ISOBRUGG

Stahlmantelrohr GmbH · Arpke

System competence in steel-casing pipes


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ISOBRUGG Stahlmantelrohr GmbH – Company profile

Founded in 1996 as an associated company of BRUGG Rohrsysteme GmbH (BRUGG Group) and HFB Holding für Fernwärmetechnik Beteiligungsgesellschaft mbH (ISOPLUS Group), ISOBRUGG started off with highly competent staff with long-standing experience in the planning and production of steel-casing pipe systems for standard and environmentally hazardous media.

This unparalleled competence combined with outstanding planning and manufacturing quality is the reason why the company based in Lehrte/Arpke immediately succeeded in convincing a wide clientele of the benefits of its steel-casing pipes - both in Germany and in other European countries.

ISOBRUGG steel-casing pipes ensure reliable heat supply in numerous cities from Hamburg, Bremen, Hannover, Frankfurt/Main, Munich, Nuremberg, Dresden, Gera, Chemnitz, Prague, Amsterdam, Budweis, Paris, Bratislava up to Zagreb, to name but a few.

In addition, large-scale enterprises such as Ingolstadt-based BAYERNOIL, Mercedes Benz in Bremen, the Cologne-based Ford plant or the waste incineration plant in Zuchwil (Switzerland) appreciate the efficiency of our high-temperature piping systems.

The CE certified ISOBRUGG products are continuously inspected by the German TÜV as per Pressure Equipment Directive 97/23/CE and characterized by long-life cycle and high efficiency.

Owing to the double-walled design and the permanent vacuum that protects against leakage and corrosion and provides ideal thermal insulation, steel-cased pipes ensure high environmental safety and are thus also suitable for use in protective areas.

***Steel-casing district heating pipes perfectly* comply with today's high demands on innovative, state-of-the-art district heating systems. Steel-casing pipes have been used internationally for over 80 years and have continued their success story on the European market for half a century.**

The German Heat & Power Association (AGFW) and the German District Heating Lines Association (BFW) recommend steel-casing pipes as safe piping system.

The main advantages over other technical solutions are:

- safe design,
- rapid laying,
- wide field of applications,
- factory pre-assembly,
- additional measuring and testing equipment.

Steel-casing pipes are vacuumized chamber systems.

ISOBRUGG manufactures steel-casing pipes in compliance with the 97/23/EC Pressure Equipment Directive with internal manufacturing checks as per module A1 and CE certification.

ISOBRUGG is a member of the BFW.

Fields of application

Steel-casing piping as "steel-in-steel" pipe system for direct ground laying has stood the test of time for decades and is suitable for conveying district heat, steam, condensate and other media.

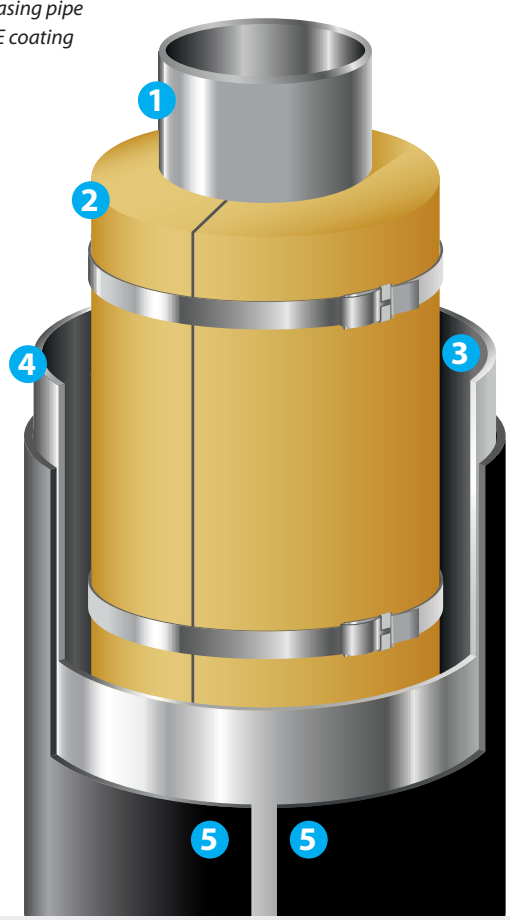
The straight pipe modules of up to 16 m length as well as the system-specific component parts such as bends, junctions, anchors and supports are factory pre-assembled, which gives higher reliability as compared to on-site manufacturing.

Steel-cased piping is suitable for virtually all fields of application and operating conditions and offers particular benefits for media conveyed at extremely high temperatures and pressures. The strictly project-related pre-assembly ensures outstanding cost-effectiveness thanks to the well-balanced ratio between manufacturing costs and operating requirements. The carrier pipe specification, the definition of the insulation thickness and the calculation of the nominal casing pipe width are generally based on the specific operating conditions.

Standard vacuum tight sealing between carrier and casing pipes in shafts and wall bushings is indispensable to allow evacuation of the annular space. Residual moisture is thus reliably removed. At the same time, the insulating effect of the entire system is substantially improved.

Vacuum maintaining and monitoring provides state-of-the-art system supervision for possible leaks at the carrier or casing pipes and gives maximum safety in plant operation.

1 Carrier pipe
2 Thermal insulation
3 Annular space
4 Casing pipe
5 PE coating



Additional safety is achieved by carefully tailored cathodic corrosion protection systems, which prevent corrosion on the outside of the casing pipe. In addition, moisture penetration into the annular space is signalled by electronic monitoring systems.

Thanks to the robust customized design based on long-standing experience in the production and use of this type of piping system, ISOBRUGG steel-casing pipes offer high-quality and reliable solutions for conveying heat and cold.

Depending on pipe material and wall thickness, steel-casing piping is suited for all media, temperatures, pipe dimensions and pressure stages used in district heat and cold supply. In addition, these pipes are used for conveying media in industrial applications.

Standard applications for temperatures up to +300°C
- Warm water
- Hot water
- Process water
- Condensate

Applications for temperatures up to +400°C
- Steam
- Hot air and gases

Applications for temperatures up to –30°C
- Chemical products
- Refrigerating agent or cooling water

ISOBRUGG steel-casing pipes are an ideal solution for
- Difficult ground conditions
- Wetland
- Subsidence areas
- Underwater river crossings (inverted siphon)
- Road crossings
- Roadwork and below concrete surfaces
- Transport piping

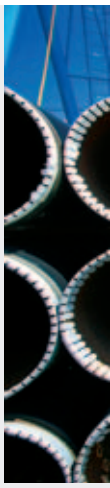
Steel-casing pipe dimensions and design data

Carrier pipe	DN 25 to DN 1200
Temperatures	up to +400°C
Special designs	upon request
Pressure stages	up to PN 64

Main components
- Standard length pipe
- Axial compensator end seal
- Wall bushing
- Bend
- T-joint
- Bellows
- Anchor

Design
- Static calculation
- Engineering and assembly drawings
- Rating of the steel-casing pipe
- Calculation of the concept of strain
- Preparation of specifications

Design and function



ISOBRUGG – your competent partner for all issues around planning, delivery and maintenance of steel-casing pipe systems.

Material specification of standard component parts

Casing pipe

- Longitudinally or spirally welded steel pipe
- Dimensions according to EN 10220
- Material P 235TR1 according to EN 10217-1
- Inspection certificate according to EN 10204-3.1
- *Exterior protection*
  - PE coating as per DIN 30670 N
  - Normal (n) or reinforced (v) version, dielectric strength 20 kV
  - Peeling resistance 35 N

Carrier pipe

- **Seamless** pipe made of high-temperature steel (boiler pipe) EN 10220
- Material P 235GH according to EN 10216-2
- **Welded** pipe with longitudinal or spiral weld seam
- Dimensions according to EN 10220
- Material P235TR2 according to EN 10217-1
- Inspection certificate according to EN 10204-3.1

Thermal insulation

- Shells made of high-silicate mineral wool fibres
- Shells made of rock wool fibres
- Water-repellent
- Temperature resistant
- Non-flammable
- Fixing of insulating shells on the carrier pipe by means of special steel bands

Supports

The supports are designed as roller or sliding bearings.

Depending on the operating temperature, dollies made of VA materials are used to reduce the thermal transfer. To interrupt the thermal flow, the support clamps are fixed by means of asbestos-free fibre strips on the carrier pipe.

Bend

Carrier pipe bend
Material according to carrier pipe specification. Non-destructive testing of the weld seams by means of X or gamma rays.

Casing pipe bend
Composed of segments, radius corresponding to the carrier pipe radius, material according to casing pipe specification. Non-destructive testing of the weld seams. 100% tightness test. In the area of the segment weld seams, the thermal insulation is protected with fire-proof material to prevent burning during the welding process.

Anchor

Designed to absorb the reaction forces produced by the carrier pipe or the compensator, factory-installed in a module, free from thermal bridging.

An anchor comprises two ultra-sound tested steel rings, reinforced by gussets and welded to the carrier pipe. An additional ultra-sound tested steel ring reinforced by gussets is welded as pipe plate to the casing pipe. To interrupt the heat flow and to ensure electric insulation, insulating blocks (asbestos-free) are installed as force-transmitting intermediate layer. Thanks to the specific anchor design, the individual component parts are subjected to pressure stress only.

End caps

Vacuum-tight end caps between the carrier pipe and the casing pipe.

Axial compensator end seal
Compensator bellows made of material 1.4541 with one or several walls, expansion absorption of max. 30 mm, PN 16. Reduction of the carrier pipe temperature along the bellows length.

Wall bushings

- Wall bushing composed of a tube sleeve with wall collar
- Protegol coating
- Casing pipe guided in slides within the tube sleeve
- Annular space sealed by means of a rubber seal
- Electrical insulation
- Connection between casing pipe and sleeve ensured by bellows or heat-shrinkable tubing
- Delivered as factory-assembled module

T-junction

Factory pre- assembled and installed in a separate module.

Plant monitoring

A specially developed warning and localization system for annular space monitoring ensures permanent all-over supervision of the entire steel-cased piping network.

Evacuation

Upon plant completion and commissioning, the annular space is evacuated using a mobile vacuum group to remove any humidity from the insulation and the annular space.

Range of services

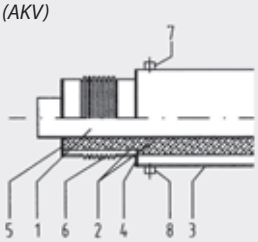
Planning and implementation
a) Piping layout plans
b) Detail plans
c) Piping statics
d) Instructions for laying, if required
e) Evacuation reports
f) Pressure increase test report, upon request

Axial compensator end seal (AKV); standard steel-casing pipe length (SL) for single-pipe conduits (I-RF)

Axial compensator end seals are gas and water-tight caps that allow the carrier pipe to be moved in axial direction.

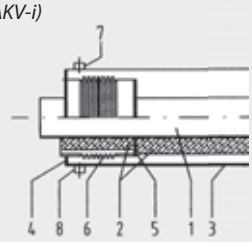
These factory pre-assembled end seals are integrated into a separate module.

External axial compensator (AKV)



1 Carrier pipe
2 Thermal insulation
3 Casing pipe
4 Casing pipe plate
5 Carrier pipe plate
6 Axial compensator
7 Vacuum connection
8 Drain plug

Internal axial compensator (AKV-i)



1 Carrier pipe
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6 Axial compensator
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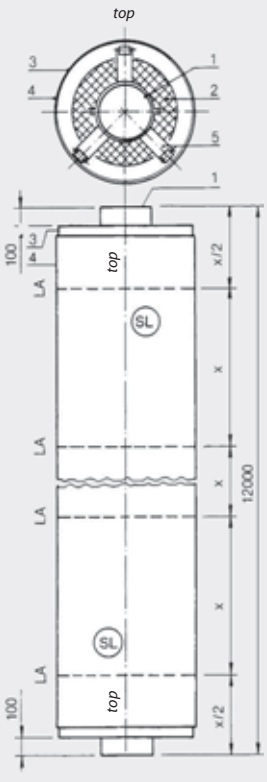


Carrier pipe (IR) 1
Thermal insulation (IS) 2
Casing pipe (MR) 3
Casing pipe coating 4
Axial support (slides or rollers) (LA) 5

Attention:
The special steel bellows must be protected against contact with chlorides.

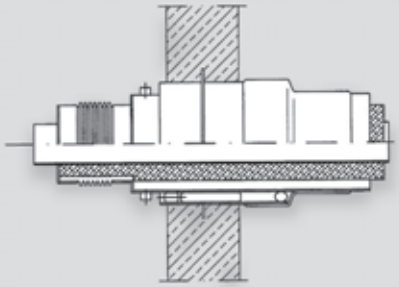
Wall bushing (MD), bend, T-junction

The project-specific design of wall bushings for ISOBRUGG steel-casing pipes offers the following advantages:

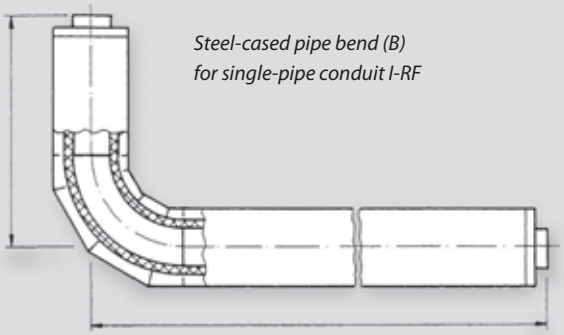
1. walls are not damaged by the longitudinal motion of the casing pipe;
2. neither ground nor surface water may penetrate into the building or the shafts;
3. minor axial sliding movements of the casing pipe can be absorbed.

ISOBRUGG wall bushings must not be exposed to high earth or subsidence loads. The earth covering in the shaft area, the sand base and the piping sand covering should be applied in layers or be compacted to avoid settling.

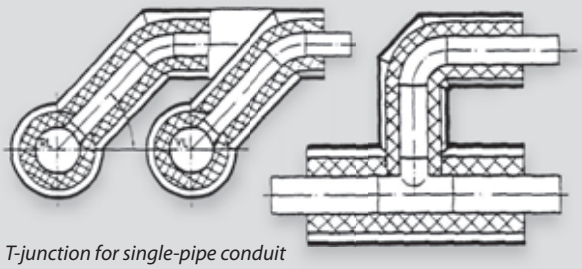
The wall bushings are delivered to the site in factory-assembled condition.



Wall bushing with Link seal and external axial compensator AKV



Steel-cased pipe bend (B)
for single-pipe conduit I-RF



T-junction for single-pipe conduit
Carrier pipe outlet
Casing pipe outlet

Parallel outlet, single-pipe conduit
Casing pipe outlet

The factory-assembled T-junctions are installed in a special module.

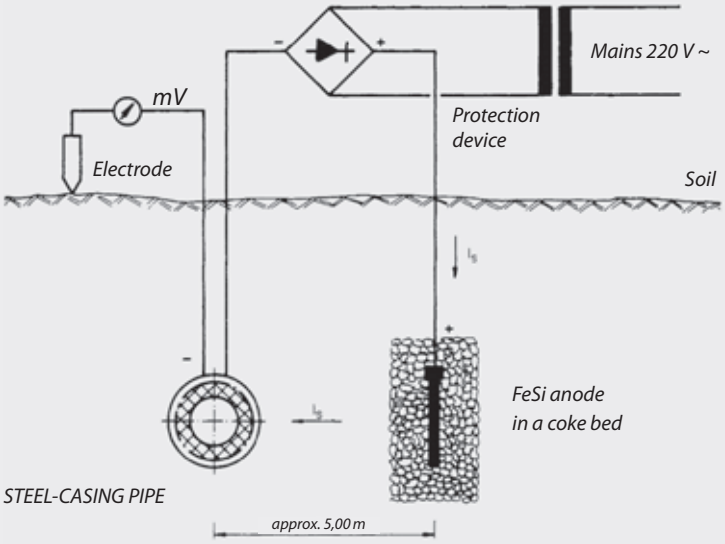
Cathodic corrosion protection of steel-casing pipes

In addition to passive corrosion protection, active cathodic corrosion protection of steel pipes laid in the ground is state-of-the art nowadays in the construction of steel-casing pipes for district heat supply.

Cathodic corrosion protection systems for steel-cased piping are required:

1. in aggressive soil, i.e. with soil resistance values equal to or below 10,000 Ohm cm;
2. for pipelines in areas of greatly varying soil resistance, i.e. differences equal to or exceeding 10,000 Ohm cm;
3. in areas endangered by groundwater, and
4. in areas with the risk of stray current exposure.

If one of the above-mentioned conditions applies, the installation of a cathodic corrosion protection system is recommended.



ISOBRUGG's warranty is subject to steel-casing pipe evacuation

During the construction of steel-casing pipes, the thermal insulation material usually gets damp and condensate is formed in the casing pipe.

Once installation is complete, a mobile vacuum system is used to suck off the damp from the piping system in the form of a steam/air mixture and the pressure is reduced to around 1 mbar. On the basis of a pressure increase measuring system, the leak rate is continuously checked and the tightness of the entire system is thus monitored. The permanent vacuum reduces heat losses to a minimum.

The mobile vacuum system consists of a vacuum pump, a refrigerating machine, a condenser, a fluid collector with automatic rapid emptying and an oil separator. A 380 V three-phase power supply and a Europlug of 32 A must be made available on site for system operation.

Unloading steel-casing pipes

Unloading of the steel-casing pipe modules from the trucks is generally performed by the installation company in charge. For lifting the modules, only carrying straps (textile, nylon or similar material) of at least 150 mm width are to be used to avoid any damage to the PE coating.

Upon arrival on site, the pipe modules are to be inspected for external damage. In addition, the delivery is to be checked for completeness and any deficiencies are noted on the delivery documents.

During unloading of the steel-casing piping, the PE coating is to be checked using an ISO tester (20 kV). Any damage to the coating is to be immediately eliminated.

Storage of steel-casing pipes

The smooth and clear storage area should be free from rubble and easily accessible via a hard access road.

Steel-cased pipes are stored on padded timber to avoid any contact with the ground during storage. With casing pipes featuring a nominal width of up to 300 max. three layers can be placed upon each other, while only two layers are recommended for pipes with a nominal width of over 300. Padded square timber is to be placed between the individual pipe layers.

Laying of the pipe modules

The ends of the pipe modules are consecutively numbered on the casing. Contiguous pipe modules feature the same site joint number (BV). The laying sequence for the different pipe modules is indicated in the piping layout plan. In addition, each casing pipe is marked with "Top" and the soffit of the carrier pipe is identified by the stamped figure "0". When pre-aligning the modules for welding, both markings must be at the top in the 12 o'clock position. In addition, make sure that the pipe is not twisted and that the "Top" and "0" marks are perfectly aligned.

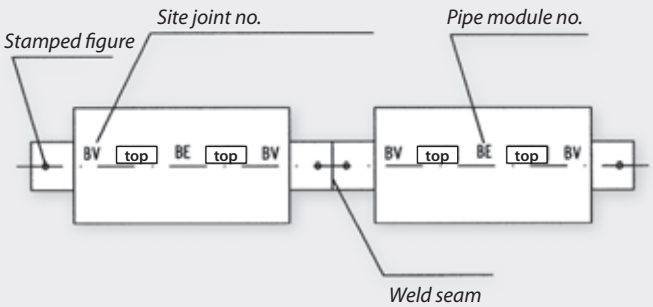
Before laying the pipe modules on the sand bed (pipes must not be laid on square timber), the bottom side of the casing pipe is to be subjected to ISO testing (20 kV). Any faults detected are to be immediately repaired.

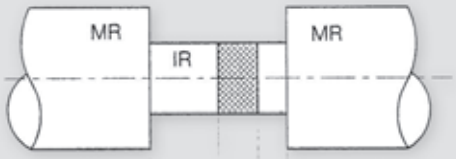
Right from the beginning, the pipes are to be placed in the correct position in the trench bed. The position is to be checked using a levelling instrument. If a height correction is required, sand is to be used for this purpose and the pipe modules must not be shimmed with timber. The final pipe position is to be maintained by backfilling sand at the sides and below the pipe modules and subsequent compacting.

The site joints are to be closed to prevent water, dirt or foreign matter from penetrating into the piping system.

Welding of steel-casing pipes

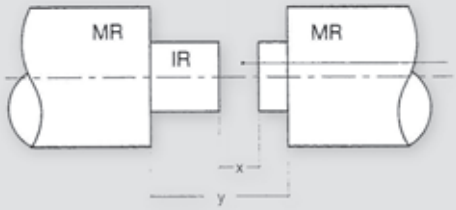
Welding operations on casing and carrier pipes must be performed exclusively by skilled welders with a corresponding welder's qualification test and a valid test certificate.



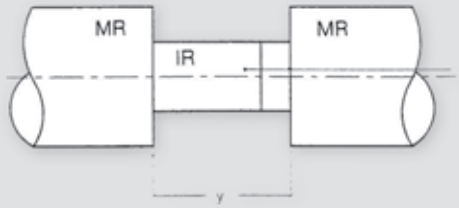


MR = Casing pipe
IR = Carrier pipe

x = Pre-stress amount
y = Casing pipe gap



Make sure not to change the casing pipe gap y (secure by sand backfilling) during pre-stressing (pulling).



Carrier pipes shortened by the pre-stress amount
Carrier pipe in pre-stressed position

When rating pipe expansion compensators, pre-stressing must be allowed for, where applicable. The carrier pipe is to be pre-stressed on site on the basis of the corresponding data (degree of pre-stressing, pre-stressing point and direction).

The degree of pre-stressing and the pre-stressing point and direction are included in the ISOBRUGG design drawings. The carrier piping is to be shortened by the specified pre-stress amount (see design drawing), provided with a welding bevel and pulled together again for welding.

Please observe the following instructions:
During pre-stressing (= pulling together) of the carrier piping, the casing piping of the expansion compensator (expansion bend or elbow joint) must not be pulled with the carrier piping or moved from its position.

Prior to pre-stressing, the bends of the anchor modules in single and twin-pipe conduits are to be completely fixed in position in the trench with backfilled sand, so that the pre-stressing forces cannot pull or move them. If this is impossible, appropriate measures must be taken to ensure that they remain unaffected by pulling and moving forces.

The welding operations are to be performed in compliance with the generally accepted rules and applicable standards and directives. The requested weld seam evaluation is to be defined in each individual case.

Transport locking elements are to be removed only after having completed the carrier pipe welding, which is of particular importance when compensator modules are handled. When centring the carrier pipe ends by means of pipe clamps, the transport locking elements must be successively loosened on one side only. Separate instructions will be provided for this purpose during project handling.

X-ray testing of the carrier pipes

The number of X-ray tests performed and the method of evaluation depend on the operating conditions and the customer-specific requirements.

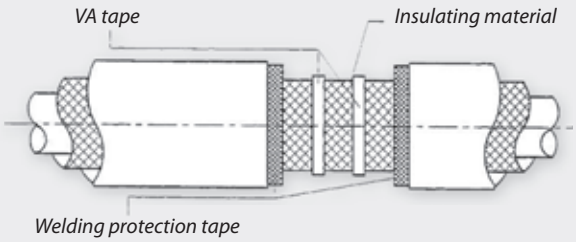
Pre-stressing (mechanical)

Pre-stressing of natural pipe expansion compensators (expansion bends and elbows).
Only the carrier pipe is to be pre-stressed!

Re-insulating carrier pipes (site joints)

Only the insulating material included in the scope of supply should be used to re-insulate the carrier piping in the site joint areas.

The length of the insulating material is to be adapted to ensure that no gap is formed at the joints. The insulation is fixed to the carrier piping using VA tape.

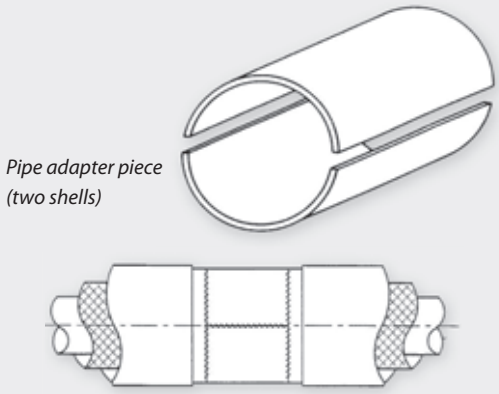


Attention:
Place a welding protection below each casing pipe weld seam to avoid damage to the insulation.

Casing pipe connections

(Inserting two-shell adapter pieces)

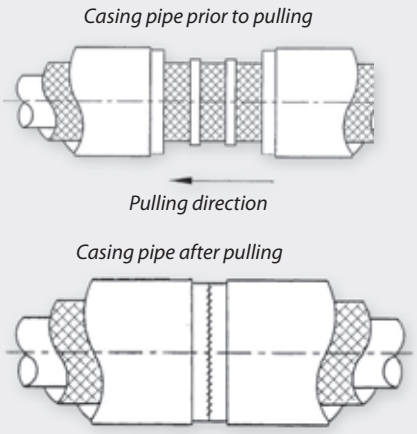
For the connection of two casing pipes in the site joint area, the scope of supply comprises a longitudinally or spirally welded pipe, which can be cut to adapters of the required length by the pipe-layer on site.



Inserting and gas-tight welding of the adapter piece

Casing pipe connections (pulling the casing pipes together)

To reduce the welding operations involved, casing pipes can also be pulled together at the site joints. This must be done extremely carefully and special attention is required to ensure that the anchoring or bend modules do not change their position.



Vacuum testing of casing pipe welding seams

The following tools are required for this purpose:

1. Portable vacuum equipment (vacuum pump)
2. Leak test vacuum box suited for the casing pipe dimensions
3. Leak spray

Advantage

Using the leak test vacuum box, the casing pipe seams can be checked for tightness immediately after welding without having to pressurize the entire casing piping.

Note:
After having cleaned the welded joint seams with a wire brush and applied leak spray to the seam, the leak test vacuum box is placed on the seam and a vacuum is created (negative pressure of up to 150 mbar).

Recoating the case piping by shrinkage

Surface preparation in accordance with the regulations of the German Technical and Scientific Association for Gas and Water (DVGW), sheet GW 15.

The surface to be coated inclusive of the adjacent factory casing must be clean (without any loosely adhering rust or dirt particles and similar), dry and free from foreign matter such as oil, fat, wax or solvent.

Roughen the factory casing in the installation area over 100 mm and bevel any edges to about 30° using a rasp.

The surface to be recoated is then heated up to about 60°C. The product included in the scope of supply is subsequently applied in compliance with the manufacturer's installation instructions. Priming is not necessary. Only skilled personnel with an appropriate qualification as per GW 15 must perform the coating process.

The finished coating is then to be checked for pores using an ISO tester. The test voltage should amount to 5 kV + 5 kV for each mm of insulation. Usually, a test voltage of 20 kV is applied.

The ISO test is to be documented.

Surface priming

Stir the primer vigorously before use. The primer is then applied with a brush to the cleaned and dry surface (steel surface and the coated casing pipe) over a length of about 100 mm. The primer dries in about 5 to 10 minutes of exposure to air.

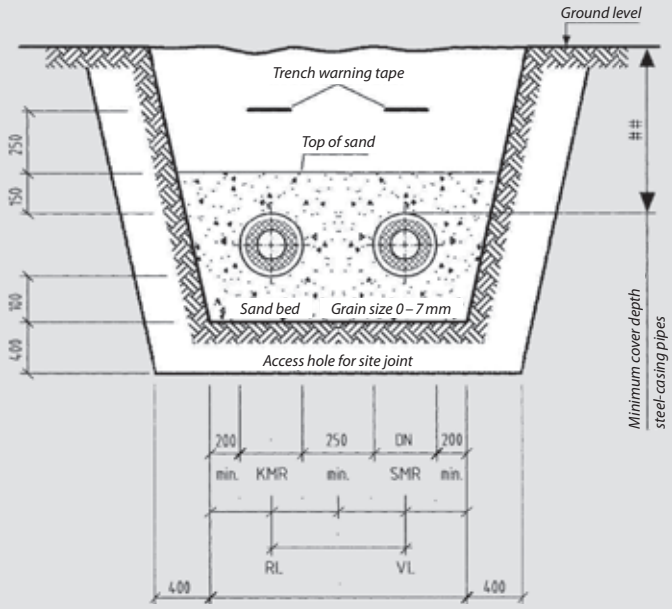
The corrosion-protection tape included in the scope of supply is to be wrapped around the piping within a maximum of 3 hours time.

Trench cross section scheme

Basis

– Technical guidelines for district piping (TRFL)

– Trench width in compliance with the current civil engineering rules



Surface recoating

The delivered corrosion-protection tape is wrapped under tension around the piping with the adhesive side showing downward and ensuring an overlap of 50%. The tape is also applied over a length of about 100 mm to both ends of the coated casing pipe. Wrap two tape layers with 50% overlap.

The finished coating is then to be checked for pores using an ISO tester.

The test voltage should amount to 5 kV + 5 kV for each mm of insulation. Usually, a test voltage of 20 kV is applied.

Attention.
Corrosion-protection tape with a width of 100 mm should only be applied using an automatic winding system. Please also observe the manufacturer's instructions.

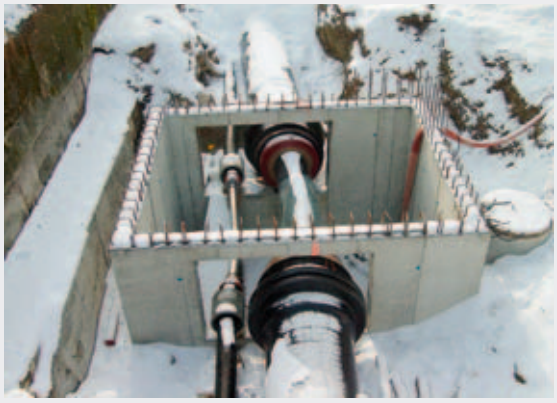
References

Left side:
2001
Paris-Vitry
610 m DN 600,
220°C, 40 bar

Right side:
2002 to 2008
Hamburg
1300 m DN 800,
250°C, 25 bar

Left side:
2004
Zuchwil-Biberist
(Switzerland)
850 m DN 500,
250°C, 16 bar

Right side:
2004
Zuchwil-Biberist
(Switzerland)
Shaft construc-
tion



Left side:
2005
Zagreb
1500 m DN 350,
250°C, 16 bar;
1700 m DN 450,
250°C, 16 bar

Right side:
2005
Wurzburg
130 m 5-pipe
conduit
DN 50 to DN 200

Left side:
2005
Skids for gas
stations –
Middle East

Right side:
2007
Danube river cros-
sing at Vohburg
2x 600 m DN 250,
130°C, 70 bar

ISOBRUGG steel-cased piping is successfully used in:

Amsterdam (NL)
Bratislava (CZ)
Braunschweig
Brno (CZ)
Budejovice (CZ)
Chemnitz
Denmark
Dresden
Erfurt
Erlangen
Gera
Gödöllö (H)
Hamburg
Hannover
Heilbronn
Ignalina (LT)
Kasachstan (KZ)
Kiel
Cologne
Copenhagen (DK)
Leipzig
Liberec (CZ)
Magdeburg
Munich
Munster
Nuremberg
Paris (F)
Primalco (FIN)
Regensburg
Solothurn (CH)
Teplice (CZ)
Tianjing (CN)
Usti nad Labem (CZ)
Wurzburg
Yarmouk (JOR)
Zagreb (HR)

Our partners

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