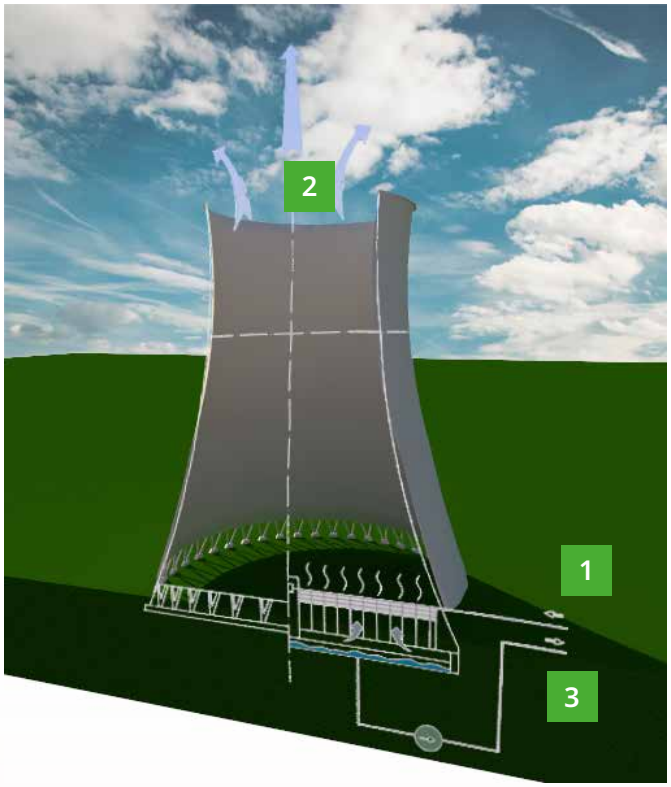
KÖSTER

Waterproofing Systems

KÖSTER Protection System for Cooling Towers

How does a cooling tower work?



The term cooling tower refers to a large technical structure designed to re-cool water. Cooling towers include natural draft cooling towers, cell coolers, and also hybrids which consist of a natural draft cooling tower and mechanically ventilated units.

The hot water is pumped from a power station to the cooling tower and spread over a large area (1).

The water cools down when trickling down through several channels into the collection tank. The warm air and water vapor rises up the tower (2).

The cooled water is then re-circulated to the power plant (3).

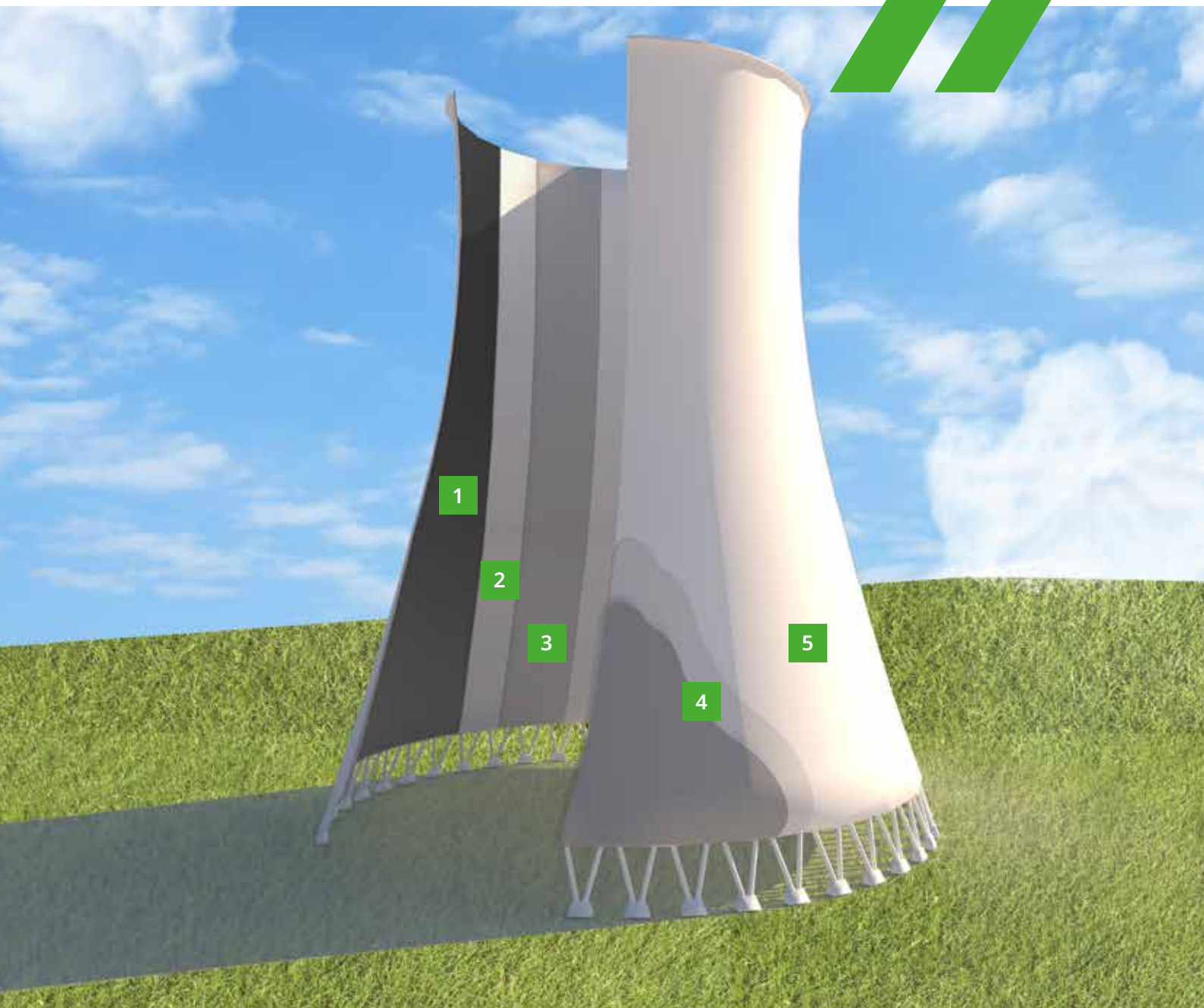
Construction elements have to be protected against the following exposition classes:

Carbonization	XC1 - XC4
Saltwater, chlorides	XS1, XS2
Chemical Attack	XA2, XA3
Frost with and without deicers	XF3

Principles of protection for cooling towers

A cooling tower is subjected to both chemical and mechanical stresses. The protection system must therefore be designed accordingly.
A natural draft cooling tower is a shell with a particular geometry that draws air upward without any electrical support. Given the size of the construction, it is easy to understand that a single part of it can be subjected to multiple exposition classes and therefore the highest protection standards have to be chosen to meet with optimum results.
The surface has to be inspected for cracks and imperfections. Corners must be rounded off, and any protruding reinforcement steel must be cut off in its depth and subsequently the minimum concrete coverage achieved.
Any exposed reinforcement has to be free of rust and subsequently protected from corrosion with KÖSTER Z1 and KÖSTER Z2 before replacing the concrete cover with KÖSTER Repair Mortar NC (1).

A thorough substrate preparation by sand-blasting removes formwork release agents and opens the pore structure of the substrate.
In the next step, the substrate needs to be pre-wetted until saturation before the KÖSTER NB 1 Grey (2) is applied with a brush vertically and horizontally in two coats. This method will seal and smooth out the surface, preparing it for the epoxy application with KÖSTER Polysil TG 500 2C (3) in the next step.
For the exterior, depending on climate and concrete conditions, KÖSTER NB 1 Grey or KÖSTER Primer P is applied (4). Then KÖSTER Acrylic Paint (5) is applied. This final decorative layer is a weather resistant white paint and can be colored according to the customer's requirements.



Application: 1. Substrate preparation

As in every waterproofing application, substrate preparation is of crucial importance to ensure uniform quality and endurance. In the protection system of a cooling tower substrate preparation may make up over 50% of the labor costs.

Before applying any coating, the concrete must be sufficiently prepared and freed from bond-inhibiting substances to reach a sound and solid substrate. This is achieved by sandblasting.

Any exposed reinforcement has to be free of rust and subsequently protected from corrosion with KÖSTER Z1 and KÖSTER Z2 before replacing the concrete cover with KÖSTER Repair Mortar NC.

All cracks, rough surfaces, voids, irregularities, and breakouts with a surface roughness greater than 5 mm must be evened out with KÖSTER Repair Mortar NC.

The mineral substrate has to be sound and solid as well as free of bond inhibiting agents.
The surface is prepared by sandblasting.

Careful preparation is important in order to obtain a stable substrate that ensures high quality and durability of the waterproofing.

Exposed reinforcement must be cut back and covered with KÖSTER Repair Mortar NC.

Application of KÖSTER Z1 / Z2 as a mineral corrosion protection.

The surface is leveled using KÖSTER Repair Mortar NC. Holes and voids bigger than 5 mm have to be closed and filled with KÖSTER Repair Mortar NC.

For an even result, all processing steps must be followed precisely.

2. Application of KÖSTER NB 1 Grey

In the next step, the substrate needs to be pre-wetted to saturation before the material is applied. Generally KÖSTER NB 1 Grey is applied with a KÖSTER Brush for Slurries. The KÖSTER Brush for Slurries is a coarse bristle brush that works the slurry into the substrate.

The second layer is applied when the first layer is cured well enough so that it is not damaged by brushing. The surface is kept moist over the following three days to avoid premature drying out of the coating.

KÖSTER NB 1 Grey is applied by brush.

Pre-wetting the surface and application of KÖSTER NB 1 Grey in one step.

The material should be brushed vertically and horizontally to work it into the substrate.

3. Application of KÖSTER Polysil TG 500 2C

After no less than seven days and at a maximum substrate moisture content of 4%, KÖSTER Polysil TG 500 2C is applied. KÖSTER Polysil TG 500 2C has a pot life of approximately 20 minutes. It is therefore recommended to mix smaller amounts to have adequate time for application before the material starts to react. Components are mixed with a KÖSTER Resin Stirrer (below 400 rpm) at a temperature between + 10 °C and + 25 °C for a minimum of three minutes until a homogeneous consistency is achieved. That will guarantee a sufficient pot life. During mixing, repot the material to avoid mixing errors. KÖSTER Polysil TG 500 2C is an extremely durable coating and after application, the final finished surface has a uniform, clearly defined dark glossy surface.

The well mixed material is spread evenly using a brush or roller .

4. Quality control

The final layer quality needs to be inspected every one thousand square meters by a pull-off test. A minimum pull-off strength of 1.5 N / mm² must be achieved. Acceptable results are a cohesive failure in a minimum 3 mm depth in the substrate, (100% failure in the substrate). Failures in the adhesive or coating are adequate if 50% of the failure is in the substrate and a minimum of 2 N / mm² pull-off strength is obtained.
During each step of the application, weather conditions, material consumption, as well as the results of quality controls must be thoroughly documented. A minimum of +3 °C must be held to the dew point during application and cure.

In order to ensure a long service life of the seal, the quality must be documented. In addition, the outer layer needs to be protected from environmental influences.

5. Exterior protection

Having a thermal drive from inside toward outside drives water vapor in the same direction. The interior of the tower is sealed with KÖSTER Polysil TG 500 2C to tackle the problem of capillary condensation. On the exterior, water ingress needs to be stopped. That is achieved by applying two layers of KÖSTER NB 1 Grey. KÖSTER NB 1 Grey is open to vapor diffusion, allowing the concrete to dry out.
On the exterior, a final coating of KÖSTER Acrylic Paint is applied. This decorative mineral layer is a weather resistant façade paint with a smooth, matt finished look and is as open to vapor diffusion as the KÖSTER NB 1 Grey. The primary color of KÖSTER Acrylic Paint is white but it can be pigmented according to customer's requirements.

If the concrete has a good quality and the surface is smooth, and if the climate is warm with little or no stress through freezing, KÖSTER Primer P is applied instead of KÖSTER NB 1 Grey underneath the KÖSTER Acrylic Paint.

Selected references at a glance

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