

Pond waterproofing system

FATRAFOL-A

CONSTRUCTION AND TECHNOLOGICAL INSTRUCTIONS

for the application of waterproofing membranes
in ponds and water tanks



PN 5422/2017

FATRAFOL-A

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INTRODUCTION

These Instructions are intended for the design and installation of AQUAPLAST waterproofing membranes manufactured by FATRA, a.s. Napajedla, in ponds and water tanks of all sizes, shapes, types and uses.

The regulation deals almost exclusively with the application of the principles and rules that are binding for the creation of liners from AQUAPLAST membranes. Information relating to the operation of ponds, water treatment technology, etc. are mentioned only marginally and are rather informative.

The regulation presents a summary of theoretical and practical knowledge and experience of current research, verification, design and installation of waterproofing membranes since 1958. The regulation is an integral part of the FATRAFOL-A pond waterproofing system. Any changes or deviations from the criteria, requirements, and principles stated herein, motivated by economic, performance, or operational interests, are inadmissible without the prior assessment and consent of the publisher!

Any questions should be directed to:

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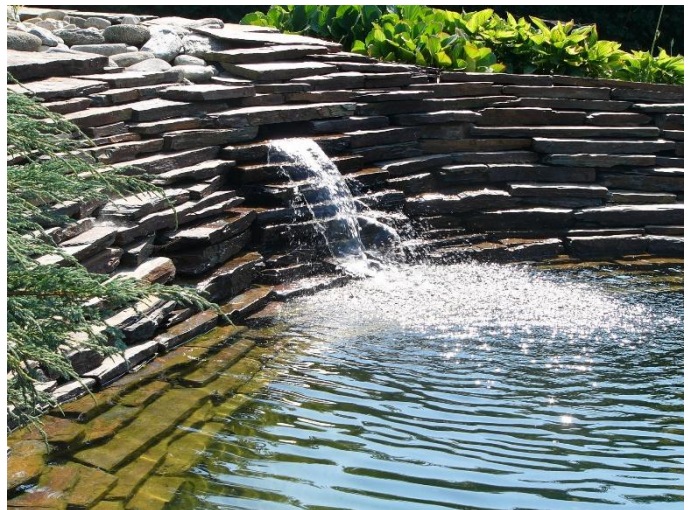
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1 APPLICATIONS AND CHARACTERISTICS OF THE FATRAFOL-A SYSTEM

1.1 *Scope of use*

The FATRAFOL-A waterproofing system is designed for the waterproofing of swimming, decorative or fish farming garden ponds, bio-ponds, biotopes and other water structures such as fire tanks, reservoirs and tanks that come in contact with drinking water, etc.

The versatility of FATRAFOL-A is based on its wide variability for various applications.



1.2 Typical functional characteristics of the FATRAFOL-A waterproofing liners

- the waterproofing liner typically comprises a single layer of membrane with a thickness of 1 to 2 mm
- it prevents water leakage, has high elongation and is adaptable to the ruggedness of the underlying surface
- all joints of the waterproofing liner are made of high strength and watertight welds which can be further proofed
- AQUAPLAST waterproofing liner offers long-term resistance to water stress with various aggressiveness as well as direct weather effects
- the waterproofing liner has a very good chemical resistance to all naturally occurring waters regardless of the amount of minerals and natural substances dissolved therein
- it is harmless to fish and aquatic plants



- AQUAPLAST is resistant to plant root penetration
- mutual compatibility of AQUAPLAST membranes with all the supplementary and auxiliary elements within the FATRAFOL-A system is ensured
- the membranes can be laid year-round with the exception of rain, snow and temperatures below 0°C. It can also be placed on damp surface.
- the waterproofing membrane does not require any maintenance throughout its life
- it allows easy repair in the case of mechanical damage

1.3 Warranty

Fatra, a.s. automatically provides an extended warranty on waterproofing membranes in FATRAFOL-A system beyond the statutory warranty. The conditions of warranty for material are published at www.fatrafol.cz. As a standard, FATRAFOL-A waterproofing membranes come with a 5-year warranty from their installation into a structure, but no more than 6 years after the first sale.

Damaged material or material suspected of not complying with the manufacturer's technical specification (technical data sheet) must be claimed prior to its processing. The origin of the material is proven by a label.

Warranties do not apply to colour stability, surface contamination or environmental contamination, and to other changes to the film resulting from inappropriate operation or maintenance.

2 MATERIALS OF THE FATRAFOL-A WATERPROOFING SYSTEM

The materials comprising the FATRAFOL-A system are divided into:

- AQUAPLAST waterproofing membranes
- additional waterproofing materials
- auxiliary materials

Specific materials mentioned in the following text are for the given purposes directly produced by Fatra, a.s. or selected and verified from the production of other producers. When applying FATRAFOL-A, the specified waterproofing materials must be considered not interchangeable. The author accepts no responsibility for the design and implementation of waterproofing structure that is inconsistent with this CTI.

2.1 AQUAPLAST waterproofing membrane

AQUAPLAST waterproofing membranes are the basic material for creating a waterproofing layer of a water structure.



2.1.1 Manufacture of membranes and basic division of product range

AQUAPLAST membranes are made from plasticised polyvinyl chloride (PVC-P) and only raw materials of well-defined properties are used for their manufacture. The formulas ensure that the membranes have the technical parameters optimal for the intended use.

The membranes are produced by rolling and lamination or extrusion technologies.

The division of the product range is shown in Table 1.

Table 1: Overview of the AQUAPLAST membrane range

Product applications	Calendered and laminated membranes	Extruded membranes
General use	AQUAPLAST 805	AQUAPLAST 805/V
Suitable for contact with drinking water	-	AQUAPLAST 825/V



2.1.2 Temperature resistance and welding temperatures

AQUAPLAST membranes offer long-term resistance to most types of corrosion stress, including heat stress. The basic functional properties of the membranes do not substantially change in the temperature range from -30°C to +80°C and are processable at temperatures from 0°C to + 40°C. The liner can withstand even very sudden and repeated temperature fluctuations, and also short-term extreme overheating.

Recommended welding temperatures for the PVC-P based membranes range from 480°C to 600°C. The welding temperature depends on many factors, such as liner thickness and type, type of welding machine, welding speed, temperature and humidity of the environment and underlying surface, wind velocity, etc. They must therefore be based on a test carried out on-site under the given conditions. The manufacturer recommends that prior to commencing the work, test welds should be made at various welding machine settings, and that optimum parameters for the given conditions should be selected according to the tear test results.

2.1.3 Chemical resistance

The excellent chemical resistance of AQUAPLAST membranes allows them to be used even in environments with high chemical aggressiveness. The membranes also resist all commonly commercially available water treatment products. A basic overview of chemical resistance at a normal temperature of 23°C is shown in Table 2. Because chemical resistance is greatly dependent on the concentration of the substance, its temperature and its duration of action, if the membrane is chemically stressed, it is necessary to treat all cases individually, and separately evaluate especially substances or their combinations not mentioned herein, depending on the expected conditions under which they affect the membrane.

Table 2: Chemical resistance of AQUAPLAST PVC-P membranes

Inorganic acids		Salt solutions	
Sulfuric acid 25%	+	Sulphates	+
Sulfuric acid 98%	Δ	Chlorides	+
Sulphurous acid 6%	+	Nitrates	+
Nitric acid 5%	+	Organic substances	
Hydrochloric acid 10 %	+	Acetone	–
Concentrated hydrochloric acid	Δ	Ethyl alcohol 10%	+
Organic acids		Ethylene glycol	Δ
Benzoic acid	+	Petrol	–
Butyric acid	Δ	Diesel fuel	–
Acetic acid 10%	+	Vegetable and animal oils	Δ
Citric acid	+	Motor and mineral oils	Δ
Tartaric acid	+	Tar	–
Oxalic acid	+	Toluene	–
Oleic acid	Δ	Other	
Inorganic alkalis		Asphalt	–
Sodium hydroxide	+	Beer	+
Potassium hydroxide	+	Soap solutions	+
Ammonium hydroxide	+	Seawater	+
Calcium hydroxide	+	Detergents	+
		Weed control agents (herbicides)	+
		Plant fertilizers	+

Chemical resistance level: + long-lasting resistance Δ limited resistance – no resistance

2.1.4 Strength characteristics

In terms of mechanical properties, AQUAPLAST membranes are characterized by high tensile and compression strength and high yield. In the case of PVC-P membranes, the deformations are largely reversible (elastic). AQUAPLAST membranes also very well withstand point puncture (piercing, tearing, etc.) and they are not subject to the so-called “cold flow” when loaded.

2.1.5 Packaging, transport and storage

The membranes are wound and wrapped in rolls, the rolls are placed on wooden pallets and fixed with a PE foil.

By default, one pallet contains 19 rolls of 1,300mm wide membranes and 21 rolls of 2,000mm wide membranes.

2,000mm wide membrane wound in rolls of smaller lengths and weights can be wrapped on non-standard pallets with each pallet containing 18 rolls placed in 3 layers on top of each other into a block.

The basic types of packaging are shown in Figure 1.

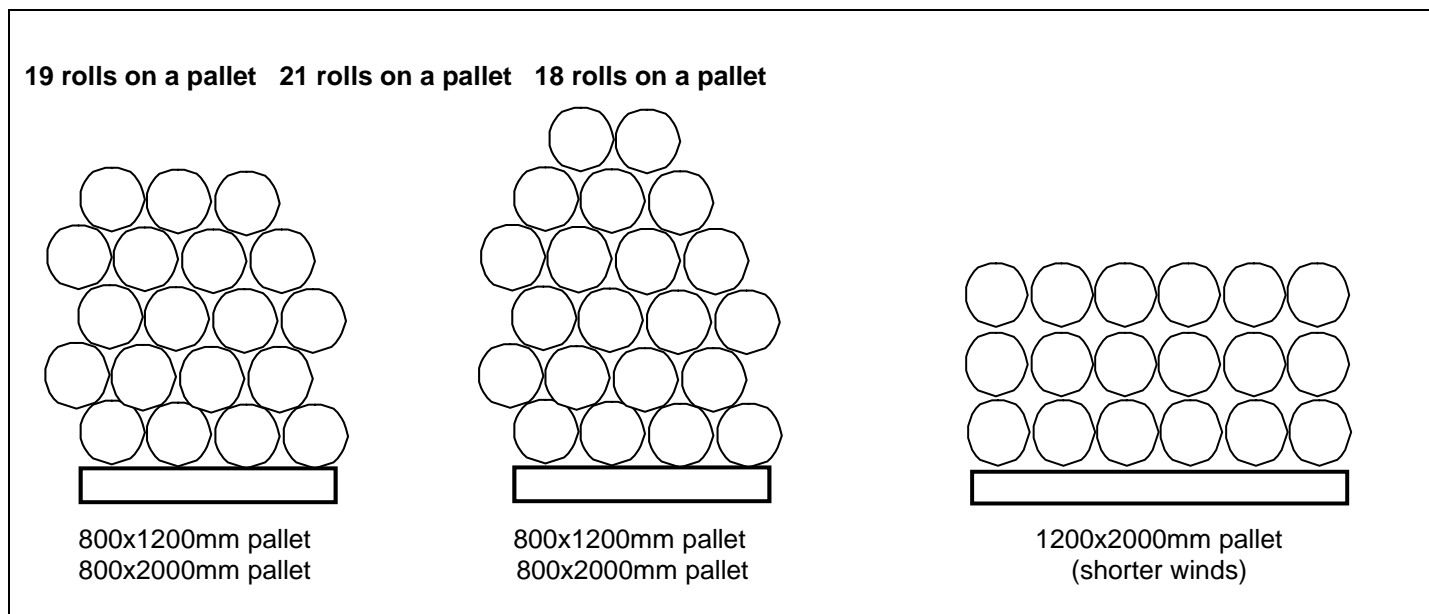


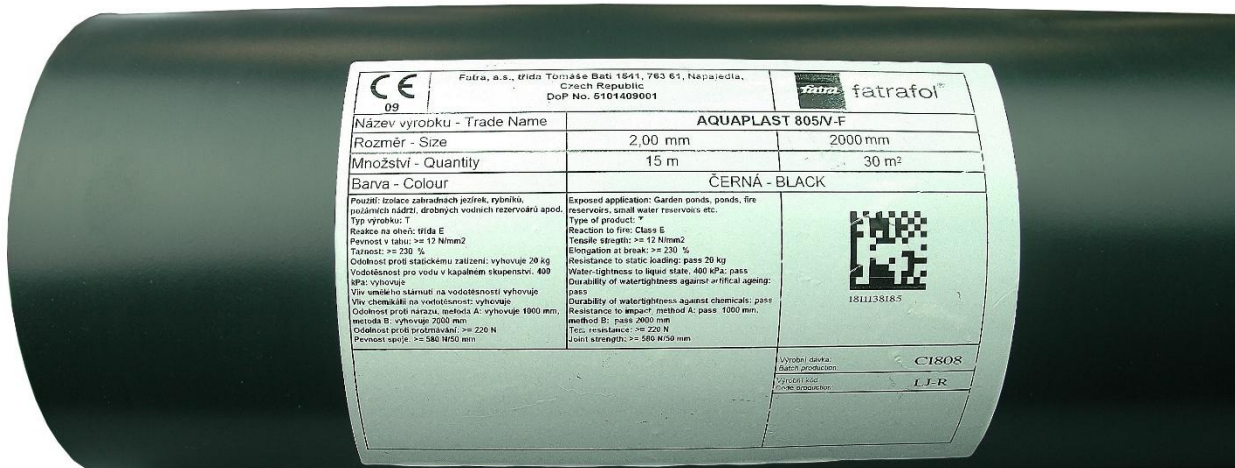
Figure 1: Handling transport units – schematic illustration of roll layout on a pallet

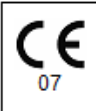


The membranes must be transported in covered vehicles and stored in original sealed packaging.

The recommended storage temperature is -5°C to +30°C. It is necessary to protect the membrane from contamination on the construction site. It is recommended that the film be protected from weather conditions before processing.

2.1.6 Labelling and identification of membranes

Each roll of the membrane is labelled with CE marking. For the identification of the material in the factory, the indication of the production batch and the product code is characteristic.



	Fatra, a. s., třída Tomáše Bati 1541, 763 61 Napajedla, Czech Republic DoP No. 5101107001	 fatrafol®
Název výrobku – Trade name	AQUAPLAST 805/V	
Rozměr – Size	1,00 mm	2 000 mm
Množství – Quantity	30 m	60 m ²
Barva – Colour	RAL 6014	
Použití: Izolace zahradních jezírek, rybníků, požárních nádrží, drobných vodních rezervoárů apod. Typ výrobku: T Reakce na oheň: třída E Pevnost v tahu ≥ 12 N/mm ² Tažnost: ≥ 220 % Odolnost proti statickému zatížení vyhovuje 20 kg Vodotěsnost pro vodu v kapalném skupenství, 400 kPa: vyhovuje Vliv umělého stárnutí na vodotěsnost: vyhovuje Vliv chemikálií na vodotěsnost: vyhovuje Odolnost proti nárazu, met. A: ≥ 600 mm, met. B: ≥ 1750 mm Odolnost proti protrhávání: ≥ 160 N Pevnost spoje: ≥ 460 N/50 mm	Exposed application: Garden ponds, ponds, fire reservoirs, small water reservoirs etc. Type of product: T Reaction to fire: Class E Tensile strength: ≥ 12 N/mm ² Elongation at break: ≥ 220 % Resistance to static loading: pass 20 kg Water-tightness to liquid state, 400 kPa: pass Durability of watertightness against artificial ageing: pass Durability of watertightness against chemicals: pass Resistance to impact, method A: ≥ 600 mm, method B: ≥ 1750 mm Tear resistance: ≥ 160 N Joint strength: ≥ 460 N/50 mm	 XXXXXXXXXX
		Výrobní dávka: Batch production: XYZZ
		Výrobní kód: Production code: XX-Y

2.1.7 Safety regulations

Occupational safety and health

AQUAPLAST membranes are designed for professional use.

AQUAPLAST membranes are articles within the meaning of Article 3.3 of Regulation (EU) No 1907/2006 (hereinafter “REACH”) and are therefore not **subject to the obligation to compile safety data sheets pursuant to Article 31 of REACH**. Products are not classified as hazardous pursuant to Regulation (EU) No 1272/2008 (hereinafter “CLP”).

When installing and joining the membranes, all applicable safety, hygiene and fire regulations must be observed.

Waste disposal

AQUAPLAST waste can be recycled. Waste unsuitable for recycling can be landfilled. Waste contaminated by hazardous substances must be disposed of by incineration in a hazardous waste incinerator.

Table 3: Classification and utilization of AQUAPLAST waste

Catalogue number	Waste name according to catalogue number	Closer waste characteristics, note	Estimated method of recovery or disposal
07 02 13	Plastic waste	PVC-P membrane	- material recovery ^{a), c), d)} - disposal (thermal disposal ^{b)} , landfilling ^{a)})
15 01 01	Paper and cardboard packaging	Paper tubes	- material recovery
15 01 02	Plastic packaging	Packaging PE foil and PE stretch foil	- material recovery

(a) waste

(b) waste contaminated by hazardous substances

2.1.8 Legislative requirements

The quality management system for the development and manufacture of AQUAPLAST (FATRAFOL) membranes is certified according to EN ISO 9001:2009.

Environmental protection and adherence to the principles of environmental management in the development and manufacture of waterproofing membranes is certified according to EN ISO 14001:2005.



In accordance with Directive 89/106/EEC of the Council of the European Communities, as amended by Directive 93/68/EEC, Act No 22/1997 and Government Decree No 190/2002, as amended, all membranes are certified, meet the requirements of the harmonized European standard EN 13967 and have a CE Declaration of Conformity.



2.1.9 Description and technical specifications of individual types of waterproofing membranes

2.1.9.1 AQUAPLAST 805 waterproofing membrane

■ PRODUCT DESCRIPTION

AQUAPLAST 805 is a non-reinforced plasticised polyvinyl chloride (PVC-P) membrane. The membrane is stabilised against UV radiation and has a very good chemical resistance to all naturally occurring waters regardless of the amount of minerals and natural substances dissolved therein. It is resistant to root penetration.



■ USE

AQUAPLAST 805/V is designed for waterproofing of domestic ponds and large water bodies.

■ APPLICATION

The membrane is applied in accordance with the principles set out and described in these instructions. The handling, joining and laying of the membrane can be carried out at temperatures above 0°C but it is recommended to apply the membrane at temperatures above +10°C. The membranes can be joined together by hot air welding. The overlap of the membrane must be at least 50 mm in all cases. To remove the risk of membrane puncture by the underlying surface, a separation geotextile is placed underneath the membrane.

■ PRODUCT INFORMATION





■ Dimensions and basic information on the packaging of the AQUAPLAST 805 membrane

Thickness [mm]	Width [mm]	Surface density*) [kg/m ²]	Winding on the coil		Coil weight *) [kg]	Quantity per pallet		Palette weight *) [kg]
			[m]	[m ²]		coil	[m ²]	
1.00	1,300	1.27	30	39	50	21	819	1,040
			200	260	330			
1.50	1,300	1.90	20	26	50	21	546	1,037
			150	195	370			

*) indicative value

■ Appearance and Colour

- smooth membrane with a matte finish
- top side – in the colour shades specified in the table
- bottom side – black

Model	AQUAPLAST 805 – top side colour	Colour shade
		RAL *)
	anthracite (khaki)	6006
	black	9011
	olive	6014
	green	6000

*) according to the RAL colour table, the shades in some batches (production dates) may differ, up to the 3rd degree of the grey scale according to ČSN EN 20105-A02

■ Technical parameters of the AQUAPLAST 805 membrane – guaranteed values

Property	Testing standard	Guaranteed values	
		1.00 mm	1.50 mm
Tensile strength	ČSN EN 12311-2/B	≥13 MPa	
Elongation		≥ 270 %	
Joint strength	ČSN EN 12317-2	≥ 480 N/50mm	≥ 720 N/50mm
Tear resistance	EN 12310-1	≥ 160 N	≥ 240 N
Resistance to static load	EN 12730/B	bears 20kg	
Watertightness for water in liquid state, 400kPa	ČSN EN 1928/B	compliant	
Impact resistance at 23°C	EN 12691/A	equivalent to 800mm	equivalent to 1250 mm
	EN 12691/B	compliant 2,000 mm	compliant 2,000 mm
Impact of artificial ageing on waterproofness, 60kPa	ČSN EN 1296 ČSN EN 1928	compliant	
Impact of chemicals on watertightness 60 kPa (Ca(OH) ₂ , 10 % NaCl)	ČSN EN 1847 ČSN EN 1928	compliant	
Reaction to fire	ČSN EN 13501-1	E class	
Resistance to roots penetration	ČSN CEN/TS 14416	compliant	

■ RELATED TECHNICAL DOCUMENTATION

- TL 5-1001-06 Technical Data Sheet, AQUAPLAST 805 waterproofing membrane, issued by Fatra, a. s., Napajedla
- Production Control System Certificate No 1390-CPD-0022/06/Z issued by CSI, a.s., Prague, Zlín office

Validity of documentation: For the application of the membrane in a particular project, it is necessary to use the current applicable product documentation (Technical Data Sheet, Declaration of Conformity, Verification, Certificate, etc.), which is available at www.fatrafol.cz or from a business or technical representative of the manufacturer.



2.1.9.2 AQUAPLAST 805/V waterproofing membrane

■ PRODUCT DESCRIPTION

AQUAPLAST 805/V is a non-reinforced plasticised polyvinyl chloride (PVC-P) membrane. The membrane is stabilised against UV radiation and has a very good chemical resistance to all naturally occurring waters regardless of the amount of minerals and natural substances dissolved therein. It is resistant to plant root penetration.



■ USE

AQUAPLAST 805/V is designed for waterproofing of domestic ponds and large water bodies.

■ APPLICATION

The membrane is applied in accordance with the principles set out and described in these instructions. The handling, joining and laying of the membrane can be carried out at temperatures above 0°C but it is recommended to apply the membrane at temperatures above +10°C. The membranes can be joined together by hot air welding. The overlap of the membrane must be at least 50 mm in all cases. To remove the risk of membrane puncture by the underlying surface, a separation geotextile is placed underneath the membrane.

■ PRODUCT INFORMATION

■ Dimensions and basic information on the packaging of the AQUAPLAST 805/V membrane

Thickness [mm]	Width [mm]	Surface density*) [kg/m ²]	Winding on the coil		Coil weight *) [kg]	Quantity per pallet		Palette weight *) [kg]
			[m]	[m ²]		coil	[m ²]	
1.00	2,000	1.28	30	60	77	21	1260	1613
			125	250	320			
			180	360	461			
			500	1000	1,280			
1.50		1.92	20	40	77	21	840	1,613
			65	130	250			
			120	240	461			
2.00			2.54	15	30	76	21	630

*) indicative values

■ Appearance and Colour

- smooth membrane with a matte finish
- top side – in the colour shades specified in the table
- bottom side – black

Model	AQUAPLAST 805/V – top side colour	Colour shade
		RAL *)
	anthracite (khaki)	6006
	black	9011
	olive	6014
	green	6000

*) according to the RAL colour table, the shades in some batches (production dates) may differ, up to the 3rd degree of the grey scale according to ČSN EN 20105-A02

■ Technical parameters of the AQUAPLAST 805/V membrane – guaranteed values

Property	Testing standard	Guaranteed values		
		1.00 mm	1.50 mm	2.00 mm
Tensile strength	ČSN EN 12311-2/B	≥ 12 MPa	≥ 12 MPa	≥ 12 MPa
Elongation		≥ 220 %	≥ 230 %	≥ 230 %
Bond strength	ČSN EN 12317-2	≥ 460 N/50 mm	≥ 650 N/50 mm	≥ 860 N/50 mm
Tear resistance	EN 12310-1	≥ 160 N	≥ 240 N	≥ 320 N
Resistance to static load	EN 12730/B	bears 20kg		
Watertightness for water in liquid state, 400 kPa	ČSN EN 1928/B	compliant		
Impact resistance at 23°C	EN 12691/A	≥ 600 mm		
	EN 12691/B	≥ 1,750 mm		
Impact of artificial ageing on waterproofness, 60kPa	ČSN EN 1296 ČSN EN 1928	compliant		
Impact of chemicals on watertightness 60 kPa (Ca(OH) ₂ , 10 % NaCl)	ČSN EN 1847 ČSN EN 1928	compliant		
Reaction to fire	ČSN EN 13501-1	E class		
Resistance to roots penetration	ČSN CEN/TS 14416	compliant		

■ RELATED TECHNICAL DOCUMENTATION

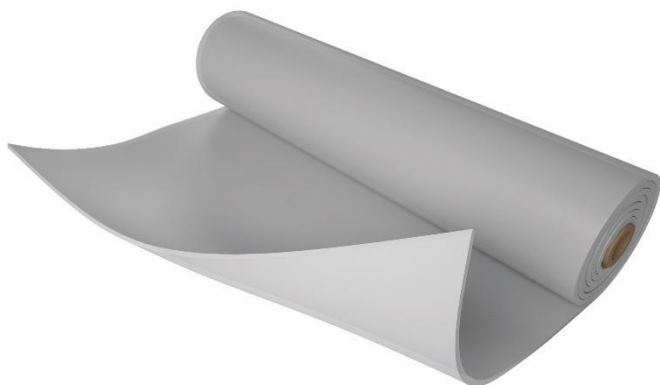
- TL 5-1011-07 Technical Data Sheet, AQUAPLAST 805/V waterproofing membrane, issued by Fatra, a. s., Napajedla
- Production Control System Certificate No 1390-CPD-0022/06/Z issued by CSI, a.s., Prague, Zlín office

Validity of documentation: For the application of the membrane in a particular project, it is necessary to use the current applicable product documentation (Technical Data Sheet, Declaration of Conformity, Verification, Certificate, etc.), which is available at www.fatrafol.cz or from a business or technical representative of the manufacturer.

2.1.9.3 AQUAPLAST 825/V waterproofing membrane

■ PRODUCT DESCRIPTION

AQUAPLAST 825/V is a homogeneous non-reinforced plasticised polyvinyl chloride (PVC-P) membrane. The membrane is stabilized against UV radiation.



■ USE

AQUAPLAST 825/V is designed for waterproofing of reservoirs, tanks and other structures coming into direct contact with drinking water. The membrane is not intended for use in swimming pools.

■ APPLICATION

The membrane is applied in accordance with the principles set out and described in these instructions. The handling, joining and laying of the membrane can be carried out at temperatures above 0°C but it is recommended to apply the membrane at temperatures above +10°C. The membranes can be joined together by hot air welding. The overlap of the membrane must be at least 50 mm in all cases. To remove the risk of membrane puncture by the underlying surface, a separation geotextile is placed underneath the membrane.

■ PRODUCT INFORMATION

■ Dimensions and basic information on the packaging of the AQUAPLAST 825/V membrane

Thickness [mm]	Width [mm]	Surface density*) [kg/m ²]	Winding on the coil		Coil weight *) [kg]	Quantity per pallet		Palette weight *) [kg]
			[m]	[m ²]		coil	[m ²]	
1.20	2,000	1.50	25	50	78	21	1,050	1,628
			20	40	62	21	840	1,302
1.50	2,000	1.94	20	40	78	21	840	1,630

*) indicative values

■ Appearance and Colour

- smooth membrane with a matte finish
- top side – grey RAL 7047

Model	AQUAPLAST 825/V – top side colour	Colour shade
		RAL *)
	grey	7047

*) according to the RAL colour table, the shades in some batches (production dates) may differ, up to the 3rd degree of the grey scale according to ČSN EN 20105-A02

■ **Technical parameters of the AQUAPLAST 825/V membrane – guaranteed values**

Property	Testing standard	Guaranteed values	
		1.2 mm	1.5mm
Tensile strength	ČSN EN 12311-2/B	≥ 15 MPa	
Elongation		≥ 250%	≥ 275 %
Bond strength	ČSN EN 12317-2	≥ 550 N/50mm	≥ 650 N/50mm
Tear resistance	EN 12310-1	≥ 200 N	≥ 240 N
Resistance to static load	EN 12730/B	bears 20kg	
Watertightness for water in liquid state, 400 kPa	ČSN EN 1928/B	compliant	
Impact resistance at 23°C	EN 12691/A	≥ 600 mm	
	EN 12691/B	≥ 1,750 mm	
Impact of artificial ageing on waterproofness, 60kPa	ČSN EN 1296 ČSN EN 1928	compliant	
Impact of chemicals on watertightness 60 kPa (Ca(OH) ₂ , 10 % NaCl)	ČSN EN 1847 ČSN EN 1928	compliant	
Reaction to fire	ČSN EN 13501-1	class F	
Resistance to roots penetration	ČSN CEN/TS 14416	compliant	

■ **RELATED TECHNICAL DOCUMENTATION**

- TL 5-1030-16 Technical Data Sheet, AQUAPLAST 825/V waterproofing membrane, issued by Fatra, a. s., Napajedla
- Production Control System Certificate No 1390-CPR-2016-0114/Z issued by CSI, a. s., Prague, Zlín office; Certificate for permanent contact with drinking water No 472110011 issued by ITC, a.s., Zlín

Validity of documentation: For the application of the membrane in a particular project, it is necessary to use the current applicable product documentation (Technical Data Sheet, Declaration of Conformity, Verification, Certificate, etc.), which is available at www.fatrafol.cz or from a business or technical representative of the manufacturer.



2.2 Waterproofing accessories

Waterproofing accessories are system elements of the FATRAFOL-A waterproofing system whose use helps to create perfect sealing of the waterproofing liner, including individual details. These include vacuum-shaped pieces made of non-reinforced membranes for the processing of spatial details (internal, external corner), membrane cut out patches, drainage elements, plastic-coated sheet metal profiles and sealing materials with high adhesion to the membrane. All these materials (except polyurethane sealant) are based on individual types of waterproofing membranes produced by FATRA, a.s., Napajedla. This ensures their mutual compatibility and material consistency within the FATRAFOL-A waterproofing system.

2.2.1 Shaped piece – internal corner

Vacuum-shaped component of AQUAPLAST 805 membrane; thickness = 2.00 mm

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

Documentation: Company Standard PND 5-101-97, ML No 1/1997

Colour: same as AQUAPLAST 805 membrane

Dimensions: height 50 mm, diameter 120 mm

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

Application: for working and sealing of corners



2.2.2 Shaped piece – external corner

Vacuum-shaped component of AQUAPLAST 805 membrane; thickness = 2.0 mm

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

Documentation: Company Standard PND 5-101-97, ML No 2/1997

Colour: same as AQUAPLAST 805 membrane

Dimensions: height 25 mm, diameter 160 mm

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

Application: for working and sealing of corners



2.2.3 Skimmer

A surface contamination skimmer that can be connected firmly to a pipe that penetrates with use of flange through the wall of the pond or can be connected to a flexible hose. There are also free-floating skimmers with their own motor for smaller ponds.

Type: rigid plastic

Dimensions: neck diameters 60 mm to 110 mm (10 mm increments), 125 mm, 150 mm

Application: Device that cleans the pond surface from floating contamination



2.2.4 Bottom drain

The bottom drain is usually connected to the filter system at the lowest point of the pond

- Type:** rigid plastic
- Dimensions:** neck diameters 60 mm to 110 mm (10 mm increments), 125 mm, 150 mm
- Application:** ensures proper drainage of sludge from the bottom of the pond; thanks to the wide pipe it allows the water to be pumped into other parts of the system; the use of the bottom drain is also advantageous in that no pump hoses and cables are visible in the pond



2.2.5 TW Cleaner – a PVC P membrane cleaner

Colourless liquid.

- Package:** 5L cans
- Application:** TW CLEANER ensures the removal of dirt from the PVC-P-based membrane surface.
- Warning:** highly flammable, irritant, contains acetone and ethyl acetate!



2.2.6 Polyurethane sealant

Highly elastic and flexible sealant with high adhesion to membranes and building materials and long service life when exposed to direct weathering, including UV radiation.

- Package:**
- cartridge 310 ml – 25 Sh A
 - bag 600 ml – 40 Sh A
 - buckets 5 kg – 15 Sh A
- Application:** For long-lasting elastic sealing of waterproofing membranes with metals, plastics and building materials. Sealed surfaces must be dry and clean. Not to be diluted. Apply with a glue gun or spackling knife.

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



2.2.7 Polymeric sealant

One-component elastic hybrid sealant based on MS-polymers. Versatile, air-moisture-curing, it creates a soft elastic, waterproof connection with excellent resistance to weather and chemicals. It is free of solvents, isocyanates, silicone and is characterized by a slight contraction.

- Package:**
- cartridges - 20 x 290 ml (white, light grey, black) - 25 Sh A
 - bag - 20 x 600 ml (white, black, dark brown, anthracite, shades of grey) - 25 Sh A
- Application:** For sealing and filling of joining and expansion joints in indoor and outdoor environments. Sealed surfaces must be dry and clean.

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



2.2.8 Liquid waterproofing compounds

2.2.8.1 Triflex ProDetail

Triflex ProDetail is a liquid waterproofing system based on two-component polymethylmethacrylate (PMMA) resin reinforced with Triflex Special Fleece 110 g/m². Base colour RAL 7032 (river sand), RAL 7035 (light grey) and RAL 7043 (transport grey).



Technical parameters:

- European Technical Approval ETA-06/0269 according to ETAG 005
- resistant to climatic conditions
- resistant to plant root penetration
- resistant to persistent water effect

Application: For waterproofing of non-standard difficult details. Suitable for virtually all types of underlying surfaces in combination with AQUAPLAST PVC-P membrane (FATRAFOL). Applied with a brush or a special sheep roll.

Approved types of underlying surfaces:

- asphalt, bitumen, SBS and APP modified asphalt strips
- concrete, polymer concrete, levelling screed, lightweight concrete, plaster
- steel, stainless steel, aluminium, copper, zinc, lead
- glass, wood
- PVC-P based waterproofing membrane
- plastic surfaces (membranes, coatings, parts) – PVC-P, PU, PMMA, epoxy and polyester resins, EPDM

Application: Can only be applied by a qualified company.

All underlying surfaces must be clean, dry, free from dust, oil, grease, incoherent coatings and other contamination. Adjustment of underlying surfaces (mostly roughening, sandpapering, etc.) must be done according to the manufacturer's recommendations.

Some underlying surfaces require the use of appropriate penetration. Triflex ProDetail is applied in two layers; a reinforcing fleece is inserted between the layers.

The waterproofing becomes waterproof after 30 minutes and walkable after 45 minutes.

Note: The actual application material is prepared by mixing the base component with the Triflex Katalysator catalyst (100 g of catalyst per 5 kg of material). The workability of this material is about 30 minutes.

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

Consumption: approx. 3 kg / 1 m²

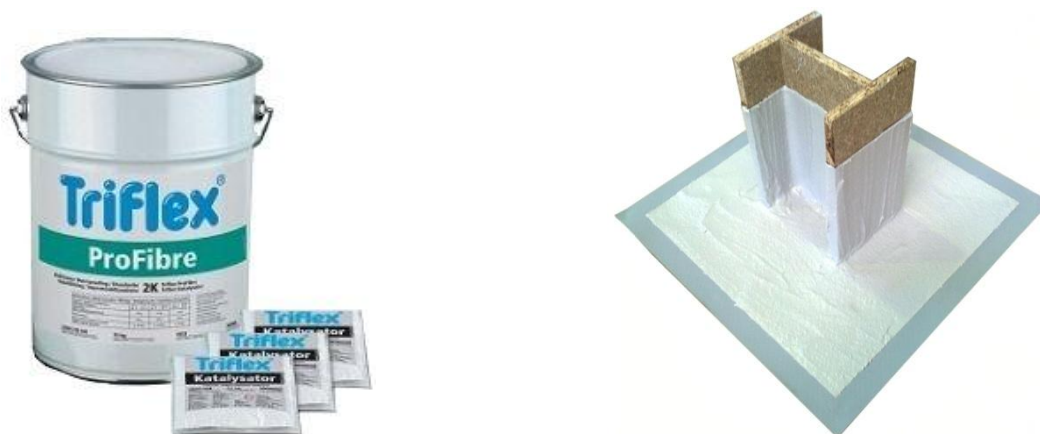
Package: - Triflex ProDetail – a 15kg can
- Triflex Katalysator – a 0.1kg plastic bag
- Triflex Special fleece – reinforcing fleece, widths of 20cm, 52.5cm, 105cm; coil of 50m
- Triflex Cryl Primer 222 and 276 – a 10kg can

Cleaner: Triflex Cleaner (9L can)

Note: *Triflex Profibre is not certified for contact with drinking water and living organisms. Fatra, a.s. cooperates with Triflex GmbH & Co. KG only in the Czech Republic. For the sale and application of Triflex products outside of the Czech Republic please contact directly Triflex GmbH & Co. KG Minden, Germany."*

2.2.8.2 Triflex ProFibre

Triflex ProFibre is a liquid waterproofing system based on two-component polymethylmethacrylate (PMMA) resin reinforced with scattered fibres.



Application: For waterproofing of non-standard difficult details. Suitable for virtually all types of underlying surfaces in combination with AQUAPLAST PVC-P membrane. Applied with a brush or a special roll.
For approved types of underlying surfaces and their modifications, see Triflex ProDetail.

Technical parameters:

- resistant to climatic conditions
- resistant to plant root penetration
- resistant to persistent water effect

Application: All underlying surfaces must be clean, dry, free from dust, oil, grease, incoherent coatings and other contamination. Adjustment of underlying surfaces (mostly roughening, sandpapering, etc.) must be done according to the manufacturer's recommendations.

At least 3kg/m² of Triflex ProFibre is applied on modified and penetration-treated underlying surface with a wool roller or brush.

The waterproofing becomes waterproof after 30 minutes and walkable after 45 minutes.

Application temperature: 0 °C to +40°C

Consumption: approx. 3 kg / 1 m²

Package: - Triflex ProFibre – a 15kg can
- Triflex Katalysator – a 0.1kg plastic bag
- Triflex Cryl Primer 222 and 276 – a 10kg can

Cleaner: Triflex Cleaner (9L can)

Note: *Triflex Profibre is not certified for contact with drinking water and living organisms. Fatra, a.s. cooperates with Triflex GmbH & Co. KG only in the Czech Republic. For the sale and application of Triflex products outside of the Czech Republic please contact directly Triflex GmbH & Co. KG Minden, Germany."*

2.2.9 FATRANYL-PVC plastic-coated sheet metal flashing profiles

Product description: FATRANYL-PVC is a hot-dip galvanized sheet metal with a protective varnish coating on both sides and a plasticised PVC layer on the top.



The functional characteristics of the plastic-coated sheet metal are mainly due to the use of high-quality sheet metal suitable for building applications, and the PVC layer composition ensuring high UV resistance and thermal degradation resistance in hot air welding. FATRANYL-PVC metal sheets do not require maintenance or renewal of the PVC layer throughout their service life.

FATRANYL-PVC meets the requirements of EN 14783.

Use: The plastic-coated sheet metal is designed for line anchoring and perimeter flashing profiles of PVC-P membrane-based waterproofing liners.

Application: The processing of FATRANYL-PVC sheets metal (cutting, bending, shaping, etc.) is similar to the treatment of sheets metal without PVC-P layer, except that these metal sheets cannot be joined by soldering or welding. Joining and connecting is possible with an expansion gap or overlap, followed by patching with strip of membrane.

FATRANYL-PVC plastic-coated metal sheets are weldable by hot-air welding machines with all FATRAFOL-A PVC-P-based waterproofing membranes.

Dimensions and basic information on the packaging:

- metal sheet thickness: 0.6mm, PVC-P layer thickness: min. 0.6 mm
- typically supplied as 2x1m boards
- shaped profiles – for shapes and dimensions see Table 4

Appearance and colour:

- the standard colour is light grey
- also in the shades according to the table


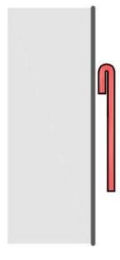

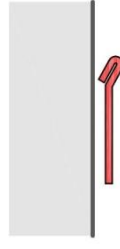

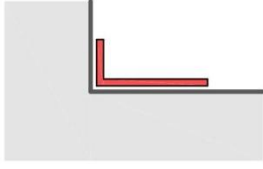

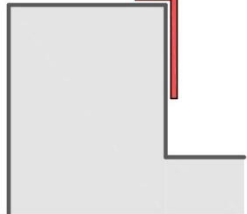
Model	FATRANYL-PVC top side colour	Colour shade	
		Fatra colour card	RAL *)
	white		9010
	light grey	2761	7040
	dark grey	2003	7012
	silver		7001
	red	3104	3016
	blue	9113	5015
	green	7060B	6000
	copper brown	3503	8004

*) according to the RAL colour table, the shades in some batches (production dates) may differ, up to the 3rd degree of the grey scale according to ČSN EN 20105-A02

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

Property	Testing standard	Guaranteed values
Resistance to weather conditions	EN ISO 4892-3	compliant
Adhesion of PVC layer to metal sheet	PZN 1005-11	compliant
Strength of welded joints after aging in water and air	PZN 1001-11	tearing outside the joint
Behaviour in external fire	ENV 1187	B _{ROOF} (t3)

Table 4: Basic recommended shapes and dimensions of FATRANYL-PVC sheet metal profiles

Recommended shape	Name	Recommended minimum unwound width [mm]	Application	Placement layout
	wall profile with bend	70	termination of the waterproofing on a vertical structure	
	wall profile, outbowed	70	termination of the waterproofing on a vertical structure	
	inner corner profile	70 (100)	fastening on inner edges	
	outer corner profile	70 (100)	fastening on outer edges	

Technical documentation: Technical data sheet TL 5–1070-14, FATRANYL-PVC laminated sheet metal, issued by Fatra, a.s., Napajedla



2.3 Auxiliary materials

Auxiliary materials are a set of products serving primarily to ensure contact of membrane insulation with other pond design elements. They include separating and protective fabrics and other materials needed to complete the waterproofing. These products have been tested and verified for this purpose, but are equally interchangeable for products of other manufacturers while retaining the same properties. For an updated product range of auxiliary and supplementary materials, see the current price list.

If it is necessary to use another material not specified above to deal with a particular application, we recommend consulting its suitability with the AQUAPLAST (FATRAFOL) membrane manufacturer.

2.3.1 Separation and protective layers

2.3.1.1 Separation fabrics

Needle-punched non-woven fabric made of 100% polypropylene.

Dimensions: – width of 2,000 mm
– surface density of 200 – 800 g/m²

Application: protective and separating layer for waterproofing liners

Advantages: biological corrosion resistance, effective surface protection against mechanical damage to waterproofing membrane

Packaging: rolls are packed in PE foil, standard coil of 100 m²



2.3.2 Fasteners for mechanical anchoring of the waterproofing membrane

Use: The anchoring elements are designed to mechanically **fasten** the liner waterproofing membrane to the anchoring layer which **is** usually load-bearing structure, and also to **fasten** sheet metal elements to the underlying surface.



Product description: Depending on the type of underlying surface, a typical fastener consists of a bolt or rivet and a steel plate. The screws are usually made of stainless steel with anticorrosion protection or austenitic stainless steel. The plates are made of a steel metal sheet with a suitable surface finish (e.g. Aluzink).

Fasteners designed to mechanically anchor the waterproofing liner must have sufficient anticorrosion resistance.

Dimensions: The screws or rivets are manufactured in a wide range of lengths (from about 25 mm to 300 mm). Steel plates typically have a circular shape with a diameter of 50 (40) mm or a rectangular shape of about 80x40 mm.

Application: The AQUAPLAST membrane is anchored using hand-held power tools.

The fasteners are positioned at the edge of the anchored strip so that the minimum distance between plate and membrane edge is 10 mm.



In the case of anchoring to reinforced concrete, a hole with a diameter of 5.0 to 5.5 mm is usually pre-drilled according to the recommendations of individual manufacturers, which also indicate the recommended drilling depths.

2.3.3 Adhesives

2.3.3.1 Contact solvents adhesives

2.3.3.1.1 FATRAFIX PVC

Contact adhesive for gluing plasticised PVC waterproofing membrane onto different types of underlying surfaces.

Application: For the fixing of AQUAPLAST membranes on vertical wall structures. The membranes can be adhered to a wide range of underlying surfaces, such as concrete, varnished metal sheet, wood fibre boards etc.

Application: The glued surfaces must be clean, dry, free of contamination and dust, free from grease, paint and varnishes that are not fixed to the underlying surface. The optimum **adhesive temperature** for application is above 18°C, but its temperature must always be at least 10°C. The optimal **surface temperature** for application of the adhesive is 15 to 30°C. At temperatures below 15°C, the time required for the adhesive to dry is considerably longer.

FATRAFIX PVC is applied by spraying in a thin, even layer on both surfaces, resulting in approximately 80–100% surface coverage. The spraying is carried out at a distance of approximately 30–40 cm perpendicular to the surface, preferably in the vertical direction on one surface and in the horizontal direction on the other.

Once the adhesive has been applied to both surfaces, it is let to dry slightly until it is not sticky when touched. This takes about 3 minutes at 23°C. Then, the two adhered surfaces are joined together and pressed sufficiently; a roller is to be used to achieve uniform pressure and maximum bond strength. Final bond strengths are achieved 24 hours after joining the adhered surfaces.

Efficiency: 75–100 m² / 17 kg can

Package: 17.0 kg (22.0 L) disposable container for professional use only

Cleaner: FATRAFIX AC cleaner

Storage: in original packaging, recommended storage temperature +5 to +30 °C

Storage: in original packaging, recommended storage temperature +5 to +30 °C



2.3.3.2 FATRAFIX cleaners

2.3.3.2.1 FATRAFIX AC cleaner

Solvent cleaner for contamination with non-hardened FATRAFIX polyurethane adhesives.

Application: **FATRAFIX AC cleaner**
– for cleaning the hose and application gun and nozzle assembly.

FATRAFIX AC cleaner 500 ml – for cleaning work equipment and nozzles

Package: 5 kg (13.7 L) disposable container for professional use only
500 ml spray for professional use only

Storage: in original packaging, recommended storage temperature +5 to +30 °C



3 MAIN CONSTRUCTION PRINCIPLES

3.1 General requirements for the design of pond waterproofing

The waterproofing must be designed and constructed in such a way that it cannot be damaged when the structure is used. A solid and consistent underlying surface prevents undue load on the waterproofing membrane. The edges should be made in such a way as to avoid uncontrolled water leakage.

The general requirements for the waterproofing of water structures depend on their type. In the case of bathing ponds and bio-ponds, it is recommended to lay the waterproofing membrane in the bathing area without folds for easier cleaning. The edges of these water structures should be elevated above the level of the surrounding terrain (min. 100 mm) to prevent surface water from entering the pond. The raised edge can be accompanied by a bypass groove from the outside. For controlled drainage of excess water, it is good to create an overflow.

If water structures are fitted with filtration pumps, it is necessary to ensure that the bottom drain (outlet) is installed at the lowest point. To ensure the correct water circulation, the shape of the structure should be designed without backwater, i.e. still, non-circulating water.



3.2 Base structures



The underlying surface of the water structure's waterproofing layer may be ground (soil), concrete, blocks of formwork or a concrete wall or frame. The top of the underlying surface must be continuous and sufficiently rigid, without sharp edges and protrusions. In the case of dirt underlying surface, it is necessary to remove sharp stones and protruding roots, and then it is recommended to apply a layer of sand. It is also possible to coat the dirt underlying surface with a thin clay to modify the clay substrate. If the bottom of the pond is below the design level of groundwater, it is necessary to ensure the drainage of this water.

3.3 Separation layer

Separation layers are designed to provide mechanical protection for the waterproofing membrane. In most cases, non-woven fabric is used. The surface density of the geotextile may be 300–800 g/m² depending on the quality of the underlying surface.

3.4 Main waterproofing layer

The waterproofing layer in the FATRAFOL-A system consists of one layer of a waterproofing membrane of a defined type which prevents the water leakage from ponds, reservoirs or tank into the subsoil.

3.4.1 Principles of joining waterproofing membranes

When installing waterproofing membrane, the most important operation is a completely watertight and solid connection of the adjacent sheets of the waterproofing membrane, membrane with linear perimeter anchoring profiles made of plastic coated sheet metal and also membrane with various additional elements (shaped pieces, etc.) into one assembly. For welding, manual or automatic welding machines are used.

- **hot-air welding** – hot-air welding is based on so-called fusion welding, which means melting the contact surfaces of the membrane overlap with hot air while compressing them together. This is achieved by a directional flow of hot air from the slot nozzle of the welding machine with a continuous temperature control. We slide the welding machine continuously in the direction of the unwelded joint (while the edge of the slot nozzle extends about 2 mm over the edge of the top membrane). The melted contact surfaces of the membrane are pressed right behind the slot nozzle by a pressure rubber or Teflon roller.

When welding on softer underlying surfaces such as clay or sand, it is necessary to use a pad of stiffer flexible material that is not compatible with PVC. Suitable are strips of PE-HD (EKOTEN 915) or PE-LD membranes (SANOTEN 1116) or FPO membranes. This strip will provide a sufficiently rigid underlying surface for the welding of adjacent sheets of membrane. Approximate welding temperatures for PVC-P based membranes range from 480°C to 600°C. Before welding the membrane sheets, a test weld should always be made on a small sample to achieve the optimum temperature setting. The membranes can be joined at temperatures above 0°C; the recommended application temperature is +10°C to +40°C.



If the correct working procedure is used, this technology allows to reach at least 80% of a shear joint strength declared by the manufacturer. Welding is performed in membrane sheets overlaps of min. 50 mm. When using a manual welding machine, the weld width must be min. **30 mm**. Most automatic welding machines have a welding nozzle width of 40 mm.

3.4.2 Termination of waterproofing membrane around the water structure perimeter

The structural design of the shape of the water structure along its perimeter may be in the form of a soil edge, a concrete wall, blocks of formwork or a stone, stone wall, etc. The termination of the waterproofing membrane should prevent any leakage of water outside the water structure.

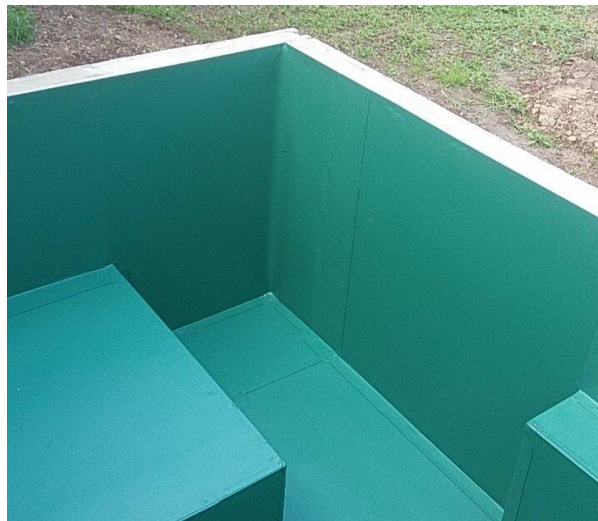
Termination of the membrane into the soil – place the free edge of the membrane into the prepared trench behind the perimeter of the water structure and bury it with soil ([Detail 301A, 302A](#)).

Termination on a stone wall – In this case, it is possible for a practical and aesthetic purposes to place the membrane, under the water level, into a horizontal joint and then continue up behind of the stone wall, i.e. between the wall and the terrain, where we end it above the water level ([Detail 307A](#)).

Termination on a flat, solid substrate – When finishing the membrane on a flat, solid substrate (concrete wall, formwork blocks), it is possible to use line termination elements made of plastic-coated metal sheet.

Termination on a strip of PP – The membrane can be terminated on a PP strip founded in the soil by using mechanical fasteners and plates, or possibly by using a pre-anchored strip of plastic-coated metal sheet or simply by folding over the PP strip. ([Detail 303A, 304A, 305A](#)).

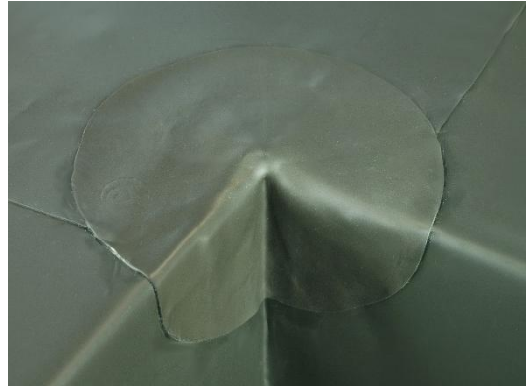
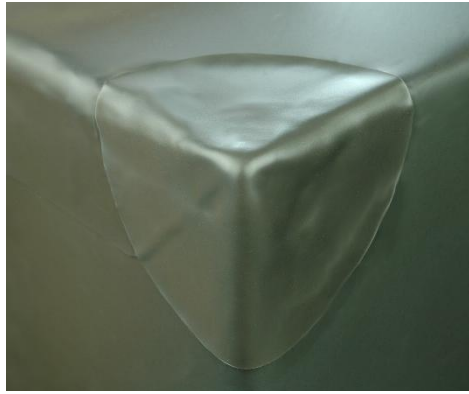
Termination on a plastic edging – The membrane can be anchored on a plastic edging (curb) using mechanical fasteners and plates, using a pre-anchored strip of plastic-covered metal sheet or simply by folding over the strip. ([Detail 306A](#)).



3.4.3 Sealing of spatial details and penetrations

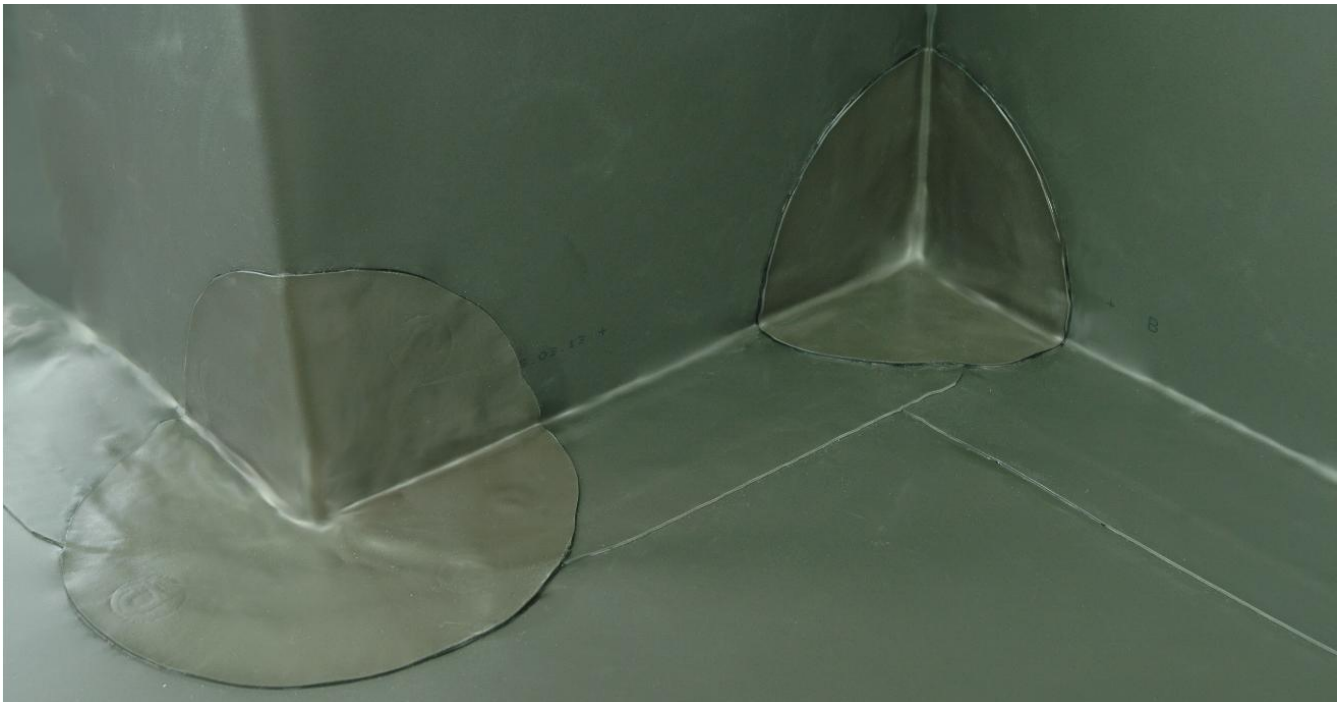
When assembling the waterproofing layer at the point of contact of three waterproofing planes (corners) and in the treatment of other penetrations through the waterproofing liner, the following working procedures are followed.

When processing 3D details, the spatial detail in the first stage is made up of suitable plane sheets of the membrane. This spatial detail (without corrugation and tension) is completed in the second stage by welding a vacuum-shaped spatial component of the corresponding kind, which ensures perfect water tightness of the whole assembly ([Detail 204, 205A](#)). The pre-shaped pieces are joined with the membrane only by hot-air welding all over its area or around its perimeter at a weld width of min. 30 mm.



In the case of working of circular penetrations through the waterproofing membrane (pump hoses, pipes, etc.), spatial shaped pieces are used, either prefabricated (if available in the required dimension) or made of membrane on-site. It is recommended to always use a homogeneous membrane with at least the closest higher table thickness than the thickness of the waterproofing itself. Both types of fittings are welded to the waterproofing membrane by hot-air welding. The upper edge of the shaped piece or the subsequent vertical bandages on the PVC pipe are welded to the pipe, on pipes made of other materials they are sealed with a suitable sealant and fixed in place by a stainless steel worm drive clam ([Detail 401A](#)).

In the case of membrane penetration with a more complicated, difficult-to-work shape, we can use Triflex liquid waterproofing ([Detail 402A](#)). Another reliable method of sealing a penetration is to use a fixed and loose flange. For pond systems they are made of plastic and the inside diameter is designed to precisely connect the pump hose ([Detail 404A](#)) or to the waste pipe ([Detail 405A](#)). For large projects such as sumps or water tanks, it is also possible to use a suitable fixed and loose flange made of metal in combination with a segment seal ([Detail 403A](#)).



4 Procedures for technical preparation of a project

4.1 Documents for preparation of a project

Ponds up to 40 m² – this size is not directly regulated by the Building Act, swimming pools (often applied to ponds) up to this size are not subject to any notification or building permit. (valid for Czech Rep.)

Ponds from 40 to 300 m² and depth max. 3 m – notification obligation, it is necessary to go to the Building Authority with a sketched ground plan of the pond and its location in the garden. (valid for Czech Rep.)

Water areas over 300 m² or more – requires a building permit, project and notification to the Water Authority (valid for Czech Rep.)

Where a construction project is available, the following materials are particularly important to prepare the construction of a pond or water tank:

- technical report
- geological survey
- drawings – ground plan
 - characteristic sections of the pond
 - details of design structures including their thicknesses
- method of filtration
- itemised budget excl. prices
- proposed operation of the pond, including method of maintenance

4.2 Project preparation

The actual preparation of the project includes:

- determination and justification of the type of waterproofing membrane
- the method of stabilizing the waterproofing membrane
- specification of requirements for the adaptation of the underlying surface (see Article **Chyba! Nenalezen zdroj odkazů.**)
- calculation of the area of individual water structure parts (based on given or measured dimensions)
- determining the types and dimensions of the perimeter termination elements (if any)
- determining the type and thickness of the stabilizing / protective / decorative layer
- determining the types and number of spatial fittings, bottom drains, skimmers, penetration fittings
- determining the total material requirements
- compiling the calculation on the basis of the expected workload, project duration and all relevant costs necessary for the implementation of the project, or, alternatively, the compilation of a budget.

5 TECHNOLOGICAL PROCEDURES

5.1 Conditions for waterproofing work

5.1.1 Site preparation

Construction site takeover, i.e. the takeover of a designated workplace pursuant to **Government Decree No 591/2006** (valid for Czech Rep.) on the minimum requirements for health and safety at work on construction sites, including completed structures, all terminating, perimeter and penetration structures and other fixed elements, is performed by the responsible representative of the contractor (site manager, head of shift) in the presence of the sectional or principal site manager of a higher contractor, the technical supervisor of the investor and other authorized persons.

Work should not be commenced on underlying structures not accepted by the technical supervisor of the builder. The takeover of the construction site must be recorded in a construction site diary where the following must be recorded:

- date and time of the construction site takeover
- exact delimitation of the construction site using modular axes (plan or sketch)
- condition of the construction site or workplace in relation to OSH, FP and EMS
- any defects and unfinished work
- signatures of the party handing over and taking over the construction site.



Upon taking over the site, it is recommended to make a photographic documentation of the current state.

As part of site takeover, it is necessary to ensure and determine in particular:

- the place for storing materials and securing them against mechanical damage, weathering and theft
- safe access to the site and assembly point
- safe and economical way of both horizontal and vertical transport
- the location for storing the material directly on the load-bearing or base structure with respect to the permissible load
- connection points for power supply 230/400 V according to valid regulations, including consumption metering
- method of waste management (sorting, environmental disposal, documents)
- necessary measures in accordance with the construction scheme and the requirements of safety, legal and hygiene regulations and standards
- method of coordination of parallel and subsequent construction works and other waterproofing activities (taking into account the operation on completed and not yet taken over parts of waterproofing)
- leakage testing and quality assurance – handover of parts.

5.1.2 Working conditions

The handling, joining and laying of the membrane can be carried out at temperatures above 0°C but it is recommended to apply the membrane at temperatures above +10°C. Work must not be carried out while it is raining, snowing, while there is frost and strong wind.

Waterproofing technicians may only step on installed waterproof membranes with soft-sole footwear which prevents mechanical damage to the membrane while ensuring safe walk on the membrane without the risk of slipping and at the same time meets safety criteria for personal protective equipment.

We recommend checking the sole before stepping on the membrane. It is necessary to clean and remove small wedged objects, stones, traces of asphalt etc.

It is necessary to minimize the entry of other persons on an installed membrane, completely prohibited is using light construction machinery as well as transport and storage of heavy loads on the unprotected membrane.

5.2 Working procedures for mounting insulation membranes

After the construction of the required pond shape, preparation of the underlying surface (removal of sharp protrusions and ruggedness), the completion of the construction works (wall, concrete frames), installation of the piping for filtration and backfilling the pit with a sand layer, it is possible to proceed with the installation of the FATRAFOL-A waterproofing membrane itself. This involves performing the following works, generally in the following order:

- visual inspection of the underlying surface, and removal of any inequalities
- laying of the base, protective and separating layer of nonwoven biocidal fabric
- installation of FATRANYL plastic-coated metal sheet fasteners, if any
- installation of AQUAPLAST waterproofing membrane – dimensional stabilization
- attachment of the membrane to the underlying surface (mechanical anchoring, bonding) – if necessary
- joining the waterproofing membrane overlaps (hot air welding)
- detailing of penetrating structures
- sealing of waterproofing termination elements (flashing) on protruding structures, with a permanently flexible sealant, if necessary
- leakage check of all welds (mechanical probe check, vacuum test, spark test)



Under specific construction conditions, some work operations may be omitted or the following may follow:

- laying a top protective layer (layer of aggregate, decorative stones, etc.)
- planting of aquatic plants
- installation of filtration

5.2.1 Laying of base, protective and separating layers

The base and protection sheets of textile are laid loosely on the underlying surface, with longitudinal and transverse overlapping widths of at least 50 mm. In the overlaps, the individual sheets of fabric are joined together across the whole surface with hot air and compression.

In windy weather it is recommended to temporarily load the loose textile as needed. On vertical surfaces, the base, protective and separating layer is anchored by perimeter terminating elements (flashings) made of plastic-coated metal sheet and/or bonded by PU adhesives.



5.2.2 Installation of perimeter flashing

The installation company is responsible for the correct selection and dimensioning of the perimeter flashing, unless otherwise specified in the flashing element list in the project documentation. The installation of the perimeter flashing, which are bent profiles made of FATRANYL-PVC plastic-coated sheet metal of various shapes and sizes, is generally carried out immediately after laying the base separating layer of the fabric.

Fasteners Flashings made of plastic-coated sheet metal may be installed at the point of termination of vertical waterproofing, but also in places where the slope of the underlying surface suddenly changes, at the points of elevation and the protruding edges of the underlying surface.



Perimeter sheet metal profiles are usually attached directly to the underlying surface. Fastening is done with the designed or recommended fastener type. The distance of the fasteners should not be greater than 250 mm (consumption of 4.5 pcs/m of length). The fasteners must always reach down to a statically stable layer of load-bearing structure (concrete, masonry, etc.).

The method for installing sheet metal profiles for waterproofing liners is described in ČSN 73 3610. Perimeter flashing with a length of 2 m are fitted with mutual expansion joints at least 2 mm wide. If fitted with mutual overlap and fastening, they must be dilated at no more than every 6 meters (e.g. corner strips). The length and shape of the sheet metal profiles are adjusted by cutting.

5.2.3 Laying waterproofing membranes

The laying of all types of waterproofing membranes consists in the unrolling of the sheet, dimensional stabilization, its alignment to the correct position, fastening to the underlying surface in the prescribed manner (if necessary) and making of waterproof joints.

Prior to laying, we must review the supplied material. We first check the condition and integrity of the packaging. We unroll the membrane, perform a visual check of the basic parameters such as the type of membrane, the dimensions, the thickness, the quantity per roll, and we must also find out if the material does not show obvious defects such as mechanical damage, colour deviations, deviations from straightness, edge ripples, contamination, etc. If we find any serious defects, we must not install the membrane. We find the label, copy the printout data at the edge of the sheet and agree with the sales point on further course of action. The manufacturer excludes responsibility for damage caused by deliberately installed material which showed obvious defects and deficiencies prior to installation.

We lay the membrane on the underlying surface which is completely covered with protective and separation textile and usually after fitting the perimeter flashing (if installed).



AQUAPLAST membrane can be laid in two ways. The first simple way is to weld together a sufficiently large sheet on a flat surface, which is then placed in the area of the future water structure, where we shape it as needed. The consumption of the membrane is greater in this way, and we cannot avoid membrane folds.

The second way is to accurately format the waterproofing membrane in the area of the future water structure so that it accurately copies the underlying surface. This method is more difficult because it requires more welding, but it will greatly save the amount of installed membrane. Even the visual impression is better because we avoid folds on the membrane.

Laying of the sheets is done with longitudinal and transverse overlapping. The minimum width of membrane overlaps without mechanical fastening is 50 mm. The length and width of the sheets are adjusted as necessary with a knife or scissors. After laying the sheet in the required position, the membrane is hot-air welded with a weld width of at least 30 mm.

5.2.4 AQUAPLAST membrane fastening

Waterproofing membranes can be anchored using plastic coated metal sheet profiles or point fasteners.

5.2.4.1 Line fastening

Line fasteners for anchoring vertical waterproofing of PVC-P membrane are:

- Profiles made of FATRANYL-PVC plastic-coated metal sheet

Principles for the installation of line fasteners:

- they are usually installed after covering the underlying surface with textile, thereby also fixing it in position
- on walls up to 5 m high, they are usually placed only on their upper edges, on higher walls at several levels above each other
- 2 m length profiles are installed with at least 2 mm wide expansion gaps or with overlap
- they are fastened to the underlying surface by fastener at a spacing of 250 mm. The head of the fastener must tightly rest against the flashing and the underlying surface. Fasteners with round head are recommended.
- the top edge of the end wall profile can be sealed with a PU or MS polymer sealant against the base structure

5.2.4.2 Point fasteners

Point anchoring is carried out as necessary in longitudinal overlaps of sheets by means of a fastener with a plate with minimum diameter of 40 mm according to the following principles:

- in a horizontal area around the perimeter of the insulated section at a spacing of approximately 250 mm
- on vertical surfaces in longitudinal or transverse overlaps of the membrane. The placement of the fasteners in the overlaps must allow for a homogeneous joint (weld) at least 30 mm wide
- outside the membrane overlaps, depending on the nature of the design, the fastener is then waterproofed by welding a patch on it.

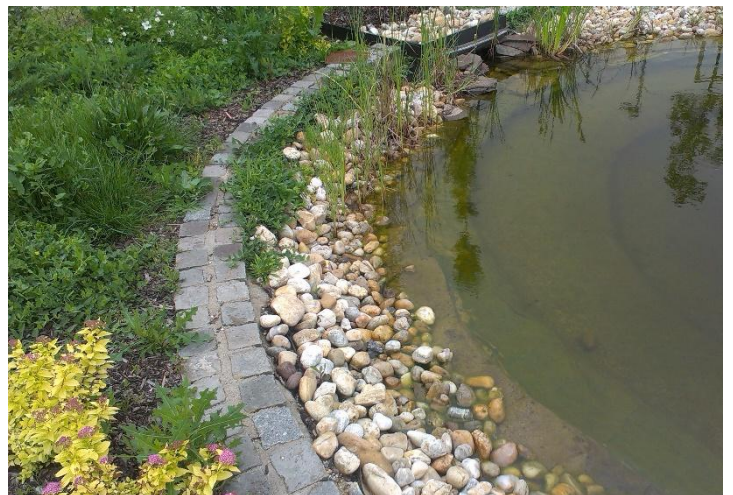
5.2.5 Working of water structure details

5.2.5.1 Termination of waterproofing membrane in the terrain

Typically, the AQUAPLAST waterproofing membrane, together with the separation textile, ends in a solid or prepared terrain in a prepared trench along the perimeter of the water structure. After the textile and membrane have been laid, the excavation is covered with soil and a “lock” is created to secure the membrane against sliding on the sloping surface of the underlying surface ([Detail 301A, 302A](#)). The depth of excavation or gully depends on the size of the isolated water structure. For small ponds, the size of the gully is sufficient for the depth of a spade, and for larger water structures these trenches may reach depths of up to 1 m.

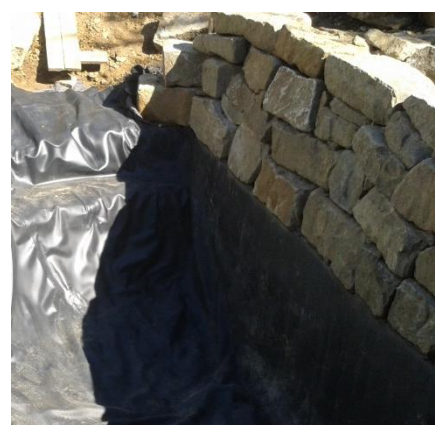


Another way of terminating the membrane on solid terrain is by using a PP strips or a garden plastic curb that we place in the soil at the desired location. This creates a perpendicular surface extending about 5 cm above the terrain. It is possible to terminate the membrane either by means of point fasteners with screws and plates or by anchoring the strip of plastic-coated metal sheet onto which the membrane is subsequently welded ([Detail 303A, 304A](#)). In some cases, for example, when the membrane is loaded with large stones around the perimeter of the horizontal surface of the pond, the membrane is only folded over the top edge of the PP strip or curb ([Detail 305A](#)). With sufficient loading and securing of the membrane around the perimeter of the water structure, it is also possible to pull the membrane and to grip it between larger aggregates ([Detail 501A](#)).



5.2.5.2 Termination of the waterproofing on vertical structures

Termination with a stone wall – If the water surface is delimited by a facework stone wall, the following method of pulling the membrane can be used. We will build a load-bearing wall from the formwork, which will end below the water level. Place the protective textile and AQUAPLAST waterproofing membrane over the front edge of the load-bearing wall with sufficient overlap. We lay the protective textile strip on the upper horizontal edge of the wall and build the stone wall. The membrane clamped between the textile layers is taken up above the water level from the back of the stone wall ([Detail 307A](#)).



Termination on a flat, firm underlying surface – For finishing, perimeter and penetrating structures (e.g. walls) with a flat underlying surface, the membrane can be terminated on pre-installed FATRANYL-PVC plastic-coated profiles by welding the membrane with hot-air. The terminating sheet metal profile is mechanically fastened to the underlying surface by means of suitable fasteners with anticorrosive protection (for example, expansion rivets, concrete screws). The adjacent terminating profiles are placed against each other with a dilatation gap of about 2 mm. The free edge of the membrane is welded on the installed profiles. The protective geotextile should always be pulled up under the terminating profile to protect its back side against damaging the protective varnish.

The transition of the waterproofing liner from a horizontal to a vertical surface can be made from a single piece of membrane. If the transition is geometrically uneven, the membrane can be transitioned in two steps. The vertical part of the waterproofing transitions independently to the terminated horizontal waterproofing liner (usually by welding on the inner corner profile or by spot fastening).



5.2.6 Detailing penetrations

5.2.6.1 Detailing penetrations with collar and sleeve

When the membrane is unfolded, an opening is cut at the penetration point with sufficient reserve for the membrane to pass and be placed in the correct position. The size of the collar must allow a weld with a width of at least 30 mm (the recommended membrane overlap is at least 50 mm). A hole of about 2/3 to 1/2 of the dimension of the penetrating element is cut into the collar. In the case of large penetrations, the collar should protrude approximately 20 to 30 mm above the penetration wall once placed in the final position. The collar is heated with hot air along the circumference of the carved hole and pulled on the penetrating element.

The horizontal part of the penetration is worked with a sleeve from the membrane strip of the desired width. The sleeve is wrapped around the penetration and welded to the collar. The sleeve's elongation and the tighter winding of the penetration can be increased by heating. If the materials of the sleeve and penetration are mutually weldable, it is possible to weld them together. In all other cases, the sleeve is sealed with sealant and fixed with a stainless worm drive clam around the edge ([Detail 401A](#)).

5.2.6.2 Detailing penetrations with shaped pieces

When the membrane is unrolled, an opening is cut as precisely as possible at the penetration point for the membrane to pass and be placed in the correct position. Depending on the possibility of passing, the membrane is cut and overlapped or left intact. For the working of the detail, an open or closed pre-shaped piece is selected. A closed shaped piece is fitted on the penetration and welded to the bottom membrane; an open shaped piece is fitted on the penetration, welded together in the vertical part and welded to the bottom membrane.



At the upper edge, the shaped piece is sealed with a sealant and fixed with a stainless worm drive clam.

5.2.6.3 Detailing the penetrations using a fixed and loose flange

The waterproofing membrane is pulled over the fixed flange. At the location of the bolts and around the perimeter of the casing pipe (pipe sleeve), holes are cut out with maximum accuracy. The membrane is removed and sealant is applied to the fixed flange in two rows.

The waterproofing membrane is placed back on the fixed flange into the sealant and placed in the correct position. The loose flange is fitted on the bolts and tighten evenly ([Detail 403A](#)). The plastic flanges are usually fastened using screws from the outside.

There must be no membrane joint between the flanges.

The gap between the penetrating element and the casing pipe is sealed by system components. For larger metal flanges, these are segmented, expansion or sleeve seals. For plastic pond flanges, most of the system hoses are glued directly to the pipe, or waste pipe with neck and seal is used.



5.2.6.4 Detailing penetrations with liquid waterproofing system

The penetrations of non-closed shapes or hard-to-reach spatial details can be treated with the Triflex liquid waterproofing system in the FATRAFOL-A system. Depending on the nature of the detail, we choose a liquid waterproofing reinforced with fabric or scattered fibres ([Detail 402A](#)).

For application options, consult the developer of this regulation.

5.2.6.5 Installation of bottom drain

Every filter system must contain a bottom drain (a gully). It can be connected directly to a gravity filter or to a pump shaft.

The bottom drain form part of the base structure and should therefore be built before the waterproofing membrane is installed. They are installed in the lowest places of the bottom of the water surface. The design of the drain must allow a reliable connection of the waterproofing membrane and a tight connection to the drainage pipe.

The bottom drain is placed in a pre-excavated trench and together with the connected pipe, it is secured against movement by covering in concrete. Connection of the drain to the pipeline is done either by gluing or by connecting to the neck with a seal. The watertight joint between the drain and the waterproofing membrane is performed using a fixed and free flange. We place membrane exactly onto the drain and cut a hole. We apply PU sealant on the fixed flange in two rows. We place the membrane in position and secure it from above with the free flange ([Detail 406A](#)).



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5.2.7 Laying the top protective layer

If, for example, we place aggregate (or pebble gravel or larger decorative stones) on the waterproofing membrane, it is necessary to separate it completely with a separating (protective) layer. In order to reduce the risk of mechanical

damage, typically nonwoven textile with a density of 300 g/m^2 is sufficient. The individual textile sheets must be welded together over the entire length of the joint.

5.2.8 Repair of damaged insulation



If the integrity of the waterproofing membrane is locally damaged (mechanically, by high welding temperature), the damaged area is repaired with a patch of suitable size from a membrane of the same type and thickness which is welded around the perimeter by hot air. For small-scale local damage, we use the prefabricated round-shaped PVC-P patches, type 12. When applying patches of a square or rectangular shape, we need to wrap the corners of the patches in a radius of about 40 mm. Before applying the patch it is necessary to thoroughly clean the membrane from all impurities (by washing with water with detergent, alcohol or benzine). If the membrane cannot be perfectly cleaned, it is better to place the patch under the original repaired membrane and weld it with a clean back side. In this way, the AQUAPLAST membrane can easily be repaired quickly at any time during its lifetime.

6 OCCUPATIONAL SAFETY AND HEALTH, FIRE PROTECTION

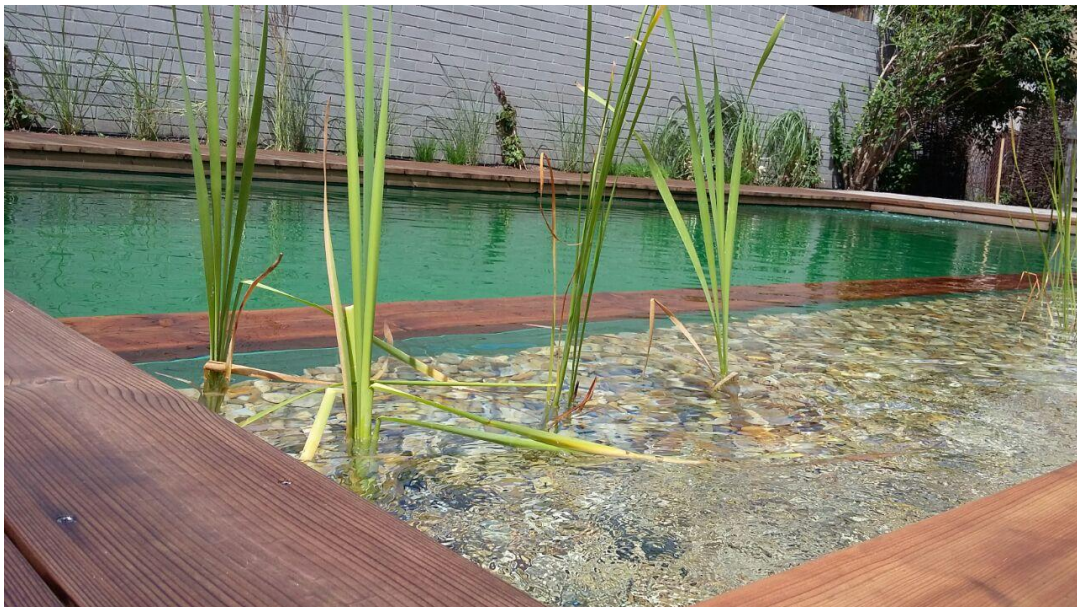
6.1 Occupational safety and health on site

The basic legal regulations of the Czech Republic regulating occupational safety and health include **Act No 309/2006**. (Act on ensuring other occupational health and safety conditions), **Act 262/2006**, (Labour Code, as amended), **Government Decree No 101/2005** on more detailed requirements on the workplace and working environment, **Government Decree No 591/2006** on more detailed minimum requirements for occupational safety and health on construction sites, **Government Decree No 361/2007**, laying down the conditions for the protection of health at work, as well as **Government Decree No 362/2005**, on more detailed health and requirements for occupational safety and health and protection in workplaces with the risk of falling from a height or to depth.

The general obligations of the contractor in the preparation of a project and the execution of construction are specified by Act No 309/2006.

More detailed requirements for construction site protection, safe operation and use of machines, technical equipment, devices and tools are laid down in Government Decree No 378/2001 and specified for construction sites in Government Decree No 591/2006, as well as requirements for the organization of work and the working procedures in the execution of construction activities. (e.g. storage and handling of material, earthworks, concrete works, assembly works, etc.).

The provision of personal protective equipment (PPE) is regulated by Act No 262/2006, the Labour Code; more detailed requirements for PPE are specified in Government Decree No 495/2001.



6.2 Fire protection

Act No 133/1985, on fire protection, as amended by Act No 186/2006, is a basic regulation for creating the conditions for effective protection of life and health of citizens and property against fires and the provision of first aid in the course of natural disasters and emergencies.

Decree No 246/2001 on fire prevention is an implementing regulation of the aforementioned Act and defines basic terms in the field of fire safety.

Other relevant regulations regulate and further specify the specific requirements for fire safety of buildings, e.g. Decree No 23/2008, as amended by Act No 268/2011. On the technical conditions of fire protection of buildings, Act No. 102/2001 and Act No 59/1998 on general requirements for the safety of construction products.

6.3 Safety risks of the implementation process

The connection and operation of used power tools (welding machines, drills, etc.) must comply with the applicable regulations, in particular with Government Decree No 378/2001. The power lines for the operation of hand-held power

tools and equipment on construction sites must be maintained in accordance with the manufacturer's instructions and subject to revisions within specified deadlines.

Special attention must be paid to the handling of adhesives and other materials containing diluents, solvents, and the like. Usually, these are combustibles or caustics and they are required to be handled according to prescribed safety rules.



Most of the newly-started construction projects require the preparation of an OSH risk prevention system. This documentation is usually part of such documentation for the takeover of the construction site. Observance of the measures is checked by the construction managers, and in larger projects by the occupational safety coordinator.









6.4 Excavation work

General protective measures for excavation work (excavation for water supply and sewerage connection located at unknown depth) are as follows:








- prior to the commencement of earthworks, **any underground lines at the construction site must be surveyed in a report and must be demonstrably secured or disconnected**, as documented by an entry in the construction site diary
- slope or support the excavation walls from a depth of 1.3m; with regard to flooded or otherwise incoherent soils that are susceptible to sliding, it is necessary to support the excavation walls even at smaller depths
- proper enclosure, covering or inclusion of all open excavations, openings, exposed pits and shafts on the construction site and their continuous inspection
- the smallest clear width of the vertical wall excavations into which physical persons enter shall be 0.8 m
- the excavation dimensions must be chosen so as to enable the safe performance of all subsequent assembly work, in particular laying pipes, installing fittings, connecting joints, making connections, or welding
- when manually removing the excavation wall supports, it is necessary to proceed from the bottom with the simultaneous backfilling of the excavation with supports removed so as to ensure the safety of work
- engineers and workers must have the required authorization for the operation and handling of machinery and equipment, and must will be familiarized with the manufacturer's instructions and other documents
- a protective zone must be established around the machine, which must be secured by defining the danger area or by supervision of an authorized person (if this is not specified for a particular machine or equipment, it is the maximum range of the machine plus 2 m)
- entry into the excavation is prohibited until the excavation is secured (by supports, sloping)
- prior to the commencement of excavation work, the person responsible for the excavation checks the excavation (checks the supports and excavation walls) and then allows the workers to enter the excavation, and enters the check in the construction site diary
- a safe way (stairs, ladder) must be used for the exit and entry into the excavation.
- the edges of the excavation cannot be loaded within 0.5 m from the edge of the excavation
- an excavation must be secured against falling of persons by a rail or fixed barrier located at least 1.5 m from the edge of the excavation

Other measures – see Government Decree No 591/2006.

Risks, measures taken and steps to ensure OSH on site during earthworks:

Predominant risks		Procedures and measures taken	
 	Earthworks – injury by electric current when encountering underground power lines		written handover of the workplace before commencement of demolition work
			delineation and marking of underground network utility networks, protection zone boundaries and any other barriers
			before commencing excavation work, demonstrably secure or disconnect underground utility networks in the excavation area
			when encountering an unknown line, suspend work until the identification and disconnection of the line
			uncovered underground utility networks must be secured against damage, bending, deflection and uncoupling
 	Earthworks – risks for workers and other persons on site of falling into excavations, excavation slide		secure the site against unauthorized entry
			secure the excavation against the fall of persons (fixed railing or fencing, cover, safety markings)
			secure and mark points of entry and exit to and from the excavation site
			a safe descent to the excavation must be provided (stairs, ladder, ramp)
			before starting the works, secure surrounding buildings endangered by the excavation
			the edges of the excavation must not be loaded within 0.5 m of the excavation edge
			excavation work from a depth of 1.3 m must not be carried out by a single worker
			excavation walls must be secured against sliding by supports or sloping from a depth of 1.3 m in a built-up area and 1.5 m in a non-built-up area
			with regard to flooded or otherwise incoherent soils that are susceptible to sliding, it is necessary to support the excavation walls even at smaller depths
			before commencing work in excavations, the responsible person shall check the excavation (performs a check of the supports and excavation walls) and then allows workers to enter the excavation
			the smallest clear width of the vertical wall excavations into which physical persons enter shall be 0.8 m
			the dimensions of the excavations must be chosen so as to enable the safe performance of all subsequent assembly work, in particular

laying pipes, installing fittings, connecting joints, making connections, etc.

Predominant risks		Procedures and measures taken	
			work safety
			boulders, remnants of building structures or non-cohesive materials in the excavation walls must be secured against release or removed immediately
			covering or enclosing openings or shafts with dimensions of more than 0.25 m with solid railing (installation of warning tape is not a sufficient measure!)
			overpasses must be made over excavations in public areas and publicly accessible roads with a width of at least 150 cm, must have a two-sided two-bar rail with a stop
			0.75 m wide overpasses must be made over excavations at construction sites from depth of 0.5 m; excavations with a depth of up to 1.5 m need to be fitted with railings at least on one side, overpasses over deeper excavations must have a double-sided railing
			carry out periodic professional inspection and necessary maintenance of barriers, rails, supports, crossings, signs and other equipment ensuring the safety of the workplace and its vicinity
	Earthworks – risks of construction workers machinery, transport of material, handling of loads		engineers and workers must be authorised for operation and handling of machines and equipment and be familiar with the manufacturer's instructions and other documents
			when the machine is in operation, do not enter the protection zone (machine working area), which must be secured by fencing the hazardous area or by supervision (for machinery or equipment where this is not specified, this is the maximum range of the machine plus 2 m)
			when backfilling with soil, do not enter the handling area
			when handling material (sheeting, pipe parts, etc.) NEVER walk under suspended loads
			use of PPE according to risk assessment (working helmet, high-visibility workwear, work shoes)
			ensuring permanent supervision by site manager throughout the earthworks



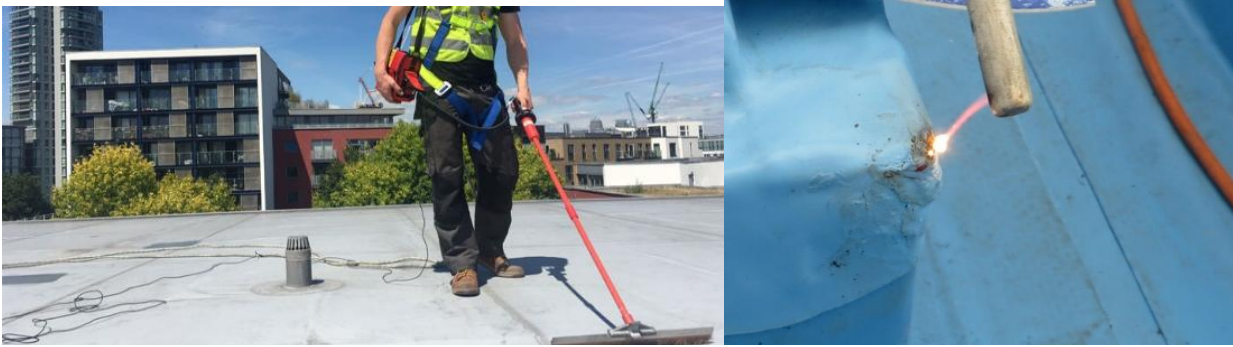
6.5 Leak testing

Tightness of the liner / waterproofing layer of a part of or the whole project can be demonstrated in several ways or a combination thereof. For the FATRAFOL-A system, mechanical, vacuum or spark (high-frequency voltage) test is preferred. Other tests specified here are only used in exceptional cases and are conditional on the corresponding equipment.

1. **Mechanically** – the test probe can be used to check for all weld types no earlier than 1 hour after welding. The test probe used for this type of test is part of the basic equipment of the welder. The tip of the **probe** should not be sharp but rounded. By moving the test needle along the welding axis with a slight lateral pressure, non-welded or separated segments can be detected. This test must be carried out prior to the treatment of the welds with a sealing compound.
2. **Vacuum testing** – according to the ČSN EN 1593 methodology we check randomly selected places of the waterproofing layer (usually T-joints, 3D details, ditches, drains, etc.), using shaped organic glass bells and vacuum pumps. The test is limited to the direct test bell size of approx. 600 mm and the testing of all welds over their entire length is uneconomical and time consuming. Detection liquid (soap solution) is applied to the tested liner, the test bell is applied and vacuum pump is used to create a vacuum. If there is no bubble formation on the surface within 30 seconds, the test point is tight.



3. **Spark test** – This method is able to detect even the smallest leaks in joints as well as spatial mechanical damage to the membrane. A portable high-frequency device capable of generating high voltages of 10–55 kV is used for the spark test. The test electrode ends with a copper brush (or copper rod), which is moved along the installed membrane. In the event of leakage, there is a spark between the brush and the point of leakage, and the device gives an acoustic alert to signal the defect.



All of the above tests must be agreed in advance with the site managers and technical supervisor of the builder and approved by the author of the project documentation. It is also necessary to consider the cost of these tests, because, for example, the spark test can cost up to tens of thousands of CZK.

All the tests must be recorded in technical documentation and a test report must be prepared. For some tests, model reports are directly prescribed by the standard, for others it is possible to create their own report. Persons performing certain types of testing should be professionally qualified to do so in accordance with special regulations.

7 COMPETENCE AND EQUIPMENT OF THE WORKING GROUP OF INSULATION WORKERS

7.1 Professional qualification

Practitioners – waterproofing technicians who install FATRAFOL waterproofing systems have the opportunity to be trained. Regular or special training of new installation companies is provided by a specialized workplace of Fatra, a.s., Napajedla, (Waterproofing Studio) and “Certificates of professional qualification for the installation of AQUAPLAST waterproofing membranes” are issued following the completion of a 2-day course. The validity period of the certificate is 5 years. Fatra, a.s., Napajedla, in line with the Sustainable Development Program, organizes training courses focusing on product innovation, progressive technologies and legislative changes. These training courses enable, *inter alia*, sharing technical information and improving the professional level of installation companies.

The team leaders can, upon request, provide a copy of this Certificate of professional qualification for AQUAPLAST waterproofing membrane installation. By this certificate, the membrane manufacturer AQUAPLAST – FATRA, a.s. Napajedla guarantees that the workers have been trained and are qualified to perform the activities specified on it.

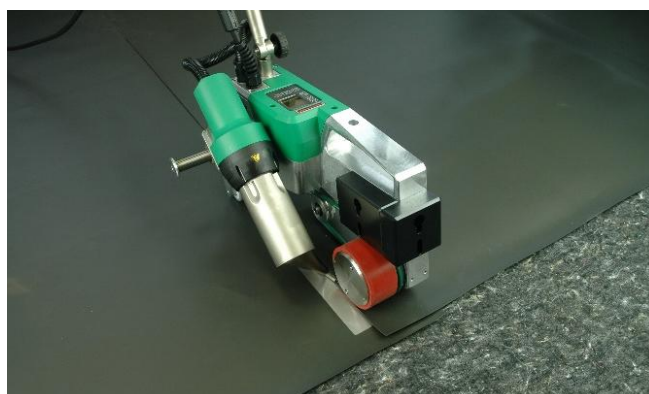
This certificate does not replace vocational training (e.g., the vocational certificate in the field of waterproofing) and it does not entitle the holder to obtain a trade license for the craft trade of waterproofing.



7.2 Equipment of working team

7.2.1 Electrical devices

- hot air welding machine with 40 mm and 20 mm slot nozzle (LEISTER TRIAC S or AT, HERZ - Rion ...)
- hot air mobile welding machine (recommended type LEISTER VARIMAT, HERZ - Laron, etc.)
- impact drill with drill bit set for concrete and other materials
- water vacuum cleaner
- vacuum pump and bells for vacuum tightness check
- cordless screwdriver
- angular grinder with metal cutting disc
- other power tools and devices such as glue gun, PU adhesive applicators, etc.
- electric extension cord



7.2.2 Basic protective equipment:

- work clothes
- shoes with soft soles with safety toe (summer/winter types)
- protective leather gloves
- protective goggles or faceplate
- knuckles
- cap with a visor
- UV glasses
- ear protectors
- respirator (not necessary)

7.2.3 Work tools and aids

- | | |
|---|---|
| <ul style="list-style-type: none"> • tape ruller • steel ruler • felt tip pen • knife with hook • scissors • mat for cutting the membrane • hand-held rubber and Teflon pressure rollers • pressure roller (if the film is glued to the underlying surface) • tool for hammering of support rivets (steel tube Js 4 ÷ 5 mm, length approx. 150 mm) • hammer • mechanical extrusion pistol for cartridge sealant • combination pliers • test probe for weld testing • cleaning cloths • flat and cross screwdrivers | <ul style="list-style-type: none"> • rubber cleaners for cleaning the membrane surface • hacksaw • hand-held sheet metal shears • PE bags for waste • brass brush for slot nozzle cleaning • broom • sealant cleaners • dustpan • PE or TPO membrane welding pad |
|---|---|

7.2.4 Basic set of hand tools – tool bag



8 LIST OF REFERENCE STANDARDS

Standard Designation	Name (Czech)	Name (English)
ČSN 73 3610	Navrhování klempířských konstrukcí	Design of sheet metal constructions
ČSN EN 1593	Nedestruktivní zkoušení - Zkoušení těsnosti - Bublínková metoda	Non-destructive testing - Leak testing - Bubble emission techniques
EN ISO 14001	Environmental management systems – Requirements with guidance for use	Environmental management systems - Requirements with guidance for use
EN ISO 9001	Systémy managementu kvality - Požadavky	Quality management systems - Requirements
EN 13967	Waterproofing bands and membranes – Plastic and rubber bands and membranes for the insulation against humidity and plastic and rubber bands and membranes for insulation against pressure water – Definitions and characteristics	Flexible sheets for waterproofing – Plastic and rubber damp proof sheets including plastic and rubber basement tanking sheet – Definitions and characteristics
ČSN EN 20105-A02	Textilie. Zkoušky stálobarevnosti. Část A02: Šedá stupnice pro hodnocení změny odstínu (ISO 105-A02:1993)	Textiles. Tests for colour fastness. Part A02: Grey scale for assessing change in colour (ISO 105-A02:1993)



9 Principles of finishing typical details

9.1 Overview of details

9.1.1 Joining AQUAPLAST membranes mutually

Detail 101: Single weld in membrane overlap

9.1.2 Transition of membrane from vertical to horizontal position

Detail 201: Membrane transition from horizontal to vertical position with mechanical point fastening

Detail 202: Membrane transition from horizontal to vertical position with mechanical linear fastening

Detail 203: Membrane transition from horizontal to vertical position alternatives

Detail 204: Internal and external corner insulation

9.1.3 Ending membrane on vertical or horizontal surface

Detail 301: Ending membrane AQUAPLAST in trench - Alternative 1

Detail 302: Ending membrane AQUAPLAST in trench - Alternative 2

Detail 303: Ending membrane AQUAPLAST on PP strip with plasticized sheet metal profile

Detail 304: Ending membrane AQUAPLAST on PP strip with mechanical fasteners and plates

Detail 305: Ending membrane AQUAPLAST by bending it over the PP strip

Detail 306: Ending membrane AQUAPLAST by plastic garden edging with plastic coated sheet metal profile

Detail 307: Ending membrane AQUAPLAST on stone wall

9.1.4 Detailing penetration objects

Detail 401: Detailing pipe penetration with membrane collar and pre-shaped piece

Detail 402: Detailing pipe penetration with liquid waterproofing insulation Triflex Prodetail

Detail 403: Detailing pipe penetration with fixed and loose flange

Detail 404: Detailing pipe penetration with PVC fixed and loose flange

Detail 405: Detailing pipe penetration with PVC fixed and loose flange in sloped terrain

Detail 406: Joint of drain outlet and waterproofing membrane AQUAPLAST with fixed and loose flange

9.1.5 Pond section

Detail 501: Pond section

9.2 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: