

Liquid Applied Waterproofing Systems (LAWS) offer a highly durable solution for both new build applications and the refurbishment of existing roof, balcony and walkway systems. There are many benefits which can be summarised as follows:

- Seamless
- Fully bonded
- Minimum disruption
- Ease and speed of installation
- Cost effective
- Compatible with most substrates and easily detailed
- Proven and guaranteed performance
- Long life
- Technologically advanced
- Range of specifications to suit all needs
- Availability of colours, decorative and solar finishes and anti-slips
- Availability of elastomeric systems
- Availability of vapour permeable systems
- Ease of maintenance

However these benefits are available from a number of reputable systems employing a number of different chemical solutions; these are explained in more detail following.

## 1. Introduction

This Guidance Note describes the generic types of liquid applied waterproofing systems available for use in roof, balcony and walkway waterproofing and presently being used in the UK and throughout Europe. The Guidance Note is based on the combined experience of member companies of the Liquid Roofing and Waterproofing Association (LRWA), which includes major manufacturers, contractors and specifiers in the roofing industry.

This Guidance Note describes systems which are endorsed by the members of LRWA. It should be used in conjunction with other LRWA Guidance Notes, the Code of Practice, and where systems are covered by the EOTA European Technical Approval guideline (ETAG) 'Liquid Applied Waterproofing Systems for Use in Roof Waterproofing'. LRWA acknowledges the participation of the representatives of the National Federation of Roofing Contractors (NFRC) and the Flat Roofing Alliance (FRA) in the preparation of this note.

## 2. British Board of Agrément (BBA)

They are designated by government to issue EUROPEAN TECHNICAL APPROVALS.

Several Manufacturers of Liquid Applied Waterproofing Systems (LAWS) have Agrément certificates to guarantee their products.

An up to date listing can be found on the BBA website ([www.bbacerts.co.uk](http://www.bbacerts.co.uk)).

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### 3. European Technical Approvals

As a requirement of the Construction Products Directive (80/106/EEC), European Technical Approvals (ETA's) have been produced for liquid applied waterproofing systems. The work has been undertaken in each member state by national technical committees and approval bodies and the overall co-ordination of the documents has been the responsibility of the European Organisation for Technical Approval (EOTA). The objective has been to produce harmonised technical standards for liquid applied waterproofing systems.

A variety of types of liquid applied waterproofing systems exist and it was recognised that the ETAs should accommodate these systems in a formalised structure. This has led to the development of, to date, eight separate parts to the ETA, each covering a generic type. See [www.eota.be](http://www.eota.be).

The primary document ETAG 005 (Part 1 - GENERAL)

Gives overall guidance on assessment of fitness for use, including methods of verification and attestation of conformity. The remaining seven parts, known as the Complementary Parts or the ETA Parts, deal with specific requirements for particular families of products and are the generic types covered primarily by this Guidance Note, shown following:

- Part 2: Polymer modified bitumen emulsions and solutions
- Part 3: Glass reinforced resilient unsaturated polyester resins
- Part 4: Flexible unsaturated polyesters
- Part 5: Hot applied polymer modified bitumens
- Part 6: Polyurethanes
- Part 7: Bitumen emulsions and solutions
- Part 8: Water dispersible polymers

#### **National certification**

National approval for liquid applied systems in the UK can run in parallel with ETAs and involves Agrément certification from the British Board of Agrément (a member of the UEAtc and EOTA). BBA Certificates for approved systems are based on the same test procedures as detailed in ETAG 005 but also include additional statements on the UK national building regulations and non-regulatory requirements, standards, design and installation details and a durability statement. Current Certificates are downloadable from the BBA website [www.bbacerts.co.uk](http://www.bbacerts.co.uk)

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### 4. Generic Type Descriptions

#### **ETA: PART 2**

#### **Polymer Modified Bitumen Emulsions and Solutions**

This section summarises products based upon polymer modified bitumen where the material is formulated in one of two ways:

- As an aqueous emulsion;
- As a solution, usually in hydrocarbon solvent.

In these systems bitumen is modified with suitable polymers or co-polymers in order to impart enhanced durability, flexibility and elasticity to the dried roof or balcony coating. Examples of suitable modifiers are:

- Atactic polypropylene (APP)
- Polychloroprene (CR)
- Ethylene vinyl acetate (EVA)
- Polyisoprene (IR)
- Natural rubber
- Polybutylene (PB)
- Styrene butadiene rubber (SBR)
- Styrene butadiene styrene (SBS)

In addition to bitumen and polymer modifiers, both the emulsion systems and solutions may also contain inert fibres and fillers. The products are designed for application by brushing or spraying or may have a viscosity suitable for spreading.

The polymer modified bitumen emulsion or solution will form part of a liquid applied waterproofing system which may have the following elements:

- Bitumen primer consisting of a low viscosity solution or emulsion used to seal and prepare surfaces and to improve adhesion of subsequently applied coatings
- Polymer modified bitumen emulsion or solution
- Internal reinforcing layer
- Solar reflective coating or protective finish of mineral granules/chips.

### **ETA: PART 3**

#### **Glass Reinforced Resilient Unsaturated Polyester Resins**

These systems are often referred to as GRP, glass fibre or fibreglass. They consist of a glass fibre reinforced polyester resin cold applied on site normally by what is referred to as the hand lay-up process.

It is recommended that only systems currently holding Agrément Certificates should be specified. Certain products are also approved for balconies or walkways.

The unsaturated polyester resins used within roofing or balcony systems have been specifically formulated to provide a combination of wear-resistance flexibility, elasticity and fire retardancy not available in general purpose resins. Care must be taken to ensure applicators are using the correct blend of the polyester resins developed for roofing or balcony purposes.

Systems normally comprise the following elements:

- An unsaturated polyester resin used as a base coat between the ~~plywood~~ substrate and matting and as a second coat over the matting;
- Chop strand emulsion bound glass fibre matting;
- An unsaturated polyester resin to be used as a top or flow coat to the system;
- Pigment and catalyst to suit the unsaturated polyester resin;
- Pre-formed components usually referred to as GRP trims used to provide a fast, reliable and neat solution to finishing details;
- Non-slip additive.

All BBA certified manufacturers insist on application by contractors trained and approved by them. Pre-formed GRP components from either a standard range or specifically designed to suit the roof can be moulded into the system to finish difficult details neatly.

### **ETA: PART 4**

#### **Flexible Unsaturated Polyester Resins**

These systems consist of an unsaturated polyester resin reinforced with a polyester fleece or glass fibre mat. They can be sprayed or hand-roller applied. It is recommended that only systems holding current Agrément Certificates or ETA's for roofing should be specified.

The unsaturated polyester resins incorporated within the system have been specially formulated to provide a high degree of flexibility and elasticity combined with fire retardancy. As with all polyester resins, care should be taken to ensure applicators are using resins especially designed for roofing purposes. Systems normally comprise of the following elements:

- A pigmented unsaturated polyester resin;
- A polyester fleece to be used as a reinforcement;
- Catalyst and Accelerator – the accelerator can be incorporated within the resin;
- Primer – optional depending on substrate.

Systems can be applied to most substrates. However, some manufacturers insist on primers on certain materials. All BBA certified manufacturers insist on applicators being trained and approved by them.

## **ETA: PART 5 Hot Applied Polymer Modified Bitumen**

This section summarises products based upon hot applied bitumen which is polymer modified and is generally applied in two layers incorporating a polyester reinforcement (or neoprene reinforcement at movement joints and across junctions of different substrates).

This type of material is solid at ambient temperature and requires heating in thermostatically controlled, paddle agitated, enclosed melters. The material is supplied in large 'cake-form' which is placed in the melter for heating to the required laying temperature. Modification of the bitumen is carried out with:

- Oxidised Bitumen
- SBR – Styrene Butadiene Rubber
- SBS – Styrene Butadiene Styrene
- Process Oils
- Inert Fillers

Installation is carried out generally onto concrete substrates but application on timber, metal, brickwork etc is carried out more commonly for detail applications. Installation is executed by spreading the material over the surface by squeegee to form a pre-designated thickness of material which cools and solidifies as it is applied. Reinforcement is brush applied between coats to remove air pockets. Due to the relative softness and tacky surface of the material a surface protection membrane is brush applied into the top coat of material. The protection membrane varies dependent upon roof usage and access required. Root resistant protection membranes are available for use under green roof build-ups.

The system can only be used as an inverted/buried roof membrane application or in roof garden/green roof design and therefore can only be used on roofs of up to 15 degrees pitch. The material is sensitive to UV light and at all upstands/details where the membrane becomes exposed a protective membrane must be applied to prevent UV degradation.

## **ETA: PART 6 Polyurethanes**

This section summarises a family of products with many variations. The common characteristic is a reaction between an isocyanate component and a polyol or pre-polymer to produce a polyurethane. The types may be single or two component, and cure/dry by reaction, or moisture trigger from latent hardeners, or by moisture cure from the air – possibly some of these in combination.

In these systems a selection is made from an aliphatic or aromatic isocyanate and a reactive polyol often combined as a modified pre-polymer, some examples of these are:

- Aliphatic isocyanate– isophorone di-isocyanate (IPDI)
- Aromatic isocyanate – 4:4 methylene diphenyl di-isocyanate (MDI) (or TDI)
- Polyol types – polycarbonate, polyether, polyester etc.

Reinforcement is used either locally or overall to produce the toughest, longest-lasting systems; although unreinforced polyurethane is a very tough material in its own right and reinforcement may be added selectively.

It is not uncommon to find different base coats or materials used for the lower reinforcements layer, perhaps in a dark colour or of an aromatic nature; with a naturally solar reflective top coat which is aliphatic (colour retentive) or aromatic in nature. The former gives highest colour stability and chemical resistance. Polyurethanes provide a complete colour range, including white for highest solar reflectivity in the aliphatic systems.

Polyurethanes are formulated to give fire retardance and resistance to penetrating mould growth from subsequently soiled roof areas. All are highly resistant to UV light and infra-red radiation. Root resistant grades for green roofs are available.

The materials are usually self-priming although adhesion-enhancing bonding primers are available for friable or highly porous substrates. Internal reinforcing layers vary from supplier to supplier, but all should provide multi-directional tensile strength with sufficient retained elongation to accommodate all subsequent roof movement. Non-slip walkways are formed by the incorporation of anti-slip media into the finishing layer(s).

#### SUSTAINABILITY IN POLYURETHANE SYSTEMS

With increasing environmental concerns, coating technologies have in recent years begun to focus more on developing products with less impact on the environment.

Whilst single component polyurethanes usually contain solvents, two component systems can be formulated solvent free.

These systems have no or a very low VOC (volatile organic compounds) and thus less impact on the environment. A further benefit to the end user is that these products are virtually odourless.

In addition some manufacturers use polyols made from renewable resources (like castor oil or sun seed oil) for their two component polyurethanes. These polyols may be used solely or in combination with petrochemical resins.

#### **Polyurea Systems**

Polyurea Liquid Applied Waterproofing Systems (LAWS) are chemically similar to polyurethanes, but have key chemical differences that can result in quite different application characteristics and physical properties.

Polyurea LAWS are two component systems and cure by chemical reaction. Like polyurethane, polyurea has isocyanate as one component. The other component, however differs from a polyurethane system, is amine chain extenders and/or amine-terminated polyether, in order to form a urea linkage. They are less sensitive to moisture than polyurethanes. Reaction times are typically very fast and both spray and hand applied systems are available.

Polyurea LAWS can be formulated with both aliphatic and aromatic isocyanate, the same types as polyurethane LAWS.

Due to the typically high tensile strength and elongation of polyurea LAWS, they are usually applied in one coat. Fabric reinforcement is not usually required.

Polyurea LAWS are typically very fast cure, durable, damage resistant and have good long term resistance to UV light and infra-red radiation. Root resistant grades for green roofs are available, obviating the need for additional root protection measures.

Excellent adhesion is achieved to substrates including concrete, cementitious screeds, metal, plywood, asphalt and bitumen sheets. Epoxy or polyurethane primers are normally used to seal the substrate and enhance bond.

Polyurea LAWS are BBA Certified for up to 25 year lifetimes.

#### SUSTAINABILITY OF POLYUREA SYSTEMS

Polyurea LAWS usually contain no solvents and have very low volatile organic compound (VOC) content. A further benefit to the end user is that these systems are virtually odourless.

#### **ETA: PART 7**

#### **Bitumen Emulsions and Solutions**

This section covers products based upon either bitumen (unblown vacuum residues) or blown bitumen, both without added polymer modification and formulated for application as either:

- an aqueous emulsion
- a solution in either an aliphatic or aromatic hydrocarbon solvent

The bitumen emulsion will usually be formulated with unblown vacuum residue and will contain a stabilising agent such as clay and/or resin soap. It may be reinforced with suitable fibrous material and extenders and if formulated with a clay stabilising system, it will permit the substrate to breathe.

The bitumen solution may be formulated with either unblown vacuum residues or blown bitumen which is dissolved in a suitable hydrocarbon solvent. In common with the bitumen emulsions it will probably contain a combination of fibrous reinforcing extenders and viscosity modifiers.

Both bitumen emulsions and solutions are used as part of a multicoat waterproofing system which will in addition contain other elements:

- Bitumen based primer to seal or prepare the substrate particularly if it is dusty or porous
- Reinforcing membrane for use as specified but particularly at points of stress, eg upstands. This may be woven glass fibre but could also consist of other organic fibres, eg polyester.
- A final coat of coloured or solar reflective finish to provide an architectural appearance or UV reflectance.

The base emulsion or solution waterproofing system may be applied by brush or spray and usually the first two coats will be used to wet and encapsulate the reinforcing membrane. Subsequent coat(s) serve to give the system integrity.

## **ETA: PART 8**

### **Water Dispersible Polymers**

This section summarises a generic family which covers a wide range of emulsion or dispersion coatings, the common characteristic is a waterbased binder plus additives which dry via the coalescing process as water evaporates.

Manufacturers' descriptions may include terms such as:

- 'acrylic mastic' or 'acrylic coating'
- 'co-polymer' or 'terpolymer' based
- 'waterborne rubber'
- 'styrene butadiene rubber'
- 'styrene-acrylate co-polymer based...'

These all indicate that the emulsion base or film binder is of the type described. To these may be added pigments for colour, additives for flame retardancy, weather resistant additives such as extenders, secondary pigments, anti-oxidants, UV absorbers etc. All these enhance the performance in roof LAWS and help to retain strength, elasticity and integrity. They come in paste-like form for application by airless spray, air-assisted spraying, roller or brush. The coating forms part of a system which may comprise:

- primer, which is often reactive to the substrate to give best adhesion, consolidation of surface and offer excellent adhesion to the top coat
- internal reinforcement layer if needed for use either locally or overall; this could include tapes, mats, or fleeces, and is set into the wet coating
- the water-dispersed polymer coating
- non-slip media for finishing for walkways. Products may be used in a range of thicknesses from the thinner pure solar reflective coating through to multi-layer reinforced tough coatings for highest demand use. They come in a range of colours including solar reflective white. Products are normally applied in appropriate weather conditions as recommended by the manufacturer, but are highly waterproof once dry.

It is recommended that only systems holding current Agrément Certification or ETA's for Roofing, Balconies and Walkways should be specified.

### **Additional LAWS Types**

A range of New Resin chemistries for LAWS (Liquid Applied Waterproofing Systems) has evolved the past 25yrs which are not covered by the existing ETAG 005 (parts 2-8):

#### **Acrylic Roof Coating Systems (Solvent Based)**

Description: A one component polymeric composition for use in repairing and coating leaking roofs, gutters and similar structures. They are particularly useful in an emergency repair situation in adverse weather conditions and will cure under water.

Application: Cold applied by roller or brush direct from the container onto a clean, dust-free surface with any wide gaps being reinforced with glass-fibre tape. Application can be made onto wet surfaces or, in an emergency, under water.

Priming: Most sound surfaces are suitable without a priming coat but priming is required on fresh bitumen, metal or asbestos.

Lifetimes: There are now more advanced Acrylic systems which incorporate greater flexibility, produce built up systems, reinforcement to give up to a 15yr Guarantee.

#### **Thermoplastic Block Copolymers (S-EB-S), (S-EP-S)(Solvent Based)**

These Elastomeric Roof Coatings combine long lasting protection against water penetration and ponding for extended durability and service life, internal reinforcement layers are incorporated to increase the lifetimes of the coatings to produce BBA certified Built up waterproofing systems.

#### **Performance Advantages**

- BBA Certified systems available
- Single Pack
- In-can stable, so no losses with product
- Works instantly

#### **Application**

Priming: All Roofing substrates require priming prior to overcoating

Application: Can be Rolled or Brush Applied, Reinforcement is embedded into the Basecoat for all detailing and larger areas. A final Topcoat is applied to complete the Built up System.

Lifetimes: BBA Certified systems are available up to 15-25yrs depending on the system specified.

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## 5. Health & Safety

All aspects of safety should be properly considered. The Health & Safety at Work Act deals with simple working practices, more recent legislation also contributes to the welfare of those undertaking the work and those in the vicinity who may be unaware of the work being carried out. Even though the CDM or CONDRAM Regulations (Construction (Design & Management) Regulations) may not be a legal requirement on small and short term contracts, it is still good practice from both a safety and efficiency point of view to apply its principles.

The COSHH (Control of Substances Hazardous to Health) Regulations include identification of the risks inherent in the process and the relevant occupational exposure limits for the ingredients in the preparation being used. Such ingredients can be identified by reading the CHIP (Chemical Hazard Information and Packaging) Safety Data Sheet, the issue of which is a legal requirement for all hazardous goods, and is produced by most companies even for products not classified as hazardous.

It should be noted that no product is completely safe if handled incorrectly. For hazardous products, the CHIP Safety Data Sheet will give Risk (R) and Safety (S) phrases which indicate the severity of the hazard and suggest practices to minimise the risks. These documents should be read and understood before opening - and using - any product or disposing of partly used or empty containers and packaging.

It is essential that all roofing work is carried out in strict accordance with The Work at Height Regulations (WAHR). HSE publication "Working at Height Regulations 2005" (ref INDG401 – Revision 1) is a brief guide on how to comply with the regulations and can be downloaded from the HSE website.

Important reading for site safety is publication HSG/33 'Health and Safety in Roofwork' available from the HSE (Health & Safety Executive).

Further information can be obtained from a comprehensive list of HSE publications which also include 'Guide to the Control of Asbestos Regulations' among others and are available from HSE website ([www.hsebooks.co.uk](http://www.hsebooks.co.uk)).

LRWA members are committed to these principles and provide comprehensive safety information on their products.

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## 6. Guarantees

Guarantees include but are not limited to the schemes described following:

- Manufacturers' guarantees.
- Contractors' guarantees, sometimes in association with manufacturers; industry schemes such as the NFRC Co-Partnership Scheme, which requires UKAS accredited third party certification of the material e.g. a BBA certificate; or FRA members can arrange through third party insurers
- Insurance Bonding schemes involving third party certifiers, manufacturers and insurance companies and contractors.

Specifiers should verify the credentials of any insurance scheme.

*LRWA represents a group of manufacturers, applicators and raw material suppliers who are dedicated to best industry practice. Advice can be given, either centrally or from individual manufacturers, with the intention of supplying and applying systems to a client's full satisfaction. LRWA is involved in the preparation of European Technical Approvals, as the UK's official trade body, in conjunction with the BBA and EOTA. The Association produces a series of Guidance Notes, often in collaboration with the leading contractors' representative bodies, thus seek into reinforce the performance and quality potential of liquid roofing systems.*

*Whilst every effort has been made to ensure the accuracy of the information contained in this publication, it must be emphasised that the Association has itself not verified the information by independent testing: for this reason and because the Association has no control over the precise circumstances in which it will be used the Association, its officers, employees and members can accept no liability arising out of its use, whether by members of the Association or otherwise. The publication is of a technical nature only and makes no attempt to state or conform to building regulations or other legal requirements; compliance with these must be the individual user's own responsibility.*