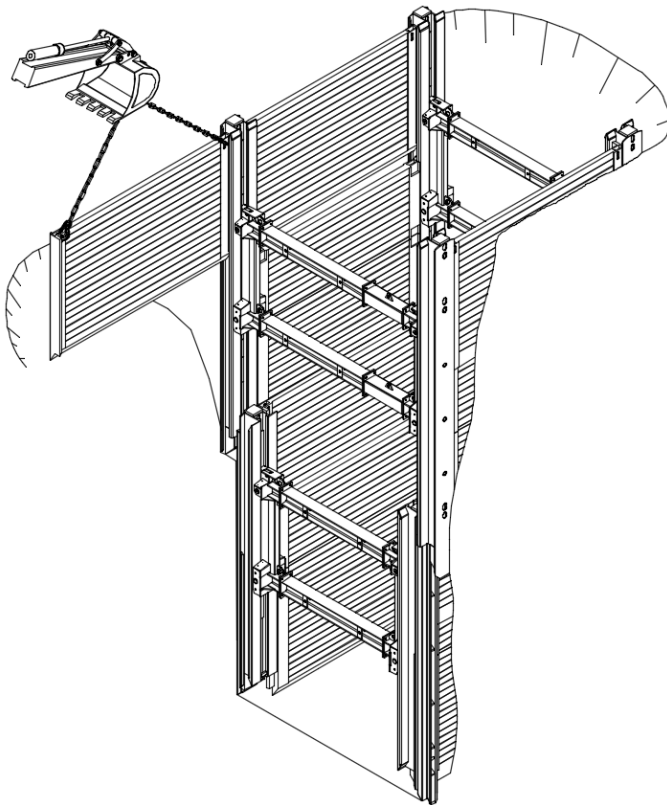


If the strut cart of the outside shoring field is positioned in accordance with the static requirements, it must be secured in its position with locating pins. For all subsequent lowering steps, only elements of the inside shoring field are lowered to the final installation depth.

When lowering the inside shoring field, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



## 16. Setting the next shoring field (outside shoring field)

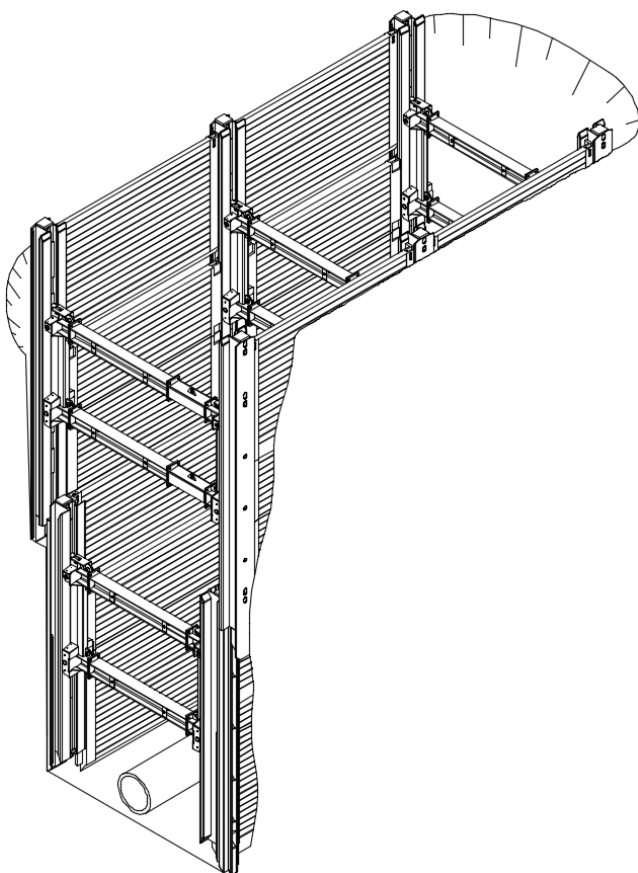


The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned and fixed vertically in accordance with the static requirements. The installation is carried out according to the described points 2 to 15.

The other fields are aligned with the precisely installed first field. When inserting the shoring panels, the clear trench width and diagonal dimension (point 3) should be checked for each subsequent field.

Before each use of the shoring elements, all screw connections must be checked for tightness and retightened if necessary.

## 17. Pipe laying



Once the shoring has been lowered completely and without gaps to the bottom of the trench to the required length, pipe laying can begin.

The strut carts must be positioned and fixed vertically with pins in accordance with the static requirements.

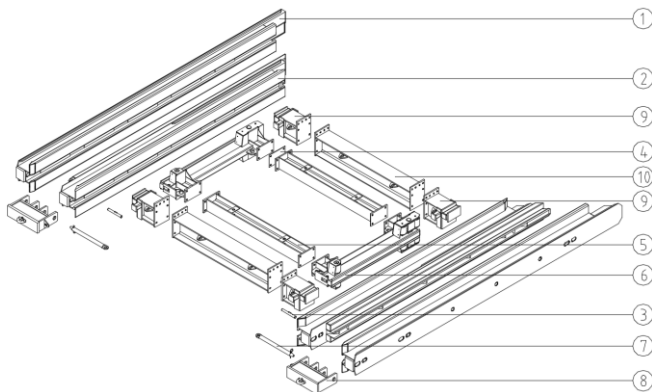
### 3.5 Installation instructions deep linear shoring with head end shoring

Before starting the work, it is obligatory to observe all safety precautions from section "Occupational health and safety and general remarks according to DIN EN 13331-1/-2" (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

The guide frame is completely pre-assembled on a sufficiently large surface that is as flat as possible.

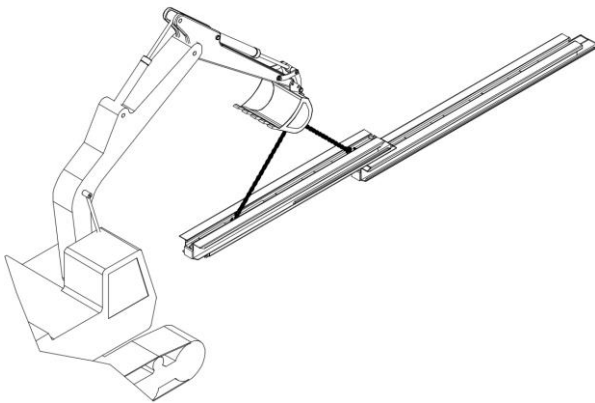
To facilitate installation - especially on uneven ground - all components must be placed on squared timber.

#### 1. System overview guide frame



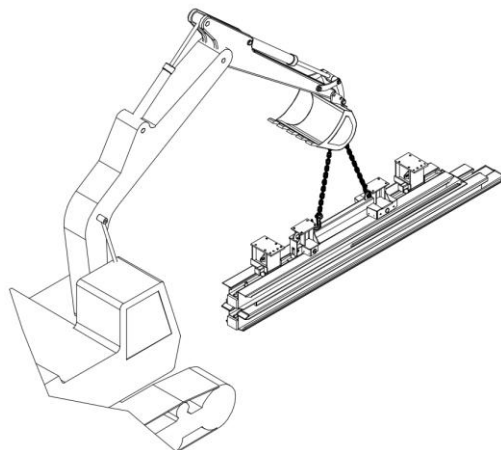
- (1) Beam "Deep linear shoring" outside
- (2) Beam "Deep linear shoring" inside  
(with guide rails welded on at the back)
- (3) Locking pin slide rail
- (4) Distance plate
- (5) Extension bars or combinations
- (6) Strut cart linear shoring
- (7) Pin pressure adapter
- (8) Pressure adapter "Deep linear shoring"
- (9) Adapter head end shoring right / left
- (10) Extension bar head end shoring

#### 2. Beam installation



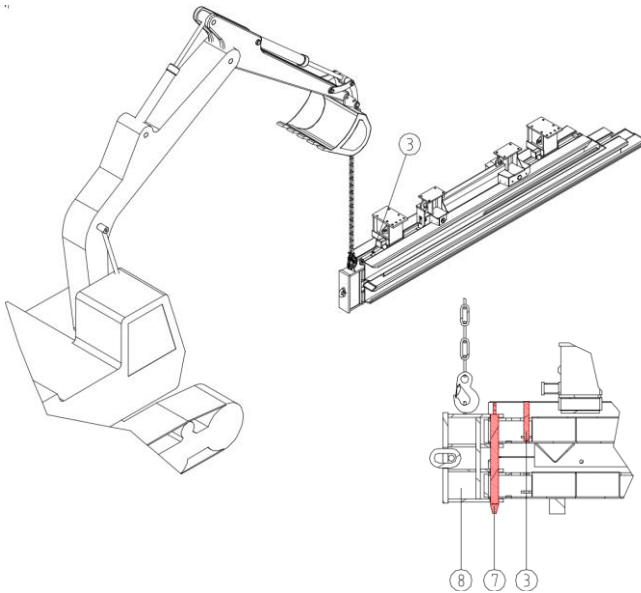
The outside beam must be positioned on suitable terrain. The inside beam is then inserted using a lifting device and suitable lifting sling (GS approval). Make sure that both beams are flush with each other in the area of the impact plate.

#### 3. Strut cart installation



After the insertion of an adapter, one strut cart each is inserted into the inside beams with the pendulum roller first using lifting gear and suitable lifting slings (GS approval). The second head end adapter is then inserted. It must be ensured that the mounting plates of the adapters projecting on one side point in one direction.

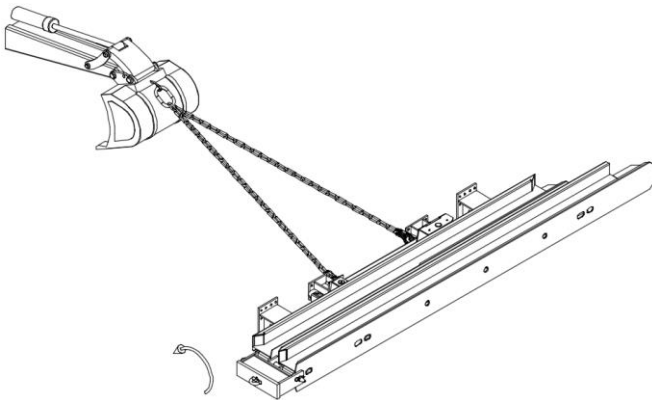
#### 4. Installation of the pressure adapters



The pressure adapter (8) must be moved up to the linear shoring supports by means of a lifting device and secured with a locking pin and spring cotter (7). The locking pin (3) is inserted to secure the strut cart. It is used to secure the strut cart against unintentional removal from the slide rail carrier during the installation phase.

After insertion of the pin (3) it must be turned by 180°. In the lower area of the inside beam, a fixed stop serves to fix the strut cart downwards.

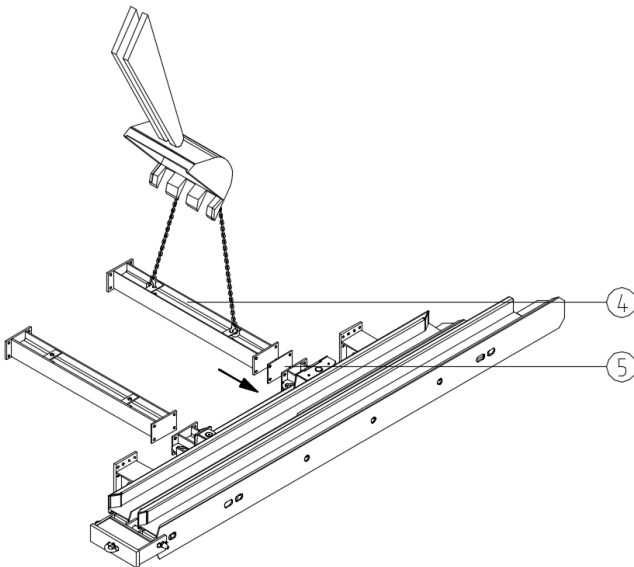
#### 5. Turning of the linear shoring support



Before the extension bars can be installed, the linear shoring supports must be rotated by 90°.

The turned linear shoring support must be secured against tipping over.

#### 6. Pre-assembly of the extension bar combination

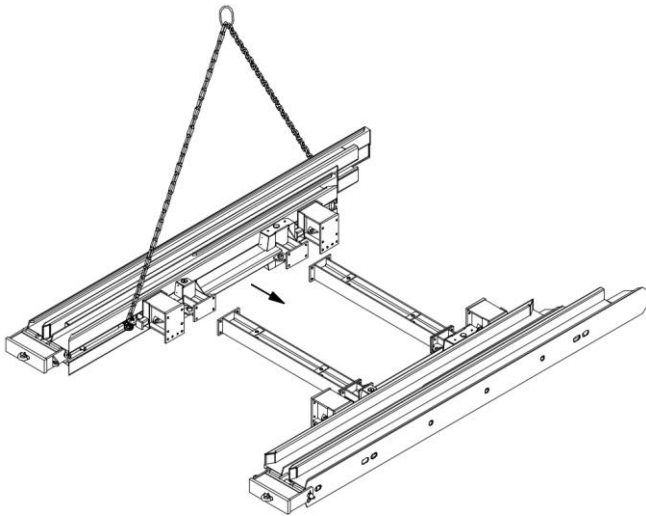


The pre-assembled extension bar combinations (4) required for the desired trench width are aligned with the mounting plates of a strut cart and screwed with the required number of screws according to the parts list. The screws are only slightly tightened for easier alignment of the spacers for the following installation steps.

Insert the distance plate (5) between the extension bar pointing towards the tip of the beam and the stop panel.

The frame provided with a combination of extension bars must be secured against tipping over, e. g. by means of a lifting device.

## 7. Installation of the complete guide frame



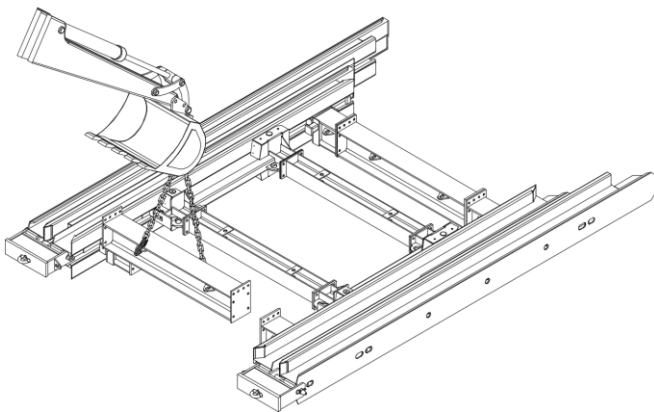
The complete guide frame must be installed in a lying position.

Both strut carts inserted into the beams must be pre-assembled with approximately the same spacer length. After pre-assembly, both beams are laid flat to each other on the side of the ground so that the spacers can be screwed together.

Tighten all screw connections.

Two fully mounted guide frames are required to create a shoring field. An additional guide frame must be provided for each additional shoring field.

## 8. Installation of the head end shoring spacers

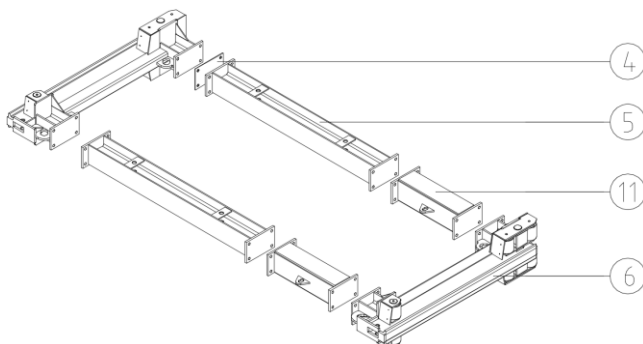


The head end shoring extension bars are installed in horizontal and lying position.

The head end shoring extension bars are screwed to the adapter pieces of the previously installed guide frame.

Tighten all screw connections.

## 9. System overview strut carts for outside beams



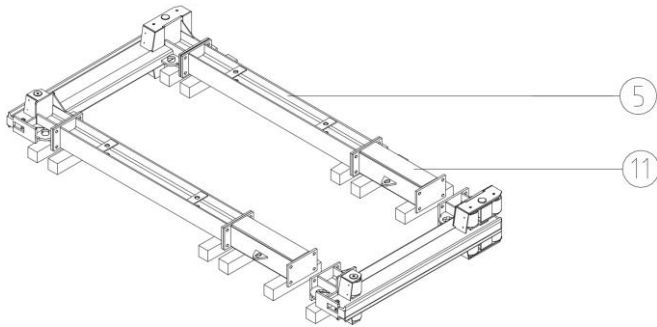
(4) Distance plate

(5) Extension bars or combinations

(6) Linear shoring strut cart

(11) Compensation extension bars; length 840 mm

## 10. Installation of the strut carts

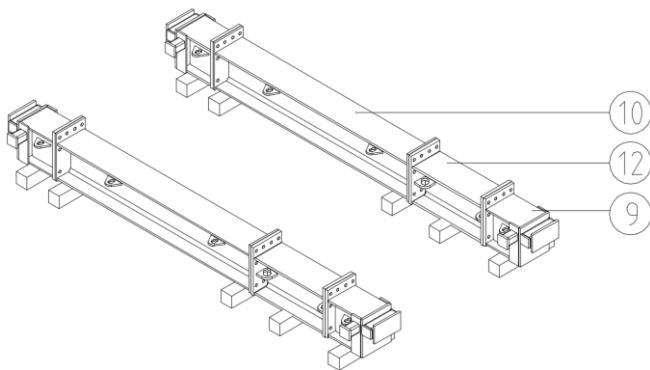


The strut carts must be mounted in lying position. It is recommended that any unevenness in the terrain be corrected by placing squared timber underneath.

The strut cart for the outside beam is installed by screwing the corresponding spacers (5) together. An additional 840 mm long compensating spacer (11) is required for the strut cart of the outside beams.

The screws are only tightened hand-tight to facilitate alignment of the spacers. Only when the strut cart is completely installed are all screw connections fully tightened.

## 11. System overview head end shoring extension bar combinations (outside shoring field)



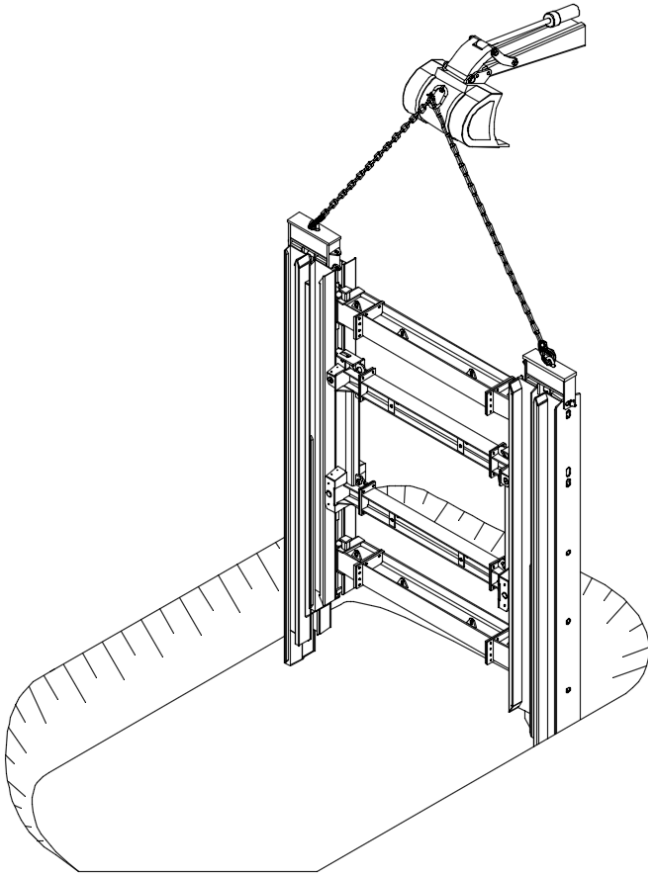
(9) Adapter head end shoring right / left

(10) Extension bars head shoring

(12) Compensation extension bars for head end shoring length 840 mm

### 3.6 Assembly instructions deep linear shoring with head end shoring

#### 1. Setting the 1st guide frame (outside shoring field)



After the trench alignment has been measured, advance excavation for the 1st shoring field takes place in accordance with the instructions of the site management.

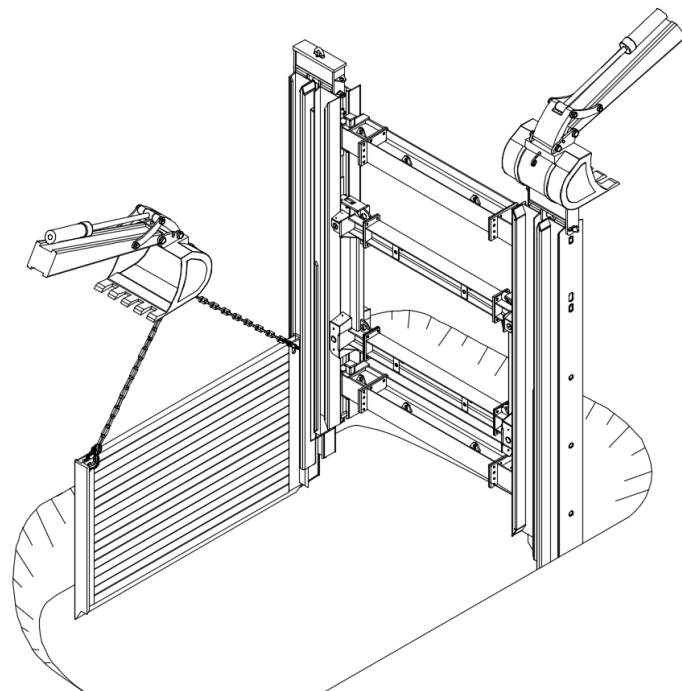
Trench width  $b_a$ : required clear trench width  
 $b_c + \text{approx. } 1.50 \text{ m}$

Shoring field length: module length + approx. 1.00 m  
 (and / or length of the panels + approx. 1.20 m)

The first outside guide frame is adjusted by means of lifting gear and suitable sling gear (GS approval) in the center of the trench axis and at right angles to the alignment in the trench.

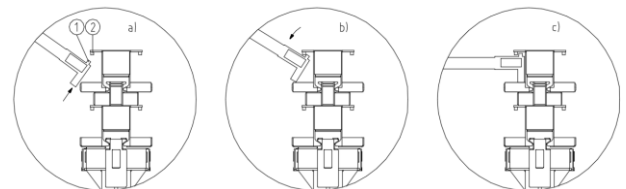
In order to make it easier to set the frame, E+S pressure adapters TLV are to be used. The strut cart is secured at the top by a locking pin in the guide frame (see installation instructions). If necessary, the frame should be locked vertically (e. g. using a second lifting gear).

#### 2. Inserting the outside base panels (outside shoring field)



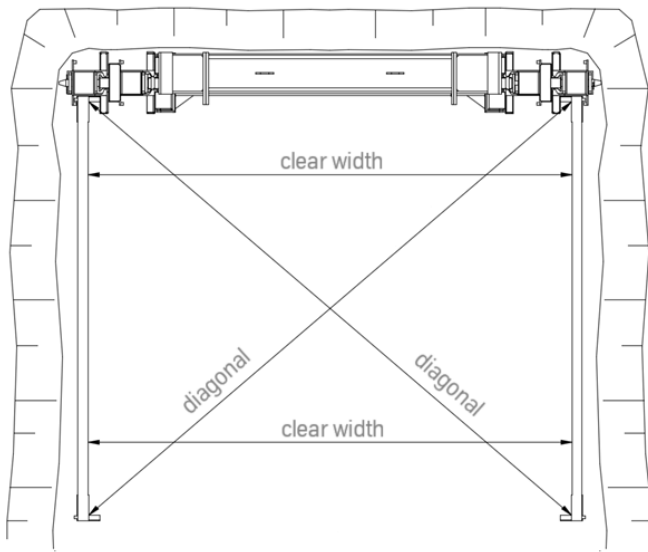
The outside base panels are swiveled into the support profile using lifting gear (see image a, b, c). Ensure that the square on the rear of the shoring panels (1) engages behind the square in the linear shoring support (2). After being swiveled in, the shoring panels are adjusted to the bottom of the trench.

Before lowering the linear shoring frame, it is essential to remove all locating pins located beneath the strut cart.



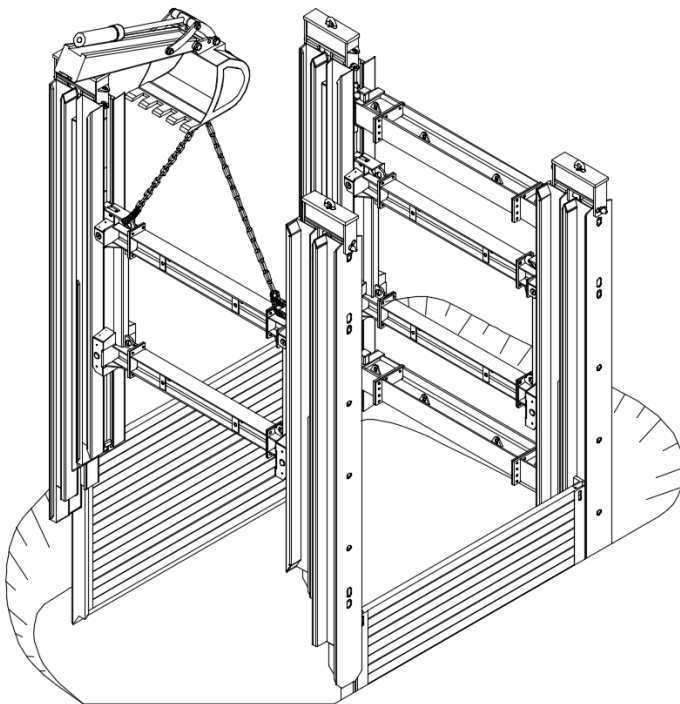


### 3. Alignment of the shoring panels (outside shoring panel)



The alignment of the first shoring field is decisive for the creation of an exact shoring field running parallel to the trench axis. For this purpose, on the one hand the clearance between the shoring panels at both panel ends and on the other hand the dimension across the two diagonal axes of the shoring field must be the same.

### 4. Setting the 2nd guide frame (outside shoring field)

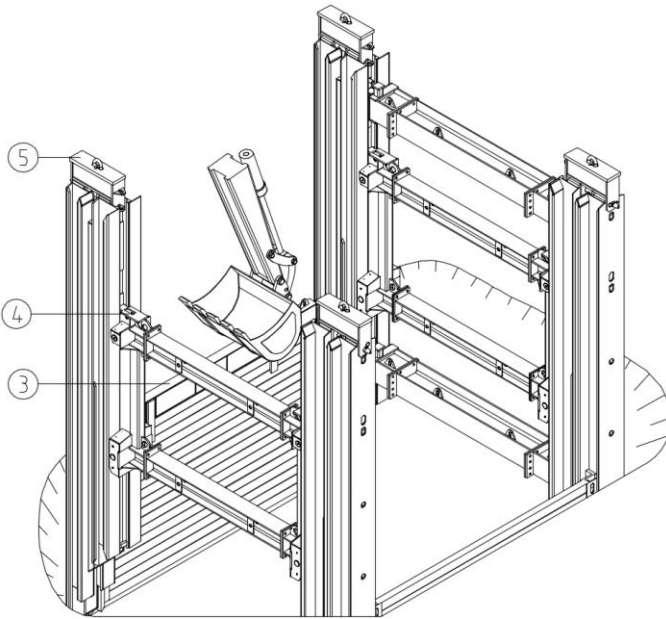


The second frame is guided over the free-standing guide profiles of the base panels and adjusted to the bottom of the trench.

After adjusting the shoring field should be aligned again as described in work step 3, as this makes it easier to install and remove the subsequent shoring fields.

To ensure that the shoring is guided correctly, the cavity between trench wall and shoring panel must be backfilled with suitable material during lowering.

## 5. Lowering the shoring field (outside shoring field)

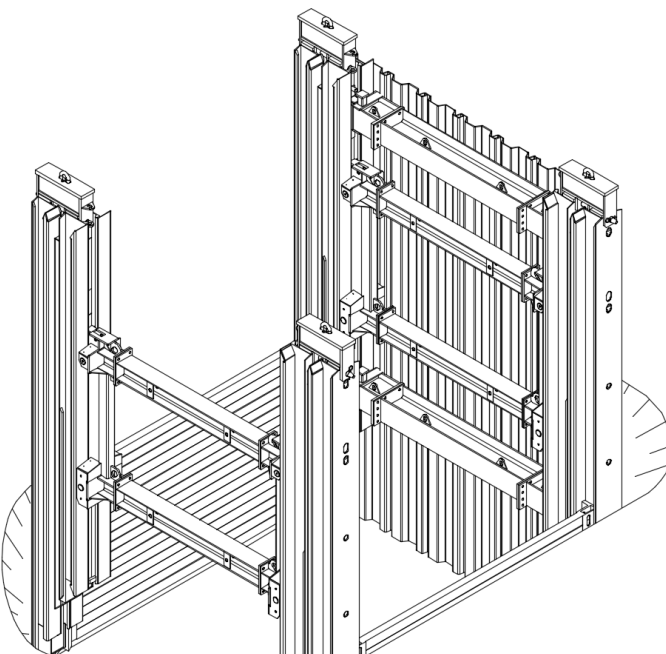


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the previously installed pressure adapters (5) in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering.

When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths). Depending on the required trench depth, after lowering the outside base panels to the temporary bottom of the trench, the outside top panels are inserted into the shoring supports.

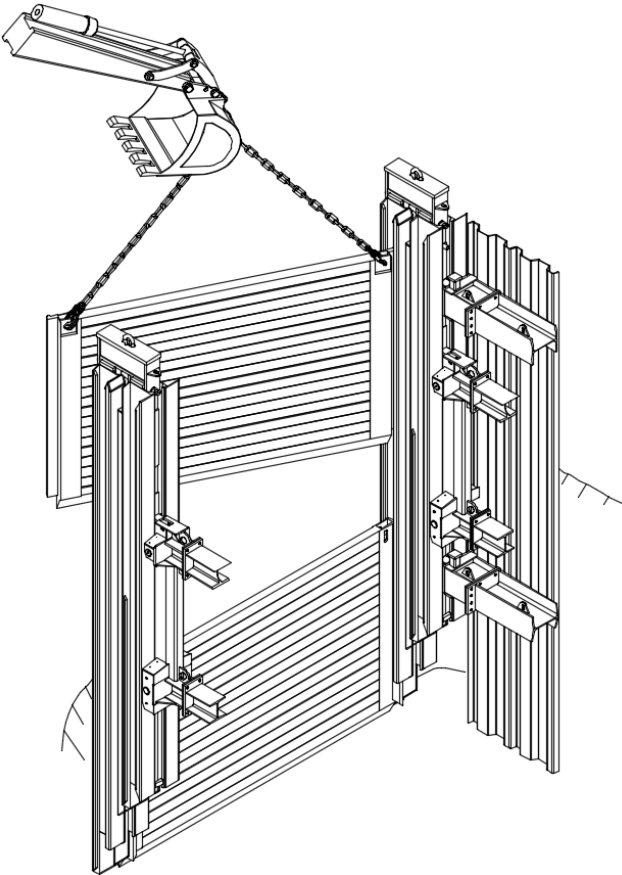
## 6. Inserting the trench sheets



The trench sheets are attached and lowered at the top end. In addition, the cavity between the trench sheets and the existing soil must be backfilled.

Here too, the statically specified cantilever arm lengths must be observed.

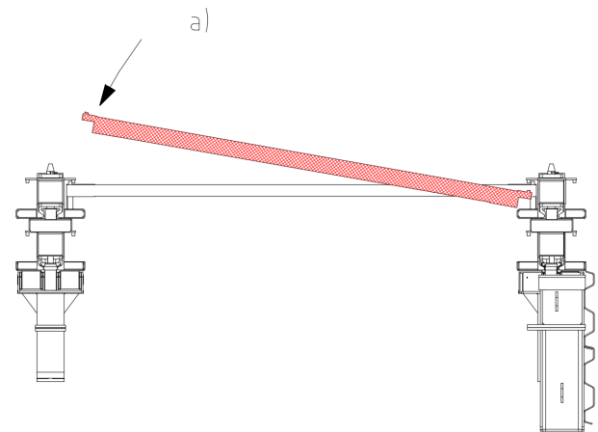
## 7. Inserting the inside base panels (outside shoring field)



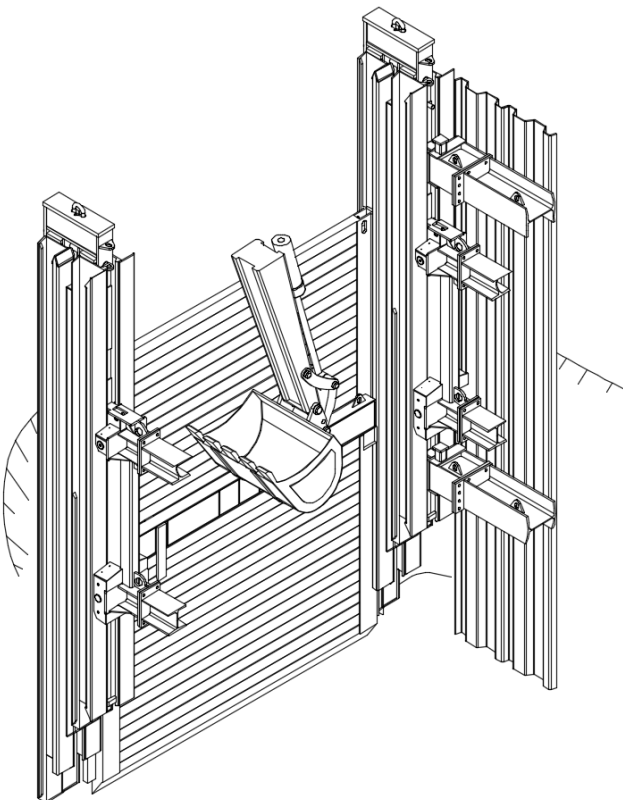
The inside base panel is swiveled between the guide frames as shown in image a), guided in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench.

Further trench excavation is carried out by lowering the inside base panels, the guide frames and the strut carts.

When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



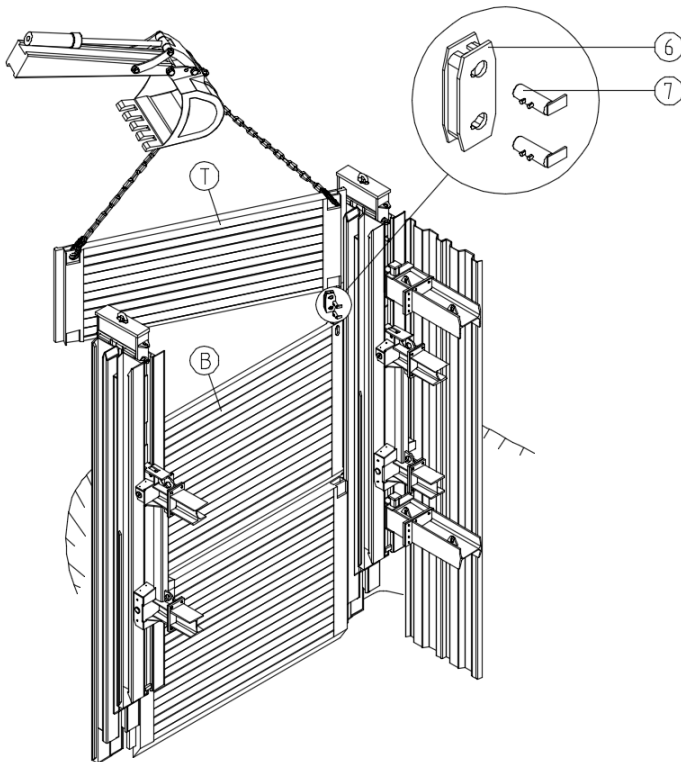
## 8. Lowering the shoring field (outside shoring field)



Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams being used in particular in the case of the shoring panels, the pre-assembled pressure panels in the case of the strut carts and the previously installed pressure adapters in the case of the shoring beams.

All shoring components must be inserted under pressure and under no circumstances by knocking or hammering. When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

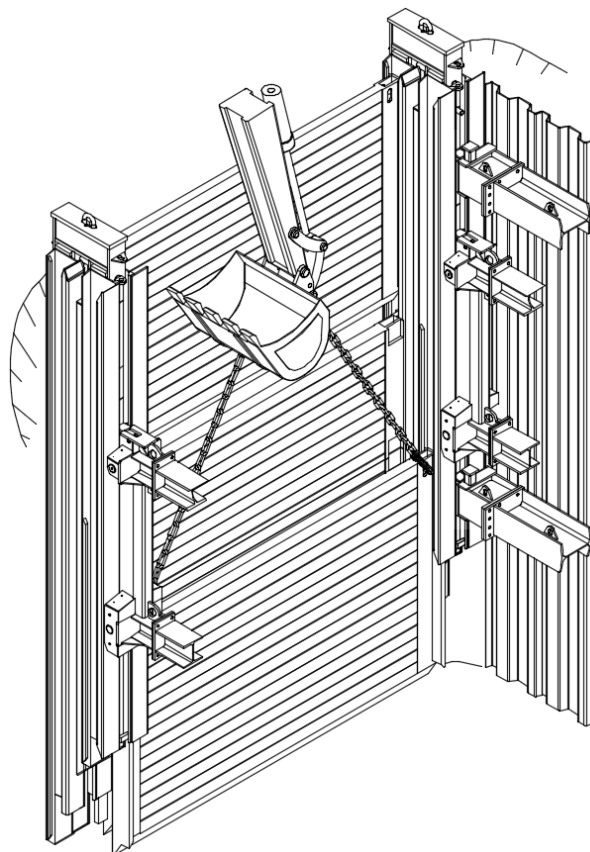
## 9. Inserting the inside top panels (outside shoring field)



Further height adjustment of the shoring wall is possible by inserting the inside top panels (T).

Base (B) and top panels are to be connected by stan-chions (6) and pins (7). The pins must be turned by 180° after insertion.

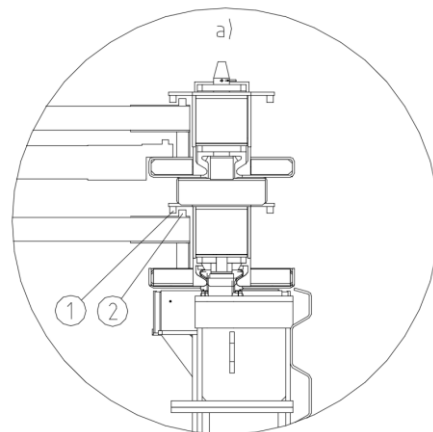
## 10. Inserting the outside base panels (inside shoring field)



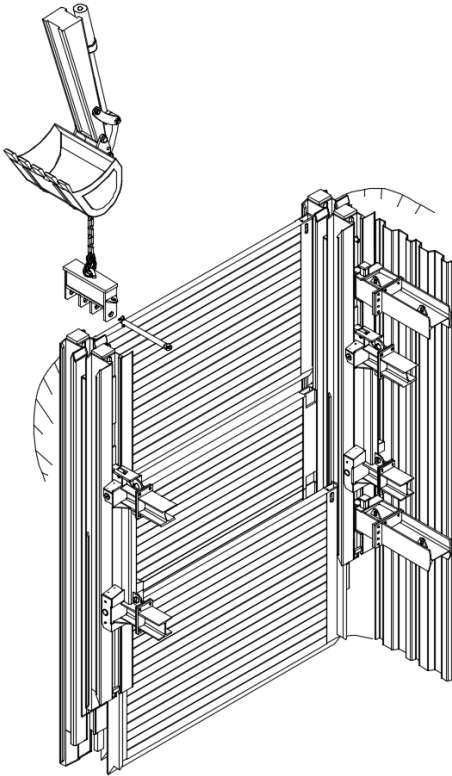
The shoring panels of the inside shoring field must only be installed after the shoring panels of the outside shoring field have been lowered completely to the temporary sole.

The outside base panels are inserted into the support profile of the inside guide frames from above using lifting gear (see image a)). Ensure that the square on the rear of the shoring panels (2) engages behind the square in the linear shoring support (1).

After being inserted, the shoring panels are adjusted to the bottom of the trench.



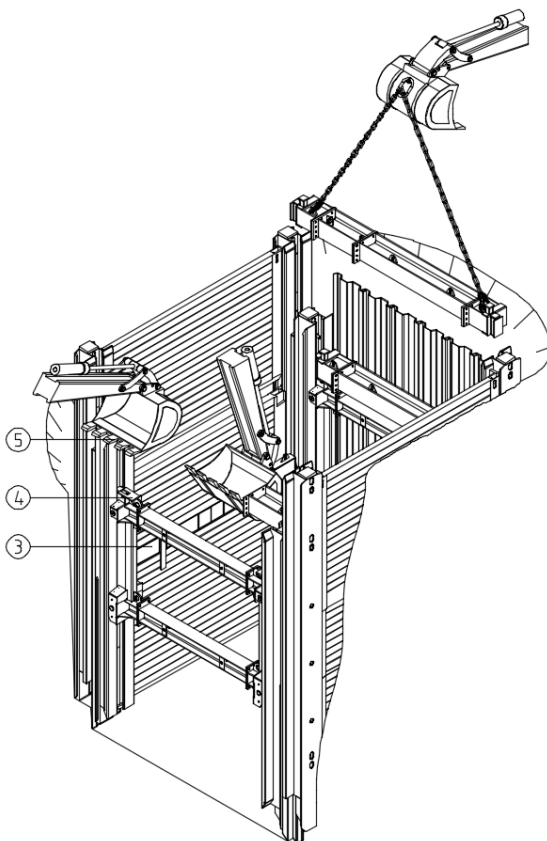
## 11. Removing the pressure adapters



Before lowering the inside shoring field, the pressure adapters must be removed. For this purpose these are secured in advance with a suitable lifting device.

Afterwards the spring cotters on the pin can be removed and the locking pins can be pulled out. The pressure adapters can now be removed with the lifting device.

## 12. Lowering of the shoring field / insertion of the head end shoring beam (inside and outside shoring field)



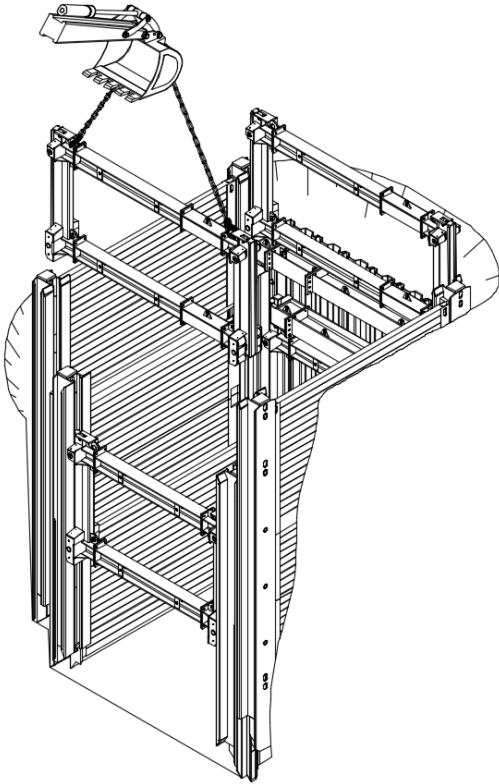
Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring beams must be inserted under pressure and under no circumstances by knocking or hammering. When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

At the top end, the first head end shoring extension bar is inserted into the outside frame.



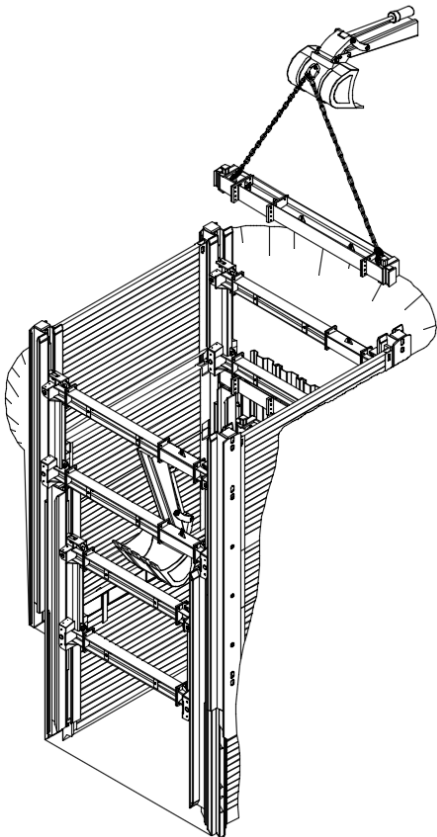
### 13. Inserting the outside strut cart (outside shoring field)



The inside guide frames are first lowered so far that the outside strut cart frames can be inserted from above. When lowering the inside system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

The outside strut carts are inserted into the outside linear shoring supports with the pendulum roller first using lifting gear and suitable lifting slings (GS approval). Then the strut cart must be secured by inserting the upper locking pins.

### 14. Lowering of the shoring field / insertion of the head end shoring beam (inside and outside shoring field)

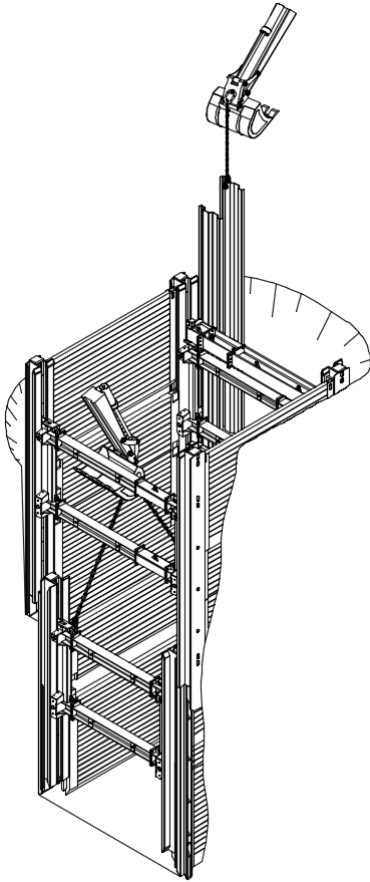


Before the actual lowering procedure, the soil beneath the shoring panels and beams is excavated in accordance with the instructions of the site management. Vertical beams, shoring panels and strut carts are pressed down alternately, additional pressure beams (3) being used in particular in the case of the shoring panels, the pre-assembled pressure panels (4) in the case of the strut carts and the firmly welded-on pressure panels (5) in the case of the shoring beams.

All shoring beams must be inserted under pressure and under no circumstances by knocking or hammering. When lowering the system, it is essential to ensure that the strut carts are positioned vertically in accordance with the structural requirements (note cantilever arm lengths).

At the top end, the first head end shoring spacer is inserted into the outside frame.

### 15. Inserting the inside base and top panels / setting the trench sheets (inside and outside shoring field)

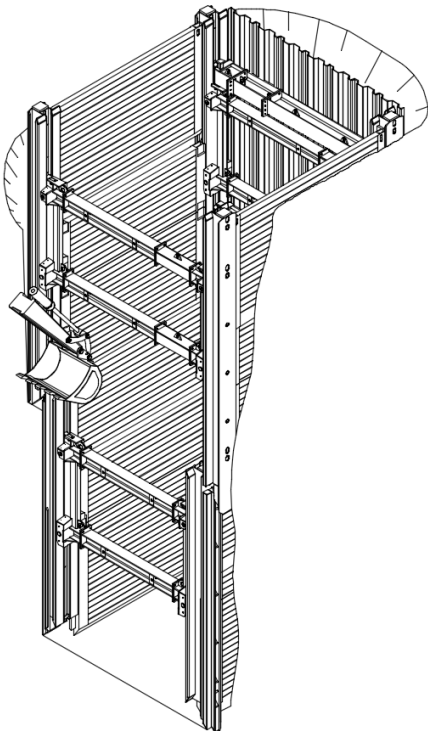


The inside base and top panels are guided from above in the U-shaped guide rails of the outside panels and lowered to the bottom of the trench. Further trench excavation is carried out by lowering the inside shoring panels, the guide frames and the strut carts.

When lowering the system, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.



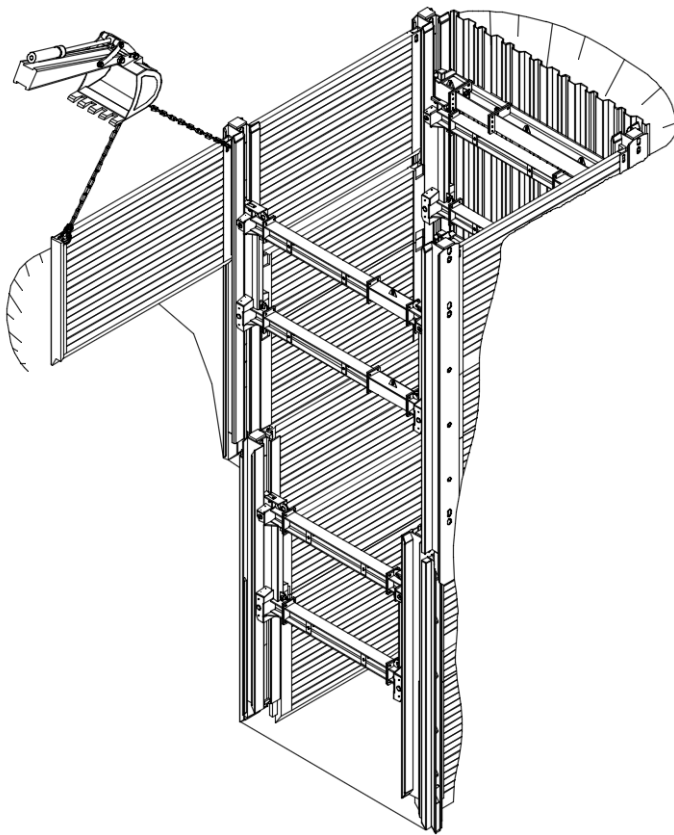
### 16. Lowering the shoring field to its final depth (inside shoring field)



If the strut cart of the outside shoring field is positioned in accordance with the static requirements, it must be secured in its position with locating pins. For all subsequent lowering steps, only elements of the inside shoring field are lowered to the final installation depth.

When lowering the inside shoring field, it is essential to ensure that the strut carts are positioned centrally to the respective installation depth. The static specifications for the cantilever arm length must be observed.

### 17. Setting the next shoring field (outside shoring field)

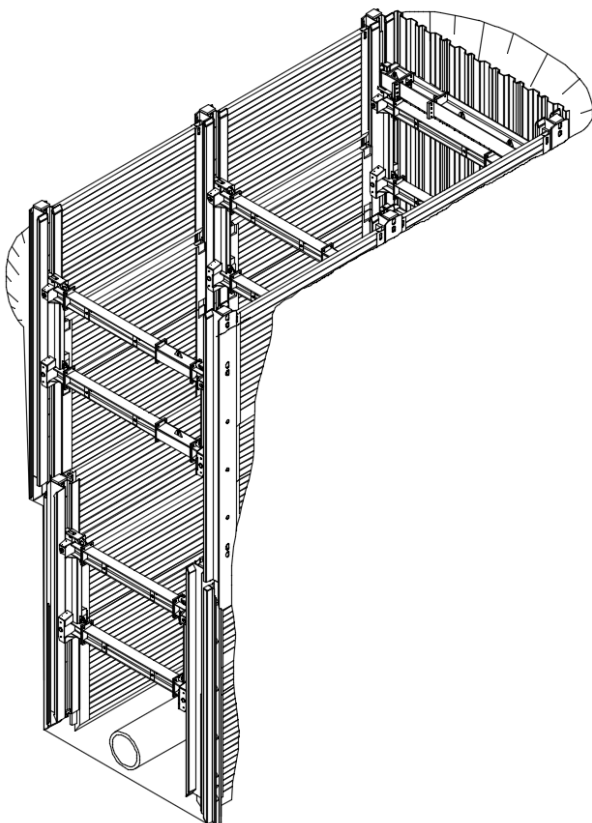


The next shoring field is installed as soon as the previous field has been fully lowered to the bottom of the trench and the strut carts are positioned and fixed vertically in accordance with the static requirements. The installation is carried out according to the described points 1 to 15.

The other fields are aligned with the precisely installed first field. When inserting the shoring panels, the clear trench width and diagonal dimension (point 3) should be checked for each subsequent field.

Before each use of the shoring elements, all screw connections must be checked for tightness and retightened if necessary.

### 18. Pipe laying



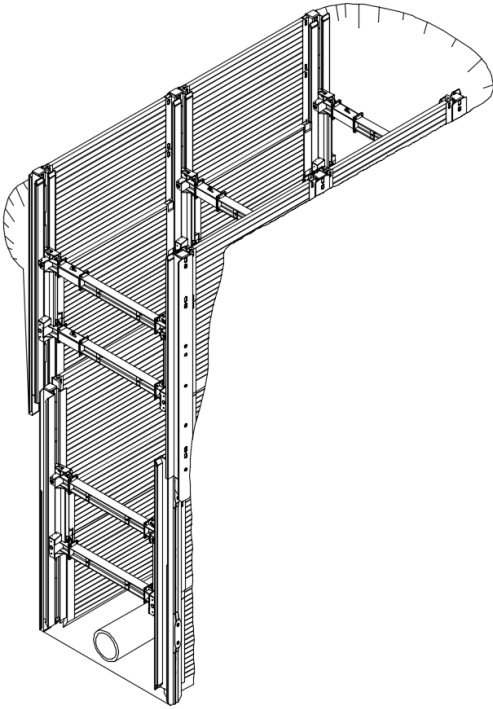
Once the shoring has been lowered completely and without gaps to the bottom of the trench to the required length, pipe laying can begin.

The strut carts must be positioned and fixed vertically with pins in accordance with the static requirements.

### 3.7 Instructions for removing deep linear shoring

Before starting the work, it is obligatory to observe all safety precautions from section “Occupational health and safety and general remarks according to DIN EN 13331-1/-2” (see section 2 Occupational health and safety and general remarks according to DIN EN 13331-1/-2 on page 3)!

#### 1. Removing, backfilling and compacting



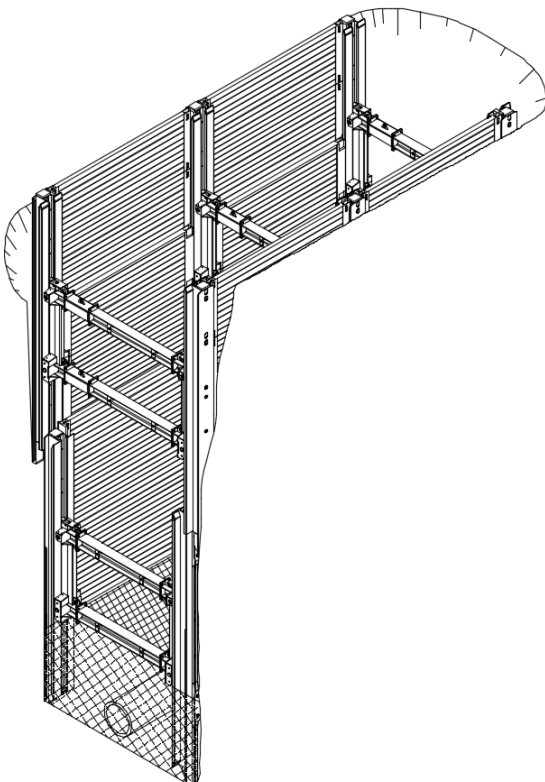
After completing the pipe-laying work the shoring is removed with layer-by-layer backfilling and compacting. The shoring is pulled in stages according to the instructions of the local site management and / or in accordance with the expert's specifications and the backfilling material previously inserted is compacted against the existing soil.

To pull the shoring, a two-strand chain at least 19 mm thick with a load capacity of 11.2 t must be used at an angle of inclination of  $\beta \leq 60^\circ$ . The pulling eyes at the individual attachment points are dimensioned and designed for the permissible load on the chain.

Alternatively, pulling adapters can be used to make it easier to pull the shoring panels and supports.

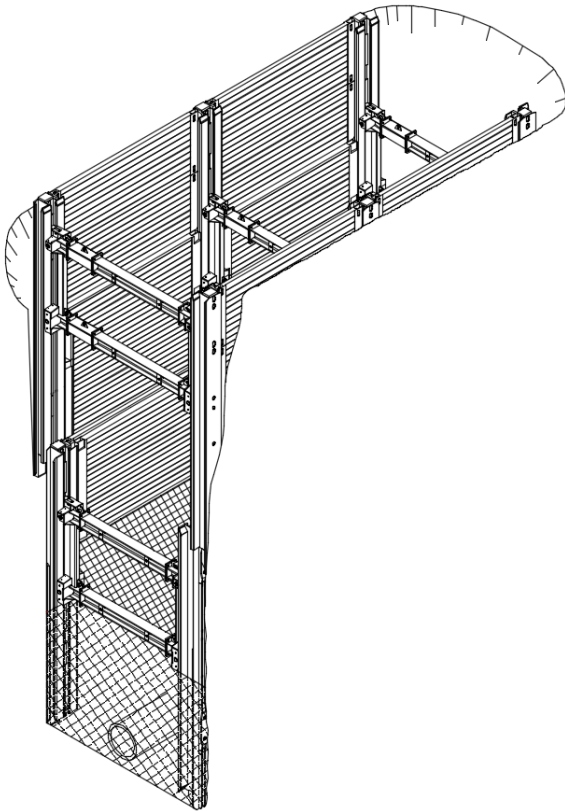
Lifting slings may only be attached to the provided attachment points.

#### 2. Pulling the inside panels (inside shoring field)



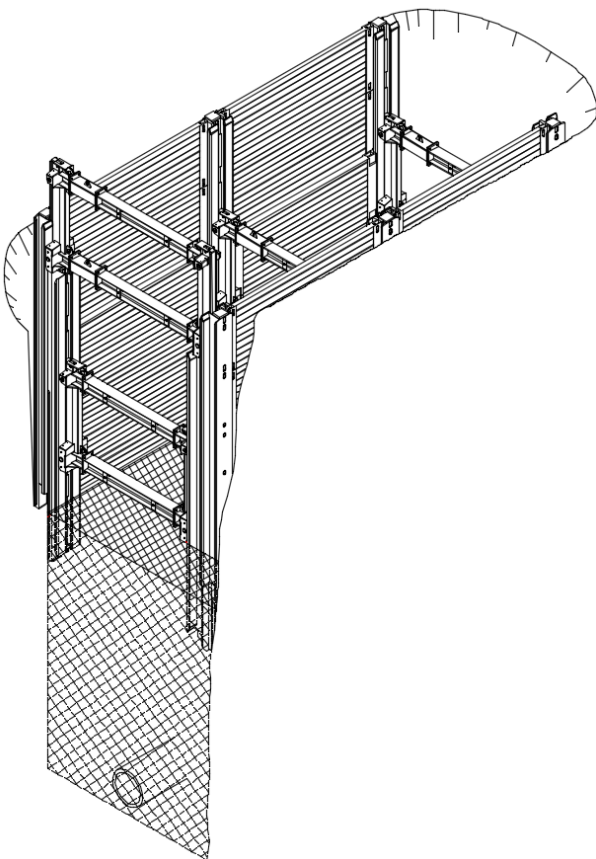
The plates of the inside system are gradually pulled up to the upper edge of the inside beams. The previously mentioned backfill material is backfilled and compacted in layers against the existing soil.

### 3. Pulling the strut cart frame (outside shoring field)



Then the outside strut cart frame is pulled up to approx. 2.50 m above the upper edge of the inside beam and secured in this position. The panels of the inside shoring field can then be pulled upwards out of the beams.

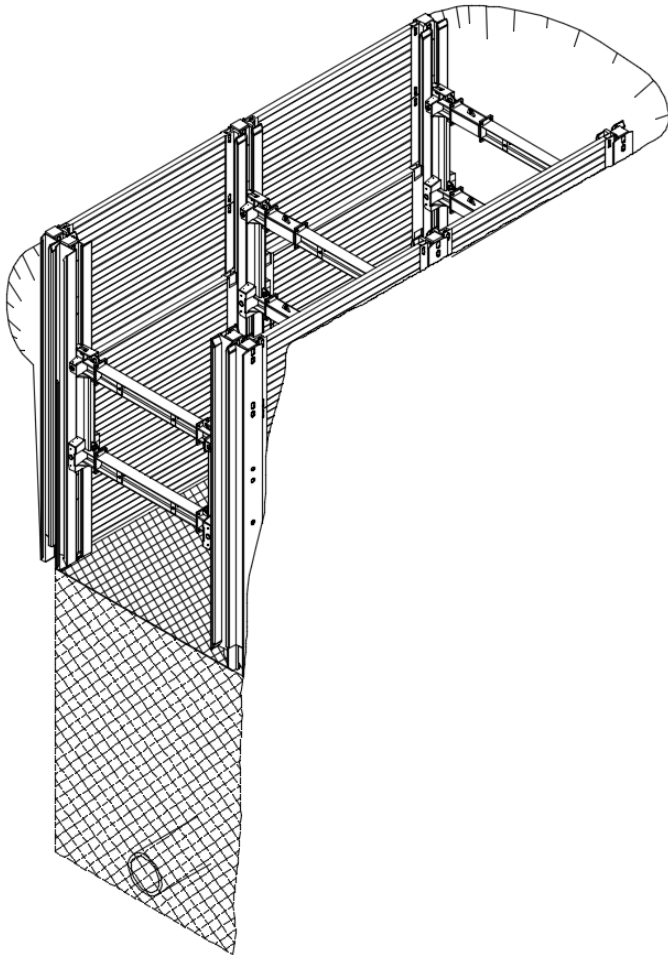
### 4. Pulling the linear shoring supports (inside shoring field)



The lower beams are pulled to the lower edge of the outside strut carts and secured. Then the upper strut carts and the outside panels of the lower field can be pulled step by step and alternately according to the instructions of the local site management and / or as instructed by the expert, and the previously placed backfill material can be compacted against the existing soil.



## 5. Removal of the outside shoring system



The shoring is removed as described in work step 1. It is essential to ensure that the inside and outside beams are pulled together and that the previously placed backfill material is backfilled and compacted layer by layer against the existing soil.

## 4 Statics questionnaire

thyssenkrupp Infrastructure can carry out a static calculation on the basis of multiple requirements.

Company:	_____	Quote/order no:	_____
Construction project:	_____		
Contact person:	_____	Mobile:	_____
Tel.:	_____	Fax:	_____
Email:	_____	Shoring system:	_____
Shoring material dimensions:	_____		
	(e.g. panel or box length and height, module length, etc.)		

### 1. Trench/excavation dimensions:

Trench depth T [m]	Trench width b [m]	Clear shoring width $b_c$ [m]
<input type="text"/>	<input type="text"/>	<input type="text"/>
Pipe culvert height $h_c$ [m]	Pipe length l [m]	Pipe diameter DN [mm]
<input type="text"/>	<input type="text"/>	<input type="text"/>

### 2. Building impact:

yes <input type="checkbox"/>	no <input type="checkbox"/>	Distance between building and trench edge [m]:	<input type="text"/>
		Number of floors:	<input type="text"/>
		Foundation depth (lower edge of foundation) [m]:	<input type="text"/>

### 3. Traffic loads:

#### 3.1 Site traffic

yes <input type="checkbox"/>	no <input type="checkbox"/>
------------------------------	-----------------------------

#### 3.2 Excavators

yes <input type="checkbox"/>	no <input type="checkbox"/>	Type/weight	<input type="text"/>
		Distance between vehicle and trench edge [m]	<input type="text"/>
		Vehicle position	alongside trench <input type="checkbox"/>
			head ends of trench <input type="checkbox"/>

**3.3 Road traffic (load model 1) in accordance with DIN EN1991-2**

Yes ☐ no ☐ Distance between vehicle and trench edge [m]

Vehicle position alongside trench ☐

head ends of trench ☐

**3.4 Rail traffic in accordance with DIN EN 1991-2**

yes ☐ no ☐ Type of rail traffic

Distance between axis and trench edge [m]

**3.5 Crane**

yes ☐ no ☐ Type/weight

Dimensions of support brackets [m]

Center distance of support brackets [m]

Max. support load per bracket [kN]

**4. General information:**

**4.1** Can be sloped yes ☐ no ☐ Berm height  $h_1$  [m]:

**4.2** Head end shoring yes ☐ no ☐ with:

**4.3** Lines crossing the trench yes ☐ no ☐ Pipe Ø, height of bottom of pipe

**4.4** Concrete floor (building concrete) yes ☐ no ☐

**5. Soil-mechanical parameters**

(please forward appropriate information from the geological survey, core samples or soil characteristics)

**5.1** Site plan yes ☐ no ☐

**5.2** Geological survey yes ☐ no ☐

**5.3** Soil characteristics  $\varphi$    $\gamma$    $c$

**6. Other:**


---

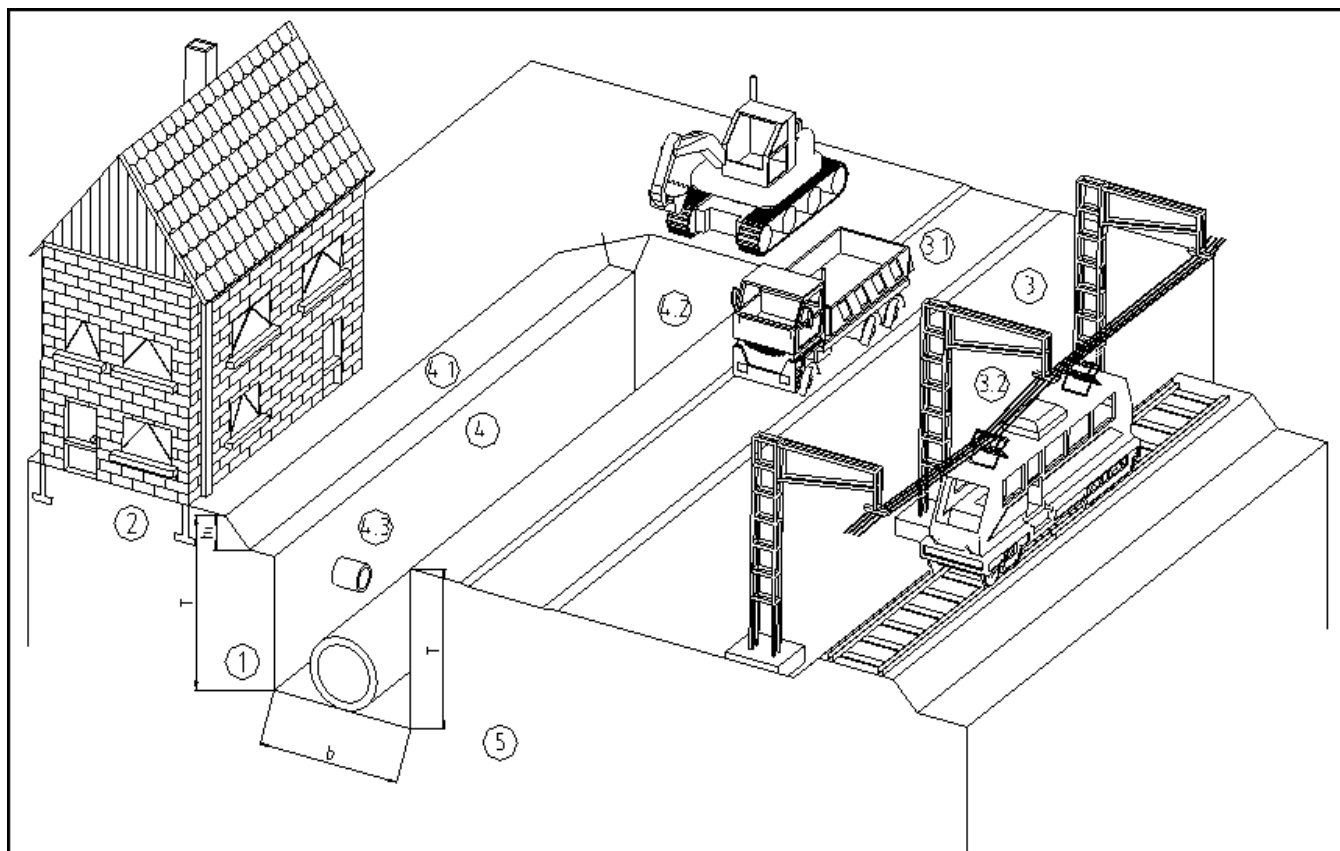


---



---

## 7. Drawing



Place, date

Signature

## Materials Services Infrastructure

thyssenkrupp Infrastructure GmbH  
Hollestraße 7a  
45127 Essen, Germany  
T: +49 201 844-562313  
F: +49 201 844-562333  
info.tkinfrastructure@thyssenkrupp.com  
www.thyssenkrupp-infrastructure.com

### **Trench Shoring**

thyssenkrupp Infrastructure GmbH  
Ottostr. 30  
41836 Hückelhoven, Germany  
P: +49 2433 453-0  
F: +49 2433 453-100  
trenchshoring.tkinfrastructure@thyssenkrupp.com