DELTA MEMBRANE SYSTEMS LTD

DUALPROOF

Date: March 2019

DELTA MEMBRANES

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CONTENTS

A DELTA SOLUTION

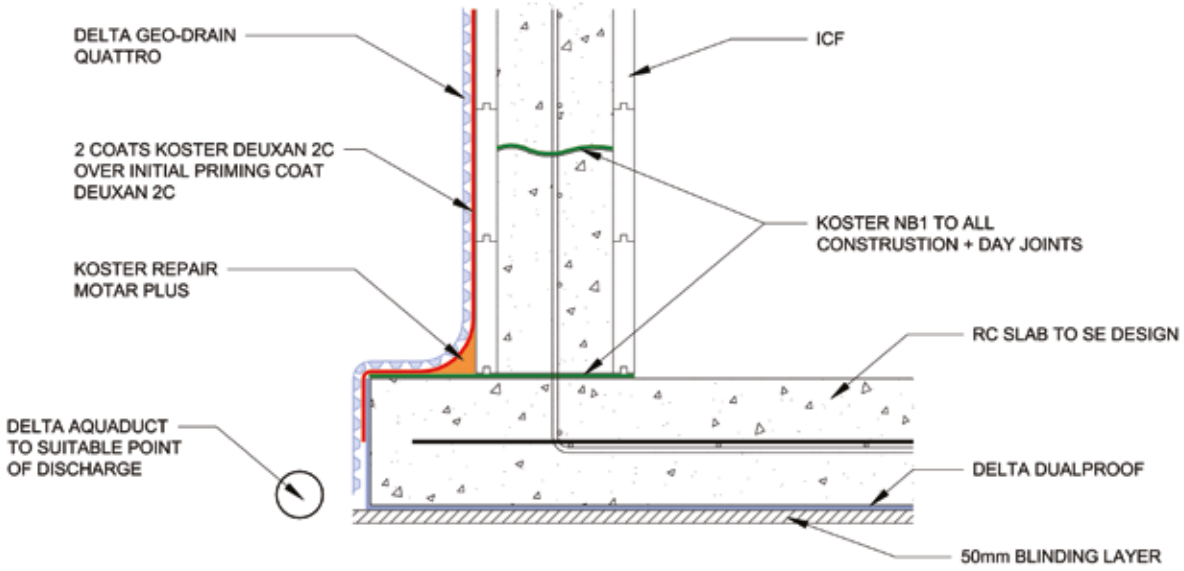
BS 8102:2009 (Code of Practice for Protection of Below Ground Structures Against Water from the Ground) recommends that every Design Team should incorporate a Waterproofing Design Specialist.

Delta Membrane Systems Limited has a dedicated team of Waterproofing Design Specialists. Our trusted Technical Team offer knowledge and experience and can provide expertise in structural waterproofing. As a Waterproofing Specialist Manufacturer, we work with architects, surveyors, contractors and engineers alike to provide a design service which complies with BS 8102:2009 and offers the highest level of technical expertise and assurance.

BELOW GROUND WATERPROOFING SOLUTIONS FOR:

- Residential Buildings
- Commercial Buildings
- Retail Units and Warehouses
- Leisure Facilities
- Archives/Libraries/Vaults
- Hospitals
- Schools
- Underground Rail Stations and Tunnelling
- Underground Car Parking areas
- Listed Buildings
- Heritage Buildings
- Insulated Formwork Construction (ICF)

ICF CONSTRUCTION - EXTERNAL WATERPROOFING



SERVICES

Delta Membrane Systems Limited provides a full range of waterproofing, damp proofing, flood resilient and ground gas protection solutions suitable for all new, retrofit and refurbishment construction. With over 125 years of manufacturing experience Delta is an impeccable partner on every project. Our skills have been mastered through experience in the waterproofing industry. Delta's trusted Technical Team will help from concept to completion. Our hands on approach and knowledge is what sets us apart.

DESIGN SUPPORT

- Architecture knowledge
- Concept and waterproofing solutions
- Advice on design and best practice
- Custom solutions, as each project is unique in requirements
- Qualified CSSW staff (named on the Waterproofing Design Register)

SPECIFICATION SUPPORT

- Detailed drawings including CAD
- Watertight and locking down structure concepts
- Specifications
- BIM
- NBS Plus
- RIBA Product Selector

SITE SUPPORT

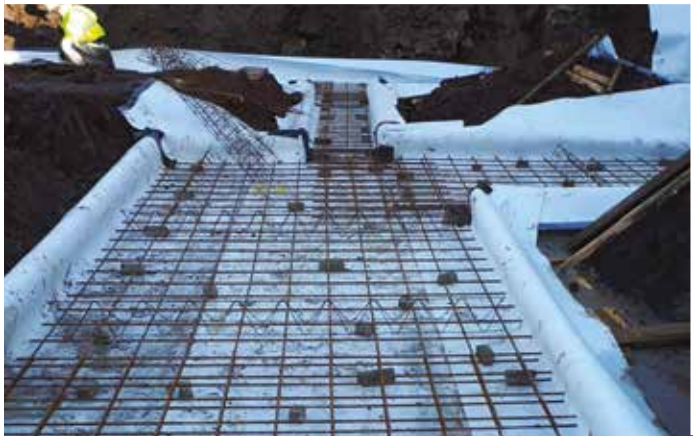
- Training and guidance offered at every step
- Technical Team attendance at site meetings
- Knowledge and experience
- Troubleshooting solutions

DUALPROOF PRE-APPLIED MEMBRANES

DualProof is a Type A waterproofing pre-applied, sealed two layer highly flexible PVC membrane laminated with a non-woven PP-fleece, composite waterproofing membrane which forms a permanent mechanical bond with freshly poured concrete preventing the tracking of water between the waterproofing membrane and the concrete sub-structure.

- Robust, flexible and high performance
- Waterproof, damp proof, gas proof and gives
- Concrete protection against chemicals
- Tough and resistant, quick and easy to install, high compound shear strength
- Can be installed in every season regardless of
- temperature and weather condition
- Prevents any lateral water migration between the waterproofing membrane and the structural concrete
- Minimal accessories/additional components for installation required

DualProof is easily applied - No need for complicated welding equipment and simple to install, overlapping can be easily secured with Delta Double-sided Tape and detailing around corners with CEM 805 adhesive. DualProof can be applied horizontally as well as vertically and is used in all applications where structures require protection against groundwater and seepage



DualProof is suitable for:

- New build Residential/Commercial basements
- Foundations
- Car Parks
- Museums and Heritage
- Hospitals
- Schools
- Hotels
- Infrastructure Projects
- Railways/Tunnelling
- Garages
- All other concrete constructions below ground

DUALPROOF

BENEFITS OF DUALPROOF:

- Seals small cracks of the concrete
- Can be used in saltwater conditions
- CE marked and DIN certified
- BDA Agrément Certificate
- Provides all Grades of Protection according to BS8102:2009
- Unaffected by ground settlement

This manual covers the installation of the DualProof Pre-applied waterproofing system for new concrete structures and covers installation best practice for site formed concrete structures including below slab and retaining wall structures. For applications not covered in this guide or for site specific technical support, please contact Delta Membrane Systems

WHAT IS DUALPROOF?

DualProof is Type A, external, pre applied waterproof membrane suitable for use on new, site-formed concrete structures.

DualProof is a fully and permanently bonded, composite sheet that not only provides and effective waterproof barrier but protects the structure against gases and chemicals. DualProof consists of a sealed two layer highly flexible PVC membrane laminated with a non-woven PP-fleece.
DualProof is cold/pre-applied and is installed without heat or open-flame. It is applied before the steel reinforcement is fixed and the concrete poured. The new PP FiberTex Technology gives the DualProof its unique bond and connection to the concrete. The PP-Fleece integrates into the concrete when poured giving a strong mechanical bond once cured. DualProof is an innovative system that prevents any lateral water migration between the waterproofing membrane and the structural concrete.

DUALPROOF

DUALPROOF A COST-EFFECTIVE SOLUTION

The Flexible nature of DualProof means that it can easily be formed on site to suit the exact design requirements. Unlike some, more rigid, external waterproofing systems, expensive corner ancillaries are not required. As DualProof forms a mechanical bond with the concrete via the integral fleece layer it does not activate in contact with water avoiding expensive damage to the system and delays.

DualProof System Products.

DualProof Pre Applied Membrane - Available in two sizes:

Small-1x20M-20M2

Large 2x25M- 50M2

CEM Adhesive- A high performance liquid applied waterproof sealant. Used to join the sheets of DualProof membrane.

QUALITY ASSURANCES

The BDA Agrément strengthens Delta's DualProof brand. BDA Agréments are a mark of excellence, ensuring products are safe, high quality, reliable and regulatory compliant. Products are examined and rigorously tested following precise installation instructions. Agréments confirm the compliance and durability of DualProof under the specified method of installation.

The BDA Agrément process takes into account:

- European product standards, relevant codes of practice and test reports
- Independently verified product characteristics
- Factory production control
- Annual verification procedures
- Points of attention for the specifier and specific details
- Installation procedure
- Compliance with Building Regulations and any other required standards
- Boundaries of use (restriction to geographical scope)
- Validity

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A visible sign of conformity is DualProof's CE Mark. The CE Mark denotes conformity that DualProof satisfies European Laws relating to European CEN Standards.

COMBINED SYSTEMS

The British Standard for waterproofing, BS8102:2009, states that a combined waterproofing system should be considered following a risk-based assessment for the below ground project in order to meet the required environmental grade.

Structural Warranty Providers have also in recent years started to insist on two forms of waterproofing for below ground living areas.

The DualProof system is considered an "External Type A"- fully bonded pre-applied waterproofing system and is ideal for use in a combined waterproofing application.

Dualproof can be positioned in a variety of different situations as part of a combined system, for example:

- Externally to new formed concrete
- Between contiguous or secant piles and a concrete liner wall
- Externally in combination with a Type B Waterproof concrete system
- Beneath basement and ground bearing slabs
- In combination with an internal Type C Delta Cavity Drainage Membrane System
- As an effective external system for lift pits and service trenches

The Delta Membranes Technical Department are on hand to help design a suitable combined waterproofing system. Our experienced and CSSW qualified advisors can help design a combined waterproofing system that takes into account the site conditions and the build requirements for the most challenging of projects.

PROJECTS

DualProof has a long demonstratable use in a variety of projects both in the UK and throughout the world. DualProof has been designed for structural waterproofing of below ground concrete structures and has proven itself in the most demanding of applications. DualProof forms a permanent mechanical bond with freshly poured concrete preventing the tracking of water between the waterproofing membrane and the concrete sub-structure.

DualProof compliments all new concrete structures and can be used in both commercial and residential buildings.

Residential/Commercial Basements

Car Parks

Museums and Heritage

Hospitals

Schools

Hotels

Infrastructure Projects

Railway and Tunnelling

Libraries

ANCILLARY PRODUCTS

Our range of ancillary products work as the perfect complement to the Delta DualProof System. Allowing for application on different substrates and surfaces.

KOSTER NB1 SLURRY

Koster NB1 Grey Waterproofing Slurry Koster NB1 is a mineral coated waterproofing slurry containing crystallising and capillary-plugging agents. It can be used for waterproofing against ground moisture and for non-pressurized and pressurized water.

Positive and negative side waterproofing against pressurized water Resistant against chlorides, sulphates and phosphates Penetrates the surface where crystallization leads to inseparable waterproofing-substrate bond.

- Does not contain corrosion promoting ingredients.
- No VOC emissions
- Substrate does not have to be continually kept wet to cure
- Suitable for new construction and repair on existing structure

KOSTER DEUXAN 2C

Koster Deuxan 2C is a robust crack-bridging (2 component polymer) modified bitumen thick film sealant for waterproofing construction. Deuxan 2C is designed for the secure and permanent exterior waterproofing and is suited for the intermediate waterproofing underneath screeds and for bonding insulation and drainage boards.

BBA Approved, Koster Deuxan 2C is satisfactory for use as a fully bonded, Type A Barrier protection waterproofing as defined in BS 8102:2009 Positive and negative side waterproofing against pressurized water Can be used internally and externally on concrete, brickwork, blockwork or masonry, or as a dampproof and waterproof membrane for solid floors and tanking to provide an effective barrier to the transmission of liquid water.

ANCILLARY PRODUCTS

DELTA PUDDLE FLANGES

A puddle flange offers an effective solution against water penetration around service pipes. Incorporating a puddle flange into designs ensures a watertight seal is offered where pipes pass through concrete structures (i.e. the walls of any structure below groundwater level and in flood resilience designs). Pipes passing through concrete will not bond to the concrete and water can pass long the external surface of the pipe, a puddle flange will act as a barrier to this flow. The seal body within the puddle flange is compressed during the concrete pouring process, should the concrete shrink during curing the rubber relaxes and maintains a seal against any flow path. A puddle flange is recommended for use around any pipe penetration in a below ground structure. Puddle flanges are available in various sizes from 32mm up to 160mm.

DELTA GEODRAIN QUATTRO

Geo-Drain Quattro is a unique drainage protection system/external waterproofing membrane that works in conjunction with Type A External Waterproofing or can simply be used in civil engineering situations. Geo-Drain Quattro is a compact 4-layer membrane which can be used vertically and/or horizontally.

Geo-Drain Quattro offers maximum safety for thick viscoelastic coatings and a multitude of alternate Type A systems. This holds true even if driving rain can penetrate through an imperfectly installed upper edge trim. In a watertight system, such rainwater would exert hydrostatic pressure on the waterproof coating. However, the micro-perforated slip film which together with the additional filter cloth, acts as a backup drainage layer behind the dimpled sheet ensures that any water is drained off safely. In addition, the slip film prevents the transmission of movement to the waterproof coating.

CE

ANCILLARY PRODUCTS

KOSTER QUELLBAND

Koster Quellband is used as a waterstop in concrete construction joints. The robust strip is simply nailed onto an existing joint face before the consequent concrete pour. Any leakage through the joint activates the Quellband.

Quellband is a sodium-bentonite based water swellable joint tape with an alkalinity activated surface coating which stops premature swelling of the tape on the building site, which breaks down during the swelling process and the resulting paste seals all cracks and voids permanently.

KOSTER REPAIR MORTAR PLUS

Koster Repair Mortar Plus is a watertight, fast setting, slightly expanding repair mortar with excellent adhesion (even to old building material substrates). With the addition of Koster SB Bonding Emulsion, it can be used as a PCC (polymer-modified cement concrete) mortar.

- Watertight (Positive and negative side waterproofing)
- Fast Setting (Seamless, easy application)
- Slightly expanding
- Excellent adhesion
- Can be applied to all mineral substrates
- Suitable for watertight repairs and touch ups to substrates
- Can be used internally and externally on concrete, brickwork, blockwork or masonry

CEM 805 ADHESIVE

CEM 805 is a one-component, odourless adhesive/sealant that is resistant to weathering and reacts with atmospheric moisture to form an elastic seal. It does not contain solvents, is free of silicone and isocyanates, cures neutrally, is compatible with paints and features excellent chemical resistance.

DUALPROOF SYSTEM

DualProof should only be installed to a suitably prepared substrate.

DualProof Is not suitable for the following construction types:

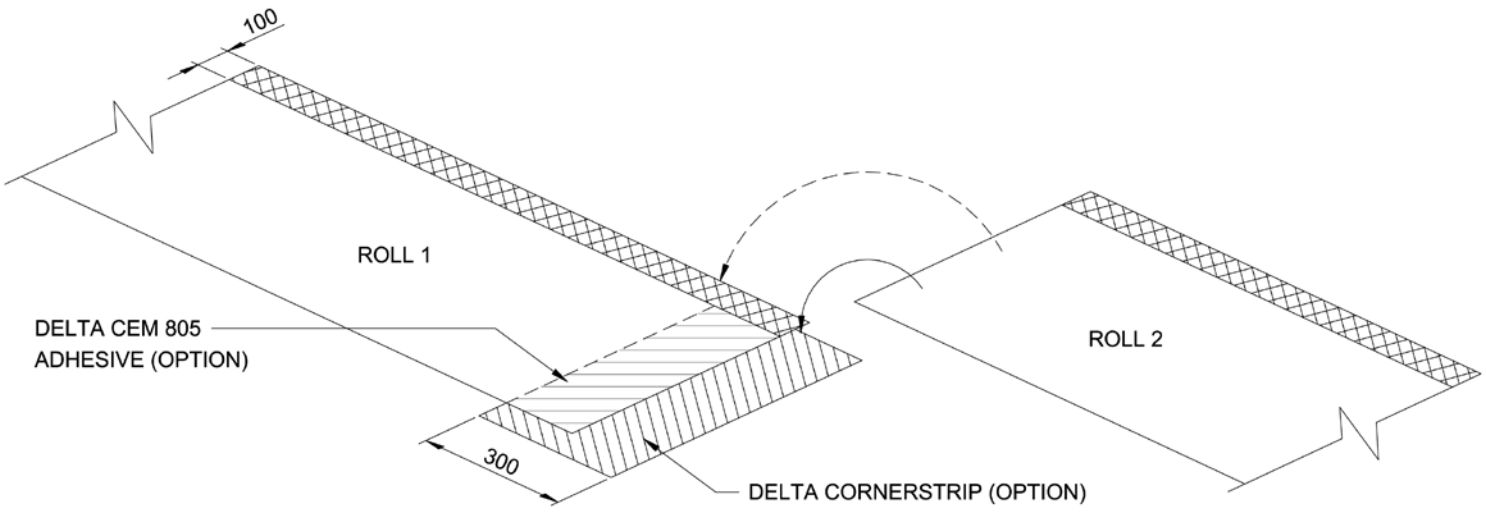
- Masonry Structures
- Concrete Filled Block - Stepoc Block Structures
- Pre-cast concrete elements
- Podium Decks or concrete soffits

JOINT SEALING

DualProof is supplied with a 50mm non fleeced Sleeve edge. CEM Adhesive should be applied to the Sleeve Edge and the next layer of DualProof pressed into the adhesive.

Where an immediate fix is required, Delta Double Sided Tape can be used to provide this bond.

Where DualProof is used on the outside of vertical walls. The upper sheet of membrane should lap over the lower sheet.



ROLL END WELDED OVERLAP

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DUALPROOF SYSTEM

SECURING OF DUALPROOF MEMBRANE

DualProof should be securely fixed in place to prevent movement during the pouring of the concrete. This can be achieved by:

Pinning the DualProof membrane above the line of the cast concrete.

Securely fixing the DualProof to the substrate using Delta Tape of bonding agent.

Using a mechanical clamp to secure the DualProof membrane.

CORNERS

DualProof corner pieces can be easily cut to shape on site.

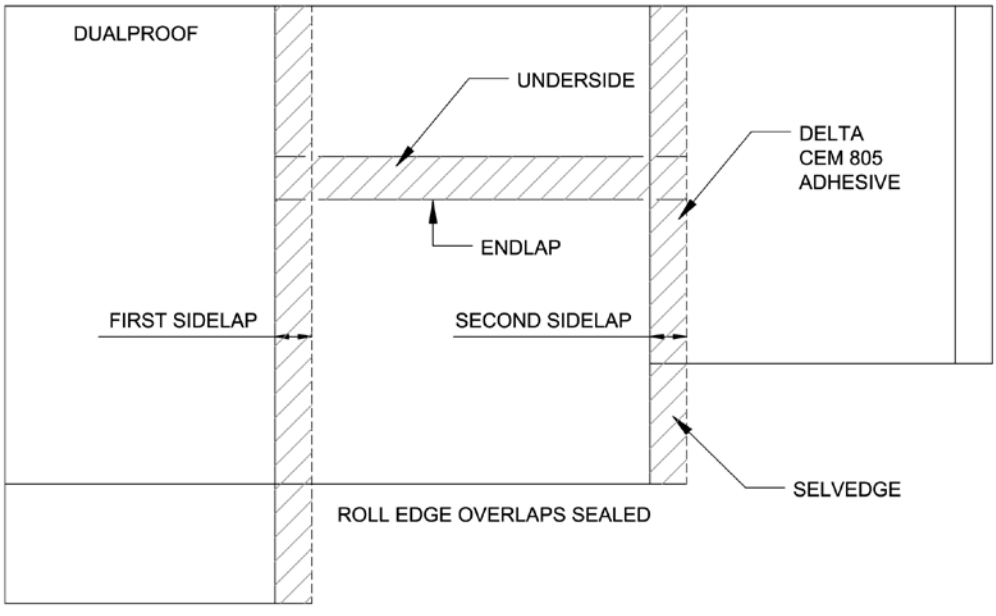
Detail 321-1 to be checked and relabelled.

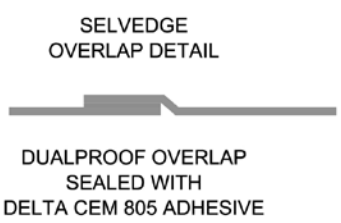
DELIVERY AND SITE HANDLING.

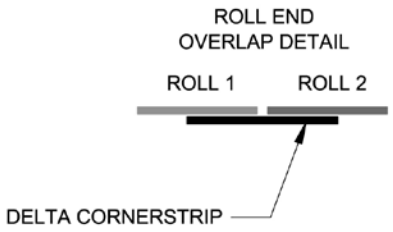
DualProof is available in two sizes and suitable manual handling procedures should be employed to safely received delivery and move around a site. Due to the weight of the DualProof large roll, this is only available for palletised delivery.

Small - 1Mx20M Roll - Weight of roll - 34KG

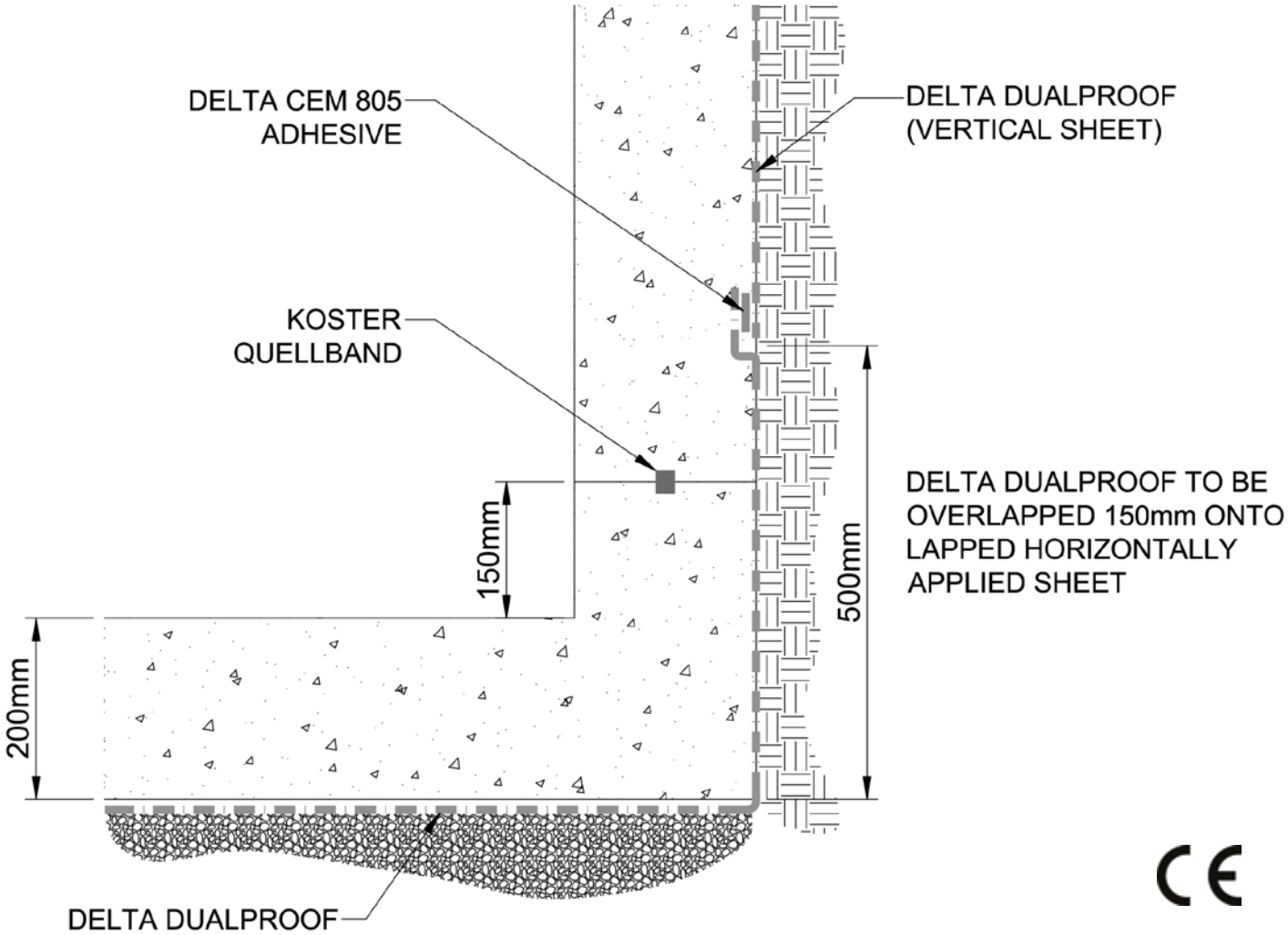
Large 2Mx25M Roll- Weight of Roll - 68KG - Only available for palletised delivery.







DUALPROOF SYSTEM



SECTION 1 - UNDER-SLAB INSTALLATION GUIDELINES

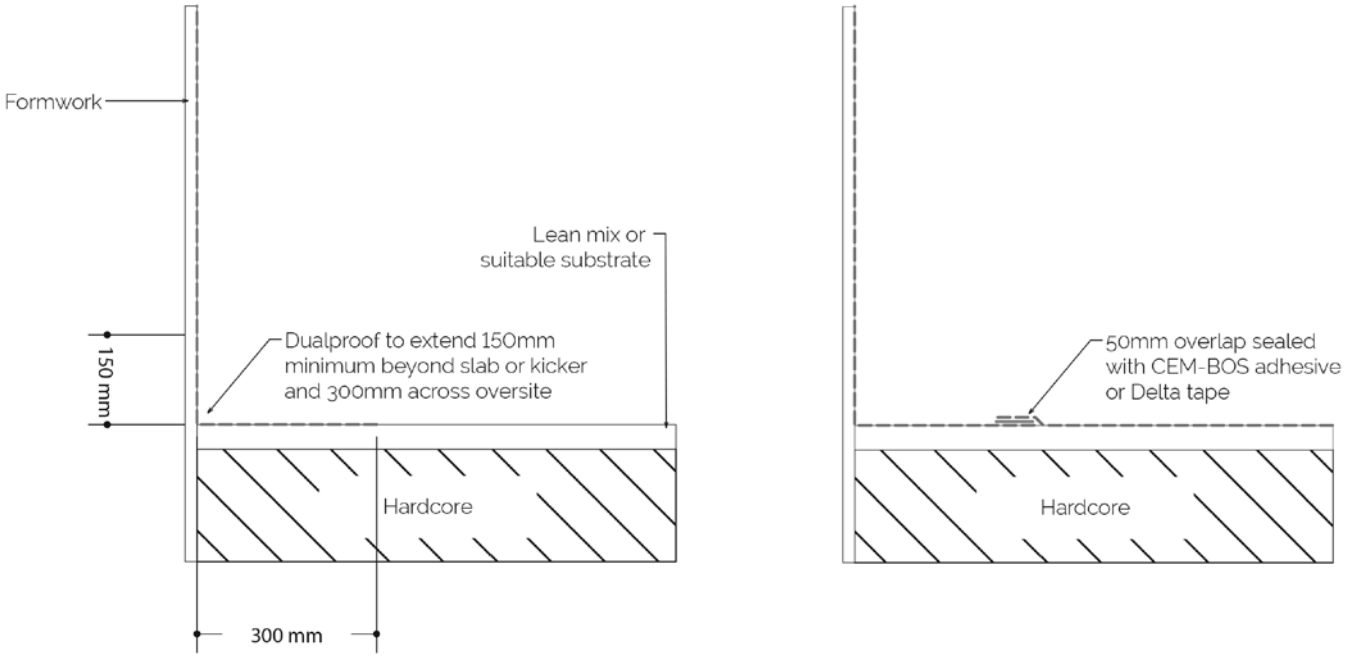
DUALPROOF INSTALLATION GUIDELINES

Before installing DualProof please read the installation manual in order to become familiar with the installation process. For site specific installation assistance, please contact Delta Membranes Technical Team.

1a) Substrate Preparation

The Delta DualProof membrane should be placed onto a properly prepared substrate that is free from sharp edges or damages, the surface should be without voids that are greater than 12mm. Suitable substrates include:

- Concrete blinding layers.
- Lean Mix.
- Well Compacted Sand.
- Closed Cell Insulation- suitable for external use.
- Anti Heave Systems.
- External Drainage and protection systems, such as Delta Geo Drain Quattro
- Delta MS Sub Base System.



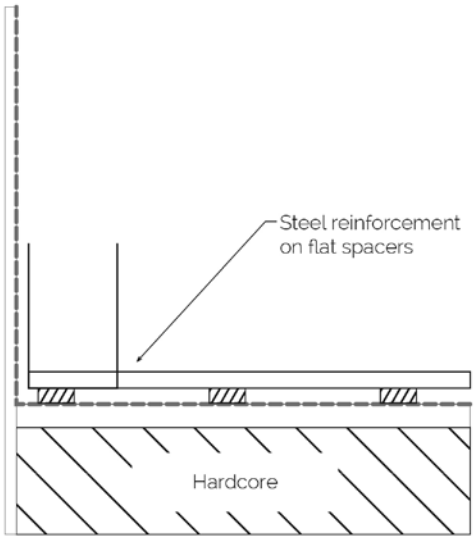
1b) Under-slab installation

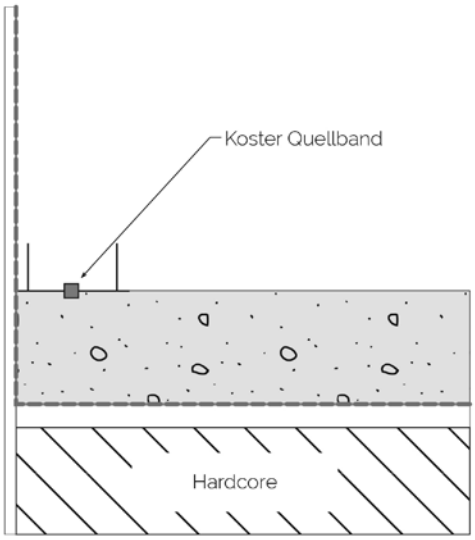
The fleece side of the Delta DualProof Membrane should face the concrete to be waterproofed.

- Detail any pipe penetrations using the methods provided in section 1d.
- Using a sharp blade cut the membrane into suitable lengths.
- Starting at a point that is 30cm in from the end of the Retaining Wall, with the fleece side facing the concrete to be poured, install the Delta DualProof Membrane so that one end extends up the Retaining Wall to 150mm above the finished height of the floor-slab or the level of the kicker joint and that the other end extends out onto the oversite at least 300mm.

When the slab is to be installed in sections, the DualProof membrane must extend a minimum of 300mm beyond the slab edge. This allows for a suitable overlap and joint seal detail to be formed.

DUALPROOF SYSTEM



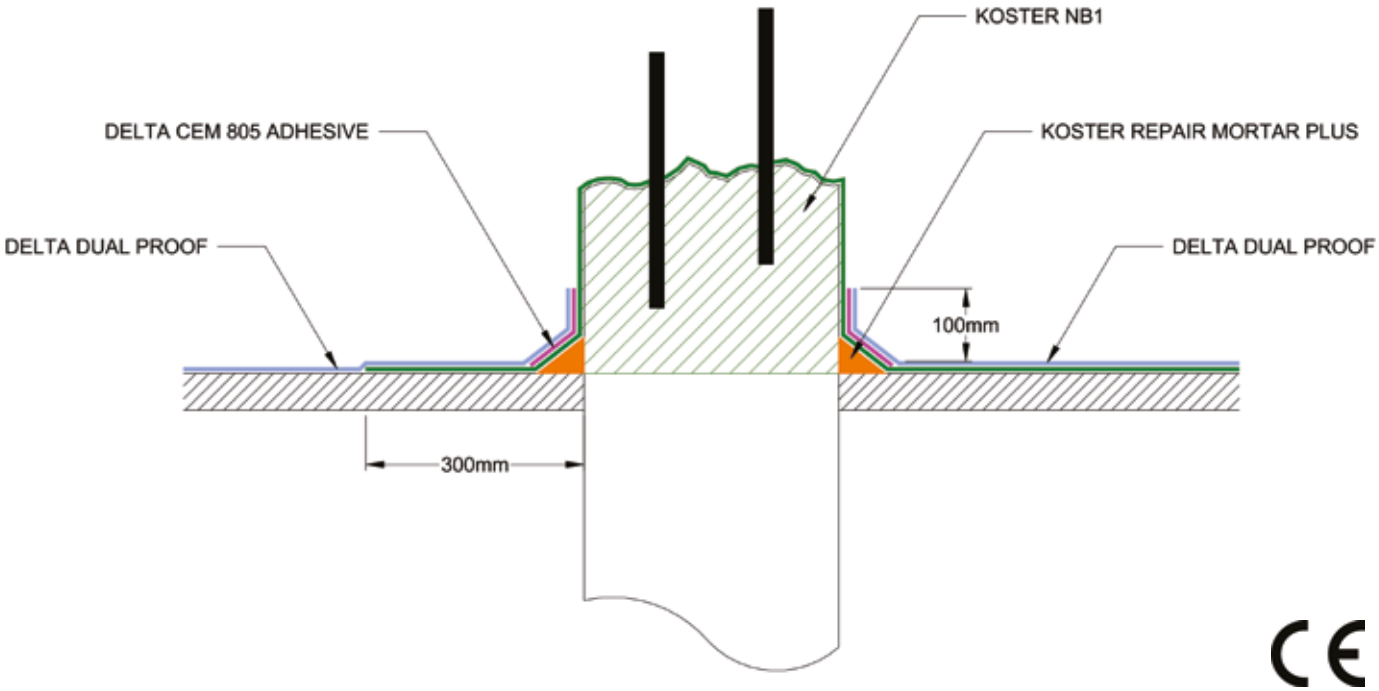


Koster Quellband should be included in the applicable slab construction joints.

1c) Pile cap detailing

The DualProof membrane should not normally be installed over the pile cap but instead, trimmed to fit accurately around the pile cap. Koster NB1 Grey is used to seal joint between the pile cap and the slab.

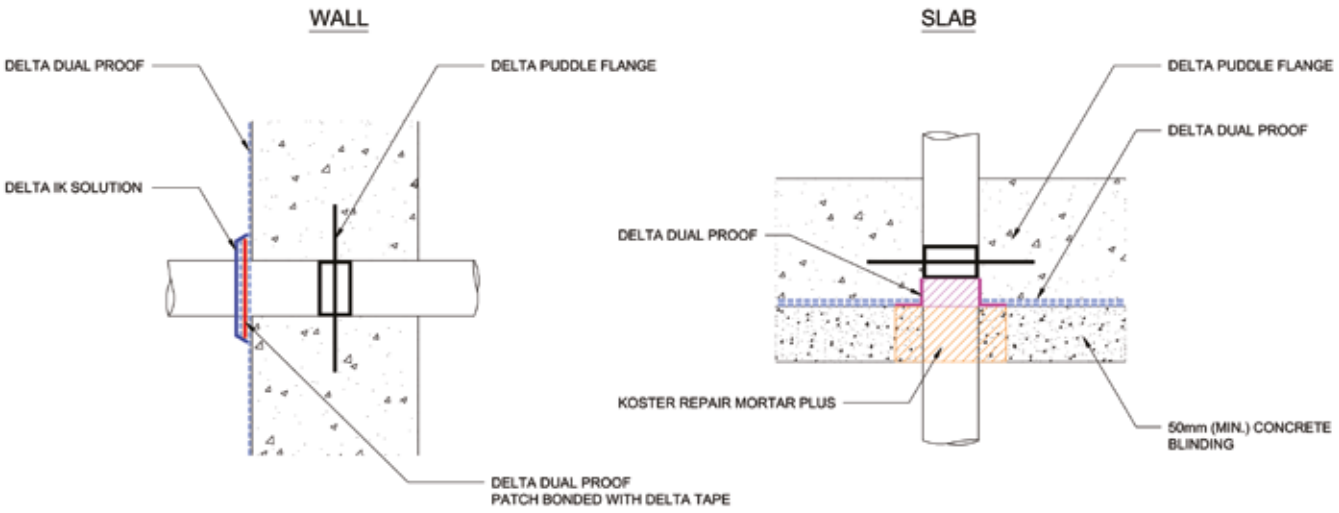
- Cut DualProof membrane to required size around pile cap.
- Apply Koster Repair Mortar Plus at junction between pile cap and DualProof Membrane to form a 40mm rounded fillet.
- Apply 2 coats of Koster NB1 Grey over pile cap, fillet and rebar.



SECTION 1 - UNDER-SLAB INSTALLATION GUIDELINES

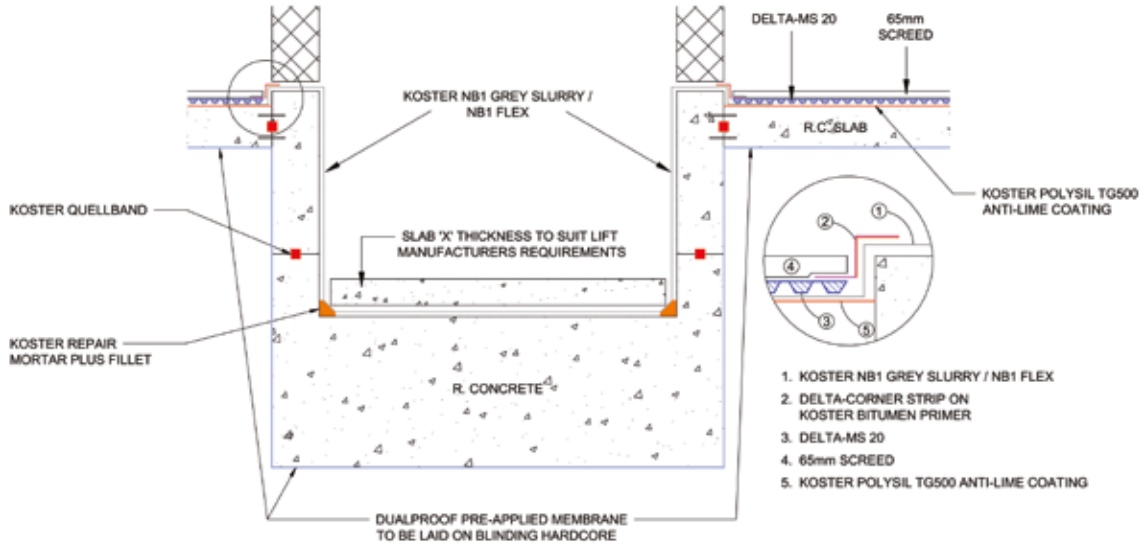
1d) Service Penetrations Through Slab

- Fill around penetration in oversite using Koster Repair Mortar Plus to create a level surface
- Cut DualProof membrane to required size around penetration pipe or sleeve.
- Form Sleeve around pipe using DualProof. Ensure that fleece side will face the new concrete.
- Install Delta Puddle Flange to penetration/pipe.



1e) Lift Pits

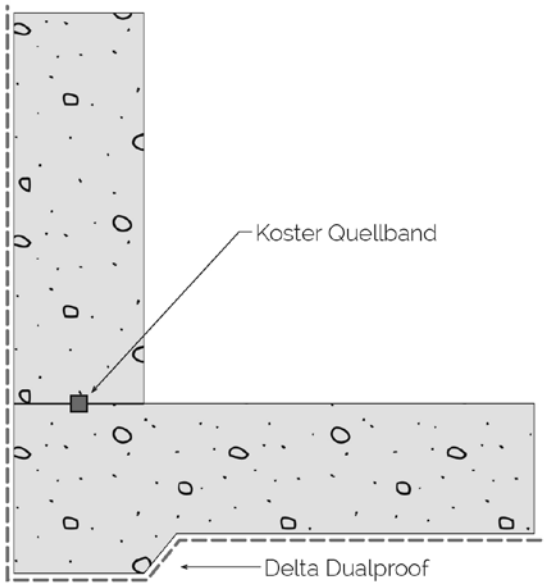
- DualProof should be installed to the vertical and horizontal surfaces of the substrate to form a continuous envelope around the lift pit
- Please contact Delta Membranes for site specific design and detailing around sumps and piston plungers in the slab.
- A 300mm overlap should be provided to allow for jointing to the DualProof below the slab.
- Koster Quellband should be included in the lift pit construction joints.



DUALPROOF SYSTEM

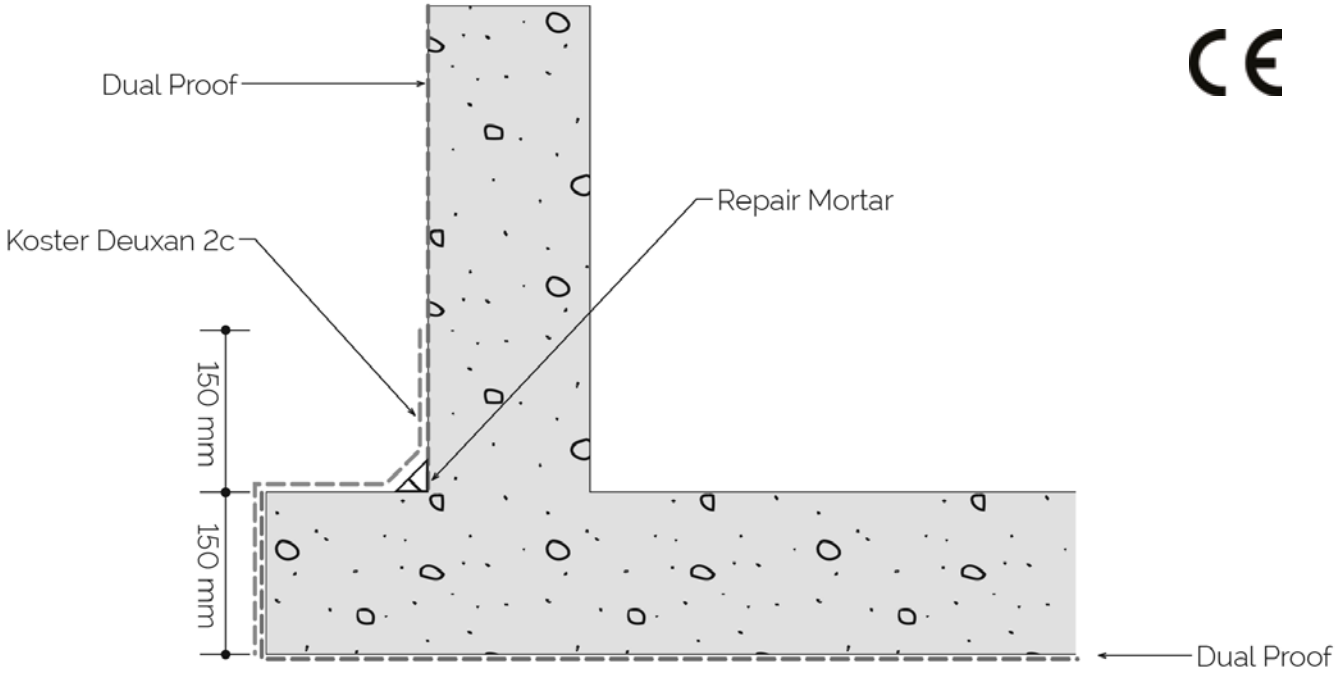
1f) Slab Edge Detailing

- DualProof Should be continued up the slab edge formwork to extend 150mm beyond the top of the slab or the height of the kicker joint.



1g) Toe of Slab Detailing

- Koster Deuxan 2c should be used to seal the toe of the slab. Deuxan 2c is a post applied system that should be applied after the concrete formwork is removed.



SECTION 2 – VERTICAL INSTALLATION GUIDELINES

DUALPROOF INSTALLATION GUIDELINES

Before installing DualProof please read the installation manual in order to become familiar with the installation process. Some types of retaining wall systems, such as caisson retention, may require site specific detailing. Please contact Delta Membranes for technical support.

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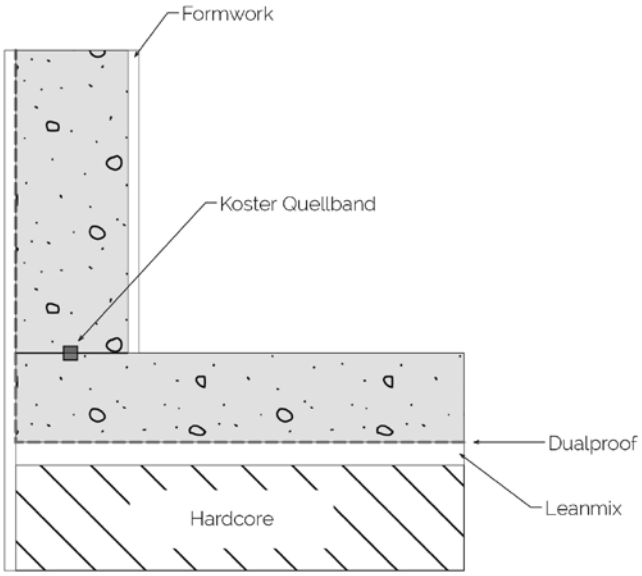


2a) Formwork Installation

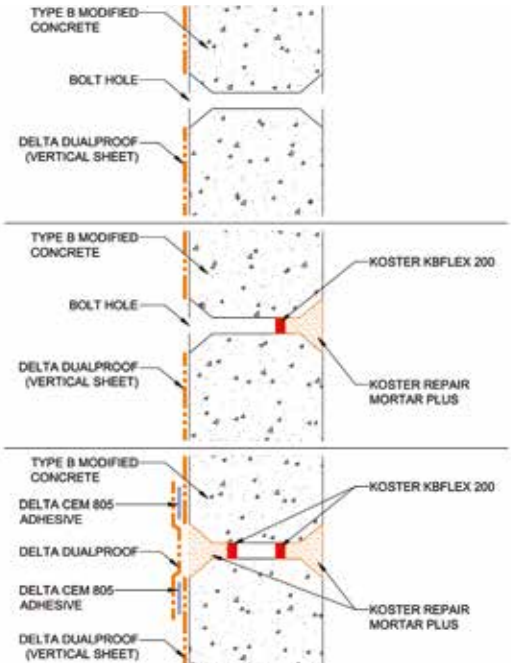
Transition from slab edge to wall.

A 150mm overlap of the under slab DualProof should be available to continue the installation. Please contact Delta Membranes if this is not present.

DualProof can be pinned or stapled to the formwork to hold securely in place during the installation.

Timber formwork used in front of an uneven surface (such as contiguous piles) should be supported from behind using sand or cementitious grout to prevent deflection.

Tie Bar holes should be filled using Koster Repair Mortar Plus and oversealed using the DualProof patch method.



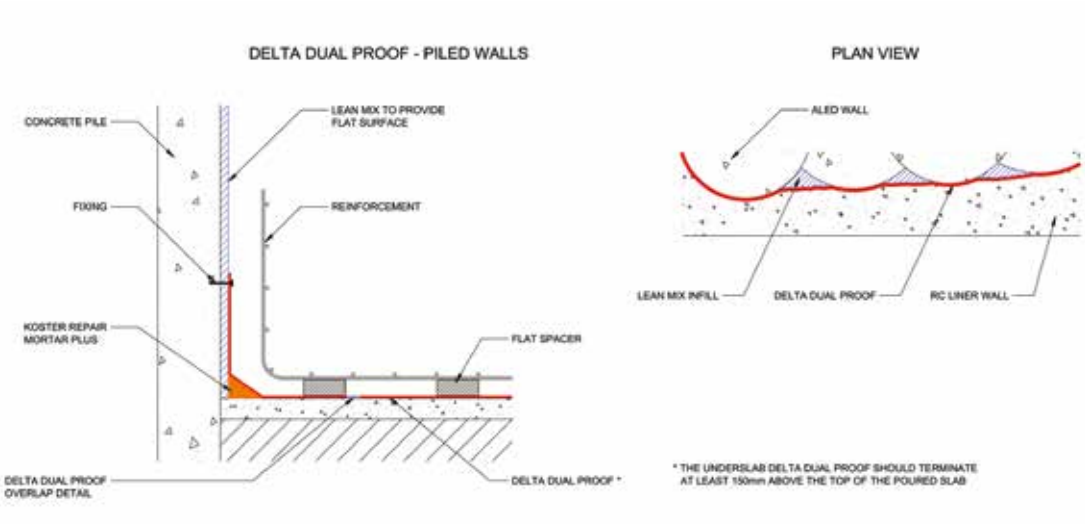
DUALPROOF SYSTEM

2b) Contiguous and Secant Piles

Contiguous Piles

The cusps between the piles should be levelled using a cementitious grout or shotcrete system.

DualProof can be installed, following the profile of the piles.



2c) Metal Sheet Pile Retaining Walls

Preparation:

The clutches of the sheet piling are typically welded to reduce water ingress.

DualProof sheet joints should not occur at unwelded junctions between the sheet piles.

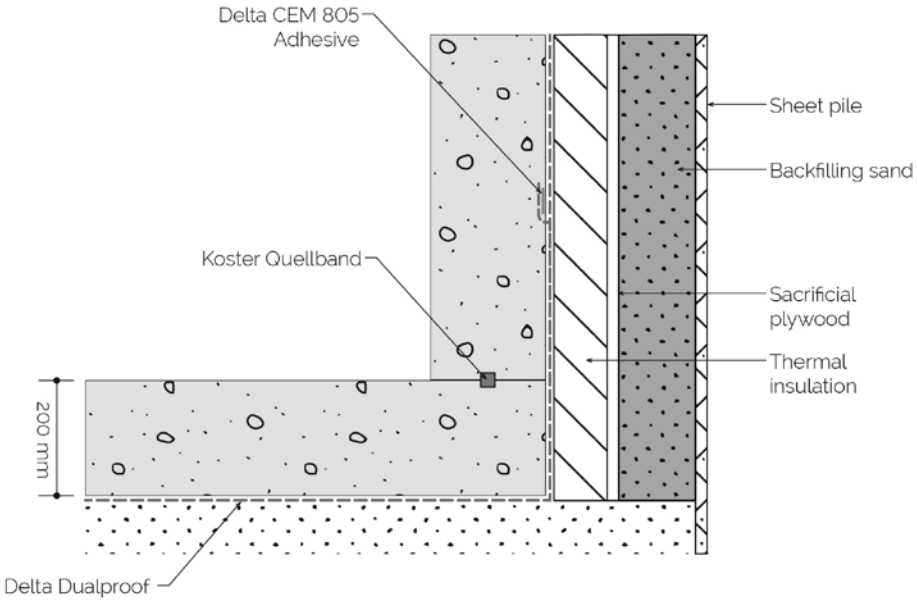
A level surface can be formed to the surface of the sheet piles using a layer of sacrificial plywood formwork.

2d) Shotcreted Earth Or Rock Retention

Shotcrete should be applied to create a level surface with depressions of no more than 12mm.

Where depression of more than 12mm are present, this should be flush filled using Koster Repair Mortar Plus.

DualProof can be continued over any ground anchor heads if direct contact with the retaining wall concrete is not required. Where direct contact is require, the pile cap method, 1c, should be used.



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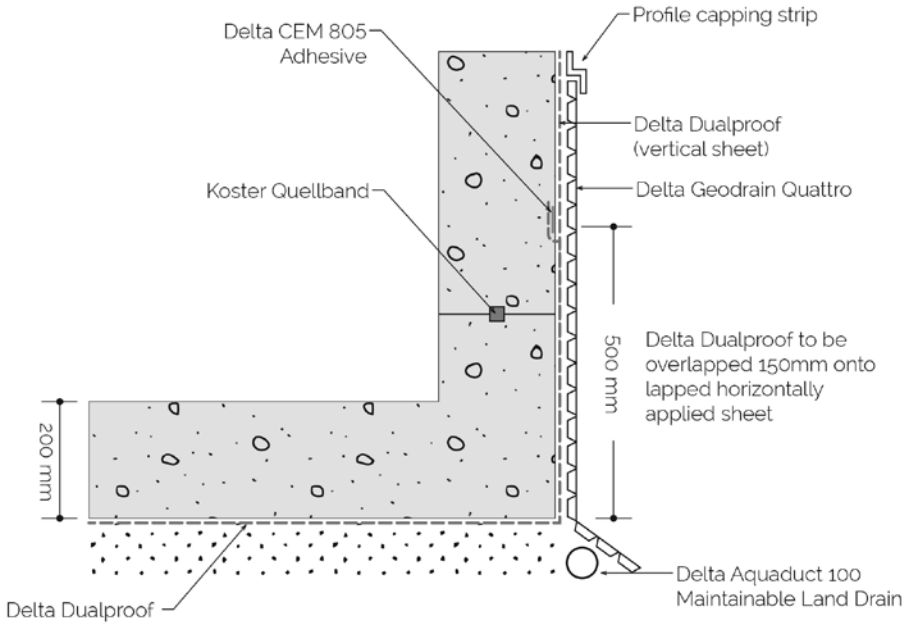
SECTION 2 – VERTICAL INSTALLATION GUIDELINES

2e) Backfill Protection and Temporary Formwork

Where temporary formwork is used, it may be necessary to use a backfill protection system.

Delta Geo Drain Quattro should be installed vertically to protect the DualProof damage against damage during the backfilling process.

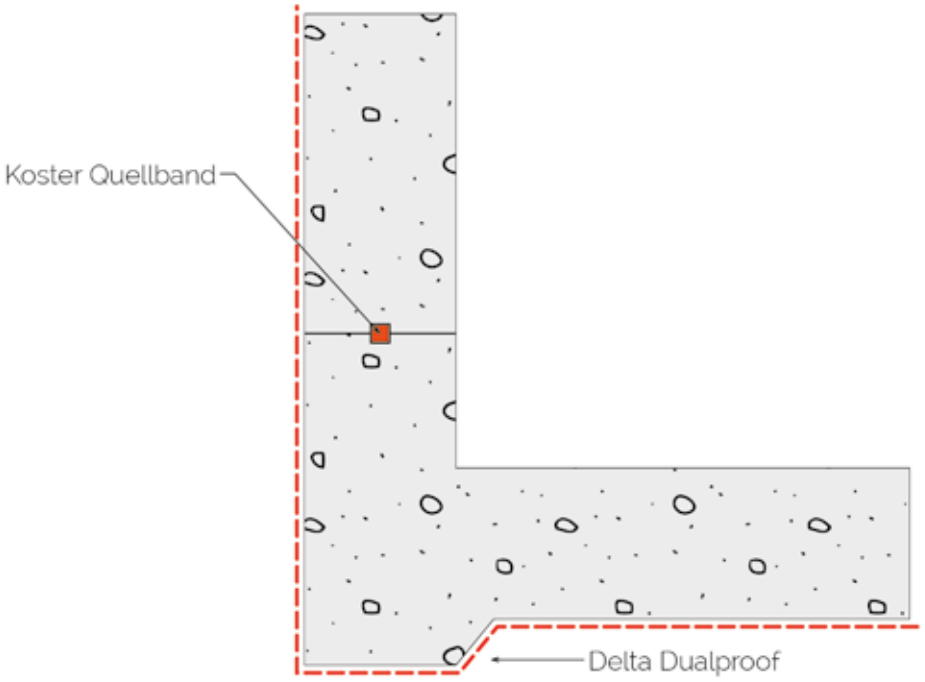
Delta Geo Drain Quattro will also improve external surface water drainage.



2f) Position of Land Drain

Delta Aquaduct 100 can be used as an external surface water drain and should be connected to a suitable drainage outlet. Typically, this land drain should be positioned below the height of the slab.

Maintainable land drain not to be positioned closer than a line of 45˚ from the underside of the slab/blinding or with an invert above the upper surface of the floor slab. Please refer to chapter 6.4 and figure 3 of BS8102:2009 for further information on external sub surface drainage.



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DUALPROOF SYSTEM

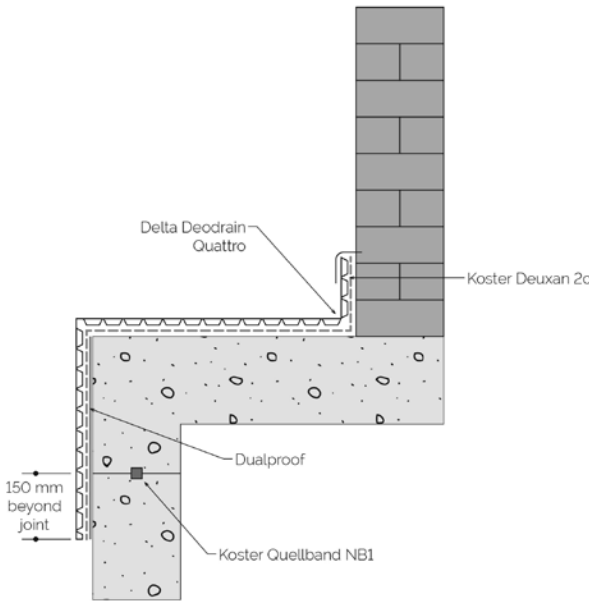
2g) Connection to External Buried Roof Detail

DualProof is not suitable for use on buried roofs or podium decks over basement structures.

Buried roofs should be formed from solid reinforced concrete. Rib deck or block and beam should not be used.

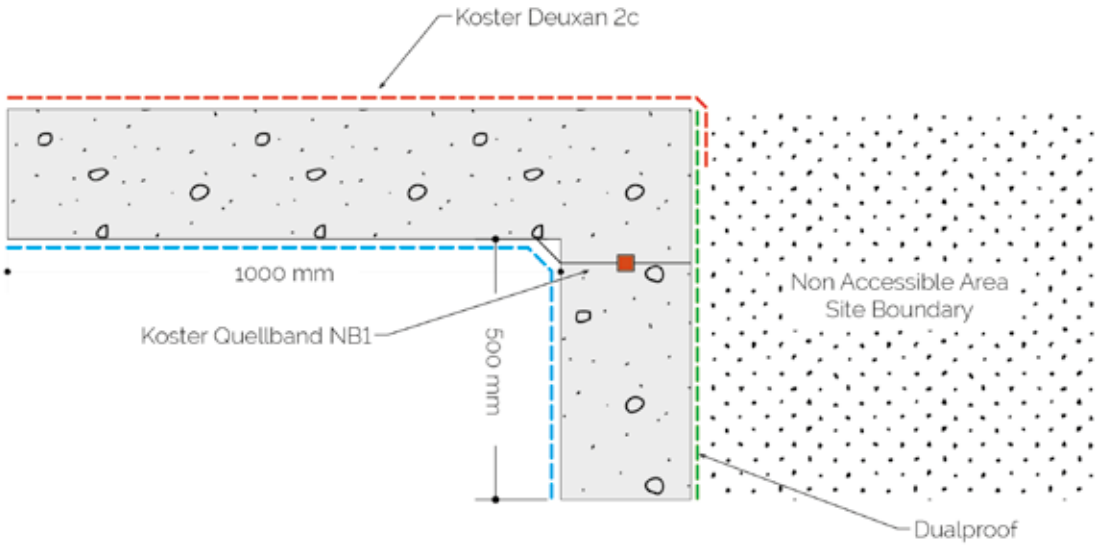
Where possible the deck should be laid to falls away from the building.

Koster Deuxan 2x should be applied in 2 coats to the outside of the deck. Koster Deuxan 2c should continue across the outside face of the deck and lap OVER the DualProof membrane. This overlap should extend 150mm past the DualProof membrane or past the uppermost construction joint between the deck and the retaining wall. Whichever is greater.



SITE RESTRICTIONS

Where it is not possible to access the outside of the structure to adequately form this overlap an additional waterproofing layer will be required to the underside of the buried roof. Koster NB1 Grey should be applied to the negative side of the deck.



Test data and further product technical information can be found on the BDA Agrément® BAB 18-089/01/A.

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