

# “WHITE TANK”

WATERPROOF CONCRETE PRINCIPLES  
AND METHODOLOGY OF INSTALLATION



## THE “WHITE TANK” CONCEPT

The “White Tank” system (from the German Weiße Wanne) is a concept of construction of reinforced concrete structures which provides waterproofing of structures exposed to active hydro static pressure from water ingress by placing watertight concrete and sealing the

construction and dilatation joints. This system does not include the use of conventional external waterproofing.

The “White Tank” system is based on two requirements:

- Good quality of concrete, proper application and curing of concrete;
- Proper sealing of all joints in concreting.

## PRODUCTION, PLACEMENT AND CURING OF CONCRETE



In order to ensure water resistance of the reinforced concrete structures, it is necessary for the concrete to have closed structure that provides minimum water absorption in the concrete. For that reason, the concrete must be properly placed and cured; it must have be uniform composition, without any cracks or segregations.

The basic preconditions for production of quality concrete with good waterproof properties, intended for installation of the “White Tank” system, are as follows:

- Right choice of materials for preparation of concrete (aggregate, cement and admixtures);
- Right choice of concrete production and application technology;
- Curing of fresh concrete.

To avoid cracking, the casting of concrete must be done continuously without any interruptions. In massive concrete sections (foundation slabs), it is necessary for the layers in which the fresh concrete is poured to be subject to revibration while the concrete is still workable, meaning that each successive concrete layer should be poured over concrete which is still fresh and enables proper revibration and homogenization of the two layers.

For these reasons, the production technology, transport, placement and curing of fresh concrete should be adjusted to the site conditions, and interruptions during concreting should be avoided.

Finally, immediately after setting, the poured concrete should be cured in wet environment. Constantly, during several days, it should be sprayed with water and/or covered with material that can keep the moisture (PVC Foil, geo-textile, jute fabric). In big, open concrete surfaces exposed to wind, it is preferable for the concrete to be protected by spraying a specialised material for surface protection (curing) - ZASTITA-B/B3.

### ADMIXTURES FOR PRODUCTION OF WATERTIGHT CONCRETE

For production of high-performance concrete with high degree of waterproofing, we recommend a combination of two types of admixtures from ADING's production program:

- SUPERPLASTICISER SUPERFLUID-21M1M EKO
- WATER RESISTING ADMIXTURE HIDROFOB 21

The superplasticiser SUPERFLUID-21M1M EKO improves workability of the concrete, enables proper application,



Protection of fresh concrete – Zastita- B/B3





## ADMIXTURES FOR PRODUCTION OF WATERTIGHT CONCRETE



reduction of water in concrete, enables decrease of the W/C ratio of concrete, increase of concrete compactness and density, increase of the early and final strengths of concrete. The result is increased resilience of concrete to water ingress under pressure. The properties of SUPERFLUID-21M1M EKO make it suitable for production of high-strength concrete, concrete resistant to ice and chlorides, concrete resistant to carbonation and chemical aggression. The function of HIDROFOB-21 is to prevent the capillary absorption of water in concrete pores and to make the concrete surfaces water repellent. The dosing of the admixtures is in ratio with the cement mass in the concrete mixture.

Recommended admixture dosage:

- SUPERFLUID-21M1M EKO – 0.6% to 0.9% in relation to the cement mass in the concrete mixture. If works take place under conditions of high ambient temperatures (in summer), or if the concrete undergoes a prolonged transportation (up to 3 hours), we would recommend a higher dosage (over 1%) and concrete slump class of S4.

- HIDROFOB-21 – 0.4% to 1.0% in relation to the cement mass in the concrete mixture.

It is best for the admixtures to be dosed automatically during the preparation of the concrete in order to enable proper control of water reduction (~15% for SUPERFLUID-21M1M EKO dosage of 0.7%), as well as proper control of concrete slump.

- HIDROFOB KRISTAL - Alternatively, concrete designed to build structures using the "White tank" system may be used with waterproofing additive featuring crystal formation, "Hidrofob Kristal". In cases of water penetration in concrete pores and micro cracks, this additive enables forming insoluble crystals which seal the cracks and thus prevent water penetration into the structure. When using "Hidrofob Kristal" for "White tank" systems, it is necessary to apply all other measures regarding production, application and care of fresh concrete, as well as using admixtures from the group of plasticizers and hyper-plasticizers.



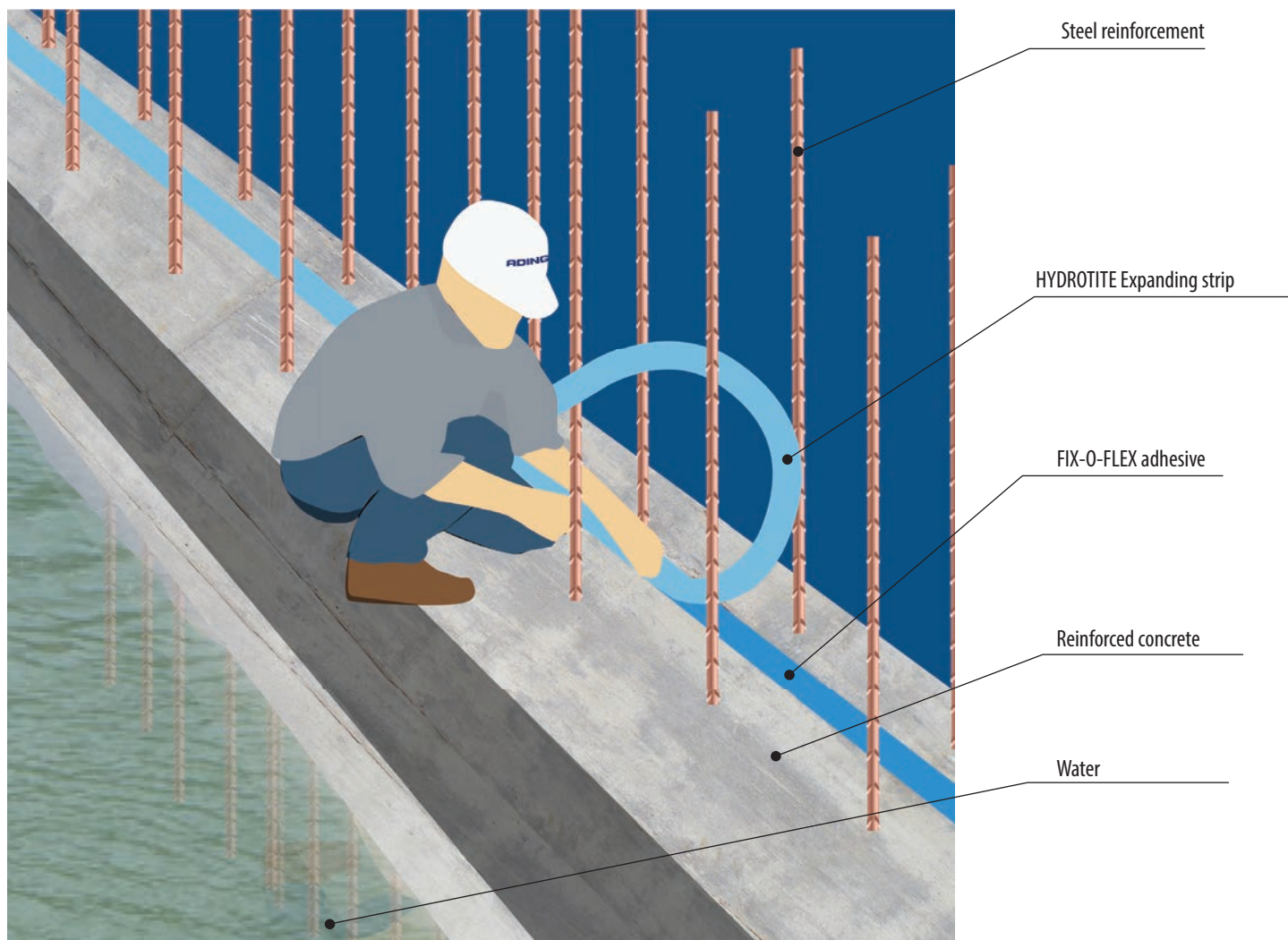
Water repellent concrete surface

Testing of capillary absorption

Effects of capillary absorption



## DETAILS FOR SEALING OF CONSTRUCTION JOINTS

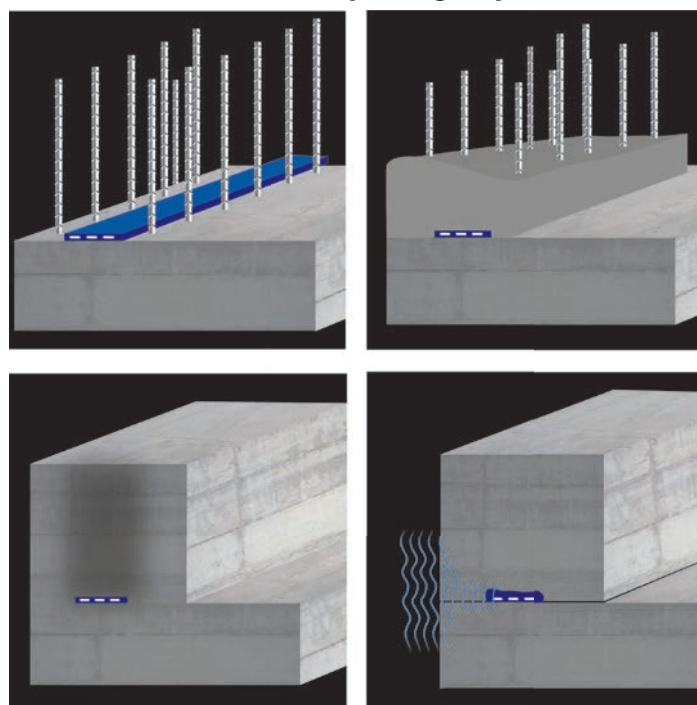


### HYDROTITE EXPANDING STRIP, FIX-O-FLEX ADHESIVE

Apart from placement of watertight concrete, in order to provide waterproofing of the entire structure, it is necessary to do proper treatment of the areas where there are interruptions during the concreting. For that purpose – protection of the construction joints from water ingress – several systems have been developed based on installation of a waterproof barrier made of elastic material (physical barrier - membrane, expanding strip, elastic grout material, etc.) which is preventing water ingress and at the same time waterproofed joints are flexible, and they can adjust to the expansions of the structure. Below, several systems for sealing construction joints in concreting have been described by using materials from the portfolio of the company TPH GmbH, Germany. ADING AD Skopje is the general representative for the TPH products in Macedonia and in the region.

**HYDROTITE expanding strips** – strips made of material that has the property of increasing its volume (expanding) in contact with water, thus sealing the crack that appears in the area where the concreting had been interrupted, and blocking the water ingress in the structure. The material is designed in such a way as to have

### HYDROTITE expanding strips



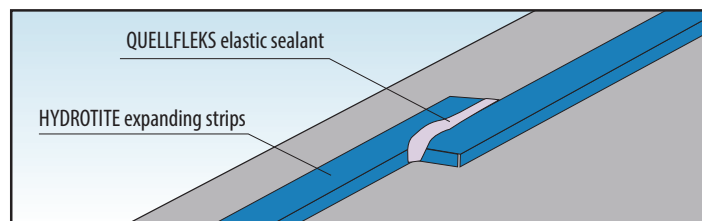
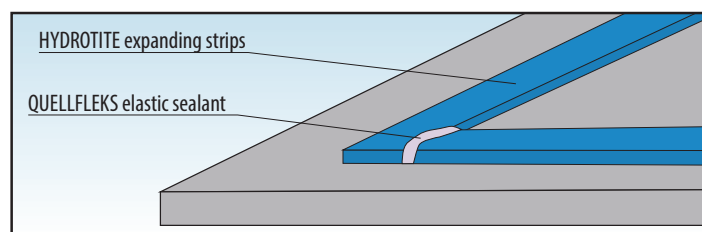
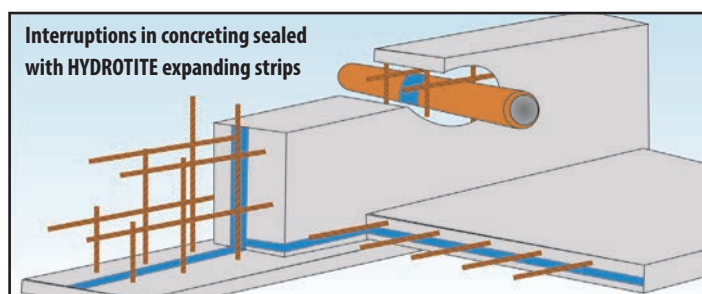
a delayed effect – which stops the expansion of the strip in the first couple of days upon application (while the concrete is still fresh).

HYDROTITE expanding strips are applied according to the given details. They are applied by adhesion onto the already concreted parts of the structure, on the areas where the placement of concrete is to be continued, thus providing water tightness of the section:

- Joints between the horizontal (foundations slab) and vertical (foundations reinforced concrete walls) surfaces;
- Joints in concreting in the foundations slab and the walls;
- Pipes' penetrations and other installation penetration through concrete

The expanding strips and other installation penetration through concrete are glued using permanent elastic adhesive FIX-O-FLEX. In the case of an extreme water pressure, it is recommended to use QUELLFLEX, expanding elastic sealant, also a product of the company TPH, Germany.

HYDROTITE expanding strips are placed in the middle of the section, between the reinforcement at least 10-15 cm from the ends of the section. For this reason, it is recommended that the width of the sections of the reinforced concrete elements – walls, part of the underground section of the structure, to be ~30 cm. Also, the concrete where the strip is going to be placed must be properly applied and vibrated, and must have relatively clean and even surface. The new concrete must also be properly placed and vibrated in order to avoid the occurrence of segregation. The strips are produced in several profile shapes and in different thickness. For structures with depth up to 2 m the recommended thickness is 2 mm, 3 mm for 3 m and 4 mm for 4 m of depth. For depths bigger than 4 m we recommend using HYDROTITE CJ profile (with three chambers). This way of sealing the construction joints in concreting has been tested at 7 bar active water pressure (in extreme situations it can be used for up to 10 bar of pressure).



Treatment of overlapping of HYDROTITE expanding strips

### Detail for sealing the construction joints with PROOFMATE FD FOIL



### PROOFMATE FD Foil elastic membrane

- It is used as an addition to or substitution of the expanding strips. It is applied on the external side of the structure on areas exposed to positive hydro-static pressure (the external side of the structure must be accessible for intervention while it is being applied).

The membrane is applied using a permanent elastic FIX-O-FLEX adhesive on the entire surface of the membrane, and membrane is placed along the concreting joint (crack). PROOFMATE FD Foil membrane is based on EPDM (Ethylene propylene dien copolymer) and it has permanent elasticity, resistance to extreme chemical aggression and UV-radiation.

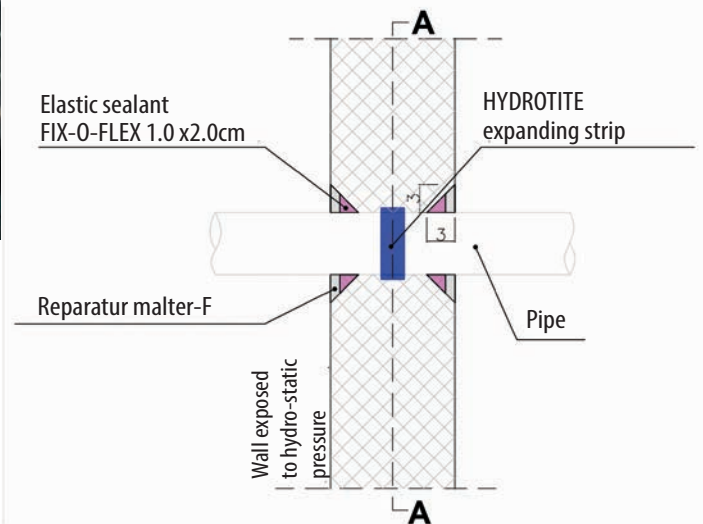
Because of its high durability and elasticity, PROOFMATE FD Foil is used in repair of cracks exposed to positive hydro-static pressure in engineering and hydro-technical structures.



## DETAILS FOR SEALING OF THE PENETRATIONS THROUGH THE CONCRETE SECTION



**DETAIL 1 – PIPE PENETRATION**



Detail 1

The points of the structure where pipes or other installations penetrate the reinforced concrete walls require treatment with permanent elastic sealant FIX-O-FLEX which enables proper waterproofed sealing of the contact between the pipe (installation) and the concrete structure. In case there is a possibility of mechanical damage, it is recommended that the elastic sealant be protected with REPARATUR MALTER – F. Under conditions of high hydro-static pressure, the penetration may be additionally protected by applying HYDRTITE expanding strip (detail 1).

### SEALING PIPE PENETRATIONS WITH PERMANENT ELASTIC SEALANT FIX-O-FLEX



Penetration of reinforced concrete piles through foundation slab



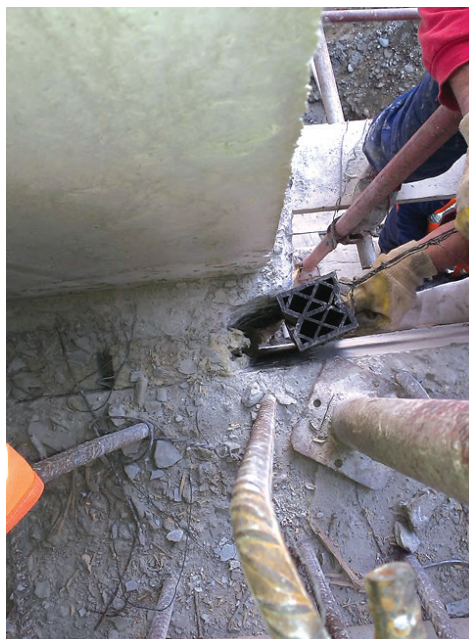
Penetration of pipe through the dam structure



Penetration of pipe through an underground wall



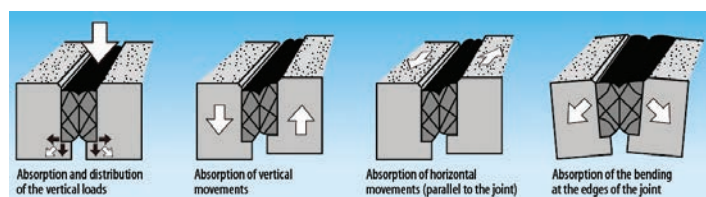
## DETAILS FOR SEALING OF EXPANSION JOINTS



Depending on the width of the expansion joint, as well as the degree of exposure to hydro-static pressure and mechanical influences, there are several types of systems for sealing the expansion joints, which enable free dilatations of the structure.

**Box profiles for sealing expansion joints PROOFMATE-EK**, product of the company TPH GmbH, Germany. As it is shown in the drawing, the profile is designed to absorb horizontal, vertical and bending movements of the structure.

The box profiles PROOFMATE-EK are available in various dimensions depending on the expansion width – for joints



with width from 15-120 mm.

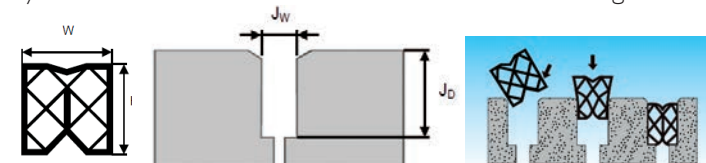
PROOFMATE EK profile is based on EPDM (Ethylene propylene dien copolymer). Therefore, it is permanently elastic, resistant to extreme chemical aggression and to positive hydro static pressure of 1 bar. Because of their high dura-

bility and elasticity, PROOFMATE EK profiles are used for sealing expansion joints in structures with several underground levels (down to 10 m), underground car parks, and engineering and hydro-technical structures.

PROOFMATE EK is placed by mechanical insertion into the joint, usually with a pneumatic hammer. The concrete edges of the joint should be smooth and parallel so that the profile could seal the entire joint. Before the insertion of the PROOFMATE EK profile, the sides of the joint should be covered with permanent elastic sealant FIX-O-FLEX which functions as an adhesive, but also as a lubricant that facilitates the insertion of the profile in the expansion.

Depending on the structure type, the exposure and the dimensions of the expansion, as a substitute of the PROOFMATE EK box profiles, suitable PROOFMATE E round profiles can be used. For sealing expansion joints of smaller dimensions (2-3 cm), which are not exposed to high hydro static pressure, it is possible to use permanent elastic sealant FIX-O-FLEX which is applied onto an inserted polyethylene hose, PVC hose, expanded polystyrene, or other suitable material.

### SEALING OF AN EXPANSION JOINT BY USING A PERMANENT ELASTIC SEALANT



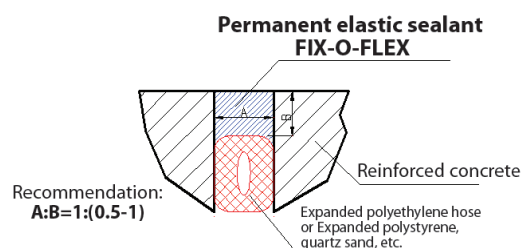
W = profile width, H = profile height

$J_w$  = minimum joint width required for installation of the profile

$J_p$  = minimum joint depth required for proper functioning

Proofmate EK type	W [mm]	H [mm]	$J_w$ [mm]	$J_p$ [mm]
Proofmate EK 15-25	36	35	20	45
Proofmate EK 18-30	36	35	25	45
Proofmate EK 20-40	46	37	30	45
Proofmate EK 27-49	56	55	35	65
Proofmate EK 30-60	68	70	45	90
Proofmate EK 35-70	80	87	55	95
Proofmate EK 50-95	107	90	65	105
Proofmate EK 55-120	135	95	80	105

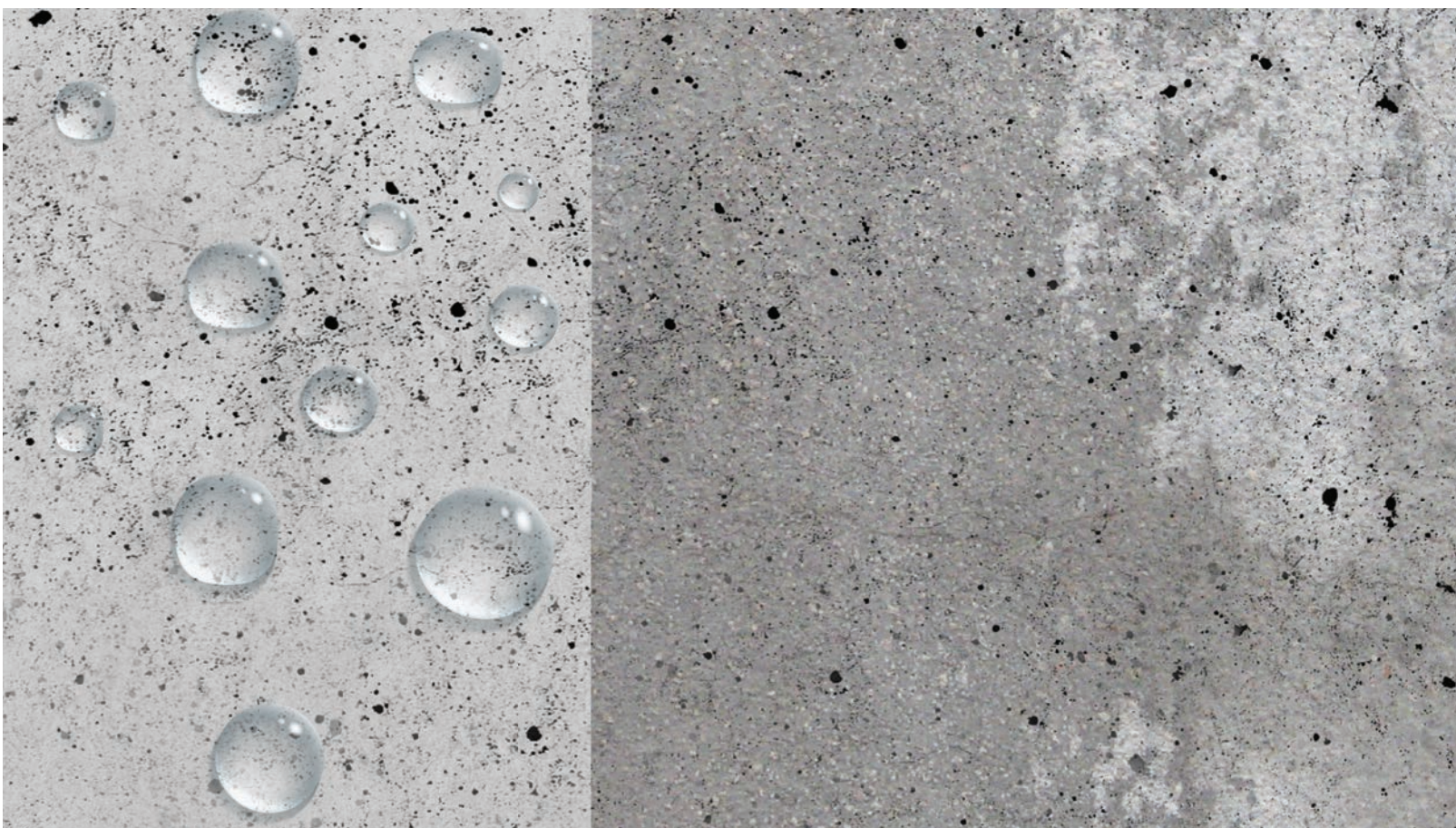
The type number shows the minimum and maximum space of the joint which the profile has been designed for.



Recommendation:  
**A:B=1:(0.5-1)**







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