



Sika Technology and Concepts for Mechanically Fastened Roofing Systems with Single Ply Membranes



Innovation & Consistency | since 1910

Sika Technology and Concepts for Mechanically Fastened



Roofs



As a leading global specialist materials manufacturer for the construction industry, Sika has a strong focus on roofing and produces a wide range of different products and systems to meet all of our customers' requirements and conform to the latest standards. This brochure illustrates this roofing competence with the application and technical aspects of mechanically fastened roofs that will assist you to find the right system to fit your project's requirements, including an overview of the alternative solutions.

Our local Sika Companies in more than 70 different countries, allow us to provide our customers and their clients not only with our proven roofing products, but also many additional services including wind load calculations, CAD details and tailored guarantees, plus application training and full on-site technical support worldwide.

Sika is the only supplier of complete integrated specialist construction solutions 'from the basement to the roof'. These include systems for high performance concrete, basement and structural waterproofing, flooring, sealing, bonding, damping, grouting, concrete repair and reinforcing, structural glazing and more. This is in addition to our wide range of roofing systems for all types of buildings and civil engineering structures, which makes us ideal as the most complete and competent partner for you on both new construction and refurbishment projects.

This brochure is intended to give you an overview of Sika's solutions for mechanically fastened roofing systems as an important part of our overall construction systems portfolio.

For additional information, advice or assistance, please contact your local Sika Technical Services Department or visit www.sika.com.

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The Principles of Mechanically Fastened Roofing



General Description

Mechanical fixing of the exposed **Sikaplan**[®] or **Sarnafil**[®] roof waterproofing membrane is an option for nearly any roof. These systems are also generally the most suitable where cost efficiency is necessary, as the installation speed is unbeatable for both new construction and refurbishment projects.

These mechanically fastened systems are therefore ideal for the large, lightweight metal decked structures used on buildings such as distribution and logistics centres, warehouses, supermarkets and transportation facilities. By attaching the membrane, mechanically, the roofing system gains many advantages.

- Suitable for new construction and refurbishment
- Extensive design possibilities
- High resistance against high wind-uplift forces
- Different fixing options on different roof substrates
- Installation is almost non-weather dependent
- Easy to recycle at the eventual end-of-life



Installation Principles

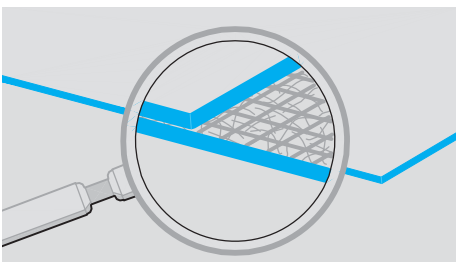
Sikaplan® and **Sarnafil®** singly ply roofing membranes together with the thermal insulation are attached to the roof deck using a fastening element. The following methods can be used:

- Spot fastening (in-lap) system
- Linear fastening system
- Induction welding

Sika mechanically fastened single ply membrane roofing systems are suitable for most building types and have many advantages for the Contractor and the Building's Owner.

- Speed of installation – covering large areas in a short time
- Lightweight and clean installation
- Cold applied membranes – no open flames, no heating
- Easy refurbishment of deteriorated bitumen roofs

Reinforced Membranes with Fully Embedded Polyester Scrim



The fully embedded polyester reinforcement provides high tensile strength. This ensures resistance to high wind forces, as required for all exposed mechanically fastened roofs.

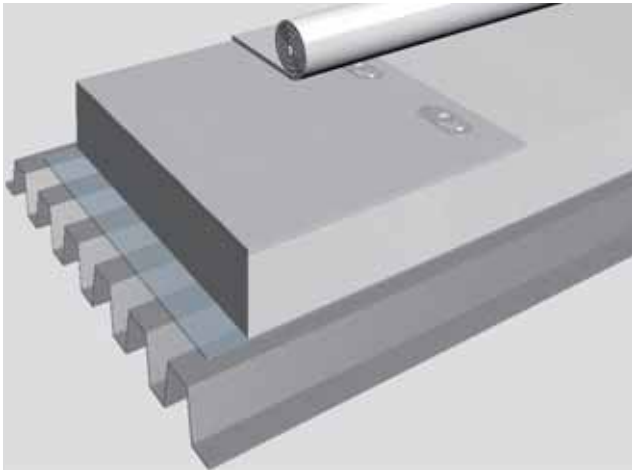
Sika products:

Sarnafil® S 327 / S 327 EL

Sarnafil® TS 77 / TS 77 E (with additional glass matt inlay)

Sikaplan® G / VG / VGWT

The Principles of Mechanically Fastened Roofing – System Build-ups

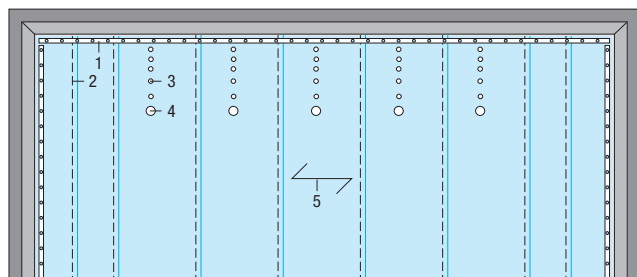


The Overlap – Spot-Fastening System

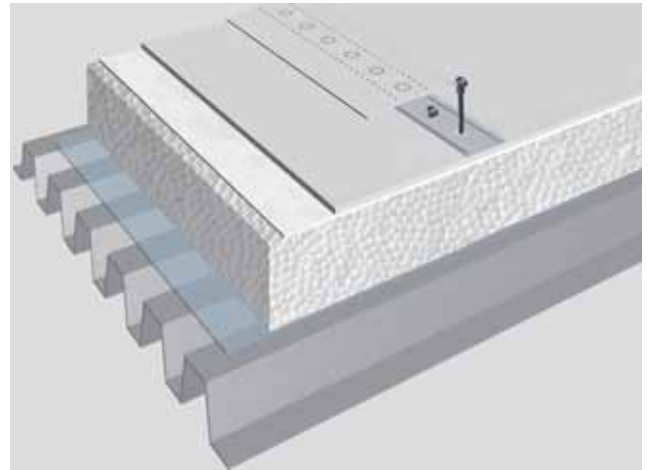
The lap edge of the membrane is mechanically fastened through the system build-up into the roofing structure. The fastening elements fixed along these laps are then covered by overlaying the next membrane sheet. The required number of fasteners is defined by the wind-uplift forces which can occur at the project's location.

Ideal for installations with the following criteria:

- Locations subject to high winds
- Large roof areas
- Fast installation speed is required
- Linear-fastening or adhered installation is impractical



- 1 Perimeter fastening using **Sarnabar**® and welding cord (or spot-fastening as an alternative)
- 2 Spot fastening in the overlap
- 3, 4 Additional corner and perimeter spot-fastening
- 5 Direction of the trapezoidal roofing deck

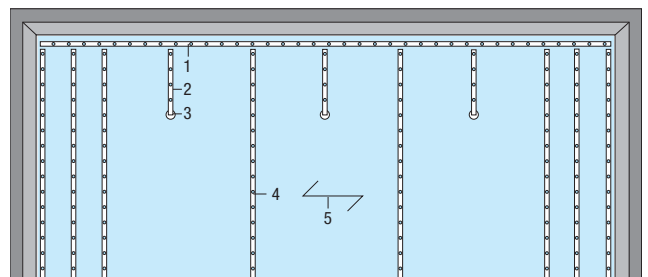


The Bar – Linear-Fastening System

If enhanced security and long term performance is required, Sika's unique bar fastening system has a proven track record of more than 40 years. The roof membranes are loose-laid and then welded before they are fixed and anchored against wind-uplift. The installation of these patented **Sarnabar**® fastening profiles follows a pre-engineered lay-out determined by our own engineers.

Ideal for installations with the following criteria:

- Locations subject to very high winds
- Concrete Decks
- Irregular or custom designs
- Spot-fastening or adhered installation is impractical



- 1 Perimeter fastening using **Sarnabar**® and welding cord
- 2, 3 Additional corner and perimeter fastening using **Sarnabar**®
- 4 **Sarnabar**® linear-fastening system – up to 5 m spacing – non-dependent on the membrane width
- 5 Direction of the trapezoidal roofing deck

The Principles of Mechanically Fastened Roofing – Solutions to Resist Wind-Load



From Pull-out Value to Fastening Pattern

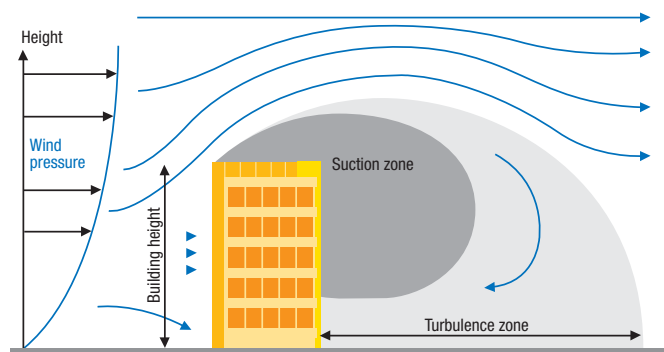
For refurbishment projects where the substrate strength details are not known, the necessary design values can be determined by performing a number of pull-out tests over the entire roof to get a good understanding of the substrate condition. On new structures where the substrate is known, the design values are defined by the fixings supplier. The fixings supplier defines the design values per fastener type for the different substrates using wind uplift machine testing as specified by European Technical Agreement Guide – ETAG 006, or by the USA Factory Mutual – FM Standards.

Sika has two of these wind-uplift machines as specified by ETAG 006 – one in Europe and one in China, plus in the USA we own a wind uplift table following the Factory Mutual Standards. Sika has performed thousands of wind uplift tests and we have continuously increased our roofing design capability. As a result of these Sika engineers were able to develop our own wind-load calculation tool – called Jet Stream. This is suitable for wind uplift calculations according to Eurocode EN 1991-1-4:2005, and also to Factory Mutual Class 4470.

Wind Uplift Resistance Principles

Resistance to wind load is a pre-requisite for all mechanically fastened roofing systems. When wind hits the roof area it creates a negative pressure called wind suction – as a result of this the wind forces are pulling on the roof membrane. To withstand the wind suction in this method of installation a defined number of mechanical fasteners and fixings is required per square metre. To determine this required mechanical fastening schedule, the following design parameters have to be considered:

- Wind speed (in m/s or mph) – Most countries have a wind map indicating the appropriate design wind speeds for specific locations
- The roof exposure as a result of the terrain surrounding the location
- Uplift design pressure coefficients for the corners, perimeters and open area
- Building height – As the higher the building the higher the wind suction
- The roof shape(s) – Different shapes can result in higher pressure coefficients
- Building Volume and Openings – Larger buildings and openings can create greater additional internal pressures



Sika's unique Jet Stream wind-load calculation software tool takes all of these parameters into account and quantifies the required quantities of fasteners, fixings and membrane requirements for each specific roofing project and its location. It allows the contractor to align his installation approach for all of the roof sections in accordance with the relevant codes and standards. Sika's local sales and technical support team can provide you with these project specific calculations, including all of the necessary technical and commercial details – and in the local language.

Sika Mechanically Fastened Roofing Experience



Sika's Experience with Roofing Membranes

The first mechanically fastened Sika roofing systems were introduced in the late 1950's and have ever since been continually proven as amongst the most durable roofing solutions available. Over the past decades many millions of square metres of Sika mechanically fastened roofing systems have been successfully completed on almost every type of building and in all climatic zones of the world.

- Long lasting waterproofing systems
- Worldwide proven solutions
- Detailed design and specification support
- Project specific wind-uplift calculations
- Installation training and on-site support

Sika is one of the most experienced single ply membrane producers with a track record of more than 50 years. With the **Sikaplan**® and **Sarnafil**® product lines, Sika provides high-quality, single ply mechanically roofing systems including all of the required ancillary components including:

- PVC and FPO single ply membranes
- Wide range of fastening and fixing products
- Thermal insulation
- Prefabricated details
- Vapour control layer

Sika Fastening Solutions

Sika evaluates fastening solutions according to the demands of the market. All Sika approved fastening suppliers must meet the highest quality and stringent performance requirements. This includes meeting these requirements of:

- Durability over the entire service life
- Resistance against environmental influences
- Easy application and use with recommended application tools
- Self-tapping fasteners, no pre-drilling for steel applications
- Being ecologically friendly e.g. Chrome VI-free
- Recyclable at eventual end-of-life

This extensive knowledge of mechanical fastening technologies supported our development of the computer based calculation tool called Jet Stream, which enables us to perform project specific wind loading calculations in accordance with local standards.

Sika Solutions for New Construction and Refurbishment



New Constructions

On large and medium sized flat roof areas – the **Sarnafil®** / **Sikaplan®** mechanically fastened roofing systems provide the most efficient and reliable solutions for owners and their design team. Sika mechanically fastened roofing systems are an ideal solution for new construction and have many advantages.

- Speed of installation
- High aesthetic appearance
- Design to resist the highest wind uplift forces
- Proven long term performance
- Almost non-weather dependent installation

A wide range of membrane thicknesses and colours presents designers with the opportunity to design the roof in most attractive and efficient way. These Sika mechanically fastened systems are generally installed on commercial and industrial buildings, including distribution centres, warehouses, production plants, airport terminals, stadiums and leisure centres.

Refurbishment

The refurbishment of existing roofs is a growing need in most markets. By far the largest number of all roof reconstructions involves the refurbishment of old bitumen roofs.

Sarnafil® / **Sikaplan®** mechanically fastened roofing systems are ideal for roof refurbishment works, making them a favourite choice for the re-roofing works without removing the deteriorated existing bitumen roof build-ups. The advantages include:

- Bitumen compatible membranes
- Light weight membranes
- Fastening solutions for all types of roof structure
- Light coloured membranes to reflect sunlight, also reducing the buildings energy consumption for air conditioning
- High aesthetic appearance and visual improvement

These systems can be installed with or without additional thermal insulation as required.

For the selection of the right refurbishment system, a professional condition survey and diagnostic assessment has to be undertaken. Please contact the Technical Services Department of your local Sika Company for assistance.

Sika Solutions for Exposed Roofs: Mechanically Fastened Systems with PIR/Mineral Wool Thermal Insulation



Requirements

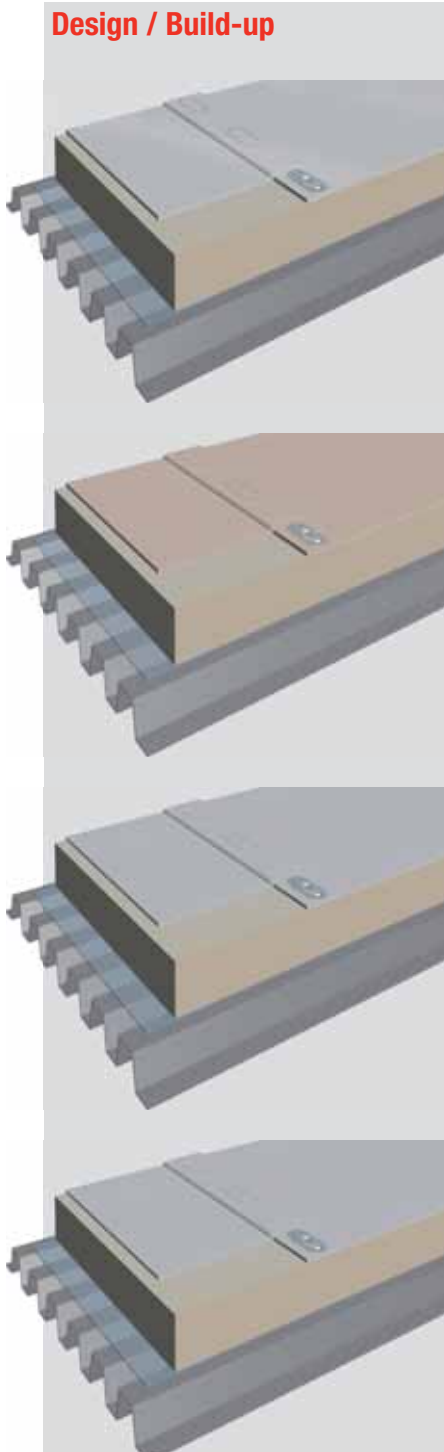
- PVC-membrane with laquered surface and extended guarantee
- Fast and easy installation
- Special colours and design (décor profiles)
- High fire resistance of the thermal insulation

- FPO membrane with extended guarantee
- Fast and easy installation
- High chemical resistance of the waterproofing membrane
- High fire resistance of the thermal insulation

- Standard PVC membrane
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)
- High fire resistance of the thermal insulation

- PVC membrane with increased fire and low temperature resistance
- Slip resistant surface
- Standard guarantee (from your local Sika organisation)
- High fire resistance of the thermal insulation

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S 327** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 1000 E**
- Steel deck



- PVC membrane **Sikoplan® G** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



- PVC membrane **Sikoplan® VGWT** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



Roofing Systems on Steel Deck

Systems with EPS/XPS Thermal Insulation



Requirements

- PVC-membrane with laquered surface and extended guarantee
- Fast and easy installation
- Special colours and design (décor profiles)
- Increased compressive strength of the thermal insulation

- FPO membrane with extended guarantee
- Fast and easy installation
- High chemical resistance of the waterproofing membrane
- Increased compressive strength of the thermal insulation

- Standard PVC membrane
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)
- Increased compressive strength of the thermal insulation

- PVC membrane with increased fire and cold resistance
- Fast and easy installation
- Slip resistant surface
- Standard guarantee (from your local Sika organisation)
- Increased compressive strength of the thermal insulation

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S 327** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Separation layer **S-Glass Fleece 120** if required by fire regulations
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 1000 E**
- Steel deck



- PVC membrane **Sikapan® G** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



- PVC membrane **Sikapan® VGWT** mechanically fastened with **Sarnafast® SF** 4,8 mm and **Sarnafast® Washer KT**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 500 E** or **1000 E**
- Steel deck



Sika Solutions for Exposed Roofs: Mechanically Fastened Systems with PIR/Mineral Wool Thermal Insulation



Requirements

- PVC-membrane with laquered surface and extended guarantee
- Fast and easy installation
- Special colours and design (décor profiles)
- High fire resistance of the thermal insulation

- FPO membrane with extended guarantee
- Fast and easy installation
- High chemical resistance of the waterproofing membrane
- High fire resistance of the thermal insulation

- Standard PVC membrane
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)
- High fire resistance of the thermal insulation

- PVC membrane with increased fire and cold resistance
- Fast and easy installation
- Slip resistant surface
- High fire resistance of the thermal insulation

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S 327** mechanically fastened with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- PVC membrane **Sikaplan® G** mechanically fastened with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- PVC membrane **Sikaplan® VGWT** mechanically fastened with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Mineral wool or PIR insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



Roofing Systems on Concrete Deck

Systems with EPS/XPS Thermal Insulation



Requirements

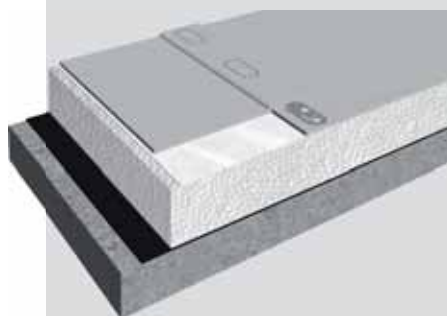
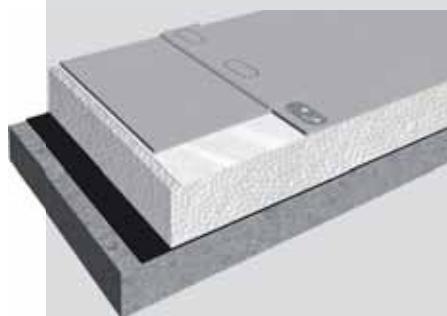
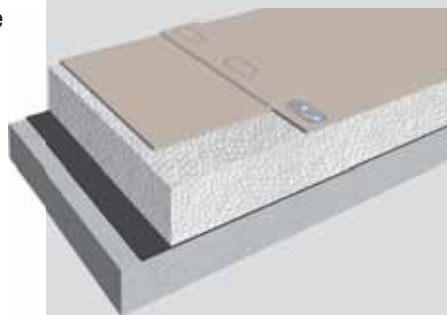
- PVC-membrane with laquered surface and extended guarantee
- Fast and easy installation
- Special colours and design (décor profiles)
- Increased compressive strength of the thermal insulation

- FPO membrane with extended guarantee
- Fast and easy installation
- High chemical resistance of the waterproofing membrane
- Increased compressive strength of the thermal insulation

- Standard PVC membrane
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)
- Increased compressive strength of the thermal insulation

- PVC membrane with increased fire and cold resistance
- Fast and easy installation
- Slip resistant surface
- Increased compressive strength of the thermal insulation

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S 327** mechanically fastened with **Sarnafast® SB 6,3 mm** and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened with **Sarnafast® SB 6,3 mm** and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120** if required by fire regulations
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- PVC membrane **Sikoplan® G** mechanically fastened with **Sarnafast® SB 6,3 mm** and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



- PVC membrane **Sikoplan® VGWT** mechanically fastened with **Sarnafast® SB 6,3 mm** and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120**
- XPS or EPS insulation
- Vapour control layer **Sarnavap® 3000 M**
- Concrete deck



Sika Solutions for Refurbishment of Bitumen Roofs with Mechanically Fastened Systems without Additional Insulation



Requirements

- PVC-membrane with laquered surface and extended guarantee
- Fast and easy installation
- Special colours and design (metal roof imitation, décor profiles)

- FPO membrane with extended guarantee
- Fast and easy installation
- Highly chemically resistant waterproofing layer

- Standard PVC membrane
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)

- PVC membrane with increased fire and cold resistance
- Fast and easy installation
- Standard guarantee (from your local Sika organisation)

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S327** mechanically attached to substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer IF/IG-C**
- Separation layer **S-Felt T 300**
- Existing build-up on concrete deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer IF/IG-C**
- Existing build-up on concrete deck



- PVC membrane **Sikaplan® G** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer IF/IG-C**
- Separation layer **S-Felt T 300**
- Existing build-up on concrete deck



- PVC membrane **Sikaplan® VGWT** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer IF/IG-C**
- Separation layer **S-Felt T 300**
- Existing build-up on concrete deck



Mechanically Fastened Roofing Systems

Mechanically Fastened Systems with Additional Insulation



Requirements

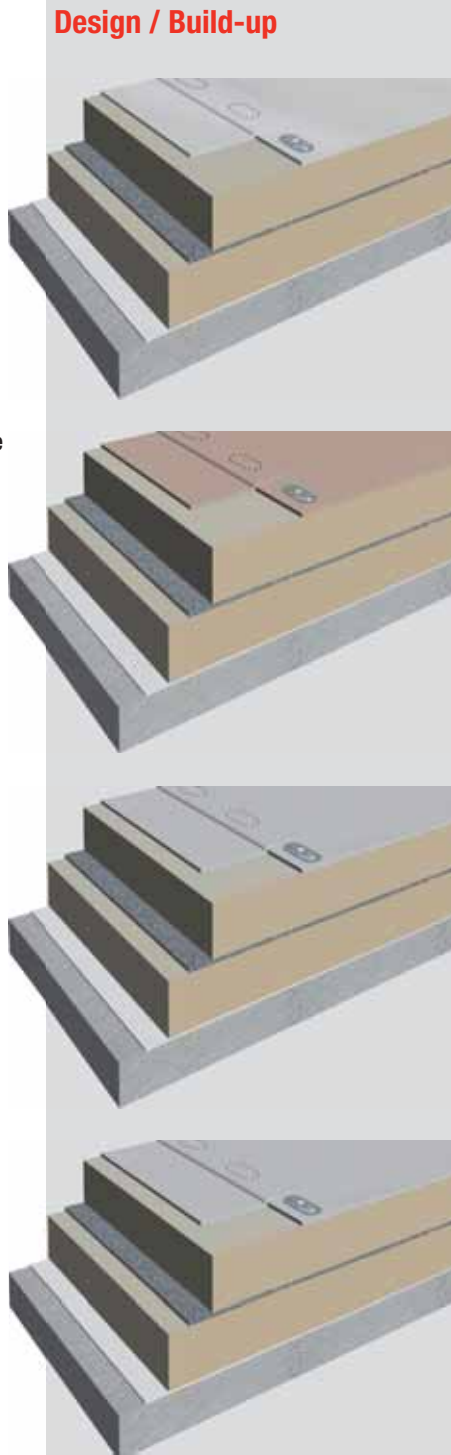
- PVC-membrane with laquered surface and extended guarantee
- Additional thermal insulation
- Special colours and design (metal roof imitation, décor profiles)

- FPO membrane with extended guarantee
- Additional thermal insulation
- Highly chemically resistant waterproofing layer

- Standard PVC membrane
- Additional thermal insulation
- Standard guarantee (from your local Sika organisation)

- PVC membrane with increased fire and cold resistance
- Additional thermal insulation
- Standard guarantee (from your local Sika organisation)

Design / Build-up



Sika System

- PVC membrane **Sarnafil® S327** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120** (with EPS/XPS insulation)
- New thermal insulation
- Existing build-up on concrete deck



- FPO membrane **Sarnafil® TS 77** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- New thermal insulation
- Existing build-up on concrete deck



- PVC membrane **Sikoplan® G** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120** (with EPS/XPS insulation)
- New thermal insulation
- Existing build-up on concrete deck



- PVC membrane **Sikoplan® VGWT** mechanically fastened to the substrate with **Sarnafast® SB** 6,3 mm and **Sarnafast® Washer KTL**
- Separation layer **S-Glass Fleece 120** (with EPS/XPS insulation)
- New thermal insulation
- Existing build-up on concrete deck



Sika as Global Leader in Single Ply Membranes



PVC Roofing Membranes

Type

PVC (poly vinyl chloride) membranes

Brand names

Sarnafil®, **Sikaplan®**, **Sika-Trocal®**

Advantages

- Established technology with the longest track record
- Availability of products for exposed roofing applications with high fire ratings / extended fire resistance
- High tensile strength from embedded polyester reinforcement
- Easy to repair
- Homogeneous hot air welded joints
- Easy to handle on site
- Suitable for use and exposure in all different climatic conditions
- Fast installation almost non-dependent on the weather
- Good vapour permeability
- Highly flexible
- Flame free installation
- Recyclable
- Proven track record for over 50 years

FPO/TPO Roofing Membranes

Type

FPO/TPO (flexible/thermoplastic polyolefin) membranes

Brand names

Sarnafil® T, **Sikaplan® T**

Advantages

- High chemical resistance
- Suitable for direct application on bitumen and both EPS and XPS insulation (polystyrenes)
- Systems for exposed roofing applications with high fire ratings / extended fire resistance
- High tensile strength from embedded polyester reinforcement
- Long life expectancy
- Easy to repair
- Homogeneous hot air welded joints
- Easy to handle on site
- Suitable for use and exposure in different climatic conditions
- Fast installation non-dependent on the weather
- Flame free installation
- Recyclable
- Proven track record for over 20 years

Designing a Mechanically Fastened Roof – Expertise from Sika

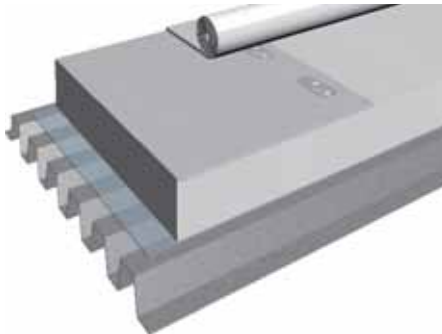


The Right Solution is Selected According to Your Project Requirements:

Spot fastening system

The spot or in-lap fastening system provides speed, security and economy of installation on roofs with regular fixing centres on profiled steel decks. Ideal for projects with the following criteria:

- Locations subject to high winds
- Large roof areas
- Fastrack installation requirements
- Linear fastening and adhered systems are impractical



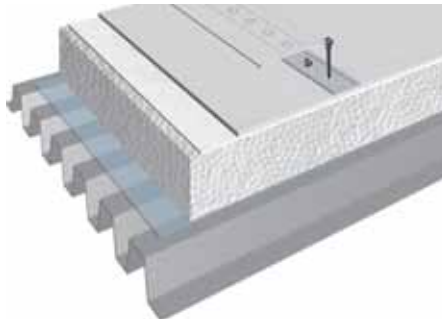
Sika products

- All Sika polymeric roofing membranes
- **Sarnatherm®** or **Sikatherm® PIR** insulation boards
- **Sarnavap®** – vapour control layers
- **Sarnafast®** fasteners and washers (hardened carbon steel or stainless steel)

Linear fastening system

The **Sarnabar®** linear fastening system features fastening profiles which are attached at right angles to the direction of the membrane. This versatile system is ideal for use when fixing points are dictated by existing timber joists, channels or reinforcement, plus for use on concrete roofs where the in-lap fastening system is less practical. Ideal for projects with the following criteria:

- Locations subject to very high winds
- Concrete decks
- Irregular or bespoke designs
- Spot fastening or adhered systems are impractical



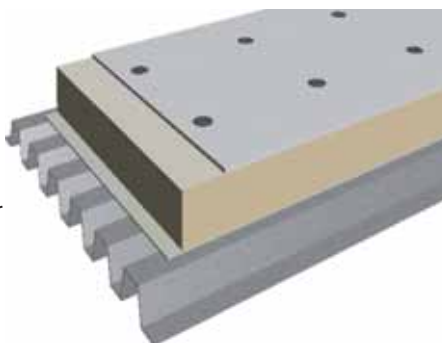
Sika products

- All Sika polymeric roofing membranes
- **Sarnatherm®** or **Sikatherm® PIR** insulation boards
- **Sarnavap®** – vapour control layers
- **Sarnabar®** fastening profiles (hot dipped galvanized steel)
- **Sarnafast®** fasteners and insulation washers (hardened carbon steel or stainless steel)

Regular grid fastening system

The regular grid fastening system is ideally suited for attachment to structural metal roof decks (using their grid pattern), as well as when re-roofing metal buildings (using existing purlins). This system distributes the wind-uplift load in an even load pattern rather than concentrating it along single rows. Ideal for projects with the following criteria:

- Reduced point loading on the steel deck
- Orientation of the roofing membrane is not an issue
- Reduced membrane sheet fluttering caused by wind-uplift



Sika products

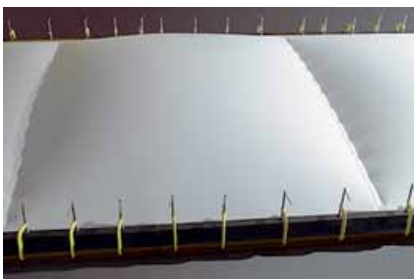
- All Sika polymeric roofing membranes
- **Sarnatherm®** or **Sikatherm® PIR** insulation boards
- **Sarnavap®** – vapour control layers
- **Sarnafast®** fasteners and washers (hardened carbon steel or stainless steel)

Induction Welding



How does it Work?

This innovative fastening system relies on electromagnetic induction welding to eliminate any fastener penetrations through polymeric roof waterproofing membranes – both FPO and TPO. Special coated metal plates are fastened through the roof assembly into the deck and later heat-welded to the underside of the membrane by using an induction welding tool. The plates are fastened in a regular pattern into the roofing deck before laying the membrane. This allows easy location of the plates after unrolling the membrane, and ensures even load distribution after the induction welding is completed.



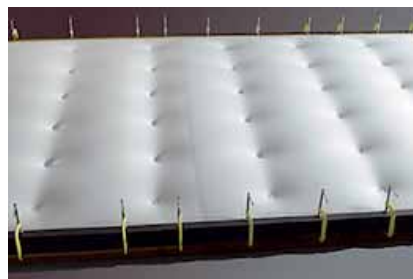
Wind-uplift testing – Spot fastening

System Components

- Induction welding tool from approved suppliers
- Coated metal plates for FPO and TPO membranes
- Range of fixings tubes and fasteners for different substrates

Advantages:

- Quick and easy to install
- No membrane fastener penetrations
- Even wind load distribution
- Enhanced wind-uplift resistance
- Reduced membrane 'flutter'
- Elimination of half sheets in perimeter and corner areas



Wind-uplift testing – Induction welding

Induction Welding – World Wide



Sika® – Japan



RhinoBond®
OMG-USA



Centrix®
Afast – Europe



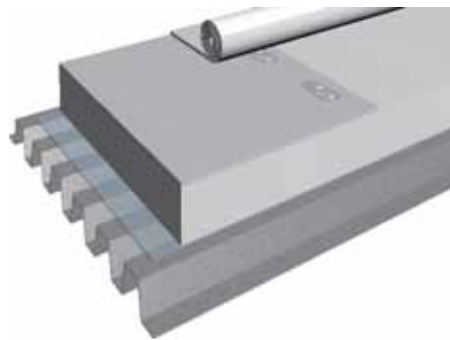
Coated
metal plates

Roof System Build-ups with Sika Products



Spot - / In-lap fastening

Linear-fastening system



Main component / function

Roof waterproofing membrane

Loose-laid
Mechanically fastened

Loose-laid
Mechanically fastened

Fire protection layer or separation layer
(where required)

S-Glass Fleece 120 g/m²

S-Glass Fleece 120 g/m²

Thermal insulation

Sikatherm®
Sarnatherm®
Mechanically fastened

Sikatherm®
Sarnatherm®
Mechanically fastened

Vapour control layer

Sarnavap® 500E
Sarnavap® 1000E
Sarnavap® 2000E
Sarnavap® 3000M
Sarnavap® 5000SA

Sarnavap® 500E
Sarnavap® 1000E
Sarnavap® 2000E
Sarnavap® 3000M
Sarnavap® 5000SA

Levelling layer
(where required)

S-Felt A 300 g/m²
S-Felt M 500 g/m²
S-Felt S 800 g/m²

S-Felt A 300 g/m²
S-Felt M 500 g/m²
S-Felt S 800 g/m²

Roof deck

Concrete, steel or timber

Concrete, steel or timber

Installing Mechanically Fastened Roofs



Substrate Quality

In mechanically fastened roofs, the wind loads acting on the membrane are transmitted through the fastening system into the substrate.

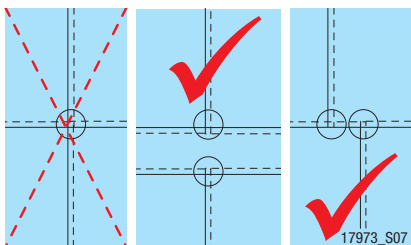
The following basic rules are therefore crucial:

- Wind load resistance is directly dependent on the quality of substrate and the permanent anchoring of the fasteners
- The substrate quality must be sufficient to resist all the wind uplift forces
- Wind-uplift determined from project specific wind load calculations

Substrate Preparation

No special additional measures are required.

T-Joints and Cross Joints



Cross joints are to be avoided. By properly laying out the roofing membranes, all junctions can be limited to straight welding seams and T-joints (transverse joints).

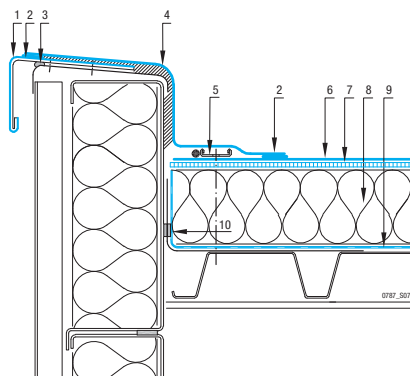
Thermal Insulation

The thermal insulation is also mechanically fastened to the roof deck. The number of insulation fasteners needs to be in accordance with local standards or the suppliers specifications.

The main insulation technologies are:

- PIR/PUR offering excellent thermal characteristics
- Mineral wool, which can be considered as a non-combustible material
- EPS is the most cost effective solution
- XPS provides very high compressive strength

Perimeter Flashing



Membrane

The membrane must be loose-laid and mechanically fastened according to the installation guidelines provided by Sika.

- The number of fasteners per square metre needs to be determined on each specific project
- Sika provides project specific wind load calculations according to the relevant National or International Standards
- On metal decks the membranes must be attached at right angles to the direction of the metal ribs
- The overlaps for spot-fastening must be at least 120 mm whereas for linear fastening a minimum of 80 mm is required

- 1 Laminated metal sheet
- 2 Hot-air weld
- 3 Sealing tape
- 4 Roofing membrane, adhered
- 5 **Sarnabar**® with welding cord
- 6 Roofing membrane, mechanically fastened
- 7 Separation layer / fire protection layer (where required)
- 8 Thermal insulation
- 9 **Sarnavap**® vapour control layer
- 10 **Sarnavap**® jointing tape



Welding

The seams of **Sikaplan®** and **Sarnafil®** membranes are always hot-air welded. To ensure optimum seam quality, the following actions are required:

- Always conduct test welds under matching external weather conditions, before starting the works
- The weld areas must be clean and dry, wash with clean water or use an appropriate cleaner if necessary
- Mechanically check all of the seams, to ensure the integrity and completeness of the weld

Manual Hot-Air Welding

- Handheld welding machine
- Suitable for smaller, complicated roofs
- Used for detailing work



Securing the Perimeter

The entire perimeter must be secured by the use of a **Sarnabar®** fastening profile and a welding cord to absorb the horizontal forces (or spot-fastening as an alternative):

- Around the entire roof edge
- At all upstands
- At all terminations
- Around all roof penetrations

If it's not possible to drive fasteners along the perimeter edge into the roof deck, the perimeter must be fastened into the base of the upstands using a **Sarnabar®** and a welding cord in accordance with local standards or the fixing suppliers specifications.

Automatic Hot-Air Welding

- Technically advanced automatic hot-air welding machine
- Efficient and safe welding
- Reliable, high quality seams
- Suitable for large roof areas

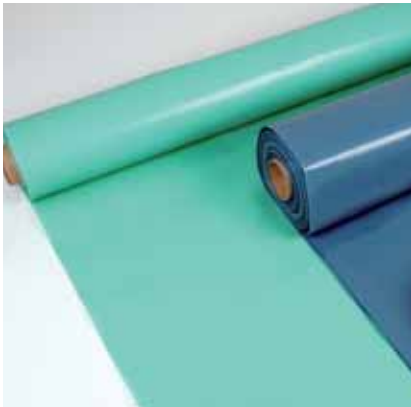


Maintenance and Inspection

Regular maintenance of the roof saves costs in the long run and helps keep the building in prime condition. Periodic inspections should also be conducted by qualified personnel for the owner; any damage repairs should only be carried out by Sika trained roofing professionals. These periodic inspections should include:

- Inspection of the roof from below and internally
- Physical inspection of the roof surface
- Checking of all connections and flashings
- Checking of all drainage systems, in addition to their normal cleaning and maintenance
- Checking the integrity of the lightning protection system

Ancillary Materials and Accessories



Vapour Control Layers

Vapour control layers are integral components of Sika Roofing systems, allowing airtight, vapour-controlled seals at joints and terminations. The **Sarnavap**® vapour control layers are based on polyethylene or polymer bitumen, with aluminium facings and are available in a range of sizes and types.

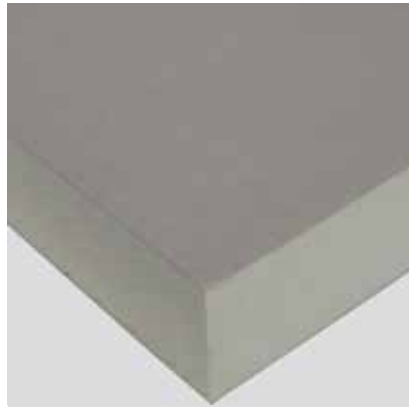
- Range of diffusion resistance ($\mu = 3'000'000$ to $600'000$)

Alternative vapour control and separating layers:

- **Sarnavap**® **3000M** has a foam backing for installations over rough substrates
- **Sarnavap**® **5000E SA** is a self-adhesive vapour barrier made from polymer bitumen with an aluminium foil facing

These vapour control layers come in rolls and all have the following properties:

- Remain flexible at low temperatures
- Resistant to chemicals
- Long life-span
- Non-decaying
- Constant vapour diffusion resistance



Thermal Insulation

Sika roofing systems also incorporate the most efficient types of thermal insulation available on the market and include materials suitable for all types of mechanically fastened roofing applications including:

PIR/PUR

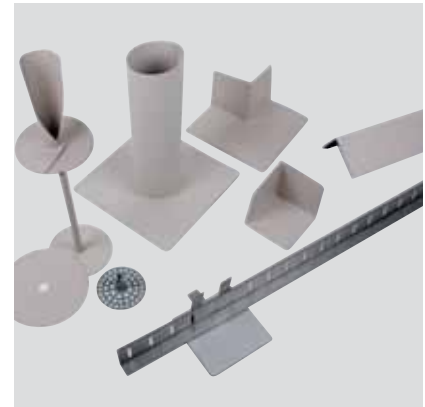
Thermal insulation boards produced from rigid PU foam with an isocyanurate catalyst. This is a universal and efficient solution and is the most suitable insulation type for mechanically fastened systems used in the following Sika systems:

- **SarnaTherm**® **PIR**
- **Sikatherm**®
- **Sarnapur**®

EPS

Thermal insulation boards produced from rigid PU foam with an isocyanurate catalyst. This is a universal and efficient solution and is the most suitable insulation type for mechanically fastened systems used in the following Sika systems:

- **SarnaTherm**® **EPS**
- **S-Therm EPS**



Prefabricated Pieces

Sikaplan® and **Sarnafil**® prefabricated connection pieces are produced from polyvinylchloride (PVC) or polyolefin (FPO) and are designed exclusively as integral components of the Sika Roofing system:

- Easy and rapid installation
- Neat and reliable details
- Good resistance to weathering, UV-radiation and stress cracking
- Guaranteed system compatibility
- Secure welding to Sika roofing membranes



Combined Roofing Systems – Mechanically Fastened Roof and Liquid Applied Membrane



Project Case Study:

Project TD Garden, Boston USA

This multi-purpose arena is home to two of the main professional sports teams in Boston – basketball’s Boston Celtics and ice hockey’s current champions, the Boston Bruins. This award winning facility hosts more than 200 major entertainment events throughout the year and the roof upgrading and refurbishment was completed with a Sika solution that combined a mechanically fastened, polymeric roofing membrane, in combination with a liquid applied membrane (LAM) system – A tailor-made and fully compatible solution using two proven Sika systems.



Sika solutions

Sika-PVC mechanically fixed roofing system:

Sarnafil® S 327-18EL mechanically fastened membrane in traffic white for the main barrel roof and in lead grey for the lower sloped roof areas, fastened with the **RhinoBond®** induction welding system (see details page 18).



Sika-liquid applied (LAM) roofing system:

The wide gutters and lower edge sections of the barrel roof (up to the snow guards) completed with liquid applied – **Sikalastic® 621** LAM membrane system.

Project participants:

Owner: Delaware North Company, Buffalo, NY

Architect: Stephen J. Wessling Architects

Main contractor: Shawmut Design & Construction

Specialist roofing contractor: Greenwood Industries

Standards and Approvals



What is FM Global?

FM Global is an American based insurance company with business and offices worldwide, which specializes in loss prevention services and primarily to larger corporations throughout the world, in the Highly Protected Risk (HPR) property insurance market. Since 1999 “FM Global” has been the business and trading name of the “Factory Mutual Insurance Company”.

Their business model determines insurance risk and premiums by engineering analysis as opposed to historically based actuarial calculations. This business approach is centred on the belief that property losses can be prevented or mitigated. FM Global engineering personnel regularly visit insured locations to evaluate hazards and recommend improvements to property or work practices, in order to reduce personnel and financial risks if a loss occurs.

As part of this strategy FM Global’s engineering team has developed testing procedures to define performance levels and minimum requirements that products and systems must meet. This includes materials for roofing systems, where performance in fire, hail and wind uplift are tested and measured. All testing is performed at FM Approvals Laboratories in the USA.

Practical Experience

The FM approval defines the complete roofing package which includes:

- Steel deck
- Vapour control layer – if required
- Insulation including fixings
- Separation layer – if required
- Membrane including the fastening system

All approved build-ups and combinations are listed and these can be accessed via FM Approvals complimentary online support tool – www.RoofNav.com at:

<https://roofnav.fmglobal.com/RoofNav/Login.aspx>

The use of any different types of insulation or fastenings is not possible – without additional FM Approvals testing and approval.

How to Acquire a Project Based on FM Global Requirements?

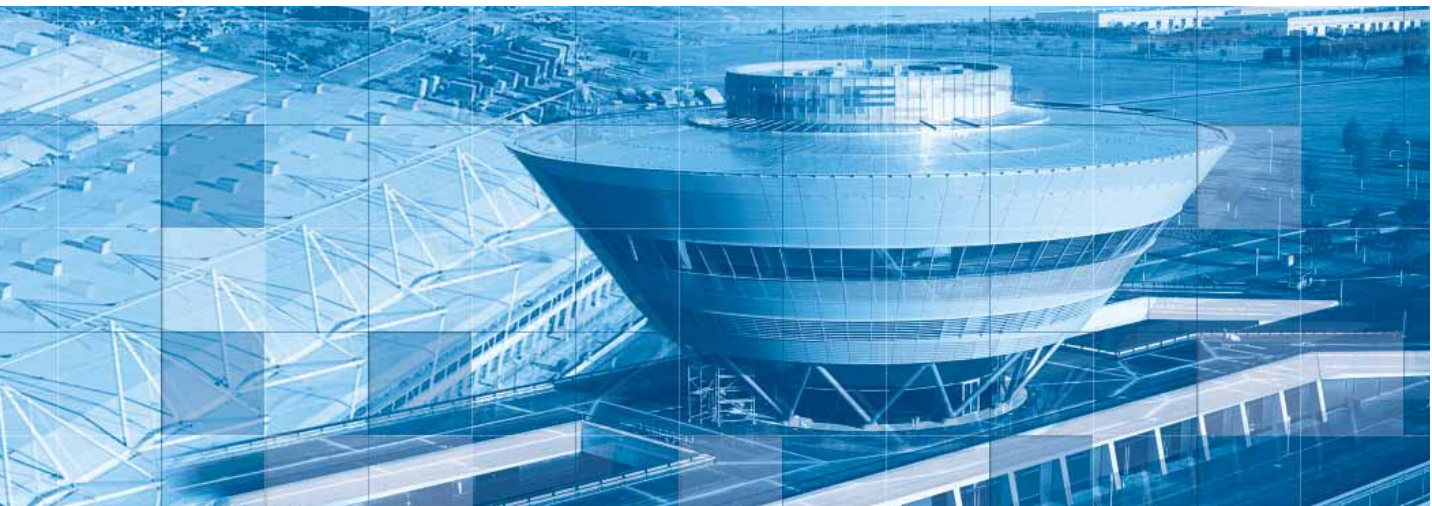
- The building owner is insured by FM Global and uses the FM Global Engineering Services. Sika agrees to support this project based on the feedback of the FM Engineer:
 - Roof Slope: The FM Engineer will specify based on FM Global Data Sheets
 - Wind pressure and Classification: The FM Engineer will specify based on FM Global Data Sheets (for Europe the minimum classification is FM 1-60)
 - Internal Fire: The FM Engineers recommend a Class 1 roof, as this gives the highest flexibility. If Class 1 is provided and no other combustible materials are involved, then sprinklers may not be needed.
 - External Fire: The FM Engineer will specify based on FM Global Data Sheets
 - Hail: The FM Engineer will specify based on FM Global Data Sheets.
- The Building Owner’s decide that they want to follow the Highly Protected Risk Guidelines from FM Global and therefore to follow FM Global Data Sheets requirements:
 - Sika then supports this project and helps to engineer the roof system and build-up according to these FM Global Data Sheets.

What can Sika Provide with FM Approval?

Sika holds a number of approvals for mechanically fastened roofing systems which meet the different FM requirements, including:

- **Sarnafil® TS 77-12E, 15E, 18E, 20E**
- **Sarnafil® S 327-12EL, 15EL, 18EL**
- **Sikaplan® 12G, 15G, 18G, 20G**
- **Sikaplan® 12VG, 15VG, 18VG, 20VG**





What is EOTA?

EOTA is the European Organisation for Technical Approvals that comprises the Approval Bodies nominated to issue European Technical Approvals (ETA's) by EU Member States and EFTA States who have contracted into the European Economic Area Agreement. A construction product with an ETA, which means that it satisfies the relevant Attestation of Conformity provisions, can carry CE marking (Certified European product) and can therefore be placed on the market in any EEA country.

The role of EOTA is primarily to monitor and progress the drafting of ETA Guidelines (ETAG's) and to co-ordinate all activities relating to the issuing of ETA's.

What is an ETA?

A European Technical Approval (ETA) is used when there is no relevant Harmonised European Standards for construction products, following a favourable technical assessment by an Approved testing Institute of its fitness for an intended use.

In conjunction with an Attestation of Conformity procedure (which is intended to ensure that the product specification set out in an ETA is maintained by the manufacturer), ETA's allow manufacturers to place CE marking on their products. When a European Technical Approval has been issued it is valid in all EEA countries, for a period of five years, and is renewable thereafter.

What can Sika Provide from EOTA?

Sika holds ETA 006 for our mechanically fastened roofing systems and specifically includes the following products and systems:

a) From Sika's FPO product family:

Sarnafil® systems

Sarnafil® TS 77-12 up to **Sarnafil® TS 77-25**

Sarnafil® TS 77-12E up to **Sarnafil® TS 77-20E**

b) From Sika's PVC product family:

Sarnafil® systems

Sarnafil® S 327-12 up to **Sarnafil® S 327-24**

Sarnafil® S 327-12EL up to **Sarnafil® S 327-20EL**

Sikaplan® systems

Sikaplan® 12G up to **Sikaplan® 20G**

Sikaplan® 12VG up to **Sikaplan® 18VG**

Sikaplan® 12VGWT up to **Sikaplan® 15VGWT**



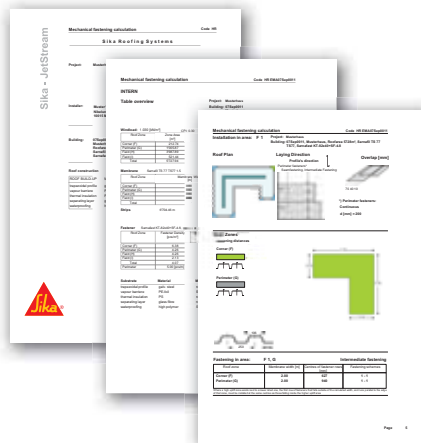
Sika Services and Support in Roofing



Sika is a proven and reliable partner to the whole of the building and construction industry. Worldwide we provide our customers with far more than just the best 'state of the art' and technically proven roof waterproofing systems. We also strive to assist and add value for our customers, by providing much more support and services for our products and their installation.

Jet Stream Wind Load Calculations

The Sika "Jet Stream" software was developed to support the design of optimized mechanically fastened roofing systems for Building Owners, their Designers and Contractors. This 'state of the art' software includes the latest European Code and FM Approvals requirements, which cover most National standards and regulations. It is an extremely efficient and practical tool for producing the most efficient design and fixing solutions, including a detailed roof membrane layout and Method Statements, plus all of the necessary information for Sika trained Specialist Contractors to provide estimates, tender and actually carry out the works on site. This tool can also contribute to significant savings in the roof build-up and your overall construction costs.



Features and Benefits:

- A complete system design, consisting of the roof build-up, waterproofing membranes and fasteners with wind load calculations in accordance with the relevant standards.
- The roof is optimized to your requirements.
- Applications are worldwide; a unique system that eases communication.
- Calculations available with all of our approved fastening systems and fixing suppliers.
- Membrane layout drawings give a clear advice on the most efficient method of installing the membranes and fasteners.
- Includes calculations of the quantities of membrane rolls, fastenings, fixings and cover strips, saving you time and money in planning and tendering.
- The output is available in almost any language.

Technical and Product Application Training



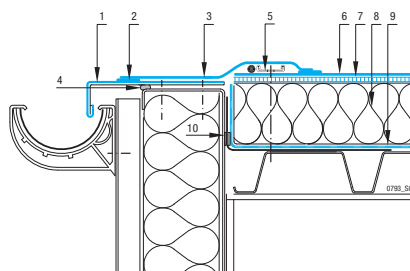
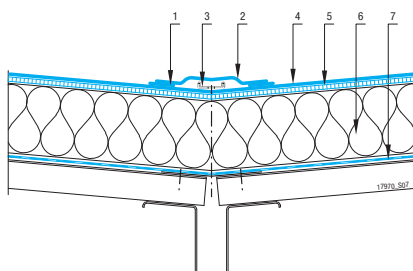
The many different applications for Sika roof waterproofing systems obviously can require different installation techniques and detailing solutions. The theoretical, technical and practical application training courses run by Sika's roofing engineers also help to ensure the security and durability of your installation.





Sika provides extensive support and services for each of our roofing product ranges. This is tailored for each system and covers all stages in the design, planning and execution of Sika roof waterproofing systems. This includes everything from defining the detailed requirements analysis for new structures or the roof condition survey and diagnostic assessment for roof refurbishment projects, through full specification and tender documentation, to expert technical and practical installation training, plus full support on site – Anywhere in the world.

Full Range of CAD Details and Technical Documentation



A complete range of CAD detail drawings and installation guidelines, Method Statements, Product Data Sheets and considerable additional technical documentations, approvals and certificates are available for all Sika roofing systems.

Sika Guarantees



Sika's roofing guarantees are provided to meet our customer's needs. These fully comprehensive guarantees for watertightness and compatibility with other building materials are issued individually for each project and in accordance with all relevant local regulations.

Roof Condition Survey and Assessment for Refurbishment



Sika roofing engineers can advise and assist with the necessary roof Condition Survey and Diagnostic Assessment required for roof refurbishment. This provides tailor-made roof re-waterproofing specifications which also include full detailing solutions and Method Statements.

Sika Roofing Systems – Worldwide Project Case Studies



Porsche, Leipzig, Germany

Main requirements:

- Long lasting roof waterproofing
- High aesthetic appearance

Sika solution:

- Mechanically fastened **Sarnafil® TS 77**



Industrial Building, France

Main requirements:

- Fast and efficient application
- Lightweight system

Sika solution:

- Mechanically fastened **Sikaplan® 15G**



Imax Cinema, Cologne, Germany

Main requirements:

- High aesthetic appearance
- Complex roof shape

Sika solution:

- Mechanically fastened **Sarnafil® S 327**



Miller Park, Milwaukee, USA

Main requirements:

- High aesthetic appearance
- Complex roof shape

Sika solution:

- Mechanically fastened **Sarnafil® S 327**



Utah Olympic Oval, Kearns, USA

Main requirements:

- Energy saving
- Customized logo inclusion

Sika solution:

- Mechanically fastened **Sarnafil® S 327**



Walmart Distribution Centre, UK

Main requirements:

- Fast and efficient application
- Cost effective solution

Sika solution:

- Mechanically fastened **Sikaplan® 15G**

Performance and Installation Related Requirements



UV-Resistance

Light, especially energy-rich ultraviolet light, has an ageing effect on roof membranes that can eventually result in surface cracking and degradation. Sika roofing membranes for exposed roofs are all more than sufficiently UV stabilized against this to perform for the long term, even in extreme climates and locations with high UV light exposure.



High Fire

Fire resistance requirements can be very individual and dependent on the type of construction and use of the building. If the roofing membrane is the top roof surface, then the membrane material must generally be classified as self-extinguishing. Sika roofing materials are all designed to comply with this and all relevant international and local building regulations in terms of fire.



Compatibility to Bitumen

As bitumen has been used as a traditional roofing material for many years, it is often still present on existing roofs to be refurbished or upgraded in terms of waterproofing, fire or insulation. For a fast and secure solution bitumen compatibility is a major requirement. Sika provides systems which are bitumen-resistant and can be used in almost any refurbishment situation.



Resistance to Cold

The weather around the world provides different climatic conditions in which roofing systems have to perform and resistance to minus temperatures is one of the main requirements here. All membranes from Sika stay flexible in cold within their stated performance limits. Some Sika roofing systems have the advantage that they can be installed at temperatures below zero.



Thermal Shock Resistance

Sika roof waterproofing membranes and all of the ancillary roofing products are specially designed to withstand sudden changes of temperature and weather conditions. They will not be damaged by extended or sudden thermal changes in cold, heat, snow, rain, etc.



Slip Resistance

The Sika roofing product range includes sheet membranes with embossed surfaces to provide slip resistance. Different degrees of slip resistance can be also achieved with Sika liquid applied membranes by broadcast-casting with selected grades of quartz sand.



Root Resistant

Membranes used under ballast must also withstand penetration from the roots of plants. Roof gardens and other green roofs obviously have a particular requirement for this, not only from the membrane, but also at their welded seams, connections and terminations. Sika single ply and liquid applied membranes for ballasted roof systems all resist root penetration and are treated to be resistant against micro-organisms, or they are inherent by fully resistant.



Resistance to Pedestrian and Light Wheeled Traffic

Increasingly, roofing systems are being used for areas exposed to pedestrian and vehicular traffic, i.e. on roof terraces or car parking areas. If the roofing membrane is the top surface for traffic, it must withstand this abrasion and wear without additional protection. It also has to be slip-resistant and may need different colours for line marking etc. Sika liquid applied membrane systems provide full service trafficability for pedestrians and / or vehicles as required.



Fast Installation

Installation time is always an important issue and cost factor for roofing systems. Sika has developed many special roofing systems and ancillary products which allow extremely rapid and cost effective installation.



Mechanical fastenings and fixings

If the membrane is installed as the top layer of the roof, wind uplift will occur through wind suction and pressure. The membrane must therefore be restrained against wind uplift and the most cost effective method of doing this is by mechanical fastening into the support structure. Sika systems are designed to withstand wind loads using the most efficient fixings.



No Penetrations into the Deck

A mechanical fastening system may not be possible due to unacceptable drilling noise for the fixings, contamination through the deck, or due to the structural design itself. All of these difficulties and their potential costs can be overcome by using Sika adhered, ballasted or liquid applied membrane systems.



Loose Laid Build-up

Loose laying of the flexible membrane and its ancillary materials is the main method established to build-up a roof deck and waterproofing system. It allows free air flow to ventilate the thermal insulation and it also helps to compensate for the structure's movement. The membrane must then be mechanically fastened or ballasted for restraint against wind uplift.



Partially Adhered to the Substrate

If the membrane is to be used in an exposed situation, but mechanical fixing is not desirable for technical or other reasons, all layers of the system build-up must be bonded to the substrate below. In Sika partially adhered systems the liquid adhesive is applied on the substrate in beads or strips. This provides fast cost effective installation with low adhesive consumption.



Fully Adhered to the Substrate

Superior aesthetic appearance, regardless of the roof shape, or with no penetration of the roof deck, is often a requirement for both new and refurbishment projects. With Sika fully adhered systems the membrane is fully bonded to the substrate, therefore it can meet these high aesthetic and performance requirements reliably and with low maintenance costs.



Highest Aesthetic Appearance

Sometimes roofing materials not only have an important waterproofing function, but they must also meet high design and architectural requirements. Sika has developed several advanced systems suitable for installation over complex roof shapes with good looking top surfaces, i.e. including smooth surfaces, standing seam metal roof imitation and other special profiles, etc.



Wide Colour Range

Sika membranes are supplied in several standard colours, some in an extensive range. Special colours can also be made to order or colour matched to a client's requirements.



Seamless Waterproofing

The Sika liquid applied membranes provide seamless waterproofing over the entire roof surface. In addition to technical advantages, it can also create an excellent visual appearance.



Crack Bridging Ability

The Sika liquid applied membranes in particular can provide outstanding crack-bridging properties, with high flexibility and elasticity – even at low temperatures



1-C Single Component Products

1-C Sika liquid applied membranes are probably the easiest to install. They are applied 'direct from the can' and do not require mixing with other components.



Good Vapour Permeability

Sika has developed membranes which are waterproof, but with excellent vapour diffusion properties. This allows any moisture in the structure below to evaporate.



Easy Application by Brush or Roller

Sika liquid applied membranes can be applied by brush and roller. This application is easy and does not require investment in expensive application equipment.

Sika Full Range Solutions for Construction

Concrete Production



Sika® ViscoCrete®
Sika® Retarder®
Sika® SikaAer®

Waterproofing



Sikaplan®, **Sikalastic®**
Sika® & Tricosal® Waterstops
Sika® Injection Systems

Flooring



Sikafloor®
SikaBond®

Corrosion and Fire Protection



SikaCor®
Sika® Unitherm®

Concrete Repair and Protection



Sika® MonoTop®
Sikagard®
Sikadur®

Structural Strengthening



Sika® CarboDur®
SikaWrap®
Sikadur®

Joint Sealing



Sikaflex®
Sikasil®

Grouting



Sikadur®
SikaGrout®

Roofing



Sarnafil®
Sikaplan®
SikaRoo® MTC®

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 prior to any use and processing.

