

# Carl Hamm

Pipesystems



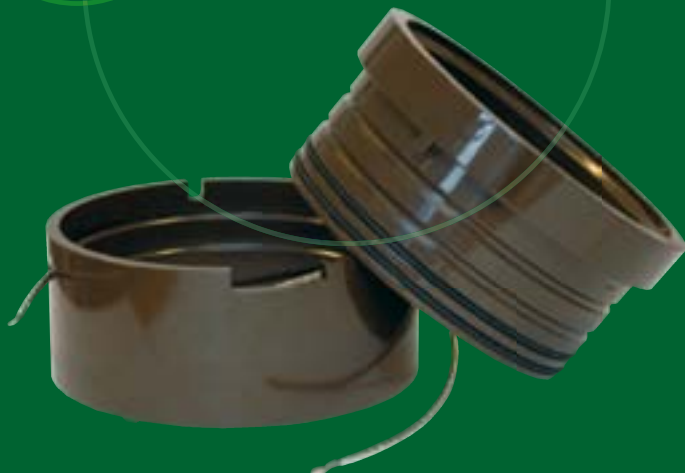
## ZSM Connection



## ZSM Connections

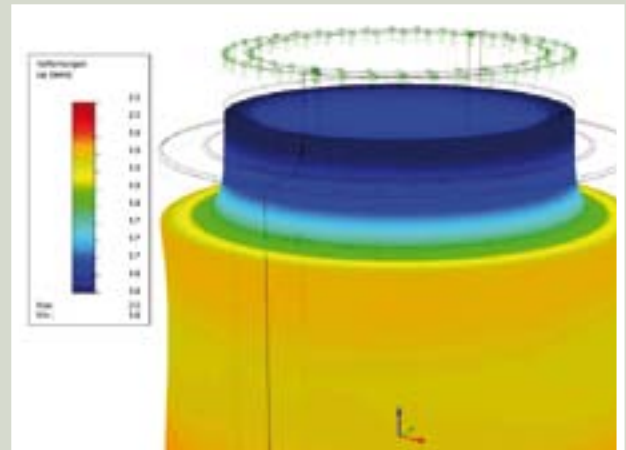
The tight sleeve connection – ZSM – is an axial non-positive and detachable pipe connection. Used as a pit pipeline in underground mining and deep-well sinking.

Our patent-protected tight sleeve system is a unique alternative to other conventional connection systems thanks to its quick and easy assembly/disassembly, space-saving design and favourable price.



ZSM Connection with corrosion-proof coating

- **Small installation dimensions.**
- **Quick, easy and safe to assemble/disassemble.**
- **No special tools.**
- **The ZSM Connection permits low deflections.**



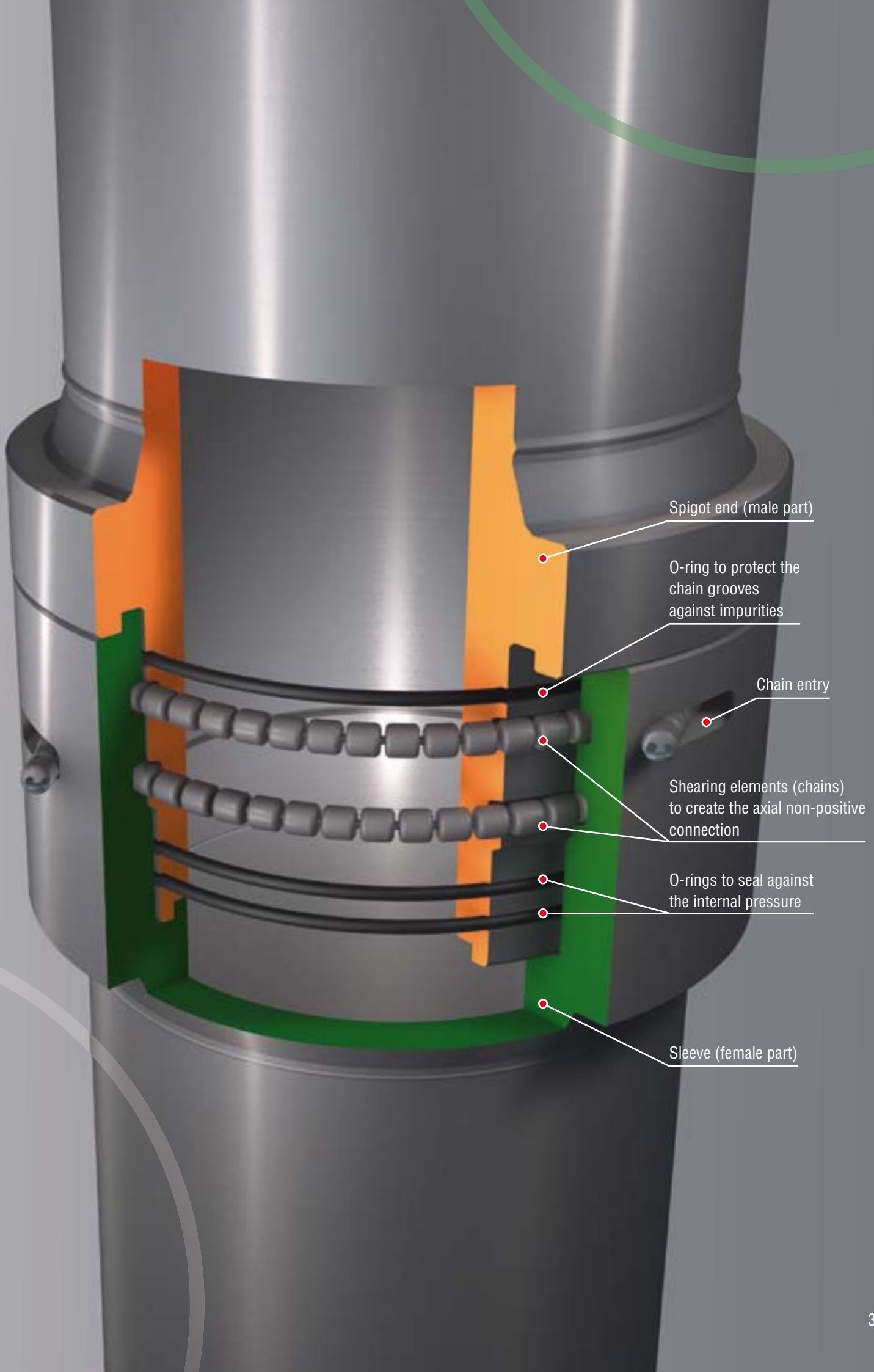
FEM calculation

### Technical Data

Dimensions	DN 50-DN 1400
Nominal pressure	up to PN 400
Axial forces	up to 1600 tonnes (rupture loads)

The ZSM Connections were examined at the DMT Rope Testing Centre and various tensile tests were conducted for the maximum rupture loads.

The development of the ZSM Connections was flanked by FEM calculations.



Spigot end (male part)

O-ring to protect the chain grooves against impurities

Chain entry

Shearing elements (chains) to create the axial non-positive connection

O-rings to seal against the internal pressure

Sleeve (female part)

## The success story of the Carl Hamm ZSM Connection

The ZSM Connection was launched in 1992 as a simple, quick, tight connection – initially as a casing (lost formwork) in well sinking.

The potential of this connection was recognised in the mid-1990s. The ZSM Connection was further developed in cooperation with Rheinbraun (now called RWE Power). The objective was a medium-carrying, axially load-bearing, quick-to-install and detachable connections. The results revolutionised the well operations of Rheinbraun. As a consequence, all wells were operated with ZSM pipelines.

The ZSM Connection was further developed for use underground on the basis of this technical success.

In 2003, the first pit pipeline was equipped with ZSM Technology in German hard-coal mining – Heinrich colliery, Essen. In such cases the higher tensile and compressive loads as well as the high safety requirements in a shaft used for descent were taken into account.

The ZSM Connection was continuously developed and also successfully used in a wide range of installation situations in German mining and more recently internationally as well.



Installation of a ZSM Pipeline



Easy fitting of the shearing elements

## Easy installation

- The spigot end (male part) has three sealing grooves and two chain grooves on the outside.
- The sleeve (female part) has two chain grooves on the inside.
- O-rings are inserted into the sealing grooves of the spigot end.

- The spigot end and sleeve are pushed together without any additional aids.
- The seal is created in this way.
- The optional anti-torsion devices absorb the torsional moments of the pump.

- The chain grooves form two annular cavities.
- Shearing elements (chains) are inserted manually through openings in the sleeve. Tools are not required.
- The spigot end and sleeve therefore have an axial non-positive connection.

- The chains can be simply withdrawn again for disassembly. The pipeline can be separated.

### ZSM vs. flange

	ZSM	Flange
Hydrostatic forces	O-ring (gasket)	Screws, nuts, gaskets with a defined tightening torque
Axial forces	Shearing chain	
Torsion forces	Torsion safety element	
Tools	–	Impact wrench



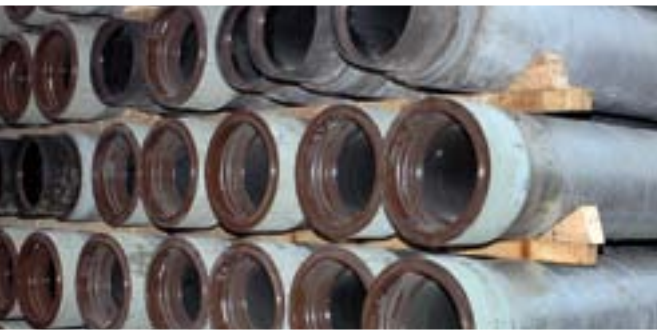
## ZSM in underground mining

The ZSM Connection excels owing to its cost-effectiveness, especially when used with high-performance submersible pumps.

Here it shows off its system advantages of time-saving assembly and disassembly.

In confined installation situations the low installation dimensions of the ZSM Technology permit optimised pipeline cross-sections.

The uncomplicated disassembly of the pipe section guarantees shorter times required to change a pump. Downtimes due to maintenance and repairs are reduced to a minimum.



Corrosion-protected ZSM Sleeves



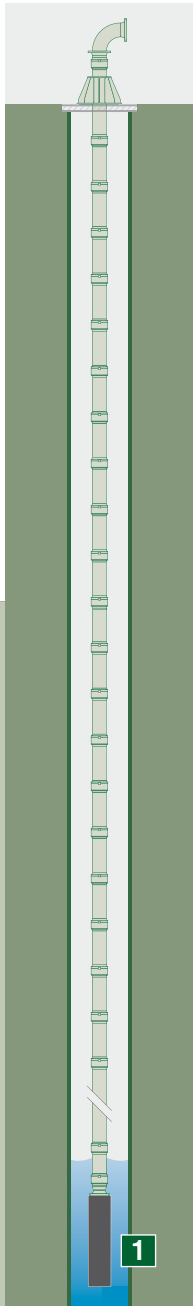
Hydraulic assembly flap



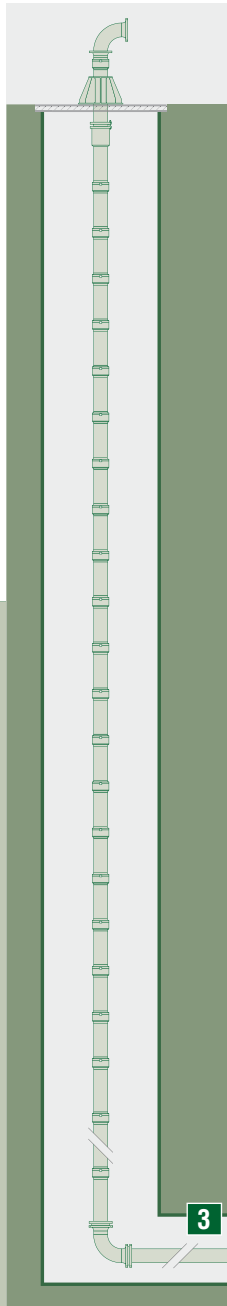
Prosper Haniel colliery, Germany

German mining			
Major projects implemented			
Year	Customer/Plant	Dimensions	Total length
2013	RAG/Walsum	DN 300	3 x 830 m each
2012	RAG/Rob. Müser	DN 350	600 m
2011	RAG/Heinrich	DN 500	485 m
	RAG/DSK Ibbenbüren	DN 500	600 m
	RAG/Amalie	DN 350	900 m
	RAG/Concordia	DN 300	1050 m
2010	RAG/Carolinenglück	DN 500	950 m
	RAG/Heinrich	DN 500	485 m
	K+S/Esco Werk Braunschweig	DN 200	480 m
2009	RAG/Heinrich	DN 500	485 m
	RAG/Amalie	DN 350	900 m
	RAG/Prosper	DN 350	800 m
	RAG/Camphausen	DN 250	800 m
2008	RAG/Carolinenglück	DN 500	950 m
	EON/Huntorf power station	DN 500	700 m
	RAG/Saar	DN 400	1000 m
	RAG/Rossenray	DN 400	1050 m
2007	RAG/Amalie	DN 350	900 m
	RAG/Rob. Müser	DN 350	600 m
	RAG/Auguste Victoria	DN 350	800 m
	RAG/Prosper	DN 350	800 m
	RAG/Concordia	DN 300	1050 m
2005	RAG/Zollverein	DN 500	2 x 1050 m each
	RAG/Concordia	DN 300	1050 m
2003	RAG/Heinrich	DN 500	485 m
2002	EON/Huntorf power station	DN 500	2 x 700 m each

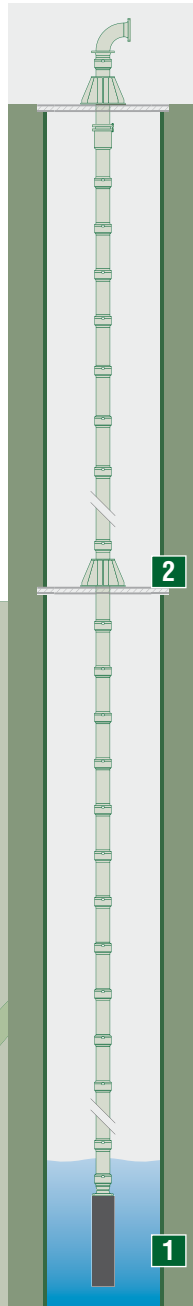
Freely suspended



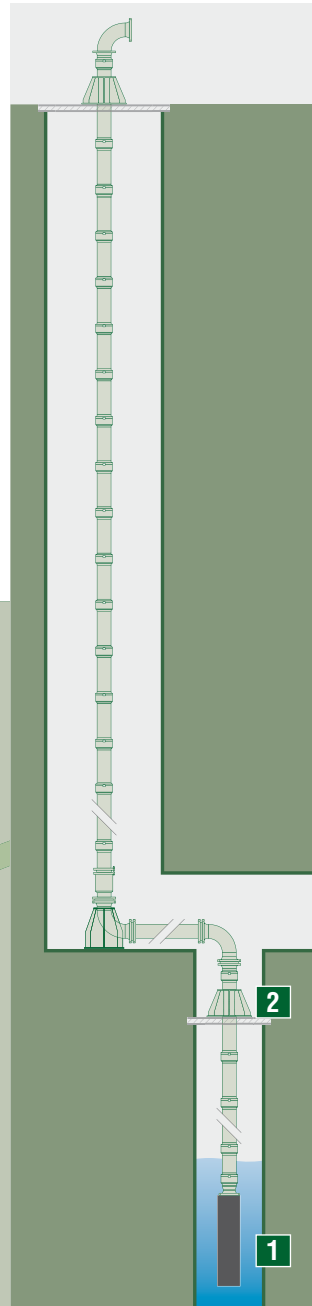
Freely suspended



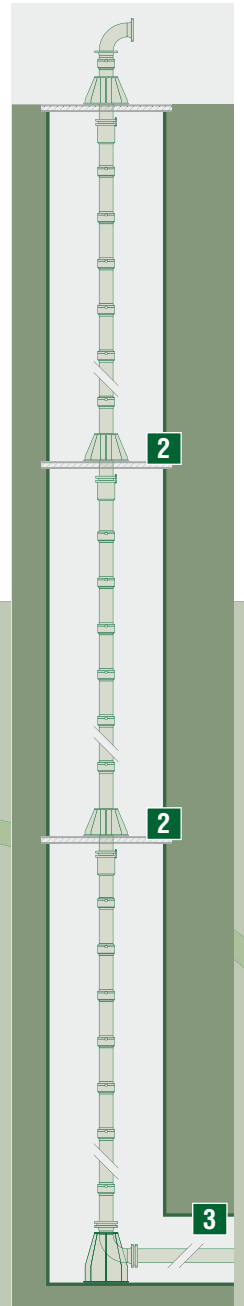
Partially suspended



Partially suspended



Standing pipe column



1 Pump 2 Intermediate support point 3 To pump station

Installation situations of the Carl Hamm ZSM Connection

### International mining

#### Major projects implemented

Year	Customer/Plant	Dimensions	Total length
2013	South Africa/Johannesburg	DN 400	7 x approx. 400 m
2012	Congo/Kipushi	DN 300	400 m
2010	Poland/Copper mining	DN 350	2 x 1000 m

#### Major projects in the advanced planning phase

Customer/Plant	Dimensions	Total length
Russia/Alrosa	DN 250	3 x 550 m
South Africa/Evander 6	DN 200	1300 m
Zambia/Kanshansi	DN 400	400 m

## ZSM in deep-well sinking

The ZSM Technology has been used for more than 15 years in German brown coal open-cast mining to regulate the groundwater level. The strengths of the ZSM Connection come to the fore with interconnected wells, with several hundred individual wells.

The very frequent pump changes – due to the low pH of the water and the moving open-cast mining – can be performed much more economically thanks to the very short assembly and disassembly times.

The low installation dimensions of the connections permit higher pipeline cross-sections of the pipes used. As a result, lower flow rates can be achieved at the same pump capacity. This ensures a substantial extension of the service life of a pipeline and the pump used.

The ZSM Technology is also becoming popular for applications in irrigation projects using deep wells, especially owing to the low installation dimensions and the resultant benefits.



Corrosion-protected  
ZSM Pipes



Application possibilities for irrigation using deep wells



ZSM Connection, stainless steel



Welding of the spigot end and pipe



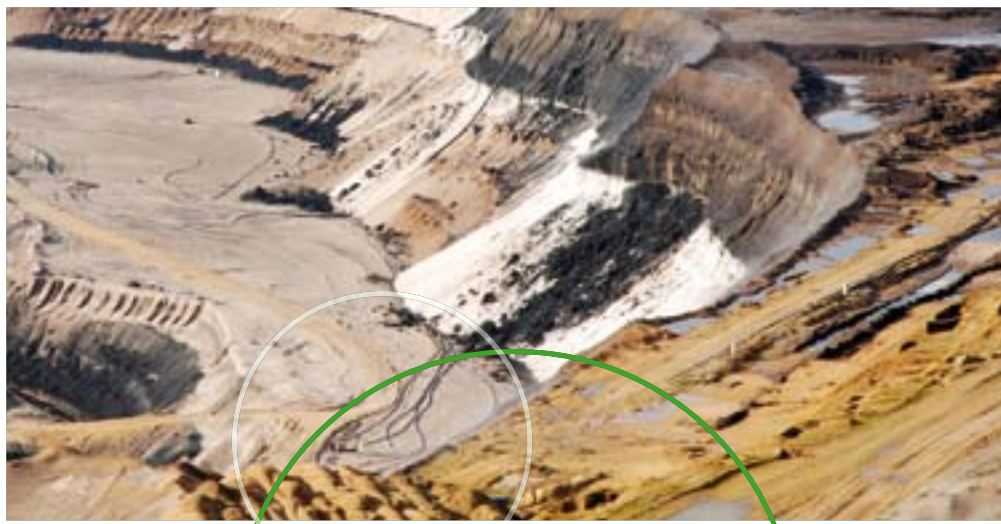


Use of the ZSM for groundwater management in brown coal mining

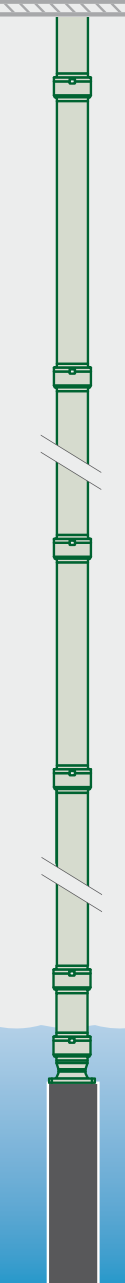
### German brown coal mining

#### Projects implemented

Year	Customer/Plant	Dimensions	Well	Total length
since 1998	RWE Power	DN 50 to DN 400	approx. 2000	250-500 m



Brown coal open-cast mining



## Everything from one source

We supply ready-to-install ZSM Pipelines.

In order to offer you optimum solutions, we apply our experience from over 80 years in the mining industry and support you in all phases of your project.

### Our services:

- **Budget planning on the basis of your information (see adjacent table).**
- **Planning of a pipeline including all components required.**
- **Static calculations.**
- **Preparation of the overview and detail drawings.**
- **Design of the ZSM Components on the basis of the specific requirements.**
- **Destructive tensile testing of the ZSM Components.**
- **Professional production of the complete pipeline using the in-house process – according to the specific manufacturing and test sequence plan.**
- **Depending on the requirement, we produce ZSM Pipelines made of:**
  - **Carbon steels (e.g. P355 ff)**
  - **Stainless steels (e.g. 1.4571)**
  - **Duplex steels (e.g. 1.4462)**
- **Inside and outside coating systems.**
- **Non-destructive tests of the welds.**
- **Worldwide shipment.**
- **Support during assembly.**



Planning and conceptual design



Mechanised welding line





Documented quality testing

## Budget planning on the basis of your information (details required):

1. Installation situation (see page 7)
2. Pipeline length
3. Individual pipe length
4. Diameter/dimensions
5. Weight of pump/motor/cable
6. Pump feed pressure
7. Spacing of intermediate support points
8. Corrosion protection
9. Details of the safety concept (official specifications)

## Quality management

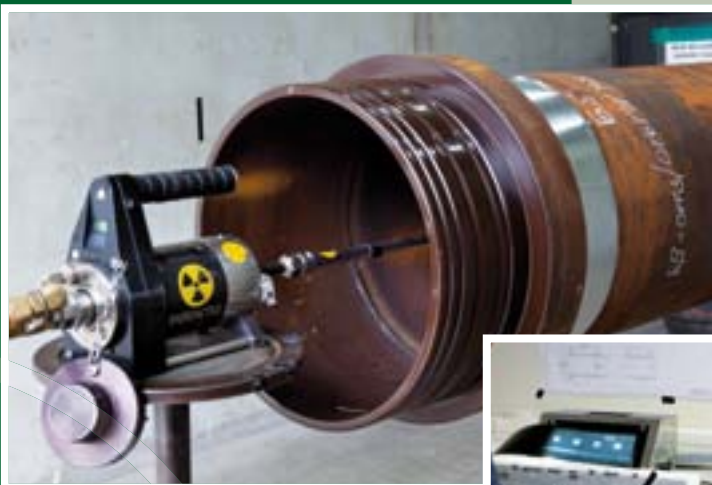
A certified quality management system was introduced in 1997. The development and design section was added in 2010.

As a certified specialised welding company, we satisfy national and international standards.

Certificates, permits (e.g. Germanischer Lloyd) and process inspections as well as the personal qualifications of our employees in the production and quality assurance departments guarantee a constantly high standard of quality.

### Extract:

- |                                      |                                  |
|--------------------------------------|----------------------------------|
| • Quality management system          | DIN EN ISO 9001:2008             |
| • Welding quality requirements       | DIN EN ISO 3834-3                |
| • Inspection of the production shops | AD 2000 HPO                      |
| • Manufacture of steel structures    | DIN 18800-7                      |
| • EC Certificate of Conformity       | CE marking of pressure equipment |
| • Process inspections                | DIN EN ISO 15641-1               |
| • Welding staff                      | DIN EN 287-1 and DIN EN 1418     |
| • NDT (RT, PT, MT, VT)               | DIN EN 473 – Level 2             |



Non-destructive testing



Worldwide shipment

Competence, experience, innovative thinking, modern production plans and motivated employees form the basis of our services.

With the flexibility of a modern, medium-sized company management and the experience of our over 80-year history, we are well equipped to meet the demands of the future.

Numerous certifications and permits give you the certainty that applicable rules and regulations are observed throughout the production process.

Our product range focuses on the water, waste water and power industries, tunnel construction and well sinking as well as open-cast and underground mining.

Profit from a strong partner who integrates itself and its skills with your specific requirements: from the conceptual planning to professional production and punctual delivery.



**Carl Hamm**

Röhrenwerk Kupferdreh Carl Hamm GmbH

Gasstraße 12  
45257 Essen  
Germany

info@carl-hamm.de  
www.carl-hamm.de  
Tel.: +49 (0) 2 01 / 8 48 17 - 0  
Fax: +49 (0) 2 01 / 8 48 17 - 70