

Bentonit under an electron scanning microscope

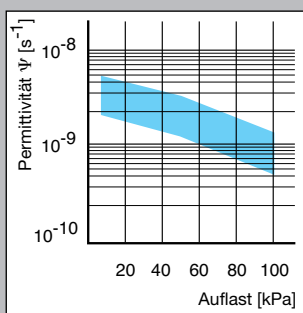
NaBento® is a geosynthetic clay liner (GCL), in which a sandwich-type composite of only around 10 mm thickness contains a high quality bentonite between various geotextile layers.

A large percentage of the bentonite used comprises a three-layer clay mineral - montmorillonite.

▶ **The properties of NaBento®**

Montmorillonite is a clay mineral with a potential to swell due to its large surface area of 800 m²/gramme. During hydration water molecules become locked between and within the clay particles - the bentonite swells and increasingly reduces the movement of water.

Bentonite encapsulation within the **NaBento®**- GCL combined with loading from the construction and swelling due to hydration leads to a low permeability clay layer.



Water permeability reduces with increasing load.

In many situations a permeability value of around 5×10^{-9} 1/s is acceptable when replacing conventional mineral lining with a **NaBento®**-GCL.

NaBento® Geosynthetic Clay Liner - a powerful combination of nature and technology!

NaBento® can replace a conventional impermeable mineral lining much more safely and economically.



NaBento®- installation in a landfill construction

Basic advantages of geosynthetic clay liner:

- ▶ **NaBento®** installation is simple and largely independent of weather.
- ▶ **NaBento®** being a thin sealing layer reduces earthwork time and provides more landfill space.
- ▶ **NaBento®** is less sensitive to settlement than conventional mineral lining.
- ▶ **NaBento®** can easily be repaired should there be subsequent damage.
- ▶ **NaBento®** being factory-made is a consistent, quality controlled product.
- ▶ A safe and cost-efficient alternative.

NaBento® offers in addition:

▶ long-term consistent permeability value by using sodium- or calcium bentonite, according to the type of applications

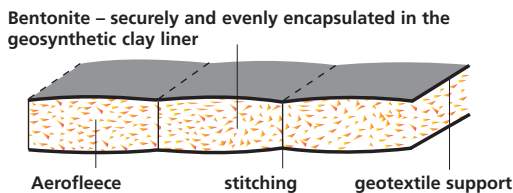
For most applications GCLs are filled with sodium bentonite. The advantage is an extremely high swelling capacity of sodium bentonite. This guarantees a durable sealing also with low surcharges and with permanent water pressure.

Sodium bentonite generally over time is converted through ion exchange into calcium bentonite, when in contact with naturally occurring soils. This can result into an increase of the permeability. To avoid this process and to reduce the shrinkage tendency of sodium bentonite HUESKER can offer **NaBento®** manufacture from calcium bentonite.

▶ long-term high internal shear strength

The special stitching of all components guarantees a constant, high internal shear strength.

To ensure a shear-resistant composite, the supporting geotextiles containing aerofleece and bentonite are held together by a positive stitching system.



The optimal combination of support and cover geotextiles, stitching and aerofleece within the bentonite guarantees the consistently high internal shear strength of **NaBento®**, thereby making it possible to achieve the stable lining of steep embankments up to 1:1.75 (~ 30°) without internal failure of the **NaBento®**.

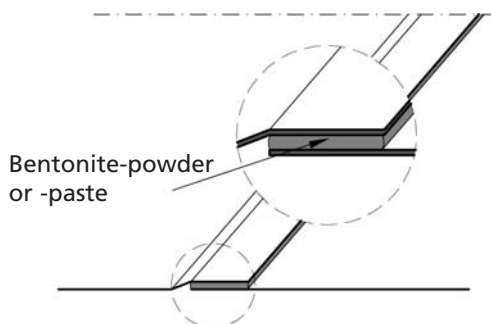
▶ long-term high external shear strength

NaBento® RL-N and **NaBento® RL-C** have a special surface coating, which provides an increased shear (friction) value with adjacent materials.

▶ optimised overlapping

The overlapping of **NaBento®** GCLs can be adapted in a project-specific manner.

- The standard approach involves either bentonite powder or paste being applied in the overlap zone.
- To simplify and, in particular, speed up installation, a bentonite layer can be factory-applied to **NaBento® RL-N** / **NaBento® RL-C**. A longitudinal overlap can be easily made easily by rolling the GCL onto the edge of a previously installed material. Additional application of bentonite powder or paste is then unnecessary.
- If a tension-proof, shear-resistant overlap is required, a special adhesive can be provided.



Overlapping options:

- Sealing of the overlap with bentonite
- Sealing of the overlap by means of a factory-applied bentonite layer
- Sealing with special adhesive applied to the overlap zone to achieve a tension-proof and shear-resistant joint.

▶ improved dessication protection

Due to the special coating of the external surfaces **NaBento® RL-N** and **NaBento® RL-C** are less sensitive to dessication than other bentonite liners. A stable permeability value is thus assured.

► transverse shrinkage

Uncoated, needle-punched GCLs are more sensitive in exposed conditions to transverse shrinkage than coated **NaBento®**.

► flexible manufacturing

NaBento® is manufactured in modern manufacturing plants. In addition to the standard types, well-proven in practice, GCLs can be specially made to meet your requirements.

With the availability of other polymers, higher density components and the integration of additional geosynthetic / geotextile materials, the properties of **NaBento®** can be adapted more specifically to your local conditions.

► guaranteed quality

Quality starts with the technical design of **NaBento®** and the selection and coordination of the components. The properties are guaranteed through strict inspection; from the receipt of bentonite to the final geotextile components. During manufacture, weight and thickness are controlled constantly.

All decisive mechanical and hydraulic parameters, especially the permittivity Ψ , are guaranteed by consistent internal and external monitoring. The external monitoring is performed regularly by independent, recognised testing institutes.

The product properties of **NaBento®** go beyond those required for the conventional use. Professional engineers and cooperation with our customers also introduce future product innovations. True to our motto: Geosynthetics made by HUESKER – reliability from experience!



Regular quality control: Internal and external monitoring by recognised institutes is the normal procedure.

NaBento® – standard variants are differentiated by bentonite type

► bentonite (sodium = N, calcium = C) ► and surface properties (R = rough)

After extensive testing arising from individual requirements, we are ready to advise you, as to which **NaBento®** GCL is most suited for your project.

Summary of technical data for standard NaBento® GCL products

	Typ RL-N	Typ L-N	Typ RL-C	Typ L-C
Bentonite type	Natural or activated sodium bentonite	Natural or activated sodium bentonite	Natural calcium bentonite	Natural calcium bentonite
Bentonite content	4,500 g/m ²	4,500 g/m ²	10,000 g/m ²	10,000 g/m ²
Geotextile layer	coated	not coated	coated	no coated
Geotextiles – support/cover	PP as raw material	PP as raw material	PP as raw material	PP as raw material
Permittivity	< 5 x 10 ⁻⁹ 1/s	< 5 x 10 ⁻⁹ 1/s	< 7 x 10 ⁻⁹ 1/s	< 7 x 10 ⁻⁹ 1/s
GCL width	3,6 m 5,10 m	3,6 m 5,10 m	3,6 m 5,10 m	3,6 m 5,10 m
GCL length	30 m - 40 m	40 m	20 m	20 m
Overlaps	seal joints with bentonite powder / paste or a special adhesive			

The product properties detailed above are based on certified results obtained using appropriate EN/ISO test methods.

NaBento® - the versatile liner for technical applications. . .



Landfill construction

- ▶ Capping landfill sites
- ▶ Mineral lining improvement



Hydraulic engineering

- ▶ Settling lagoons
- ▶ Lining of dams and ditches



Road and railway construction

- ▶ Lining for groundwater protection

...as a reliable and economical solution!



Landfill capping with NaBento®



Settling lagoons - Lining with NaBento®



River-bed lining with NaBento®



Groundwater protection on a road scheme



Railway lining with NaBento®

