

Flexible High Pressure Pipelines



PRIMUS  **LINE**



RAEDLINGER GROUP

Primus Line® – the flexible system for the transport of different media

Primus Line® is a trenchless technology for the rehabilitation of pressure pipelines for different media such as water, gas and oil. The process is based on a flexible high-pressure hose which is specially developed for the system's connection technique.

Due to its multi-layered structure and very thin wall thickness, the Primus Line hose provides both flexibility and ultra high strength material.

The inner layer of the hose can be selected for the specific media. The outer layer - regardless of medium - is made of wear-resistant PE. Seamless aramid fabric is between the inner and outer layers, functioning as a static load-bearing layer.

Primus Line® is produced in nominal diameters from DN 150 to DN 500.

The hose is inserted into the host pipe from small construction pits - thus avoiding large roadworks. Primus Line® is not stuck to the host pipe and is self-supporting. Between Primus Line® and the host pipe remains an annulus.

At the ends, the Primus Line hose is connected to the existing pipe (steel, iron cast, PE or other materials), and thus to the pipe network, via a specially developed high-pressure connector.

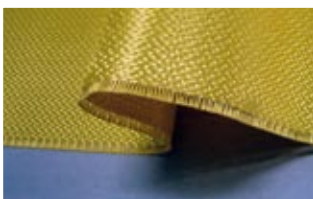
Primus Line® has short rehabilitation times and rapid recommissioning, and thus represents not only an inexpensive alternative to open rehabilitation, but also a high quality method for the renewal of pressure pipes.

Primus Line Hose

Outer Layer

Abrasion-resistant PE sheath

Kevlar®-Fabric

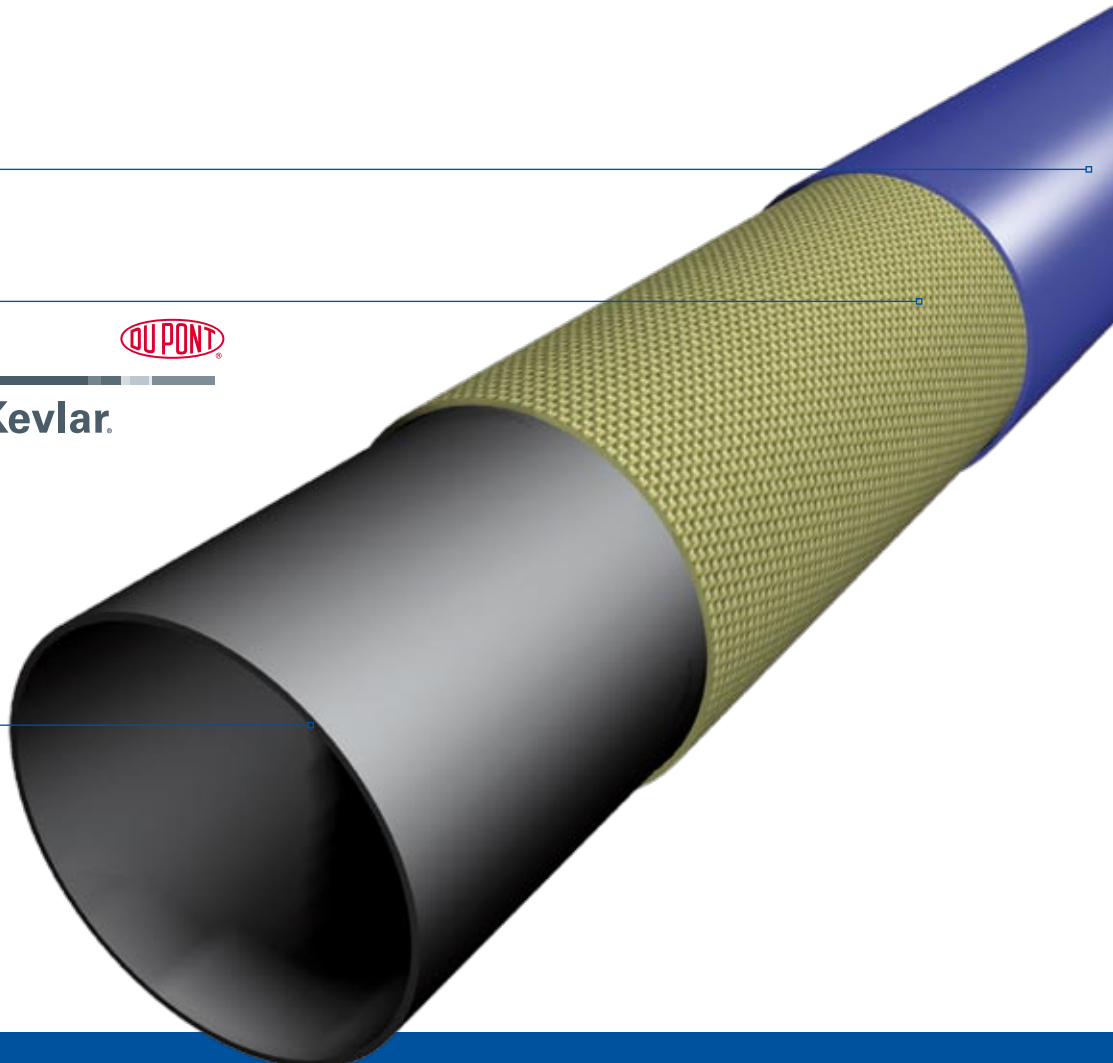


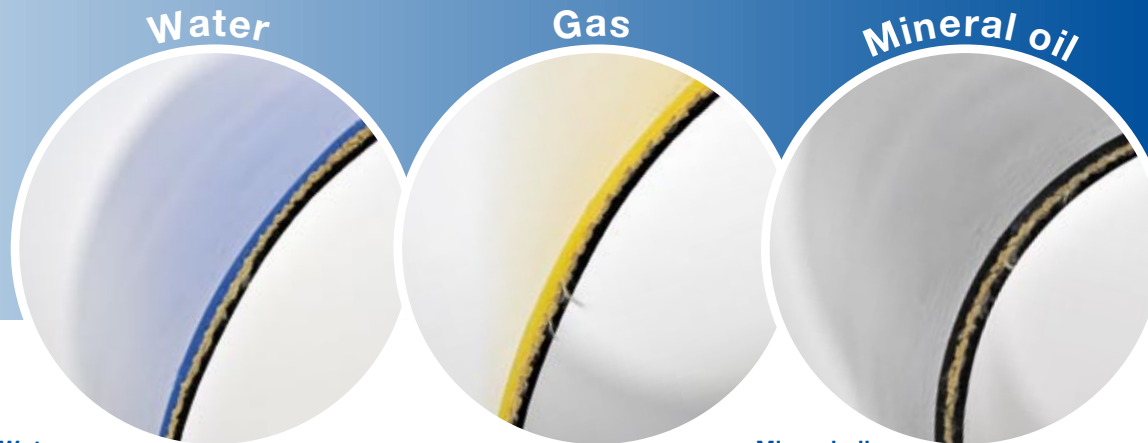
Kevlar.

Seamless, woven aramid fibres
(single-layer or double-layer fabric design)

Inner Layer

Media-specific
based on PE or TPU





Water:
Drinking water, hot water,
industrial water, waste water
and sea water

Gas:
Natural gas, sweet gases,
sour gases, gas mixtures

Mineral oil:
Crude oil, refined oils, fuel
oil, fuels, oil sludge

Other media: Chemicals, abrasive media

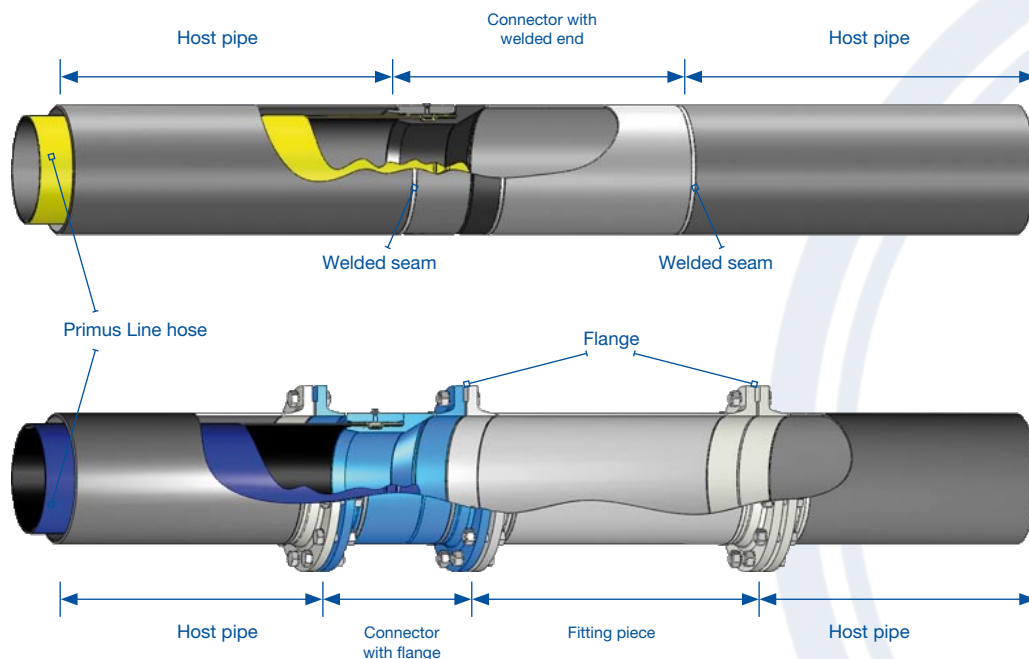
Primus Line Connector

At the ends, the Primus Line hose is connected to the existing pipe using Primus Line connectors. The high-pressure connector consists of a contoured inner tube and outer tube. The outer tube has a malleable steel jacket on the inside. A resin, which is injected through a valve on the outer tube, forces the steel casing and thus Primus Line® into the contours of the inner casing. So we obtain a durable, pull-proof connection.

After pressure-resistant sealing of the connector on the rehabilitated pipe section, a leak test is performed.

Depending on requirements, the Primus Line can be fitted either with a flange or welded ends. In this way, it is also possible to join bends, tees or other fittings and fixtures (made of different materials).

Connector with flange or welded end





Primus Line® – Low Pressure System

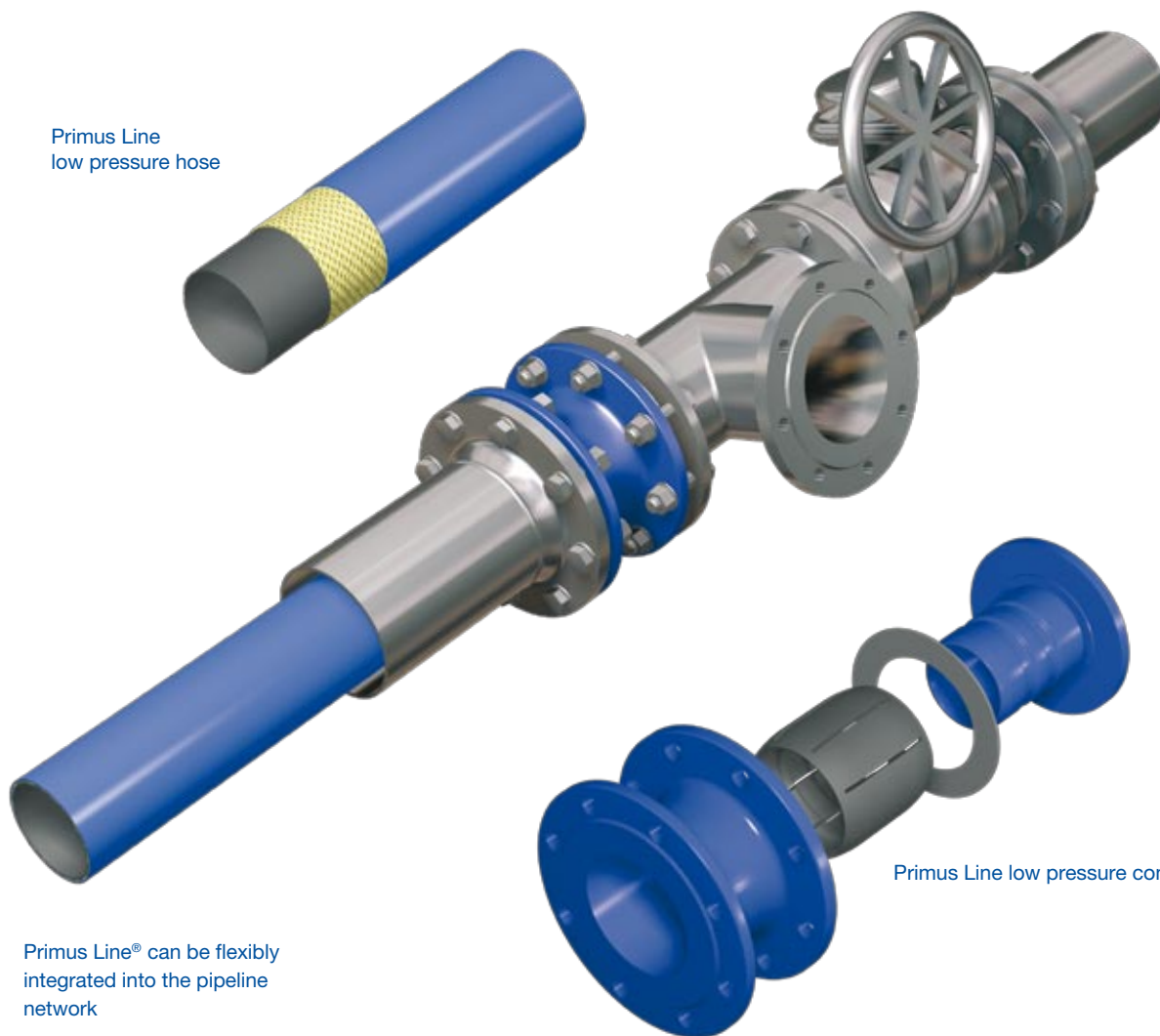
A new development for the drinking water sector

Primus Line® which is a technology for trenchless renovation of high-pressure pipelines was originally developed for the high-pressure gas sector. Because the many advantages of this system are now increasingly being utilized for other media, this new development has been especially adapted for these applications.

The new alternative has been designed for applications for which Primus Line® has, up to now, been too large.

The aramide weave for the new system has been modified and the connector technology has been revised to adapt it to the operating pressure of the media.

Primus Line
low pressure hose



Primus Line low pressure connector

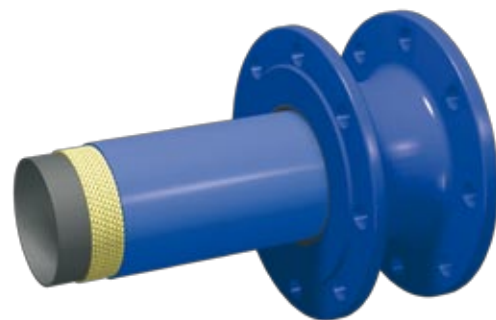
Primus Line® can be flexibly integrated into the pipeline network



The Primus Line low pressure connector

- ▶ Compact construction with double sided DIN flange
- ▶ High-quality epoxy powder coating
- ▶ Immediately ready for operation after installation
- ▶ Can be removed and is therefore reusable
- ▶ Low weight
- ▶ Short delivery times due to modular construction
- ▶ Cost-optimised solution

Nominal size	Burst pressure [bar]	Operating pressure [bar]
DN 150	74	28
DN 200	53	20
DN 250	40	15
DN 300	33	12



Commonalities with the high pressure system

- ▶ Same insertion technology
- ▶ Easy connector installation; no complex special tools required
- ▶ Connector technology has been subjected to long-term testing and is resistant to burst pressure
- ▶ Suitable for drinking water, approved acc. the German standards KTW and W270
- ▶ Operating temperature up to +50 °C

Primus Line® – Installation



1 Operational shut-down of the pipeline to be renewed. Pit construction, cutting and drainage of the pipes

2 Sectional pipe inspection with a mobile TV camera and subsequent analysis of video recordings

3 Insertion of an auxiliary rope by TV camera, for example

4 Mechanical coarse cleaning of the pipe interior using scraper pigs and pull through pigs

5 Positioning of the Primus Line coiled tubing and pulling winch at the start and destination pit

6 Installation of pulling head, hose guides and feeder cable

7 Insertion of the Primus Line hose (folded or unfolded)

8 Assembly of the transition connector fixed to the host pipe

9 Running of pressure tests

10 Integration of the renewed pipe in the pipeline network and commissioning

11 Pit closure





5



6



7



8



11

Technical Details

Nominal sizes	150 - 500	DN	
Operating pressure max. (water) depends on diameter	55	bar	Single-layer fabric
	62	bar	Double-layer fabric
Operating pressure max. (gas) depends on diameter	34	bar	Single-layer fabric
	39	bar	Double-layer fabric
Bursting pressure max. depends on diameter	135	bar	Single-layer fabric
	175	bar	Double-layer fabric
Wall thickness	6,5	mm	Single-layer fabric
	9,0	mm	Double-layer fabric
Weight (from / to) depends on diameter	2,0 - 8,5	kg/m	Single-layer fabric
	4,0 - 8,7	kg/m	Double-layer fabric
Abrasion resistance (DIN 53516)	10,5	mm ³	
Insertion length max.	2.000	m	
Hose length per drum max. depends on diameter	4.500	m	
Bendability	up to 30	Grad	
Bend radius	5	D	
Continuous operating temperature	up to 50	°C	
Service life duration	50	years	

Primus Line® – Projects, References, Partners

Water project: Trinkling water pipeline in Sao Paulo, Brasilia, Sanit Engenharia Sao Paulo



The renewed cast iron drinking water pipeline DN 500 runs in Sao Paulo along a main traffic road.

Laying of Primus Line DN 500 PN 16, MOP of pipe 10 bar

Total length: 230 m, 1 installation section

Water project: Trinkling water pipeline in Grums, Sweden, Scandinavia VA-Teknik



The trinkling water pipeline runs between a railroad and a motorway, crosses under the railroad and passes through a bridge. Primus Line® was inserted from already existing concrete chambers and from chambers in the bridge abutment.

Laying of Primus Line DN 250 PN 30, MOP of pipe 10 bar

Total length: 330 m, 5 installation sections

Oil project: Crude oil line in the Ruehlermoor oil field, Germany, ExxonMobil Production



The oil pipeline renewed runs crossways through the Ruehlermoor oil field in the administrative district of Meppen. ExxonMobil Production Deutschland GmbH was convinced of the concept and technology of Raedlinger primus line GmbH and achieved enormous cost savings versus conventional pipe construction in stainless steel.

Laying of Primus Line DN 250 PN 38 and DN 200 PN 39, MOP of pipe 32 bar

Total length: 2.200 m

Water project: Double-inverted drinking water siphon in Dresden, Germany, DREWAG municipal utility



Renewal of a double-inverted drinking water siphon under the river Elbe. DREWAG Stadtwerke Dresden GMBH supplies approx. 500,000 residents with drinking water. The double-inverted drinking water siphon constructed in 1929 using the open construction method represents a major part of the supply network. The client and the engineering consultant have decided on Primus Line® technology for economic and time-related reasons.

Laying of Primus Line DN 500 PN 16, MOP of pipe 10 bar

Total length: 2 x 220 m

Water project: Trinkling water pipeline in Telfs, Österreich, Swietelsky-Faber Kanalsanierung GmbH



The renewed drinking water pipeline DN 150 PN 25 runs with a length of 175 m along a steep hillside through a wooded area and above a waste deposit in the Municipality of Telfs

Laying of Primus Line DN 150 PN 55, MOP of pipe 25 bar

Total length: 175 m



Gas project: Gas pipeline in Braunschweig, Germany, E.ON Avacon AG

The renewed gas pipe runs in the city of Braunschweig. The first section runs along a residential area. The second section passes under a driving practice ground and a federal road. A new high pressure gas pipeline was established in the existing pipe and the planned reduction of the host pipe diameter was achieved.

Laying of Primus Line DN 400 PN 25, MOB of pipe 25 bar

Total length: 2 x 360 m



Water project: Drinking water pipeline in Kornwestheim, Germany, Zweckverband Landeswasserversorgung Stuttgart

The renovated drinking water pipe runs in Kornwestheim along busy roads. The supply of drinking water could be restarted after short time and without any interference with the traffic. The security of supply is ensured for the next decades.

Laying of Primus Line DN 300 PN 26, MOB of pipe 16 bar

Installation: 300 m and 1.100 m



Gas project: Gas transportation pipeline in Sibiria, Russia, E.On Ruhrgas Ag and OAO Gazprom

Gas transportation pipeline under the River Ob in the Siberian taiga, OAO Gazprom, OAO Tomsktransgaz.

Within the scope of the technical co-operation with E.ON Ruhrgas AG, OAO Gazprom is looking for suitable technical solutions for the sustainable renewal of the gas pipeline, which has been laid under the river Ob for 40 years. This solution was found with Primus Line® technology.

Due to the successful realisation with the Primus Line® system, the gas and heat supply of the city is assured on a long-term basis with far more favourable cost conditions for the households connected.

Laying of Primus Line DN 150 PN 45, MOB of pipe 25 bar

Total length: 2.500 m



Licence Partners

Rädlinger primus line GmbH works successfully with national and international partners from the pipe rehabilitation industry. Due to the low investment cost and simple handling, Primus Line® convinces both sales and cooperation partners.

To implement our high quality standards in construction, licensees are trained in a several-day course which combines theory and practice in mutually reinforcing ways. In addition, we offer

reliable technical support to local construction sites.

Are you interested in becoming our licensing partner and tapping into new markets with us? Then please contact us. Of course we are also happy to give you information in person, by telephone or in an appointment at our offices.



Primus Line® – Benefits

Benefits of trenchless pipe rehabilitation technology

Compared to open construction, trenchless construction methods have environmental and economic benefits.

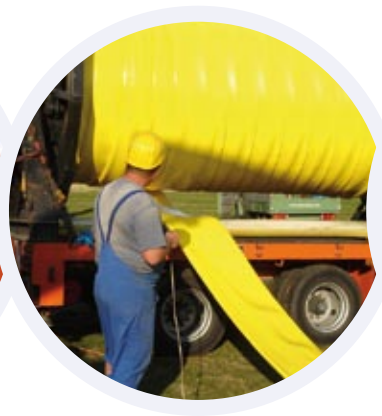
Due to constantly-increasing traffic density, and in terms of environmental protection, it makes economic sense to lay pipes without damaging the surface. Because of the expense of road surfaces, soil replacement and high groundwater levels, trenchless design can be more economical than conventional construction even at relatively shallow depths.

In addition, there are also considerable economic savings such as the avoidance of congestion, environmental protection and the elimination of weather-related downtime.

Benefits at a glance

- ▶ Low intervention in landscapes and protected areas
- ▶ No disruption to road, rail and shipping traffic
- ▶ Reduction of noise and emissions
- ▶ Low interference with existing building fabric
- ▶ Protection of vegetation and species due to small construction sites
- ▶ Sustainability due to the use of existing infrastructure (host pipes)

Specific benefits of Primus Line®



Easy to use

- ▶ Reduced use of machinery
- ▶ Up to 4.500 m at a time can be delivered on a transport drum
- ▶ Short construction period due to long insertion lengths
- ▶ Small pits and reduction of roadworks
- ▶ Elimination of digging and transportation of large soil masses
- ▶ Omission or limitation of groundwater treatment
- ▶ Coarse cleaning of the host pipe only, as no adhesive is required
- ▶ Fast recommissioning
- ▶ Full piggability also during operation

High Strength and Quality

- ▶ Pipe renovation with a lifetime of at least 50 years
- ▶ High abrasion and cut resistance of the outer coating
- ▶ No corrosion of Primus Line®

High Flexibility

- ▶ Fewer construction pits due to bendability
- ▶ Insertion through bends of up to 30°

High Performance

- ▶ Minimal cross-section loss due to low wall thickness of 6.5 and 9.0 mm
- ▶ Improved flow properties of the pipe



History

Rädlinger primus line GmbH is part of the Rädlinger corporate group which has been active in the construction sector for over 40 years. Today, the company is one of the most successful construction companies in Germany whose expertise mainly lies in road construction, civil engineering and asphalt construction.

From the idea to success

Primus Line® was developed to solve the recurring, time-consuming and costly problem of run-down pipelines in existing buildings.

Josef Rädlinger already had the idea of using a hose for civil engineering 20 years ago. The hose was to be characterised by flexibility, portability, light weight and low wall thickness, while having the material strength of a steel pipe.

Open to new ways, the know-how from the fields of construction, mechanical engineering and web technology were combined 10 years later to find a creative and effective solution. Together with partners from research and industry, experts from the Rädlinger group developed the Primus Line® technology, which sets new standards in the transport of gases and liquids.

Milestones

- 1963 Establishment of Josef Rädlinger Kiesbaggerei und Fuhrunternehmen e.K in Cham
- 1971 Establishment of Josef Rädlinger Bauunternehmen GmbH in Cham
- 1988 Establishment of Rädlinger Maschinen- und Anlagenbau in Cham
 - Production of circular looms for fabric hoses
 - Production of construction equipment
- 1995 Opening of the new ready-mixed concrete mixing plant in Weiding
- 1996 Establishment of Rädlinger Straßen- und Tiefbau GmbH in Selbitz / Frankenwald
- 1996 Development of a high-pressure hose for pipe rehabilitation
- 2000 Establishment of Rädlinger Asphaltbau GmbH
- 2001 Establishment of Rädlinger primus line GmbH
 - Production and distribution of the flexible, high-pressure pipe Primus Line®
- 2002 Establishment of Josef Rädlinger Ingenieurbau GmbH in Vilshofen
- 2004 Establishment of Rädlinger Bauunternehmen Ges.m.b.H. in St. Pölten Austria
- 2005 Establishment of S.C. Trust Constructii Rädlinger S.R.L. in Romania
- 2006 Establishment of RWenergy GmbH in Schwandorf
- 2006 Takeover of the Professional Education Centre in Schwandorf (BBZ)
- 2008 New construction of the production plant for Primus Line® in Weiding





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