FULLY BONDED MEMBRANE TECHNOLOGY

The Complete SikaProof® System with patented hybrid technology

BUILDING TRUST

CONTENTS

FOREWORD

Fully bonded membrane technology has established itself as one of the most innovative and advanced developments in structural waterproofing. It has become an integral part of modern watertight concrete structures and is now indispensable in the construction of high end basements. With the advantages of a permanent concrete bond, and reliable crack-bridging capability, plus watertight protection against lateral underflow, this method provides maximum operational safety and watertight security. To achieve this, selection of a suitable fully bonded membrane system, fully detailed design, and professional installation on site are essential. The German Concrete and Construction Technology Association (DBV, Deutscher Beton- und Bautechnik Verein e.V.), published the Guide to Good Practice "Pre-applied fully bonded membrane systems " in September 2023, which is now the regulatory guidance for this method.

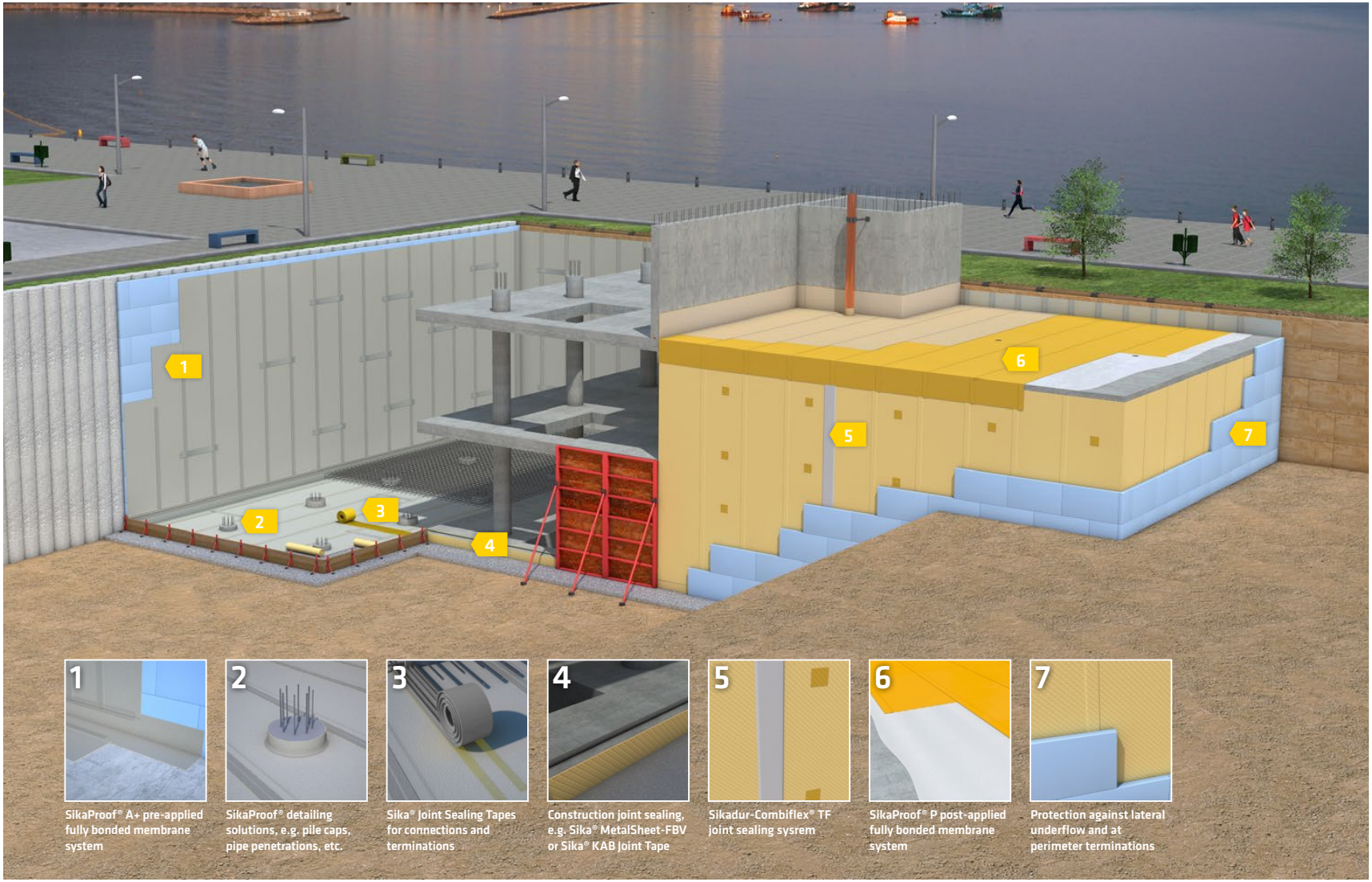
The SikaProof® A+ system has passed all the tests required in the DBV Guidelines, and its approval - General Statement of Applicability (a.A.-FBVS), to the highest performance classification. This includes all the basic tests required, plus a wide range of optional and additional tests. The SikaProof® A+ system is impressive, with its patented hybrid bonding technology, ease ofhandling and workability, thermally welded seams and extended weathering resistance for exposure on site.

The combination with SikaProof® P and Sikadur-Combiflex® TF systems provides a complete and fullytested waterproofing system which resolves almost all design details and requirements. This makes it one of the most efficient and accommodating systems on the market.

With this new 3rd edition of the SikaProof® Manual, you have a fully updated document for guidance. Thank you for your confidence and interest in the SikaProof® complete system. I wish you an enjoyable read and continued success with the completion of your projects. Please do not hesitate to contact us if you have any questions. Your local Sika representatives will be happy to assist you.

Dipl.-Ing.**Marco Bloch**,
Product Engineer, Structural Waterproofing

1 SikaProof®
THE COMPLETE SYSTEM



1 SikaProof® A+ pre-applied fully bonded membrane system

2 SikaProof® detailing solutions, e.g. pile caps, pipe penetrations, etc.

3 Sika® Joint Sealing Tapes for connections and terminations

4 Construction joint sealing, e.g. Sika® MetalSheet-FBV or Sika® KAB Joint Tape

5 Sikadur-Combiflex® TF joint sealing sysrem

6 SikaProof® P post-applied fully bonded membrane system

7 Protection against lateral underflow and at perimeter terminations

The SikaProof® system is a specially developed, complete and integrated structural waterproofing system, consisting of three main components: SikaProof® A+, SikaProof® P, and the Sikadur-Combiflex® TF system. The system includes a wide range of ancillary products that can be used in combination with many other structural waterproofing products to provide specific details and solutions. All of the necessary design details and requirements can be reliably, safely and securely accommodated.

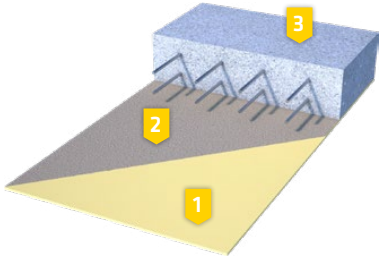
The crack-bridging properties, combined with secure protection against lateral underflow, offer maximum protection and operational safety. Quality and performance you can rely on—all the components, connections, and transitions are fully integrated and tested to relevant standards, as well as for their practical application and function in service.

1.1 SikaProof® A+: Mode of Operation, Characteristics, and System Build-up

SikaProof A+ consists of a proven, highly flexible waterproofing membrane based on flexible polyolefins (FPO) and an innovative hybrid bonding layer.

System Build-up

1) Highly flexible sheet membrane based on FPO (flexible polyolefin)
2) Hybrid bonding layer
3) Concrete structure



Hybrid Bonding Layer - Mode of Action

The three active principles of the innovative hybrid bonding layer provide maximum security

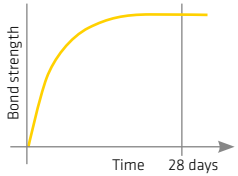
1. Adhesive Bond

Full surface bond to the concrete structure with the special hybrid polymer bonding layer.

2. Mechanical Interlocking

Mechanical interlocking of the fresh concrete into the textured profile of the membrane bonding layer.

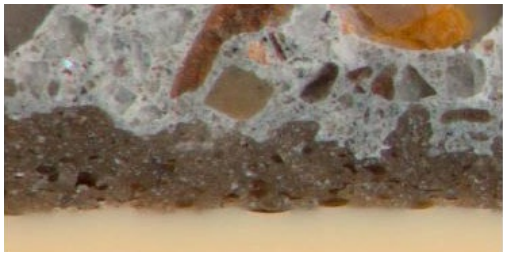
3. Hydration Interlocking



Cement particles in the hybrid bonding layer further increase adhesion through their continued hydration (crystalline growth) interlocking with the fresh concrete. As a result, the adhesive bond increases over time.

These first two active principles come into play right after concreting, thus ensuring a rapid and secure bond.

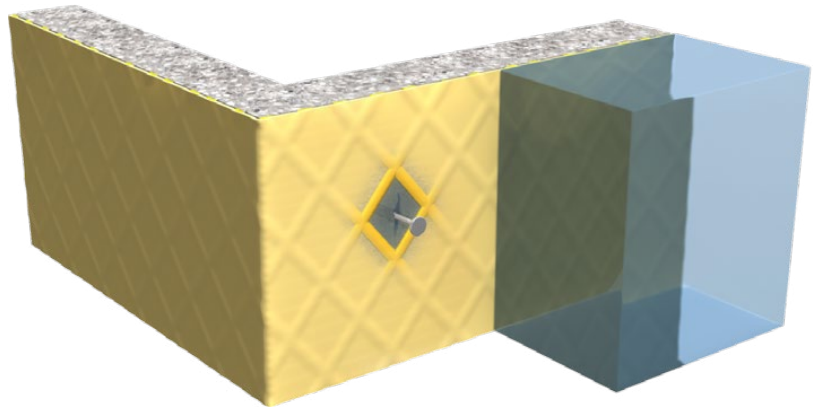
The third principle continuously improves the bond throughout the concrete hardening period.



Magnified cross-section of the SikaProof® A+ system build-up

Crack-bridging and Lateral Underflow Protection

The highly flexible FPO membrane gives SikaProof® A+ reliable, permanent crack-bridging properties. The extremely robust and reliable hybrid bonding layer provides lateral underflow protection against water under hydrostatic pressure. In contrast to loosely laid systems, standing water cannot penetrate and get trapped between the membranes and the concrete elements, being effectively stopped and contained at any point of damage. This guarantees maximum protection with operational safety and security.



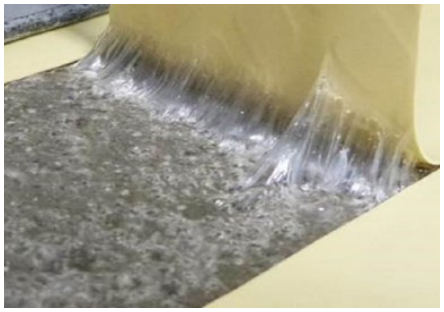
Proven full surface bonding, with crack bridging capabilities, and protection against lateral underflow, even under hydrostatic pressure

1.2 SikaProof® P: Mode of Operation, Characteristics, and System Build-up

The SikaProof® P system consists of multiple layers, which are based as with SikaProof® A+, on a highly-flexible polyolefin (FPO) sheet membrane. The membrane is fully coated with a layer of the specially developed, high-performance adhesive and sealant. A special integrated system primer is also available for bonding to the substrate.

Bonding Effect

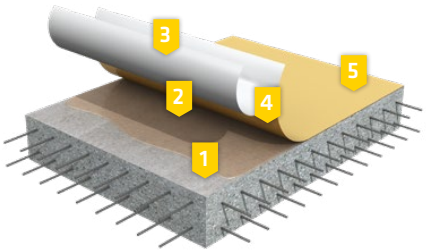
This differs from the pre-applied method in that SikaProof® P is post-applied to the existing concrete structure. It is therefore suitable for use on walls and soffits as well as other horizontal surfaces, such as in large recesses. The surface of the existing concrete substrate is pretreated with a system primer. The membranes are then cold-bonded to the surface. Exceptional contact adhesion ensures a durable and flexible bond with the structure.



Full-surface bonding through high-performance contact adhesion with the system primer

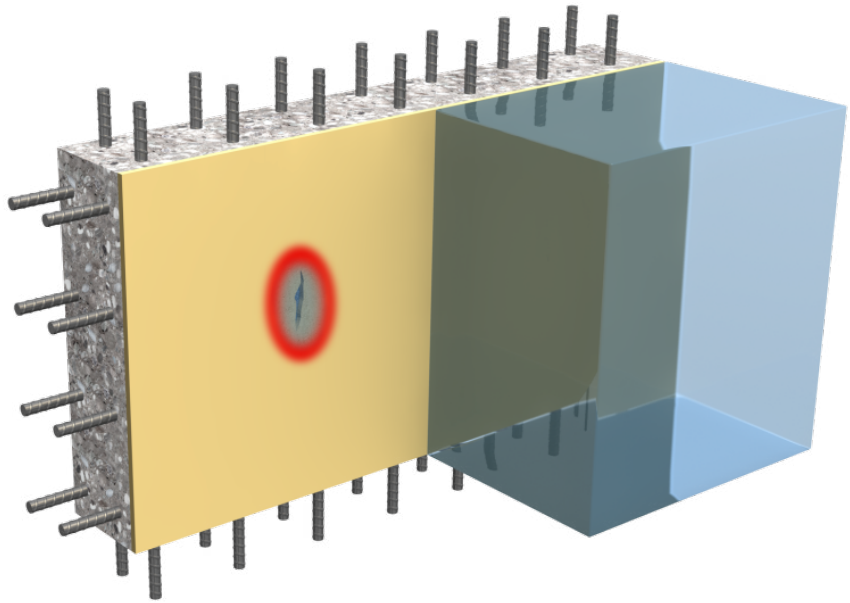
System Build-up

1. Existing concrete structure
2. SikaProof® Primer-01
3. Peel-off protective liner
4. Unique, polyolefin-based adhesive and sealant layer
5. Highly flexible membrane based on FPO (flexible polyolefin)



Crack-bridging and Lateral Underflow Protection

With SikaProof® P, the highly flexible FPO membrane ensures reliable crack bridging. The full surface bond, with a unique and permanently flexible contact adhesive, ensures that the highest performance requirements for protection against lateral underflow can also be met by the post applied system.



Proven full surface bonding, with crack bridging capabilities, and protection against lateral underflow, even under hydrostatic pressure

1.3 Sikadur-Combiflex® TF System – Mode of Operation, Characteristics, and Build-ups

Structure of Sikadur-Combiflex® TF System and its Build-up

The Sikadur-Combiflex® TF System (formerly known as the Tricoflex® adhesive sealing system) is a watertight sealing system for construction and expansion joints under hydrostatic water pressure. It consists of an elastomeric sealing strip based on thermoplastic TPE, bonded with a structural epoxy adhesive. For watertight sealing of expansion movement joints in concrete, with additional joint sealing tapes available for sealing external transitions and terminations. Connection joints to existing structures/ components can also be sealed using Sika joint sealing tapes with a single-sided flange for bonding with the system.

Substrates

The system is fully tested for installation on watertight impermeable concrete structures and has the German General Building Authority Test Certificat (apB). In addition, it also has good adhesion on many other building materials, including steel and hard plastics. Hence all the integral components, transitions and material interfaces can be securely sealed. The suitability of substrates should be verified in advance to confirm any pretreatment requirements for secure adhesion.

Tested Combination

The ability to combine and connect with the SikaProof® A+ and SikaProof® P systems has been successfully demonstrated in

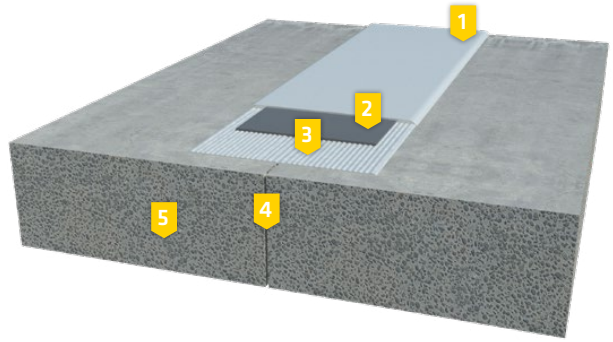
Sikadur-Combiflex® TF joint sealing system for watertight sealing of expansion and construction joints

functional tests up to a hydrostatic water pressure of at least 5 bar.

Weldability and Elasticity

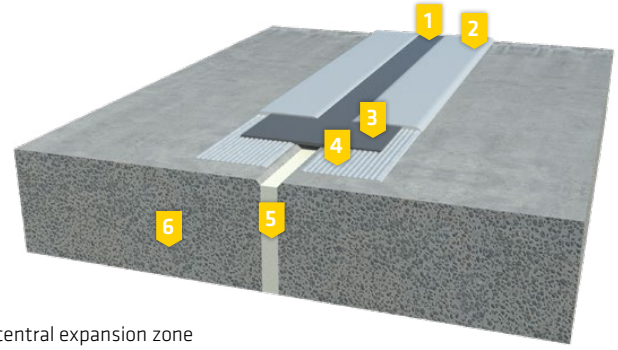
The TPE joint tapes and sealing strips can be thermally welded, producing a closed and homogeneous joint sealing and water-proofing system The highly flexible TPE material with an elongation at break of over 400%, allows permanent and reliable accommodation of joint movements.

Sealing of Construction Joints



1. Top layer of **Sikadur-Combiflex® CF adhesive, 1-2 mm**
2. **Sikadur-Combiflex® TF sealing strip, 1 mm**
3. Base layer of **Sikadur-Combiflex® CF adhesive , 1–2 mm**
4. Construction joint
5. Watertight concrete structure

Sealing of Expansion Joints



1. Adhesive-free central expansion zone
2. Top layer of **Sikadur-Combiflex® CF adhesive, 1-2 mm**
3. **Sikadur-Combiflex® TF sealing strip, 2 mm**
4. Base coat of **Sikadur-Combiflex® CF adhesive, 1–2 mm**
5. Expansion joint with Fibreboard filler
6. Watertight concrete structure

1.4 Portfolio – System Components, Accessories and Equipment

Overview of the Key System Components and Accessories. Please refer to the respective Product Data Sheets for further and full details. The latest versions are available on your local Sika website.

FULLY BONDED MEMBRANE SYSTEM

SikaProof® A+

The pre-applied fully bonded membrane system is available in roll widths of 1 m and 2 m.

Thicknesses available:

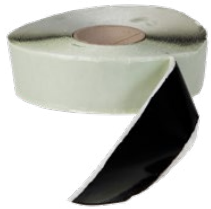
- SikaProof® A+ 08 (membrane 0.8mm, total thickness 1.35mm)
- SikaProof® A+ 12 (membrane 1.2mm, total thickness 1.75mm)

SYSTEM ACCESSORIES

SikaProof® Tape A+N Internal adhesive tape

SikaProof® Sandwich Tape double-sided adhesive tape

SikaProof® Patch-200 B FPO membrane tape laminated with butyl adhesive



SikaProof® FixTape-50 double-sided butyl adhesive tape

POST-APPLIED SYSTEM

SikaProof® P-12

The self-adhesive waterproofing membranes come in widths of 1 m, with a self-adhesive lap edge and installation guide marks.

The perfect addition to the SikaProof® A+ product line for all post-applied horizontal and vertical component surfaces. The connections to SikaProof® A+ are easy to make by lapped bonding.

SikaProof® P-12
Waterproofing membrane with special lap edges

SYSTEM ACCESSORIES

SikaProof® Primer-01

SikaProof® ExTape-150 butyl-based tape for external bonding

1.4 Portfolio – System Components, Accessories and Equipment

SEALING SYSTEM COMPONENTS

Sikadur-Combiflex® TF System

Sikadur-Combiflex® TF sealing strip Thermoplastic elastomer	Total width (mm)	Tape thick-ness (mm)	Roll length (m)
For expansion joints			
Sikadur-Combiflex® TF 200/2	200	2	20
Sikadur-Combiflex® TF 250/2	250	2	20
Sikadur-Combiflex® TF 300/2	300	2	20
For construction joints			
Sikadur-Combiflex® TF 150/1	150	1	20
Sikadur-Combiflex® TF 200/1	200	1	20
Sikadur-Combiflex® TF 250/1	250	1	20

Other widths are available on request

Sikadur-Combiflex® TF Profiles For insitu, cast-in-place concrete connections,and building expansion joints	Total width (mm)	Expansion zone width (mm)	Tape thickness (mm)	Profile depth (mm)	Number of Locking Anchors
DFT 330/3	330	104	4	30	6
DFT 330/3 KF	330	104	4	30	3
LFT 240	240	-	4	-	-
LFT 330	330	-	4	-	-
FAT 130/3 K	Profile depth 180 mm, cover slab 30 mm, locking bar (f) 35 mm				
DFT 330/3 KI	As for DFT 330/3 KF, but angled				
DFT 330/3 KA	As for DFT 330/3 KF. but angled				

For building expansion joints, insitu cast-in-place concrete connections, construction joints, etc.

Sikadur-Combiflex® CF adhesive	Packaging
Combined pack A+B	4 kg
Combined pack A+B	9 kg

OTHER PRODUCT COMBINATIONS

To meet all design and detailing requirements, the SikaProof® system can be used and combined with, or added to many other products from the Sika structural waterproofing range, such as the following:

- Sika® Tricomer and KAB joint profile waterbar systems
- Sika® MetalSheet FBV
- SikaFuko® injection hose systems
- SikaSwell® swellable sealing profiles
- SikaPlan® waterproofing membranes and protection sheets
- Sikaflex® permanently elastic sealants

1.4 Portfolio – System Components, Accessories and Equipment

The following tools and equipment have proved effective for secure professional installation:

Welding Machines
Suitable specialist welding machines are used for the thermal welding of overlapped membrane joints. The following welding machines from Leister are recommended:

- Triac AT (handheld hot-air device)
- Unidrive 500 (semi-automatic)
- Uniroof 300 or Uniroof 700 (automatic welding machines)

Pressure Rollers
A 28 mm manual pressure roller with a PTFE roller has proved effective in manual welding procedures, to consistently press the membranes together. The small roller allows consistent and constant high pressure to be applied to the seam areas.

Hot Air Gun
A hot air gun is required to form and reshape the membranes. This is necessary for example, on collars around pipe penetrations. The Triac AT handheld hot air gun from Leister is recommended.

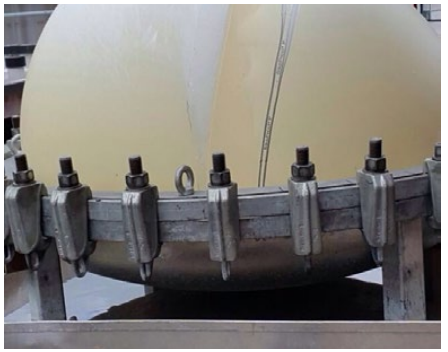
Staple Gun, ClampingRails, Nailing Strip
To secure the membrane to the formwork.

Other Tools
Other tools for installation on site, include: a suitable sharp knife (ideally with a hooked blade), a metal straight edge for cuts, a soft felt-covered float (for rubbing in SikaProof® P), plus a suitable ruler, marker pencil, and the required PPE.

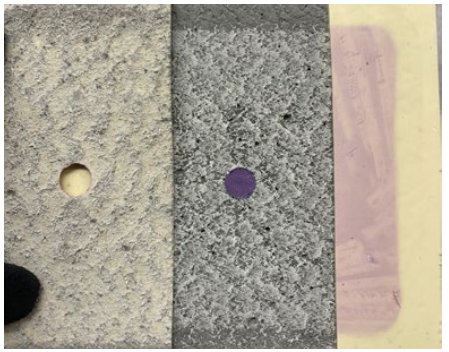
1.5 Testing and Approvals

The fully bonded method is regulated by the German Concrete and Construction Technology Association (DBV) in their Guide to Good Practice: "Pre-applied fully bonded membrane systems" - September 2023. This bulletin also details the necessary system testing principles, on the basis of which, an accredited testing, monitoring, and certification body (PÜZ) can issue a general statement of applicability, usually abbreviated to a.A.-FBVS. The testing requirements are divided into three performance classifications with different water pressure loadings ranging from 3 to 20 m. There is also a distinction between minimum testing required, and optional additional tests. All systems must pass the minimum tests in full, as a prerequisite for use in accordance with the DBV Guide. Depending on the project requirements and site conditions, the system may require additional verification, e.g., for specific detailing, material interfaces, special performance / properties, etc. These are also outlined as the optional additional tests.

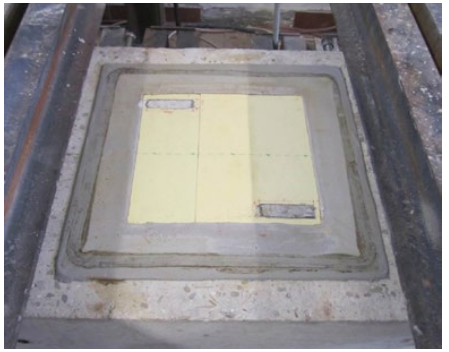
The SikaProof® complete system has passed all additional tests for detail designs, material interfaces, including combinations of SikaProof® A+ with SikaProof® P and the Sikadur-Combiflex® TF system. In addition, for SikaProof® A+, a range of other test results and proof statements is available, including for radon tightness, watertightness of a T-joint without concrete bonding, coefficients of sliding friction, or enhanced UV weathering etc. The SikaProof® A+ System therefore constitutes an efficient and comprehensively tested complete system solution. It is a.A.-FBVS certified and also has a wide range of the optional additional testing with results to the highest performance classification. In addition, AbP Approvals are also available for the SikaDur- Combiflex® joint sealing system. On the next pages there is a selection of the additional certificates and approvals available, as well as functional and detailing testing that is available.



Lap joint compression test



ASTM test to verify laterial underflow prevention using coloured water, pressure level 7 bar, duration 14 days



Functional testing for lap joint and cross-lapping construction/control joints, including an inspection window for verification of the lateral underflow prevention and free margin, at a pressure of 5 bar, for the test duration of 28 days

GENERAL PROOF OF APPLICABILITY AND GENERAL BUILDING AUTHORITY (DIBT) TEST CERTIFICATES:

- **SikaProof® A+ 08 and A+ 12:**
  General Statement of Applicability (a.A.-FBVS) under the DBV Technical Bulletin on fully bonded membrane systems, Performance Classification 3 (approval up to 20 m head of water pressure)
- **SikaProof® A+ 08 and A+ 12:**
  General Building Authority Test Certificate (abP) for strip sealing of construction joints and cracks in concrete with high water penetration resistance (approval up to 20 m head of water)
- **SikaProof® P-12:**
  General Building Authority Test Certificate (abP)) for strip sealing of construction joints and cracks in concrete with high water penetration resistance (approval up to 10 m head of water)
- **Sikadur-Combiflex® system:**
  General Building Authority Test Certificate (abP) for strip sealing of construction joints and cracks in concrete with high water penetration resistance (approval up to 20 m head of water)
- **Sikadur-Combiflex® TF system:**
  General Building Authority Test Certificate (abP) for strip sealing of expansion joints in concrete with high water penetration resistance (Approval up to 7 m head combined with 2 cm resultant deformation)

Elongation and crack bridging capability illustrated with a flexural tensile test (in overview and close-up)

FUNCTIONAL AND DETAILING TESTING:

- **ASTM 5385M:**
  Lateral underflow protection test (SikaProof® A+ and SikaProof® P), test pressure 7 bar
- **Functional test:**
  Combining and lap jointing of Sikadur-Combiflex® TF with SikaProof® A+ and SikaProof® P-12, test pressure 5 bar
- **Functional test:**
  Combining and lap jointing of SikaProof® P-12 with SikaProof® A+, test pressure 5 bar
- **Functional test:**
  Joint formation with SikaProof® Tape A+N including cross-lapping of construction and control joint with widening to 2 mm, test pressure 5 bar
- **Functional test:**
  Joint formation with SikaProof® Sandwich Tape, including cross-lapping of a construction and control joint with widening to 2 mm, test pressure 5 bar
- **Functional test:**
  Joint formation by thermal welding, including cross-lapping of construction and control joint with widening to 2 mm, test pressure 5 bar
- **Functional test:**
  Waterproofing of a pipe penetration with SikaProof® collar and SikaProof® Tape A+N, test pressure 5 bar
- **Functional test** by the MFPA Leipzig on combining pipe penetrations with the Doyma system
- **Functional test** by the MFPA Leipzig on combining pipe penetrations with the Hauff Technik system
- **Functional test:**
  Waterproofing of a tensioning point and external sealing of any damage using an exterior FPO membrane tape with test pressure 5 bar
- **Functional test:**
  Integration of a bored pile cap, test pressure 5 bar

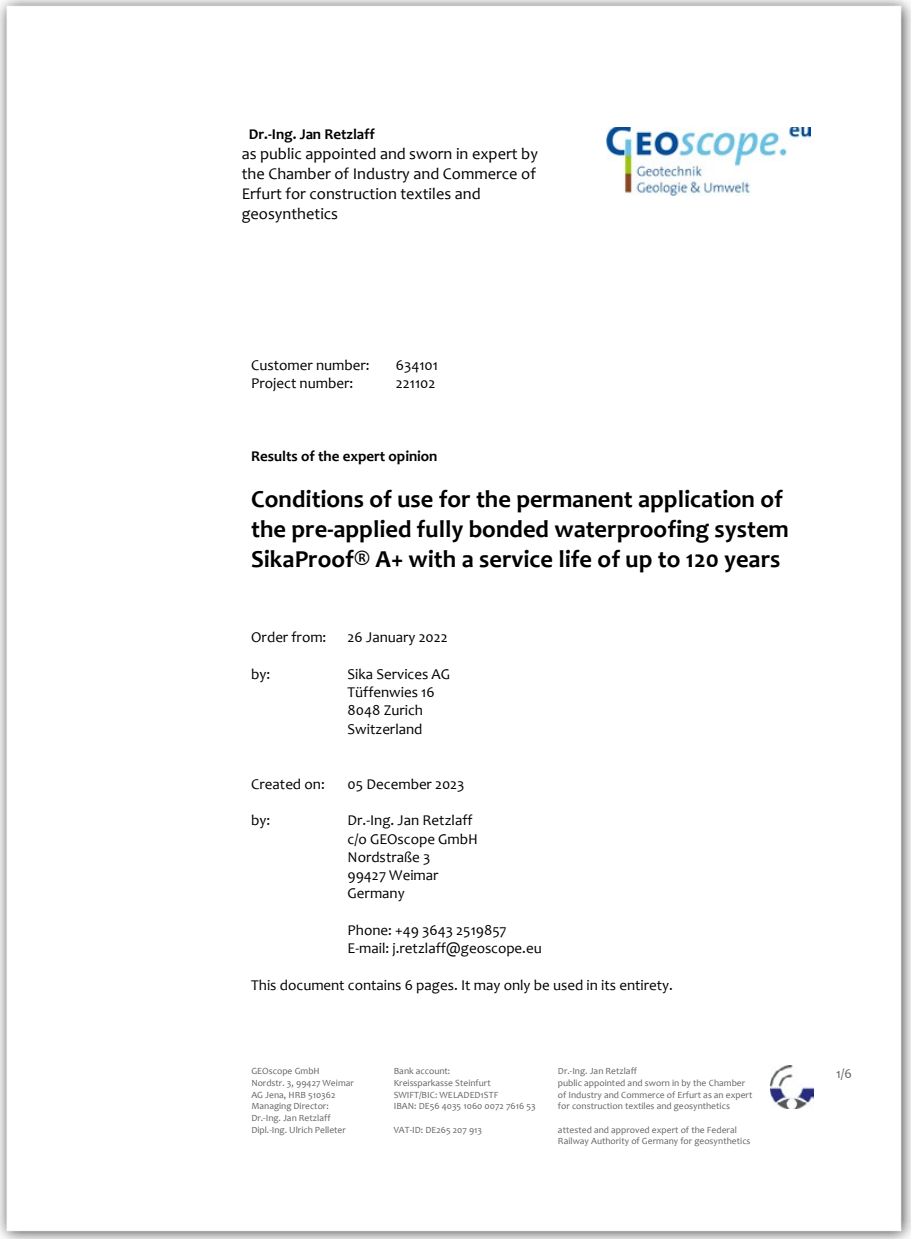
Additional Functional Tests:

- **Functional test:**
  Integration of a steel bar penetration, test pressure 7 bar
- Testing the watertightness of a T-joint without adhesion to the concrete, thermally welded seams, test pressure 5 bar
- Coefficient of sliding friction on concrete and the separation layer
- Resistance to methane gas and CO^2 permeability
- Test report on radon tightness
- Compressive strength and puncture resistance of SikaProof® A in accordance with EN 12390-3
- Analysis of load transfer from the reinforcement through spacers
- Tests on adhesive tensile strength and lateral underflow protection at various levels of contamination
- Root resistance

1.6 Durability

The durability and service life of structures, and the materials and systems used in them, are critical factors to be considered during the design phase. Waterproofing systems are designed to give structures reliable protection and to ensure they can fulfill their intended function, and hence preserve the building's asset value, for as long as possible. This is why Sika, in association with renowned geosynthetics experts, has developed a multi-year testing plan for the SikaProof A+ system and conducted extensive durability analyses.

Using the results of these tests, it was possible to carry out time and temperature dependent assessments of the expected functional service life. Subject to correct installation and use, external expert opinion gives the system an expected functional service life of 120 years.



Dr.-Ing. Jan Retzlaff
as public appointed and sworn in expert by the Chamber of Industry and Commerce of Erfurt for construction textiles and geosynthetics

GEOscope.eu
Geotechnik
Geologie & Umwelt

Customer number: 634101
Project number: 221102

Results of the expert opinion

Conditions of use for the permanent application of the pre-applied fully bonded waterproofing system SikaProof® A+ with a service life of up to 120 years

Order from: 26 January 2022

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Durability and Service life: Expert Opinion (Title page)

1.7 Sustainability

A key criterion in the development of all Sika systems is the most efficient, sustainable and resource-saving design possible, also leading to innovative solutions for optimum performance. This is why we only use the best-quality materials for the SikaProof® A+ system, and we manufacture it in Switzerland, which also avoids long transport routes around Europe, and conserves resources. The introduction of SikaProof® A+ technology with a more efficient central production process, has also significantly reduced the carbon footprint from the previous SikaProof® A generation. The net result is CO^2 equivalent savings of approximately 9 kg per $100m^2$. A direct contribution to sustainable construction / sustainable buildings. The system also has an independently tested EPD, and holds an environmental safety compliance certificate. Another crucial factor is durability. This has been assessed in an external Expert Opinion, using extensive accelerated aging tests, to have a service life of 120 years, subject to correct installation and use–see previous section.

We have produced a clear summary of these key points in a separate Sustainability Data Sheet.

Important Aspects for the SikaProof® A+ System:

- It has an EPD (Environmental Product Declaration).
- It is free from lead and tin
- It has an SVHC content ≤ 0.1%
- It has an Environmental Safety Certificate
- The system reduces waste by eliminating unnecessary protective layers
- We use > 50% recycled content in the packaging materials
- Has a lower carbon footprint than the previous generations
- Correctly installed, the system has a service life of up to 120 years
- The system also acts as a barrier to radon, methane, and CO^2

BUILDING TRUST

NACHHALTIGKEITSDATENBLATT

SikaProof® A+ 08 und A+ 12

SikaProof® A+ 08 und A+ 12 sind vollständig verbundene Membranabdichtungssystem für Stahlbetonkonstruktionen. Sie bestehen aus einer Membran auf Polyolefinbasis (FPO), die eine Hybridverbundschicht auf TPO-Basis mit speziellen adhäsiven Eigenschaften und Zementpartikeln besitzt und so einen dauerhaften Verbund mit dem Frischbeton herstellt.

PRÜFUNGEN/ZULASSUNGEN

- Allgemeines bauaufsichtliches Prüfzeugnis des MPA NRW
- Prüfbericht nach Anhang A des Heft 44 des Deutschen Beton- und Bautechnikvereins e.V.
- CE-Zeichen (Zertifizierungsstelle 1213-CPR-065)
- Prüfbericht zum Einsatz als Barriere gegenüber Radon (Czech Technical University, Prag, Tschechische Republik)
- Verhalten bei Brandeinwirkung gemäß EN ISO 11925-2, Klasse E
- Durch kalte Verarbeitung wird keine offene Flamme benötigt
- Dauerhaftigkeit / Beständigkeit der Wasserdichtheit gegenüber Alterung nach EN 1847 und EN 1928 B bestanden
- Dauerhaftigkeit / Beständigkeit der Wasserdichtheit gegenüber Chemikalien nach EN 1847 und EN 1928 B bestanden
- Prüfungen zur Kohlendioxid- und Methandurchlässigkeit nach ISO 7229
- Umweltunbedenklichkeitsbescheinigung gemäß Bundesbodenschutzverordnung (BBodSchV) Wirkungspfad Boden-Grundwasser (Institut Dr. Lörcher, Ludwigsburg)
- Erfüllt die Anforderungen der DGNB Systemversion 2018 (Neubau Büro- und Verwaltungsgebäude) an Kunststofffolien

GEBÄUDEZERTIFIZIERUNGEN

DGNB (VERSION 2018)

(DEUTSCHE GESELLSCHAFT FÜR NACHHALTIGES BAUEN E.V.)

EIGNUNG FÜR DIE QUALITÄTSSTUFEN

Eignung des Produktes/Systems für die einzelnen Qualitätsstufen entsprechend der Kriterienmatrix des DGNB-Kriteriums ENV1.2 „Risiken für die lokale Umwelt"

Relevante Anforderungen gemäß Matrix:
Zeile Nummer 36: *Kunststofffolien an Dach und Gründung*

Qualitätsstufe 1	Qualitätsstufe 2	Qualitätsstufe 3	Qualitätsstufe 4
Ja	Ja	Ja	Ja

Zeile Nummer 44: *Erzeugnisse aus Kunststoffen*

Qualitätsstufe 1	Qualitätsstufe 2	Qualitätsstufe 3	Qualitätsstufe 4
		Ja	Ja

Nachhaltigkeitsdatenblatt
Waterproofing
SikaProof® A+ 08 und A+ 12
Oktober 2020, Version 1

1/3

2 DESIGN

2.1 Traditional Watertight Construction

There are essentially two ways to protect basements from external water ingress (ground water, intermittent percolating water, or water under hydrostatic pressure): the "Black Box" method, according to DIN 18533 and the "White Box" method according to the WU Guidelines.

2.1.1 "Black Box" Method According to DIN 18533

This is a purely surface-based waterproofing system in the form of protective tanking around the structure. This can be made from plastic, elastomer or bituminous membranes, as well as liquid-applied materials. In this method, the function of the structure is just load bearing and it is considered water-permeable. Therefore, the waterproofing function is provided entirely by the surface sealing system. Use and installation are in accordance with DIN 18533. This method can only be successful if all the requirements in the standard are correctly designed and installed professionally, creating an effective and fully closed box around the structure. In addition to the concrete surfaces, this includes across and around all fixings, penetrations, terminations, and any protective layers, etc.

Generally this method does not provide protection against lateral underflow, and defects or deficiencies in the surface waterproofing system, which can lead to water penetration, which could spread throughout the structure. In these situations, leak detection and remedial actions can be very difficult and costly, plus the prospects of success are unpredictable and cannot be guaranteed.

Therefore, the major disadvantages of the 'black box' method are the high initial cost of compliance with the necessary design and installation standard, plus the increased risks from only the surface sealing layer being watertight, and having no lateral underflow protection.

IMPORTANT NOTE:

Fully bonded membrane systems are not covered by this standard and not regulated by DIN 18533. For this reason, fully bonded membrane systems must not be designed or installed according to this standard!

2.1.2 "White Box" Method According to the DAfStb WU Guideline

Watertight concrete structures, also known as "White Box," again have the load bearing function, but they also provide protection against water ingress as the concrete is impermeable. They consist of concrete with high water penetration resistance and suitably engineered structural design and concrete mix technology.

Leaks due to unforeseen cracking cannot be completely ruled out, even with good design and execution. In areas with variable ground water levels, there is a risk that water ingress will not actually occur until the structure is in use. However, leaks in localized areas can be effectively sealed using specialist grouting systems, provided that access is available.

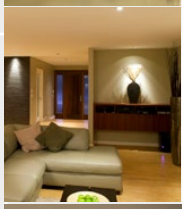
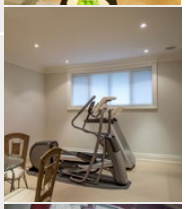
The work is all carried out in accordance with the German Committee for Reinforced Concrete (DAfStb) Guidelines for "Water-impermeable Concrete Structures" (WU Guideline). Since the introduction of these guidelines, this type of construction has become the established standard approach in Germany, and has gradually replaced the "black box" concept, including planned sealing of any unforeseen and accidental cracking. The key reasons are the greater certainty of success in real world site conditions, combined with the more effective repair solutions in the event of any damage.

Designing a watertight structure is a challenging task for all the parties involved and demands special expertise. The owner's criteria for the functional use of the structure, and its performance in service, must be defined and discussed right from the beginning. It is an important part of the responsible design engineer's responsibility to inform and advise the owners in this context. They must explain the alternative design choices with their advantages and limitations to the client, together with the costs and potential risks. This is because these choices all have a direct influence on the future functional performance and operational safety. In particular, the "risks of leakage in service, and access for any necessary remediation" must be clarified.

Nowadays, nearly all basements have a high-end use. Even structures that would be typically allocated to class B are often expected by the owners to look similar to basement facilities with a high-end use. This makes the blanket allocation to class A or class B inadequate, therefore the DBV Guidelines for "High-Quality Basements" now further subdivides class A.

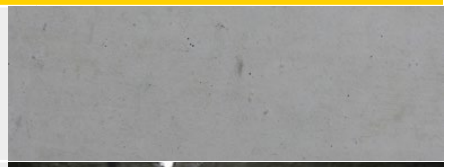
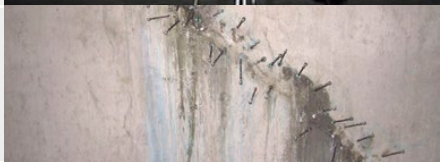
2.1 Traditional Watertight Construction

Usage Classifications According to the DBV Guidelines for High-end Basements

Sub-classification	Use of the area	Indoor climate (generally)	Examples (typical)	Measures [2] (typical)	
A ***	High	Warm, very low humidity, Low climate fluctuation range	Archives, libraries, plant rooms with moisture sensitive equipment (laboratories, IT rooms, etc.), storage facilities for high moisture or temperature sensitive goods	Thermal insulation in accordance with EnEV [3], Heating, forced ventilation, air conditioning (dehumidification)	
A **	Normal internal	Warm, low humidity, moderate climate fluctuation range	Rooms for long-term use by people, including meeting rooms, offices, living space, changing rooms, retail units; storage facilities for moisture-sensitive goods, plant rooms	Thermal insulation in accordance with EnEV [3], Heating, forced ventilation, Air conditioning (if applicable)	
A *	Simple	Warm to cool, natural humidity, wide climate fluctuation range	Rooms for temporary use by a few people; fitted-out basement areas, such as hobby rooms, workshops, utility rooms in single-family homes, laundry / drying rooms, storage areas	Thermal insulation in accordance with EnEV [3], if applicable without heating, natural ventilation (windows, light wells, if applicable user-independent)	
A [0 1)]	Secondary	No requirements	Simple plant rooms (e.g. service connection room)	–	

[1)] Complies with WU Guidelines [R1], 5.3 (2); allocation to class B possible in some circumstances
[2)] Compliance with the structural requirements for access to the enclosing building components is essential
[3)] EnEV: Energy Saving Ordinance [R37]

Source: DBV Guide to Good Practice: "High-Quality Use of Basements – Building Physics and Indoor Climate", German Concrete and Construction Technology Association E.V. Berlin, 2009 edition

Design principles of the DAfStb Guidelines "Watertight Concrete Structures", Beuth-Verlag, 2003:	Agreed outcome
a) Preventing shrinkage cracks	
b) Allowing shrinkage cracks, but with a limit on crack width and maximum use of autogenous sealing	
c) Allowing shrinkage cracks, but with a limit on crack width and sealing of designed and anticipated cracks	

To meet the defined requirements discussed and agreed with the owner, three design principles are available to the responsible engineer. These must be carefully adapted to the demands of the specific buildings and structures being designed. Not all measures are suitable for all requirements and site conditions.

In summary, even with the most meticulous design, planning and installation on site, the final results cannot be predicted with absolute certainty. Cracks can always occur in concrete, regardless of which design principle is selected. So the risk for each different structure can never be entirely managed, just reduced as much as possible. This makes professional design and detailing even more important, and as a result, selecting the right waterproofing concept and its implementation should be the job of qualified specialists with the necessary expertise. Equally crucial is professional execution of the detailed design. Unfortunately, in practice the specified products and systems, as well as the execution of design detailing, are subsequently allowed to be changed on site by the contractors. This poses a major risk. Many are unaware of the potential consequences and impact of such changes. The overall waterproofing concept is severely disrupted, and the future operational safety and functional use of the basement is jeopardized. This is why it is also important to monitor the design and execution throughout the process with a quality assurance system.

2.2 Modern Watertight Concrete Construction with FBV Technology

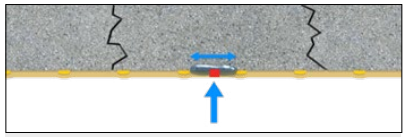
Due to rising demand for basement usage, structures with traditional watertight concrete concepts are increasingly reaching their limits. Today, nearly all watertight building projects are being designed entirely or at least in part, to be class A, i.e. for "high-end use" . Owners want flexibility to use their buildings without restrictions from day one. Any subsequent remedial grouting and repairs generate costs and severely restrict usage. This is always undesirable, or simply cannot be tolerated. Thus it is becoming increasingly challenging to be sure of meeting the future expectations for the structure.

In many cases, the WU Guidelines and provisions, are not easy to reconcile with owners requirements and architect's vision. This includes, for example, the requirement of a support structure that is as free from constraints as possible and a simple geometry, which conflicts with the architects vision. The most common requirement is that building component surfaces remain accessible at all times for possible remediation. If this is mandated, then the owners will be severely restricted in their use and layout of the premises. This limitation is quite often disregarded later on, which then leads to massive difficulties and problems with high leak repair costs and extended downtimes. With these concepts, even with the most detailed planning, cracks and leaks can never be totally prevented. Whether the cracks are filled with water or they have been successfully grouted, it is not apparent until hydrostatic water pressure increases. In areas with fluctuating ground water levels or at risk of flooding, this is inevitably only apparent in service. This represents a significant risk. To increase operational safety and minimise the residual risks, additional measures are required.

Combination with a Fully Bonded Membrane System as a Modern Construction Method

All the aforementioned reasons have led to the increased use of fully bonded membrane systems in combination with the WU-Guidelines for watertight concrete structures. This has generally proved successful in practice and is now an indispensable part of the design today. The basis for this method is a professionally designed watertight concrete structure tailored to include the fully bonded membrane system. The FBV system is not to be understood as a standalone waterproofing solution–it functions in conjunction with the concrete component and must therefore always be considered and planned holistically as part of the watertight concrete structure. For this reason, all the parameters (in design and execution) must meet strict quality requirements. There are currently a large number of different systems on the market. These have significant differences in performance, material basis, mode of operation, detailing solutions, approvals and certification. The selection of a suitable fully bonded membrane system to meet all the specific project requirements, is therefore an important factor. It must be carefully selected, designed, detailed and installed on site. For this reason, the German Concrete and Construction Technology Association (DBV) set up a working group for detailed investigation of the method. As a result, DBV Bulletin 44, "Status Report with Recommendations for Action" for FBV systems, was first published in October 2018. In the following years, this work was further developed into the DBV Guide to Best Practice, issued in September 2023.

SikaProof® A+ - No Lateral Underflow protection



Permanent bond with the concrete structure

+

Lateral underflow protection

+

Crack-bridging capability

=

Maximum security

Reasons for Selection and Intended Use

Fully bonded membrane systems can be used for two main reasons according to the DBV Guidelines:

Reason 1. Added for Additional Security (FBVS-1)

Here the system is installed in addition to a complete watertight concrete structure design in accordance with DAfStb, to increase operational safety and minimize the risk.

Reason 2. Used as a Compensatory Variation (FBVS-2)

In this approach, the system is combined with a design for a watertight concrete structure that differs from the provisions of the waterproofing guideline. Possible differences include a lack of access to the surfaces on the inside of the structure, and/or for any planned crack injection.

Typical reasons for the decision to use a fully bonded membrane system include:

- The structure contains a severe or uncontrollable constraint, and separation cracks cannot be ruled out by the design (Design Principle A: A crack-free structure in line with the WU Guidelines is too risky.).
- Water ingress due to cracking can only be detected in service due to zones of fluctuating water levels or flooding situations.
- Grouting of water-bearing cracks in the construction phase or during use is either not possible (accessibility), extremely costly (massive structures), or undesirable (exposed concrete).
- Access to the component surface is not possible. Water ingress is not detected immediately, and remediation with reasonable effort is not feasible.
- Risk of high costs in the event of damage (e.g., sports hall flooring, storage of high-cost goods, downtime costs in industry and research facilities).
- The design risk is reduced.
- High security with reliable results.
- More cost effective (e.g. compared to Black or White Box).
- The concrete structure is protected, e.g. from aggressive groundwater.
- Special protection against radon, methane, or CO^2.

2.2 Modern Watertight Concrete Construction with FBV Technology

DBV Guide to Best Practice for Fully Bonded Membrane Systems

The basis for the design and execution of watertight concrete structures using fully bonded membrane systems, is the DBV Guide to Best Practice for fully bonded membrane systems - September 2023, by the German Concrete and Construction Technology Association (DBV). This explains the FBV method and gives clear guidelines on each step of the design and execution. It is also supplemented by the DBV Bulletin 54 'Pre-applied Fully Bonded Membrane Systems' - September 2023, which provides additional guidance.

To help assess the performance of the systems to be used, these Guidelines contain testing principles as the basis for full testing of the FBV systems. This is verified by a General Statement of Applicability (a.A.-FBVS), see also section 1.5 “Testing and Approvals”. It is always important to verify all the detailing, material combinations and interfaces planned and occurring in the structure, together with other special requirements in the relevant performance classification.

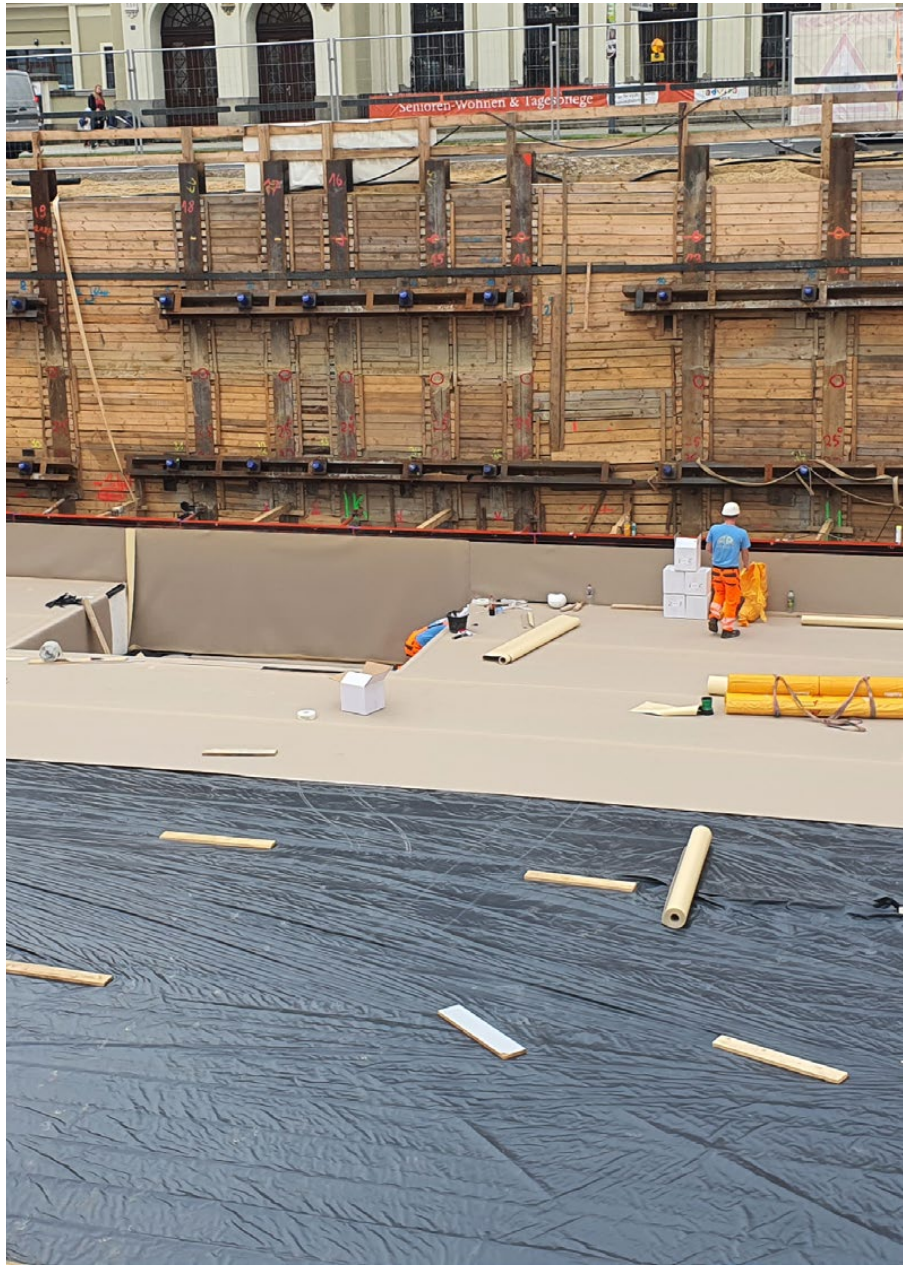
This means that the basic tests needed as a minimum requirement are generally insufficient, and therefore further optional tests and approvals are necessary. As already mentioned, selection of the FBV system is of central importance. The system and structure must be considered holistically and designed together, including all of the necessary details.

DBV Bulletin 54: Additional Guidance for Pre-applied Fully Bonded Membrane Systems.

Subsequent changes to the system specifications or design details will constitute an intervention in the design and can have serious consequences. This can jeopardize durability and safety in use, and could lead to defects and reduce the intrinsic value.

All later modifications must therefore be checked with care and must be assessed and approved by the responsible design engineer.

For these reasons, professional sound and expert coordination by a waterproofing specialist, also called a WU- coordinator in Germany, is important throughout both the design and build phases. [1, 2]



2.2 Modern Watertight Concrete Construction with FBV Technology

Qualification of the Waterproofing Specialist (WU-coordinator)

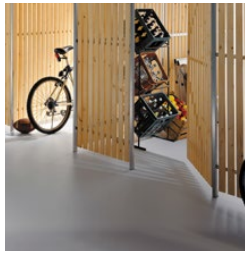
The DBV Guidance on FBVS sets out clear qualification requirements for the waterproofing specialist. They must provide evidence of the following [1]:

- Degree in Architecture or Civil Engineering from a recognized University, Technical College, Science and Engineering School etc.
- Minimum of 5 years' experience in waterproofing and watertight systems.
- Reference projects no more than 3 years old.
- Certificate of participation for at least one training course on the design and installation of FBVS under the DBV guidelines, no more than 3 years old.

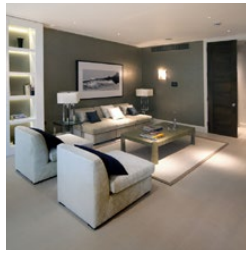
As part of Sika's training and continuing education program, we can regularly offer this mandatory training for such FBVS waterproofing specialists.

[1] Source: DBV Guidlines on Fully Bonded Membrane Systems, German Concrete and Construction Technology Association (DBV), September 2023 edition [2] Source: DBV Guidelines 54 Fresh Concrete Bonding Systems, German Concrete and Construction Technology Association (DBV), September 2023 edition.

2.3 Recommended Applications



Habitable basements, e.g. residential housing



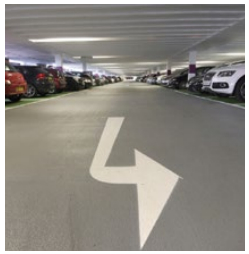
Living & working spaces

IT Centres

Archives and storage areas for moisture-sensitive goods

Recreational facilities

Plant rooms



Parking garages

Shopping centers

3 SikaProof® A+: INSTALLATION AND USE

3.1 General Requirements

To achieve the full performance of fully bonded membrane systems, professional handling and installation, plus compliance with general construction standards are mandatory.

3.1.1 Installer Training

Installers must have all the tools and equipment necessary for professional installation of the fully bonded membrane systems system. Every specialist installer responsible for producing system details must be properly trained and qualified. [1] Qualification can be obtained at one of our regular FBVS training courses. For training dates, please contact your local Sika company. Installers receive a personal certificate on completion of our courses. Personnel without a valid training certificate may only perform support tasks, such as: substrate cleaning and preparation, materials handling & transport, membrane unrolling, and waste disposal etc.

Training in FBV Systems design and installation is caried out at the Sika Training Center in Stuttgart

[1] Source: DBV Guide to Good Practice on fully bonded membrane systems System, German Concrete and Construction Technology Association (DBV), September 2023 edition

3.1.2 Transport and Storage

SikaProof® A+ and all the system components should be stored in unopened original sealed packaging, in a dry place, protected from snow, ice, direct sunlight, and extreme heat or heat sources, at temperatures between +5 and +30°C. Heavy objects must not be stacked on top of the rolls during storage and transport.

Shelf life when stored correctly for:
- SikaProof® A+: 24 months
- SikaProof® Tapes: 18 months

On site the incoming materials must be inspected and checked immediately on delivery, to confirm they are undamaged, and that the order is complete and correct.

- Protect the materials from damage
- Do not store directly on site roads or in machinery operating areas
- Protect from contamination and exposure to direct sunlight or weathering (do not remove original packaging prematurely)
- Cover and protect opened or partially used materials with suitable protective sheeting
- Do not stack pallets or other heavy objects on the rolls
- If possible store under cover, or in the shade, especially in the summer
- In winter, store in temperature controlled areas or storage containers if possible

Store in the original packaging on pallets under cover and protected from damage

3.1.3 Installation for Walls

The substrate surface must meet the following requirements and have:

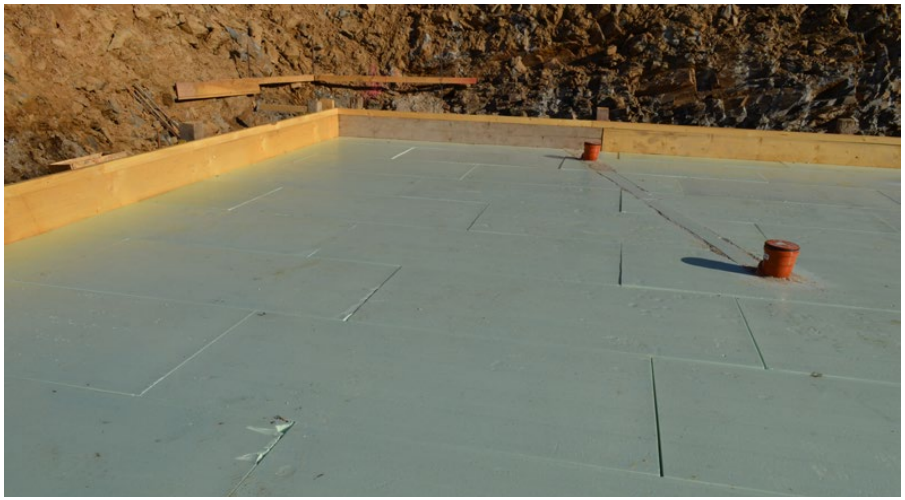
- Sufficient load-bearing capacity (substrate must not deform during follow-on works such as concrete placement)
- Uniform support for the membranes; no voids or gaps > 15 mm in the substrate surface
- No sharp-edged or pointed elements protruding from the surface
- The responsible structural engineer must specify whether additional slip membranes are required. SikaProof ® A+ has the following coefficients of friction:
  - on smooth concrete: 0.59
  - on additional PE film: 0.47
- Level and free from sharp-edged irregularities
- Clean and free from dirt and damaging materials
- May be damp, but should be free from standing water
- Free from damaging contaminants such as hazardous chemical waste in the subsoil – this must be assessed and confirmed before installation.

Installation for base slab areas:

- Lean concrete blinding: poured in as fluid as possible and then vibrated to compact, and allow the aggregates to settle and ensure a good surface is achieved
- Perimeter terminations

Installations for wall construction

- Perimeter terminations
- Mineral surfaces
- Formwork

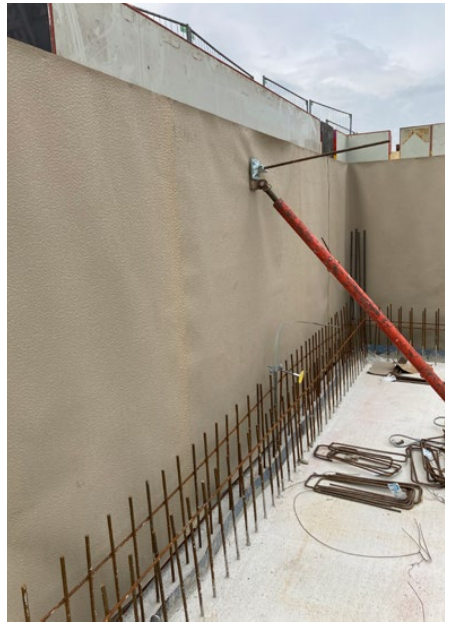


Well prepared substrate for installation of edge formwork and perimeter terminations

Lean concrete blinding, poured and vibrated to allow the aggregate to settle for a good surface finish

Floor slab installation on slip membrane (PE film)

Installation on perimeter insulation in single-sided formwork sections



Installation on the formwork for double-sided walls and construction in sections

Improving Poor Substrates
If substrates do not meet the requirements described above, they must be individually assessed and appropriate improvement measures taken to ensure compliance and protection of the FBV system. Any sharp-edged elements protruding from the surface must be knocked off. Any loose or friable materials must be brushed away.

Various protective layers can be used, such as sheet waterproofing membranes or geotextile protection sheets of minimum 300 g/m^2. The substrate surface can also be improved: For example, limited surface voids in the substrate can be filled with suitable mortar.


Inadequate substrate quality


Voids in the substrate can be filled with mortar


Knock off any protruding sharp edges, brush away and remove loose and friable particles


Sheet membranes and geotextiles can be used as a protective layer

3.1.4 Cleanliness and Damaging Contaminants

The SikaProof® A+ bonding layer is very robust in site conditions and relatively resistant to contamination. Common contaminants can be cleaned off the bonding surface quite easily and thoroughly by several methods including jet-washing, using 'leaf' blowers, and by vacuum. Nevertheless, the primary aim should be to avoid introducing dirt and contaminants as far as possible. To ensure the system's functional performance, certain cleanliness requirements must be met. It is important to distinguish between minor dirt and contaminants that could affect functional performance. In general, purely visual contamination, such as surface foot prints or localised rust spots are not an issue. The key limiting factor is that the surface contamination will not have a separating effect, i.e. by preventing full surface contact between fresh concrete and the membrane bonding layer.

Several internal and external studies have examined this aspect with practical advice for applications with different types and levels of contamination. The studies showed that functional performance can be achieved by cleaning before concreting, even with severe contamination.

However, as stated, the aim should always be to prevent contamination as much as possible, and keep it to a minimum. An example of how this can be done is by maintaining a clean environment, such as by making a gravel or lean concrete layer in the working area outside the footprint of the floor slab. Through defined clean-walk only access areas and waste removal routes, clean walkways can be created. Even when soil in the surrounding area is cohesive clay, the amount of dirt introduced into the area can be significantly reduced.

Common Sources of Contaminants and Countermeasures:
- Dust and Dirt (e.g., surface discolouring and footprints) are purely visual and will have no adverse effect on the adhesive bond or the lateral underflow protection, as the bonding layer can fully adhere to the fresh concrete.
- Dirt that can lead to separation from the bonding layer (e.g, thicker clumps or layers of clay or peat) must be removed from the surface before concreting; for example by jet washing and blowers.

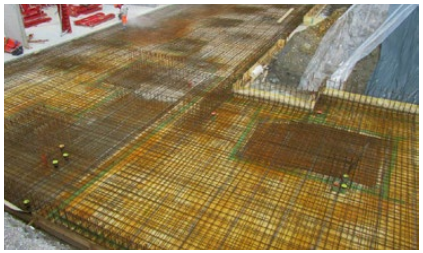

Cleaning the bonding layer


Strictly defined access by installing a grids to form a clean walking zone

3.1 General Requirements

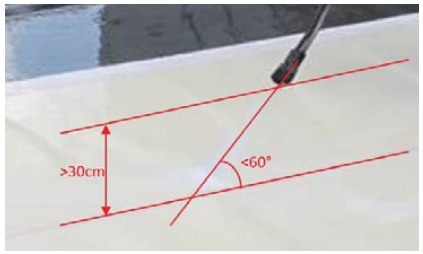
■ Contamination from concrete residues, cement slurry, or other hardened materials around connection joints and machine operating areas (e.g. the crane or concrete pump slewing range, main access pathways, cleaning stations, etc.), must initially be prevented by covering with protective sheeting. Any contamination that does occur must be cleaned off immediately and while still fresh e.g., by jet washing. Otherwise, after drying and hardening, they could be firmly adhered to the bonding layer and prevent direct contact and bonding with the fresh concrete. Design and execution-related solutions to prevent contamination can be found in section "3.7 Construction Joints".
■ Sawdust from woodwork for example, arising from saw cutting formwork in the working area, must be collected on a protective sheet, fleece, or mats and removed before concrete placement.
■ In autumn, fallen leaves should be cleared with a leaf vacuum or blower.
■ Discolouration due to rust spotting can occur during the reinforcement works but does not constitute impairment.
■ Any other waste and leftover materials on the surface and forming a separation from the bonding layer must be removed.
■ Occasionally pieces of tie-wire can remain on the surface, but generally these have no adverse effects.
■ Mould release oil is generally not required with this system and should not be used. However, should it be used nearby, any adjacent edges should have mould release agents applied and worked in cleanly and carefully with a non-drip cloth.

Otherwise, the bond to fresh concrete and the outer bond with other post-applied products in the system may be compromised.



Recommended Cleaning for the Functional Surface:
The bonding layer of the SikaProof® A+ must be cleaned carefully with as little pressure as possible by water jetting (clear water only, no cleaning additives).

Special note on high-pressure cleaners:
■ Do not use cleaners of > 200 bar
■ Set the pressure as low as possible
■ Use only flat nozzles, not spiral nozzles
■ Keep the nozzle at least 30 cm above the bonding layer; more if possible provided the cleaning effect is sufficient
■ Jet only at a flat angle < 60°
■ Do not jet directly against joints, always work over and across the joints, following the umbrella principle
■ Prepare a test area for evaluation



Clean the bonding layer at < 60° and > 30cm

Special Notes for High-pressure Cleaners
For bond areas, connections and other detail solutions joined to the outside of the SikaProof® A+, all contaminants reducing adhesion must be removed from the FPO surface in advance. It is often enough just to wipe with a damp cloth. Do not use cleaning products that leave an oily film or residue. If necessary, any contamination can be removed with Sarnafil® T Prep. Stubborn contamination can be removed with Sarnafil® T Clean and the bonding areas prepared with Sarnafil® T Prep. Apply both materials sparingly with a clean cloth to remove dirt and contaminants, then leave exposed to dry completely, before any further work with the areas.

3.1.5 Weather Conditions

The system can be successfully installed and used in a relatively wide range of weather conditions. However, the application limits must be observed, or special protection measures must be taken.

Installation in Damp or Wet Conditions:
The system can be installed on a damp substrate without any problems. However, any standing water must first be removed with a brush or rubber squeegee. In general, the aim should be to keep the joint areas as dry as possible. If rain showers occur during installation or condensation forms on the surface, the following points must be observed:

■ Remove standing water with a rubber squeegee
■ Dry seam welding / bonding areas as much as possible
■ Any minor residual dampness remaining (damp to the touch, no water droplets) is acceptable for joint seam welding-machines or SikaProof® Tape A+N at temperatures ≥ 0 °C, and for joints using SikaProof® Sandwich Tape at temperature ≥ 10 °C

3.1 General Requirements

It is important to firmly roll and smooth the tapes into position very carefully.

Thanks to the use of automatic welding machines to form thermally welded seams, as well as it's excellent cold flexibility, SikaProof A+ system can be successfully and economically installed even at very low temperatures during the winter months.

Notes Regarding the Connection Surfaces:
If connection work must be performed on surfaces that have already been installed and are exposed to the elements, the following must be observed: Due to the functional properties of the hybrid bonding layer, the tapes only possess very good wet adhesion when applied to freshly installed material (ideally within 1–2 days). Therefore, it is recommended that the connection joint seams to older existing surfaces should always be bonded to the outside of the sandwich tape. The sandwich tape is then stuck to the bonding layer of the newly installed membrane and bonded to the back of the existing surface. When using interior tapes or for thermal bonding, the joint must be thoroughly dried in advance (e.g. by hot air).

Installation at Low Temperatures:
The temperature range of +5°C to +35°C specified in the product data sheet represents the generally accepted range within which the system may be installed without additional measures. If the temperature falls below +5°C, installation of the system can still continue. On thermally bonded seams, this can be done by adjustments to the welding settings. On taped seams, additional measures must be adopted. As the temperature decreases, the adhesive properties of the tapes diminish. A sufficiently high material temperature at the time of bonding is crucial for optimal bond. This can be achieved by warming the seams and tapes with hot air when necessary. To do this, lay out the material and warm the surface bonding area gently with a suitable hot-air gun immediately before bonding (ensure the gun is not too close to the tape to prevent damaging the inner side). At the start of the works, always make a test joint to assess the optimum site parameters. Control of the material temperatures on site by storing them indoors in a heated location is also helpful.

Installation at High Temperatures and with Wide Temperature Fluctuations:
When installing in the summer months in strong sunlight, or in the transitional seasons with wide temperature fluctuations, some dimensional changes in the membranes may be noted. These changes in length are inherent to the physical properties of plastic sheet membranes and cannot be avoided. The change in length is effectively a side effect, resulting from the membrane's high flexibility.

IMPORTANT NOTE:

The change in length of the membranes due to temperature fluctuations. This is a side effect that is always present due to the high flexibility of the material. This material property also guarantees good workability as well as reliable crack bridging.

After the installation work is completed, it is recommended to carry out the reinforcement work as soon as possible. The reinforcement load clamps the system via the spacers and minimizes dimensional changes.

Any such changes in length may cause rippling. However, this generally does not impair the overall system and therefore does not constitute a defect.

3.1.6 Resistance

SikaProof® is designed for use in areas that will subsequently be backfilled, and is therefore UV stabilised for temporary exposure during the construction period on site, but not for permanent exposure. The permissible unprotected exposure time for the concrete bond side is max. 3 months, but the outside (FPO membrane) can be exposed to weathering for up to max. 12 months. Concreting or backfilling on or over the membrane as soon as possible is generally recommended. This also reduces the risk of contamination and damage. If the concrete placement has to be more than 3 months (90 days) after installation, the exposed bonding layer of the membrane must be covered and protected from UV exposure and weathering. The covering material must be capable of providing sufficient UV screening throughout the required period of protection. Also as previously mentioned, the outside of the membrane should be backfilled and protected as quickly as possible after formwork stripping, and within a maximum of 12 months. If backfilling around any connections is impossible within this time, then the membrane surfaces must also be covered and protected. Suitable methods include installing perimeter insulation boards or covering with protective sheeting.

In general, the FPO membrane has high chemical resistance and protects structures against any aggressive substances in the natural groundwater. The FPO membrane is also resistant to many different industrial contaminants in polluted sites.

However, a resistance assessment must be carried out in advance and must include a groundwater and soil analysis in addition to the precise boundary conditions. However, an assessment of the specific chemical media is necessary before the system is used. Note: the system is not approved for use as a seal for waterproofing containment areas under the WHG (Water Resources Act) for the storage, filling and handling of water-hazardous substances (LAU). However, the SikaProof® system can be used in these plants to seal and protect the structure against external groundwater under hydrostatic pressure. Internal waterproof containment lining against environmentally hazardous substances can only be carried out using systems with specific WHG-approval (e.g., Sika Westec® joint tapes, SikaTank® FB-25, Sikaplan® WT 6200, Sikafloor®-390 N, etc.).

3.1.7 Combination with Other Construction Products

The complete SikaProof® system has been comprehensively tested in all combinations of the products in the range. During applications on site, contact and interfaces with other products and materials will arise. SikaProof® has good chemical resistance and in principle it can be used and combined with many common construction chemicals and other materials, such as solvent-free PU, PUR, and epoxy resins, as well as with insulation and geotextiles. The same applies to the thick, solvent-free PMBC coatings typically used to fix perimeter insulation. Unknown material combinations must be evaluated and, if necessary, tested in advance for compatibility and resistance. If an adhesive bond is required, it must again be tested and evaluated in advance.

Rippling & distortion due to temperature fluctuations are inherent to the material and do not constitute a defect.

Installation of perimeter insulation with solvent-free, 2-component, PMBC adhesive coating

3.2 Welded and Taped Seams

With SikaProof® A+, joint seams can be made by thermal welding and adhesive bonding with tapes. All seam connections, whether longitudinal or transverse, are made according to the same principle. This makes installation even more flexible and allows for uniform connection on all edges of the membrane—regardless of the installation direction. This saves time and reduces waste. All joints must be made with a 5 cm lap width. For easier and safer handling, the membranes have an overlap guide mark on both sides in the form of a black dotted line. The formation of a butt joint (comparable to a cross joint) should be avoided and T-joints should always be staggered and offset. In general, ensure that all joints are clean and free of dust, dirt, or other contaminants that could reduce adhesion before joining. If the work is carried out in poor weather conditions (cold, damp, etc.), please refer to section "3.1.5 Weather Conditions".

As part of self-monitoring and quality assurance, all seams on the construction site must be tested and documented using the hand-pull method in accordance with DBV Information Sheet FBVS. For details, please refer to section "3.1.9 Quality Assurance".

Membrane installed with longitudinal and transverse seams, as well as T-joints

Installation guide mark for easy alignment of the 5 cm lap width

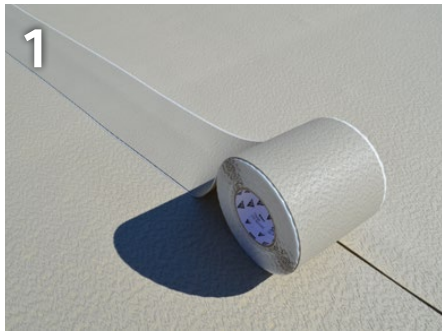
IMPORTANT NOTE:

The ability to create thermally welded seams using automatic welding machines is a key advantage of the SikaProof® A+ system. Technically this method is extremely reliable and represents the highest-quality type of seam connection. Thermally welded seams are extremely robust for construction site conditions and have been tested for watertightness up to 5 bar at the T-joint, even without a concrete bond!

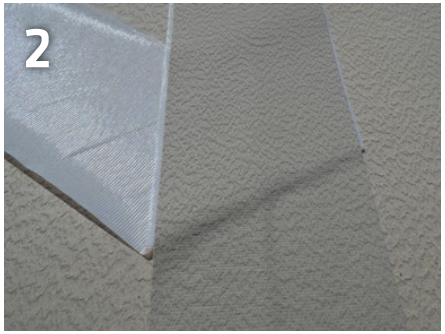
3.2 Welded and Taped Seams

3.2.1 Seam Jointing with SikaProof® Tape A+N

In this method, the seam is jointed on the bonding layer using SikaProof® Tape A+N (internal tape). The tape is 12 cm wide and should be located centrally over the seam to be jointed. Allowing for standard site tolerances, form a bond width that is as uniform as possible, and a minimum of 5 cm on both sides. All T-joints are then automatically sealed. It is essential to apply the tape without creases or voids and to firmly roll and rub it into place.



Aligning SikaProof® Tape A+N centrally over the seam



Peeling off the protective liner

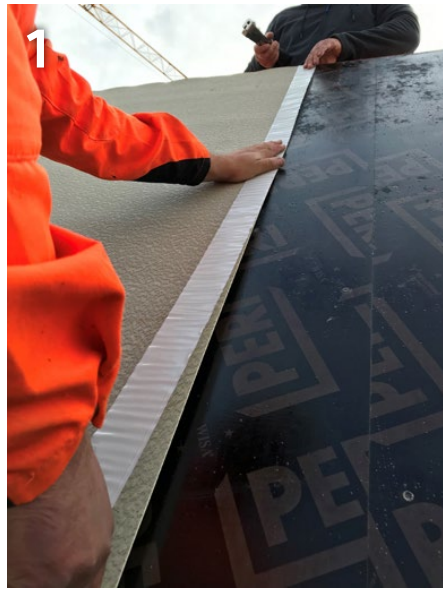
Applying the tape

Rolling out the SikaProof® Tape A+N without creases

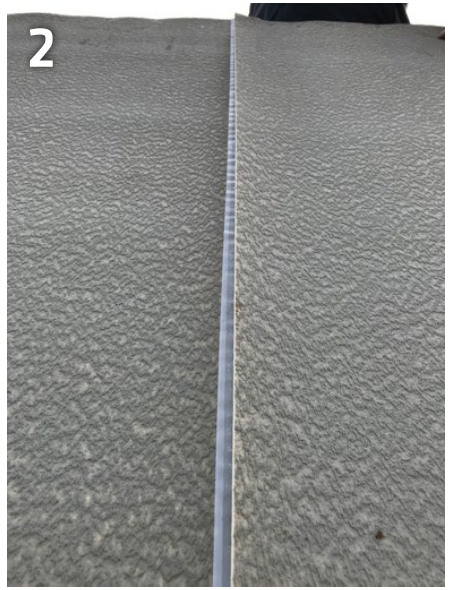
3.2.2 Seam Jointing with SikaProof® Sandwich Tape

When jointing with SikaProof® Sandwich Tape, the seam is bonded directly in the overlap area. The double-sided adhesive tape is 5 cm wide and can therefore bond the full lap width. The tape is bonded on the edge, as indicated by the overlap mark, on the bonding side of the membrane underneath, and then to the back of the membrane applied above. Care must be taken to ensure that bonding always extends to the full inner zone and voids are not formed. Finally, roll and rub the seam to remove any wrinkles. This method is particularly useful for walls and has the advantage that, after formwork stripping, there is no free overlap of membrane that could lead to damage.

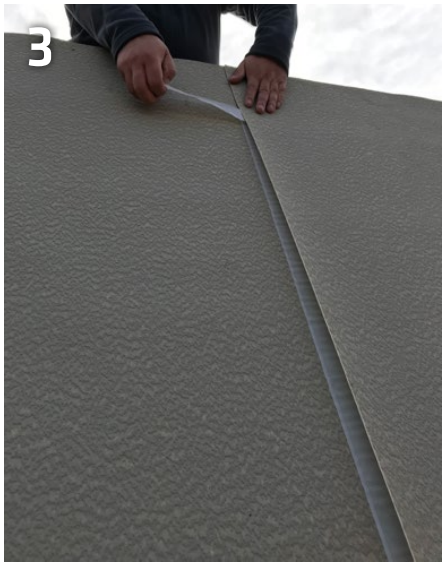
It is recommended that T-joints from Sandwich Tape seams should be sealed internally with a SikaProof® Tape A+N (internal tape) to protect against potential voids and capillary action caused by the height difference.



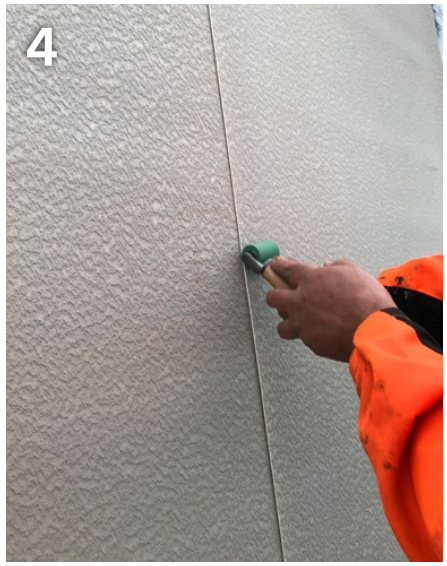
Applying the SikaProof® Sandwich Tape underneath the edge of the membrane



Aligning the overlap of the membrane above



Peeling off the protective strip



Rolling / rubbing the seam firmly

The seam must be fully bonded over the entire bonding areas, with no voids or capillaries

3.2.3 Seam Jointing by Thermal Welding

Due to its advanced, TPO-base, SikaProof® A+ membranes can also be jointed by thermal welding using hot air and pressure. Thermally welded seams provide the highest quality and most robust type of joint. In the testing to confirm general application details, T-joints were successfully certified for watertightness up to 5 bar, even without a concrete bond. In addition to high durability, the consistency and quality of the workmanship is a crucial factor, and the majority of seams are made by automatic welding machines. Short seams and detailing work is done by hand welding with a hot air tool. The overlap and bond areas must always be clean and as dry as possible. Standing water must be removed and any residual moisture must also be wiped and dried-off as much as possible. Ambient conditions such as cold and exposure to wind can significantly affect jointing. Therefore, the site environmental conditions must also be considered to select the correct joining parameters. Before starting the main works, a trial joint must always be produced to confirm the seam quality. The welding parameters are correct when the membranes melt and fuse together properly. This can be checked by a peel test on the trial seam. To do this, cut strips approximately 2 cm wide across the cooled test seam and peel them off by hand. The surfaces must show a cohesive fracture with a minimum 50% of the material on the opposite side of the membrane. If this is not the case, the welding parameters must be adjusted and the trial joint seam and peel test repeated. For automatic welding

machines, the parameters that can be adjusted include temperature, feed rate, and the air flow rate. Care must be taken not to damage the membranes through excessive temperatures. Too high a temperature, or too long an exposure time can cause distortion and damage to the weld seam.

IMPORTANT NOTE:

Always perform a trial joint followed by a peel test (after cooling) to check and confirm the welding parameters. Thermal welding requires special care and must only be performed by appropriately trained and certified specialists.

Manual thermal welding
Manual thermal welding is done using a suitable hot-air gun, e.g. Leister TRIAC AT, a 20 mm wide nozzle, and a PTFE pressure roller. The recommended welding temperature is approx. 400°C. The correct 3-step sequence for thermally welding seams is:

1. Spot weld the seam in the lap area at the back This is to prevent the overlap from shifting.

2. Pre-weld the overlap. Here the seam is welded until an unwelded edge of 20 mm remains. This pre-connection is designed to prevent heat dissipation during the main welding operation and ensure uniform seam quality.

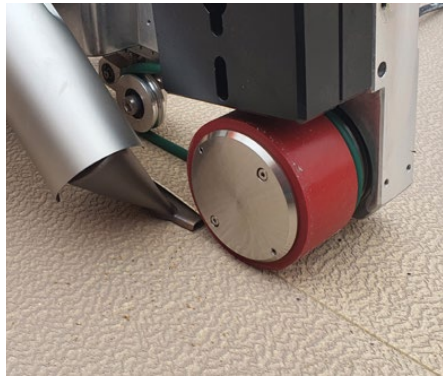
3. Main weld: This is the main welded joint that ensures the seam is watertight. A minimum welded joint width of 20 mm must be achieved. The pressure roller is moved parallel to the nozzle at a distance of 20 mm. The roller must always be moved over the seam edge. A so-called welding bead should be visible along the seam edge.

3.2 Welded and Taped Seams

Thermal joint welding with automatic or semi-automatic machines
For longer joints automatic welding machines are used for thermal welding of the seams. For horizontal surfaces, the Leister Uniroof 300 or Uniroof 700 automatic machines are recommended. For vertical surfaces, the Leister Unidrive 500 semi-automatic machine is recommended. Always also follow the specific directions of each machine during installation.

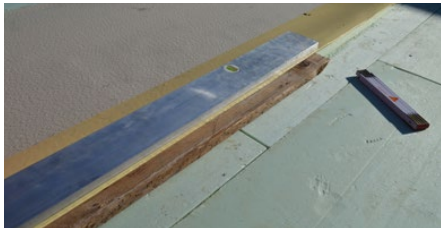
The operator must be trained on the specific device and possess the appropriate theoretical and practical expertise and experience.

The recommended settings are approx. 450°C at a speed of 1.5 m/min.



3.3 Edge Upstands

Before installing on floors, it is generally recommended to first install the edge trim all around the perimeter first. To do this, the membrane is thermally reformed to the geometric dimensions required, by briefly heating and folding the membrane.



Thermal reforming of the membranes for installing the edge upstand

When installing the edge upstand, the future configuration of the construction joint at the base slab : wall connection must also be taken into consideration. It is important to confirm if the SikaProof® A+ will be recessed or laid continuously through the joint area, as the two different options affect the installation depth.
If the joint is recessed, SikaProof® A+ must only be applied up to a maximum of 5 cm below the top edge of the base slab. This option is recommended for components with double-sided formwork, as no connection areas are then exposed during the construction period, preventing contamination and damage.

If the SikaProof® A+ is laid continuously through the joint, the membrane must be extended upwards so that it will protrude above the connecting reinforcement. Otherwise, a proper connection to the wall surfaces is not possible. To achieve this, the wall formwork, or, in the case of single-sided components, the substrate must be prepared to a sufficient height.

For detailed joint design options,
see section "3.7 Construction Joints".

The substrate or formwork must be sufficiently prepared to allow the membranes to be pre-stretched and laid from the floor slab up over the future connection reinforcement.

It is fixed to the formwork at the top edge by fastening with staples, clamping rails, or nailing bars. Holes resulting from these fastenings at the top edge area will later be covered by the connection/overlap area with the adjacent membrane.

Exposed front face of base plate in a double-sided formwork area

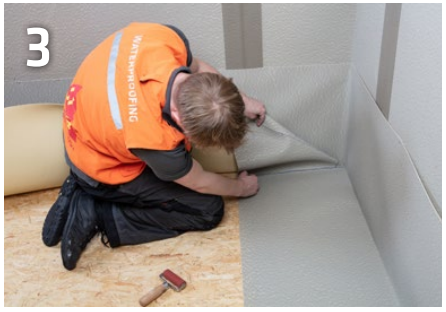
3.4 Corner Detailing

Corners and details can be formed simply and easily by cutting, lapping, and joining the membranes. With its thermoplastic properties, the membrane can be flexibly adapted to the local geometry by thermal reforming and shaping. All types of corner detailing can be professionally produced in this way.

Forming Inner Corners
When forming inner corners, the membrane must not be cut right into the corner. The membrane is thermally shaped in the corner and a so-called compression or pinch fold is formed. This method ensures a secure corner design, it also avoids an otherwise "dead spot" and the membrane system is fully sealed. The individual steps for correctly producing an inside corner are detailed in the following instructions.

Inserting and marking

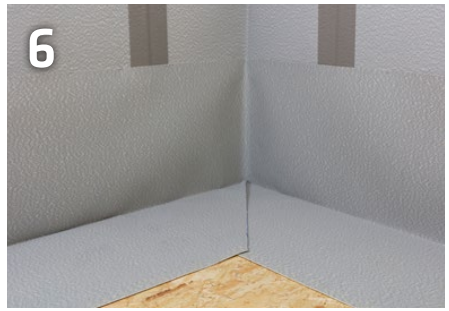
Shaping (thermally)



Marking the section to be cut out

Making the cut

Not cutting right into the corner!
Leaving material for inverted pleats



Folding over and pleating

Making a corner sealing piece from the inner tape

Forming into a cone shape to fit the corner

Positioning in the corner without creases

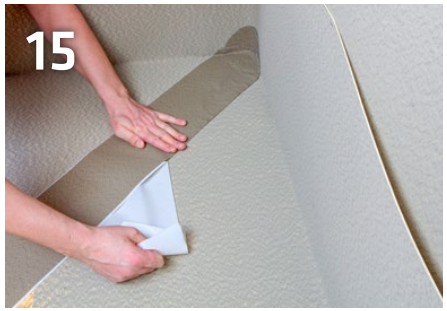
Carefully rolling and forming it with a roller

Carefully removing the protective peel liner

Carefully rolling and rubbing it firmly to bond the piece in position on the membrane in the corner

Cutting the interior tape to size

Positioning the interior tape



Peeling off the tape's protective liner and bonding in position by rubbing on

Rolling and firmly rubbing the interior tape for a full bond to the membrane with a pressure roller

Outer Corner Detailing

The various steps to form an outer corner correctly are illustrated in the explanatory photos below.

Cutting and laying the membrane

Cutting and making a sealing piece to size

Fitting the sealing piece in position

Cutting the internal tape to size, removing the liner, and bonding it in position firmly with a roller

Rolling on the internal tape

Repeat with the 2nd piece of internal tape

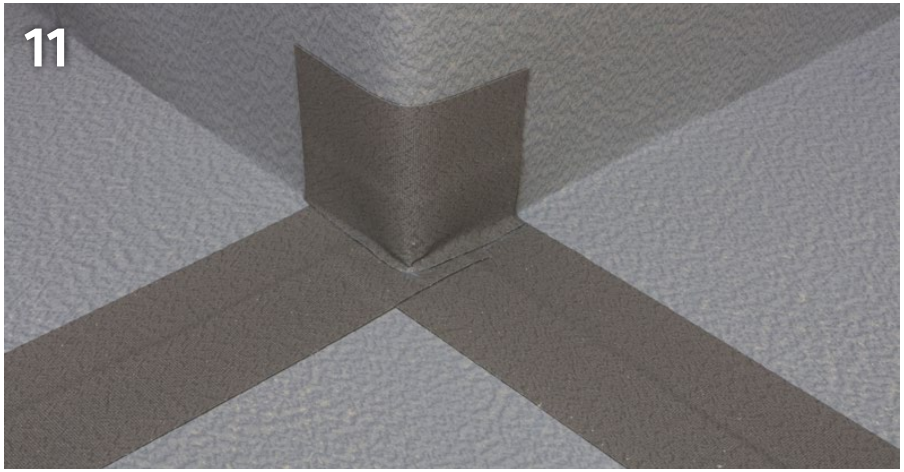
3.4 Corner Detailing

Carefully rolling to form the internal tapes in position on the corner

Remove the peel liner from the tapes and carefully bond to seal them on the corner with a roller

Cut and apply an additional section of internal tape to cover the corner detailing

Remove the peel liner and carefully roll to bond the additional cover tape in position



Finished outer corner detailing

Non-standard Corners

Due to height differences, e.g. in elevator pits or arched structures, other corner details are necessary and these can have very different geometry and angles. However, the formation and production of these corner details, is basically carried out following the same procedure as for the standard corners as described above.

Non-standard corner detailing in a sloping area

Corner detailing in an elevator pit

3.5 Installation on Base Slabs

For installation on base slabs, the wider 2-metre wide membrane rolls can provide significant advantages. They are very cost-effective due to faster installation and greater output with a reduced number of joints.

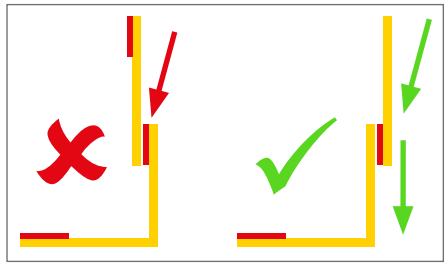
NOTES ON RIPPLING AND WARPING:

Due to temperature fluctuations, all thermoplastic sheet membranes are subject to some degree of dimensional change. This physical process is inherent in the material and always present. Any resultant warping or buckling does not constitute a defect. It is recommended that the edges and corners be weighted immediately after installing the membranes, or better still that the reinforcement works start directly afterwards. In this way, the area is clamped through the reinforcement load and spacers to reduce any buckling.

Cost-effective installation of large areas with 2 m wide sheets

3.6 Installation on Walls

For walls it is recommended that the membranes are installed vertically and upright. In most situations, this also makes assembly easier, and the self-adhesive seam joints also run vertically. Make sure that all horizontal joints in areas with double-sided formwork are formed using the umbrella principle (where the higher membrane always overlaps externally on the side facing the water –see illustration).



Always locate horizontal joints in areas with double-sided formwork following the umbrella principle

Generally the 1-meter-wide membrane rolls are used on walls, though if sufficient trained personnel are available, then the 2-metre-wide rolls can also be used. Since the membranes will drop slightly after installation under their own weight, it is recommended that connections at the bottom should be made later as the final task.

Depending on the type of formwork and the substrate material, the fastening methods described in the following two sections can be used. As a general rule, it is recommended to limit the fastening to the upper edge area. Fixings across the lower surfaces can impede the membrane during concrete placement and promote warping and buckling. If fixings are required elsewhere across the surface, they should be located in the seam areas whenever possible. The internal membrane then covers the perforation points. All other fixings in the surface must be sealed with an internal tape.

3.6 Installation on Walls

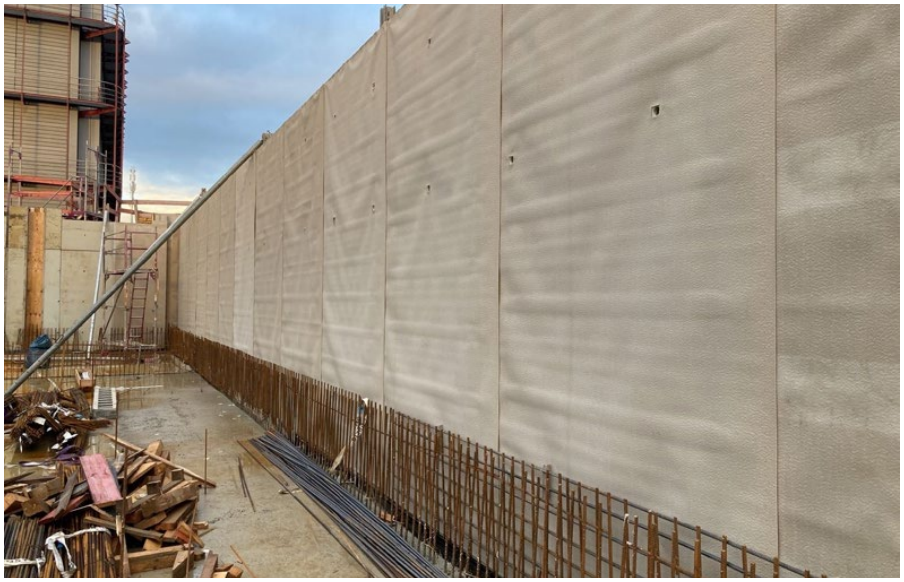
3.6.1 Walls with Double-sided Formwork

The Fixing Procedure:

1. Erection of the external formwork
2. Installation of SikaProof® A+
3. Installation of the steel reinforcement and joint sealing
4. Erection of the internal formwork
5. Concrete placement
6. Stripping the formwork and sealing the tensioning points and any construction joints

Fixings for Double-sided Formwork:

- Fastening with staples in the top edge
- Hanging or clamping onto rails or battens

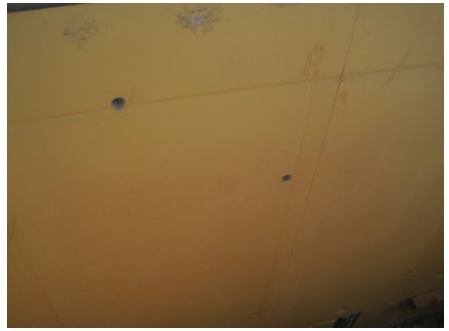


Forming the Tensioning Points:

In walls with double-sided formwork, the correct detailing of the tensioning points is required. During installation, ensure that the tension anchors are not pushed through the membrane, but through a circular hole that is cut out of the membrane, approximately 2-3 cm in diameter. Without these cut-outs, the membrane cannot move freely during concrete placement, as with the fixings in the area, which could result in increased warping.

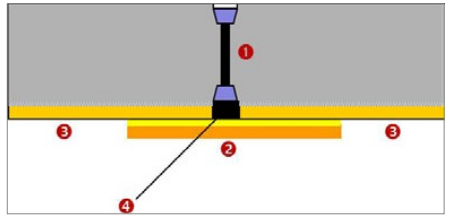
Installation of the tension sleeve in the formwork

After stripping and removing the formwork, the tension sealing plugs must be inserted, bonded and sealed in place in accordance with the manufacturers instructions. The adjacent SikaProof® A+ membrane must be thoroughly cleaned to remove any dirt and contaminants that could prevent or reduce adhesion, such as dust, oil, grease, etc., and then wiped dry. Where necessary, any light soiling can be removed with Sarnafil® T Prep to clean and prepare the surface. Stubborn dirt can be removed with Sarnafil® T Clean followed by Sarnafil® T Prep to clean and prepare the surface. Apply both sparingly with a clean cloth, wipe clean, and leave the surfaces to completely dry-off before continuing to work on them. Afterwards the tensioning points can be covered and sealed on the outside with SikaProof® Patch-200 B tape,using a piece cut out 20 x 20 cm with rounded corners. The patch is bonded centrally over the tensioning point, then rolled and smoothed out without any wrinkles. Any unevenness in the substrate can be compensated for using SikaProof® FixTape-50 if necessary.



Cutting circular holes 2-3 cm diameter for the tension bars, rather than pushing them through the membrane, to prevent rippling.

Alternatively, the tensioning points can be sealed with the Sikadur-Combiflex® TF system. This is recommended if there is a rough profile in the area, as the adhesive can compensate for it. It is important to pretreat SikaProof® A+ by briefly torching it. See Chapter “5 Sikadur-Combiflex® TF System” for details.



Covering and Sealing with SikaProof® Patch-200 B
1. Tension sleeve with sealing plug
2. SikaProof® Patch-200 B
3. SikaProof® A+
4. SikaProof® FixTape-50 (if required for surface levelling)

3.6 Installation on Walls

3.6.2 Walls with Single-sided Formwork

For single-sided formwork walls, the structure or element to be sealed is adjacent to an existing building, a diaphragm wall, a bored pile wall, or another retaining wall or support on the other side. The nature and surfaces of these, generally make them unsuitable for direct installation of the membranes. These sides are also generally covered with perimeter insulation. This substrate is then uniform and ideal. If full-surface bonding of SikaProof® to the thermal insulation is required, it should be done by following the installation guidance in section "3.17 Perimeter Insulation". If insulation is not specified, the substrate must either be treated and covered with suitable mineral materials or protective sheets (e.g., geotextiles or Sikaplan® WT Protection Sheet) to meet the substrate requirements.

Fixings in Single-sided Formwork Wall Areas:

- Hanging (canvas principle) by fixing with staples, a nailing strip, or clamping rails at the top edge
- Fixing with insulation anchors and sealing with SikaProof® Tape A+N
- Welding onto Sikaplan® WT Tape-200

Fixing SikaProof® membrane with anchors into perimeter insulation

Fixing SikaProof® A+ to pre-bonded SikaPlan® WT Tape-200 welding points or strips. This produces a high-quality, non-penetrating fixing on mineral substrates.

Hanging from clamping rails or nailing strips

Offsets in Single-sided Formwork Wall Areas:

For structural reasons, recesses or interlocking joints may be necessary in single-sided formwork wall areas. In these situations the FBV system must not be installed above horizontal runs. For this reason, these offsets should always be formed at a 45° angle. This ensures sufficient concrete pressure and correct venting at every point during concrete placement, and thus a void-free uniform bond is guaranteed to be achieved.

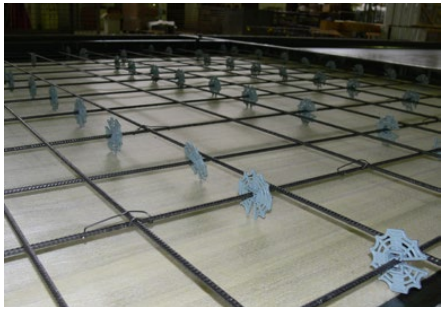
Forming interlocking joints and recesses at a 45° angle in single-sided formwork sections

3.6.3 Walls Made with Precast Sections

Generally, walls produced with precast cocrete units are waterproofed with SikaProof® P. However, waterproofing with SikaProof® A+ is possible if required. To do this, the surfaces of the precast elements are pre-formed with SikaProof® A+ and fixed in the formwork at the plant. All lap joints must be aligned vertically, or following the umbrella principle (the higher membrane covers the lower one externally on the side facing the water). The precast section walls must have a minimum 5 cm free concrete edge all round to the butt and bedding joints. After the walls have been erected and concreted, the butt and bedding joints are sealed with the Sikadur-Combiflex® TF system. The tape is applied and connected to the adjoining SikaProof® A+ surface with a minimum overlap of 2.5 cm. The lap area on the back of the SikaProof® A+ must be prepared. The Sikadur-Combiflex® TF tape is detailed and installed in accordance with the Sikadur-Combiflex® TF installation guide. See also Chapter "5 Sikadur Combiflex® TF System".

Placing the prepared membrane on the formwork

Erecting the wall sections and pouring the core concrete



Installation of the reinforcement

Sealing the joints with Sikadur-Combiflex® TF

Concreting the precast sections

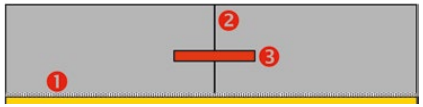
3.7 Construction Joints

Construction joints in watertight structures must be sealed with suitable, approved joint sealing solutions. They must either be according to a relevant standard (e.g., thermoplastic joint waterbars according to DIN 18541), be approved according to the waterproofing guideline (e.g., uncoated joint sheets), or hold a general building materials test certificate (e.g., sealing systems with abP according to PG-FBB). Even though FBV systems are crack-bridging and able to seal over construction joints, the additional use of a joint sealant is advisable and is also required according to the WU guidelines.

Construction joints generally represent potential weak points and thus an increased risk. Therefore, careful design and clean execution are essential. In the connection areas, special attention must be given to the risk of damage or potential contamination. Recommendations with solutions for design and detailing on site for different jointing situations are outlined in the following subsections. For all connection areas, it is also important to note that SikaProof® A+ is not permanently UV-stable and the permissible exposure time must not be exceeded; see section "3.1.6 Resistance"

Secure Construction Joints

1. SikaProof® A+
2. Construction joint
3. Tested and approved Sika Waterbar



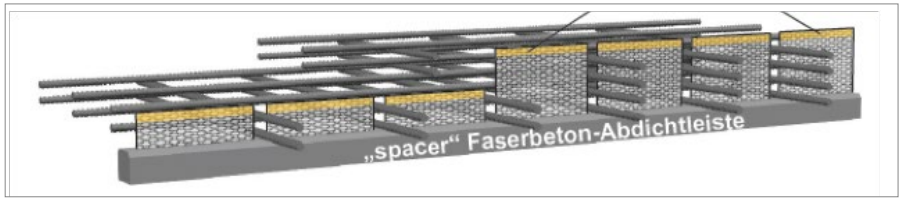
3.7 Construction Joints

3.7.1 Slab-to-Slab Construction Joint

When placing the first concrete pour, it is essential to ensure that the construction joint is positioned correctly and that the longest tie bar extends sufficiently into the second pour. Accordingly, the surface of the first section must extend beyond the area of the connecting reinforcement. This is the only way to make a proper connection when the second pour is placed. To this end, the installation substrate must also be adequately prepared.

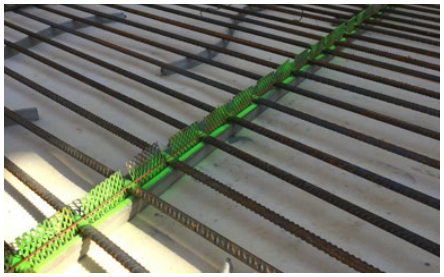
Expanded metal formwork components are usually used for construction joints. To protect the bonding layer of SikaProof® A+ in the adjoining second concrete pour, and to prevent contamination due to concrete leaching over or under the formwork, the use of fiber-cement lateral underflow protection strips, known as spacers, is recommended. These spacers are strips consisting of fiber cement board with expanded metal connectors, designed to be laid under the bottom layer of reinforcement. The spacers can also be bonded in position with SikaProof® TapeFix-50 double-sided butyl tape. This allows construction joints of the highest quality to be produced.

Extend the FBV membranes in the connection area, to beyond the longest connecting reinforcement.



Example of stopend spacer leakage protection, source: www.trigoform.de

Contamination from grout loss and leaks around formwork must be prevented, with any seepage removed and cleaned off immediately whilst fresh



Reinforcement spacers are designed to provide an effective solution to preventing leaks and contamination of joint connection areas

In addition to concrete contamination from leakage under the formwork, contamination can also occur from spillages during concreting in adjacent areas. Therefore, it is also recommended to protect the adjacent areas with suitable protective sheeting. Any such contamination that does occur must be removed immediately and cleaned while still fresh with clean water, and the bonding layer must be thoroughly dried and prepared.

Protect adjacent surfaces with protective sheeting.

Result: Perfectly formed construction joint: The spacer under the lowest reinforcement layer is clearly visible and the adjacent SikaProof® A+ is free of any unwanted contamination

3.7 Construction Joints

3.7.2 Slab-to-Wall Construction Joints

A slab-to-wall construction joint can be formed in two ways.

Method 1 – Recess and Seal with the Sikadur-Combiflex® TF Tape System:
To recess the joint area for external taping with Sikadur-Combiflex® TF afterwards, the SikaProof® A+ membrane is set back from the construction joint on all sides, and a minimum free concrete edge of 5cm from the joint is formed. The Sikadur-Combiflex® TF tape system is then applied over the construction joint, and joined to the adjacent SikaProof® surfaces, with a minimum 2.5 cm lap.The lap area on the back of the SikaProof® A+ must be cleaned and pretreated by briefly torching it. The Sikadur-Combiflex® TF tape is detailed and installed in accordance with the Sikadur-Combiflex® TF installation guide. Please note the additional information in Chapter 5 "Sikadur-Combiflex® TF System".

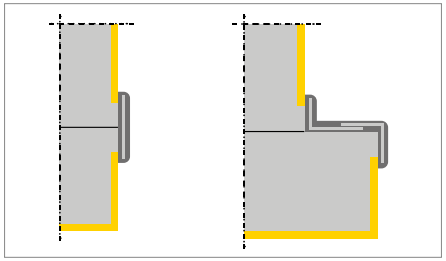
This method is strongly recommended for double-sided formwork walls, as it ensures that no SikaProof® A+ connection areas are exposed during the construction period, preventing contamination and damage. This method can be used for formwork with or without a floor slab overhang.

OPTION:
Joints with wide base slab overhangs can also be sealed with SikaProof® P-12 self-adhesive membrane.

Recessing SikaProof® A+ in the joint area for the subsequent external sealing with the Sikadur-Combiflex® TF System

Sikadur-Combiflex® TF taped sealing of the floor-to-wall joint with a floor slab overhang

Sikadur-Combiflex® TF taped sealing of the floor-to-wall joint without a floor slab overhang



Sikadur-Combiflex® TF sealing of construction joints in the general areas and with an extended base slab

Method 2 - Installing SikaProof® A+ Through the Joint:
With this method, SikaProof® A+ is laid through the slab-to-wall joint and extended into the future wall area. It is important to note that:

- The connection areas must be protected from contamination, e.g. from the concrete works (protective sheeting has proven to be effective).
- The connection areas must be kept safe and protected from mechanical damage. With double-sided walls, the formwork must be left in place for the full period until after the walls have been concreted!
- The subfloor is prepared with sufficient height for the wall formwork with double-sided walls, and the perimeter insulation, for single-sided walls
- The height of the connecting reinforcement must be extended sufficiently for the proper connections to be made
- Any contamination during adjacent concrete placement is immediately removed and cleaned off while still fresh.

This method is used in single-sided formwork areas. Method 1 is recommended for double-sided formwork, as the risk of contamination and damage is greatly reduced.

SikaProof® A+ laid through in the slab-to-wall area: The installation substrate in the single-sided wall section is prepared with sufficient height and SikaProof® is extended over the connection reinforcement. A sheet matching the height protects the connection area from concrete contamination

Protected connection area after the floor slab is concreted

The protective sheet has served its purpose (photo left); Contamination should be avoided or be cleaned off immediately while still fresh (negative example pictured right)

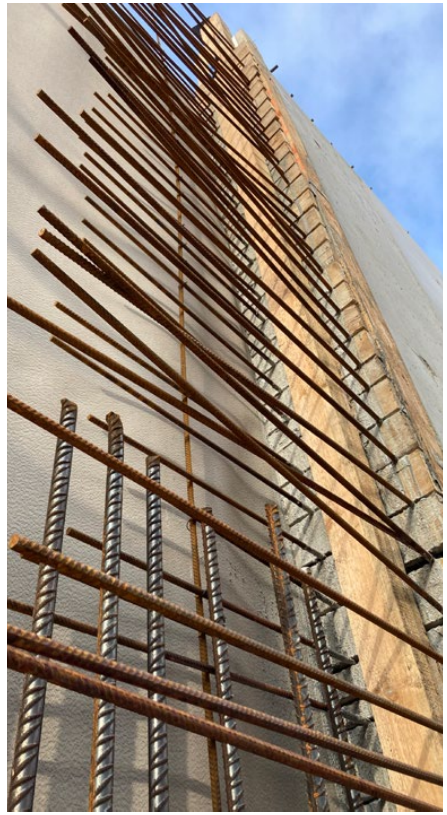
3.7 Construction Joints

Result: a clean construction joint achieved by using a protective sheet

3.7.3 Wall-to-Wall Construction Joints

Wall-to-wall construction joints are basically formed as outlined in the previous section. This means that on components with single-sided formwork, SikaProof® A+ is applied across the construction joint. On double-sided formwork, the SikaProof® A+ can either be cut and taped over with Sikadur-Combiflex® TF, or it can be applied across the joint. In general, there is enough wall formwork already in place from the first pour, and the risk of contamination is much lower in the vertical joint.

Therefore, applying SikaProof® A+ across wall-to-wall joints is usually the preferred method.In these situations, special attention must be given to the base point at the intersection of the construction joints. It is very important to ensure cleanliness and make the correct transition / connections.



Wall-to-wall construction joint with continuous SikaProof® A+

3.8 Expansion Joints

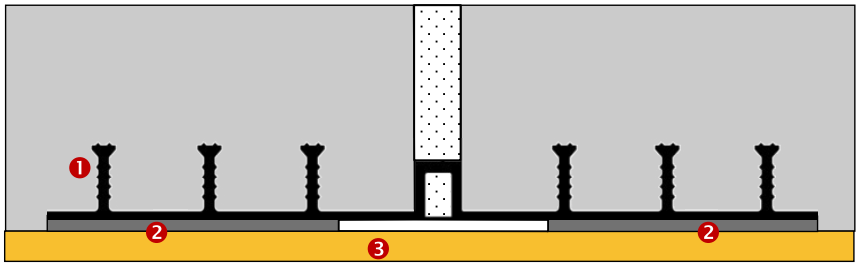
Dependent on the specific exposure and design parameters (water pressure and resulting deformation), expansion joints must be sealed with suitable external expansion joint waterproofing systems. These should be designed and dimensioned according to the abP specifications of the the system, or to relevant standards, such as DIN 18541 for example .

3.8.1 Expansion Joints in New Build Sections

External thermoplastic expansion joint tapes and waterstops are generally used for expansion joints between two new build sections. They are designed and installed in accordance with DIN 18197 (Sealing Concrete Joints with Tapes and Waterstops). The use of Sikadur-Combiflex® TF joint tape profiles (e.g., DFT 330/3) is recommended.

The advantage of these is that they can also be combined with bonding and sealing strips from the Sikadur-Combiflex® TF system for wall and soffit use. The Sikadur-Combiflex® TF joint tape profiles can be connected to the full-surface SikaProof® A+ by hot- air welding. Alternatively, they can be bonded using Sikadur-Combiflex® CF adhesive or SikaProof® FixTape-50.

Tricomer® profiles (e.g. DA320) can also be used. In these situations, the connection to the SikaProof® A+ membrane is achieved through bonding with SikaProof® FixTape-50.



Sikadur-Combiflex® TF installation method:
1. Sikadur-Combiflex® TF joint tape profile, e.g. DFT 330/3
2. Welding with hot air or bonding with Sikadur-Combiflex® CF adhesive or SikaProof® FixTape-50
3. SikaProof® A+

Tricomer installation method:
1. Joint tape profile, e.g., DA 320
2. Bonding with SikaProof® FixTape-50
3. SikaProof® A+

Expansion joint forming with Sikadur-Combiflex® TF joint tape profile DFT 330

Expansion joint forming with Sika Tricomer® joint tape profile DA 320/3

NOTE:

As an alternative to the joint waterbars cast-in-place with the concrete, it is also possible to use an external tape system using Sikadur-Combiflex® TF system on walls and soffits, forming an expansion joint seal with the 2 mm thick TPO strip. In these instances, the expansion joint in the floor slab must also be sealed with a Sikadur-Combiflex® TF strip system. In the transition from waterbars to the TPE Sealing tapes, a factory-made transition piece must be installed.

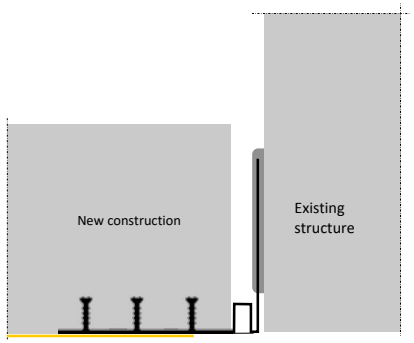
3.8 Expansion Joints

3.8.2 Connection to Existing Structures

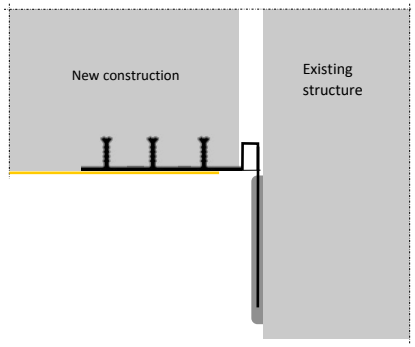
When structures are extended and new elements or sections are connected to existing buildings, the isolating movement joint must be incorporated and sealed into the waterproofing system. The same applies when new base slabs are laid in existing buildings or halls and have to be connected to the perimeter walls or penetrating columns. These isolation joints can be sealed with adhered or flanged systems. The joint waterbar profile is connected to the existing structure on one side and is embedded in the cast-in-place concrete on the new build side, forming an external sealing profile.

Adhered Method:
Sikadur-Combiflex® TF adhesive systems have significant advantages for this application, as they allow for much greater working flexibility (e.g. for the joint tape running over edges and offsets) and any minor substrate irregularities can be accommodated within the Sikadur system adhesive. This method uses special Sikadur-Combiflex® TF profiles with a bonded flange and a cast-in leg, which are fixed to the existing substrate with the system adhesive. The Sikadur-Combiflex® TF profile is joined to the SikaProof® A+ as described in the previous section. The TF profiles are available in the different geometries (KI, KA, or KFV - see illustration) to match the respective joints.

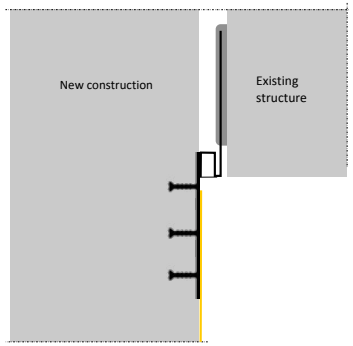
Using TF profile type DFT330-3KI



Using TF profile type DFT330-3KA



Using TF profile type DFT330-3KFV



Connection joint to an existing building with Sikadur-Combiflex® TF Profile DFT 330/3 KFV

Sikadur-Combiflex® TF Profile DFT 330/3 KI

Clamping System
For flanged systems, such as with a Sika® Tricomer DA 320 KI flanged profile, the connection is made on the existing side with a loose-type flange connector. A natural rubber sealing layer is laid under the flanged leg of the joint tape and clamped to the existing structure at a defined contact pressure. The Sika® Tricomer profile is connected to the SikaProof® A+ as described in the previous section. When using flanged profiles, the existing substrate must be of very high standard. The surface must be completely level and free of defects to ensure full surface contact with no gaps. In practice, this usually means cutting the existing structure back, or repairing and leveling up the surface.

Flanged system using Sika® Tricomer DA 320 KI profile

NOTE:

When connecting to an existing building using bonding and flanged methods, the existing waterproofing system must always be considered and maintained. The existing waterproofing systems and joint seals must be integrated into the overall concept.

3.9 Pipe Penetrations

Pipe penetrations can be easily and flexibly waterproofed. To do this, SikaProof® A+ is first cut out to the approximate size when the area is laid. After laying, a sealing collar is formed by hand, sealed to the pipe, and the membranes connected on the adjacent surface. This standard method has been tested to a pressure up to at least 5 bar.

Forming a Standard Pipe Penetration Detail with a SikaProof® Membrane Collar

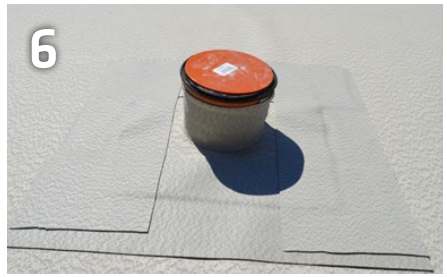
Lay the membrane and roughly cut out a hole for the pipe penetration

Prepare the patch and mark the circumference of the pipe penetration in the centre

Cut out the marked circle with a radius approx. 2–4 cm smaller (depending on pipe's dimension) and heat the membrane on the back around the cutout with hot air

Carefully draw the heated membrane over the pipe penetration

Thanks to the thermal flexibility of the SikaProof® A+ collar, it can easily be formed & adjusted to fit exactly.



Secure the pipe penetration detail with SikaProof® Tape A+. To do this, wind the internal tape once around the pipe onto the collar and bond it to the pipe. Finally, connect the patch to the adjacent surface using an appropriate seam welding or bonding method

Detailing Solutions for Pipe Casings and Ducts

If the pipes will not be inserted and installed until later, pipe casings can be installed in the designated positions as required. These can be sealed with the same procedure described above for pipe penetrations.

As an alternative, there are fiber-cement pipe casings with an external adhesive flange. SikaProof® A+ can then be lapped on this type of flange and bonded, for example with Sikadur-Combiflex® CF Adhesive. The actual service pipe is later sealed inside the duct or pipe casing with a suitable sealing insert. Integrated systems (pipe casing + sealing insert) from a single manufacturer should always be used.

Pipe Penetrations with Loose/Fixed Flange Systems

Alternatively, loose/fixed flange systems can also be used of course. In this method, the SikaProof® membrane is clamped between the loose and fixed flange. The bond in the area of the fixed flange is additionally secured with intersecting beads of swelling paste (e.g., SikaSwell® S-2). In addition, an EPDM overlay at least 2 mm thick must be installed on both sides. This method has been tested in two functional tests in collaboration with Doyma and Hauff-Technik systems, both at a water pressure of at least 5 bar . Detailed specifications on the system build-up, dimensions, and tightening torques etc., are all detailed in the respective test reports.

IMPORTANT NOTE:

For all construction methods with sealing inserts and integrated components as outlined, the sealing insert manufacturer's specifications and installation instructions must be followed.

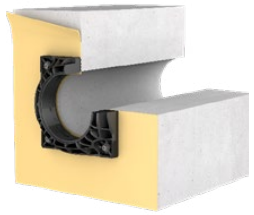
3.9 Pipe Penetrations

System Solution with Doyma GmbH & Co
Most of the pipe penetrations in the wall are formed later using a core drill. A specially tailored sealing insert has been developed for this application in collaboration with Doyma GmbH & Co, which has been proven in external functional testing to a water pressure of at least 5 bar . The Doyma Curaflex SD sealing insert features a connection flange with special butyl sealants that forms a watertight seal when tightened onto the existing SikaProof® A+. The system is available for various pipe sizes. A simple, fast and reliable solution, independently tested and certified.

System build-up: Doyma Curaflex SD on SikaProof® (Illustration: Doyma)

For further technical details on the Doyma pipe penetration system products, please contact Doyma GmbH & Co, Oyten (www.doyma.de).

System Solution with Hauff Technik GmbH & Co KG
Cable and pipe feeds into multi-purpose buildings are frequently installed with double sealing packs from Hauff Technik. Two versions are available:
1. For Retrofit: The Hauff HSI DFK can be retrofitted by installation through core drilled holes. It is sealed with a special adhesive and dowelled in position. Various system covers are available to seal the utility lines, in either a closed or split configuration to suit the requirements, and also for pressure-tight sealing of the empty conduit connection. In combination with SikaProof® A+ this system has been tested watertight to at least 2.5 bar by Hauff Technik.



System build-up: HSI 150-DFK (Illustration: Hauff Technik)

2. Pre-installed: the Hauff HSI with a trowel-on flange is preinstalled in the structure or element. A SikaProof® A+ collar piece is bonded to it with a special adhesive and then connected to the adjacent membrane surface. Various system covers are available to seal the utility lines, in either a closed or split configuration to suit the requirements, and also for pressure-tight sealing of the empty conduit connection. This method has been tested internally by Hauff Technik and approved by them for use up to 1 bar.

System build-up: HSI 150-K2-AF 1x1/ 1x4 with a trowel-on flange (Illustration: Hauff Technik)

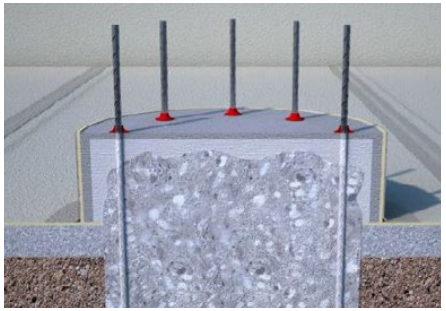
For further technical details on the Hauff Technik pipe penetration system products, please contact Hauff Technik GmbH & Co KG, Hermaringen (www.hauff-technik.de).

3.10 Bored Pile Cap Connection

Pile heads and pile head connections can be configured in a wide variety of designs. The final design and method can only be specified by the responsible engineer with understanding of the requirements and conditions on each specific project. The connection also has to be integrated and adapted to the overall design concept, as this has a direct impact on other design details.

If structurally feasible, it is recommended that the bored piles be detached from the floor slab above. This may be done by incorporating pile cap beams. If this option is available, SikaProof® A+ can pass through under the floor slab on the blinding layer and pile cap beam. In these instances, the pile cap beam surfaces should be prepared and made smooth (or poured with flowable concrete) to prevent surface defects causing perforations under high surface pressures (where necessary, install another protective layer on the surface as a base. Where the pile cap does have to be connected to the floor slab by the structural reinforcement, there are several alternative detailing options that can be considered. As previously outlined, the responsible design engineer must evaluate and specify which design option is the most appropriate for each specific project and the overall watertight concept for the structure. The three typical options are:

Connection with Sika Waterbar® FB-125:
This option is a further development of our previous standard detail, but now requires only 6 cm build-up. This detail has been independently tested to be watertight up to 5 bar. With this configuration, the bored pile cap must first be re-profiled. The adjacent SikaProof® A+ membrane is brought up to the head of the bored pile cap. Then, a minimum 6 cm wide strip is formed from Sika Waterbar® FB-125. (Note: this product is very easy to cut to size. This allows the waterbar to be cut to the right width to give the required depth of the ring.) The length of this collar should also correspond to the pile cap diameter plus at least 6 cm, to provide a minimum clearance of 30 mm on all sides between the joint and the tapered bored pile cap surface. The collar is then sealed by a lap weld and also welded or bonded to the adjacent SikaProof® A+ membrane. The collar can then be grouted with watertight, non-shrink grouting mortar to seal the bored pile cap.



3.10 Bored Pile Cap Connection

Connection with a Collar:
For this option, it is essential to prepare a smooth pile cap surface in advance, as the SikaProof® A+ is laid though it.. The membrane piece is then pre-formed to fit, including punched holes or cutouts to match the corresponding rebar penetrations. The membrane can then be drawn over the tie reinforcement and laid continuously through it. The membrane piece is connected around the circumference to the adjacent SikaProof® A+ surface by the standard seam formation methods. The rebar penetrations can be sealed with an epoxy resin adhesive. Independent testing with results up to 5 bar are available for sealing rebar penetrations with epoxy adhesives in this way.

Connection with Epoxy Resin Adhesive:
For this method, the surfaces of the bored pile cap must be as smooth as possible without any spalling, by preparing and reprofiling as required. A minimum bonding surface of 5–10 cm outside the tie-bar reinforcement is required for these connections. The SikaProof® A+ can then be bonded to that surface with Sikadur-Combiflex® CF adhesive. The FPO side must be pretreated by briefly torching it.

GEWI Anchors and Micropiles
GEWI anchors and micro-piles are generally encased in ducts, so the SikaProof® A+ membrane has to be connected to the respective ducts. Typically, this is done in the same way as standard pipe penetrations, with a sleeve as a sealing collar (see section 3.9 "Pipe Penetrations"). However, ribbed ducts are not bonded with the tape, they are bonded in position using Sikadur-Combiflex® CF system adhesive. The duct and the back of the SikaProof® A+ membrane must be prepared by briefly torching them.

3.11 Foundation Earth Electrodes

Penetrating earthing straps should always be made of stainless steel. Foundation earth electrodes must never be located in joint detail areas, but always in open areas. For all systems, additional securing of the steel bars with a sealing sleeve, or a bead of swellable paste, in the concrete cross-section is recommended.

Waterproofing a Foundation Earth Electrode

Cut out and heat the SikaProof® A+ membrane to fit and draw it over the electrode

Seal the transition from bonding layer to electrode with SikaProof® Sandwich-Tape as shown

Cutting the SikaProof® Tape A+ to size, drawing it over the electrode and fixing it onto the waterproofing membrane.

Cut a second piece of SikaProof® Tape A+ to size and use it to seal the transition

3.12 Precast Concrete Elements

When precast elements are used with integral waterproofing (e.g. sump pumps), they must be connected and integrated in the system. The Sikadur-Combiflex® TF system is an ideal solution to ensure these connections are watertight. This allows for a securely bonded flexible connection with a seamless transition to the SikaProof® A+ membrane. The back of the SikaProof® A+ must be prepared and pretreated in the lap area before bonding. Please refer to the information in Chapter 5 "Sikadur-Combiflex® TF System".

An example of sealing a precast sump pump with the Sikadur-Combiflex® TF System

3.13 Other Integrated Components

Technical components such as wastewater lifting stations or backflow preventers are available from various manufacturers in versions with a flanged connection. These components must be selected and fitted so that when in position the connecting flange is flush with the SikaProof® A+ membrane installation base substrate. The membrane is inserted between the loose and fixed flanges and then it is additionally secured in the contact area on the bond side by two intersecting beads of swellable paste (e.g. SikaSwell® S-2). The elastomeric gasket for the flanged system must also be placed underneath.

If there are other integrated components such as penetrating steel columns or beams, they can usually be flexibly sealed and made watertight with the Sikadur-Combiflex® TF system. These details and the method statement should be designed and specified in advance, and according to the nature of the component and the detailing required.

Typical example integrating a backflow preventer using a connecting flange

3.14 Reinforcement Works

For quality assurance reasons, the installed surface should be carefully inspected before starting the reinforcement works (see section 3.19 Quality Assurance). In addition, site personnel must be instructed before the works in the limitations and handling of SikaProof® A+. The reinforcement works should begin immediately, shortly after the FBV membrane has been installed, as the reinforcement load fixes the membranes in place, preventing or reducing warping, rippling and tension.

3.14.1 Protective Measures During Reinforcement Works

The reinforcement works are carried out directly on the surface of the freshly installed sheet membranes. SikaProof® A+ is very robust, but the works will still demand due care. In general, the rebars should not be stored directly on the bonding layer. Suitable squared timbers should be placed under any steel bars for protection and support. When lowering the steel bars into the area with a crane, make sure that the ends of the bars do not puncture the membrane surface and damage it. Protective measures (e.g. guard plates or boards) should be in place during any potentially damaging works such as thermal bending, heating, welding, use of grinders, cutters, or other equipment etc. , to prevent damage to the bonding layer.

If damage does occur, it must be repaired immediately with a SikaProof® Tape A+N.

Reinforcement works underway on SikaProof® surfaces with appropriate protective measures

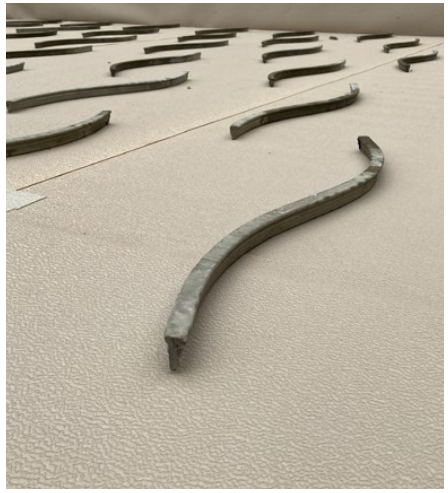
Support timber for the temporary storage of a pre-tied reinforcement cage

Protective measures for the steel reinforcement

3.14.2 Spacers and Permissible Loads

Spacers must always be selected so as not to cause damage to the FBV membrane. Typically, linear spacers made of fiber cement in a serpentine shape are used. They should be arranged in a staggered pattern and laid on the narrow side. This allows the cement paste in the fresh concrete to flow laterally under the spacer.

Single spacers are also an option. They are advantageous when dealing with very high reinforcement loads. It is important to ensure that only fiber-cement spacers with a smooth underside are used as a flat bearing surface. Single, bone-shaped spacers are therefore not recommended.



Linear fiber-cement spacers installed on the narrow side and arranged in a staggered pattern

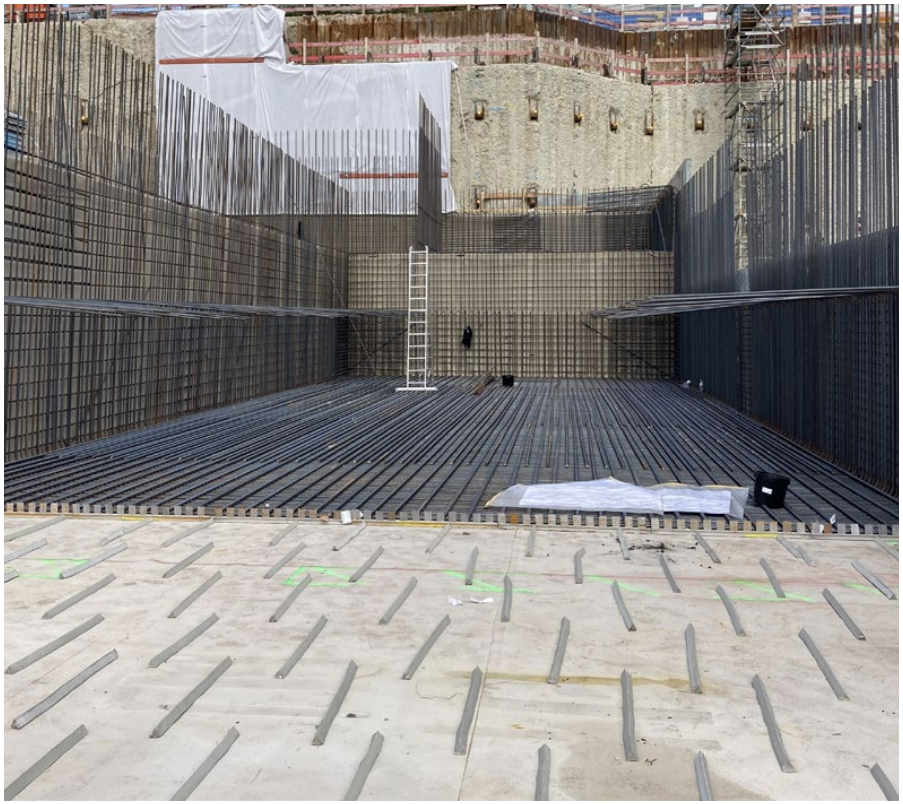
Single fiber-cement spacers with a smooth and level bearing surface

3.14 Reinforcement Works

Permissible Reinforcement Load:
As a general rule, when using SikaProof® A+08 and SikaProof® A+12, with linear fiber-cement spacers at maximum 50 cm centres, a reinforcement load of up to 300 kg/m² can be accommodated (even when the spacers are installed on the narrow side). This naturally assumes that the installation substrate meets the quality standards specified in this manual.

For higher reinforcement loads, please contact us for a case-by-case assessment.

The extremely high robustness of SikaProof® A+ means that solutions are possible even with very high reinforcement loads. In this case, the use of single spacers offers certain advantages. Based on independent studies, positive feedback and test results are available for reinforcement loads of up to 750 kg/m².



3.15 Concrete Placement

Before concreting, further quality control checks and records must be completed (see Chapter 3.19 "Quality Assurance").

3.15.1 Formwork Oil

Formwork oil, also called mould release oil, is not required for fully bonded membrane systems. If additional concrete surfaces are being poured in adjacent areas, make sure that any such oils do not come into contact with the SikaProof® A+ surfaces.

3.15.2 Concrete Quality and Consistence

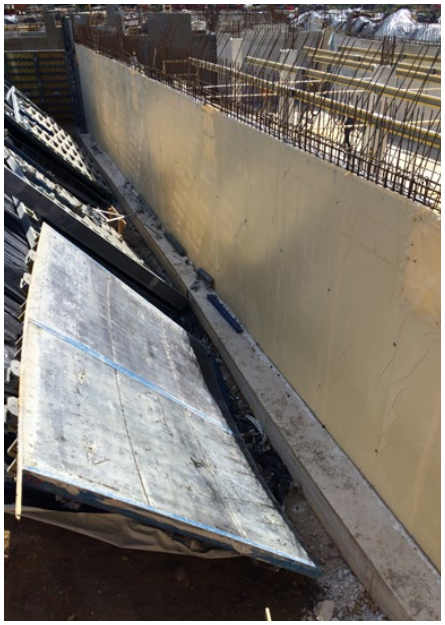
In general, concrete placement must be carried out in accordance with currently applicable regulations (e.g., DIN 1045, and the DAfStb Waterproofing Guidelines) as well as other specifications defined in the design. Particular attention must be paid to ensuring professional placement and correct compaction of the fresh concrete, in order to obtain a void-free and watertight concrete microstructure. This is the only way to achieve the required lateral underflow protection for the surfaces. Watertight concrete with a consistency of F3 to F6 may be used for the works. Lightweight and porous concretes are not suitable, because lateral underflow protection cannot be achieved with these materials.

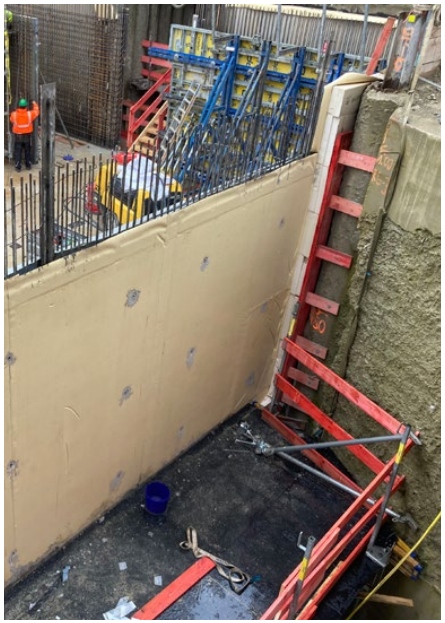
Concreting of SikaProof® A+

3.15 Concrete Placement

3.15.3 Formwork Stripping and Removal

SikaProof® A+ has a positive influence on the quality of structural concrete elements and acts as the ideal curing agent to protect from premature evaporation. To avoid damaging the adhesive bond and to achieve the full functional performance of the fresh concrete bonding system, the formwork must not be stripped until a minimum compressive strength of ≥ 10 N/mm^{2}is achieved. Caution: Until this point, the formwork must remain in place with full formwork pressure. Tensioning anchors should only be released after the specified minimum compressive strength has been achieved. Strength development times can vary in practice due to weather and other environmental conditions. The responsible site management must take these factors into account. Formwork stripping / demolding should always be carried out with due care. Additional information and advice can be found in the DBV Guidelines “Fully Bonded Membrane Systems” and “Concrete Formwork and Stripping Times”, published by the German Concrete and Construction Technology Association (DBV) in Berlin.





Freshly removed formwork

3.16 Connections and Transitions to Other Waterproofing Systems

If SikaProof® P-12 is used for additional adjacent waterproofing, the transitions must comply with Chapter 4 “SikaProof® P – Use and Design”. However, depending on the project demands, there are a variety of other waterproofing system transitions. It goes without saying that all the connections and transitions outlined below, require the SikaProof® A+ lap areas to be correctly cleaned and prepared. They must be clean, dry, and free from any contaminants that could reduce adhesion. Wipe off any light soiling with a damp cloth. Do not use cleaning products that leave an oily or release film. If necessary, any contamination can be removed with Sarnafil® T Prep. Stubborn contamination can be removed with Sarnafil® T Clean and the bonding areas prepared with Sarnafil® T Prep. Apply both products sparingly with a clean cloth to remove dirt and contaminants, then leave exposed to dry completely, before any further work with the areas.

Further waterproofing work with SikaProof® P-12

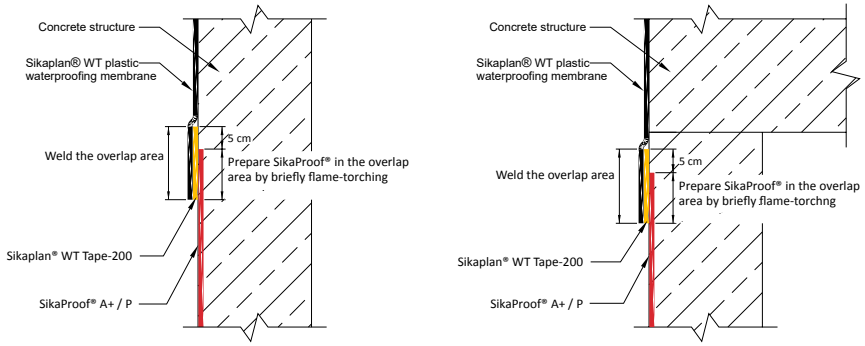
Further waterproofing in the kicker / plinth area with SikaTop®-126 Pro

3.16.1 Connections and Transitions to Soffit Waterproofing

The transition to soffit waterproofing with membrane materials can be made with loose/fixed flange systems, as outlined in DIN 18533. However, due to various technical limitations and the amount of work involved, alternative special solutions are often used instead, see below:

Transitions to Polymer Waterproofing Membranes

Transitions to polymer waterproofing membranes can be made with special tapes from the Sikaplan® range. Sikaplan® WT Tape-200 is used for FPO-based, polymer waterproofing membranes. It is compatible with all Sikaplan® FPO membranes in the WT 1200, WT 2200, WT 5200, and WT 6200 series. Sikaplan® WP Tape-200 can be used for connections to PVC waterproofing membranes. It is compatible with all Sikaplan® PVC membranes in the WP 1100, WP 1110, WP 2101, and WP 2110 series. These special 20 cm wide tapes are bonded at the transitions with Sikadur-Combiflex® CF adhesive. The back of SikaProof® A+ membranes in the bonding areas must be prepared by brief torching. Bonding should be done so that approximately 5 cm of the tape is bonded on the exposed concrete and 15 cm on the SikaProof® A+ (see detail graphic below). The sheet waterproofing membrane connection can then be made by thermal welding to the Sikaplan® WP or WT Tape-200. Both tapes have been verified with independent external testing to confirm watertight connections and transitions to Sikaplan® FPO and PVC sheet waterproofing membranes respectively. The watertight bond of Sikadur-Combiflex® CF adhesive to SikaProof® A+ has also been tested and independently verified.



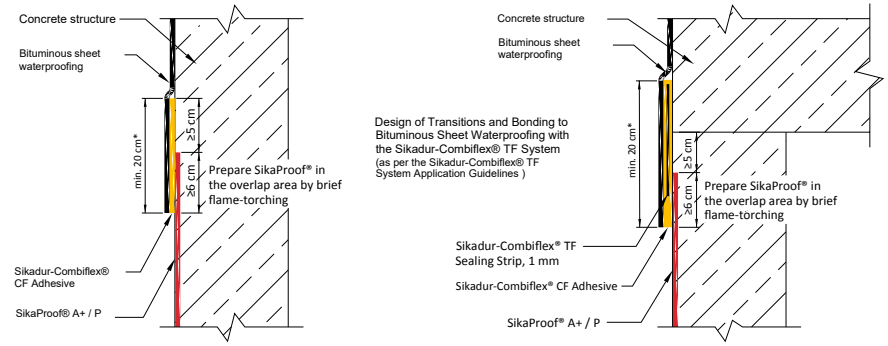
Transitions and Connections using Sikaplan® WT Tapes and WT Membranes

Transitions to Bituminous Waterproofing Membranes

Transitions to bituminous waterproofing membranes are often made with Sikadur-Combiflex® TF systems. Where required, this can be done with an embedded Combiflex-TF strip, which simultaneously also ensures that the wall-soffit joint is watertight. If the transition is in an area without a joint, then the embedded strip is generally not required. Transfer strips should be at least 20 cm wide and be laid lapped (as in the graphic detail below). The Sikadur-Combiflex® CF adhesive is applied and sprinkled with kiln-dried quartz sand while still 'wet' for a physical key. The bituminous membrane can then be lap bonded to the hardened adhesive over the transfer strip. It is essential to ensure that the transfer strip is not damaged by heat when torching the bituminous membrane. For this reason, it is advisable to weld the membranes up to about 30–50 cm from the transition and then to bond the lap area with bituminous cold adhesive. If hot application is required the bituminous membrane must be folded back around the joint. Then only the underside of the bituminous membrane may be heated with the flame. The heated and softened bituminous membrane can then be unfolded into the lap area and rolled in. Bituminous membrane connections with Sikadur-Combiflex® TF to SikaProof® A+, have been independently tested and verified watertight. The sand sprinkled epoxy surface provides an ideal substrate for connecting bituminous membranes and has been well proven in multiple applications.

Surface Transitions

Joint Transitions



Transitions and connections with Bituminous membranes using Sikadur-Combiflex® TF Systems

3.16.2 Connections and Transitions to Plinth Waterproofing

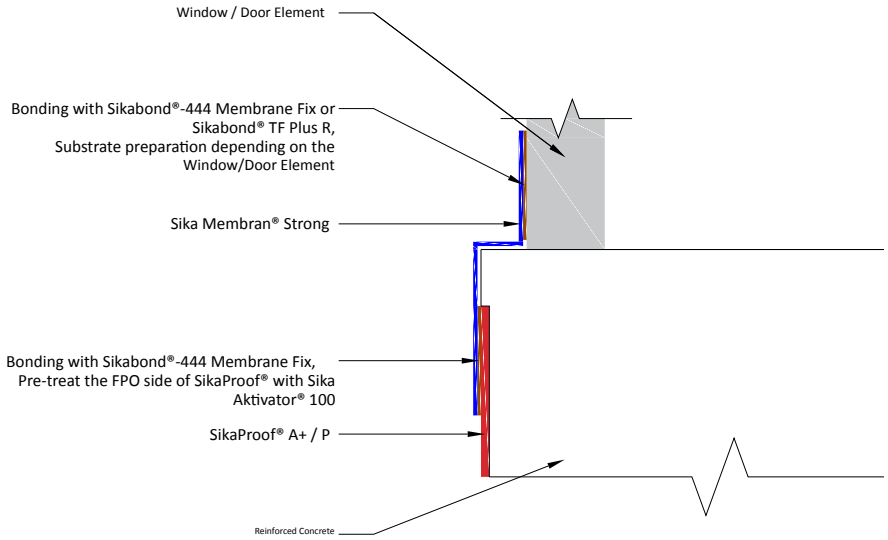
Transitions to Liquid-applied Membranes and Coatings
Transitions to liquid-applied membranes and coatings are generally made in a similar way to those to bituminous sheet membranes described above, formed with a sand-sprinkled transfer strip of the Sikadur-Combiflex® TF System – see previous section and detailing graphic.

All subsequent coatings, sealing slurries and liquid applied membranes can be applied directly to the sand-sprinkled transfer strip. Bituminous membrane connections with Sikadur-Combiflex® TF to SikaProof® A+, have been independently tested and verified watertight. The sand-sprinkled epoxy resin adhesive surface of the transfer strip provides an ideal substrate for many different coating systems and has already proved itself on multiple occasions in site practice.

Sanded Sikadur-Combiflex® CF adhesive creates an ideal substrate for bonding liquid applied membranes and coatings

3.16.3 Connections and Transitions to Facade Waterproofing

Transitions to Facade Membranes
SikaMembran® sheet waterproofing systems are frequently used on facades. These high-quality EPDM waterproofing and vapor control membranes can be connected at the transition to SikaProof® A+ by adhesive bonding. The bond is formed with the elastic system adhesives SikaBond®-444 Membrane Fix or Sikabond® TF Plus R. The SikaProof® A+ bond areas must be clean and pretreated with Sika® Aktivator.



Transitions and connections to Sika facade membrane systems

3.17 Perimeter Insulation

Pressure-stable XPS insulation boards are generally used for perimeter insulation and are fully bonded to the substrate. Two-component, solvent-free PMBC (polymer-modified bituminous thick layer coatings) can be used for bonding.

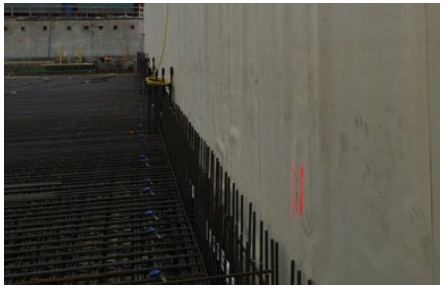
Single-sided Formwork Areas:
If full surface bonding of the perimeter insulation is required in single-sided formwork areas, a significant additional cost is incurred. This must be taken into account during the design. To prevent the membrane from detaching from the fresh adhesive under its own weight, sufficient additional mechanical fastenings are required. It is recommended to hang the membrane according to the "canvas" principle from a nailing strip in the upper edge area.

Recommended Procedure:
1. Cut the rolls to length.
2. Roll the sheets back up.
3. Apply the solvent-free, 2-component PMBC adhesive to the perimeter insulation in segments with a notched trowel.
4. Fix the membrane at the top (e.g. with a nailing strip), roll it from top to bottom into the fresh PMBC layer, and rub it in firmly.
5. If necessary, such as on high walls, additional mechanical fasteners may be helpful across the surface. Seal all penetrations in the surface with interior tape.

Full-surface bonding of Perimeter Insulation

NOTE:

Due to external boundary influences and the weight of the membrane itelf, isolated delamination and defects cannot be completely ruled out with full-surface bonding in single-sided formwork areas.



Single-sided formwork wall with full surface bonding of the perimeter insulation

3.18 Backfilling and Backfill Protection

In general, the FBV system should be completed as soon as possible after formwork stripping and be protected from direct exposure to weathering and mechanical damage. It is therefore advisable to backfill the areas as soon as possible. Backfilling must be done with care to prevent mechanical damage to the FBVS. Therefore, the whole surface must be given suitable backfill protection (e.g., suitable perimeter insulation, protective mats or geotextiles etc.). Avoid leaving SikaProof® A+ surfaces exposed for extended periods. The reasons for this include the risk of damage from ongoing site operations and the limited UV stability of SikaProof® A+. See also section "3.1.6 Resistance".

3.19 Quality Assurance

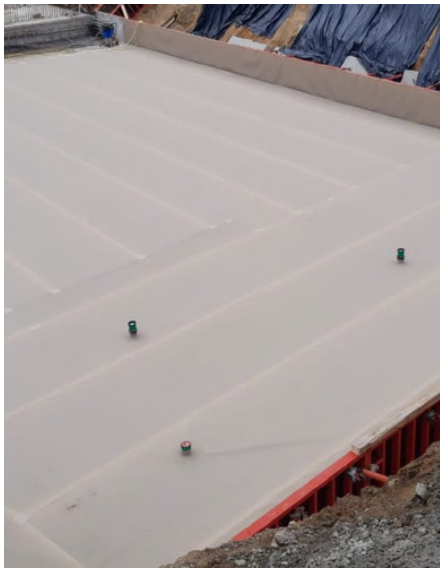
3.19.1 Quality Assurance and Site Records

To ensure the highest quality standards, appropriate quality assurance is required. This should be implemented, monitored and recorded throughout the construction works on site for all significant steps and stages. These key points include:

- Before installation of the FBVS
- After installation / before the reinforcement works
- After the reinforcement works / before concrete placement
- After concrete placement and formwork stripping

There is good guidance and checklists for this quality control and records in the Appendices to the DBV Guide to Good Practice for fully bonded membrane systems published by the German Concrete and Construction Technology Association (DBV), Berlin. This can be reviewed and considered to create a suitable quality control procedure according to the nature and requirements of each different project. There are checklists provided for:

1. Quality Control for the in-house monitoring of the FBVS installation works
2. Quality Control for self-monitoring by the contractor
3. Quality Control by the construction site managment

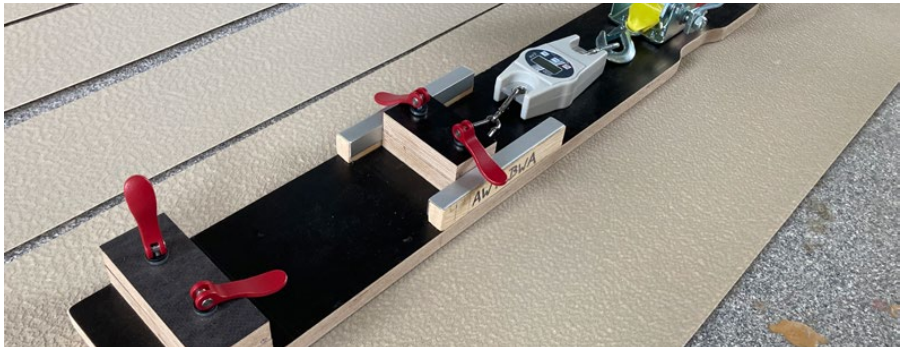


3.19.2 Shear Strength of the Joint as an On-site QA Test

The latest DBV Guide to Good Practice for fully bonded membrane systems has introduced a new requirement for quality assurance of joint quality by the FBVS installer. To do this, the installer must determine the shear strength levels of the seams and compare them with the reference values given by the FBV system manufacturer. This is intended to ensure adequate joint installation quality in line with the requirements. For testing, 50 mm wide test specimens must be cut out perpendicular to the joint. They should be long enough to be securely clamped into the manually operated tensile testing device with a free clamping length of 200 mm. The seam should be positioned in the center of the free clamping length. A uniform force is then developed using a hand crank, and the test strip is subjected to shear stress. A load cell determines the maximum shear force reached. For the SikaProof® A+ system, in accordance with the DBV Guide is type 2.

The maximum shear force is measured as the force is increased until the yield point is reached, when the test strip is stretched to 10% elongation (=20 mm). Once the 10% elongation is reached, no further force is applied and the hand crank is locked in position. The clamped seam must then withstand a holding time of 20 seconds without opening.

This test is always conducted as a series with several sample strips, and the mean shear force determined. The results are then compared with the reference values given by the FBVS manufacturer. Each individual value must be at least 50% of the manufacturer's reference shear force (Criterion 1). In addition, the determined mean value must reach at least 80% of the manufacturer's reference shear force and, independently of this, a minimum shear force of ≥ 100 N/50 mm (Criterion 2). If this is the case and the joint has withstood a holding time of 20 seconds at 10% elongation without tear failure (Criterion 3), the test is considered passed.



Hand-held tensile testing machine for on-site testing of the shear strength of welded seams

Test Frequency:
The test should be performed at the start of the works as a baseline test on a series of 3 strips. If more than 200 m² is being laid, there should be a further spot test on a minimum of 2 strips. If work is interrupted for several days, the installation crew is replaced, or the environmental conditions change, a repeat test must be performed (e.g. dry to wet, or a temperature change of more than 10°C), . The complete test description can be found in Appendix B5 of the DBV Guide to Good Practice for fully bonded membrane systems published by the German Concrete and Construction Technology Association (DBV) in Berlin. Please also note the clarifications in DBV Bulletin 284, September 2024.

Reference Values and Documenting the Site Testing:
Reference values are available for the SikaProof® A+ system in all types of joint connections and environmental conditions. A form is also available as a printable template for subsequent documentation on the construction site. All reference value tables, as well as the form in a printable template, can be downloaded from the landing page www.sika.de/sikaproof.

Reference shear strength for on-site testing using the hand-stretched method at an ambient temperature of 10°C

Testing in accordance with the DBV guideline Appendix B4 and B5, DIN EN 12317-2.

The sheets were preconditioned for 24 hours under the ambient conditions (temperature) to be tested. For each temperature range, the seams were joined and tested once under dry conditions and once under wet conditions.
For testing under wet conditions, the conditioned sheets were wetted with water on the surface. Before bonding, the water was removed by wiping with arubber squeegee and a clean dry cloth.
At the time of bonding, the surface was free of standing water in the form of droplets, but still had residual moisture. The subsequent bonding was carried out in accordance with the requirements of the SikaProof application guidelines. After bonding, test strips were taken from the samples and tested in shear tension at the respective ambient temperature.
temperatures. Status: 09/29/2023

Ambient conditions / Weather		10°C / dry (reference for On-site testing)					10°C / wet (reference for On-site testing)				
Sheet	Seam joint variant	Result type per Table B3	Single value F_{max} [N/ 50mm]	Average value $F_{m,N}$ [N/50mm]	10% elongation, hold time 20 sec.	Remarks	Result type per Table B3	Single value F_{max} [N/ 50mm]	Average value $F_{m,N}$ [N/50mm]	10% elongation, hold time 20 sec.	Remarks
SikaProof A+08	SikaProof Tape A+ N	2	175	176	passed	no seam failure,passed	2	170	174	passed	no seam failure,passed
			175		passed			180		passed	
			180		passed			180		passed	
			180		passed			170		passed	
			175		passed			175		passed	
			170		passed			170		passed	
SikaProof A+12	SikaProof Tape A+ N	2	190	184	passed	no seam failure,passed	2	185	181	passed	no seam failure,passed
			185		passed			175		passed	
			190		passed			185		passed	
			185		passed			175		passed	
			175		passed			180		passed	
			180		passed			185		passed	
SikaProof A+08	SikaProof Sandwich Tape	2	260	262	passed	no seam failure,passed	2	230	244	passed	no seam failure,passed
			280		passed			250		passed	
			270		passed			255		passed	
			245		passed			235		passed	
			260		passed			245		passed	
			255		passed			250		passed	
SikaProof A+12	SikaProof Sandwich Tape	2	340	358	passed	no seam failure,passed	2	340	356	passed	no seam failure,passed
			360		passed			370		passed	
			345		passed			345		passed	
			385		passed			365		passed	
			370		passed			365		passed	
			345		passed			350		passed	
SikaProof A+08	Thermally fused seam	2	230	236	passed	no seam failure,passed	2	230	233	passed	no seam failure,passed
			245		passed			220		passed	
			225		passed			240		passed	
			220		passed			245		passed	
			250		passed			225		passed	
			245		passed			240		passed	
SikaProof A+12	Thermally fused seam	2	430	444	passed	no seam failure,passed	2	390	405	passed	no seam failure,passed
			440		passed			410		passed	
			450		passed			395		passed	
			450		passed			410		passed	
			460		passed			420		passed	
			435		passed			405		passed	

Reference mean shear force values for various types of joints at an ambient temperature of 10°C

Form for recording on-site QA inspection per DBV guideline FBVS, Appendix B5.

Jobsite:
Date:
Inspection date/time:
Area (component, gridline, etc.):
Installer and inspector:
Signature:

FBV sheet	Seam joint variant	Test	Ambient Conditions / Weather	Reference Shear Strength per Manufacturer [N/50mm]	Measured individual field-test values $F_{max,i,N}$ [N/50mm]	Average of field tests $F_{max,i,N}$ ≥80% of the reference shear strength [N/50mm]	10% elongation (20mm), hold time 20 sec.	Measured individual values $F_{max,i,N}$ ≥ 50% of the reference shear strength	Average field-test value $F_{max,i,N}$ ≥ 100 N/50mm
☐ SikaProof A+08 ☐ SikaProof A+12	☐ SikaProof Tape A+ N ☐ SikaProof Sandwich Tape ☐ thermal seam bonding	☐ Initial test (3 specimens) ☐ Sample (2 specimens)	Temperature: _____°C ☐ dry ☐ damp				☐ passed ☐ passed ☐ passed	☐ min. requirements ☐ min. requirements ☐ min. requirements	☐ min. requirements
☐ SikaProof A+08 ☐ SikaProof A+12	☐ SikaProof Tape A+ N ☐ SikaProof Sandwich Tape ☐ thermal seam bonding	☐ Initial test (3 specimens) ☐ Sample (2 specimens)	Temperature: _____°C ☐ dry ☐ damp				☐ passed ☐ passed ☐ passed	☐ min. requirements ☐ min. requirements ☐ min. requirements	☐ min. requirements

On-site QA Results Template for documenting the mean shear strength of the welded joint seams

3.19.3 Damage and Defect Management and their Repair and Remediation.

Project related factors may lead to deviations from the required specifications. This is why meticulous quality assurance is particularly important. If deviations are detected, they should always be assessed in respect of the overall waterproofing system, the nature of the structure, and the design objectives. This classifies acceptable deviations and the unacceptable deviations that must be corrected and made good.

The most common issues are:

- Contamination: should primarily be avoided and secondarily removed. If the contamination is minor (palm-sized) and occurs only in isolated areas, it may be acceptable. Extensive and contiguous contamination must always be removed.
- Rippling: is material-related and unavoidable due to temperature fluctuations. It does not generally constitute a defect and can be left in place. However, creases must not develop, to ensure a complete surface bond with the concrete is guaranteed. Any creases that could adversely affect concrete bonding must always be removed.
- Failed joint seams or shear test failure, mean the seam must be redone correctly and the shear test must be repeated.
- Minor mechanical damage such as cracks or holes: these can be covered and repaired on the inside and outside using the appropriate SikaProof® A+ accessories such as tapes.
- Delamination and bond problems: If the delaminations are minor (palm-sized) and isolated across the surface, it may be acceptable to leave them as is. This is because by opening the delaminations, a new point of weakness could be created. Larger delaminations and inadequate bond problems should be repaired with the SikaProof® P or Sikadur-Combiflex® TF systems.

4 SikaProof® P: USE AND INSTALLATION

4.1 General Requirements

As already outlined for SikaProof® A+, certain conditions must also be observed when using the post-applied version. This is the only way to ensure the full efficiency of this method.

4.1.1 Transport and Storage

SikaProof® P and all system components must be stored in their unopened original packaging in a dry place, protected from snow, ice, direct sunlight, and extreme heat or heat sources. The storage temperature should be between +5 and +30°C.
During storage and transport, pallets or other items must not be stacked on top of the rolls. The shelf life of the materials, when stored correctly, is:

- SikaProof® P-12: 18 Months
- SikaProof® Tapes: 18 Months
- SikaProof® Primer-01: 12 Months

from the date of production (see product label for date).

On delivery to the construction site, the products must be inspected immediately for any damage. Important points for optimal storage of the product on the site are:

- Protect the product from damage
- Do not store directly on site roads or in machinery operating areas
- Protect the product from contamination and direct exposure to weathering (do not remove the original packaging prematurely)
- Protect opened or partially used products
- Do not stack pallets or other items on the rolls
- If possible store under cover, or in the shade at the height of summer
- In winter, store in temperature-controlled areas or storage containers if possible

SikaProof® P-12 roll label

4.1.2 Requirements for the Substrate and Concrete Quality

SikaProof® P is a post-applied bonding system. The concrete component to be waterproofed is therefore the direct substrate. The efficiency and functionality of the overall structure are significantly influenced by the quality of the concrete. To ensure optimal adhesion and effective lateral underflow protection, the substrate must meet the following requirements:

- Sufficiently strong and load-bearing (minimum-compressive strength ≥ 25 N/mm²; minimum tensile bond strength ≥ 1.5 N/mm²)
- Dry, clean, and free of all contaminants and materials that could reduce adhesion (e.g., oils, release agents, loose and friable particles, cement laitance etc.)
- Free from rough or uneven surfaces, cavities, voids, honeycombing, and any protruding or sharp edges or materials
- Effective lateral underflow protection can only be guaranteed with components made of watertight concrete with a dense and closed microstructure (assuming professional installation and proper compaction). Lightweight and porous concretes are not suitable, as they allow water to pass through the concrete.
- Residual moisture of the concrete ≤ 6%
- All edges must be chamfered and chamfers must be rounded.

Quality concrete is crucial for the performance and efficiency of this method

Typical surface of a watertight concrete component

Watertight basement with precast concrete walls

4.1.3 Weather

Installation of the system is weather-dependent and can only be done on a dry substrate. Damp and residual moisture-laden surfaces must be dried before further processing, for example with a torch (Caution: Do not use heat or flames near to the primer–fire hazard!). During the bonding process, the substrate and material temperatures must be +5°C. If temperatures fall below this level during cold weather, suitablee measures must be taken to ensure that the required minimum temperature is maintained at the time of installation.

4.1.4 Resistance

SikaProof® P-12 is designed for use in backfilled areas and is not permanently UV-resistant. The membrane is UV-stabilized only for the duration of installation. The system must be backfilled and protected as soon as possible after installation and within a maximum of 30 days. If backfilling in connection areas (e.g., in the base area) is not possible within this time, the membrane must be covered and protected. Suitable methods include applying perimeter insulation or covering with protective films and membranes that provide sufficient UV protection.

In general, the FPO membrane has high chemical resistance. This allows buildings to be protected against aggressive substances found in natural groundwater. In many cases, the membrane is also resistant to industrial pollutants in contaminated sites, however, an assessment of this must be carried out in advance. The assessment requires detailed site conditions as well as groundwater and soil testing and analysis. The system's effectiveness against chemical media must be assessed in advance for each specific project. SikaProof® P-12 is not approved as a WHG sealing solution for designated LAU facilities and WHG areas! However, the system can be used in such facilities to protect the structure against external groundwater. Sealing against the ingress of environmentally hazardous substances must be carried out with approved WHG systems (e.g., Westec® joint tapes. SikaTank® FB-25, Sikaplan® WT 6200, and Sikafloor®-390 N, etc.).

4.1.5 Combining with Other Construction Products

In practical construction applications, various combinations and transitions to other materials may be necessary. In principle, SikaProof® exhibits good chemical resistance and can normally be bonded to commonly used materials such as solvent-free PU, PUR or epoxy resins, as well as insulating materials and geotextiles. The same applies to the solvent-free PMBC thick coatings typically used to secure perimeter insulation. In all cases, an evaluation and, if necessary, testing of compatibility and resistance must be done in advance. If an adhesive bond is required for the combination, this must also be tested and confirmed in advance.

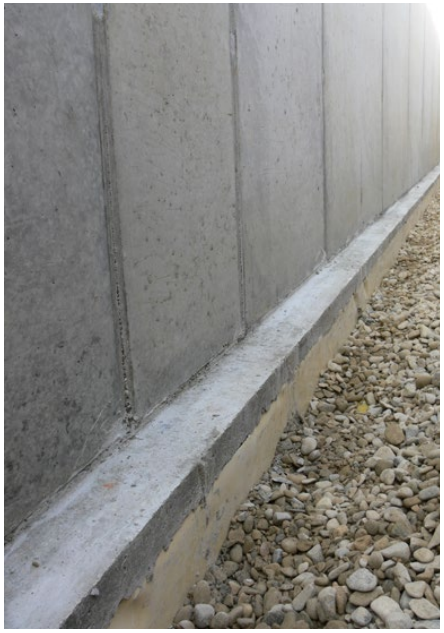
4.2 Preparatory Work – Substrate and Component

In general, all loose and adhesion reducing substances must be removed. The requirements described in chapter "4.1.2 Requirements for the substrate" must be met. The most essential measures are outlined in more detail below. This list is not exhaustive, and additional specific project measures may be necessary.

Surface Flatness:
Walls normally have good surface finishes, provided that the concrete was poured correctly using smooth formwork and high-quality concrete. As a rule, only the formwork joints need to be ground smooth afterwards.

On horizontal surfaces (recesses/soffits), a smooth, level concrete finish should have been specified. If this is not achieved, horizontal surfaces must be sanded to create a sufficiently smooth surface. For larger uneven surfaces, the substrate must be prepared and leveled using appropriate PCC systems. Sika® MonoTop or Icoment® Systems are suitable for this.

Grinding formwork joints



Initial condition: Before applying SikaProof® P-12, formwork joints and the floor slab overhang must be ground smooth, edges chamfered and rounded, plus coves formed as necessary

Voids, Spalls, Blowholes, and Areas of Honeycombing:
The performance of the FBV system, especially the lateral underflow protection, is also dependent on the concrete quality. However, isolated shrinkage cracks and blowholes in the surface do not pose a problem. Spalls and larger voids, honeycombing, or extensive surface pores must be filled and sealed in advance. For sealing internal voids, grouting is a suitable method using Sika injection systems and surface concrete repairs can be made with PCC mortar systems such Sika® MonoTop® or Icoment®.

Channels and Edges:
All edges must be rounded and/or chamfered. This can be done with suitable grinding equipment (5 mm min. chamfer). Coving must be triangular or rounded, forming a smooth corner fillet for correct installation of the membrane. This coving can also be formed using suitable PCC mortar systems. To prevent capillary action, the surface profiling material must be watertight. Fast-setting mortar systems using rapid-setting cements, reduce drying times and allow the waterproofing works to continue quickly.

Extensive shrinkage cracks, surface blowholes and honeycombing must be repaired in advance

Plinth edge rounded by grinding

Forming a PCC mortar cove

4.3 Primer Application

Before installing the membranes, the SikaProof® Primer-01 system primer must be applied. This one-component primer is supplied ready for use in metal tins and is applied with suitable rollers, always stir before use. Care must be taken to ensure that the primer is applied over the entire surface and that all pores are saturated with primer. The primer consumption is dependent on the substrate and application, on average approx. 200–250 g/m².

Only prime an area that SikaProof® P-12 can be applied over on the same day. In the event of longer interruptions, e.g., overnight, the primer should be reapplied. The same applies if primed surfaces are contaminated and covered with dirt or dust etc.

The primer must be sufficiently dry before the SikaProof® P-12 membrane is installed. The minimum waiting time depends on the weather conditions and is approximately 20–30 minutes, possibly even less in summer. A finger test should be performed as a check—the surface must be dry to the touch before installing.

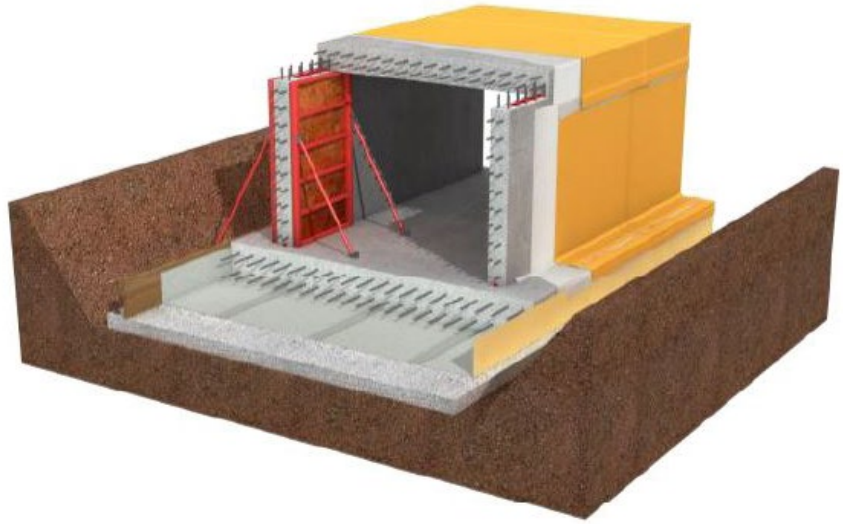
Fully primed surface: Only prime an area that can be installed on the same day

Applying SikaProof® Primer-01

Finger test: Before installing SikaProof® P-12, the primer must be dry to the touch

4.4 Installing the Membranes

SikaProof® P-12 is installed by the "peel and stick" method, by peeling off the protective film and sticking the membrane on the primed surface. Due to the specially formulated high-performance polyolefin adhesive and the proprietary system primer, a unique and highly durable bond is developed. The excellent initial adhesion is further improved by firmly rubbing the surface after application and later by the back-pressure when the area is backfilled, ensuring maximum performance and security.



SikaProof® P-12 can be installed on both walls and soffits and offers seamless protection for the structure.

4.4 Installation of the Membranes

Installation Steps Using the Example of a Wall with a Floor Slab Overhang:

Determine the required length and cut the membrane to size
Tip: Assembling in advance simplifies installation, improves quality, and saves overall time

First, peel off just the top 5–10 cm of the protective film

Align the membrane horizontally and secure it at the top edge

Peel off the protective film gradually from top to bottom, stick on the membrane and rub it down fully with suitable tools (e.g. a float with a fleece/felt covering). Make sure it is applied without wrinkles

Gradually fit the membrane over (as described in 4) the joint and floor slab overhang down to the face of the slab. Make sure that the membrane is applied without wrinkles and is fully bonded in channels and along the edges

Rub the membrane in firmly over the whole area—and repeat in channels and at edges. The connection to the existing SikaProof® A+ from the base slab is made exactly as stated in section 4.7

Installation in Horizontal Areas over Soffits:

The same installation steps apply on horizontal areas. It is advisable to determine the direction of installation in advance. It is best to work in sections, starting from the area that has already been applied and proceeding towards the area to be laid. This minimizes direct foot traffic on the prepared and primed substrate surfaces (to prevent soiling). When walking on the completely dried primed surfaces, always ensure that footwear is as clean as possible. In the finished areas, defined walkways should be protected from mechanical damage by suitable fleece or mats.

Installation of SikaProof® P-12 on horizontal areas over soffits below

NOTE:

SikaProof® P-12 must not be used on areas with any direct vehicular traffic! Also, temporary loading during site operations, e.g. from forklifts, and movement or storage of other building materials etc., must be prevented! Areas that may later be subjected to light vehicular traffic must be protected with protective layers, protective mats, and additional protective concrete.

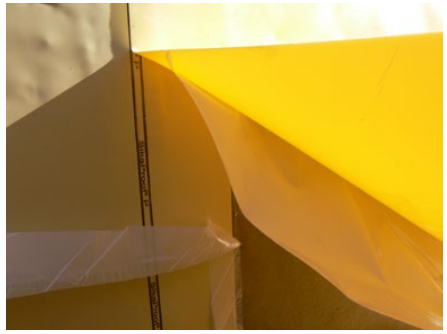
Horizontal areas with wide floor slab overhangs

4.5 Jointing

With SikaProof® P-12, joints are formed with a bonded lap joint. Each subsequent sheet is applied with a 10 cm lap over the previous one and is bonded on to it. For easier alignment and to ensure the correct lap width, with SikaProof® P-12 a double stripe is applied on the outside as an installation guide. The edge of the overlapping membrane should sit between the two installation marks so that only one stripe remains visible on completion. It is not a problem if both stripes are covered, as the lap width is then even greater.

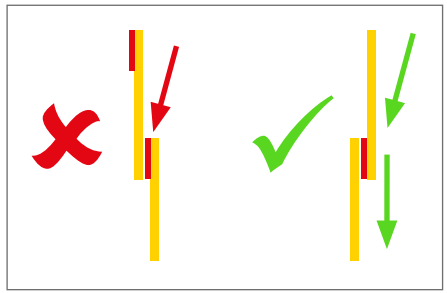
To accommodate the thickness difference at the edge of the membrane along longitudinal joints, an additional adhesive bonded edge is formed to prevent any capillaries occurring. This edge has a separate protective liner, which must be removed before bonding the overlapping membrane. After bonding, roll the bonded joint edge firmly with a hand roller.

Lap joint with double stripe installation guide: Before bonding, align the top membrane so that the edge sits between the two stripes



Additional bonded edge at a longitudinal joint: Remove the protective liner before bonding the membrane

When installed on walls, the membranes should be positioned as vertical as possible. This usually makes installation easier, and the longitudinal joints run vertically. Ensure that all joints running horizontally (e.g., cross joints) are formed on the umbrella principle (the higher membrane overlaps externally on the side facing the water – see illustration).



Always form horizontal joints on the umbrella principle.

Details and T-joints:
All joints differing from the longitudinal joint (i.e. T-joints, cross joints at the end of a roll, detail joints at mouldings etc.) must be protected against capillary action from the membrane thickness offset. This is done according to the water pressure:

- For up to 5 m head: sealing with SikaProof® ExTape-150 (pressed firmly against the membrane offset with a hand roller)
- For pressures up to 10 m head: bonding with extruded sealant (e.g. Sikaflex® 11FC) beads in combination with SikaProof® ExTape-150 (pressed firmly against the membrane offset with a hand roller)

For pressures over 5 m head: additionally secure the offset of T-joints and detailing joints with sealant (e.g., Sikaflex® 11FC), applied in beads (2–3 mm), then pressed and rubbed in firmly with a hand roller

Secure T-joints with SikaProof® Ex-Tape-150, pressed on firmly with a hand roller

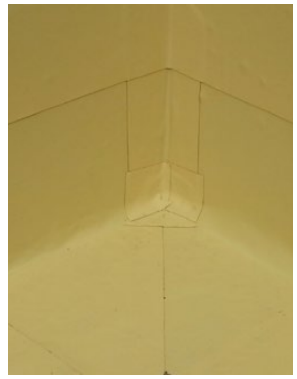
Finished sealed T-joints

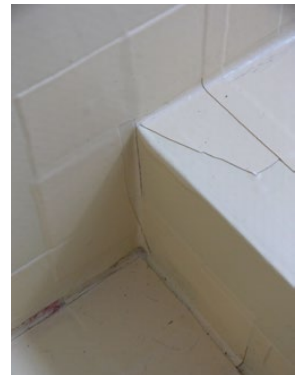
4.6 Corner Detailing

By cutting, shaping, lapping, and bonding of SikaProof® P-12, the corners are formed to match the geometry of the structural component. For outer corners, individual fitted pieces known as 'mirrors' must be cut to size. The design of these pieces must ensure they can be lapped onto the adjacent surfaces. The joints in the corner details must be additionally secured according to the anticipated water pressure. The pieces should be secured in accordance with the instructions in section "4.5 Joining".

Inserting fitted pieces

Forming external corners





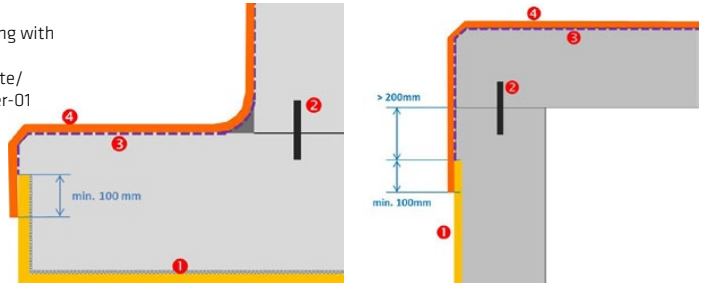
Forming internal corners / corner combinations

Final sealing and securing of the detailing in accordance with section "4.6 Corner Detailing"

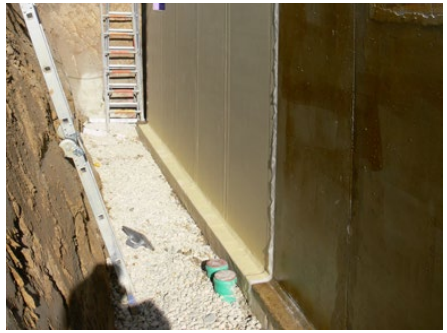
4.7 Transitions and Connections to SikaProof® A+

The connections and transitions to surfaces with SikaProof® A+ from slabs or walls are again made by a bonded lap joint.
The minimum lap width is 10 cm. Before application, the existing SikaProof® A+ surface must be cleaned to remove any contaminations from the site operations. At the time of bonding, the lap area must be clean, dry, and free from any substances that reduce adhesion. Do not use cleaning products that leave an oily or release film. If necessary, lighter soilingcan be cleaned and pretreated with Sarnafil® T Prep. Stubborn dirt can be cleaned with Sarnafil® T Clean and pretreated with Sarnafil® T Prep. Apply both materials sparingly with a clean cloth, remove dirt and leave the treated surfaces to dry completely before further work.
Then lap the SikaProof® P-12 by at least 10 cm over the SikaProof® A+ and bond. Roll the lap area firmly with a hand roller.
All T-joints in the connection area must be protected and sealed against capillary action (see section "4.5 Jointing").

1. SikaProof® A+
2. Joint waterproofing with Proof of function
3. Prepared substrate/ SikaProof® Primer-01
4. SikaProof® P-12



Connection of SikaProof® P-12 to the existing SikaProof® A+
Connection of SikaProof® P-12 to the existing SikaProof® A+
Left: Transition from base slab to wall with slab overhang
Right: Transition from wall to slab over soffit



Connections and transitions in the area where the base slab meets the wall

4.8 Construction Joints

Construction joints must also be sealed with watertight sealing systems
In watertight structures, the joint waterproofing products have a certificate of suitability in the form of an abP (general building inspection test certificate),or they are regulated by the DAfStb WU Guidelines and installed in accordance with DIN 18197 (Sealing joints in concrete with waterstops).

Even though the SikaProof® system is capable of bridging construction joints, it always makes sense to use appropriate additional joint sealing measures, and this is also a requirement under the WU Guidelines (also see the graphic illustration in the previous Chapter).

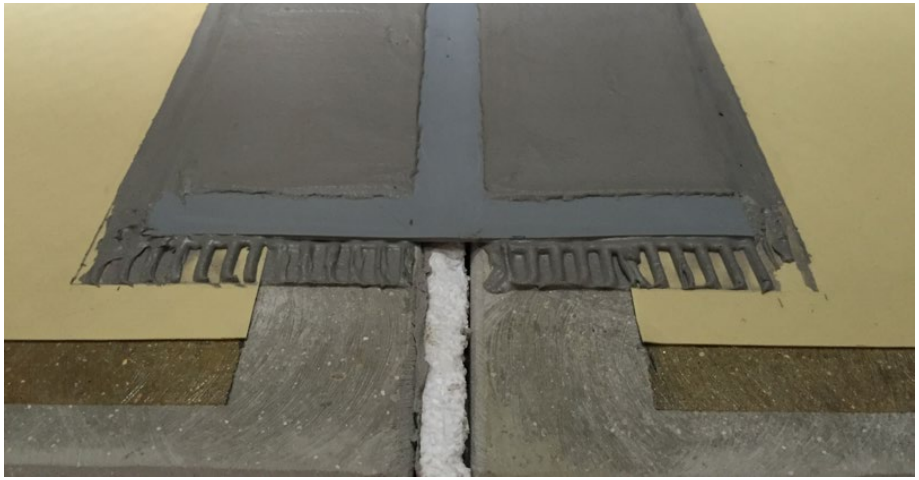
Bridging the construction joint with SikaProof® P-12 and connecting directly to the existing SikaProof® A+ surface, in combination with an additional integral Waterbar

Recessing the joint area of SikaProof® A+ and SikaProof® P-12 on both sides, in combination with an external strip-type joint seal with the Sikadur-Combiflex® TF system

4.9 Expansion Joints

Expansion joints in walls and slabs with soffits can also be formed with the Sikadur-Combiflex® TF System. Firstly, the SikaProof® P membrane is applied to the surface and bonded set-back from the expansion joint arris /edge, to leave a free and exposed concrete surface of minimum 7.5 cm on both sides (note: 5 cm is used for construction and connection joints).
The 2 mm thick Sikadur-Combiflex® TF sealing tape can then be applied later, and bonded with the Sikadur-Combiflex® TF Adhesive, directly onto the exposed concrete on either side of the expansion joint, and also directly onto the prepared (briefly torched) surface of the SikaProof® P membrane, which must be overlapped by a minimum of 2.5 cm.

The design, installation, and connection of the Sikadur-Combiflex® TF Tape System are made in accordance with the Sikadur-Combiflex® TF System Installation Guidelines Manual, as outlined in Chapter 5 of this manual.



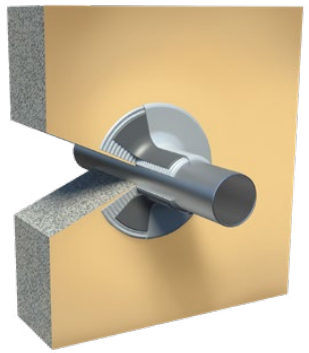
Expansion movement joint sealed with the Sikadur-Combiflex® TF System, which is bonded on each side of the joint to min. 7.5 cm exposed concrete surface, and lapped min. 2.5 cm onto the SikaProof®-P membranes

4.10 Pipe Penetrations

Pipe penetrations cannot be made with a SikaProof® collar due to the contact bonding. In these instances, the pipe penetrations are sealed with the Sikadur-Combiflex® TF System. To do this, a suitable sized piece is shaped from the 2 mm sealing strip to form a pipe collar of the appropriate diameter, and then applied using the Sikadur-Combiflex® CF Adhesive. Check the pipe wall material when bonding; for example, PE pipes must be torched briefly before bonding. The connection to SikaProof® P-12 is then made by lapping and bonding with the system adhesive. See Chapter "5 Sikadur-Combiflex® TF System".

Alternatively, loose/fixed flange systems can also be used. In this method, the SikaProof® P-12 membrane is clamped between the loose and fixed flanges. An elastomeric spacer at least 2 mm thick must be inserted on both sides.

If retrofit pipe penetrations are required, they must be made by core drilling. In this case, they are sealed with a suitable proprietary sealing insert. The retrofit sealing inserts from Doyma and Hauff-Technik already described for SikaProof® A+ can be used (see Pipe Penetrations with SikaProof A+).



Pipe penetrations with the Sikadur-Combiflex® TF system and SikaProof® P-12

System configuration:
Doyma Curaflex SD on SikaProof®
(Illustration: Doyma)

4.11 Formwork Joints

After stripping formwork, the sealing plugs for the clamping sleeves must be sealed and bonded in place according to the manufacturer's instructions. The clamping points are fully and continuously covered and sealed with the SikaProof® P-12. If the plugs are set too deep or unevenness is present, SikaProof® FixTape-50 may be used in advance to level the surface.

The tensioning points are covered over the entire surface after sealing with the plugs included in the system

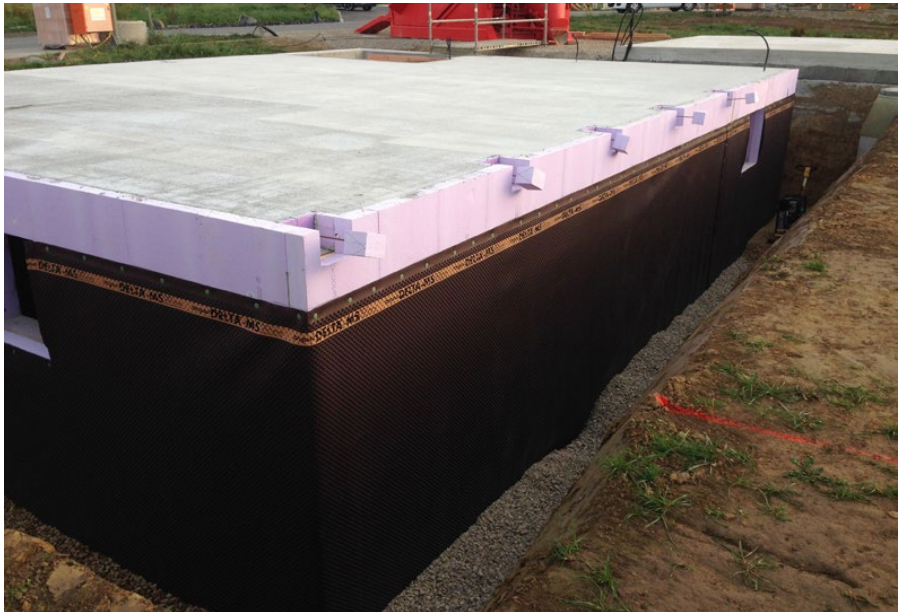
4.12 Perimeter Insulation

Pressure-resistant XPS insulation boards are used for perimeter insulation. They must be fully bonded to the substrate according to the specification. Two-component, solvent-free PMBC adhesives can be used for bonding.

Perimeter insulation with pressure-resistant XPS boards

4.13 Backfilling and Backfill Protection

As a general rule, the surfaces should be protected from direct weathering or mechanical damage as early as possible after completion. The backfill pressure further improves contact bonding and protects against potential blistering. For this reason, backfilling of the area as soon as possible is recommended. However, the waterproofing must be given suitable backfill protection first (e.g., perimeter insulation, protective mats, or geotextiles). Avoid leaving the waterproofed areas exposed for an extended period. The reasons for this include the risk of damage from ongoing site operations and the temporary UV stability of SikaProof® P-12. Please also refer to section "4.1.4 Resistance Properties." .



Backfilling the working area as soon as possible after completion of the bonded waterproofing system

Note on Slabs over Soffits:
SikaProof® P-12 has the required root resistance. However, suitable backfill protection materials must be applied before backfilling (see above). SikaProof® P-12 must not be used on areas with any direct vehicular traffic! Likewise, temporary loading during site operations, such as from forklifts, as well as the storage of building materials and other heavy objects on the surfaces must be prevented! Areas that will later be exposed to light vehicle traffic must be protected with suitable protective layers, such as protective mats and additional concrete.

4.14 Quality Assurance

Maximum security and quality are ensured by conducting and recording a thorough quality inspection after completing the works and before backfilling the area. The following questions assist in the quality assurance inspection.

Quality Assurance – Final Inspection Before Insulating/Backfilling:

- Are the design specifications met?
- What components have been used? Are they tested and certified for functional performance in this combination, for the transitions, and compatibility? Test certificates / general building test certificate?
- Have the requirements of these guidelines been met?
- Is all the detailing professionally completed?
- Are all the penetrations sealed?
- Are all the post-applied details completed? (e.g., Sikadur-Combiflex® TF System)
- Have the follow-on trades/local site management been informed of necessary measures required?
- What protective measures will be taken before backfilling/covering?

After inspection and recording data, approval is given for backfilling.

Note on Any Damage or Defects Identified:

- Any damage that has occurred may be remedied appropriately with the defined systems and accessories.
- Any peeling or blistering may have various causes (contamination, failure to rub in or inadequate rubbing pressure etc.). In such situations, loose areas should be firmly rubbed down and bonded properly. Since the adhesive remains active,a retroactive bond can be achieved

Visual inspection and quality assurance before applying protection and backfilling the area

5 Sikadur-Combiflex® TF System: INSTALLATION AND USE

5.1 Installation Guidelines Sikadur-Combiflex® TF System

The Sikadur-Combiflex® TF System is an All in One system for the watertight sealing of joints (construction and expansion joints) and cracks in concrete structures with high water pressure resistance. The system can be used on both cast-in-place and precast concrete elements. It is therefore a perfect system component and represents the third pillar of the complete SikaProof® system.

Its design and use is generally covered by the separate Sikadur-Combiflex® TF System Installation Guidelines, and its general German Building Authority Test Certificates (abP). Please refer and ensure compliance with the latest editions.

In addition to the Sikadur-Combiflex® TF Installation Guidelines, the following sections of this manual outline aspects that require special attention in combination with SikaProof®.

5.2 Sikadur-Combiflex® TF Transitions and Connections

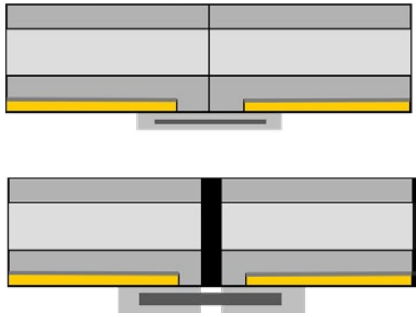
In the combination of the two systems, the Sikadur-Combiflex® TF tape is joined to the outside of the SikaProof® (FPO membrane) by a bonded lap. The FPO membrane must be correctly prepared to ensure adequate adhesion of the epoxy resin adhesive. Basically, the FPO membrane in the connection area must be clean, dry, and free of any substances that could reduce adhesion. The surface must be correctly cleaned according to the site conditions. It is then prepared by briefly torching the FPO membrane. Thermal preparation by hot air is insufficient; the polymer surface must be prepared by applying an open flame to the FPO membrane surface. Care must be taken to ensure that the open flame is only briefly in contact with the FPO membrane (always keep the flame moving) and the membrane is not damaged by excessive or prolonged heat exposure. The Sikadur-Combiflex® CF system adhesive can then be applied directly on the SikaProof® membrane.

Briefly torching the surface of the SikaProof® membrane in the lap area before applying the Sikadur-Combiflex® TF system

5.3 Joint Design in the SikaProof® System with Sikadur-Combiflex® TF

When forming the joint, make sure that the SikaProof® is set back 5 cm from the joint edge arris, not up to it. A minimum free concrete edge zone of 5 cm must be left on both sides of the joint. This exposed concrete edge area is where the Sikadur-Combiflex® TF tape strips will be bonded later and lapped onto the adjacent SikaProof® surface. The lap should be 2.5 cm minimum. The lap area must be prepared as described in the previous chapter. The Sikadur-Combiflex® TF system is designed as detailed in the Sikadur-Combiflex® TF system manual - (Installation Guidelines). With this combination, a fully sealed, integrated, and fully approved waterproofing system can be constructed.

Joints Formed with a Combination of SikaProof® & Sikadur-Combiflex® TF



Exposed concrete edges on both sides of the joint

Application of the Sikadur-Combiflex® TF system and connections to the SikaProof® membrane surface.

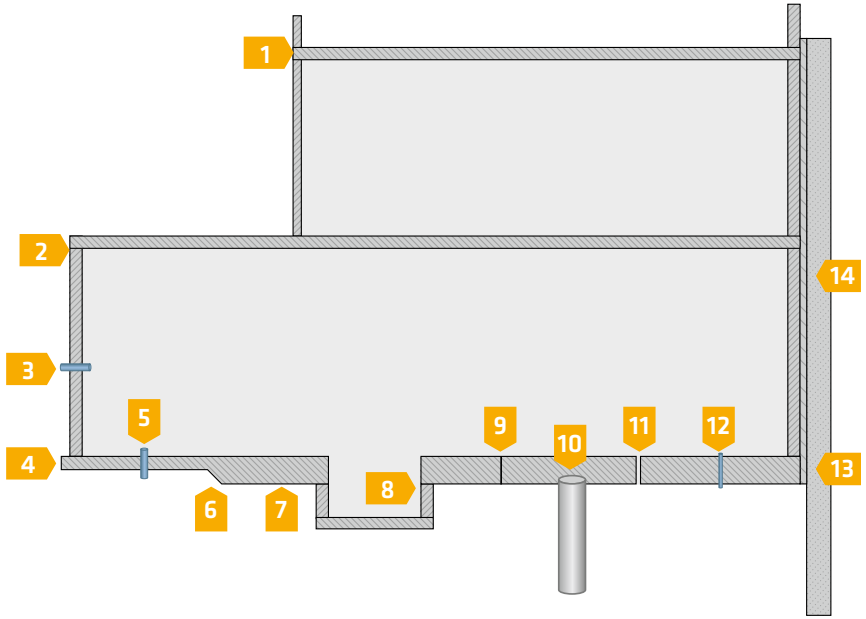
Maximum flexibility when designing shaped pieces for intersections, etc. due to thermal weldability

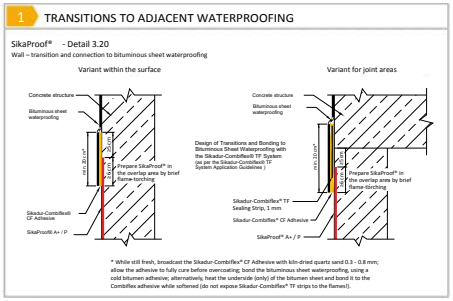
Finished Sikadur-Combiflex® TF system installation and connection to SikaProof® membrane

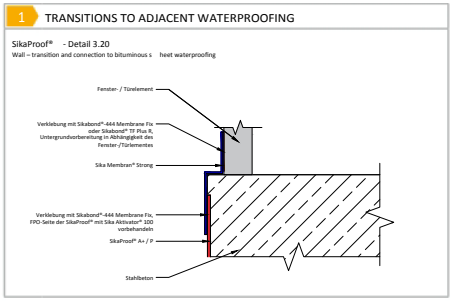
6 STANDARD DETAILS

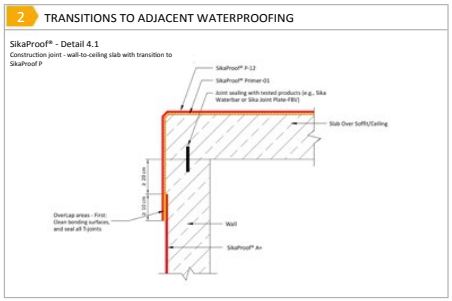
CAD detail drawings are available for the most important standard design details. These are available in PDF or DWG format on request. The details shown here are typical examples; further details and specific / bespoke solutions are also available on request. Please ask your local Sika representative for the specific details and solutions you require.

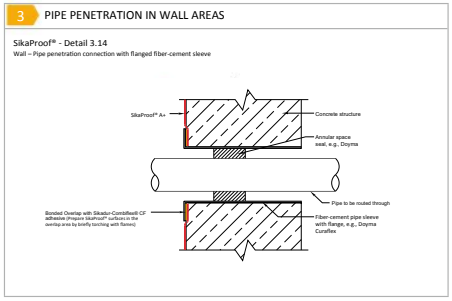
Note - These CAD Drawings depict the standard details as outlined in this manual. They do not cover specific project requirements or special conditions and are advisory. The final design and specification details for each structure must be confirmed by the responsible design engineer.

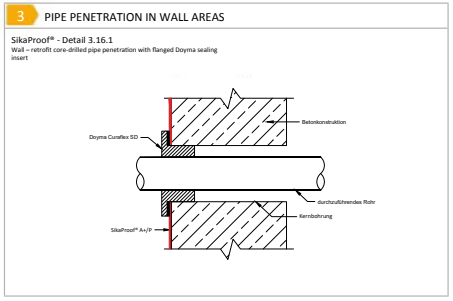


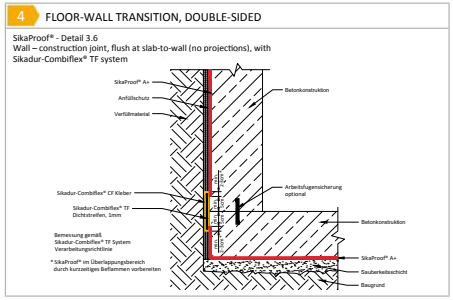


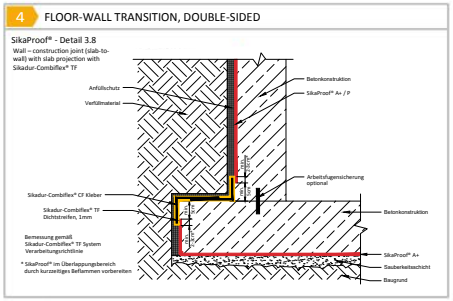










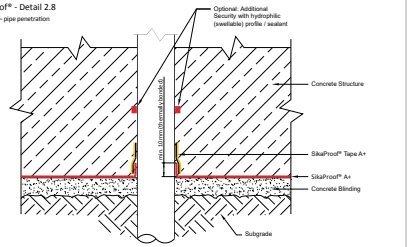


6 Standard Details

5 PIPE PENETRATION IN SLAB

SikaProof® - Detail 2.8

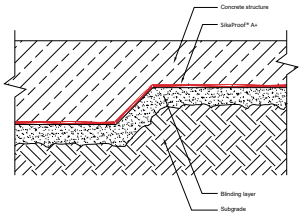
Floor slab – pipe penetration



6 CHANGE IN CROSS-SECTION OF THE BASE SLAB

SikaProof® - Detail 2.5

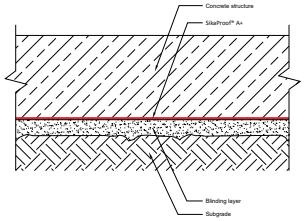
Base Slab - Haunch within the floor slab



7 INSTALLATION UNDER THE SLAB

SikaProof® - Detail 2.1

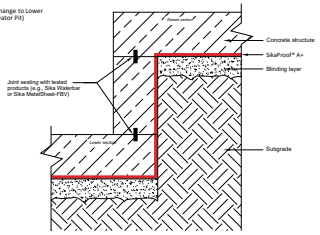
Floor slab – installation on the blinding layer



8 DEEP-SET ELEMENTS (E.G. LIFT SHAFTS)

SikaProof® - Detail 2.7

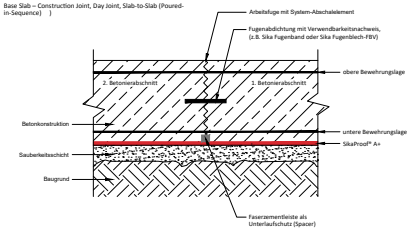
Floor slab – Elevation Change to Lower Sections (e.g., Lift / Elevator Pit)



9 CONSTRUCTION JOINTS

SikaProof® - Detail 2.4

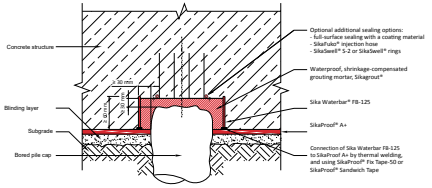
Base Slab – Construction Joint, Day Joint, Slab-to-Slab (Poured-in-Sequence)



10 BORED PILE CAP

SikaProof® - Detail 2.10

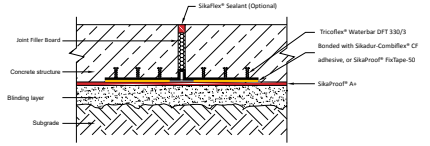
Floor slab – bored pile cap



11 EXPANSION JOINTS

SikaProof® - Detail 5.2

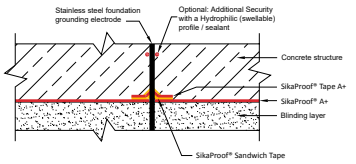
Expansion joint – Expansion joint with Sikadur-Combiflex® TF tape profile



12 FOUNDATION SOIL

SikaProof® - Detail 2.9

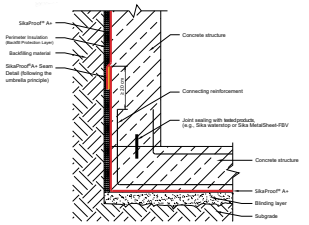
Foundation Base Slab with Grounding Electrode



13 FLOOR-WALL TRANSITION, SINGLE-LAYER

SikaProof® - Detail 3.5

Wall - construction joint slab-to-wall, continuous with no projections



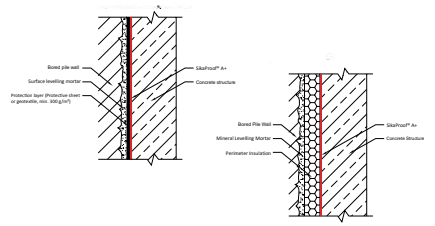
14 INSTALLATION IN WALL AREAS – SINGLE-LAYER

SikaProof® - Detail 3.3

Wall – single-sided formwork wall with protection layer

SikaProof® - Detail 3.4

Wall – single-sided formwork wall with perimeter insulation



7 SPECIFICATIONS / BILLS OF QUANTITIES

All the relevant specification items for the SikaProof® complete system are available at www.ausschreiben.de. Your local Sika consultant will be happy to answer any other questions.

8 IMPORTANT NOTES

Legal Notices
The information provided in this manual and any other advice are based on our current knowledge and experience, assuming correct storage, handling, and use of our products under normal conditions and in accordance with our recommendations. The information applies only to the uses and products explicitly mentioned and is based on laboratory tests, which are not a substitute for site trials. Should the installation parameters change, due to variations in substrates etc., or if used differently, please contact our Technical Support for advice and assistance in advance. The information provided here does not relieve the user of the obligation to verify the suitability of the product for its intended use and purpose. Our current General Terms and Conditions of Sale and Delivery apply to all orders. Product users must always refer to the latest edition of the local product data sheet for the product concerned, which is available on request.

Technical Notes
The graphics are schematic and may differ from the actual installation situation.

Installation Qualifications
The product systems described in this manual must always be installed by qualified and trained specialists. Certified installers are installers who have been trained by Sika according to their need. They are trained to install the SikaProof® system correctly. The training is confirmed with certificates bearing the participants name.

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Notes

As a subsidiary of the globally active Sika AG, Baar, Switzerland, Sika Deutschland CH AG & Co KG is one of the world's leading suppliers of construction chemical product systems and sealants and adhesives for industrial manufacturing.

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