

Handling and installation



Pipe handling and installation instructions

These installation instructions include additional information for the transportation, storage and installation of different Krah pipe systems. These instructions do not supersede appropriate documentation like worksheets, standards, guidelines, data sheets and accident prevention regulations.

It is assumed that the installation of the pipes has been planned according to the standards and that the installation workers know the contents of the above - mentioned documents. Apart from this installation instruction the following standards and worksheets have to be taken into account:

DIN EN 1610

ATV A 127

DWA A 139

DIN 18300

DIN EN 13476 (ISO 21138)

DVS 2207

Transportation

Pipes and fittings have to be transported with appropriate vehicles. During the transport and especially during the loading and unloading they have to be protected against damages. Before unloading the pipes make sure that all products on the vehicle aren't damaged. If there is any damage you have to inform the truck driver and write it down on the shipping documents.

The contractor should set aside an area for products to be stored on site. This area should be flat, free of large rocks, rough surfaces and debris. It should also be out of the way of construction traffic.

Unloading of pipes

- During the unloading of the pipes with hoists only belts should be used. Steel wire ropes, chains as well as sharp-edged hoists should be avoided.
- During the unloading of the pipes with a fork-lift, the prongs which carry the pipes should be examined for sharp edges. It is recommendable to wrap e.g. a protecting foil around the prongs or to use a suitable Krah pipe inside the pipes that have to be unloaded.



Pipe transportation



Pipe transportation

Unloading of fittings

- The same guidelines as for the pipes apply.
- During unloading of fittings, the belts should be fastened on all factory-made brackets.
- Do not use only a part of them, as a result the construction would be damaged and the workers on jobsite may be hurt. Before lifting it should be assured that the belts are correctly fastened on the brackets.

Attention:

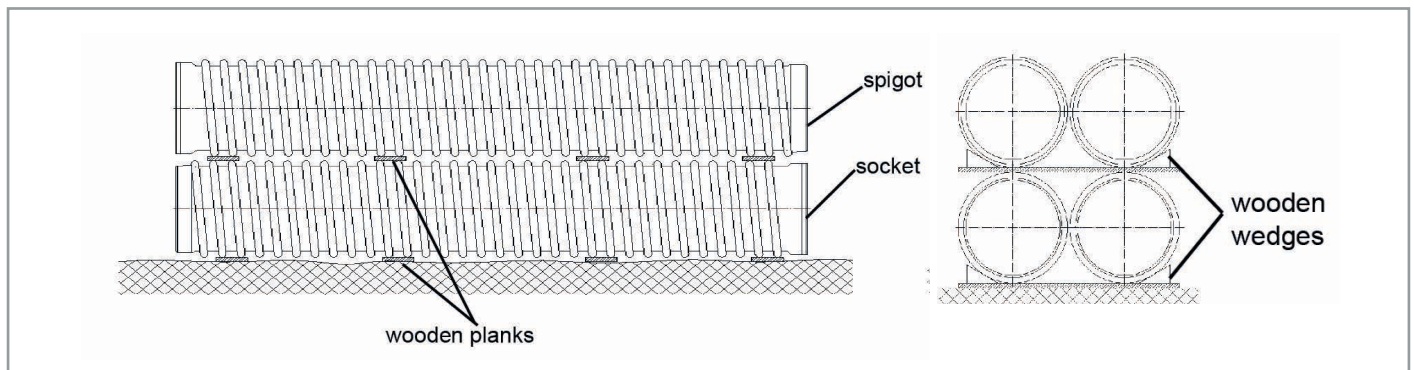
Depending on the construction of the fittings, a tilt may occur. Therefore the safety distance during the unloading has to be kept.

Storage

The pipes should be stored on even ground which is free of stones or sharp-edged objects. The pipes are to be stored in such a way that they cannot deform and are protected against dirt, mechanical damages and punctual load; this applies especially for the socket, the spigot and the Electro-Fusion wire inside of socket.



Storage on site

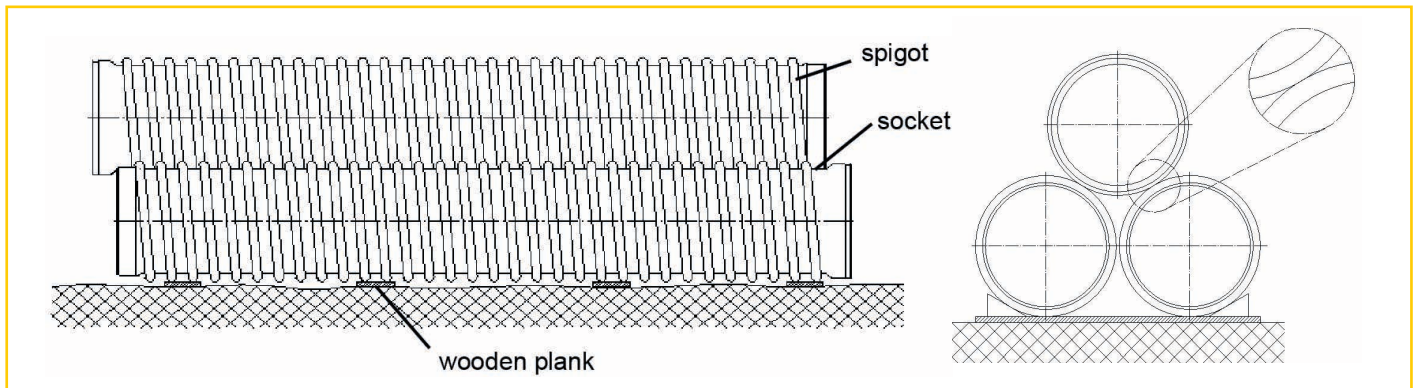


Pipe stack of two or more layers

Note:

It is recommended to put each pipe layer alternatively, with socket and spigot end in the opposite direction.

In order to guarantee a later proper and qualified welding it has to be checked before storing that the packing material has not been damaged. Should damages have occurred, firstly the socket and the spigot have to be checked if they are clean. Possible dirt has to be washed away with clean water. Afterwards the cleaned areas should be protected with a foil. In order that a later proper welding is not at risk, in no case adhesive film may get mixed with the outside of the spigot as well as the inside of the socket (heating wire). Under optimum conditions, if planks with a width of at least 200 mm are laid underneath the pipes, a maximum stack height of 3 m can be reached. In very cold weather all pipes should be stored on supports to avoid freezing to the ground.



Pipe stack of max. 2 layers

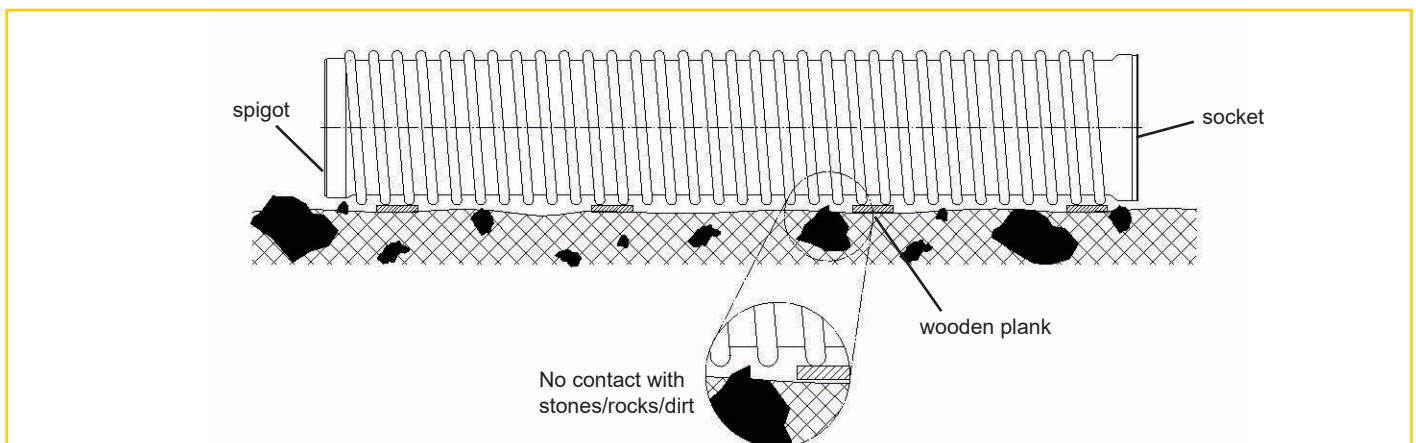
With the help of wooden planks a correct stack height of 3m can be reached. If no planks are used as underlay, even if the underground is smooth, the maximum stack height of 3m does not apply anymore. In this case the stack may not achieve more than 1m. Take care that the socket bell is not touching the pipe or the spigot end. Otherwise the socket bell may experience deformation.

Take care that manholes and fittings are stored in the position they will lay in the trench. This will avoid damages.

If you have outside temperatures of more than 25°C, diameters DN/ID > 1700 mm or the time of storage is more than 24 hours, support the pipe from the inside between bottom and crown. Use a beam and put small planks between the beam and the pipe surface.



Storage on site



No point load

Avoid a point load by placing the pipe on wooden stacks or planks so they won't come in touch with uneven, dirty or stony ground.

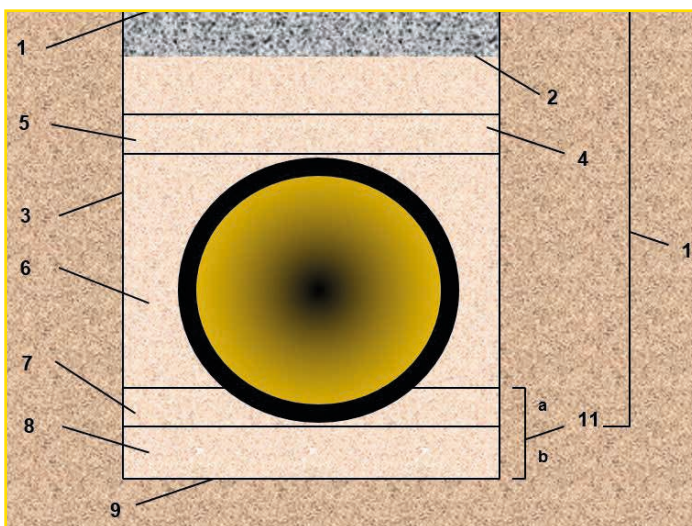
Installation

Krah pipelines are engineered products. The basic installation for these pipes is based on the worksheet ATV A 127. The basis of the installation procedure is:

- **DIN EN 1610**
- **Worksheet DWA A 139**



Compaction



Detailed view of different bedding layers

In EN 1610 the following definitions apply:

1. surface
2. lower edge of the road or rail construction, if existing
3. trench wall
4. main backfilling
5. cover
6. side backfilling
7. upper bedding layer
8. lower bedding layer
9. trench bottom
10. coverage height
11. thickness of the bedding

According to EN 1610, the load carrying capacity pipe / ground for earth-laid pipes has to be checked before the start of the installation. This evidence is provided by the static calculation ATV A 127.

Conduction area

By using appropriate actions it has to be prevented that the soil enters into the conduction area (12) or that a displacement of material from the conduction area to the soil can occur. The conduction area has to be protected against any predictable damaging change of its carrying capacity, stability or location. Reasons of such changes can be:

- **Removal of the blank walls**
- **Impact of ground water**
- **Other neighbouring ground works**

Water retention

- During the installation works the trenches are to be kept free of water.
- The way of the water retention may not affect the conduction area and the pipeline.
- Further instructions can be taken from EN 1610.

Note:

The compaction which is determined in the static calculation cannot be reached with wet compaction material with less than 11% of humidity.

Trench width

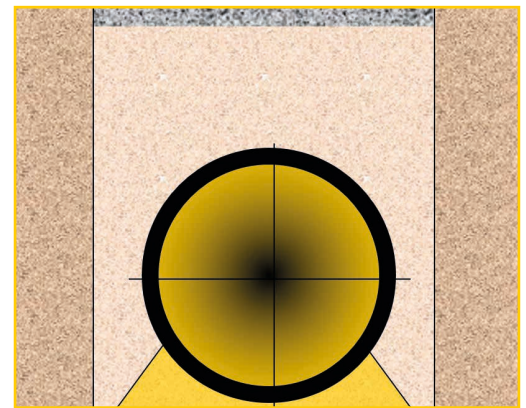
Big head access holes as well as a greater trench width for welders are not required for the electro-fusion socket jointing technique. Here, the widths indicated in EN 1610 respective in the static calculation are sufficient. It only has to be guaranteed that the used welding device can work without any problems.

Compaction of the conduction area

The embedding of the pipes considerably rules the load distribution and the pressure distribution on the pipe. Inapplicable bedding can lead to excessive pipe deformation. It is recommendable to fill the pendentive area with a compactor, should the pipes be $\geq \text{DN/ID } 1000$. For pipes $\leq \text{DN/ID } 900$ the lateral compaction power of the devices is sufficient in order to compact the pendentive area adequately.

The pendentive area has to be compacted as follows:

- The side of the pipe has to be compacted with a respective vibratory plate.
- In the range of the pipe area (figure 1, pipe support and embedding, up to 0.30m under the pipe crown, if embankment sideways of the pipe at least $1,5 \times d_a$, only the compaction soil which is indicated in ATV Standard A127 may be used.



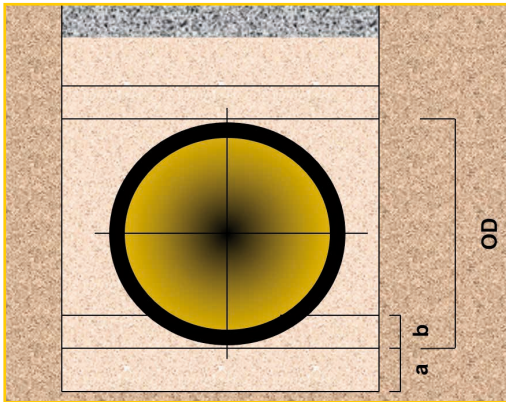
(figure 1) Pipe embedding

The bedding material has to be filled up in layers of 30 cm maximum. The soil on both sides of the pipeline has to be filled up in layers at the same time and compacted accurately. It has to be paid attention that the pipeline remains in its position. The compaction grade D_{pr} has to correspond to the indications in the static calculations of ATV A 127.



Placement on bedding material

The EN 1610 describes the following three types of carrying out the bedding:

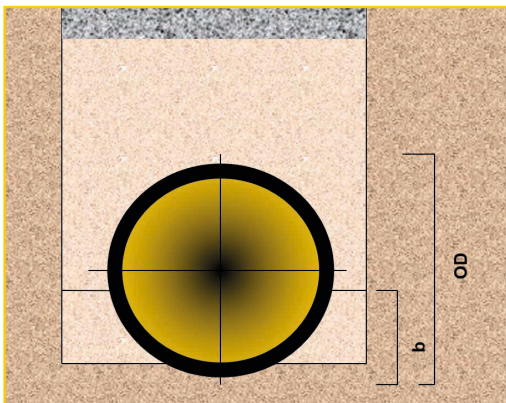


(figure 2) Bedding type 1

Bedding type 1 (figure 2) can be used for any conduction area, that allows a support of the pipes along their total length and that is produced by taking the required thickness of layers (a) and (b) into account. This applies for any dimension and form of the pipes. As far as nothing else is given, the thickness of the lower bedding layer (a) measured under the pipe bottom should not be lower than the following values:

- **100 mm with normal soil conditions**
- **150 mm with rock or hard soil**

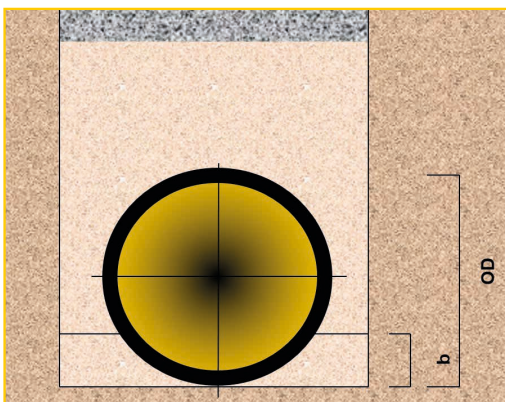
The thickness (b) of the upper bedding layer has to be according to the static calculation.



(figure 3) Bedding type 2

Bedding type 2 (figure 3) may be used in smooth, relatively loose, fine-grained soil, which allows a support of the pipes in their total length.

The pipes can be laid directly on the pre-formed trench bottom. The thickness (b) of the upper bedding layer has to be according to the static calculations.



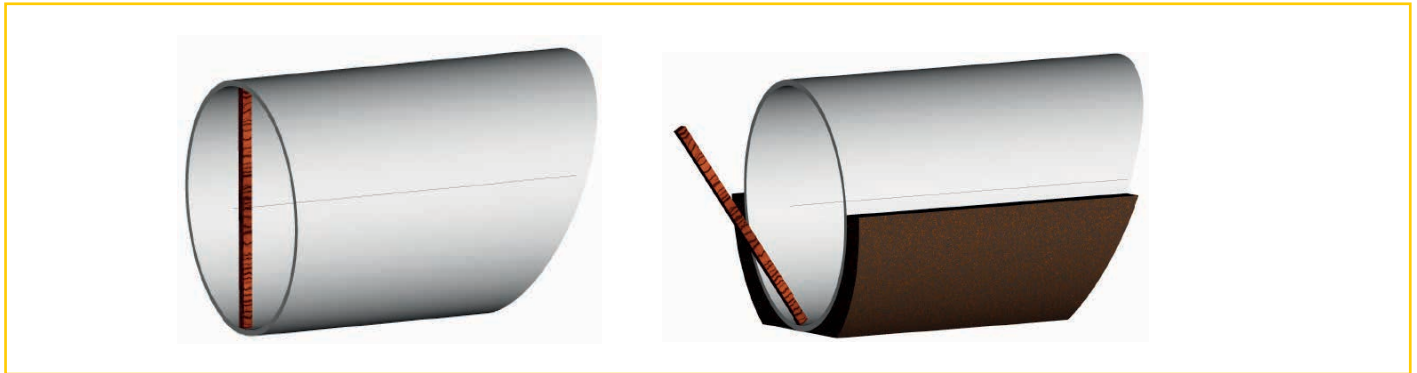
(figure 4) Bedding type 3

Bedding type 3 (figure 4) may be used in smooth, relatively loose, fine-grained soil, which allows a support of the pipes in their total length. The pipes can be laid directly on the pre-formed trench bottom.

The thickness (b) of the upper bedding layer has to be according to the static calculations.

Decisive is the bedding type which is indicated in the static ATV A 127!

Pipes and components change their dimensions under big variations of temperature. If you try to join two pipes with two different temperatures you may get problems with the tolerances of the joints. Store the pipes under the same outside conditions or take care that you store a new pipe for at least 30 min. in the trench before jointing. For the compaction works the below shown simplification has been proved in practice, which gives first information of a compaction on the side of the pipe.



Wooden stick application

Before the compaction works with suitable devices, a wooden stick, which is adapted in its length to the inside pipe diameter, can be put vertically into the pipe. After compaction on the side of the pipe, the pipe becomes a little bit vertically oval, but which is hardly measurable. The clamp effect for the wooden stick decreases and it drops.

The compaction grade required according to the static calculation has to be checked by a device-specific regulation or has to be proved by a measurement. The load which is determined in the static requires that in the trench filling the compaction grade is proved.

Compaction of the main backfilling

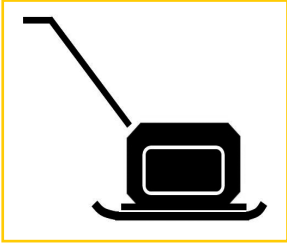
All materials which are defined in the EN 1610 can be used for embedding the pipes, materials like washed gravel, crashed gravel, sand, granular ground, a.s.o. The mechanical compaction of the main backfilling directly above the pipe should only be started when a layer of minimum 300 mm is above the apex of the pipe.



Compaction of main backfilling



Compaction work with a vibratory plate



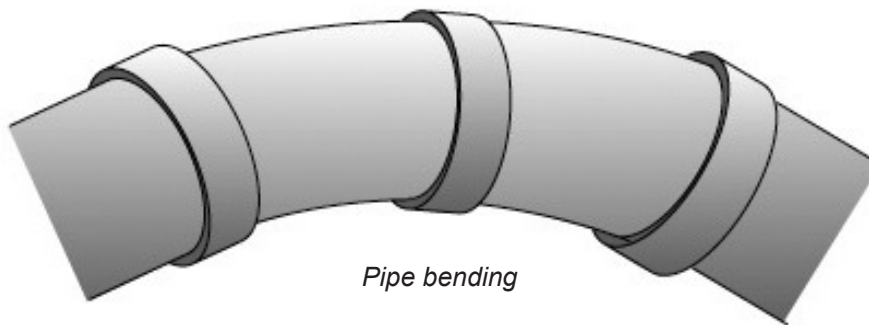
Vibratory plate

Note:

The mechanical compaction of the main backfilling is carried out with the help of a vibratory plate, min. 300 mm above the pipe crown.

Bending radius

The high flexibility is one of the most important advantages of HDPE pipes. Before the installation into the trench the pipes are welded together in a straight line and can then be installed in a radius of 30 x DN by HDPE and 60 x DN by PE-GF. Should a smaller bending radius be necessary, it has to be coordinated together with our technical department taking into account the installation temperature, the installation time (bending time), diameter, wall thickness and the technical devices.



Pipe bending

For pipes, which are not installed in a bent pipeline before welding, the above-mentioned indications in respect of the bending radius do not apply. In order to be able to carry out a secure welding of the E-Fusion socket, the pipes may not be bent by more than 0.6°. That means that a pipe with a length of 6 m may differ 60 mm from the pipe axis.

Should the turnarounds be bigger, i.e. the radius smaller; pipe bends and fittings should be used. The basis for the indications of the bending radius is an installation temperature of 20 °C.

Inspectioning & Testing

I. Preparation – *Filling and anchor*

If needed the pipes have to be covered with filling material before the pressure tests, so that changes in position which can lead to leakage are avoided. The pipelines are to be tested in total or if necessary in sections. The test sections have to be determined so that:

- the test pressure is reached on the deepest point of each test section
- on the highest point of each test section minimum MOP can be reached, except of differing determination of the planner.
- The required quantity of water for the pressure tests are readily available and can be discharged without any problems.

Pressure test on buried pressure pipes

I. Pressure test – *General*

For all pipelines the value of the test pressure depends on the designed pressure for the pipeline and the maximum operating pressure (MOP). The MOP contains all available pressure loads even peaks due to water hammer. Design pressure and maximum operating pressure must consider the environmental conditions. Typically the design is made for 20°C according (DIN SPEC 19674,PE-GF) or (ISO4427).

The unfavourable operation conditions should be taken as the basis. Usually the measuring devices have to be connected at the lowest point of the test section of the pipeline. If the measuring devices cannot be connected at the lowest point, the value for the pressure tests decrease. The test pressure must attend the minus difference in height.

II. Pressure test – *Procedure*

For all kinds of pipes and materials different approved pressure test procedures can be used. The test procedure has to be determined and confirmed by the planner. The following procedure is recommended:

1. Preliminary test – *After welding and cooling process*

- a. visual inspection
- b. test with Krah pneumatic joint testing device (with air 0, 5 bar, testing time = 5 minutes)

2. Pressure test for buried pipes

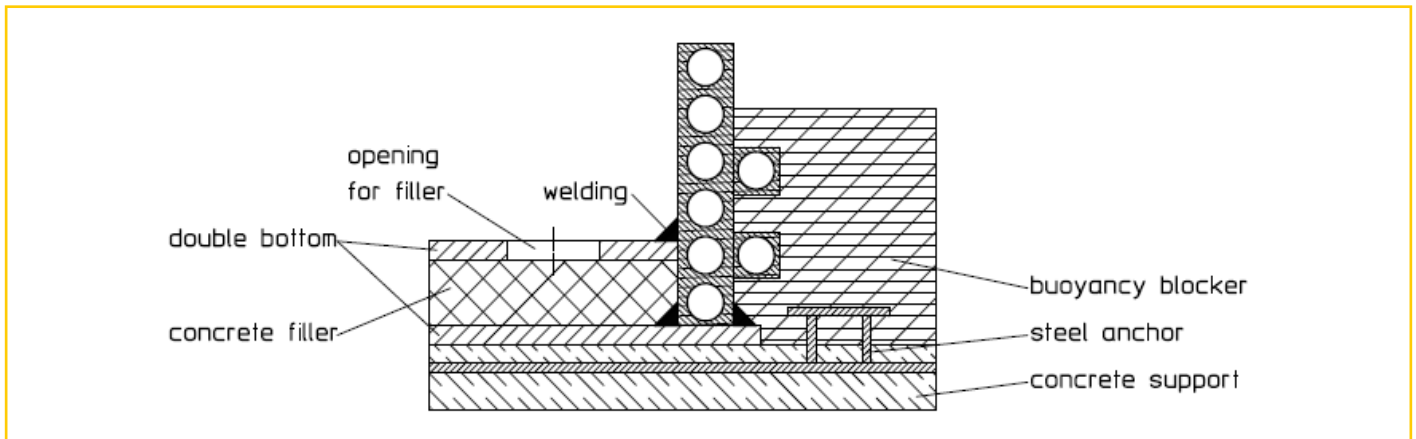
- test pressure = 1.5 x MOP, but max. MOP + 5 bar
- testing time = ca. 1 h
- test temperature = 20°C

Note:

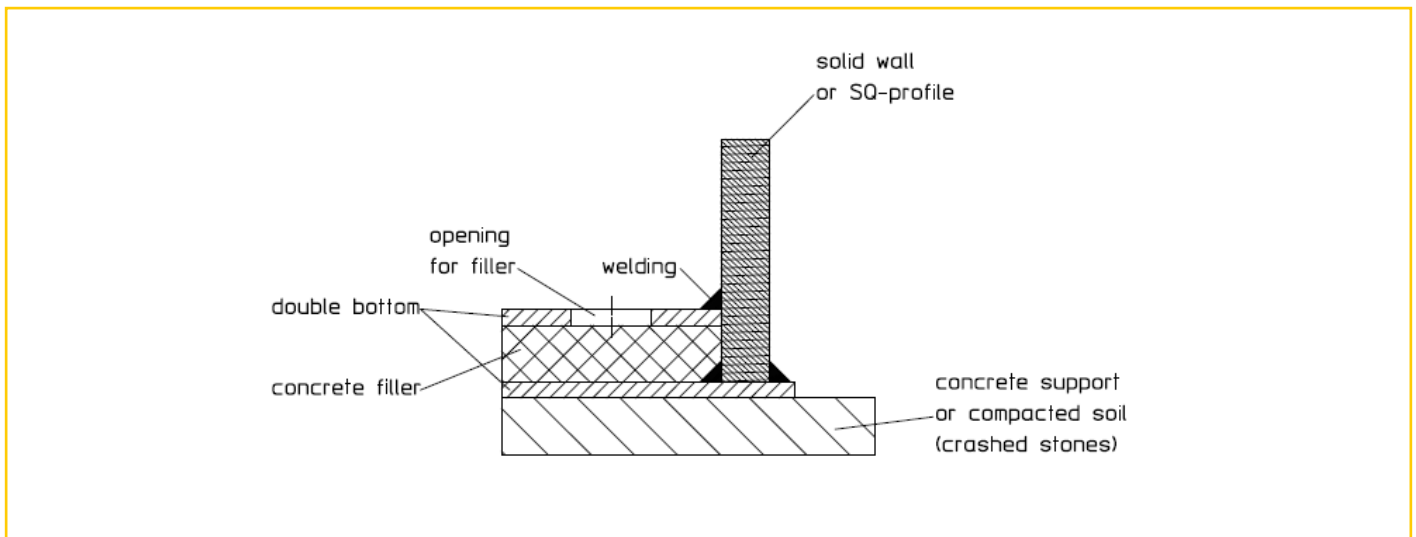
For testing of non - buried pressure pipes the test conditions have to be agreed with the planner.
 For PE-GF pipes a test pressure of 1.2 MOP(time 1h) is recommended.

Methods for installation of Krah manholes and chambers

Generally we distinguish between single wall bottom and double bottoms construction for manholes and chambers. If these products are to be installed in areas with high ground water levels, a double bottom construction is necessary, which has to be filled with liquid concrete on site.



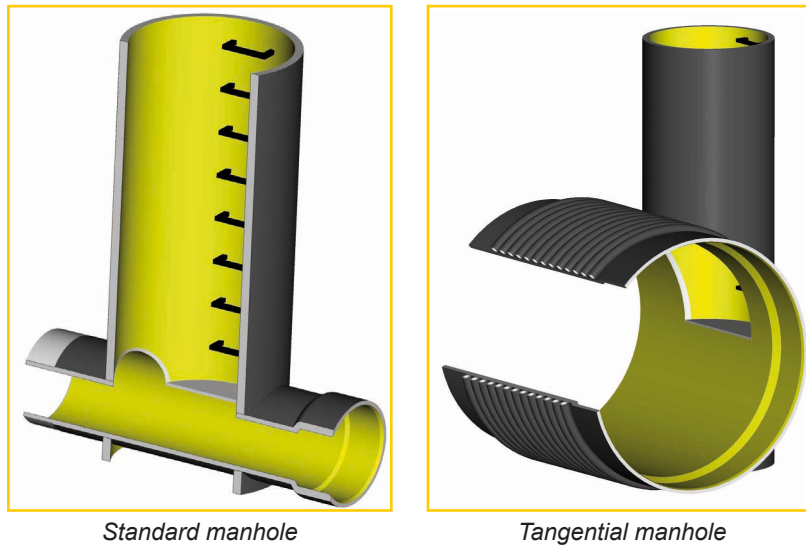
Double bottc



Double bottom construction of manhole without additional concrete anchor and profile outside
 (for manhole diameter including DN/ID 1200 mm with ground water)

In case the double bottom type needs to be used, there are two openings in the upper bottom; one is for the filling of the liquid concrete and one is for the venting during the filling process. They have to be closed after filling and hardening of the concrete with covers.

When installing the manholes of up to DN/ID 1200 mm diameter in ground water, a backfilling width of at least 50 cm is to be, for lift retention reasons, maintained outside and a concrete filling inside is in any case necessary.



Standard manhole

The standard kind of manhole is situated centrally above the pipe. Because of static and safety reasons this type is only recommended if the diameter of the pipe is smaller or equal to the diameter of the manhole.

According to the static requirements the bottom construction, the benching, the lower shaft, the cone and the upper shaft (or riser) are made out of either polyethylene or polypropylene. Just the very top is a concrete or reinforced concrete ring according to DIN4043. Even very complex constructions according to the engineers requirements are possible. The main advantage is the sustainable, flexible, light weight, inspection-friendly, self-cleaning and durable construction.

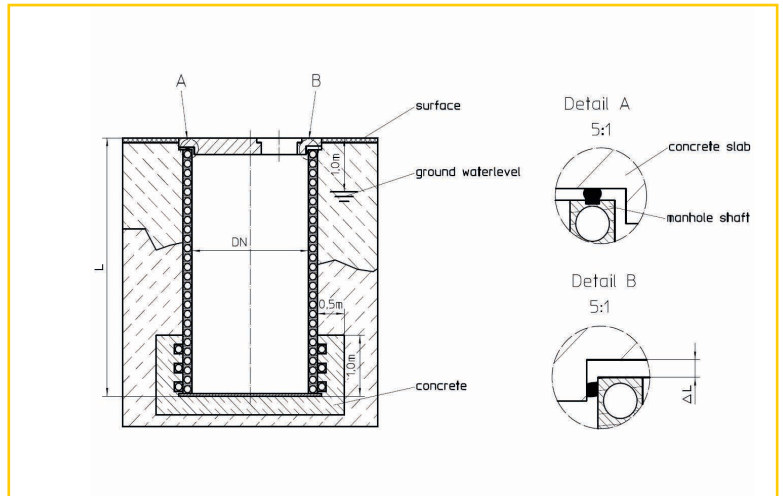
Tangential manhole

The tangential manhole is one of the most efficient and cost-saving designs for plastic manholes, especially for large pipe dimensions. The standard diameter of the tangential manhole shaft is DN/ID 1000, even for very big pipe diameters. The manhole is situated tangentially to the pipe, that means it is displaced from the middle.

This kind of manhole is very popular in Europe due to its low costs without losing any performance and quality. Krah manholes usually are designed for the installation with the top shortly under the ground surface level. These manholes can be produced up to 5000 mm diameter. Normally the top end will be closed with concrete plates for diameters bigger than 1200 mm. The plate is sealed with a rubber sealing ring or a TOK-tape band either at the connection to the manhole or the top of the manhole.



Manhole transportation on site



Manhole sealing and close-up

The most preferred solution is to place the sealing in radial direction (as shown in the drawing above) to avoid direct, axial loads to the manhole shaft.

Very close, above and next to the pipe, it is suggested to work with the hand tamper. For the compaction of the different ground layers the vibratory plate is the most commonly used item. For bigger areas that have to be compacted it is recommended to use heavier equipment.

Note:

Krah Manholes are usually equipped with lifting lugs that ensure safe transportation on site. All these lugs are homogenously welded to the pipe.



Krah pipe with manholes



For large diameter manholes it is necessary to have a second anchor at the outside near the bottom of the manhole. Here, the use of an additional profile which is produced with distance, is available at the Krah pipe system. Also concrete can be used here in this area, which will be connected to the profiles and is connected to the concrete support under the manhole which is given by steel anchors.

With the help of this packing, no additional static load is appearing in view to the manhole but is increasing the total weight of it and is acting against the buoyancy. The preparation of the ground construction for the placement of the manhole is most important for a good installation of the manholes. By using concrete base plates or compacted soil (crushed stones) under the bottom plate of the manhole, a guarantee is given against settlement in the ground and by that a damage of the manhole construction is avoided.

For the installation of manholes in areas without ground water, the preparation of the ground construction for the placement of the manhole is also a concrete basement or compacted soil (crushed stones) but here the placement is possible without additional concrete anchor and filling.

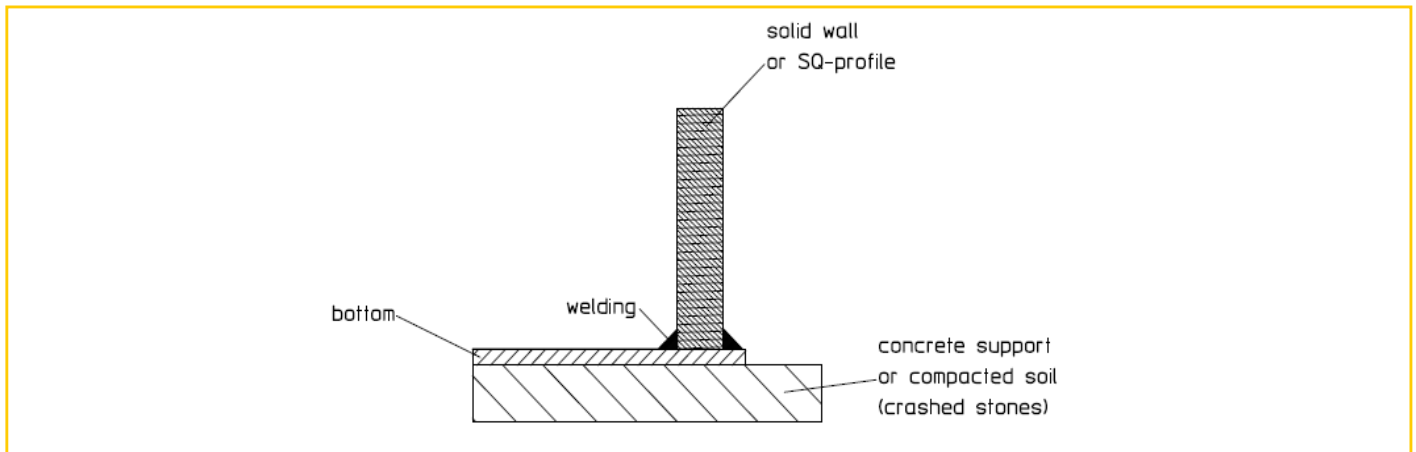


Installation of tangential manhole based on compacted soil (crushed stones)



Installation of tangential manhole

For this application of manholes in areas without ground water only a single bottom construction or in some cases also a manhole without bottom can be used.

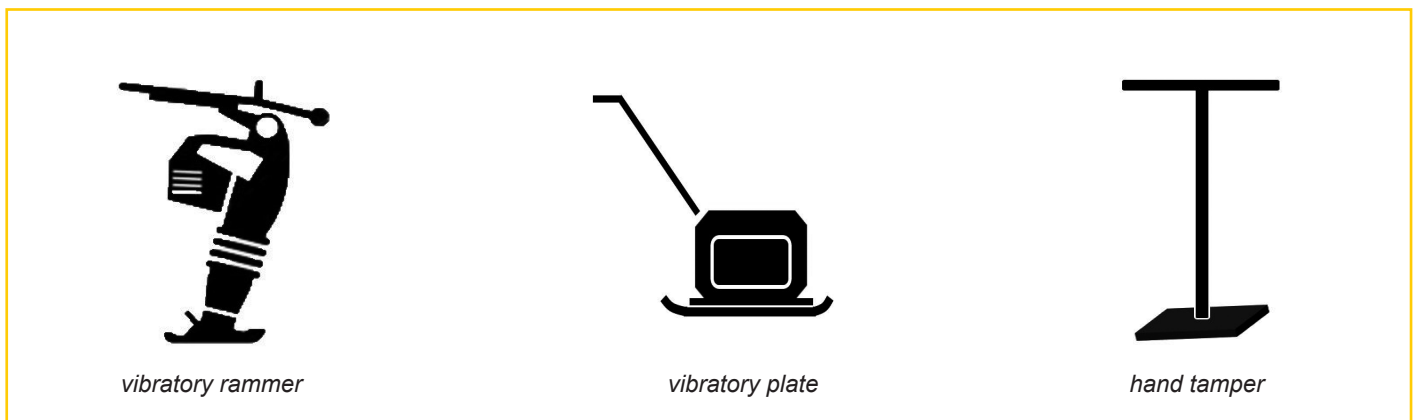


Single bottom construction of manhole with base support

All applicable bedding materials are listed in the EN 1610. The details regarding the support bedding have to be prepared according to the static calculation and the tender documents of the consultant engineer. For the compaction of the ground around the manhole shaft the right working equipment has to be used. The back-filling material is to be inserted carefully and in layers of 20 - 40 cm layer thickness and compacted with a medium weight vibration backfill rammer (approx. 50 kg).

The number of required compacting passes per layer dependent on back-filling material, dumping height and compacting device are to be taken from table 4 from ATV A-139 or table 6 from DIN EN 1046. A minimum degree of compaction of $DPr = 95\%$ according to ATV-A 139, section 11.1 is to be established.

The following equipment is useful for compaction of manholes:



Note:

The following equipment is **not** useful for the compaction of manholes:



Picture 13: Installation equipment which cannot be used for compaction of manholes and chambers

In case of shortage of space around the manhole, a compaction has to be done with hand tools like the hand backfill rammer (as shown in the pictograms on the previous page).

All Krah pipe products are manufactured out of black PE material which has an amount of 2,5% carbon black. Due to that, the lifetime of Krah pipe products (pipes, manholes, fittings and chambers) which are permanently under UV radiation is actually more than 20 years.

Testing of manholes after installation

The manholes and inspection chambers (manholes) shall be conducted either with air (method “L”) or water (method “W”). For the closure of the manhole top are any “shut-off bladders” available. It is important to use the right bladder for the adequate test method.



Shut-off bladders for manhole testing with water inlet



With help of this tool, all areas also near pipe connections can be prepared for the right compaction in small layers. The highest protection against UV radiation is given by adding of carbon black on the raw material.

Shut-off bladders for manhole testing with additional air connection

Transportation of manholes

Delivery

The manholes and components are delivered with help of trucks. Before you unload the truck, make sure that all products on the truck are without any damage.

Lifting

The standard unloading method for manholes from the truck is lifting from top of the truck. If you use tools to lift the pipes and manholes from the side or from above, take care that you only use textile ropes, or steel ropes which are covered with plastic. Never use hard materials like steel ropes and chains.

Due to the low weight of the pipes, it is possible to use just one rope in the middle of the pipe. During the lifting of the pipe, you have to make sure that you will not smash the pipe against the wall of the truck, which could damage the pipes and manholes. Lifting lugs have been welded on the top of the wall construction of the manholes on site, where you can fix your ropes to move the manhole.

Usually there are three lifting lugs. Nevertheless, you should use all of these available for lifting. If you use only some of the lifting lugs, they may be destroyed due to overload weight. The manhole would be damaged and the workers on job site are at risk.

Just before lifting, you have to check once again that the rope is firmly touching all lifting lugs at the manhole. You have to notice that due to the construction of the manhole there might be a movement from the point of

Note:

Especially the handling of manholes requires a couple of specifications which have to be considered. Local safety standards for safety on site have to be respected at any time.



Manhole placement on site

balance from the axes to another point in or outside the manhole.

Note:

Please take care that the lifting lugs might not prevent the manhole from moving sideways once it is lifted. Don't use other points for lifting than the original ones. If due to any technical reason it is not possible to use the pre-fabricated lugs, choose alternative points for lifting only after contacting the manufacturer and releasing by the supplier.

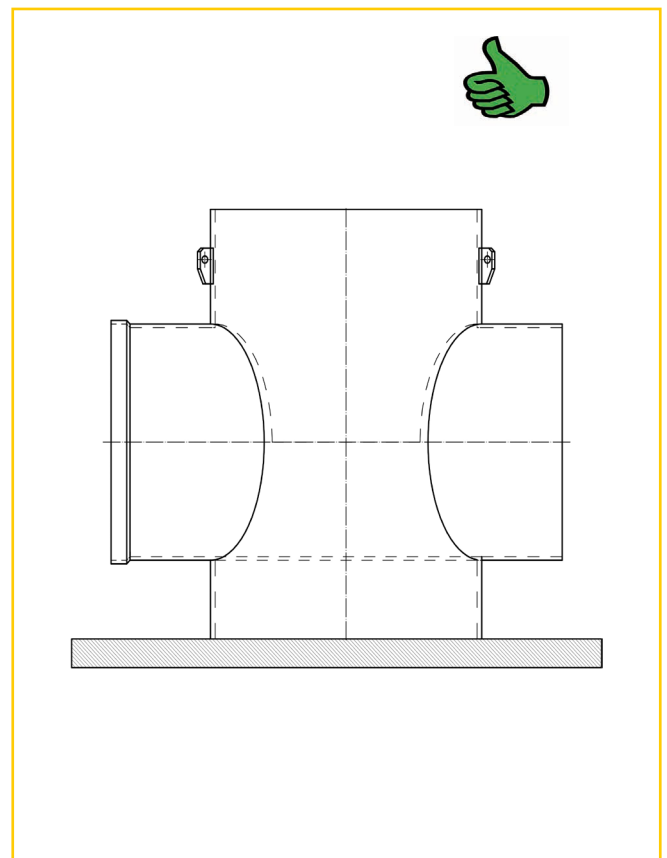
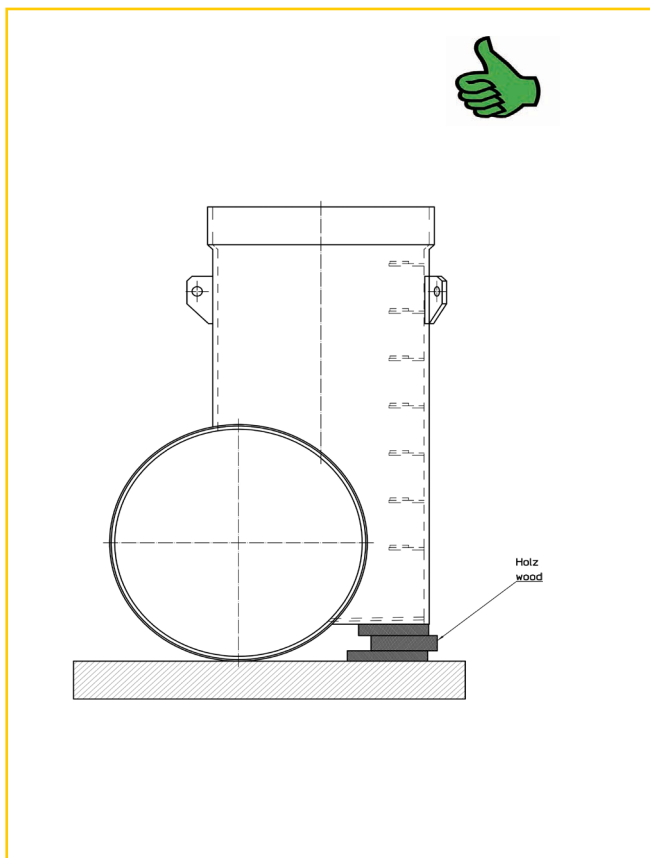
The storage on the job site

The kind of storage depends on the kind of ground and the kind of additional materials which are available. In general the area for the storage place must be leveled. The area can be a fabricated surface like a parking area with tar asphalt or gravel or just a flat open field with grass or sandy ground.

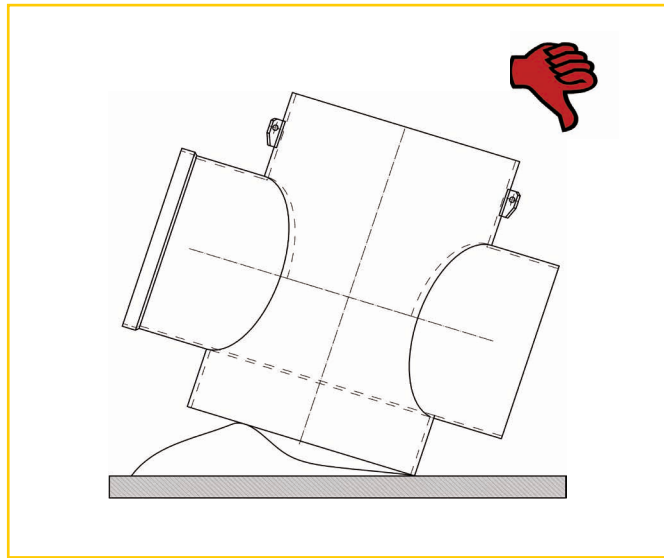
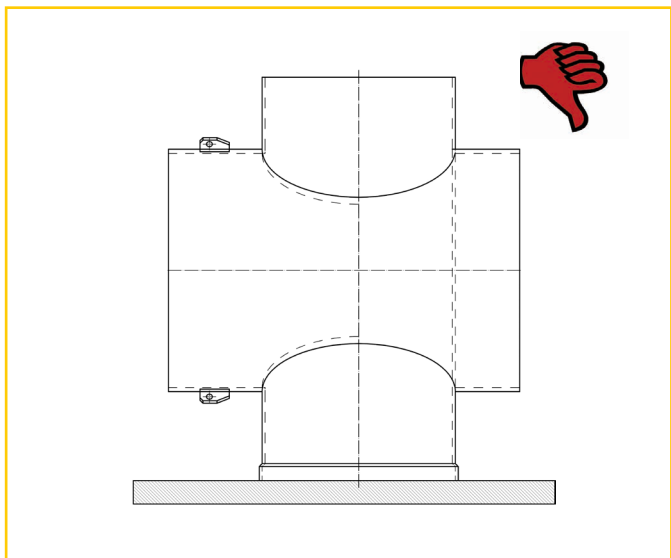
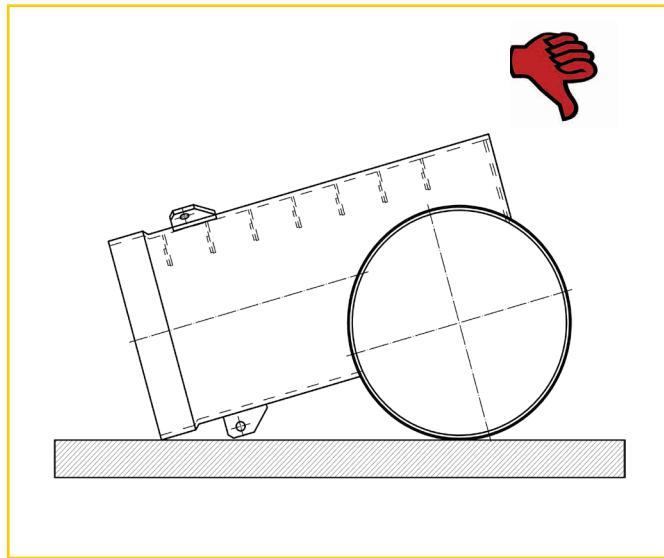
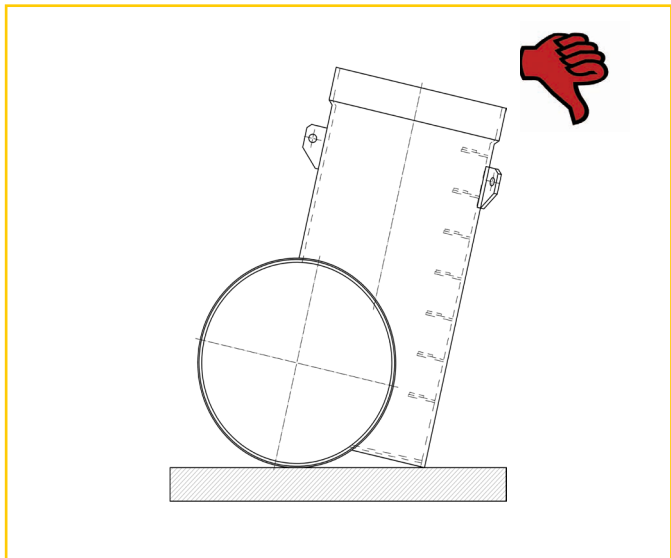
Take care that all manholes and fittings are in general stored in the position they will have later in the trench, this will avoid damages at the outside of the components.

Samples of right manhole storage:

Place the manholes in an upright position. Avoid point load. If necessary, wooden planks or wedges can be used as underlay to prevent stones, rocks or dirt from damaging the manhole.



Samples of wrong manhole storage:



It has to be made sure that the socket and spigot are absolutely clean and without damages. If the pipe ends are packed in film wrapping, make sure the wrapping is intact, so that a later dense welding is possible.



Get more information from your local Krah Pipe producer:

