

# High Voltage and Extra High Voltage Cable Protection

Borealis polyolefin solutions for durable pipes  
in demanding conditions



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# Why use plastic cable protection pipes?

Plastic cable protection pipes offer essential mechanical protection for underground cables, shielding them during the installation phase and from third-party damage. This includes reliable protection when future installations or excavations are carried out by other parties—for example, for water, gas, or district heating pipelines. In this way, the long-term durability of the system is secured, and maintenance is made easier.

## Key advantages include:

- **Facilitating modern pipe installation techniques:** These pipes support advanced installation methods such as horizontal directional drilling (HDD), reducing the risk of cable damage compared to direct plough-in installations.
- **Easier cable replacement:** When repairs are needed, cables can be pulled out of a pipe more easily than they can be replaced directly in the ground, especially in congested areas.
- **Optimized project execution:** Large-scale projects benefit from better use of installation capacity and shorter open trench periods. Reducing trench exposure time also helps streamline groundwater management and minimize environmental impact. Additionally, decoupling installation from cable pull-in allows for greater flexibility in project scheduling and reduces the risk of delays.
- **Safe, water-tight connections:** Pipes can be securely joined using sockets, electrofusion or butt-fusion-welding.





# Benefits of our polyolefin materials



## Polyolefin-based cable protection pipes deliver multiple advantages:

- **Low environmental impact:** Supports modern installation techniques that minimize environmental disturbance and lower CO<sub>2</sub> emissions.
- **Outstanding durability:** Proven resistant to cracking, corrosion, and high temperatures, ensuring long-term performance and reliable service life.
- **Optimized flexibility and stiffness:** Ensures ease of installation and allows for ground movement, while providing the required ring stiffness for structural integrity.
- **Cost-effectiveness:** Enables quick and easy installation, reducing costs; minimal ongoing maintenance lowers lifetime expenses.
- **Enabling circular economy:** BorSafe™ polyethylene (PE) and BorECO™ polypropylene (PP) grades are available based on renewable and chemically recycled feedstock. At the end of their service life, pipes made from these grades can be mechanically or chemically recycled.

# BorSafe™ HE3493-LS-H

## Polyethylene material designed for high voltage cable conduit pipes

BorSafe™ HE3493-LS-H is a high-performance polyethylene PE100-RC material with excellent mechanical strength. It is PE100-RT Type II with high temperature stability, designed for high-voltage-cable protection pipes.

### Key features include:

- Classified as a PE100-RC material (Minimum Required Strength  $\geq 10.0$  MPa).
- Meets the mechanical requirements of PE100-RC in Part 1 of EN 1555, EN 12201, ISO 4437, and ISO 4427.
- Excellent long-term temperature stability, with a proven lifetime of over 50 years at 70°C, in line with PE-RT Type II requirements in ISO 22391-2, DIN 16833.
- Offers excellent resistance to outdoor weathering, with a cumulative radiant exposure of  $\geq 7$  GJ/m<sup>2</sup>—equivalent to approximately one year in hot climates—providing added reliability in case of project delays.
- A co-extruded light-colored inner layer of BorSafe HE3493-LS-H improves visibility during camera inspections.
- As a PE100-RC material, it is suitable for challenging installation conditions – see an example on the following photo.







Image: ©Karl Schöngen KG

## Long-term hydrostatic strength evaluation of BorSafe™ HE3493-LS-H

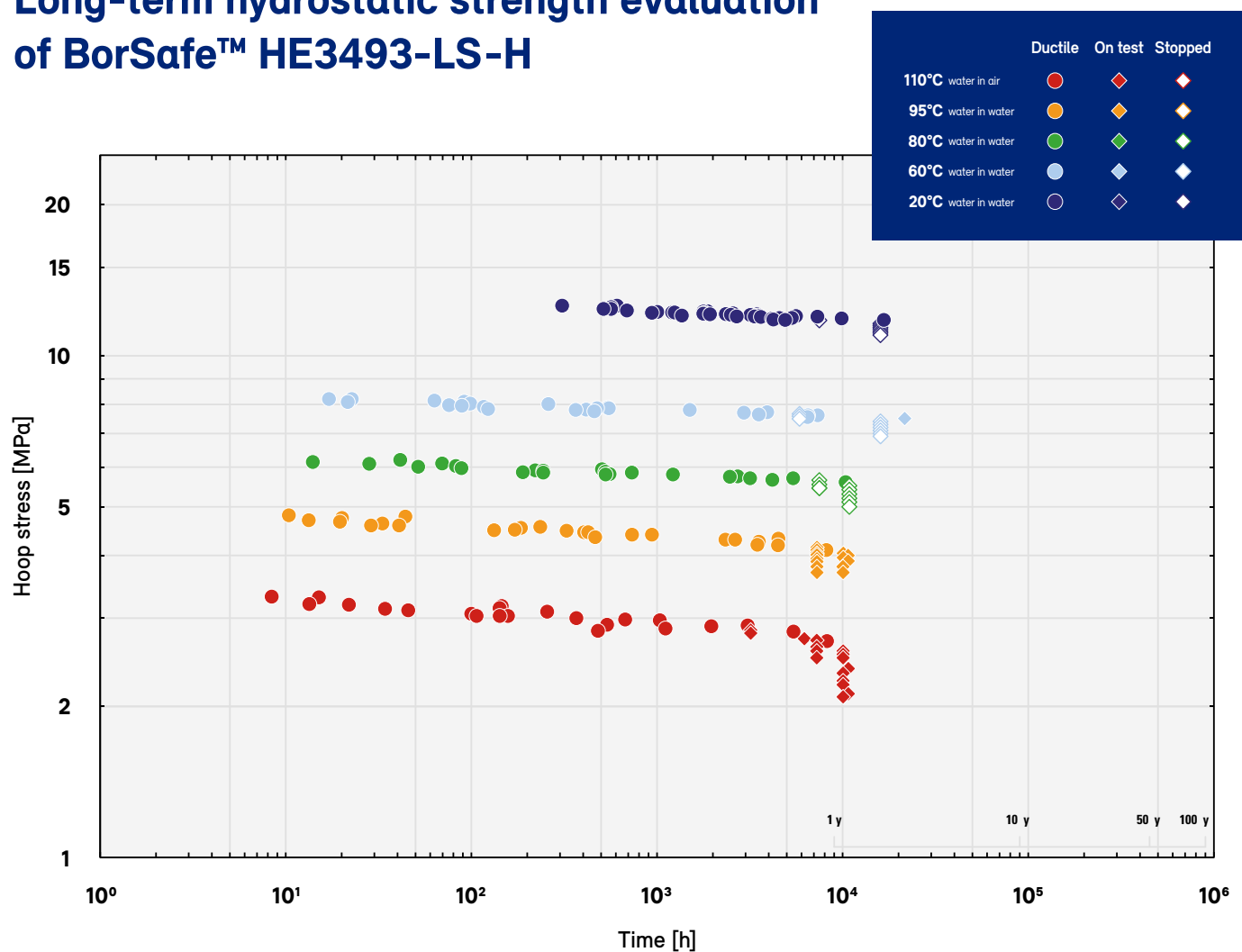


Figure 1: Long-term hydrostatic strength evaluation of BorSafe™ HE3493-LS-H, demonstrating its durability and resistance to pressure over time in accordance with ISO 9080:2012. The data confirms its suitability for high-performance PE pipe applications.





# BorSafe™ HE3493-LS-H

## PE100-RC material developed for rough installation conditions

### Superior Slow Crack Growth (SCG) resistance:

- High-performance PE100-RC (raised crack resistance) grade formulated with hexene co-polymer resin that meets all required industry standards and performance benchmarks:
- Strain Hardening (SHT ISO 18488)
- Accelerated Notched Pipe Test (ANPT ISO 13479)
- Accelerated Full Notch Creep Tests (AFNCT ISO 16770)
- Crack Round Bar Test (CRB ISO 18489).
- Suitable for sandless and trenchless installation techniques, such as Horizontal Directional Drilling (HDD), relining, pipe bursting, and pipe ploughing.

### Excellent processability:

- Bimodal polymer structure enhances extrudability while maintaining strength and durability
- Smooth surface appearance
- Reliable extrusion with precise tolerances
- Consistent quality with low batch-to-batch variation.

### Industry compliance:

- Meets the specifications of the leading transmission system operators (TSOs) for high-voltage and extra-high-voltage corridor projects.

# BorECO™ BA212E

## High modulus polypropylene block copolymer (PP-B) designed for high-temperature resistance and durability

BorECO™ BA212E is a high molecular weight, low melt flow rate polypropylene block copolymer that provides high stiffness and good impact strength. It exceeds the material standards set out in EN 13476 and EN 1852, ensuring reliable performance in demanding applications.

### Reduced wall thickness

The high E-modulus of BorECO BA212E allows for thinner wall pipes compared to alternative solutions, while maintaining the same ring stiffness performance. This results in:

- Reduced material consumption
- A lower weight per meter
- Improved heat exchange with the surrounding ground
- A lower CO<sub>2</sub> footprint due to material efficiency.

### Long-term temperature resistance

The PP-B grade BorECO BA212E fulfills the pressure test control points of DIN 8078. Reference curves for PP-B materials show a residual hydrostatic strength at 70°C after 50 years.

### Balanced impact resistance and stiffness

BorECO PP grades are designed to accommodate soil settlement, continuous loads, and rough handling. They provide structural integrity as well as considerable impact resistance.



Image: © Karl Schöngen KG



# Cable protection pipe installation

## Cable protection pipes made from BorECO and BorSafe materials support various installation techniques, including:

Open trenches with sand-bedding and/or screened backfill; in some cases, alternative installation techniques can be used such as:

- Horizontal directional drilling (HDD) and micro tunneling
- Impact moling
- Pipe ploughing with PE pipes.

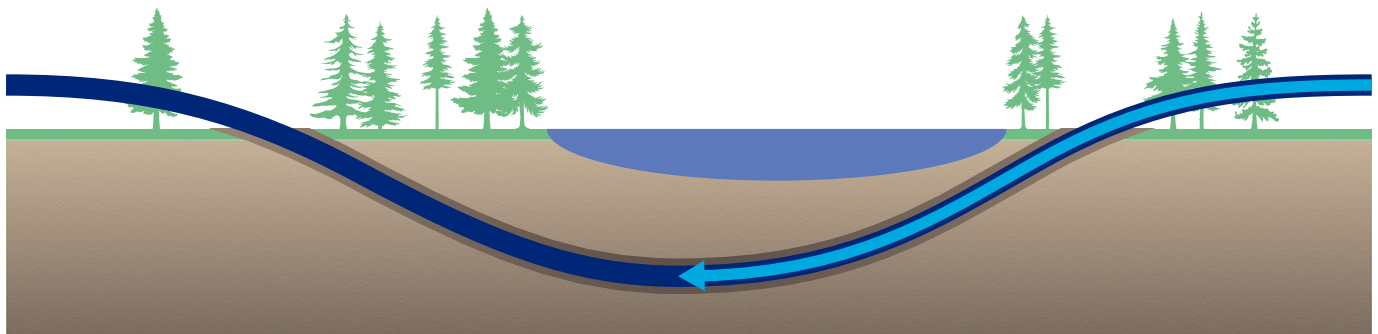
Renovation of existing pipe installations in the ground:

- As a continuous liner to reinforce old pipes
- In pipe bursting or pipe slitting to replace old or damaged pipe sections
- In short pipe relining to insert and seal smaller sections within an existing pipeline.

The installation techniques mentioned above follow the terminology defined in EN ISO 11295.

The selection of pipe materials should be based on the installation method, soil conditions, backfill characteristics, degree of compaction, and design requirements. This decision should be made in agreement with the network owner, the installation company and the pipe system manufacturer.

Figure 2: Illustration of horizontal directional drilling (HDD) for cable protection pipe installation, demonstrating the guided insertion of a protective conduit beneath a water body to ensure a secure and efficient underground cable pathway. ©Borealis



## Cable protection pipes made from BorSafe™ PE80, PE100 and PE100-RC materials are well-suited for pipe ploughing, offering several advantages:

- High flexibility and bendability, even for pipes with outer diameters greater than 200 mm.
- Secure and durable butt-welding connections, enabling longer pipe strings.
- Robust resistance to scratches and notches during installation.
- Significant reduction in environmental impact during installation compared to open trench.



Image: ©Fäckersperger Germany





# The Bornewables™ and Borcycle™ C

## Accelerating action on circularity with the Bornewables™ and Borcycle™ C ISCC PLUS-certified polyolefins

Meet your sustainability targets with renewable or chemically recycled feedstocks, offering the same material performance and regulatory compliance as virgin grades.

### The Bornewables

The Bornewables offer polyolefins with a reduced carbon footprint and are produced with renewable feedstock derived entirely from waste and residue streams.



### Borcycle C

Borcycle C is our chemically recycled line of polyolefins and renews plastic back to plastic, giving polyolefin-based, post-consumer waste another life.







## Borealis and Borouge polyolefin infrastructure solutions for pipes and fittings are enabling life's essentials

date of issue: August 2025

As a trusted and experienced partner with close to 60 years of experience, Borealis offers market leading polyethylene and polypropylene materials for pipe systems in water and gas distribution, waste water and sewage disposal, plumbing, heating, and industrial, along with multi-layer steel pipe coating solutions for onshore and offshore oil and gas pipelines. With the proprietary Borealis Borstar® technology as the main foundation, complemented by selected other processes, Borealis can offer a wide variety of tailored pipe solutions.

In addition, Borcycle™ M and the ISCC Plus certified Borcycle™ C compounds based on mechanically and chemically recycled feedstock as well as the ISCC Plus certified Borneowables™ compounds using renewable-based feedstock meet growing demand for high-sustainability building and infrastructure pipe polymers. At the same time, they align with Borealis's EverMinds™ platform to promote and accelerate the transformation of the plastics industry towards circularity.

By offering more durable and reliable as well as circular pipe solutions, Borealis' step-change innovations continue to boost the sustainability of pipe networks by making them safer, leak free, longer lasting and more efficient, with installation costs reduced by up to 60% compared to traditional pipe materials.

Based on Borealis' European assets, its Middle Eastern joint venture Borouge as well as the American joint venture Baystar®, Borealis confirms its position as a partner of choice for global pipe customers, helping to meet the growing needs and requirements of the building and infrastructure industry today and in the future.

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