

Brandenburger Liner BB^{2.5} FLEX

1. Technical data

according to the general approval of the German Institute for Building Technology (DIBt) in Berlin [approval number: Z-42.3-490 dated 15.09.2022]

Material properties	Standard	DN 150 - DN 875	DN 875 - DN 1600
Short-term circumference-e-module	EN 1228	14,200 N/mm ²	16,875 N/mm ²
Long-term circumference-e-module	EN 1228	11,180 N/mm ²	13,288 N/mm ²
Short-term bend-e-module	ISO 178	11,800 N/mm ²	13,600 N/mm ²
Long-term bend-e-module	ISO 178	9,290 N/mm ²	10,708 N/mm ²
Material code group	DWA-M 144-3	22	26
Density	ISO 1183	1.54 g/cm ³	1.54 g/cm ³
Short-term bending stress	ISO 178 ISO 11296-4	200 N/mm ²	200 N/mm ²
Long-term bending stress	ISO 178 ISO 11296-4	157 N/mm ²	157 N/mm ²
Long-term reduction factor (50 years)	EN 761	1.27	1.27

2. Diameter/wall thickness

Circular profile: DN 150 - DN 1600

Oval profile: DN 200/300 - DN 1200/1800

The Brandenburger Liner **BB^{2.5} FLEX** is ordered by the executing company from Brandenburger Liner GmbH & Co. KG according to specified requirements based on structural design. At the Landau plant, the liner is manufactured with an average wall thickness that meets the static specifications. The wall thicknesses are average values due to the winding technology.

The wall thickness after installation results from the initial wall thickness, the expansion during installation and the volume constancy. The design of this individualised product is to be defined in close consultation with our sales department.

3. Load-bearing behavior

The Brandenburger Liner **BB^{2.5} FLEX** takes the loads with the existing pipe. The pipe is measured along its entire length and the liner is dimensioned for the respective application. Structural calculations for the corresponding rehabilitation cases are to be based on the respective old pipe condition.

4. Material certificates

The GRP liner is produced endless, ready for installation, protected inside and outside by special air-tight and water-tight films and packed in a UV-proof film.

DIN 16869, Part 2 "Pipes made of glass-fibre-reinforced polyester resin (UP-GF)" is taken into account when using the individual materials.

5. Material certificate for resin

Unsaturated polyester (UP) or vinyl ester (VE) resin equipped with a UV-light initiator that causes curing. The reactive resin compound is produced in a processing method developed by Brandenburger for this purpose, so that it can be used for exceptionally uniform waterproofing.

UV light-curing resins

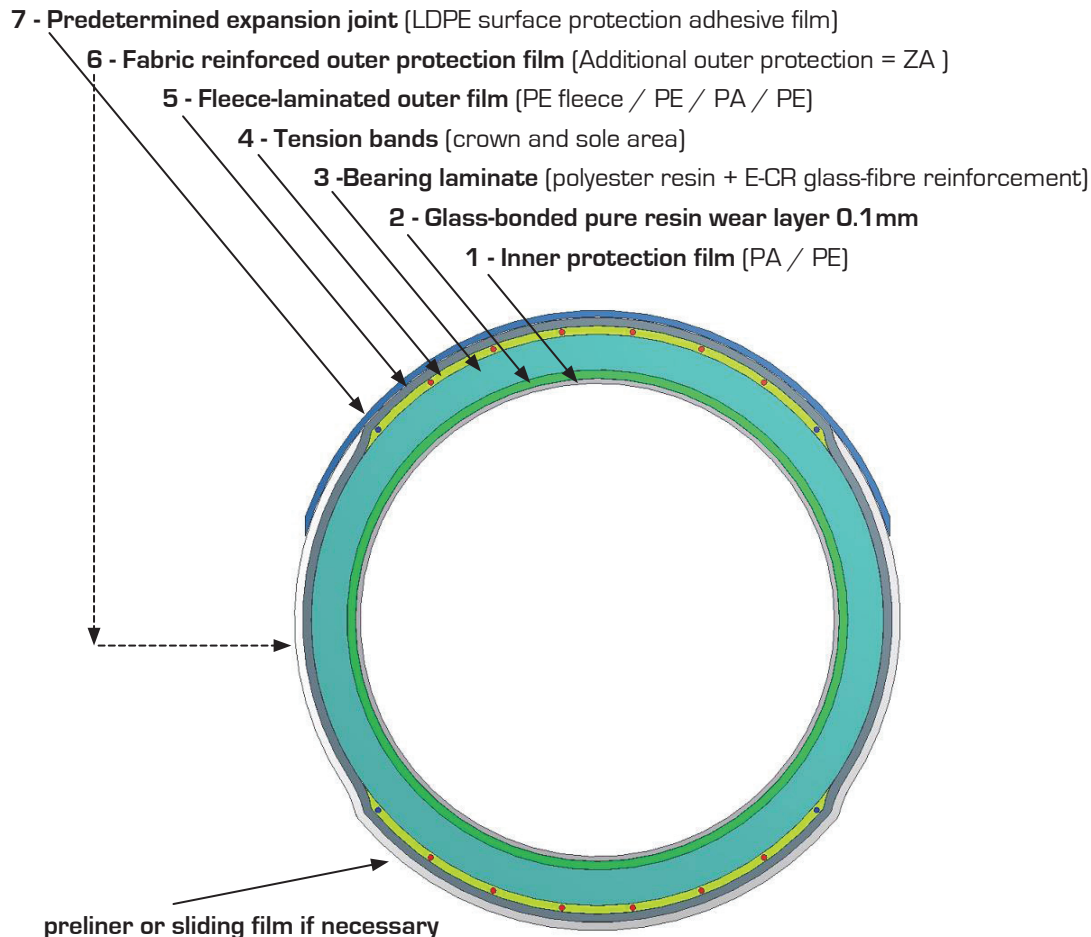
[selected resin properties]:

Resin	UP resin	VE resin
Type acc. to DIN 16946	1140	1310
Group acc. to DIN 18820 part 1 acc. to EN 13121	3 4	5 7A
Density	1.1 g/cm ³	1.1 g/cm ³
Glass transition temperature DIN 53445	140°C	132°C
Resin E-module DIN 53457	4000 N/mm ²	3700 N/mm ²

6. Material certificate for reinforcing material

A laminate of a specially developed glass-fibre complex is used, which has a glass-bonded pure resin wear layer of 0.1 mm and an extraordinary glass structure part. In accordance with EN 14020, the chemically high-quality textile glass-fibre quality Advantex® with a basis weight of approx. 730 g/m² is used. The Brandenburg Liner **BB^{2.5} FLEX** has no seams, as it is bonded **seamlessly** to the glass complex laminates in a specially developed patented process.

GRP inliner structure: seamless design
with additional outer protection



The Brandenburger Liner **BB^{2.5} FLEX** is manufactured with additional outer protection (fabric-reinforced outer protection film + predetermined expansion joint) as standard from a nominal width of DN 600. Depending on the condition of the old pipe to be rehabilitated, this additional outer protection can serve as an integrated sliding film.

For nominal diameters up to DN 600, points 6 + 7 are omitted and a sliding film must be used. Up to nominal size DN 600, the additional outer protection can be ordered as an option.

7. Protection films

The Brandenburger Liner **BB^{2.5} FLEX** is manufactured including the outer and inner protective films:

- The styrene-resistant inner film/calibration tube, (polyamide (PA)/ polyethylene (PE) - composite film), is removed again after curing.
- The fleece-laminated outer film is UV-proof and styrene-proof as a laterally welded flat film. The outer film protects the liner against water penetration in the channel.
- The fabric-reinforced outer protection film, from DN 600 serves as additional protection against mechanical damage to the fleece-laminated outer film.

8. Resistance to chemical attack as well as high (wastewater) temperatures (acc. to ATV M 143-3; DIN 18820-1)

For waterproofing of the Brandenburger Liner **BB^{2.5} FLEX**, a UP resin (type 1140, DIN 16946 and group 3, DIN 18820) is used, which meets the high required resistance to municipal wastewater according to DIN 19550. In the case of very aggressive wastewater as well as higher continuous temperatures (> 30°C to approx. 70°C) a vinyl ester resin can be used. (An overview regarding selected chemical resistances to a wide range of substances is available on request) In each individual case, the chemical durability of the resin type must be checked by means of individual water analysis.

9. Mechanical abrasion resistance

Proof of resistance to stresses caused by high-pressure rinsing cycles was provided by the tested specimen (acc. to Test report

1347671 dated 14.05.2013 Siebert + Knipschild GmbH Oststeinbek):

Abrasion behavior according to DIN EN 295-3 (Darmstadt tipping trough) with subsequent testing of the high-pressure flushing resistance according to DIN 19523 method 1 (materials testing).

- Result according to DIN EN 295-3 with 100,000 load cycles, abrasion depth of 0.07 mm
- Result according to DIN 19523, method 1 (material testing), internal resin-rich Layer present - high pressure flush resistance passed.

10. Leak test

The leak test is carried out after curing according to DIN EN 1610. It can be performed with air as well as with water as the medium.

11. Transportation of the liners and their storage

The liners come standard with sturdy wooden packaging and are packed in a UV-proof film. If necessary, intermediate packing layers are used. They can be shipped both on the ground by shipping agencies and by air or sea freight. The liner is approved for transport by IATA. The UP resin liner can be stored at a temperature between +5°C and +30°C for up to 12 weeks and at a storage temperature between +12°C and +20°C for up to 26 weeks after the date of manufacture.

The VE resin liner can be stored between a minimum of +5°C and a maximum of +30°C for a maximum of 6 weeks and at a storage temperature of +12°C to +20°C for up to 12 weeks after the date of manufacture.

It is essential to note that the storage period begins from the moment of completion of the liner. Basically, it is recommended to store the liners in the wooden boxes in temperature-controlled warehouses until installation, as they must not be exposed to direct weather influences (sun, moisture, frost) and, if possible, to temperature fluctuations. Mechanical damage must be avoided under all circumstances. Deviations from the prescribed storage and transport conditions, may affect or prevent the durability of the liner and proper installation. In the course of any warranty claims, the storage conditions must be complied with completely and demonstrably.

It should also be noted that the storage temperatures do not correspond to the recommended installation temperatures. The minimum installation temperature measured on the laminate starts at +15°C. Before installation, the liners must be brought to the recommended minimum installation temperature.

12. Installation advantages

- The GRP liner is prefabricated ready for installation
- The **BB^{2.5} FLEX** is ideally suited for old pipes with variable cross-sections or dimension changes.”
- The liners are shipped worldwide by air, sea or truck freight
- Liner inner surface is exceptionally homogeneous/smooth, good appearance, thus resulting in high flow rate of wastewater
- Very good radial ductility of the glass mat complex.
- High strength allows the use of smaller wall thicknesses compared to conventional pipe liners and thus a lower weight of the GRP liner. This exceptionally improves handling on the construction site.
- Due to specially developed and adjusted resin system, controlled and fastest curing (compared to conventional pipe liners) is achieved.

13. Quality assurance

The Brandenburg group of companies owes its international competitiveness to its innovative strength and its own high standards for the products it manufactures. This is expressed in a lived quality concept and the successful certification according to DIN EN ISO 9001:2015. The focus of all processes is product safety for our customers as well as the safety of our employees and the environment.

The products of the Brandenburger group of companies are produced under the supervision of the quality management system implemented in 1994, which is certified by TÜV Rheinland according to DIN EN ISO 9001:2015 and has international validity. The Brandenburger Liner **BB^{2.5} FLEX** is also manufactured under strict supervision of these specifications, thus meeting the high-quality demands of our customers.

We reserve the right to make changes within the scope of further technical developments. The reference values listed in this data sheet are not contractual data.



Brandenburger Liner accepts no liability for the accuracy, completeness and actuality of the data transmitted.