



Waterproofing Membranes

KÖSTER TPO TF for Tunnels and Foundations

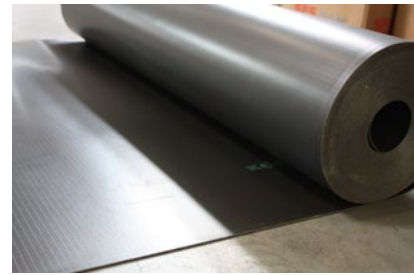
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KÖSTER TPO TF Membranes

For over 30 years, KÖSTER has been manufacturing waterproofing membranes in Aurich, Germany. These waterproofing membranes have proven their effectiveness over time in multiple structural waterproofing applications. KÖSTER TPO TF membranes are suitable for waterproofing all types of underground structures including basements, foundations, retaining walls, slabs, embankments and many others. KÖSTER TPO TF membranes consist of a thermoplastic polyolefins, with a silver signal layer on the top layer, produced in Germany with the highest quality compounds and standards. KÖSTER TPO TF membranes conform to DIN EN 13967:2012. The membranes guarantee long lasting protection against water ingress into structures. They provide high elongation and are highly tear resistant so that even large cracks are bridged securely. KÖSTER TPO TF membranes are free of PVC as well as plasticizers and are age and root resistant. As they can withstand high mechanical influences and stresses, they are the perfect protection for underground structures.



Fields of application

The main fields of application for these special membranes are basement and below grade structures, but also the secure waterproofing of:

- Artificial or natural tunnels
- Rafts or mat foundations
- Retaining walls (positive side)
- Contiguous piling & diaphragm walls
- Embankments

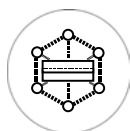
All KÖSTER TPO TF membranes have been CE certified according to DIN EN 13967:2012 (Waterproofing against ground water in direct contact with the structure). Fields of application (assuming no free weathering): walls/wall bases in contact with the ground; floor slabs; earth-covered ceiling surfaces; in and under walls. Fields of application (assuming no free weathering): earth-contact walls/skirting; floor slabs; earth-covered roof decks; in and under walls.

- Room use class: RN1-E to RN3-E
- Water exposure class: W1.1-E; W1.2-E; W2.1-E; W2.2-E; W3-E; W4-E
- Crack class: R1-E to R4-E

Advantages of KÖSTER TPO TF Membranes



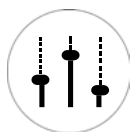
Immediate waterproofing effect



Seams homogeneously welded (not glued)



Fast and clean installation



Signal layer for damage control



High mechanical and impact resistance



No chemical activation of the seam needed

KÖSTER TPO TF membrane range

TPO Waterproof homogenous membrane with signal layer

Product name	Thickness	Width	Article No.	Length
KÖSTER TPO TF 1.5	1.5 mm	1.75 m	WT 815 175 TF B S	20 m
KÖSTER TPO TF 2.0	2.0 mm	2.10 m	WT 820 210 TF B S	20 m

Welding the membranes

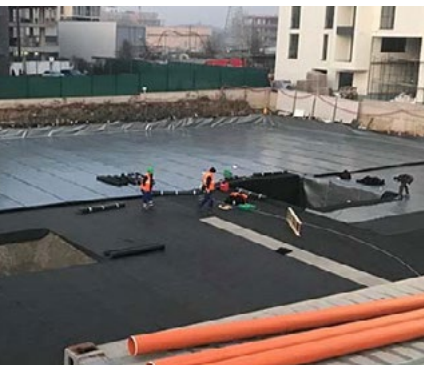
To ensure a watertight installation and long service life, the KÖSTER TPO TF membrane seams are welded homogeneously with hot air, using special welding seam dedicated machines. Chemical activation of the seam or the use of prep nozzles is not necessary for the KÖSTER membranes.

The minimum seam overlap for the waterproofing membranes is 5 cm, or 10 cm by double weld seam system. The width of the homogeneous joint weld must be at least 2 cm. For special requirements, such as in landfill and tunnel construction, double seams with a width of at least 1.5 cm each are necessary.

For detection of leaks and integrity of the dual track seams, an air pressure test manometer with compressed air is used.

KÖSTER TPO TF membranes can be welded within a wide temperature window between + 400 °C to + 600 °C; depending on the local environmental conditions. The welds are tested at earliest 24 hours after completion and can be inspected with a test needle, through a peel test or via Electronic Leak Detection methods.

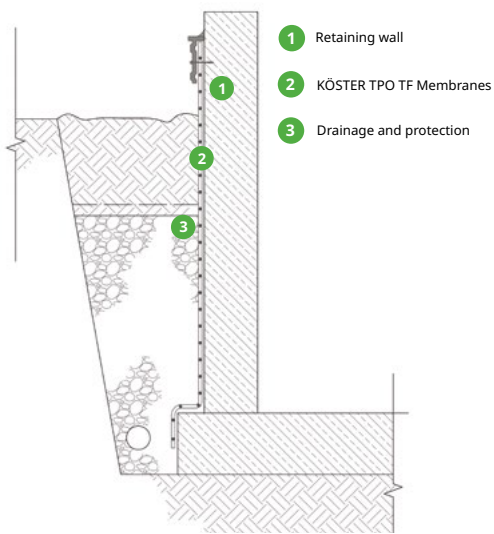
On vertical applications with mechanical fastening of the membrane, the overlap is 11 cm, when loose laying, the overlap is 5 cm. When applying over a geotextile layer, the overlap is increased to 8 cm. For mechanical fastening, the fasteners are chosen according to the project and site conditions.



- 1 KÖSTER SD Protection and Drainage Sheet
- 2 KÖSTER TPO TF Membranes

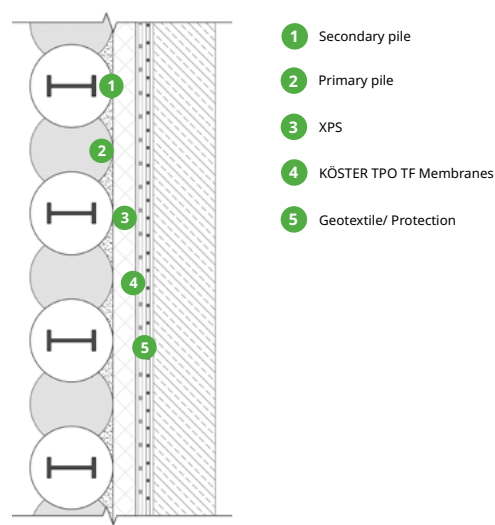


For all underground construction methods



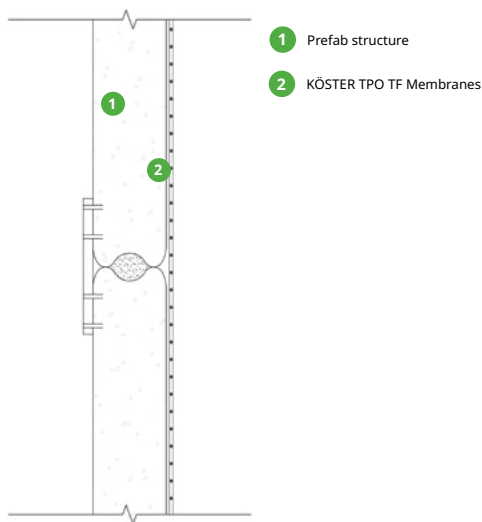
In situ retaining walls

Retaining walls are earth retention systems where the wall is built on the designated area using form work systems for concrete casted in place (or other type of walls such as bricks, stones, and blocks). This type of construction allows a positive side waterproofing to be installed since only after the waterproofing, drainage, and protection systems are placed, the ground can be backfilled against the wall to the desired level.



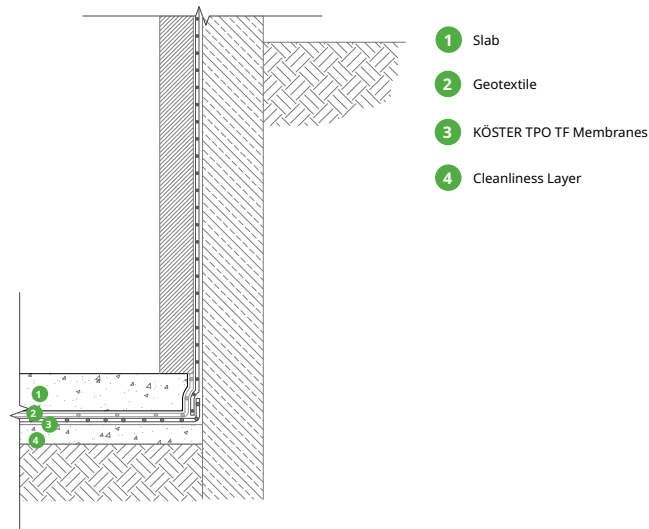
Secant pile and contiguous bored pile walls

Secant pile wall structures are inground retaining walls with piles cut or overlapping into each other, forming a continuous wall that reduces water inflow into the excavation and retains the soil behind the wall. The most common pile wall methods are secant piles and contiguous bored pile walls. A contiguous bored pile wall is formed by installing closely spaced bored piles, with a small gap between adjacent piles.



Prefab concrete panels

Similar to the In Situ Retaining Wall system, the earth retention wall is also installed freely on the designated area allowing a positive side waterproofing. The drainage and protection system is installed and the ground is backfilled against the wall afterwards. The only difference is that this system uses prefabricated concrete panels and the wall is not casted in place.

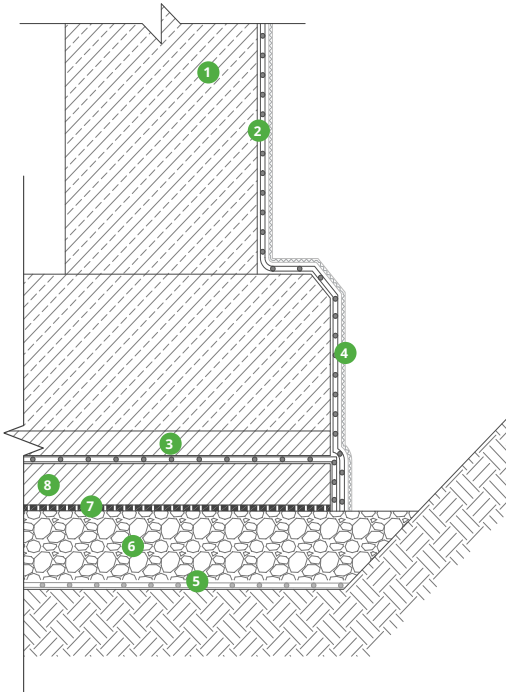


Diaphragm walls

A Diaphragm Wall is a structural concrete wall constructed in a deep trench excavation, either casted in situ or using precast concrete elements. The excavation stability is maintained by the use of a drilling fluid, usually bentonite slurries or muds. This method is designed to retain soils during the construction of underground structures and allow the waterproofing from the inside and installation of the protection sheet before building the inner wall.

The KÖSTER Method

- 1 Structural concrete wall
- 2 KÖSTER TPO TF Membranes
- 3 Protective layer
- 4 KÖSTER SD Protection 3-400
- 5 Geotextile separation (optional)
- 6 Filter bed with gravel (optional)
- 7 PE Foil (optional)
- 8 Cleanliness layer



Horizontal and vertical connections

The KÖSTER Method constitutes a series of application steps towards a secure installation of the KÖSTER TPO TF, while guaranteeing a better connection between the horizontal and vertical surfaces.

Every membrane has markings printed onto it to ease positioning and orientation of the membrane during application. The top layer has a silver laminate that acts as a signal layer to show eventual mechanical damage during the application.

Horizontal areas

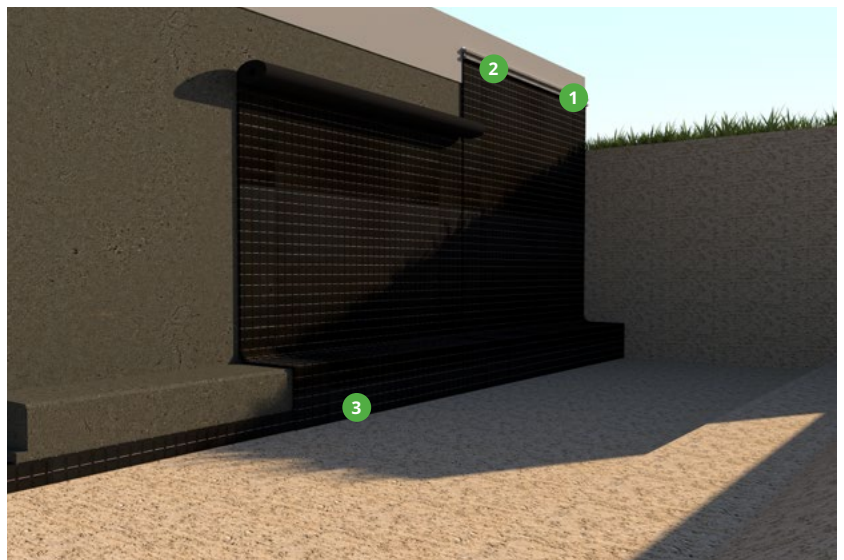
The initial blinding concrete must be as smooth as possible and free of edges, depressions, and other defects that can mechanically damage the membrane. KÖSTER TPO TF are placed over the horizontal surface and the overlaps are connected by hot air welding, which creates a homogenous, watertight and durable connection. The horizontal waterproofing is welded to a strip of membrane vertically placed on the foundation slab formwork, and folded over the blinding layer to allow the subsequent connection to the vertical waterproofing. The horizontal waterproofing membranes are then protected with a 5 cm blinding concrete slab to reduce mechanical stresses on the membranes and facilitate the placement of the foundation reinforcement as well as casting the concrete.

Vertical surfaces

The vertical waterproofing membranes are mechanically fastened on the upper end and secured with a finishing profile to avoid water infiltration behind the membrane. In this case, the seam welding is done with a light-weight automatic welder.

The vertical and horizontal waterproofing membranes are then connected by hot air welding to finish the waterproofing envelope.

- 1 Waterproofing joints
KÖSTER MS Joint Sealant
- 2 Finishing profile
KÖSTER Wall connection profile
- 3 KÖSTER TPO TF Membranes
KÖSTER TPO TF 1.5
KÖSTER TPO TF 2.0



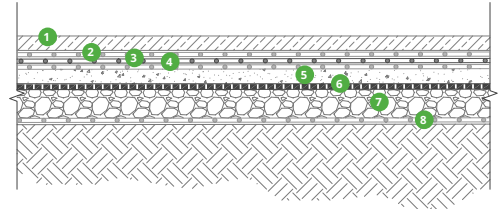
Lost Formwork

When excavation is restricted or requires extensive additional measures, the waterproofing and concreting of the structure must be accordingly adjusted. The KÖSTER TPO TF membrane are characterized by their high elongation and tear resistance properties, which are ideal characteristics for a lost formwork installation.

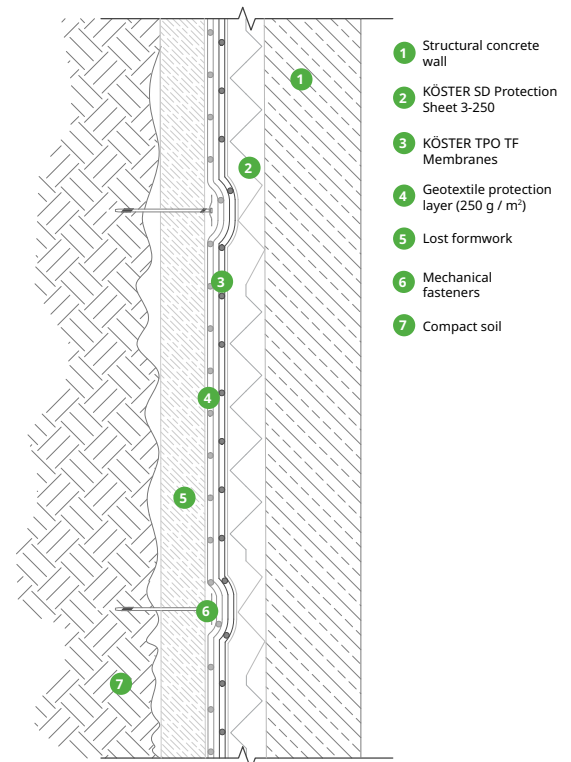
Horizontal areas: Similar to The KÖSTER Method, the KÖSTER TPO TF are laid loose on the clean substrate and welded with hot air. For extra mechanical protection it is recommended to install a geotextile separation layer underneath and on top of the membrane before building a 50 mm protection screed.

Vertical surfaces: Before installing the membranes, a formwork is properly placed and mechanically fastened on the previously prepared substrate. To protect the membrane from mechanical stresses or irregularities in the formwork during the installation process, a geotextile protection layer is attached to the formwork. The KÖSTER TPO TF are then welded with hot air using the light weight custom equipment. The installed membrane is finally protected with the KÖSTER SD Protection Sheet 3-250 to avoid damage of the membrane while placement of the reinforcement steel and casting and compacting of the concrete.

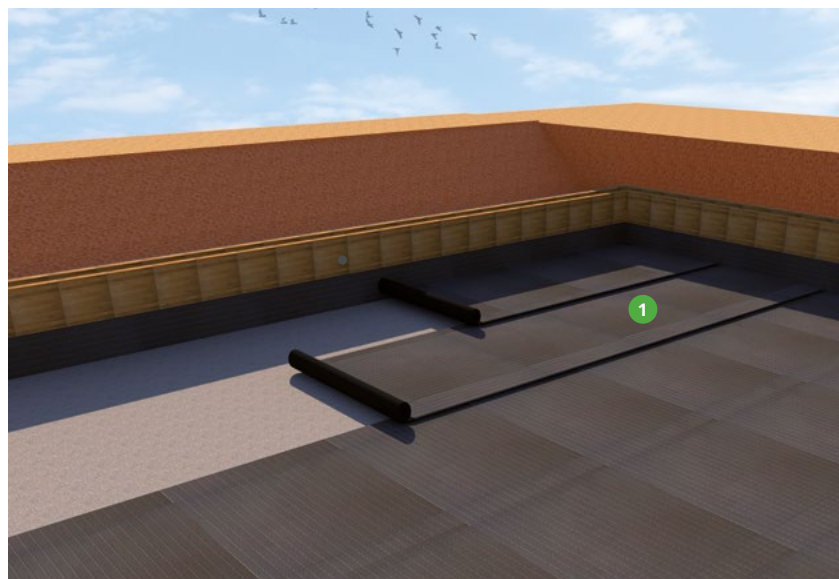
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| 1 50 mm protection screed | 5 50 mm concrete blinding |
| 2 Geotextile protection layer (250 g/ m ²) | 6 PE Foil (Optional) |
| 3 KÖSTER TPO TF Membranes | 7 Filtered bed with gravel (optional) |
| 4 Geotextile separation layer (150 g/ m ²) | 8 Geotextile separation layer (150 g/ m ²) |



Waterproofing horizontal installation structure with KÖSTER TPO TF membrane



Waterproofing lost formwork installation structure with KÖSTER TPO TF membrane



- 1 KÖSTER TPO TF Membranes
KÖSTER TPO TF 1.5
KÖSTER TPO TF 2.0



We are there for you – worldwide.



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