

**for oil-gathering systems in water-flooded oilfields**

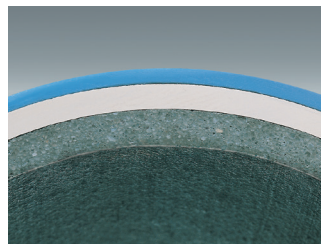
**Product description**

For the transportation of oil-water mixtures Mannesmann Line Pipe offers steel pipe with slip-welding joints and a modified cement mortar lining as internal corrosion protection. The method of applying the lining with the aid of a rotor head and the subsequent controlled rotation of the pipe together ensure maximum compaction and smoothing of the lining without demixing the cement mortar.

Steel pipes with modified cement mortar lining (mCML) and slip welding joints are a technically mature and cost-effective solution, which has proved its reliability in numerous laboratory tests as well as in many years' successful service in an experimental pipeline.



Spray lining



Smoothing of the lining by pipe rotation

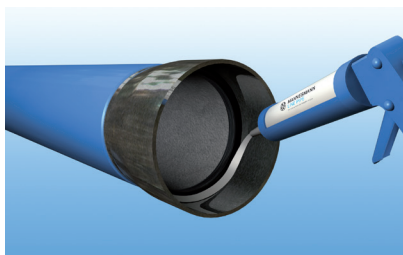


Caulking tool

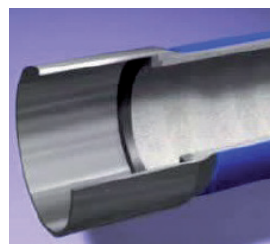
The use of slip-welding joints provides for sealing of the pipe joint areas. For completion of the pipe lining before welding, a thermosetting sealant is applied to the socket base.

Pipe-laying is facilitated through the use of a caulking tool perfectly adapted to the design of the slip-welding joint. Before lining, an oil-resistant rubber stop ring is placed into the socket base. Firmly anchored in the cement mortar, it prevents lining damage and spalling during the installation of the pipe joint.

Steel pipes for buried and above-ground pipelines are protected by proven PE or PP coatings. For above-ground pipelines, both mill-applied and field coating systems are available for corrosion protection.



Sealant application



Slip welding joint with stop ring in socket base

**Application area**

The pipe described here is primarily intended for use in enhanced oil recovery. This frequently involves water flooding or re-injection. Although the recovery rates are almost doubled, over time water flooding changes the properties of the medium being produced and hence calls for stronger corrosion protection on the pipe inside surface.

**Product properties**

Depending on their size, the pipes can be used at high operating pressures (up to 100 bar) and temperatures (up to 130 °C). The lining is suitable for liquid media containing dissolved salts, gases and solids and is resistant to basic, neutral and weakly acidic (pH>6) environments.

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



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**Typical product properties and data**

Parameter	Properties (standard value)
Diameter	DN 100 to DN 600
Wall thickness	3.2 - 13 mm
Pipe length	up to 16 m
Yield strength	235 - 360 N/mm <sup>2</sup>
Tensile strength	360 - 460 N/mm <sup>2</sup>
Elongation at break	20 to 25 %

**Typical values of the cement mortar lining based on modified blast furnace cement**

(Report MA 39 – VFA 2011-1353.01 Inspection and Certification Board, Vienna, Austria, 2013)

Property	Requirements acc. to EN 598	Verified
Variation of the cement mortar lining thickness:		
pH 3	0.2 / -0.2 mm	0.05 mm
pH 13	0.2 / -0.2 mm	-0.09 mm
Abrasion resistance	≤ 0.6 mm	0.21 mm
Compressive strength	50 MPa	59.06 MPa
Axial bending strength	19 kNm	Free of damage under loads of 19 kNm
Ring stiffness	Free of damage	Free of damage

**Verified stability in sour gas (H<sub>2</sub>S, CO<sub>2</sub>) environments**

(Report of the Institute for Maintenance and Corrosion Protection, Iserlohn, Germany, 2006)

**Test conditions:**

Immersion of a steel pipe specimen with mCML in salt water solution (235g/l NaCl), 42 °C, P<sub>H<sub>2</sub>S</sub> = 4 bar, P<sub>CO<sub>2</sub></sub> = 11 bar, 1000 h

- Mass loss: 0.143 %
- Carbonization rate: 40-50 % (3-4 mm depth)
- pH value on the steel pipe surface: 10-11
- No H<sub>2</sub>S induced damage on the steel pipe surface

**Thermal stability**

(Report SZMF-ED-PB-2009-0219, Salzgitter Mannesmann Forschung, Germany, 2009)

**Test conditions:**

Immersion of a steel pipe specimen (DN 150, L = 220 mm) with CML into drinking water, 250 °C, P = 43 bar, 60 days

**Findings on cement mortar lining:**

- no damage

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