

# contents

## THIS PUBLICATION

This manual provides the technical information necessary to correctly specify the Rawmat® system. It has also been designed for use by Waterproofing Systems Ltd (WPS) approved applicators, for training and quality management purposes.

This manual may also be used by main contractors and Building Consent Authorities (BCA's) for quality management and inspection purposes.

## NOTE TO APPLICATORS

As an approved applicator you are required to comply fully with the contents of this manual. Where a specific situation arises on a particular project that makes it difficult for you to follow the published procedure or comply with a particular detail drawing, you are required to communicate this to WPS for an approved solution.

## USING THE ICONS

Four different visual icons have been created for this manual to draw the reader's attention to important pieces of information.



### 1. QUALITY CONTROL ICON

Information about warranties, quality control checks and related information.



### 2. USEFUL TIPS ICON

Helpful advice to make the applicator's job easier and successful installation more likely.



### 3. CRITICAL ICON

Vital information about the system and installation methodology. It is crucial the specifier and/or applicator is aware of these facts.



### 4. HEALTH & SAFETY ICON

Information about the importance of safety checks and ensuring that the work environment is always safe with potential hazards identified and minimised.

# Introduction

## PRODUCT DESCRIPTION

The Rawmat® Pre-hydrated Bentonite tanking system is designed to protect foundations and vertical walls from aggressive soil attack, dampness and vapour transmission.

The Rawmat® tanking system is the premier tanking system and is used in challenging tanking applications.

## HOW DOES BENTONITE WORK?

When in contact with water the natural sodium bentonite clay will absorb the water and expand and when confined, e.g. between the ground and the floor slab, this tendency to swell generates substantial swell pressures preventing the passage of water. When correctly installed, the Rawmat®/Rawseal® acts as an effective hydrostatic seal. It is important that both faces and all edges are tightly and fully confined.

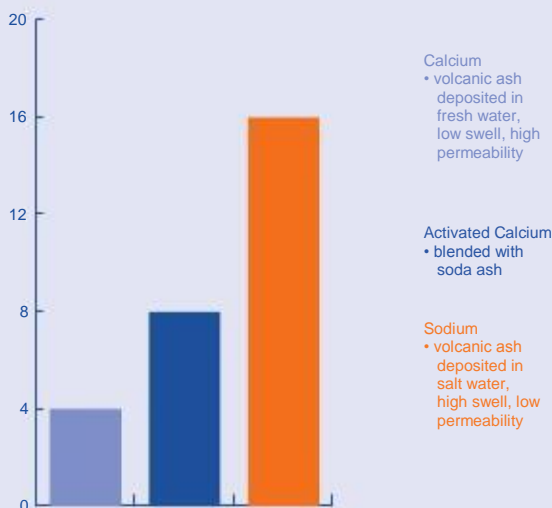
An important factor affecting the amount of swell achieved is the quality of water hydrating the bentonite. The significant advantage of the pre-hydrated system is that the initial hydration occurs under factory controlled conditions.

Unlike the dry systems, which are prone to shrinkage and cracking, the Rawmat® pre-hydrated bentonite is highly resistant to the effects of water contaminants. These contaminants induce cationic exchange in dry bentonite systems causing them to have a reduced swell and to shrink and crack as the clay converts from sodium bentonite to the calcium form.



The Rawmat® system must be adequately confined in order to perform effectively.

Swell capacity of the three different forms of bentonite clay available.



## permeability under contaminant conditions

Permeant	Effective Pressure	Permeability
Fresh Water	450 KPa	$5.4 \times 10^{-14}$ m/sec
100 K ppm Salt Water after 18 Wet/Dry Cycles	450 KPa	$5.2 \times 10^{-14}$ m/sec
100 K ppm Salt Water after 30 Freeze/Thaw Cycles	450 KPa	$1.6 \times 10^{-12}$ m/sec
30 g/l Conc. Ethylene Glycol	450 KPa	$4.9 \times 10^{-13}$ m/sec
30 g/l Conc. Ethylene Glycol after 30 Freeze/Thaw Cycles	450 KPa	$3.9 \times 10^{-13}$ m/sec
Diesel Oil (Overlap with Mastic applied)	450 KPa	$2.8 \times 10^{-13}$ m/sec
Unleaded Petrol	25 KPa	$2.1 \times 10^{-12}$ m/sec
Landfill Leachate (After 19 months contact)	25 KPa	$2.6 \times 10^{-11}$ m/sec
Landfill Leachate (After 29 months contact)	25 KPa	$4.6 \times 10^{-12}$ m/sec

## WHY RAWMAT® / RAWSEAL®

Unlike dry bentonite systems, the Rawmat® membrane and Rawseal® waterstops are resistant to chemical degradation (cationic exchange), are easy to install and also have the ability to withstand minor movement in the structure.

Additionally the Rawmat® / Rawseal® products ...

- Can be installed on damp and uncured substrates, and in inclement weather.
- Require no priming.
- Can be nailed to the substrate.
- Lose no bentonite when handling, folding or cutting.
- Are highly resistant to chemicals and hydrocarbons.
- Are natural products with an indefinite life.
- Can be installed onto a variety of substrates including; concrete, rock-face, compacted sub-base, shutters etc.
- Can also be installed onto uncured or wet substrates, and be installed in any weather conditions.
- Are able to self heal when cut or damaged.
- Are British Board of Agrément (BBA) Approved (Cert. No. 97/3337, 2<sup>nd</sup> Issue).

## INSTALLATION ADVANTAGE

Joining two sheets of Rawmat® could not be more simple. The nature of Rawmat® enables a self sealing joint to form at all laps without the need for the addition of bentonite between the joints.

The membrane can be simply trimmed and cut with a utility knife to fit around pipes, inlets, posts and other protrusions. Rawmat® has a unique solid form which can be cut without any loss of bentonite, ensuring a secure seal in all cases.

# Introduction

## PRODUCT OVERVIEW

### Rawmat® Type S Membrane

A geosynthetic clay liner comprised of a woven geotextile, a factory pre-hydrated sodium bentonite core and a non-woven scrim layer.

Core thickness: 4.6mm  
Nominal roll size: 1m x 5m or 2m x 30m  
Unit weight: 8.0kg/m<sup>2</sup>

### Rawmat® Type P Membrane

The same as Rawmat® Type S, but with a polypropylene fabric in place of the non-woven scrim. Rawmat® Type P is used under floor slabs in compacted sub-base applications.

### Rawpaste Mastic

Sodium bentonite paste used in a variety of detailing applications.

### Repair Mortar

Non-segregating, shrink-compensated, high strength mortar, for repair of surface defects and voids in concrete substrates and for treatment of pile caps.

### Rawseal® Internal Waterstops

- CJ2025  
A 20mm x 25mm high density bentonite waterstop. Supplied in boxes of 5m coils (5/box) and installed into preformed rebates within the concrete joint, or nailed/glued into position.

### Rawseal® External Waterstops

- TR35  
A triangular fillet high density waterstop used in all horizontal to vertical junctions, including those around pile caps and penetrations. Supplied in boxes of 1m strips (18/box).

### Protection Boards

Protection boards must be coreflute boards over lapped 50mm and taped together and mechanically fixed into position. All coreflute boards must be wrapped around internal and external corners.

### Back-Filling Materials

Includes sand and natural soil, free from stones larger than 15mm in size with a minimum of 25% fines. It is important that the back-fill has cohesive properties and can be compacted. Around the drainage coil, 6-15mm stones without fines should be used.

### Expansion Joints

Expansion joints must be custom designed to meet the specific stresses expected. Expansion joints which require the Rawmat® membrane to be compatible must be approved by WPS.

### Ultraplug™

A single component of hydraulic cement, selected silica sands, accelerators, and adhesion promoter.

### duroQIK

A water-based rubberized liquid membrane.



Waterstops come in two grades - Black and Green. Black waterstops should be used where delayed swell is required or when installing in salty/contaminated conditions.

## PRODUCT LIMITATIONS

Rawmat® Type S should not be used directly on compacted sub-base substrates as the bentonite may wash out through the light scrim. Rawmat® Type P should be used.

## STORAGE AND HANDLING

Products must be stored in a clean and dry location, free of material that may damage the products during storage. Keep rolls individually wrapped to ensure that they do not dry out.

Do not lift rolls by inserting forks under the rolls or by forcing the forks into the cardboard cores, as this will damage the membrane.



Prior to installing a roll, check that the wrapping is intact and that the material has not dried out.

## MANAGING THE INSTALLATION

It is important to adequately drain the area where the membrane is being installed. We recommend 150mm away from the tanking membrane and 200mm below the floor surface. To drain the area, dig a hole next to the installing area to position the pump. The hole should be deeper than the area to be drained. Use the pump to take water from the installation area. In large construction situations a full site dewatering system may be required.

Co-ordination between the membrane installers, steel-fixers and concrete contractor is important to minimise the likelihood of damage to the membrane.

WPS recommend that you brief the concrete contractors prior to concrete placement to ensure that they are aware of how the membrane works, and the importance of getting confinement.



Note that while dry substrates are not required it is important not to lay the membrane in standing water unless it can be covered immediately.

## COVERAGE AND CONFINEMENT

Rawmat® membranes must be covered each day by concrete (floor applications) or back-fill (wall applications), or if this is not possible, by DPC sheeting. This acts as a temporary protection to prevent the membrane from drying out, or swelling in the event of constant heavy rain.

Rawmat® must be confined in order to provide waterproofing protection. This confinement can be with a minimum 200mm concrete or 300mm compacted soil.

In hydrostatic situations where the floor slab is below the water table, an engineers calculation is necessary for specifying the required floor slab thickness, steel reinforcement and concrete strength.

Back-fill is placed in layers around the building, to the engineers requirements, and compacted to a min. 95% proctor.



Concrete cover should be vibrated in such a way to eliminate voids.

It is critical that the bentonite is fully confined so a fair-face finish in the concrete cover is required.



Pipes or services running through a floor slab should be positioned on chairs prior to pouring the floor. The concrete can then be placed over the membrane, confining it. Pipes or services coming out of the floor must be at least 50mm away from walls/columns so concrete can be placed behind, confining the membrane.

# Installation

## SUBSTRATE REQUIREMENTS

### Concrete / Blinding

Make sure that the concrete/blinding onto which the membrane is being installed is sound, smooth and clean.

Ensure all upstands and internal junctions have TR35 waterstop fillets installed with all sharp edges chamfered 45°.

Fill any voids over 10mm.

### Compacted Sub-base

Make sure that the sub-base is smooth and compacted with fines free from voids in excess of 10mm and free from items such as rocks and sharp stones that could tear the membrane.

Rawmat® Type P membrane should be used when installing onto compacted sub-base. Ensure the grey non-woven fabric is placed face down.

### Pre-cast Panels

For information on pre-cast concrete panels, see next page.

### Sacrificial Shutters or Steel Sheet Piles

Make sure the Rawmat® membrane is installed directly onto these prior to constructing walls, provided running water through the shutter/piles is purged.

### Concrete Blocks

Ensure that the mortar is pointed flush to provide a smooth surface where the tanking membrane will be subsequently applied. This will prevent water from tracking behind the membrane.

In all cases, all voids in excess of 10mm in the substrate shall be filled using the repair mortar, ultraPLUG™ or Rawpaste mastic.

### Construction Joints

Ensure all construction joints are tightly formed with the Rawseal Waterstop equally confined into each slab through the joint. Vibrate concrete to ensure maximum confinement.

### Cracks

Shrinkage or movement cracks in walls and floors must be tightly closed to ensure Rawmat confinement, repair any unacceptable or open cracks identified. Live cracks must be repaired to confine the Rawmat membrane.

### Slab Curl

Concrete slabs which are not cured correctly or remain with live external edges which may create concrete slab curl creating non confinement. It is important structural engineers ensure slab curl is avoided ensuring Rawmat confinement is maintained.

## FORMING LAPS

Laps in the Rawmat® Type S membrane, laps are formed simply by overlapping and walking down the lap, or Hilti nailing to form the overlap.

In salty or contaminated conditions, peel back the black scrim to give bentonite-to-bentonite contact in the lap area.

For the Rawmat® Type P membrane, peel the grey non-woven fabric back to expose the clay core and ensure direct contact with the black geo-textile. Ensure the grey non-woven fabric is peeled back the width of the lap (100mm) only.

Do not peel the grey non-woven fabric back more than the 100mm lap width.



When forming laps it is critical to ensure there is no debris or contamination in the lap area.

## INSTALLING FLOOR SLAB MEMBRANE

Ensure the excavation is well drained and free from standing water at all times, until the floor slab has been completed.

- Remove the film encapsulating each roll.
- Lay the rolls onto the blinding or compacted sub-base.
- On blinding substrates, make sure the membrane is rolled out with the black woven geotextile side facing up.
- When laying onto compacted sub-base, lay the Rawmat® Type P with the grey geotextile side facing down. Cover with 50mm blinding.
- Lap each roll using a minimum of 100mm overlap at the side and 150mm overlap at the end. Stagger the sheets of Rawmat® to prevent a concentration of laps at any particular point. Walk along lap areas to ensure good contact.
- Extend the Rawmat® a minimum of 150mm outside the perimeter of the building line and shutters, to enable a clean lap to be achieved when the vertical Rawmat® membrane is in place.



Protect this 150mm extension from weather/damage by wrapping the edge in a strip of polythene and cover with protective blinding, concrete or other suitable material.

## INSTALLING WALL MEMBRANE

Ensure walls are free from voids, dust and debris. Install the membrane with 100mm side laps and 150mm end laps, and pull the membrane tight to provide close contact to the walls.

Prior to fixing the wall membrane, place the Rawseal® TR35 waterstop on the horizontal membrane (at the floor-to-wall junction) and push tightly into the concrete. The lengths of TR35 should be butt-jointed and kneaded together to form a continuous length of fillet.

When installing directly onto the wall to be waterproofed, apply the vertical Rawmat® Type S membrane with the black woven geotextile outermost and the thin perforated scrim side against the concrete.

When installing onto sacrificial shutters or onto the rock face, make sure that the thin perforated scrim is outermost and the black woven geotextile is in direct contact with the shutter/rock face.

Install the vertical membrane horizontally around the structure ensuring the first sheet extends 150mm out over the TR35 waterstop and under slab membrane.

Fix the membrane by using masonry nails and 30mm washers or trackmaster gun washers and pins, or Hilti nails and washers fired through a 75mm x 75mm hardboard pad as a washer. Fix all nails or pins 150mm below the top of each sheet. This will leave sufficient membrane to ensure an overlap from above. On subsequent rows make sure the upper sheet overhangs the lower sheet by 100mm, place additional fixings through the joint to secure.

Where the membrane is installed directly to the rock face and the wall constructed against it, ensure the membrane is protected from drying out by covering with polythene during fixing of the rebar. Remove polythene sheet immediately prior to pouring the concrete.

### Shotcrete walls

The formation of a shotcrete substrate and as confinement concrete for Rawmat a special specification is to be developed specifically for the project.

### Considerations

There should be no water leaching from the shotcrete Substrate at the time of Rawmat membrane installation.

An engineer to calculate shotcrete which will confine the Rawmat thickness and strength directly relating to hydrostatic pressure and any other relevant elements for the shotcrete substrate and for the confining shotcrete.

It is important an experienced nozzleman applying the shotcrete fully understands the confinement requirements, issues like shadowing, hand packing behind beams and metal structures ensuring no areas remain unconfined. Shotcrete droppings are removed at the wall floor junction so an excellent bond is made. The shotcrete specification is correct and is not diluted with water for convenience of application.

The shotcrete must be of a standard to confine Rawmat Membrane with out having live cracks form. If any live or open cracks form these must be confined immediately with a repair system such as 996 injection or similar.

## INSTALLING ONTO PRE-CAST PANNELS

Have the panels delivered to site and located where the membrane can be installed. Cut the Rawmat® to the size of the panel allowing for 100mm side laps and 150mm end laps.

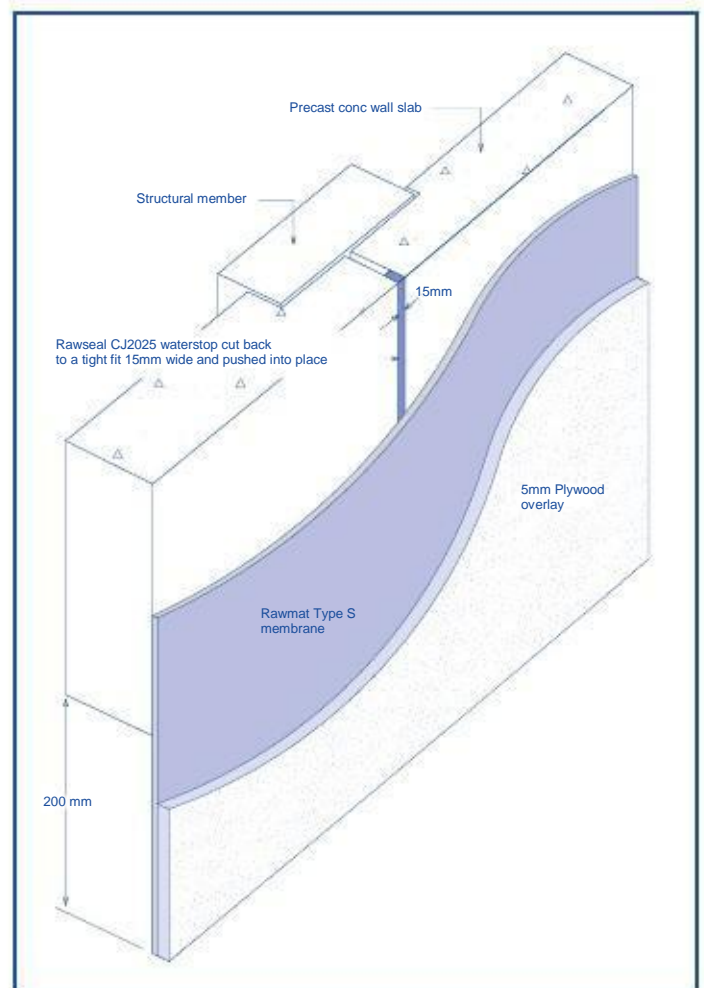
Place the membrane and fix to the panel using Hilti/Ramset masonry nails and washer. Mechanically fix coreflute boards over the Rawmat® prior to lifting the panel into place.

Install a CJ2025 waterstop between the panel and foundation slab, ensure the waterstop is thicker than, and higher than the shim height to guarantee connection.

Lower the panel into position, seated and located on shims and held permanently into position.

Ensure the membrane extends 150mm below the bottom of the panel and ensure an intimate junction with the under slab membrane. Also ensure side laps are effectively created with the adjacent panel. Use mastic in the lap areas to help ensure that sound laps are formed.

Make sure the vertical tilt slab joints have a waterstop (CJ2025) installed before forming the stitch-joint.



# Installation

## DRESSING PILE CAPS

Clean off all dirt and debris and apply a 2mm thick layer of Rawpaste to the first 100mm face of the pile. Place a length of TR35 waterstop around the pile and push into Rawpaste, moulding into the contour of the pile circumference.

## VERTICAL MEMBRANE TERMINATION

Cut strips into the Rawmat® so the membrane fans out when pushed into the face of the pile cap. Press into the Rawpaste. Repeat from the opposite side of the pile, allowing for a 150mm overlap of the two sheets. Trim the membrane to the pile and discard off-cuts. Apply an additional layer of Rawpaste to seal all cuts in the membrane.

If the membrane is to be terminated at ground level, trim the membrane to a minimum of 100mm below the finished ground level. Apply duroQIK liquid rubber membrane to substrate as a transition membrane from 200mm below the top of the Rawmat termination point to above ground level terminating beneath external cladding. Coat the exposed duroQIK with duroTUF membrane. Turn the Rawmat® membrane vertically up the face of the concrete wall or up-stand and continue over the liquid flashing material. Fix the membrane with Hilti nails or drill / plug fixings through a rigid termination bar of galvanised steel or aluminium. Make sure the fixings are at 200mm centres and the bar is placed at the top of the membrane.

If using proprietary polyethylene DPC, dress same into brickwork and drape down over the Rawmat® prior to fixing of membrane. the termination bar. Then fix the termination bar through the Rawmat® and DPC.



Waterstops must be installed in all construction joints. CJ2025 is used in any internal construction joints. Use RC50 in any external construction joint.

## PIPE PENETRATIONS

Secure the pipe or duct firmly within the shuttering. Wrap a length of CJ2025 around the pipe centrally within the wall and fix into place.

Once the concrete has been poured and shuttering struck, wrap a length of TR35 around the circumference of the pipe, against the face of the concrete wall. Apply Rawpaste around the penetration and the waterstop.

Place a collar of Rawmat® membrane over the pipe, black geotextile layer outermost. Make sure the collar is 300mm wider than the diameter of the penetration.

Apply Rawpaste liberally over the collar and install the main Rawmat® sheet by making a star cut in the sheet and feeding over the pipe. Apply more Rawpaste.

Where pre-cast panels have penetrations installed afterward, contact WPS for a job specific detail.

## INSTALLING CONSTRUCTION CAPS

Tightly butt-join lengths of waterstops, kneading joints to ensure a continuous strip. Ensure the waterstop is located within the pre-formed rebate. Where no rebate has been formed, nail into place so the joints cannot be dislodged when concrete is poured.

Locate waterstops 50mm from the rebar to allow 50mm of concrete cover. This will provide adequate confinement of the bentonite. Call WPS if 50mm cover is not possible.

Cover the construction joint with 500mm wide lengths of Rawmat® membrane, centred over the joint and with the black geotextile outermost.

Ensure the back-fill is thoroughly compacted against these construction joints.

## BACK-FILL AND DRAINAGE

Use soil, sand or aggregate and compact in layers to a minimum of 95% proctor. Note that ideal back-filling materials comprise fine granular with 25% fines or cohesive soils which compact easily.

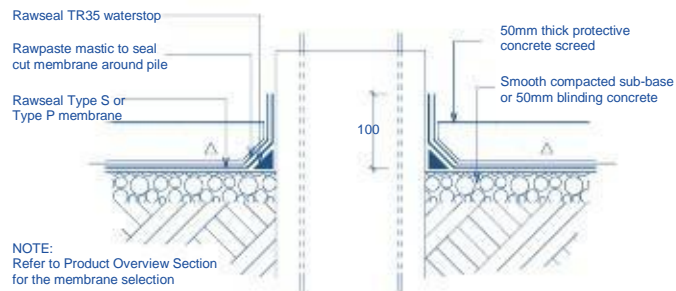
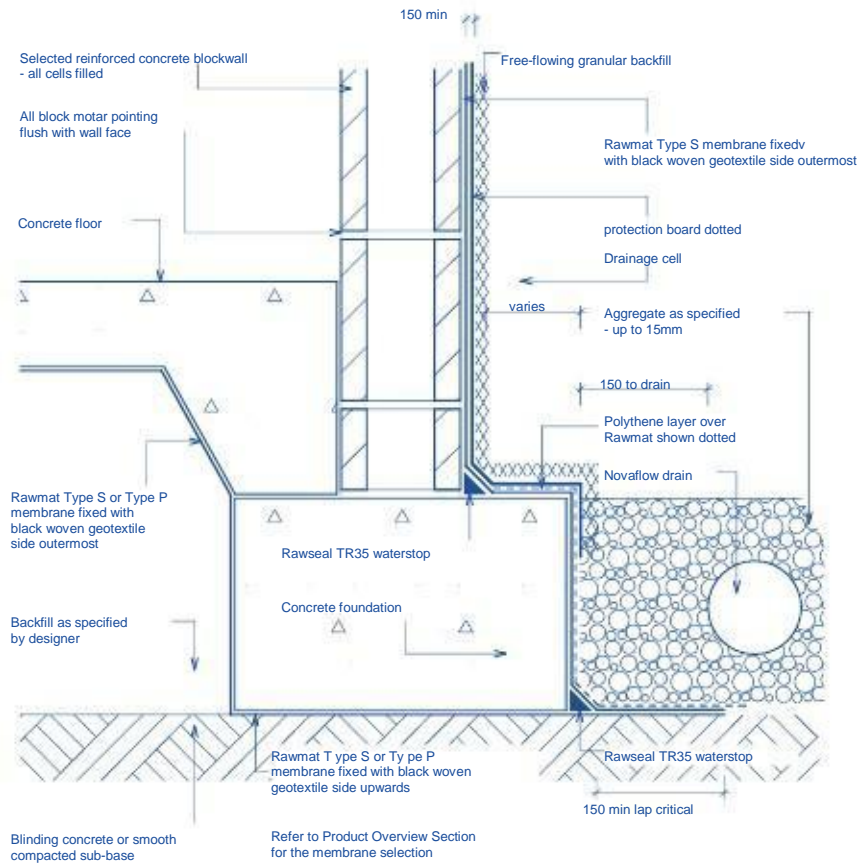
When back-filling wall installations, work horizontally around the building to make compaction more effective. If good compaction is not possible, install a rigid protection board to the ensure equal distribution of the necessary confinement to the membrane.

A compliant drain must be installed around the perimeter of the building. Ensure that the drainage system is sufficient to effectively remove anticipated water volumes on the site. Ensure the drain is positioned below the footing or 150mm out from the Rawmat® membrane and make sure it cannot be pushed back against the membrane during back-filling. Install a plastic sheet between the drain and the Rawmat® membrane.

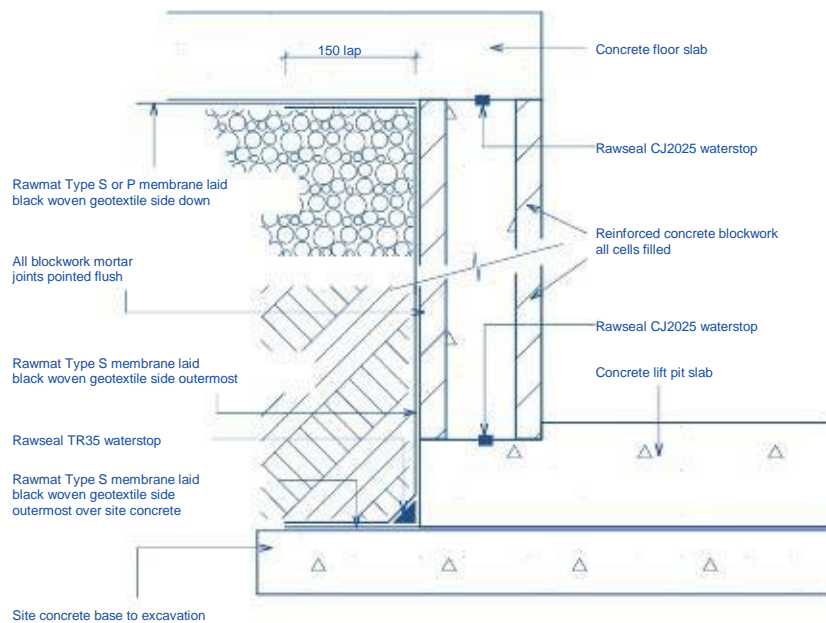
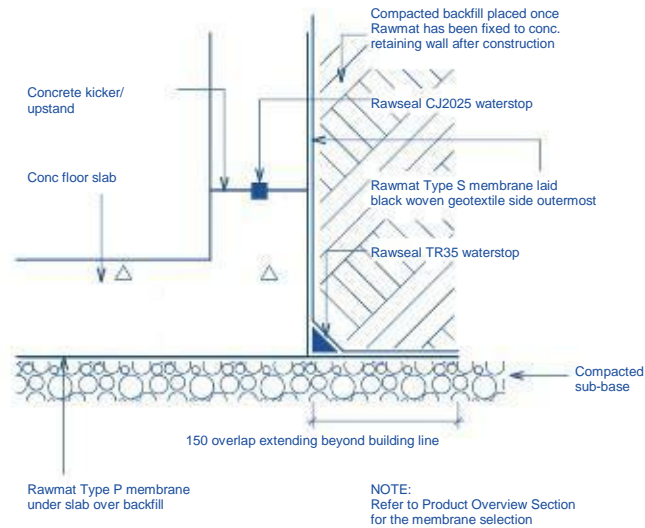
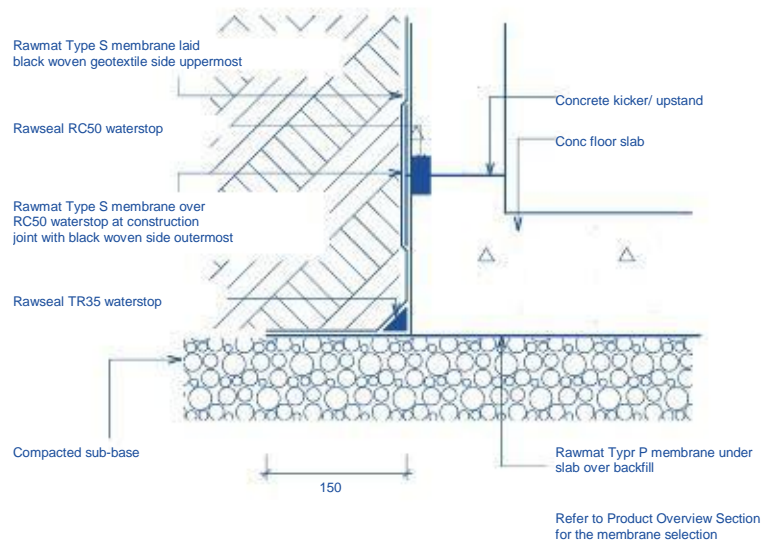


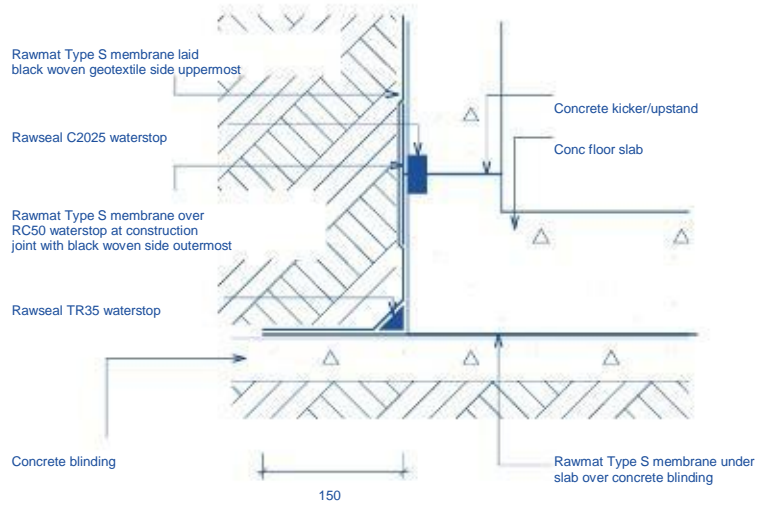
Ensure the drain is kept at least 150mm from the membrane to prevent wash-out of the bentonite.

# Detail Drawings

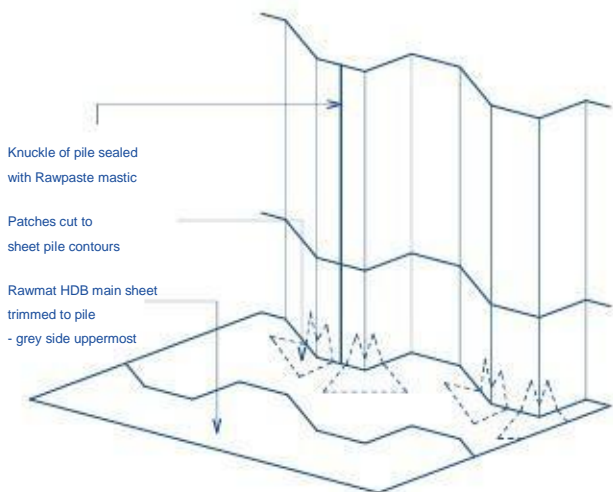
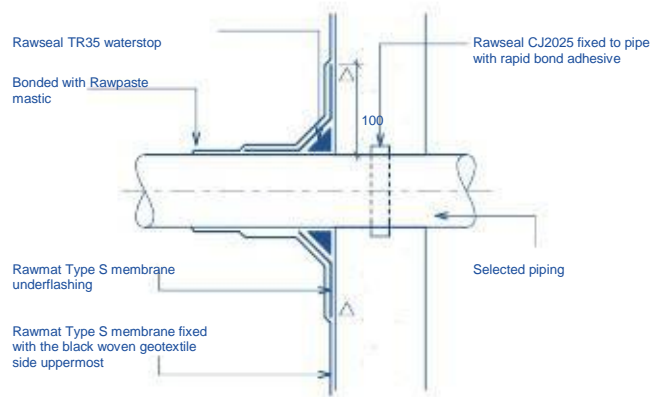


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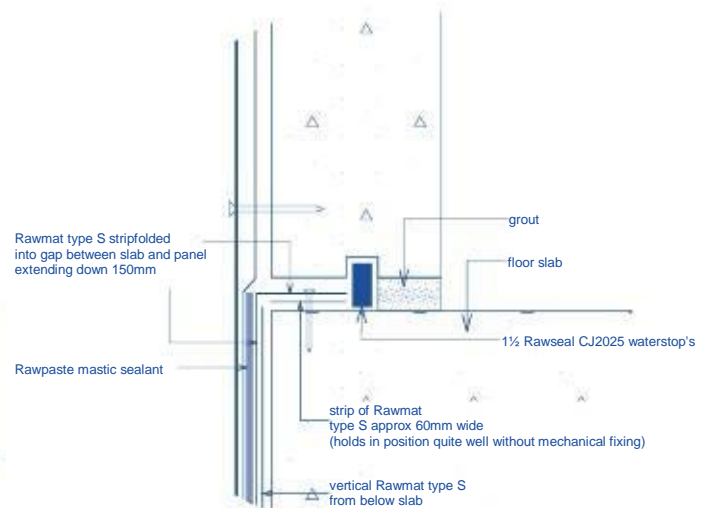
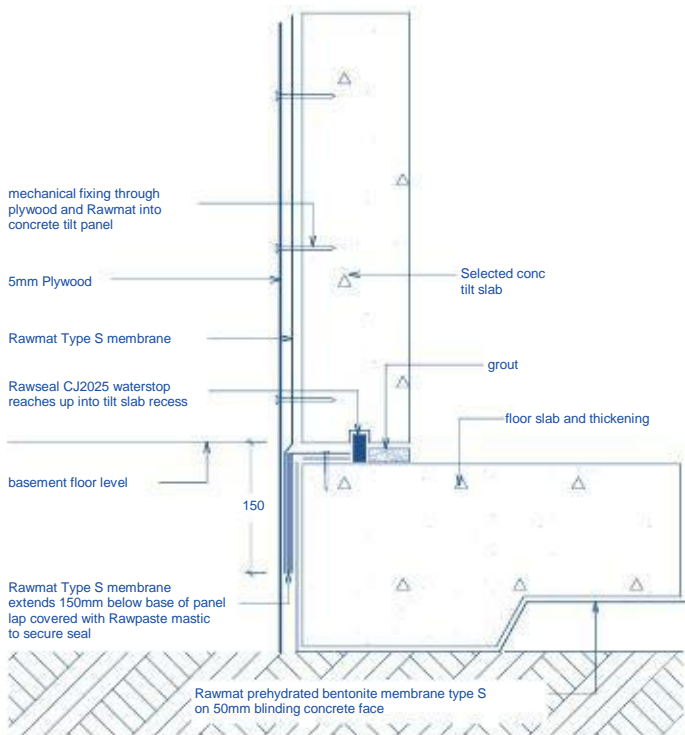
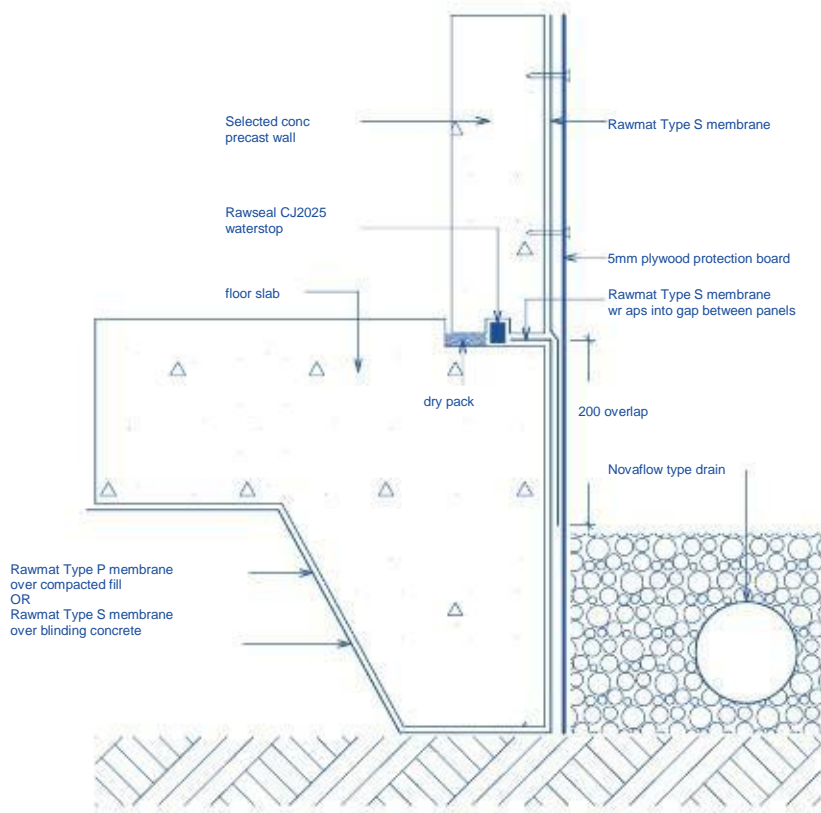


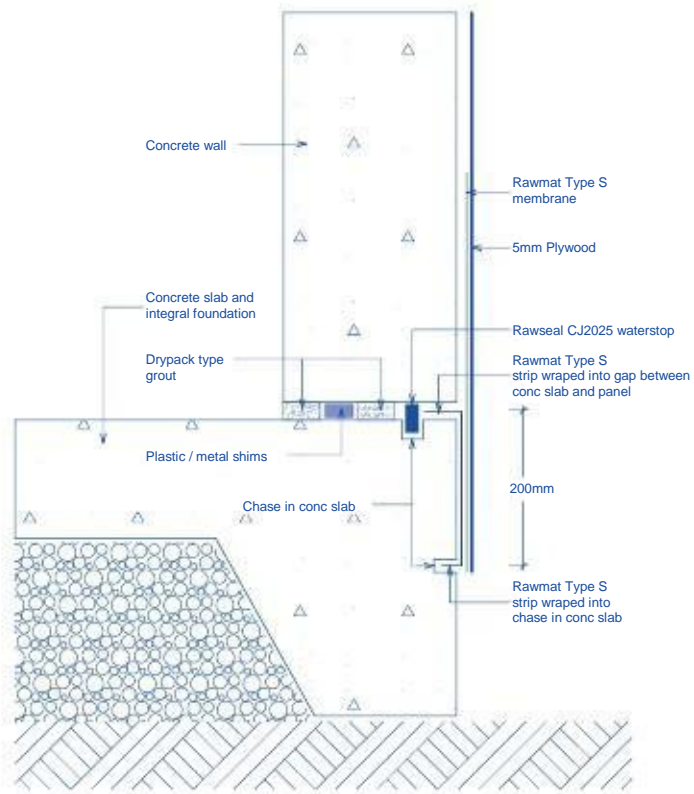
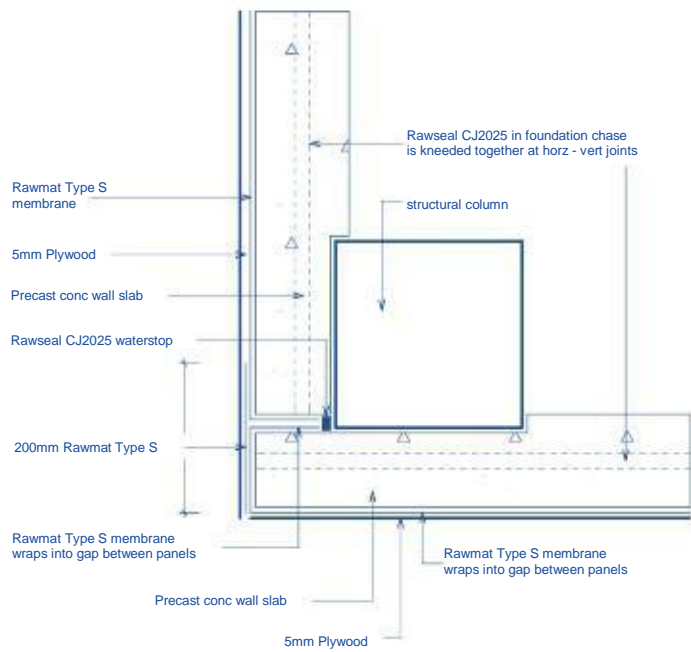


Refer to Product Overview Section for the membrane selection

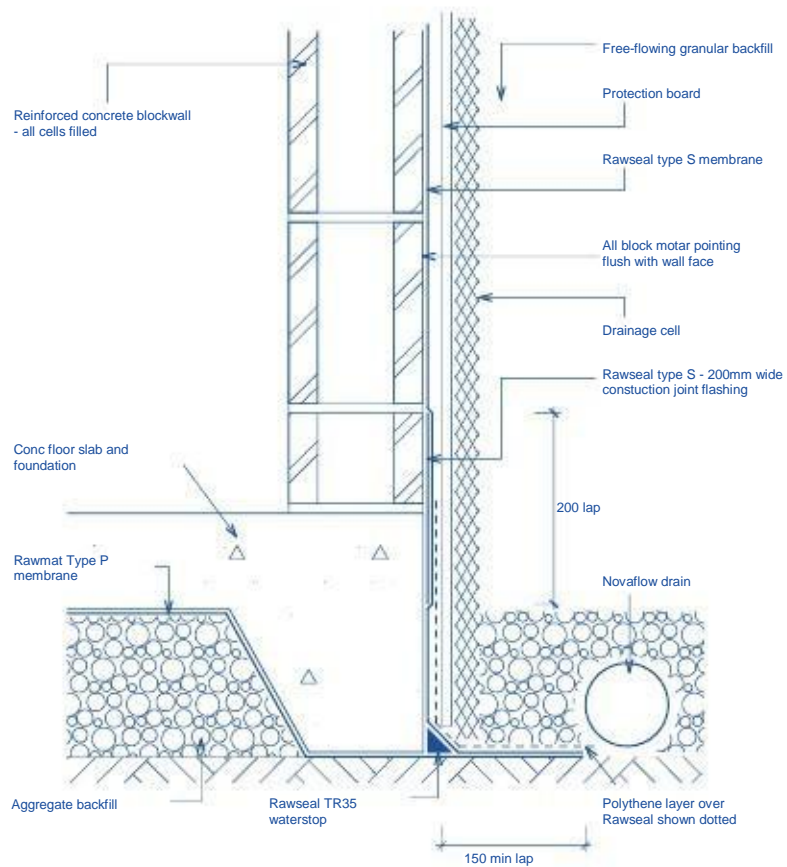
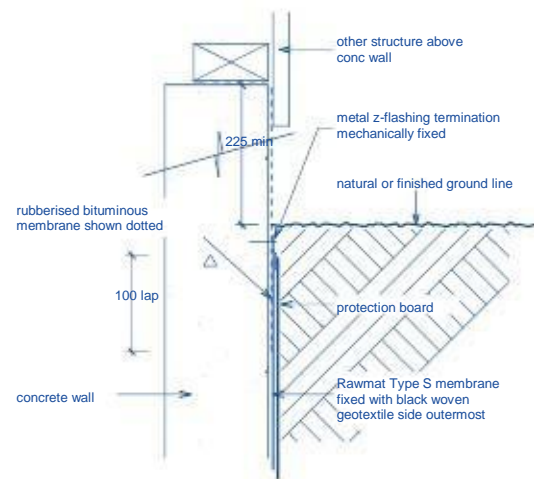
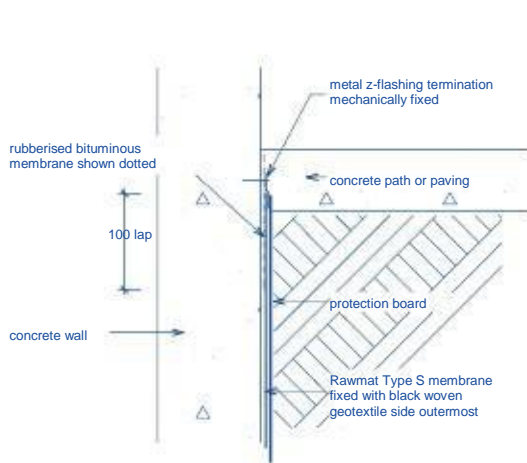
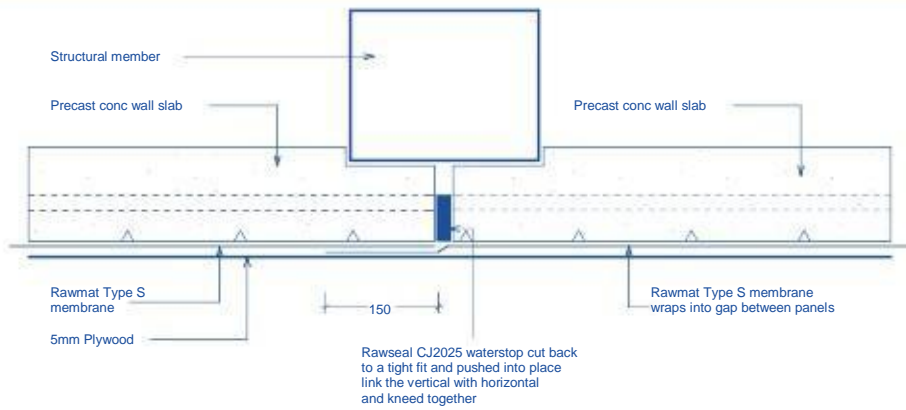


# Detail Drawings





# Detail Drawings



# Quality Control

## concrete substrate readiness checksheet

Project Name: \_\_\_\_\_

Subcontractor: \_\_\_\_\_

Area ready: \_\_\_\_\_

Fax Number: \_\_\_\_\_

Smooth, clean surface. Repair any soft or poor condition concrete

Cavities and cracks filled with stop repair mortar

Mortar fillets to all internal corners

Radius all external Corners

If terminating into a chase, pre-form the chase and ensure that it is straight and 20mm deep

IF terminating with compression termination bar – ensure fixing is through the Rawmat membrane also confining the rawmat tightly

Ensure all steel work is covered by concrete, no reinforcement steel is seen on top surface of concrete (vertical rebais exempt)

Coloum detailing for the Rawmat concrete floor poured is suitable

Concrete block wall mortar is pointed lush

When the substrate is ready, complete this form and fax to the Waterproofing Subcontractor

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# Quality Control

## BENTONITE TANKING QC SHEET

Project Name: \_\_\_\_\_

Sign-off below by: \_\_\_\_\_

Area covered by QC sheet: \_\_\_\_\_

Date: \_\_\_\_\_

Rawmat® tanking installation item	Comply Y/N	Sign-off (Initials)	Comments
Concrete substrate clean, sound and free from foreign matter.			
Substrate smooth with all voids over 10mm filled.			
Concrete block substrates and panels pointed flush.			
Compacted sub-base firm and free from sharp objects and voids over 10mm.			
Rawmat® Type P membrane used in compact sub-base applications.			
TR35 waterstop installed to up-stands, and corners chamfered 45°.			
Waterstops to all construction joints as per specification and located 50mm from rebar.			
Movement joints identified and installed to approved specification/detail - approved drawing attached.			
Under slab membrane extends 150mm beyond footing and is in sound condition.			
Under slab 150mm extension fully protected while wall construction takes place.			
Membrane laps staggered to prevent build up of laps.			
Membrane installed with light scrim against the surface to be waterproofed.			
Side laps 100mm and end laps 150mm with no foreign matter in the lap areas.			
All penetrations installed to specification including under/overflashings, using Rawpaste and waterstops.			
Floor services and pipes positioned to give full cover of concrete.			
Floor-to-wall junction installed to specification including TR35 waterstop.			
All non-standard details installed as per pre-approved specification - approved drawing attached.			
Any mechanical damage to membrane repaired to specification.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Rawmat® tanking installation item	Comply Y/N	Sign-off (Initials)	Comments
Vertical membrane fixings to specification with laps facing right way, preventing entry of debris.			
Concrete contractors briefed, areas of concern re confinement highlighted.			
Concrete placed giving full cover and vibrated.			
Membrane termination installed to approved detail.			
Membrane covered in a timely manner and to specification.			
Back-fill staged around walls and compacted in segments to specification.			
Back-fill quality to specification. Minimum 25%			
Suitable drainage system installed below footing and correctly located away from membrane. Minimum 200 below floor and 150mm away from wall.			
Membrane protection boards installed correctly. Coreflute Overlapped 50mm and Tapped to form a seal.			
Overall installation free from wrinkles and creases, and bridging across voids.			
Job sheet completed, recording area installed, date of installation and batch numbers used.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Issues to note or raised during installation:

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Remedial action required:

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Note of damaged areas repaired:

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