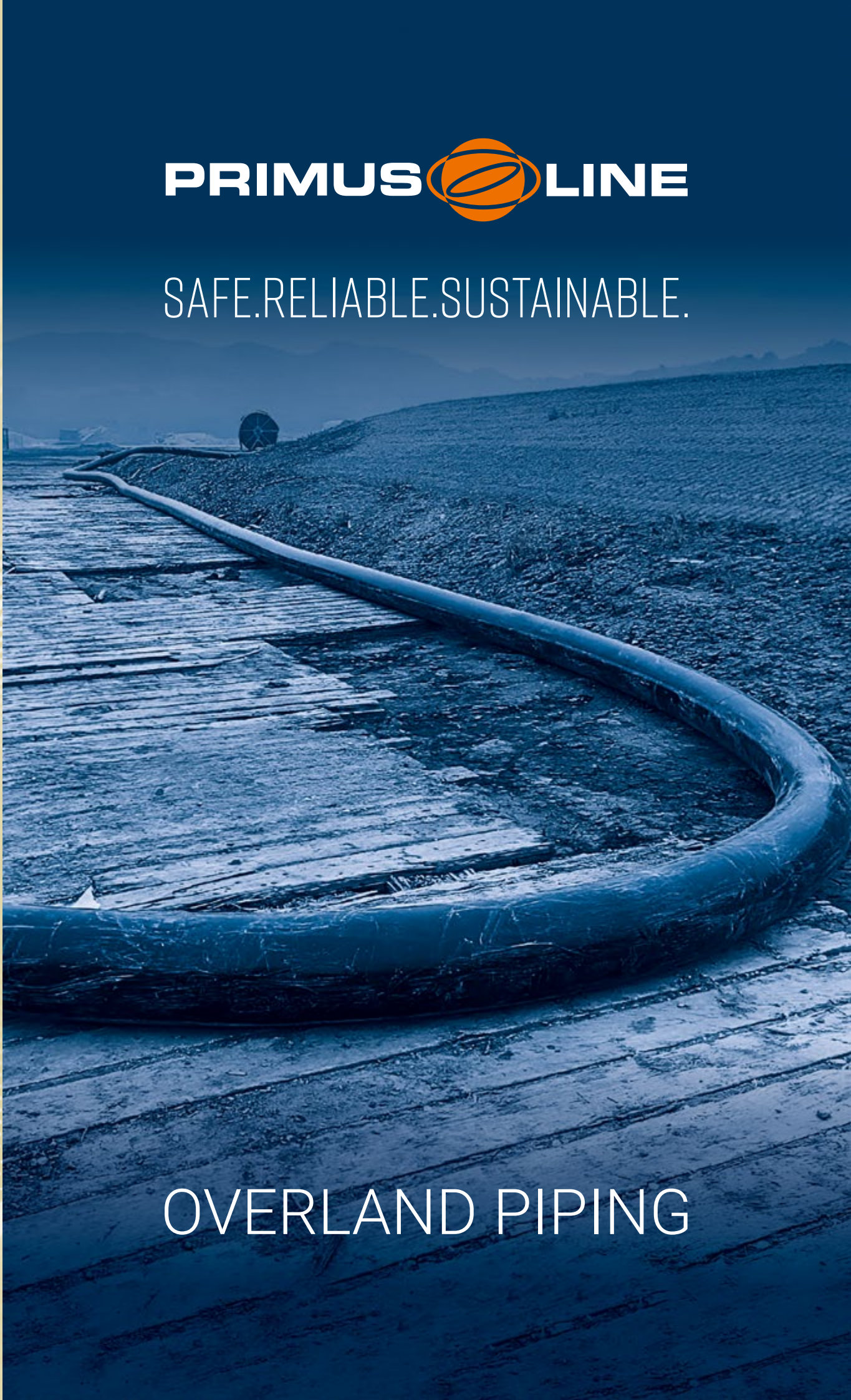
PRIMUS LINE

SAFE.RELIABLE.SUSTAINABLE.



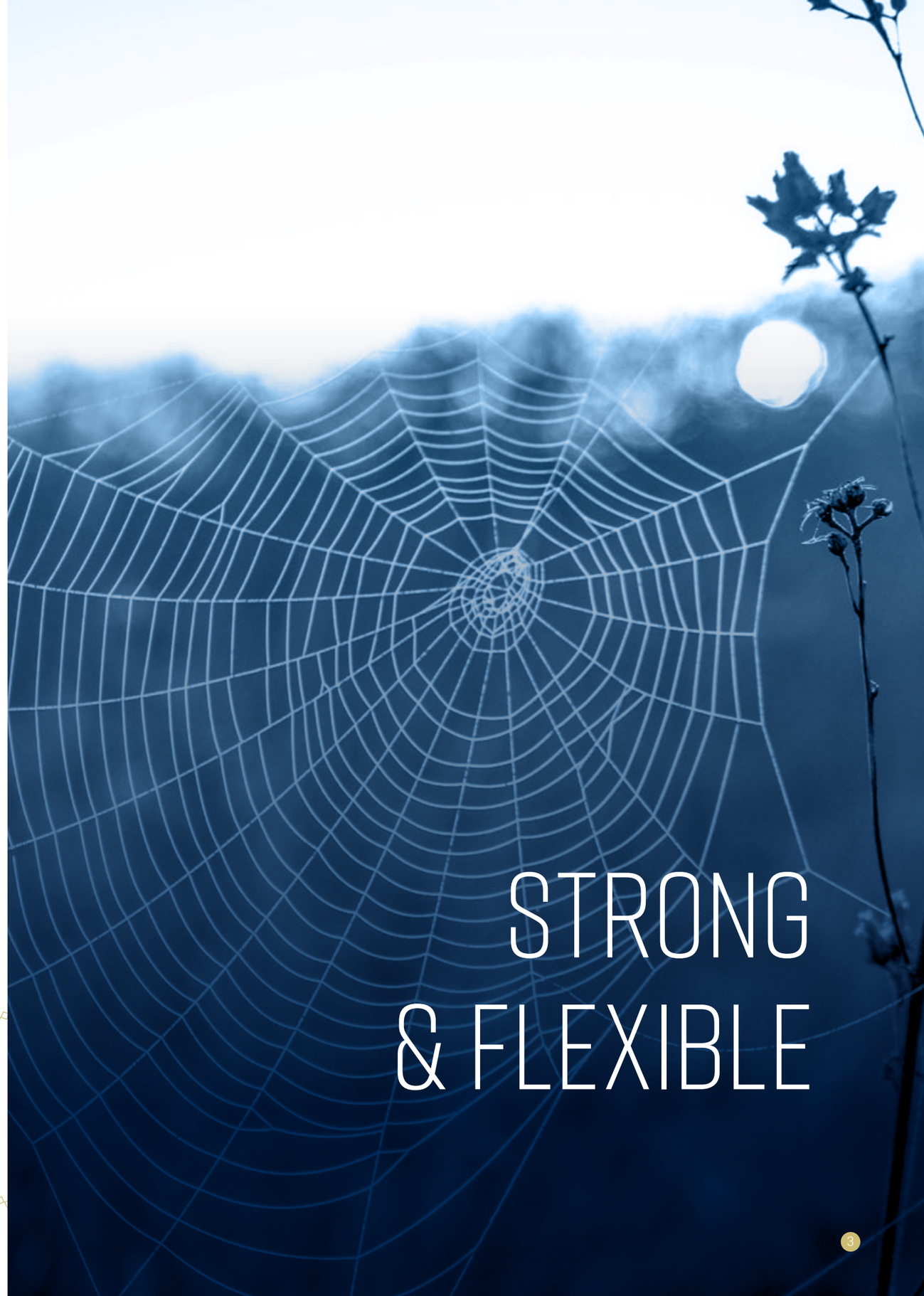
OVERLAND PIPING

PRIMUS LINE®
OVERLAND PIPING[1]

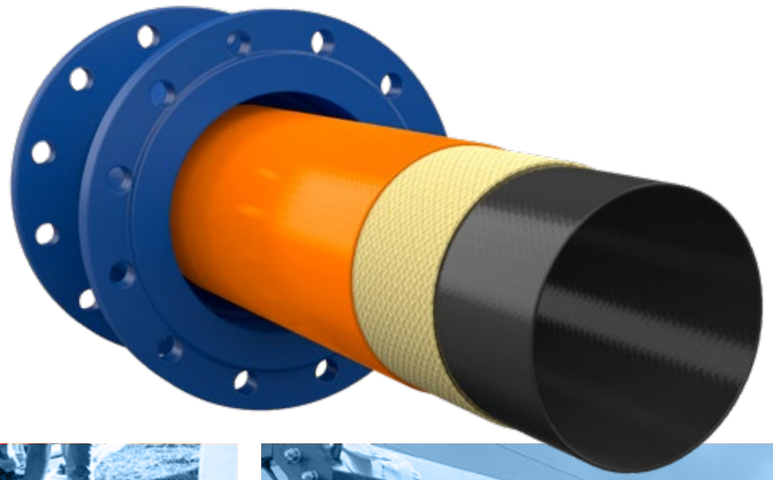
BENEFITS

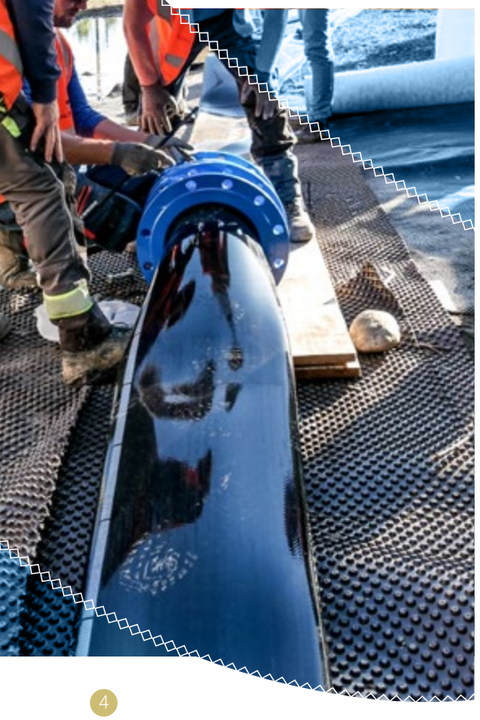
DESIGNED,
DEVELOPED AND
MADE IN GERMANY

Please note the disclaimer and the technical requirements at the end of the brochure.



FLEXIBLE SURFACE PIPE = LINER + CONNECTOR





PRIMUS LINE® OVERLAND PIPING – LEAK-FREE PERFORMANCE

Primus Line® Overland Piping is an environmentally orientated solution, spoolable and reusable[2] for numerous deployments. In addition, it can be rapidly installed. It is specifically developed for above-ground piping for demanding and potentially hazardous media.

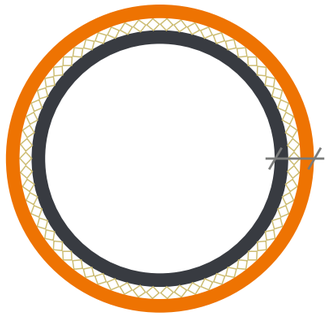
The lining of the flexible pipeline consists of thermoplastic polyurethane (TPU) and offers high chemical resistance that withstands contact with highly corrosive hydrocarbon compounds.[3]

The reinforcement made of Kevlar® fabric gives Overland Piping a high tensile strength that allows for a complete stand-alone absorption of even very high operating pressures.

Its outer layer made of TPU offers protection from UV light and abrasion as well as the required flexibility for repeated installations and coiling of the reusable[4] system.

Specially developed high-pressure end fittings with flanges or specialised quick couplers compatible with Victaulic notch are used to link various flexible pipelines. They can also be connected to pumps or other pipeline assets.

COMPOSITE LINER



Wall thickness = 6 mm / 0.24 inches

TECHNICAL DETAILS[5]

- Available in nominal diameters from DN 150 to DN 350 / from 6 inches to 14 inches
- Maximum operating pressure depending on diameter:
  56 bar to 20 bar / 812 psi to 290 psi
- Design values for temperatures greater than 30 °C / 86 °F
  and, under certain conditions, up to 60 °C / 140 °F
- Design values for installation around bends
- Friction coefficient: k = 0.028 mm

Inner layer

Thermoplastic polyurethane (TPU)

- High chemical resistance
- High abrasion resistance
- Corrosion resistant

Reinforcement

Seamless, woven Kevlar® fabric

- Accommodates operating pressure by itself
- Up to 10 times stronger than steel of equal weight

Outer layer

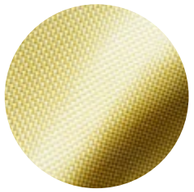
Thermoplastic polyurethane (TPU)

- High abrasion resistance, protecting the fabric during installation and operation
- High UV-resistance

The Primus Line® Overland Piping system is suited for the following fluids:[6]

- Raw water
- Process water
- Flowback water
- Residential wastewater
- Industrial wastewater
- Fire water
- Brine
- Formation water
- Injection water
- Brackish water
- Sea water
- Supply water
- Treated wastewater
- Other media only after detailed review and approval

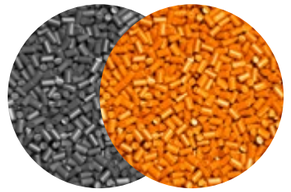
WE EXCLUSIVELY UTILISE TOP-QUALITY RAW MATERIALS



Kevlar®

Kevlar® is a high-strength, lightweight para-aramid synthetic fiber known in the industry for its exceptional tensile strength and durability.

The chemical structure of Kevlar® is comprised of several repeating inter-chain bonds. These chains are cross-linked with hydrogen bonds, providing a tensile strength up to 10 times greater than steel on the same weight basis. For us, it is the perfect reinforcement material for temporary surface pipelines due to its ability to withstand mechanical stress, resist abrasion and adapt to changing terrain. Kevlar®'s thermal stability makes it ideal for diverse environments.



TPU

Thermoplastic polyurethane is for our solution the ideal polymer for the inner and outer layers of our flexible pipeline. It offers a high level of flexibility, impact resistance, high abrasion resistance, chemical compatibility, resistance to UV radiation, moisture, extreme temperatures, bonding capability, and processability. TPU ensures the pipeline's durability, protection and reliable performance in above-ground environments.

Lab tests have shown that TPU has a up to 5 times higher abrasion resistance than HDPE.

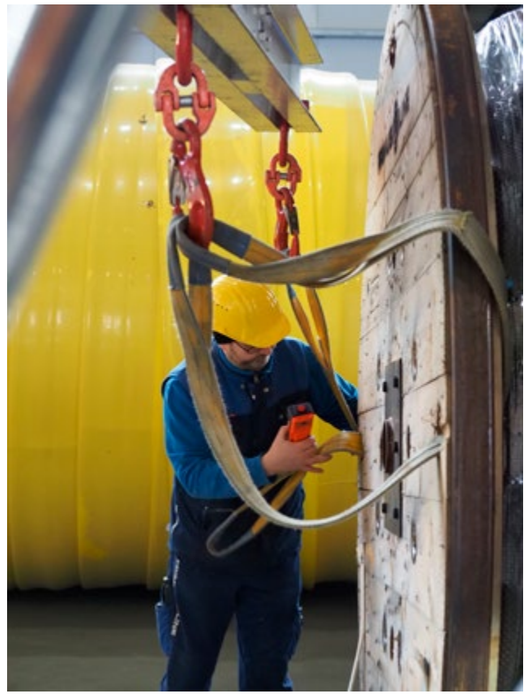
LEAK-FREE CONNECTORS[7]

M-CONNECTOR
WITH FLANGE

- A pull-proof hold between our flexible pipe and the Primus Line M-Connector is established purely by mechanical forces.[8]
- This is achieved by pressing the core into the bushing with hydraulic equipment that is suitable for on-site use. Not only does this speed up the assembly, it opens up the possibility of reusing the connector multiple times.
- Available in nominal diameters from DN 150 to DN 350 / 6 inches to 14 inches with flanges according to DIN, ANSI and AS4087 with PN10 / PN16 or 150 psi / 300 psi flanges. Project-individual solutions are available on request.

Q-CONNECTOR

- Compatible with the patented notch by Victaulic and as such flexibly deployable with a large range of other compatible components.
- Available in nominal diameters from DN 150 to DN 350 / 6 inches to 14 inches.



TRANSPORT

The flexible pipe is coiled flat onto special transport reels and delivered to the customer. Depending on its diameter, a single reel can accommodate up to 4,000 meters / 13,120 feet of pipeline, efficiently fitting onto a single truck. This approach minimizes both logistics costs and the environmental impact associated with transport.[9]

FAST AND EASY DEPLOYMENT

Primus Line® Overland Piping makes it easy to pass through rough and hard-to-reach terrain. It adapts naturally to surface irregularities.

FAST EMERGENCY PIPELINE

In the event that your current pipeline is compromised by factors such as landslides, floods or wildfires, the Primus Line® Overland Piping system offers a solution. It allows for the storage of two to four kilometers of flexible pipeline and matching connectors in only one single container.

In emergency situations, the flexible and spoolable Primus Line® flexible surface pipe can be installed immediately and - depending on environmental conditions - within an extreme short time frame. Furthermore, it is important to note that the Primus Line® Overland Piping system - depending on the specific type of use and circumstances in each case - has a very long service life.[10]

BENEFITS

SAFETY

COST ADVANTAGE

EFFICIENCY

ENVIRONMENTALLY ORIENTATED

SAFETY

- The core of the Primus Line Overland pipe is made of seamlessly woven Kevlar®. This synthetic fiber is up to ten times stronger than steel and has twice the strength of glass fiber or nylon. Due to its core, the pipe has a very high factor of safety (FoS). The burst pressure of the flexible pipeline is at least 2.5 times higher than the allowable operating pressure.
- No hot works, like welding or butt fusion jointing, are necessary for the installation. Flange connectors or quick-couplers are used instead.
- No work with hazardous materials for curing on site.
- The entire production process is accompanied by in-depth monitoring. Sensors and cameras constantly capture process parameters and are the basis for comprehensive mechanisms for the control of wall thickness and consistency. In addition, every pipe produced is pressure-tested in-house before delivery to site.

COST ADVANTAGE

- Reusable[11] several times: Long-term bend tests have been performed.
- Small storage requirements:
  Storing HDPE pipes requires up to 10 times more space.
- Transport up to 4 kilometers / 2.5 miles on a single transport spool / truck – depending on the diameter.
- On average, reduced operating costs due to minimal mobilisation and demobilisation costs, reduced manpower[12]
- Due to easy uncoiling and recoiling - depending on the specific use in the individual case.

EFFICIENCY[13]

- 1,000 meters / 3,300 feet and more are available as one continuous length.
  Limitation of connection points = limitation of weak points
- Handle large volumes:
  Transport up to 500 liters / 132 gallons per second
- Fast deployment:
  Installation time up to 12 times faster compared to HDPE
  (based on client information)
- Install up to 6 kilometers / 3.7 miles per day
- Flexible: Adapts naturally to surface irregularities
- Lightweight:
  2.5 kg to 6.1 kg per meter / 1.7 lbs to 4.1 lbs per foot

ENVIRONMENTALLY ORIENTATED[14]

- Waste reduction due to reusability[15]
- No heavy equipment:
  The installation can be performed with a winch, a mini-excavator or directly from a truck. This results in a significant reduction of the on-site carbon footprint. Proven in a project in North America.
- Eliminate CO_2 emissions of heavy trucks during operation for the transport of liquids.
- Installation through bushland, nature parks or waterways possible with less damage to the environment.

HDPE VS. PRIMUS LINE®

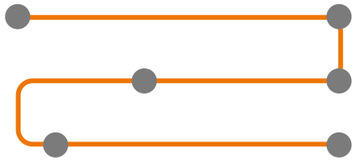
Requirements for construction of 6 km / 3.7 miles of pipeline:[16]

	HDPE	PRIMUS LINE® OVERLAND PIPING
MOBILISATION	• 4 - 6 trucks • 2 excavators • 300 - 500 pipe shots	→ 1 - 2 trucks → 1 mini-excavator or winch → 2 - 5 pipe reels
EQUIPMENT	• 2 excavators • fusion welding equipment • heating tents	→ 1 mini-excavator or winch → basic hand tools
INSTALLATION TIME WITH ONE CREW	• 25 - 30 days installation time	→ 1 - 2 days installation time
REMOVAL TIME	• 7 - 10 days removal	→ 1 - 2 days respool
FUSION WELDING	• required at every pipe shot	→ not required
MANPOWER	• 4 - 6 people	→ 3 - 4 people
COLD WEATHER APPLICATION	• - 20 °C / - 4 °F and below requires heating tents	→ can be deployed in - 40 °C / - 40 °F without heating

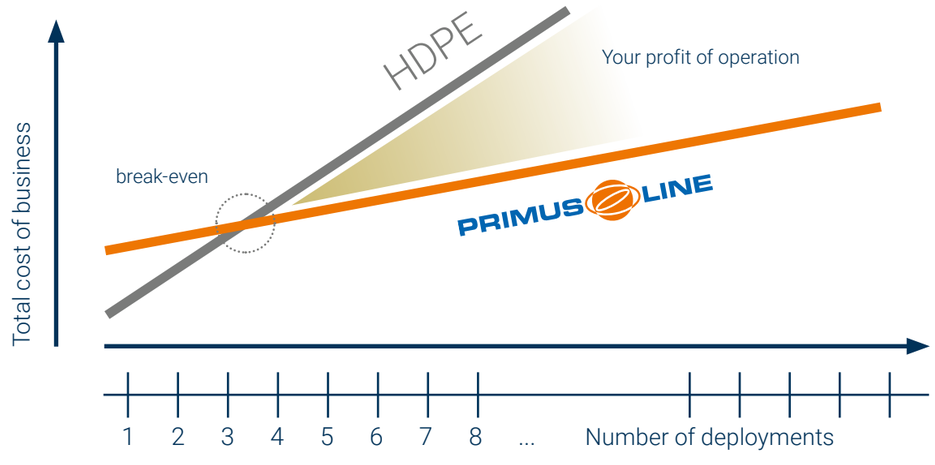
Connections needed on 6 km / 3.7 miles of temporary surface pipeline:[17]

300 - 500 connection points

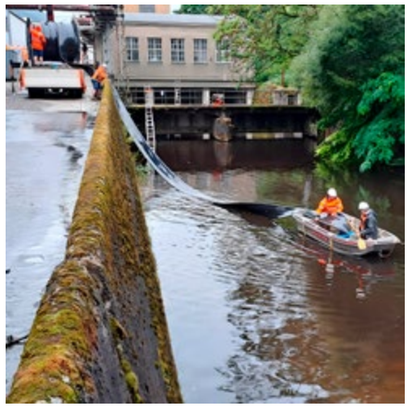
6 - 12 connections points



Total cost of business:[18]



APPLIED WORLDWIDE[19]



GERMANY

Transported medium: Wastewater from a paper factory
Project duration: 13 days

- Transport pipeline for the return of the accruing wastewater over a length of 685 meters / 2,247 feet
- The pipe was laid directly in the river bed

> *"Everything worked wonderfully, even unforeseen "difficulties" were quickly resolved."*

Primus Line® Overland Piping user

NORTH AMERICA

Transported medium: Produced water from hydraulic fracturing
Project duration: 11 days

- Over 7,000 two-way truckloads were removed from the road (information provided by client)
- About 10 kilometers / 6.2 miles of temporary pipeline route vs. 20 kilometers / 12.4 miles of trucking route

> *"Over the course of three years, more than 320 tonnes of CO_2 emissions could be saved."*

Primus Line® Overland Piping user

CANADA

Transported medium: Oil sands process water
Project duration: Depending on project

- On different locations, over 11,000 meters / 36,000 feet of Primus Line® Overland Piping are in use
- The Overland Piping system is in permanent use, even in the winter period at -40 °C / -40 °F

> *"Over the course of three years, more than 1 million cubic meters / 264 million gallons have been transported leak-free. The installation process is ten times less expensive than HDPE."*

Primus Line® Overland Piping user

FRANCE

Transported medium: Brine

- Operating pressure of 16 bar / 232 psi with a test pressure of 20 bar / 290 psi
- Reduction of the carbon footprint of about 150 truckloads per day
- 8 times reused within this project

> *"The deciding factor was both a financial aspect, which is undeniable, and the simplification of the French operators' authorisation procedure."*

Primus Line® Overland Piping user

NORWAY

Transported medium: Temporary bypass for residential wastewater

- About 1,050 meters / 3,445 feet
- Up to 300 liters / 79 gallons pumped per second

> *"The Overland Piping system could be operated safely in a natural area."*

Norwegian Primus Line® partner

Visit our website for additonal references:
https://www.primusline.com/en/applications/references

PRIMUS LINE® FLEXIBLE PIPE PRODUCTION

The Primus Line® system for Overland Piping requires unique production facilities.

MANUFACTURING TECHNOLOGY

The centerpiece of the pipe production is the patented, self-developed circular loom by Primus Line.

With its high-precision electronic controls, it weaves a seamless and twist-free fabric out of Kevlar®.

This is the basis for the extrusion process that applies the inner and outer layers based on thermoplastic polyurethane (TPU).

The nearly 20-meter high vertical production line combines the three raw materials to create a robust three-layered liner.

The technology is constantly improving and allows the use of new polymers for the inner and outer layers. This offers the opportunity to further optimize the layers or develop them for entirely new fields of application.

QUALITY

Starting with sourcing raw materials, we set high standards and only work with reputable manufacturers. We carefully check all inbound goods for their quality.

Primus Line® is subject to continuous quality control with optoelectronic measuring instruments. These capture all process parameters and allow a continuous control of the consistency and wall thickness of each layer of the pipe. In addition, every production charge receives a batch ID for an unambiguous traceability and undergoes a burst pressure test that reliably confirms the maximum operating pressure.

The connectors are subject to a thorough visual and mechanical inspection. Customers receive technical documentation summarizing all results.

THE PRIMUS LINE FLEXIBLE PIPE IS FUNDAMENTALLY DESIGNED FOR A LEAK-FREE ABOVE-GROUND TRANSPORT.[20]

Its tried and tested three-layer structure in combination with a new material composition facilitates the handling of the pipe and allows its reuse[21] in a multitude of applications. Its black TPU outer layer reliably protects it from wear and degradation in UV light.

CERTIFICATIONS

ISO 9001:2015 - Quality management system
ISO 14001:2015 - Environmental management system
ISO 45001:2018 - Occupational health and safety management system
ISO 50001:2018 - Energy management system

INTERNATIONAL TEAM AND TRAINED PARTNER NETWORK

Primus Line® is applied in over 55 countries worldwide. In order to better cover the global market and support our partners, four international offices have been established.

At Primus Line's headquarters in Germany and on site, our partners receive a tailored training course. The participants are introduced to the technical details of the system components and trained for the requirements of their construction site.

We also work with local international distributors to be close to the customer.

- Raedlinger Primus Line, Inc. (2013)
  in Charlotte, North Carolina, operating in the United States only
- Raedlinger Primus Line Pty Ltd. (2016)
  in Sydney, New South Wales, operating in Australia only
- Raedlinger Primus Line CA Inc. (2018)
  in Toronto, Ontario, operating in Canada only
- Primus Line (China) Ltd. (2019)
  in Shanghai, operating in China only

LOGISTICS CENTER

The smooth transport of Primus Line® on reels and in freight containers is prepared by the shipping specialists in the logistics center in Germany. We stock a range of standard sizes of our flexible pipes, which can be prepared for their journey around the world in a short time using the most suitable handling equipment.

Shipments are sent to international partners or regional offices.

RELY ON EXPERIENCE!

The family-managed company manufactures the Primus Line® system, which has been developed in-house, for the trenchless rehabilitation of pressure pipes and overland piping.

In doing so, it relies on the know-how of its employees, which has grown over decades, going back to the beginning of development in 1996 and incorporating many influences from research on the way to market maturity in 2001. This knowledge has also led to the innovative vertical production line for the flexible pipe and the logistics warehouse that is ideally suited to its handling.

Operating in the United States of America only
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Charlotte, NC 28284-2109
Phone: +1 704 5694460

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Raedlinger Primus Line CA Inc.
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info@primusline.com

01 2024 US CA

Disclaimer and technical requirements:

The installation of the Primus Line® system has to be performed by an accredited and trained installer. The execution of the work on site is done in accordance with the manufacturer's installation manual. The design guidelines - including but not limited to the maximum allowable operating and testing pressure for the installed system - are documented in the manufacturer's Submittal Support Document. Product specific information available on product datasheet. The installation company is requested to provide the manufacturer's operating instructions to the network operator. It is the responsibility of the installing company to work with the most current guidelines of the manufacturer which will be made available by the manufacturer upon request or via cloud access. In case of any doubts on the technical properties of the product or the suitability for a certain application, please contact the Primus Line technical experts in your region.

1, 7, 8, 20: Please consider that the following information serves purely informative purposes about the product and does not provide any warranties or guarantees with regard to the product presented. Rather, the following information as well as the conditions for the suitability and usage of the product must be specifically assessed and verified for each individual case. We, as the manufacturer of the product shown, will be happy to provide you with customized advice for your project. Please note, however, that the ultimate responsibility for operation and compliance with regulatory and, in particular, environmental regulations is with the user of the product.

2, 4, 11, 15, 21: Please consider that reusability depends on the particular use and the possibility of cleaning of the product. The information given serves purely informative purposes about the product and does not provide any warranties or guarantees with regard to the product presented. The reusability must be specifically assessed and verified for each individual case. We, as the manufacturer of the product shown, will be happy to provide you with customized advice for your project. Please note, however, that the ultimate responsibility for operation and compliance with regulatory and, in particular, environmental regulations is with the user of the product.

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5, 13, 16, 17, 18: Please consider that the technical details given are to be understood as average values. The specifications given serve purely informative purposes about the product and do not provide any warranties or guarantees with regard to the product presented. Rather, the specific values largely depend on the specific type of use and must be specifically assessed and verified for each individual case. We, as the manufacturer of the product shown, will be happy to provide you with customized advice for your project.

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