Instructions for the Installation of FW STEEL-CASED PIPE-IN-PIPE

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These instructions for the installation of FW STEEL-CASED PIPE-IN-PIPE have been compiled so that the high quality standard with which FW STEEL-CASED PIPE-IN-PIPE is prefabricated can be extended to the area of installation, and also to answer frequently asked questions about the laying of this pipe system. It is essential that these instructions should be followed, otherwise any warranty claims will be void.

1 Civil engineering

1.1 Standards and guidelines

1.1.1 Standards

The execution of works must comply with the currently valid standards and the approved technical regulations in force.

In addition, all safety regulations are to be observed.

1.1.2 Distances from other mains services

The national official regulations and requirements of the supplying companies must be observed. Unless none specification exists, we recommend the application of the minimum distance as mentioned below, all dimensions referring to the outer edges of the pipes.

Minimum distance from district heating pipelines when running parallel for a length of up to 5 m:

1 kV signal or test cables	30 cm
several 10 kV cables or one 30 kV cable	60 cm
several 30 kV cables or one cable of over 60 kV	100 cm
gas and water mains	40 cm

Minimum distance from district heating pipelines when running parallel for a length of more than 5 m:

1 kV signal or test cables	30 cm
several 10 kV cables or one 30 kV cable	70 cm
several 30 kV cables or one cable of over 60 kV	150 cm
gas and water mains	40 cm

Minimum distance of other services when crossing district heating systems:

1 kV signal or test cables	30 cm
several 10 kV cables or one 30 kV cable	60 cm
several 30 kV cables or one cable of over 60 kV	100 cm
gas and water mains	30 cm

1.1.3 Routes in public areas

When the route of the district heating pipeline runs through a public area (streets, squares etc.) the work is to be carried out in collaboration with the public authorities.

1.1.4 Civil engineering

The contractor carrying out the civil engineering work is not to hinder the installation of the FW STEEL-CASED PIPE-IN-PIPE system.

The heaps of excavation material must be located on only one side of the pipeline route.

1.1.5 Fencing, securing of building site

Open trenches and pits are to be fenced off in accordance with the regulations (UVV Accident Prevention Regulations) and to be appropriately illuminated during hours of darkness.

1.2 Construction of the pipe trench

1.2.1 Areas of responsibility

The route plan with the trench profile for the prefabrication and installation of FW STEEL-CASED PIPE-IN-PIPE is prepared by FW-FERNWÄRME-TECHNIK GmbH.

The profile plan and longitudinal sections are prepared by the planning office or the civil engineering contractor. The civil engineering contractor is responsible for complying with and verifying the dimensions. They must take care that any deviations or other peculiarities are recorded and later made available for the preparation of the final as-built documentation.

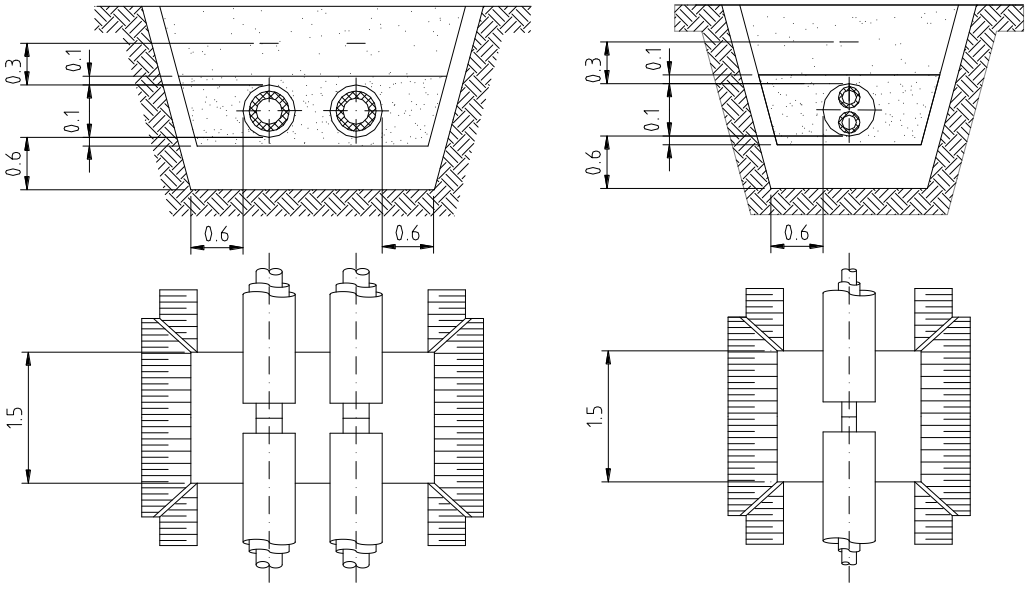
1.2.2 Field joints

For all field joints (BV) head access holes of at least the following dimensions are to be excavated:

Length: 150 cm along the axis of the pipe-in-pipe, symmetrically around the field joint

Width: 60 cm on both sides of the pipe-in-pipe(s)

Depth: 60 cm below the bottom of the pipe-in-pipe



1.2.3 Minimum gradient of the pipeline

district heating water	1‰	(10 cm in 100 m)
steam in direction of flow	1‰	
steam against direction of flow	5 ‰	

1.2.4 Bottom of pipe trench

The bottom of the pipe trench is to be filled with a layer, at least 10 cm thick, of mechanically compacted sand (0/4 round grain), on which the FW STEEL-CASED PIPE-IN-PIPE is to rest.

The pipe trench is then to be levelled and after verification of the levelling handed over to the pipeline installation company.

1.2.5 Surface and ground water

The pipe trench and the head access holes are to be kept free of surface or ground water by the civil engineering contractor throughout the period of assembly work. The contractor is liable for any ingress of water.

1.2.6 First partial filling

When the pipe-laying and testing are completed, the pipe trench is to be filled by hand with sand (0/4 round grain) up to the level of the crown of the pipe-in-pipe and compacted.

When this first partial filling has been completed, a follow-up-levelling is to be carried out and verified jointly with the site manager and the installation firm. A record is to be kept of this process.

It must be ensured that no inadmissible hollows have formed along the pipeline. If these should be found, however, such hollows are to be eliminated before further backfilling, this particularly applies to steam pipelines.

1.2.7 Second partial filling

When the follow-up-levelling has been completed and verified, sand (0/4 round grain) is to be filled in by hand to a level of 10 cm above the crown of the pipe-in-pipe and compacted.

1.2.8 Pipeline warning strip

The pipeline warning strip is to be laid 30 cm above the crown of each encasing pipe.

1.2.9 Third partial filling

The remaining trench opening is to be backfilled with the excavated material and mechanically compacted according to the valid standards and approved technical regulations in force.

2 Pipeline construction

2.1 Unloading and storage of FW STEEL-CASED PIPE-IN-PIPE

2.1.1 Material acceptance inspection

On arrival at the construction site, FW STEEL-CASED PIPE-IN-PIPE is to be checked by visual control for external damage.

When unloading the FW STEEL-CASED PIPE-IN-PIPE, the encasing pipe insulation should be checked by means of a spark testing device with 25 kV. Any possible defects must be eliminated immediately.

Furthermore, the consignment has to be checked for its completeness. Any deficiencies found must be noted on the delivery note accordingly.

If serious shortcomings or defects are found, the project manager of FW-FERNWÄRME-TECHNIK GmbH is to be informed immediately.

2.1.2 Unloading from the truck

The unloading from the truck lies in the responsibility of the pipe-laying firm. For the unloading the appropriate lifting gear shall be used. FW STEEL-CASED PIPE-IN-PIPE is only to be lifted using textile lifting slings (minimum width 150 mm).

The weights of the 12 m standard lengths are as shown in the following table. The weights given (in kg) are resulting from the combination of inner and encasing pipes of the diameters used. Construction units measuring 16 m in length weigh 33 % more accordingly.

standard length 12 m	Encasing pipe DN														
inner pipe DN	100 114,3 x 3,6	150 168,3 x 4,5	200 219,1 x 4,5	250 273 x 5,0	300 323,9 x 5,6	350 355,6 x 5,6	400 406,4 x 6,3	500 508 x 6,3	600 610 x 6,3	700 711 x 7,1	800 813 x 8,0	900 914 x 10,0	1000 1016 x 10,0	1100 1120 x 12,5	1200 1220 x 12,5
25 33,7x2,6	163	283	378	525	697	779	997	1315	1664	2201	2840	3843	4418	5833	6527
50 60,3x2,9		305	400	547	719	801	1019	1337	1686	2222	2862	3865	4440	5854	6549
100 114,3x3,6			455	602	774	865	1074	1393	1741	2278	2917	3920	4496	5910	6604
150 168,3x4,5				681	853	935	1153	1471	1820	2356	2996	3999	4574	5988	6683
200 219,1x4,5					892	975	1193	1511	1860	2396	3036	4039	4614	6028	6723
250 273,0x5,0						1048	1266	1584	1933	2469	3109	4112	4687	6101	6796
300 323,9x5,6							1354	1672	2021	2557	3197	4200	4775	6189	6884
400 406,4x6,3								1805	2154	2691	3330	4333	4909	6323	7017
500 508x6,3									2212	2749	3388	4391	4967	6381	7075
600 610x6,3										2778	3417	4420	4996	6410	7104
700 711x7,1											3582	4585	5160	6575	7269
800 813x8,0												4792	5368	6782	7476
900 914x10,0													5890	7304	7999
1000 1016x10,0														7328	8023

2.1.3 Storage

If the FW STEEL-CASED PIPE-IN-PIPE is not positioned in the pipe trenches immediately on delivery, then it should be noted that during temporary storage construction units may be stacked on top of each other only as follows:

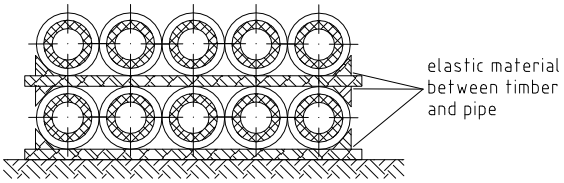
- Pipe-in-pipe of up to DN 300 **no more than 3 tiers**
- Pipe-in-pipe of over DN 300 **no more than 2 tiers**

It is to be ensured that the storage site has a flat surface and is free from rubble and vegetation. The FW STEEL-CASED PIPE-IN-PIPE is to be laid upon cushioned timbers (at least 2 per construction unit). The lower pipes must not be in contact with the ground.

In the area of follow-up-coatings there must be no contact points (to avoid damaging).

For construction units with a wall duct, particular attention should be paid that the wall duct is not in contact with the ground and does not rest against any piece of timber.

Furthermore, special care has to be taken that the “OBEN” (“TOP”) marking of each pipe is in the 12 o’clock position during storage and transport so that the pipe bearings installed within the FW STEEL-CASED PIPE-IN-PIPE can fulfil their intended function.



The FW STEEL-CASED PIPE-IN-PIPE is to be secured against rolling away sideways.

The stacks of pipes are to be located at a sufficient distance from the pipe trench, so as not to endanger the stability of the trench walls (see 1.1.4).

If FW STEEL-CASED PIPE-IN-PIPES have to be stored for any extended period of time before laying, then attention must be paid to the following points:

In case of intense sunshine, FW STEEL-CASED PIPE-IN-PIPE is to be protected by being covered with white sheeting, especially where the insulation has to be finished on site (on fitted pieces such as elbows and reductions).

During the summer months the subsequent insulation is protected against intense sunlight with wrappings of white foil. This foil must be removed prior to the laying of the construction unit into the trench!

If, contrary to expectations, the inscribed writing on the construction units from the factory should no longer be legible, it is imperative to inform FW-FERNWÄRME-TECHNIK GmbH.

2.1.4 Transportation caps

The transportation caps on the inner and encasing pipes resp. the foil packaging around the ends of the encasing pipes put on by FW-FERNWÄRME-TECHNIK GmbH must not be removed until the actual pipe installation begins. Transportation caps remain the property of FW-FERNWÄRME-TECHNIK GmbH and are to be returned when the pipes have been installed. Missing or damaged caps have to be reimbursed.

2.2 Placing of FW STEEL-CASED PIPE-IN-PIPE in the pipe trench

2.2.1 Testing of the encasing pipe insulation

Before the FW STEEL-CASED PIPE-IN-PIPE is placed in the pipe trench, the insulation of the lower part of the encasing pipe is to be tested with a 25 kV spark testing device. Any possible damage has to be removed immediately.

2.2.2 Markings

FW STEEL-CASED PIPE-IN-PIPE is marked as follows on the encasing pipe:

BE construction unit number (numbers in sequence)

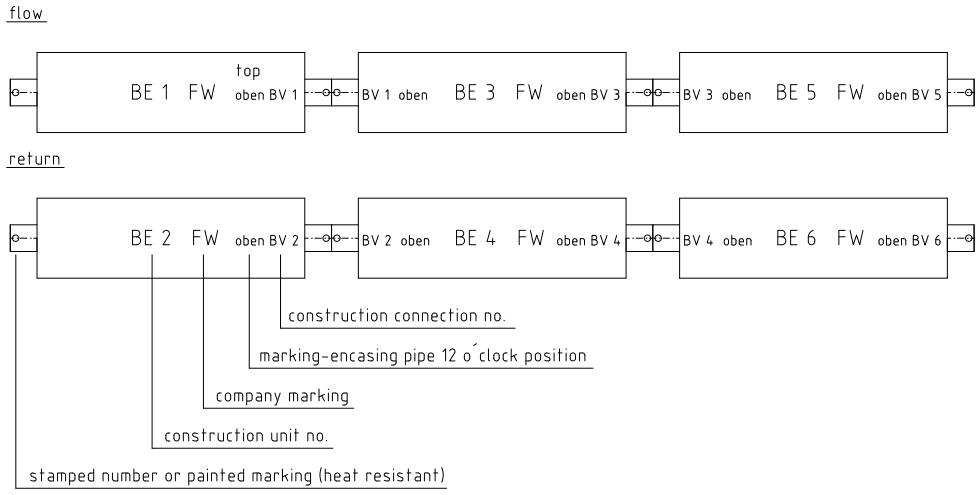
BV field joint number. Construction units that are to be joined together bear the same BV number.

Each individual construction unit is to be positioned in accordance with the FW Installation Plan.

OBEN Every encasing pipe bears the word “OBEN” (“TOP”).

O The top of every inner pipe is indicated by an O painted onto both ends of the pipe.

When a construction unit is positioned, special care shall be taken to ensure that the markings on the encasing pipe and on the inner pipe are in the 12 o’clock position.



2.2.3 Laying into the pipe trench

FW STEEL-CASED PIPE-IN-PIPE is to be laid immediately in the prescribed position on the bottom of the pipe trench.

The construction units must not be laid upon timbers.

The pipes are to be fixed in their position by means of tamped sand which is laterally supported in places.

Open field joints are to be protected in such a way that even in the case of a sudden inrush of water (e.g. in the event of a storm or a burst water main) no water or dirt can penetrate the inner pipe or the ring space between the inner pipe and the encasing pipe (sleeves, foil, adhesive tape).

2.3 Welding of the inner pipes

Inner pipes may only be welded by welders possessing a valid examination certificate in accordance with EN ISO 9606-1. The approved rules of good welding practice and the standards relating to welding techniques are to be observed.

The pipe ends have to be provided with bevels made at factory.

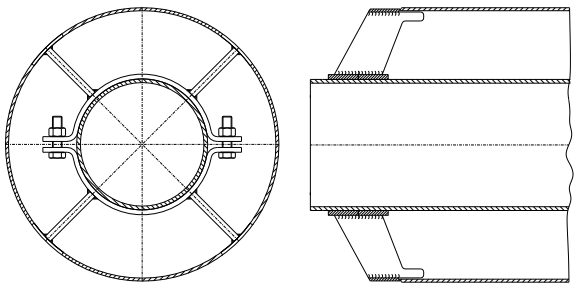
Before welding begins, the construction units are to be positioned in such a way that there is no lateral or vertical misalignment between the pipe ends that are to be welded together.

The transport safety devices (see drawing below) must not be removed until after the pipes have been laid in the pipe trench and the inner pipes aligned and, where possible, tack-welded.

On-site connections, where mechanical pre-stressing is carried out, the transport safety devices are explicitely removed from the construction units to be prestressed. It must be ensured that it is no longer possible for the encasing pipe to be displaced (where necessary, the pipe string should be partially backfilled and the sand compacted).

At those points, where the inner pipe is to be prestressed, the welding of the inner pipes is to be carried out only after the prestressing (for prestressing see Point 2.4).

The transport safety devices remain the property of FW-FERNWÄRME-TECHNIK GmbH and have to be returned after completion of the pipe mounting works. Missing or damaged safety devices shall be reimbursed.



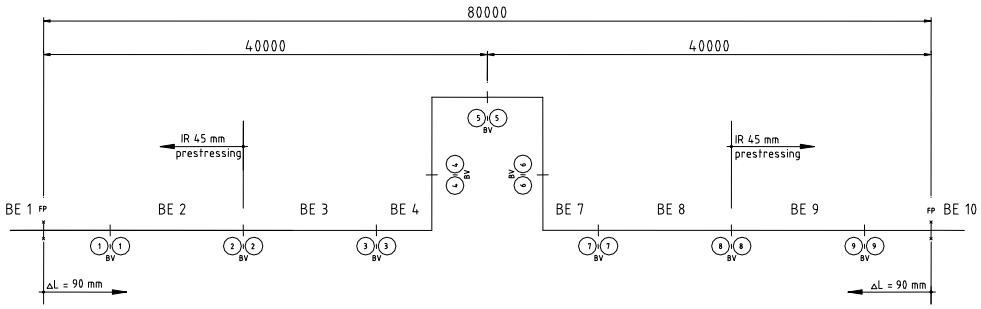
2.4 Mechanical prestressing of the inner pipes

2.4.1 Natural expansion compensators

Prestressing may not be carried out until the whole of the pipeline section, including the anchor points, has been laid and welded. Special care must be taken to see that the encasing pipe is not displaced during prestressing. Anchor points and elbow units are to be secured against displacement. Point 2.3 (Removal of the transport safety devices and partial filling of the pipe string) is also to be observed.

It is absolutely essential that the prestressing values given in the FW installation plan are observed.

Example: Prestressing of a U-bend

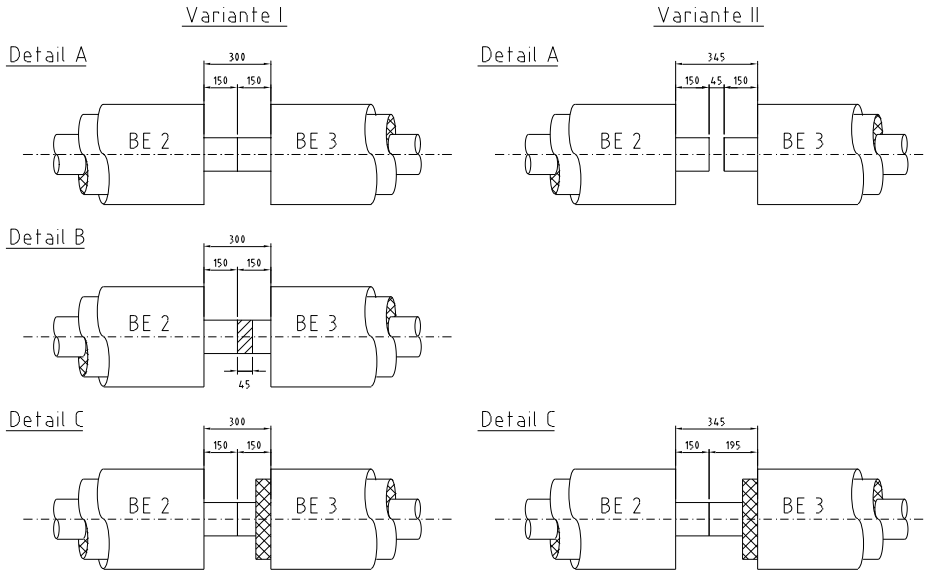


Variant I:

- weld inner pipes at all field joints (BV), except BV 2 and BV 8
- secure the encasing pipes against displacement
- remove the transport safety devices to secure the inner pipes from field joints BV 2 and BV 8 (see Detail A)
- shorten the inner pipe by 45 mm at construction units BE 3 (field joint BV 2) and BE 8 (field joint BV 8) (see Detail B)
- bevelling of the inner pipes of construction units BE 3 and BE 8
- Using suitable tools, pull the inner pipe of construction unit BE 3 towards unit BE 2 and the inner pipe of construction unit BE 8 towards unit BE 9 until the weld gap is of the prescribed width and weld (see Detail C). Suitable for prestressing are prestressing clamps, which FW will provide on loan on request. They consist of two pairs of pipe clamps connected to each other by threaded rods.

Variant II:

There is no need to shorten the inner pipe, because the construction units have already been positioned at the correct distance from each other (45 mm in the example) when being lowered into the pipe trench.



Expansion compensators in the form of elbows and Z bends are prestressed by the same procedure.

If auxiliary anchor points have been mounted at the axial compensator seals at factory (e.g. in case of wall ducts), these are to be inspected prior and after pre-stressing to ensure their correct position. The positions of the auxiliary anchor points must not have changed during prestressing.

2.5 Radiographic testing of inner pipe

The number of radiographic tests is generally determined by the customer. The radiographic records are evaluated, unless otherwise specified, in accordance with EN ISO 5817, evaluation group B. Recommendation by FW-GmbH: 100 % of the inner pipe welds.

2.6 Tightness and pressure testing of inner pipe

2.6.1 Pneumatic tightness testing of inner pipe

If the installation procedure makes it necessary to carry out a partial tightness test, this is to be carried out at 0.5 to max. 1.0 bar, all safety precautions being observed. As a rule, this procedure applies to inner pipes of < DN 200.

In case of inner pipes of > DN 200 the tightness test is carried out using a vacuum glass.

2.6.2 Hydraulic pressure test of inner pipe

For pressure vessels, the hydrostatic test pressure referred to by the Pressure Equipment Directive 2014/68/EU must not fall below the higher value of the following values:

- 1.25 times the value of the maximum stress of the pressure equipment in operation, taking into account the maximum pressure and the maximum allowable temperature;
- 1.43 times the maximum allowable pressure

Remarks to Point 2.6.1 and 2.6.2

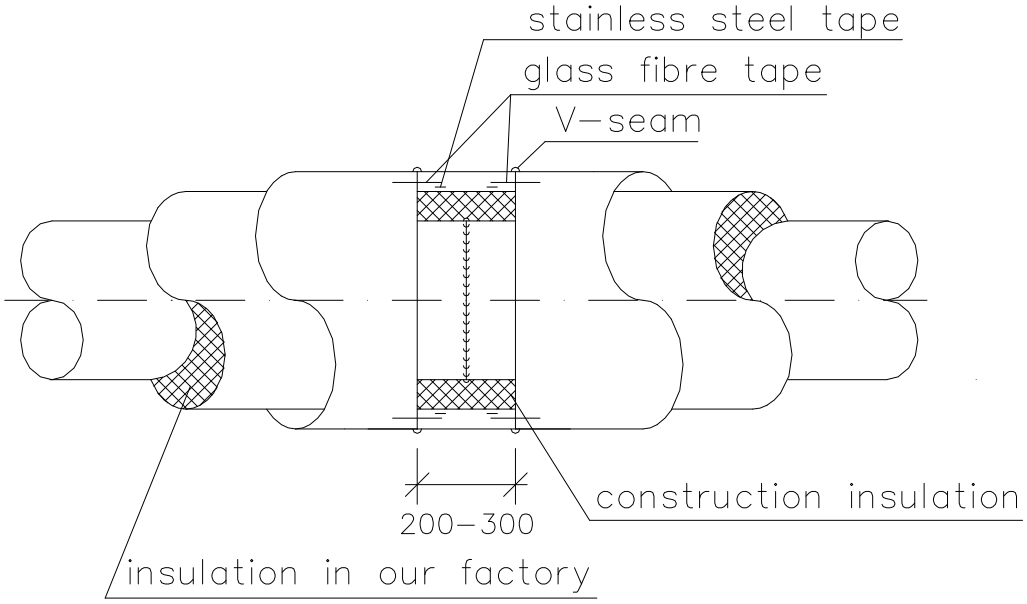
If axial compensators are installed into FW STEEL-CASED PIPE-IN-PIPE, special implementing instructions for pneumatic or hydraulic pressure testing have to be observed.

2.7 Inner pipe insulation

After completion of the radiographic testing, the pressure and tightness testing of the inner pipes carried out, the insulation of the inner pipes is to be finished in the areas of the field joints using the insulating shell sections delivered with the units.

It must be ensured that no gap is left between the mounted insulating shell and the insulation fitted at the factory. The insulation shell must be attached to the inner pipe with two stainless steel straps supplied for each construction site connection.

It must be ensured that only perfect, dry insulating shells are installed. For operating temperatures above 200 °C, the insulation must be double-shelled with staggered joints.



As soon as the insulation of the inner pipe has been finished, this area is once again to be protected in such a way that no water or dirt can penetrate into the ring space between the inner and encasing pipes resp. into the on-site insulation; also see Point 2.2.3.

Before the welding of the encasing pipe, the insulation of the inner pipe is to be protected in the vicinity of the weld by the use of the protective material (glass fabric tape) supplied (two wrappings for a single encasing pipe seam and five wrappings for a half-shell 300 mm).

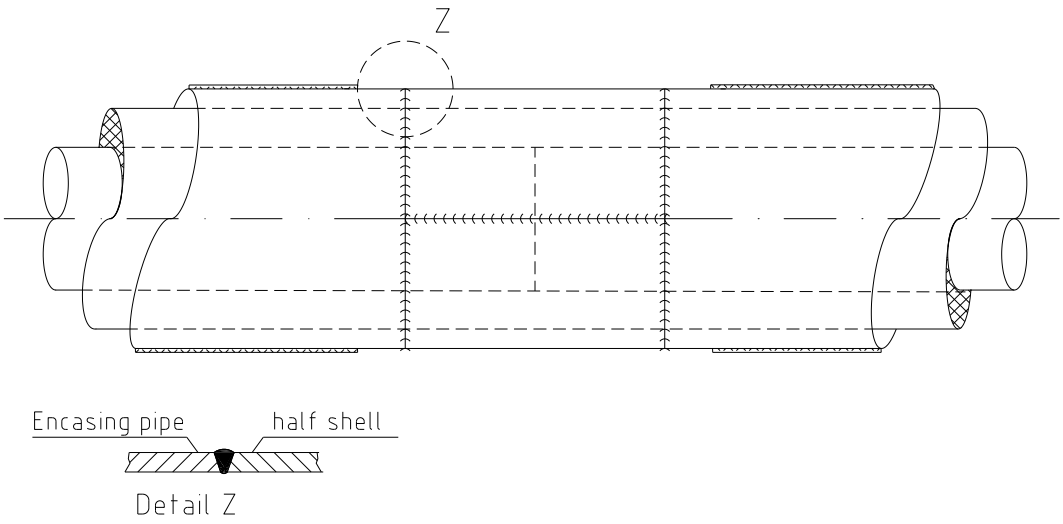
2.8 Signal cables

In the case of FW STEEL-CASED PIPE-IN-PIPE where a monitoring system is incorporated, the signal cables have to be connected within the field joints prior to the closing of the encasing pipe installation points. The method of carrying out this work and measures to protect signal cables from being burnt during welding work are to be found in the separate “Instructions for the Installation of Signal Cables”, which are to be observed.

2.9 Joining of encasing pipes

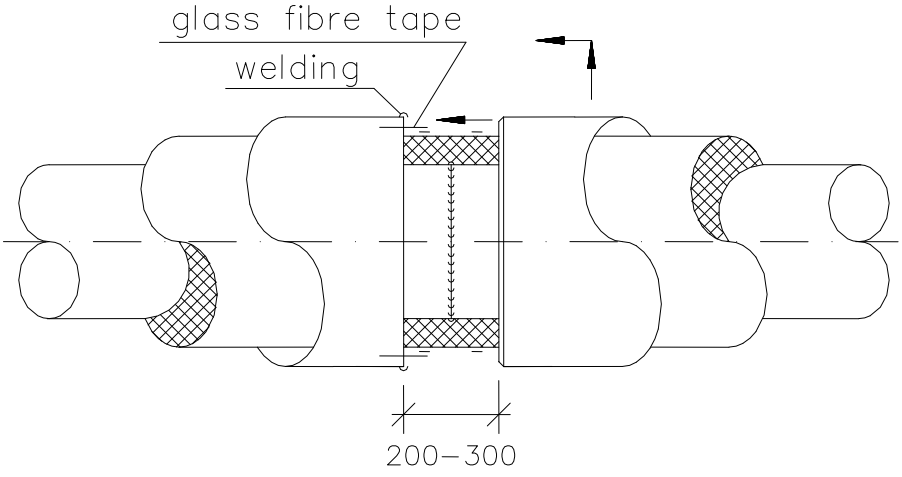
2.9.1 Joining of encasing pipes with half-shells

For joints of this kind, the required length is cut from the extra section of encasing pipe provided by FW and fitted into the field joint.



2.9.2 Joining of encasing pipes by pulling together the encasing pipes

When pipes are to be pulled together, one encasing pipe is lifted and pulled towards the adjacent encasing pipe.



This procedure is to be carried out with extreme care. In particular, special care must be taken to see that anchor points and units incorporating elbows are not displaced. Equally, construction units into which a bearing plate has been incorporated at the factory may not be pulled together, unless the pulling-together is explicitely specified on the installation plan. The pulling directions indicated on the assembly plan have to be adhered to.

2.9.3 Welding of the encasing pipe connections:

Regardless of the method of joining used, the following points are to be observed in the welding of encasing pipe connections :

- The insulation of the inner pipe, in particular the signal cables, are to be protected during welding work (see Point 2.7).
- Only welders disposing of a valid examination certificate as per EN ISO 9606 may weld encasing pipe seams.
- Encasing pipe seams are only to be welded electrically. Welding may be performed either vertically downwards or vertically upwards.
- The edge preparation for the V-seams is to be carried out in such a way that perfect root, filler and finishing passes can be achieved.
- Particular attention is to be paid to the intersection of circumferential and longitudinal seams.
- The welding of all encasing pipe seams is to be gas-tight. The weld seams are to be radiopaque. Radiographically inspected seams are to be evaluated, unless otherwise specified, in accordance with DIN EN 5817, evaluation group C.

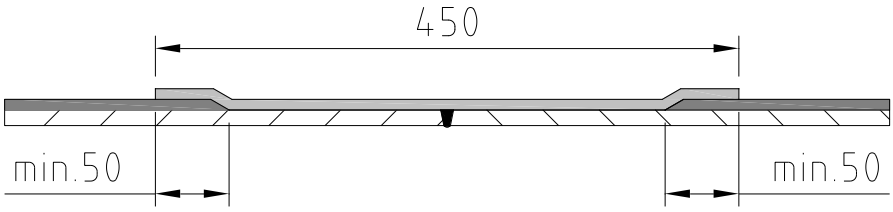
2.10 Pneumatic thightness test, encasing pipe

When the joining of the encasing pipe has been completed, the field joints are to be pneumatically tested for thightness at a pressure of between 0.5 and 1 bar. A foaming soap medium is to be applied to the weld seams during this test.

The thightness test of encasing pipes of a nominal diameter > DN 200 may be carried out by means of a vacuum glass alternatively.

2.11 Subsequent/Follow-up insulation of encasing pipes

2.11.1 Follow-up insulation by means of shrink materials of encasing pipes coated with PE



Preparation

- Remove any grease, oil, dirt and loose rust from all areas which are to be subsequently insulated, including overlapping area.
- The overlapping area is at least 50 mm.
- When the shrink material to be used already exists as a ready-to-use sleeve (hose), then this must be pulled first over the PE-coated pipe because a later installation is no longer possible. In this case, the PE-coated pipe must be cleaned over a length of at least 1.5 m. The sleeve being pulled over is a protection against welding beads and overheating.
- Remove the PE-coating (factory coating) each time to a length of 100 mm.
- Weld the pipes; afterwards, any slag or welding beads are to be removed.
- Warm up the non-insulated area and 100 mm of the adjacent PE-insulation according the external instructions of the supplier's manufacturer. For the warm-up-temperature please refer to the manufacturer's instructions of the used/supplied follow-up-insulating material.
- Roughening of the PE-coated pipes with course abrasive paper on a length of 200 mm.

- **Inspection of the shrink sleeve**

  The sleeve must fit smoothly all round the pipe and be free of bubbles.

  The hot-melt adhesive must have been pressed out sideways onto the PE insulation round the whole circumference of the pipe; there must be an overlap of at least 50 mm on the PE insulation.

2.11.2 Finishing insulation with corrosion protection wrappings

Finishing with DENSOLEN S 40 tape is particularly suitable to provide corrosion protection at elbows and junctions, as it adapts well to the surface.

Preparation

- Remove any grease, oil, dirt and loose rust from the pipe ends that are to be welded.
- Paint the metal surface and the adjacent factory sheathing with DENSOLEN HT primer over a distance of 75 mm on each side.
- Allow the HT primer to dry for around 5-10 minutes, depending on air temperature and wind conditions.

Inner wrapping

- Wind the DENSOLEN S 40 tape spirally around the pipe with the grey side towards the metal, keeping it pulled tight all the time and with at least 50% overlap. The separator layer is to be removed. The factory sheathing is to be covered by the wrapping for a length of 50 mm on each side.

Outer wrapping

- Repeat the same process as for the inner wrapping, but with an overlap of only 10 to 20 mm.

Alternative for straight pipes from DN 250 upwards

- With the assistance of a special winding machine it is possible to wrap the pipe in anti-corrosion wrapping in a single step, with 67% overlap. For this, DENSOLEN tape with a width of 100 mm is required. The factory sheathing is then covered by the wrapping for a length of 100 mm on each side.

2.12 Testing of the encasing pipe insulation

Shortly before the backfilling of the pipe trench the coating of the encasing pipe including that of the field joints is to be tested for non-porosity and integrity with a spark testing device (25 kV). Any defective points are to be repaired.

A log of the testing of the encasing pipe insulation is to be prepared with the site manager and submitted to the customer.

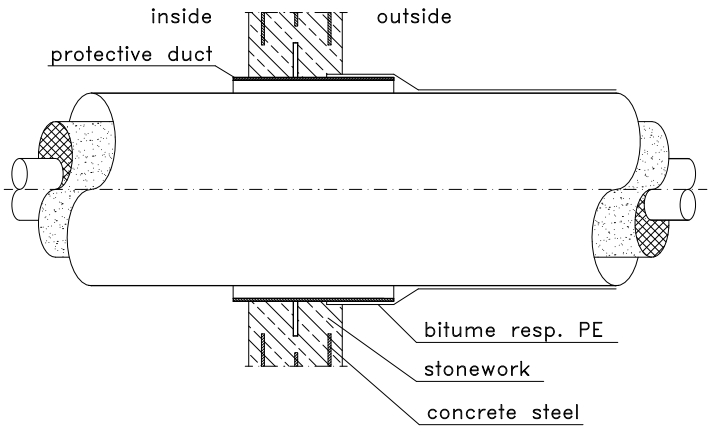
3. Special construction elements

3.1 Wall ducts

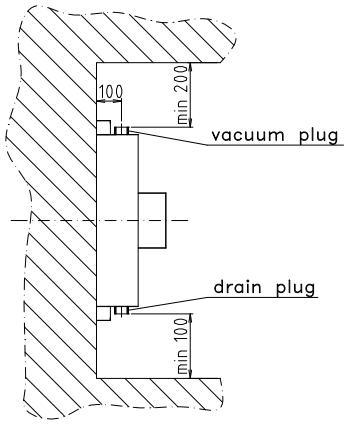
Wall ducts where the protection pipes with a coating for electrical separation (e.g. a two-component plastic on an epoxy resin base) are to be tested before and after installation in the wall openings with a spark testing device (5kV). Any damage is to be repaired, and the spark test is then to be repeated. Care must further be taken that there is no electrically conductive contact between concrete reinforcing steel and coated wall ducts.

If wall ducts are fitted with lenticular compensators, these must be cushioned on site with non-perishable material.

Wall duct:

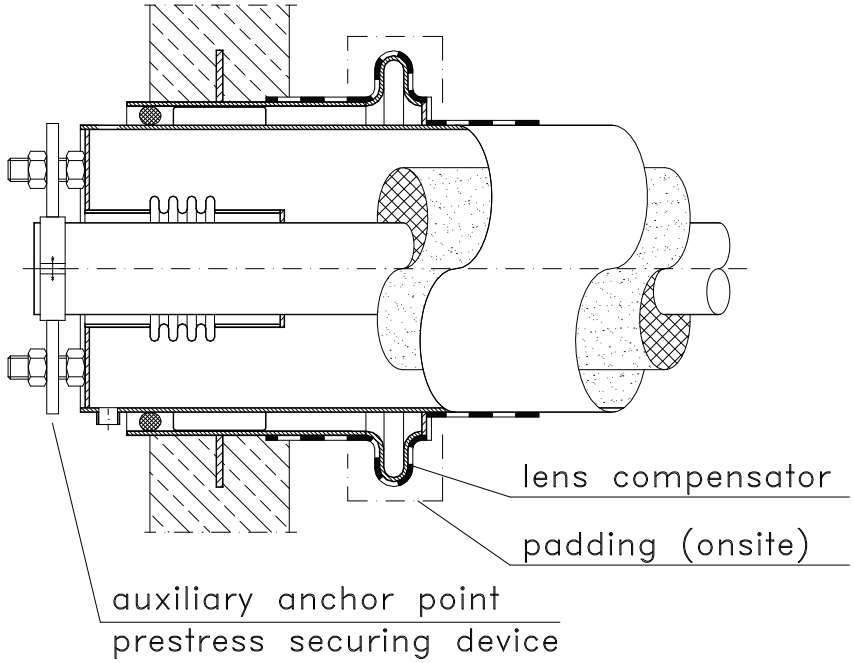


The encasing pipe drainage and vacuum plugs must be freely accessible.



3.2 Axial compensator end seals

End seals of the vacuum-tight variant contain axial compensators as elastic sealing elements. Where required, these compensators are prestressed at the factory. The prestress securing device may not be removed until after the inner pipes have been joined together under stress. This also involves the inner pipes having already been prestressed at the specified points.



3.3 FW STEEL INSPECTION CHAMBERS

When installing FW STEEL INSPECTION CHAMBERS, attention must be paid to the following points:

- A compacted sand cushion (0/4 grain), at least 15 cm thick, is to be prepared in the chamber pit.
- When installing steel inspection chambers at groundwater level, it is necessary to take additional precautions against the chambers lifting. This may take the form of an additional ring of concrete around the lower part of the body of the chamber. On site, a separation layer being resistant to corrosion, has to be inserted. The concrete masses are defined by FW-FERNWÄRME-TECHNIK GmbH.
- Before lowering the chamber, the external bitumen insulation is to be tested for integrity using a 25 kV spark testing device. Any damage is to be rectified immediately.
- The jack rings mounted on the chamber cover for transportation purposes are to be removed once the chamber has been lowered into the pit. The resulting gaps in the bitumen insulation are to be closed by the application of two layers of bitumen and tested at 25 kV.

- The connecting pieces for the ventilation and evacuation tubes, which are supplied loose with the inspection chamber, are to be welded onto the body of the chamber directly after positioning of the chamber into the pit, thus preventing any inadvertent ingress of water into the chamber. The weld is also to be insulated by the application of two layers of bitumen and tested at 25 kV.
- The access shaft is adjustable in height. The shaft is to be adjusted on site to the height required and welded to the chamber cover. The weld is to be insulated by application of two layers of bitumen.
- If lenticular compensators are fitted to chamber penetrations, they must be cushioned on site.
- Directly before the backfilling of the pit the bitumen insulation is to be tested for non-porosity with a 25 kV spark testing device. Any defective points are to be repaired.
- The pit is to be refilled with sand layer by layer. Each layer is to be properly compacted, in order to avoid any shearing stress on the pipe connections.

4. Alterations and Commissioning

4.1 Alterations

Any deviations from the installation plan that are found to be necessary when laying FW STEEL-CASED PIPE-IN-PIPE must be approved in advance by FW-FERNWÄRME-TECHNIK GmbH. Any alterations must be documented and the documents made available to FW-FERNWÄRME-TECHNIK GmbH for use in the compilation of the final as-built documentation.

4.2 Commissioning

The pipeline must not be taken into service until the installation work has been completed and the pipe trench completely backfilled.

Before commissioning, the ring space is to be evacuated to an absolute pressure of 1 mbar by an evacuation technician of FW-FERNWÄRME-TECHNIK GmbH. To shorten the evacuation time, the inner pipe should be heated from time to time to a low temperature (approx. 100°C). The FW evacuation technician will properly seal all plugs and will prepare an evacuation log giving details of the measurement of the pressure rise. This log is to be signed by the customer. The leakage rate must not exceed the level recommended as acceptable in the AGFW regulations.

The pipeline must not be taken into service without evacuation except with the express approval of FW-FERNWÄRME-TECHNIK GmbH. In this case, it may be necessary for the manufacturer to limit the maximum permissible operating temperature. Care must then be taken to see that the encasing pipe drainage plugs at the end seals are opened in order to allow evaporated moisture to escape. If there should be any indication that water is collecting in the ring space, it is essential that this water should be removed immediately.

The operating parameters given on the FW route plans must not be exceeded.

Commissioning is to be carried out in accordance with generally recognised rules of technology and good engineering practice.

4.3 Subsequent/Follow-up Evacuation

The pressure in the ring space of the FW STEEL-CASED PIPE-IN-PIPE is to be checked at regular intervals (at least every three months). If there is a slight increase in pressure (100 mbars), it lies within the discretion of the operator whether the ring space should be evacuated again in order to reduce the heat loss. If there is a significant rise in pressure (500 mbars), the manufacturer should be consulted immediately.

5. Rental equipment

All transport safety devices, red caps, rubber protective mats for site connections, timbers and pre-stressing clamps remain the property of FW-FERNWÄRME-TECHNIK GmbH and shall be returned after completion of the pipe-laying works. Missing or damaged rental equipment is subject to being reimbursed by the customer.

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