

# CEMtobent® CS-Plus

## Sealing System

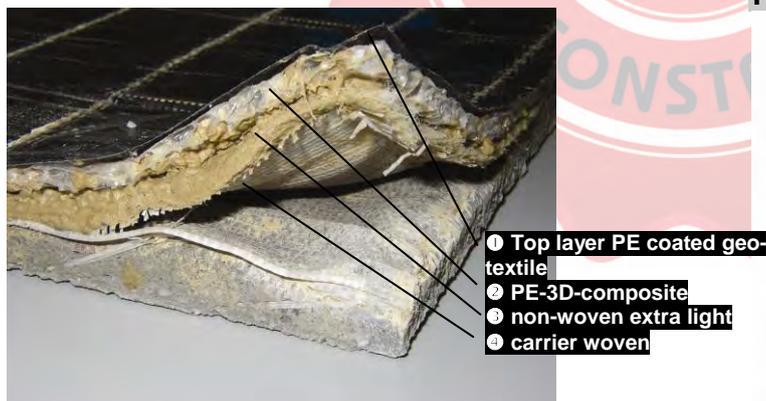
### Product

CEMtobent lining system replaces all conventional waterproofing methods used in civil engineering, such as bituminous materials, coatings and synthetic foils of all kinds. The innovative manufacturing technology differentiates CEMtobent Lining System from similar products, which also use PE and bentonite as waterproofing agents. CEMtobent CS-Plus is a unique bentonite membrane especially created for structural waterproofing! CEMtobent CS-Plus is radon tight and the black PE-coated woven is UV-resistant and root-resistant!

### CEMtobent CS-Plus (CombiSeal)

CEMtobent CS-Plus is a waterproofing system, which consists of three complementary components:

- the primary liner: a high-quality (GCL) geocomposite clay liner
- the secondary liner: a 3D composite (PE honeycomb) with a unique cell structure where the swelling sodium bentonite powder is encapsulated.
- The third liner: a strong polyethylene (PE) coated geotextile (root-resistant / radon tight)



The self-healing properties of the bentonite secure the integrity of the system in the case that the PE-coating is damaged during installation. Penetrating water causes the bentonite to hydrate and thus renders the GCL impermeable. The building structure is permanently protected against penetrating water, even small cracks and voids in the concrete are sealed. CEMtobent is a highly effective waterproofing composite of high strength geotextile and 5 kg of natural activated sodium bentonite powder per square metre. The high swelling, low permeable activated natural sodium bentonite is encapsulated

between a non-woven and a 3-dimensional PE sheet. A patented mechanical connection interlocks the geotextiles together forming an extremely strong composite that maintains the equal coverage of bentonite as well as protects it from inclement weather and construction related damage.

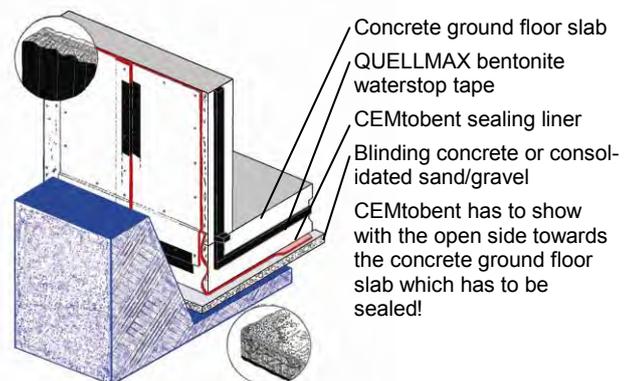
CEMtobent has a unique rain-protection layer and has one open and one completely closed side. This feature allows the use of CEMtobent also in areas where fluent groundwater levels are expected.

Once backfilled, CEMtobent hydrates and forms a monolithic waterproofing membrane. CEMtobent can be installed in any weather condition to green concrete, and most importantly, has proven effective on both new and remedial waterproofing projects worldwide. CEMtobent works by forming a low permeability membrane upon contact with water. When wetted, unconfined bentonite can swell up to 8 - 12 times its dry volume.

When confined under pressure the swell is controlled, forming a dense, impervious waterproofing membrane.

The swelling action of CEMtobent can seal small concrete cracks caused by ground settlement, concrete shrinkage, or seismic action; problems over which there is normally no control. CEMtobent forms a mechanical bond to concrete when the geotextile is encapsulated into the surface of poured-in-place concrete.

### Function of the System



No protection layer (protection concrete) has to be on top of the CEMtobent sealing liner. The construction concrete should have direct contact with the open side of the CEMtobent sealing liner.

### Advantages of CEMtobent

#### • Tough and resistant

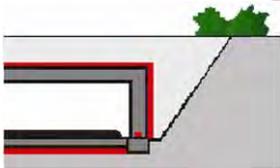
Higher puncture and tear resistance compared to conventional foils and coating.

- **Quick and easy to install** without complicated welding equipment and specially trained staff, double lining in one step
- **High compound shear strength**  
The reinforcement fibre structure and thermally bonded cover layer form a tight composite
- **Can be installed in every season** independently of temperature and weather condition
- **Quality control tests** to ensure consistent high quality
- **Self-healing properties** by the pressure of the swelling bentonite. Seals small cracks in the concrete by the pressure of the swelling bentonite

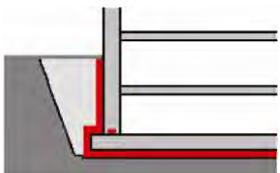
### Application

CEMtobent is designed for below-ground vertical and horizontal structural foundation surfaces. Typical applications include backfilled concrete walls, earth-covered roofs, structural slabs, tunnels and property line construction. Property line construction applications include secant and contiguous piling, skin wall, metal sheet piling, shotcrete and stabilized earth retention walls. Applications may include structures under continuous or intermittent hydrostatic pressure.

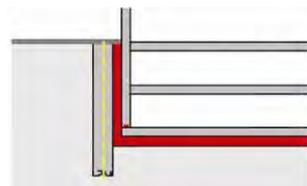
Where contaminated groundwater or saltwater conditions exist, use only CEMtobent CS-Plus with an extra PE-coated geotextile. This extra PE-coated geotextile is also a tested and approved root-resistant protection layer. In this particular case (saltwater contact) you have to pre-hydrate CEMtobent with regular tap water. CEMtobent is resistant to: nitrates, phosphates, chlorides, sulfates, lime and organic solvents.



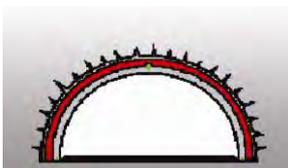
**Cut and cover tunnel construction**



**Foundations and other subsurface structures**



**Concrete piles and sheet piling**



**NATM tunnels (inner lining)**

### Installation in general

Install CEMtobent in strict accordance with the manufacturer's installation guidelines. Use accessory products as recommended. Also use CEMtobent CS-Plus as required for contaminated conditions.

CEMtobent CS-Plus is open on one side as well (regular geotextile) and completely closed on the PE-coated black side.

### Special Features

CEMtobent CS-Plus is root-resistant and is also radon-tight even under dry condition!

CEMtobent is tested up to 6 bar water pressure!

CEMtobent is a solution for high grade structural waterproofing!

CEMtobent is well tested in laboratories and also proven in practical use! Ask for references!

### Methods of Joint Adjacent Panels

- Overlapping (approx. 15 cm) and adding bentonite in seam area – additionally fixed to the concrete by nails.



- Overlapping (approx. 15 cm) and gluing with CEMstar adhesive.



- Overlapping (approx. 15 cm) and using the self-adhesive tape CEMtobent SealTape.



### Storage

Keep CEMtobent and all accessory products dry, with adequate polyethylene or canvas cover for sides and top. Block up or pallet material to prevent contact with ground surface water.

CEMtobent bentonite geosynthetic clay liner (GCL) is a unique, patented technology **made in Germany**.

**Technical Data CEMtobent CS-Plus**

Technical data	Test method (based on)	Unit	Value
Mass per unit area, total	DIN EN 965	g/m <sup>2</sup>	~5,500
Mass per unit area, non-woven extra light (PP white, filled with bentonite)	DIN EN 965	g/m <sup>2</sup>	60
Mass per unit area, honeycomb (PE-3-D-Composite, filled with bentonite)	DIN EN 965	g/m <sup>2</sup>	70
Mass per unit area, bentonite layer (sodium bentonite, powder)	DIN EN 965	g/m <sup>2</sup>	5,000
Mass per unit area, carrier woven (PP-slit film woven, beige)	DIN EN 965	g/m <sup>2</sup>	120
Mass per unit area, top layer woven (PE-coated woven, black)	DIN EN 965	g/m <sup>2</sup>	200
Thickness, total	DIN EN 964-1	mm	≥ 8
Max. tensile strength, md / cmd*	DIN EN ISO 10319 ASTM-D-4595	kN/m	30 / 25
k-value	DIN EN ISO 18130 ASTM-D-5887	m/s	2 x 10 <sup>-15</sup>
Roll dimensions, width x length	--	m x m	1.80x30 3.60x30

\*md = machine direction, cmd = cross machine direction

**Bentonite properties, sodium bentonite**

	Test method (based on)	Unit	Value		Test method (based on)	Unit	Value
Montmorillonite content	XRD	%	≥ 70	Water absorption	DIN 18132(24 hrs)	%	≥ 500
Methylene blue consumption	Methylene blue test, VDG P 69	mg/g	≥ 200	Swell index	ASTM-D-5890	ml/2g	≥ 20
Water content	DIN 18121 (5 hrs, 105 °C)	%	≤ 15	Fluid loss	ASTM-D-5891	ml	< 20

**CEMtobent® CS-Plus**

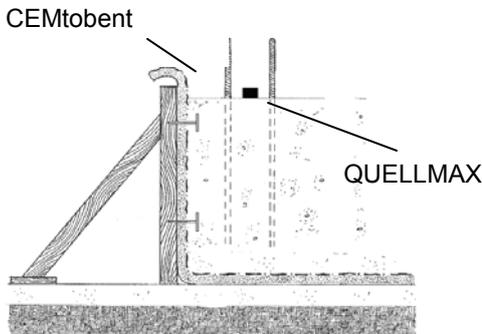
The above mentioned technical values are average values over the roll width. These data are guiding values achieved in laboratories and/or independent testing institutes. Our products can be subject to changes without prior notice.

The data published in this leaflet are to the best of our knowledge true and correct. They may be changed at any time without notice. No warranty or liability is expressed or implied.

**CEMtobent CS-Plus** is an official trademark of CEMproof AG Switzerland.

# Installation Guideline of CEMtobent®

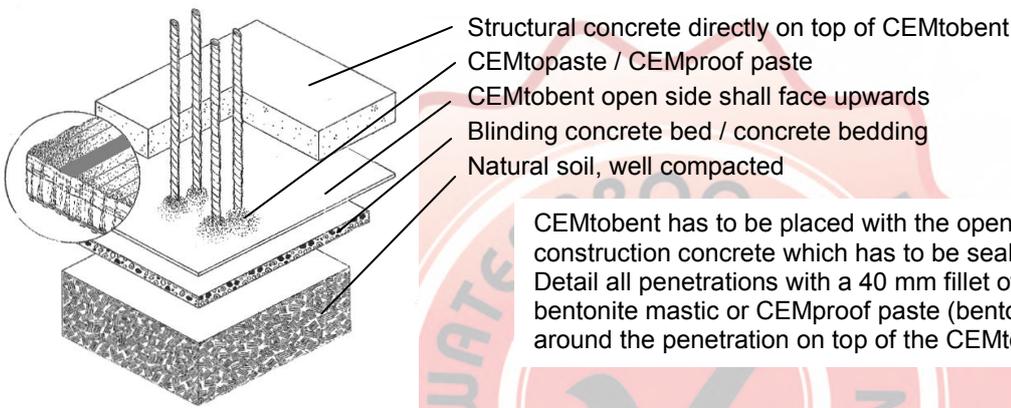
For CEMtobent DS/CS



Place CEMtobent over the properly prepared concrete bedding / blinding concrete bed with the dark grey stripe (CEMtobent DS) or with the beige open side (CEMtobent CS-Plus) facing towards the structural concrete to be waterproofed!

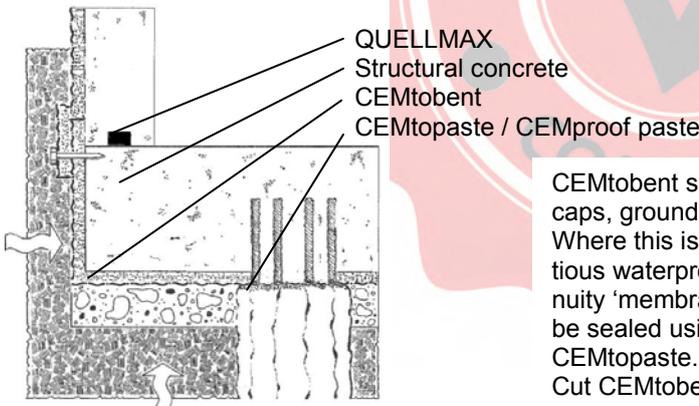
Overlap all adjoining edges a minimum of 100 mm and stagger ends to a minimum of 300 mm. Staple or nail edges together as required to prevent any displacement before and during concrete pouring.

Apply a layer of CEMproof bentonite powder/paste or better CEMtopaste bentonite paste between overlaps.



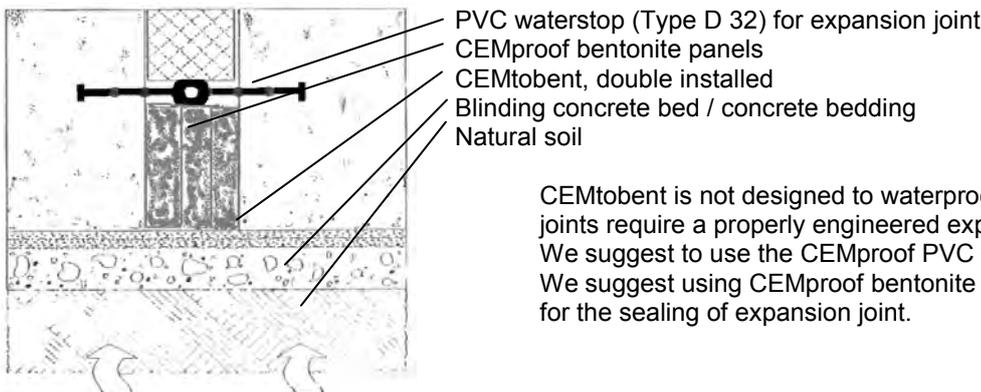
CEMtobent has to be placed with the open side facing towards the construction concrete which has to be sealed!

Detail all penetrations with a 40 mm fillet of CEMtopaste, special bentonite mastic or CEMproof paste (bentonite powder & water) around the penetration on top of the CEMtobent.

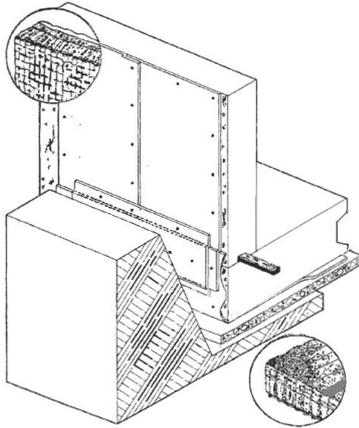


CEMtobent should not extend into foundation bearing planes (i.e. pile caps, ground beams, pads, etc.) but should completely envelop them. Where this is not possible/desirable, CEMdicht 3 in 1 mortar (cementitious waterproofing by crystallisation) or similar can be used as a continuity 'membrane' through the bearing plane, to which CEMtobent can be sealed using a 100 mm lap, incorporating a 5x50 mm fillet of the CEMtopaste.

Cut CEMtobent to provide a snug fit around all applicable penetrations (pipes, piles, etc).



CEMtobent is not designed to waterproof expansion joints. Expansion joints require a properly engineered expansion joint sealant product. We suggest to use the CEMproof PVC waterstops for expansion joint! We suggest using CEMproof bentonite panels as an additional security for the sealing of expansion joint.

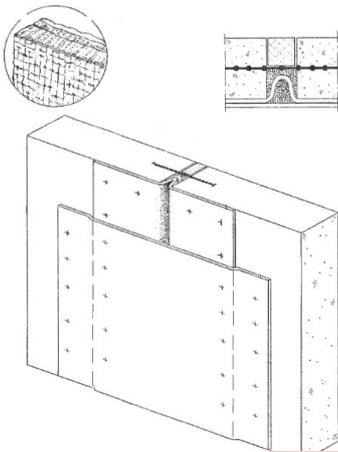


CEMtobent can be applied to formed walls in two ways: Mechanically fastening to cast concrete just prior to backfilling (post-applied), or alternative by utilizing the adhesion properties of the CEMtobent (pre-applied on the formwork before concreting).

Honeycombing or other indentations should be repaired before installing any CEMtobent bentonite liner (post-applied / standard).

Fix CEMtobent by using approx. 1 up to 2 shot-fired 'softwasher' per square meter vertical wall installation (post-applied)!

For Tunnel Construction Sealing please see extra installation manual / installation guidelines!

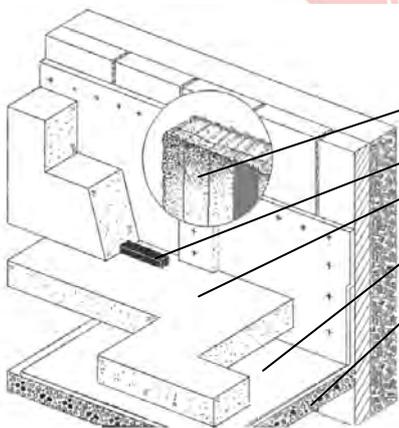


CEMtobent must always be installed with the open side facing to the concrete which has to be sealed!

Expansion joints have to be sealed with an additional expansion joint waterstop!

Cold joints have to be sealed with QUELLMAX bentonite waterstop tape or with PREDIMAX injection hose system!

Terminate CEMtobent at DPC level! Apply a fillet of CEMtopaste, place CEMtobent using fitting rail, cover joint with CEMtopaste, and close joints with tape (SealTape). Extend DPC level at least 150 mm over this point.



Open side facing to the structural concrete

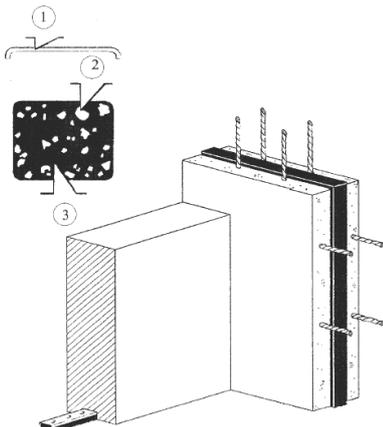
QUELLMAX

Structural concrete, should be placed directly on top of CEMtobent

CEMtobent, open side should face to the concrete

Natural soil, well compacted

Where CEMtobent is terminated below DPC level you shall coat the wall with a waterproof coating at least to DPC level.



QUELLMAX is a simple and secure solution for all kinds of construction joint sealing! QUELLMAX Plus is available with a unique rain-protection coating!

# Installation Guideline of CEMtobent

## For CEMtobent DS/CS

### Notes

#### System Description

CEMtobent is recommended for use under structural reinforced concrete 250 mm thick or greater. Concrete should be well compacted and of the highest quality, the use of well-compacted concrete is recommended. Please contact our Technical Department for further information.

#### Surface Preparation

The surface must be properly prepared before CEMtobent is installed. Honeycombing or other indentations should be repaired. Detail all penetration etc. as per method statement.

Form-tie holes should be detailed with a stripe of CEMswell hydrophilic rubber (Ø 23 mm) inserted into the centre of the hole and covered with a minimum of 80 mm non-shrink grout.

#### DPC Level

CEMtobent is designed for below ground structural waterproofing and should not extend above DPC level. We recommend Soil Testing should be carried out before choosing waterproofing system i.e., CS or DS and that Site Groundwater should be controlled before and during application of membrane and until concrete is fully cured.

The following are our preferred application methods to ensure a watertight seal at this point.

If the CEMtobent is to terminate close to the DPC level:

Apply a fillet of CEMtopaste to the wall, place CEMtobent over this fillet by using a fitting rail, fix into position with shot-fired fixings, close the joint with a layer of SealTape or CEMflex Elasto-Tape.

Ensure the termination point of the CEMtobent is overlapped by at least 150mm by the DPC.

If the CEMtobent is to be terminated some distance from the DPC level:

Apply a fillet of CEMtopaste to the wall, place CEMtobent over this fillet by using a fitting-rail, fix into position with shot-fired fixings, close the joint with a layer of SealTape or CEMflex-Elasto-Tape. CEMdicht 3 in 1 (cementitious waterproofing by crystallisation) has to be used as a continuity “membrane” up to the DPC level. The DPC should overlap this coating by at least 150 mm.

#### Backfilling

Backfill with clean well-compacted soil (compacted every 30 cm) that are free from construction debris. Do not use stones or rocks that are larger than 50 mm. Backfill material shall be compactable soils and free of construction debris. Backfill shall be clean, well-graded, and compacted every 300 mm to 90 % modified proctor (as defined by ASTM 1557), and meet these general specifications:

- No rocks, stones or boulders larger than 50 mm
- 90 % minimum soil particles smaller than 5 mm
- 10 % maximum soil particles finer than 74 micron (200 mesh)

#### Disclaimer:

BPA-GmbH endeavour to ensure all products supplied are to the highest standards and that advice and information given is accurate and correct. However, as BPA-GmbH have no control over the application of the product(s). Accordingly, no liability will be accepted by BPA-GmbH.

# CEMproof® CEMtobent Bentonite Lining System in the Field

CEMtobent is a multifunctional bentonite-double sealing membrane to seal concrete construction!



Neufeldtunnel Bern, Switzerland



Seewinkeltherme Frauenkirchen, Austria



Hotel Mercure Budweis, Czech Republic



Mutual savings bank Bratislava, Slovakia

