

Corrosion protection by linings

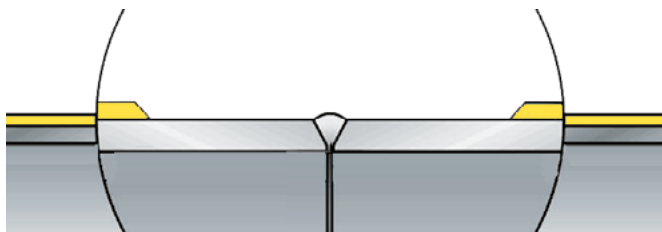
Product description

Depending on the composition of the medium, steel pipe for the transportation of wastewater, salt water, brines and similar should be protected by an anti-corrosion lining, especially when the media do not promote passivation of the steel surface. For this purpose, special linings are available whose chemical resistance has been verified in additional type tests.

Steel pipe for sewer systems is standardized in DIN 2460 (Steel water pipes and fittings). This standard also provides information about the static design of steel pipes. Pipe deliveries are usually made in accordance with the technical delivery conditions of DIN EN 10224.

Application area

Steel pipes with and without cement mortar lining are chiefly used for pressure pipelines with welded joints for the transportation of wastewater, salt water, brines and similar media. If the medium promotes the passivation of steel by the formation of a surface layer, the pipes are joined by butt-welding, a method typically employed in gas and drinking water supply systems. For pipelines with a special cement-mortar lining, slip welding joints are used, which are sealed by applying an optionally available flexible, thermosetting sealant to the socket base before welding. The advantage of this joint is that it provides axial conductivity which – as in the case of pipelines carrying media that are hazardous to groundwater – allows cathodic corrosion protection as a supplementary measure to the pipe coating, thus enabling continuous monitoring of the pipeline.



Butt-weld joint



Slip-welding joint

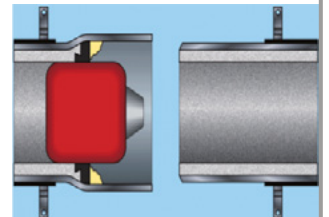
Product properties

The lining's chemical resistance is verified in a six-month type test according to DIN EN 598 in a sour (pH 3) and in an alkaline environment (pH 13). In a second test, the solid components typically encountered in sewer pipes are measured. For this purpose, a 1-meter-long pipe section filled with a gravel sand-water mix is fixed in place in a test stand and inclined in alternating directions through 100,000 cycles. In both tests, the abraded material must not exceed the values specified in the standard.

Application example: pipes with slip-welding joint

Welding procedure

Before inserting the spigot end, a thermosetting sealant is applied to the socket base. When the spigot end is inserted, this material is pressed against the pipe wall in the joint area. After tack welding, any excess material can be removed with the aid of a foam pig. Only then can the pipes be joined by a fillet weld. The sealant is cured under the effect of the welding heat.



Pipe-laying

Directional changes, irrespective of whether or not the steel pipes are lined with cement mortar, are made with the aid of prefabricated pipe/segment bends or within the limits of the permissible elastic bending radius. Based on standing agreements with manufacturers of such fittings we can offer you a suitable solution or bring you in touch with a manufacturer. The maximum permissible elastic bend is 500 x OD. The pipes – including pipes with slip-welding joints – are welded together in a straight line before being subjected to elastic bending. Inserting the spigot at an angle before welding is not recommended.

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Typical product properties and data

Pipe ¹⁾	
Size range	DN 100 to DN 600
Wall thickness	3.2 to 10 mm ¹⁾
Yield strength (steel)	235 to 480 N/mm ² (depending on steel grade) ¹⁾²⁾
Fracture resistance (steel)	415 to 570 N/mm ² (depending on steel grade) ¹⁾²⁾
Elongation after fracture	20 to 25 % (depending on steel grade) ¹⁾
Elastic modulus	210 000 N/mm ²
Coefficient of thermal expansion	11.2 x 10 ⁻⁶ 1/K (cement mortar, depending on moisture content between 6 and 14 x 10 ⁻⁶)
External corrosion protection	Pain coats, protective coatings
Internal corrosion protection	with without cement mortar lining
Permissible crack width	– 0.6 mm (after immersion in water, if appropriate)
Surface roughness	– $k_s = 0.1$ mm ³⁾
Service temperature	400 °C 50 °C ⁴⁾
Typical range of pH	≥ pH 5 ⁵⁾
Permissible flow rate	Cement mortar lining: up to 10 m/s (without cavitation!)

¹⁾ Other wall thicknesses and steel grades on request.

²⁾ Depending on pipe size

³⁾ Hydraulic calculations are usually based on the pipeline conditions. With drinking water pipelines, the integral roughness R_i is 0.1 mm for straight routes, and >0.4 mm to 1.0 mm for systems with multiple bends and branches. In sewer systems, the surface roughness parameter R_a under service conditions ranges from 0.25 mm to 0.5 mm and from 0.7 mm to 1.5 mm.

⁴⁾ Temperatures up to the boiling range are possible. Cavitation must be avoided.

⁵⁾ The application range may be further expanded after successful additional field studies.

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