EUROPEAN ASSESSMENT DOCUMENT

EAD 030350-00-0402

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LIQUID APPLIED ROOF WATERPROOFING KITS

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This European Assessment Document (EAD) has been developed taking into account up-to-date technical and scientific knowledge at the time of issue and is published in accordance with the relevant provisions of Regulation (EU) No 305/2011 as a basis for the preparation and issuing of European Technical Assessments (ETA).

Contents

1. SCOPE OF THE EAD

1.1 Description of the construction product

The Liquid Applied Roof Waterproofing Kits (LARWK) consist of a material or a combination of materials, where at least the main component is liquid form, applied on roofs, terraces or balconies.

The LARWK may incorporate components defined by the manufacturer, such as a:

- Supporting layer (a layer of material forming the base of the assembled system).
- Separation layer (a layer of material applied between parts of the roof as a protection against mechanical and/or chemical effects).
- An internal layer (a layer of fabric scrim, non-woven mat of synthetic material, glass fibres or other material used.
- Reinforcement fibres.
- Fillers.
- A finish layer (one or more layers of material (e.g. slate chips, solar protective coating, etc.) applied on top of the assembled system). The finish layer may have several functions, e.g. protection of the system against the effects of weathering or as an aesthetic finish**.**
- Other liquid components such as primer and protection or,
- A ballast layer made of liquid applied material including fillers, if the kit is not bonded to the substrate.

The assembled system (obtained by installing a liquid applied roof waterproofing kit) can be fully, partially or not bonded to the substrate.

The liquid applied materials can be applied by pouring, brushing, spraying or spreading. The process shall be given in the ETA.

The common substrates of these kits are concrete, mortar, steel or other metals, waterproofing membrane (bitumen, PVC, TPO, etc.) and thermal insulation products. Type and kind of substrate shall be given in the ETA.

The liquid waterproof products covered by this EAD are based on:

- Polymer modified bitumen emulsions and solutions, in situ applied by brushing, spraying or spreading, with or without a supporting layer, an internal layer and/or a protective finish of mineral granules, chips or solar reflective coating.
- Glass reinforced resilient unsaturated polyester resins, in situ applied to defined timber-based substrates by spreading by hand (e.g. hand lay-up). The incorporation of a pigmented flow coat as an aesthetic and protective finish is assumed.
- Flexible unsaturated polyester or Reactive poly(methyl) methacrylate (PMMA).
- Polymer modified bitumen. The assembled systems may be reinforced or unreinforced and may only be applied to concrete substrates, although other substrates (e.g. metal, brickwork, timber-based, etc.) are permissible at details. The assembled systems are always protected by inverted roof insulation systems, heavy protection, roof gardens or green roofs and therefore may only be used on roofs with slopes ≤ 27% (15 º).
- Polyurethane, Polyurea, and Polyaspartic.
- Silane modified polymers (SMP).
- Bitumen emulsions and solutions. These products are only used for repair, renovation or maintenance, or solely for use in construction works, which have a limited intended working life of five years.
- Water dispersible polymers.
- Thermoplastic block copolymer.

The products based on Polysiloxane are covered by EAD 030019-00-0402[1] and its amendments.

These LARWK are not covered by a harmonised European standard (hEN).

1 All undated references to standards, to EADs, to EOTA report etc. in this EAD are to be understood as references to the dated versions listed in clause 4

Concerning product packaging, transport, storage, maintenance, replacement and repair, it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport, storage, maintenance, replacement and repair of the product, as he considers necessary.

It is assumed that the product will be installed according to the manufacturer's instructions or (in absence of such instructions) according to the usual practice of the building professionals. Relevant manufacturer's stipulations having influence on the performance of the product covered by this European Assessment Document shall be considered for the determination of the performance and detailed in the ETA.

1.2 Information on the intended use(s) of the construction product

1.2.1 Intended use(s)

The intended use of LAWRK is the waterproofing of the roofs, terraces and balconies preventing or controlling the passage of water from one plane to another.

This LARWK is made of non-load bearing construction elements. It does not contribute directly to the stability of the roof on which is installed, but it can contribute its durability by providing enhanced protection from the effect of weathering.

This LARWK can be used on new or existing (retrofit) roofs. It can also be used on vertical surfaces (singular details). Each LARWK shall be categorised according to Annex 1:

1 Expected working life.
2 Climatic zone of use.
3 User loads.
4 Roof slopes.
5 Minimum surface temperatures.
6 Maximum surface temperatures.

This EAD is not intended for use on roofs accessible to vehicles, on bridges and for the use according to EN 1504-2.

1.2.2 Working life / Durability

The assessment methods included or referred to in this EAD have been written based on the manufacturer's request to take into account a working life of 10 years, provided that the LARWK is subject to appropriate installation (see 1.1). In special circumstances, where indicated by the manufacturer, this may be modified to 5 or 25 years, provided that the LARWK is subject to appropriate installation (see 1.1).

The assumptions of the three different working lives are related to the outcome of those tests that give relevance to the categorization of working life (see 2.2.8 and 2.2.10[2]); in particular:

- 5 years: an estimated working life of assembled systems of 5 years shall only be assumed when LARWK is intended to be used as a repair, renovation or maintenance medium only, or for use solely in construction works, which have a limited intended life.
- 25 years: an estimated working life of assembled systems of 25 years shall only be assumed when LARWK is intended to be used in circumstances that imply higher resistance to fatigue movement and higher resistance to ageing.

When assessing the product, the intended use as foreseen by the manufacturer shall be taken into account. The real working life may be, in normal use conditions, considerably longer without major degradation affecting the basic requirements for works[3].

The indications given as to the working life of the construction product cannot be interpreted as a guarantee neither given by the product manufacturer or his representative nor by EOTA when drafting this EAD nor by the Technical Assessment Body issuing an ETA based on this EAD, but are regarded only as a means for expressing the expected economically reasonable working life of the product.

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2 All the assessment methods but 2.2.8 and 2.2.10 are identical for all the assumed working lives.

3 The real working life of a product incorporated in a specific work depends on the environmental conditions to which that work is subjected, as well as on the particular conditions of the design, execution, use and maintenance of that work. Therefore, it cannot be excluded that in certain cases the real working life of the product may also be shorter than referred to above.

1.3 Specific terms used in this EAD

1.3.1 General definitions / descriptions

Anti-skid additives: A mineral aggregate applied to, or mixed with, the finishing layer to impart non-skid properties to the assembled system.

Ballast layer: One or more layers of materials applied on the liquid applied assembled system (roof waterproofing membrane) to serve as ballast against the system being blown away. It may also have additional functions, e.g. protection of the system against ageing, mechanical damage and/or as an aesthetic and/or foot traffic resistant finish.

Base coat: Applied as a first layer of an assembled system into which the reinforcement is embedded and consolidated.

Day joint: A joint necessitated by a temporary termination in the liquid applied roof waterproofing layer due to a suspension of work (e.g. end of the working day).

Finish layer: One or more layers, which is liquid applied on the assembled system and may have several functions, e.g. protection of the waterproofing assembled system against UV-light or chemicals or as an aesthetic coloured finish.

Internal layer: A layer of fabric scrim, non-woven mat of synthetic material, glass fibres or other material used.

Manufacturer's technical documentation (MTD): A document, or collection of documents, consisting of the Factory Production Control (setting out the specific quality practices, resources and sequence of activities), the design rules, the application methods (including procedures for quality control on site) and the directions concerning maintenance and repair of the assembled system, relevant to a particular product or a range of products.

Non-accessible: The qualification (respect to categorisation according to user load) of any roof only accessible, with the use of specific equipment due to features such as slope, shape, nature of materials used, etc.

Primer: A primer is a one or two component solvent or water-borne or solvent-free penetrating first coat, based on materials such as polyurethane, polyacrylate, polyester or epoxy, to improve adhesion on the waterproofing membrane and to seal the substrate.

Protection layer: One or more layers of materials applied on top of the assembled system to control the effects of physical, mechanical and chemical stresses or to act as a separation sheet. Examples are ballast layer, finish layer and separation sheet made from e.g. PE-foil, non-woven, bitumen sheets or boards.

Sample: A representative part of (one or more) of the components of a liquid applied roof waterproofing kit (LARWK) or a representative part of the LARWK (as an assembled and cured system) for the purpose of identification and / or assessment of its characteristics.

Structural deck: The part of the roof that, as a construction element, has to transfer both permanent and variable loads to the other parts of the building.

Solar reflective coating: A liquid coating, sufficiently light in colour, used for the purpose of protection against solar degradation, in particular reducing heat gain of the roof surface and associated thermal movement. The coating can be of bitumen base containing metal flake or of polymer base containing pigments and inert fillers and/or fibres. The coating can be in an aqueous or volatile organic solvent(s) medium and is applied as a finish layer to the assembled system.

Test specimen: Part of a sample taken as defined by a specific method of assessment and/or test method.

User load: The load associated with the accessibility of the roof.

Waterproofing kit: A particular combination of a defined set of components, to be installed in the works by application and/or incorporation and/or assembly of its components in conformity with particular design methods and/or particular execution procedures.

1.3.2 Particular definitions / descriptions of the materials

LARWK based on Polymer modified bitumen

Bitumen adhesive (cold): A high viscosity homogeneous blend of bitumen or polymer modified bitumen and volatile organic solvent(s), which may incorporate fillers and/or fibres. Can be used as a cold applied adhesive for bonding bituminous roofing sheets used as a supporting layer.

Bitumen adhesive (hot): A solid bitumen gradually softening when heated. It can be used as a hot-applied adhesive for bonding bituminous roofing sheets used as a supporting layer. The bitumen can be either oxidized or polymer modified.

Bitumen emulsion: A substantial amount of bitumen, finely dispersed in an aqueous medium by one or more suitable emulsifying agents. The emulsion may also incorporate inert fillers and/or fibres. A liquid or paste of brushing, spraying or spreading consistency that, when dried, provides a film that forms part of the assembled system of the LARWK.

Catalyst: A destabilizing salt solution, added to certain bitumen emulsion systems in order to break or destabilise the emulsion and initiate the curing process.

Polymer/copolymer (modifier): A polymer/copolymer in solid, viscous liquid or liquid emulsion (latex) form, suitable for blending with bitumen to improve properties such as durability, flexibility and elasticity within the dried film. Examples are:
- Acrylics-atactic polypropylene (APP).
- Polychloroprene (CR), ethylene methyl acetate (EMA), ethylene vinyl acetate (EVA).
- Polyisoprene (IR), natural rubber (NR).
- Polybutylene (PB), styrene butadiene rubber (SBR), styrene butadiene styrene (SBS).

Polymer modified bitumen emulsion: A substantial amount of polymer modified bitumen, finely dispersed in an aqueous medium by one or more suitable emulsifying agents. The polymer is usually added during the manufacture in the form of a polymer emulsion (latex). The emulsion may also contain inert fillers and/or fibres. Applied by brush, spray or by spreading it provides, when dried, a film that forms part of the assembled system.

Polymer modified bitumen solution: A blend of polymer modified bitumen in volatile organic solvent(s) which may incorporate inert fillers or fibres. A viscous liquid or paste of brushing, spraying or spreading consistency that, when dried, provides a film that forms part of the assembled system.

LARWK based on Glass reinforced resilient unsaturated polyester

Glass reinforced resilient unsaturated polyester: An unsaturated polyester resin which is reinforced with an internal layer of glass fibres.

Additives (accelerator / inhibitor): Chemical compounds which, when added to a polyester resin, controls the reaction and, in conjunction with a catalyst, facilitates curing without the application of heat. Accelerators / inhibitors may be added during mixing, or may be supplied ready mixed with the polyester resin (pre-accelerated resin).

Catalyst: A chemical compound, added to a polyester resin to initiate the curing process. Catalysts may be supplied as paste, as liquid dispersion in a plasticiser, or as powder in an inert filler.

LARWK based on Flexible unsaturated polyester or Reactive poly(methyl) methacrylate (PMMA)

Flexible unsaturated polyester: Liquid or solid resins with high molecular weight and low unsaturation, to improve flexibility dissolved in a reactive monomer, e.g. styrene.

Reactive poly(methyl) methacrylate (PMMA): Produced by the polymerisation of the liquid monomer methyl methacrylate (MMA) via a free radical polymerisation mechanism.

LARWK based on Hot applied polymer modified bitumen

Bitumen: A viscous semi-solid or solid, consisting essentially of a complex mixture of hydrocarbons and their derivatives, which is soluble in carbon disulphide; it is substantially non-volatile and softens gradually when heated. It is black in colour and possesses waterproofing and adhesive properties. It is obtained by refinery processes from petroleum and is also found as a natural deposit or as a component of naturally occurring asphalt where it is associated with mineral matter.

Bitumen emulsion: A substantial amount of bitumen finely dispersed in an aqueous medium by one or more suitable emulsifying agents. The emulsion may also incorporate inert fillers and / or fibres. A liquid or paste of brushing, spraying or spreading consistency that, when dried, provides a film that forms part of the assembled system of a LARWK.

Bitumen primer: A low viscosity bitumen emulsion or solution for the purpose of improving adhesion, sealing and preparing surfaces prior to the application of the LARWK.

Bitumen solution: A blend of bitumen dissolved in volatile organic solvent(s), which may contain inert fillers and / or fibres. A viscous liquid or paste of brushing, spraying or spreading consistency that, when dried, provides a film that forms part of the assembled system of a LARWK.

Polymer / copolymer (modifier): A polymer, copolymer in solid, viscous liquid or liquid emulsion (latex) form, suitable for blending with bitumen to improve properties such as durability, flexibility and elasticity within the dried film. Examples are: atactic polypropylene (APP); polychloroprene (CR); ethylene vinyl acetate (EVA); polyisoprene (IR); natural rubber (NR); polybutylene (PB); styrene butadiene rubber (SBR); styrene butadiene styrene (SBS).

LARWK based on Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer and Water dispersible polymers and Polyaspartic

Polyurethane: Elastomeric polymer formed by reacting a di- or poly-isocyanate with a polyol.

Polyurea: Elastomeric polymer formed by reacting a di- or poly-isocyanate with a polyamine.

Hybrid polyurea: Elastomeric polymer formed by reacting a di- or poly-isocyanate with a mixture of polyamines and polyols.

Water dispersible polymers: In water dispersiable binder based on polymers (e. g. acrylic, vinyl-acrylic, styrene-acrylic, styrene-butadiene copolymers).

Silane modified polymers (SMP): This family includes:

*Silane modified polyurethane***:** Manufactured by polyaddition of isocyanate-functional prepolymer with amino-functional silanes or polyaddition of polyurethane-polymers with silanes with NCO group.

*Silane modified polyether***:** A silane-modified polyether is formed via the polyaddition of an isocyanate group containing silane with a polyether, or the polymer group is formed via hydrosilylation of alkoxyhydrosilane to a double bond of the polyether**.**

Thermoplastic block copolymer: A single part, solvent-based, homogeneous blend of styrene ethylene butylene styrene copolymer (SEBS), fillers, UV stabilizers and other additives.

Polyaspartic: Aliphatic polyurea because it is derived from the reaction product of an aliphatic polyisocyanate component and a polyaspartic ester component.

2. ESSENTIAL CHARACTERISTICS AND RELEVANT ASSESSMENT METHODS AND CRITERIA

2.1 Essential characteristics of the product

The following Table 1 shows how the performance of LARWK is assessed in relation to the essential characteristics.

Table 1 - Essential characteristics of the product and methods and criteria for assessing the performance of the product in relation to those essential characteristics

Nº	Essential characteristic	Assessment method	Type of expression of product performance
Basic Works Requirement 2: Safety in case of fire			
1	External fire performance of roofs	2.2.1	Class
2	Reaction to fire	2.2.2	Class
Basic Works Requirement 3: Hygiene, health and the environment			
3	Content, emission and/or release of dangerous substances	2.2.3	Description
4	Resistance to water vapour	2.2.4	Level
5	Watertightness	2.2.5	Level
6	Resistance to wind loads	2.2.6	Level
7	Resistance to mechanical damage (perforation)	2.2.7	Class (P)
8	Resistance to fatigue movement	2.2.8	Class (W)
9	Resistance to the effects of low and high surface temperatures	2.2.9	Class (T)
10	Resistance to ageing media (heat and water)	2.2.10.1-2.2.10.3	Class (W)
11	Resistance to UV radiation in the presence of moisture	2.2.10.2	Description, Class (M/S)
12	Resistance to plant roots	2.2.11	Description
13	Effects of variations in kit components and site practices	2.2.12	Description / Level
14	Effects of day joints	2.2.13	Description / Level
Basic Works Requirement 4: Safety in use			
15	Slipperiness	2.2.14	Level

2.2 Methods and criteria for assessing the performance of the product in relation to essential characteristics of the product

This chapter is intended to provide instructions for TABs. Therefore, the use of wordings such as “shall be stated in the ETA” or “it has to be given in the ETA” shall be understood only as such instructions for TABs on how results of assessments shall be presented in the ETA. Such wordings do not impose any obligations for the manufacturer and the TAB shall not carry out the assessment of the performance in relation to a given essential characteristic when the manufacturer does not wish to declare this performance in the Declaration of Performance.

Testing will be limited only to the essential characteristics, which the manufacturer intends to declare. If for any components covered by harmonised standards or European Technical Assessments the manufacturer of the component has included the performance regarding the relevant characteristic in the Declaration of Performance, retesting of that component for issuing the ETA under the current EAD is not required

2.2.1 External fire performance

The liquid applied roof waterproofing kit as an assembled system shall be tested using the method relevant for the corresponding external performance roof class, in order to be classified according to EN 13501-5 (*this does not preclude the possibility of other assembled systems being tested, at the request of the manufacturer).*

External fire performance cannot be claimed for individual products alone, since it is a characteristic of a complete roof system. The manufacturer will need to fully define the assembled system of which the product will form part in order to make any external fire performance claim.

The liquid applied roof waterproofing kit as an assembled system, may form as part of a roof, may be

considered “deemed to satisfy” all the provisions for external fire performance of all National regulations of the Member States without the need for testing. This on the basis that is included within the definitions given Commission Decision 2000/553/EC and provided that any national provisions on the design and executions of works are fulfilled.
Where more than one assembled system is possible for an individual liquid applied roof waterproofing kit a minimum of one ‘typical’ roof system shall be tested in accordance with CEN/TS 1187, except where the assembled system can be classified without further testing (CWFT) (*Where assembled systems are protected by a durable protection layer, the external fire performance can be controlled by the nature of this protection layer. Therefore, external fire performance may be omitted, provided the effect of the protection layer is assessed and/or stipulated by Commission Decision (2000/553/EC)).*

This test can be used to make an extended application (EXAP) according CEN/TS 16459.

2.2.2 Reaction to fire

The liquid applied roof waterproof kit as an assembled system shall be tested, according to the method(s) referred to in EN 13501-1 and relevant for the corresponding reaction to fire class. The product shall be classified according to the Commission Delegated Regulation (EU) No 2016/364.Details are given in Annex 3, Reaction to Fire – Test Procedures.

2.2.3 Content, emission and / or release of dangerous substances

The performance of the product (components of the kit) related to the emissions and / or release and, where appropriate, the content of dangerous substances will be assessed on the basis of the information provided by the manufacturer[4] after identifying the release scenarios (in accordance with EOTA TR 034) taking into account the intended use of the product and the Member State where the manufacturer intends his product to be made available on the market.

The identified intended release scenario for the product and intended use with respect to dangerous substances is S/W2: Product with indirect contact to soil, ground - and surface water.

Leachable substances. For the intended use covered by the release scenario S/W2 the performance of the product concerning leachable substances has to be assessed, if the product contains agents for root penetration. A leaching test with subsequent eluate analysis must take place, each in duplicate. Leaching tests of the membrane contained agents for root penetration are conducted according to CEN/TS 16637-2. The leachate shall be pH-neutral demineralized water and the ratio of liquid volume to surface area must be 25 ± 5 l/m².

The membrane must be applied to a sandblasted glass plate by heating. The edges are not sealed. The cut edges of the membrane strip exposed to the eluent should be included in the calculation as a leachable area.

The eluates taken after 6 hours / 1 day / 2 days and 6 hours / 4 days / 9 days / 16 days / 36 days / 64 days shall be analysed for all environmentally relevant parameters, presumably at least the following:

- TOC according to EN 1484.
- pH-value according to EN ISO 10523.
- Electrical conductivity according to EN 27888.
- Agents for root penetration concentration (µg/L), agents for root penetration release [µg/m²] and the cumulative agents for root penetration release (g/m²) according to appropriate test method.

In eluates of 6 hours and 64 days, the following biological tests shall be conducted:

- Acute toxicity test with Daphnia magna Straus according to EN ISO 6341.
- Toxicity test with algae according to ISO 15799.
- Luminescent bacteria test according to EN ISO 11348-1, EN ISO 11348-2 or EN ISO 11348-3.

[4] The manufacturer may be asked to provide to the TAB the REACH related information which he must accompany the DoP with (cf. Article 6(5) of Regulation (EU) No 305/2011). The manufacturer is **not** obliged:
- to provide the chemical constitution and composition of the product (or of constituents of the product) to the TAB, or
- to provide a written declaration to the TAB stating whether the product (or constituents of the product) contain(s) substances which are classified as dangerous according to Directive 67/548/EEC and Regulation (EC) No 1272/2008 and listed in the "Indicative list on dangerous substances" of the SGDS.

Any information provided by the manufacturer regarding the chemical composition of the products may not be distributed to EOTA or to TABs.

- For each biological test, EC20-values shall be determined for dilution ratios 1:2, 1:4, 1:6, 1:8 and 1:16.

If the parameter TOC is higher than 10 mg/l, the following biological tests shall be conducted with the eluates of 6 hours and 64 days eluates: Biological degradation according to OECD Test Guideline 301 part A, B or E.
Determined toxicity in biological tests must be expressed as EC20-values for each dilution ratio. Maximum determined biological degradability must be expressed as …% within …hours/days. The respective test methods for analysis must be specified.

2.2.4 Resistance to water vapour

To establish the resistance to the passage of water vapour through the assembled system, the water vapour permeability of the assembled system shall be determined in accordance with EN 1931 (using a free sample according to Annex 2). The mean value shall be stated in the ETA.

2.2.5 Watertightness

The watertightness of the assembled system shall be determined by testing in accordance with Annex A4.11. The watertightness (or not) of the product shall be stated in the ETA.

2.2.6 Resistance to wind loads

1. The resistance to wind loads of partially or fully bonded assembled systems shall be assessed by measuring the delamination strength at 23°C and 50% HR in accordance with the test method given in Annex A4.1 for all substrates for which the manufacturer intends the product to be used for. Other smaller diameter of the circular (5 cm) and other speed (250 N/s) testing could be used. The value of 50 kPa is derived from the maximum load applied by wind. In practice, the delamination strength will be significantly in excess of this load. The mean value shall be stated in the ETA.
2. In the case of an assembled system incorporating a partially bonded supporting layer, a wind uplift test in accordance with the method given in Annex A4.2 shall be performed. This test shall be performed on the substrate giving the lowest delamination strength at 23°C and 50% HR {see (1) above}. The mean value shall be stated in the ETA.

   Assessment performances of mechanically fastened supporting layer, including fasteners, shall be tested according to the test of wind load of EAD 030351-00-0402 (Annex 1) (Systems of Mechanically Fastened Flexible Roof Waterproofing Membranes). The value shall be stated in the ETA.
3. In the case of loose laid and ballasted assembled systems the mass of the proposed minimum thickness of ballast layer shall be stated in the ETA to enable the user to judge whether or not the assembled system is suitable for use under local conditions.

2.2.7 Resistance to mechanical damage (perforation)

The resistance to mechanical damage shall be assessed by subjecting the assembled system to dynamic indentation and to static indentation. These tests shall be performed on the most and least compressible of the substrates specified by the manufacturer for the kit in question. The relationship between the user load category and the levels of resistance to dynamic indentation is given in Table 2.

Table 2 - Relationship between user load category and levels of performance

User load category	Minimum level of resistance	
(see Annex 1)	Dynamic indentation	Static indentation
P1	I1	L1
P2	I2	L2
P3	I3	L3
P4	I4	L4

After the following tests, the assembled system(s) shall remain watertight:

2.2.7.1 Resistance to dynamic indentation. The resistance to dynamic indentation at 23°C shall be determined in accordance with the test method given in Annex A4.3, using the indentor size appropriate to the level of performance required and defined by the relevant user load category (Annex 1). The level of resistance shall be stated in the ETA.

2.2.7.2 Resistance to static indentation. The resistance to static indentation at 23°C shall be determined in accordance with the test method given in in Annex A4.4, using the load appropriate to the level of performance required and defined by the relevant user load category (Annex 1). The level of resistance shall be stated in the ETA.

These tests (static and dynamic indentation) shall be performed on the most and least compressible of the substrates specified by the manufacturer for the kit in question.

2.2.8 Resistance to fatigue movement

A fully bonded assembled system shall be subjected to fatigue movements at – 10 °C, in accordance with the method given in Annex A4.5.

The number of cycles to which the assembled system shall be subjected shall be determined by the categorisation of the kit according to the expected working life (Annex 1) and is defined in Table 3.

After testing the assembled system(s) shall remain watertight and the debonding shall be indicated. The debonding, if any, shall not exceed a total of 75 mm and shall not exceed 50 mm on one side of the gap.

Table 3 - Number of cycles of fatigue movement

Categorisation of expected working life	Number of cycles
W1	250
W2	500
W3	1000

- **Glass reinforced resilient unsaturated polyester resins**. Due the stiffness of the glass reinforced resilient unsaturated polyester resin, it is unlikely to be affected by fatigue movement. Consequently, determination of the fatigue movement will be omitted.

2.2.9 Resistance to the effects of low and high surface temperatures

2.2.9.1 Low temperatures

1. The effect of the minimum surface temperatures on the resistance to mechanical damage shall be determined by performing the dynamic indentation test in accordance with the method given in in Annex A4.3 on the least compressible substrate, changing the conditions of TºC to the appropriate minimum surface temperature (TL) defined by the categorisation of the kit (Annex 1).

   After testing (dynamic indentation), the assembled system(s) is kept at 23°C and 50% HR for a minimum of 24h and it shall remain watertight (23°C and 50% HR) . The level of resistance shall be stated in the ETA.

2. To determine the possible decrease in flexibility of the assembled system, as a result of exposure to low temperature, the appropriate tests shall be performed according to the different composition of the LARWK:

   - **Polymer modified bitumen emulsions and solutions**. *Low temperature* flexibility. The test shall be performed in accordance with EN 15813 to the appropriate minimum surface temperature (TL) and these shall be compared with the samples after UV ageing period. The test results shall be stated in the ETA and shall meet with the temperature set by the TL-categorisation applied (Table 14(a)).

   - **Hot applied polymer modified bitumen**. *Low temperature* flexibility. The test shall be performed in accordance with EN 15814 to the appropriate minimum surface temperature (TL) and these shall be compared with the samples after heat ageing period and with other samples following water ageing period (W3/P4). The test results shall be stated in the ETA and shall meet with the temperature set by the TL-categorisation applied.

2.2.9.2 Extreme low temperatures. For kits categorised according to minimum surface temperature TL 4 (Annex 1) the crack bridging capability of the assembled system shall be determined according to the method given in Annex A4.10 at a temperature of -30 °C.

Assembled systems categorised according to minimum surface temperatures TL 4, after testing crack bridging capability, shall show no visible cracks and no loss of adhesion to the substrate at either side of the gap (visual control).

2.2.9.3 High temperatures

1. The effect of the maximum surface temperatures on the resistance to wind load shall be determined by performing the delamination strength test in accordance with the method given in Annex A4.1 at a temperature of +40 ºC.

   The delamination strength of the assembled system(s) shall exceed 50 kPa.

   Depending on the nature of different families of products specific is applied:
   - **Water dispersible polymers, Polyurethane, Polyurea, Thermoplastic block copolymer, Silane modified polymers (SMP) and Polyaspartic.** Effects of high surface temperature is unlikely to be affected by elevated surface temperatures. It will not flow or soften by the high temperatures envisaged in service; the determination of delamination and sliding at elevated temperatures will be omitted

2. The effect of the maximum surface temperatures on the resistance to mechanical damage shall be determined by performing the static indentation test in accordance with the method given in Annex A4.4 on the least compressible substrate changing the conditions of TºC to the appropriate maximum surface temperature (TH) (see Annex 1) and the level of resistance (see Annex 1), defined by the categorisation of the kit. In order to assign category, after testing (static indentation), the assembled system(s) is kept at 23°C and 50% HR for a minimum of 24h and it shall remain watertight (23°C and 50% HR). The level of resistance shall be stated in the ETA.
3. The level of resistance shall be state in the ETA.

4. The effects of high temperatures on the stability of assembled systems from kits categorised S3 and S4 only, shall be determined by performing the resistance to sliding test in accordance with the method given in Annex A4.6 changing the conditions of TºC to the appropriate maximum surface temperature (TH) defined by the categorisation of the kit (see Annex 1) and at the maximum slope as defined by the categorisation of the kit according to roof slope (see Annex 1).

   This test is not required for assembled systems from kits categorised according to slope as S1 or S2. However, for all kits used on vertical or near vertical parts of details, this test shall be performed at a slope of 90°.

   The calculated mean displacement of the assembled system, after testing shall not exceed 2 mm.

   Depending on the nature of different families of products specific is applied:

   - **Water dispersible polymers and Polyurethane, Polyurea, Thermoplastic block copolymer Silane modified polymers (SMP) and Polyaspartic.** See above 1**.**

5. Where an assembled system contains a supporting layer, which is not fully bonded, the effects of high temperatures are governed by the dimensional stability of that supporting layer. Measurement of the dimensional stability of the supporting layer shall be given by component´s manufacturer according to EN 1107-1 or 1107-2.

   Depending on the nature of different families of products specific is applied:

   - **Glass reinforced resilient unsaturated polyester resins, Flexible unsaturated polyester and PMMA.** Since the resilient polyester resin and flexible unsaturated polyester it is unlikely to be affected by elevated surface temperatures. It will not flow or soften at the high temperatures envisaged in service. Consequently, the determination of the effects of elevated temperatures shall be omitted.

2.2.10 Resistance to ageing media

2.2.10.1 Resistance to heat ageing. The effects of heat ageing on the resistance to mechanical damage shall be assessed by subjecting an assembled system (according to Annex 2) to heat ageing in accordance with Annex A4.8 at 80 ± 2 ºC for a period defined by the categorisation according to climatic zone (see Annex 1) and the categorisation according to expected working life (see Annex 1). The relationship between these aspects and the period of exposure is given in Table 4.

Table 4 - Relationship between climatic zone, working life and period of exposure to heat

Climatic zone category	Moderate (M)			Severe (S)		
Working life category	W1	W2	W3	W1	W2	W3
Exposure period (days)	25	50	100	50	100	200

Depending on the nature of different families of products specific is applied:

- **Flexible unsaturated polyester and Reactive poly(methyl) methacrylate (PMMA).** Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period is allowed.
- **Polymer modified bitumen emulsions and solutions.** Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period is allowed.
- **Hot applied polymer modified bitumen**. Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period is allowed.
- **Polyurethane, Polyurea, Silane modified polymers (SMP) , and Thermoplastic block copolymer and Polyaspartic.** Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period is allowed.
- **Water dispersible polymers.** Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period of the Table 4.
- **Thermoplastic block copolymer.** Specific ageing conditions of 70 ± 2 ºC at a doubled exposure period is allowed.

Following the heat ageing period:

1. The resistance to dynamic indentation at the surface temperature according to the TL categorisation shall be performed as defined in 2.2.9.1. The level of resistance shall be stated in the ETA.

2. The resistance to fatigue movement at –10 °C, as defined in 2.2.8, shall be performed. The number of cycles shall be 50 for all categories W1, W2 and W3. In order to assign the category, after testing the assembled system(s) shall remain watertight.

3. Additional specific assessment after heat ageing depending on the nature of different families of products is applied:

   - **Flexible unsaturated polyester and PMMA.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527-1 and –3 (unreinforced), or –4 (reinforced), test piece shape 1B; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.
   - **Hot applied polymer modified bitumen**. *Low temperature* flexibility. The test shall be performed in accordance with EN 15813. This test shall be performed on samples without ageing and after ageing. The test results shall be stated in the ETA and shall meet with the temperature set by the TL-categorisation applied.
   - **Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer and Polyaspartic.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527-1 and –3 (unreinforced), or –4 (reinforced); test piece shape 1B; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.
   - **Water dispersible polymers.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527–3 (unreinforced); test piece shape 170x15 mm; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.

2.2.10.2 Resistance to UV radiation in the presence of moisture. The effects of ageing by UV in the presence of moisture shall be determined by testing the defined characteristics of the assembled system before and after subjecting it to artificial weathering according to the exposure procedure defined in Annex A4.7. The precise exposure conditions are determined by the categorisation to climatic zone of the kit (see Table 5); the radiant exposure is related to the categorisation to expected working life.

Table 5 - Relationship between categorisation to climatic zone and UV-exposure conditions

Categorisation to climatic zone (see Table 11)	**Exposure conditions** (see Annex A4.7)
Category "M"	Conditions "M": UV + spraying
Category "S"	Conditions "S": UV + spraying

NOTE: *The exposure to UV radiation is performed by using artificial weathering apparatuses with either a Xenon-arc or a fluorescent UV light source.*

The exposure doses, expressed in a year's equivalent radiant exposure, related to the categorisation to working life of the kit, are given in Table 6.

Table 6 - Relationship between UV radiant exposure doses and estimated working life

UV (300-400 nm)	**Category W1**	**Category W2**	**Category W3**
Radiant exposure (MJ/m^2)	200	400	1000

The UV ageing procedure is not required for assembled systems incorporating a permanent heavy protection layer like ballast or tiles.

Following the UV ageing procedure:

1. The resistance to dynamic indentation shall be performed at a temperature of -10 ºC as defined in 2.2.9.1. The level of resistance shall be stated in the ETA.
2. Additional specific assessment after UV ageing depending on the nature of different families of products is applied:
   - **Glass reinforced resilient unsaturated polyester resins.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527 –3 (unreinforced), or –4 (reinforced); test piece type III; testing speed 2 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.
   - **Flexible unsaturated polyester and PMMA.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527-1 and –3 (unreinforced), or –4 (reinforced); test piece shape 1B; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.
   - **Polymer modified bitumen emulsions and solutions** *Low temperature* flexibility. The test shall be performed in accordance with EN 15814. This test shall be performed on samples without ageing and after ageing. The test results shall be stated in the ETA and shall meet with the temperature set by the TL-categorisation applied.
   - **Hot applied polymer modified bitumen**. UV ageing the assembled systems are always protected by inverted roof insulation systems, heavy protection, roof garden or green roofs. Therefore, all tests to determine the effects of artificial weathering by UV in the presence of moisture will be omitted.
   - **Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer and Polyaspartic.** *Tensile properties*. The test shall be performed at 23º C in accordance with EN ISO 527-1 and –3 (unreinforced), or –4 (reinforced); test piece shape 1B; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.
   - **Water dispersible polymers.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527–3 (unreinforced); test piece shape 170x15 mm; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.

2.2.10.3 Resistance to water ageing. The effects of water ageing shall be determined in accordance with the method as given in Annex A4.9 by exposing the upper surface of the assembled system to water at 60 ± 2 °C. The period of exposure will be determined by the categorisation of working life and of the roof slope of the kit. The relationship between working life categorisation and period of exposure is given in Table 7.

Table 7 - Relationship between application, working life and exposure period

Application	**Exposure period (days)**		
Category	**W1**	**W2**	**W3**
S1 or S2	15	30	60
P4	Not applicable *	90	180

NOTE: *The categorisation according to expected working life of kits for application in roof gardens, inverted roofs and green roofs (P4) shall be at least 10 years (W2).*

Following the water ageing procedure:

1. The resistance to static indentation at the surface temperature according to the TH-categorisation shall be performed as defined in 2.2.9.3 indent 2. The level of resistance shall be stated in the ETA.

2. Additional specific assessment after water ageing depending on the nature of different families of products is applied:

   - **Glass reinforced resilient unsaturated polyester resins.** *Specific two-hour water boil test*. For this family of products, the effect of water ageing is additionally assessed by subjecting 3 test pieces to a two-hour water boil test in accordance with Annex A4.12. Following the two-hour water boil test additional comparative testing of tensile properties shall be performed according EN ISO 527-3 or EN ISO 527-4 on boiled and unboiled samples; test piece type III; testing speed 2 mm/min. The mean values shall be stated in the ETA.

   - **Flexible unsaturated polyester and PMMA.** *Delamination.* Determination of the resistance to delamination after water ageing period. The test shall be performed at 23 ºC in accordance to Annex A4.1 after the water ageing chosen. The mean value shall be stated in the ETA.

   - **Hot applied polymer modified bitumen**. Since the assembled systems are used in roof gardens, green roofs and inverted roof application, the most severe conditions of exposure (P4/W3) shall be selected when performing tests to determine the effects of ageing by water.

     Low temperature flexibility. The test shall be performed in accordance with EN15814. This test shall be performed on samples without ageing and after ageing. The test results shall be stated in the ETA and shall meet with the temperature set by the TL-categorisation.

   - **Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer, Water dispersible polymers and Polyaspartic.** *Delamination.* Determination of the resistance to delamination after water ageing period. The test shall be performed at 23 ºC in accordance to Annex A4.1 after the water ageing chosen. The mean value shall be stated in the ETA.

2.2.11 Resistance to plant roots

The resistance to plant roots of an assembled system of a kit in user load category P4 (inverted roofs, roof gardens and green roofs) shall be assessed according to EN 13948. For these LARWK this test shall be done with 3 samples with the LARWK and at least 1 sample of reference. “Penetration of roots” or “No penetration of roots” shall be stated in the ETA.

2.2.12 Effects of variations in kit components and site practices

To check that an assembled system can be achieved over the whole range of permitted weather conditions and variations in proportions of constituent parts quoted by the manufacturer, the following tests shall be performed comparatively under the defined conditions.

- **Glass reinforced resilient unsaturated polyester resins.** *Tensile properties*. The test shall be performed at 23 ºC in accordance with EN ISO 527–3 (unreinforced), or –4 (reinforced); test piece III; testing speed 2 mm/min. This test shall be performed on samples:
  - Prepared at extremes of the quoted application temperature range indicated by the manufacturer, the variation in the property measured shall be less than 20%, and
  - Prepared at the maximum application temperature indicated by the manufacturer and subjected to a 2-hour water boil in accordance with Annex A4.12. The measured property shall not be reduced >15 %.

  The elongation at break shall be at least 1,5% on reinforced and unreinforced samples. The mean value of each conditions shall be stated in the ETA.

- **Flexible unsaturated polyester**. *Tensile properties*. The test shall be performed in accordance with EN ISO 527–3 (unreinforced), or –4 (reinforced); test piece shape 1B; testing speed 200 mm/min. This test shall be performed on free samples prepared from the same batch under the weather conditions and variations in proportions of constituent’s parts defined by the manufacturer. The mean value of each condition shall be stated in the ETA.

- **Hot applied polymer modified bitumen.**

  Effects of remelting. The polymer modified bitumen shall be remelted following the procedures and the maximum number of times indicated by the manufacturer, and the following properties measured:
  - Penetration at 50 ºC, method EN 1426: initial and remelted.
  - Flow at 60 ºC, method: EN 15814: initial and remelted.

The mean value of each condition shall be stated in the ETA.

Effects of prolonged heating. The polymer modified bitumen shall be held at the maximum temperature for the maximum period indicated by the manufacturer, and the following properties measured:

- Penetration at 50 °C, method EN 1426: initial and after prolonged heating.
- Flow at 60 ºC, method EN 15814: initial and after prolonged heating.

The mean value of each condition shall be stated in the ETA.

- **Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer and Polyaspartic.**

  Tensile properties. The test shall be performed in accordance with EN ISO 527–3 (unreinforced), or –4 (reinforced); test piece shape 1B; testing speed 200 mm/min. This test shall be performed on free samples prepared from the same batch installed under the weather conditions defined by the manufacturer. The mean value of each condition shall be stated in the ETA.

  Resistance to dynamic indentation. This test shall be performed at a temperature of 23 ºC on samples prepared from the same batch under the weather conditions defined by the manufacturer. The level of resistance of each condition shall be stated in the ETA.

- **Polymer modified bitumen emulsions and solutions.**

  Resistance to dynamic indentation. This test shall be performed at a temperature of 23 ºC on samples prepared from the same batch under the weather conditions and variations in proportions of constituents parts defined by the manufacturer. The level of resistance of each condition shall be stated in the ETA.

  Resistance to static indentation. This test shall be performed at a temperature of 23 ºC on samples prepared from the same batch under the weather conditions and variations in proportions of constituents parts defined by the manufacturer. The level of resistance of each condition shall be stated in the ETA.

- **Water dispersible polymers.**

  Tensile properties. The test shall be performed at 23 ºC in accordance with EN ISO 527–3 (unreinforced); test piece shape 170x15 mm; testing speed 200 mm/min. This test shall be performed on samples without ageing and after ageing. The mean value shall be stated in the ETA.

  Resistance to dynamic indentation. This test shall be performed at a temperature of 23 ºC on samples prepared from the same batch under the weather conditions defined by the manufacturer. The level of resistance of each condition shall be stated in the ETA.

2.2.13 Effects of day joints

To check the compatibility of the assembled system, freshly applied to the dried assembled system. Delamination strength test shall be performed according to Annex A4.1, where the substrate is the assembled system bonded on the most suitable substrate for adherence (generally concrete) and dried for the period given by the manufacturer at normal conditions and the test specimen is the fresh kit applied on that substrate.

- **Glass reinforced resilient unsaturated polyester resins.** The mean value shall be stated in the ETA.
- **Flexible unsaturated polyester.** The mean value shall be stated in the ETA.
- **Polyurethane, Polyurea, Silane modified polymers (SMP), Thermoplastic block copolymer, Water dispersible polymers and Polyaspartic.** The mean value shall be stated in the ETA.

2.2.14 Slipperiness

The coefficient of friction is determined in accordance with EN 13893. The kit will be applied on the support (indicated by the manufacturer), with its different finishing coats. The samples will have the dimensions indicated in the EN. After the curing time (indicated by the manufacturer) the test will be performed.

Roof surfaces of bituminous products are not slippery and do not need to be tested. For bituminous products, the ETA shall state: Not slippery

In the ETA shall be stated the mean value obtained from the tests.

3. ASSESSMENT AND VERIFICATION OF CONSTANCY OF PERFORMANCE

3.1 System(s) of assessment and verification of constancy of performance to be applied

For the products covered by this EAD, the applicable legal acts are Decision 98/599/EC and amended by Commission Decision 2001/596/EC.

The system of assessment and verification of constancy of performance (AVCP) is 3.

In addition, with regard to external fire performance for products covered by this EAD the applicable European legal act is Decision 98/599/EC. The system is 3 for products requiring testing or 4 products "deemed to satisfy' without testing.

In addition, with regard to reaction to fire for products covered by this EAD the applicable European legal act is Decision 2001/596/EC. The system is 1 for products A1*, A2*, B*, C* or system 3 for products A1**, A2**, B**, C**, D, E or system 4 for products (A1 to E)***, F.

* Products/ materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).
** Products/ materials not covered by footnote (*).
*** Products/ materials that do not require to be tested for reaction to fire (e.g. Products/materials of classes A1 according to Commission Decision 96/603/EC, as amended. This is not applicable for the liquid applied roof waterproofing kits because all the products are based on organic material and therefore not covered by the Commission Decision 96/603/EC and its amendment.

When a product is classified as A1, A2, B or C, due to the nature of the product, a fire retardant has been added, footnote ** is not applicable. The level of AVCP then shall be 1.

Due to their properties with regard to the uses subject to regulations on roof waterproofing use, external fire performance and reaction to fire, uses different AVCP systems as stated before shall be applied to the products. That means for the performance of AVCP for the product that only the product properties related to these uses shall be evaluated according to the relevant AVCP system. The tasks for the manufacturer and the technical assessment body resulting on the combination of different AVCP systems shall be laid down by reference to a deposited "control plan" which is part of the ETA and has to be applied for attestation of conformity and the CE marking on the basis of the ETA.

3.2 Tasks of the manufacturer

The cornerstones of the actions to be undertaken by the manufacturer of the product in the procedure of assessment and verification of constancy of performance are laid down in Table 8:

Table 8 - Control plan for the manufacturer

Subject / Type of control	Test or control method	Criteria, if any	Minimum n. of samples	Minimum frequency of control
Bond strength of the kit to support (initial / ageing)	2.2.6 - 2.2.10	Acc. control Plan	5	One / year
Tensile properties of the kit (membrane at solid state on free film) (initial / ageing)	2.2.10	Acc. control Plan	5	Once / 20 batches (1 /year min)
Low temperature flexibility of the kit (membrane at solid state on free film) (initial / ageing)	2.2.10		5	Once / 20 batches (1 / year min)
Type / Nature of Internal reinforcement	IR/ TG / Documents acc. Control Plan	Acc. control Plan	1	Every delivery
Tensile characteristics of Internal reinforcement	ISO 9073-2, 3 / 3342		3	Every delivery
Weight / Area of Internal reinforcement	ISO 9073-1 / 3374		3	Every delivery
Type / Nature of mineral aggregate	IR / TG / Documents acc. Control Plan	Acc. control Plan	1	Every delivery
Particle size distribution of mineral aggregate	EN 933-1		3	Every delivery

Table 8 (continuation) - Control plan for the manufacturer

Subject / Type of control	Test or control method	Criteria, if any	Minimum n. samples	Minimum frequency of control
Raw material for membrane	Documents acc. Control Plan	Acc. control Plan	---	Every batch
Type / Nature of membrane	IR / TG		1	Once year
Viscosity of membrane	EN ISO 2555 / 2431 / 3219		3	Every batch
Density of membrane	EN 1675		3	Every batch
Curing time (progress of hardness) of membrane	EN 1789 / EN ISO 2535		3	Every 10 batches
Volatile content of membrane	EN ISO 3251 / 1428 / EN 1768		3	Every 10 batches
Ash content of membrane	EN ISO 3451-1 / EN 1879		3	Once year
Raw material of primers, finish and other layer	Documents acc. Control Plan	Acc. control Plan	---	Every Batch
Type / Nature of primers, finish and other layers	IR / TG Documents acc. Control Plan		1	Every Batch
Viscosity of primers, finish and other layer	EN ISO 2555 / 2431 / 3219		3	Every batch
Density of primers, finish and other layers	EN 1675		3	Every batch
Volatile content of primers, finish and other layers	EN ISO 3251 /1428 / EN 1768		3	Every 10 batches
Ash content of primers, finish and other layers	EN ISO 3451-1/ EN 1879		3	Once a year
Curing time (progress of hardness) of primers, finish and other layers	EN 1789 / EN ISO 2535		3	Every 10 batches

3.3 Tasks of the notified body

The intervention of the notified body under AVCP system 1 is only necessary for reaction to fire for products/materials for which a clearly identifiable stage in the production process results in an improvement of the reaction to fire classification (e.g. an addition of fire retardants or a limiting of organic material).

In this case the cornerstones of the actions to be undertaken by the notified body in the procedure of assessment and verification of constancy of performance (AVCP) with system 1 for LARWK are laid down in Table 9.

Table 9 - Control plan for the notified body; cornerstones

No	Subject / type of control	Test or control method	Criteria, if any	Minimum number of samples	Minimum frequency of control
Initial inspection of the manufacturing plant and of factory production control *(for system 1 only)*					
1	Inspection of the factory and the factory production of the manufacturer as described in the control plan	Control of devices, personal, equipment and the documentation of the FPC	See control plan		When stating the production process or when starting a new production line
Continuous surveillance, assessment and evaluation of factory production control *(for system 1 only)*					
2	Continuous surveillance, assessment and evaluation of factory production control as describe in the control plan including an annual inspection of the factory	Control of devices, personal, equipment and the documentation of the FPC	See control plan		Once per year

4. REFERENCE DOCUMENTS

CEN/TS 1187: 2012	Test methods for external fire exposure to roofs.
CEN/TS 16637- 2:2014	Construction products – Assessment of release of dangerous substances – Part 2: Horizontal dynamic surface leaching test.
CEN/TS 16459:2013	External fire exposure of roofs and roof coverings - extended application of test results from CEN/TS 1187
EAD 030019-00-0402:2014	Liquid applied roof waterproofing on the basis of polysiloxane.
EAD 030351-00-0402:2018	Systems of mechanically fastened flexible roof waterproofing membranes.
EN 513: 1999	Unplasticized polyvinylchloride (PVC-U) profiles for the fabrication of windows and doors -Determination of the resistance to artificial weathering.
EN 1107-1: 1999	Flexible sheets for waterproofing. Determination of dimensional stability - Part 1: Bitumen sheets for roof waterproofing.
EN 1107-2: 2001	Flexible sheets for waterproofing – Determination of dimensional stability – Part 2: Plastic and rubber sheets for roof waterproofing.
EN 1297: 2004	Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Method of artificial ageing by long-term exposure to the combination of UV radiation, elevated temperature and water.
EN13501-1: 2007 + A1: 2009	Fire classification of construction products and building elements – Part 1: Classification using test data from reaction to fire tests.
EN 13501-5: 2016	Fire classification of construction products and building elements – Part 5: Classification using test data from external fire exposure to roof tests.
EN 13893: 2002	Resilient, laminate and textile floor coverings – Measurement of dynamic coefficient of friction on dry surfaces.
EN 13948: 2007	Flexible sheets for waterproofing – Bitumen, plastic and rubber sheets for roof waterproofing – Determination of resistance to root penetration.
EN 1426: 2015	Bitumen and bituminous binders - Determination of needle penetration.
EN 1428: 2012	Bitumen and bituminous binders – Determination of water content in bitumen emulsions – Azeotropic distillation.
EN 1484: 1997	Water analysis - Guidelines for the determination of total organic carbon (TOC).
EN 1504-2 : 2004	Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity - Part 2: Surface protection systems for concrete.
EN 15813: 2011	Polymer modified bituminous thick coatings for waterproofing - Determination of flexibility at low temperatures.
EN 15814: 2011	Polymer modified bituminous thick coatings for waterproofing - Definitions and requirements.
EN 1789: 2007	Products and systems for the protection and repair of concrete structures. Test methods. Surface drying test. Ballotini method.
EN 1931: 2000	Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing – Determination of water vapour transmission properties.
EN 27888: 1993	Water quality; determination of electrical conductivity.
EN 933-1: 2012	Tests for geometrical properties of aggregates – Part 1: Determination of particle size distribution. Sieving method.
EN ISO 10523: 2012	Water quality - Determination of pH.
EN ISO 11348-1: 2008	Water quality- Determination of the inhibitory effect of water samples on the light emission of Vibrio Fischeri (Luminescent bacteria test) – Part 1: Method using freshly prepared bacteria.
EN ISO 11348-2: 2008	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio Fischeri (Luminescent bacteria test) – Part 2: Method using liquid-dried bacteria.

EN ISO 11348-3: 2008	Water quality - Determination of the inhibitory effect of water samples on the light emission of Vibrio Fischeri (Luminescent bacteria test) – Part 3: Method using freeze-dried bacteria.
EN ISO 1675: 1998	Plastics – Liquid resins – Determination of density by the pyknometer method.
EN ISO 2431: 2011	Paints and varnishes – Determination of flow time by use of flow cups.
EN ISO 2535: 2011	Plastics – Unsaturated polyester resins – Measurement of gel time at ambient temperature.
EN ISO 2555: 2018	Plastics – resins in the liquid state or as emulsions or dispersions – Determination of apparent viscosity by the Brookfield Test method.
EN ISO 3219: 1994	Plastics – Polymers/resins in the liquid state or as emulsions or dispersions - Determination of viscosity using a rotational viscometer with define shear rate.
EN ISO 3251: 2008	Paints, varnishes and plastics – Determination of non-volatile matter content.
EN ISO 3451-1: 2008	Plastics – Determination of ash – Part 1: General methods.
EN ISO 527-1: 2012	Plastics – Determination of tensile properties – Part 1: General Principles.
EN ISO 527-3: 2018	Plastics – Determination of tensile properties – Part 3:Test conditions for films and sheets.
EN ISO 527-4: 1997	Plastics – Determination of tensile properties – Part 4: Test conditions for isotropic and orthotropic plastic fibre-reinforced composites.
EN ISO 6341: 2012	Water quality - Determination of the inhibition of the mobility of Daphnia magna Straus (Cladocera, Crustacea) - Acute toxicity test.
EN ISO 4892-1: 2016	Methods of exposure to laboratory light sources. Part 1: General Guidance.
EN ISO 4892-2: 2013	Plastics. Methods of exposure to laboratory light sources. Part 2: Xenonarc Sources.
EN ISO 4892-3: 2016	Plastics. Methods of exposure to laboratory light sources. Part 3: Fluorescent UV lamps.
EN ISO 3696: 1995	Water for analytical use - Specifications and test methods.
EOTA TR 034: 2015	EOTA Technical Report TR 034: General checklist for EADs/ETAs – Content and/or release of dangerous substances in construction products.
ETAG 005: 2000	Liquid applied roof waterproofing kits.
ISO 15799: 2019	Soil quality - Guidance on the ecotoxicological characterization of soils and soil materials.
ISO 3342: 2011	Textile glass – Mats – Determination of tensile breaking force.
ISO 3374: 2000	Reinforcement products – Mats and Fabrics – Determination of mass per unit area.
ISO 9073-1: 1989	Textiles – Test methods for nonwovens – Part 1: Determination of mass per unit area.
ISO 9073-2: 1989	Textiles — Test methods for nonwovens — Part 2: Determination of thickness
ISO 9073-3: 1989	Textiles – Test methods for nonwovens – Part 3: Determination of tensile strength and elongation.
EN 1879:1991	Products and systems for the protection and repair of concrete structures – Test methods – Determination of ash by direct calcinations.
EN 1768:1984	Products and systems for the protection and repair of concrete structures. Test methods. Determination of volatile and not volatile matter.
Regulation(EC) 1272/2008	Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (Text with EEA relevance).

ANNEX 1 - CATEGORISATION ACCORDING TO USE

The declared categorisation shall be taken into account in the assessment of performance.

A1.1 Categorisation according to working life

This EAD is written on the assumption that the estimated working life of assembled systems for the intended use is 10 years. In special circumstances, where indicated by the manufacturer, this may be modified to 5 or 25 years: The categories according to working life are given in Table 10.

Table 10 - Categorisation according to working life

Category	Category W1	Category W2	Category W3
Expected working life (years)	5	10	25

A1.2 Categorisation according to climatic zone of use

The assembled system, including its support and protection (if any) is submitted to solar exposure effects (solar energy, temperature, etc) occurring during its expected working life which will depend on the geographical location of use. Two categories of climatic zone have been established (Moderate and Severe) and the limiting values for mean annual radiant exposure and the mean air temperature during the warmest month are defined in Table 11.

Table 11 - Categorisation according to climatic zone

	Category M Moderate climate	Category S Severe Climate
Annual radiant exposure on horizontal surface and Average temperature of the warmest month per year	< 5 GJ/m^2 and < 22°C	≥ 5 GJ/m^2 and/or ≥ 22°C

NOTE 1: *The annual radiant exposure is the total amount of solar energy received by horizontal global surface within a defined geographical region, calculated as a mean measured value over a period of five years. The average temperature of the warmest month is the calculated mean value over a period of five years for the average measured maximum air temperature of that month*.

NOTE 2: *The "isoline 5" (see map of Annex A4.7.3 (Figure 10-mean UV radiant exposure) can be used as an indicative dividing line between "moderate" and "severe" climatic zones of use, related to temperatures. For a Category M kit to be suitable for use in a particular location both, the parameters at that location (derived from national meteorological statistics) shall comply with the limiting values given in Table 11. If one of the parameters exceeds the limiting values for Category M then only kits of Category S may be used. The appropriate climatic zone category required may be declared by Member States [see CPR art. 3(2)]. Kits assessed in the Moderate zone may not be used in those climates categorised as Severe for the same expected working life.*

A1.3 Categorisation of user loads

The assembled systems, including their support and protection (if any), is submitted to mechanical damage due to the user loads likely to occur during their working life. The risk of mechanical damage will depend on the accessibility of the roof and the frequency of the traffic envisaged. The appropriate categories of user loads and examples of the related accessibility are given in Table 12.

Table 12 - Categorisation according to user loads

Category	User load	Examples of accessibility
P1	Low	non-accessible
P2	Moderate	accessible for maintenance of the roof only
P3	Normal	accessible for maintenance of plant and equipment and for pedestrian traffic
P4	Special	roof gardens, inverted roofs, green roofs

A1.4 Categorisation of roof slope

The assembled system, including its support and protection (if any), is submitted to the effects originating from its slope. The appropriate categories of roof slopes and examples of the related effects are given in Table 13.

Table 13. Categorisation according to roof slopes

Category	Roof slopes (%)	Examples of possible related effect
S1	<5	frost (thickness of ice layer) UV/standing water user loads (accessibility) effects of standing water fire behavior plant roots (roof gardens and green roofs
S2	5-10	frost (thickness of ice layer) UV user loads (accessibility) effects of standing water fire behavior plant roots (roof gardens and green roofs
S3	10-30	sliding frost (freezing snow) UV user loads (accessibility) fire behavior plant roots (green roofs only)
S4	>30	sliding UV user loads (accessibility) fire behavior

A1.5 Categorisation according to surface temperature

The assembled system, including its support and protection (if any) is submitted to the maximum and minimum surface temperatures occurring during its expected working life which will depend on the geographical location of use (see Table 14) and the levels of protection. Tables 14(a) and 14(b) define the appropriate categories.

Table 14(a) - Categorisation according to minimum surface temperature of the assembled system

Category	Climatic zone	Surface protection	Minimum surface temperature (°C)
TL1	All climatic zones	Inverted roofs and roof gardens (excluding green-roofs)	+ 5
TL2	Moderate low temperature	All other protected assembled systems or exposed roofs	-10
TL3	Severe low temperature		- 20
TL4	Extreme low temperature *		-30

****NOTE**: The particular location(s) for which Category TL4 has to be taken into account may be declared by Member States (see CPR - art. 3.2)*

Table 14(b) -Categorisation according to maximum surface temperature of the assembled system

Category	Climatic zone	Surface protection	Maximum surface temperature (°C)
TH1	All climatic zones	Inverted roofs and roof gardens	30
TH2	Moderate high temperature	Exposed, uninsulated roofs or heavily protected roofs including green-roofs	60
TH3	Moderate high temperature	Exposed, insulated roofs	80
TH4	Severe high temperature *	Exposed, insulated roofs	90

***NOTE**: For southern European regions considered as having severe climatic conditions related to high surface temperatures (area south of indicative "isoline 5" -see map of Annex A4.7.3, Figure 10).*

ANNEX 2 – PREPARATION OF FREE SAMPLES

This Annex gives guidance on the procedure for the preparation of free samples of (an) assembled system(s) of roof waterproofing kits (LARWK).

To perform specific tests and/or assessments (e.g. the effects of ageing media on different characteristics of liquid applied waterproofing membranes), it is necessary to prepare free film samples of systems.

The method of free film sample preparation may differ with the system under examination and the advice of the manufacturer should be sought on the most appropriate method to be used with the materials.

Apparatus

Base. A rigid support (e.g. of plywood, glass, plastic coated chipboard or MDF etc.) of sufficient size to provide an even and stable substrate on which to prepare the sample(s).

Release agent. To avoid adhesion to the base and to allow subsequent removal of the sample. Examples of release agents known to work are siliconized paper, spray furniture polish, spray silicone release agent, micro-crystalline paraffin wax, etc.

Thickness control. A mean of ensuring a constant and controllable thickness of the free film. Examples: wet film gauges, film spreaders, film casters, bar coaters, steel frames, etc.

Spirit level. To allow the base plate to be adjusted to a horizontal position.

Free sample. The free sample is the roof waterproofing kit (LARWK), applied in accordance with the manufacturer's instructions to the appropriate ratio of constituent parts, or to the specified composition by the Technical Assessment Body.

The number and size of free samples will be declared by the Technical Assessment Body, dependent on the relevant method of assessment.

Procedure. The base shall be placed on a firm support ensuring that it is horizontal. The release agent shall be applied and, where necessary, allowed to dry. Where sheet release agents are used, these shall be firmly fixed to the base without creases or wrinkles.

Apply the roof waterproofing kit (LARWK) in the appropriate number of coats, including reinforcement, where appropriate, in accordance with the manufacturer's instructions (by spraying, spreading or brushing) to the prepared base. For two-coat brush-applied roof waterproofing kits the manufacturer's instructions for the direction of brushing shall be followed. The mean thickness of the applied membrane shall be controlled in the appropriate manner.

The sample shall be allowed to fully cure before removal, without straining, from the base. Any area of free film falling outside the manufacturer's thickness specification shall be rejected.

ANNEX 3 – REACTION OF FIRE – TEST PROCEDURES

The test methods depend on the classification, which the product shall meet.
Tests according to EN ISO 11925-2 shall be carried out on substrates according to EN 13238.

When the liquid applied roof waterproofing kit is intended to be used in combination with other substrates, it shall be tested in end-use practice. Liquid applied waterproofing kit shall be tested in its highest intended thickness. The result is valid for lower thickness.

If the liquid applied waterproofing kit is intended to be used in combination with other substrates it shall be tested as in end-use practice. The liquid applied roof water proofing kit shall be tested in its highest and lowest thickness intended to be used. The test specimen shall be installed on the sample carrier according to Figure 1.

As a result, the fire classification B, C, D and E according to EN 13501-1 refer to the specified substrates and their characteristics. This may cause different fire classification for the liquid applied roof waterproofing as an assembled system for different substrates.

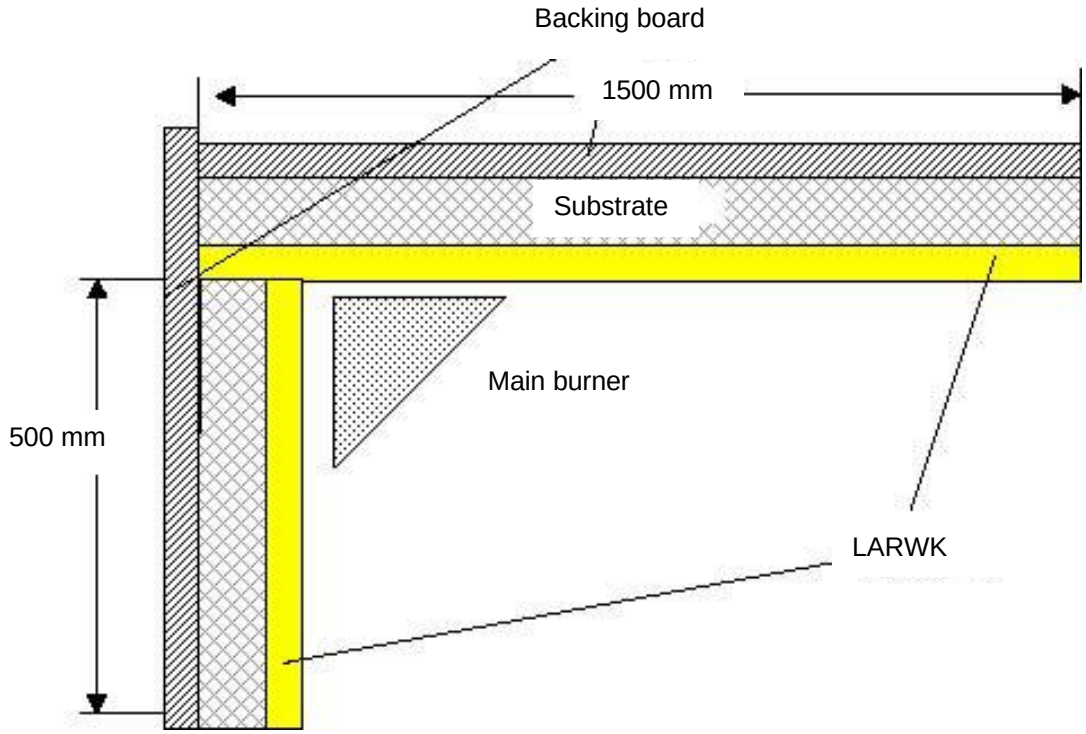


Figure 1. Example for SBI – test

ANNEX 4 – TEST PROCEDURES

A4.1 Determination of the resistance to delamination

Scope. It specifies the equipment and procedures for determining the resistance to delamination of assembled "system"(s) of liquid applied roof waterproofing kit(s), partially or fully bonded to a substrate.

Principle. The resistance to delamination of assembled "system(s)", fully bonded to a substrate, is determined by placing the test specimen, attached between a stiff plate and a fixed rigid substrate, in a tensile testing machine and pulling it apart at a given speed.
The recorded maximum force, corresponding to the cohesion of the test specimen divided by the cross sectional area of the test specimen gives the delamination strength.

Apparatus

Tensile testing machine. With suitable capacity (minimum 2000 N) and displacement involved and adjustable to a constant crosshead speed of 10 ± 1 mm/min. The tensile testing machine shall allow measurement of force with an accuracy of ± 1 %.

Recording equipment. For measuring forces during the tensile operation.

Steel plate. With a thickness of min. 10 mm (to resist deformation during the test).

Accessories. Which permit self-alignment of the test specimen and allow an equally distributed tensile stress.

Adhesive. Which is compatible with the roof waterproofing kit and the substrate.

Cutting device. To cut test specimen with a diameter of 100 ± 1 mm.

Test specimen

Dimensions of the test specimen. The test specimen is the assembled "system" of the liquid applied roof waterproofing kit including its rigid substrate and shall have a diameter of 100 ± 1 or 50±1 mm.

Number of test specimens. The number of test specimens is five.

Preparation of test specimens. The roof waterproofing kit shall be applied to the substrate as specified by the manufacturer.
The test specimen shall either have a diameter of (100 or 50 ± 1) mm, or the sample of the assembled "system" shall be cut to the substrate to provide a circular testing area with a diameter of (100 or 50 ± 1) mm. The steel plate shall be attached on top of the test specimen after curing of the "system".

In particular, it is important that:
- The used hot or cold adhesives shall not reinforce or in any other way affect the characteristics of The test specimen.
- The used solvent shall be compatible with the test specimen.
- The used adhesive shall not be the weakest part of the test specimen.

NOTE: *In the relevant product, specification advice may be available concerning the type of adhesive to be used and its possible effect on the assembled "system" may be obtained from the manufacturer of the kit*.

Curing and conditioning of test specimens. The test specimens shall be cured at 23 ± 2 °C and 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer.
After attaching the stiff plate to the test specimen, the whole shall be conditioned at 23 ± 2 °C and 50 ± 5 % relative humidity for a period of at least 16 h, until the adhesive used has sufficient strength.

Test procedure

- The test shall be carried out at a temperature of 23 ± 2 °C and a relative humidity of 50 ± 5 %, unless otherwise specified.
- Clamp the test specimen including the attached stiff plate in the tensile testing machine by means of the accessories.
- Adjust the speed of the testing machine to 10 mm/min or 250 N/s and start the testing.
- The maximum force of the roof waterproofing kit is recorded in Newton.
- Note and record how the assembled "system" or the substrate failed.
- Discard and replace any test specimen, where the test specimen failed totally or partially in the adhesive layer between the specimen and the plate, or where failure occurred at the bond of the

substrate to the tensile testing machine.
- Perform the test on the remaining test specimens.

Calculation and expression of results. Calculate for each test specimen the resistance to delamination using the following equation:

$$R = F/A \times 10^{-3}$$

Where:
R is the resistance to delamination in kPa,
F is the force at delamination in N,
A is the cross sectional area of the test specimen in mm^2.

In order to determine the resistance to delamination of partially bonded "system(s)" the mean calculated value from the test results shall be expressed in relation to the percentage of bonding of the partially bonded "system" to the substrate, following the design rules of the manufacturer.

Test report. The test report shall include the following information:
a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the assembled "system", including dimensions, curing and conditioning.
e. A description of the substrate (used for classification).
f. The test conditions.
g. All individual tensile strengths and an arithmetical mean value, rounded to the nearest 1 kPa.
h. A description of the failure modes in the test specimen/substrate combination.
i. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.2 Determination of the resistance to wind loads of partially bonded roof waterproofing membranes

Scope. It specifies the method for determining the resistance to wind loads of installed kits of liquid roof waterproofing partially bonded to a substrate.

Principle of the method. The resistance to wind load of a partially bonded installed product is determined by the application of cycles of suction pressures to a test specimen of given dimensions, according to a given proportional array of suction pressures and determining the peak pressure of the cycle, preceding that during which the test specimen fails.

Apparatus

Pressure chamber. With sufficient length and width to accommodate the dimensions of the test specimen and with such height, unaffected by deformations, if any, of the test specimen and the applied pressure is evenly distributed.

The pressure chamber shall be provided with one or more windows (or other means) that the test specimen can be observed during the testing.

The pressure chamber shall be capable of resisting a suction pressure of 4 kPa and shall have the possibility to create an airtight seal between the test specimen and the pressure chamber during the suction pressure phase.

Fan, controlling and recording equipment. They have to be connected to the pressure chamber, to achieve dynamic suction pressure cycles with the proportional array of suction pressures (see Figure 2) with an accuracy on the suction pressures of ± 10%.

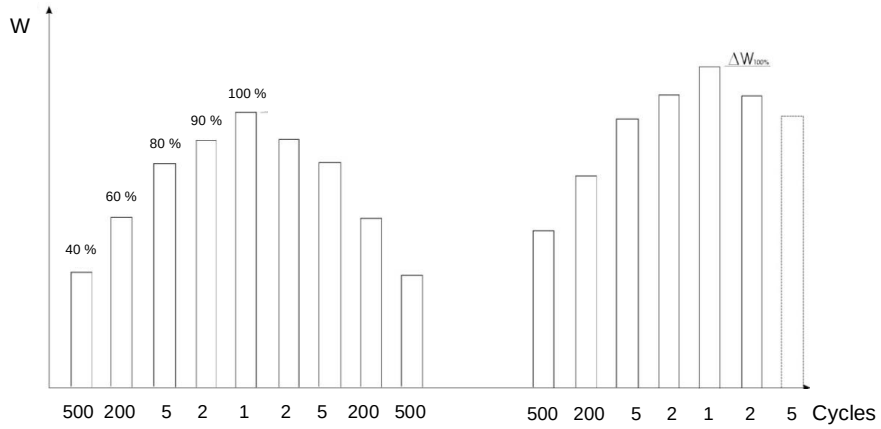


Figure 2. Proportional array of suction pressures

Test specimen

Dimensions. The test specimen is a model of a roof construction, incorporating the installed product partially bonded.

The dimensions of the test specimen will depend on the dimensions of the pressure chamber chosen but shall have a minimum testing area of 4 m² and a shortest dimension of at least 1.5 m.

Number. The number of test specimens is one.

Preparation. The installation of the product partially bonded shall be executed in accordance with the manufacturer's instruction to the least compressible of the substrates specified by the manufacturer (see also the Note on test procedure).

Lap joints, if any, in the support layer shall be symmetrically positioned in accordance with Figure 3.

Where the substrate consists of board materials (thermal insulation), the boards shall be positioned in accordance with Figure 4a and 4b.

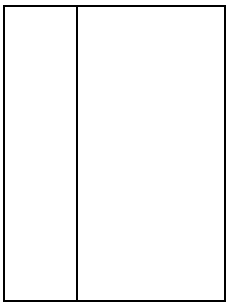


Figure 3. Positioning of lap joints of a partially bonded assembled "system" incorporating a supporting layer

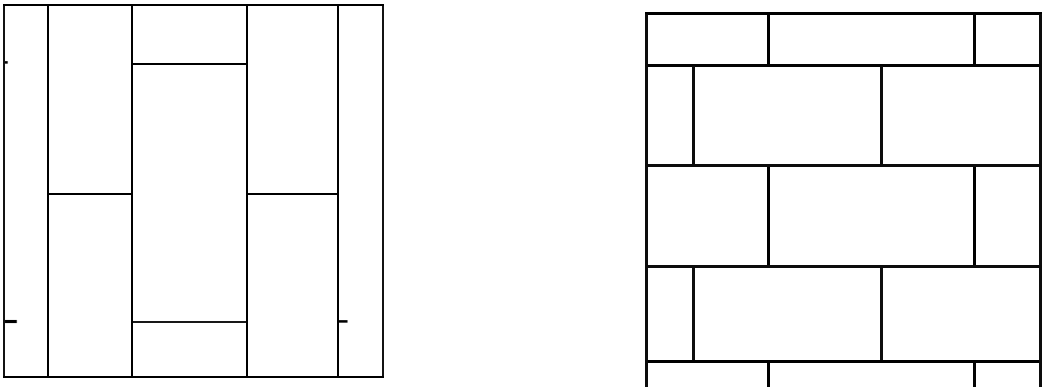


Figure 4. Positioning of boards as a substrate

4a - Double symmetrical positioning with staggered butt joint 4b - Positioning at will with staggered butt joints

Curing and conditioning. The test specimen shall be cured at 23 ± 5 °C for at least the period of time as prescribed by the manufacturer of the product.

The cured test specimen shall be conditioned at 23 ± 5 °C for at least 16 hours.

Test Procedure. The test shall be carried out at 23 ± 5 °C and the test specimen shall be fixed symmetrically in the pressure chamber.

Provision shall be made at the edge zones so that these areas do not influence the mode of failure (e.g. movements must remain possible) and to ensure an airtight seal during the application of the suction pressures.

The fan and the controlling equipment shall be used to apply to the test specimen the proportional suction pressures in accordance with Figure 2.

The time/suction pressure diagram shall comply with that given in Figure 5.

The tolerance on the time is ± 0.1 s and 90% of the peak pressure shall be reached in between 0.7 and 1.0 s after the loading has started.
The lapse time for one suction pressure shall be ≤ 8 s.

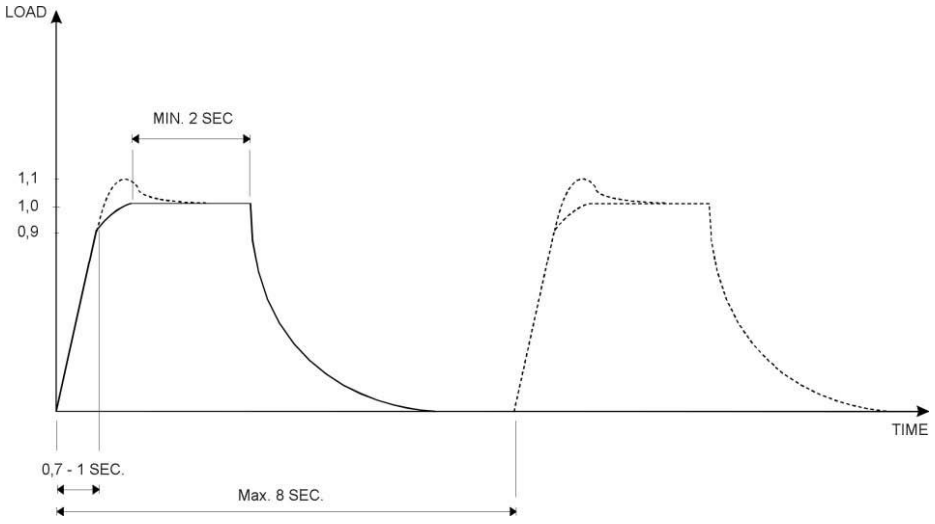


Figure 5. Time/suction pressure diagram (trapezium)

The applied suction pressure of each array of cycles shall be in accordance with Table 15.
The behavior of the test specimen shall be observed during each cycle: the stage, the number of suction cycles at which the roof waterproofing kit fails and the mode of failure, shall be recorded.

Table 15 - **Peak suction pressure at each cycle (∆W 100%)**

Number of cycles	Applied suction pressure in kPa
1	1.0
1	1.0
1	1.0
1	1.0
1	1.5
1	2.0
1	2.5
1	3,0
1	3.5
1	4.0

NOTE: *In the test specimen provisions shall be made that the peak suction pressure with an accuracy of ± 10 % directly affect the installed product. Where the peak suction pressure does not act directly on the installed product, the test specimen shall be adjusted accordingly for example by means of openings between boards and/or in the supporting structure.*

Expression of results. Record of the load at which the roof collapses and the peak load (ΔW100 %) of the preceding cycle, expressed in kPa for the partially bonded product.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. The date of testing.
d. A description of the installed product including dimensions and conditioning.
e. A description of the substrate (used for classification).
f. All observations made during the testing including the description of the failure mode of the test specimen.
g. The test conditions.
h. Test results.
i. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.3 Determination of the resistance to dynamic indentation

Scope. It specifies the method of the determination of the resistance to dynamic indentation installed liquid applied roof waterproofing kits.

Principle. The resistance to dynamic indentation of installed liquid roof waterproofing kits on a given substrate is determined by applying an impact energy of 5.9 J by means of a given steel indentor on the exposed side of the installed product.

Perforation of the installed product shall be identified, in case of doubt, by determination of the watertightness.

Apparatus

Hammer device. With indentor adjuster providing an impact energy of 5.9 + 0.1 J. (see Figure 6).

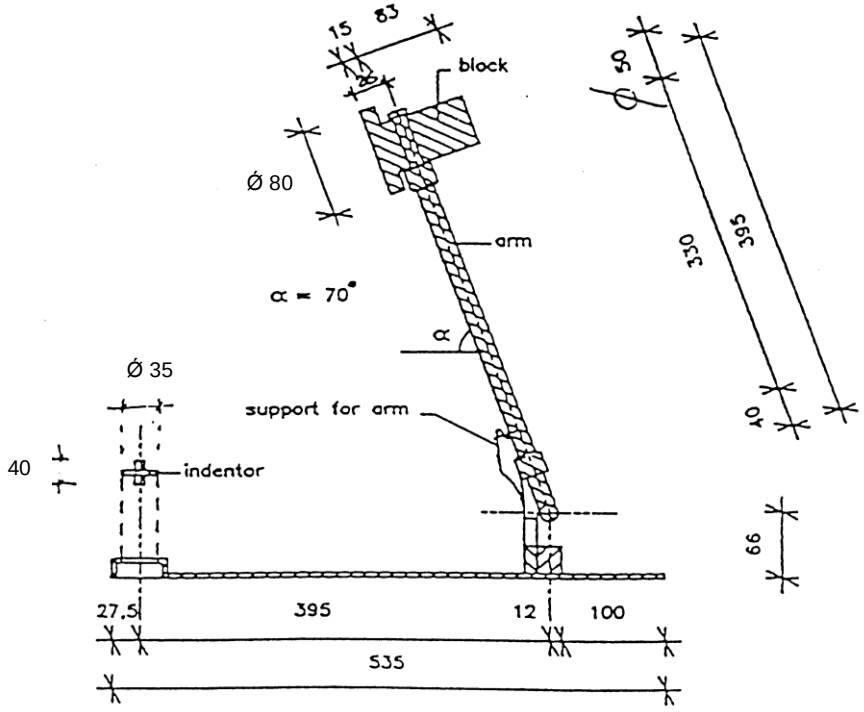


Figure 6. Schematic diagram of the hammer device

Set of steel indentors. According Table 16 and Figure 7.

The edge radius R of the cylinder shall be 0.3 ± 0.1 mm.
The steel shall have a hardness of at least 58 HRC; all surfaces polished.

Table 16- Types of indentors (Dimensions in mm)

	Type of indentors			
	l_4	l_3	l_2	l_1
Ø D	6 ± 0.05	10 ± 0.05	20 ± 0.05	30 ± 0.05
A	10	15	15	15
B	20	15	15	15

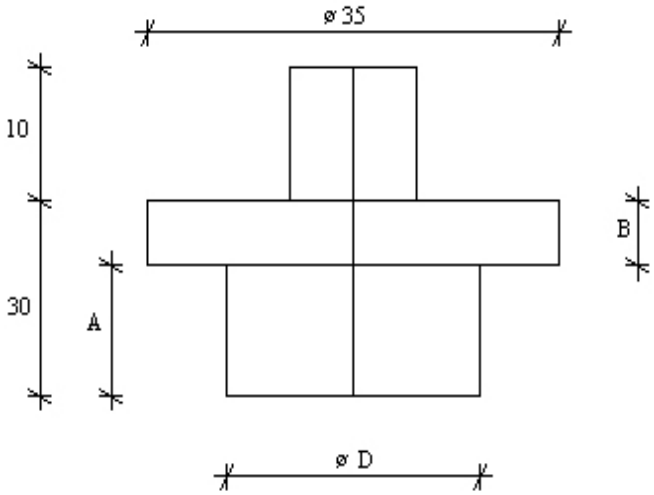


Figure 7 - Shape of the indentor

*Frame. T*o clamp or fix the test specimen with internal dimension between 200 mm x 200 mm and 300 mm x 300 mm.

Rigid flat base plate of sufficient size.

Siliconized paper

Devices for testing watertightness. In case of fully bonded "system(s)":

a. suitable electrical spark tester;
b. cylinder, diameter 50 mm, to apply a head of (coloured) water of at least 100 mm.

Test specimen

Dimensions. The test specimen is the assembled "system" of the assembled "system" including its substrate. The dimensions of the test specimen shall be based on the frame used but shall have a test area of 200 ± 1 mm x 200 ± 1 mm.

Number of test specimen. The number of test specimen of the assembled "system" is three.

NOTE: *Depending on the type of substrate applied for and its dimensions, it is permissible to use the substrate more than once. If the substrate is damaged as a result of the test, the use of the same substrate is only allowed when the new position is not within 100 mm of any previous indentation or of the internal sides of the frame. In this case, the same piece of substrate can be used for three tests.*

Preparation of test specimen. In the case of a "system" being defined as loose laid or partially bonded, the test specimens shall be cut from a free film sample (eg. obtained by the use of siliconized paper etc.)

In all other cases the test specimen shall be the "system", bonded to the most and least compressible substrate specified by the manufacturer for that "system"; except where that substrate is concrete, a steel plate (at least 6 mm thick) shall be used as a substrate.

NOTE 1: *If the "system" incorporates a supporting layer and/or an internal layer the test specimen shall not include joints.*

NOTE 2: *Only in the case of fully bonded "system(s)" where the least compressible substrate specified is concrete, a steel plate is used as a substrate in order to allow subsequent assessment of watertightness by electrical means e.g. by an electrical spark tester.*

Curing and conditioning of test specimen. The assembled "system" shall be cured at 23 ± 2 ºC and 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer.
The cured test specimens shall be conditioned at 23 ± 2 ºC for a period at least 16 h.

Test Procedure

- The test shall be carried out at a temperature of 23 ± 2 º C and a relative humidity of 50 ± 5 %, unless otherwise specified.
- Clamp the test specimen in the frame in such a way that it is fully restrained and supported at the edges.
- Position the apparatus in the centre of the test specimen when using dimensions of 200 mm x 200 mm, or at a distance of at least 100 mm from the internal sides of the framework, when using larger test specimen.
- Adjust the hammer device to the release position. Place the indentor in the apparatus resting on the exposed side of the test specimen. The type of indentor (Table 16) is related to the level of resistance, corresponding with the user load category as specified by the manufacturer.
- Apply an impact energy of 5.9 ± 0.1 J on the steel indentor.

NOTE: *If due to the combination of impact energy and rigid substrate the hammer (Hammer device) springs back from the indentor, the movement should be stopped manually as to prevent a second impact on the indentor.*

- Remove the test specimen; examine the liquid applied roof waterproofing kit visually for perforation and (in case of doubt) determine the watertightness of the "system" at the place of indentation by using one of the following procedures:

a. free film	No penetration: the test result is favourable when after the test, the impactor has not passes the test specimen and the free films is watertight with a head of water of 100 mm.
b. bonded to substrates	By the application of a 100 mm column of (coloured) water for a period of 24 hours. After this period the assembled "system" shall be carefully removed from the substrate and the substrate shall be examined for evidence of water penetration (e.g. by use of UV lamp).
c. bonded to steel	By the application of a small amount of salt water to the indentation and the use of an electrical method (e.g. spark tester). The steel plate is then acting as the earth. Care must be taken to ensure that the voltage applied across the test specimen is not too high to cause damage.

NOTE: *When the "system" contains conductive material(s) the electrical spark tester cannot be used.*

- Perform the test on the remaining test specimens.

Expression of results. Determine whether the test specimen has been perforated by visual examination and by testing the watertightness. The "system" is considered "watertight" when all three test specimens pass the test.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the liquid applied roof waterproofing kit including dimensions of test specimen and curing conditions.
e. A description of the substrate (used for classification).
f. A description of the indentor type used.
g. All visual examinations at the place of indentation.
h. The watertightness of the three test specimens at the place of the indentation and the method of determination, if relevant.
i. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.4 Determination of the resistance to static indentation

Scope. It specifies the method of the determination of the resistance to static indentation of an installed product of liquid applied roof waterproofing kits.

Principle. The resistance to static indentation of the product installed on a given substrate is determined by applying a given static load by means of a steel indentor to the exposed side of the product for a period of 24 hours and investigating whether the test specimen is perforated or not by the determination of the watertightness.

Apparatus

A device, including weights if any. To apply the constant loads, according to Table 17, on a steel indentor.

Table 17 - Loads

Level of resistance	Loads (N)	User load category
L1	70 ± 1	P1
L2	150 ± 1	P2
L3	200 ± 1	P3
L4	250 ± 1	P4

Indentor. A 10 mm diameter steel rod, having a hemispherical end with a measuring gauge of at least 100 mm long.

Frame. To clamp the test specimen, internal dimensions with a minimum of 200 x 200 mm.

Flat rigid base. Base of sufficient size.

Devices for testing watertightness. In case of fully bonded product:

a. electrical spark tester;
b. cylinder, diameter 50 ± 2 mm, to apply a head of (coloured) water with a minimum length of 100 mm.

Test specimen

Dimensions. The test specimen is the installed product including its substrate. The dimensions of the test specimen shall be based on the frame used, but shall have a testing area of at least 200 ± 1 mm x 200 ± 1 mm. The substrate shall have a thickness of 100 ± 2 mm.

Number of test specimens. The number of test specimens is three.

NOTE: *Depending on the type of substrate used and its dimensions, it is allowed to use the substrate more than once. However, if the substrate is damaged as a result of the test, the use of the same substrate is only allowed when the new position of indentation is not within 100 mm of any previous one or the internal sides of the frame. in that case the same piece of substrate can be used for three tests.*

Preparation of test specimens. In the case of a product being defined as loose laid or partially bonded, the test specimens shall be cut from a free film sample (e.g. obtained by the use of siliconized paper, etc.).

In all other cases, the test specimens shall be the product, bonded to the most and least compressible substrate specified by the manufacturer for that product, except where that substrate is concrete, a steel plate (at least 6 mm thick) shall be used as a substrate.

NOTE 1: *If the liquid applied roof waterproofing kit incorporates a supporting layer and/or an internal layer the test specimen shall not include lap joints.*

NOTE 2: *Only in the case of fully bonded product where the least compressible substrate specified is concrete, a steel plate is used as a substrate in order to allow subsequent assessment of watertightness by electrical means e.g. by an electrical spark tester.*

Curing and conditioning. The installed product shall be conditioned at a temperature of 23 ± 2 °C and a relative humidity of 50 ± 5 % for a period of at least the period prescribed by the manufacturer. The cured test specimens shall be conditioned at 23 ± 2 °C for a period of at least 16 hours.

Test Procedure

- The test shall be carried out at a temperature of 23 ± 2 °C and a relative humidity of 50 ± 5 %, unless otherwise specified.

- Clamp the test specimen in the framework in such a way, that the installed product is fully restrained and supported at the edges.
- Position the loading device in the centre of the test specimen when using dimensions of 200 mm x 200 mm, or at a distance of at least 100 mm from the internal sides of the frame work when using a larger test specimen.
- Place the indentor on the exposed side of the test specimen and connect it to the loading device.
- Apply the load to the steel rod (see Table 17) corresponding to the product user load category, related to its intended use as specified by the manufacturer.
- Remove the test specimen; examine the installed product visually for perforation and (in case of doubt) determine the watertightness of the installed product at the place of indentation by using one of the following procedures:

a. free film	No penetration: the test result is favourable when after the test, the impactor has not passes the test specimen and the free film is watertight with a head of water of 100 mm.
b. bonded to substrates	By the application of a 100 mm column of (coloured) water for a period of 24 hours. After this period the assembled "system" shall be carefully removed from the substrate and the substrate shall be examined for evidence of water penetration (e.g. by use of UV lamp).
c. bonded to steel	By the application of a small amount of salt water to the indentation and the use of an electrical method (e.g. spark tester). The steel plate is then acting as the earth. Care must be taken to ensure that the voltage applied across the test specimen is not too high to cause damage.

NOTE: *When the installed product contains conductive material(s) the electrical spark tester cannot be used.*

- Perform the test on the remaining test specimens.

Expression of results. Determine whether the test specimen has been perforated by visual examination and by testing the watertightness. The installed product is considered “watertight” when all three test specimens pass the test.

Test report. The test report shall give the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the installed product, including dimensions, curing and conditioning.
e. A description of the substrate.
f. The watertightness of the three test specimens at the place of indentation and the method of determination, if relevant.
g. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.5 Determination of the resistance to fatigue movement

Scope. It specifies the equipment and procedures for the determination of the resistance to fatigue movement of fully bonded assembled "system(s)" of liquid applied roof waterproofing kits, due to gaps (not expansion joints) in the substrates.

Principle. The resistance to fatigue movement of assembled "system(s)" of liquid applied roof water-proofing kits is determined by applying the kit on a specified substrate with a specified gap and investigating, after opening and closing the gap at a given speed, amplitude and temperature, the effects on the "system" both visually and by determining the watertightness at the area over the gap in the substrate.

Apparatus.

Fatigue testing machine. Capacity 30 kN, with two rigid plates at both sides of a gap, on which a specified substrate can be fixed (at both sides of the gap between the rigid plates). One or both of the plates are capable of moving in a horizontal plane with a speed of 16 ± 0.1 mm/h.

Cold box or refrigerator. Designed to reach a temperature of -20 °C and adjustable to ± 2 °C with a size that can contain the fatigue testing machine.

Specified substrate. Concrete slabs prepared as follows:

- Mix ratio: -1 part ordinary Portland cement (CEM I according to EN 197 - 1).
  - 2 parts sand (0.63 - 2 mm).
  - 4 parts course aggregate consisting of 35 % of 5 - 10 mm and 65 % of 10 - 20 mm.
- Water/cement ratio 0.6.

The surface of the slab onto which the roof waterproofing kit is to be applied, shall be formed by the top surface. The concrete shall be vibrated to full compaction. The surface shall be levelled to produce a uniform surface. When the concrete has sufficiently hardened and the bleed water has evaporated the surface shall be trowelled to produce a hard, dense surface free from screed marks and exposed aggregate. Finally the surface should be lightly textured with a wooden float or equivalent. Usual concrete practice shall be followed as regards demoulding and storage under normal laboratory conditions for a period of 28 days.

Cutting device. To cut the test specimens to the specified dimensions.

Test specimen

Dimensions of test specimen. The test specimen is the assembled "system" of a liquid applied roof waterproofing kit. The kit shall be applied as prescribed by the manufacturer to the surface of the substrate with a 1 mm gap.
The test specimen shall have a width of at least 50 mm and a length of at least 150 mm.

Number of test specimens. The number of test specimens in one direction (length or width) is three.

***NOTE**: If the mechanical properties of the assembled "system" are not equal in the longitudinal and the transversal direction, 3 test specimens shall be taken in both directions.*

Preparation of test specimen. The kit shall be applied as prescribed by the manufacturer and shall be fully bonded to the surface of the two pieces of the specified substrate with gap, utilizing a gap protection spacer of 1.0 mm.

The substrate shall have dimensions of at least 401 mm x 200 mm.

The assembled "system" shall be cut in longitudinal direction (square to the gap) to provide individual test specimens of at least 50 mm in width and a length of at least 150 mm. Optional: In one support can be installed the three samples (see Figure 8).

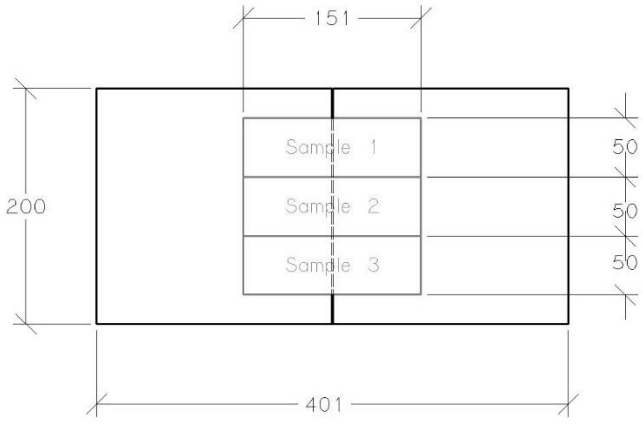


Figure 8. Situation of test specimen on the substrate

Curing of the test specimen. The assembled "system" shall be cured at 23 ± 2 °C and at 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer of the kit.

Test Procedure

- The test shall be carried out at a temperature of -10 ± 2 °C.
- Position the fatigue testing machine in the cold box and adjust the temperature to -10 ± 2 °C.
- Fix the starting point and adjust the amplitude of movement and the speed of the movement to 16 ± 0.1 mm/h.
- Condition the cured test specimen including the substrate at -10 ± 2 °C for at least 16 h.
- Place the test specimen including the substrate in the fatigue-testing machine.

NOTE: *Any distortion of the substrate and/or of the test specimen during transport shall be avoided e.g. by using a frame and a spacer, which, as a whole, are placed into the fatigue testing machine.*

- Fix the relevant substrates to the rigid plates of the machine. The test specimen shall be placed in such a way that movement occurs only at the gap in the substrate, which shall be exactly in line with the gap between the two rigid plates.

NOTE: *The amplitude of movement can be realised by either one or two movable rigid plate(s)*

- Start the fatigue procedure by increasing the 1.0 mm gap to 2.0 mm, remove the gap spacer and subsequently cycle between 2.0 and 0.0 mm.
- Apply the number of cycles related to the "system's" expected working life category as specified by the manufacturer.
- Stop the test after the specified number of cycles. Take the test specimen from the cold box and return it to ambient temperature. Examine the test specimen thoroughly for effects such as loss of adhesion, cracks, delamination, splitting or tearing at the gap.
- Measure the length of debonding, if any.
- Determine the watertightness of the roof waterproofing kit over the gap at room temperature by using a pipe of sufficient size to impose a head of water of 100 mm during 24 h.
- Perform the test on the remaining test specimen.

Expression of results. Record the mode of failure. Record as final result whether the test specimen remains watertight or not.
The "system" is considered to be proven when all three test specimen pass the watertightness test and that the debonding, if any, does not exceed 75 mm in total or 50 mm on one side of the gap.

Test report. The test report shall give the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the assembled "system", including dimensions, curing and conditioning.
e. A description of the substrate (used for categorization).
f. The test conditions.
g. A description of the failure mode in the test specimen, if any.
h. Watertightness of the three specimens.
i. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.6 Determination of the resistance to sliding

Scope. It specifies the equipment and procedure for the determination of the resistance to sliding of partially and fully bonded assembled "system(s)" of liquid applied roof waterproofing kits.

Principle. The resistance to sliding due to the self-weight of the partially or fully bonded "system" is determined, using a defined substrate and slope, by heating the test specimen of the "system" for a specified period of time in a heat chamber and measuring the displacement of the "system" with reference to the substrate.

Apparatus

Heat chamber. Oven with forced air circulation: with temperature regulation in the range of 50 to 100 °C with an accuracy of ± 2 °C with a size which can contain the frame.

Frame. To support the test specimen, adjustable to the given slope between 0° and 90° with an accuracy of 1° with sizes according the dimensions of the substrate.

Cutting device. To cut the test pieces and the test specimen to the specified dimensions.

Sliding calliper. Permitting reading to an accuracy of 0.1 mm.

Scribing pen and metal ruler.

Thin aluminium plates. Thickness e.g. 1 mm; dimensions 50 mm x 100 mm.

Guide marks. E.g. screws or bolts and nuts.

Test specimen

Dimensions of test specimen. The test specimen is the partially or fully bonded assembled "system" of a liquid applied roof waterproofing kit, including its substrate.

The substrate shall have a width of at least 320 mm and a length of at least 320 mm; the test specimen shall have a width of at least 300 ± 1 mm and a length of at least 300 ± 1 mm.

Number of test specimen. The number of test specimen is three.

Preparation of test specimen. The roof waterproofing kit shall be applied as prescribed by the manufacturer to the substrate.

The substrate shall be larger than the test specimen of the assembled "system".

Put both guide marks in place as shown in Figure 9.

Glue the thin aluminium plates along the edges and in the middle to the surface of the test specimen in line with the guide marks and draw a line on the aluminium plates, using a scribing pen and a metal ruler, placed against the guide marks.

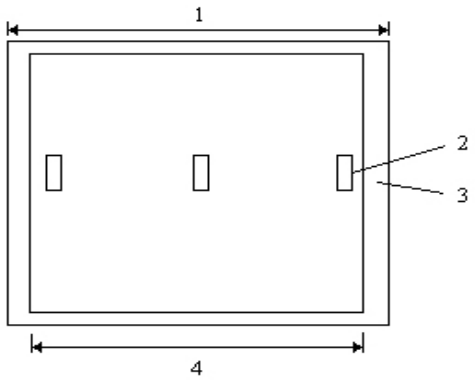


Figure 9. Plan of the test specimen

Curing and conditioning of the test specimen. The assembled "system" shall be cured at 23 ± 2 °C and at 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer of the kit.

After attaching the aluminium plates to the surface of the cured "system", the test specimen shall be conditioned at 23 ± 2 °C and at 50 ± 5 % relative humidity until the adhesive has sufficient strength, and at least for a period of 16 h.

Test Procedure

- The test shall be carried out at the temperature and the maximum slope as defined in the kit's categorization to slope.
- Bring the heat chamber to the required temperature as specified.
- Place the frame, adjusted to the slope as specified and containing the test specimen, in the heat chamber and maintain the temperature for a period of 7 days.
- After 7 days of exposure remove the test specimen from the heat chamber and allow it to cool in horizontal position for a period of at least 16 h at 23 ± 2 °C and at 50 ± 5 % relative humidity.
- Draw a new line on the aluminium plates by using the scribing pen and the metal ruler, placed against the guide marks.
- Measure the distance between the initial line and this new line on all three aluminium plates with the sliding calliper to an accuracy of 0.1 mm.
- Record any displacement.
- Perform the test on the remaining test specimen.

Calculation and expressing of results. Record, as result of the tests the calculated arithmetical mean displacement of each individual test specimen with reference to its substrate with an accuracy of 0.1 mm.

Record the calculated arithmetical mean value of displacement.
The "system" is considered to be proven when all three specimens pass the test.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the assembled "system", including dimensions, curing and conditioning.
e. A description of the substrate and the angle of slope (used for classification).
f. The test conditions.
g. A description of the measured relative displacements and the arithmetical mean value.
h. A description of the failure mode, if any.
i. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.7 Exposure procedure for artificial weathering

Introduction. This exposure procedure for artificial weathering of assembled "system(s)" of liquid applied roof waterproofing kit(s) is based on ISO 4892 - Parts 1, 2 and 3 and EN 513. Distinction is made to two different sets of conditions for exposure, defined as 'conditions M' and 'conditions S', based on the different climatic zones of use in Europe, for either apparatuses with Xenon arc light source or fluorescent UV light source.

Scope. It specifies exposure procedures, for artificial weathering, for the apparatuses and the conditions for exposing test specimens, being a cured assembled "system" of a liquid applied roof waterproofing kit, to laboratory light sources, elevated temperature, humidity and wetting conditions.

Principle. Test specimens, being a cured assembled "system" of a liquid applied roof waterproofing kit, are exposed in a Xenon arc or fluorescent UV artificial weathering apparatus at a specified irradiance, Black and White Standard Temperature, relative humidity and spray cycles.

After defined UV radiant dose the changes in characteristics, to be specified by the nature of the cured assembled "system", are determined.

Apparatus

Artificial weathering apparatus. With a Xenon arc light source or with a fluorescent UV light source.

The apparatus shall comply with ISO 4892 - Parts 1, 2 and 3 and with the following specifications.

- **Xenon arc light source.** In accordance with method A of ISO 4892 - Part 2, with a spectral irradiance in the bandpass of 290 nm to 800 nm of 550 ± 55 W/m^2 and a spectral irradiance in the bandpass of 290 nm to 400 nm of 60 ± 12 W/m^2.

- **Fluorescent UV light source.** In accordance with ISO 4892 - Part 3, a laboratory light source type 1 (UV-A 340 nm peak) where radiant emission below 400 nm makes up at least 80 % of its total light output and where radiant emission below 300 nm is less than 2 % of its total light output, with a spectral irradiance in the bandpass of 300 nm to 400 nm of 45 ± 10 W/m^2.

- **Test chamber**. Containing a frame to retain the test specimens holders:
  - Specimen holders for Xenon arc light source apparatus. The specimen holders for Xenon arc light source apparatus shall be in accordance with clause 4.7 of ISO 4892 Part 2.
  - Specimen arrangement for fluorescent UV light source apparatus (in accordance with EN 1297).The test specimen racks shall allow the specimens to:
    - lie flat in the plane ≥ 5° above the horizontal,
    - be mounted so that the exposed face is in the plane of the uniform irradiance.

  The specimens shall be attached to stainless steel plates of at least the same size as the specimens by appropriate means. The attachment shall leave an area open to free irradiation in order that subsequent tests can be performed on irradiated parts of the specimen.

  For inclinations near to horizontal the specimens may alternatively be placed in stainless steel pans of at least the same size as the specimens. The specimens shall be weighted in this arrangement by means of a U shaped stainless frame. The external dimensions of the frame shall correspond to the specimen size. The cross section of the steel section shall be 5 ± 0.5 mm by approximately 10 mm.

The dimension of 5 ± 0.5 mm stands for the width of the cross section, i.e. the plane that is in contact with the specimen. If the specimens are placed in pans, the lower end of the pans shall have sufficient slits or holes to avoid any collection of water.

- **Spray nozzles**. To provide a uniform and continuous wetting of the exposed test specimens for defined periods of time. For fluorescent UV light source apparatus the flow ate through the nozzles shall be 10 ± 3 l/min.m² of the exposed surface.
- **Means of providing controlled humidity** at the defined level.
- **Means of controlling air temperature** within the test chamber.
- **Black Standard thermometer**. In accordance with clause 4.1.5.1.1 of ISO 4892-Part 1, with a response time less than 1 min. and a means of recording maximum temperatures during each cycle.
- **White Standard thermometer**. In accordance with clause 4.1.5.1.1 of ISO 4892-Part 1, and with means of recording maximum temperatures during each cycle.
- **Device**. To determine the UV radiant exposure in the wavelength region 280 nm to 400 nm expressed in joules per square metre (J/m^2).
- **Device (Solar Eye Control)**. To monitor the level of radiation output of the light source(s).

NOTE 1*: It is recognised that not all the above parameters can be met on all apparatuses at the present moment, but all apparatuses must comply with these requirements from 1 January 2003.*

NOTE 2: *Relative spectral irradiance data are given in informative A4.7.2 to this document*

Demineralized water. Grade 3 according to ISO 3696.

NOTE*: In general the temperature of the water to be used in the spraying procedure will be 25 ± 5 ºC.*

*Cycle timer***.** A continuously operating cycle timer shall be provided to program the selected cycle of UV and spraying periods. Hour meters shall be provided to record total time of operation and total time of UV exposure.

Test specimen

Dimensions of test specimens. The test specimen is the assembled "system" of a liquid applied roof waterproofing kit.

The dimensions of test specimens shall be determined by the size of the test specimen racks or holder and shall in any way be of sufficient size to provide the test specimens needed for the test methods to evaluate any exposure effects on the resistance of the roof waterproofing kit as specified in this EAD.

NOTE*: In general, to avoid possible effects, due to exposure to artificial weathering, at the edges of the test specimens meant for evaluation purposes, these test specimens shall be prepared from exposed samples, with greater dimensions.*

Number of test specimens. The number of test specimens equals the number of test specimens needed for those test methods used to evaluate any exposure effects on performance at least three series of specimens for recommended checks between times.

Preparation of test specimens. The roof waterproofing kit shall be applied as prescribed by the manufacturer of the kit in such a way, that a free sample is obtained (e.g. by using siliconized paper). After curing of the assembled "system", the test specimens shall be cut from these free samples with the EAD indicated dimensions.
The test specimens shall be placed loose-laid in the specimen rack or holder.

NOTE: *When the "system" incorporates a supporting layer, tests shall not be performed at lap joints in this supporting layer.*

Curing and conditioning of test specimens. The free samples of the "system" shall be cured at 23 ± 2 ºC and at 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer of the kit.
The test specimens, prepared from the cured free samples, shall be conditioned at 23 ± 2 ºC and at 50 ± 5 % relative humidity for a period of at least 16 h and at the most for 168 h (one week).

Test Procedure

*General***.** For the simulation of the different climates in Europe there are different exposure conditions defined in A4.7.3 as:

- **exposure conditions "M"**: for simulation of moderate climate **(M)**
- **exposure conditions "S"** : for simulation of severe (hot and dry) climate **(S)**

The reasons for the choice for different exposure conditions are given in A4.7.1.

Exposure conditions "M" for Xenon-arc weathering apparatus

- The Black Standard Temperature (BST) shall be 60 ± 3 ºC. The air temperature in the test chamber shall be controlled to a constant value such that the BST equals the required value at the end of the dry period.
- The White Standard Temperature (WST) shall be 40 - 45 ºC.

NOTE: *The WST is predetermined by procedure BST. It should lie within the specified range; otherwise, the manufacturer of the weathering apparatus should be contacted.*

- The spray cycle used shall be 18/102 (18 minutes spraying / 102 minutes dry period) in accordance with ISO 4892 - Part 2.

NOTE: *Sample surfaces have to be continuously sprayed during the spray period, otherwise the manufacturer of the weathering apparatus should be contacted.*

- The relative humidity during the dry period shall be 65 ± 5 % RH.

Exposure conditions "S" for Xenon-arc weathering apparatus

- The Black Standard Temperature (BST) shall be 70 ± 3 ºC. The air temperature in the test chamber shall be controlled to a constant value such that the BST equals the required value at the end of the dry period.
- The White Standard Temperature (WST) shall be 50-55 ºC.

NOTE: *The WST is predetermined by procedure BST. It should lie within the specified range, otherwise the manufacturer of the weathering apparatus should be contacted.*

- The spray cycle used shall be 18/102 (18 minutes spraying / 102 minutes dry period) in accordance with ISO 4892 - Part 2.

NOTE: *Sample surfaces have to be continuously sprayed during the spray period, otherwise the manufacturer of the weathering apparatus should be contacted.*

- The relative humidity during the dry period shall be 65 ± 5 % RH.

Exposure conditions "M" for fluorescent UV weathering apparatus

- The Black Standard Temperature (BST) shall be 50 ± 3 ºC. The air temperature in the test chamber shall be controlled to a constant value such that the BST equals the required value at the end of the dry period.
- The spray cycle used shall be 60 minutes / 300 minutes (1 h spraying and 5 h dry period) in accordance with ISO 4892 - Part 3.

NOTE: *Sample surfaces have to be continuously sprayed during the spray period, otherwise the manufacturer of the weathering apparatus should be contacted.*

- The relative humidity during the dry period shall be 10 ± 5 % RH.

Exposure conditions "S" for fluorescent UV weathering apparatus (in accordance with exposure procedure in EN 1297)

- The Black Standard Temperature (BST) shall be 60 ± 3 ºC. The air temperature in the test chamber shall be controlled to a constant value such that the BST equals the required value at the end of the dry period.
- The spray cycle used shall be 60 minutes/300 minutes (1 h spraying and 5 h dry period) in accordance with ISO 4892 - Part 3.

NOTE: *Sample surfaces have to be continuously sprayed during the spray period, otherwise the manufacturer of the weathering apparatus should be contacted.*

- The relative humidity during the dry period shall be 10 ± 5 % RH.

Exposure procedure

- Expose the test specimens for the weathering tests with the upper surface towards the light source in the artificial weathering apparatus for a radiation dose as specified in Table 6. The remaining reference test specimens are stored in the dark.
- The exposure procedure shall be in accordance with ISO 4892 and EN 513, respectively with the following modifications.

  Before placing the test specimens, prepare the artificial weathering apparatus as follows:

  1. Select the appropriate filter arrangement for Xenon arc light source to achieve the irradiance in accordance with of ISO 4892 -Part 2 - method A.
  2. Install the devices for the determination of the radiant exposures defined above.
  3. Install the Black Standard thermometer and the White Standard thermometer in such a position that its temperature measurements will be representative for the test chamber.
  4. Set the test chamber relative humidity to 65 % RH for Xenon arc apparatus or 10% RH for fluorescent UV light source apparatus.
  5. Set the spray cycle in accordance with the type of light source.
  6. Set the test chamber air temperature to a constant value to achieve the Black Standard Temperature (BST) in accordance with the relevant exposure conditions ("M" or "S") and the type of light source.
  7. Check the White Standard Temperature (WST) in accordance with the relevant exposure conditions ("M" or "S") and the type of light source.

- Mount the test specimens in the holders with the upper surface towards the light source.

NOTE 1: *When the test specimens do not completely fill the racks, the empty spaces shall be filled with blank panels to maintain the test conditions within the test chamber.*

NOTE 2: *It is not recommended to expose specimens of different nature simultaneously in order to avoid interaction of any kind.*

- Start the exposure procedure and control and record:
  - The air temperature in the test chamber.
  - The Black Standard temperature.
  - The White Standard temperature.
  - The relative humidity.

NOTE: *It is difficult to specify minimum recording intervals due to differences in equipment and laboratory procedures. The test laboratory should record at intervals that are appropriate to maintain the test conditions in the particular laboratory on a particular apparatus.*

- At regular intervals check and record the irradiance in accordance with Xenon arc or fluorescent UV light source.
- The exposure is completed when the specified amount of radiant exposure is reached.
- Take the test specimens holder from the test chamber and the specimens from the holders and condition them for a period of at least 16 h at a temperature of 23 ± 2 ºC and at 50 ± 5 % relative humidity.
- Examine the test specimens visually and note any visible exposure effects.
- Prepare the test specimens according to the appropriate test methods for evaluation of any exposure effects on the relevant products characteristics.

Expression of results

- Examine visually unexposed and exposed test specimens and record any occurred exposure effects.
- Observe, compare and record the differences in appearance of the unexposed and exposed test specimens as regards their relevant characteristics.

Test report. The test report shall give the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date / period of exposure.
d. A description of the assembled "system", including dimensions, curing and conditioning.
e. Type of artificial weathering apparatus used.
f. Type of light sources and filter "system" used, if any.
g. Type of temperature measurements and description.
h. Set value of the relative humidity in the test chamber.
i. Spray cycle used.
j. Conditions of test specimen rotation, if any.
k. UV radiant exposure in MJ/m^2 and, if appropriate, in Xenon-arc apparatus radiant exposure < 800 nm in GJ/m^2.
l. Exposure time in hours (h).
m. All visual observations.
n. Results of evaluation of exposure effects.
o. All operating details not specified in this procedure, such as deviations from the test procedure, as well as incidents likely to have influenced the results.

A4.7.1 Reasons for the choice of the exposure conditions (informative)

Scope. It gives the reasons for the choice of exposure conditions for artificial weathering:

- to more accurately simulate natural weathering conditions in moderate and severe (hot and dry) climates in Europe;
- for the purpose of an adequate uniform procedure serviceable for both Xenon-arc and fluorescent UV lamp apparatuses.

Spray cycles. As the test results of UV radiation in combination with ponding water cycles show no additional and/or specific information for the assessment of the effects of artificial weathering, the decision has been made on expertise support to abandon the ponding water cycles. Consequently, the 'vertical' exposure procedure enables the use of both Xenon-arc and fluorescent UV lamp apparatuses, provided similarity in radiant exposure can be performed.

1 year's equivalent UV radiant exposure dose. For the purpose of an adequate uniform artificial weathering procedure for liquid applied roof waterproofing kits, serviceable for both Xenon-arc and fluorescent UV light source apparatuses, the choice has been made for a defined 1 year's equivalent UV radiant exposure dose of 200 MJ/m^2. For the assessment of roof waterproofing kits the exposure dose is related to the “system” categorization to expected working life (see Table 6).

Simulating climate conditions "M" and "S". Related to the possibility of using apparatuses with different light sources there is the need for differentiation in exposure conditions, in addition to the necessity of varying the exposure conditions to simulate the difference between moderate and severe climatic conditions.

To simulate moderate climate condition "M", the BST = 60 ºC where chosen for Xenon-arc apparatus; the BST = 50 ºC for fluorescent UV lamps apparatus.

The Black Standard Temperature (BST) is the maximum surface temperature of a black polymer specimen. In contrast to Xenon-arc apparatuses, where white or light coloured specimens show surface temperatures clearly below the BST, in fluorescent UV lamp apparatuses all specimens (whether white or black) have nearly the same surface temperature. To obtain about the same surface temperatures of medium coloured specimens in Xenon-arc and fluorescent UV lamp apparatuses, the BST in fluorescent UV lamp apparatuses has to be reduced by about 10 K.

Because BST can be controlled in Xenon-arc apparatus by different procedures, the range of WST is prescribed in order to get constant temperature conditions during exposure.

To simulate severe (hot) climate condition "S", the BSTs for both Xenon-arc and fluorescent UV lamps apparatuses were increased by 10 ºC with an adjustment of WST.

The proposed spray cycles in Xenon-arc and fluorescent UV lamps apparatuses and the relative humidity in the dry periods correspond with the recommendations given in ISO 4892 - Parts 2 and 3.

A4.7.2 Spectral irradiance of typical light sources in artificial weathering apparatus

General. A variety of Xenon-arc and fluorescent UV lamps can be used for purposes of exposure. The lamps shown in this Annex are specifically chosen for the exposure procedure.

Representative spectral irradiance data. All spectral distributions of radiation shown in this Annex are representative only and are not meant to be used to calculate or estimate total radiant exposure for tests in accelerated weathering devices. Actual irradiance levels at the test specimen surface will vary due to the type and/or manufacturer of the lamp used, the age of the lamps, the distance of the lamp array and the air temperature within the chamber.

The following data (Table 18) is representative of the spectral irradiance received by a test specimen mounted in the sample plane:

Table 18 - Spectral irradiance in weathering apparatuses according to ISO 4892 - Parts 2 and 3

Wavelength range	Irradiance in W/m^2		
	Xenon-arc	Type I (340) fluorescent UV lamps	Fluorescent UV lamps combination
Below 290 nm	0	0	0
290 nm to 320 nm	3.3	3.1	3.3
320 nm to 360 nm	23	25	22
360 nm to 400 nm	34	11	18

A4.7.3 Calculation method for the determination of the radiation and exposure time to be used for artificial weathering

Scope. It gives a procedure to calculate the duration of the exposure needed to assess resistance to moderate (M) and severe (S) climates to be used for artificial weathering. In this point, a justification for the chosen method is included.

NOTE: *This calculation method represents a very approximate means of estimation. However, it does put the requirements on some sort of logical basis bearing in mind that natural weathering itself is a very variable phenomenon depending on location, aspect, shading and so on.*

Calculation. The climatic zones are classified M (moderate climate) and S (severe climate) as defined in Table 11. If the annual solar radiant exposure on a horizontal surface is equal to or greater than 5 GJ/m^2 and/or the average temperature of the warmest month of the year is equal to or greater than 22 ºC the climate is classified as severe (S).

NOTE: *Materials which are designed for use in a moderate climate (M) are not used in the severe climate (S).*

For the purpose of calculating the duration of the exposure the value for annual radiant exposure of 5 GJ/m^2 is used.

In order to compare this Table 11 with the usual practice in artificial weathering we need to consider not the total radiation energy, 5 GJ/m^2, but that part falling in the ultraviolet region between 300 nm and 400 nm. This is about 6 % of the total radiant exposure.

A further correction of 67 % is applied to allow for the fact that not all this radiation is acting at higher summer temperatures and so will be less damaging to the affected surfaces.

This leads to the recommended 1 year's equivalent radiation dose of 0.67 x 0.06 x 5 GJ/m^2 = 201 MJ/m^2 for the wavelength range between 300 nm and 400 nm (see also Table 19).

Table 19 - Recommended radiant exposure for wavelength range 300 - 400 nm in GJ/m^2

Climate type	Moderate (M) and Severe (S)	Formula used
1 year's equivalent	0.201	0.67 x 0.06 x 5 GJ/m^2 year) x 1(year)
2 year's equivalent	0.400	0.67 x 0.06 x 5 GJ/m^2 year) x 2(year)
5 year's equivalent	1	0.67 x 0.06 x 5 (GJ/m^2 year) x 5(year)

For an artificial weathering device having a time-averaged UV irradiance of E W/m^2 in the range of 300 nm and 400 nm the exposure times are given in Table 20. Where UV irradiance E = 55 W/m^2, this means for 5 year's equivalent 5000 h.

Table 20 - Recommended exposure times for wavelength range 300 nm - 400 nm in 10^3 hours

Climate type	Moderate (M) and Severe (S)	Formula used
1 year's equivalent	$\frac{55}{E}$	$\frac{0.200\ (GJ/m^2)}{3600(s) \times E(W/m^2)} \times 1\ h$
2 year's equivalent	$\frac{110}{E}$	$\frac{0.400\ (GJ/m^2)}{3600(s) \times E(W/m^2)} \times 1\ h$
5 year's equivalent	$\frac{275}{E}$	$\frac{1\ (GJ/m^2)}{3600(s) \times E(W/m^2)} \times 1\ h$

In order to obtain useful information on the course of possible reaction of test specimens to artificial weathering it is strongly recommended to check and register results at least at three moments during the exposure period. Where this additional information leads to a judgement of critical behaviour, such as serious or sudden progress in deterioration, it is recommended to prolong the exposure period until a further check.

Isoline 5 can be considered as an indicative borderline between the climatic zones related to temperatures. (Isolines according to "World Maps of Climatology" (H.E. Landsberg et al.) (Figure 10).

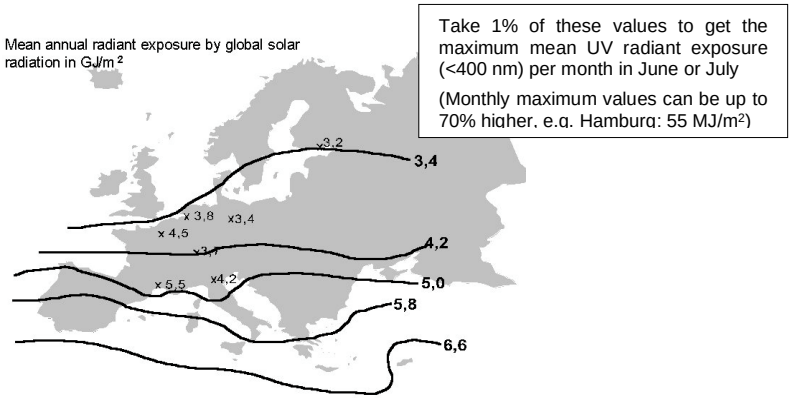


Figure 10. Mean radiant exposure by solar global radiation per year in GJ/m^2

A4.8 Exposure procedure for accelerated ageing by heat

Scope. It specifies the exposure procedure for accelerated ageing by heat, equipment and the procedure for conditioning samples of assembled "system(s)" of liquid applied roof waterproofing kits, in order to determine the possible effect of this exposure on various characteristics of the "system", by comparative testing.

Principle. The conditioning of samples is performed by exposing the samples to a defined temperature during a specified period.

Apparatus

Oven. With forced air circulation and with temperature regulation to a range of 50 to 100 °C with an accuracy of ± 2 °C and with dimensions, which can contain the frame.

Frame. To support the test sample and enabling a uniform heating with dimensions to fix the test specimen.

Accessories. Siliconized paper to avoid deformation in case of thermoplastic samples.

Test specimen. The test specimen is a free sample, defined as required for the specific test, of the assembled, applied and cured roof waterproofing kit, from which the test specimens are obtained after exposure.

Test Procedure

- Bring the oven to the required temperature.
- Place the test specimen on its supporting frame in the oven.
- Maintain the required temperature during the specified period.

- After the exposure period remove the sample from the oven; bring it back to ambient temperature and maintain it at that temperature for 24 h before further testing.
- Prepare the test specimens according to the appropriate test method(s) for evaluation of any exposure effects on the relevant products characteristics.

Expression of results

- Examine visually unexposed and exposed test specimens and record any occurred exposure effects.
- Observe, compare and record the differences in appearance of the unexposed and exposed test specimens as regards their relevant characteristics.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date/period of exposure.
d. Description of the assembled "system", including shape/dimensions.
e. Type of exposure, temperature and period of time.
f. All visual observations.
g. Results of evaluation of exposure effects.
h. All operating details, not specified in this procedure, as well as incidents likely to have influenced the process.

A4.9 Exposure procedure for accelerated ageing by hot water

Scope. It specifies the exposure procedure for accelerated ageing by hot water, the equipment and the procedure for conditioning test specimens of assembled "system(s)" of liquid applied roof waterproofing kits, in order to determine the possible effect of this exposure on various characteristics of the "system" by comparative testing.

Principle. The conditioning of test specimens is performed by exposing the upper, weathering surface of the test specimen to water at a defined temperature during a specified period.

Apparatus (see Figure 11).

Heater/water circulator. To circulate and heat the water in the range of 25-100 °C and temperature control to an accuracy of ± 1 °C.

Frame. 250 mm x 250 mm x 150 mm in marine grade plywood or other suitable material to contain the heated water.

Clamps. To clamp the frame to test specimen.

Means to prevent evaporation. To reduce the rate of water loss.

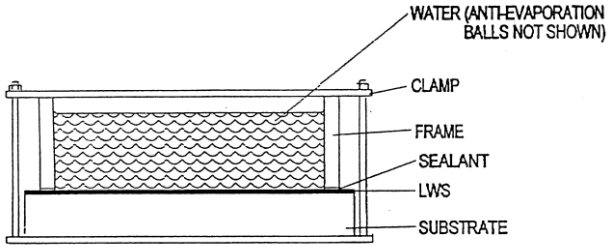


Figure 11. Schematic diagram of apparatus

Test specimen. The test specimen is the assembled "system" of the roof waterproofing kit, applied in accordance with the manufacturer's instructions to the appropriate substrate(s) having size of 300+ 50/0 mm x 300+ 50/0 mm.

Test Procedure

- Seal the frame to the test specimen using silicone sealant and clamp the frame in place. Allow the sealant to set in accordance with the manufacturer's instructions.

- Introduce water to a depth of 100 mm over the specimen and ensure that the water surface is covered with means to prevent evaporation.
- Bring the water to the required temperature.
- Maintain the required temperature and the water level during the specified period.
- After lapse of the exposure period remove the heated water and bring the specimen back to ambient temperature and maintain it at that temperature for 24 h before conditioning before further testing.

Expression of results

- Examine visually unexposed and exposed test specimens and record any occurred exposure effects.
- Observe, compare and record the differences in appearance of the unexposed and exposed test specimens as regards their relevant characteristics.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date / period of exposure.
d. Description of the assembled "system", including shape / dimensions and substrate(s).
e. Type of exposure, temperature and period of time.
f. All visual observations.
g. Results of evaluation of exposure effects.
h. All operating details, not specified in this Procedure, as well as incidents likely to have influenced the process.

A4.10 Determination of crack-bridging capability

Scope. It specifies the equipment and procedure for the determination of the capability of assembled "system(s)" of liquid applied roof waterproofing kit, to bridge cracks in the concrete substrate, both directly after curing and after accelerated ageing by heat.

Principle. The assessment is performed by inducing a defined crack in the concrete substrate as part of the test specimen and determine the resistance to cracking of the fully bonded "system" at low temperature during a defined period.

Apparatus

A tensile testing machine. Of suitable capacity (minimum 10 kN) and displacement involved and adjustable to a constant crosshead speed of 0.5 mm/min.

Recording equipment. For measuring time, speed, tension and displacement to an accuracy of 0.1 mm.

Cold box or refrigerator. Designed to reach a temperature of -30 °C and adjustable to ± 2 °C.

Cold chamber. Designed to reach a temperature of -30 °C and adjustable to ± 2 ºC and suitable to be mounted to the tensile testing machine.

Scales. With a measuring range of at least 600 g at an accuracy of 0.1 g.

Test specimen

Dimensions of the test specimen. The test specimen is the assembled "system" of the liquid applied roof waterproofing kit, including its specified substrate, to which it shall be applied as prescribed by the manufacturer of the kit.
The test specimen shall have a width of 50 ± 1 mm and a length of 290 ± 2 mm.

Number of test specimens. The number of test specimens is 6.

Specified substrate. The substrate of the test specimen consists of two concrete blocks of dimensions 50 mm x 150 mm x 30 mm, sawn (for example from a concrete paving slab) as two halves from one block of dimensions 50 mm x 300 mm x 30 mm, and placed end-to-end with the sawn edges touching. Both pieces fixed together by rigid adhesive tape at bottom and along both sides. The surface of the concrete substrate should be smooth, dry and clean and free from screed marks and exposed aggregate.

Preparation of test specimen. Before the kit is applied the concrete blocks shall be stored at 90 ± 5 % relative humidity at a temperature of 23 ± 2 °C until moisture equilibrium is reached, which is to be determined by weighing. The kit shall be applied as prescribed by the manufacturer and shall be fully

bonded to the surface of the two pieces of the specified substrate.

NOTE: *The assembled "system" of the test specimen shall not have a protective finish.*

*Curing and conditioning of the test specimen***.** The assembled "system" shall be cured at 23 ± 2 °C and at (50 ± 5) % relative humidity for at least the period as prescribed by the manufacturer of the kit.
After curing, three of the six specimens shall be artificially aged by heat by storing them at 70 ± 2 °C for a period of 91 days.
Prior to testing the test specimen shall be gradually brought to ambient temperature and afterwards be conditioned at -30 ± 2 °C for at least 12 h.

Test Procedure

- The test shall be carried out at -30 ± 2 °C.
- The test specimen is fixed longitudinally to the jaws of the tensile testing machine and the adhesive tapes are carefully removed.
- Adjust the tensile testing machine in order to subject the specimen to static tension at a rate of 0.5 mm/min. until a gap of 1.5 mm is developed between the two halves of the concrete block.
- At that moment, bring the tensile testing machine to a stand-still and maintain this situation for a period of 5 minutes. The test specimen must be able to bridge this gap for the duration of this period without sustaining damage.
- Following the test, the temperature of the test specimen will be allowed to rise to ambient temperature, after which the crack-bridging capability is examined visually.
- In case of no clearly visible damage, the watertightness of the assembled "system" shall be determined by sealing a pipe of a matching outer diameter to the test specimen over the crack area; the pipe shall be of sufficient height to impose a head of water of 100 mm during 24 h.
- Spread a moisture indicator (e.g. a mixture of powdered sugar and methylene blue) on an even board and cover it with a filter paper. Place the prepared test specimen on the filter paper and carry out the watertightness test.
- Perform the test(s) on the remaining test specimens.

Expression of results. Any ruptures in the membrane as well as any adhesion failures will be recorded.
Record as final result whether the test specimen remains watertight or not.
The system is considered to be proven when both series of three test specimens pass the watertightness test.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. Description of the assembled "system" and its substrate, including dimensions, curing, conditioning.
e. The test conditions.
f. A description of the failure mode in the test specimen, if any.
g. All operating details not specified in this procedure, as well as incidents likely to have influenced the results.

A4.11 Determination of the watertightness

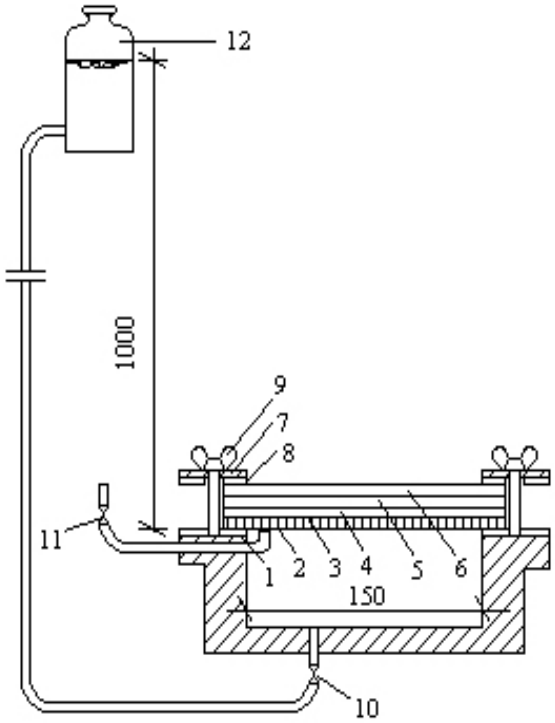
Scope. It specifies the equipment and procedures for the determination of the watertightness of liquid applied roof waterproofing kits, tested as a free film.

Principle. The watertightness of liquid applied roof waterproofing kits, tested as a free film, is determined by applying a specified pressure of water to the exposed side of the assembled "system" using a hydrostatic head of water during a certain period of time and investigating if water leakage occurs.

Apparatus

Circular metal flanged box. With a 150 mm aperture, connected to an open ended pipe or vessel which rises to a specified height or a pressure vessel with manometer to provide a specified hydrostatic pressure including inlet and exhaust values (see Figure 12).

Clamping unit. To fix the test specimen to the aperture of the metal box, including sealing gasket, steel clamping ring and wing nuts (see Figure 12).



1 = lower rubber sealing gasket
2 = inserted test specimen
3 = filter paper
4 = moisture indicating mixture
5 = filter paper
6 = circular ordinary window glass sheet
7 = upper rubber sealing gasket
8 = steel clamping ring
9 = wing nuts
10 = water inlet valve
11 = air exhaust valve
12 = level / pressure indicator

Figure 12. Schematic diagram of flanged box

Filter paper. Circular with diameter 200 ± 2 mm.

*Moisture indicator***.** A mixture of fine white (icing) sugar (99.5 %) and methylene blue dye (0.5 %) sieved over a 0.074 mm mesh and dried over calcium chloride in a desiccator.

Cutting device. To cut circular test specimen with a diameter of 200 ± 2 mm.

Circular glass sheet for window. Minimum thickness 4 mm, diameter 200 ± 2 mm.

Test water. Tap water with the addition of surfactants.

Test specimen

Dimensions. The test specimen is the assembled "system" of the liquid applied roof waterproofing kit and shall be circular having a diameter of 200 ± 2 mm.

Number of test specimens. The number of test specimens is three.

Preparation of test specimen. The liquid applied roof waterproofing kit shall be applied as prescribed by the manufacturer, in such a way that a free sample of the "system" is obtained (e.g. by use of siliconized paper).

After curing of the assembled "system", the siliconized paper, if applicable, shall be removed and the three test specimen shall be cut from the liquid applied roof waterproofing kit with dimensions as stated.

NOTE 1: *When the liquid applied roof waterproofing kit incorporates a supporting layer then one test specimen shall be taken at each of the following places: at the centre of the supporting layer, at the longitudinal overlap of the supporting layer and at the transversal overlap of the supporting layer.*

NOTE 2*. In case of testing at overlaps, additional sealant (e.g. silicones) might be necessary.*

Curing and conditioning of test specimens. The assembled "system" of the liquid applied roof waterproofing kit shall be cured at 23 ± 2 ºC and 50 ± 5 % relative humidity for at least the period as prescribed by the manufacturer.

The cured test specimen shall be conditioned at 23 ± 2 ºC for a period of at least 16 h.

Test Procedure

- The test shall be carried out at 23 ± 2 ºC unless otherwise specified.
- Place the test assembly consisting of sealing gasket, test specimen (exposed side to water), filter paper, moisture indicating mixture, filter paper, circular window glass sheet and sealing gasket respectively in the clamping unit.
- Fix the test assembly by means of the wing nuts and the steel clamping ring to the aperture of the metal flanged box.
- Open the water inlet valve and the air exhaust valve simultaneously.
- Close the air exhaust valve once water passes through, indicating the apparatus is filled with water.
- Apply and maintain a water pressure of 1000 ± 5 mm hydrostatic head of water on the test specimen.
- After 24.0 ± 0.5 h examine visually through the window glass if any coloration occurred in the upper filter paper.
- Perform the test on the remaining test specimens.

Expression of results. Determine for each test specimen if there is a leakage.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date of testing.
d. A description of the liquid applied roof waterproofing kit, including dimensions of the test specimen, curing, conditioning.
e. The test conditions; including water pressure and period of time.
f. A description of the behaviour of each test specimen to water pressure, including coloration of filter papers found.
g. All operating details not specified in this Procedure, as well as incidents likely to have influenced the results.

A4.12 Exposure procedure for accelerated ageing of glass reinforced unsaturated polyester resins by two-hour water boil

Scope. It specifies the method for accelerated ageing by two-hour water boil of glass reinforced unsaturated polyester resins, to determine the possible effect of this exposure on various characteristics by comparative testing.

Principle. The conditioning of samples is performed by exposure to boiling water for a period of two hours.

Apparatus

Flask. A five-litre glass round bottomed flange flask.

Connector. A socketed flat flanged lid for connecting between flask and condenser.

Condenser. To condense water vapour driven off by boiling to ensure a constant volume of water.

Heater. An electric heating mantle to provide uniform heating to the flask.

Timer. A suitable timer capable of measuring a two-hour time period.

Test specimen. The test specimen is a free sample of the installed, cured roof waterproofing kit of sufficient size to enable the test specimen required by the specific test method to be produced after exposure.

Test Procedure

- Fill flask to 2/3 full using distilled or deionised water.
- Heat water to boiling using heating mantle.
- Add prepared specimens to water, start timer, connect condenser and start condenser.
- After two-hour water boil remove lid, remove specimens, remove surface water from the specimens and allow them to cool.
- Prepare appropriate test specimens for specified test method(s) for evaluation of effects of exposure on the cured roof waterproofing kits according to this EAD.

Test report. The test report shall include the following information:

a. Reference to this procedure.
b. The name of the testing laboratory.
c. Date / period of exposure.
d. A description of the installed product, including shape/dimensions and substrate(s).
e. Type of exposure. Temperature and period of time.
f. All visual observations.
g. Results of evaluation of exposure effects.
h. All operating details, not specified in this procedure, as well as incidents likely to have influenced the process.