

# WATERPROOFING Sikaplan<sup>®</sup> MEMBRANE SYSTEMS FOR BASEMENTS

TECHNOLOGY & CONCEPTS

BUILDING TRUST



# Sikaplan® - A RELIABLE AND DURABLE WATERPROOFING SYSTEM

**BUILDING STRUCTURES WITH DEEP BASEMENTS** that are exposed to highly aggressive ground conditions and stress, or that must have a complete dry internal environment, whilst also being durable for a long service life, requires a reliable, high quality waterproofing system. The function of this waterproofing system also includes full protection of the concrete structure against the potentially harmful influences of aggressive ground or sea water.

Sika provides high quality compartmentalized PVC and TPO membrane systems with integrated damage and leak control, together with an injection sealing back-up that can surpass the requirements for even the most demanding below ground structures. By using the Sikaplan® basement waterproofing membrane systems, complete dry environments and very secure concrete protection can be achieved. The high reliability and watertight security of the Sikaplan® systems, together with a successful track record and experience from around the world for more than 45 years, gives basement owners, specifiers and contractors the highest level of confidence.

## TYPICAL APPLICATION

### DEEP BASEMENTS IN COMMERCIAL AND RESIDENTIAL BUILDINGS



**CAR PARKS**



**ARCHIVES**



**SERVICE ROOMS**



**LEISURE FACILITIES**

### DEEP BASEMENTS BELOW GROUND FOR INFRASTRUCTURE



**STADIUMS**



**METRO STATIONS**



**UNDERPASSES**



**MILITARY FACILITIES**

# EXPOSURES AND STRESS

Compare to traditional waterproofing solutions, Sikaplan® membrane systems are designed to resist for a long service life many combinations and extremes of following exposure and stress in the ground:

- High level of water pressure
- Aggressive ground water containing chemicals (sulphates and chlorides in solution)
- Unequal static forces due to settlements or uplift
- Dynamic forces due to earthquakes
- High temperature variations
- Various gases in the ground as methane or radon
- Aggressive biological influences

The flexibility of loose laid Sikaplan® sheet membrane waterproofing below and behind structural concrete secures watertightness and gas tightness under dynamic stress of structures.

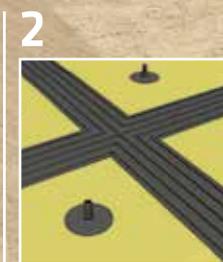


Yellow arrow: Biological attack      Blue arrow: Water pressure      Orange arrow: Gas (Methane, Radon)      Green arrow: Aggressive ground water

# Sikaplan® MEMBRANE SYSTEMS – AN OVERVIEW



Sikaplan® WP/WT



Sika® Waterbars  
WP/WT for building  
compartments



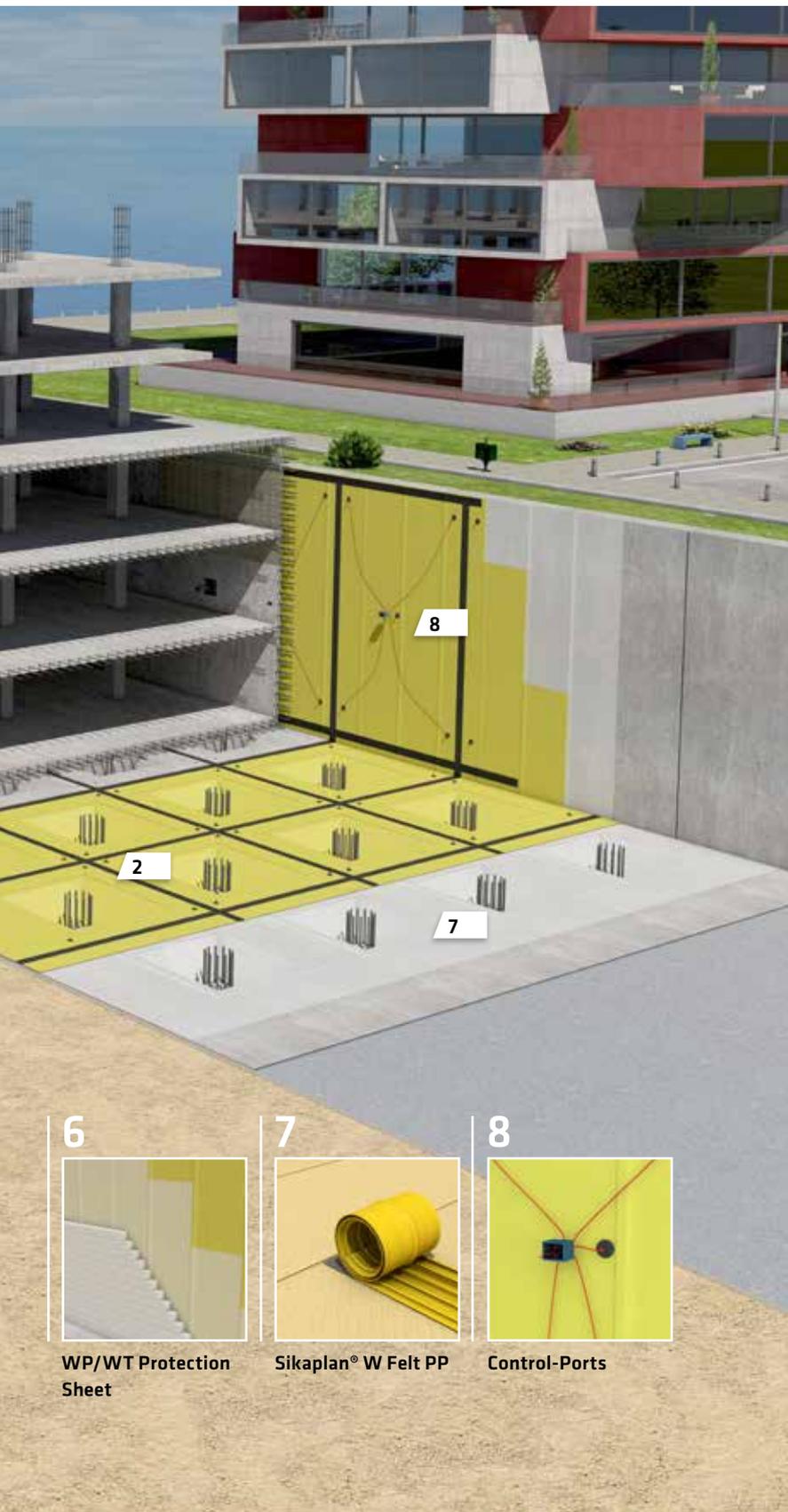
Sikaplan® Dilatec®  
Sikaplan® WT Tape



Sika® Waterbars  
for movement joints



SikaFuko® injection  
hoses



Sikaplan® membrane systems are highly flexible, thermoplastic membrane systems based on plasticized PVC or thermoplastic polyolefin (TPO). They comprise prefabricated membrane sheets and sections, prefabricated waterstops and preformed integrated control and injection ports. The membrane components are heat welded together to create a controlled and fully watertight system. The entire surface can be compartmentalized using special profiled waterstops that are welded directly onto the membranes before the protective layer and the structural concrete is placed. Each compartment has a maximum area of 60 - 150 m<sup>2</sup> depending of the system and includes preformed and positioned control ports and Sika injection flanges. For watertight terminations on vertical surfaces and for creating the compartments on roof slabs, special adhesive tapes are applied onto the structural concrete, which are also then heat welded to the sheet waterproofing membranes.

After placing, the compacted structural concrete has a mechanical connection with the profiled joint waterstops and this creates the water-stopping compartments with the Sikaplan® membrane system. In case of damage to the membranes during the construction phase or in operation, any leaking compartments can easily be detected through the control ports and repaired by sealing the entire compartment with an appropriate injection material through the integral injection flanges connected to the control ports.

Dependent on the ground conditions, the anticipated performance level and the security required, the Sikaplan® systems can be applied as single or double layer solutions and these can also be combined with other Sika waterproofing components such as injection hoses and hydrophilic (swelling) gaskets.

**6**  
WP/WT Protection Sheet

**7**  
Sikaplan® W Felt PP

**8**  
Control-Ports

# ADVANTAGES AND BENEFITS

## GENERAL ADVANTAGES AND BENEFITS: FOR HIGH PERFORMANCE AND SECURITY

### ADVANTAGES OF THE SYSTEM...

Compartmentalized system

High quality control on site with double welded seams. Testing possible with compressed air, vacuum and electronic detectors

Long term track record with more than 45 years of experience

Extensive test reports according to the leading standards worldwide

Tested and proven durability on real projects

Very high flexibility of the membranes

Resistant to many different chemicals in the ground, and also provides a barrier to aggressive gases

Do not require any curing/waiting times or primers

### ...AND THEIR BENEFITS

Limits water underflow in case of local leaks due to damage/perforated membrane during or after construction works, or inadequate heat welding of any membrane seams or overlaps

Guaranteed watertightness of the entire system before concreting and backfilling

Confirming high security and reliability of the systems

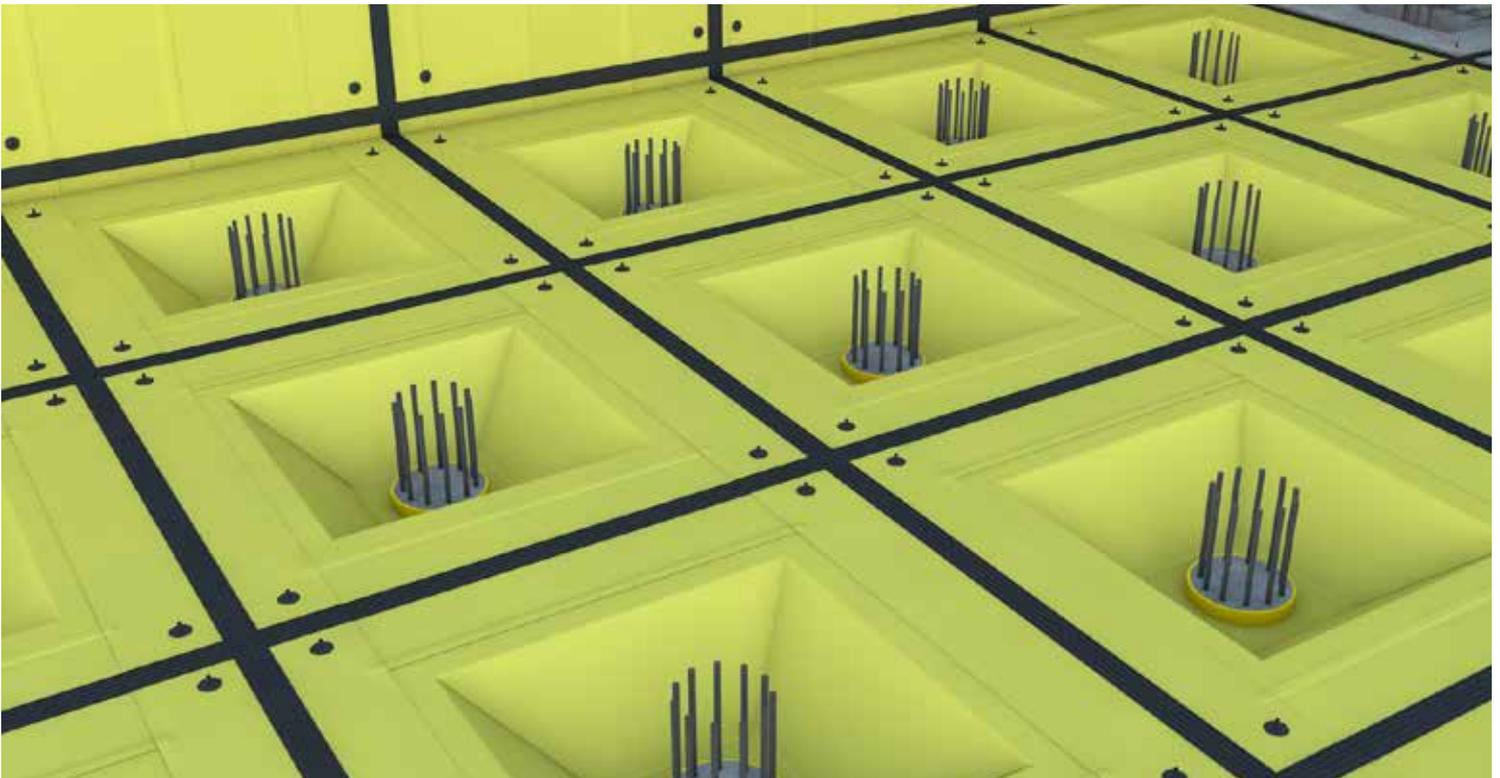
Confirming very high performance

Confirming a very long service life of the waterproofed basement

Watertight with settlement, or even after earthquakes. Allows easy installation and completion of details that results in faster membrane installation

High protection to the concrete, even in very aggressive ground water such as sea water

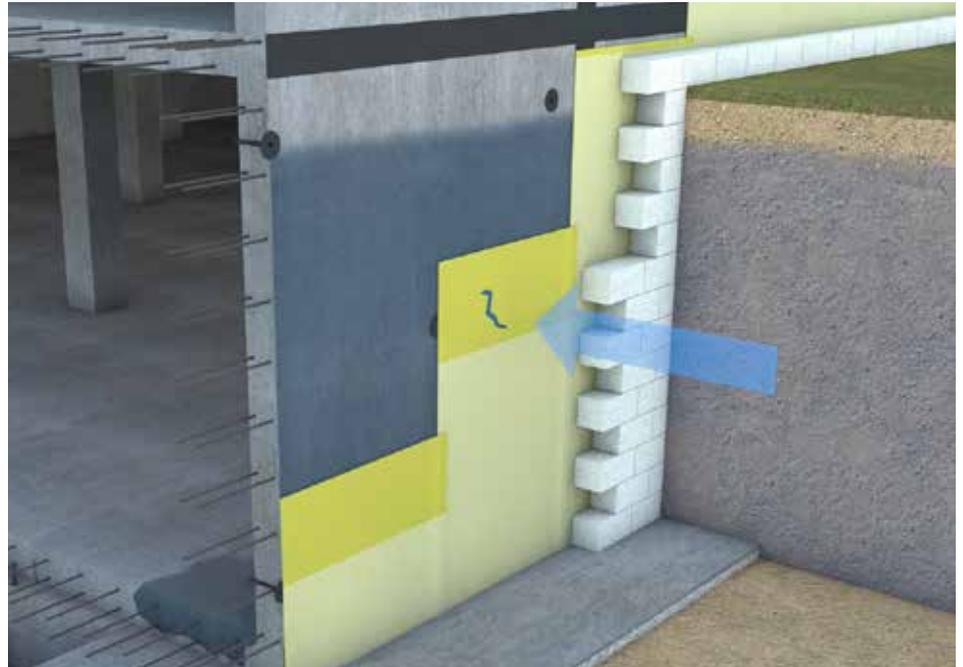
Allow fast application even at low temperatures



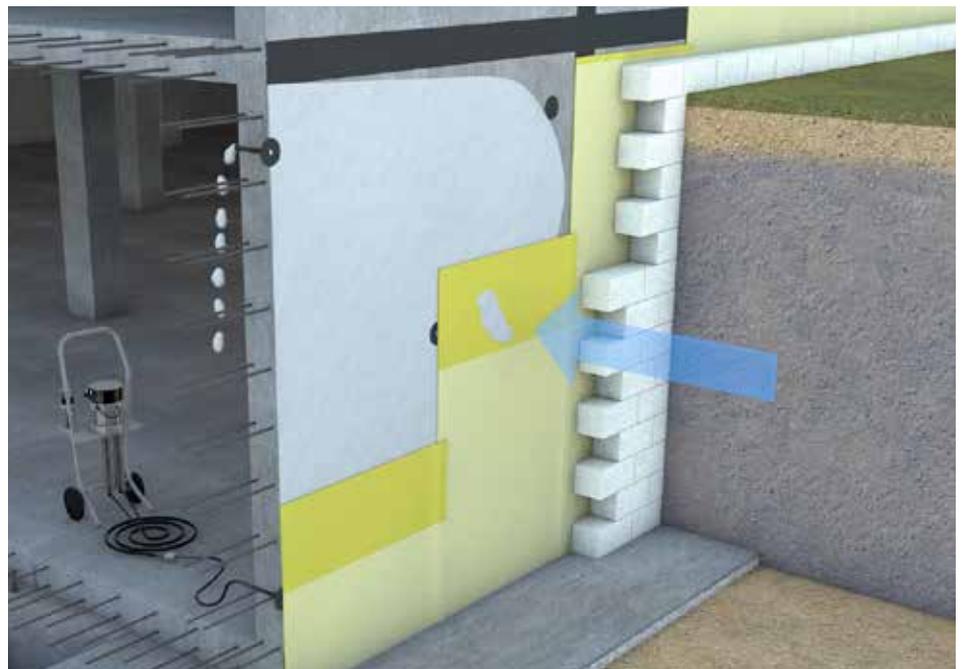
## THE UNIQUE BENEFIT: LEAK CONTROL AND REPAIR BACK-UP

Sikaplan® membrane waterproofing solutions have an integrated control and injection back-up system that allows easy and quick monitoring of the functionality of the waterproofing system at any time during the entire service life of the structure. If any damaged or leaking compartments are detected, a fast repair and sealing by injection with an appropriate Sika injection material can be made.

- In case of damaged membrane, water can locally underflow the membrane but will then be limited by waterstops that create compartments.
- Any leaking compartment can easily be detected through the control ports that remain accessible from inside the completed structure.



- Repairing any leaks in the membranes is achieved by injection of Sika® Injection-306 through the integral injection flanges accessible from inside the completed structure.
- The Sika injection resin reacts with water to form a solid but flexible, elastic gel in the void between structural concrete and the membrane within the compartmentalized area to seal the damaged area.

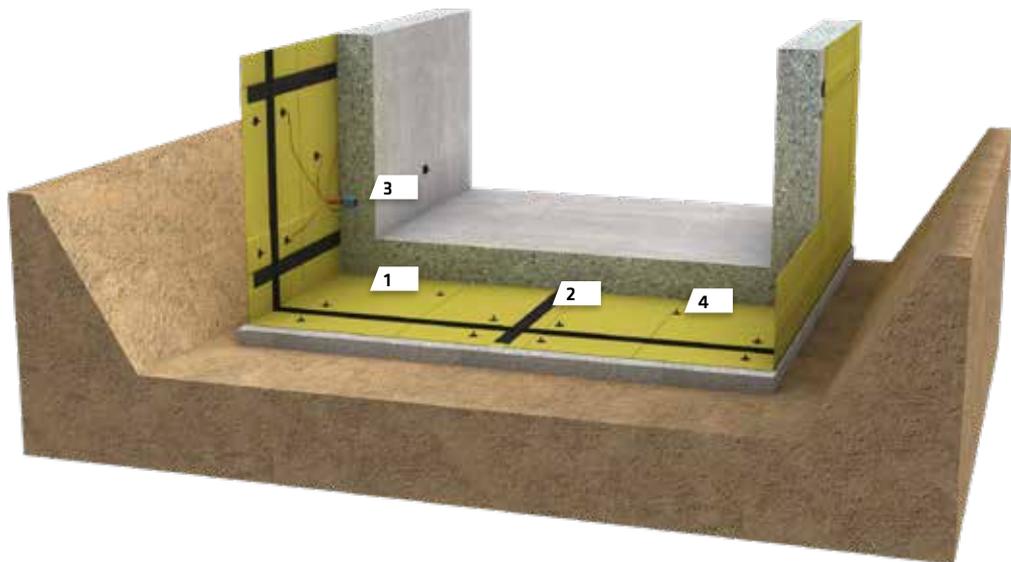


# Sikaplan® MEMBRANE SYSTEMS

## A) SINGLE LAYER SYSTEMS (WATER-STOPPING SYSTEM)

The standard, well established Sikaplan® waterproofing system consists of one layer of Sikaplan® membrane that is compartmentalized with Sika® Waterbars and integral Sika Control- and Injection flanges. These flanges allow the constant monitoring and continuous control of leakwater at any time during the system's entire service life. The compartment between the membrane layer and the structural concrete can easily be checked and then injected and sealed immediately in the event of a leak due to damage for any reason.

- 1**  
Sikaplan® membrane
- 2**  
Sika® Waterbar
- 3**  
Sika® Control port
- 4**  
Sika® Injection flange



### CHARACTERISTICS

- Well proven and established system with long-term successful experience since 40 years
- Fast installation, even under wet and low temperature conditions
- Control- and injection system for repair of any damage by injection to the membranes during the entire service life of the structure

### USE

- For totally dry basements without additional ventilation or dehumidification of the environment
- Waterproofing against high water pressure (>15 m)
- For protection against aggressive chemicals and gases in the ground water
- When high security and reliability level is required

## B) DOUBLE LAYER SYSTEMS (ACTIVE CONTROL SYSTEM)

The double layer Sikaplan® waterproofing system consists of two layers of Sikaplan® membranes that are welded together to create compartments which can also be tested for watertightness by vacuum. The compartments between the 2 membrane layers can be inspected using the control ports and if necessary, any leaks can then be injected and sealed through the injection ports. An additional safety layer and barrier is formed as a second compartment layer is created between the Sika® Waterbars, the 2<sup>nd</sup> membrane layer and the structural concrete.

- 1**  
1<sup>st</sup> layer of Sikaplan®  
membrane

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- 2**  
2<sup>nd</sup> layer of Sikaplan®  
membrane

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- 3**  
Sika® Waterbar

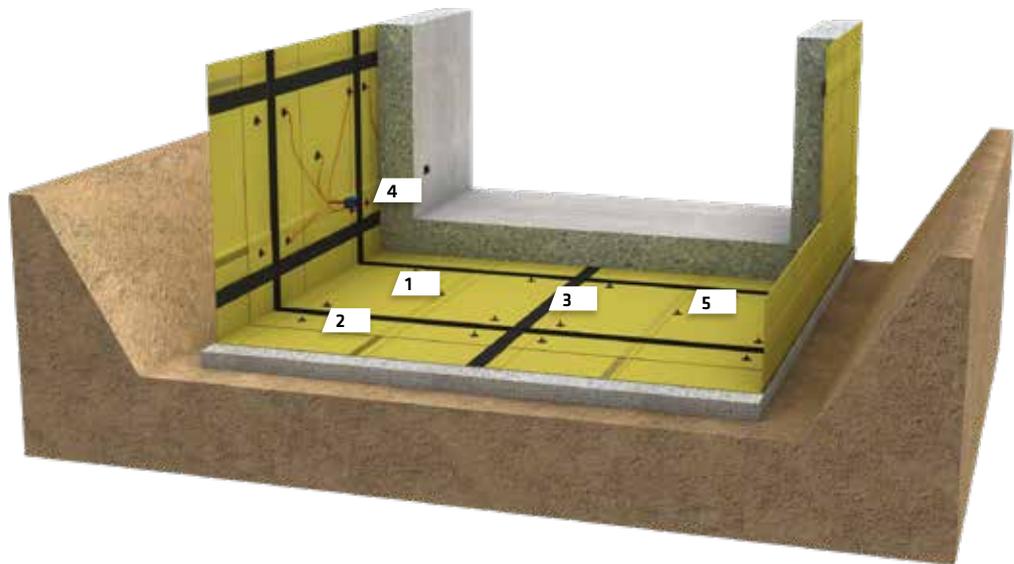
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- 4**  
Sika® Control port

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- 5**  
Sika® Injection flange

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### CHARACTERISTICS

- Highest security by two controlled membrane and compartment layers
- Allows testing and confirmation of watertightness of compartment between 1<sup>st</sup> and 2<sup>nd</sup> layer by vacuum before completion or stopping dewatering systems

### USE

- For any below ground structures in extreme ground conditions and combined requirements
- For totally dry environments over a very long service life
- For structures that requires the highest security level of watertightness
- When watertightness must be checked and guaranteed when dewatering stopped, before use of the structure/facility

# Sikaplan® MEMBRANE TECHNOLOGY

## POLYVINYLCHLORIDE (PVC) SHEET MEMBRANE SPECIFICATION

### Sikaplan® WP 1100 Series

#### Resistant to water under hydrostatic pressure:

Water-depth: 0 - 10 m	Sikaplan® WP 1100 - 15 HL/HL2
Water-depth: 0 - 20 m	Sikaplan® WP 1100 - 20 HL/HL2
Water-depth: > 20 m	Sikaplan® WP 1100 - 30 HL/HL2

Resistant to water temperatures of max. +35 °C

Resistant to aggressive groundwater (salt, sulphates)

#### Properties

Material base	Homogeneous PVC		
Types:	WP 1100: standard PVC, REACH-conform WP 1110: translucent, REACH-conform WP 1180: -20HL PVC		
Colour	Top layer: yellow Reverse layer: dark grey  Translucent (WP 1110-type only)		
Roll sizes	Width 2.20 m Lengths 15.00 - 20.00 m		
Membrane thickness	1.5 mm	2.0 mm	3.0 mm
Membrane types HL: signal layer 0.6 mm	-15 HL	-20 HL -21 HL -22 HL -25 HL	-30 HL
Membrane types HL2: signal layer 0.2 mm	-15 HL2	-21 HL2 -25 HL2	-31 HL2



#### Typical use:

For all types of demanding basement waterproofing against permanent groundwater with temperatures up to +35 °C and a long service life requirement.



## FLEXIBLE POLYOLEFINE SHEET MEMBRANE SPECIFICATION

### Sikaplan® WT 1200 Series

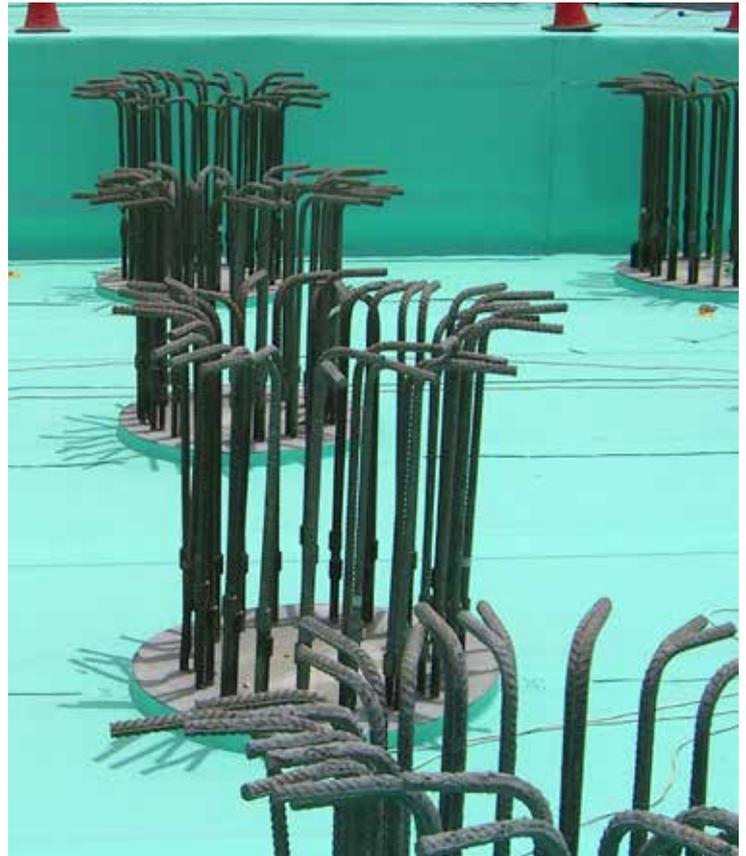
#### Resistant to water under hydrostatic pressure:

Water-depth: 0 - 10 m	Sikaplan® WT 1200 - 16 C
Water-depth: 0 - 20 m	Sikaplan® WT 1200 - 20 C
Water-depth: > 20 m	Sikaplan® WT 1200 - 30 C

Resistant to water temperatures of max. +40 °C  
 Resistant to polluted groundwater (salt, sulphates, oils)

#### Properties

Material base	Flexible Polyolefine FPO, fleece stabilized		
Type:	H: homogeneous E: Embossed surface C: fleece stabilized		
Colour	Top layer: green Reverse layer: black		
Roll sizes	Width 2.00 m Lengths 10.00 m - 20.00 m		
Membrane thickness	1.6 mm	2.0 mm	3.0 mm
Membrane types C: signal layer 0.6 mm	-16 C	-20 C	-30 C
Membrane types CE: signal layer 0.6 mm Fleeced-backed		-25 CE	
Membrane types H: for details		-20 H	



#### Typical use:

For all types of basement waterproofing with high performance demands against permanent aggressive groundwater with temperatures up to +40 °C and a long service life requirement.



# SYSTEMS AND TECHNOLOGY – SELECTION CRITERIA

## 1. SINGLE LAYER SYSTEM (WATERSTOP SYSTEM)



### PVC

Sikaplan® WP 1100 sheet membranes are used for waterproofing against damp soil and groundwater at temperatures of up to +35 °C. The most suitable thickness of Sikaplan® WP 1100 sheet membrane is specified with 1.50 mm for water pressures up to 10 m, 2.00 mm for up to 20 m and 3.00 mm for water pressures exceeding 20 m.

Rating for single layer system with Sikaplan® WP (PVC) sheet membranes	1	2	3	4	5
Resistance to chemicals					
Resistance against high temperatures of groundwater					
Controlability and redundancy level of the system					
Resistance against wave effect in open water					

### FPO (TPO)

Sikaplan® WT 1200 sheet membranes are used for waterproofing against clear, hydro carbons and groundwater at temperatures of up to +40 °C. The most suitable thickness of Sikaplan® WT 1200 sheet membranes is specified with 1.60 mm for water pressures up to 10 m, 2.00 mm for up to 20 m and 3.00 mm for water pressures exceeding 20 m.

Rating for single layer system with Sikaplan® WT (FPO) sheet membranes	1	2	3	4	5
Resistance to chemicals					
Resistance against high temperatures of groundwater					
Controlability and redundancy level of the system					
Resistance against wave effect in open water					

(1 poor – 5 excellent)

## 2. DOUBLE LAYER SYSTEM (ACTIVE CONTROL SYSTEM)



### PVC

Sikaplan® WP 1100 sheet membranes are used for waterproofing against damp soil and ground water at temperatures of up to +35 °C. The double layer compartment system fulfills the highest demands of security and control of watertightness. The double layers can be with membranes of the same types, or with a Sikaplan® WP Protection Sheet.

Rating for double layer system with Sikaplan® WP (PVC) sheet membranes	1	2	3	4	5
Resistance to chemicals					
Resistance against high temperatures of groundwater					
Controlability and redundancy level of the system					
Resistance against wave effect in open water					

(1 poor – 5 excellent)

### FPO

Sikaplan® WT 1200 sheet membranes are used for waterproofing systems that can also resist chemically aggressive and hydro carbons and ground water at temperatures exceeding +40 °C. The double layer system meets the highest demands for security and control of watertightness. The double layers can be with membranes of the same types, or with a Sikaplan® WT Protection Sheet.

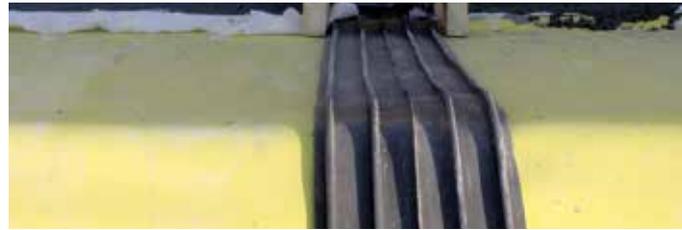
Rating for double layer system with Sikaplan® WT (FPO) sheet membranes	1	2	3	4	5
Resistance to chemicals					
Resistance against high temperatures of groundwater					
Controlability and redundancy level of the system					
Resistance against wave effect in open water					

# Sikaplan® SYSTEM COMPONENTS

## DESCRIPTION

### Sika® Waterbar

Waterstops are used for linear and permanent fixing of the membranes on vertical areas, and to form watertight compartments. These preformed waterstop profiles are either heat welded on previously installed Sikaplan® waterproofing membranes, or in open-cut construction projects they are fixed into the formwork prior to the concreting works, the Sikaplan® membranes are then heat welded on the waterstops after they are cast in the concrete.



### Sika® Dilatec®

Sealing tapes, Sika Dilatec® for PVC, or Sikaplan® WT Tape for FPO, are bonded with Sikadur®-31 epoxy adhesive for terminations and details on vertical and horizontal areas to form compartments on below ground roof areas. After the first layer of Sikadur®-31 has been applied on to the prepared concrete substrate, the prepared sealing tape is firmly pressed into the uncured adhesive. After curing of the adhesive, the Sikaplan® membranes can be heat welded on exposed parts of the sealing tapes.



### Sikaplan® Control Socket

Injection sockets or ports for the inspection and control of watertightness, and for the injection of compartments are either spot welded on single layer membrane systems, or fully welded on double layer systems. These sockets are connected with special, high elastic tubes to accessible injection ports on the inside concrete surface.



### Sikaplan® Injection Flange

Injection flanges for control of watertightness by injection of the compartment areas are heat welded onto the installed Sikaplan® membrane, then connected with metal pipes or hoses to injection ports, prior to the concreting works in areas that will remain accessible in the completed structure.



### Sikaplan® Disc

Fixing discs for the spot and temporary fixing of sheet waterproofing membranes on vertical surfaces. Fixing of the discs is by nail gun (e.g. Hilti DX 36) into shotcrete substrates, or by fixing spikes into pre-drilled holes in reinforced concrete substrates. The protection fleece gets spot fixed to the substrate and then the Sikaplan® sheet membranes get fixed by heat welding them on to the surface of these fixing discs.



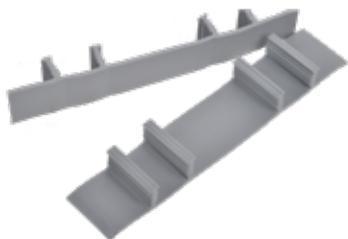
### Sikaplan® Fixing Plate

Fixing plates for the permanent linear fixing of sheet waterproofing membranes on vertical surfaces. Fixing of the plates is by spikes into pre-drilled holes in reinforced concrete substrates. The protection fleeces get spot fixed to the substrate and then the Sikaplan® sheet membranes get fixed by heat welding them on surface of these fixing plates.



**FOR THE Sikaplan® WP 1000 SERIES (PVC BASED)**

Sika® Waterbar WP



Sika® Dilatec® E/ER



Sikaplan® WP Control Socket



Sikaplan® WP Injection Flange



Sikaplan® WP Disc yellow



Sikaplan® WP Fixing Plate PVC



**FOR THE Sikaplan® WT 1200 SERIES (TPO BASED)**

Sika® Waterbar WT



Sikaplan® WT Tape



Sikaplan® WT Control Socket



Sikaplan® WT Injection Flange



Sikaplan® WT Disc grey



Sikaplan® WT Fixing Plate PE



# ANCILLARY PRODUCTS FOR Sikaplan® MEMBRANE SYSTEMS

## DESCRIPTION

### Sikaplan® WP/WT protection sheets

Prefabricated PVC or FPO sheets for temporary protection of the Sikaplan membrane system on walls and other vertical surfaces against damage during backfilling.



### Sikaplan® W Felt

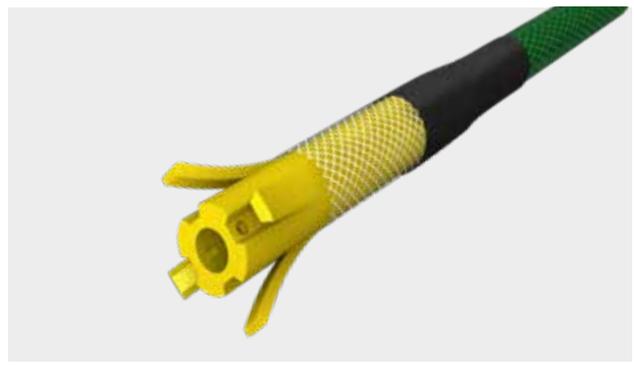
Prefabricated Fleece as a protection layer used to protect against punctures from the ground due to rough elements. It is laid out under the base slab before installation of the Sikaplan® membrane system.



### SikaFuko® Injection hoses

Injection hoses for post sealing of construction joints by injection and re-injection using appropriate injection material as Sika® Injection-306.

SikaFuko® hoses can also be used as secondary or additional back-up systems for all sorts of construction or movement joint waterproofing systems or around piles in order to increase their watertight security.



### SikaSwell® swellable products

A range of hydrophilic (swellable) profiles, rings, plugs and gun applied sealants for sealing construction joints and around many different types of penetrations.

These SikaSwell® products can also be used to prevent water transmission between compartment-crossing construction joints, or for additional security in sealing around concrete or steel piles.



# INSTALLATION PROCEDURES

Dependent on the type and method of excavation, the sequence for the installation of Sikaplan® membrane systems will be different and this must also be taken into consideration during the design phase.

## OPEN CUT EXCAVATION METHOD

An open cut excavation with sloping sides or retaining walls with enough space for access to the structure, results in double-sided formwork for casting concrete walls. The waterbars for creating compartments, and the flanged control and injection ports are positioned and fixed into the formwork before concreting. The Sikaplan® membrane is welded to the waterbars after the concrete is placed and formwork is removed from the walls.

### Sequence of installation:

**1**

Lining with the Sikaplan® membrane before the base slab is poured

**2**

Placing reinforcement and concreting the base slab

**3**

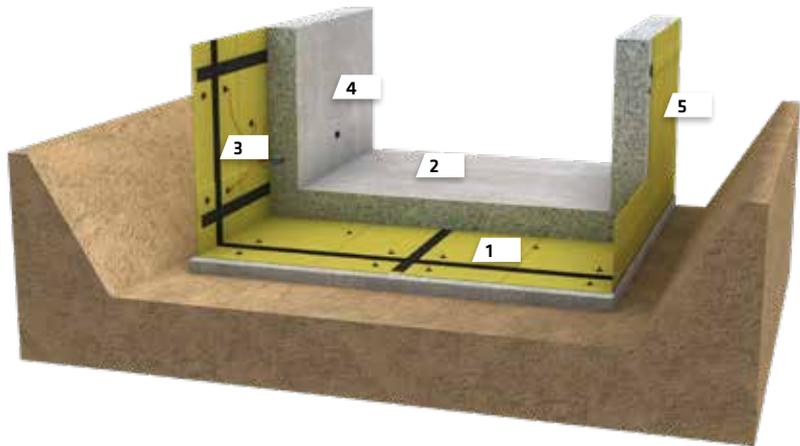
Positioning the joint waterbars and injection flanges into the formwork for the walls

**4**

Concreting the walls

**5**

Positioning and welding the Sikaplan® membrane around the walls



## CONSTRUCTION WITH PILED/DIAPHRAGM WALLS

As there is no access to the outer side of the external walls using this method of construction, the entire Sikaplan® membrane system must be installed before placing the concrete. The fixing of single-sided formwork must then be done without damaging or penetrating the Sikaplan® membrane system.

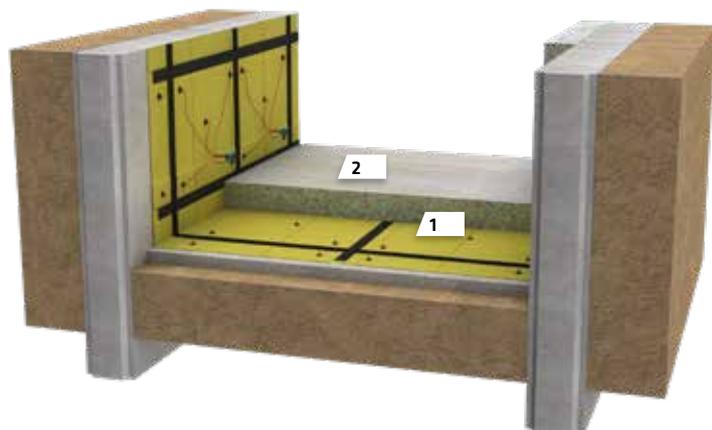
### Sequence of installation:

**1**

Lining with the Sikaplan® membrane below the base slab and on the inside of the retaining walls

**2**

Concreting the base slab and the walls



# HEAT WELDING OF Sikaplan® MEMBRANE SYSTEMS

The installation procedure for the membranes considers the unrolling, positioning and temporary fixing or holding in order to create the defined overlaps at membrane edges, which are heat welded, either by a hot air, or hot wedge system to achieve a watertight seam. The heat welding procedures are performed by hand welding for detailing works, or with automatic welding machines for longer overlaps and seams.

## HAND/MANUAL WELDING



Handheld hot air welding gun and pressure roller, welding temperature adjustable. Suitable for single seam overlap weldings and detailing works, such as pile head connections or corners.

## SEMI-AUTOMATIC WELDING



Semi-automatic hot air welding machine and pressure roller, welding temperature and welding speed adjustable. Suitable for single seam overlap weldings, detailing works and welding of waterstops on installed membranes.

## AUTOMATIC WELDING



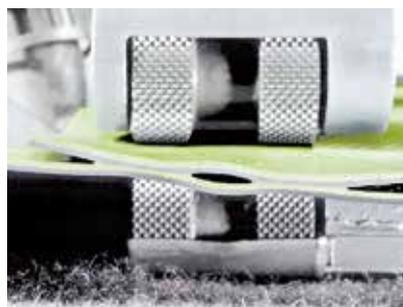
Automatic hot air, or heating wedge welding machine with clamped pressure roller, welding temperature, pressure force of rollers and speed are adjustable. Suitable for single seam and double seam welding with air pressure channels between seams.



Butt-jointing of waterbars by welding with heating blade for creating compartments.



Butt-jointing of waterbars by heat welding using the semi-automatic welding equipment SG 320L.



Cross section of double seam: 15 mm welding of each side plus 10 mm air testing channel in between.

# QUALITY CONTROL OF WELDED Sikaplan® MEMBRANES

Completed basement structures that are waterproofed with Sikaplan® sheet membranes are intended to be exposed to water under hydrostatic pressure. It is therefore essential to approve the watertightness of the completed membrane installation works, prior to covering and protecting the membrane from ongoing construction works. There are also a variety of different methods to check and approve the welded seams and overlaps in particular on the installed membrane.

## VISUAL INSPECTION



Visually checking with the aid of a broad screw driver to search for voids or misses at seam edges.

The surface area can be visually checked by control of signal layer.

## COMPRESSED AIR TESTING



Air pressure testing using an air pressure pump, reverse flow valve and test needle that is inserted into a test channel between the seams of double seam welding (suitable for double seams only).

## VISUALLY WITH ELECTRICAL SENSOR



Area defect testing with an electrical copper wire brush. Electrical sparks signalizes capilarities in seams. Any defects in the membrane or at seam edges can be dedected, if an electrical conductor is placed underneath.

## VACUUM TESTING OF DETAILS BY VACUUM BELL



Vacuum testing using a vacuum bell and electrical vacuum pump for testing of details. After treating the seam edges with soap solution, the vacuum bell is firmly pressed over the area to be tested and the vacuum applied. Any leaks are clearly seen by bubbling of the soap solution under vacuum.

## VACUUM TESTING OF COMPARTMENT OVER SIKAPLAN CONTROL SOCKETS



Vacuum testing of compartments of a double layer membrane system using vacuum pump. During the testing the vacuum should not drop less than 20% in 10 minutes to be completely watertight.

# GLOBAL BUT LOCAL PARTNERSHIP



## FOR MORE INFORMATION:



### WE ARE SIKA

Sika is a specialty chemicals company with a leading position in the development and production of systems and products for bonding, sealing, damping, reinforcing and protecting in the building sector and the motor vehicle industry. Sika's product lines feature concrete admixtures, mortars, sealants and adhesives, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

Our most current General Sales Conditions shall apply. Please consult the most current local Product Data Sheet prior to any use.



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