Controlit® FACTORY

CONTROLIT CONDUCTIVE UNDERLAYS

HANDBOOK 2023

CONTENTS

ELECTRONIC LEAK DETECTION & CONTROLIT CONDUCTIVE UNDERLAYS

The Electronic Methods for Detecting and Locating Leaks in Waterproof Membranes (ELD) with Controlit electrically conductive underlays are innovative and reliable proactive technologies that offer safer and more efficient alternatives to traditional flood testing.

The American Society for Testing and Materials (ASTM) has provided standard procedures for using ELD methods to locate leaks in exposed or covered waterproof membranes. These procedures are outlined in ASTM D7877-14, guidelines for utilizing ELD methods (such as High Voltage and Electric Field Vector Mapping (EFVM) / Low voltage test methods). While these methods are accurate and effective, they do have certain limitations.

For accurate Electronic Leak Detection, the deck material directly below the membrane must be conductive enough. In some cases, a concrete or steel substrate can facilitate this method. However, if the membrane is installed over electrically insulating materials like wood, insulating foam, stone wool insulation, or a protection board, it interrupts the electric path to any conductive deck. In such cases, a conductive material must be placed directly under the membrane to provide the necessary return path for the test currents.

A conductive substrate, such as Controlit® underlays, is essential for the ELD technology to function effectively.

Controlit® solutions are suitable for a variety of roofing and waterproofing applications, such as exposed flat roofs, green roofs, blue roofs, loaded roofs and exploitable terraces, balconies, podium decks, swimming pools, and civil engineering solutions.

Controlit solutions can be used as a proactive quality control and leak detection tool in the construction process, building maintenance, and warranty programs.

Conductive underlays meet industry standards and specifications regarding conductivity, durability, fire resistance, thickness, flexibility, and other relevant parameters.

Proactive method

Fast & Precise

Optimized maintenance costs

Sustainable

ELD TESTING METHODS WITH CONTROLIT UNDERLAYS

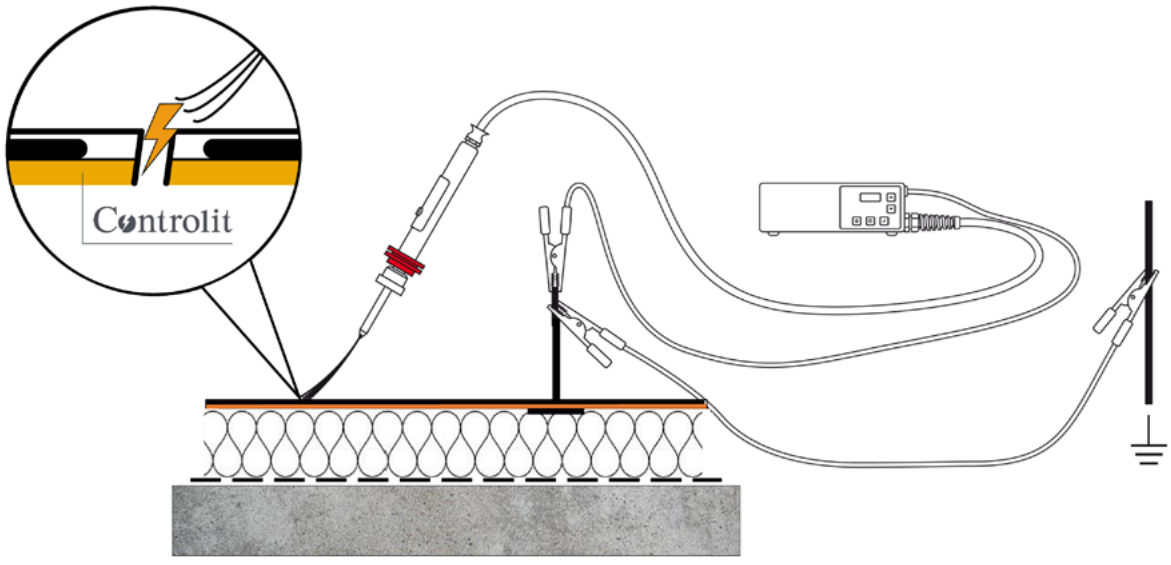
The basics required for both high- and low-voltage ELDs are very similar, even though they achieve results through different methods. Electrical principles apply to both testing methods, and specific conditions must be meet for the testing to work. It is important to adhere to the expiration date of the test equipment calibration. Operator skills and knowledge play a crucial role in obtaining accurate results.

ELD High voltage testing method
ASTM standard D7877-14

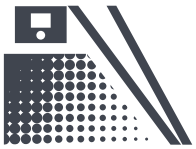
- Tests entire horizontal, and vertical roof surface
- Waterproofing must be exposed and dry during the inspection process
- For non – conductive waterproofing membranes
- Pinpoints the exact location of the surface damages
- Can repair and retest on the same day
- High inspection productivity - approx. 400m²/h

The High voltage electronic leak detection (ELD) method (performed with a dry membrane) is a fast and non-destructive way to test the water tightness of waterproofing membranes using Controlit® conductive underlays. It works by connecting a portable "pulse generator" to the conductive substrate and a device with copper bristles. When the circuit completes, it detects breaches in the membrane. The ELD method is safe, using low amperages similar to static electricity. It provides quick and accurate leak detection without damaging the membrane or building.

Limitations: The test only works on non-conductive roof membranes with a conductive substrate. The surface must be known to calculate the test voltage according to the technical manual from the test equipment producer. Excessive voltage settings can damage the membrane, so be careful. The operator must be isolated and protected from the voltage source (following the manufacturer's recommendations for the inspection equipment).



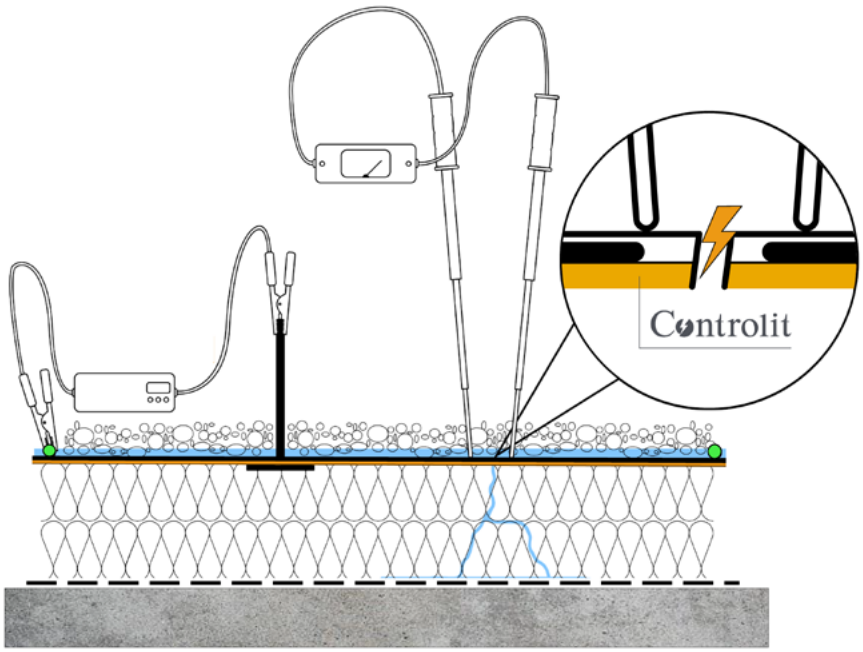
ELD Electric Field Vector Mapping (EFVM) / Low voltage method
ASTM standard D7877-14



- Tests entire horizontal roof surface
- Method recommended for loaded, green roofs inspection
- Waterproofing must be damp during the inspection process
- For non – conductive waterproofing membranes
- Exact location of the surface damage
- Trace wire area for inspection (- 250m²)
- Connection contact R max 25m

EFVM, or Electrical Field Vector Mapping, is a testing method used to assess membranes installed on horizontal substrates. It involves inducing low-voltage electric pulses on a moist surface using a perimeter cable and a generator unit to create an electric field. If there are any leaks or breaches through the waterproofing membrane, which acts as an electrical insulator, a small electric current will flow across the membrane surface and down through the breach, thereby completing the circuit between the two electric plates. Imperfections in the waterproofing layer allow moisture to reach the Controlit® underlay. The location of these imperfections can be identified by specialized equipment that detects voltage variations. A technician utilizes a receiver connected to two probes to determine the direction of the electric current. By systematically moving the probes, the technician can effectively trace the flow, even pinpointing the smallest breach or leak through the membrane. Once the location of the leak is determined, it can be marked for repair.

Limitations: Proper operation of the Electric Field Vector Mapping method requires a continuous layer of water on the membrane within the testing perimeter, which must always reach any breach to the conductor cable. Gaps in water coverage can result in missed areas and potentially missed breaches. This limitation is particularly noticeable on new clean membranes where water beading occurs, impeding the formation of a continuous wet surface. Locating breaches on the top layer of a protected membrane roof system covered with additional layers, including insulation, root barriers, and drainage mats, can interrupt the leak-locating signal. The root-barrier and thermally insulating layers form an electrically insulating layer, which can disrupt the locating signal or cause offset errors in the leak locate position.

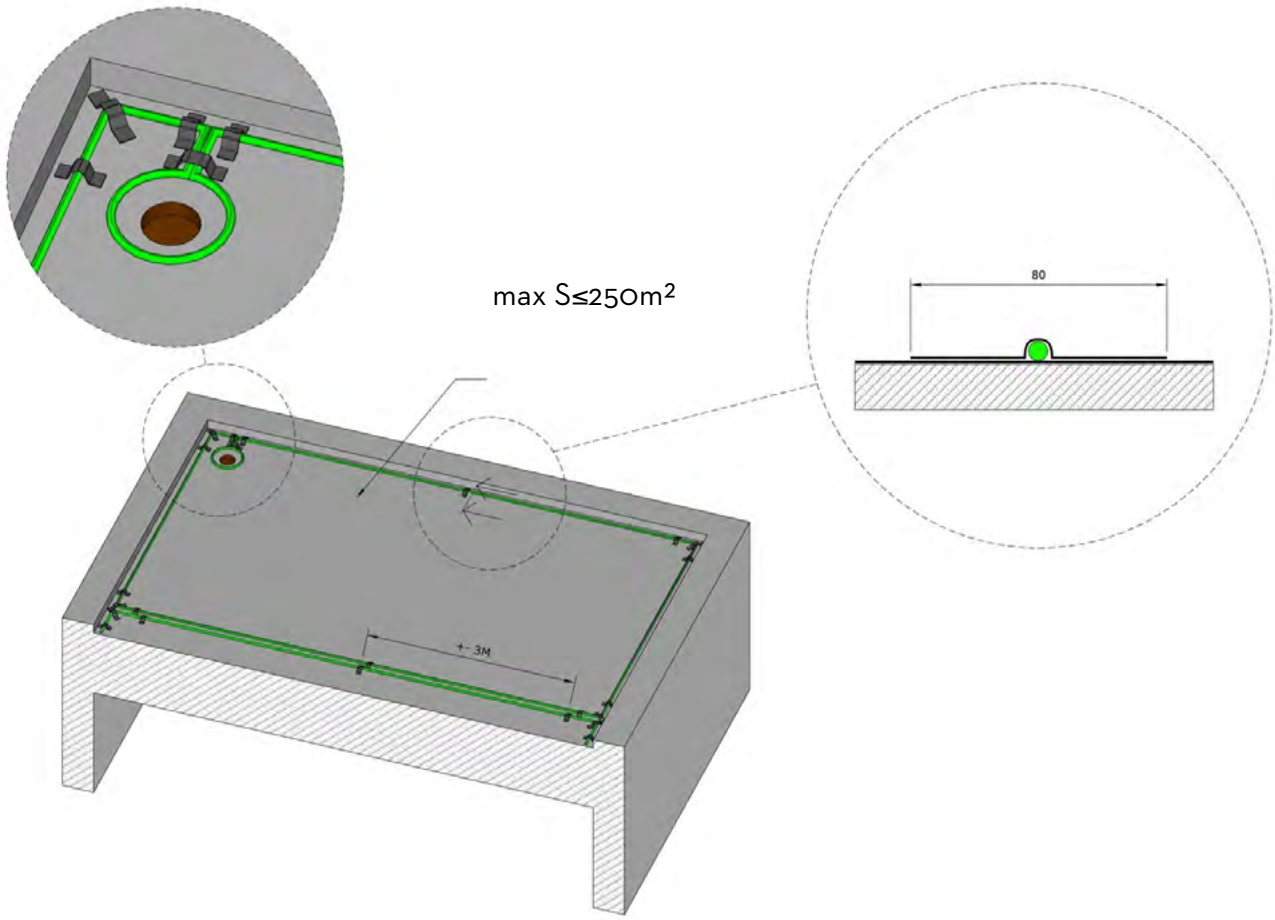


PERIMETER WIRING

To ensure proper testing and future monitoring of the roofing system using the FVM (Electrical Field Vector Mapping) method, a perimeter wiring system made of stainless-steel filament is installed. It is positioned around the roof's perimeter, up to a maximum area of 250 m².

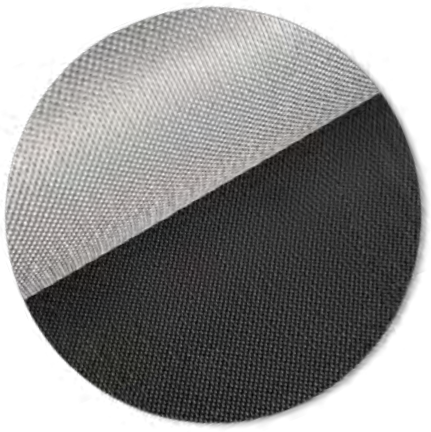
During testing, low-voltage electric pulses are induced in direct current on the wet surface of the roof system through the perimeter wiring. This creates a surface electric field, with the membrane acting as an insulator against electricity. The voltage variation along the equipotential lines indicates the direction and intensity of the field, highlighting potential imperfections in the waterproofing layer that allow moisture to meet Controlit® underlay beneath it.

Using a pair of electrodes and a specialized reading instrument, the operator can identify and determine the precise location of any damage to the roof cover. This method ensures thorough testing, enabling the detection of infiltration or future issues with the roofing system.



Controlit® CONDUCTIVE UNDERLAYS PRINCIPLE

UNDER BITUMINOUS WATERPROOFING



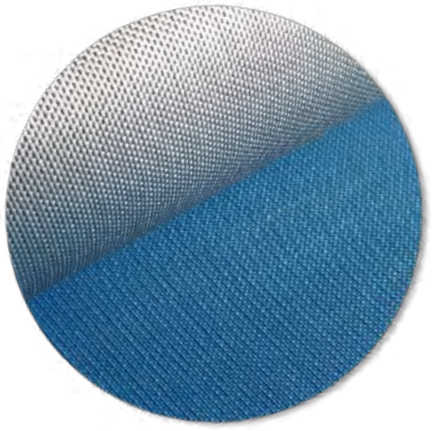
CONTROLIT GS, GS SINGLE PLY

Technical parameters

Controlit GS Single Ply is an electrically conductive underlay, meant to be installed in under synthetic waterproofing membranes.

Controlit GS is an electrically conductive underlays, meant to be installed under or in between bituminous waterproofing membranes.

- Glass fiber fabric Type E, weave- Plain
- Yarn tex (DIN EN 12654) sized warp EC 9-68 Z 20 weft EC 9-68 Z 20
- Coating Stainless steel(Ni Cr) nanoparticles
- Electrical resistance < 1000 Ohm/sq
- Surface Treatment Plasma
- Weight (DIN EN 12127)165 +/- 10 g/m2
- Thickness (DIN EN ISO 5084)0.16 +/- 0.02 mm
- Tensile strength not less than (EN ISO 13934 1) warp 2500 N/5cm weft 2000 N/5cm
- Fire resistance (EN13501-1:2007+A1:200-9)A2-s1-d0
- Tested and approved by manufacturers of electronic integrity control systems (ELD) both low voltage EFVM sec. ASTM D7877-14 .7 and high voltage HVMT sec. ASTM D7877-14 .9
- Installation with lateral & horizontal overlaps equal to 10 cm.

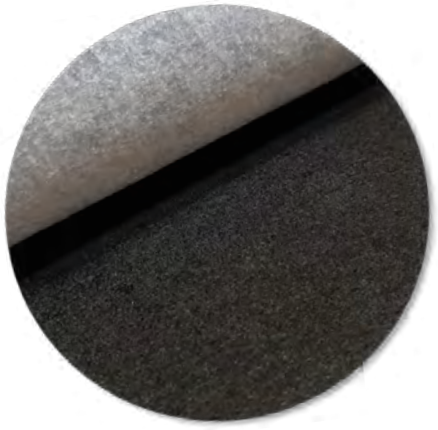


CONTROLIT GSP

Technical parameters

Controlit GSP is an electrically conductive underlay, meant to be installed under swimming pool waterproofing membranes.

- Glass fiber fabric Type E, weave- Plain
- Yarn tex-size warp 68 weft 68
- Setting per 100mm warp 120 weft 120
- Tensile strength N/50mm warp 2500, weft 2000
- Thickness 0,16mm+/- 0,02mm
- Weight (DIN EN 12127) 165 +/- 10 g/m2
- Coating Stainless steel(Ni Cr) nanoparticles
- Electrical resistance < 1000 Ohm/sq
- Fungal growth ES ISO 846(Method C)
- No visible growth of bacteria in agrar culture around the tested sample.
  ES ISO 846(Method A) 0
- Tested and approved by manufacturers of electronic integrity control systems (ELD) both low voltage EFVM sec. ASTM D7877-14 .7 and high voltage HVMT sec. ASTM D7877-14 .9
- Installation with lateral & horizontal overlaps equal to 10 cm.



CONTROLIT PK

Technical parameters

Controlit PK is an electrically conductive underlay, meant to be installed under synthetic waterproofing membranes.

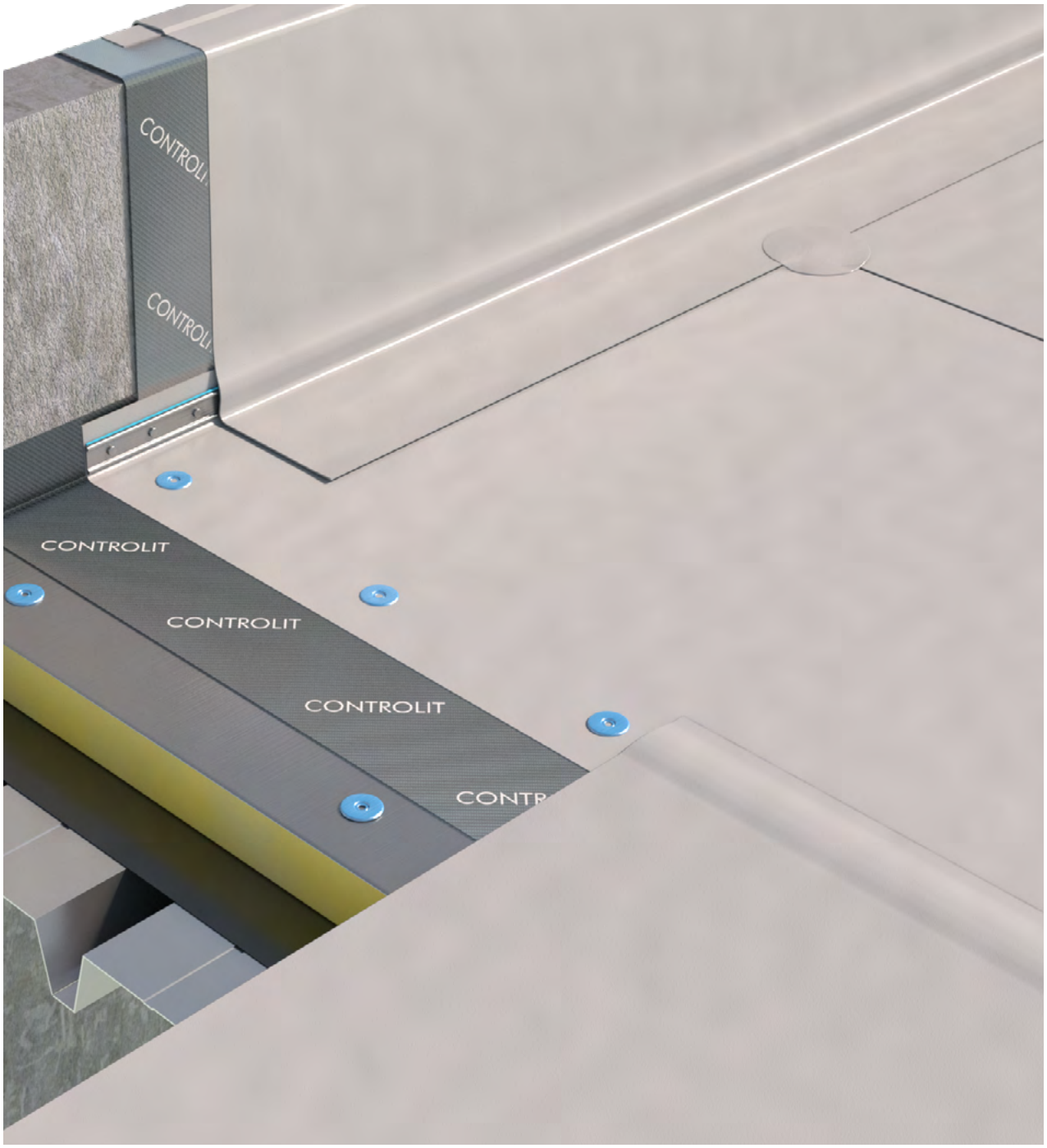
- Non-woven polyester PES
- Weight EN ISO 2286-2 g/m2 +/-10% 300
- Thickness mm+/- 10% 1,5
- Treatment Chemical/ Conductive carbon(CC)
- Surface resistance ohm/sqm <10 000
- Tensile strength CD EN ISO 1421 N/5cm 600 MD EN ISO 1421 N/5cm 400
- Fire resistance F
- Tested and approved by manufacturers of electronic integrity control systems (ELD) both low voltage EFVM sec. ASTM D7877-14 .7 and high voltage HVMT sec. ASTM D7877-14 .9

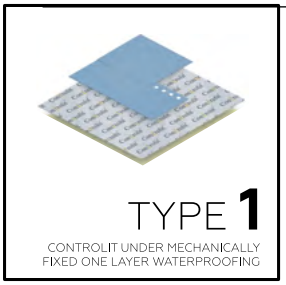
When installing Controlit® underlays:

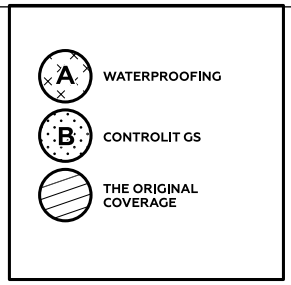
- Install a non-conductive waterproofing membrane.
- Install Controlit® simultaneously with the waterproofing membrane, following the manufacturer's instructions.
- Controlit® is installed loose laid with 10cm overlap.
- Piercing Controlit® does not affect its mechanical strength, conductivity, or testing properties.
- Cuts and damage do not have an impact on Controlit® functional performance.
- No sensors, wires, or data collection units are involved, minimizing the risk of damage and system failure.
- For synthetic membranes, Controlit® GS Single Ply or Controlit PK are mechanically fastened with the waterproofing membrane fasteners.
- For bituminous waterproofing, Controlit® GS is fastened or torched with the first bituminous layer.
- Controlit® underlays can be used as a separation layer between old bituminous and thermoplastic single-ply waterproofing membranes.
- Controlit GS can be torch-treated if needed to fix the first layer of bituminous membrane to the thermal insulation.

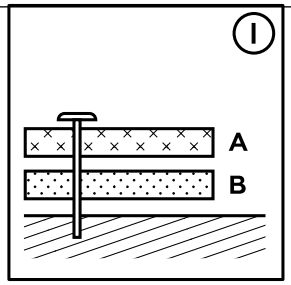
CONTROLIT GS SINGLE PLY - INSTALLATION PRINCIPLES

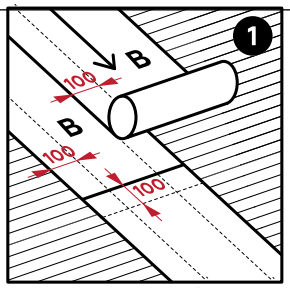
UNDER SYNTHETIC WATERPROOFING MEMBRANES (MECHANICALLY FASTENED)



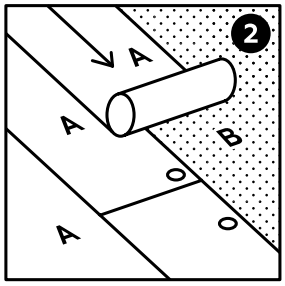




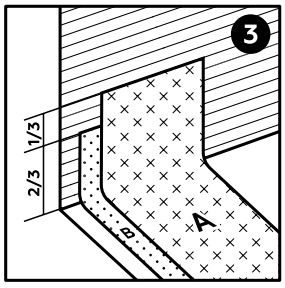




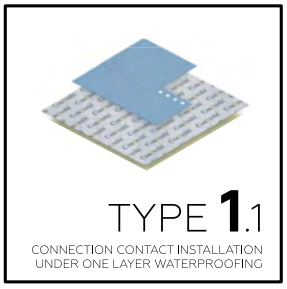
1. Roll out Controlit GS on the surface with 100mm overlap

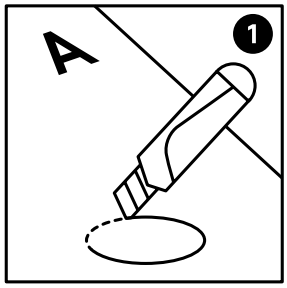


2. Mechanically fix the waterproofing

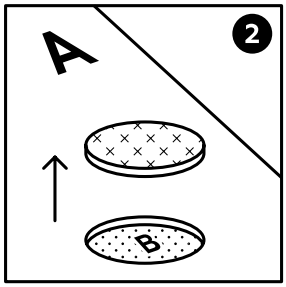


3. On vertical surfaces Controlit GS is always 1/3 below waterproofing level

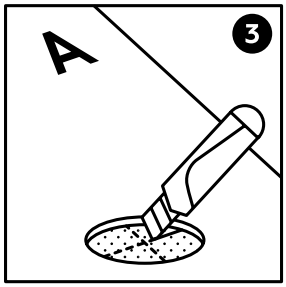




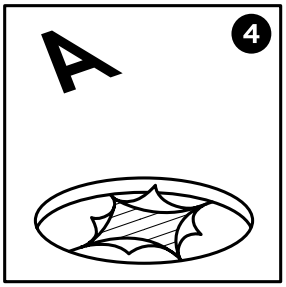
1. Cut out 100mm in diameter hole from the waterproofing



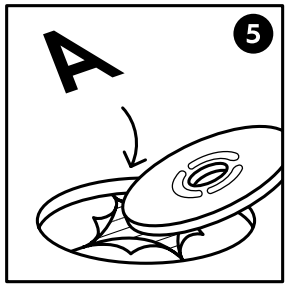
2. Take out the cut detail



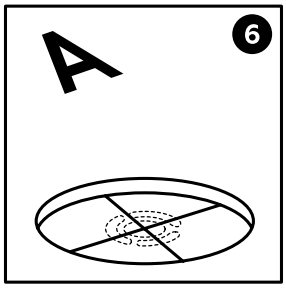
3. Cut the two lines in the cross shape in Controlit GS



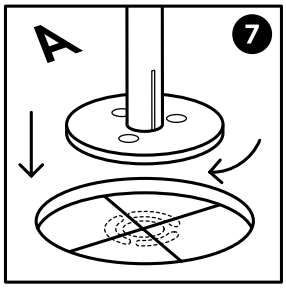
4. Now you can freely unfold the Controlit GS



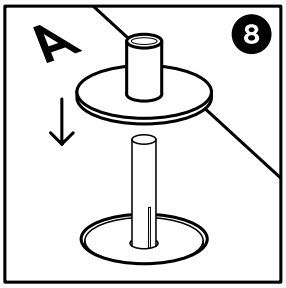
5. Install A detail below unfolded Controlit GS



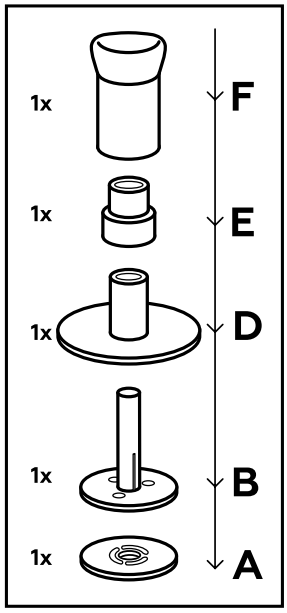
6. Fold back unfolded Controlit GS

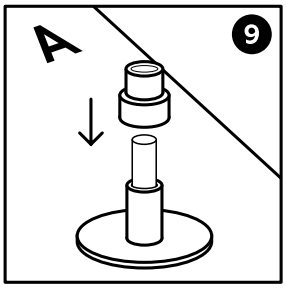


7. Install B detail. Controlit GS is not between A and B details

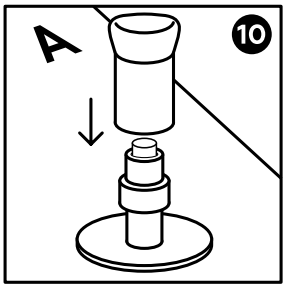


9. Install D detail

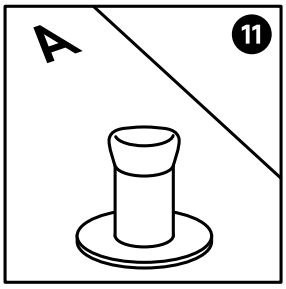




10. With hot air or flame shrink E detail



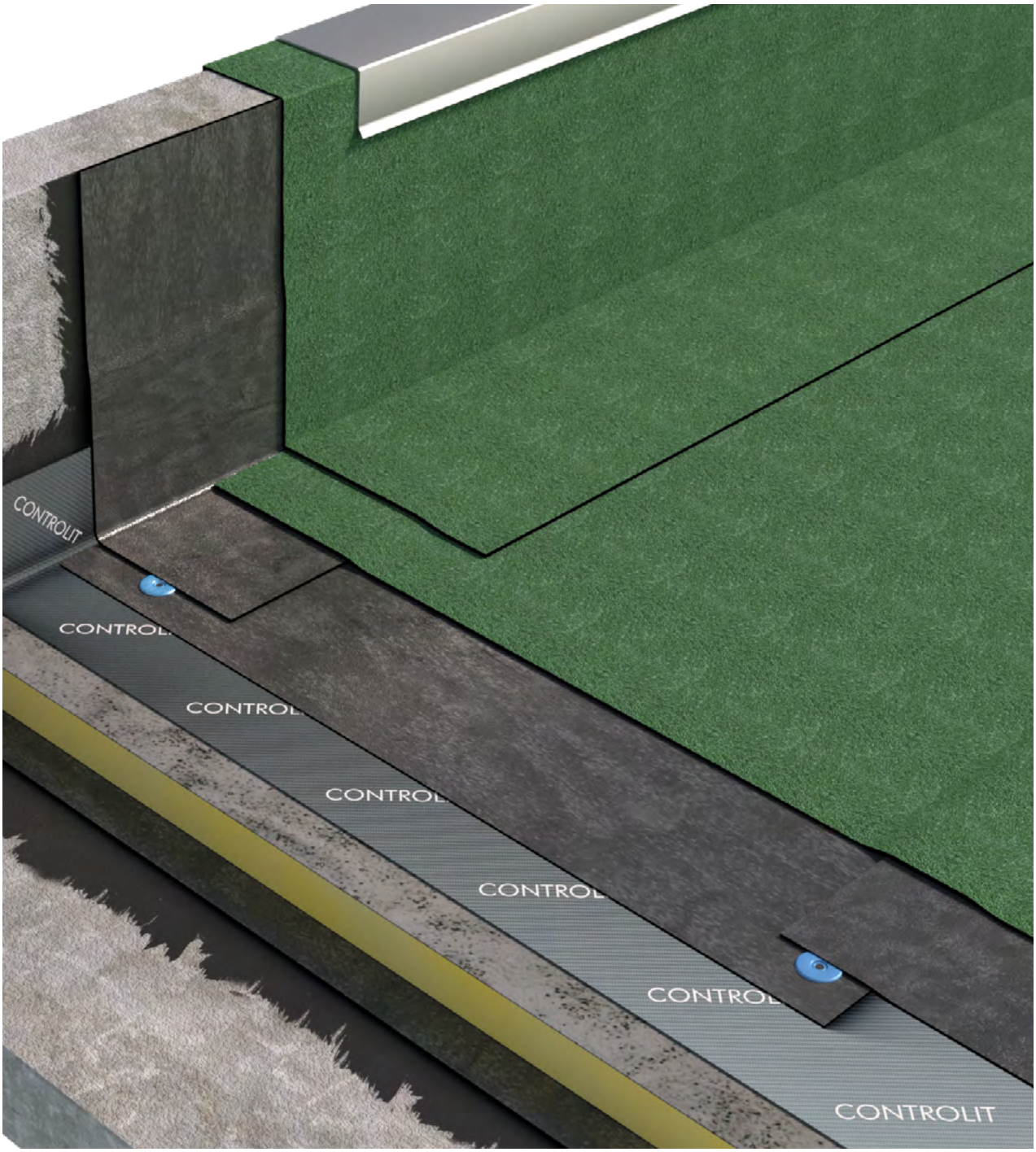
11. Apply F detail

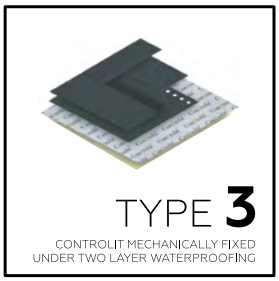


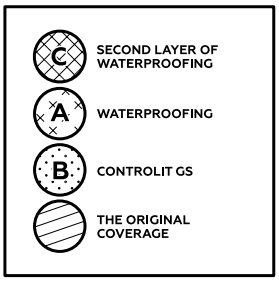
12. Ready connection contact

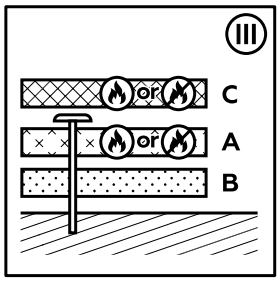
CONTROLIT GS - INSTALLATION PRINCIPLES

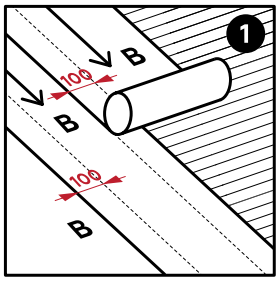
UNDER BITUMINOUS WATERPROOFING



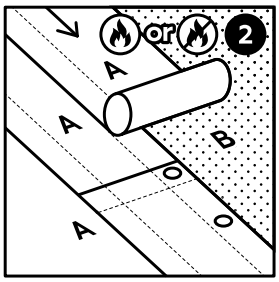




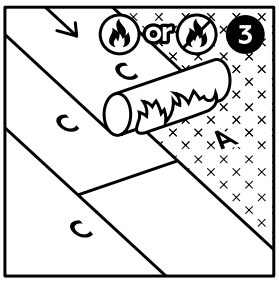




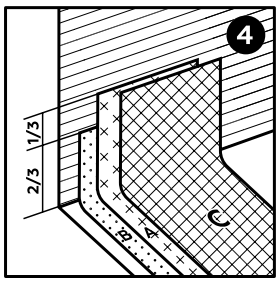
1. Roll out Controlit GS on the surface with 100mm overlap



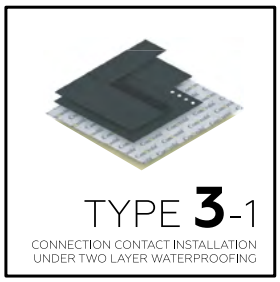
2. Mechanically fix the first layer of waterproofing with or without the fire

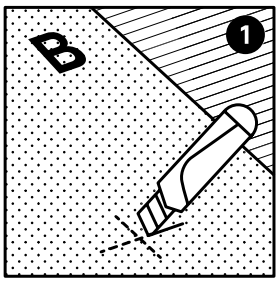


3. Melt or mechanically fix the second layer of waterproofing

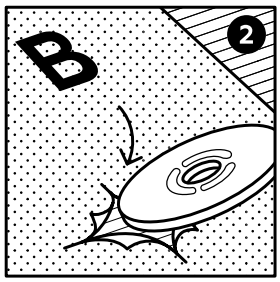


4. On vertical surfaces Controlit GS is always 1/3 below waterproofing level

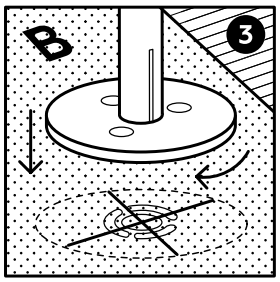




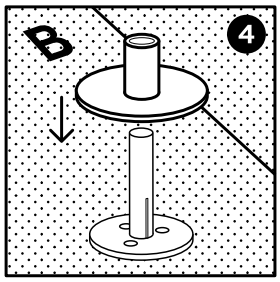
1. Cut the two lines in the cross shape in Controlit GS



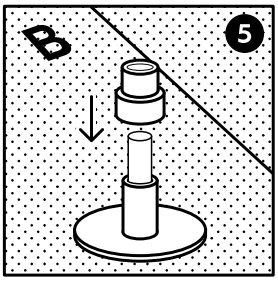
2. Install A detail below unfolded Controlit GS



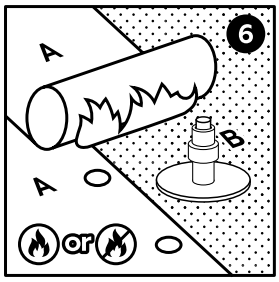
4. Install B detail. Controlit GS is not between A and B details



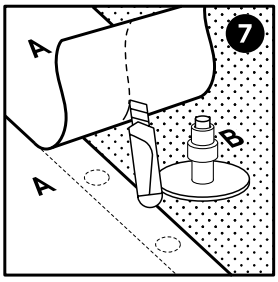
6. Install D detail



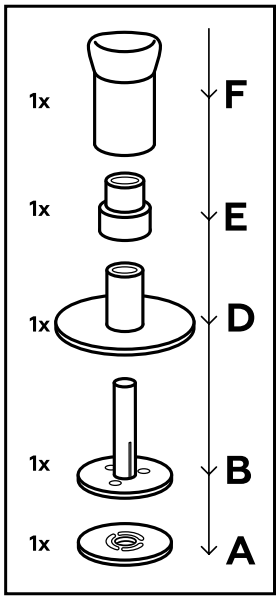
7. With hot air or flame shrink E detail

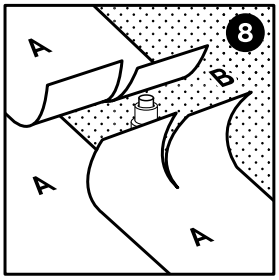


8. Fix the first layer of waterproofing directly on Controlit GS

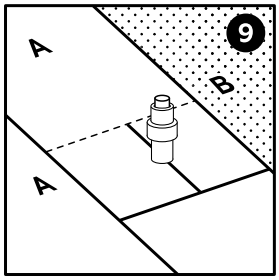


9. Cut line in the first layer of waterproofing

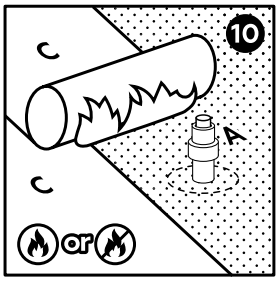




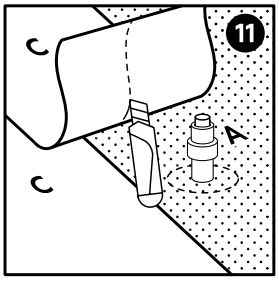
10. Fold the first layer of waterproofing from both sides of the connection contact



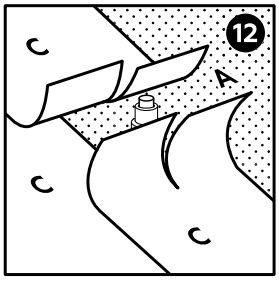
11. Connection contact is now hermetically sealed between two overlaps



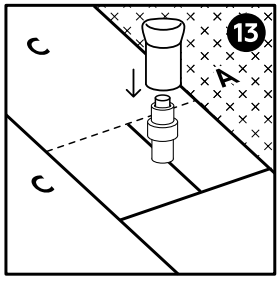
12. Fix the second layer of waterproofing



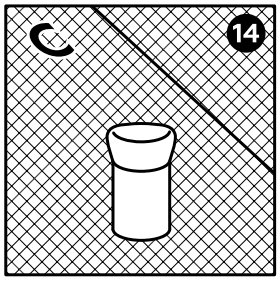
13. Cut line in the second layer of waterproofing



14. Fold the second layer of waterproofing from both sides of the connection contact



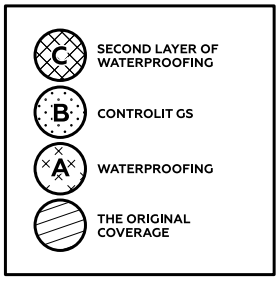
15. Connection contact is now hermetically sealed between two overlaps. Apply F detail

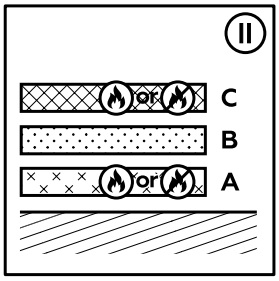


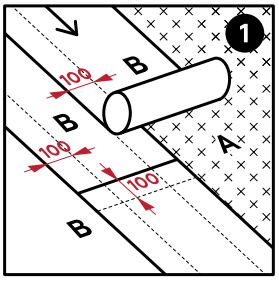
16. Ready connection contact

CONTROLIT GS - INSTALLATION PRINCIPLES

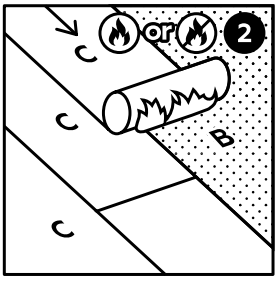
INBETWEEN BITUMINOUS WATERPROOFING LAYERS (FULLY TORCHED)



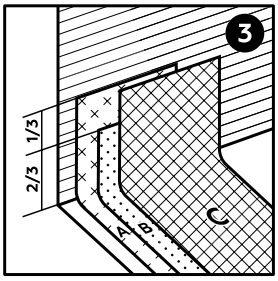




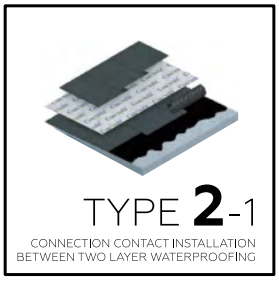
1. Roll out Controlit GS on the first layer of waterproofing with 100mm overlap

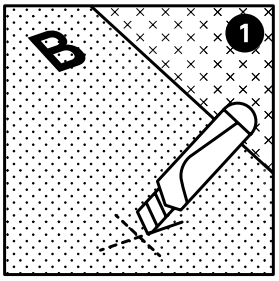


2. Melt or mechanically fix the second layer of waterproofing directly on Controlit GS.

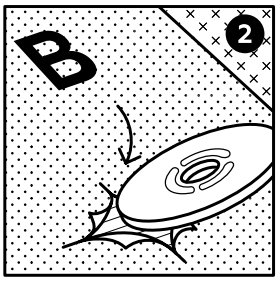


3. On vertical surfaces Controlit GS is always 1/3 below waterproofing level

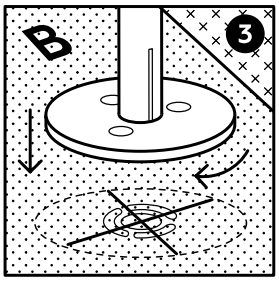




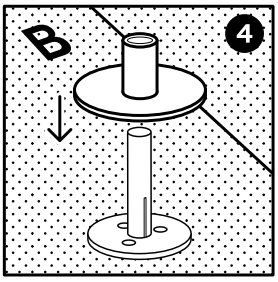
1. Cut the two lines in the cross shape in Controlit GS



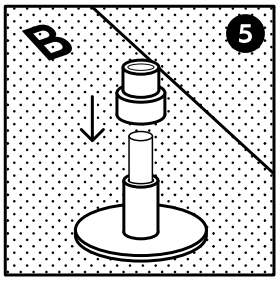
2. Install A detail below unfolded Controlit GS



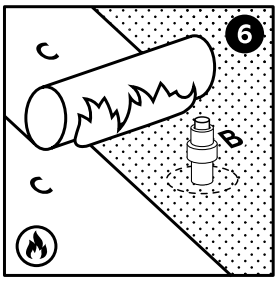
4. Install B detail. Controlit GS is not between A and B details



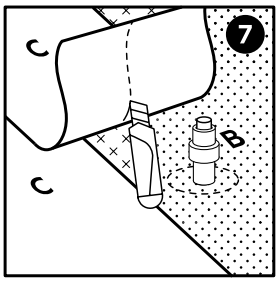
6. Install D detail



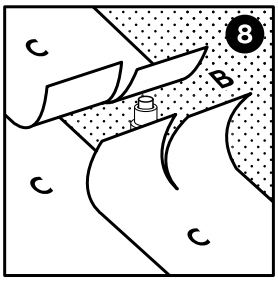
7. With hot air or flame shrink E detail



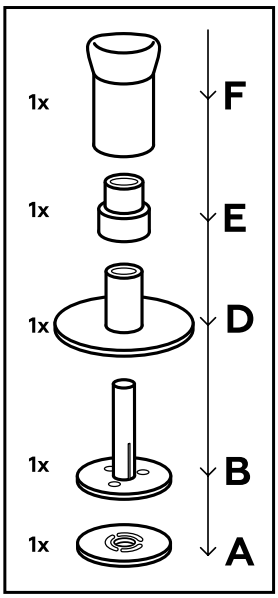
8. Fix the second layer of waterproofing directly on Controlit GS

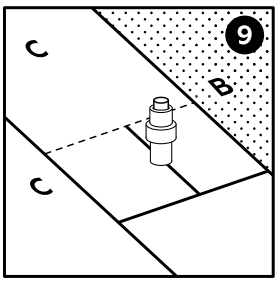


9. Cut line in the second waterproofing layer

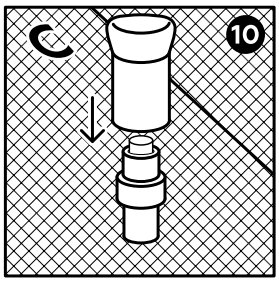


10. Fold second waterproofing layer from both sides of the connection contact

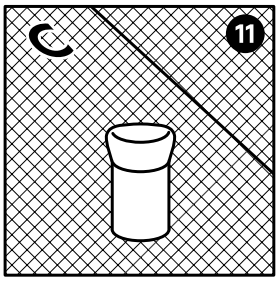




11. Connection contact is now hermetically sealed between two overlaps



12. Apply F detail



13. Ready connection contact

CONNECTION CONTACT

The connection contact is intended for the connection of an ELD impulses generator to Controlit® electroconductive underlays to guarantee a accurate and precise performance of the measuring devices.

Connection contact is in direct contact with Controlit® electrically conductive underlays and is meant to attach any Electrical leak detection method equipment.
The location of the connection point depends on the roof's configuration.
It can be installed on horizontal and vertical surfaces.

Controlit® underlays must be between two connecting contact plates, screwed together with the contact bar.

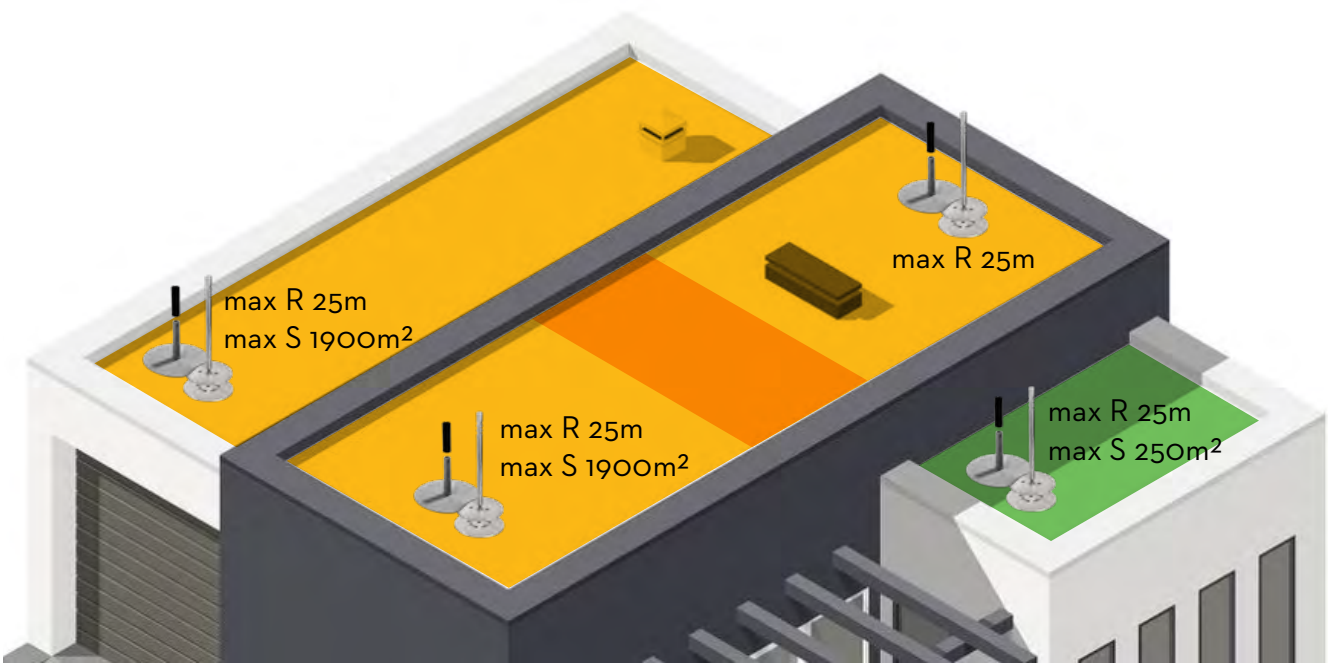
To ensure a tight connection, the contact is offered complete with a sleeve that is adapted for various seals (Bitumen, PVC, TPO) and a security cap.
The connection contact must be hermetically sealed and covered with a protection cap.
All connection contacts must be in the zone of lightning protection.

CONNECTION CONTACTS INSTALLATION PRINCIPLE

The various ELD test measuring devices have a different radius of effectiveness, which is why the contact arrangements for the various building structures can be different.

The High Voltage (ELD) test method is mainly used on roofs without load. The calculation basis for contacts is one contact per area with a radius of max. 25 m from the connection point.

When using Controlit under green roofs, gravel, and other loads for Low Voltage (ELD) test method, the contacts are laid with the calculation of “one connection contact on an area of approx. 250 m^2”.



connection points for High Voltage Electronic leak detection method

connection point for Electric Field Vector Mapping (EFVM) method

Comprehensive training is essential for technicians conducting both Low- and High-voltage ELD testing. These technicians must possess the necessary knowledge and expertise to execute tests accurately.

Several factors are essential when assessing the qualifications of a testing firm and its technicians:

- Proficiency in roofing materials, components, and systems.
- Duration of ELD service provision.
- Familiarity with the testing equipment and methods employed.
- Type and duration of technician training.
- Approvals from roofing or waterproofing manufacturers for both the testing firm and methods utilized.
- References from previous projects where similar testing was conducted by the technician.

When incorporating ELD testing into specifications, it is critical to ensure the compatibility and acceptance of the membrane and assembly by the manufacturer. Collaborating with a knowledgeable firm specializing in ELD technology during the design phase is pivotal for achieving success in roofing or waterproofing projects.

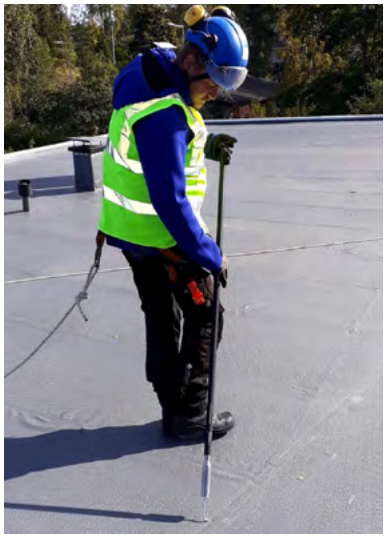
In certain assembly designs, ELD testing cannot be an afterthought, particularly when a conductive substrate is included in the assembly. Accurate test results are only achievable when the correct ELD technology is applied, and proper procedures are followed by skilled and experienced technicians.

ELD testing, when appropriate, should not replace visual quality control (QC) and other best-practice inspection requirements; it should be used in conjunction with other inspection methods. Metal flashings, drains, and other components require different inspection techniques, and the successful installation depends on the proper evaluation of all these components combined.

CONTROLIT TOOLS FOR PROFESSIONALS: extensions for curved hook for overlap welding seams inspection

Extension for seam inspection hook is designed for checking welded seams in heat-fused roofing membranes.

The product is 100% handmade from the highest quality stainless steel and features high-density rubber handles for a comfortable grip. Net weight of 2.155 kg. The hook holder length measures 160mm. The seam inspection hook extender significantly enhances seam inspection productivity, allowing users to inspect seams up to five times faster than traditional methods.



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