

## Technical data sheet

09/21 DNA  
Replaces 07/13 WSE

## Brandenburger Liner BB<sup>2.0</sup>

Brandenburger developed an innovative pipe lining procedure in the early 90s in order to optimally fulfil the high requirements for long-lasting sewer rehabilitation with a service life of at least 50 years using a method better than conventionally available. For this purpose, the materials used, the manufacturing process, the UV curing equipment as well as the rehabilitation process were optimally harmonized. The Brandenburger Liner BB<sup>2.0</sup> is a development with a different structure and in combination with high quality raw materials it provides a higher safety.

Liner characteristics*	Standard	Brandenburger Liner BB <sup>2.0</sup>
(Circumference) modulus of elasticity, short-term	EN 1228	8.700 N/mm <sup>2</sup>
(Circumference) modulus of elasticity, long-term	EN 1228	5.600 N/mm <sup>2</sup>
Modulus of elasticity in bending, short-term	ISO 178	8.000 N/mm <sup>2</sup>
Modulus of elasticity in bending, long-term	ISO 178	5.160 N/mm <sup>2</sup>
Material group	DWA-M 144-3	12
Density	ISO 1183	1,45 g/cm <sup>3</sup>
Short-term bending stress	ISO 178	150 N/mm <sup>2</sup>
Long-term bending stress	ISO 178	95 N/mm <sup>2</sup>
Long-term reduction factor (50 years)	EN 761	1,55

\* according to general technical approval of the "Deutsches Institut für Bautechnik (DIBt)" in Berlin (approval no. Z-42.3-490 from 20.09.2021)

### Diameter / Wall thickness

Circular profile: DN 200 – DN 800  
Oval profile: 200/300 – 600/900

The Brandenburger Liner BB<sup>2.0</sup> is ordered from Brandenburger Liner GmbH & Co. KG by the executing company with the required properties based on static measurements. In the Landau plant, the liner is then manufactured with an average wall thickness appropriate for the stress load conditions. The values of the wall thicknesses are averages due to the wrapping technology.

## Support characteristics

The Brandenburger Liner BB<sup>2.0</sup> takes up the load with the existing pipe. The pipe is measured and the liner dimensioned for the respective application. Statistical calculations need to be oriented to the respective old pipe condition for the corresponding rehabilitation cases.

## Material verifications

The GFRP liner is manufactured endlessly, ready-for-installation, protected inside as well as outside by special foils and packed in a UV-proof foil. As a standard, lengths of up to 300 meters are manufactured.

By using individual materials, the DIN 16869, part 2 ("Pipes made of glass-fibre reinforced polyester resin – UP-GF") is followed.

### a) Material verifications for resin:

Light-curing resins are used:

An unsaturated polyester resin (UP) and a vinyl ester resin (VE), featuring a special UV-light initiator, which effects the curing. Its light curing characteristics are measured according to a test procedure especially developed for that. The reaction resin mass is manufactured in a production method specially developed by Brandenburger for that and thus the impregnation can be used especially evenly.

### UV light-curing resins

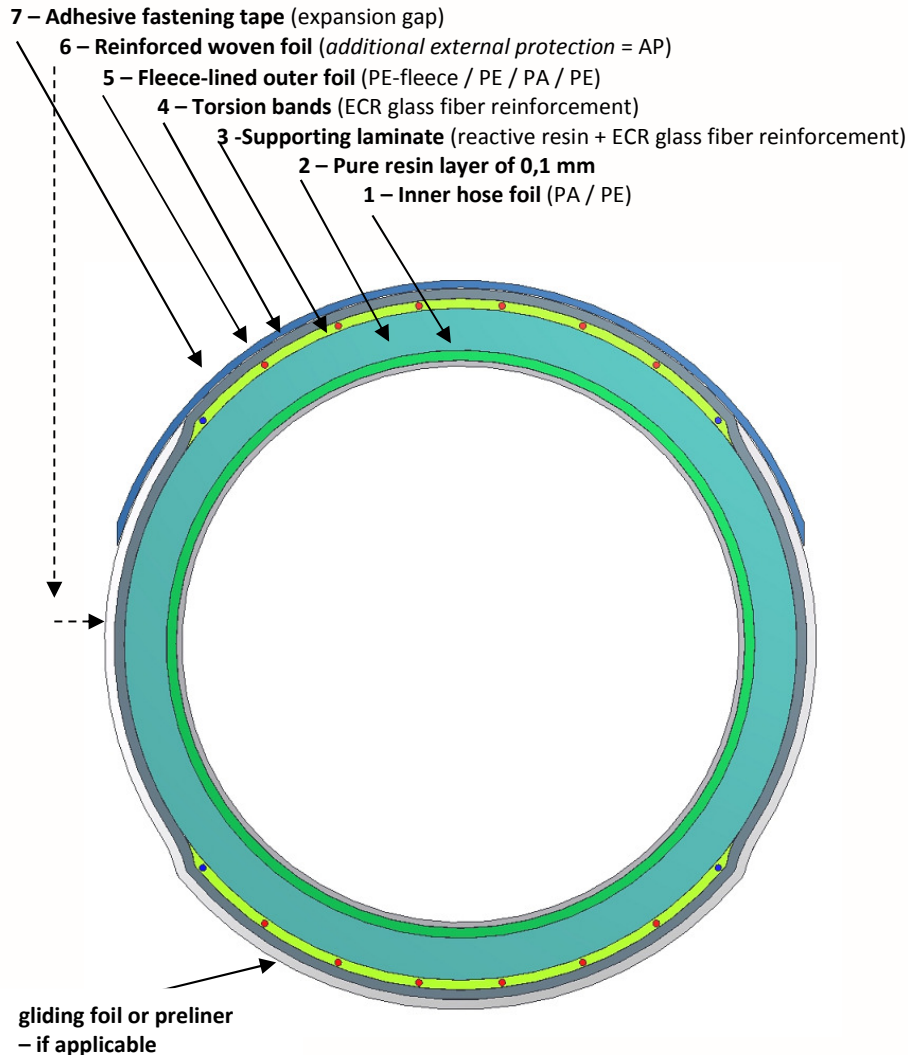
(selected resin characteristics):

Resin	UP resin
Type acc. to DIN 16946	1140
Group acc. to DIN 18820 part 1	3
acc. to EN 13121	4
Density	1.1 g/cm <sup>3</sup>
Glass transition temperature DIN 53445	140°C
Resin Young modulus DIN 53457	4000 N/mm <sup>2</sup>

UP resins with classification into lower groups as Gr. 3 show lesser chemical resistances. UP resins with lesser type classification provide lesser bending and tensile strengths as well as heat dimensional stabilities.

### b) Material verification for reinforcement material

A laminate is used that is based on a glass fiber composite specially produced for this. It features a pure resin layer of 0.1mm and an exceptional glass fiber mat. According to EN 14020 is the chemically high-grade textile glass fiber quality Advantex with a surface density of about 600 g/m<sup>2</sup>. The Brandenburger Liner BB<sup>2.0</sup> features no seams as it is seamlessly wound with the glass fiber composite laminates in a process especially developed and patented for that.

**GFRP-liner-structure: seamless construction**
*Version 2: with additional external protection*


The Brandenburger Liner BB<sup>2.0</sup> produced as a standard has an additional external protection from the diameter DN 600 (reinforced woven foil + adhesive fastening tape; version 2). Depending on the condition of the old pipe this additional external protection could be used as a gliding foil or as a full preliner.

The Liner with a dimension less than DN 600 will not get the additional external protection (no. 6 + 7) and a gliding foil or a full preliner has to be used. The additional external protection can be ordered as an option up to a nominal diameter DN 600.

**c) Protective foils**

The Brandenburger BB<sup>2.0</sup> liner is manufactured including the outer and inner protective foils:

- Inner foils/calibration hose, polyamide (PA) / polyethylene (PE) composite foils, foil hose is removed again after the completed curing, styrene-proof.
- 1st outer foil, exterior as flat foils welded on the side, UV-light protection, polyamide (PA) / polyethylene (PE) composite foils, styrene-proof. The outer foil protects the liner against water infiltration in the sewer.
- 2nd outer foil, from DN 600 additional external protection against mechanical damage.

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### d) Resistance against chemical attacks as well as high (sewage) temperatures (acc. to ATV M 143-3; DIN 18820-1)

For impregnation of the Brandenburger Liner BB<sup>2</sup> an UP resin (type 1140, DIN 16946 and group 3, DIN 18820) is used, which fulfils the high resistance required for the municipal sewage according to DIN 19550. In case of highly aggressive sewage as well as constant higher temperatures (> 30 °C up to about 70 °C), a special resin (vinyl ester resin) can be used. (An overview concerning selective chemical resistances towards various substances can be sent on request.) In each single case, the chemical durability resistance of the resin type needs to be tested by individual water analysis.

#### Test verifications:

Chemical resistance in accordance with DIN ISO 175 (test result: Ing.-Büro Siebert, Oststeinbek)

### e) Mechanical abrasion resistance

The verification of a resistance towards stress from high-pressure rinse cycles was provided by the tested GFRP pipe liner (acc. to *expert report 1347671 dated 14.05.2013* Siebert + Knipschild GmbH Oststeinbek):

*Abrasion regarding to DIN EN 295-3 (Darmstädter Kipprinne) with additional high-pressure jetting test acc. to DIN 19523-1.*

- The result of the abrasion test was successfully carried out with up to 100,000 stress reversals and an abrasion of 0.07 mm
- High-pressure jetting test was successful with a pure resin layer

### f) Inspection for leakage

The leakage test is carried out upon completed curing acc. DIN EN 1610. It can be carried out with the medium air as well as with the medium water.

### g) Liner transport and storage

The liner is packed by standard in robust wooden packaging, if necessary, with intermediate layers of packaging, and UV-proof. It can be shipped by ground transport as well as by air or sea freight. The liner is approved for transport by the IATA.

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The manufactured UP resin liner is suitable for storage up to 12 weeks at storage temperatures between + 5°C and + 30°C and at storage temperatures between +12°C and +20°C up to 26 weeks from the date of production.

In case of any warranty claims the storage conditions must be fully and verifiably adhered to.

The minimum installation temperature measured at the laminate for liners is +15 °C. If required, you may need to heat up the liner up to +15°C measured at the laminate. The laminate temperature at the start of the installation procedure is to be documented in the installation log.

Depending on the type of vehicle, loading equipment may be required on-site. Waste containers should be provided for the disposal of any construction debris.

Determine a suitable location to store the liner and park the rehabilitation vehicles before performing the rehabilitation.

The resin mixture for the UV liner contains photoinitiators that enable curing of the liner with UV light. These initiators also react to normal ambient light and are temperature sensitive. The external foil protects the liner from UV rays of the ambient light and should not be removed or damaged. Should it be damaged, the foil should be patched with a light and moisture-impermeable adhesive tape so, that neither UV-light nor water and other liquids get to the liner.

### h) Installation advantages:

- The GFRP liner is delivered ready for installation.
- The liners are shipped worldwide by air, sea, or truck freight.
- The inner surfaces of the liner are exceptionally homogenous/smooth, good optical characteristics. This allows for a high flow rate of the sewage.
- Very good radial expansibility of the glass mat composite.
- The high strength makes the use of thinner wall thicknesses possible in comparison to conventional pipe liners and, therefore, a lesser weight of the GFRP liner. This makes handling at the construction site so much easier.
- Based on specially-developed resin system, a controlled and the fastest curing speed (curing speeds up to 2m/min).

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## Brandenburger Liner BB<sup>2.0</sup>

### i) Quality control

Brandenburger Group's international competitiveness is based on the innovation activities and its own high-quality standard. Our group has been certified acc. to DIN EN ISO 9001:2008 and this quality policy is understood and followed at all levels and by all employees. The focus of every process is the product safety for our customers, the safety for our employees and for the environment.

All the products of the Brandenburger Group are produced under the quality management system of 1994 certified by the TÜV Rheinland regarding to DIN EN ISO 9001:2008 with international validity. Furthermore, the Brandenburger Liner BB<sup>2.0</sup> will be produced under the strict rules of our quality management system to guarantee our customers' quality standards.

Subject to changes due to technical progress. The listed data are guidelines only and not contractually guaranteed.

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