fatrafol®

FATRAFOL-S

CONSTRUCTION AND TECHNOLOGICAL INSTRUCTIONS

Roof waterproofing system

FATRAFOL-S

CONSTRUCTION AND TECHNOLOGICAL INSTRUCTIONS

for installation of waterproofing membranes
on roof decks

PN 5415/2011 **FATRAFOL-S**

Title:	Construction and technological Instructions for installation of FATRAFOL waterproofing membranes on roof decks
Prepared by:	Studio of insulations
Issued by:	FATRA, a.s., Tomase Bati 1541, 763 61 Napajedla, Czech Republic
Version:	09/2021 (R2)
Effective date:	01-09-2021

CONTENT:

INTRODUCTION

This Instructions must be followed when designing and installing FATRAFOL roof waterproofing membranes in new buildings and reconstructed roofs, and when refurbishing existing roof decks. The membranes manufactured by FATRA, a.s. Napajedla are based on plasticized polyvinyl chloride (PVC-P).

The Instructions summarises theoretical and practical knowledge and expertise acquired through research, testing, design and installation of roof waterproofing membranes since 1982. The Instructions constitutes an integral part of the FATRAFOL-S roof waterproofing system. Any modifications to or deviations from the criteria, requirements and rules contained herein, whether on economic, performance or operational grounds, are only allowed with FATRA's prior review and approval.

The information contained in this document is based on Czech and European codes and standards, for the application of membrane in other regions or areas of the world, it is necessary to adapt the installation procedures of FATRAFOL membrane to National and local building codes and standards

This issue of the construction and technological Instructions supersedes its previous version.

For any enquiries, please contact:

FATRA, a.s.
Třída Tomáše Bati 1451
763 61 Napajedla
Czech Republic

Tel.: +420 577 501 111
Email: fatrafol@fatra.cz
Internet: http//www.fatra.cz
http//www.fatrafol.cz

1 APPLICATION AND FEATURES OF FATRAFOL-S ROOF WATERPROOFING SYSTEM

1.1 Scope of application

The FATRAFOL-S waterproofing system is designed to create membrane roof coverings for all types of residential, public, administrative, industrial, agricultural, sports and similar buildings with a flat or pitched roof. The system is suitable for all roof designs, i.e. single-, two- and multi-ply roofs, ventilated and non-ventilated roofs, roofs with the standard arrangement of a thermal insulation layer, inverted or combined roofs, flat, pitched and steep roofs, roofs open or closed to pedestrian traffic, vehicular traffic roofs, roofs with aggregate or soil, green roofs and roof gardens, photovoltaic roofs etc.

Subject to compliance with the instructions below, FATRAFOL-S roofing membranes may be laid on all conventional substrates (concrete, concrete prefabricated components, lightweight concrete, wood, polystyrene foam, polyurethane, polyisocyanurate, mineral fibre boards, asphalt covering etc), both in new buildings and in renovated, reconstructed and refurbished old buildings.

Highly versatile, the FATRAFOL-S system suits a wide range of applications.

1.2 Roof classification by waterproofing membrane location and fastening method

Depending on the waterproofing membrane location and attachment to the roof deck, the FATRAFOL-S roof waterproofing system is divided into three distinctive subsystems:

- Mechanically fastened waterproofing membranes
  - FATRAFOL membrane is fastened mechanically to the substrate
  - Typical for lightweight roof structures
- Adhered waterproofing membranes
  - FATRAFOL membrane is adhered to a suitable substrate
  - Usable for almost all structures, pitches and shapes
- Ballasted roof covering
  - Loaded by a stabilization, traffic or vegetation layer
  - Only for roofs with static capacity able to support extra load
  - FATRAFOL membrane is protected from direct weather conditions and secured against wind loads
  - Ballast usually provides protection against external fire
  - The system requires only minimum maintenance

1.3 Typical end-use properties of FATRAFOL-S roof covering system

- The roof covering typically includes a single membrane layer with a waterproofing layer thickness of 1.5 – 2 mm.
- The roof covering weight on the roof structure does not exceed 3.2 kg.m^{-2}.
- All joints within the roof covering are made of high-strength and watertight welds and may be additionally secured.
- The roof covering offers long-term resistance to weather-caused corrosion including UV radiation.
- The roof covering is highly resistant to aggressive chemicals in the air, industrial pollution, extracts from construction materials and a number of other substances.

- The roof covering features great strength, elongation at break and elasticity and maintains its end-use properties at temperatures between -30 °C and +80 °C.
- The roof covering meets building fire safety requirements as prescribed by Czech and European standards.
- A good degree of waterproofing membrane permeability for water vapours allows continuous moisture diffusion from the roof deck into the atmosphere.
- The roof covering surface provides good reflection and minimum absorption of solar heat radiation.
- Based on existing long-term practical experience and laboratory tests, the roof covering offers at least 25 years of service life.
- The roof covering is fully compatible with all accessories and auxiliary items within the FATRAFOL-S system.
- Installation of roofing membrane can be carried out throughout the year, except rain, snow and temperatures below -5°C. The roof covering may also be installed on a damp substrate.
- The roof covering is maintenance free throughout its service life except for regular recommended inspections of selected structures.
- If damaged, the roof covering is easy to repair.
- Easy renovation or removal of roof covering if required

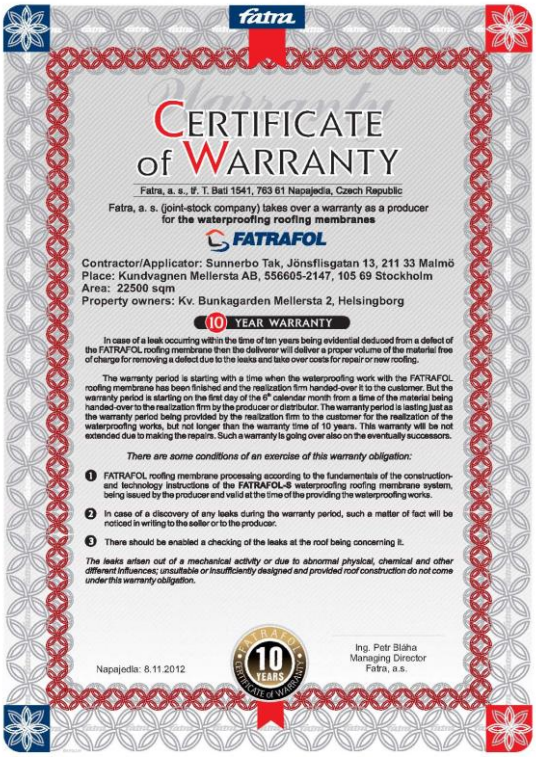
1.4 WARRANTIES

In addition to statutory warranties Fatra, a.s. provides extended warranty on waterproofing membrane in system FATRAFOL-S. Condition for warranties on material are described on website www.fatrafol.cz.

Basic warranty on function of roof covering made of waterproofing membranes FATRAFOL is 10 years starting from day of application, but no more than 11 years since day of first sale of the membrane.

Warranties on damaged material or material with uncertain technical condition must be claimed before its installation. Origin of material must be proven by its label.

Warranty cannot be claimed on material colour stability, damaged surface gloss, pollution of membrane surface or pollution of membrane caused by external environment and on membrane changes caused by inappropriate use or maintenance.



CERTIFICATE of WARRANTY

Fatra, a. s., tř. T. Bati 1541, 763 61 Napajedla, Czech Republic

Fatra, a. s. (joint-stock company) takes over a warranty as a producer for the waterproofing roofing membranes

FATRAFOL

Contractor/Applicator: Sunnerbo Tak, Jönsflisgatan 13, 211 33 Malmö
Place: Kundvagnen Mellersta AB, 556605-2147, 105 69 Stockholm
Area: 22500 sqm
Property owners: Kv. Bunkagarden Mellersta 2, Helsingborg

10 YEAR WARRANTY

In case of a leak occurring within the time of ten years being evidential deduced from a defect of the FATRAFOL roofing membrane then the deliverer will deliver a proper volume of the material free of charge for removing a defect due to the leaks and take over costs for repair or new roofing.

The warranty period is starting with a time when the waterproofing work with the FATRAFOL roofing membrane has been finished and the realization firm handed-over it to the customer. But the warranty period is starting on the first day of the 6th calendar month from a time of the material being handed-over to the realization firm by the producer or distributor. The warranty period is lasting just as the warranty period being provided by the realization firm to the customer for the realization of the waterproofing works, but not longer than the warranty time of 10 years. This warranty will be not extended due to making the repairs. Such a warranty is going over also on the eventually successors.

There are some conditions of an exercise of this warranty obligation:

1. FATRAFOL roofing membrane processing according to the fundamentals of the construction- and technology instructions of the FATRAFOL-S waterproofing roofing membrane system, being issued by the producer and valid at the time of the providing the waterproofing works.
2. In case of a discovery of any leaks during the warranty period, such a matter of fact will be noticed in writing to the seller or to the producer.
3. There should be enabled a checking of the leaks at the roof being concerning it.

The leaks arisen out of a mechanical activity or due to abnormal physical, chemical and other different influences; unsuitable or insufficiently designed and provided roof construction do not come under this warranty obligation.

Napajedla: 8.11.2012

10 YEARS

Ing. Petr Bláha
Managing Director
Fatra, a.s.

2 FATRAFOL-S WATERPROOFING SYSTEM MATERIALS

The materials comprising the FATRAFOL-S system are divided as follows:

- FATRAFOL waterproofing membranes
- Supplementary waterproofing materials
- Auxiliary materials

The materials mentioned below are made by Fatra, a.s. and by other suppliers. When installing the FATRAFOL-S system, specified waterproofing materials must be considered non-interchangeable. Author does not take any responsibility for design and installation of waterproofing construction if it isn't in comply with these Instructions.

2.1 FATRAFOL waterproofing membranes

FATRAFOL waterproofing membranes are the key material of the main waterproofing layer.

2.1.1 Membrane manufacture and basic product classification

FATRAFOL membranes are manufactured only from raw materials of exactly defined properties. The composition and design of individual membrane types are such to give the membranes optimal technical parameters for their intended use.

Table 1 shows a detailed classification of the membranes according to the type of reinforcement and roof system

Table 1: FATRAFOL range classification

Type of reinforcement	**Membrane name**	**Roofing system**
High-strength PES grid	FATRAFOL 810/V FATRAFOL 810	Mechanically fastened membrane
Glass mat	FATRAFOL 818	Ballasted membrane
Glass mat	FATRAFOL 814	Traffic membrane
Separation non – woven textile	FATRAFOL 807 FATRAFOL 807/V	Adhered membrane
Glass mat + Separation non – woven textile	FATRAFOL 807/G	Adhered membrane
Auxiliary membrane		
Non reinforced	FATRAFOL 804	Auxiliary membrane for all systems

2.1.2 Temperature resistance and welding temperatures

FATRAFOL roofing membranes offer long-term resistance to most types of corrosive loads including thermal loads. Their key performance properties remain basically stable at temperatures between -30 °C and +80 °C and the membranes can be installed at temperatures between -5 °C and +40 °C. The membranes also withstand very sudden and recurring temperature changes without damage, even offer short-term resistance to extreme overheating.

Recommended hot air welding temperatures are 430 °C up to 600 °C. The welding temperature depends on numerous factors such as membrane thickness and type, welding machine type, welding speed, substrate and ambient air temperature and humidity, wind speed etc. An on-site test must be performed to set the correct welding temperature. The manufacturer recommends making test welds with various welding machine settings before the start of work and adjusting the parameters to tensile test results.

2.1.3 Chemical resistance

With their excellent chemical resistance, FATRAFOL membranes may be used in environments with high chemical exposure. For a basic overview of chemical resistance at a standard temperature of 23 °C, see Table 2. As chemical resistance depends largely on concentration and temperature of the substance and on exposure time, every case must be treated individually and a separate assessment must be made, in particular, of any substances not listed below and their combinations with respect to their estimated impact on the membrane.

Table 2: Chemical resistance of FATRAFOL membranes

Inorganic acids	
Sulphuric acid 25%	+
Sulphuric acid 98%	Δ
Sulphurous acid 6%	+
Nitric acid 5%	+
Hydrochloric acid 10%	+
Concentrated hydrochloric acid	Δ
Organic acids	
Benzoic acid	+
Butyric acid	Δ
Acetic acid 10%	+
Citric acid	+
Tartaric acid	+
Oxalic acid	+
Oleic acid	Δ
Inorganic bases	
Sodium hydroxide	+
Potassium hydroxide	+
Ammonium hydroxide	+
Calcium hydroxide	+

Salt solutions	
Sulphates	+
Chlorides	+
Nitrates	+
Organic substances	
Acetone	–
Ethyl alcohol 10%	+
Ethylene glycol	Δ
Petrol	–
Diesel	–
Plant and animal oils	Δ
Motor and mineral oils	Δ
Tar	–
Toluene	–
Other	
Asphalt	–
Beer	+
Soap solutions	+
Sea water	+
Washing agents	+
Herbicides	+
Fertilisers	+

Chemical resistance rating: + *long-term resistance* Δ *limited resistance* - *not resistant*

2.1.4 Strength characteristics

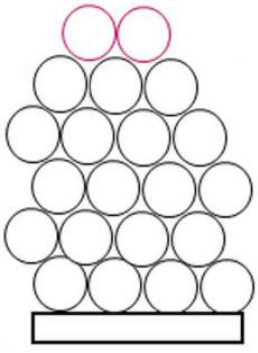
FATRAFOL's mechanical properties include great tensile and compression strength and high elongation at break. Deformations of membranes are largely reversible (elastic). FATRAFOL membranes also provide very good resistance to point stress (punctures, tears etc) and do not develop the so-called 'cold flow' when exposed to stress.

Some membrane types are reinforced with a high-strength PES mesh for added strength.

2.1.5 Packaging, transport and storage

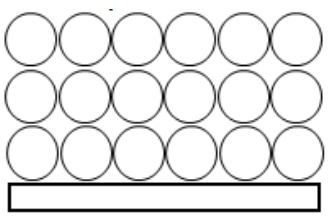
Membranes are wound into rolls and wrapped; the rolls are placed on wooden pallets and secured in place with wrap film. See Figure 1 for basic packaging arrangements. Typically, a pallet holds 19 rolls of 1200 mm, 1300 mm, and 1500 mm wide membranes and 21 rolls of 1025 mm, 1650 mm, 2000 mm a 2050 mm wide membranes. Non-standard pallets hold 18 rolls of 2000 (2050) mm wide membranes, with the rolls having reduced length and weight and being block-stacked in 3 layers.

19 and 21 rolls on pallet



Pallet 800x1,200 mm
Pallet 800x2000 mm

18 rolls on pallet



Pallet 1,200x2,000 mm
(shorter membrane length)

Figure 1: Handling and transport units – roll arrangement on pallet

Membranes must be transported in covered vehicles and stored in original closed packaging. Membranes must be stored at temperatures between -5 °C and +30 °C.

Membranes must be protected from dirt at the construction site. If possible, membranes should be protected from the weather until installed.

2.1.6 Membrane labelling and identification

Identification details are ink-printed on the top surface of FATRAFOL membranes, usually 120 mm from their edge, indicating membrane dimensions (width, thickness) in mm, date of manufacture and identification data. In addition, a "+" symbol is ink-printed at 150 mm intervals along the entire membrane length to allow easy adjustment of overlaps.

Each roll carries a label with a CE conformity mark. A DMC code containing specific number is used for material identification in the manufacturing plant.

CE 06	**Fatra, a. s., třída Tomáše Bati 1541, 763 61 Napajedla, Czech Republic**	fatra fatrafol®
	1390-CPR-2019-0006/Z — DoP: 5104418002	
	EN 13956:2012	
Název výrobku – Trade name	**FATRAFOL 810/V**	
Tloušťka / Šířka - Thickness / Width	1,50 mm	2 000 mm
Délka role / Množství - Length / Quantity	20 m	40 m²
Barva – Colour	RAL 7035	ID: 112-T3-E

Použití: Mechanicky kotvená střešní hydroizolační vrstva Reakce na oheň: třída E Nejvyšší tahová síla P/N: ≥ 1000/1000 N/50 mm Protažení při nejvyšší tahové síle P/N: ≥ 15/20 % Odolnost proti statickému zatížení: vyhovuje 20 kg Vodotěsnost 400 kPa: vyhovuje Odolnost proti nárazu, metoda A: vyhovuje 1250 mm, metoda B: vyhovuje 2000 mm Odolnost proti protrhávání P/N: ≥ 200/220 N Odolnost proti odlupování ve spoji P/N: ≥ 260/260 N/50 mm Odolnost spoje ve smyku P/N: ≥ 1000/1000 N/50 mm Ohebnost za nízkých teplot: ≤ -25 °C Vystavení UV záření, zvýšené teplotě a vodě: vyhovuje, stupeň 0	Exposed application: Mechanically fastened roofing Reaction to fire: Class E Maximum tensile force MD/CD: ≥ 1000/1000 N/50 mm Elongation at maximum tensile force MD/CD: ≥ 15/20 % Resistance to static loading: pass 20 kg Watertightness 400 kPa: pass Resistance to impact, method A: pass 1250 mm, method B: pass 2000 mm Tear resistance MD/CD: ≥ 200/220 N Joint peel resistance MD/CD: ≥ 260/260 N/50 mm Joint shear resistance MD/CD: ≥ 1000/1000 N/50 mm Foldability at low temperature: ≤ -25 °C Exposure to UV radiation, elevated temperature and water: pass, grade 0

K66254 FM APPROVED	CE 12 Fatra, a. s., třída Tomáše Bati 1541, 763 61 Napajedla, Czech Republic **1020-CPR-010037804** **ETA-12/0013** Systémy mechanicky kotvených pružných střešních hydroizolačních povlaků Systems of mechanically fastened flexible roof waterproofing membranes	**1610132391** Výrobní dávka / Batch production: G2101 Výrobní kód / Code production: RP-R

2.1.7 Safety regulations

Occupational health and safety

FATRAFOL membranes are meant only for professional use

According to article 3.3 of Regulation (EC) No. 1907/2006 (hereafter referred to as REACH) waterproofing membrane FATRAFOL is an object and therefore there is no obligation to provide **a Safety Data Sheet for this product in the sense of article 31** of REACH. According to the Regulation (EC) No.1272/2008 (= CLP) product is not classified as dangerous.

When in prolonged contact with the skin it is recommended to wear protective gloves for FATRAFOL membranes treated with biocidal product as described in Safety Instructions within the meaning of Article 58.4 of Regulation (EU) No. 528/2012 (= BIOCIDE),

Some FATRAFOL membranes contain substance listed in Annex XIV of REACH. Mandatory information about the substance content in accordance with (under) Article 33, REACH and SCIP number are listed in invoice (bill of sale). Safety instructions are provided upon the customer request.

It is necessary to follow all current safety, hygienic and fire regulations when installing and joining

Waste disposal

FATRAFOL membrane waste can be technically recycled. Waste unsuitable for recycle can be stored in landfills. Waste contaminated by dangerous substances must be incinerated (disposed of) in hazardous waste incinerator.

FATRAFOL membrane waste meeting increased fire resistance request (indicated as T3) contain substance exceeding concentration limit 1% specified in table 6, Commission Regulation (EC) No 1357/2014.

Waste must be handled in compliance with the local valid legal regulations governing the disposal of waste as well as with other local environmental regulations.

Table 3: Categorization and FATRAFOL membrane waste recovery

Catalog number	Waste name according to catalog number	Waste characteristic, note	Waste disposal or recovery operations
07 02 13	Plastic waste	**PVC-P membrane**	- material recovery [a), c)] - waste disposal (hazardous waste incineration [b)], landfill [a)])
15 01 01	Paper and cardboard packaging	**paper tubes**	- material recovery
15 01 02	Plastic packaging	**PE foil covering and PE stretch foil**	- material recovery

a) Waste
b) Waste contaminated by dangerous substances
c) FATRAFOL membrane waste meeting increased fire resistance request (indicated as T3) contain substance exceeding concentration limit 1% specified in table 6, Commission Regulation (EC) No 1357/2014

2.1.8 Legislative requirements

The quality management system for FATRAFOL development and manufacture is certified according to EN ISO 9001:2016

The development and manufacture of waterproofing membranes are certified according to EN ISO 14001:2005 to demonstrate a commitment to the environment and adherence to environmental management standards.

In accordance with European parliament and Council (EU) 305/2011 (CPR), all roofing membranes are certified, meet the requirements of the harmonised European standard EN 13956 and are issued with a CE declaration of conformity.

FATRAFOL 810/V membrane is as a part of FATRAFOL-S roof waterproofing system certified in accordance with European technical approval ETA-12/0013 by EAD 030351-00-0402 (superseded ETAG 006).

Bureau Veritas Certification

Certificate

Awarded to

Fatra, a.s.

třída Tomáše Bati 1541, 763 61 Napajedla, Czech Republic

This is a multi-site certificate, additional site details are listed in the appendix to this certificate.

BUREAU VERITAS CERTIFICATION CZ, s.r.o. certifies that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standard detailed below:

Standard

ČSN EN ISO 9001:2016

Scope of supply

DESIGN, PRODUCTION AND SALE OF PLASTIC FOILS, WATERPROOFING MEMBRANES, PLASTIC FLOOR COVERINGS, PRINTED SHEETS, WELDED PRODUCTS, INJECTION MOLDING AND PLASTIC THERMOFORMED PRODUCTS. DESIGN, PRODUCTION AND SALE OF BREATHABLE FILMS AND LAMINATES. DESING, PRODUCTION AND SALE OF PVC GRANULATES AND EXTRUDED PLASTIC PROFILES. DESIGN, PRODUCTION AND SALE OF BIAXIALLY-ORIENTED POLYETHYLENE TEREPHTHALATE FILMS AND MULTI-LAYER FILMS. DESIGN, PRODUCTION AND SALE OF PLASTIC REGRANULATES.

Original Approval Date:	23-12-1994
Certification / Recertification Cycle Start Date:	01-06-2021
Certification / Recertification Cycle End Date:	31-05-2024
Subject to the continued satisfactory operation of the organisation's Management System, this certificate is valid until:	31-05-2024

To check this certificate validity please call: +420 210 088 215

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organisation.

Version 2 Issue Date: 01-09-2021

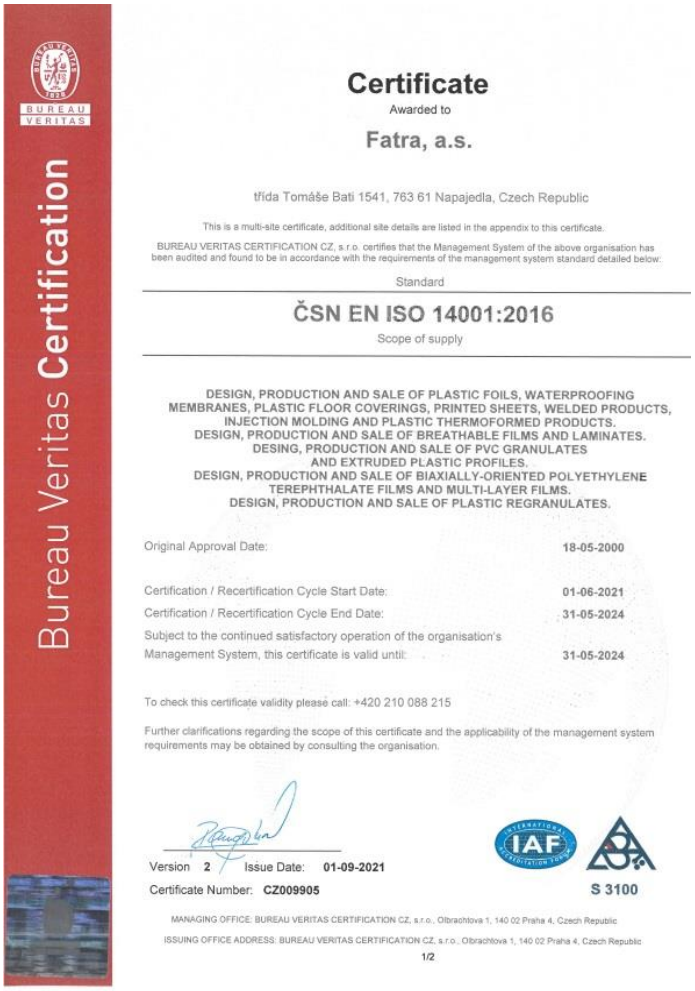
Certificate Number: CZ009904

S 3100

MANAGING OFFICE: BUREAU VERITAS CERTIFICATION CZ, s.r.o., Olbrachtova 1, 140 02 Praha 4, Czech Republic

ISSUING OFFICE ADDRESS: BUREAU VERITAS CERTIFICATION CZ, s.r.o., Olbrachtova 1, 140 02 Praha 4, Czech Republic

1/2



Bureau Veritas Certification

Certificate

Awarded to

Fatra, a.s.

třída Tomáše Bati 1541, 763 61 Napajedla, Czech Republic

This is a multi-site certificate, additional site details are listed in the appendix to this certificate.

BUREAU VERITAS CERTIFICATION CZ, s.r.o. certifies that the Management System of the above organisation has been audited and found to be in accordance with the requirements of the management system standard detailed below:

Standard

ČSN EN ISO 14001:2016

Scope of supply

DESIGN, PRODUCTION AND SALE OF PLASTIC FOILS, WATERPROOFING MEMBRANES, PLASTIC FLOOR COVERINGS, PRINTED SHEETS, WELDED PRODUCTS, INJECTION MOLDING AND PLASTIC THERMOFORMED PRODUCTS. DESIGN, PRODUCTION AND SALE OF BREATHABLE FILMS AND LAMINATES. DESING, PRODUCTION AND SALE OF PVC GRANULATES AND EXTRUDED PLASTIC PROFILES. DESIGN, PRODUCTION AND SALE OF BIAXIALLY-ORIENTED POLYETHYLENE TEREPHTHALATE FILMS AND MULTI-LAYER FILMS. DESIGN, PRODUCTION AND SALE OF PLASTIC REGRANULATES.

Original Approval Date:	18-05-2000
Certification / Recertification Cycle Start Date:	01-06-2021
Certification / Recertification Cycle End Date:	31-05-2024
Subject to the continued satisfactory operation of the organisation's Management System, this certificate is valid until:	31-05-2024

To check this certificate validity please call: +420 210 088 215

Further clarifications regarding the scope of this certificate and the applicability of the management system requirements may be obtained by consulting the organisation.

Version 2 Issue Date: 01-09-2021

Certificate Number: CZ009905

S 3100

MANAGING OFFICE: BUREAU VERITAS CERTIFICATION CZ, s.r.o., Olbrachtova 1, 140 02 Praha 4, Czech Republic

ISSUING OFFICE ADDRESS: BUREAU VERITAS CERTIFICATION CZ, s.r.o., Olbrachtova 1, 140 02 Praha 4, Czech Republic

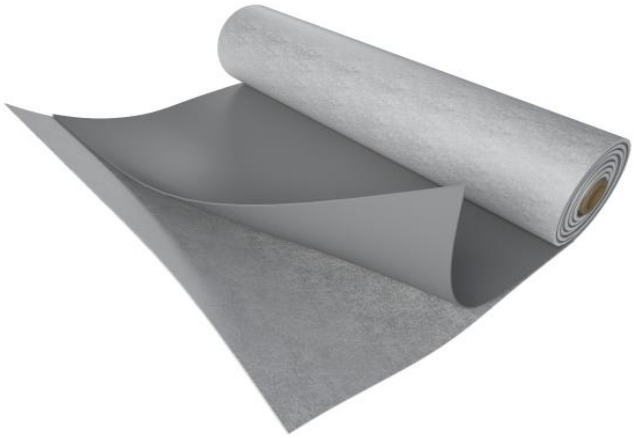
1/2

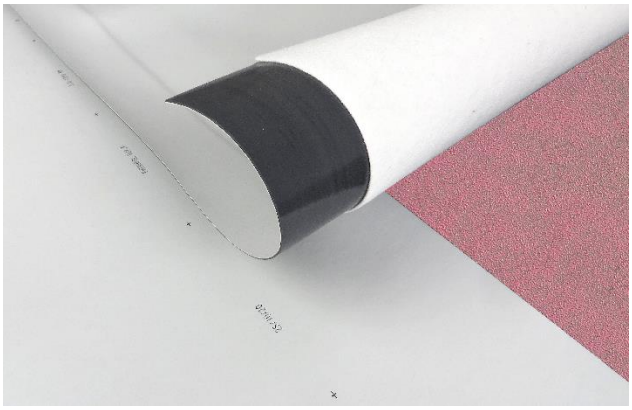
2.1.9 Description and technical specifications of waterproofing membrane types

2.1.9.1 FATRAFOL 807 waterproofing membrane

- **PRODUCT DESCRIPTION**

  FATRAFOL 807 is a PVC-P based roofing membrane with the base layer made of non-woven PES fleece. One of FATRAFOL 807 edges is left without non-woven fleece for easy membranes joining. The membrane is resistant to UV radiation and may be exposed directly to the weather.





- **USE**

  The product is intended for bonded systems, in particular:

  - Refurbishment of old asphalt coverings on flat roofs,
  - Additional roof deck thermal insulation that cannot be loaded or mechanically fastened,
  - A bonded waterproofing system for sheds, light buildings etc.

  Covered with non-woven fleece with a surface density of 300 g/m^2, the membrane underside is suitable for direct contact with bitumens. If installed on an asphalt covering, the membrane should be bonded with FATRAFIX FM adhesive.

- **APPLICATION**

  The membranes may be installed only by qualified and specially trained contractors.

  The membranes must be installed in accordance with this Instructions.

  The adhesives used for gluing the membranes must ensure sufficient adhesion to the substrate based on the calculated values of the forces acting on the roof cladding under wind load.

  Securing the roofing membrane against the effects of internal forces is described below

  The sheets are joined together in the overlap of the uncovered edge, using hand-operated or automatic hot-air welding machines.

  The sheets of membrane are connected to each other in the overlap of the free edge by manual or automatic hot air welding machines (see Detail 204S) . The cut edges of the membranes (e.g. transverse connection of adjacent strips) are folded approx. 50 mm over each other and overlapped with a strip of homogeneous membrane FATRAFOL 804 or FATRAFOL 810 (see Detail 205S). Membrane around the perimeter of the roof and around penetrating structures is secured by welding it on profiles made of plastic-coated sheet metal FATRANYL PVC, which are mechanically fastened to the load-bearing structure.

  The membrane must be installed at the temperatures recommended by the adhesive manufacturer; when joining the sheets together, the temperature of the ambient air and the substructure should not fall below -5 ° C.

PRODUCT DATA

Dimensions and packaging details of FATRAFOL 807 membrane

- Effective thickness - 1.50 mm
- Overall thickness - 2.60 mm
- Width - 1,300 mm; 2,050 mm
- Free edge width - 60 mm
- Length on roll - 15.4 m
- Amount on roll - 20.02 m^2; 31.57 m^2

Appearance and colours

- Smooth membrane with a matt surface
- Top surface - Standard colour – light grey RAL 7035
  - Also available in colours shown in the table
  - Marks are printed 120 mm from the membrane edge for easier overlap adjustment
- Underside - White non-woven fleece (textile)

Design	FATRAFOL 807 top surface color	Color tone by the RAL color chart *)
	Light grey	7035
	Dark grey	7012

*) *These are an approximate color shades, which may vary from one product batch to another*

RELATED TECHNICAL DOCUMENTATION

- Technical data sheet TL 5-1006-06, FATRAFOL 807 waterproofing membrane, issued by Fatra, a.s., Napajedla
- Certificate of conformity of the factory production control n. 1390-CPR-2019-021/Z issued by CSI, a. s., tested in Zlín, for membrane FATRAFOL 807

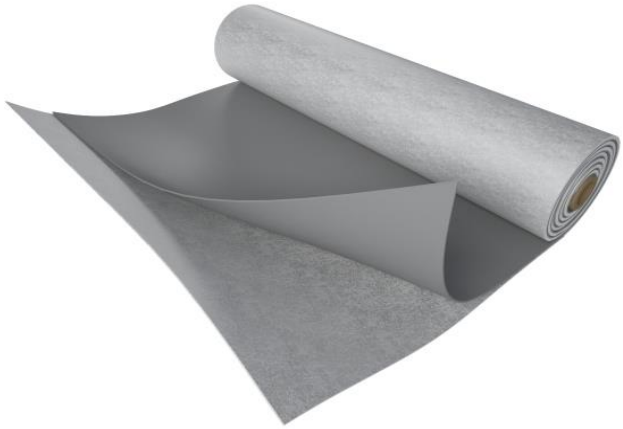
Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

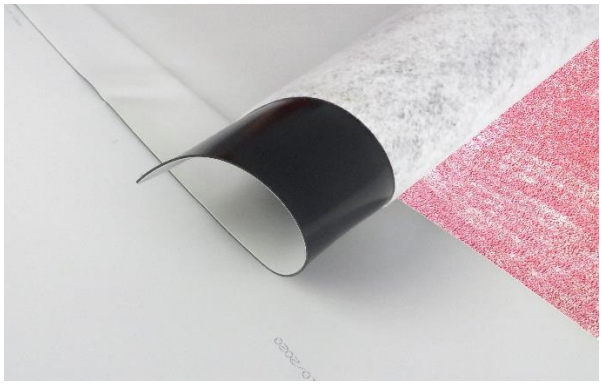
2.1.9.2 FATRAFOL 807/V waterproofing membrane

- **PRODUCT DESCRIPTION**

  FATRAFOL 807/V is a PVC-P based roofing membrane with the base layer made of non-woven PES fleece with a surface density of 180 g/m^2. The membrane is resistant to UV radiation and may be exposed directly to the weather.

  One edge of the membrane is without the non-woven fleece in order for the sheets to be joined longitudinally.





- **USE**

  The membrane is intended for fully bonded adhered systems, in particular those using FATRAFIX FM adhesive, for installation on:

  - A suitable thermal insulation layer (e.g. PIR, EPS)
  - A firm, load bearing and sufficiently flat substructure (cement board, wood particles board, vibrated concrete etc)

  In general, adhering to bitumen is not recommended, possible application always requires expert assessment of the specific bitumen substrate

- **APPLICATION**

  The membranes may be installed only by qualified and specially trained contractors.

  The membranes must be installed in accordance with this Instructions.

  Adhesives used for bonding the membrane must provide sufficient adhesion to the substrate.

  The sheets of membrane are connected to each other in the overlap of the free edge by manual or automatic hot air welding machines (see Detail 202S) . The cut edges of the membranes (eg transverse connection of adjacent strips) are folded approx. 50 mm over each other and overlapped with a strip of homogeneous membrane FATRAFOL 804 or FATRAFOL 810 (see Detail 205S). Membrane around the perimeter of the roof and around penetrating structures is secured by welding it on profiles made of plastic-coated sheet metal FATRANYL PVC, which are mechanically fastened to the load-bearing structure.

  The membrane must be installed at the temperatures recommended by the adhesive manufacturer; when joining the sheets together, the temperature of the ambient air and the substructure should not fall below -5 °C.

- **PRODUCT DATA**

  - **Dimensions and packaging details of FATRAFOL 807/V membrane**
    - Effective thickness - 1.50 mm
    - Overall thickness - 2.10 mm
    - Width - 1,650 mm; 2,050 mm
    - Free edge width - 70 mm
    - Length on roll - 16 m
    - Amount on roll - 26.4 m^2; 32.8 m^2

- **Appearance and colours**
  - Smooth membrane with a matt surface
  - Top surface - Standard colour – light grey RAL 7035
    - Also available in colours shown in the table
    - Marks are printed 120 mm from the membrane edge for easier overlap adjustment
  - Underside - Non-woven fleece (textile)

Design	FATRAFOL 807/V top surface color	Color tone by the RAL color chart*)
	Light grey	7035
	Dark grey	7012

*) *These are an approximate color shades, which may vary from one product batch to another*

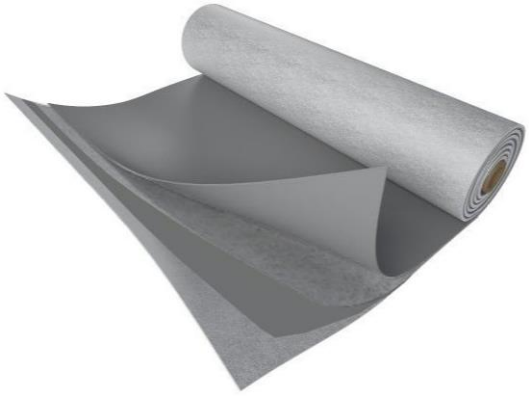
- **RELATED TECHNICAL DOCUMENTATION**
  - Technical data sheet TL 5-1016-09, FATRAFOL 807/V waterproofing membrane, issued by Fatra, a.s., Napajedla
  - Certificate of conformity of the factory production control n. 1390-CPR-2019-022/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 807/V

Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

2.1.9.3 FATRAFOL 807/G waterproofing membrane

- **PRODUCT DESCRIPTION**

  FATRAFOL 807/G is PVC based waterproofing membrane reinforced with glass mat and the base layer made of non-woven PES fleece with a surface density of 180 g/m^2. One edge of the membrane is without the non-woven fleece in order for the sheets to be joined longitudinally. The membrane is UV resistant and may be exposed directly to the weather conditions.



- **USE**

  For a adhered roof system in cases where the installation of a waterproofing coating without perforation of the layers under membrane is required. The membrane is especially suitable in the following cases:

  - roof cladding of new buildings with a sufficiently flat and load-bearing substructure
  - partially loaded (ballasted) roofs requiring the mechanical fastening of the membrane to the substrate (the weight of the load layer is not sufficient to eliminate forces from wind loads on the roof)
  - adhering of waterproofing membrane to EPS insulation boards when the composition resistant to external fire is required

- **APPLICATION**

  The membranes may be installed only by qualified and specially trained contractors.

  The membranes must be installed in accordance with this Instructions.

  The adhesives used for adhering the membranes must ensure sufficient adhesion to the substrate based on the calculated values of the forces acting on the roof cladding under wind load. It is recommended to use FATRAFIX FM adhesive full-area bonding.

  Securing the roofing membrane against the effects of internal forces is described below

  The sheets of membrane are connected to each other in the overlap of the free edge by manual or automatic hot air welding machines . The cut edges of the membranes (e.g. transverse connection of adjacent strips) are folded approx. 50 mm over each other and overlapped with a strip of homogeneous membrane FATRAFOL 804 or FATRAFOL 810 (see Detail 205S). Membrane around the perimeter of the roof and around penetrating structures is secured by welding it on profiles made of plastic-coated sheet metal FATRANYL PVC, which are mechanically fastened to the load-bearing structure.

  The membrane must be installed at the temperatures recommended by the adhesive manufacturer; when joining the sheets together, the temperature of the ambient air and the substructure should not fall below -5 °C.

- **PRODUCT DATA**

  - **Dimensions and packaging details of FATRAFOL 807/V membrane**
    - Effective thickness - 1.50 mm
    - Overall thickness - 2.10 mm
    - Width - 2,050 mm
    - Free edge width - 70 mm
    - Length on roll - 16 m
    - Amount on roll - 32.8 m^2

Appearance and colours

- Smooth membrane with a matt surface and characteristic structure made by implemented glass fibre
- Top surface - Standard colour – light grey RAL 7035
  - Also available in colours shown in the table
  - Marks are printed 120 mm from the membrane edge for easier overlap adjustment and the positioning of fasteners
- Underside - non-woven fleece (textile)

Design	FATRAFOL 807/G top surface color	Color tone by the RAL color chart *)
	Light grey	7035
	Dark grey	7012

*) *These are an approximate color shades, which may vary from one product batch to another*

RELATED TECHNICAL DOCUMENTATION

- Technical data sheet TL 5-1046-06, FATRAFOL 807/G waterproofing membrane, issued by Fatra, a.s., Napajedla
- Certificate of conformity of the factory production control issued by CSI, a. s., Praha, tested in Zlín

Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

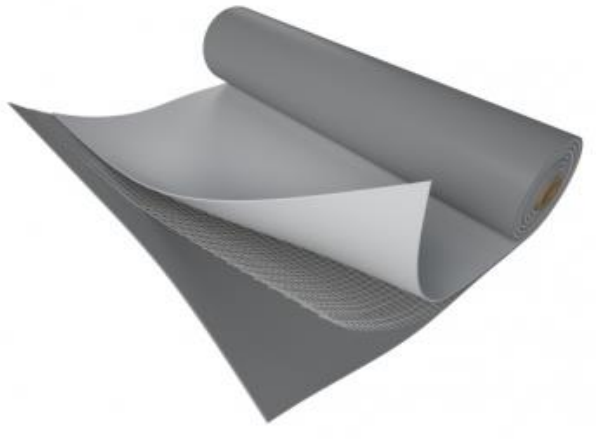
2.1.9.4 FATRAFOL 810 and FATRAFOL810/V waterproofing membranes

■ **PRODUCT DESCRIPTION**

FATRAFOL 810 (810/V) is a PVC-P based roofing membrane reinforced with a polyester grid. The membrane is resistant to UV radiation and may be exposed directly to the weather. Membrane is produced in options T1, T2 and T3 for roof structures with different fire resistance classification.

Membrane manufactured by the process of calendering and lamination or by the process of multiple extrusion.

Unless otherwise stated, all product versions are referred to below as FATRAFOL 810.



■ **USE**

- For mechanically fastened roof coverings
  - With point fastening or linear fastening
  - With adhering fixing discs or induction fastening
- For flat roof with postponed ballast or traffic layer installation *)
- For pitched or steep roofs with ballast or traffic layer *)
- For other roof types with ballast or traffic layer, where the use of FATRAFOL 810 is more advantageous than use of FATRAFOL 818, for example due to small size, logistics or due to other reasons *)

Membrane cut to strips:

- Width 160 mm – used for covering fasteners on additional point fastening of the membrane and for making local patches
- Width 215 mm – used for joining and fastening FATRAFOL 814 to the substrate
- Width 650 mm, 1,000 mm and 1,025 mm – for additional fastening in perimeter and corner zones of roofs

Embossing membrane (D205 a D336):

- as an added layer on the finished roof covering for access and service routes
- roof covering of walkways (recommended thickness 1.8 mm and higher)

*) *conditions of installation for load-bearing roofs are described in the section Applications below*

■ **APPLICATION**

The membranes may be installed only by qualified and specially trained contractors.

The membranes must be installed in accordance with this Instructions.

The membrane must be properly attached to a stable part of the roof deck. The fixing method must ensure the membrane is secured against dimensional changes and wind uplift. Membrane around the perimeter of the roof and around penetrating structures is secured by welding it on profiles made of plastic-coated sheet metal FATRANYL PVC, which are mechanically fastened to the load-bearing structure.

Following rules apply for roofs with ballast or traffic layer.

- If ballast or traffic layer is installed afterwards, membrane FATRAFOL 810 must be either mechanically fastened or effectively secured any other way against wind uplift
- If the roof´s size doesn´t exceed 40 sqm or if the width of the roof doesn´t exceed 2.5 m, no additional mechanical fastening in the field is required
- If the roof´s size exceeds 40 sqm and at the same time width of the roof exceeds 2.5 m, additional mechanical fastening of density 2.0 pcs/sqm in the field is **required**
- In uncertain cases contact author of this CTI for individual assessment
- FATRAFOL membrane must be always welded to plastic coated sheet metal flashing components installed around the perimeter of roof and in every change of slope

Membrane sheets may be joined together using hand-operated or automatic hot-air welding machines or wedge welders (single-track weld).

Ambient air and substrate temperature should not drop below -5 °C during installation.

PRODUCT DATA

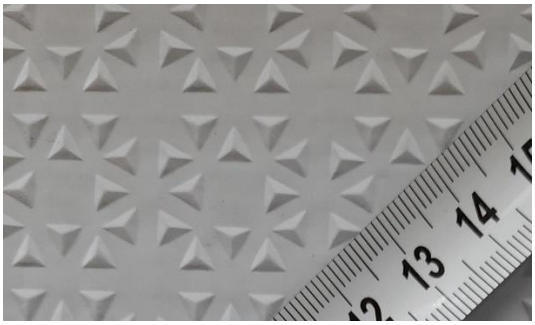
Dimensions and packaging details of FATRAFOL 810 (810/V) membrane

- thickness - 1.20 mm; 1.50 mm; 1.80 mm; 2.00 mm
- Width - 1,025 mm; 1,300 mm; 1,500 mm; 1,650 mm; 2,050 mm
- Length on roll - 25 m; 20 m; 16.5 m; 15 m; 13 m
- Amount on roll - depends on width and length on the roll

Appearance and colours

- Smooth membrane with a matt surface gently textured by reinforcement textile. Upon agreement between manufacturer and client, membrane can be produced with embossed upper surface type D205 and D336.

D205



D336

- Top surface - Standard colour – light grey RAL 7035
  - Also available in colours shown in the table (produced only certain dimensions)
  - Marks are printed 120 mm from the membrane edge for easier overlap adjustment and the positioning of fasteners
- Underside - Grey
  - White on white membranes

Design	FATRAFOL 810 top surface colour	Color tone by the RAL color chart *)
	Light grey	7035
	Dark grey	7012
	Red	3016
	Blue	5015
	White	9010
	Green	6000
	Cooper brown	8004
	Grey-white	7047
	Black-grey	7016

*) *These are an approximate color shades, which may vary from one product batch to another*

RELATED TECHNICAL DOCUMENTATION

- Technical data sheet TL 5-1008-06, FATRAFOL 810 waterproofing membrane, issued by Fatra, a.s., Napajedla
- Technical data sheet TL 5-1044-18, FATRAFOL 810/V waterproofing membrane, issued by Fatra, a.s., Napajedla
- Certificate of conformity of the factory production control No. 1390-CPR-2019-0005/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 810
- Certificate of conformity of the factory production control No. 1390-CPR-2019-0006/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 810/V
- European Technical Approval ETA-12/0013 - FATRAFOL-S, Systems of mechanically fastened, flexible, roof waterproofing membranes

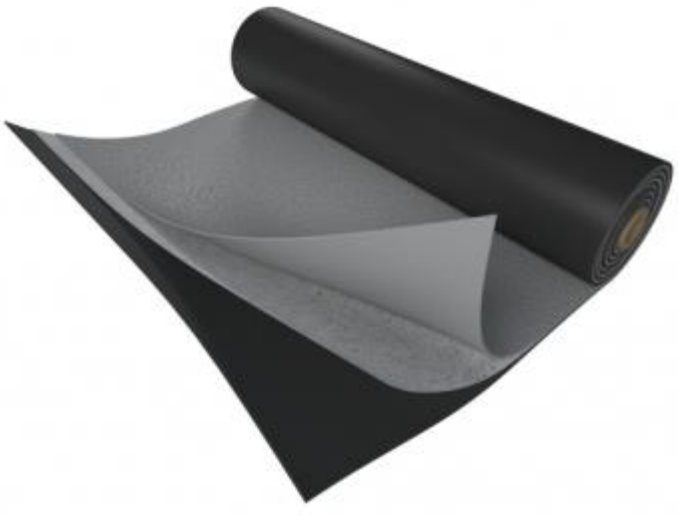
Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

2.1.9.5 FATRAFOL 814 waterproofing membrane

- **PRODUCT DESCRIPTION**

  FATRAFOL 814 is a PVC-P (plasticized polyvinyl chloride) based roofing membrane reinforced with glass fibre fleece. The membrane top surface features a special anti-slip texture.

  The membrane is resistant to UV radiation and may be exposed directly to the weather.



- **USE**

  Pedestrian traffic waterproofing layer for:

  - Open terraces and balconies of residential buildings
  - Walkways on flat roofs waterproofed with FATRAFOL PVC-P membranes

  FATRAFOL 814 meets the minimum shear friction coefficient of 0.5 required by CSN 74 4505 under both dry and wet conditions and as such is perfectly suitable to form a top layer subjected to pedestrian traffic.

- **APPLICATION**

  The membranes may be installed (on balconies, loggias, terraces) only by qualified and specially trained contractors that already have already experience with the application of this type of membrane. The great emphasis is placed on precise installation and visual cleanliness of work.

  The membrane is generally used for horizontal surfaces only and must be installed in accordance with this Instructions. The substrate planarity and slope should prevent puddling on the membrane. No puddling usually occurs if the slope exceeds 3%.

  The membranes are typically installed edge-to-edge with 2 mm gap and their edges are hot-air welded to a mechanically fastened or adhered strip of an auxiliary membrane. The 2 mm gap between the membranes is filled with extrusion welding wire with UV stabilisation (see 2.2.13) or as an alternative with Z-01 sealant can be used. To end the membrane on a wall or at the roof perimeter, weld the membrane to plastic-coated metal profiles FATRANYL PVC. For complex detailing, penetrations, railing posts etc, the FATRAFOL 804 homogeneous detailing membrane should preferably be used.

  To install the membrane on walkways, hot-air weld the sheets to a finished FATRAFOL waterproofing layer on the roof deck.

  Ambient air and substrate temperature should not drop below 0 °C during installation.

- **PRODUCT DATA**

  - **Dimensions and packaging details of FATRAFOL 814 membrane**
    - thickness - 2.50 mm
    - Width - 1,025 mm; 2,050 mm
    - Length on roll - 12 m
    - Amount on roll - 12.3 m^2; 24.6 m^2

Appearance and colours

- Embossed membrane with a shiny textured surface

- Top surface - Available in colours shown in the table
- Underside - Black

Design	FATRAFOL 814 top surface color	Color tone by RAL color chart *)
	Light gray	7035
	Dark gray	7012
	green	6000
	Cooper brown	8004

*) *These are an approximate color shades, which may vary from one product batch to another*

RELATED TECHNICAL DOCUMENTATION

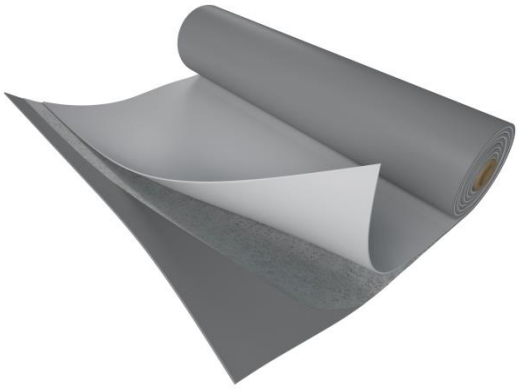
- Technical data sheet TL 5-1010-06, FATRAFOL 814 waterproofing membrane, issued by Fatra, a.s., Napajedla
- Certificate of conformity of the factory production control No. 1390-CPR-2019-048/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 814

Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

2.1.9.6 FATRAFOL 818 waterproofing membrane

- **PRODUCT DESCRIPTION**

  FATRAFOL 818 is a PVC-P based roofing membrane reinforced with glass mat. The membrane is manufactured by the process of multiple extrusion. FATRAFOL 818 is stabilised against UV radiation.



- **USE**

  The membrane is intended as a single-ply covering for flat roofs:

  - With ballast
  - With a traffic layer – pavers on support pads or vehicular traffic surface
  - With vegetation layers

  FATRAFOL 818 is unsuitable for mechanically fastened roof coverings without ballast or traffic layer.

  For penetrations and other complex details projecting from the roof deck, the FATRAFOL 804 detailing membrane should preferably be used.

  For easier insulation of vertical surfaces (parapets) it is recommended to use FATRAFOL 810 membrane (810/V), however, the use of FATRAFOL 818 membrane is not excluded.

- **APPLICATION**

  The membranes may be installed only by qualified and specially trained contractors.

  The membrane must be installed in accordance with this Instructions.

  Waterproofing membrane is installed freely without mechanical fastening. At the roof perimeter and at the point of sudden slope changes and details, the membrane must be fastened to the substrate using plastic-coated metal profiles FATRANYL PVC. Sheet overlaps must be at least 50 mm

  Membrane sheets may be joined together using hand-operated or automatic hot-air welding machines or wedge welders (single-track weld).

  Ambient air and substrate temperature should not drop below -5 °C during installation.

- **PRODUCT DATA**

  - **Dimensions and packaging details of FATRAFOL 818 membrane**
    - thickness - 1.50 mm; 1.80 mm; 2.00 mm
    - Width - 2,050 mm
    - Length on roll - 20 m; 16.5 m; 15 m
    - Amount on roll - 41 m^2; 33.8 m^2; 30.75 m^2

- **Appearance and colours**
  - Smooth membrane with a matt surface
  - Top surface - available in colours shown in the table
    - Identification details are printed 120 mm from the membrane edge.
  - Underside - grey

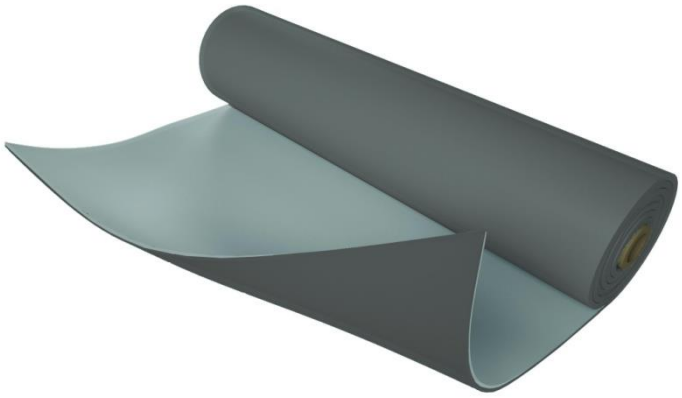
Design	FATRAFOL 818 top surface layer	Color tone by RAL color chart *)
	Light gray	7035

*) *These are an approximate color shades, which may vary from one product batch to another*

- **RELATED TECHNICAL DOCUMENTATION**
  - Technical data sheet TL 5-1017-09, FATRAFOL 818 waterproofing membrane, issued by Fatra, a.s., Napajedla
  - Certificate of conformity of the factory production control No. 1390-CPD-2019-0023/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 818/V-UV

Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

2.1.9.7 FATRAFOL 804 waterproofing membrane



- **PRODUCT DESCRIPTION**

  FATRAFOL 804 is a non-reinforced roofing membrane made on the basis of plasticized polyvinyl chloride (PVC-P). The membrane is resistant to UV radiation and may be exposed directly to the weather.

- **USE**
  - intended only as an accessory to FATRAFOL reinforced roofing membranes
  - for detailing and complex parts of FATRAFOL-waterproofed roofs
  - for end joining of FATRAFOL 807, 807/V and 807/G joints
  - for patching expansion gaps of plastic-coated sheet metal profiles FATRANYL PVC
  - for insulating expansion gaps roof cladding
  - for production of shaped 3D pieces

  The membrane is unsuitable for use as a mechanically fastened covering for entire roofs.

  It is recommended to use at least 2 mm thick membrane for insulation of spatial details.

- **APPLICATION**

  The membrane may be installed only by qualified and specially trained contractors.

  The membrane must be installed in accordance with this Instructions.

  The membranes are joined together using hot-air welding machines. When making standard joints, keep a 50 mm sheet overlap and make the homogeneous joint at least 30 mm wide. In detailing (e.g. roof deck penetrations of unusual shape and size), maintaining the minimum membrane overlap and weld width is not always possible.

  Ambient air and substrate temperature should not drop below -5 °C during installation.

- **PRODUCT DATA**
  - **Dimensions and packaging details of FATRAFOL 804 membranes**
    - Thickness - 1.50 mm; 1.80 mm; 2.00 mm
    - Width - 1,200 mm; 125 mm
    - Length on roll - 20 m; 16.5 m; 15 m
    - Amount on roll - 24 m^2; 19.8 m^2; 18 m^2

Appearance and colours

- Smooth membrane with a matt surface
- Top surface
  - Standard colour – light grey RAL 7035
  - Also available in colours shown in the table
  - Identification details are printed 120 mm from the membrane edge.
- Underside
  - Grey
  - White on a white membrane

  MAKE SURE the membrane is placed correctly with respect to top surface UV stabilisation.

Design	FATRAFOL 804 top surface color	Color tone RAL color chart*)
	Light grey	7035
	Dark grey	7012
	Red	3016
	Blue	5015
	White	9010
	Green	6000
	Cooper-brown	8004
	Grey-white	7047
	Black-grey	7016

*) *These are an approximate color shades, which may vary from one product batch to another*

RELATED TECHNICAL DOCUMENTATION

- Technical data sheet TL 5-1005-06, FATRAFOL 804 waterproofing membrane, issued by Fatra, a.s., Napajedla
- Certificate of conformity of the factory production control No. 1390-CPR-2019-049/Z issued by CSI, a.s., tested in Zlín, for membrane FATRAFOL 804

Documentation validity: Installation of the membrane requires using current product documentation (technical data sheet, declaration of performance). This is available at www.fatrafol.cz.

2.2 Supplementary waterproofing materials

Supplementary waterproofing materials are components of the FATRAFOL-S roof waterproofing system that help build a perfectly watertight roof covering and details. The materials include vacuum-shaped non-reinforced membrane components for detailing (internal corner, external corner), flat membrane cuttings, rainwater outlets, vent outlets, plastic-coated metal profiles and sealants with great adhesion to membranes. All of these materials (except polyurethane sealer) are based on individual types of the waterproofing membranes manufactured by FATRA Napajedla. This guarantees their compatibility and material uniformity within the FATRAFOL-S roof waterproofing system.

2.2.1 Shaped piece – internal corner

A vacuum-shaped FATRAFOL 804 component, thickness 2 mm

Manufacturer: FATRA, a.s., 763 61 Napajedla

Documentation: Company standard PND 5-101-97, material data sheet 1/1997

Colour: FATRAFOL 804 colours

Dimensions: Height 50 mm, diameter 120 mm

Packaging: 40-piece bag, 400-piece cardboard box

Use: Finishing and sealing of internal corners

2.2.2 Shaped piece – external corner

A vacuum-shaped FATRAFOL 804 component, thickness 2 mm

Manufacturer: Fatra, a.s., 763 61 Napajedla

Documentation: Company standard PND 5-101-97, material data sheet 2/1997

Colour: FATRAFOL 804 colours

Dimensions: Height 25 mm, diameter 160 mm

Packaging: 30-piece bag, 240-piece cardboard box

Use: Finishing and sealing of external corners

2.2.3 Vent outlets

Vent outlets with a PVC-P based collar for hot-air welding to a membrane.

Type: plasticized PVC

Dimensions: Minimum height 300 mm, opening diameter approx. 100 mm

Use: Removal of entrapped moisture from all types of roofs. Recommended quantity – 3 pieces per 100 m^2.

Type: rigid plastic

Dimensions: height 300 mm (special order up to 2,000 mm), opening diameter approx. 50 mm, 70 mm, 100 mm, 125 mm

Use: Removal of entrapped moisture from all types of roofs. Recommended quantity – 3 pieces per 100 m^2.

Type: rigid plastic substructure vent

Dimensions: height 300 mm (special order up to 2000 mm), depth under membrane 180 mm (special order up to 2000 mm), opening diameter approx. 50, 70, 100, 125 mm

Use: Designed to waterproof sewer ventilation downpipe penetration through FATRAFOL membranes .

2.2.4 Cable outlet flashing

Flat roof cable outlet with PVC-P membrane sleeve allowing hot air weld to waterproofing membrane.

Type: plasticized PVC

Dimensions: height 300 mm, opening diameter 24 mm

Use: Designed to waterproof cable penetration through FATRAFOL membrane.

Type: rigid plastic

Dimensions: height 300 mm (special order up to 2000 mm), depth under membrane 180 mm (special order up to 2000 mm), opening diameter 50 mm, 70 mm, 100 mm,125 mm

Use: Designed to waterproof cable penetration through FATRAFOL membrane.

2.2.5 Rainwater outlets

Rainwater outlets with a PVC-P based collar for hot-air welding to a membrane

Type: plasticized PVC

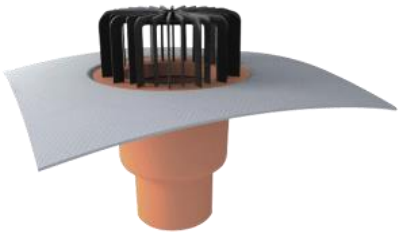
Dimensions: Neck diameters from 60 mm to 110 mm (in 10 mm increments), 125 mm, 150 mm

Use: Designed to connect FATRAFOL membrane to sewer downpipe. Built-in outlets must be fitted with a leaf or stone trap.

Type: rigid plastic

Dimensions: Neck diameters from 70 mm, 100 mm, 125 mm, 150 mm

Use: Designed to connect FATRAFOL membrane to sewer downpipe. Built-in outlets must be fitted with a leaf or stone trap.



2.2.6 Rainwater outlets for existing roof downpipes

Outlet with integrated PVC-P sleeve allowing hot air weld to waterproofing membrane.

Dimensions: neck diameters 50, 75, 90, 104, 110,125, 160 mm, depth under membrane 180 mm (special order up to 2,000 mm)

Use: Designed to connect FATRAFOL membrane to sewer pipe. Built-in outlets must be fitted with a leaf or stone trap.

2.2.7 Spouts and overflow outlets

Shaped drains with a PVC-based collar for hot-air welding to a membrane

Dimensions: Neck diameters 40 mm, 50 mm, 75 mm, 110 mm, 125 mm, square-shaped opening 50x100 mm up to 100x300 mm

Use: Finishing downpipes on a vertical wall, e.g. parapet.

2.2.8 Shaped sleeves

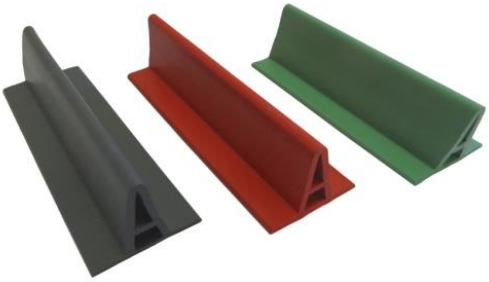
Suitably shaped pieces with a PVC-P based collar for hot-air welding to a membrane.

Dimensions: Wide range of dimensions, depending on type.

Use: Used for sealing TV aerials, cables, round and square-shaped closed profiles penetrating the roof.

2.2.9 ‘A’ profile Novoplast 1871

An auxiliary profile for FATRAFOL roofing membranes – (type 1871, nozzle number 2291).



Use: Designed to optically divide roof coverings into smaller sections to imitate a sheet metal roof. The profiles must be applied on a finished covering; they do not have a waterproofing function.

Benefits: Division of roof planes into segments, better rainwater drainage, appealing to the eye

Composition: Plasticized PVC – extruded profile, UV stabilisation

Colour: produced in colors of membrane

Dimensions: Width 31.5 mm; height 24.5 mm; length 2.5 m

Packaging: In boxes, in full length

Note: The profiles cannot be used as a snow barrier!

2.2.10 Plastic-coated installation components

PVC-coated steel components made to order (e.g. shingle flashing holder, air-conditioner support etc)

Dimensions: Any dimensions, limited by coating machine capabilities

Use: Fastening and installation of rooftop structures

2.2.11 Flat component - patch

A round cutout of the FATRAFOL 804 waterproofing membrane, thk 2 mm.

Manufacturer: FATRA, a. s., 763 61 Napajedla

Documentation: Company standard PND 5-101-97, material data sheet 3/1997

Colour: FATRAFOL 804 colours

Dimensions: Diameter: 160 mm

Packaging: 25-piece bag, 300-piece cardboard box

Use: Used to cover fasteners or damaged spots of a waterproofing membrane**.**

2.2.12 Flat component – collar

A ring-shaped cut out of the FATRAFOL 804, thk 2 mm.

Manufacturer: FATRA, a. s., 763 61 Napajedla

Documentation: Company standard PND 5-101-97, material data sheet 4/1997

Colour: FATRAFOL 804 colours

Dimensions: Outer/inner diameter 400/20

Packaging: 10-piece PE bags or 140-piece cardboard b**ox**

Use: Collars made of FATRAFOL 804 are used to create shaped pieces for circular penetrations through the waterproofing membrane

2.2.13 Extrusion wire NP 1871

Round shaped extrusion wire made of UV stable compound (profile number 1871, n.n. 2768).

Producer: FATRA, a. s., 763 61 Napajedla

Documentation: Company standard PND 5-100-95 ML 15

Colour: Same colours as FATRAFOL 814

Dimensions: Length ca 125 m, diameter 4 mm

Packing: 2 kg coil

Use: Intended for filling a gap between FATRAFOL 814 membranes

2.2.14 Z-01 sealant

A solution of PVC and additives in organic solvents.

Colour: Dark grey, light grey, green

Packaging: 2.5 l can

Use: Aesthetic treatment of the weld along the edge of the membrane. The sealant is applied using a PE bottle with a nozzle in the lid. The sealant takes about 2 hours to dry after application. To dilute the sealant, the manufacturer supplies diluent that is marketed under the L-494 name. If treating the entire weld area, approximately 1 tinful of the diluent is necessary for 300m2.

Warning: **The fumes are harmful to health! Class I flammable. Shake the tin well before use!**

2.2.15 L-494 diluent

A colourless liquid.

Packaging: 2.5 l can

Use: Designed for preparing and diluting Z-01 sealants used to secure treat FATRAFOL membrane welds. Component ratio – 20 % crushed membrane, 80 % diluent Subject to compliance with specific conditions, the diluent may exceptionally be used to cold-join PVC-P waterproofing membranes.

Warning: **The L-494 thinner contains tetrahydrofuran (THF), which is a volatile, highly flammable, poisonous and colorless liquid. The fumes are harmful to health! Class I flammable**!

2.2.16 PVC P membrane TW Cleaner

Transparent liquid**.**

Packing: 5 l can

Use: TW CLEANER helps to remove dirt from PVC-P membrane surface**.**

Warning: Highly flammable, irritant, contains acetone and ethylacetate**!**

2.2.17 Polyurethane sealant FATRAPUR PU 25

Highly elastic and flexible sealer with great adhesion to membranes and building materials. Has a long-service life even if exposed to direct weather conditions including UV radiation. Sealant hardness after curing 25 Sh A.

Packaging: - 310 ml cartridge

Use: Applied to provide long-term elastic sealing at point of contact between a waterproofing membrane and metals, plastics and building materials. The surfaces to be sealed must be dry and clean. Not to be diluted. The sealer is applied using a sealing gun or spatula**.**

Application: Temperature: +5 °C up to +40 °C

2.2.18 Polymer sealer

One-component elastic hybrid sealer based on MS-polymers. A highly versatile product, the sealer dries by air humidity and creates softly elastic and watertight joints with excellent resistance to the weather and chemicals. The sealer is free of solvents, isocyanates and silicon. It contracts slightly after application.

Packaging: - cartridge - 20 x 290 ml (while, light grey, black) – 25 Sh A

- bag - 20 x 600 ml (white, black, dark brown, anthracite, tones of grey) – 25 Sh A

Use: The sealer is used for sealing and filling connection and expansion joints both indoors and outdoors. Sealed surfaces must be dry and clean.

Application: Temperature: +5 °C up to +40 °C

2.2.19 Liquid waterproofing products

2.2.19.1 Triflex ProDetail

Triflex ProDetail is a liquid-applied waterproofing system based on two-component polymethyl metacrylate resin and reinforced with Triflex Special Fleece 110g/m². Standard colours: RAL 7032 (pebble grey), RAL 7035 (light grey) and RAL 7043 (traffic grey).

Technical parameters:

- European Technical Approval ETA-06/0269 according to ETAG 005
- Weather resistant
- Resistant to root penetration
- Resistant to hydrolysis and permanent water exposure
- Resistant to fire spread through the roof deck – classification Broof (t3)

Use: Designed for unusual, complex detailing. When combined with a FATRAFOL PVC-P membrane, Triflex ProDetail is suitable for almost every substrate. Use a brush or a special roller for application.

Approved substrates:

- Asphalt, bitumen, SBS and APP modified asphalt sheets
- Concrete, polymer concrete, levelling compound, lightweight concrete, plaster
- Steel, stainless steel, aluminium, copper, zinc, lead
- Glass, wood
- PVC-P based waterproofing membranes
- Plastic surfaces (films, coatings, panels) - PVC-P, PU, PMMA, epoxy and polyester resins, EPDM

Application: The product may only be installed by qualified contractors.

All substrates must be clean, dry and free of dust, oil, grease, deteriorated paint and other contamination. The substrate must be treated (usually roughened, sanded etc) as recommended by the manufacturer. Some surfaces require suitable bonding primer. Triflex Pro Detail is applied in two layers with inserted reinforcement fleece between them.

The waterproofing layer is watertight after 30 minutes and may be walked on after 45 minutes.

Note: To prepare the application substance, mix the product with Triflex Katalysator (100 g of catalyser per 5 kg of product). The mixture must be used within approx. 30 minutes.

Application temperature: - 5 °C up to +40 °C

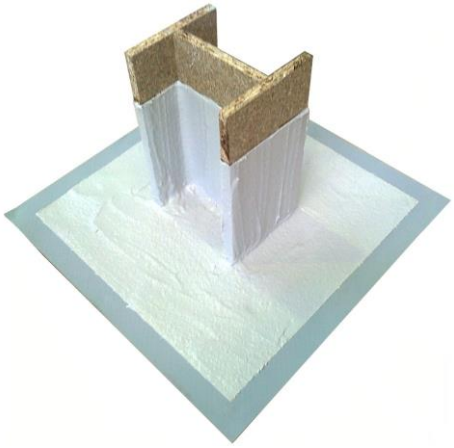
Consumption: Approx. 3 kg/1 m^2

Packaging: - Triflex ProDetail – 15.0 kg tin
- Triflex Katalysator – 0.10 kg plastic bag
- Triflex Specialvlies – reinforcement fleece, width: 20 cm, 52.5 cm, 105 cm; length: 50 m
- Triflex Cryl Primer 222 and 276 – 10 kg tin

Cleaner: Triflex Cleaner (9 l tin)

2.2.19.2 Triflex ProFibre

Triflex ProFibre is a liquid-applied waterproofing system based on two-component polymethyl acrylate resin and reinforced with fibres.



.....

Use: Designed for unusual, complex detailing. When combined with a FATRAFOL PVC-P membrane, Triflex ProFibre is suitable for almost every substrate. Use a brush or a special roller for application.

For approved substrates and their treatment see Triflex ProDetail.

Technical parameters:

- Resistance to weather
- Resistance to root penetration
- Resistance to hydrolysis and permanent water exposure
- Resistance to fire spread through the roof deck – classification B_{ROOF} (t1)

Application: All substrates must be clean, dry and free of dust, oil, grease, deteriorated paint and other contamination. The substrate must be treated (i.e. roughened, sanded etc) as recommended by the manufacturer.

After treating the substrate and coating it with a bonding primer, use a wool roller or a brush to apply at least 3.0 kg of Triflex ProFibre per m^2.

The waterproofing layer is watertight after 30 minutes and may be walked on after 45 minutes.

Application temperature: 0 °C up to +40 °C

Consumption: Approx. 3 kg/1 m^2

Packaging: - Triflex ProFibre – 15.0 kg can
- Triflex Katalysator – 0.10 kg plastic bag
- Triflex Cryl Primer 222 and 276 – 10 kg can

Cleaner: Triflex Cleaner (1l a 9 l tin)

Note: For sales and application of Triflex products outside of Czech Republic please contact directly company Triflex GmbH & Co. KG

2.2.20 FATRANYL PVC plastic-coated metal profiles

Description: FATRANYL is hot-dip galvanised sheet metal coated on both sides with a protective varnish layer and with a plasticized PVC membrane layer on the top surface.

The plastic-coated sheet metal acquires its properties primarily from the high-quality sheet metal suitable for building applications and from the PVC layer composition that guarantees high UV resistance as well as resistance to thermal degradation during the hot-air welding process. FATRANYL requires no maintenance or PVC layer renovation during its life cycle.

FATRANYL meets the requirements of EN 14783.

Use: The plastic-coated sheet metal is used:

- For linear fastening and perimeter end pieces for PVC-P based waterproofing membranes
- As a sheet metal component – for plating roofs, terraces, balconies, recessed balconies, ledges, sills etc.

Application: Work with FATRANYL (cutting, bending, shaping etc) is similar to work with sheet metal without a PVC-P layer, differing in that FATRANYL sheets cannot be soldered or welded together. The sheets may be joined edge-to-edge, keeping an expansion joint, or overlapped and then covered with patch made of homogenous membrane FATRAFOL 804 .

If hot-air welding machines are used, FATRANYL is weldable to all FATRAFOL-S waterproofing membranes based on PVC-P.

Dimensions and packaging details:

- Sheet thickness: 0.6 mm, minimum PVC-P layer thickness: 0.6 mm
- Standard size: (2 x 1) m or in coils (30 x 1) m
- Shaped profiles – for shapes and dimensions see Table 4.

Appearance and colours:

- Standard colour – light grey
- Also available in colours shown in the table

Design	FATRANYL PVC top layer color	Color tone by RAL color chart *)
	Light grey	7035
	Dark grey	7012
	Red	3016
	Blue	5015
	White	9010
	Green	6000
	Cooper brown	8004
	Grey white	7047
	Grey black	7016

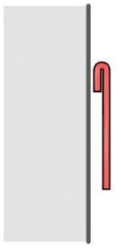
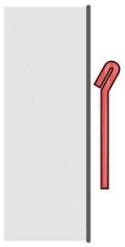
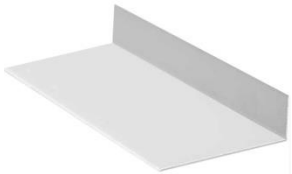
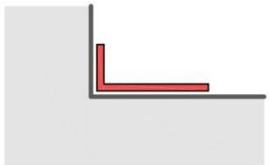
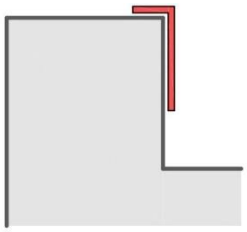
*) *These are an approximate color shades, which may vary from one product batch to another*

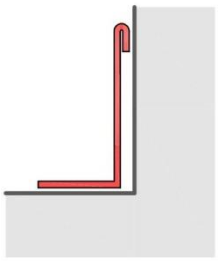
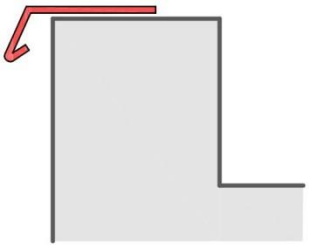
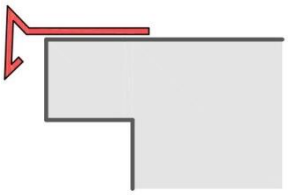
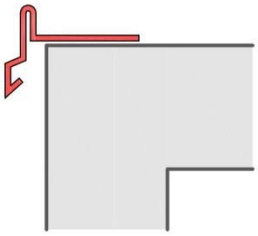
Technical parameters of plastic-coated sheet metal FATRANYL PVC – guaranteed values:

Property	Test standard	Guaranteed values
Resistance to weather	EN ISO 4892-3	Pass
PVC layer adhesion to sheet metal	Manufacturer's standard 1005-11	Pass
Welded joint strength after ageing in water and air	Manufacturer's standard 1001-11	Tearing outside of joint
External fire performance	ENV 1187	B_{ROOF} (t3)

Technical documentation: FATRANYL technical data sheet TL 5–1070-14, plastic-coated sheet metal FATRANYL PVC, produced by Fatra, a.s., Napajedla

Table 4: Recommended basic shapes and dimensions of plastic-coated metal profiles FATRANYL PVC

Recommended shape	Name	Recommended width [mm]	Use	Typical location
	Curved strip	70	membrane ending on vertical wall	
	Curved strip with bend	70	membrane ending on vertical wall	
	Internal corner flashing	70 (100)	membrane fastening on internal corners	
	External corner flashing	70 (100)	membrane fastening on external corners	

	Internal corner flashing for balconies	250	membrane ending on wall	
	Drip mould, wide	150	membrane ending at drip area and on parapets	
	Gravel stop	250	membrane ending on edge	
	Gravel stop with curve	330	membrane ending on edge	

2.3 AUXILIARY MATERIALS

Auxiliary materials are products whose primary function is to secure the contact between a waterproofing membrane and other structural components of the roof. They include separation and protective fleece and other materials necessary for a complete roof deck. The products below were tested and verified for their intended purpose but are interchangeable with products of other manufacturers that provide identical properties. Please see our current price list for an up-to-date range of auxiliary and supplementary materials.

If your application requires the use of a material not contained in this Instructions, please consult FATRA for its suitability.

2.3.1 Vapour barriers

2.3.1.1 PE vapour control barrier FATRAPAR 150, 200

Description: Non-reinforced vapour control barrier based on polyethylene and available in thicknesses of 0.15 and 0.20 mm. Vapour control barrier matches CSN EN 13984 requirements.

Use: A vapour control layer preventing the migration of water vapour and moisture through the roof and other structures. PE vapour control barrier may be used on flat and pitched roofs, walls, ceilings and floors.

Application: PE vapour control barrier must be installed in accordance with this Instructions.
The vapour control is usually placed under the thermal insulation layer, close to the inner surface of the roof structure. It should preferably be installed in the direction of slope. To join the membranes, use double-sided adhesive butyl-rubber or Al tape and follow the tape manufacturer's instructions.

Dimensions and packaging details of vapour control barrier

Thickness	Width	Surface density *)	Diffusion-equivalent air layer thickness Sd	Roll length		Roll weight *)
[mm]	[mm]	[kg/m^2]	[m]	[m]	[m^2]	[kg]
0.15	4,000	0.15	82.5	50	200	30
0.20	4,000	0.20	110	50		40

**) Approximate figures*

2.3.1.2 Bituminous vapour control barrier

Roof waterproofing system FATRAFOL-S enables to use common bituminous vapour control barriers passing the CSN EN 13970 requirements.

2.3.2 Thermal insulation

2.3.2.1 Mineral wool thermal insulation

Advantages:

- Incombustibility – protection from the spread of flames and fire (Reaction to fire class A1)
- Thermal conductivity coefficient (λ cca 0.04 $W \cdot m^{-1} \cdot K^{-1}$)
- Excellent thermal resistance and dimensional stability
- Great sound absorption
- High vapour permeability (μ cca 1-10)
- Compatibility with PVC-P membranes, no separation fleece required

Disadvantages:

- High water absorption
- Compared to thermal insulation made of plastic adds more load to roof structure(EPS, PIR)
- Relatively low point load capacity of standard product types

Description: A rigid heavy hydrophobic board of stone wool (mineral wool) bonded with organic resin.

Use: Designed for thermal, fire and acoustic insulation of buildings. In combined insulation systems, mineral wool is used mostly as an upper layer under the covering to give the roof better fire protection. Mineral wool is suitable for mechanically fastened systems or roofs loaded with shingles or pavers.

Application: Mineral wool is installed in one or more layers; the maximum width of open joints is 5 mm. Minimum recommended thickness for single-layer installation: 60 mm.

Packaging: In blocks or on pallets covered with wrap film.

Dimensions: Width x length: (600 x 1,000) mm, (1,200 x 2,000) mm
Thickness: 30 mm up to 200 mm

2.3.2.2 Expanded polystyrene foam (EPS)

Advantages:

- Low apparent density (ρ cca 20-30 kg/m^3)
- Cheaper than other insulation boards
- Thermal conductivity coefficient (λ cca 0.033 W·m^{-1}·K^{-1})

Disadvantages:

- Poorer fire performance (Reaction to fire class A1)
- Higher water absorption
- Unwanted interaction with a PVC-P membrane (120 g/m^2 glass fibre fleece or separation textile 200 g/m^2 must be used for separation)
- Low thermal resistance (e.g. volume changes may occur while membranes are hot-air welded on the boards)
- Higher thermal expansion

Description: Thermal insulation boards, dimensionally stabilised, sufficient thermal insulation performance for flat roofs.

Use: For all roof types except inverted ones.

Application: From EPS 70 S (for base waterproofing layers) up to EPS 200 S (for waterproofing layers exposed to heavy load).

EPS 100 S or higher for the top insulation layer (roofs without traffic).

Packaging: In blocks covered with wrap film.

Dimensions: Width x length: (500 x 1,000) mm, (1,000 x 2,000) mm, max. (1,000 x 6,000) mm
Thickness: from 10 mm up to 300 mm

2.3.2.3 Extruded polystyrene foam (XPS)

Advantages:

- Low apparent density (ρ cca 30 kg/m^3)
- Very low water absorption
- High compressive strength at 10 % compression (≥ 250 kPa)
- Thermal conductivity coefficient (λ cca 0.035 W·m^{-1}·K^{-1})

Disadvantages:

- Poorer fire performance (Reaction to fire class E)
- Unwanted interaction with a PVC-P membrane (120 g/m^2 glass fibre fleece or separation textile 200 g/m^2 must be used as separation layer
- Low thermal resistance (e.g. volume changes may occur while membranes are hot-air welded on the boards)
- Higher thermal expansion

Description: Thermal insulation boards with a closed cell structure, manufactured by the process of extrusion, sufficient thermal insulation performance for flat roofs.

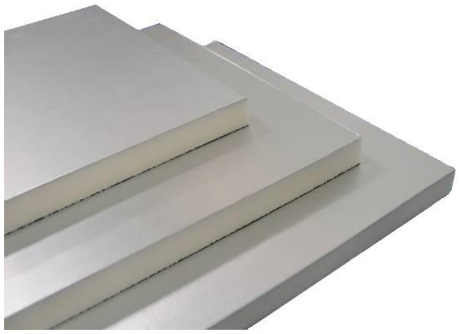
Use: For inverted roofs, roofs exposed to heavy traffic or green roofs.

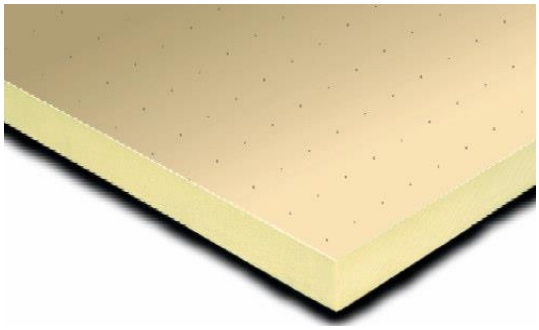
Application: Boards with a perimeter half-groove or upright edges are typically installed in a single layer.

Packaging: In blocks covered with wrap film.

Dimensions: Width x length: (600 x 1,250) mm
Thickness: 20 mm up to 200 mm

2.3.2.4 Polyisocyanurate (PIR) insulation boards





Advantages:

- Low apparent density (ρ cca 30 kg/m^3)
- High compressive strength at 10 % compression (≥ 120 kPa)
- Low water absorption due to closed structure
- The boards are not subject to sublimation caused by increasing surface temperature due to the Sun
- Premium thermal insulation properties that provide, despite thinner insulation, the same thermal resistance as standard materials. Thermal conductivity coefficient (λ cca 0.026 W·m^{-1}·K^{-1}))
- Compatible with PVC-P membranes that are installed directly on the thermal insulation boards, no need to use separation fleece

Disadvantages:

- A higher price
- Cannot be used for inverted roofs
- Poorer fire performance (Reaction to fire class E) compared to mineral wool

Use: Roof thermal insulating material

Application: For a bonded system (only for boards with mineral fiber surface finish), ballasted and mechanically fastened roofs.

Packaging: In blocks covered with wrap film.

Dimensions: Width: 600 up to 1,200 mm
Length: 1,200 up to 2,500 mm
Thickness: 30 mm up to 120 mm

2.3.3 Separation and protective textile layers

2.3.3.1 Nonwoven separation textile

Needle-punched non-woven fleece based on 100% regenerated synthetic fibres (PP, PES), white or black colour. Produced in ironed and non-ironed variation.

Dimensions: - Width: 2,000 mm
- mass per unit area: 200 g/m² – 500 g/m²

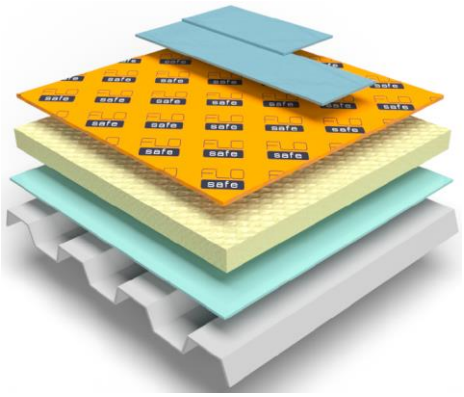
Use: Protective and separation layer for waterproofing membranes on flat and pitched roofs

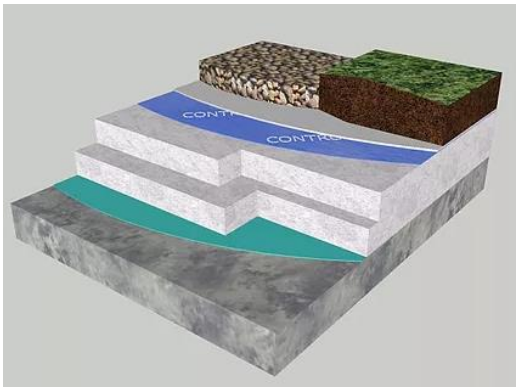
Advantages: Enhanced resistance to biological corrosion, the geotextile does not get wound around drill bits

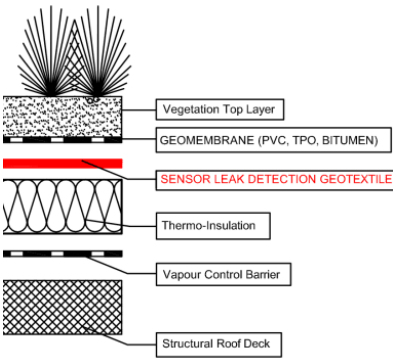
Packaging: 100 m² rolls are packed in PE film

2.3.3.2 Separation and conductive layer

Separation material (PE foil, glass fabric, non-woven textile from synthetic fibers and similar) with conductive layer.







Dimmensions: depends on manufactures (e.g. Controfoil, Controlit, FLOsafe, Sensor etc.)

Use: Conductive layer enabling reliable testing of the tightness of the waterproofing coating by the spark test method. The layer is placed directly under the waterproofing coating.

Advantage: Allows the spark test to be performed under conditions where otherwise this test is not conclusive or is difficult to perform (non-conductive or dry substrates)

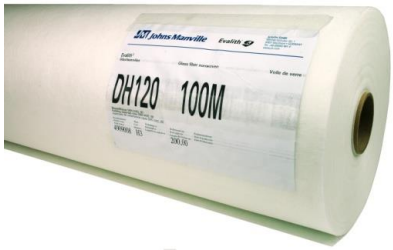
Packaging: in rolls

Note: *The suitability of use for a particular composition must be verified with the manufacturer.*

2.3.3.3 Glass fibre fleece

Non-woven fleece made of glass fibres, white colour

Dimensions: - Width: 2,000 mm
- mass per unit area: 120 g/m²



Use: Separation layer for FATRAFOL membranes/EPS-based thermal insulation

Advantages: Slows the spread of fire through the roof deck

Packaging: Rolls with 200 m² coverage

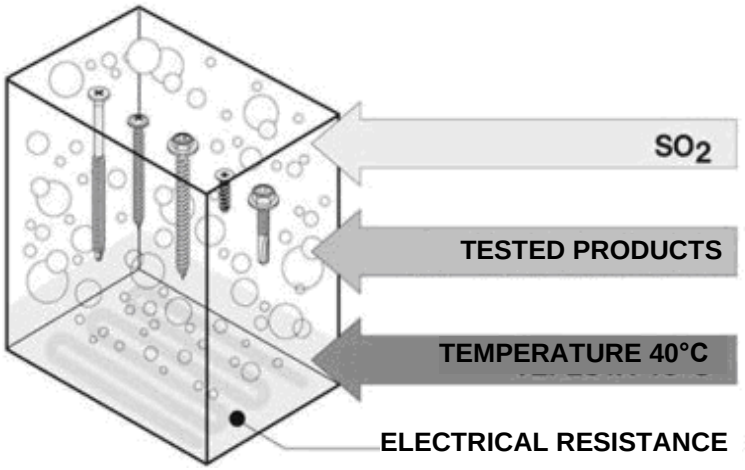
2.3.4 Mechanical fasteners for waterproofing membranes

Use: Mechanical fasteners are intended to attach waterproofing membrane and plastic-coated flashings to anchoring layer. This layer usually serves also as a support structure of roof covering.

Description: Typical mechanical fastener consist of screw or rivets and tubes (telescopes) or steel plates (washers) depending on anchoring layer. Screws are usually made of special steel with anticorrosion treatment or of authentic stainless steel. Steel plates are made of steel sheet metal with suitable surface treatment (for ex. Aluzinc). Plastic tubes (telescopes) are made of high quality polypropylene, polyamide or polyethylene.

Mechanical fasteners are intended for mechanical anchoring of waterproofing membrane and must have suitable anticorrosion treatment (15 Kesternich cycles is recommended) and also must have European Technical Assessment ETA by EAD 030351-00-0402 (superseded ETAG 006). Fastening elements from different manufacturers (screw and metal washer or plastic telescope) cannot be combined with each other, only a certified assembly must always be used

Conducting the Kesternich test

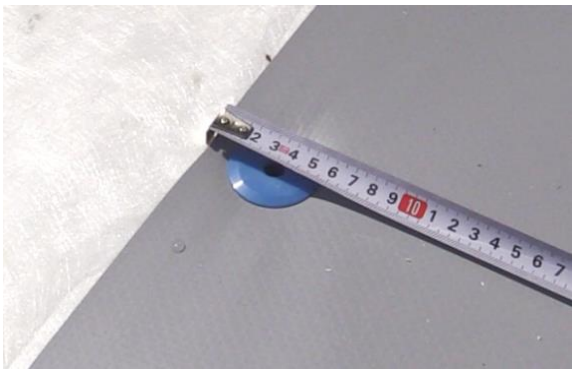


KESTERNICH TEST: Fasteners are placed into a wet chamber filled with sulphur dioxide. No red corrosion may appear when the tested product is exposed to 2 litres of SO_2. The test cycle consists of 8 hours of exposure and 16 hours of rest. The resistance depends on the number of cycles the tested product goes through without showing signs of red corrosion.

Dimensions: Screws and rivets are produced in many different lengths (from 25 to 300 mm). Plastic tubes (telescopes) are produced in different colors, depending on producer (blue, white, gray, yellow, red) and lengths from 20 mm up to 700 mm. Steel plates (washers) have round shape with diameter 50 (40) mm or oval shape 80x40 mm.

Installation: Mechanical fastening is done with use of hand electric tools or fastening automatic machines.

Mechanical fasteners are placed with minimum distance of 10 mm from the edge of membrane. If all required fasteners cannot be placed into membrane overlap it is possible to place them in the middle of the membrane sheets, but the fasteners has to be covered with membrane cut outs or precut strips.



Fastening of trapezoidal sheet metal, wood planks, wood particle boards and light weight concrete is done without pre-drilling a holes for fasteners. When fastening membrane to concrete substrates, pre-drilling is usually done, depending on manufacturer instructions. Producer of mechanical fasteners also recommends certain depth of pre-drilled holes.

Less common method of fastening is so called „ induction fastening“, that allows to place fasteners to position that does not depend on membrane sheets width. There is no penetration of membrane because fasteners with plates are placed under. This method is excellent for large scales application with trapezoidal sheet metal where less fasteners can be used with higher efficiency because there are placed in symmetrical raster. These are, for example the systems “Isoweld” and “Guardianweld”.

Consumption: The amount of fasteners needed for certain applications depends on local wind loads and load capacity of one fastener. Minimal amount of mechanical fasteners is 2 pcs/m^2. It is possible to use less density of fasteners for certain types of trapezoidal sheet metal. Depending on rib spacing of a steel deck lower density is acceptable.

2.3.5 Adhesives

2.3.5.1 Polyurethane expansive adhesives for adhered system

2.3.5.1.1 FATRAFIX TI

One component polyurethane foam adhesive designed to bond thermal insulation boards to common surfaces applied in beads.

Use: For bonding of thermal insulation EPS, XPS, PIR, MW based board to common construction substrates like concrete, wood particles boards, wood particle boards, bituminous membranes with sanding

Application: Substrate surface must be clean, dry and free of dust, oil and dirt. Optimal adhesive temperature for application is above 18 °C Minimum is 10 °C. Reactive and curing time will rapidly prolong at temperatures below +15 °C. Optimal surface temperature for proper use is between 15 °C and 30 °C, minimum +5 °C. Temperatures below 15 °C will prolong curing time.

FATRAFIX TI is applied only to subsurface, in form of 25 mm - 40 mm wide straight beads depending on roughness and straightness of substrate, approx. 100 mm - 200 mm apart along the perimeter and in corners of the roof. In the field area increase the distance between the strips to 300 mm. Two minutes after adhesive beads application, place gently thermal insulation boards on it. Do not apply any pressure. After next 10 min walk over the boards in order to press them down to substrate.

Coverage: leveled substrate 110 m^2 - 130 m^2/canister 6.0 kg
300 m^2 - 350 m^2/canister 15.9 kg

unleveled substrate 50 m^2 - 75 m^2/canister 6.0 kg
130 m^2 - 200 m^2/canister 15.9 kg

Packaging: 6.0 kg (13.7 l) single use canister, for professional use only
15.9 kg (22.0 l) single use canister, for professional use only

Cleaner: FATRAFIX AC cleaner

Storage: In original canisters at ambient temperature +5 °C to +30 °C

2.3.5.1.2 FATRAFIX FM

One component adhesive for one-sided application by spraying designed to bond waterproofing FATRAFOL fleece backed membranes to thermal insulation boards.

Use: For bonding FATRAFOL fleece backed membranes to thermal insulation boards on EPS, XPS, , PIR* and MW* basis or to load bearing structure such as wood particle boards, concrete. FATRAFOL membrane can be also bonded directly to flat load bearable existing bituminous membranes when reconstructing roof covering.

*) only board types recommended by the manufacturer can be used

Application: Substrate surface must be clean, dry and free of dust, oil and dirt. Optimal **adhesive temperature** for application is above 18 °C. Minimum is 10 °C. Optimal **surface temperature** for proper use is between 15 °C and 30 °C, but not less than +10 °C. Temperatures below 15 °C will prolong curing time.

FATRAFIX FM Adhesive is applied only on one of the bonded surfaces, usually a bottom layer(not a membrane) by spraying an even and

uniformed layer from 50 cm to 60 cm distance at 90°angle to 80 % to 100 % of surface. If necessary, spray another layer to areas where needed. Membrane can be laid immediately after adhesive application if adhered to porous surface. In case of non-porous surface let the adhesive slightly dry. It usually takes about 5 minutes at 23 °C. After the membrane is installed press it down to substrate with light roller, mop or brume.

Coverage: 120 m^2 - 150 m^2/canister 15.0 kg

Packaging: 15.0 kg (22.0 l) single use canister, for professional use only

Cleaner: FATRAFIX AC cleaner

Storage: in original canisters at ambient temperature +5 °C to +30 °C

2.3.5.2 Solvent-based contact adhesives

2.3.5.2.1 FATRAFIX PVC

Contact adhesive for bonding FATRAFOL membranes based on plasticized PVC to different types of substrate.

Use: For bonding waterproofing FATRAFOL membranes to vertical surface of parapets, vertical walls and to attach ground waterproofing FATRAFOL membranes to wall structures. FATRAFIX PVC can be used on variety surfaces such as concrete, coated sheet metal or wood particle boards.

Application: Surfaces must be clean, dry and free of dirt, dust, oil and paint before application. Optimal **temperature of adhesive** for application of FATRAFIX FM is 18 °C. Minimum is 10°C.

Optimal **surface temperature** for proper use is between 15 °C and 30 °C. Temperatures below 15 °C will prolong curing time.

Adhesive is applied to both sides by spraying an even and uniformed thin layer from 30 cm to 40 cm distance to 80 % to 100% of surface. Spray one surface (membrane) in vertical and the other (wall) in horizontal direction

Let the adhesive slightly dry (sticky to fingers but does not leave stain when touched). It usually takes about 3 minutes at 23 °C. Adhere membrane to surfaces and apply adequate pressure. To distribute pressure evenly and achieve maximum bond strength use a roller. Adhesive will reach a maximum strength in 24 hours.

Coverage: 75 - 100 m^2/canister 17 kg

Packaging: 17.0 kg (22.0 l) single use canister, for professional use only

Cleaner: FATRAFIX AC cleaner

Storage: in original canisters at ambient temperature +5 °C to +30 °C

2.3.5.3 FATRAFIX cleaners

2.3.5.3.1 FATRAFIX AC cleaner

FATRAFIX AC is a solvent cleaner specially designed to remove uncured FATRAFIX polyurethane adhesives.

Use **FATRAFIX AC cleaner**- For cleaning of spraying equipment - hoses, spray guns and nozzles

FATRAFIX AC cleaner 500 ml – cleaning of work aids and nozzles

Packaging: 5 kg (13.7 l) single use canister, only for industrial application

500 ml aerosol for industrial application and general use.

Storage: In original canisters at ambient temperature +5 °C to +30 °C

2.3.6 Drainage layer

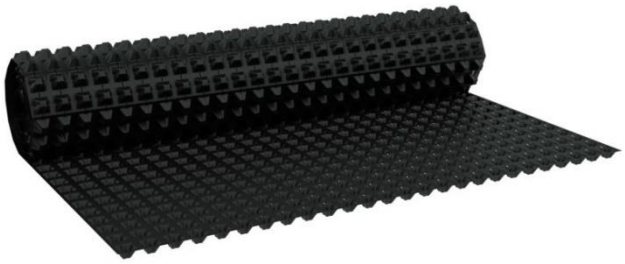
A drainage layer removes water from layers located above the waterproofing layer. A drainage layer may consist of inert bulk material, woven or non-woven fleece, mats made of space-oriented plastic fibres, profiled plastic boards or membranes and other water permeable material. The layer is usually installed as part of traffic and green roofs.

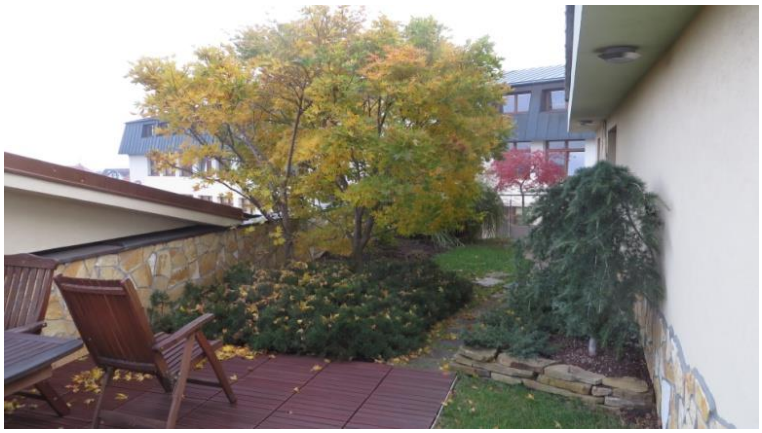
A drainage layer placed above the main waterproofing layer must be resistant to biological corrosion.

A drainage layer must be drained. If not drained, a drainage layer may perform a separation or water retention function.

Special types designed for green roofs perform both a drainage and water retention function.

2.3.6.1 Cavity drain and water retention membranes





Description: A shaped membrane designed for roofs with traffic and roof gardens.

Use: Drainage layer for roofs with traffic. A water retention and drainage layer for green roofs.

Application: Install membrane directly on the roof waterproofing layer.

Unroll the membrane sheets within the roof field, next to each other, overlap them, and bond them in the overlap using double-sided butyl rubber adhesive tape.

Dimensions: Membrane is available with a cup height of 10 mm, 20 mm, 40 mm and 60 mm. Water retention membrane dimensions are to be chosen by a garden architect, depending on the roof garden design.

Packaging: Rolls or boards

2.3.6.2 Drainage and hydroaccumulation textile

Description: Non-woven textile from synthetic fibers.

Use: Protective, hydroaccumulation and drainage layer for vegetation roofs.

Application: Installed edge to edge, loosely, directly on waterproofing layer.

Dimensions: 600 x 1,200 mm, thickness 20 mm - 40 mm

Packaging: Na pallets.

2.3.6.3 Hydrophilic mineral wool

Description: Mineral wool boards.

Use: Protective, hydroaccumulation and drainage layer for vegetation roofs. It partially replaces the substrate and is used to root plants.

Application: Installed edge to edge, loosely, directly on waterproofing layer.

Dimensions: 600 mm x 1,000 mm, thickness 50 mm - 100 mm

Packaging: on pallets.

2.3.6.4 Petexdren drainage membrane

Description: Geosynthetic mat made of polyethylene fibres. Maintains high water permeability even when loaded by other structural layers. Available in black or white.

Available separately or as a sandwich combined with PE-based non-woven fleece.

Use: A drainage and separation layer in traffic, green, aggregate-loaded flat roofs and in roofs with a control and refurbishment system.

Application: Place Petexdren edge-to-edge, directly on the waterproofing membrane. If using Petexdren without non-woven fleece, place the fleece separately on the mat. Since Petexdren has limited resistance to direct weather conditions, the subsequent layer must be placed as soon as possible after its installation.

Dimensions: Petexdren 400 – thickness 3.0 mm
Petexdren 900 – thickness 6.0 mm
Petexdren 600 + 300 (composite) – thickness 7.0 mm

Packaging: 1,500 mm wide rolls

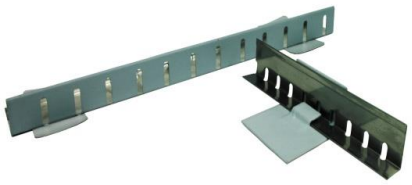
2.3.7 Other

2.3.7.1 Shingle flashing

Perforated stainless, aluminium or plastic coated sheet metal L-shaped flashing with bent edges for added strength.

Dimensions: (50 (100) x 30 x 2.500) mm or (40 to 90 x 60 x 2000) mm

Application: Securing and ending stabilisation layers of roof decks loaded with bulk material or pavers on support pads at the roof perimeter. Attached to substrate by integrated strips or membrane cut-outs welded to roof covering



2.3.7.2 Lightning rod holders

Supporting components with plastic or concrete base and a lightning rod wire fastener. Alternatively available as an all-plastic support with a sleeve

Dimensions: Depends on manufacturer

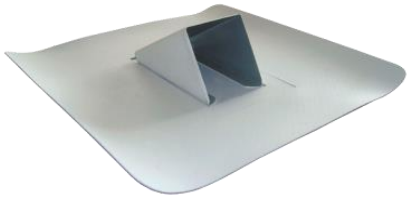
Application: Supports lightning rods on flat roofs as well as on perimeter structures.

2.3.7.3 Snow guard

Plastic coated sheet metal profile with or without membrane sleeve

Dimensions: depend on manufacturers

Use: Prevents snow from sliding off the roof**.** Guard is mechanically fastened to roof structure and its membrane sleeve allows waterproof connection to roofing membrane.



2.3.7.4 Roof Tiles spacers

Basic or adjustable roof tile spacers

Dimensions: depend on manufacturer

Use: Spacers made of thermoplastic (PE, PP) can be placed directly on roofing membrane**.** Rubber spacer has to be separated from roofing membrane. Use a patch made of FATRAFOL membrane combined with non-woven textile as separation layer.

2.3.7.5 Fall protection system

Stainless, permanent eyebolt anchor designed for temporary attachment of fall arrestors. Various versions are available, allowing installation in reinforced concrete, wooden substrate, steel beams and trapezoidal sheet metal.

Use: Eyebolt anchors are designed for installation on flat roofs with a free fall depth of at least 1.5 m. It allows safe movement of fitters and persons inspecting, maintaining and repairing the roof. Must not be used for lifting purposes.

Dimensions: Depends on manufacturer.

Packaging: Depends on manufacturer.

2.3.7.6 Butyl-rubber tape

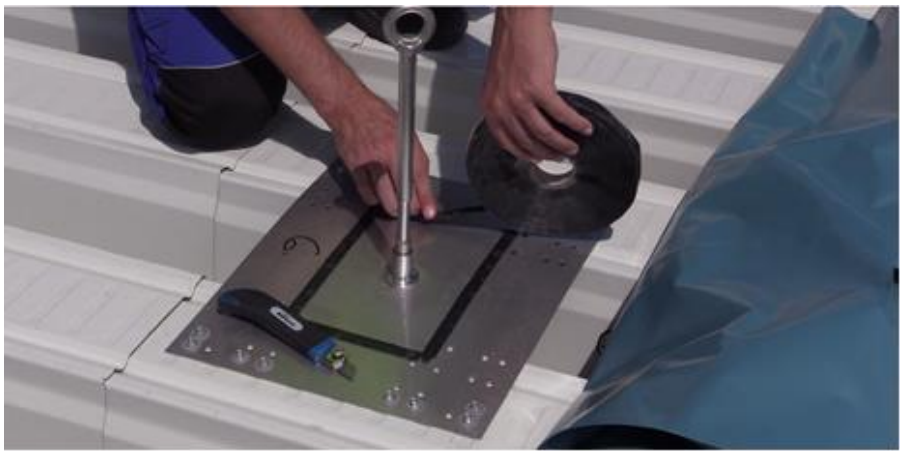
Double-sided butyl-rubber adhesive tape, UV stable, black colour

Application: Gas-tight joining of vapour control membranes, sealing of details, penetrations and connections to perimeter structures

Advantages: Extreme resistance to ageing, high tensile strength, dimensional stability, processing temperature from +5 °C to +40°C, thermal resistance from -30 °C to +80 °C

Dimensions: Width: 15 mm, roll length: 45 m (other lengths available)

Packaging: Paper boxes



2.3.7.7 Levelling compound for flat roofs

A levelling compound for flat roofs, made of natural perlite and coated in asphalt.

Use: Levelling of flat roofs, mostly during renovations of asphalt coverings, creating slopes

Application: material is spread on surface by wood plank and compacted (aprox. 30%) after a matrix is mixed with emulsion or matrix is applied directly on penetrated surface and then compacted. Application procedures may vary depending on producers.

Advantages: Easy to process

Technical parameters:

- Consumption: approx. 13 l per m^2 and 10 mm of thickness
- Thermal conductivity: 0.07 W/(m.K)
- Apparent density: 300 kg/m^3

Packaging: 100 l/bag or 25 kg/bag

Producers: Boerner Thermoperl-RM, Knauf Bituperl, Bachl Flachdachdammung.

3 BASIC CONSTRUCTION PRINCIPLES

3.1 General roof design requirements

Essential requirements for roof deck composition:

- Protection of interiors or structures against weathering
- Mechanical resistance and stability
- Fire safety
- Hygiene, health and environmental protection
- Protection against noise
- Safety and accessibility when use
- Energy savings and thermal protection
- Sustainable use of natural resources
- Other requirements (appearance, durability, reliability of the roof and its parts etc) as specified by the owner

Roof design must be such that the roof, throughout its service life, is resistant to mechanical and dynamic loads, corrosive, chemical, biological, electromagnetic and atmospheric effects and does not allow water or moisture to migrate into the roof structure. Roofs must meet thermal insulation requirements under CSN 73 0540-2 and sound insulation requirements as determined by a sound insulation calculation.

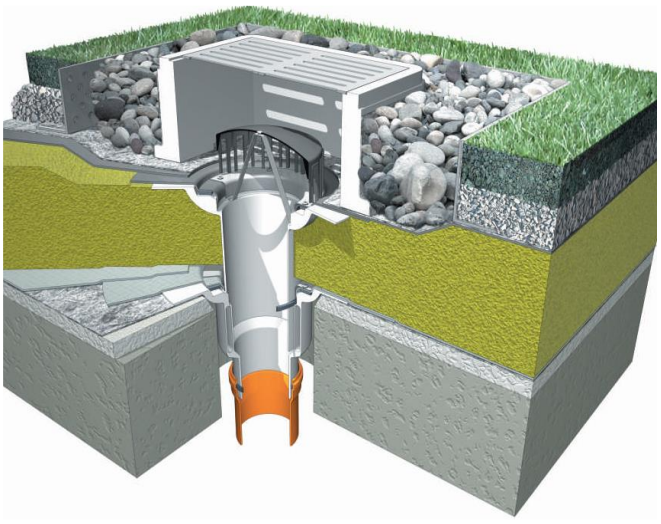
The roof project must give a full and clear description of roofing materials, technology, structure and roof use. The roof structure must withstand loads specified in applicable standards.

Throughout its service life, the roof deck must withstand all actual and estimated loads caused, in particular, by its self-weight, traffic and stabilisation layers, rooftop equipment, snow, water and ice including their mechanical effects, wind uplift and pressure, temperature changes and by roof deck use and maintenance.

None of the loads may cause the roof, its layers or components to lose its/their function, suffer damage or become less durable or reliable.

This chapter describes the required quality, design and securing of individual roof deck layers with regard to the use of FATRAFOL waterproofing membranes in these constructions:

- Mechanically fastened, flexible roof waterproofing coverings,
- Bonded waterproofing coverings,
- Waterproofing coverings with an aggregate or traffic layer,
- Waterproofing coverings with a green layer.
- Roof covering for walkways



3.2 Substrate structure

3.2.1 Requirements for substrate of new roof decks

The substrate of the main and, where applicable, of the securing waterproofing layer may be made of cement screed or concrete overcoat, ceiling or roof concrete slabs or panels, steel trapezoidal sheet metal, planks or boards made of wood-based materials, foam silicate, rigid boards made of mineral fibres and other commonly used thermal insulating materials. The substrate top surface must be unbroken and sufficiently firm (compressive strength of no less than 60 KPa at 10% compression). The substrate strength of traffic roofs is determined by the loads they are exposed to and by the structure of the traffic layers. The substrate must be free of any impurities and unevenness.

Since CSN 73 1901-1 does not give a definition of substrate planarity, make sure to always take into account what technical standards, current legislation and the investor requirements and, if possible, note this in the site handover and acceptance report. Although a substrate may be damp, it must be free of puddles, snow and ice.

If the roof covering is to consist of a FATRAFOL membrane, no roof deck layer beneath the covering may contain tar or substances from which organic solvents evaporate.

Impregnation agents for wooden substrates for FATRAFOL membranes must not contain oils or highly volatile organic solvents.

Wooden load-bearing components should be accessible for inspection, repair or renovation of the wood chemical protection throughout the structure’s service life.

The structural protection of wood is primarily designed to ensure such moisture of wooden components in the building that prevents the growth and activity of fungi and insects harmful to wood. Central European species of insects and fungi harmful to wood cease being active when wood moisture drops below 10% and 20% respectively. The only exception is dry rot fungus, which is active at wood moisture as low as 16%.

3.2.2 Requirements for substrate of refurbished roofs

Essential substrate requirements are specified in article 3.2.1.

If proper separation is used, a new waterproofing layer may be laid on asphalt roofing sheets, sheet metal, levelling compound, sprayed polyurethane, old covering of rubber and plastics, traffic layer etc. Always make sure to thoroughly check the quality and cohesion of the substrate as well as its wear. A thermo-technical calculation should be made to determine the roof moisture and moisture regime. It is essential to assess the effect of shape and dimensional changes of installed roof materials, review the slope ratios and functionality of the existing roof drainage, to check if any additional safety components are necessary for roof inspections and maintenance etc.

It is of prime importance to check the structural effectiveness of the planned fixing layer and to document the pull-out force of the fasteners to be used. The minimum pull-out force per fixing point should be at least 1,000 N. If the pull-out force is lower than that, make sure to take this into account in the fixing plan (use more fasteners, combine various methods to secure the roof covering).

Roofing materials must be so placed and combined that there is no unwanted interaction between them at the point of contact or through a water layer or water flow. A separation layer may be used to keep materials apart.

If the roof load capacity and the condition of existing materials so permit, you should keep as many of the original materials as possible on the roof. Materials removed during renovation projects should be recycled or landfilled.

The surface must be sufficiently flat, free of bulges and big undulations. Any major unevenness must be removed or filled with a suitable material.

When refurbishing single-ply bitumen roofs with a negative water vapour balance where no additional thermal insulation is required, it is necessary to perforate the asphalt waterproofing layer with at least five 50 mm big holes per square meter of the roof (1% of the area). This will allow an unobstructed discharge of water vapours through the asphalt covering. In refurbishment projects that include installing additional thermal insulation, the original asphalt waterproofing membrane functions as a vapour barrier. In most cases it is recommended to install new vapour control membrane following CSN EN ISO 6946. If probe reveals roof negative humid condition it is necessary to take measures to lower trapped humid in roof structure. To remove entrapped moisture, use substructure vent outlets (Detail 610S).

3.2.3 Substructure requirements for mechanical fastening

3.2.3.1 Fasteners for trapezoidal steel sheet metal

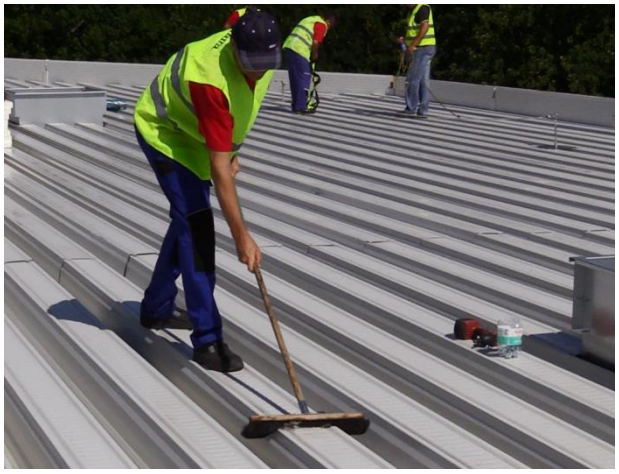
Roof supporting structures made of trapezoidal sheet metal must withstand the loads specified in applicable standards. Bending and any other shape or dimensional changes caused by mechanical loads on the roof,

temperature, and shape and dimensional changes of roof layers must not have an adverse effect on the roof function or on related structures. Bending must not exceed limits set by applicable standards. The supporting structure design must take into account the interaction of some metals (see CSN 73 3610).

Along the perimeter of the roof and around the perimeter of all penetrations, especially where the sheet is cut longitudinally or obliquely, trapezoidal sheets must be lined with suitable flashing elements to ensure the reinforcement of the roof panel edge is in accordance with EN 1090-4.

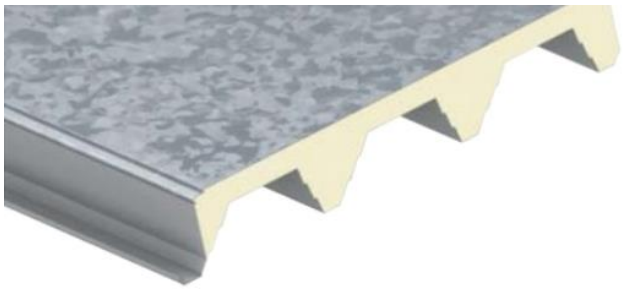
Waterproofing membranes must not be placed directly on trapezoidal sheet metal without a suitable layer that can withstand the pressure during the hot-air welding process (minimum compressive strength for thermal insulation boards is 60 kPa at 10 % compression). Minimum thickness of layer that supports the membrane on trapezoidal sheet is specified by manufacturer. Place the membrane perpendicularly or obliquely on the waves of the trapezoidal sheet, mechanical fasteners must not be placed in one wave, the fastening is always done in the upper wave.

Waves in trapezoidal steel sheet metal must not be filled with lightweight concrete. Remove dirt and standing water from top (crest) and bottom (trough) of wave before trapezoidal sheets get covered by other layers. Tread all cut metal surfaces that will be installed to roof structure against corrosion.



3.2.3.2 Mechanical fastening to sandwich panels

The waterproofing membrane is mechanically fastened to the top sheet (usually 0.7 mm thick) of sandwich roof panels with surface sheets on both sides of the insulating core



The waterproofing membrane is mechanically fastened to the bottom plate of the roof sandwich panel in case when panels has a supporting plate on the interior side and with a top base layer based on mineral fibers. The membrane can be also adhered to the panel.

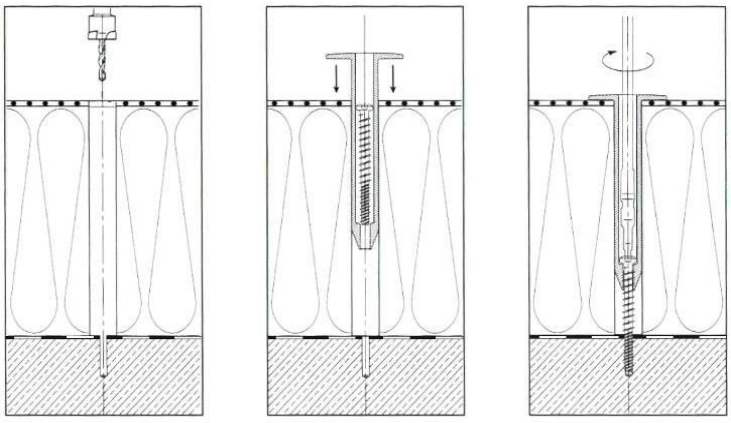
When fastening membranes and profiles made of plastic-coated sheets to wall sandwich panels with sheet metal with a thickness of less than 0.63 mm, it is necessary to use the designated fastening elements (e.g. rivet, BS-6.8 screw, etc.).

3.2.3.3 Fasteners for concrete and reinforced concrete

The substrate must be continues (unbroken) and sufficiently strong (at least 14 days old). Concrete curing time will prolong in winter time). Tensile tests must be performed for renovated flat roofs. The substrate must be free of any impurities and unevenness. The surface may be damp but it must be free of puddles, snow and ice.

3.2.3.4 Fasteners for thin concrete prefabricates

The substrate – prefabricate – surface must be unbroken and free of sharp edges and nibs. Open joints must be filled with suitable material. The substrate must be free of any impurities and unevenness. The surface may be damp but it must be free of puddles, snow and ice. For roof restoration, roof substructure static load test describing maximum additional load and way of anchoring is required.



Anchoring membrane to concrete through thermal insulation

3.2.3.5 Fasteners for porous concrete

The porous concrete substrate (glass concrete, foam concrete and gas concrete) must. It is recommended to always perform a pull out test.

3.2.3.6 Fasteners for wooden substrates

Substructure surface must be continues and must able to withstand intended additional load. All components of the wooden structure (solid timber, large boards with added wood substance) except for cementitious boards must be treated against pests. An appropriate structural measure must be taken to ensure the service life of wooden components that are integrated into a structure with humidity exceeding 16% or that may be subject to additional exposure to water in the structure (e.g. due to condensation). Possible measures include building a two-ply roof with a ventilated air layer, adding a safety waterproofing layer etc. Even with a well ventilated air layer, water vapour condense on the underside of the top ply may appear. The roof deck design must take this phenomenon into account. Wooden load-bearing components should be accessible for inspection, repair or renovation of the wood chemical protection throughout the structure's service life.

If mechanical fasteners producer does not determines otherwise, wood planks minimum width suitable for mechanical anchoring is 17 mm, usual 25 mm. For wood particle boards ("wood particle boards") it is min.18 mm.

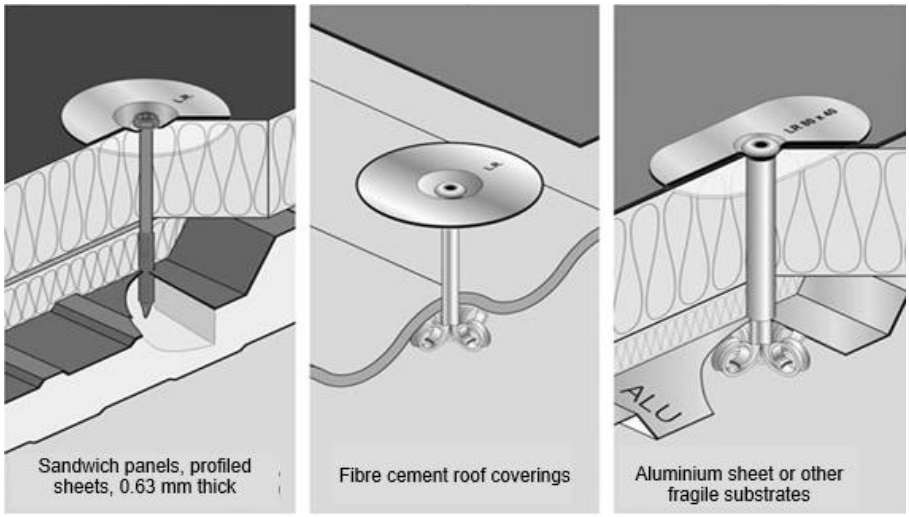
Planks must be installed tightly edge-to-edge, membrane is placed perpendicular to direction of planks, this way we avoid fastening a raw of fasteners to one plank. wood particle and plywood panels must be installed with expansion joints recommended by the manufacturer.

3.2.3.7 Problematic substrates

Problematic substrates are:

- Steel sheet with thickness smaller than 0.63 mm
- Aluminium sheet
- Concrete screed
- Wood-cement board
- Large format wood particle boards thinner than 18 mm

It is recommended to conduct pull-out resistance tests for all of these substrates and to verify their point load capacity.



3.3 Vapour control layer

Vapour control layers are integrated into roof decks to reduce water vapour diffusion flow from the interior into the roof deck and thus to avoid the condensation of water vapour and its related negative impacts *) . Water vapor condensed in the thermal insulation layer significantly impairs its insulating properties.

Vapour control layers are made of materials with high diffusion resistance. Only materials that can be airtight joined between each other and to penetration and end structures may be used

A vapour control layer made of a vapour control membrane, which is joined gastight, is placed under the thermal insulation layer, towards the inner surface of the roof structure. If a silicate pitched layer is used in the roof deck, the vapour control layer is placed on it. Vapour permeability of layers should increase towards the roof deck surface to ensure gradual removal of water vapour.

Placing a vapour control layer under a monolithic pitched or thermal insulation layer is not recommended unless moisture removal is provided for this layer from the above.

A protective or separation layer of suitable textile should be placed on a monolithic or prefabricated base or pitched layer of silicate materials, under the vapour control layer made of lightweight membranes.

To dimension the vapour control layer, make a moisture calculation. If FATRAFOL open-diffusion membranes are used and if the roof deck does not have old coverings made of asphalt sheets or another closed-diffusion layer under the waterproofing membrane, a vapour control membrane with a Diffusion equivalent air layer thickness 50 m is suitable for most applications.

If a thermal insulation layer of foam glass is used, no vapour control layer need be installed. However, always check if a vapour control layer may be omitted by making a thermo-technical calculation, assessing the water vapour balance in the roof structure and arranging the roof deck layers properly with respect to heat transfer coefficient and water vapour diffusion resistance.

Joints must remain fully functional on the entire layer throughout the roof service life or the design calculation must reflect their potential lack of tightness.

Perforation caused by fasteners does not have an effect on the overall functionality. The actual perforation in PE membranes is negligible since openings are filled by fastener shafts. In asphalt vapour control layers, the perforation value is even lower.

A vapour control layer may also function as an airtight layer or a securing waterproofing layer. If a vapour control layer also functions as a securing waterproofing layer, it must be drained. Outlets should be connected to a separate downpipe, known as ‘dry riser’ or, via a separate connection with a non-return flap, to a shared downpipe of the drainage system of the main waterproofing layer. Securing waterproofing layer minimum slope towards a drain fixture is 1%.

**) For buildings where the indoor temperature is usually lower than the outside (e.g. cold stores), it is necessary to install the vapor barrier on both sides of the thermal insulation.*

3.4 Thermal insulation

Thermal insulation must meet requirements placed on flat roofs, be heat-resistant and dimensionally stable, must not be subject to volume and shape changes, must be made of materials with reduced absorption of water and humidity and must be resistant to biological corrosion.

Thermal insulation materials must be resistant to the loads they are exposed to in roofs for specific time period.

Thermal insulation layers made of panels must be unbroken. Where the warping or dimensional and shape changes of the substrate or thermal insulation boards are likely to create gaps between thermal insulation boards, then boards with a half-groove should be used. Boards are placed in a brick pattern.

If a thermal insulation layer includes more boards placed atop each other, gaps of the upper layers should not align with gaps of the bottom layers. Due to the elimination of thermal bridges, it recommends a minimum displacement of the joints by the thickness of the insulation. In the case of different thicknesses isolated by a larger one.

A thermal insulation layer for inverted roofs must be made of a water resistant material that is guaranteed by the manufacturer to maintain its thermal insulation properties when exposed to water. Low water absorption materials should be used. It is recommended to take into account the effect of flowing water by calculation according to CSN EN ISO 6946.

In order to ensure sufficient substrate rigidity, which is necessary also for joining roof waterproofing membranes, thermal insulation boards must meet the following requirements:

- Compressive strength at 10% compression according to EN 826 ≥ 0.06 N/mm^2 (60 kPa). This requirement applies either to homogeneous materials or to the top layer of multi-layered or composite products.
- Behaviour under point load according to EN 12430 ≥ 500 N at 5 mm deformation.

3.5 Separation layer

Separation layers protect waterproofing membranes and separate them from any layers that may, in case of direct contact, interact negatively with them.

FATRAFOL waterproofing membranes without back-fleece must be fully separated from all types of substrates. Recommended separation layers described in Table 5. In case the surface is smooth without risk of mechanical or chemical damage of the membrane and at the same time separation layer is not needed due to external fire resistance, it is possible to skip separation layer. Typical detail is the inner vertical surface of parapet made of sandwich panels. In case the surface is smooth without risk of mechanical or chemical damage of the membrane and at the same time separation layer is not needed due to external fire resistance, it is possible to skip separation layer. Typical detail is the inner vertical surface of parapet made of sandwich panels.

Table 5: **FATRAFOL-S system separation layers**

Substructure	**Mechanically fastened roof coverings with fire resistance requirement in accordance with EN 13501-5+A1**	**Mechanically fastened roof coverings without fire resistance requirement in accordance with EN 13501-5+A1 and roofs with stabilisation layer**
Concrete	non-woven textile min. 200 g/m^2 + glass fibre fleece min. 120 g/m^2	non-woven textile min. 300 g/m^2
Bituminous sheets	non-woven textile min. 200 g/m^2 + glass fibre fleece min. 120 g/m^2	non-woven textile min. 300 g/m^2
EPS and XPS insulation	glass fibre fleece min. 120 g/m^2	non-woven textile min. 200 g/m^2 + glass fibre fleece min. 120 g/m^2
MW and PIR/PUR insulation	separation is not required	separation is not required
Wood planks	non-woven textile min. 300 g/m^2 + glass fibre fleece min. 120 g/m^2	non-woven textile min. 300 g/m^2
OSB and other wood particle boards	glass fibre fleece min. 120 g/m^2	a) wood boards without groves and tongues - non-woven textile min. 300 g/m^2 + glass fibre fleece min. 120 g/m^2 b) wood boards with groves and tongues - non-woven textile min. 200 g/m^2, or completely without separation
Rubber pads (e.g. part of air conditioning unit bases, paving pads, etc.)	a) up to 5 mm thick – roofing membrane FATRAFOL th. min. 1.50 mm b) over 5 mm thick- roofing membrane th. min. 1.50 mm + non-woven separation textile or glass fleece placed between membrane and rubber	

3.6 Main waterproofing layer

The main waterproofing layer prevents the ingress of atmospheric, service or technological water into or under the roof.

The position of the layer depends on the required roof structure performance.

The design of the main waterproofing layer must be based on roof purpose, fastening method, fire requirements along with reliability, durability and feasibility. The choice of fasteners for the waterproofing layer must be based on the required load capacity during the roof service life.

The main waterproofing layer of the FATRAFOL-S system is suitable also for zero-slope roofs when membrane FATRAFOL 810 (810/V) is used. Although standing water and puddles on a roof covering do not have a negative impact on the performance and service life of FATRAFOL waterproofing membranes, it is recommended to slope the roof covering for structural reasons. The recommended slope depends on the roof structure use.

The main waterproofing layer of the FATRAFOL-S system usually consists of a single layer of the specified roofing membrane type.

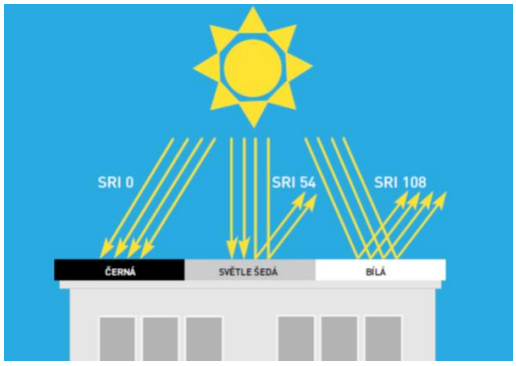
3.6.1 Choosing a suitable membrane type for the main waterproofing layer

A manufacturer of waterproofing membranes, Fatra, a.s., Napajedla offers 4 types of waterproofing membranes within the FATRAFOL-S system. Their suitability for use for certain roof systems and the way of installation to substrate is described in product data sheet..

The selection of a suitable membrane for a given project and the considered composition is assessed according to several criteria, the main criteria include:

- Placement of the membrane on the roof cladding (top unprotected layer exposed to the weather conditions or layer protected by a ballast or utility layer)
- Method of securing the waterproofing membrane against wind loads (mechanical fastening, adhering, ballast layer)
- Fire protection of the building (fire resistance of the roof cladding (hereinafter FP) and its required resistance to exposure to external fire)
  - FP of the designed structure is its characteristic and is proved by a test according to EN 1365-2 performed in an accredited testing laboratory and the subsequent issuance of a fire classification protocol according to EN 13501-2. The essence of the test is to prove the FP of the evaluated structure, i.e. the sandwich of the supporting structure of the roof cladding and the roof covering itself in the event of a fire from the inside. Based on the test of the given structure, FP is expressed in the format e.g. REI 15 DP1, REI 30 DP1, etc. This test is usually performed by the manufacturers of thermal insulation in cooperation with manufacturers and suppliers of load-bearing structure and waterproofing coating. The waterproofing covering made of plastic membranes itself is part of the fire resistance test, but it does not have a significant effect on its result.
  - From the point of view of the behavior of the roof or roof covering when exposed to an external fire, requirements for classification according to EN 13501-5 into various classes arise. These requirements differ fundamentally in national systems. In the Czech Republic, the classifications BROOF (t1) and BROOF (t3) apply. These classifications apply to the whole composition under test, not only to the waterproofing plastic membrane itself. It forms only one part of this composition!

- **energy performance of the building**
  - In connection with the requirements for reducing the energy performance of buildings, low absorption and high reflectivity of sunlight from the roof surface are required for some projects. This depends on the color and structure of the membrane surface as well as the thermal conductivity of the layers under membrane. The dark colored membranes contributes to an increase the surface temperature of the coating, which can exceed 80 ° C. The surface temperature can be further increased by the reflection of the surrounding surfaces (e.g. reflection of sunlight from facades, glazed surfaces, etc.), which should also be taken into account



  - White membranes best reflect sunlight and are used advantageously for energy-efficient buildings and for roofs with photovoltaic systems.
- **hydrophysical stress of waterproofing membranes**
  - On flat roofs as well as in protective and operational roofs, a layer of water acting under hydrostatic pressure is formed during rain or melting snow. The corresponding membrane thickness for this stress is min. 1.5 mm (recommendation CSN P 73 0606).
  - For roofs with membranes protected by a ballast and utility layer and roofs where photovoltaic power plants will be installed, it is recommended to choose a membrane with a thickness of 1.80 mm and higher

- A continuous layer of water can in some cases positively affect the life of the waterproofing membrane due to its ability to absorb thermal and reflect UV radiations. However, for practical reasons, it is preferable to drain water from the roof cladding.

- **Corrosion stress of the waterproofing membrane, compatibility with other layers of the roof cladding**
  - Corrosion stress on the roof is caused mainly by chemical, thermal, biological, electromagnetic or atmospheric influences, the environment around the building, as well as the operations and environment in the building. FATRAFOL membranes have very good corrosion resistance and the effect of the expected higher corrosion stress is usually sufficient to eliminate by increasing the membrane thickness
  - For PVC-P membranes, the generally known property is incompatibility with some building materials such as EPS, XPS, asphalt-based materials, rubber, etc. It is always necessary to avoid direct contact of the waterproofing membranes with these materials by inserting a suitable separating layer. Insufficient separation can significantly contribute to reducing the functionality and life of both materials.

To choose the most suitable membrane type for your application, refer to the recommendations in table 7. In practice, it is possible and usually also beneficial to combine some types of membranes on the roof, taking into account their typical technical properties and performance

Table 6: Use of FATRAFOL roof waterproofing membranes

Roof system type/waterproofing membrane type	Unprotected membrane, exposed directly to weather		Membrane protected by a loading or service layer		Recommended primary use of membrane
	Mechanically fastened	Adhered	Loaded with pavers, Gravel ballasted	Roof gardens	
FATRAFOL 807	+ *)	+ +	+ *)	–	Adhered systems- renovation of asphalt roofs
FATRAFOL 807/V	–	+ +	+ *)	–	Adhered systems
FATRAFOL 807/G	–	+ +	+	–	Adhered systems – new roof covering, composition with thermal insulation based on EPS
FATRAFOL 810 a 810/V (T1, T3)	+ +	–	+ *)	+ *)	Standard roofs with mechanically fastened waterproofing covering
FATRAFOL 814	+ +	–	–	–	Top, pedestrian traffic layers of balconies and terraces
FATRAFOL 818	–	–	+ +	++	Roofs with ballast or traffic layer

+ + *Primary use* + *Suitable for use* – *Unsuitable for use*

*) *Suitability for use in a specific application should be consulted with the manufacturer.*

3.6.2 Securing waterproofing membranes

3.6.2.1 Protecting membranes from internal forces

All membranes made of plasticized PVC are subject to dimensional changes depending on temperature and exposure time. The causes of this phenomenon lie in the production technology, thermal expansion and long-term structural changes in the membrane material.

While dimensional changes take place throughout membrane service life, the biggest ones (mostly contraction) occur just after membranes are unrolled from a tightly wound roll and when freely lying membranes are first warmed by sunshine or another source of heat. Therefore, after unrolling membrane sheets on the roof, you should leave them lie unconnected and unfastened for some time. In warm and sunny weather, the process takes a few minutes only, otherwise allow approximately half an hour.

Slight corrugation of the waterproofing membrane in the FATRAFOL-S system can be observed in the period after application, is a phenomenon related to the production process and material property, such as its thermal expansion and the conditions of the waterproofing coating. The membrane corrugation caused by these effects usually disappears during one season

To avoid further effects of internal forces, the covering must be fastened to a solid substrate at the perimeter or in the structure base, in accordance with applicable specifications. Likewise, a membrane must be fastened in roof valleys, when waterproofing valley and parapet gutters, at the perimeter of projecting structures, along all roof deck penetrations as well as in places where roof contraction may negatively affect the performance and stability of the

covering (creation of fillets and 'trampolines'). Such perimeter fastening is necessary also when the covering is later loaded with a stabilisation, protection or traffic layer or with green layers. In roofs with the standard arrangement of layers and a mechanically fastened waterproofing membrane, additional membrane contraction has also a positive effect on the planarity of the roof external surface by eliminating the undulations that cannot usually be avoided during the waterproofing layer installation.

From a structural point of view, dimensional changes result from forces acting, with varying intensity, inside the membrane in all directions at the level at which the membrane is unfolded. Tension generated in any point of the covering depends on the dimensions and shape of the surface being waterproofed and on the position of fixed elements (fasteners, protruding structures, penetrations, rainwater outlets etc). Fasteners in the roof deck structure should preferably be tensioned in a manner that guarantees a better transfer of active forces, i.e. subjected to pull rather than bending stresses.

To meet the above requirements, use linear plastic-coated metal profiles to which the membrane may be welded homogeneously. Basic shapes of plastic-coated metal profiles are given in Table 4. Maximum distance between fasteners is 250 mm (plastic-coated metal profiles fasteners density is 4.5 pc/m when installed edge to edge with 2 mm expansion gap). Blind rivets, dowels, wood screws, screws, nails etc may be used as fasteners, depending on the substrate. Adjacent fasteners must be spaced at a minimum of 150 mm. If installing profiles of a greater width, place fasteners in two lines, following a zigzag pattern.

When fastening perimeter profiles, make sure their length expansion is possible. Under CSN 73 3610, the maximum length of an expansion section is 6 m. If using plastic-coated and film-coated sheet metal, standard sheet metal joints and expansion modifications are not possible.

In addition to perimeter fastening, all PVC-P membranes, with only exception mentioned in art. 2.1.9.4, designed for mechanical fastening must be secured against internal forces also within the roof field. The recommended minimum fasteners density is 2 pcs/m^2. It is possible to adjust distance between fasteners when fastening membrane to trapezoidal sheets to its wave length.

3.6.2.2 Fastening of internal corner flashing

Internal corner flashing must be mechanically fastened to either load bearing horizontal or vertical substrate. The most common method of fastening to steel deck roofs is fastening to horizontal surface using screws or combination screw + plastic tubes. In case of using plastic sleeves it is necessary to pre-drill holes in horizontal part of internal corner flashing with same spacing as steel deck ribs. Plastic-coated sheet metal internal corner minimum developed width, used in system FATRAFOL -S and produced by manufacturer, is 70 (50/20) resp. 100 mm (60/40). For individually manufactured profiles of other dimensions, we recommend that the angle arm intended for mechanical fastening or welding should be at least 40 mm wide!

Following rules apply for fastening of internal corner flashing to vertical parapets made of sandwich panels:

- If the sheets of FATRAFOL membrane are oriented perpendicular to parapet, common fasteners can be used. The wind uplift forces are eliminated by fasteners placed in horizontal field of the roof.
- If sheets of FATRAFOL membrane are oriented parallel to parapet, fasteners recommended by manufacturer for given thickness of steel should be used (e.g. BS-6,8). Riveting is an alternative. The maximum distance between the nearest fastening row and the inner surface of the parapet should not exceed 950 mm. Wind load calculation can confirm bigger distance (Detail 410aS). Fasteners for fastening internal corner flashing transfer not only internal forces but also external forces from wind.

3.6.2.3 Securing the roof covering against external forces

Wind uplift is the most significant external force affecting the roof covering surface. The uplift force depends on many factors, of which the critical are in particular the terrain category, geographic position of the building, and building height. Other influencing factors are for example the parapet height and roof pitch. The volume of uplift forces is different in individual roof zones defined in CSN EN 1991-1-4, see Figure 2. Uplift forces from the wind affecting the roof cover must always be prevented using one of the conventional fixation methods, i.e. mechanical fastening in the bearing base, additional load, gluing or other suitable method.

If there is no reason to use other fixation method to eliminate uplift forces, mechanical fastening in the bearing base is preferred in the FATRAFOL-S system as compared with other fixation types.

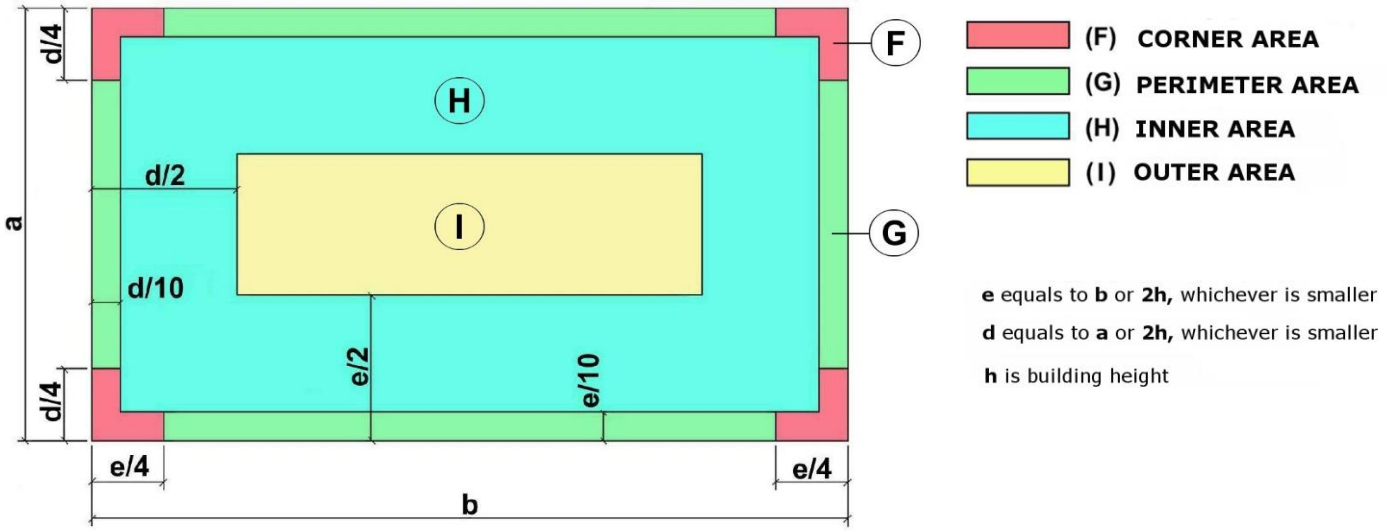


Figure 2: Example of flat roof divided into individual zones

3.6.2.3.1 Mechanical fastening of the water-proofing cover

Following general rules apply to mechanical fastening of the water-proofing cover:

- Fasteners must be arranged in the specific roof section as evenly as possible, so that the membrane and its under layer were stressed evenly to the maximum extent. Significantly irregular span within single line or omitted fasteners result in reduced efficiency of fasteners and represent a potential risk of anchoring failure.
- Fasteners are fitted usually in parallel lines in strip overlaps. Combination of the membrane strips width and the span of fasteners determine the real density of fasteners. In cases when there is impossible to place all fasteners in overlaps only, they are fitted in the strip area and such fasteners are then covered with the membrane of the same thickness and width of 160mm, or with circular patches. These are so-called inserted anchoring lines.
- Should the anchoring base be a boarded decking or corrugated sheet, membranes strips must always be oriented perpendicularly, or crossways in exceptional cases, to boards or corrugation of the sheet. This eliminates automatically anchoring to the same board or sheet within one anchoring line, which may exceed bearing capacity of base anchoring to other support components of the roof. For anchoring to the boarded decking or wooden boards, it is recommended, if technically possible, to place fasteners above the support structures of the roof, e.g. roof spars.
- If anchored in the corrugated sheet, fasteners are placed exclusively to upper waves of the sheet with interaxial spacing corresponding with the pitch of waves. Water-proofing membrane may not be laid directly on the corrugated sheet, since it does not provide full membrane support in its entire area, so the welding is necessary. In these cases, either a thermal insulation or wooden board must be added to the roof shell, or another suitable solution must be chosen.
- If the calculation shows that lower anchoring density than 2 fasteners/m^2 is required, in spite of that we suggest following this value in the specific zone. Typical example is represented by zones “I“ on roofs with extensive areas where the design load is usually about 0.5 kN/m^2. Minimum suggested density of fasteners 2 pcs/m^2 thus ensures sufficient membrane fixation even against inner forces. On corrugated sheets with the combination of membrane width of 2.05 m and wave span greater than 260 mm, the density of fasteners

2 pcs/m^2 cannot be followed. In such case, anchoring is made with the density, which allows the wave span. Design anchoring density should however not be lower than ca 1.6 pcs/m^2.

- Minimum distance of fasteners should not be lower than 150 mm in FATRAFOL S system. If the distance between two fasteners is lower than 120 mm, they are considered as one according to EAD 030351-00-0402.
- Selection of fasteners to various underlayers including their lengths is made usually in collaboration with anchoring technology manufacturers' / suppliers' recommendations while respecting technical requirements, e.g. for max. clear thickness, min. anchoring depth, etc.
- To achieve full efficiency of the fastener, its correct placement into the base is necessary,. The edge of plate (metal washer, tube) must be at least 10 mm form the edge of membrane sheet.

- For concurrent stabilization of the water-proofing and thermal insulation layer of roofs with conventional arrangement of layers, it is necessary to take into account also dimensions of used components of the thermal insulation when defining the spacing of fasteners. In central areas of the roof where a membrane width of 2,05 m is often used, the thermal insulation must in principle be fastened separately. Thermal insulation manufacturers usually suggest independent fastening of thermal insulation parts with the density of 2 pcs/m². Fasteners designed for independent stabilization of thermal insulation layers are not counted towards statically efficient anchors of the water-proofing cover.
- When height of parapet doesn´t exceed 600 mm, vertical membrane is welded only to flashing components at the bottom and on the top of parapet.
- One of the following options has to be used when the height of parapet is between 600 and 1200 mm and therefore additional fastening of vertical membrane is required:
    - Welding the membrane to mechanically fastened horizontal plastic coated metal strip (Detail 510S).
    - Point fastening with patching, distance between fasteners is 800 mm (Detail 511S).
    - Seam fastening in overlaps (Detail 512S, 513S).described
- When height of parapet exceeds 1200 mm add one or more horizontal fasteners rows and follow same principles as described above

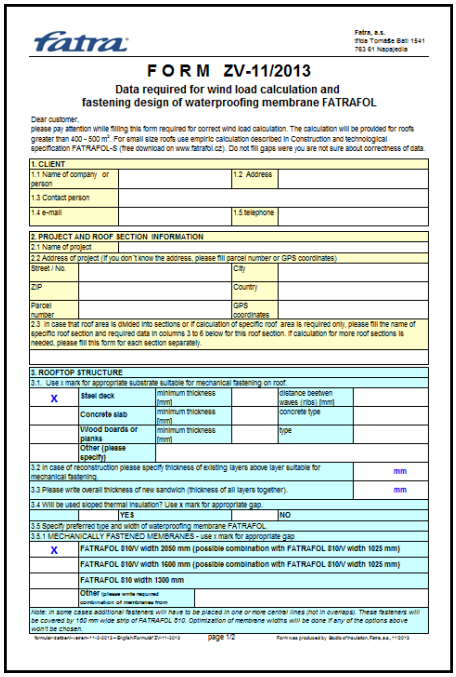
3.6.2.3.1.1 Calculation of wind load and mechanical anchoring proposal

Rated load capacity of a single fastener is defined using test described in European technical assessment (EAD 030351-00-0402, or tension test results performed on the site. Design load capacity of a single fastener is defined as the lowest of all recognized or calculated values.

In case of renewals and anchoring in older underlayers, in particular concrete screed, light concrete, and original wooden decking, but also in thin sheets, it is always necessary to perform so-called tension tests on the roof. Pull out test supplier defines in the protocol form the design load capacity of the fastener in the underlayer, taking into account safety coefficients under EAD 030351-00-0402.

Fatra, a.s. provides informative calculations of wind load with the proposal of amount and specification of fasteners for the roofs with FATRAFOL roof membranes. Calculations are made for roofs with the area exceeding 400 m^2. The calculation is not claimable automatically and may be rejected, e.g. due to small roof area. Calculations do not substitute static calculations for execution, which are made by authorised engineer or static designer only.

Calculation processing is subject to sending complete details to respective regional business-technical representative or to the following e-mail: vitr@fatra.cz. Required details are specified in the form ZV-11/2013 that is available in its electronic format at http://www.fatrafol.cz.



FORM ZV-11/2013

Data required for wind load calculation and fastening design of waterproofing membrane FATRAFOL

Dear customer,
please pay attention while filling this form required for correct wind load calculation. The calculation will be provided for roofs greater than 400 - 500 m². For small size roofs use empiric calculation described in Construction and technological specification FATRAFOL-S (free download on www.fatrafol.cz). Do not fill gaps were you are not sure about correctness of data.

1. CLIENT
1.1 Name of company or person | 1.2 Address
1.3 Contact person
1.4 e-mail | 1.5 telephone

2. PROJECT AND ROOF SECTION INFORMATION
2.1 Name of project
2.2 Address of project (if you don't know the address, please fill parcel number or GPS coordinates)
Street / No. | City
ZIP | Country
Parcel number | GPS coordinates
2.3 In case that roof area is divided into sections or if calculation of specific roof area is required only, please fill the name of specific roof section and required data in columns 3 to 6 below for this roof section. If calculation for more roof sections is needed, please fill this form for each section separately.

3. ROOFTOP STRUCTURE
3.1 Use x mark for appropriate substrate suitable for mechanical fastening on roof.

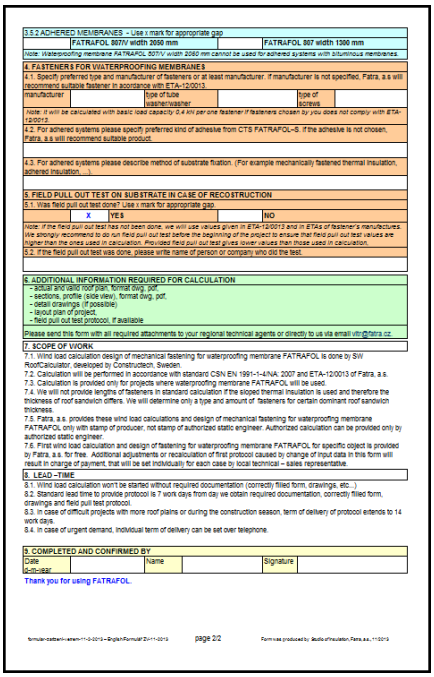
X	Steel deck	minimum thickness [mm]		distance beetwen waves (ribs) [mm]	
	Concrete slab	minimum thickness [mm]		concrete type	
	Wood boards or planks	minimum thickness [mm]		type	
	Other (please specify)				

3.2 In case of reconstruction please specify thickness of existing layers above layer suitable for mechanical fastening. mm
3.3 Please write overall thickness of new sandwich (thickness of all layers together). mm
3.4 Will be used sloped thermal insulation? Use x mark for appropriate gap.
YES | NO
3.5 Specify preferred type and width of waterproofing membrane FATRAFOL
3.5.1 MECHANICALLY FASTENED MEMBRANES – use x mark for appropriate gap

X	FATRAFOL 810/V width 2050 mm (possible combination with FATRAFOL 810/V width 1025 mm)
	FATRAFOL 810/V width 1500 mm (possible combination with FATRAFOL 810/V width 1025 mm)
	FATRAFOL 810 width 1300 mm
	Other (please write required combination of membranes from

Note: in some cases additional fasteners will have to be placed in one or more central lines (not in overlaps). These fasteners will be covered by 150 mm wide strip of FATRAFOL 810. Optimization of membrane widths will be done if any of the options above won't be chosen.

page 1/2



3.5.2 ADHERED MEMBRANES – Use x mark for appropriate gap
FATRAFOL 907/V width 2050 mm | FATRAFOL 907 width 1300 mm
Note: Waterproofing membrane FATRAFOL 907/V width 2050 mm cannot be used for adhered systems with bituminous membranes.

4. FASTENERS FOR WATERPROOFING MEMBRANES
4.1. Specify preferred type and manufacturer of fasteners or at least manufacturer. If manufacturer is not specified, Fatra, a.s will recommend suitable fastener in accordance with ETA-12/0013.
manufacturer | type of tube washer/washer | type of screws
Note: It will be calculated with basic load capacity 0.4 kN per one fastener if fasteners chosen by you does not comply with ETA-12/0013
4.2. For adhered systems please specify preferred kind of adhesive from CTS FATRAFOL-S. If the adhesive is not chosen, Fatra, a.s will recommend suitable product.
4.3. For adhered systems please describe method of substrate fixation. (For example mechanically fastened thermal insulation, adhered insulation, ...).

5. FIELD PULL OUT TEST ON SUBSTRATE IN CASE OF RECOSTRUCTION
5.1. Was field pull out test done? Use x mark for appropriate gap.
X | YES | NO
Note: If the field pull out test has not been done, we will use values given in ETA-12/0013 and in ETAs of fastener's manufactures. We strongly recommend to do run field pull out test before the beginning of the project to ensure that field pull out test values are higher than the ones used in calculation. Provided field pull out test gives lower values than those used in calculation.
5.2. If the field pull out test was done, please write name of person or company who did the test.

6. ADDITIONAL INFORMATION REQUIRED FOR CALCULATION
- actual and valid roof plan, format dwg, pdf.
- sections, profile (side view), format dwg, pdf.
- detail drawings (if possible)
- layout plan of project
- field pull out test protocol, if available
Please send this form with all required attachments to your regional technical agents or directly to us via email vitr@fatra.cz.

7. SCOPE OF WORK
7.1. Wind load calculation design of mechanical fastening for waterproofing membrane FATRAFOL is done by SW RoofCalculator, developed by Construction, Sweden.
7.2. Calculation will be performed in accordance with standard CSN EN 1991-1-4/NA: 2007 and ETA-12/0013 of Fatra, a.s.
7.3. Calculation is provided only for projects where waterproofing membrane FATRAFOL will be used.
7.4. We will not provide lengths of fasteners in standard calculation if the sloped thermal insulation is used and therefore the thickness of roof sandwich differs. We will determine only a type and amount of fasteners for certain dominant roof sandwich thickness.
7.5. Fatra, a.s. provides these wind load calculations and design of mechanical fastening for waterproofing membrane FATRAFOL only with stamp of producer, not stamp of authorized static engineer. Authorized calculation can be provided only by authorized static engineer.
7.6. First wind load calculation and design of fastening for waterproofing membrane FATRAFOL for specific object is provided by Fatra, a.s. for free. Additional adjustments or recalculation of first protocol caused by change of input data in this form will result in charge of payment, that will be set individually for each case by local technical – sales representative.

8. LEAD – TIME
8.1. Wind load calculation won't be started without required documentation (correctly filled form, drawings, etc...).
8.2. Standard lead time to provide protocol is 7 work days from day we obtain required documentation, correctly filled form, drawings and field pull test protocol.
8.3. In case of difficult projects with more roof plains or during the construction season, term of delivery of protocol extends to 14 work days.
8.4. In case of urgent demand, individual term of delivery can be set over telephone.

9. COMPLETED AND CONFIRMED BY
Date d-m-year | Name | Signature
Thank you for using FATRAFOL.

page 2/2

3.6.2.3.1.2 Empiric definition of anchoring density

Empiric definition of required density of fasteners is with respect to both, the number of variables on the part of the load and fasteners, problematic and applicable to buildings of smaller area or significance only. Empiric definition of anchoring density is mainly of informative nature. By more accurate calculation, significantly lower design anchoring density may be achieved in principle. **Table 8** shows the wind load and the min. fastening density for flat roofs (up to 5°, the positive influence of parapet is not calculated) under boundary conditions stated:

- closed roof structure (Cpi = 0), such as cast concrete roofs, roof with a fully welded bitumen sheets, new covering of the old waterproofing, etc.
- wind area II or III for the given locality read from the wind map - see **Figure 3**
- terrain category I or II determined according to the roughness of the terrain in the vicinity of the building - see **Figure 4**
- reference height determined as the height of the building from the ground to the crown of the parapet

How to divide the roof into zones F, G, H and I according to the height of the building and its dimensions perpendicular to the wind direction see **Figure 2**.

Table 7: Empiric definition of anchoring density under various boundary conditions

Terrain category ac. to CSN EN 1991-1-4	*Wind zone ac. to CSN EN 1991-1-4*	*Reference height (m)*	*Parapet height (m)]*	*Cpi*	*Roof slope [°]*	*Fastener admissible load capacity (N)*	*Wind loads [kN/m²]*				*Min. fasteners density (pcs/m²)*)*			
							Zone F	*Zone G*	*Zone H*	*Zone I*	*Zone F*	*Zone G*	*Zone H*	*Zone I *)*
I.	*II.*	5	0	0	≤ 5	600	3.47	2.77	1.66	0.28	**5.8**	**4.6**	**2.8**	**2**
		10	0	0	≤ 5	600	4.06	3.25	1.95	0.32	**6.8**	**5.4**	**3.3**	**2**
		15	0	0	≤ 5	600	4.42	3.54	2.12	0.35	**7.4**	**5.9**	**3.6**	**2**
	III.	5	0	0	≤ 5	600	4.20	3.36	2.01	0.34	**7.0**	**5.6**	**3.4**	**2**
		10	0	0	≤ 5	600	4.91	3.93	2.36	0.39	**8.2**	**6.6**	**4.0**	**2**
		15	0	0	≤ 5	600	5.35	4.28	2.57	0.43	**8.9**	**7.2**	**4.3**	**2**
II.	*II.*	5	0	0	≤ 5	600	2.83	2.26	1.36	0.23	**4.7**	**3.8**	**2.3**	**2**
		10	0	0	≤ 5	600	3.45	2.76	1.65	0.28	**5.8**	**4.6**	**2.8**	**2**
		15	0	0	≤ 5	600	3.83	3.07	1.84	0.31	**6.4**	**5.1**	**3.1**	**2**
	III.	5	0	0	≤ 5	600	3.42	2.74	1.64	0.27	**5.7**	**4.6**	**2.8**	**2**
		10	0	0	≤ 5	600	4.17	3.34	2.00	0.33	**7.0**	**5.6**	**3.4**	**2**
		15	0	0	≤ 5	600	4.64	3.71	2.23	0.37	**7.8**	**6.2**	**3.7**	**2**

**) Minimum suggested density of ca 2 fasteners/m² is based on the need to fix the cover against inner forces, although a smaller number fasteners is required for elimination of uplift forces from the wind*

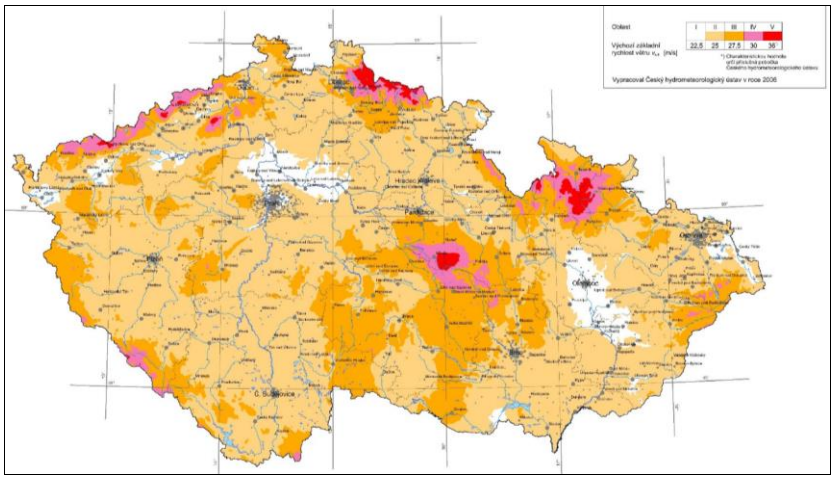


Figure 3 : Wind speed map according to CSN EN 1991-1-4

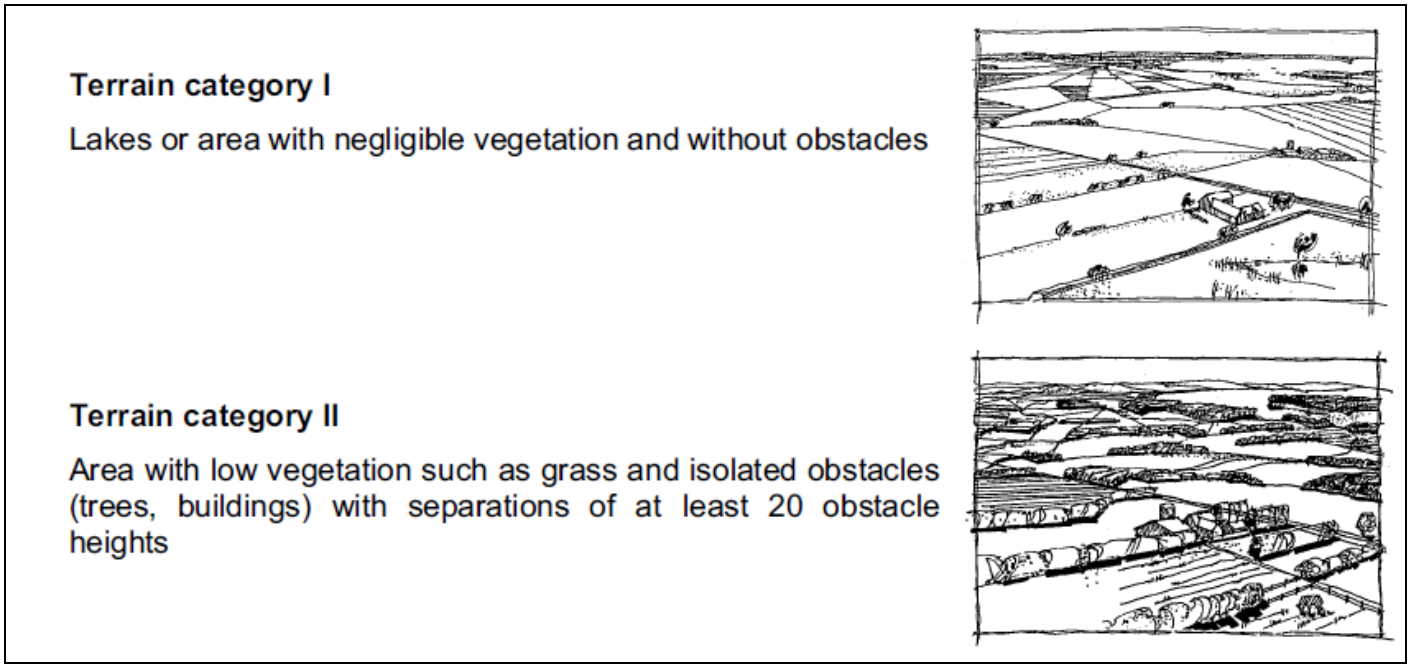


Figure 4: Definition of terrain categories I and II according to CSN EN 1991-1-4

3.6.2.3.2 Securing membranes with aggregate/ traffic layer

Waterproofing and other structural layers of the roof deck without UV stabilisation must, throughout their service life, be effectively protected with a stabilisation layer against weather effects. The stabilisation layer quality must correspond with the planned roof traffic.

Since loading the roof deck with bulk material or loose pavers fails to fully eliminate internal forces in the membrane (contraction), it is essential to install suitable linear plastic-coated metal profiles at points where the roof suddenly changes its slope and to hot-air weld the membrane to the profiles.

The following options are possible to secure roof layers against negative wind pressure and also meet other performance requirements by:

- **Gravel**
- usually contains mined and sorted aggregate of grading 16 mm - 32 mm (gravel), thickness as per a structural calculation.
- In perimeter and corner zones of the roof, ballast should be combined with concrete pavers or other measures should be taken to secure both the membrane covering and the ballast against negative wind pressure.
- In order to secure ballast on a slope of over 6°, reinforce the surface layer, e.g. by bonding, with cement primer or an alternative technical measure, e.g. by using the GEOCEL honeycomb plastic membrane.
- **Pavers**
    - ***Concrete pavers on support pads*** *(minimum recommended dimensions of (400x400x40) mm). PE- or PP-based support pads may be placed directly on the membrane without separation. Rubber pads need to be separated from PVC-P membranes (*Table 5*). Adjustable pads should be used to ensure the required flatness of the paver surface.*
    - ***Ceramic tiles adhered with frost-resistant adhesive to concrete screed*** *- thickness of reinforced screed is min. 40 mm, unreinforced usually 50 mm to 60 mm with an expansion 2x2 m. The concrete screed must be separated from the waterproofing coating with a suitable drainage layer, non-woven textile or better with a composite layer (e.g. Petexdren 600 + 300).*
    - ***Concrete tiles laid in the subsoil*** *- usually in a sand bed or a bed of crushed aggregate fraction 8/16 mm + 4/8 mm, or only 4/8 mm in a minimum thickness of 20 mm. Separation from the membrane must be performed with a non-woven textile min. 300 g / m2 welded in overlaps.*

- **Stabilisation concrete layers** –reinforced oversite concrete with expansion joints, plastic concrete or asphalt concrete. The determination of the minimum thickness of stabilisation concrete layers is based primarily on the structural assessment of wind pressure in individual roof deck zones. The typical minimum thickness of these layers is 50 mm.
- **Wooden slats** – Stabilization of the waterproofing coating with wooden slats is usually insufficient and mainly creates an traffic layer. The materials must have constant resistance to biological corrosion and be separated from the waterproofing membrane with point or linear components. Such components must not pose an obstruction to smooth removal of rainwater.
- **Vegetation layer (soil) –** The thickness of the layers and the composition is given by the type of green roof. A vegetation layer should have a thickness of 80 mm to 150 mm for extensive maintenance and of 150 mm to 1,000 mm for intensive maintenance. The overall thickness of vegetation layers depends on the load-bearing capacity of the underlying roof structure and on the plants to be grown there.

In order to protect roof layers against negative wind pressure, the main protective means must usually be combined with additional ones in perimeter and corner roof zones.

See Table 8 for approximate surface density of the most common types of stabilisation layers.

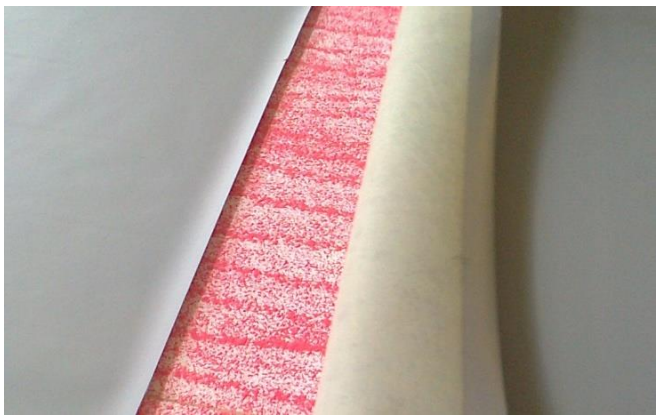
Table 8: Approximate surface density of selected loading layers

Stabilisation layer	Grading	Density, bulk weight [kg.m^{-3}]
Plain cement concrete, pavers, terrace pavers		2,300
Tile flooring		2,000
Stone gravel ballast	8 - 22	1,800
	16 - 32	1,750
Expanded clay (keramzite)	8 - 16	500
	16 - 22	450
Aggloporite		800
Soil (peat)		500
Sand		1,600

When covering a FATRAFOL membrane with any traffic layer, the membrane top surface must always be protected fully from mechanical damage by using synthetic fibre textile with a minimum square density of 300 g.m^{-2}. The textile need not be used for traffic layers made of concrete pavers on plastic support pads.

3.6.2.3.3 Securing membranes with adhesives

Within the FATRAFOL-S system, FATRAFOL 807, FATRAFOL 807/V and FATRAFOL 807/G may be secured against wind uplift with foam polyurethane adhesives. Secure the membrane covering with adhesives in applications where structure do not allow using a different fastening method.



The substrate to which the membrane covering is to be bonded must be strong enough to constantly transfer forces acting on the covering. Bonded substrates must be clean, dry, free of dust, oil, lose or embedded gravel, un-adhered coatings, deteriorated waterproofing membranes and any other materials that reduce the strength of the bonded layers.

3.6.3 Joining waterproofing membranes

When installing a membrane covering, the key task is to make entirely watertight and firm joints between waterproofing membrane sheets, membranes and linear plastic-coated metal profiles at the perimeter, and between membranes and accessories (rainwater outlets, vent outlets etc) in order to create a single unit. For hot air welding, hand held and automatic machines are used. However, hot air welding must be considered the primary method of joining FATRAFOL membranes. Welding is performed in strip overlaps.

When using a hand-held welding machine, the weld width is min. **30 mm** when using a basic nozzle 40 mm wide and keeping its correct angle and position to the edge of the membrane. Most automatic welding machines have a welding nozzle 40 mm wide, which creates a weld of the same width.

3.6.3.1 Hot air welding

This method is based on heat-melting contact surfaces of membrane and their joining by press of roller. Heating and melting of material is done by hot air flowing out of a slot nozzle of a welding machine with continuous temperature control. Move the welding machine gently in the direction of an open joint. Heated contact surfaces must be pressed down immediately behind the nozzle, using a rubber or Teflon roller. Common welding temperatures are 430°C to 600°C for PVC-P membranes.
This joining method may be used at ambient temperatures from -5 °C up to +40°C,



3.6.3.2 Cold welding

In special cases, it is possible to use cold welding method with use of THF thinners for joining membranes. This method is not very common and can be used only for strait welds in open area, not details. Cold welding method can be used at temperatures above +15 °C in dry weather. If possible, hot air welding should be always preferred as method for membrane joining.

3.6.3.3 Treatment of joints by sealing compound

Sealing compound is used for aesthetic treatment of the edge of welds, especially in details, where the bottom layer of the membrane may be extruded due to prolonged exposure to hot air coming from the welding machine.

Welds may be treated with a joint sealant only after they are checked with a testing needle or another penetrating method, not earlier than 1 hour after welding. To apply the joint sealant, use a PE bottle with a 3 mm wide delivery nozzle for horizontal welds and a 1 mm wide delivery nozzle for sloping and vertical welds.

WARNING! Sealing compound cannot be used to repair unperfect welds. It has mainly a visual function and makes easy to distinguish checked welds from unchecked. Once the weld is done properly it has same reliability and functionality with or without the sealing compound.

Mix the joint sealant and, if necessary, adjust its consistency before use. Sealing compound does not replace the sealing of the PU sealant - see Construction details.

3.6.4 Membrane transition from horizontal to vertical position

In the place of membrane transition from horizontal to vertical position around the parapet walls, skylights, superstructures and square penetrations or other similar penetrating structures with a side length greater than 250 mm, the waterproofing coating must be sufficiently fixed to the substructure for all system designs of roofs (mechanically anchored, adhered, ballasted). This fastening can be done:

- By linear fastening using L-profiles made of plastic-coated FATRANYL PVC sheets fastened separately to the substructure (Detail 400S - 408dS). The membrane is connected to these elements by a hot air welding and same principles apply as for the joints of the membranes.
- Linear fastening using steel perforated rails attached to the substructure *)
- Point fastening using the same fastening elements that are used in the roof area (only for mechanically anchored roofs). The distance between fastening elements must be the same as the distance between fastening elements of the nearest fastening row of the horizontal membrane, but not more than 200 mm *)

*) *The FATRAFOL-S system only recognizes the first method of fastening using plastic coated sheet metal profiles. Fastening by means of perforated rails and point fastening is a part of waterproofing systems of other membrane manufacturers. Fatra, a.s. in the FATRAFOLS system disclaims all responsibility for any defects caused by this fastening method and these defects are therefore not covered by the warranty provided for the functionality of the waterproofing coating. This is mainly due to the risk of the so-called "trampoline" due to the precipitation of the membrane as it ages.*

3.6.5 Ending a roof covering at the roof perimeter

Termination of the waterproofing coating is always performed using system profiles made of plastic-coated FATRANYL PVC sheets (Detail 208S, 301S - 305S, 501S - 507S)

The roof perimeter may include a parapet, ledge, wall, gutter edge etc. The design should meet the following performance requirements:

- Ensuring that wind uplift does not tear off the membrane edge from the substrate and that wind does not get under a non-ballasted waterproofing membrane layer.
- Eliminating the ingress of rainwater under the covering, even in extreme conditions such as wind-driven rain and snow, a thick layer of melting snow on the roof, roof flooding when drain outlets are clogged with dirt, ice, etc.
- Securing the covering against internal forces inside the waterproofing membrane.
- Enabling fluent removal of water vapour from the roof layers.

On a vertical wall, the covering may, depending on circumstances, be ended either directly on the masonry and then plastered to a height above the end of the waterproofing layer, or it may be ended on the surface of existing plasterwork and sealed with permanently elastic sealer. With this type of ending, you must take into account the risk that flowing water may seep through the wall. The height of the upper membrane edge above the covering of the adjacent area must be at least 150 mm (Detail 303S, 304S, 305S).

When installing additional thermal insulation from EPS on a vertical wall, water ingress to the bottom of the thermal insulation must be prevented by welding an additional membrane sheet to the original covering and ending it on the new thermal insulation, as described above. When using an XPS board at bottom, it is not necessary to install an additional membrane strip, but with a suitable solution it is necessary to prevent direct contact of the XPS with the waterproofing membrane by a suitable separating layer (Detail 412S).

A waterproofing membrane must be ended watertight on the edge of a roof opening if its height above the adjacent area level is less than 150 mm. To ensure the membrane covering is well properly ended, the edge of the vertical

opening (e.g. for doors) and the structures below the door sill must be sufficiently firm and, if possible, positioned in a single vertical line Detail 413S.

3.6.6 Additional sealing of details

When creating a waterproofing covering at a point where three waterproofed planes intersect (internal corner and external corner), and when waterproofing roof penetrations, follow the two methods described below.

When waterproofing 3D details, first cover the detail with suitable flat cuttings of the membrane. Once prepared (without undulations and stretching), the detail is finished by welding to it a vacuum-shaped piece of suitable kind that will make the entire detail completely watertight. Shaped pieces must always be joined to the base membrane by hot-air welding – they must be welded fully or along their entire perimeter, with the weld being at least 30 mm wide (Detail 211S, 212S).

For circular roof penetrations (vent outlets, pipes etc), use is usually made of shaped pieces, either prefabricated (if the required dimension is available) or made on-site from a homogeneous roofing membrane. The homogeneous membrane should always be at least one degree thicker than the waterproofing membrane. Both types of shaped pieces must be fully hot-air welded to the waterproofing membrane. The upper edge of the shaped piece or of the adjacent vertical sheet on a penetrating PVC pipe is to be welded to the pipe. If the pipe is made of any other material, the upper edge is to be sealed with suitable PU sealer and secured in place with corrosion-proof tape. (Detail 607aS, 607bS, 608S).
All joints of waterproofing membranes described in this chapter should be treated with a joint sealant.

3.6.7 Roof covering drainage

Rainwater may be drained from the surface of flat roofs either by external drainage components – gutters – or by internal drainage components – rainwater outlets and gutters within the roof field. Drainage components must be designed and dimensioned in accordance with CSN 73 190-1,3 and CSN 73 3610 and CSN EN 12056-3. The design must take into account snow, frost and ice loads on the roof, according to CSN EN 1991-1-3, CSN EN 12056-3.

3.6.7.1 Linear drainage from roof

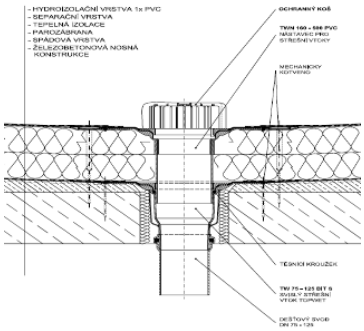
Linear drainage means removal of water using eaves, ledge, rooftop or parapet gutters. With this type of drainage, the roof covering is welded at its end to a perimeter plastic-coated metal profile (Detail 503S, 504S, 508S, 601S, 602S). It is not recommended to drain water from roofs using parapet and valley gutters.

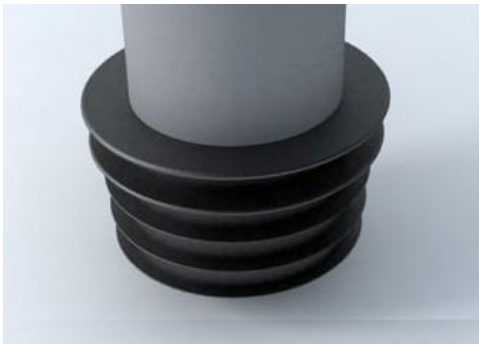
The minimum permissible slope of all gutters is 0.5 %. If a smaller longitudinal slope is provided, dirt may deposit in the gutter, reducing its capacity.

Downpipes installed outside the building or in unheated areas must be sufficiently protected against freezing, e.g. by heating. Heating cables used for this purpose do not affect the roof membrane with their temperature.

The maximum distance of rainwater outlets in gutters or valleys from their ends or the dividing crest in the gutters or valleys should not exceed 15 m.

3.6.7.2 Point drainage from roof





Two basic options are available for point drainage using rainwater outlets:

- Using a PVC-P rainwater outlet to which the membrane is welded at the roof plane or using a rainwater outlet made of a different plastic with a PVC collar to which the membrane is weldable (Detail 604S).
- Using a PVC-P corner insert to drain water through a parapet (Detail 605S). This roof drainage method requires installing overflow outlets to address the risk of ice formation in rainwater outlets in the parapet wall.

For safety reasons, we recommend installing at least two separate rainwater outlets on each roof having internal drainage elements. Where only one rainwater outlet is provided to drain water from the roof, you should install an overflow outlet for added reliability.

If the covering includes a vapour control membrane, a two-stage rainwater outlet should be used.

To drain the securing waterproofing structure, follow the instructions for the main waterproofing layer. A securing waterproofing layer should be drained using a separate pipe or at least a separate rainwater outlet. That pipe should also indicate failures of the main waterproofing layer (e.g. transparent plastic, electric alarm).

For smooth finishing, roof rainwater outlets should be at least 0.5 m from adjacent structures (parapets, roof penetrations etc).

Refer to Table 9 for dimensioning of rainwater outlets in the Czech Republic.

Connection collars or shaped pieces of rainwater outlets must always be firmly fastened at their perimeter at the roof plane to the substrate, or the underlying waterproofing layer must be fastened. Otherwise, there is a risk of them being displaced or deformed by internal and external forces.

The membrane must be joined in accordance with relevant instructions. A rainwater outlet should be recessed below the adjacent area to allow smooth drainage of water from the covering even during the maximum expected bending of the load-bearing structure.

If electric heating is not provided to protect a rainwater outlet from freezing, pay attention to the risk of water vapour condensation on the outlet inside the roof and ensure removal of all condensate. The same measure must be taken also for multi-ply roofs or, alternatively, the downpipe must be thermally insulated at the point of penetration through the ventilation and thermal insulation layer.

In case of roofs with a stabilisation layer of bulk material, rainwater outlets must always be protected from being clogged with the material; other outlets must be fitted with a leaf and dirt trap. Rainwater outlets should be so positioned and designed to allow easy inspection and cleaning.

Overflow outlets located in a parapet as protection in case rainwater outlets get clogged must be treated, at the point of penetration through the roof covering, similarly to rainwater outlets. The overflow outlet collar must also be fixed firmly to the substrate. The overflow outlet must be located next to the drained valley, at the lowest point of the waterproofing membrane on the parapet, keeping the required slope.

Fatra, a.s. recommends to design and to use rainwater outlets made of ridged plastic with integrated flange. These rainwater outlets are more reliable and profitable in compare to soft rainwater outlets, which are easy to deform.

Table 9: Rainwater outlets – dimensioning for roof types and required safety coefficients

Pipe diameter [mm] (vertical)	Flow rate [l/s]	Green roofs with vegetation layer thickness		Other roofs
		Up to 100 mm	Over 100 mm	
DN 70	5.7	380 m^2	663 m^2	190 m^2
DN 100	6.3	420 m^2	700 m^2	210 m^2
DN 125	9.0	600 m^2	1,000 m^2	300 m^2
DN 150	10.0	667 m^2	1,110 m^2	333 m^2

Note: A safety coefficient of 0.5 applies in cases where strong precipitation or a clogged rainwater outlet may cause water ingress into the building. A safety coefficient of 0.3 applies to buildings requiring extra protection (hospitals, museums, theatres etc).

3.7 Traffic layer

A traffic layer or layers on the roof surface allow using the roof for pedestrian or vehicular traffic, as a roof garden, playground, swimming pool, relaxation area etc. A limited traffic layer is provided also on roofs not open to the public to allow their inspections and maintenance.

1. Vapour control membrane
2. Thermal insulation
3. Geotextile
4. FATRAFOL 818 waterproofing membrane
5. Drainage layer (FATRADREN)
6. Loop mat
7. FATRATEX geotextile
8. Soil
9. Vegetation layer

Within the FATRAFOL-S system, FATRAFOL 814 with an anti-slip texture may be used as a traffic layer.

The traffic layer surface must be so sloped to allow rainwater to flow smoothly to the drainage system.

Special attention must be paid to balconies and terraces. No puddling may occur on these surfaces. Sloping the roof at more than 3 % usually prevents puddling.

A waterproofing layer covered with other layers or not accessible for cleaning should be resistant to root penetration. This is a mandatory requirement for vegetation roofs and roof gardens.

Traffic layers located above a waterproofing layer and consisting of ballast, pavers on support pads or pavers in ballast, layers with a reinforced concrete slab or with bonded pavers, vegetation layers etc that also serve as stabilisation against external forces are described in article 3.6.2.3.2.

Additional components:

- Reinforced concrete or plastic containers for soil and plants
- Special structures, shades, visual or protective structures
- Combinations of above layers and structures

4 Technical preparation for installation

4.1 Documentation for installation preparation

Preparatory works for installation may be based on project documentation (usually available for new buildings or general renovations) or survey results.

If project documentation is available, especially the following is necessary to get ready for roof covering installation:

- Technical report
- Structural assessment of roof load-bearing capacity
- Drawings
  - Roof plan with dimensions and slopes of roof areas
  - Characteristic roof cross-sections
  - Detailed design of roof structures including their thicknesses
  - Drainage method
  - Expansion joints
- Fastening method
- Bill of quantities
- Planned use and maintenance of the roof

If project documentation is unavailable or incomplete (e.g. 'building permit documentation') and in case of any refurbishment, it is necessary to conduct a roof survey, measure the roof, consult the details with the designer and customer, probe the roof and perform tensile tests of the proposed fasteners in order to establish:

- The composition, dimensioning and condition of individual roof deck layers, in particular the fixing and thermal insulation ones (thermal and technical assessment),
- Roof dimensions and shape,
- Roof height above the ground,
- Lengths of plastic-coated metal profiles,
- Height, shape and composition of parapets,
- Quantity and dimensions of roof penetrations including dimensions of rainwater outlets and their connection to downpipes,
- Additional adjustments to the roof covering,
- Any other requirements (thermal insulation of penetrations, substrate ventilation, positioning of rainwater outlets, expansion joints between traffic layers, slope etc) ,
- The maximum possible load on the roof and the positioning of safety components.

4.2 Getting ready for installation

The preparation for installation includes:

- Choosing the right waterproofing membrane for the main area and supplementary membrane types,
- Determining the method to secure the covering against external and internal forces,
- Specifying the required substrate treatment (see article 3.2.1),

- Determining the roof deck composition,
- Calculating the area of individual roof deck zones (based on known or established dimensions),
- Determining the types and dimensions of perimeter profiles (see article 3.6.4),
- Determining the types, positions and density of fasteners if mechanical fastening is used (see article 3.6.2.3.1.1),
- Determining the type, thickness and position of the stabilisation layer within the roof field,
- Choosing the adhesive depending on the substrate structure quality, and positions and coverage in individual roof zones,
- Determining the types and quantity of shaped pieces, rainwater outlets and vent outlets,
- Specifying the overall material consumption (see Table 10),
- Calculating the quantities or costs, or drawing up a budget if necessary, based on the labour required, installation time and all relevant costs associated with the installation (based on the contractor's experience and the calculation formula shown in Decree 21/1990 Coll. as amended).

Table 10: Approximate material consumption

Material	Installation method	Consumption per m² of roof	Note
FATRAFOL membrane Width and 1,300 mm	50 mm overlap	1.07 m²	
	100 mm overlap	1.12 m²	
FATRAFOL membrane Width and 2,050 mm	50 mm overlap	1.06 m²	
	100 mm overlap	1.08 m²	
FATRAFOL membrane Width 1600 mm	50 mm overlap	1.08 m²	
	100 mm overlap	1.14 m²	
FATRAFOL membrane Width 1600 mm	50 mm overlap	1.06 m²	
	100 mm overlap	1.10 m²	
Joint sealant	Securing of all joints (3 mm wide delivery nozzle)	0.008 kg	1 kg per approx. 130 m² of roof
Fasteners for plastic-coated sheet metal	~4.5 pcs/1 running metre	-	Typical centre-to-centre distance of fasteners: 20 cm – 25 cm
Sealers	Depending on length sealed	(0.031.d/P) kg	1 cartridge per 13 running meters

d - Length sealed [m]
P - Roof area [m²]

5 TECHNOLOGICAL PROCEDURES

5.1 EXTERNAL CONDITIONS FOR WATERPROOFING WORKS

5.1.1 Site readiness

Site takeover, i.e. typically a takeover of a delineated site under **Government Regulation 591/2006 Coll.**, on minimum occupational health safety requirements at construction sites, and of completed load-bearing structures, all end, perimeter and penetrating structures and other firmly attached components, is made by the contractor's authorised representative (site manager, shift supervisor) in the presence of a site manager representing a superior contractor, the investor's technical supervisor and other authorised persons.

As part of site takeover, a visual inspection must be made of completeness and slope of base structures and parapets, of skylights and all roof penetrations. Make sure the situation on site corresponds to the current project documentation and the fixing plan.

Works should not commence until the owner's technical supervisor accepts the base structures. Site takeover must be noted in the construction log, together with the following:

- Date and time of site takeover
- Exact site description using layout axes (map or sketch)
- Site conditions in terms of OH&S, fire prevention and EMS
- Number of skylights and steel supports for technological equipment and their conformity with current project documentation
- Defects and outstanding works, if any
- Signatures of those handing over and taking over the site

Images should be taken of the site at the time of takeover.

Key items to be provided and determined as part of a site takeover process:

- A material storage location and protection of materials from mechanical damage, weather and theft
- Safe access to the site and place of installation
- A safe and cost-effective method of horizontal and vertical transport
- Space for materials on the load-bearing or base structure, subject to permissible load
- 230/400 V connections in accordance with current regulations, including electricity meters
- A waste management system (sorting, environmentally friendly disposal, certificates)
- Necessary measures in accordance with the site rules and safety, legal and sanitary regulations and standards
- Methods to coordinate simultaneous and related construction works and other operations on the roof deck (considering the traffic on complete roof deck sections that have not been handed over to the client as yet)
- Performing tightness tests and demonstrating work quality – handover of roof sections

5.1.2 Working conditions

PVC-P membranes may be installed at an ambient temperature of no less than -5 °C *). At temperatures below +5 °C, you should first warm unwound waterproofing membranes in a heated room as close to the place of installation as practicable. Works must not be carried out in rain, snow, frost and strong wind.

Fitters may only step on laid waterproofing membranes if wearing soft-soled shoes that prevent mechanical damage to the membrane, ensure safe treading on the membrane without the danger of slipping and meet the safety requirements regarding personal protective equipment.

It is necessary to remove dirt, small object, stones and asphalt stains form boots soles before entering roof area with membrane.

Access by any other persons to laid membranes must be reduced to a minimum. No movement of light construction equipment and no transport and storage of heavy loads is allowed on an unprotected membrane.

Transport routes for people, construction materials and equipment on a finished roof covering, especially on single-ply roofs with the standard arrangement of layers and rigid mineral wool boards for thermal insulation, must be covered with firm material (e.g. OSB boards) to prevent destruction of the thermal insulation. The same protection must be provided where technical equipment is installed and heavy loads temporarily stored.

**) The lowest application temperature for FATRAFOL 814 is +5°C.*

5.2 Installing a roof covering

The installation of a FATRAFOL-S system roof covering includes the following sequence of steps:

- A visual inspection and, if necessary, levelling and sweeping the substrate
- Installing a suitable vapour control layer
- Laying a thermal insulation layer (usually two layers with overlapped joints)
- Fastening thermal insulation boards to the substrate
- Laying base, protective and separation layers of non-woven biocide textile
- Installing perimeter profiles of FATRANYL PVC plastic-coated sheet metal
- Laying a FATRAFOL waterproofing membrane – dimensional stabilisation
- Fastening the membrane to the substrate (mechanical fastening, bonding)
- Joining the membranes at overlaps (by a hot-air welding machine or wedge welder)
- Waterproofing roof penetrations
- Installing end elements
- checking the tightness of the joints mechanically with a test needle and possible treatment of the membrane joints with a sealant Z-01
- Treating the roof covering end components, on projecting structures, with permanently elastic PU sealer

Depending on specific on-site conditions, some jobs may be skipped or the tasks below may follow:

- Testing the covering tightness (submersion test, vacuum test of welds, high-frequency voltage, coloured smoke, impedance defectoscopy etc)
- Applying an upper protective layer (aggregate etc)
- Applying a traffic layer (pedestrian or vehicular traffic roofs or roofs having another specific function)
- Applying vegetation layers for roof gardens
- Installing a lightning conductor, TV aerials etc

5.2.1 Installing a vapour control layer

A vapour control layer should be installed on an unbroken substrate. If it is placed on a discontinuous base, the base must be adapted so that the joints of the vapor barrier are supported when it is joined.

If using a PE membrane as a vapour control layer, lay it loose on the base layer, keeping both side and end overlaps with the width recommended by the manufacturer, usually at least 100 mm. Use specific tape to join, in a vapour-tight manner, the overlaps of neighbouring sheets to each other and to all penetrating and end structures and structural components. The surface of joined areas must be clean, dry and free of dust and impurities.

Before installation of a vapour control layer of bitumen sheets, the substrate is usually treated with an adhesion primer. Follow the manufacturer’s instructions to connect the layer to all penetrating and end structures and structural components. Bitumen sheets are usually used as a vapour control layer for concrete substrates and for adhered systems.

On parapets and projecting structures, a vapour control layer must reach at least to the level of the upper surface of the thermal insulation layer.

If a vapour control layer functions simultaneously as an airtight layer, it must not be perforated by roof fasteners.

5.2.2 Installing a thermal insulation layer

Thermal insulation boards are to be installed on a prepared, sufficiently firm and planar substrate that has the required or recommended slope. Bear in mind that if the substrate does not have the required slope, this will have a negative impact on the waterproofing layer surface (risk of puddling). The boards must always be installed in accordance with the manufacturer’s instructions.

Thermal insulation layers made of rigid pressed boards must be joined tightly edge-to-edge or in a brick-like manner. Some types of thermal insulation boards are joined using a half-groove. In case of single-layer mineral fibre insulation, all boards must have an identical direction. If trapezoidal sheet metal is used as a substrate, you should place the boards with their longer side perpendicularly to the profiles in the sheet metal.

If the substrate has a zero slope, pitched thermal insulation boards may be used for sloping. These boards are usually installed on the first thermal insulation layer, having the minimum design dimensions.

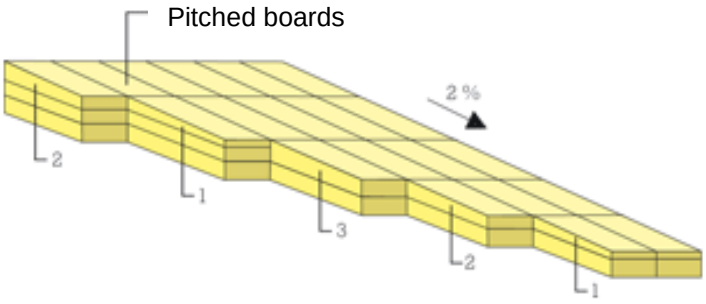
Make sure gaps are sufficiently covered if installing two layers of thermal insulation boards. Gaps between thermal insulation boards and/or perimeter and penetrating structures may be up to 5 mm wide as this width usually has no

effect on their thermal insulation properties. Larger gaps between the boards must be filled with expansion PU foam to prevent the thermal bridges.

If thermal insulation boards are not sufficiently secured with waterproofing membrane fasteners or a loading or traffic layer, they must be secured and fastened to the substrate mechanically or by bonding. In case of single-ply roofs with the standard arrangement of layers, thermal insulation boards must be fastened separately. If producer does not specify amount, use at least 2 fasteners per m². These fasteners are not included in the number of structural fasteners, i.e. the covering still needs to be secured against internal forces (at least 2 fasteners per m²).

Thermal insulation boards made of foam glass feature zero absorption but they must not be fastened mechanically to the substrate and no waterproofing layer may be fastened through them. Their use is limited to adhered or ballasted systems.

In justified cases, e.g. multi-ply roofs or a bonded system, thermal insulation boards are bonded using organic PU-based adhesives, cold asphalt varnishes, or alternatively fixed on special self-adhesive or easily fused asphalt sheets. The boards may be bonded in points or lines, and the adhesive must cover an area specified by the adhesive manufacturer (the bonded surface must provide stabilisation against external forces).



5.2.3 Installing a base, protective and separation layer

Sheets of base and protective fleece as well as glass fibre mats are to be placed on the substrate loosely while keeping side and end overlaps of at least 50 mm in width. Overlaps of fleece sheets are only point-joined by hot-air welding and pressing, glass mat do not joint. Overlaps of a protective layer made of non-woven textile should be welded fully when applying protective or traffic layers on the waterproofing membrane that may cause displacement of the protective fleece.

If concrete is to be placed over the protective fleece, use an open-diffusion membrane for separation to provide protection from the ingress of cement milk. If possible, the materials must be installed dry. Unfastened fleece should be temporarily loaded (with membrane rolls, boards etc) during windy conditions. A protective and separation layer placed on vertical surfaces is to be fastened using perimeter plastic-coated metal profiles and/or bonded with PU adhesives. The adhesive must not have any negative impact on the micro-ventilation function of this layer.

5.2.4 Installing perimeter profiles

Unless specified in list of flashing material in project documentation, proper material and correct dimension of all roofing flashings is always application company responsibility. Perimeter profiles, i.e. bent plastic-coated metal profiles of various shapes and sizes, are usually installed immediately after the placement of a base or separation fleece layer since they also secure the layer against wind uplift. If fleece-backed membrane FATRAFOL 807, 807/V and 807/G is used, perimeter profiles are installed after the placement of a waterproofing membrane on the horizontal surface.

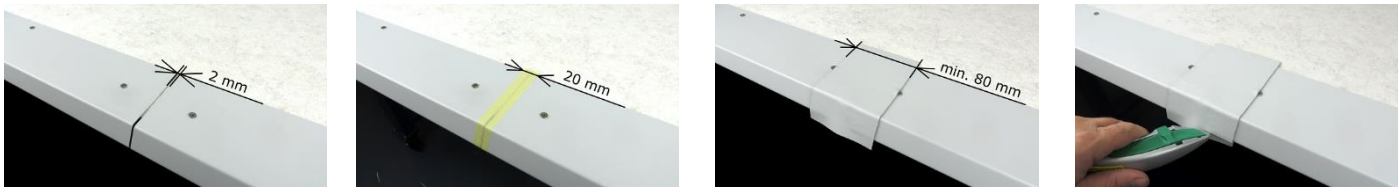
The plastic-coated profiles are installed along the entire roof perimeter (eaves, parapet, backing) as well as at points of sudden changes in the base slope like in roof valley (Detail 209S), at stairs and projecting substrate edges, along gutter edges and at the perimeter penetrations. Round penetration are described in chapter 5.2.6.6.

Flashings are usually mounted directly to substrate (without support pieces).Suitable fasteners are used for fixing perimeter profiles. The fasteners must not be spaced more than 250 mm apart (minimum density: 4 fasteners per running meter, i.e. 4,5 pcs/2 m long flashing component). If wide perimeter profiles are used, they should be fixed alternately in two lines. Fasteners must always reach as far in as a solid and structurally sound layer of the roof deck (concrete, masonry, wood, trapezoidal sheet metal etc).

How to install roofing flashings is described in CSN 73 3610, 2 metre long perimeter profiles are installed edge to edge with 2 mm expansion gap. All flashings must have expansion gap every 6 m in case they are joined with overlap with fastener (same as internal corners profiles). If necessary, use metal shears to adjust the length and shape of sheet metal components; avoid using an angle disc grinder.

At points of structural expansion and connection joints, the perimeter plastic-coated metal profiles must also have an expansion joint.

Except internal and external corner, all flashing components joints must be patched by min. 80 mm - 100 mm wide strip of homogenous membrane. Membrane should be welded only along edges by min. 30 mm weld. This will create 20 mm wide unwelded expantion gap in the axis of the flashing joint (Detail 509S). It is recommended to use 20 mm wide masking tape to create unwelded gap in flashing joint area.



For external and internal corner flashing joints leave only 50 mm wide unwelded gap without homogenous membrane patch. It is recommended to use 50 mm wide masking tape to create unwelded gap in flashing joint area.

In the places of object dilatations and connecting joints, the peripheral fastening elements made of plastic-coated sheet metal must also be dilated.

5.2.5 Installing a waterproofing membrane

Installing any type of a waterproofing membrane requires unrolling the roll, letting it dimensionally stabilise, putting it in the right position, correctly fastening the membrane to the substrate and making watertight joints.

Always check all materials before installation. First of all, check if the packaging of the entire pallet is intact. Unroll the rolls and refer to the label to make a visual check of key parameters such as membrane type, dimensions, thickness,

number of rolls on pallet. Also check if the product is free of any visible defects such as mechanical damage, colour deviations, deviations from straightness, undulated edges, contamination etc. If any major defects are discovered, do not install the membrane. Keep the label, note the details printed on the sheet edge and contact the distributor for further arrangements. If you fail to do so, the manufacturer disclaims liability for damage caused by deliberate installation of any material that had visible defects and flaws before installation.

5.2.5.1 FATRAFOL 810 and 810/V (mechanically fastened covering)

With their structure, technical parameters and end-use properties, the FATRAFOL 810, 810/V membranes (referred to below as “FATRAFOL 810”) are the primary type of a waterproofing membrane designed for mechanical fastening.

The membrane is laid on a substrate covered fully with protective and separation fleece, usually after the placement of perimeter profiles. An exception to the rule is a substrate of rigid thermal insulation mineral fibre boards or of rigid PUR and PIR boards and smooth sandwich panels on which the membrane may be laid without non-woven separation fleece.

Sheets are laid with side and end overlaps. Side overlap width may differ depending on the fasteners used but must not be less than 100 mm (Detail 203S) . The minimum overlap width for membranes not fastened mechanically is 50 mm (Detail 201S) . To determine the overlap, refer to the printed identification strip on the membrane face, located 120 mm from its edge. If necessary, cut the sheet length and width with a knife or scissors.

Do not tear membrane sheets. This causes major damage to the reinforcing layer and affects the membrane strength.

After putting the membrane to the desired position, fasten it mechanically as per the fixing plan, using fasteners designed for that roof section.

An empiric method of dimensioning may be used for flat roof small size flat roofs – see article 3.6.2.3.1.2.

For other buildings it is recommended to calculate each roof individually through a structural calculation under CSN EN 1991-1-4 and the fasteners must be chosen based on system tests conducted according to EAD 030351-00-0402 (superseded ETAG 006) on the basis of which the ‘European Technical Approval’ (ETA) was issued.

Central zone membrane sheets are usually fastened at their perimeter only.

In perimeter and corner zones where, as demonstrated by a structural design and assessment, perimeter fastening alone fails to secure the covering against negative wind pressure, additional measures must be taken:

- Installing sheets of a smaller width,
- Point fastening in the sheet area (inserted rows)and then covering the fasteners (Detail 210S, 213S)
- Using fixing discs for fastening.(induction fastening)

For fastener spacing for various sheet widths and for fastener density see Figure 5 and Figure 6.

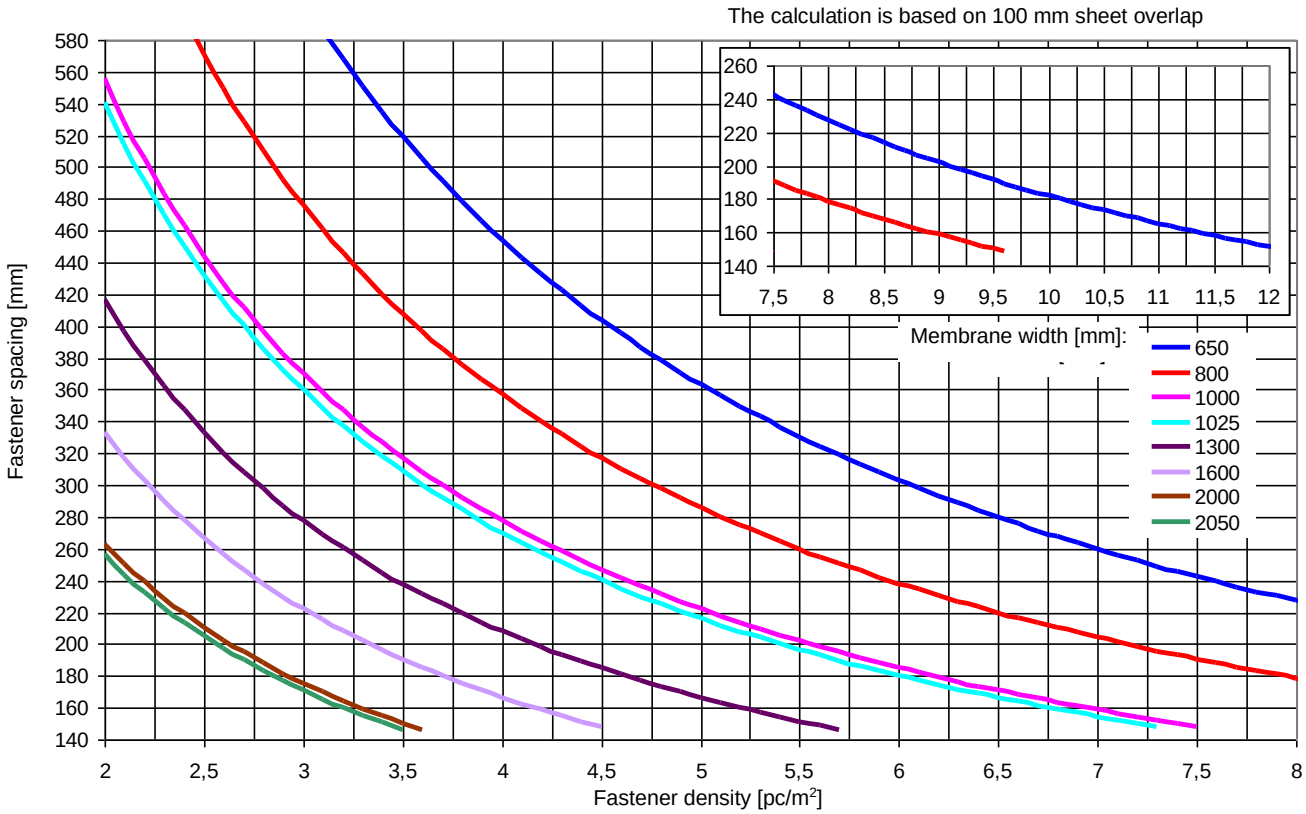


Figure 5: Fastener spacing for various sheet widths and fastener density

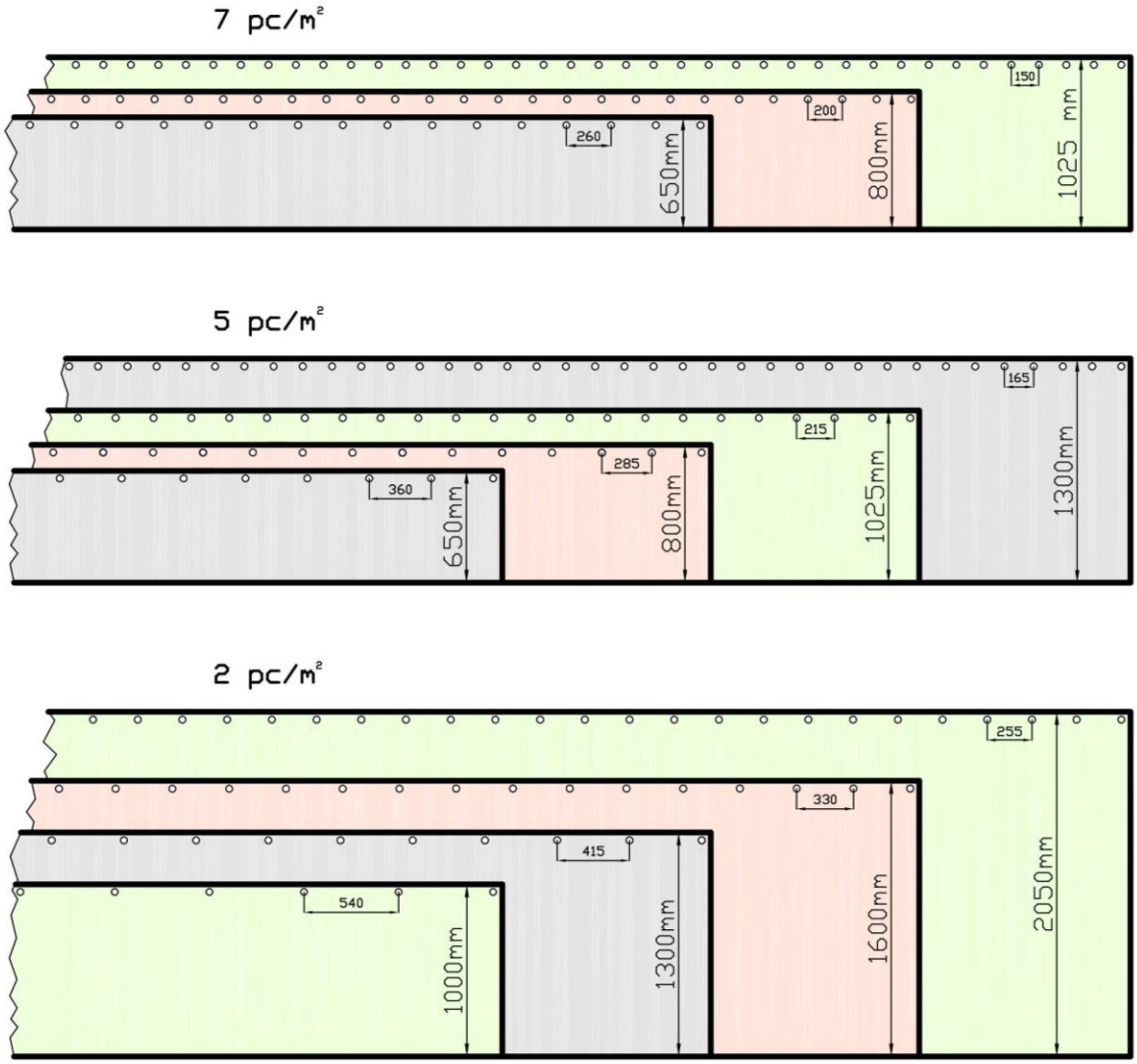
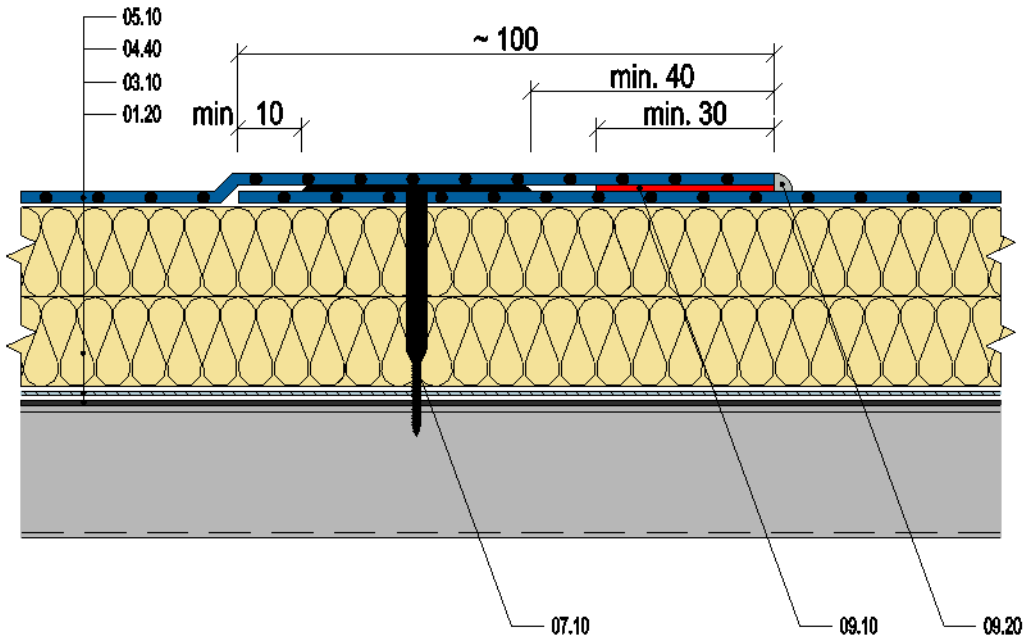


Figure 6: Fastener spacing for various sheet widths and with typical fastener density

5.2.5.1.1 Fastening a membrane at its perimeter

Fasteners must be so positioned that the washer edge is at least 10 mm from the sheet edge; for finishing of a hot-air welded joint see Figure 9. The minimum permissible linear spacing of fasteners is 150, maximum 560 mm (e.g. for trapezoidal sheet metal with waves spaced at 280 mm). Fasteners must be fixed to the substrate in accordance with manufacturer's instructions. Previously used fasteners must not be reused.

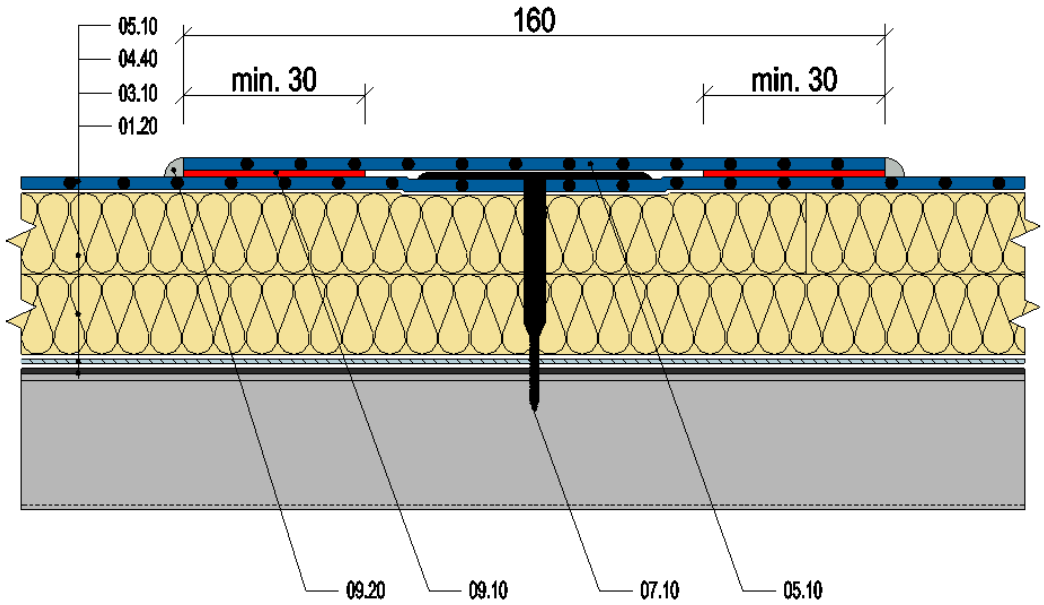


05.10 FATRAFOL for mechanical fastening
04.40 Mineral wool
03.10 Vapour control barrier
01.20 Trapezoidal sheet
07.10 Fastener
09.10 Hot air weld
09.20 Z-01 sealant (not required)

Figure 7: FATRAFOL joint in overlap of sheets fastened to substrate

5.2.5.1.2 Point-fastening a membrane in sheet area

Sheets are fastened in a line in their area, using the same fasteners as for perimeter fastening. A round patch or a minimum 160 mm wide FATRAFOL 810 strip is then welded over the line of fasteners.

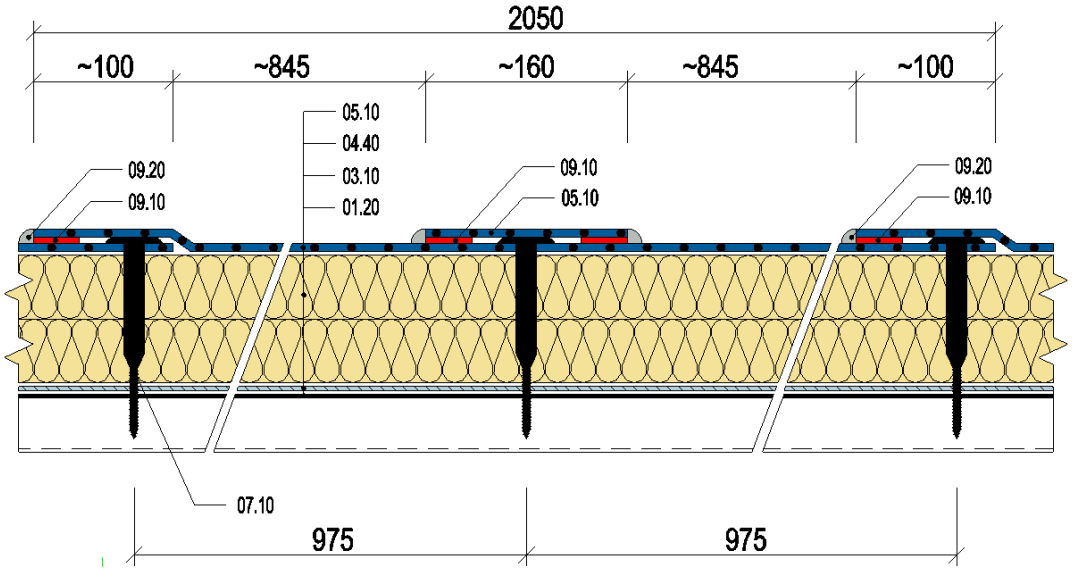


05.10 FATRAFOL for mechanical fastening
04.40 Mineral wool
03.10 Vapour control barrier
01.20 Trapezoidal sheet
07.10 Fastener
09.10 Hot air weld
09.20 Z-01 sealant (not required)

Figure 8: Covering of additional fasteners in centre of sheets

See **Figure 8** for the waterproofing of a centre-located fastener with a round patch. See **Figure 9** for the fastening of a 2,050 mm wide waterproofing membrane, fastener layout and minimum membrane overlaps.

Centre-located fasteners must be aligned along the entire length of the sheet/roof deck zone and oval washers for fasteners must have a uniform direction. A marking string with powder paint may be used to mark the position of a fastener line.



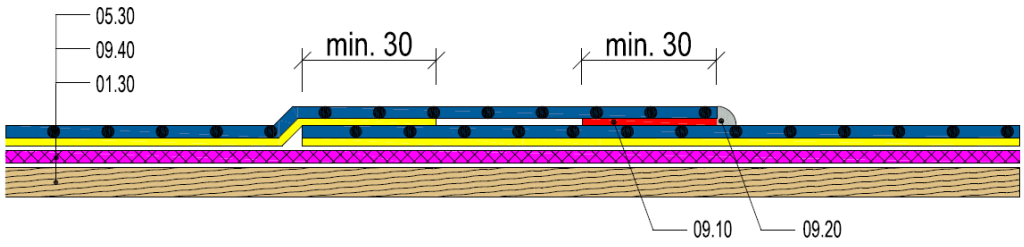
05.10 FATRAFOL for mechanical fastening
04.40 Mineral wool
03.10 Vapour control barrier
01.20 Trapezoidal sheet
07.10 Fastener
09.10 Hot air weld
09.20 Z-01 sealant (not required)

Figure 9: Fastening of FATRAFOL 810/V in centre of sheet and covering it with membrane strip

5.2.5.2 FATRAFOL 807 and 807/V and 807/G membranes (bonded covering)

The FATRAFOL 807 and 807/V and 807/G backed-fleece waterproofing membranes are laid directly on the substrate and bonded to the base layer with a foam adhesive FATRAFIX FM. If the base layer is made of thermal insulation boards (fastened separately), it must be bonded or mechanically fastened to the substrate to ensure that it can transmit wind loads to the load-bearing structure.

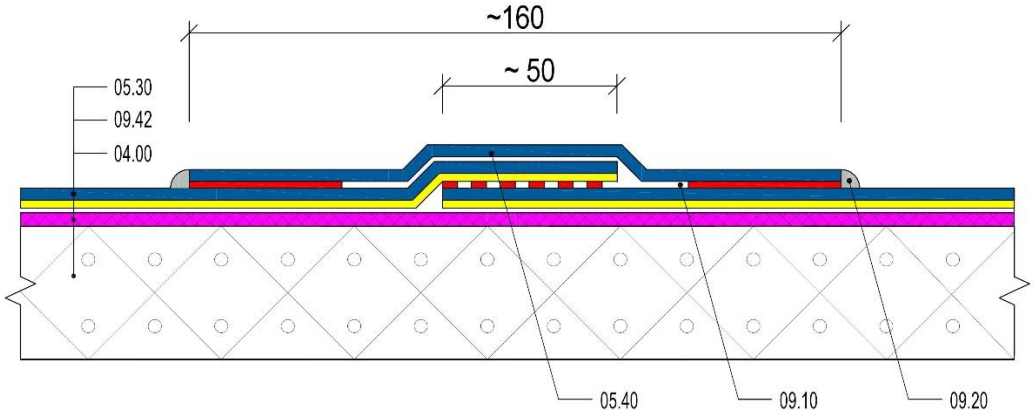
Membrane sheets are laid with longitudinal overlaps with an 30 mm overlap of the textile layer over the bottom sheet. The edge without textile allows the sheets to be welded together – see **Figure 10**.



05.30 FATRAFOL for bonding
09.40 Adhesive FATRAFIX FM
01.30 Wooden board
09.10 Hot air weld
09.20 Z-01 sealant (not required)

Figure 10: **Joining adhered FATRAFOL membrane on long side**

In transverse direction, membrane sheets are joined with 50 mm welded overlap and then covered with a strip of the FATRAFOL 804 auxiliary homogeneous membrane – see **Figure 11**.



05.30 FATRAFOL for adhered roofs
09.42 FATRAFIX FM
04.00 Thermal insulation
05.40 FATRAFOL for details
09.10 Hot air weld
09.20 Z-01 sealant (not required)

Figure 11: End joint of fleece backed FATRAFOL

At the roof perimeter where the membrane is joined to perimeter profiles, the membrane is usually installed before the perimeter profiles. Perimeter plastic-coated metal profiles are installed afterwards and fastened together with the membrane to the deck with suitable fasteners. For detailing, use FATRAFOL 804.

5.2.5.3 FATRAFOL 818 membranes (ballasted roof covering)

The FATRAFOL 818 waterproofing membranes with glass fibre fleece feature excellent dimensional stability, allowing so-called loose installation without point fastening in the roof field. Linear fastening to plastic-coated sheet metal is still necessary at perimeter and points where the roof plane changes suddenly. A suitable stabilisation layer must be applied immediately after membrane installation to provide protection from external forces. Different negative wind load forces in roof area must be taken in account when dimensioning ballast layer weight.

The membrane is laid on a substrate covered fully with separation fleece and lined at the perimeter with plastic-coated metal profiles. An exception to the rule is a substrate of mineral wool, or of rigid PUR and PIR boards on which the membrane may be laid without separation non-woven fleece.

Sheets are laid with side and end overlaps. Side overlaps must be at least 50 mm wide.

For ballasted systems, it is recommended to install a conductive layer directly under the membrane (see 2.3.3.2), which allows a reliable test of the tightness of waterproofing coating by the high-voltage test immediately after the waterproofing coating is completed and subsequently throughout its life. If no other non-conductive layers (XPS boards, profiled foil, etc.) are placed above the waterproofing membrane, it is usually possible to reliably locate the leak despite the ballast layer of the gravel or vegetation substrate without the need to remove it.

5.2.5.4 ***FATRAFOL 814 membrane*** (pedestrian traffic covering)

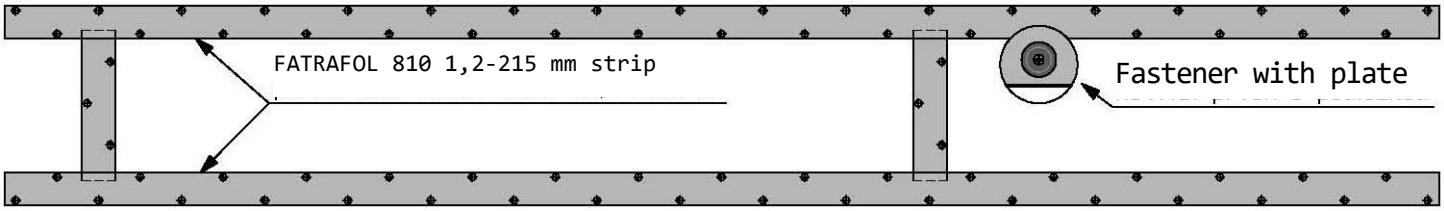
FATRAFOL 814 membrane is installed edge to edge without overlapping on 1,2 mm thick FATRAFOL 810 membrane preinstalled strips at joints (Detail 206aS, 206bS). Substrate slope must big enough to prevent creation of pools of standing water (min. 3%). In addition, conventional joints between a membrane and the perimeter components on the eaves edge may obstruct smooth rainwater drainage from the surface. In result, the drip mould should be recessed approx. 5 mm below the adjacent base structure (by cutting an approximately 150 mm wide edge, reducing the pitched concrete layer or cement levelling compound etc).

There are several ways to extend the traffic layer onto vertical end structures (Detail 304S, 305S). Before the installation, the method of finishing details should be agreed to meet the owner's conditions and requirements. This agreement should be made in writing and signed by both parties.

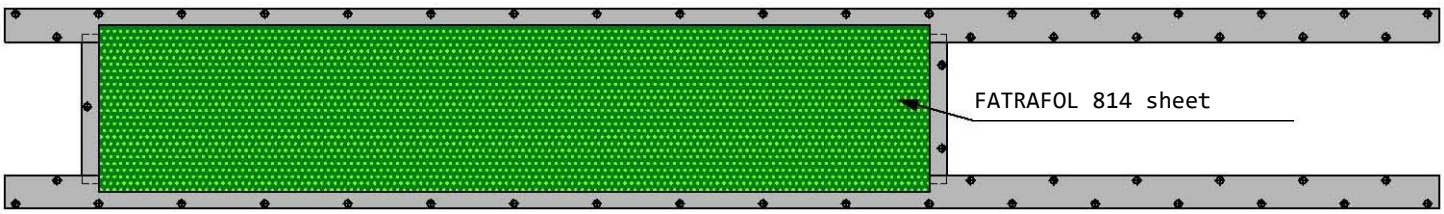
Sheets may also be laid similarly to conventional types of FATRAFOL waterproofing membranes, i.e. with side and end overlaps. However, this method is only used occasionally, mainly to create walkways on a finished waterproofing layer made of PVC-P based membranes for the purpose of inspecting and operating rooftop technical equipment.

Installation process:

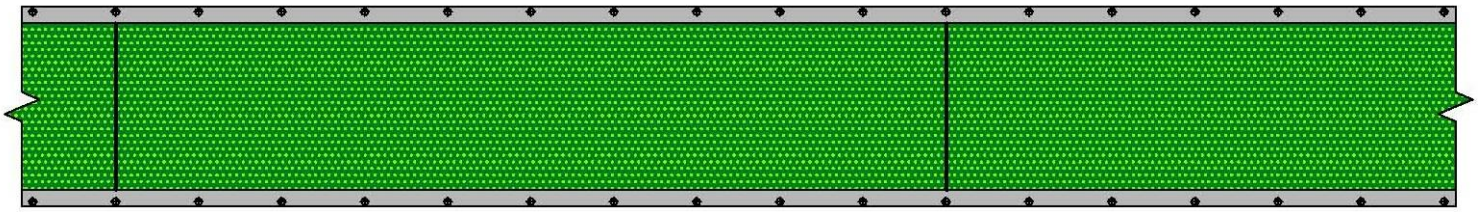
1. The substrate must be covered with non-woven separation fleece having a minimum surface density of 300 g/m². Before FATRAFOL 814 installation, fasten perimeter plastic-coated metal profiles and fastening strips made of the reinforced FATRAFOL 810 membrane (1.20 mm in thickness and 215 mm in width) to the substrate. The fastening strips of FATRAFOL 810 are installed in the longitudinal axis of joints of membrane sheets as well as at the point of end joints of sheets. Fastening strip on long side needs to be overlapped and hot air welded with fastening strip on short side of sheet. Fasten the strips to the substrate alternately at both edges, ensuring that the washer edge is at least 10 mm from the strip edge. Fastening plates with minimum recess and fasteners with flat heads should be used.



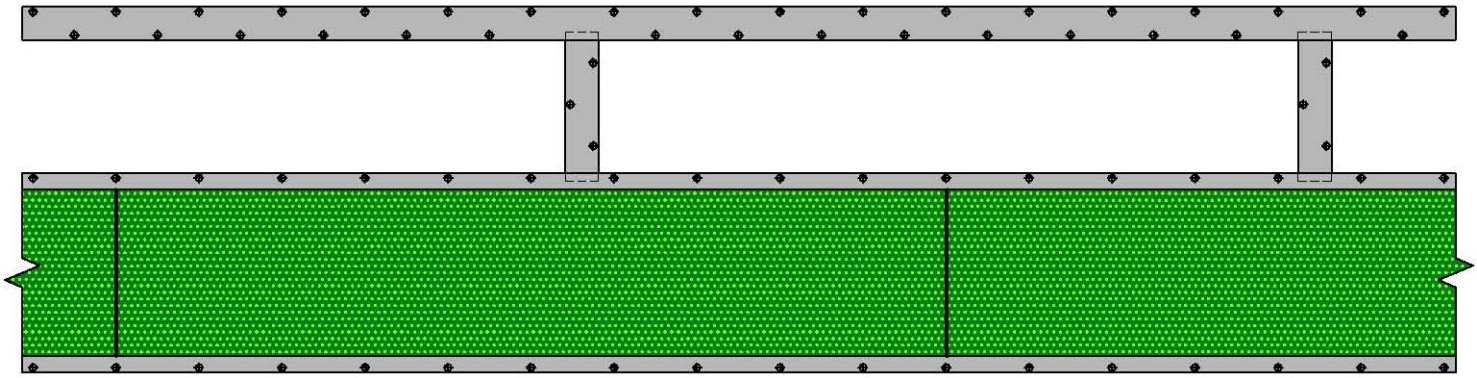
2. Lay the first sheet of FATRAFOL 814 on the prepared substrate.



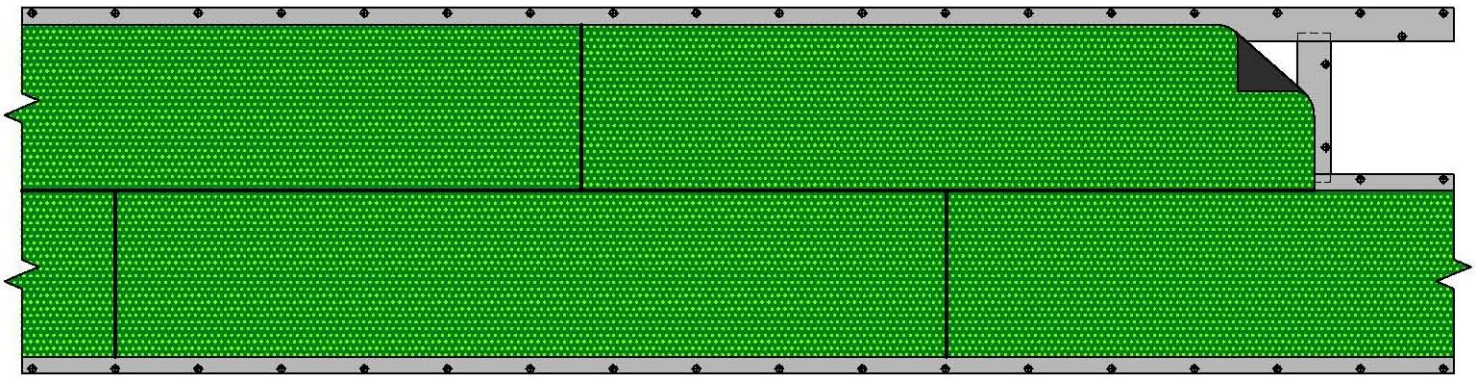
3. Lay the membrane sheets edge-to-edge with 2-3 mm gap.



4. Repeat the procedure under points 1 to 3 for each additional sheet of FATRAFOL 814.



5. Gaps between membranes sheets can be filled with UV stable extrusion wire (Ø 4 mm) or with sealing compound in same color as installed membrane.



For detailing, use FATRAFOL 804 or, if necessary, FATRAFOL 810 of the same colour. For sealing 3D details, use shaped pieces.

5.2.6 Roof detailing

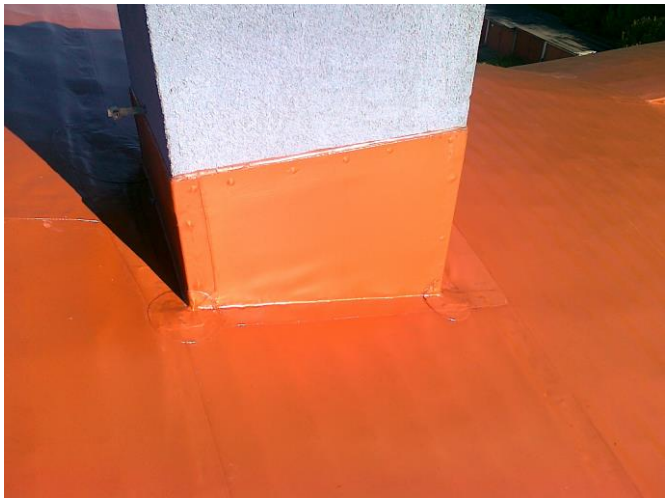
5.2.6.1 Ending waterproofing membranes on vertical structures

If the installation includes end, perimeter and penetrating structures (parapets, skylight edges, pipes etc), the waterproofing membrane must always extend to the vertical part of such structures, at least to a height of 150 mm above the outside surface of the adjacent horizontal roof area (Detail 303S). The joining gap of the waterproofing covering must not be exposed to water under pressure; it may only be exposed to water flowing down the surface of the structures. The height of the waterproofing layer extension to the end or penetrating structure must be chosen with consideration to local weather conditions, possible snow accumulation, snow dynamic effects and other factors. The upper edge of the membrane must be hot-air welded to pre-installed perimeter plastic-coated metal profiles (Detail 301S, 302S). Horizontal to vertical membrane transition must be done in two steps(Detail 400S).

In the first step, the waterproofing of the horizontal surface is terminated either by welding on the inner corner L profile (Detail 402S, 403S, 405S, 407S, 408aS, 408bS) or it is brought to vertical wall approximately 10 mm above the inner corner L profile and pressed against the corner by profile (Detail 401S, 404S, 406S). In the second step, the vertical part of the membrane is installed and transferred to the horizontal surface.

In case of round penetrations, bond the membrane with a PU or polymeric adhesive and secure it in place with a corrosion-proof binding strap. This loose extension of the membrane to penetrations where the membrane is puttied and secured with a binding strap is possible for small-sized circular penetrations. If any of the penetrations, in particular bars and pipes, are likely to be exposed to dynamic loads (impact), the connection to the waterproofing membrane must withstand such loads. The roof deck structure adjoining the bottom part of a penetration must be sufficiently strong and unbroken to allow proper detailing. Pipes and bars penetrating the roof deck must be attached to the load-bearing structure of the roof deck or fixing layer.

Penetrating bar structures (support, auxiliary, technological) should be shaped as closed, ideally round profiles, and allow smooth finishing and ending of the waterproofing membrane on the structure. The shape of open rolled or thin-walled profiles is absolutely unsuitable. In such case use liquid membrane insulation (for example Triflex)



At the point of contact with the waterproofing membrane, pipes with a surface temperature exceeding 40 °C must be equipped with protection and thermal insulation at least to the height of the upper waterproofing membrane edge. The gap between the upper waterproofing membrane edge and the penetration must be sealed with permanently elastic sealer resistant to the surface temperature and fitted with a sleeve or a cap that must be joined watertight to the penetration (Detail 607aS, Detail 607bS).

Vertical ending of roof covering can be done by suitable plastic coated sheet metal L shaped profile, where horizontal membrane is hot air welded to horizontal part of the L profile (Detail 304S). Top edge of L profile is sealed by suitable sealant.

5.2.6.2 Parapet detailing

5.2.6.2.1 Ending a parapet with plastic-coated metal profiles

For added transverse strength, perimeter plastic-coated metal profiles must be fastened alternately in two lines (zigzag pattern). To prevent wind from blowing through the joining gap under the profiles (especially in reconstruction

projects), use a permeable profile to seal the profiles (removal of entrapped moisture through fleece installed over the entire area must be possible). In new buildings, it is usually sufficient to extend the separation layer to the outer edge of the parapet wall coping.

The upper outer surface of the parapet should slope at least 3° (5%) towards the building. Perimeter profiles overlap via the exposed face of the adjacent vertical structure should be min. 30 mm (CSN 73 3610). FATRAFOL membranes must be hot-air welded to perimeter plastic-coated metal profiles and the weld must be at least 30 mm wide (Detail 501S, 503S).

5.2.6.2.2 Ending membranes under parapet flashing

If the parapet has a standard flashing, a FATRAFOL membrane is usually ended by being welded to perimeter plastic-coated metal profile on the inner or outer upper edge of the parapet (Detail 502S). If parapet height exceeds 600 mm, the loose waterproofing membrane must be properly fastened to the parapet (Detail 510S to 513S).

5.2.6.3 Ending membrane at roof plane

5.2.6.3.1 Ending membranes at roof plane with drip mould made of plastic-coated sheet metal

The detailing work is similar to article 5.2.6.2.1. Before installing a drip mould, attach brackets for the eaves gutter. Detailing work for roofs without thermal insulation is shown in Detail 503S. The drip mould extension over the edge of the eaves base structure depends on the gutter dimension and roof slope and must also reflect any loads the edge may be exposed to, e.g. snow or ice. If the drip mould edge extends to far, it should be supported with a suitable profile of steel strips. In hilly and mountainous locations, it is highly recommended to provide complete protection to roof overhangs, e.g. by thermally insulating the soffit, installing electric heating cables etc. Sheet metal components must be fastened in accordance with CSN 73 3610. If direct fastening to the substrate is used, fasteners should not be spaced at more than 250 mm in line.

FATRAFOL membrane should be ended at point where the perimeter flashing component has firm undrelay. (Detail 207S and 208S). Perimeter flashing components are installed with 2 mm expansion joint. These joints are patched with 80 to 100 mm wide homogenous membrane strip. Strip should be welded only around the edges to create expansion gap in flashing joint area. To help creating this expansion gap use 20 mm masking tape over placed over the flashing joint.



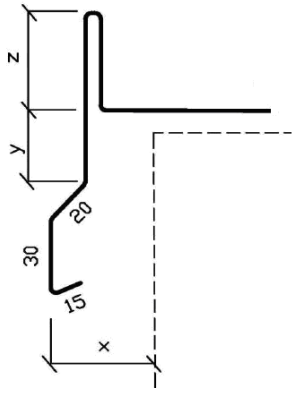

On roofs loaded with a stabilisation, traffic or protective layer of loose aggregate or if it is a green roof, install aluminium or steel shingle profile on top of drip mould. For an example of eaves of a thermally insulated roof with aggregate see Detail 504S.

5.2.6.3.2 Ending membranes at roof plane with gravel stop

The main steps of the detailing work are identical to article 5.2.6.2.1. Gravel stops are usually fastened in two lines, in a zigzag pattern. Recommended height of the '**z**' perimeter component must be at least 50 mm above the adjacent section of the roof plane (CSN 73 1901-3).

Termination of membrane at the edge of the roof by gravel stop flashing made of other material than plastic coated sheet metal is described in Detail 514S.

If the facade is thermally insulated or the gravel stop width **y+z** ≥ 100 mm, the gravel stop must be fastened to a pre-installed steel clip for added rigidity. The same applies if the facade is to be thermally insulated at a later time. In this case, the gravel stop must extend beyond the exposed face of the wall by the necessary length (i.e. thickness of the future thermal insulation). Under CSN 73 3610, the recommended extension length **x** is 30 mm.



5.2.6.3.3 Termination of the waterproofing membrane on the roof plane with existing waterproofing coating

If the existing waterproofing coating is made of FATRAFOL membrane, we can connect a new waterproofing coating made of FATRAFOL membrane to it for the entire period of its service life. Before joining, it is necessary to clean the existing membrane at the weld area with water and then with a cleaner and verify the weldability with the applied membrane. If the weldability is not ideal, the membranes can be joined by welding new to the underside of the existing one. This way, FATRAFOL membrane can usually be connected to PVC-P membranes from other manufacturers to. In this method of terminating a waterproofing coating, it is necessary to keep in mind that the watertightness of the new waterproofing coating at the connection point depends on the service life of the existing waterproofing membrane.

If the existing waterproofing coating is made of another material incompatible with FATRAFOL membranes, the connection can be made using Triflex ProDetail liquid waterproofing. For an example of connection to an existing asphalt covering, see Detail 411S. Watertightness in the transition area is again limited by the service life of the existing waterproofing coating.

5.2.6.4 Valley and parapet gutters, recessed valleys

Valley and parapet gutters as well as recessed valleys should be kept to a minimum in roof structures. Under CSN 73 3610, the recommended longitudinal slope of all such gutters is at least 0.5 %. Make sure that water flow is unobstructed and that waste does not deposit on the roof. When choosing the gutter slope, pay attention to gutter material and distances between gutter outlets. When roof is reconstructed, it is recommended to change recessed valleys to just valleys by filling it with suitable material.

Gutters and downpipes may be blocked by ice in winter, especially if the downpipes are installed in unheated parts of the building. Therefore, it is advisable to keep gutter bottoms and relevant downpipe sections warm. If gutter outlets and downpipes are to be kept warm only by inside air, pay attention to water vapour condensation on the cold surface of these components. Make suitable structural arrangements to avoid its negative effects, e.g. by controlled condensate removal or by installing a water retention or thermal insulation layer.

The method of finishing valley and parapet gutters and recessed valleys depends on their shapes and dimensions.

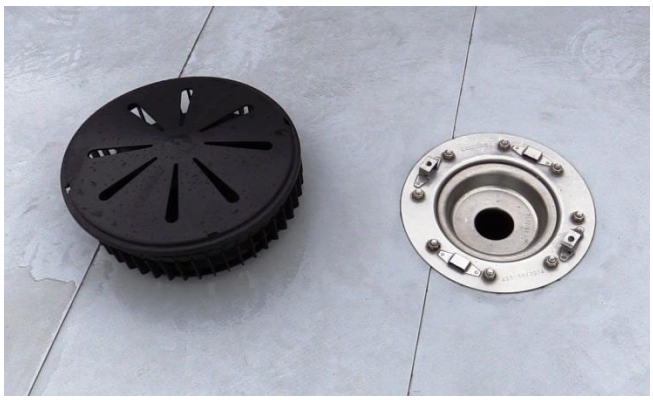
Gutter must be waterproofed in phases by joining membranes at its bottom (see Detail 601S, 602S). Where internal corners cannot be installed, adhere membrane fully to gutter structure.

5.2.6.5 Rainwater outlets

Rainwater outlets and downpipes are part of the base structure and as such they should be installed before the installation of the membrane covering begins and as close to the drained surface as possible. Pay attention to the surface slope and possible changes to the roof surface shape due to loads (snow, ice or occasional loading). Rainwater outlets must allow smooth connection of the membranes and a tight connection to the downpipe. Rainwater outlets should be recessed about 20 mm under the adjacent surface of the drained roof.

If the roof is intended for pedestrian or vehicular traffic, rainwater outlets must withstand related stresses. Rainwater outlets must always be attached to the roof structure with suitable fasteners to secure them against external and internal forces acting in the waterproofing layer. Rainwater outlets must always be fastened to the substrate in at least three points at their perimeter. In adhered system, adhesive supplies mechanical fastening. The method of joining the covering to a rainwater outlet on a concrete roof is shown in Detail 604S.

For PVC-P roofing membranes, use rainwater outlets made of materials compatible with membrane. If rainwater outlets of other materials are used, the membrane is connected by fixed and loose flange.



Ridged PVC rainwater outlets must be sealed to the downpipe they are joined to. Sealing prevents the ingress of water under the covering in case the downpipe is blocked or full, and the ingress of warm humid air from sewers to the roof layers. Use a properly sized rubber seal for reliable sealing of the rainwater outlet and the downpipe. If the downpipe has an unconventional shape or when renovating coverings made of asphalt sheets, use a special outlet with a flexible sleeve.

Use of plasticized rainwater outlet can cause poor quality connection with down pipe, especially at roof reconstructions.

Depending on the roof composition, rainwater outlets must have a suitable dirt and stone trap. It is not recommended to discharge rainwater from the roof deck via parapets into outside drain pipes since there is a risk of freezing in winter. If no alternative solution is available, water should be drained using a PVC rainwater side outlet (Detail 605S). The rainwater side outlet is fastened mechanically to the substrate and hot-air welded to the membrane. An electrically heated outlet should be used for this type of drainage.

5.2.6.6 Pipe penetrations

5.2.6.6.1 Circular pipe penetrations

All bars and pipes penetrating the roof must be securely fastened to the roof deck bearing structure. The fastening method is specified in project documentation, structural assessment and design or by the manufacturer of the penetration.

To eliminate membrane internal forces place three mechanical fasteners around every penetrations.

To finish a pipe penetration use PVC-P shaped sleeves (closed or open up to 200 mm diameter) or combination of collar type 13 and homogenous membrane FATRAFOL 804.(see video FATRAFOL - Pipe penetration).

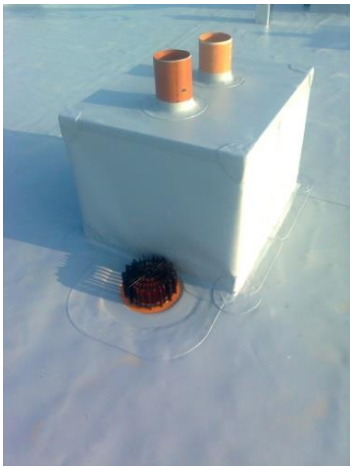
The upper edge of the homogeneous membrane cutting is secured with a corrosion-proof strap and sealed with permanently elastic PU sealer (Detail 606S, 608S).

5.2.6.6.2 Non-circular penetrations

The way to finish non-circular penetrations (chimneys, access holes, skylights, HVAC ducts, supporting structures, bars etc) must be chosen depending on penetration material and shape. For ease of detailing, these penetrations

should preferably have a closed shape (circle, square or rectangle) at the waterproofing layer level. If making any changes to their shape, always remember that the membrane covering must extend at least 150 mm above the external surface of the adjacent roof area. If supporting components of metal or highly heat conductive materials penetrate the entire roof deck (from the interior to the exterior), suitable structural arrangements must be made to prevent water vapour condensation on their surface or to reliably remove the condensed vapour.





A wall flashing may be used for ending a membrane covering on a vertical surface, according to article 5.2.6.1. Alternatively, the membrane must be joined, in a watertight manner, to the penetration with a waterproof material, i.e. by being welded directly to a rigid PVC penetration or by being sealed with PU sealer if the penetration is made of materials not weldable to PVC.

When finishing non-circular penetrations, you should make relevant structural modifications to give the penetration as uniform a geometrical shape as possible, at least to the height covered by the membrane. The membrane covering of the adjacent area must end immediately next to the penetration and be always ended with perimeter plastic-coated metal profiles that must be fastened to the base structure or the penetration if its structure and other aspects so permit. For finishing small dimensions penetration (square or rectangular, max. 150 x 150 mm) is possible to use PVC-P shaped sleeves.

5.2.6.7 Installing vent outlets

Vent outlets are positioned on the roof, so that their ventilation capacity is fully used. This means positioning them on the ridge of individual roof planes and at the perimeter of end structures. When choosing the right position, you should consider the possibility of the outlets being covered with snow.


To reach maximum contact of ventilating air with damped materials inside of structure of reconstructed roofs with thermal insulation, remove the insulation in areas where vent outlets are to be installed. In this case, vent outlets must be mechanically attached to roof substructure by three mechanical fasteners.

This opening must be filled with a suitable thermal insulation material to prevent the ingress of cold air and humidity into the roof structure and to avoid thermal bridges. For vent outlet installation methods see Detail 609S (new building) and Detail 610S (renovation with thermal insulation). Alternatively, a turbine vent may be used to remove entrapped moisture. To finish a turbine vent, follow the instructions for circular pipe penetrations.

5.2.6.8 Dividing roof area with Novoplast profile

When waterproofing pitched or steep roofs, it is sometimes required that their covering imitates the appearance of a profiled sheet covering. For PVC-P membranes, a Novoplast profile, type 1871, nozzle number 2291, serves this purpose.

The profile is laid on a finished membrane covering. Novoplast profiles are available in a length of 2,500 mm. Profiles hot air welding can be done by hand held welding gun or Hertz Belton automatic welding machine.

A Novoplast profile, type 1871, must always be laid in the direction of the roof slope or diagonally to ensure rainwater flow from the membrane covering. Novoplast profiles are installed only for aesthetic purposes and as such they are not designed to and must never be used to join two membrane sheets!

5.2.6.9 Expansion joints

FATRAFOL membrane installation in the axis of building expansion gap depends on the method of fixation and orientation of membrane sheets.

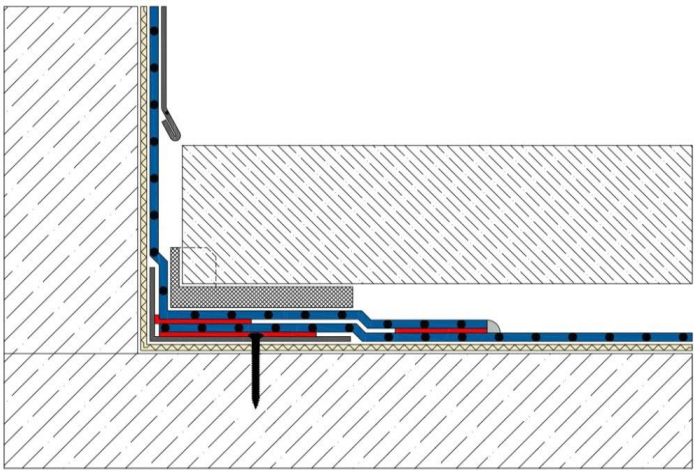
Loosely laid membrane on ballasted roofs doesn´t require any special modification in the axis of expansion gap. FATRAFOL membrane is flexible enough to withstand every movement of the structure (Detail 701S).

Mechanically fastened roofs require to create membrane expansion joint depending on orientation of sheets. If sheets run parallel to building expansion joint, no special treatment is needed (Detail 702S). If sheets of FATRAFOL are oriented perpendicular to building expansion joint, use a strip of 300-400 wide homogenous membrane instead of reinforced one. Same principle apply for adhered roofs (Detail 704S).

5.2.7 Protecting the roof covering surface from mechanical damage

A roof deck must be properly protected during installation works to avoid damage to or deterioration of individual layers, or the loss or reduction of designed performance. Unless specified in the project documentation, the method of protection must be proposed and agreed before the start of works. Suitable measures include dividing the installation into stages or providing protection to finished layers. In addition, placing the main waterproofing layer under a traffic layer or layers reduces the risk of its mechanical damage.

Where intense mechanical stress on the roof covering is envisaged, it is advisable to protect the waterproofing membrane from damage by a protective layer. by doubling the membrane or placing it on a rigid material. Such protective layers usually enhance the roof deck resistance to external fire (Detail 214S).



If the substrate is sufficiently firm, large-format concrete pavers (typical dimensions,400x400x40 mm) on support pads may be used to create a pedestrian traffic layer (over the entire area or walkways only).

Walkways may also be created using the slip resistant FATRAFOL 814 membrane that must be hot-air welded at its perimeter to the finished membrane covering. These sheets must not obstruct rain water drainage.

5.2.8 Installing top separation layer

Where the membrane covering is not the top surface of the roof deck, i.e. in case of roofs with a stabilisation, protective or traffic layer, green roofs and inverted roofs, individual layers must be fully separated with a separation and protective layer to avoid interaction between some of the materials and reduce the risk of mechanical damage. It is usually sufficient to use fleece with a surface density of 300 g/m^2. Fleece sheets must be welded together along the entire length of the joint, not only in points.

5.2.9 Installing ballast layer on roof covering

If installing any additional layers on a finished membrane covering, give consideration to :

- pedestrian and equipment traffic
- stabilisation against wind forces
- roof slope
- roof ballast stabilisation (slope ≥ 6°)
- vegetation layer kind
- admissible roof structure load

Loading and traffic layers should always be removable to allow inspection and repair of the main waterproofing layer or any underlying layer.

5.2.10 Repairing damaged roof covering

If roof covering integrity is damaged locally (mechanically, by high temperature or chemicals), the damaged spot must be covered with a suitably-sized patch, made of FATRAFOL membrane of same or bigger width, that will be hot-air welded at its perimeter to the roof covering. For minor local damage, use circular PVC-P ready-made patches. When applying square or rectangular patches, round their corners to give them a radius of approx. 40 mm. Before applying a patch, make sure to clean the membrane thoroughly of all dirt (wash it using water with detergent; alcohol, benzine). If the membrane cannot be cleaned thoroughly, it is best to insert a patch under the original membrane being repaired and to weld the patch to the clean bottom surface of the covering (applies only to membranes without fleece backing).

This process allows for easy repair of a FATRAFOL membrane covering throughout its service life.

6 OCCUPATIONAL HEALTH & SAFETY, FIRE PREVENTION

6.1 Occupational health & safety at construction site

The essential Czech republic legal regulations that lay down the requirements for occupational health and safety include **Act 309/2006 Coll.** (further conditions for occupational health and safety), **Act 262/2006 Coll.** (Labour Code as amended), **Government Regulation 101/2005 Coll.** on detailed requirements for workplaces and work environments, **Government Regulation 591/2006 Coll.** on essential requirements for occupational health and safety at construction sites, **Government Regulation 361/2006 Coll.** on essential requirements for occupational health and safety at work and **Government Regulation 362/2005 Coll.** on detailed requirements for occupational health and safety for works involving the risk of a fall from a height or into a depth.

The contractor's general obligations regarding project preparation and implementation are laid down in Act 309/2006 Coll.

Detailed requirements for construction site safety, and safe operation and use of machines, equipment, devices and tools are laid down in Government Regulation 378/2001 Coll. Construction site specific requirements are given in Government Regulation 591/2006 Coll., including requirements related to the organisation of works and construction works (e.g. material storage and handling, groundwork, concreting, installation works etc).

Act 262/2006 Coll., Labour Code, applies to the provision of personal protective equipment (PPE). Detailed requirements for PPE are given in Government Regulation 495/2001 Coll.

6.2 Fire prevention

Act 133/1985 Coll. on fire prevention, is the essential framework for creating conditions that effectively protect human life, health and property from fire, and for providing first aid during natural disasters and emergencies.

The act is implemented through Decree 246/2001 Coll. on fire prevention, which defines basic terms related to fire safety.

Other regulations that lay down specific requirements for building fire safety include Act 23/2008 Coll. with regulation 268/2011 Coll. about technical regulation of building fire safety, Act 102/2001 Coll. and Act 59/1998 Coll. on general requirements for building product safety.

6.3 Installation-related safety risks

When installing FATRAFOL-S membranes, follow the above safety, sanitary and fire regulations, as most recently amended, regarding work at construction sites, in particular work at heights.

Electrical equipment (welding machines, drills etc) must be connected and operated in accordance with current regulations, in particular Government Regulation 378/2001 Coll. Connection cables for handheld electrical equipment and construction equipment must be maintained in accordance with manufacturer's instructions and inspected at regular intervals.

Take extra care when handling adhesives and other materials containing solvents, thinners etc. These products are class I flammables and their handling requires adherence to common safety precautions.

TEMPLATE: **RISK FACTORS AND MITIGATION MEASURES**

SITE: studio izolací FATRAFOL

CONTRACTOR **Fatra, a.s., Napajedla, Třída Tomáše Bati 1541, 763 61**

WORK TYPE: **Roof deck membrane covering**

Place	Hazard type	Risk	Precautions
Fatra, a.s., Napajedla	Risk of falling from a height or into a depth	**1**	Protective structures must be erected at the site (scaffolding, protective barriers, fall arrests etc, Decree 362/2005 Coll.). Employees must have personal protective equipment against falls from a height according to EN 358 and EN 361. Employees must be trained in OHS and have a current medical examination.
	Damage to health or risk to life due to inappropriate storage and handling of materials	**1**	Materials must be stored and placed in such a manner to ensure their stability and avoid damage to employee health; do not exceed the permissible load of the substrate. An employee must not handle loads heavier than 50 kg.
	Tripping, sprains, hitting obstructions and penetrations at the site or getting caught by them	**1**	Remove obstructions, keep routes safe and clear, create transport routes for employees.
	Slipping, stepping on a stair edge with the foot in an unstable position upon the stair	**1**	Keep an anti-slip surface on vertical routes, walk carefully on staircases, use prescribed safety footwear.
	Knife cuts, sliding and/or cracking of blade ⇒ cuts on hands, legs and front part of the body	**1**	Take extra care when cutting and splitting material. Use OEM cutting tools and replaceable knife blades, use manufacturer-recommended cutting tools for the material, work with care and do not apply excessive force on the tools, use PPE – Kevlar gloves.
	Eye injury caused by flying debris or chips (material cutting, concrete or metal drilling etc)	**1**	Follow safe working practices, make sure there are no chips and cracks on the tools, use suitable eye and face protection.
	Employee being hit by a loose tool or its component (hammer, cutter, drill bit etc)	**1**	Follow proper working practices and use proper tools, fasten the tools to your belt or working platform, use required PPE (hard hat, goggles, gloves, footwear, work clothing).
	Clothes or their loose parts getting caught in rotating equipment (typically a drill bit of an electric drill, grinding disc, fastener etc)	**1**	Wear suitable, closely fitting clothes and cap. Do not wear gloves close to rotating equipment. Concentrate on the work.
	Irritation to airways and mucous membranes when handling solvents, thinners mineral wool	**1**	Follow safe working practices, wear breathing masks, protective clothing, cap and protective goggles. Make sure fine dust is removed from the workplace. Provide sufficient ventilation for interior works.
	Operator injury by electric shock	**1**	Do not use any damaged power tools, keep connection cables, distribution boards and connection points in full working order and protect them from damage by construction works. Advise all employees of occupational safety rules – only persons familiar with the rules may use power tools. Provide the protection class required by the tool or equipment manufacturer.
	Limb bruises caused by load handling (membrane rolls, palettes)	**1**	Use PPE for hand protection and work footwear with toe protection, take extra care when laying material on rigid support.

A written system of OHS risk prevention is required for most new construction projects. Such documentation is usually part of site takeover documents. Compliance with safety precautions is reviewed by site supervisors and by occupational safety coordinators at larger construction sites.

6.4 Roof safety during use

The durability of the entire roof deck depends on the durability of structural components with the shortest renewal or replacement interval. When a finished roof deck is handed over to the client, make sure to schedule inspections and, if necessary, renewal of selected roof components. If the roof is open to public use (parks, playgrounds, sports grounds etc), give consideration to the risk of intentional damage to or theft of roof deck structural parts or components and adopt suitable measures to minimise such risk.

Safe access to the roof deck must be provided in line with the intended use of the roof. Access to roofs open to traffic is usually described in project documentation. Access to other types of roofs must be provided to allow inspection, maintenance and repair of rooftop equipment.

Recommended minimum dimensions of roof access openings:

- walk through opening (600x1,800) mm (roofs with traffic)
- vertical access opening (600x1,200) mm (roof without traffic)
- horizontal access opening (600x600) mm (roof without traffic)

Roof decks must incorporate a fall arrest system to allow inspection, maintenance and repair of the traffic layer and all equipment placed on it. Under CSN 74 3305 – Safety railings, a safety railing may be used instead of a fall arrest system. The roof Instructions must include safety instructions regarding movement on the roof deck under various weather conditions. The Instructions should also contain a list of informed persons who are allowed access to the roof.

Roof walkways to individual devices must be made of anti-slip material. Also material used under walkways should resist to predicted traffic loads.

Lightning conductors placed on rooftop walkways must not cause an obstruction and safety passages must be built to cross them.

The roof deck perimeter must be so designed that roof deck structural parts and components or rooftop equipment cannot fall over the edge.

7 INSPECTIONS AND ACCEPTANCE OF INSTALLED FATRAFOL-S SYSTEM

7.1 Quality inspection

As part of its internal production management system, Fatra, a.s., Napajedla, the manufacturer of waterproofing membranes, formulated and maintains the '*Inspection Instructions for FATRAFOL Waterproofing Membranes*' that specifies general rules, responsibility for and methods of inspections of membrane coverings and of data processing.

1. The quality of the base structure must be checked before installation of a vapour control layer. The inspection should focus primarily on the structure completeness within the main field, detailing of penetrations and adjacent structures, adherence to process times, on whether the surface is planar and free of dirt, debris, puddles, ice and snow etc, on the required slope angle, completeness of rooftop equipment and connecting pipes, certificate of acceptance by the owner's technical supervisor of documentation etc.
2. An inspection of the vapour control layer covers its quality in terms of technical parameters and quality of its installation in the roof structure. Check, the layer integrity, joints of individual sheets, the way the membrane is joined to perimeter, end and penetrating structures.
3. Inspect of thermal insulation: thickness and slope, gap width, gap filling if appropriate, the way the boards are fastened mechanically or bonded to the substrate, recesses around rainwater outlets, entrapped moisture, deformation of boards, surface strength after installation etc.
4. Before installing the main waterproofing layer, check the membrane quality and its conformity with the approved project documentation, in particular its type, thickness, straightness, undulating and other aspects that allow for visual inspection.
5. Check the following during the installation process: correct installation of the base and separation layer, if necessary, the position of plastic-coated metal profiles and their fastening and expansion gaps, Check placement of membrane sheets in accordance with the fixing plan, method of membrane sheet cutting, side and end overlaps, position of fixing lines, fastener type and quality, distance of fasteners from sheet edges and their required centre-to-centre distances in line, welding method, weld quality and geometry, details and detailing of rainwater outlets.
6. Each roof structure layer should be inspected and sign off to investor's technical supervisor before covered by following layer.
7. These inspections are to be made by a contractor's representative. Within a handover process, complete sections of the membrane covering are inspected, in accordance with contract terms and conditions, by the contractor's engineer, construction site representative, the owner's technical supervisor and other authorised persons as necessary. Details of the handover process are noted in the construction log or constitute a separate report.
8. The work handover and acceptance process is governed by current legislation, owner's requirements, approved terms. In addition to other documents demonstrating the work quality, the handover documentation must also include the so-called 'roof Instructions' and an inspection and renewal schedule for selected structural parts of the roof. It is highly important to schedule inspections of rainwater outlets to ensure they are in full working order. (When drafting this part of documentation, reference may be made to Annex B to current CSN 73 1901-1 inspection schedule). A handover report must be prepared in connection with the work handover and acceptance, indicating all relevant matters. such as obvious defects, outstanding works, deadlines for corrective action.

7.2 Tightness tests of roof covering

Proof of the waterproofing coating tightness, sometimes required when passing the waterproofing layer, can be done in one of several ways or a combination thereof. In the FATRAFOL-S system, after the completion of the waterproofing coating, in addition to performing a complete visual inspection of the integrity of the waterproofing cover, it is recommended to perform a mechanical tightness test with a test needle. After performing this inspection, it is possible to contractually implement one of the other test methods described below.

All tests listed below must be agreed in advance with the construction management and technical supervision of the builder and approved by the PD processor. It is also necessary to consider the price for performing these tests, as the cost of performing, for example of flood test can be expensive.

Technical documentation must be kept for all types of tests performed and a test report must be issued. Protocol templates are for some tests directly prescribed by the standard, for others it is possible to create your own protocol. Persons performing certain types of tests should be professionally qualified for this activity according to special regulations.

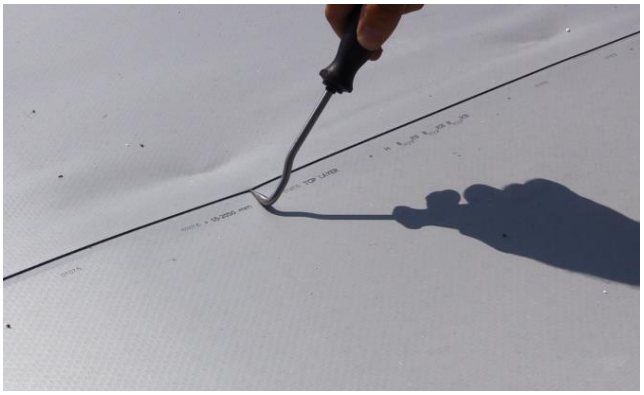
Detected leaks are usually visibly marked, for example, with a marker and subsequently corrected according to the extent. Capillary and local leaks up to approx. 15 mm must be repaired with circular patch. For larger leaks, where the welding nozzle can be sufficiently inserted between the membranes, the repair is performed by repeated welding.

7.2.1 Mechanical tightness test

The test is performed with a so-called test needle and all types of welds can be checked with this method. In the FATRAFOL-S waterproofing system, this test must be performed on all welds made by a manual welding machine, T-joints and at random all continuous joints made by an automatic welding machine.

The welds are checked only after they have cooled down. The test needle used for this type of test is part of the basic equipment of the welder. Needle tip must not be sharp but rounded and dull. By guiding the test needle in the axis of the weld with a slight lateral pressure, it is possible to detect non-welded or separated areas. Testing of the joint, which must be non-destructive to the membrane and its edge, must be carried out with adequate force, taking into account that the membrane does not have unlimited puncture strength. The points where the needle tip penetrates the joint are considered leaky.

ATTENTION! This test must be performed before any treatment of the welds with sealant Z-01, after its aplication it is practically impossible to perform this test and detect leaks.



7.2.2 Tightness test by under pressure– vacuum test

The test is described in CSN EN 1593. Due to the time-consuming nature of this test, it is not possible to perform it in the entire area of the roof, only the membrane joints are checked, in problematic places such as T-joints, corners, corners troughs, gutters, etc. The test is performed using a vacuum pump and shaped bells made of organic glass, which correspond to the geometry of individual details.

A detection liquid (soap solution) is applied to the tested area and a test bell is applied and a vacuum is created by pump. If there is a leak in the joint, air will be drawn from the composition after the vacuum has been created, bubbles will form under the bell and show the leak. The vacuum test can find even very small capillary leaks.

7.2.3 Submersion test

The principle of this test is a modification of the methodology described in CSN 75 0905.The use of this methodology is limited by the given parameters of the roof cladding, in particular the permissible load of the load-bearing structure, the maximum water level and the area of the roof. Usually, roof coverings with an area of up to 100 m² are flooded by a continuous surface, larger areas are then only partially flooded, for example, by depressions of roof planes or otherwise delimited sectors. The maximum height of the water should be recommended by a structural engineer, taking into account the maximum roof cladding load.

The recommended test duration after flooding the roof is 24 hours to 48 hours. For detection purposes, the water can be stained with a food or fluorescent dye, but the stained water can leave colored marks on the waterproofing membrane. In the case of only slight signs of leakage, it is not possible to distinguish colored water from uncolored water.

The flood test usually only reveals the fact that there is a leak in the waterproofing coating. The leak in the waterproofing membrane is manifested by the stain on the ceiling. If there is another continuous waterproof layer in the roof structure under the waterproofing coating (steel trapezoidal sheets, reinforced concrete slab, well-made vapor barrier, etc.), water flows down this layer to a place where it can penetrate further into the interior and the visible leakage in the ceiling does not correspond to the initial place of leak in waterproofing membrane.

It should be noted that leakage into the roof cladding with a properly installed vapor control barrier will not cause water to leak into the interior, but the water will remain retained in the thermal insulation layer. In this case the properties of thermal insulation can damaged. To identify leakage into the roof cladding, it is recommended to install vent outlets in the lowest places of the substrate (usually at drains) before the flood test. The vent outlet allow us to control moisture when flood test is performed. At the end of the test, the vent outlets are removed, the opening is filled with thermal insulation and the roof cladding is closed.

The disadvantage of the flood test is the risk of incorrect evaluation. This happens in cases where the vapor barrier is properly made (usually made of asphalt sheets) and the leaks are only very small. In this case, the test can be evaluated without a negative result, but in fact the penetration of water through the waterproofing membrane occurs but without being detected at the control points.

7.2.4 Spark test

The principle of the spark test is the detection of a leak by a spark between the electrode of the tester and a grounded conductive substrate. The test is performed with a device with a high voltage source and a brush or other electrode that is dragged over the surface of membrane. At the point of the leak, skipped spark is accompanied by an acoustic signal from the device.

The test is conclusive only on roofs with a conductive substrate. In some cases, the natural humidity of building materials can also ensure conductivity. On roofs with a layer of non-conductive thermal insulation under the membrane (e.g. EPS, PIR boards, mineral wool) and in the dry and hot season, the test may be inconclusive or impossible. In order to improve the conductivity of the substrate, conductive membranes or separating fabrics are placed under the waterproofing layer, which will allow an effective spark test to be performed.

In the case of defects in the joint, the significance depends on the size of the overlap of the membranes and the moisture in the given place. The spark test is popular for its simplicity and speed. Its fundamental limit is the presence of a conductive substrate.

7.2.5 Impedance defectoscopy

Impedance defectoscopy is a non-destructive method based on measuring the electrical impedance under a waterproofing membrane. This method uses so-called impedance hygrometers. The method is not directly applicable to clearly demonstrate the tightness of the coating, but allows you to create a detailed moisture map of the roof. After being applied to the floor plan, including the measured values, it allows to locate places under the waterproofing membrane, which are wetter than the surroundings. This makes it possible to approximately locate potential leaks and at the same time diagnose the condition of the thermal insulation layer. The method is used for the overall diagnostics of the roof cladding.

7.2.6 Smoke test

The principle of the smoke test is the injection of colored, non-hazardous smoke under the waterproofing membrane through a hole cut in the waterproofing. In the leak or in the place of a faulty joint, smoke emits above the membrane and is visually detectable.

The test is especially suitable for detecting leaks around details and along the end of waterproofing on adjacent structures. The disadvantage of this test is the fact that it is necessary to cut a hole in the membrane through where smoke is blown under the membrane. This test usually reveals only major leaks in the waterproofing coating and is therefore more of a test that is usually used in combination with other leak detection methods.

7.2.7 Under pressure test for two layer systems

Under pressure tests of two-layer system is part of the inspection activity in various stages of work in progress. The entire sectors in which the air is sucked out, a defined negative pressure is created and it is monitored for a specified time whether the negative pressure drops below the defined value. If the vacuum is lost and the sector is marked as leaking, the leak must be found by one of the above methods.

8 FITTER'S QUALIFICATIONS AND EQUIPMENT

8.1 Qualifications

Fitters installing the FATRAFOL-S waterproofing system must be trained in this work. Regular and special training for new contractors is provided by Fatra's Insulation Studio and a "Certificate of qualifications for installation of FATRAFOL waterproofing membranes" is issued after completion of a 2-day training course. The certificate is valid for 5 years. In accordance with its sustainable development programme, Fatra, a.s., Napajedla provides training courses in product innovations, advanced technologies and legislative changes. These training courses are an opportunity to share technical information and enhance contractors' expertise.

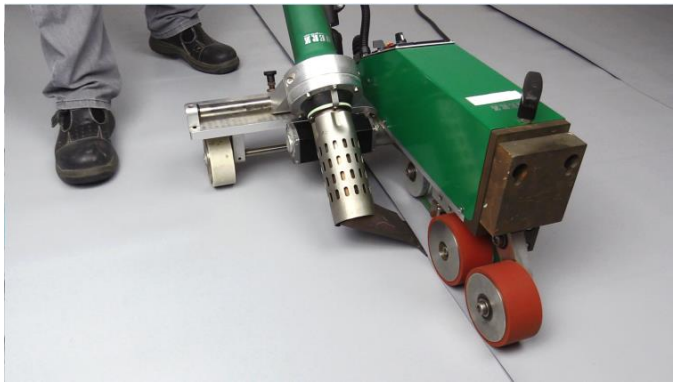
The fitters' supervisor should submit the above 'Certificate of qualifications for installation of FATRAFOL waterproofing membranes' at request. The certificate is a guarantee by Fatra, a.s. Napajedla, the FATRAFOL manufacturer, that the fitters received training and are qualified for the works indicated therein. Team members not holding this certificate may only do unskilled work.

This certificate is not a substitute for technical education (e.g. certificate of apprenticeship in insulation) and does not lead to obtaining a trade licence in the field of insulations.

8.2 Fitters' equipment

8.2.1 Electrical equipment

- Hot-air welding machine with 40 mm and 20 mm wide slot nozzle (recommended type: LEISTER TRIAC S or TRIAC PID, TRIAC AT, HERZ – Rion)
- Hot-air mobile automatic welding machine (recommended type: LEISTER VARIMAT, HERZ – Laron etc)
- Impact drill with set of drill bits for concrete and other materials
- Water extractor
- Vacuum pump and bells for vacuum tightness test
- Cordless screwdriver
- Angle grinder with metal cutting disc
- Other electrical equipment and devices such as automatic fastening machines, sealing guns, PU adhesive applicators etc
- Electrical extension cord



8.2.2 Work tools

- Tension meter
- Levelling instrument
- Folding ruler
- Steel ruler
- Thermometer
- Greasy chalk
- Carpenter's pencil
- Knife with hook
- Scissors
- Membrane cutting pad
- Handheld rubber and Teflon rollers
- Pressing roller (if membrane is bonded to substrate)
- Tool for driving blind rivets (steel pipe Js 4÷5 mm, approximate length 150 mm)
- Hammer
- Rivet pliers
- Sealant cartridge gun
- Combination pliers
- Joint testing needle
- Puncher set
- PE bottles with delivery tube
- Steel cutter
- Cleaning cloths
- Flat and crosshead screwdrivers
- Rubber spatulas for cleaning membrane surface
- Hacksaw
- Sponges for removing puddles
- Hand metal shears
- PE waste bags
- Brass brush for cleaning slot nozzles
- Broom
- Spatulas for sealant
- Dustpan

8.2.3 Essential hand tools – installation kit

Essential protective equipment:

- Work clothing
- Soft-soled shoes with a safety toe cap for summer/winter use
- Protective gloves made of chrome tanned leather
- Protective goggles or face shield
- Knee guards
- Cap with shield
- Sun glasses with UV filter
- Ear protectors
- Dust mask (not necessary)

9 NORMATIVE REFERENCES

Standard	Czech title	English title
CSN 73 0540-2	Tepelná ochrana budov - Část 2: Požadavky	Thermal protection of buildings - Part 2: Requirements
CSN P 73 0606	Hydroizolace staveb - Povlakové hydroizolace - Základní ustanovení	Waterproofing of buildings - Continuous sheet water proofing - Basic provisions
CSN 73 1901-1	Navrhování střech -- Část 1: Základní ustanovení	Designing of roofs -- Part 1: Basic provisions
CSN 73 1901-3	Navrhování střech - Část 3: Střechy s povlakovými hydroizolacemi	Designing of roofs - Part 3: Roofs with waterproofing from flexible sheets
CSN 73 3610	Navrhování klempířských konstrukcí	Design of sheet metal constructions
CSN 74 3305	Ochranná zábradlí	Protective railings
CSN 74 4505	Podlahy – Společná ustanovení	Floors – Common Regulations
CSN 75 0905	Zkoušky vodotěsnosti vodárenských a kanalizačních nádrží	Water supply and sewerage tanks. Testing of water-tightness
CSN EN 1090-4	Provádění ocelových a hliníkových konstrukcí - Část 4: Technické požadavky na ocelové za studena tvarované prvky a konstrukce pro použití ve střechách, stropech, podlahách a stěnách	Execution of steel structures and aluminium structures - Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications
EN 13956	Hydroizolační pásy a fólie - Plastové a pryžové pásy a fólie pro hydroizolaci střech - Definice a charakteristiky	Flexible sheet for waterproofing - Plastic and rubber sheets for roof waterproofing - Definitions and characteristics
EN 13984	Hydroizolační pásy a fólie - Plastové a pryžové parozábrany - Definice a charakteristiky	Flexible sheets for waterproofing - Plastic and rubber vapour control layers - Definitions and characteristics
EN 13970	Hydroizolační pásy a fólie - Asfaltové parozábrany - Definice a charakteristiky	Flexible sheets for waterproofing - Bitumen water vapour control layers - Definitions and characteristics
EN 14783	Celoplošně podepřené plechové výrobky pro střešní krytiny a vnější a vnitřní obklady - Specifikace výrobku a požadavky	Fully supported metal sheet and strip for roofing, external cladding and internal lining - Product specification and requirements
EN 1593	Nedestruktivní zkoušení - Zkoušení těsnosti - Bublinková metoda	Non-destructive testing - Leak testing - Bubble emission techniques
CSN EN 1991-1-1	Eurokód 1: Zatížení konstrukcí - Část 1-1: Obecná zatížení - Objemové tíhy, vlastní tíha a užitná zatížení pozemních staveb	Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings
CSN EN 1991-1-3	Eurokód 1: Zatížení konstrukcí - Část 1-3: Obecná zatížení - Zatížení sněhem	Eurocode 1: Actions on structures - Part 1-3: General actions - Snow loads
CSN EN 1991-1-4	Eurokód 1: Zatížení konstrukcí - Část 1-4: Obecná zatížení - Zatížení větrem	Eurocode 1: Actions on structures - Part 1-4: General actions - Wind loads
EN 358	Osobní ochranné prostředky pro pracovní polohování a prevenci pádů z výšky - Pásy a spojovací prostředky pro pracovní polohování nebo zadržení	Personal protective equipment for work positioning and prevention of falls from a height - Belts and lanyards for work positioning or restraint
EN 361	Osobní ochranné prostředky proti pádům z výšky - Zachycovací postroje	Personal protective equipment against falls from a height - Full body harnesses

EN ISO 14001	Systémy environmentálního managementu - Požadavky s návodem pro použití	Environmental management systems - Requirements with guidance for use
EN ISO 9001	Systémy managementu kvality - Požadavky	Quality management systems - Requirements
CSN 73 0202	Geometrická přesnost ve výstavbě-Základní ustanovení	Geometric accuracy in building. General requirement
CSN EN ISO 6946.	Stavební prvky a stavební konstrukce - Tepelný odpor a součinitel prostupu tepla - Výpočtová metoda	Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods
CSN EN 12056-3	Vnitřní kanalizace - Gravitační systémy - Část 3: Odvádění dešťových vod ze střech - Navrhování a výpočet	Gravity drainage systems inside buildings - Part 3: Roof drainage, layout and calculation
EAD 030351-00-0402	Systémy mechanicky kotvených pružných střešních hydroizolačních povlaků	System of mechanically fastened flexible roof waterproofing sheets

10 Typical roofing details

10.1 Overview of details

10.1.1 Joining FATRAFOL- mutually and with supplementary materials

Detail 201S: Joining FATRAFOL membrane at overlaps without mechanical fastening and at crosswise joints

Detail 202S : Joining adhered FATRAFOL at overlaps

Detail 203S: Joining FATRAFOL membrane at overlaps when mechanically fixed

Detail 204S: Joining FATRAFOL 807 membrane on long side

Detail 205S: FATRAFOL 807 and 807/V and 807/G membrane cross joint

Detail 206aS: Joining FATRAFOL 814 membrane when mechanically fastened

Detail 206bS: Joining FATRAFOL 814 membrane using adhered strip of FATRAFOL membrane

Detail 207S: Joining FATRAFOL membrane with roof perimeter edging profiles

Detail 208S: Joining FATRAFOL 807 and 807/V and 807/G membrane with roof perimeter edging profiles

Detail 209S: Joining FATRAFOL membrane with linear fixing components from plastic coated sheet metal profiles

Detail 210S: FATRAFOL membrane – additional fastening

Detail 211S: Additional insulation of internal corner by shaped piece

Detail 212S: Additional insulation of external corner by shaped piece

Detail 213S: Mechanical fastening of FATRAFOL membrane in center of sheet (with patch)

Detail 214S: Maintenance walkways on roof cover

10.1.2 Ending roof covering on vertical surface

Detail 301S: Ending FATRAFOL membrane on vertical surface

Detail 302S: Ending FATRAFOL membrane on vertical surface

Detail 303S: Ending FATRAFOL membrane on thermal insulated vertical surface

Detail 304S: Ending FATRAFOL 814 membrane on vertical surface – metod 1

Detail 305S: Ending FATRAFOL 814 membrane on vertical surface – metod 2

10.1.3 Transition of roofing membrane from vertical to horizontal position

Detail 400S: Transition of FATRAFOL membrane from horizontal to vertical position

Detail 401S: Transition of FATRAFOL membrane from horizontal to vertical position at wall (parapet) corner - roof covering without thermal insulation

Detail 402S: Transition of FATRAFOL membrane from horizontal to vertical position - roof with typical order of layers on trapezoidal sheet metal

Detail 403S: Transition of FATRAFOL membrane from horizontal to vertical position - restoration of roof covering

Detail 404S: Transition of FATRAFOL membrane from horizontal to vertical position - roof with typical order of layers

Detail 405S: Transition of FATRAFOL membrane from horizontal to vertical position – roof covering with tiles installed on spacers

Detail 406S: Transition of FATRAFOL from horizontal to vertical position – ballasted roof by pea gravel with typical order of layers

Detail 407S: Transition of FATRAFOL membrane from horizontal to vertical position – inverse roof

Detail 408aS: Transition of FATRAFOL membrane from horizontal to vertical position – roof with vegetative layer

Detail 408bS: Transition of FATRAFOL membrane from horizontal to vertical position – waterproofing parapet with non-system flashing components

Detail 408cS: Transition of FATRAFOL membrane from horizontal to vertical position – ending membrane by drip mould

Detail 408dS: Transition of FATRAFOL membrane from horizontal to vertical position – ending membrane by gravel stop

Detail 409S: Connection of bituminous membrane with FATRAFOL membrane with added thermal insulation

Detail 410S: Transition of FATRAFOL membrane to vertical position – fastening of “L” profile to sandwich panel when FATRAFOL oriented parallel to parapet

Detail 411S: Transition of bitumen membrane and FATRAFOL with liquid membrane Triflex

Detail 412S: Transition of FATRAFOL membrane to vertical position at the heal of wall (parapet) with additional installation of EPS

Detail 413S: Ending FATRAFOL membrane at the vertical opening

10.1.4 Detailing of parapets and ending of roof covering at roof plane

Detail 501S: Detailing of parapets with plastic coated sheet metal profiles

Detail 502S: Detailing of parapets on sandwich panels

Detail 503S: Ending FATRAFOL membrane with plastic coated sheet metal drip mould in roof plane

Detail 504S: Ending FATRAFOL membrane with plastic coated sheet metal drip mould, ballasted layer secured by pea gravel stop profile

Detail 505S: Ending FATRAFOL membrane with plastic coated flashing component

Detail 506S: Ending FATRAFOL membrane with drip mould on wall (parapet) with system ETICS

Detail 507S: Ending FATRAFOL membrane with plastic coated flashing component

Detail 508S: Ending FATRAFOL membrane with plastic coated sheet metal drip mould

Detail 509S: Patching plastic coated flashing components expansion gap

Detail 510S: Fastening FATRAFOL membrane at parapet of 600 – 1200 mm height – metod 1

Detail 511S: Fastening FATRAFOL membrane at parapet of 600 – 1200 mm height – metod 2

Detail 512S: Fastening FATRAFOL membrane at parapet of 600 – 1200 mm height – metod 3

Detail 513S: Fastening FATRAFOL membrane at parapet of 600 – 1200 mm height – metod 4

Detail 514S: Ending FATRAFOL membrane by non-system gravel stop

10.1.5 Gutters, rainwater outlets and penetrations

Detail 601S: Detailing of thermal insulated rainwater gutter with FATRAFOL membrane

Detail 602S: Detailing of existing rainwater gutter behind parapet with FATRAFOL membrane

Detail 603S: Joining FATRAFOL membrane with PVC water outlet – ballasted roof on trapezoidal metal

Detail 604S: Joining FATRAFOL membrane with doubled rainwater outlet

Detail 605S: Joining FATRAFOL membrane with horizontal rainwater outlet

Detail 606S: Detailing of railing pole with FATRAFOL membrane

Detail 607aS: Detailing of thermal insulated pipe penetration

Detail 607bS: Detailing of thermal insulated pipe penetration

Detail 608S: Detailing of non-insulated pipe penetration

Detail 609S: Vent outlet on thermal insulated roof

Detail 610 S: Vent outlet on thermal insulated roof with original roof composition

10.1.6 Expansion joints

Detail 701S: Expansion joint in ballasted roof

Detail 702S: Expansion joint in mechanically fastened roof, FATRAFOL oriented paralel to expansion joint

Detail 703S: Expansion joint in mechanically fastened roof, FATRAFOL oriented across expansion joint

Detail 704S: Expansion joint in adhered roof

Detail 705S: Expansion joint in parapet – alternative 1

Detail 706S: Expansion joint in parapet – alternative 2

10.2 Drawings of details

The following drawings show how standard details are finished. The method of fastening membranes to the substrate is only indicative in the cross sections. Fasteners and their layout must always be chosen in accordance with the above construction specifications.

NOTES:

Fatra, a. s.
třída Tomáše Bati 1541
763 61 Napajedla
Czech Republic

tel.: +420 577 501 111

www.fatrafol.com
info@fatrafol.cz

09/2021