THE PERFECT GUIDE FOR CONTRACTORS, HOME OWNERS AND PROFESSIONALS

BUILDAID

WATERPROOFING CONCRETE SLABS

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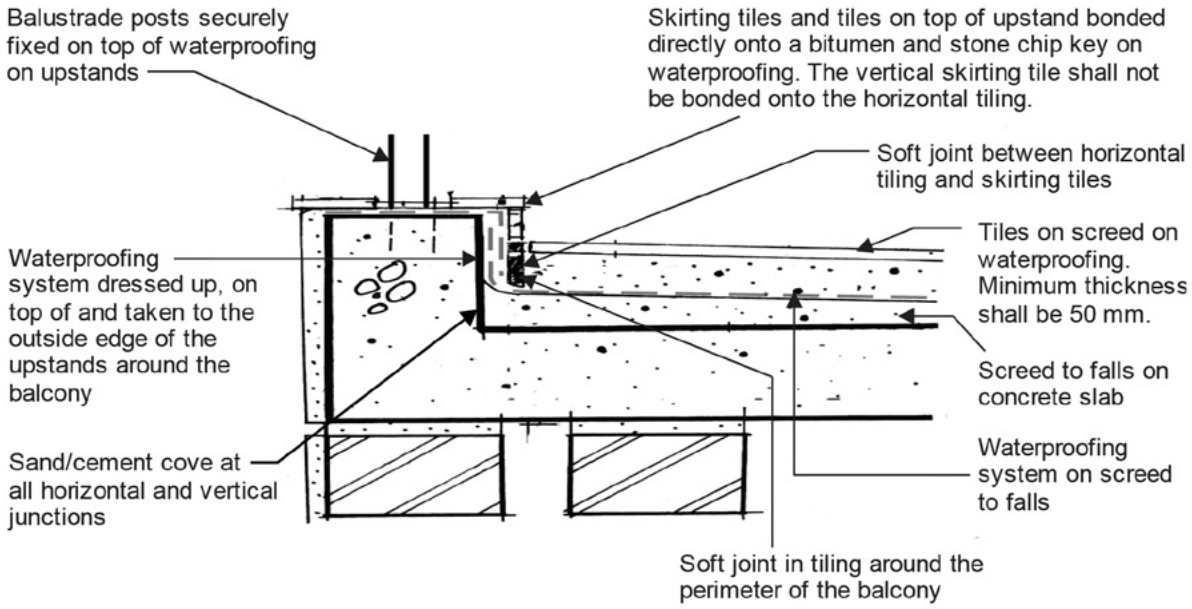
WATERPROOFING CONCRETE SLABS

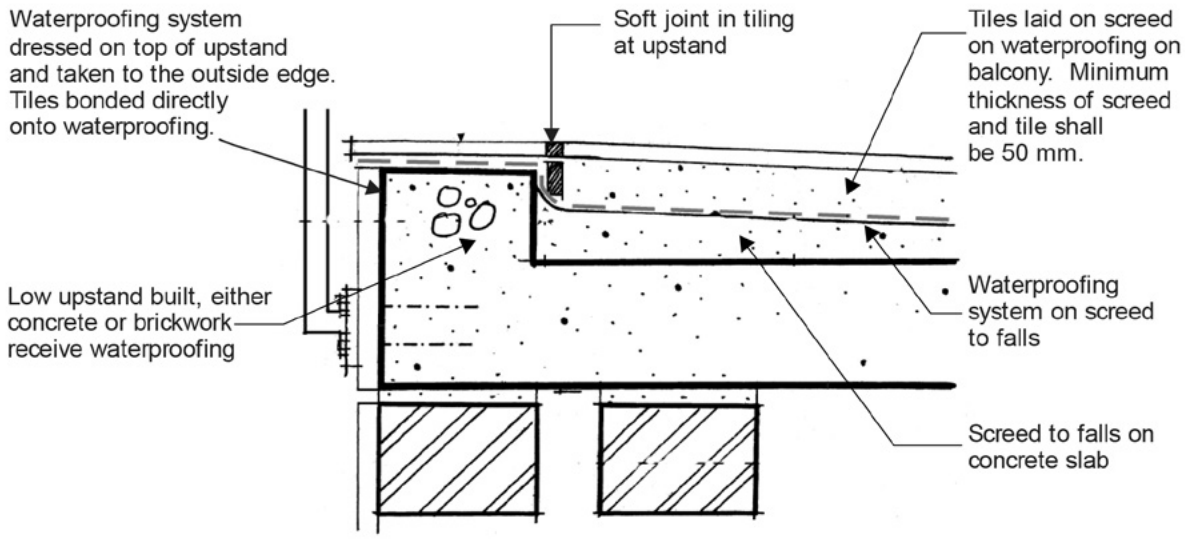
Any concrete slab design should take the thermal properties of concrete into account. This will be determined by a concrete technologist or other competent person, who will determine the required thickness of the concrete and its density and design the slab in such a way that a waterproofing layer is built up. Often the designer will incorporate a "thermally insulating layer" above the structural concrete deck.

The concrete used for flat roofs shouldn't contain more than 7% moisture by weight; and sand-cement or lightweight screeds shouldn't contain more than 10% moisture by weight.

If expansion joints to accommodate the flow of water are not custom-designed by a competent person, "twin kern upstand-type joints" should be installed over any expansion joints. These should be positioned away from any outlets and should be built in accordance with SANS 10400-L. Upstand beams that are at least 170 mm high should be incorporated where masonry walls meet the concrete surface of the roof. At these "intersections" (i.e., where they join) corner fillets measuring at least 75 mm (vertically and horizontally) should be built in.



Waterproofing detail at perimeter upstand around balcony



Waterproofing detail at low perimeter upstand around balcony

In addition to these design elements, all concrete and screened roof surfaces must be waterproofed and constructed to the correct falls and cross falls. It is vital that there are no undulations in the concrete surface, and nothing should be allowed to protrude into the concrete or contaminate it.

The recommended finish for concrete roofs is wood floating. While the final surface should be sound and smooth, concrete, and screened surfaces should not be highly polished. So they should NOT be power floated.

Concrete slabs can be extremely difficult to waterproof, which is they should be built with a fall of 1:80. This might require a steeper design slope of 1:50 in concrete slabs where construction is not always 100% accurate. A 1:50 slope is also required where there is an interruption in the flow of water on the roof.

The slope should be towards external gutters, roof edges and outlets. Other factors that should be considered include:

- an avoidance of "penetrations" through the roof, or they should be at least 200 mm away from vertical surfaces like walls and "upstand" beams.
- an avoidance of having clusters of plumbing pipes, air conditioning pipes, and electrical conduits.
- formation of a suitable step between inside and outside areas (floor levels) to prevent water flowing or dripping into the interior of the house or other building.

It is very important that precast panels and precast roof structures are designed in a way that if there is subsequent movement of the concrete elements, this will not damage the waterproofing system or compromise its performance.

Waterproofing Systems

Any waterproofing system that is installed on flat roofs MUST be done by a "competent person" who MUST follow the manufacturer's instructions. SANS 10400-L states that for roofs to be up to standard, they must remain watertight for at least five years without the need for any form of maintenance other than the normal cleaning of downpipes, gutters and so on. It is also important that the person doing the installation is satisfied that the materials used are appropriate for that particular application (fit for purpose), and should therefore take into account:

- the degree UV and temperature exposure the waterproofing system will be subjected to.
- how much protection the waterproofing material will have.
- and ultimately whatever affects the building because of where it is located.

It is important to realize that waterproofing systems can delaminate if the substrates don't allow any moisture vapor that has been trapped to escape. Generally a sand-cement screed or topping that is not very dense will allow retained moisture vapor to dissipate and therefore protect against the possibility of delamination.

SANS 10400-L indicates that a 20 mm screed is laid over all "lightweight" screeds, because these are generally too friable and porous to provide good adhesion for waterproofing systems. The SANS also suggests that concrete and screened roof surfaces be allowed to dry thoroughly before any type of waterproofing system is applied.

Where waterproofing turnups are provided against abutments, they should be counter-flashed using the same membrane, and the flashing should be cut into walls to a depth of at least 40 mm.

Generally, sand-cement coves with a radius of at least 45 mm should be formed at all the inside corners of both vertical and horizontal surfaces – unless a particular waterproofing system has a different design and doesn't require this.

There is always a potential problem with outlets. The installer must therefore pay close attention to overflow pipes, flues and so on, and make sure that the waterproofing material used covers everything but the opening. Generally waterproofing membranes around any pipe work should be clamped with a hose clamp or something similar before flashing is applied over the pipe.

If outlets aren't the "full-bore", coned type, pipes should be flanged so that waterproofing can be done correctly. Elements such as water storage tanks and solar absorbers should never be allowed to penetrate the waterproof layer.

In addition to this part of SANS 10400, SANS 10021 also provides some information and guidance about the waterproofing of slabs. Remember, it's important to do it correctly!

Reference: http://www.sans10400.co.za/waterproofing-roofs/

Reference: SANS10400 PART L

Membrane waterproofing systems
Membrane waterproofing systems whether torch-on, acrylic or other, are the only certain method of waterproofing concrete slabs. Systems are essential in a variety of applications, as they provide durability, dimensional stability at different temperatures (thermal movement) and most are installed with a guarantee.

Manufacturers also provide assistance from specification support at design phase to on-site support during material/system application.

Torch-on membrane systems
Torch-on membranes can be described as sheets of fibres matted into felt and bonded by saturating with bitumen, bitumen-polymer or other modified bitumen's and other components such as rot-proof polyester reinforcements. The fibres are usually a non-woven polyester fleece, or glass wool, which both have better resistance to puncturing or tearing. They are mostly applied by torching-on and can be used in dry applications like roofing and damp proof membranes.

Torch-on systems are generally the most suitable and the most commonly specified waterproofing systems used for concrete roofs. Torch-on systems are basically bitumen felt sheets welded together to create a waterproofing membrane to a concrete substrate, that has been primed using a bituminous solution with petroleum solvents.

Felt waterproofing membranes: have been developed to meet specific requirements of buried, exposed and covered situations and are available in various thickness to suit different applications.

Specification
4mm membranes are the most commonly used, with the ideal system being a double layer system which incorporates the application of two torch-on membranes; the under layer being a 3mm membrane and the top layer a 4mm membrane, which are typically used in roofing and balcony applications. There is a proliferation of membranes being imported into South Africa, with some not suitable for use in our climate and are only suitable to use as a "cap sheet" or top layer.

Covered grade membranes (CG) are typically available in the following thicknesses.

Sizes (mm)	Application
1.7 - 2	multipurpose underlay and DPC
3	torch applied membrane for buriedsituations
4	torch applied membrane for underground tanking parking decks, retaining walls, roof gardens etc

Exposed grade membranes: are a range of superior quality special polyester (SP) dual reinforced membranes to suit exposed applications and available in the following thicknesses.

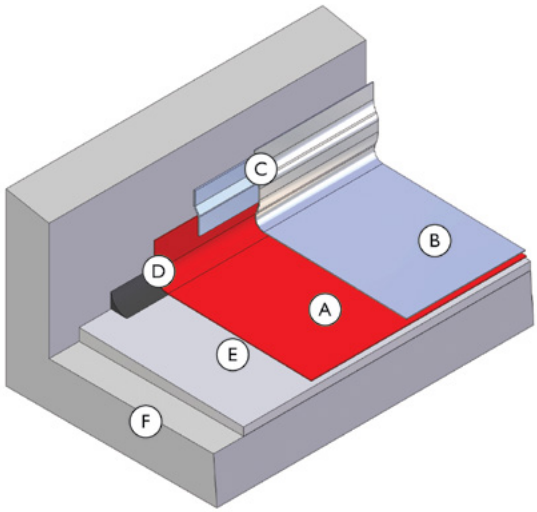
Sizes (mm)	Application
3	torch applied membrane for box gutters, parapets and as an underlay to a dual systemusing a 4mm top sheet
4	torch applied membrane for flat roofs, boardedroofs, parking decks, balconies, terraces, reservoirs etc

Application
This application refers to general low-slope (less than 5° pitch) concrete roofs screeded to falls and cross falls to rainwater outlets where the roofing membrane is exposed to the elements and temperature fluctuations. The waterproofing membrane, correctly selected, installed and maintained, is now considered as a permanent structural element with a life expectancy equal to that of the building it is protecting.

Note: Simplicity in design together with proper preparation of the substrate are key to successful waterproofing.

Substrates
As with most membranes and coatings, the substrate plays an extremely important part in the success or failure of the waterproofing system. Too often Waterproofing Contractors do or are compelled to install the waterproofing system on inadequate or poorly prepared surfaces.

Aluminium paint - Typical specification:
One layer waterproofing membrane, with 75mm side laps and 100mm end laps, sealed to primed surface to falls and crossfalls by 'torchfusion' finished with two coats bituminous aluminium paint. Refer to Fig below.



A: Derbigum SP4
B: Roofcote Aluminium paint
C: Counter flashing
D: Cove
E: Screed to fall
F: Structure

Concrete/screeded roof with aluminium paint

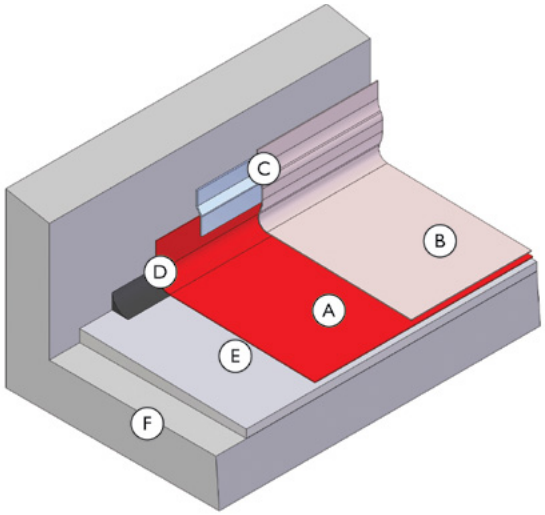
Roof Finishes and Protection
Generally, all waterproofing systems require protection from ultra- violet radiation and pedestrian traffic occasioned by more than general maintenance or servicing.

Paint
Bituminous Aluminium Paint is the most widely used protective coating. Whilst not the most aesthetically pleasing finish it has particular advantages. Being bitumen-based, adhesion is assured and excellent solar reflection is achieved.

Acrylic Paint
Acrylic Co-polymer Paint is available in selected colours Waterproofing contractors must be advised by the paint manufacturer about the application procedure and suitability as regards adhesion to flexible waterproofing membranes. Whilst many membranes are unaffected by standing water, it should be noted that pooling in slight hollows or behind overlaps, besides being unsightly, could result in rapid deterioration of the paint coating.

It is important to note, that when using Acrylics as UV protection for torch-on membrane, that not all acrylics are suitable, as many delaminate as they are not bitumen compatible.

Acrylic paint - Typical specification
One layer waterproofing mem-brane, with 75mm side laps and 100mm end laps, sealed to primed surface to falls and crossfalls by 'torchfusion' finished with two coats acrylic paint. Waterproofing to be installed by an approved Contractor under a ten year guarantee.



A: Derbigum SP4
B: Roofcote Acrylic paint
C: Counter flashing
D: Cove
E: Screed to fall
F: Structure

Concrete/screeded roof with acrylic paint

Polyurethane Waterproofing
This relatively new product has quickly become a fast-growing product among waterproofing contractors in South Africa. It is therefore vital that more contractors use and adapt to this product in their waterproofing processes and understand the product better.

What is Polyurethane?
Initially invented as an adhesion, Polyurethane has been around for over 30 years. However, it has only been in South Africa for a small period. Polyurethane is a non-toxic liquid-based system that will attach to about any cooling material such as concrete, bricks, wood and glass. It is entirely seamless and can easily be applied by either a brush or a roller. The product is non-toxic and entirely safe to be used in water tanks and the like. It comes in different colours, depending on the volume required by the client.

How does it react to different temperatures?
A lot of the Polyurethane range products can deal with temperatures going as low as -30 degrees and as high as 90 degrees.

The application
Most of these products come in a one part application, but it can also come in a two-part application. Polyurethane products can be applied by brush, roller or spray, depending on the type of product. After some training and knowledge of the product, the application is quite easy. Due to strict quality assurance, the products are not available in stores as DWASA requires proper training before using and applying these products. Training is necessary to know which product to use for which application. Laymen must therefore be properly trained to fully understand which products go with which applications, and how the build-up process works.

One would usually start with a primer, then put on two coats of waterproofing material. If it is exposed to UV, there would also have to be a protective top coat.

TPO Waterproofing Membrane
TPO or thermoplastic polyolefin is a single-ply reflective roofing membrane. It is composed of polypropylene and ethylene-propylene rubber which are polymerized together to form what we call TPO.

TPO was first introduced in the roofing industry way back in the 1980's. In much earlier years, TPO was initially used in the automotive industry to protect surfaces and also for geomembrane applications.

Since it has been around for only more or less than 35 years, it's technically newer than other commercial flat roofing systems. Some materials have been present in the industry for more than a century already.

TPO originated as a more malleable material than it is today. One of the reasons why it became popular is that it doesn't contact chlorine as well as plasticizers and halogens which are all harmful to the environment. It is also a good alternative to PVC as they have similar benefits.

When the 90s came, TPO entered the mainstream roofing industry and started to become a popular option for many property owners.

This synthetic roofing membrane comes in various thickness and dimensions. Usually, customers can find 45 to 80 mils thickness in the market. TPO is typically available in just three colors namely white, gray, and tan. If you want to achieve an energy efficient cool roof, you can go for the color white which effectively reflects the sun's energy. This also reduces the building's energy consumption as well as the urban heat island (UHI) effect.

TPO temporarily shifts from a solid material to a semi-solid state. This happens when it undergoes proper heating treatments. When it changes its state, the sheets or panels are overlapped and combined together to form a solid surface until it cools down.

If you're curious about TPO waterproofing membrane specification. Here's where the magic happens: a TPO's hot air-welded seams make it 100% resistant to water penetration.

Cementitious Coatings
A number of cementitious coatings are available; some are not manufactured specifically as waterproofing coatings and are used as more decorative type coatings. It is therefore important to ensure the product you specify, or use is classed as a waterproofing system and not as a decorative coating even though they may serve a dual purpose as a weatherproofing coating.

Applications
Cementitious systems should never be used on areas greater than 50sqm and always used with a re-inforcing membrane.

Cementitious coatings can be used in almost all applications in residential buildings, refer to the manufacturer's instructions.

Rubberized Bitumen
Bitumen emulsions and solutions, some containing rubber latex are used to provide an economical system for the sealing and waterproofing of tanks, floors, walls and roofs. It can also be used as an adhesive for the fixing of wooden flooring blocks, insulation boards, a concrete curing agent etc.

Rubberized bitumen emulsion dries to provide a tough, seamless, flexible waterproof coating. Bitumen coatings used in conjunction with fibre reinforced membranes, provide maximum protection on parapets.

Advantages
- Water based
- Good adhesion to concrete, brick and plaster
- Excellent adhesion to damp surfaces
- Quick drying
- No primers necessary

There are solvent based bituminous coatings available, which are used for metallic surfaces but can be used for cementitious surfaces as well.

Typical Specifications
Apply by brush, roller or spray; All surfaces should be clean and free of loose and unsound material; Surfaces may be damp but there should be no surface water.

Applications
Rubberized bitumen coatings can be used on parapet walls, flashings, retaining walls, balconies, terraces and patios, roof gardens and planter boxes. Can also be used as an adhesive for wood blocks, insulation board, etc. May also be used in conjunction with a polyester fibre membrane/mat for maximum protection on retaining walls, ponds, etc.

Polyurethane resins
Polyurethane is manufactured from synthetic resins which are elastic and not subject to hair cracks and have excellent stability properties to light whether clear or pigmented. Polyurethane based systems and coatings are ideal for heavily trafficked applications and the hard elastic surface is resistant to chemicals and abrasion; making it ideal for workshop and parking garage floors.

Typical Specifications/Applications
Polyurethane coatings may be specified as a protective trafficable wear resistant membrane for a variety of applications including:

- Car park decks
- Trafficable flat roofs
- Traffic ramps
- Dams and ponds
- Balconies
- Protection of concrete from the damaging effects of salt water, chemicals, fuel and oil spillage e.g. garage floors and workshops

Epoxy resins
Are expensive and are typically a two-part synthetic resin which cures to a strong, durable, water-resistant coating.

Carriers
They assist in the durability of systems and help withstand the elements, thermal heat changes and prevent the system from cracking. A number of fibre mesh/reinforcement membranes are available which can be made of polyester, polypropylene and other combinations of fibres and strands. They are typically used to reinforce different types of waterproofing systems, including bitumen felt membranes.

Waterproofing Admixtures
A variety of waterproofing admixtures are available, which when added to the basic constituents (aggregate, cement, and water) of concrete or mortar alter the combination of properties of the mix while it is fresh becoming an integral waterproofer in the mixture.

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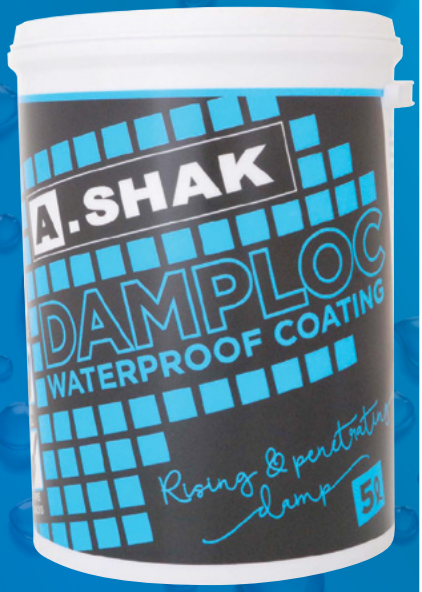

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