

Flexible Waterproofing of Basement Structures with Sikaplan® Membranes

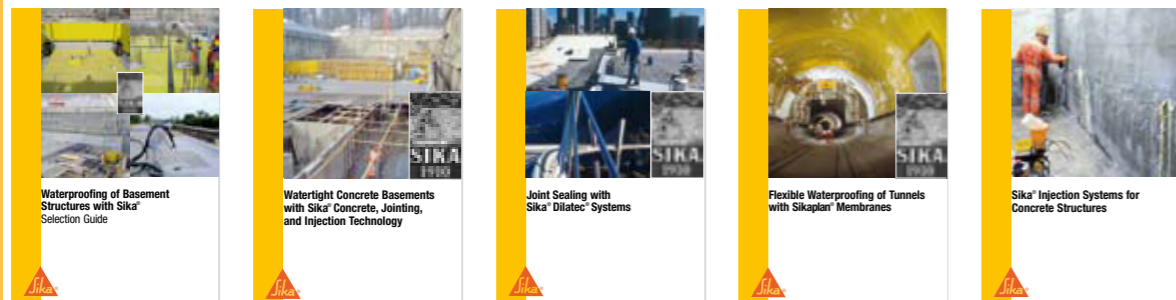
The Sikaplan® Flexible Sheet Membrane Products

Sikaplan® WP 1100 HL2 yellow/black	Homogeneous waterproofing sheet membrane based on polyvinylchloride (PVC-P), available in thicknesses of 1.5 mm, 2 mm and 3 mm, not resistant to bitumen or permanent exposure to UV light.
Sikaplan® WP 1110 20 H transparent	Homogeneous waterproofing sheet membrane based on polyvinylchloride (PVC-P), thickness 2 mm and not resistant to permanent UV exposure, light absorption <30 %.
Sikaplan® WT 1200 C green/black	Reinforced waterproofing sheet membrane based on polyolefin (TPO/FPO) with non-woven polyethylene (PE) glass inlay for restraint, available in thicknesses of 1.6 mm, 2 mm and 3 mm. Resistant to bitumen and polystyrene, not resistant to permanent UV light exposure.
Sikaplan® WT 1200 CE green/black	Reinforced waterproofing sheet membrane based on polyolefin (TPO/FPO) with non-woven polyethylene (PE) glass inlay restraints available in thicknesses of 2.5 mm and 3.5 mm. Surface embossed with ribs to increase bond and watertightness. Resistant to bitumen and polystyrene, not resistant to permanent UV light exposure.

The Sikaplan® Ancillary Products

Sikadur®-Combiflex® joint sealing system	Joint sealing strip, based on hypalon (TPO/FPO) for producing bonded compartments and terminations of TPO/FPO membranes.
Sika® Dilatec® tape joint sealing system	Joint sealing strips type E / ER, based on polyvinylchloride (PVC-P) for producing bonded compartments and terminations with PVC membranes.
Sika® WP/WT waterbars	Waterbar types AR and DR, based on polyvinylchloride (PVC). Waterbar types MP and AF based on polyolefin (TPO/FPO) cast in concrete for compartments and the base slabs, roof slabs and external walls of basements.
Sikadur®-31 CF (EP adhesive)	Normal and rapid (for low temperatures or accelerated curing) grades available based on epoxy resin (EP) for the bonding of Sikadur-Combiflex and Sika Dilatec joint sealing tapes.

Also available from Sika



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www.sika.com.eg



Flexible Waterproofing of Basement Structures with Sikaplan® Membranes



Flexible Waterproofing of Basement Structures with Sikaplan® Membranes

Residential Apartments

Commercial Offices

Leisure Facilities

Retail Units and Storage Areas

Archives

Metro Stations

Parking Areas

Plant Rooms



■ Drainage systems can be incorporated



■ Can accommodate settlement and ground movement
■ Will flexibly bridge cracks and joints in concrete



■ Protects the structure from aggressive groundwater



■ Prevents reinforcement steel corrosion due to water ingress



■ Secure and homogeneous with welded seams tested on site



■ Protects and maintains thermal insulation values



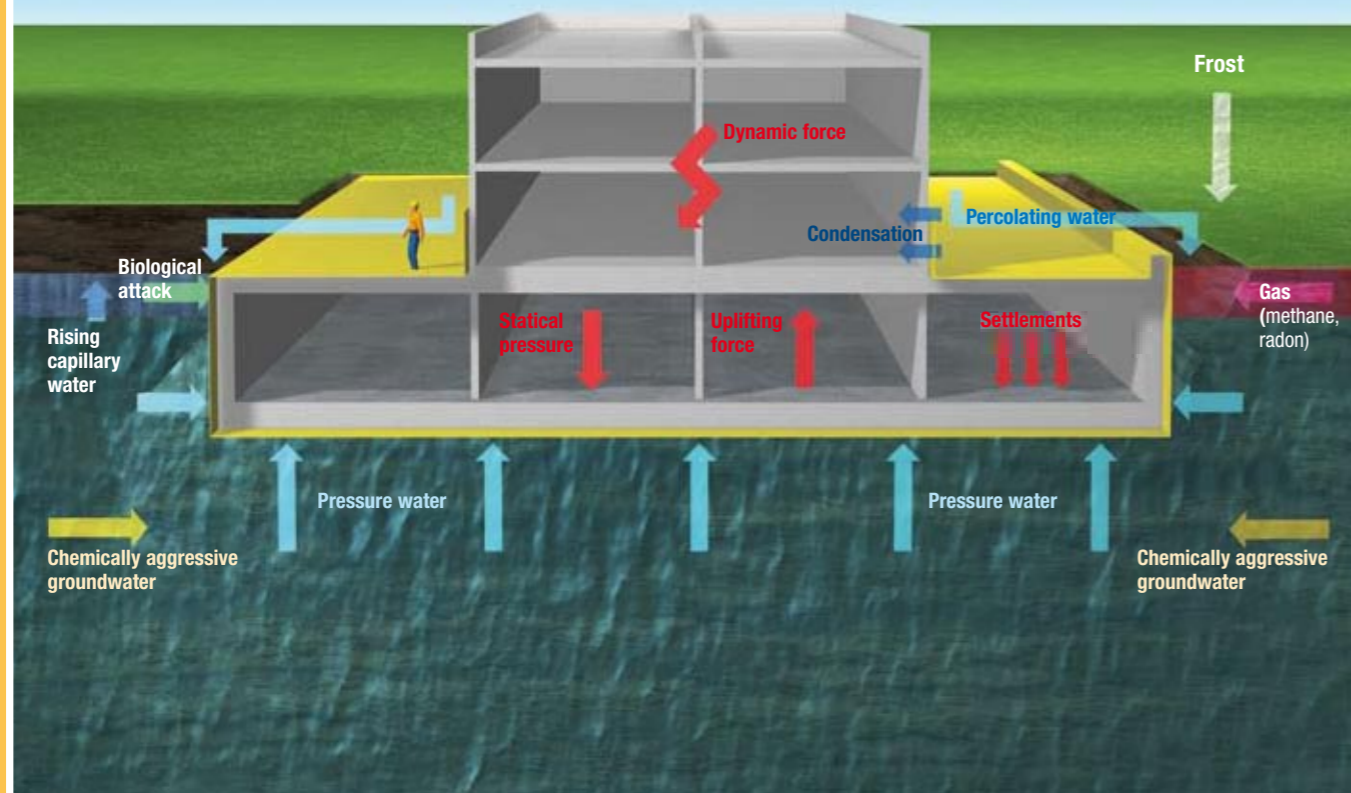
The different Levels of Exposure and Requirements

The Degree of Watertightness required

(Grades defined according to BS 8102)

The Ground Conditions

Basements are immersed in differing levels of groundwater, and aggressive influences including damp soil contact, percolating water, water under hydrostatic pressure plus aggressive chemicals in solution, different soil, gravel and rock, etc. These all require different and often specific waterproofing treatments to be applied to the structure. A part or partial waterproofing treatment can also be achieved with drainage or porous screeds that are laid to falls on horizontal surfaces to drain off any water.



Flexible Sikaplan® membrane waterproofing for damp soil contact, percolating water and water under hydrostatic pressure



Damp Soil Contact

Soil with low water permeability or high water retention.



Percolating Water

Water percolating by gravity through permeable soil.



Water under hydrostatic Pressure

Hydrostatic pressure develops with high water levels in permeable ground.

Grade 1

Basic Utility

Some seepage and damp patches tolerable (min. wall thickness: 150 mm)

- Car parking areas
- Plant rooms/workshops **excluding** any electrical equipment in the areas



Grade 2

Better Utility

No water penetration but moisture vapour tolerable (min. wall thickness: 200 mm)

- Retail storage areas
- Plant rooms and workshops requiring drier environment **with** electrical equipment in the area



Grade 3

Habitable

Dry environment – ventilated (min. wall thickness: 250 mm)

- Residential areas, offices, restaurants
- Leisure centres, gymnasiums



Grade 4

Special Requirements

Totally dry environment – ventilated (min. wall thickness: 300 mm)

- Archives and special equipment or storage areas
- Controlled environment



Rigid Waterproofing (Grades 1 to 3)

Waterproof concrete/waterproof rendering and joint sealing systems

To seal structures against groundwater ingress, where some limited moisture presence or damp patches are tolerable.

Note: Can be used for Grades 3 and 4 with additional Sika jointing, waterproofing and other technologies.

Flexible Waterproofing (Grades 2 to 4)

Loose laid and welded sheet membranes

To waterproof all types of structures in all different ground conditions against all types of groundwater ingress including high water levels with strong hydrostatic pressure even where the internal environment must be totally dry (i.e. Grade 4 in areas with a totally controlled environment or other special requirements).

Selection Guide for different Waterproofing Systems

A Comparison between Flexible and Rigid Waterproofing Systems for new Watertight Basement Structures

	Rigid Waterproofing Systems		Flexible Waterproofing Systems		
	Waterproof mortar rendering	Watertight concrete	Loose laid Sikaplan® WP/WT sheet membranes	Hot applied "torch-on" bitumen membranes	Liquid applied polymer membrane
Suitable against hydrostatic water pressure	✓	✓	✓	✓	✓
Specialized contractor required	✗	✗	✓	✓	✓
No substrate preparation required	✗	n.a.	✓	✗	✗
No priming of substrate required	✗	n.a.	✓	✗	✗
Crack-bridging ability	✗	✗	✓	✓	✓
Prevents water underflow	✓	✓	✓ with compartments	✓	✓
Requires no support	✗	n.a.	✓	✗	✗
No need to be bonded to the surface	✗	n.a.	✓	✗	✗

Waterproofing with Sikaplan® Flexible Sheet Membranes

Dependent on the groundwater conditions, the type of structure and the degree of watertightness required, a full range of alternative Sikaplan® flexible membrane waterproofing solutions are available. These include systems in combination with drainage, plus systems in combination with Sika® Waterbars, for both single and double compartment waterproofing. For the most stringent requirements, the Sikaplan® Active Control System with additional vacuum dewatering capabilities is used.

1. Drainage System

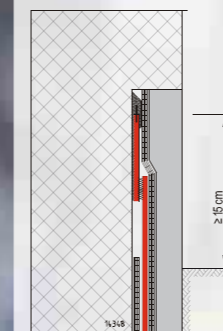
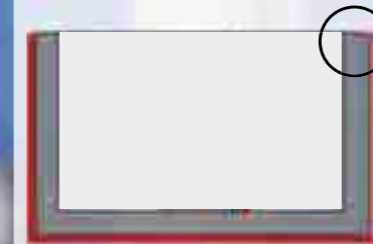
Not suitable against hydrostatic pressure

Loose laid, with lateral drainage, without compartments

- For waterproofing against damp soil contact and percolating water
- Requires drainage pipes at the base (sump drain) bottom to prevent any build-up of water pressure

Suitable products

- Sikaplan® WP 1100
- Sikaplan® WT 1200
- Sika® Dilatec®, type E/ER sealing strips
- Sikadur®-Combiflex® System



2. Waterstopping System

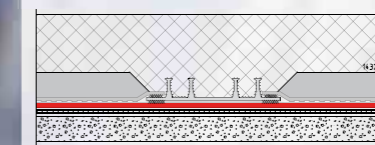
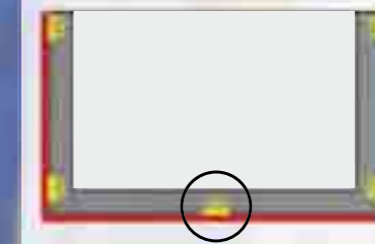
Suitable against hydrostatic pressure

Loose laid, welded with compartments formed from additional waterbars

- For waterproofing against water under hydrostatic pressure
- Compartments are injectable in the event of any movements or damage causing leaks in the waterproofing membranes

Suitable products

- Sikaplan® WP 1100
- Sikaplan® WT 1200
- Sika® Waterstops, PVC types
- Sika® Waterstops, FPO types
- Sika® Dilatec®, type E/ER strips
- Sikadur®-Combiflex® System
- Sika® Control® system and injection ports
- Sika® Injection-305 resin



3. Active Control System

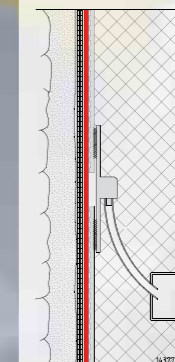
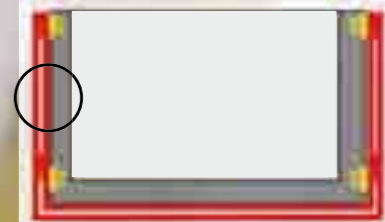
A waterstopping system with dewatering capabilities – suitable against hydrostatic pressure

Loose laid, welded with compartments formed from additional waterbars

- For waterproofing against water under hydrostatic pressure and incorporating the Sika Active Control System
- High security for maintaining the watertightness with vacuum dewatering
- Compartments are injectable in the event of any movement or damage causing leaks in the waterproofing membranes

Suitable products

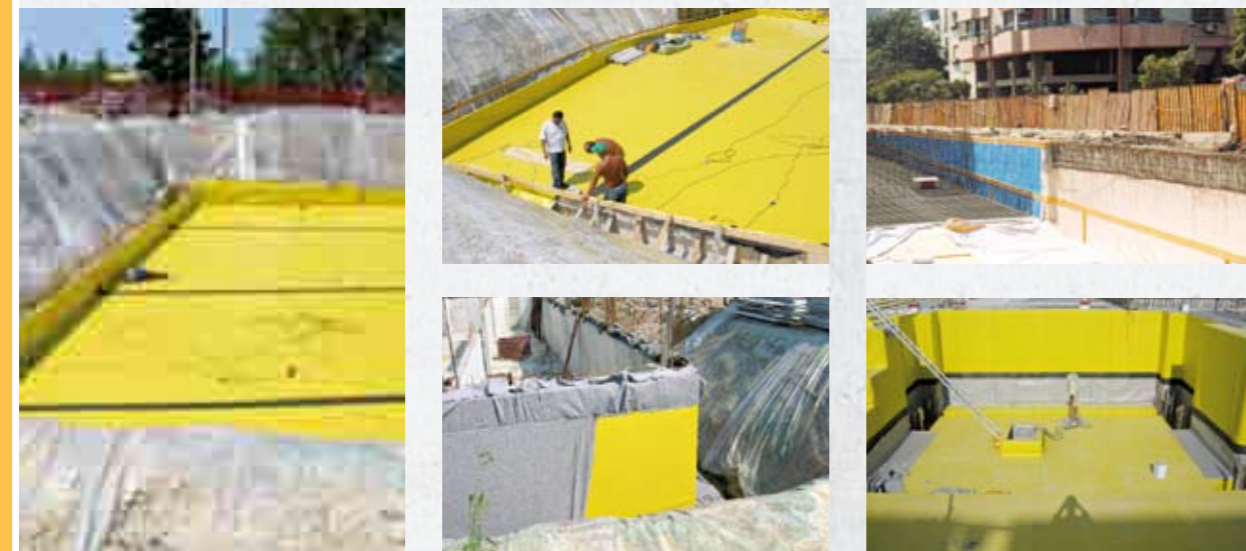
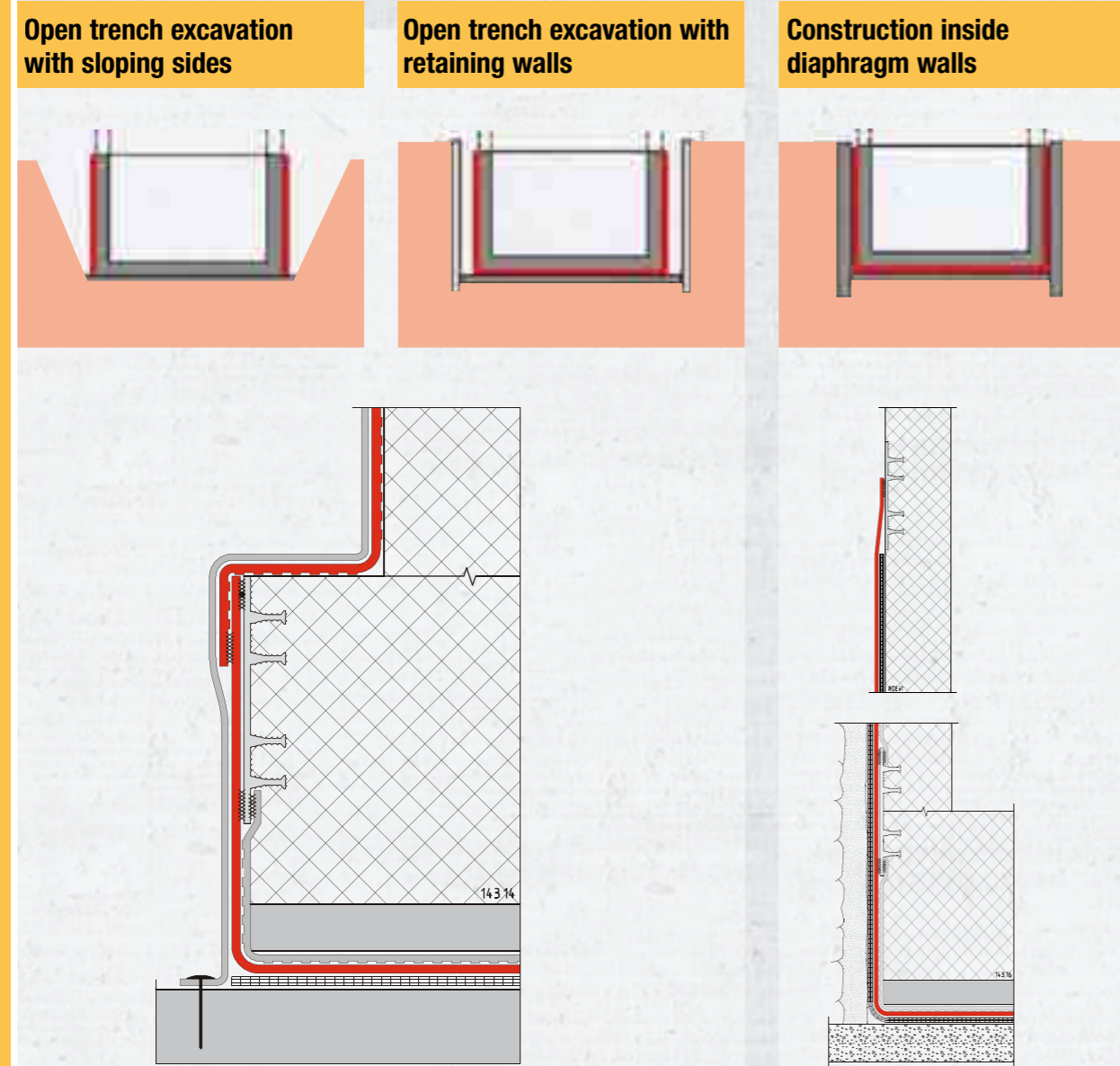
- Sikaplan® WP 1100 H / HE
- Sikaplan® WT 1200 C / CE
- Sika® Waterstops, PVC types
- Sika® Waterstops, FPO types
- Sika® Dilatec®, type E/ER strips
- Sikadur®-Combiflex® System
- Sika® Control® system and injection ports
- Sika® Injection-305 resin



Sikaplan® Membrane Systems for all Types of Construction Procedures

The Sikaplan® Flexible Waterproofing Membranes

Construction Procedures



The Sikaplan® Membranes

Properties	Sikaplan® WT 1200		Sikaplan® WP 1100		
	Sarnafil TG 68-...	Sarnafil TG 68-...N	Sikaplan-9.6	Sikaplan-14.6	Sikaplan-24.6
C: Fleece stabilized E: Embossed H: Homogeneous L: Laminated 2: Extruded	-16 C -20 C -30 C	-25 CE -35 CE	-15 HL2 -20 HL2 -30 HL2		
Material base	FPO-PE with glass fleece restraint		PVC-P, homogeneous		
Available thickness* (mm)	16, 20, 30	25, 35	15, 20, 30		
Colour	Top layer: green Reverse layer: black		Top layer: yellow Reverse layer: black		
Membrane surface appearance	Smooth	Top layer: smooth Reverse: embossed	Smooth		
Roll width (m)	2.00		2.00		
CE conformity	According to EN 13967				

* Thickness depending on project requirements and local standards.

Physical properties according to Product Data Sheets

The correct Selection of Sikaplan® WP (PVC-P) or Sikaplan® WT (FPO-PE) Membranes

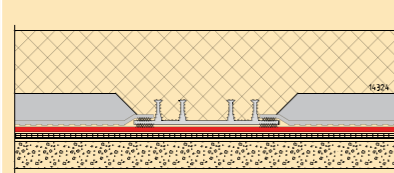
	Sikaplan® WP (PVC-P)	Sikaplan® WT (FPO-PE)
Bitumen resistance	No	Yes
Resistance to salt water	Yes	Yes
Resistance to chemically polluted groundwater	No	Yes
Resistance to water under hydrostatic pressure at 5 bar	Yes	Yes
Suitability for installation during cold temperatures	Good	Needs experience
Site seam preparation	Not required	Activation and cleaning with solvent cleaner
Seam welding	With suitable heat welding machines	With suitable heat welding machines

Ancillary Products for Sikaplan® Membrane Systems

The compatibility of materials and the professional sealing of details will decide on the successful waterproofing of basement structures.

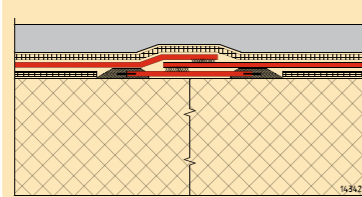
Sika® Waterbars, PVC and TPO/FPO based types

- Sika® Waterbar type AR (PVC)
- Sika® Waterbar type DR (PVC)
- Sika® Waterstop type MP AF (TPO/FPO) for compartments on the base slabs and walls



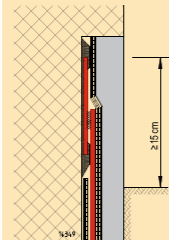
Sikadur® Combiflex joint sealing system

- Sikadur®-Combiflex® strip
- Sikadur®-31 CF (EP adhesive) for watertight compartments and terminations

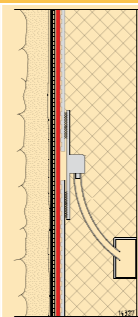


Sika® Dilatec, type E/ER joint and edge sealing strips

- Sika® Dilatec® E-220 for expansion joints
- Sika® Dilatec® ER-350 for waterproofing terminations
- Sikadur®-31 CF (EP adhesive) for watertight compartments and terminations using PVC membranes



Sika® Control system and injection flanges



Sikaplan® WP/WT laminated metal sheets

Sikaplan® WP/WT protection sheets

Sikaplan® WP/WT disk fixing pieces

Detailing and Connections with Sikaplan® Membrane Systems

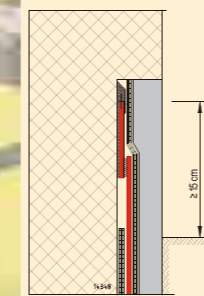
Sika® Waterbars are used to form watertight compartments with the Sikaplan® sheet membrane waterproofing systems below base slabs, above roof slabs and behind external walls. These compartments above underground roof slabs must be produced using Sika® Dilatec® and Sikadur®-Combiflex® waterproofing tapes. The waterproofing terminations on external walls and at intersections are made using liquid applied Sikalastic® products, to ensure that completely watertight basements are achieved.

Sikaplan® WP – Sika® Dilatec®

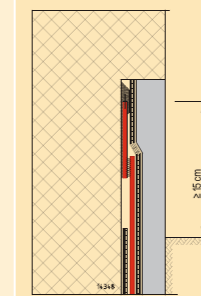
Sikaplan® WT – Sikadur®-Combiflex®

Sikaplan® WP/WT – Sika® Waterbars AR/DR

Waterproofing terminations of Sikaplan® sheet membranes at walls



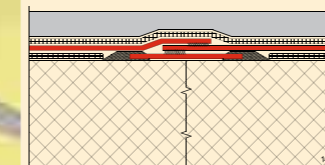
- Sika® Dilatec® ER-350
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WP 1100 membranes



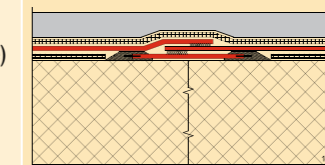
- Sikadur®-Combiflex® strip
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WT 1200 membranes

- Sika® Waterbars AR/DR (PVC)
- Sika® Waterbars AF (PE)
- Sikaplan® WP/WT membranes

Compartments over construction joints on roof slabs

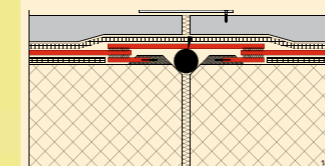


- Sika® Dilatec® E-220
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WP 1100 membranes

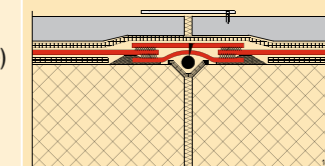


- Sikadur®-Combiflex® strip
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WT 1200 membranes

Compartments over expansion joints on roof slabs



- Sika® Dilatec® ER-350
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WP 1100 membranes



- Sikadur®-Combiflex® tape
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WT 1200 membranes

Intersection details with liquid applied Sikalastic membranes



- Sika® Dilatec® E-220
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WP 1100 membranes
- Sikalastic®-450/-801/-822 liquid membranes
- Sikagard®-186 (EP primer)



- Sikadur®-Combiflex® strip
- Sikadur®-31 CF (EP adhesive)
- Sikaplan® WT 1200 membranes
- Sikalastic®-450/-80/-822 liquid applied membranes
- Sikagard®-186 (EP primer)



Heat Welding of Sikaplan® Membranes

The seam overlaps of the membranes are securely and homogeneously welded with electric heat welding machines; this can be done manually with hand welding guns, or automatically with self-propelled machines. The butt joints of the Sika® Waterbars are heat welded with special heated blades.

Manual welding with hand welding gun and pressure roller



Automatic welding with self-propelled machine roller



Heat welding of Sika Waterbars onto the installed Sikaplan® membrane with heated blades



Single seams (width >30 mm) are produced with hand welding guns and pressure rollers or with automatic welding machines.



Double seams (widths: 15 mm each plus 10 mm air testing channel) only with automatic welding machines.



Butt joints between **Sika® Waterbars** type AR/AF are made with hot copper blades whilst the waterbar's ends are fixed into special clamps.

Quality Control of welded Seams on Site

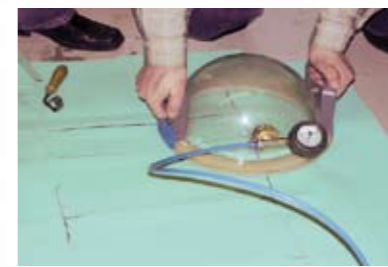
The welded seams of Sikaplan® flexible membranes are always thoroughly quality control tested on site to confirm their watertightness. This is done by both visual and physical testing methods, electrical testing for voids is also straightforward. Quality control of the completed membrane installation on the structure prior to the concreting works is therefore particularly easy and extremely important. It therefore gives the Sikaplan® flexible sheet membrane systems another real advantage in ensuring the prevention of any future leaks in important basement structures that are specifically designed to be watertight.

Visual testing



Testing with blunt screw driver

Physical testing



Physical testing with a vacuum bell

Electric testing



Electric testing with a "holiday" detector



Physical testing of double welded seams and central void with compressed air

Inadequate workmanship or incorrect installation of membrane waterproofing could mean that the structure is not watertight, thus allowing future water ingress. Sika trained professional contractors and quality control on site are always recommended to prevent such defects.



Non-professional welding



Incorrect welding



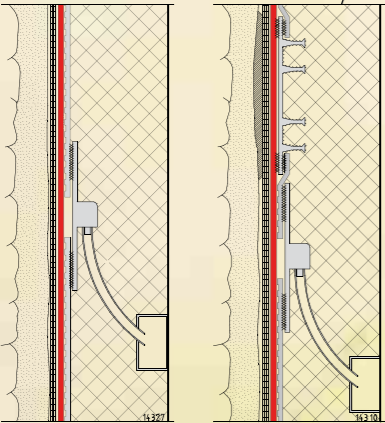
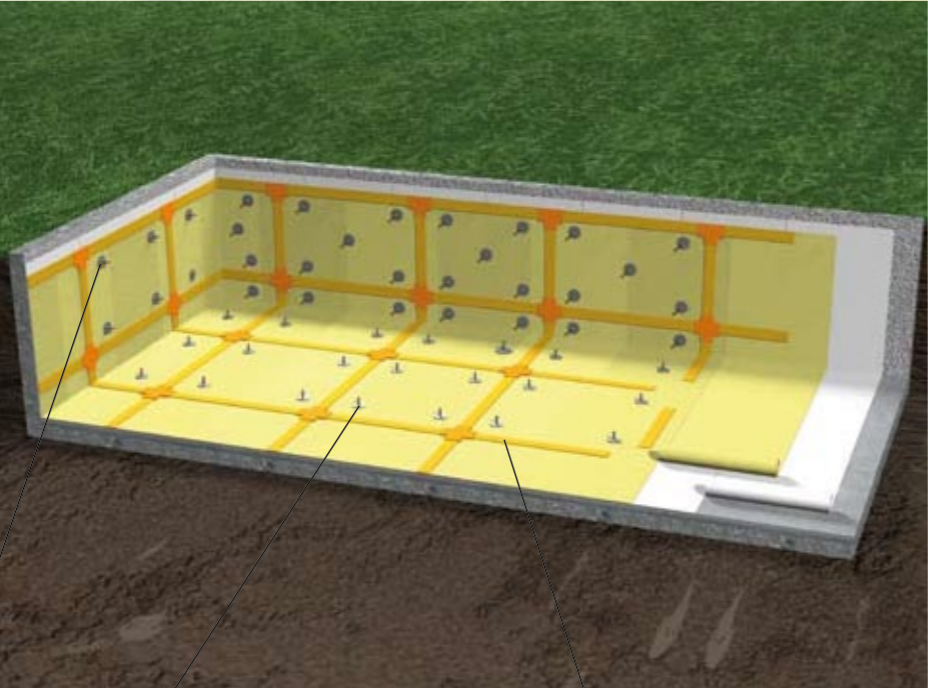
Ignoring substrate requirements and omitting protective backing materials



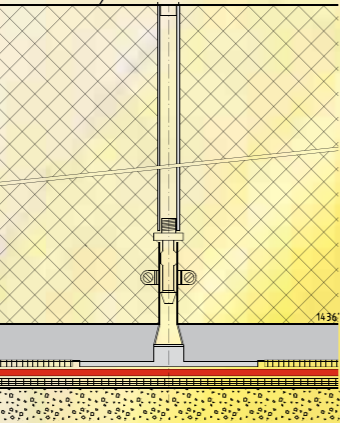
Watertight Security and Extending Service Life with Sikaplan® Flexible Membrane Systems

Repairing Leaks at any Time during the Construction Period and the Service Life of the Structure

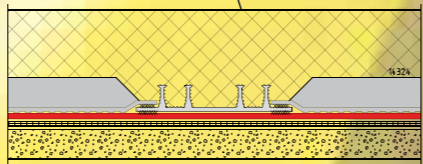
A compartmental water-stopping system with Sika® Waterbars and welded double layer Sikaplan® sheet membranes is combined with Sika® injectable pipes and ports cast into the concrete structure, to provide the security of complete watertightness control, allowing fast location, then fast and easy repairs using Sika® injection resins, if this is ever required at any time during the construction period or during the entire service life of the structure.



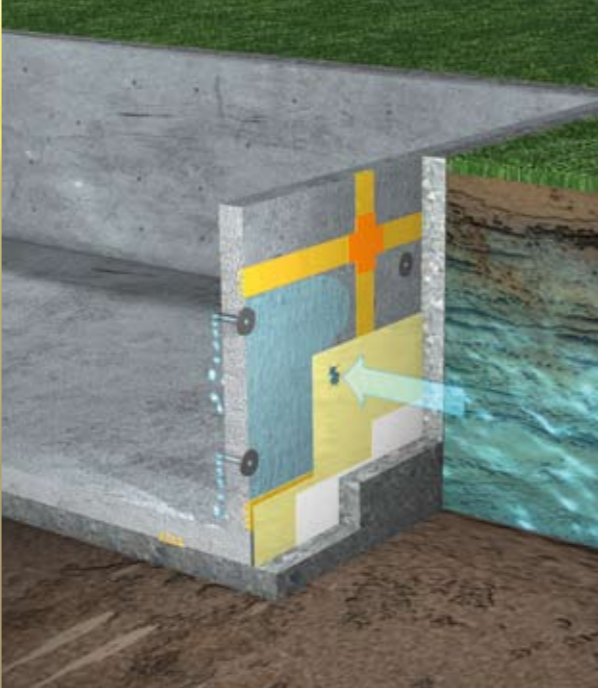
Sika® Control and injection ports



Sika® Control and injection ports



Watertight compartments cast under the floor slabs



Leaks through damaged membrane are easily detected as water appears in the Sika® Control pipes and injection ports.



Repairing the waterproofing by the injection of Sika® Injection-305 resin through the Sika® Control pipe and injection port.

Possible Reasons for Membrane Waterproofing System Leaks

- Membrane perforated during construction works
- Welded seam overlaps not professionally welded and tested to be watertight
- Torn membrane after excessive settlement or other structural movement

Sika® Injection-305 Two-Component Sika® Injection Pump for Polyacrylate Gels

A flexible, very low-viscous and fast-reacting polyacrylate injection gel for the permanent watertight sealing of damaged membrane waterproofing installations (both single and double layer systems). The material reacts to form a waterproof, flexible but solid gel with good adhesion to both dry and wet substrates.

The **Sika® Injection Pump PN-2C** is specially designed for full curtain injection watertight sealing. A two-component pump is required, for the fast-reacting polyacrylate gels to the individual components are introduced separately and mixed at the gun. The actual mixing takes place in a static mixer in the head. Suitable injection packers are inserted into the **Sika® Control** system injection ports.



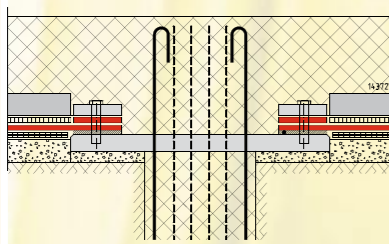
Global Case Studies

Flexible Waterproofing of Basement Structures with Sikaplan® Membranes



Project
The National Bank HQ Building, Lisbon, Portugal, 1992

Sika solution
Pile cup waterproofing details with preformed double-flanged sections of **Sikaplan®** sheet membranes.
Sikaplan® WP 1100-20 HL: 25 000 m²
Sikaplan® WP Waterbar type AR: 12 000 m

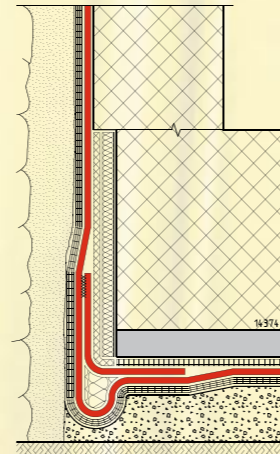


Details of the pile head



Project
Turkish Commercial Centre, Moscow, Russia, 2001

Sika solution
Waterproofing details with **Sikaplan®** membrane for the floating slab design, to accommodate the anticipated settlement movement and building load both during and after construction.
Sikaplan® WP 1115-20 H translucent: 14 500 m²

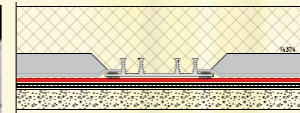


Detail of the slab/wall intersection

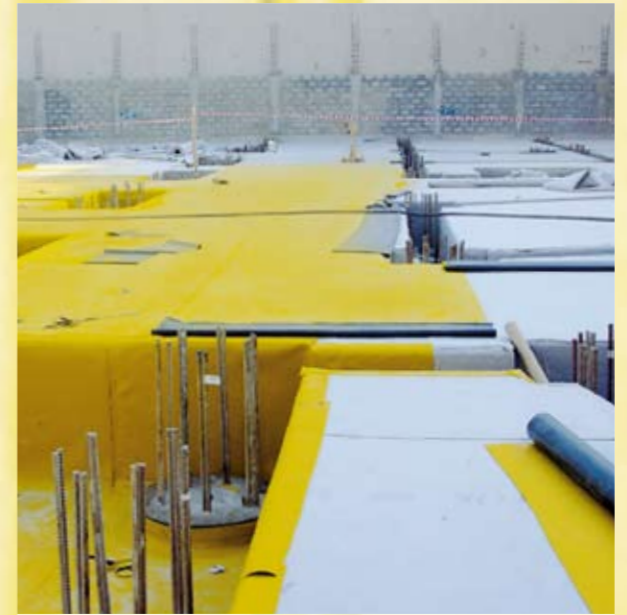


Project
Central Aquarium, Moscow, Russia, 2007

Sika solution
Single-layer compartmentalized **Sikaplan®** TPO/FPO membrane with the **Sika®** Active Control System injection pipes and ports installed in the concrete.
Sikaplan® WT 1200-20 C: 60 000 m²
Sikaplan® WT Waterbar type AR: 12 000 m

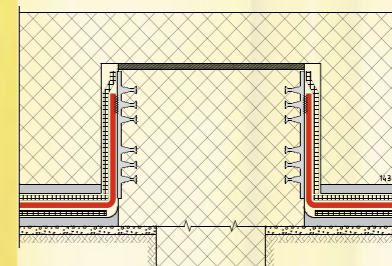
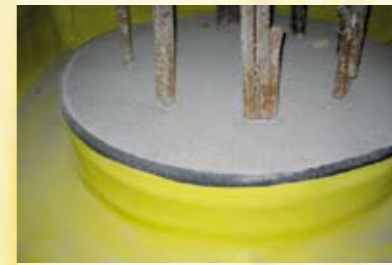


Details of the base slab compartments



Project
Golden Mile Project, Palm Island, Dubai, U.A.E., 2007

Sika solution
A large basement of 80 000 m² made watertight with **Sikaplan®** flexible waterproofing, including preformed detailing sections for more than 1500 pile caps installed in combination with **Sikadur®-42** epoxy grout.
Sikaplan® WP 1100-20 HL: 90 000 m²
Sikaplan® WP Waterbar type AR: 27 000 m



Detail of the pile cap waterproofing



Global Case Studies

Flexible Waterproofing of Basement Structures with Sikaplan® Membranes



Project
Wadi El Nile Street underpass, Cairo, Egypt, 1988

Sika solution
Sikaplan® flexible sheet membrane waterproofing, installed with automatic double-seam welding and air pressure testing, to confirm watertightness prior to backfilling over protective sheeting.

Sikaplan® WP 1110-15 H: 6100 m²



Double-seam welding and pressure testing



Project
Pavan 2, Residential and commercial complex, Venice, Italy, 2004

Sika solution
Basement waterproofing with **Sikaplan®** flexible waterproofing installed on the formwork and then welded to the **Sika® Waterbars** in the joints to ensure a watertight structure.

Sikaplan® WP 1100-20 HL: 9500 m²

Sikaplan® WP Waterbar type AR: 3000 m



Lining for the basement slab formwork



Project
Hotel Moscow, Moscow, Russia, 2007

Sika solution
Waterproofing by installation of the **Sikaplan®** flexible sheet membrane system with work continuing on site even during temperatures as low as -15 °C.

Sikaplan® WT 1200-20 C: 20 000 m²



Membrane installation at extremely low temperatures



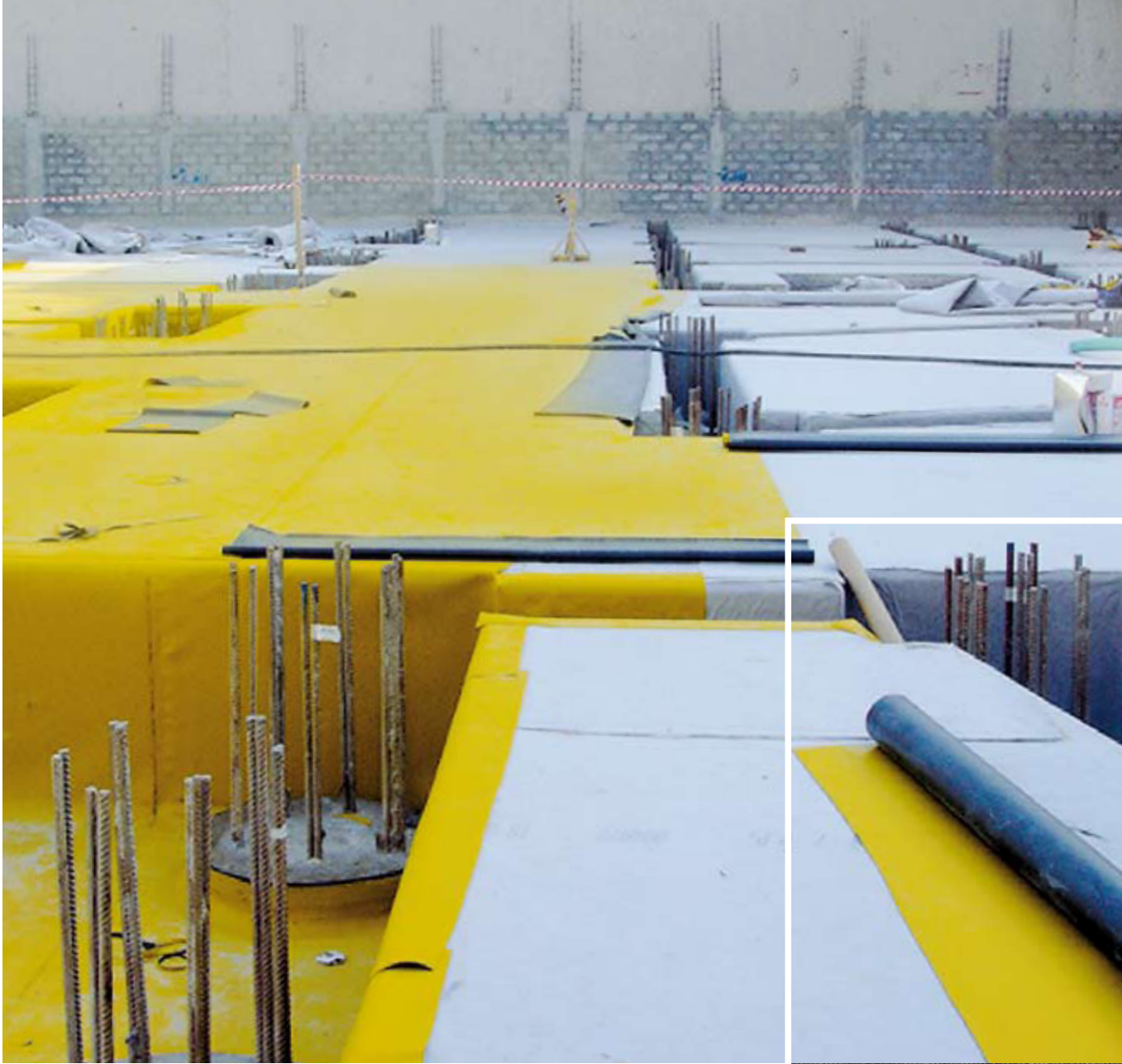
Project
Vorobyovi Gori condominium, garage and basement roof deck, Moscow, Russia, 2007

Sika solution
Underground car parking and storage areas with the roof slab waterproofed with **Sikaplan®** flexible sheet membranes, also providing watertight tree planting box-outs and bases for children's play areas.

Sikaplan® WP 1100-15 HL/-20 HL/-30 HL: 128 000 m²



Garage roof deck with integrated tree planting box-outs; watertightness testing by flooding the plant boxes



Flexible Waterproofing of Basement Structures with Sikaplan[®] Membranes

Sika[®]