NURALITE

FLAT ROOFS | BUILT RIGHT

Flat Roof Design Guide | V2

An up-to-date, impartial & comprehensive resource for designers in Aotearoa

TOITŪ CARBON ZERO

After promoting warm roof systems for years, this second edition celebrates the actual changing of the guard. The industry is now recognising, specifying, and investing in airtight, insulated membrane roofs. With a view to a healthier and more efficient future of warm roofs, we bid farewell to the condensation and ventilation of New Zealand's traditional cold roof.

EDITOR'S NOTE:

My pick of all the new material is the Floated Deck Design Chapter (Pages 81-94) and the section covering the challenge of our times to reduce carbon in construction - Climate Leadership & NZ Construction (Pages 13-18).

This Design Guide also takes a deeper look into the sustainability merits of reroofing and insulated roof systems. We have added more on TPO and single-layer systems, and a new tag where relevant: "MYTH-BUSTED!"

Joseph Nicholls
NURALITE - WELLINGTON

PS: All the enclosed content and extensive technical knowledge is available via our website live chat function, which are real people - experts, not robots!

NURALITE
FLAT ROOFS | BUILT RIGHT

Our Sustainability Pledge

Nuralite is New Zealand's leading flat roofing company.
As leaders, we pledge to provide sustainable, durable systems that form critical components in Zero-energy buildings.

We undertook our journey to create pathways for others to follow and pursue a Carbon Zero future. These principles are explained throughout this Design Guide, and apply to the whole Nuralite family:

NURALITE FLAT ROOFS | BUILT RIGHT
NURAJACK DECKING MADE EASY
OUTRIGHT Continuous Insulation

Nuralite is the first New Zealand company in the construction products sector to certify as Carbon Zero.

If Toitū or Net Carbon Zero is new to you, please see page 17 to learn what it means for our company and our customers. Or see our journey to becoming Carbon Zero on the Nuralite website.

TOITŪ CARBON ZERO

Built right, with a focus on our future

We are pleased to have had such positive feedback from our initial Flat Roof Design Guide, which we developed and released in 2017. Thank you for using it and for requesting this update.

In preparing this second edition of the Design Guide, we have drawn further on Nuralite's long experience in the design, installation and maintenance of membrane roof systems. In addition, we have drawn on our more recent learnings from an ever-changing landscape of industry demands and a widening array of both competitive offerings and advancements in membrane roofing technology.

At Nuralite, we pride ourselves on our leadership and integrity, our staff and our story as a New Zealand family orientated team. At the start of this new decade, we want to emphasise our shared industry obligation to "get it right" with the fundamentals of construction. This Design Guide gives you clear advice on our offering and contribution towards a smarter future in flat roof design and construction.

Specifically, we want to expand our already clear ecological values to prioritise legitimate steps to a Carbon Zero Nuralite operation. We are pleased to announce, through a rigorious audit process, Nuralite's commitment to Toitū Carbon Zero Certification. We encourage New Zealand businesses to step up and do the same, so we can all trust our commitments and actions amidst a wash of green claims. We believe that anything less than actual change and commitment is irresponsible and negligent.

Nuralite offers extensive consultation services regarding design, specification and material selection. Our services are delivered via a team of regional specialists, live chat online and our main centre offices. Since the last Design Guide we have moved to a larger warehouse in Mt Wellington and opened new warehouse facilities in both Wellington and Christchurch. Additional changes to our recently updated website, Revit files, and our compliance details, cap off this period of development and growth for Nuralite.

We look forward to working with you on your next project and in the decade to come. We hope you find this Design Guide a valuable aid to achieve optimum and future-focused design solutions.

Shane Clarke

GENERAL MANAGER

Grace Apartments by Cox Architecture and WSP

INTRODUCTION

Much has happened since the 2017 Flat Roof Design Guide was released. There have been many changes affecting the industry in relation to Building Code, CodeMark, BRANZ, Health and Safety, liability, façade engineering demands, fire concerns, climate emergency and more Council Request For Information (RFI's). Most notably: the design community is embracing the leap in performance offered by warm roofs.

We are also seeing more projects taking sustainability seriously, more green-rated outcomes and Living Building Challenge awareness. The second edition of this Design Guide responds to these current industry factors with the addition of a Floated Deck Design chapter and a Reroofing section.

Few elements of modern construction have such an effect on long-term environmental sustainability as the roofs over our heads. In addition to shielding building occupants from the elements and offering desired building aesthetics, a flat roof can provide a wide variety of functions critical to the sustainability of our urban and rural environments.

A carefully designed and specified modern flat roof can perform until the end of the century. Furthermore, this valuable surface area of our built environment can deliver significant benefits through the flexibility of outdoor space, clean energy generation, water retention and collection, positive atmospheric contribution and, with living roofs, habitat restoration.

This Design Guide covers the principles, challenges, risks, solutions, opportunities and considerations for best practice flat roofing in New Zealand. Designing and specifying with reference to this Design Guide will ensure successful, robust and sustainable flat roof solutions.

A flat roof can provide a wide variety of functions critical to sustainability

» Hidden Island House by Mason & Wales Architects

As well as this Design Guide, Nuralite has several other channels to help you to make informed design decisions.

- Live chat at **www.nuralite.co.nz** is a fast way to answer questions or peer review your details. Our service has real humans, not robots, answering your questions!
- Use the "Solution Flow" option at **www.nuralite.co.nz** to identify the best product solution and relevant technical details and specifications.
- Find the local Nuralite representative for your region and test out their knowledge and service.
- Check out our Education page where we have 30-minute Webinars covering many topics from this Design Guide.

RISKS & SOLUTIONS

Throughout this Design Guide, design **Risk(s)** are identified and best practice **Solution(s)** to these risk(s) are suggested. Where one field relates to another you will see:

» **ALSO REFER TO:**

NURALITE SOLUTIONS

NURALITE SOLUTION:
When you see this box, it is the optimum Nuralite system or design solution. For more information on any Nuralite recommendations visit **www.nuralite.co.nz** or contact our regional experts.

The principles and insight contained in this Design Guide are based on over 50 years of experience and expertise in New Zealand. We believe the knowledge and principles in this Design Guide are applicable for all flat roof scenarios in New Zealand, regardless of which product brands are used. To make this clear we have kept our own product recommendations separate as follows:

ECO NOTES

This icon helps you to quickly find sustainability related information.

FLAT ROOF MYTH-BUSTING

MYTH-BUSTED:
And a brief description of that myth.

The team at Nuralite encounter a variety of industry sound-bites that often need to be corrected. This can include ideas we hear from specifiers who are working hard to find a way through contradictory and misleading pitches about membrane roof systems. Where the content of this Design Guide sets the record straight, look out for this indicator:

NURALITE WEBINARS

Throughout 2020, Nuralite has been running a 30-minute Webinar every fortnight. The format is discussion-based and usually we have an architect or other expert join the panel. All of the Webinars are available for viewing on our website at **www.nuralite.co.nz/education** and throughout this Design Guide we will highlight Webinars where you can find more information.

LIMITATIONS

This Design Guide offers some important design principles and a range of typical scenarios. When a project reaches the stage of requiring detailed and technical precision, it is prudent to contact the selected supplier for review.
The Nuralite technical team offer a fast and expert review service of roof designs and specifications to ensure code compliance, warranty and knowledge of optimum product application.

» Ao Tawhiti Unlimited Discovery School by Stephenson & Turner Architects

NEW ZEALAND CONDITIONS

New Zealand has a uniquely demanding environment with very high UV exposure, gale-force winds, along with thermal, humidity and solar conditions that can shift numerous times in one day.

Some membrane systems have been inadequate in dealing with these harsh conditions. Poorly detailed or installed work on a New Zealand roof will not stand up to our conditions. Our designers must consistently look for product/system performance that has proven successful in New Zealand.

MYTH-BUSTED:
"This product is popular overseas so will certainly work in NZ"

Wanaka Sports Facility by Warren & Mahoney Architects

Risk(s): A product or system that is new to New Zealand and installed by inexperienced operators carries a higher risk of failure than a proven product installed by an experienced operator. The quality of imported products is often unreliable and their claims of success may be founded in climates and industries quite different to New Zealand.

Solution(s): Choose a product/system that is proven over time in New Zealand conditions. Ensure it will be applied by an experienced local installer. Claims of success overseas should be researched before specifying.

Climate Leadership & NZ Construction

NURALITE'S FOUR STEPS FOR POSITIVE IMPACT
TOITŪ – NET CARBON ZERO
ARCHITECTS DECLARE NZ

We support these initiatives as it is imperative now more than ever to start reducing carbon

CLIMATE LEADERSHIP & NZ CONSTRUCTION

We would like to think that this whole chapter has become a no-brainer in 2020. Four years ago we recommended the statement below, and we still stand by it.

> "2017: In a time of increased environmental awareness and urgency, clients and designers hold real influence and opportunity in realising their projects. Globally, the construction industry accounts for, and influences, over 40% of all carbon emissions and 30% of all landfill waste.
>
> This guide encourages roof systems that maximise efficiency and longevity and minimise environmental impact. It also considers how roofs can go beyond sustaining a depleted environment and give a positive or restorative ecological contribution."

Since then Nuralite has backed our message with action and we have recently become Toitū Carbon Zero rated to start the new decade.

2019 saw many great carbon initiatives including "A Zero Carbon Road Map for Aotearoa's Buildings" by New Zealand Green Building Council, Toitū and Architects Declare NZ. We support these initiatives to ensure the 2020's see the slashing of carbon use in the industry.

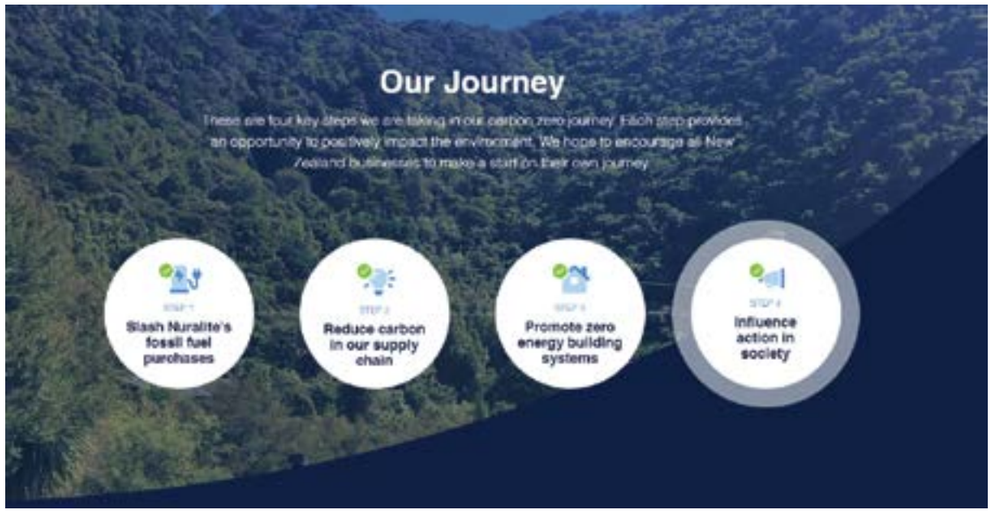
ECO NOTE: Nuralite is the first construction products supplier in New Zealand to achieve Toitū - Carbon Zero

Oliver's Ridge by Team Green Architects

NURALITE'S FOUR STEPS FOR POSITIVE IMPACT

Our role has become broader than just suppling quality waterproofing products. Nuralite is committed to operating in a way that is sustainable and has a positive impact on the environment.

We have made a deep commitment to change how we operate. To do this we have adopted a 4-step model. The great news is that this process is simple to follow by any business.



If every company embraced this process, New Zealand would immediately make huge progress toward becoming Net Carbon Zero

NURALITE CHALLENGE: We must all act now! What have you and your practice done to make a real difference in carbon pollution? How can you apply pressure on your clients and suppliers to dramatically reduce their carbon pollution?

Breamtail House by Studio2 Architects

Step 1: Identifying fossil fuel that is purchased directly and taking steps to reduce, and cease usage. At Nuralite this involved committing to a rapid replacement of our fleet of cars to 100% electric vehicles and swapping forklifts from gas to electric.

Step 2: Observing the supply chain, and identify areas of high carbon usage, seek ways to limit this carbon usage. Freight and air flights make up most of this category for Nuralite so we made changes to reduce our consumption of these. For example, we invested in warehouses in Christchurch and Wellington so that we can ship directly to customers in these markets. This change cut carbon usage from road freight by 15%.

Nuralite has increased the quantity of stock held in New Zealand to try and eliminate the use of air freight which has a large carbon cost.

Step 3: Analysing our products and the ways they are used. This step is where large impacts can be seen. Could we be distributing more sustainable products and are they being used optimally? This step reinforces our commitment to warm roofs – if every property had quality insulation we would go a long way toward having zero-energy properties in New Zealand. More comfortable, healthy, low-energy homes is a great goal that we want to work towards.

Step 4: Providing support to organisations who are promoting better building practices. Nuralite is part of a wider community pushing for change and we will provide active support.

View the Nuralite Net Carbon Zero Webinar for more information.

TOITŪ – NET CARBON ZERO

We are proud to have been awarded Net Carbon Zero certification by Toitū, as proof that we are accurately measuring, reducing and finally offsetting the residual greenhouse gas footprint of our business.

Nuralite is the first construction products supplier to get certified by Toitū – we hope we are the first of many.

ARCHITECTS DECLARE NZ

The Architects Declare initiative (nz.architectsdeclare.com) lists many important principles for designers.

Signatories can help the cause by asking suppliers to also do what it takes to meet the goals under the principles of Architects Declare.

Here is a table that sets out what Nuralite is doing to support Architects Declare.

Architects Declare	Nuralite
• Raise awareness of the climate and biodiversity emergencies and the urgent need for action among our clients and supply chains.	• Nuralite is committed to its role highlighting pathways to carbon zero with the construction sector. This has resulted in real change internally and with partner companies.
• Advocate for faster change in our industry towards regenerative design practices and a higher governmental funding priority to support this.	• For the regenerative design of living roofs, Nuralite offers the Nuraply 3PG system.
• Share knowledge and research to that end on an open source basis.	• Nuralite is transparent about changes it has made with a view to encouraging others to follow.
• Evaluate all new projects against the aspiration to contribute positively to mitigating climate breakdown, and encourage our clients to adopt this approach.	• Our warm roofs are robust and durable systems which are also vital to meeting the goal of zero–energy buildings.
• Upgrade existing buildings for extended use as a more carbon–efficient alternative to demolition and new build whenever there is a viable choice.	• Upgrading the current stock of buildings so they are more fit–for–purpose, instead of demolishing them is critical. Nuratherm warm roofs can be retrofitted to membrane and metal roofs to extend life and improve building performance.
• Encourage life cycle costing, whole–life carbon modelling and post-occupancy evaluation as part of our basic scope of work, to reduce both embodied and operational resource use.	• Became Toitū – Net Carbon Zero certified - reducing both embodied and operational resource use.
• Adopt more regenerative design principles in our studios, with the aim of designing architecture and urbanism that goes beyond the standard of net zero carbon in use.	• Flat roofs are the best option for green buildings. They can be used for energy production with solar panels, storm water reduction with green roofs or additional usable space with roof decks.
• Collaborate with engineers, contractors and clients to further reduce construction waste.	• Net Carbon Zero certification includes waste reduction. Nuralite has lowered its waste stream and is working with customers to reduce construction waste.
• Accelerate the shift to low embodied carbon and non-toxic materials in all our work.	• Net Carbon Zero certification means that Nuralite has actively worked to ensure from the factory to the project site net zero carbon is created. Our key products are all non-toxic and have Environmental Product Declarations.
• Minimise wasteful use of resources in architecture and urban planning, both in quantum and in detail.	• Try our new software to optimise the layout and ordering of warm roof products to reduce wastage on site.

Table 01: **NURALITE'S GOALS ALIGNING WITH ARCHITECTS DECLARE PRINCIPLES**

View the Nuralite Architects Declare Webinar for more information.

Design for Rooftop Sustainability

FLAT ROOF V. PITCHED ROOF
ROOF RENEWAL & SPECIFYING FOR 90 YEARS
THE RED-LIST
ROOFTOP SOLAR
GREEN ROOFS / LIVING ROOFS
BALLAST ROOFS / BROWN ROOFS
HIGH R-VALUE ROOFS & PASSIVE HOUSE PRINCIPLES
ROCKWOOL INSULATION

Green options that can make a flat roof come to life

DESIGN FOR ROOFTOP SUSTAINABILITY

While membrane systems are steadily evolving to meet the demands of greater waterproofing integrity, flat roofs also present innovative opportunities for enhancing the environmental sustainability of our built environment.

Each generation of construction and design needs to challenge the standard and go further to help rebalance our impact on the environment. This section offers some simple design options that can make a flat roof come to life and give a positive or restorative ecological contribution.

Challenge the standard & go further to help rebalance our impact

» Breamtail House by Studio2 Architects

FLAT-ROOF V. PITCHED ROOF

All roofs serve the primary function of preventing water ingress and shedding rain. There are three main aspects which support the argument that designing a flat roof is “greener” than defaulting to a pitched roof. These are as follows:

1. **Airtight Efficiency:** A pitched roof design will introduce airflow into the attic/roof space. This can be an unintended cause of inefficiency in the building performance over time. A flat roof system can eliminate the air leakage concern by removing the ventilated roof space altogether.

   This logic applies to warm flat roofs because a cold roof needs ventilation which compromises the thermal efficiencies of an airtight enclosure.

   » **ALSO REFER TO:** Warm Roof - Why It Matters on page 33.

2. **Green Receptivity:** A flat roof is significantly more receptive to the installation of green components such as solar panels, green/living roofs and urban agriculture. A flat roof remains flexible for these elements to change and adapt over time.

   » **ALSO REFER TO:** Rooftop Solar on page 24 and Green Roofs / Living Roofs on page 25.

3. **Multi-Functional Space:** A flat roof can be utilised by building occupants for many outdoor activities. From basic outdoor decking, to gardening, hot tubs and bars, rooftop activity is a growing niche that becomes a valuable and functional space for building users. Again, the flat roof is flexible for the life of the building and comes without the impact or cost of using additional planetary surface area.

   » **ALSO REFER TO:** Floated Deck Design on page 81.

ECO NOTE: To ensure the new flat roof can be used as a multi-functional space for decades to come, the design should allow for easy access and edge balustrades.

MYTH-BUSTED:

“You can’t beat a regular old metal roof”

Designing a flat roof is “greener” than defaulting to a pitched roof

ROOF RENEWAL & SPECIFYING FOR 90 YEARS

The lowest carbon building is the one that is not built. Recycling, repurposing or renewing existing buildings is an excellent way to get more use out of the embodied carbon of the existing structure, lower the energy used by the inhabitants of the property and prevent expending more carbon on a rebuild.

In tracking the life cycle of resources and materials, it is pertinent to avoid the linear path that leads directly to landfill. Before “closing the loops” and recovering or repurposing resources, it is important to maximise the lifespan of a construction material while in its original use.

Some building elements last longer than others. We expect foundations to outlast the interior fitout. Similarly, some roof membranes will need replacement sooner than others.

This chapter is included because Nuralite maintains that a long-lasting outcome is one of the best ways to add sustainable value to any specification choice. We also want to explain the extended 90-year renewal cycle that Nuraply 3PM manufacturers work to in Europe.

Two renewals of the original system will keep all materials in service for up to 90 years, which is considerably longer than most exterior waterproofing. It makes for greater efficiency in recovering all three generations at once.

0-30 years: The original two-layer Nuraply 3PM system.

30-60 years: The first renewal is installed over top of the original.

60-90 years: A second renewal is directly overlaid.

NURALITE SOLUTION:

Consider anticipating future membrane renewals when detailing the original roof, including junctions to other building elements. The above 90–year model relates specifically to the **Nuraply 3PM** system.

It is important to maximise the lifespan of a construction material while in its original use

THE RED-LIST

After designing to ensure that minimal carbon is expended in the scope, materials, construction and operational requirements of a building, the design will have a reduced contribution to global warming.

Another important environmental design consideration is the ecological impact of toxic ingredients in construction products.

Red–Listed building materials contain chemicals that have been designated as harmful to living creatures, including humans, or the environment. The LBC Red-List is set up by The Living Future Institute as one aspect of evaluation towards the Living Building Challenge. They also have established the transparency label – Declare.

Risk(s): The words “Red-List free” are easy to write and difficult to establish. Focusing on the toxicity specification alone can distract from the carbon elephant in the room.

Solution(s): Ask suppliers if a third party is verifying Red-List free status for reliable transparency. Address Red-List free status as one important factor of many required to build sustainably.

NURALITE SOLUTION:

If being Red-List free is a chief factor for a project, the Nuraply TPO membrane and PIR have Declare Red-List free status, and at the time of writing is the only roof membrane globally to hold this level of transparency. The Nuraply 3P range of membranes is confirmed LBC Red-List free by the manufacturer.

As well as Red-List free information, Nuralite products have the transparency of EPD (Environmental Product Declarations) and for carbon analysis beyond the factory gate, we have a full Toitū inventory of emissions covering freight both internationally and within New Zealand.

MYTH-BUSTED:

“Our supplier has self-declared and that’ll do just fine”

ROOFTOP SOLAR

Flat roofs can accept solar panels easily, whether at the time of construction or at a later date. A flat roof also gives optimum flexibility for the orientation of the solar array. In New Zealand latitudes, we need to pitch the solar panels toward the north for optimum solar capture. Site parameters and building orientation will often mean a pitched roof cannot support that direction and future installations will then have reduced efficiency with solar energy capture.

Design considerations for rooftop solar

- Avoid roof designs where one portion of the roof shades another.
- Avoid complex roof geometries that create valleys or gutters where solar arrays may be located.
- Future-proof the substrate engineering to support future additions of green elements such as: a green roof, floated deck or water retention.
- Choose a durable roofing material to avoid the need to remove the solar panels for reroofing or maintenance.
- Consult your solar array specialists to ensure optimised integration with roof design and future solar installations.

NURALITE SOLUTION:

The Nuralite Fixing Plate is a factory-waterproofed structural node that allows the fast, clean and slim fixing point for solar array frames. It comes with a **Nuraply 3PM** membrane skirt ready to be integrated into the roof.

Nuralite Fixing Plate

ALSO REFER TO: Flat Roof Penetrations on page 73 and Nuralite Goose-neck For Cable Penetrations on page 74.

View the Penetrations & Fixings Webinar for more information.

Viaduct Events Centre by Moller Architects

GREEN ROOFS / LIVING ROOFS

Green roofs or living roofs are an obvious, visible and celebrated device in sustainable design. They offer both ecological advantages and some design challenges.

Living roofs can provide aesthetic green space that visually softens the built environment. In addition, designing greenery into human environments is also proven to help the mental and physical health of people. Green roofs are a successful component in sustainable management of stormwater systems, as covered in the next section.

Northland House by Bossley Architects

Green roofs are also beneficial to a building's performance as they can absorb thermal energy and reduce fluctuation because of solar gain. The green roof layer also protects the roof membrane beneath from the extremes of the elements.

Green roofs can affect structural engineering, construction budgets and maintenance needs. They also might require an irrigation system to stay alive through dry spells.

It is useful to explain the above long-term benefits to clients so that the green roof is prioritised and remains specified through the entire design and estimation process.

ECO NOTE: Ecosystems and layers of biodiversity are displaced when buildings and roads are built. This particularly impacts ecology in towns and cities. Living roofs can provide pockets of habitat and conditions for ecosystems to extend back into the urban setting.

TYPES OF GREEN ROOFS

Intensive green roofs

Intensive green roofs are essentially roof gardens. They are most often designed for public access with high visual and recreational amenity. The vegetation options can be designed to allow shrubs and trees; however, the cost of these roofs is high.

Intensive green roofs require more soil depth and, when saturated, can get very heavy. In some cases, structural loading costs can be prohibitive. Maintenance of these roofs require careful consideration and planning, with irrigation of intensive green roofs often being needed.

Semi-intensive

Semi-intensive green roofs can have varying depths of substrate and generally have elements of both intensive and extensive roof design. Vegetation can include shrubs, grasses, sedums or mosses.

Extensive

Extensive green roofs have a shallow substrate and are generally cheapest to install. They have the lightest weight and as such are generally the most favoured option for retrofitting a living roof onto an existing building.

Extensive green roofs are commonly planted with sedums, mosses and grasses that are able to thrive in a shallow substrate and require minimal maintenance and irrigation.

FACTOR	Intensive Green Roofs	Semi-intensive Green Roofs	Extensive Green Roofs
Substrate	150mm-1500mm	150mm-500mm	20mm-150mm
Vegetation	trees, shrubs, grasses	shrubs, grasses	grasses, succulents, mosses
Cost	high	moderate	low
Structural Loading	high	moderate	light, generally suitable for retrofit
Maintenance	high	moderate	low
Saturated Weight	high	moderate	low

Table 02: **GREEN ROOF FACTORS**

Whichever system is selected, it is important to have a specific engineering design for the structure and to employ green roof specialists for the installation of the soil substrates, plants and irrigation.

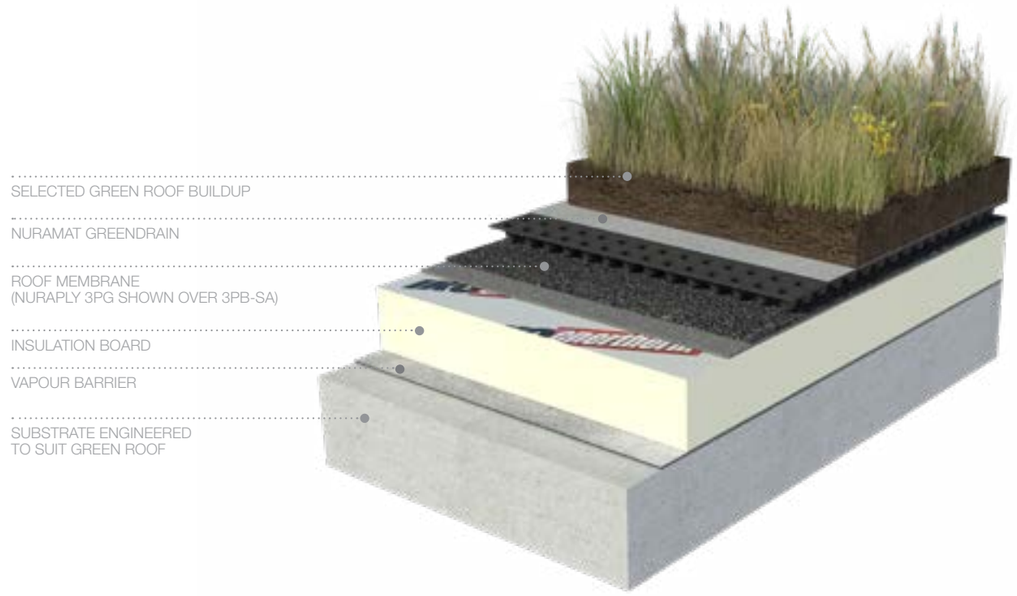


Figure 01: **GREEN ROOF SYSTEM. TYPICAL BUILDUP OF SEMI-INTENSIVE GREEN ROOF OVER NURAPLY 3PG MEMBRANE AND NURATHERM WARM ROOF**

GREEN ROOFS & STORMWATER RETENTION

Effective stormwater management is a concern in our cities. Many existing urban drainage systems were designed long ago and are operating at, or beyond, their ideal capacity. Green roofs are a useful component of a sustainable drainage system.

An intensive green roof will soak up 70% of water from a typical New Zealand rainstorm before it is released back into the environment by evaporation. The water that is not caught in the green roof is delayed on its path into the stormwater system, typically some time after the initial and peak deluge.

If a sustainable drainage or low-impact design approach is taken as part of a development, it ensures the site is not increasing surface water flood risk or polluting the environment.

In projects with landscape elements, stormwater from the roof can be integrated into sitewide surface water treatment wetland design.

NURALITE SOLUTION:

Nuraply 3PG membrane is manufactured to perform as the waterproofing layer in any green roof design. It will not be compromised by tree roots. It is compatible with the rest of Nuralite systems and can be used in collaboration with various green roof buildups.

BALLAST ROOFS / BROWN ROOFS

A ballast roof or brown roof is when the roof membrane has a layer of gravel, pebbles, rubble, or similar metal that will not be affected by wind. As it is not as absorbent as soil, a ballast roof does not hold as much water or grow as much greenery.

A ballast roof can introduce landscaping textures to the roofscape and can offer a micro-habitat for lichen and insects which can, in turn, provide a desirable terrain for birdlife in the city.

Figure 02: **BALLAST ROOF. DETAIL SHOWN OVER NURATHERM WARM ROOF**

ECO NOTE: A ballast roof, like a green roof, will protect the membrane from the elements and increase its lifespan. A ballast roof also creates micro-shading which enables passive cooling based on the principle that parts of each stone are always in shade.

A desirable terrain for birdlife in the city

A ballast roof requires four key additions to the roof design:

- A suitable membrane.
- A geotech drainage grid to allow drainage between the ballast and the membrane.
- A geotextile fabric filter layer preventing soil particles from entering the drainage area.
- A barrier detail to keep the ballast out of the gutters.

NURALITE SOLUTION:

Future-proofing a ballast roof can be done by specifying Nuraply 3PG membrane. It will then have the flexibility to also become a green roof, though structural engineering must also be considered in this case.

NURAMAT GREENDRAIN is a 25mm plastic drainage grid with an integrated geotextile filter layer and water retention capacity.

Hidden Island House by Mason & Wales Architects

HIGH R-VALUE ROOFS & PASSIVE HOUSE PRINCIPLES

When a design strives to be “eco”, “passive” or “green”, one of the fundamental features (and easier solutions) is to allow for higher insulation performance in the roof. This requires the design to achieve R-values that are above and beyond the Building Code minimum.

The advantage of a high R-value roof is that it seriously limits the escape of thermal energy. Therefore, less heating energy is required to maintain the desired temperature. A high R-value enclosure will deliver energy savings for years ahead.

Enertherm PIR insulation

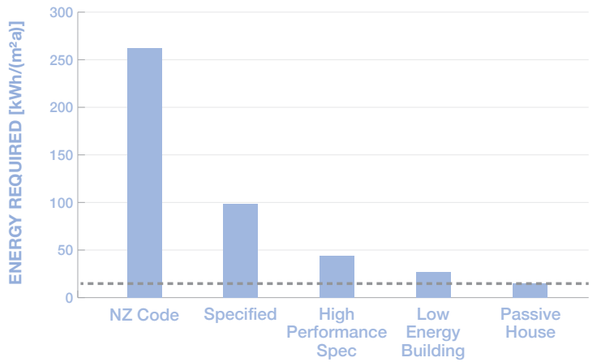
It is likely that our buildings will continue to be designed to higher and higher standards. Designing for mere compliance with the current minimum requirements could be seen as imposing an unnecessary energy burden for the life of the building.

With high R-value roofs, design effort needs to also reduce all cold bridges and penetrations that can defeat the value of the additional insulation.

ALSO REFER TO: Warm Roof - Why it Matters on page 33.

ECO NOTE: Space heating and cooling places a huge demand on energy supply networks. With 30-35% of heat lost through the roof of an uninsulated house, it is clear that roof insulation is critical to an energy-efficient building. Well-insulated roofs and enclosures demand much less heating energy to stay warm. Over a building's lifespan, these energy losses can amount to a much greater carbon footprint than was first emitted during the construction of the building. Designers and clients can choose minimum insulation requirements to save costs initially, but this forces costly inefficiency for long-term energy use. An environmentally responsible approach is to design for high insulation rating, so that during its lifespan, the building uses less overall energy.

Commissioning a detailed energy analysis (such as the one pictured here) will help quantify the cost and benefits of additional insulation.



Graph 01: **EXAMPLE CHART SHOWING ENERGY USAGE UNDER DIFFERENT INSULATION SCENARIOS**

PIR PRODUCT OPTIONS

A high R-value flat roof in New Zealand is currently best achieved using a warm roof with rigid board insulation. Of the rigid board insulation products available, PIR is widespread. PIR refers to Polyisocyanurate, which is a thermoset plastic foam. There are a range of PIR products available.

Comparing the compressive strength of the different insulation products is recommended. A strong product provides a solid foundation for the waterproofing and anything that sits upon it.

Enertherm boards are lightweight and easy to handle. The boards can be installed over plywood, concrete or metal substrates, on new or existing buildings, and on flat roofs regardless of their slope.

NURALITE SOLUTION:

- Enertherm PIR insulation has the highest efficiency per square metre. When compared to other insulation materials (such as EPS, XPS and Rockwool), a higher insulation value is achieved with a thinner board.
- Greater thicknesses and R-value can easily be achieved by installing two layers of a thinner board. 100mm (R4.5) of Enertherm for Zone 1 and 2, and 120mm (R5.45) for Zone 3 is better practice than meeting code minimums.
- Enertherm PIR insulation has very high compressive strength (175kPa). Combining this with the excellent R-values of the aluminium-faced Enertherm PIR boards achieves the optimum flat roof insulation.
- Using NPM900 Metal Tray as the substrate for Nuratherm is a cost-effective solution (it may even be installed for less than the cost of a traditional cold roof system).

Enertherm PIR (mm)	30	40	50	60	70	80	90	100	110	120	140	160	180	200
R-VALUE	1.36	1.80	2.25	2.7	3.15	3.6	4.05	4.55	5	5.45	6.35	7.25	8.18	9.1

Table 03: **ENERTHERM PIR R-VALUES**

Oliver’s Ridge by Team Green Architects

ROCKWOOL INSULATION

If designing buildings of national significance, fire performance criteria can require some projects to use a Rockwool insulation. Rockwool is an insulation product with exceptional fire resistance properties as it is made from spun stone. A unique characteristic of Rockwool is its excellent acoustic performance - it is like a sponge for sound.

NURALITE SOLUTION:

Nuralite supply Rockwool to New Zealand and can incorporate this into the Nuratherm warm roof system as an insulated roof solution for buildings of national significance. This provides optimal thermal, acoustic and fire performance.

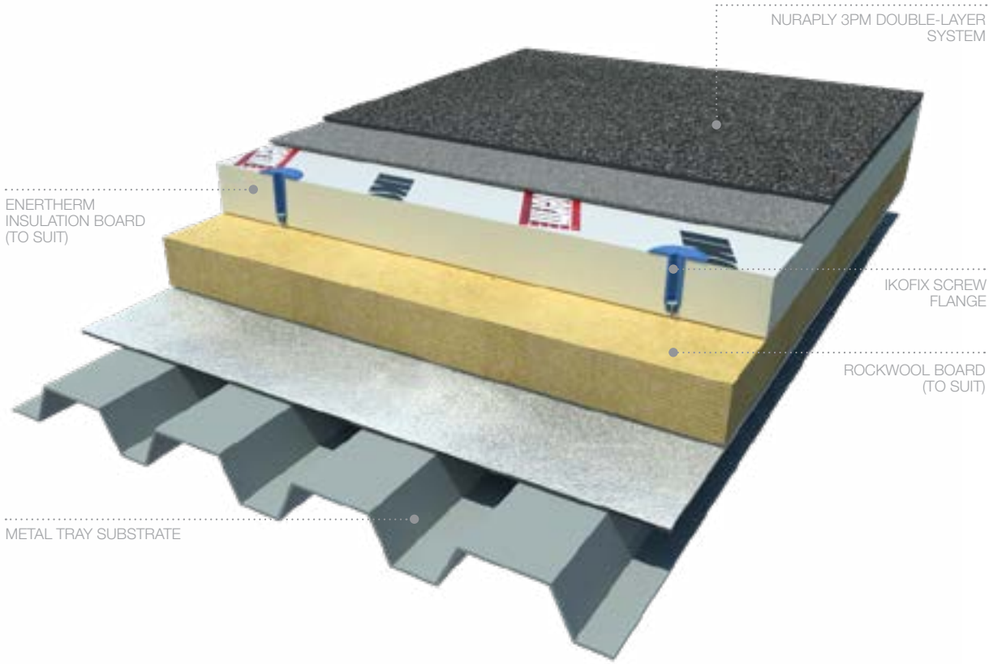


Figure 03: **NURATHERM HYBRID WARM ROOF SYSTEM**

Warm Roof - Why it Matters

AIRTIGHTNESS
THERMAL INSULATION (R-VALUE)
THERMAL BRIDGE V. CONTINUOUS THERMAL ENVELOPE
VAPOUR CONTROL
WARM ROOF COSTS
ACOUSTIC PERFORMANCE
WARM ROOF FIRE PERFORMANCE

The structure & substrate is protected from thermal extremes & will remain stable & last longer

WARM ROOF - WHY IT MATTERS

Warm roof systems are now mandatory in much of Europe and North America. Their benefits are compelling, and it is not just the insulation that helps.

Takapuna House by Bossley Architects

NURALITE SOLUTION:

Nuratherm Insulated Membrane Roof System. This includes Nuraply 3PM two-layer membrane, Enertherm PIR insulation, Nuralite ALU vapour barrier, and for mechanical fastening - the IKOfix thermally broken screw flange.

ECO NOTE: Over a building's lifespan, the energy losses through poor insulation performance can amount to a much greater carbon footprint than emissions from the original construction. In contrast, a warm roof with quality PIR will reduce energy use for decades.

WARM ROOF DEFINITION

Warm roof construction has the principal thermal insulation layer placed above the structural deck and immediately below the waterproofing membrane. Locating the insulation above the structural deck is desirable, as the insulation is a continuous plane and the R-value of the insulation product is therefore achieved. The structure and substrate is protected from thermal extremes and will remain stable and last longer.

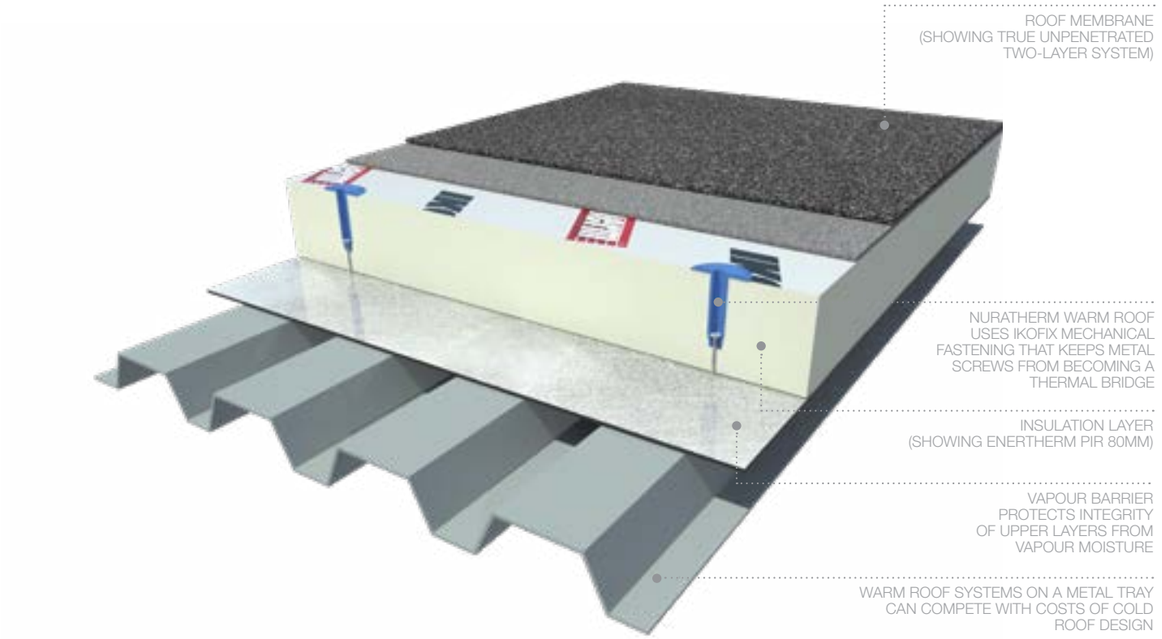


Figure 04: **NURATHERM WARM ROOF. DIAGRAM SHOWING CONTINUOUS INSULATION OF WARM ROOF DESIGN**

Risk(s): In a cold roof, dampness through roof space condensation can lead to fungal growth, decay in structural timbers and the accelerated corrosion of metal components and fixings. There is also the risk that insulation boards containing organic fibres will decay from the growth of fungus, lose their strength and suffer a reduction in their insulating efficiency. These effects may be taking place within the structure but with no visible indication of problems. In extreme cases, it may appear that the roof is leaking, when in fact the issue is interstitial condensation.

Solution(s): A warm roof system with a suitable thermal insulation product. This insulative layer must have sufficient depth and thermal performance for its underside to remain above the temperature at which condensation will occur. This can require expert thermal modelling or dew point analysis of a proposed buildup.

View the Abodo Project and School Roofs Webinars for more information.

With the growing awareness of Passive House principles, we can now illustrate the wider benefits of warm roof design

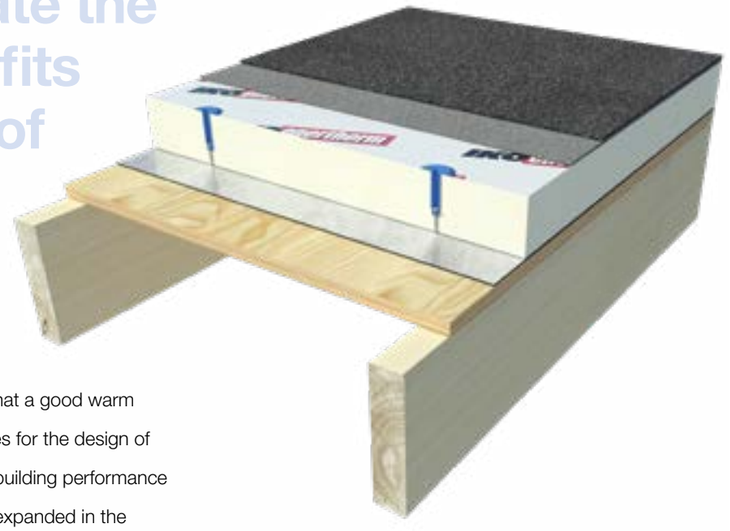


Figure 05: **TYPICAL WARM ROOF WITH CONTINUOUS INSULATION**

There are six important functions that a good warm roof system will resolve. This applies for the design of the building envelope, and for the building performance over time. These six functions are expanded in the following segments.

You can see that a cold roof will only offer the basic solution of watertightness.

	Watertightness	Airtightness	Insulation	Thermal Bridge	Vapour Control	Cost
Nuratherm Warm Roof	No extra penetrations or details	Vapour barrier provides air barrier and may be sealed to wall air barrier	Any R-value may be accommodated	Enertherm layer provides continuous insulation	No condensation because of vapour barrier before dew point	Nuratherm install on Metal Tray saves costs
Traditional Cold Roof	Nuravents are a breach in the membrane	No air barrier, in fact airflow is critical to the system	R-value limited by the depth of the rafter	Thermal bridge from rafters	Condensation expected hence the need for venting	Cold roofs cost more during the build and life of the building

Table 04: **ADAPTED FROM PASSIVE HOUSE TABLE DEVELOPED BY DARRYL SANG (sangarchitects.com/passive-house-design)**

AIRTIGHTNESS

Unintended airflow and air leakage through the layers of the building envelope carry the risk of thermal energy loss.

Professional energy auditors use blower door tests to help determine a home's airtightness. An airtightness test result (n50) of ≤ 0.6 air changes/hour is a requirement for Passive House certification. Incorporating Passive House principles makes common sense even if the property is not being built to fully meet these standards.

ECO NOTE: Even well-insulated homes can be hard to heat if draughts constantly replace hot air with cold air. Airtight building and controllable ventilation let occupants manage air replacement for a warmer, healthier, more comfortable home.

NURALITE SOLUTION:

A Nuratherm warm roof system does not require any roof space ventilation, as the membrane and vapour control layers form an airtight roof.

THERMAL INSULATION (R-VALUE)

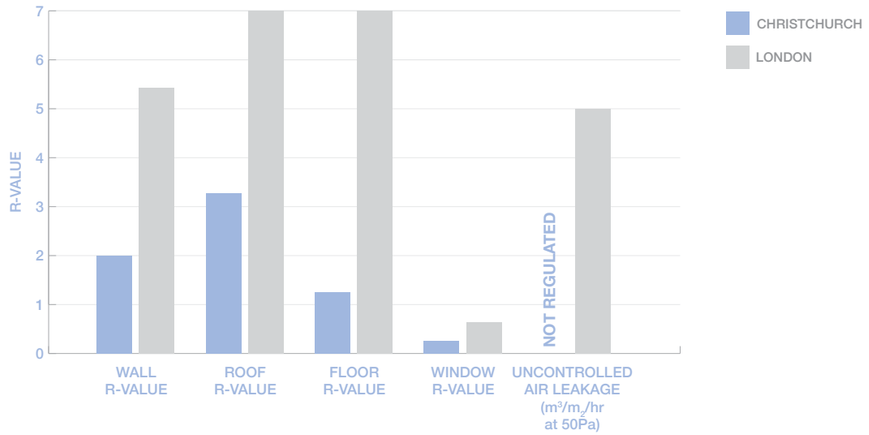
Thermal design is concerned with resisting the flow of thermal energy through the roof construction. Thermal performance is measured in R-value. When specifying insulation, the following should be considered:

- The New Zealand Standards are a minimum only and should not be seen as a target.
- Internationally the New Zealand minimum is low. Other countries, including Australia, the United Kingdom and United States, have significantly higher insulation targets.
- It is difficult and costly to retrofit insulation. The best time to fit insulation to the maximum is during the initial build.

In its review of New Zealand's energy policy the International Energy Agency stated:

> "Air leakage through the layers of the building envelope carry the risk of thermal energy loss."

It has been noted that London and Christchurch have similar climates but required insulation levels are at least double in the UK and, unlike in the UK, New Zealand has no requirements on airtightness.



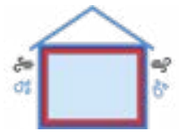
Graph 02: **INSULATION & AIRTIGHTNESS REQUIREMENTS IN CHRISTCHURCH & LONDON**
SOURCE: A CARBON ZERO ROAD MAP FOR AOTEAROA'S BUILDINGS, NEW ZEALAND GREEN BUILDING COUNCIL

NURALITE SOLUTION:

Nuralite provides the complete Nuratherm insulated roof system with Enertherm PIR boards.

ALSO REFER TO: High R-value Roofs & Passive House Principles page 30.

THERMAL BRIDGE V. CONTINUOUS THERMAL ENVELOPE



Whether inspired by Passive House principles or not, most of the architectural community is attempting to design for continuity of the thermal envelope. By removing cold bridges, this will increase both thermal performance and building energy efficiency over time.

Any break in the insulation layer of the thermal envelope will allow heat energy to escape. Thermal bridges such as structural and service roof penetrations and roof joints should be minimised. The simpler the roof design, the better.

The simple test for continuity is to trace or draw a line on the insulation products over a proposed section drawing (of the whole building). If you have to stop or lift the pen because there are uninsulated elements, then the continuity is broken.

NURALITE SOLUTION:

As well as a Nuratherm insulated roof, consider other building elements insulated with Outright Continuous Insulation.

VAPOUR CONTROL

In a warm roof configuration, a vapour barrier layer is recommended to achieve the highest performance standards. Because the insulation is kept dry between the membrane and the vapour barrier, it will retain the R-value performance. In contrast, cold roof insulation products often degrade over time.

The vapour control layer prevents warm moist air from reaching the dew point where it will form condensation. It also acts as an air barrier by preventing air leakage through the roof system.

The vapour barrier to the roof membrane must be properly sealed at roof penetrations and at the roof perimeter. If not, there will be an opportunity for moisture to be drawn into the insulation envelope. If moisture does enter the insulation, it can create vapour expansion and compromise the roof buildup. Without proper vapour management, condensation underneath the membrane arises and therefore the roof is not a true warm roof.

NURALITE SOLUTION:

A Nuratherm Warm Roof System installed with an IKO ALU Vapour Barrier is optimum. This Nuralite vapour barrier provides temporary waterproofing during construction and a third layer of defence. We recommend a vapour barrier on all warm roofs. This allows for changes in both climate and building use. The best practice vapour barrier has foil with a bituminous, self-sealing backing.

Without vapour management, it is not a true warm roof

MYTH-BUSTED:
"You don't need a vapour barrier"

Risk(s): The provision of insulation alone is not enough to prevent condensation. If the insulation is permeable to water vapour, the vapour will pass upwards through it and condense on the underside of the waterproof membrane resulting in the insulation facer delaminating and blisters forming in the membrane system. This is unsightly and almost impossible to remedy, especially if the membrane is fully bonded to the insulation board.

Solution(s): To prevent this from occurring, a vapour control layer should be provided directly below the insulating layer. As an additional precaution, the membrane should only be partially bonded, fleece lined or mechanically fixed.

ECO NOTE: Designing ventilated cold roofs or airtight warm roofs without careful attention to risk of condensation can compromise the whole building's fabric and integrity. The performance of a building over time can seem less relevant when the budget and schedule are immediate. Design and specification with attention to condensation and airtightness can help extend the building's lifespan.

WARM ROOF COSTS

We suggest that designers balance three key budget-related insights when deciding on a warm roof:

1. The cost of the substrate. A cold roof can seem simpler and cheaper, but if it is put over a plywood substrate, screwed and glued over timber roof joists and blocking, there is a costly amount of labour and materials in just the substrate. Talk to Nuralite about the profiled metal substrates that are significantly faster to install and are a cheaper warm roof substrate. Substrate savings can often cover the remaining cost of the warm roof system. Nuralite has had an independant Quantity Surveyor suggest that construction costs of a warm roof could save up to $50 per m^2 over a cold roof.
2. The payoff. What is the cost of long-lasting thermal integrity with continuous insulation and a warm dry roof space? Although a building owner may not receive these payoffs immediately, the occupants of the building will have significantly reduced power consumption and less health implications as a result of the investment. Conversely, a cold roof can be measured against the same issues with opposite impacts.
3. Educating clients. Sometimes a membrane warm roof will cost more than other roof types - for good reasons. Use this Design Guide to teach your clients and gain their buy-in.

We have an ethical responsiblity to provide warm homes for Kiwis

MYTH-BUSTED:

"Warm roofs will cost more than a good old cold roof"

ACOUSTIC PERFORMANCE

Some projects require the roof to have specific acoustic performance. A roof may be designed to reduce external noise levels or prevent internal noise escaping. Impact noise of rainfall is often considered as well. Often a flat roof buildup will be considered acoustically in conjunction with an acoustic ceiling system.

Reputable flat roof systems will have tested Sound Transmission Class (STC) ratings that an acoustic engineer can apply to design calculations.

NURALITE SOLUTION:

The Nuratherm warm roof system on NPM900 steel profile substrate has been independently tested in an acoustic lab. The 7mm thickness of relatively dense modified bitumen on 80mm PIR offers the STC loss of 50dB. It is frequently specified on airports and other noisy environments. Additional layers of acoustic products can easily be included beneath the Nuraply 3PM membrane.

A hybrid warm roof using Rockwool and Enertherm PIR provides excellent acoustic performance with market-leading insulation values.

ALSO REFER TO: Floated Deck Acoustics on page 92.

Ao Tawhiti Unlimited Discovery School by Stephenson & Turner Architects

WARM ROOF FIRE PERFORMANCE

Fire can have a catastrophic impact on a property and those within it. Building materials have an important role to play in minimising the consequences of a fire event.

Objectives of clause C1 of the Building Code are to:

- safeguard people from an unacceptable risk of injury or illness caused by fire;
- protect other property from damage caused by fire; and
- facilitate firefighting and rescue operations.

In a flat roof situation, it is therefore critical to consider the fire performance of the materials individually and as a complete system. Selecting materials that resist the spread of fire from other buildings (i.e. have low combustibility and self-extinguish) will assist the roof to meet the Code requirements.

Attention must be paid when detailing near heat sources such as chimneys or flues. The membrane and insulation should be separated from the heat source to ensure long-term performance.

All waterproofing products can be installed safely on new-build installations. Suppliers and installers should have a fire safety plan for safe practice on-site.

Reroofing can require installing new membrane where there is a risk of existing flammable materials catching fire. In these situations, it is recommended to consider a fully adhered thermo-lap welded system like a TPO.

NURALITE SOLUTION:

- The Nuratherm system is a complete system that consists of self-extinguishing Enertherm PIR insulation (meets NZ 2122. 1-1993 and a flame retardant Nuraply 3PM membrane.
- The Nuratherm system on 0.75mm NPM900 Metal Tray achieves a group number 1-S – the highest standard available.
- Rockwool may be added as a layer in the warm roof buildup to further enhance the system's fire performance.
- The Nuraply 3PM membrane has an expandable graphite powder-coating to the membrane carrier. In the heat of a fire this will expand to 250 times its original volume, which works as a flame retardant and inhibitor. There are no toxic effects in the event of fire and the graphite layer also acts as a smoke suppressant.
- The base sheet of the Nuraply 3P range is installed using self-adhered methods – limiting flame use on-site. If a 100% flame-free install is necessary, specifiers can choose the Nuraply TPO system.

Types of Membrane

Choose your system with confidence

TYPES OF MEMBRANE

There are a variety of membrane products and systems available. All products can be shown to work well in the lab, but in the real world, problems in waterproofing membranes arise within appropriate product selection and/or inadequate product installation. The main system categories are liquid membranes, single-layer (TPO, Rubber, PVC/KEE), and double/multi-layer.

MYTH-BUSTED:
"Spray-on and liquid-applied systems are superior to sheet membranes"

Within the system categories, there are also different products and adhesion methods to keep the membrane fixed to the substrate - glued, peel-and-stick, heat-applied or mechanically fastened.

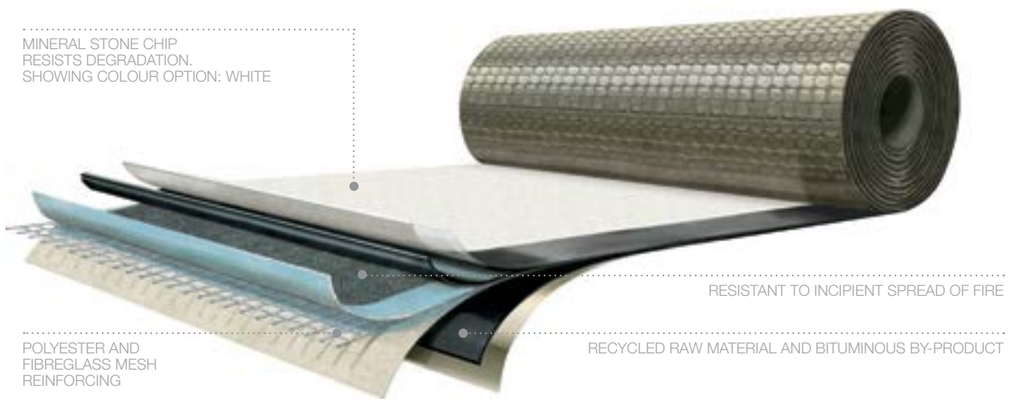


Figure 06: **MODERN MEMBRANE. THE QUALITY OF MODERN NURAPLY 3PM TORCH-ON IS THE RESULT OF A SOPHISTICATED MANUFACTURING PROCESS**

TYPE	Thickness	Joints	Layers	Risk of Installation Issue
Liquid Membrane (Paint-on)	0.6 – 1.5mm	N/A	Multi-layer	Very High
Rubber (Butyl or EPDM)	≈ 1mm	Glued or Taped	One	High
Single-layer (PVC / TPO)	0.7 - 2mm	Welded	One	Moderate
Double-layer (Reinforced Modified Bitumen)	≈ 7mm	Welded	Two	Minimal

Table 05: **TYPES OF MEMBRANES**

MEMBRANE SYSTEMS RISK

The lap joints between sheets are a vital part of any waterproofing system. Membrane products are delivered in sheets or rolls which need to be lap-jointed to form one continuous roof. For a durable lap joint, it is imperative that the entire joint is welded rather than contact glued or taped. Other risks include:

- Liquid-applied membranes require correct weather conditions to be installed successfully.
- Liquid-applied membranes often require regular re-coating to maintain their performance.
- Glue or tape joints have consistently struggled to last under New Zealand conditions.
- Lightweight products may be easily damaged by other on-site trades during construction.
- Recently developed products, or those recently introduced to New Zealand, may not tolerate the New Zealand UV extremes.
- When using single-layer sheet materials, avoid joints around complex gutter junctions or roof shapes.

Single-layer membrane options such as TPO have their place, but require care and diligence on the construction site and absolute competence in application.

Risk(s): When an unsuitable membrane has been installed, the resulting leaking membrane roof can cause moisture damage to the building structure, resulting in a high cost of replacement.

Solution(s): The peace of mind and long-term savings that a reliable membrane system provides are often underestimated during the design stage. Remind clients of both the importance of their roof and the risks of making unsuitable specifications.

All products can be shown to work well in the lab

ECO NOTE: Replacing or repairing an inappropriate or poorly applied roof membrane after a short lifespan is an inefficient and wasteful use of material and energy.

MEMBRANE TECHNOLOGY

Last century, flat roof selection and design was simple. The product was black and a single layer would suffice. Substrates, insulation and condensation were often not considered important to the performance of the membrane roof. Furthermore, once installed, flat roofs were often forgotten about with little or no maintenance.

For many consumers, membrane waterproofing and flat roofs developed a bad reputation. With hindsight, we can also see that this reputation grew from the use of inappropriate products and substandard installation.

Recently, flat roof systems and product technology have grown more complex. Flat roofs now have multiple elements and options. Consumers have far higher expectations of both the waterproofing integrity and the environmental performance of the system.

With careful selection and skilled application, today's products and systems enable robust membrane waterproofing systems that can be designed with confidence.

MYTH-BUSTED:

"Avoid designing membrane roofs"

REINFORCED MODIFIED BITUMEN

Reinforced Modified Bitumen membranes can be applied either by a peel-and-stick self-adhesive on the underside of the sheet, setting in a liquid bedding compound or by torching onto a primed substrate or base sheet.

The membranes are able to be used in a wide range of combinations with each application meeting a specific situation requirement, for example green roof membranes have added herbicides.

The membranes are normally over 3mm thick and are installed as two layers to ensure a robust waterproofing system wtih built-in redundancy.

NURALITE SOLUTION:

For robust, reliable and long-lasting membrane, a true two-layer Reinforced Modified Bitumen membrane is the optimum choice. The CodeMark certified Nuraply 3PM is a polymer-enhanced, bitumen-based membrane with a mineral chip cap sheet. It forms a homogenous 7mm-thick membrane that is both durable and flexible. The 3PM (and components) are manufactured in Belgium and are an upcycled diversion of an existing waste stream. The bitumen-based ingredient is a by-product of the petroleum industry.

TPO MEMBRANE

TPO stands for Thermoplastic Polyolefin. It is a single-layer system that uses thermal welding of lap joints. As such it can be considered a big step up from tape or adhesive jointed single-layer systems.

TPO is manufactured in a single process, joining two separate layers with a reinforcing mesh sandwiched in the middle. The upper layer incorporates UV stabilisers. It comes in smooth and fleece-back options for adhesive bonding or mechanically fixing to various substrates.

A key benefit of TPO is the availability of 3m or 3.6m wide and up to 30m long rolls, which enable the product to be installed with fewer lap joints. Often, gutters will have no lap joints at all. Installation is done without flame which is helpful, especially on renovation jobs.

TPO requires a 2° (1:30) minimum fall on roof areas, 1.5° (1:40) for decks and 0.5° (1:100) for gutters.

MYTH-BUSTED:

"All single-layer products are the same"

Risk(s): Potential leaks can occur through workmanship error with just one chance to get lap joints 100% watertight. Care must be taken after install to ensure later trades do not damage the membrane. UV degradation can reduce lifespan, especially if a 1.14mm or dark-coloured TPO is used. TPO on low grade PIR can be a problematic on a warm roof, as any dents in the insulation will be visible.

Solution(s): Select a minimum 1.5mm quality TPO for projects that suit a TPO solution.

ALSO REFER TO: Table 06: Membrane Comparison on page 50.

NURALITE SOLUTION:

Nuralite has carefully chosen a TPO which scores number one in independent industry UV-aging resistance testing. Nuralite TPO is only available in light colours. Nuralite has invested in taking our leading TPO applicators to the United States for training. Nuralite recommends Nuraply TPO as the best option for single-layer membranes in New Zealand.

NURAPLY TPO WARM ROOF

The Nuraply fleece-back TPO is used with Nuratherm warm roof configurations as the fleece-backing mitigates the risk of blisters if moisture vapour is trapped and also vastly adds to the aesthetic appearance of the complete system. The TPO Nuratherm system is the market leader for quality, durability and aesthetic outcomes.

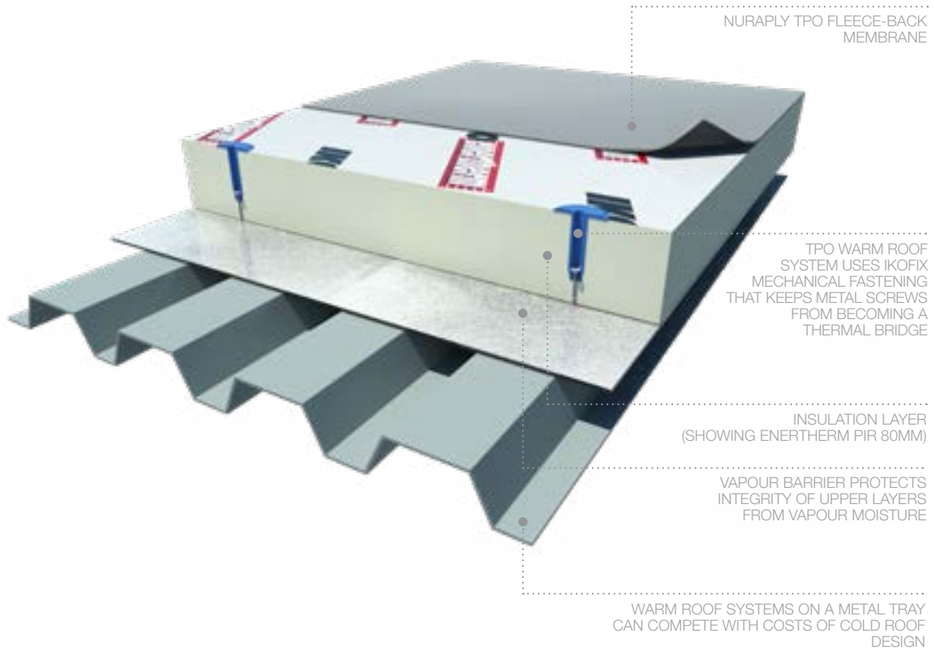


Figure 07: **NURATHERM TPO WARM ROOF. DIAGRAM SHOWING CONTINUOUS INSULATION OF WARM ROOF DESIGN**

ECO NOTE: The Nuraply TPO is the only roof membrane that has been officially certified as Declared Red-List free. Alternatives rely on self-declare status.

TPO V. REINFORCED MODIFIED BITUMEN

When choosing between Reinforced Modified Bitumen and single-layer TPO the following table will assist your design decisions. We suggest ensuring you have access to physical samples to help gauge the difference.

Choose your system with confidence

NURALITE SOLUTION:

In comparing TPO with Reinforced Modified Bitumen, Nuralite will happily supply both options to most projects.

Contact your local Nuralite representative to discuss your specific roof and we can determine which membrane will provide the best outcome.

Papamoa Beach House

FACTOR	Nuraply 3PM Double-layer System	Nuraply TPO Single-layer
ROOF TYPE	Robust and reliable for almost all design applications: • Warm roofs • Commercial roofs • Reroofing and overlays • Under floated decks • Plant areas • Complex roof geometries • Best longevity and confidence required • Buildings of national significance • Green and ballast roofs	Can be advantageous on certain types of projects: • Large gutters not likely to be used as foot traffic thoroughfares • Large scale "big barn" projects with a very simple roofscape • Collecting potable water • Remedial where flammable elements pose risk of fire
INSTALLATION	Two layers reduces potential workmanship issues because a mistake at the same location is extremely unlikely. The extra layer of security and confidence is called built-in redundancy.	A single layer gives just one opportunity for the installer to make it 100% watertight. Not suitable for installation in cold climates. Fewer lap joints, which is especially helpful in gutters.
AESTHETICS	• Mineral chip texture • The 7mm-thick system will be forgiving to any substrate imperfections, they will not stand out visually and will be largely concealed by the membrane • The darker colours prove more popular which suits floated decks and overlooked roofs well • A skilled installation of Reinforced Modified Bitumen mineral chip is a beautiful indicator of quality waterproofing • Colour and richness can be enhanced with Nuraglaze	• Smooth, flat and matte • As a thin membrane, TPO carries the risk of revealing imperfections in the substrate (fixings and sheet joints). If this is a design concern, the fleece-back TPO can achieve improved results • Lighter colours are safer for UV lifespan but can show black scuff marks and dirt more easily • Smooth flat texture is preferred by some • Fewer lap joints for homogenous appearance
LIFESPAN	Reinforced Modified Bitumen has proven itself to last in NZ so we have confidence in its performance over time. It has a layer of natural mineral stone chip that protects from UV degradation. Total thickness is 7mm, making it more forgiving for installation and maintenance, and generally more robust.	Nuraply TPO tops the scores of TPO UV resistance. Lighter colours tend to last longer.
SUSTAINABILITY	• Manufacturer Declared Red-List free • Imported from Europe • Allows 90-year renewal plan with 3x 30 year overlay cycles with no waste to landfill • Has 3PG option for green roof design • EPD available	• The only roof membrane in NZ to be declared Red-List free • Imported from US • Requires adhesives • Good for cool roof performance • EPD available
FALL	With built-in redundancy, Nuraply 3PM CodeMark Compliance offers falls below one degree (1:80) for roofs and decks and 0.5 degree (1:100) in gutters.	TPO membranes typically require a two degree (1:30) minimum fall via E2-AS1 for roofs, 1.5 degrees (1:40) for decks and 0.5 degree (1:100) in gutters.
SYSTEM COMPONENTS	• Comes with standard and heavy duty 2mm thick welded aluminium scuppers, sumps, droppers • Can be bonded to most metals in a range of project specific details • Customised Lockin' Pocket accessory for difficult penetrations	• Nuraply TPO is compatible with our TPO coated aluminium scuppers and trims • Customised Pour Pocket for difficult penetrations
FIRE RISK	Uses a gas torch during install which is manageable with strict fire safety practice and training. Modern two-layer systems such as Nuraply 3PM use self-adhered base sheets, minimising direct flame to substrates.	The safer option for remedial work on timber buildings. Uses hot blown air applied from an electric heat gun.
COLLECTING RAIN WATER	Tested as suitable for collection of potable water, though a Nuraglaze coating is recommended and should be maintained. First flush diverters and filters are advised.	The smooth texture of TPO makes it a cleaner catchment for drinking water. First flush diverters and filters are advised.
WARRANTY	Nuralite 20-year Materials Defect Warranty. For certain projects an insurance-backed 10-year system warranty is available.	Nuralite 20-year Materials Defects Warranty.

Table 06: **MEMBRANE COMPARISON**

KEE/PVC MEMBRANES

Another single-layer system available in New Zealand is made of PVC (Polyvinyl Chloride). PVC on its own will tend to shrink and also be rigid and brittle.

A good membrane has to be flexible. This is achieved by mixing the PVC with plasticisers. Historically those plasticisers were fairly volatile and on hot roofs they migrated out and evaporated. Consequently, the PVC became brittle and often cracked. Over the years, the plasticisers have improved; they are now less volatile and stay in the sheet much longer. The least volatile plasticiser is KEE (Ketone Ethylene Ester).

The difference therefore between a PVC and KEE membrane is that a PVC membrane is comprised of over 50% PVC polymer, while a KEE roofing membrane still uses PVC polymers but is modified with over 50% KEE. PVCs have been marketed in New Zealand for some time. In contrast, KEE has only recently become available in New Zealand and therefore is unproven in our unique UV conditions. Some PVC/KEE membranes are installed in New Zealand in dark colours and as thin as 1.1mm. This makes the membrane especially vulnerable to heat stress, punctures or UV damage. With less than 0.4mm covering the reinforcing, it will not take much plasticiser migration for an issue to arise. Experience suggests that the thicker the membrane the better and, with plastic membranes, the lighter the colour the better.

A good membrane has to be flexible & durable under New Zealand conditions

ECO NOTE: PVC is a polymer which is on the LBC Red-List. Consequently, neither PVC or KEE product is able to be Red-List free.

NURALITE SOLUTION:

Nuralite recommends in single-ply membranes that specifiers stick to proven, light-coloured product that is at least 1.5mm thick - such as the Nuraply TPO.

Cathedral Grammar School by Andrew Barrie Lab and Tezuka Architects

CHOOSING A DURABLE MEMBRANE SYSTEM

Selecting a durable, low-maintenance system is a critical decision. The more durable a system proves to be, the longer it will remain in use and the smaller its environmental footprint will be.

ALSO REFER TO: For a guide to durable membrane systems see Types of Membranes on page 43.

Risk(s): Choosing an inappropriate membrane system may result in leaking roofs, short life, moisture damage, reduced thermal performance and high cost of repair.

Solution(s): A reliable and reputable membrane system will provide peace of mind and long-term savings. Consider all the relevant aspects of this Design Guide before selecting the desired membrane.

NURALITE SOLUTION:

Nuraply 3PM – a two-layer Reinforced Modified Bitumen waterproofing system with built-in redundancy, that is proven in NZ conditions. It features a total thickness of 7mm, with two layers of reinforcing and a mineral chip surface for protection from UV damage.

ECO NOTE: Replacing or repairing an inappropriate or wrongly applied roof membrane after a short lifespan is an inefficient and wasteful use of material and energy. If something fails and is discarded, the embodied energy in that system is also wasted. This typically includes impacts of raw material extraction, manufacture, transportation, labour time in installation and removal. It is essential for the efficacy of our construction efforts to specify systems that are fit-for-purpose and last.

COST COMPARISONS

The cost of an installed system varies depending on complexity, size, substrate and access. The table below is a guide to the cost of installed waterproofing membrane systems (ignoring the cost of the substrate).

There is still some perception that multi-layer products are exclusively for premium projects; however, cautious and responsible specifiers are increasingly sticking to multi-layer systems on all their flat roofs.

The cost of remedying roofing failure can outweigh the initial savings that a budget system may have. Maintenance and/or replacement costs can be costly when done properly.

The actual costs of a robust multi-layer waterproofing system should always be checked and compared with other systems. The peace of mind and long-term savings in a reliable membrane system have more value than is often appreciated. Reminding clients of the importance of their roof is recommended.

MYTH-BUSTED:

"Single-layer is only half the labour, double-layer systems must be double the price"

SYSTEM	INSTALLED COST
Liquid Membrane (Paint-on)	$-$$
Rubber (Butyl or EPDM)	$$
Single-layer (PVC / TPO)	$$$
Double-layer (Reinforced Modified Bitumen)	$$$

Table 07: **COST GUIDE TO TYPES OF MEMBRANES**

ALSO REFER TO: TPO v. Reinforced Modified Bitumen on page 49.

A reliable membrane system has more value than is often appreciated

Oliver's Ridge by Team Green Architects

COMPATIBLE ACCESSORIES (COMPLETE SYSTEM ASSURANCE)

Product compatibility within any construction system is an important factor for design and specification. All flat roof products and accessories should come from one supplier to ensure there is no opportunity for disputes over responsibility if a problem arises.

Risk(s): Components that are sourced from various international suppliers may not work together. System failures can be unclear, and liabilities reduced.

Solution(s): Select a supplier who markets an entire system of compatible components. Be sure the entire system has been independently appraised – not just one or two components. A system that is a hybrid of imported products should be avoided.

NURALITE SOLUTION:

Nuraply membrane systems and PIR insulation are sourced from one European manufacturer. Nuralite custom-made scupper and sump outlets are manufactured here in New Zealand. All Nuralite components are compatible and certified compliant to New Zealand codes.

Below are some of the flat roofing system components and accessories that can be specified confidently along with the membrane:

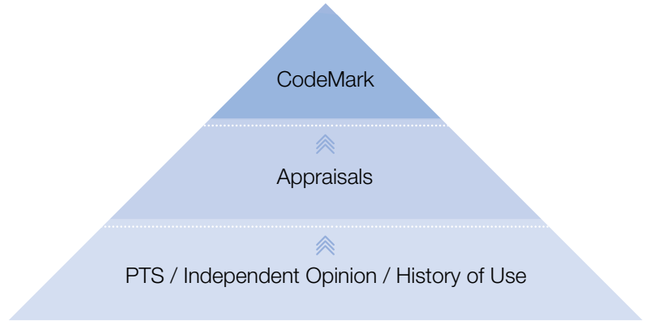
- Insulation layers
- Substrate options
- Vapour control layers
- Mechanical fixings including thermally broken fixings
- Floated deck systems in timber or tile
- Drainage outlets
- Pre-formed scuppers
- Diverters
- Primers and contact bond adhesives
- Edge flashings
- Ventilation cowls
- Goose-neck penetrations for electric cables and services pipes
- Corner fillet
- Termination bars
- Sealants
- Mechanical fixings
- Structural fixing elements (Nuralite Fixing Plate)
- Primers and seal coats
- Pour Pockets for difficult penetrations

Product compatibility is an important factor for design & specification

Riverlands House by Warren & Mahoney Architects

CODEMARK

A serious supplier in New Zealand construction will ensure that CodeMark certificates and independent appraisals are provided for the complete system that they are promoting. This ensures the long-term success of their products. CodeMark is the most rigorous and reliable means of code compliance for membrane roofs.



Graph 03: **APPRAISAL PYRAMID**

CODEMARK™ BCS - 151216 - CMNZ

BRANZ Appraised Appraisal No.732 [2019]

CodeMark is the best way to ensure a hassle-free path to compliance

Ōtāhuhu Train Station by Jasmax

Auckland Council has provided the following guidance in Practice Note AC2210:

" • New Zealand CodeMark is a product certification system administered by the Ministry of Business Innovation and Employment (MBIE) which **must be accepted by Council** (our emphasis) so long as the product or system is designed and used within the scope of the CodeMark certificate.

- Product Appraisals independent assessment of compliance by a recognised New Zealand Body e.g. BRANZ appraisals; the assessment body must be independent of the product manufacturer or supplier and the use of the product or system specified must fit within the scope of approval.
- Product Technical Statements (PTS) a statement from the manufacturer or supplier of a product or system stating that the product will, if installed in accordance with the technical data, plans, specifications, and advice prescribed by the manufacturer, comply with the relevant provisions of the Code, refer to s.14G(1)."

A CodeMark is desirable because the system will have demonstrated a higher standard of compliance and will be accepted by Council if the use is within its certified scope. It is the best way to ensure a hassle-free path to compliance.

NURALITE SOLUTION:

The Nuraply 3PM, 3PG, 3PC and 3PT range carry CodeMark certificates (CM70033 and CM70034). This ensures acceptance by Councils.

MYTH-BUSTED:

"A letter from the supplier is sufficient to establish compliance"

WARRANTIES

A warranty should always be provided with the products that are supplied, but few specifiers ever read them. Legislation provides general protection for consumers but if selecting a supplier based on the warranty they offer, remember the truism that the most generous warranties are often offered by those with the least to lose!

Risk(s): The chosen membrane supplier or applicator may appear to carry fair liability with clear warranty, but in reality they may not.

Solution(s): Select a reputable system from a supplier with a good history of minimal failures and a reputation for reliable post-installation support.

NURALITE SOLUTION:

Nuralite has been supplying membrane systems since 1966. Our policy of zero failure roofs has led to an industry leading reputation of quality and post-installation support.

MYTH-BUSTED:

"Sounds like a good warranty, they must really stand by their products"

Choosing an approved component that complements a membrane system is vital to longevity & lifespan

INTERNATIONAL INSURANCE-BACKED WARRANTIES

Instead of relying on the supplier for the warranty, best practice is to arrange for a warranty which is supported by an international insurance company. These are desirable since, if an issue arises, the client can make a claim against an insurance company which has significantly more resources than an installer or supplier.

NURALITE SOLUTION:

If Nuralite is involved in the project from the design stage until completion, we can apply for an insurance-backed warranty. Once accepted, these cover the entire system, product, and installation for 10 years from completion.

Te Kōngahu Museum of Waitangi by Harris Butt Architects

Roof Drainage & Falls

Complying with the Building Code, flat roofs must be designed to clear surface water

Oliver's Ridge by Team Green Architects

ROOF STRUCTURE & SUBSTRATES

The structural system and substrate of the flat roof will affect what type of membrane, drainage and outlet details are appropriate. The main issue to consider is the stability and rigidity of the completed structure. The more rigid the structure the better, to reduce the amount of stress on the membrane. The most common substrates are concrete, plywood and profiled steel (for warm roofs).

NURALITE UPDATE:

The NURAPLY 3PM compliance scope has recently expanded timber substrates to include CLT (Cross Laminated Timber) and Strandboard, under certain conditions.

A warm roof is often the substrate for its selected membrane

Each type of substrate will require specific preparation and/or priming in accordance with the chosen membrane system. The membrane should be compatible with the substrate and follow the supplier's specification.

Risk(s): Sagging or deflection in the substrate can lead to drainage and durability problems in the membrane. Sheet joints in the substrate can move and create localised stress on the membrane. Poor construction can lead to tolerance for movement in the roof and adjoining elements, which will see membranes stretched or compromised.

Solution(s): The span of the substrate materials must be within the manufacturer's recommendations for material thickness and loadings. Plywood substrate sheet joints must be joined tightly and be securely fixed so that they can behave as a homogenous surface. Design must always suit construction movement joints and design membrane movement laps.

NURALITE SOLUTION:

Following Nuralite's CodeMark certification, on a plywood substrate, Nuraply 3PM systems can be used with 600mm joist and nog spacing (this applies to 17mm plywood on roofs and 21mm plywood on decks). When compared to 400mm spacing, this offers a reduction in material resource, labour, energy and costs.

ECO NOTE: Choosing a substrate that lasts can also mean choosing natural materials treated with preservatives. A code compliant timber flat roof requires a plywood substrate and support to be H3 chemically treated. When a client wants a toxin-free construction, consider alternatives such as a profiled steel substrate.

ROOF FALLS

Under the Building Code, flat roofs must be designed to shed water. Falls are regulated depending on the type of roofing. Metal roofing profiles can be used to a minimum of three degrees. Beyond that, only membrane systems can be used and these are regarded as flat roofs.

The fall is most commonly expressed as a ratio, such as 1 in 80, or as an angle, although it is sometimes convenient to describe it in terms of a percentage slope where 1 in 100 is 1%. This is convenient for calculation as it expresses the fall in centimetres per metre run.

Each type of substrate will require specific preparation in accordance with the chosen membrane system

The relationship between falls, angles and percentage slope is indicated below:

FALL RATIO	Slope angle	% Slopes	Rise in mm over 1m
1 : 120	0.5°	0.8%	8
1 : 100	0.6°	1.0%	10
1 : 80	0.7°	1.3%	13
1 : 60	1.0°	1.7%	17
1 : 40	1.4°	2.5%	25
1 : 38.2	1.5°	2.6%	26
1 : 28.6	2.0°	3.5%	35
1 : 19.1	3.0°	5.2%	52
1 : 14.3	4.0°	7.0%	70
1 : 11.4	5.0°	8.7%	87

Table 08: **ROOF FALLS**

Flat roofs do need a fall, and the minimum fall in New Zealand has until recently been two degrees (1:30 ratio) and 1:100 in the gutters. Recent membrane testing and technology allows some systems to work at lower falls. This creates an impact on the design scenarios in which the overall roof buildup has a height limitation. Gutter minimum remains at 1:100 fall.

NURALITE SOLUTION:

1° GUARANTEE

New Zealand's lowest slopes - guaranteed.

Following Nuralite's CodeMark certification, a flat roof in the Nuraply 3PM range must have a minimum finished fall of 1:80 (0.7°). For design purposes, we suggest a 1:40 finished fall should be assumed for timber and metal substrates or 1:60 for concrete. Gutter minimum remains at 1:100 fall.

A slope closer to 1:80 may be accommodated following detailed analysis of the roof, including overall and local deflection, direction of falls and outlet design.

SUBSTRATE	Plywood	Concrete	Existing Nuralite	Concrete with Tapered Boards or Flat Enertherm	Plywood with Enertherm	NPM900 Metal Tray with Enertherm
Minimum Compliant (constructed) **Falls**	1:80	1:80	1:80	1:80	1:80	1:80
Recommended Design Fall (excluding gutters)	1:40	1:60	1:60 Confirm no ponding areas	1:60	1:40	1:40
Comments	Using 17mm (roofs) or 21mm (decks) plywood, rafters at 600 centers, nogs at 600 centers	Create required slope with a screed. Wait for concrete and screed to cure	Confirm substrate is sound	Nuralite to assist with tapered board layout	Create required slope in the plywood	Create required slope in the NPM900

Table 09: **FALLS CERTIFIED UNDER NURAPLY 3PM MEMBRANE**

ACHIEVING ROOF FALLS

STRUCTURAL FALLS

Falls may be formed in the roof structure or can be created within the roofing system above the substrate. Falls in the structure can be achieved by adjusting the height of supporting beams or purlins, by using tapered supports, or by the addition of firing pieces before the substrate is laid. The latter method is normally used with decks such as plywood, pre-cast concrete and metal decking. In the case of an in-situ cast concrete slab, falls are normally provided by using a separate screed.

NURALITE SOLUTION:

Nuralite supply a smooth finish screed, which is an excellent surface to bond the Nuraply TPO system.

FALLS IN THE INSULATION

Pre-formed tapered insulation products provide both thermal performance and drainage falls. They are of particular importance for reroofing existing roofs, many of which do not have sufficient falls and often do not have sufficient insulation.

Pre-formed tapered insulation is also useful in situations where a horizontal substrate is needed for other reasons, such as on a horizontal, internally exposed roof structure.

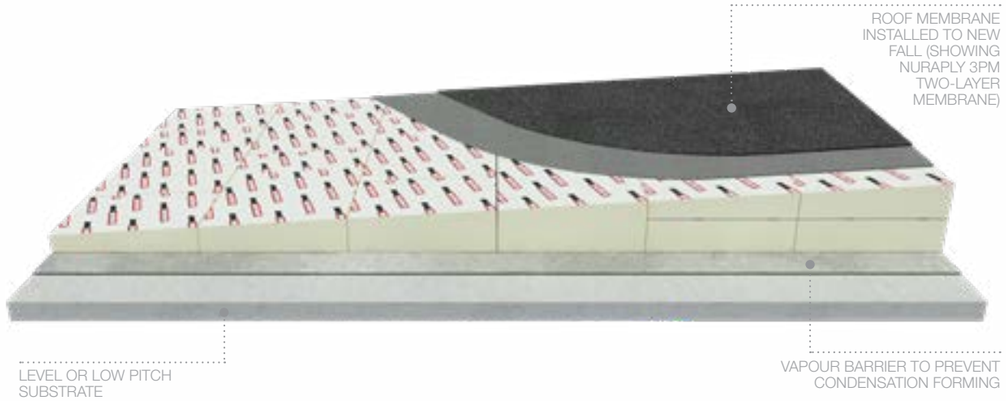


Figure 08: **DIAGRAM OF TAPERED PIR INSULATION LAYOUT**

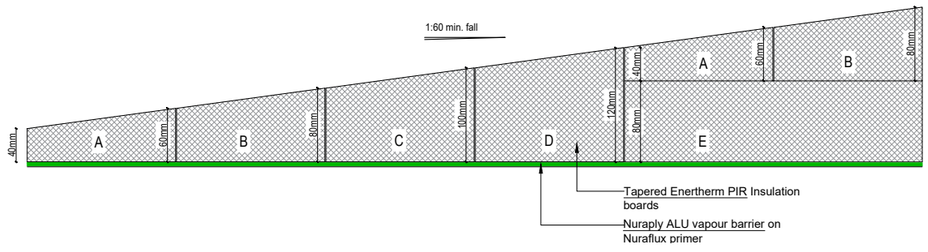
Tapered insulation can provide falls in one direction to a gutter or level valley, or in two directions to form falls and crossfalls. Any intersection in the boards should be at 45° to avoid complex geometries during installation. The below example used falls from tapered insulation boards.

PIR products are appropriate in these situations. Non-PIR products such as Expanded Polystyrene (EPS) have been used in the past but carry the risk of low performance around fire, compression, moisture absorbency and environmental factors.

» **ALSO REFER TO:** PIR Product Options on page 31.

NURALITE SOLUTION:

If you provide a roof plan, Nuralite can design a detailed map and table of materials to install a tapered insulation system with the Enertherm tapered PIR 1:degree (1:60).



» Figure 09: **EXAMPLE OF AN ENERTHERM TAPERED BOARD INSTALLATION PLAN**

View the Tapered Insulation Webinar for more information.

» Knoll House by Megan Edwards Architects

ROOF DRAINAGE: INTERNAL OUTLETS & GUTTERS

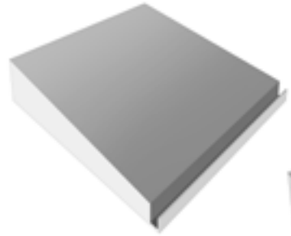
Flat roofs may be drained by two basic methods: towards the outer edges and into external gutters, or towards internal gutters or outlets within the main roof area. Straight falls to external gutters are desirable as drainage penetrations are outside of the enclosure. Internal drainage is achieved by straight falls to gutters or a pattern of falls and crossfalls to outlets.

Internal gutters should be laid to a minimum fall of 1:100. This can lead to a considerable depth of gutter at the low point. On a flat roof it is often better to omit the internal gutter in favour of sloping sections of roof between outlets.

NURALITE SOLUTION:

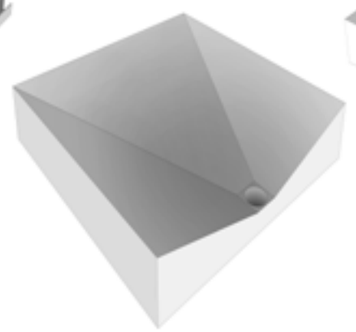
The Nuraply 3PM CodeMark certified membrane allows for watertight outlet connections in a hip-and-valley design as well as an internal gutter.

On a flat roof it is often better to omit the internal gutter in favour of sloping sections of roof between outlets



» Figure 10: **MONOSLOPE TO GUTTER**

» Figure 11: **CORNER OUTLET**

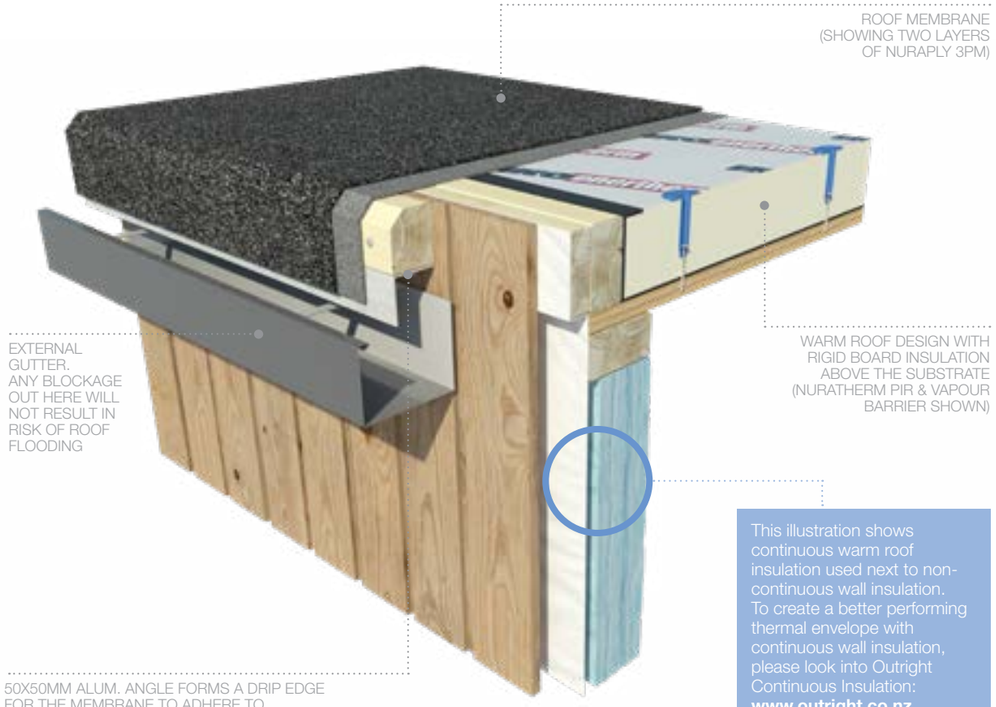


» Figure 12: **VALLEY FALLS TO SIDE OUTLET**

One of the advantages of flat roofs is the opportunity to avoid gutters and include a continuous wall-to-wall waterproof covering and insulation. As a general rule, a well-designed flat roof will contain a good number of outlets and no internal gutters.

EXTERNAL GUTTERS

A flat roof that drains to external gutters is the most risk-averse solution. Best practice ensures the detail of the termination of the membrane to a secure drip edge.



This illustration shows continuous warm roof insulation used next to non-continuous wall insulation. To create a better performing thermal envelope with continuous wall insulation, please look into Outright Continuous Insulation: **www.outright.co.nz**

Figure 13: **TYPICAL EXTERNAL GUTTER DETAIL**

ECO NOTE: As a part of the drainage scheme, consider rainwater collection options to future-proof for water scarcity.

External gutters are the most risk-averse solution

INTERNAL GUTTERS

If the design requires an internal gutter, it should be a minimum of 300mm wide to allow sufficient room for membrane applicators to complete installation. It should also be sized to suit the catchment and capacity.

A minimum pitch or 1:100 is required for internal gutters.

Internal gutters are a vulnerable part of the roof and as such, design must include careful consideration of membrane sheet sizes, risk of blockage, and location of overflows to prevent flooding or ponding.

Internal gutters are a vulnerable part of the roof design

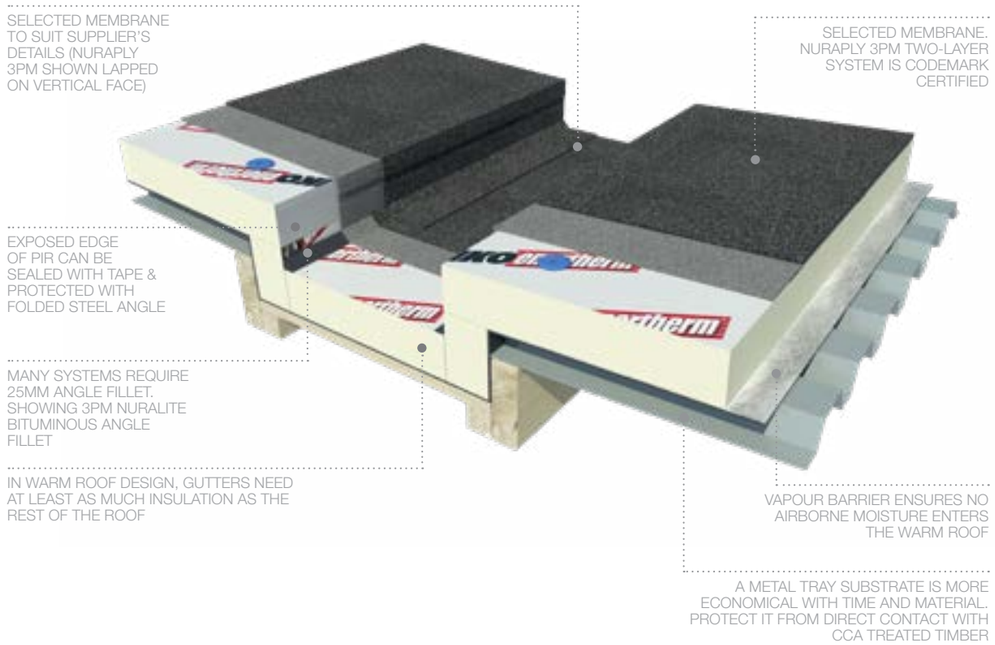


Figure 14: **TYPICAL INTERNAL GUTTER. DETAIL SHOWN ON A WARM ROOF DESIGN**

ECO NOTE: How the gutters impact the thermal envelope is an important consideration. Best practice demands that internal gutters must be properly insulated.

OUTLETS

Proprietary roof outlets need to be compatible with the type of roof membrane. They need to be sized to suit the drainage requirements. The outlet details need to be designed to connect suitably to the specific substrate. An outlet should also come with netting to prevent large objects from entering and blocking the drain.

It is the responsibility of the designer to ensure sufficient drainage capacity for the roof design. It may also be advisable to consult a drainage specialist.

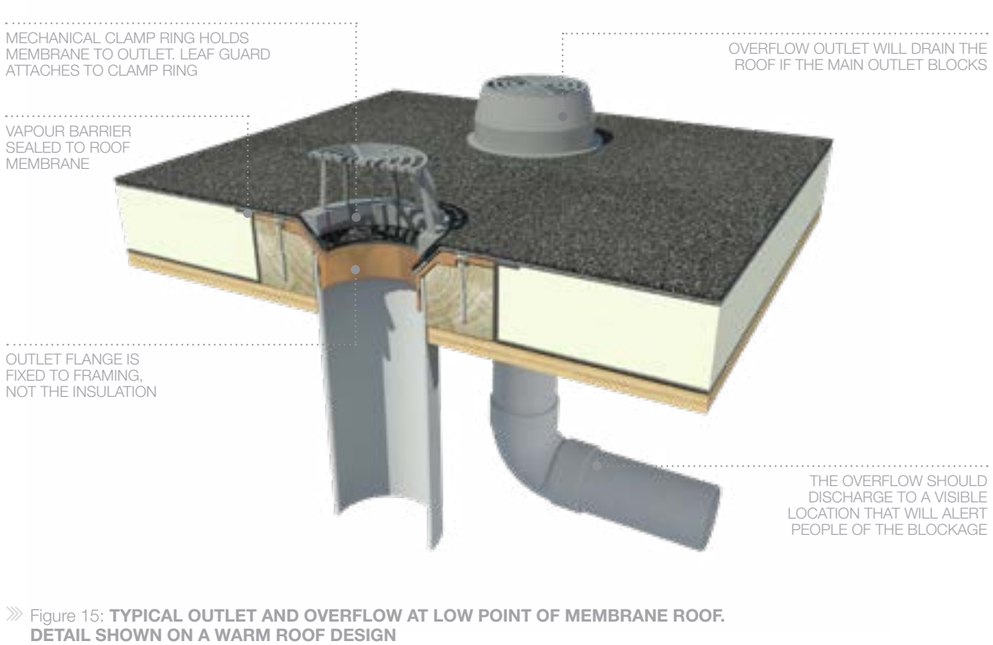


Figure 15: **TYPICAL OUTLET AND OVERFLOW AT LOW POINT OF MEMBRANE ROOF. DETAIL SHOWN ON A WARM ROOF DESIGN**

Proprietary roof outlets need to be compatible with the specified roof membrane

OVERFLOWS

On an enclosed flat roof, it is important to have a backup plan in the form of an overflow. Blockage of the primary outlet is always a possibility. Overflows offer a temporary alternative method of draining the roof. The overflow must be located at a height that will work without significant ponding or flood damage and also at a location where the overflowing water will be easily seen by the building occupants.

It is important to have a backup plan in the form of an overflow

NURALITE SOLUTION:

As part of CodeMark certification, Nuralite has a range of products available including drainage outlets, overflows, drainage scuppers and rainwater heads. The Nuraply TPO system has the same robust scuppers pre-lined with TPO for fast and reliable installation.

- Circular available in 80mm & 100mm diameter.
- Square 100mm x 100mm.
- Rectangular 200mm x 75mm.

Figure 16: **TYPICAL SCUPPER OVERFLOW OPTIONS**

HOW TO CALCULATE DRAINAGE REQUIREMENTS

The size and location of any roof will determine the drainage design requirements. This may affect the size of gutters and the number and diameter of downpipes. As discussion of drainage options is beyond the scope of this Design Guide, it is recommended that a suitably qualified drainage expert is involved at the design stage.

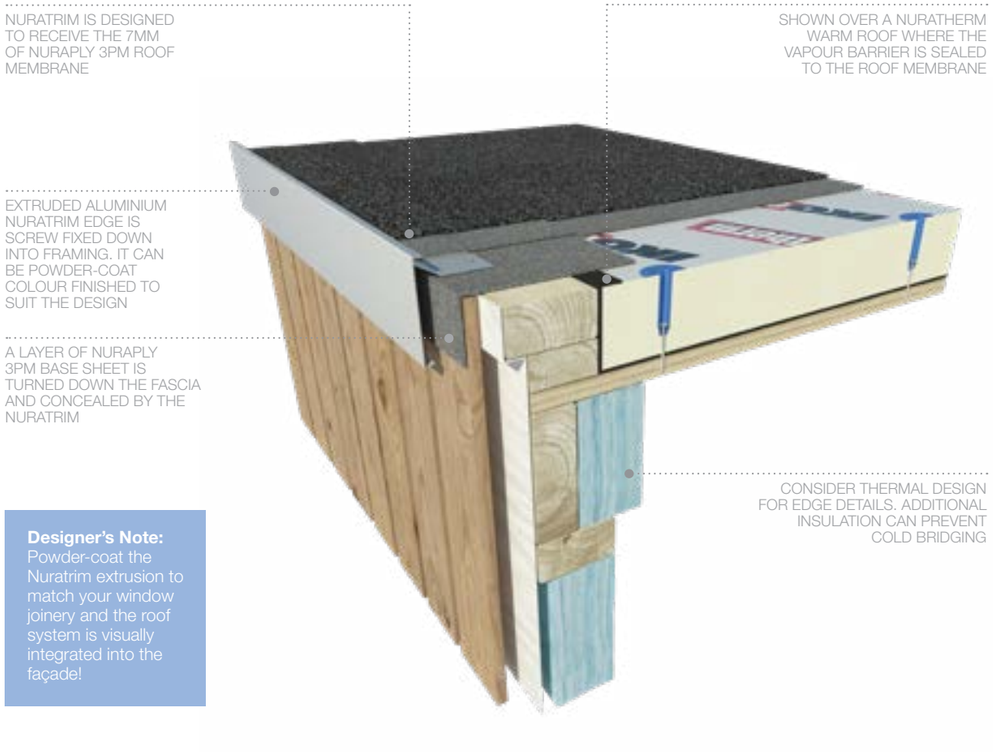
NURATRIM EDGE DETAIL

The greatest wind pressure on a flat roof is experienced at the windward corners and edges of the roof, where the negative pressure can be several times the pressure of central areas.

Protection against wind forces should be one of the fundamental principles behind good membrane roofing design. Nuratrim was developed as an elegant and watertight solution that offers resistance to dynamic wind forces. Because it is visually flat and true, with concealed fixing, we have seen designers use it as a clean and tidy addition to their façade design. As it is made of aluminium and can be anodised or powder-coat finished, it can complement other joinery or panelised systems.

We have seen designers use it as a clean addition to their façade design

Seatoun Home by Judi Keith-Brown Architects. Features Nuratrim on pitched membrane roof



Designer's Note: Powder-coat the Nuratrim extrusion to match your window joinery and the roof system is visually integrated into the façade!

Figure 17: **NURATRIM. MECHANICALLY FIXED EDGING SYSTEM FOR RESISTING DYNAMIC WIND FORCES. DETAIL SHOWN WITH A NURATHERM WARM ROOF**

Risk(s): Extreme wind forces can break down a mechanically attached or poorly adhered waterproofing system. If a wave form develops, the amount of air under the waterproof covering can sometimes increase rapidly, and failure can occur by simple lift-off. It is also possible for the waterproofing to be lifted up and down or dragged out of position until air can find an entry point and cause further damage. Oversails, fascias, cappings, trims and drip edges take the brunt of the wind forces, so these details are usually the first components to fail.

Solution(s): All details should be designed to reduce the free entry of air beneath the membrane. If the waterproofing is fully bonded to a good, stable surface, the wind forces involved will not be sufficient to break down the bond and will not allow a wave to form. For roofs with very high wind exposure, the membrane supplier should recommend any additional design and specification measures (such as extra mechanical fixings).

NURALITE SOLUTION:

- The robust Nuratrim extruded aluminium edge flashing neatly contains a wind-resistant and watertight roof edge (see below detail). It offers a clean, straight edge to the roof and façade. It meets 70mm E2 vertical measure and is designed to form a watertight edge with the Nuraply 3PM two-layer reinforced modified bitumen membrane.
- As a rough guide, all metal cappings and trims should be fixed at 300mm centres, with extra fixings added under conditions of extreme exposure. The grounds to which the details are secured must themselves be firmly attached to the structure.
- Always seek input from the Nuralite technical team in extra high (or above) wind zones. Special details and fixings may be used to ensure project success.

Nuratrim is an aluminium edge system, purpose-designed for the Nuraply 3PM roofing membrane. It provides excellent protection from dynamic wind situations, leaving a crisp and flat vertical face on parapets and roof verges.

Dimensions: 100mm (H) x 80mm (W), in standard 3m lengths.

Figure 18: **NURATRIM**

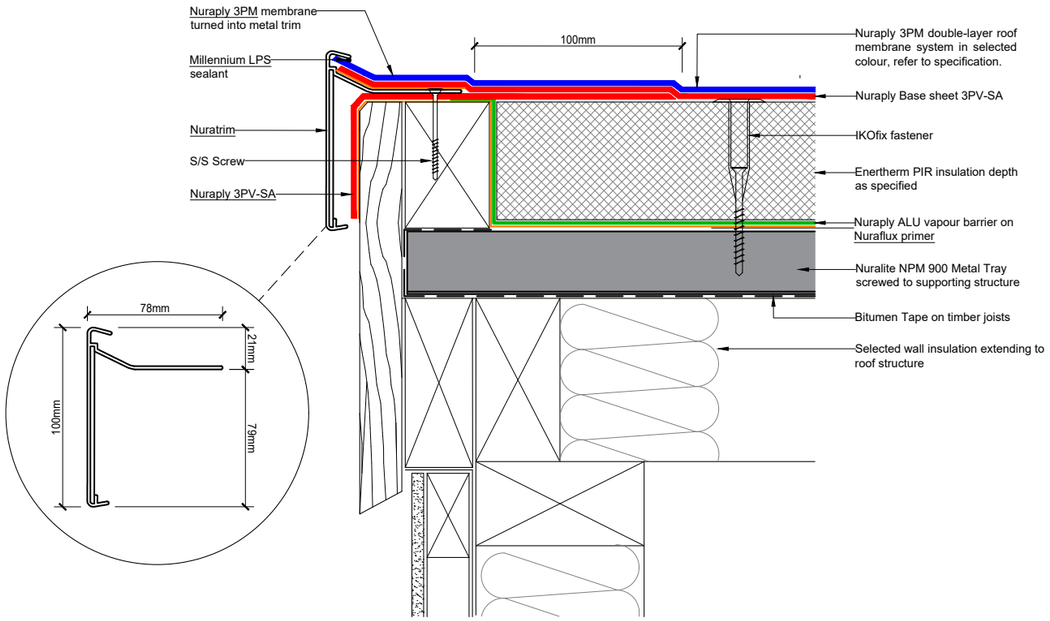


Figure 19: **NURATHERM ON METAL TRAY - WARM ROOF**

Flat Roof Penetrations

RAINSCREENS OVER MEMBRANE
WATERPROOFING DIFFICULT PENETRATIONS
LARGE PENETRATIONS & DRAINAGE CRICKETS

A penetration can be detailed as an integral part of an enclosure

FLAT ROOF PENETRATIONS

The best strategy for flat roofs is to minimise penetrations. Where they are unavoidable, a penetration to a roof membrane can be detailed as an integral part of an enclosure.

Although best avoided, roof membrane penetrations are very common, therefore membrane systems will provide specific ways to detail these penetrations. Circular pipe penetrations are relatively easy to dress and waterproof. A skylight is a penetration that needs to be set into a raised plinth or kerb with standard compliance details. Designers should know the recommendations specific to the chosen system, and if in doubt, ask the supplier for project-specific input to resolve.

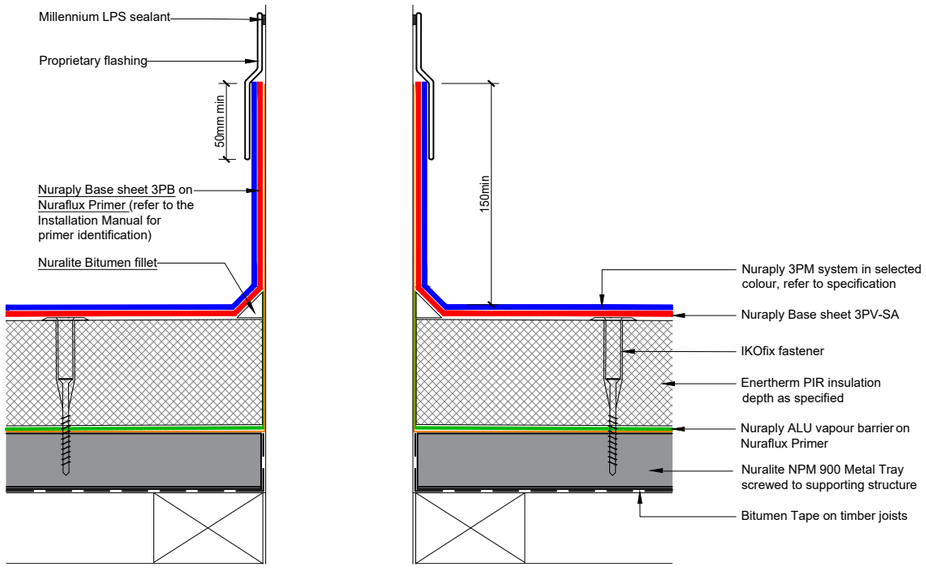


Figure 20: **TYPICAL PENETRATION. DETAIL SHOWN ON A WARM ROOF DESIGN**

Risk(s): The penetration is a gap in the thermal performance of the roof. It is a physical break in the roof membrane and can increase the risk of leaks.

Solution(s): Penetrations should be overflashed with metal or liquid flashing so that the leading edge of the membrane is not exposed. This ensures a watertight connection to the penetrating element and gives the best results.

NURALITE SOLUTION:

For waterproof electrical or service penetrations, use the Nuralite Goose-neck detail.

Figure 21: **NURALITE GOOSE-NECK FOR CABLE PENETRATIONS**

Pt Chevalier House by Guy Tarrant Architects

RAINSCREENS OVER MEMBRANE

The design detailing of a timber rainscreen over membrane has often been a difficult set of details to achieve with functional scope for removal and maintenance access. It is more commonly used on walls, but for a roofscape this is made more difficult by the need for raised plinths to fix the rainscreen to the roof structure. Raised structural plinths have often meant a thermal bridge in the warm roof insulation and can be expensive to waterproof. The same is true of fixing other rooftop components such as solar panels or plant equipment.

Rainscreens are generally used as an exterior surface or a cladding layer to break the force of sideways, wind-driven water movement

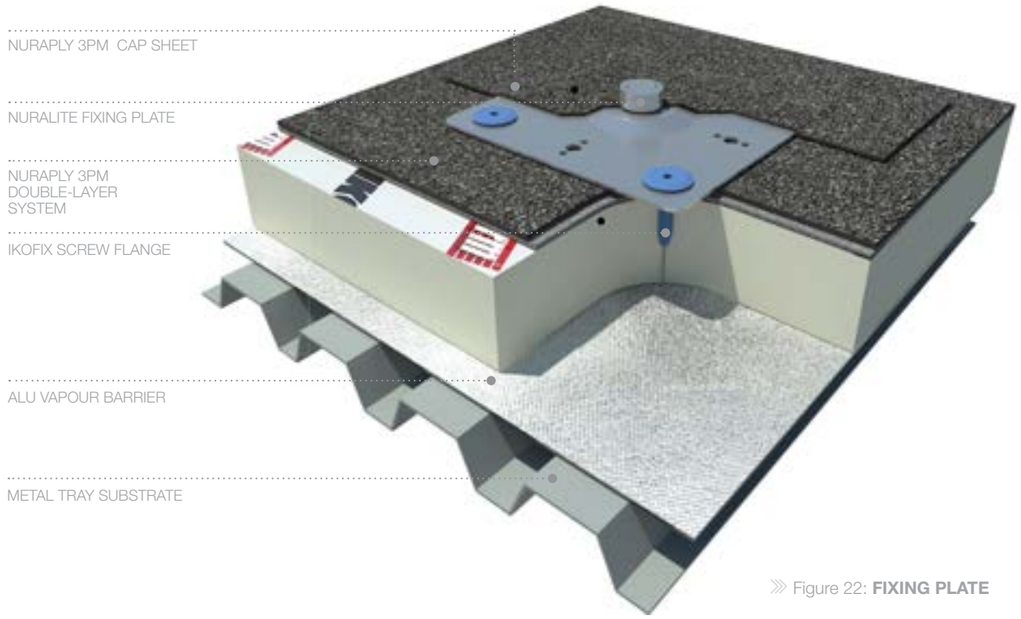


Figure 22: **FIXING PLATE**

NURALITE SOLUTION:

Nuralite is excited to introduce the pre-waterproofed Nuralite Fixing Plate. This offers a clean, simple and watertight fixing node that is slim in profile and allows up to 300kg per plate without the thermal bridging of a warm roof. The stainless steel node comes with 2x M10 threaded holes, perfect for easy top-fixing of cleats for track systems that can support rainscreens or solar arrays, etc.

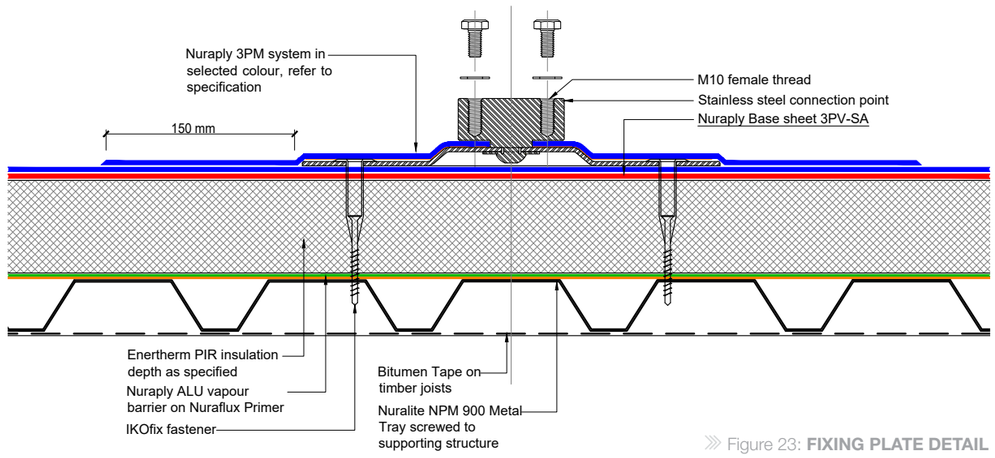


Figure 23: **FIXING PLATE DETAIL**

ECO NOTE: Every little detail that helps modern buildings to maintain continuous external insulation and reduce thermal bridging will help improve thermal performance over time.

MYTH-BUSTED:

"You can't install rooftop objects without a thermal bridge"

WATERPROOFING DIFFICULT PENETRATIONS

Structural posts or balustrade brackets that penetrate the roof can bring their own range of challenges. For example, it is nearly impossible to add a mechanical termination detail to a steel universal column. Some solutions will look smarter than others, some may be hidden beneath a floated deck.

Add correct penetration details to the project drawing set

Abodo show home By Assembly Architects. Features Nuraply membrane and Enertherm PIR insulation beneath the timber rainscreen

Risk(s): There are multiple risks when waterproofing difficult penetrations. For example, the membrane system primer/adhesive is not compatible with the material of the penetration. Over time the bond to the penetrating element could loosen and allow water in. The shape of the penetrating element makes adhesion or bonding too challenging. If not detailed specifically, the penetration could be overlooked or installed after the membrane install, with non-compliant detail. Posts fixed through membranes rock back and forth over time, placing additional stress on penetration seals.

Solution(s): Include a mechanical or specific termination detail to hold the membrane to the penetration. Choose a membrane with standard Pour Pocket components for irregularly shaped penetrations. Add penetration details to the project drawing set.
Note: The penetration should be sealed by the waterproofing specialist who signs off on the whole roof membrane. Avoid top-fixed balustrade posts or structural posts. Where unavoidable, over-engineer and customise the penetration with input from your supplier.

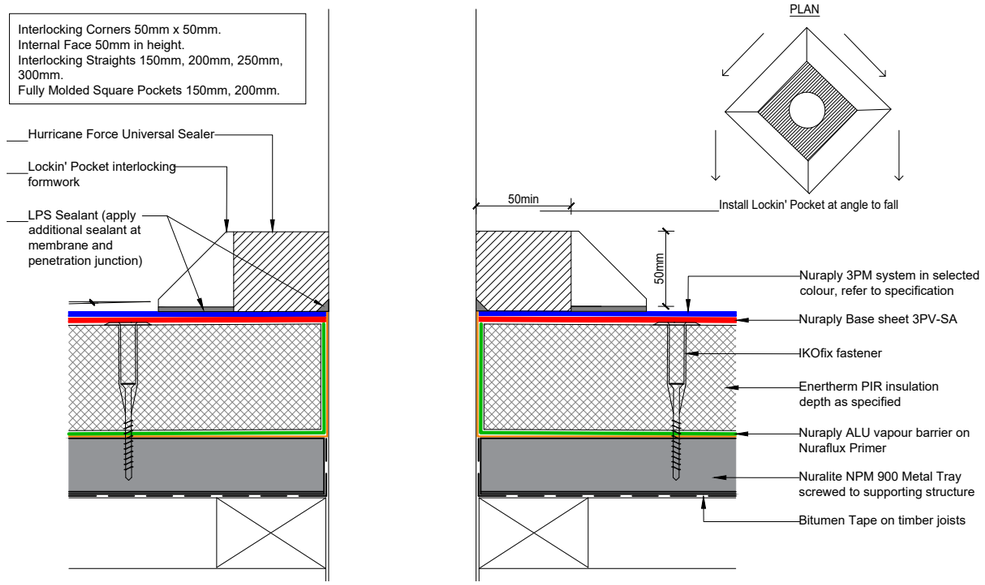
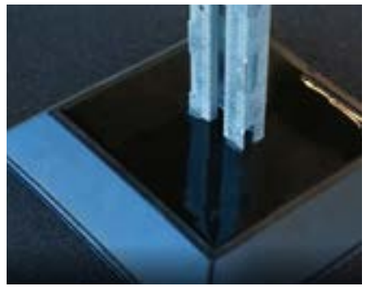


Figure 23: **TYPICAL DETAIL FOR NURALITE LOCKIN' POCKET FOR DIFFICULT PENETRATIONS**



View the Roof Penetrations Webinar for more information.

NURALITE SOLUTION:

For difficult and irregularly shaped penetrations, Nuraply membrane systems have Lockin' Pocket. This detail builds a permanent frame at least 50mm off the penetrating element. It then uses a liquid free of volatile organic compounds (VOC), flexible sealant to pour in and fill a 50mm deep moat around the penetration. It is a modular system that can be adapted for irregular sizes. The liquid cures to a solid state while some flexibility is still maintained.

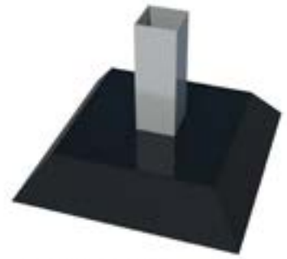


Figure 24: **LOCKIN' POCKET**

LARGE PENETRATIONS & DRAINAGE CRICKETS

Drainage crickets (or saddles) may be used to prevent water ponding behind an obstacle. Crickets will displace standing water and provide a modest fallback to the main roof fall. In effect, crickets introduce a new valley with improved falls.

Risk(s): Poor drainage flow behind a roof object will result in the buildup of silt and debris that will require more maintenance or increase the risk of membrane degradation.

Solution(s): A cricket must be designed for all roof objects that are wider than 200mm. Best practice is that the cricket is designed and formed as part of the substrate layer.

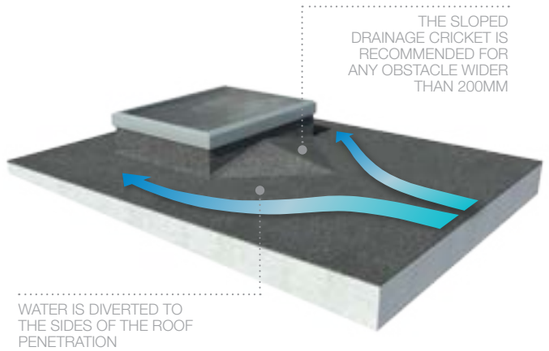


Figure 25: **DRAINAGE CRICKET**

Floated Deck Design

A floated deck is superior to a trafficable membrane for many reasons

Island floated deck by Patchwork Architects & Dorset Construction, Wellington. Nurajacks on torch-on membrane

WHAT IS A FLOATED DECK?

A floated deck is different to a regular deck because it sits over another element without being fixed down to it. The floated deck both protects the membrane and creates a usable outdoor area. A floated deck allows rainwater to fall between the deck boards or tiles, so the deck is permeable and does not direct the flow of surface water.

The deck surface should be supported off the edge elements to allow water to flow down the vertical surface unimpeded. Buildings constructed to the Building Code Clause E2-AS1 require a 12mm gap to be maintained.

Recently, a floating deck has become the standard solution in comparison to other methods, as the waterproofing is visually obscured, whilst remaining Building Code compliant, as it is still accessible for maintenance purposes. In the past, many tile decks were bonded directly to membranes which made maintenance impossible.

Modern, floated decking systems are typically split into either timber or tiled decks. Both will utilise an adjustable and proprietary deck support system. This system is an array of nodes that take the weight of the deck and distribute it onto the membrane while still allowing the membrane to discharge surface water.

A floated deck both protects the membrane and creates a usable outdoor area

BENEFITS OF A FLOATED DECK

A floated deck is superior to a trafficable membrane deck for many reasons:

- The membrane waterproofing is protected from foot traffic so that it can continue to provide its primary purpose of waterproofing the structure.
- Decks can be level rather than sloping, which is better for deck furniture and foot traffic.
- The deck can be raised up flush with the internal floor level, creating level entry for wheelchairs and a desirable indoor/outdoor flow without a step down onto the deck.
- Deck outlets will be guarded against blocking from excessive leaf litter, or larger items like plastic bags, laundry etc.
- The void between the decking and the membrane can be used to accommodate pipes and other services. Services such as outlets, spreaders, conduits, and balustrade fixings can all be hidden from sight below the floated deck.
- Transmission of acoustic impact noise is significantly mitigated by a floated deck.
- The sustainable merit of functional roofs is that they add another use without demanding any additional land area. This enriches the density and quality of experience of the same building footprint.
- Under a floating deck, the membrane is protected from UV and weather extremes and therefore should last considerably longer than regular roof installations.

ALSO REFER TO: Types of Membranes on page 43.

Cathedral Grammar School by Andrew Barrie Lab and Tezuka Architects

NURALITE SOLUTION:

Nuralite membrane with Nurajacks and/or Nurapads will ensure a robust waterproofing system is installed with a tested, compatible, flexible, and innovative deck support system. Nuraply 3PM membrane system with CodeMark Certificate achieves compliance as low as one degree. It will not be compromised by the moisture and weight of a floated deck situation.

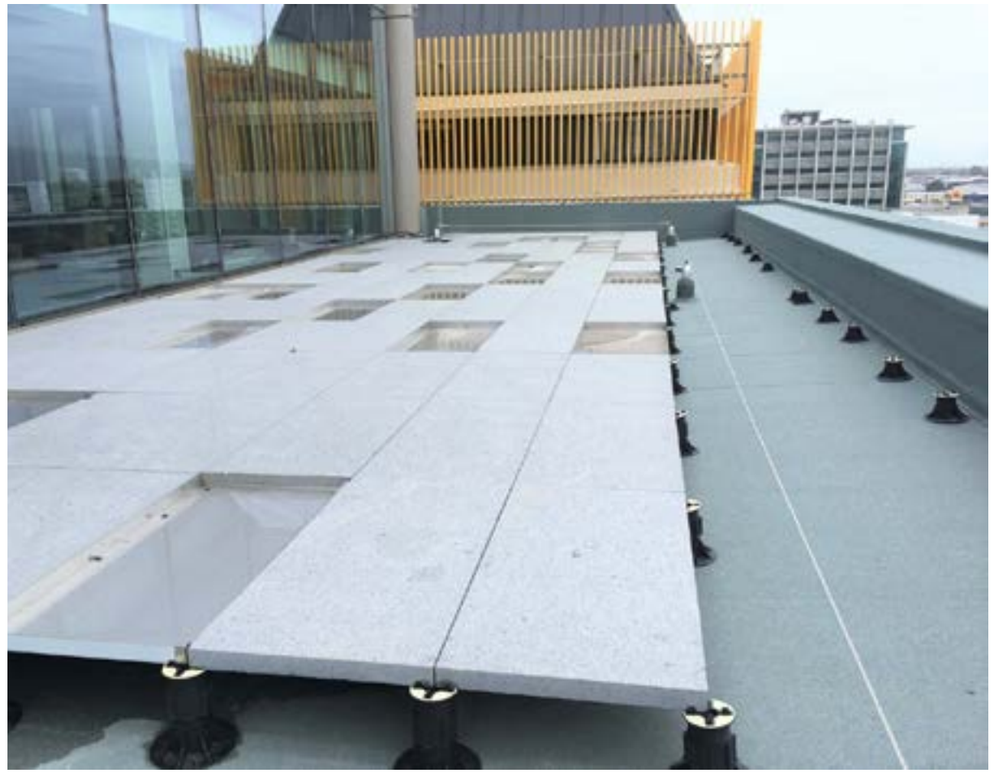
NURAJACK
DECKING MADE EASY

Laying a deck with Nurajacks is straightforward, whether it is with tiles, pavers or timber decking. The Nurajacks rest on top of the waterproofing membrane and the tiles or joists sit on the self-levelling head of the Nurajack. The void between the decking and the membrane can be used to accommodate pipes and other services. Adding an acoustic shim is a cost-effective way to further enhance the acoustic reduction properties of the system.

The Nurajack system has a dedicated tiled head with an integrated neoprene pad and tile spacers. The swivel head automatically finds level. Nurajacks offer an adjustment key that adjusts the height of the Nurajack even after the tiles are installed. For more information and support, contact your local Nuralite representative or visit **www.nurajack.co.nz**

ECO NOTE: Nurajacks and Nurapads are made of 100% recycled consumer plastics. The manufacturer has also achieved ISO14021 for quality and environmental compliance.

Figure 26: **NURAJACK SIZES AVAILABLE**



Grand Chancellor Hotel Christchurch by Warren & Mahoney Architects / Horizon International

ALTERNATIVES TO A FLOATED DECK

The only common alternative to floated deck applications is to specify a membrane that is deemed “trafficable” for outdoor living. While most membranes are durable enough for some occasional foot traffic, all will suffer a reduced lifespan or risk significant damage if exposed to the unknowns of outdoor living in New Zealand. To see the truth of the previous statement one only has to imagine the rusty legs on a deck chair, stilettos or maybe the odd dropped barbecue knife or broken glass when entertaining.

MYTH-BUSTED:

“Just use a membrane that is trafficable instead”

THE DECK SUBSTRATE – PLYWOOD & PIR INSULATION

When adding a floated deck to a membrane roof, it generates a different category of structural loading. As a result, the minimum thickness of plywood is 21mm instead of 17mm on a standard membrane roof. For Nuraply 3PM membranes via CodeMark, the roof joists can be at 600mm x 600mm centres while E2-AS1 compliance path requires 400mm centres.

Another common and important question is: “Can I put a floated deck over a warm roof?” This will depend on the systems specified. Some types of PIR foam will have more integrity than others. We suggest making sure that the suppliers will stand by their specific offerings as those with inferior boards will require a cover board to be installed.

NURALITE SOLUTION:

A Nuratherm insulated membrane and a Nurajack floated deck have been laboratory compression tested and proven compatible by Nuralite.

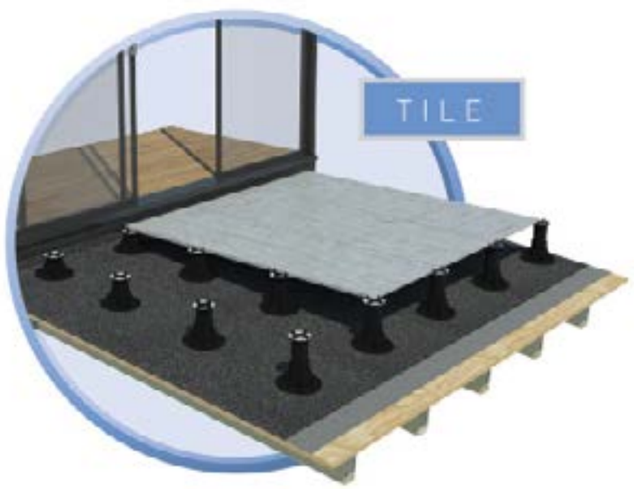
Gain the confidence of a proper warm roof system - no condensation/ mould or cold bridging in the deck structural zone.

MYTH-BUSTED:

“You can’t float a deck over a membrane warm roof”

Riverlands House by Warren & Mahoney Architects

TILED FLOATED DECKS



Design insights for a floated tile deck

While floated tile decks have become commonplace in New Zealand, there are still some insights that should be considered. Many designers will try to design a deck to the format of a tile. However, not all tiles are the same size; some advertised 600mm x 600mm may actually be 595mm x 595mm. Also, as buildings are very rarely straight and since the tile cannot be stretched to fit, best practice is for tilers to cut the tiles around the perimeter of the deck to match. For this reason, consider designing the size of the deck to be approximately 100mm smaller than a module of a tile or paver.

Another consideration is that small cut tiles can be very difficult to support on a floated tile system. Try and avoid tiles that are smaller than 150mm^2. Where this cannot be avoided, consider using an edge support, such as an aluminium angle to support the leading edge of a cut tile against a wall.

Walls not at right angles to adjacent and opposing walls can also create a few issues. As the tiles lead away from a wall, the triangular shapes of the tiles will slowly get smaller and cannot be held in place by a jack. Again, consider using an aluminium angle to support the leading edge of the tile against the wall.

Some designers will want tiles to finish resting on a parapet wall, but a compliant parapet wall typically has a minimum five-degree slope. Designers should allow enough clearance for a tile to bridge the parapet and be supported by the balustrade or to allow for a Nurajack to be placed on the parapet. The tile will still need the balustrade or some other vertical surface for perimeter bracing. Also, care should be taken to ensure excessive wind cannot get under the tiled system.

TIMBER FLOATED DECKS

Time-saving adjustable jacks can be used for the whole deck

The key design decision for achieving a floated timber deck is often a factor of the height available. It will determine whether the levels are achieved with pads (not adjustable) or height adjustable pedestals or jacks.

If there is enough height to use a standard sized joist, then the time-saving adjustable jacks can be used for the whole deck. Depths of deck joists will determine the spacing and number of jacks.

If there is not much height available, the deck joists may need to be ripped/tapered to match the exact fall of the membrane roof deck. Ripped lengths can then use the non-adjustable pads, but do require more careful and time-consuming measuring and cutting.

Most floated timber decks over membrane will use both jacks and pads along the length of one joist.

Risk(s): A ripped/tapered joist can be cut too thin. It needs enough structural integrity to perform as a joist. Also, the cut face may not be treated and could decay prematurely.

Solution(s): Revert to an aluminum joist which may impact both costs and embodied energies. Consult the table at **www.nurajack.co.nz** to match the Nurapad spacing to the depth of the ripped joist. Treat the cut edges of treated timber deck joists to prevent rot/decay.

NURALITE SOLUTION:

The Nurajack system has a dedicated timber head with a pre-drilled cleat for screwing to the deck joist. The swivel head automatically finds the angle of the surface below. The Nurapad is the simple 12mm spacer for when joists are being ripped instead. For more information and support, contact your local Nuralite representative or visit **www.nurajack.co.nz**

ECO NOTE: Historically, some of the nicest hardwood decking timber, specifically Kwila, has been associated with rainforest destruction in other parts of the world. The demand for this wood and the rainforest depletion and associated species extinction is still happening. “Sustainable management” of a forest does not solve the problem. It is suggested that specifiers and clients look for locally sourced options and/or thermally treated products. Avoid contributing to the demand for imported, dense, old-growth hardwoods, even if it carries environmentally approved branding.

Whatever the decking, it will probably have optimum requirements for fixing methods and periodic protection with oiling/staining for long-lasting solutions.

MYTH-BUSTED:

“Just use a piece of malthoid under a timber joist”

LOW HEIGHT BUILDUP OF FLOATED DECKS

Sometimes a design situation leaves very little space for a deck supporting system at the high point of the membrane. It can be overlooked during design, especially if ceiling height and overall building height are both critical. This can also become problematic on-site.

NURALITE SOLUTION:

The following design tips can be enough to make it work:

1. Use a suitable fall. Nuraply 3PM at one degree can easily save 50mm or 100mm on a good size deck.
2. Question the need for a classic internal gutter. Try achieving falls to a single low point and flush outlet.
   » **ALSO REFER TO:** Roof Falls on page 61.
3. For tiles, utilise the adjustable Nurajack Star T which is as low as 8mm.
4. For timber decks, consider ripping the joists to less than 90mm and using Nurapads at 12mm thick. Check the required spacing of Nurapads as it decreases with the reduced joist thickness.
5. Consider aluminium joists instead of timber.
6. Allow for the thickness of the membrane because a robust two-layer Reinforced Modified Bitumen system can account for as much as 11mm over a sheet lap. If this creates an issue, consider Nuraply TPO membrane as a 1.5mm thick alternative.

WIND ZONES & FLOATED DECKS

Deck elements being lifted or blown off a roof is very uncommon, yet we are noticing some Council requests to prove that it will not happen. If this is a design concern for your project, here are three solutions that Nuralite have on offer:

- Have a solid balustrade that prevents wind gusting under the floated deck.
- Mechanically fix the floated timber deck to perimeter elements with horizontal fixings. These will probably penetrate the vertical face of the membrane. Nuralite has a detail for this if required.
- For tiles, specify Nurajack SE Windproof system. The SE Windproof has clips that secure the tile to the top of the Nurajack, creating a homogenous deck surface. For more information consult your local Nuralite representative.

MYTH-BUSTED:

"The only wind uplift solution is to use heavy concrete pavers"

A DECK FLOATED OVER AN INTERNAL GUTTER

This situation can be confusing. Should I design deck pedestals into the gutter or cantilever decking over the gutter? The best solution is to design this rather than let it be resolved on-site. The starting question is to check if an internal gutter is even required.

» **ALSO REFER TO:** Achieving Roof Falls on page 63.

With narrow gutters, a 600mm deck tile could span the gutter and be supported by a perimeter lip or ledge. Timber floated deck joists can often span or cantilever a gutter.

NURALITE SOLUTION:

If you have enough width in the gutter, the simplest answer is to locate the Nurajack pedestal in the gutter and cut a section off the baseplate so water flow has minimal resistance.

» Takapuna House

REPAIR & MAINTENANCE ACCESS

A floated deck design needs to consider the intended means of maintenance access to the membrane and specifically to the gutters, valleys and drainage outlets/overflows. Here are some typical solutions:

- Deck tiles can be lifted off as required;
- Timber decking is fixed with screws and specific boards are easily removable; and
- Timber deck could include an access hatch, designed to be removable or hinged.

FLOATED DECK ACOUSTICS

The transmission of acoustic impact noise to the space or the tenancy below is significantly mitigated by a floated deck. A smart pedestal system will offer additional measures to reduce this even further.

NURALITE SOLUTION:

Adding a Nurajack Acoustic Separation Pad is a cost-effective way to further enhance the acoustic reduction properties of the system. Reduce acoustic vibration even further with a Nuratherm insulated membrane roof system as well.

The Nurajack tile head has an intergrated rubber surface to improve acoustic performance and limit tile movement.

BALUSTRADE SYSTEMS

A common design challenge is to elegantly attach a balustrade system to a floated deck or the perimeter structure. Many fixing clamps can be concealed beneath the floated deck; however, the most reliable solution, from a waterproofing perspective, is to mount the balustrade system on the external face of the deck/balcony structure.

When fixing to the internal face, we have one main suggestion: Avoid top-fixed balustrade posts over a waterproofing membrane. This method used to be commonplace, but the industry has moved away from this because no matter how carefully it is done, it is a weak approach point with increased likelihood of leaking over time.

» See instructional videos at **www.nurajack.co.nz**

NURALITE SOLUTION:

Nuralite and Nurajack have details available for how to achieve standard solutions for balustrade fixings.

Balustrade fittings can be concealed beneath a floated deck

» Waiheke House

E2-AS1 & DECKS OVER 40M²

A membrane roof deck performs much the same as a membrane roof does. Therefore, an entire roof area can be made functional and designed as an enclosed or floated deck.

E2-AS1 restricts decks to 40m² if a fall of 1:40 is used. However, the Nuralite CodeMark covers decks of all sizes so designers can specify falls to one degree on Nuraply 3PM decks.

WHAT TO LOOK FOR IN A FLOATED DECK SUPPORT SYSTEM

There are a variety of deck support systems available in the market. They will each consist of an array of supports or jacks that support the floating tile or timber. A few factors to consider are:

- **Self-levelling heads -** A jack with a self-levelling head provides a level deck every time, even with variations in the roof pitch. With fixed heads, tilers must resort to placing ad-hoc shims under the base of the jacks - a time-consuming practice that has the potential to damage the waterproofing membrane through point-loading.
- **Base size –** A wide footprint ensures that the deck load is distributed on a wide base, giving stability and an integrity that does not compress or damage the membrane.
- **Height adjustment -** The tiler should be able to complete the installation with perfect accuracy by adjusting the height of the tiles from above, without the need to remove the tiles to fine-tune the installation.
- **Waterproofing compatibility -** Some suppliers' warranties may be voided by the use of non-approved systems. Liquid membrane systems should be avoided as they require future re-coating and maintenance to maintain their integrity. The best protection is to purchase the membrane and deck support from a single supplier.
- **Structural deck tiles -** A structural tile or paver must be used. Before purchasing a tile or paver, ensure it is strong enough to carry foot traffic weight when supported by deck supports.
- **Lateral bracing -** The deck must be braced against the surrounding cladding systems using a consistent cladding spacer. Check this is available as part of the supplied system.

View the Roofs as a Liveable Space Webinar for more information.

ECO NOTE: Nurajacks and Nurapads are made of 100% recycled consumer plastics. The manufacturer has also achieved ISO14021 for quality and environmental compliance.

Reroof, Renewal & Overlay of Existing Roofs

MEMBRANE COMPATIBILITY
UNEVEN SURFACES
LEAKS & WATER DAMAGE
NON-COMPLIANT FALLS IN EXISTING ROOFS
LONG RUN METAL ROOFS BELOW THREE DEGREES
ENCAPSULATING ASBESTOS
RENOVATION WORK & FIRE PRECAUTION

Preserve & protect our existing resources

REROOF, RENEWAL & OVERLAY OF EXISTING ROOFS

One of the best ways to avoid new-build carbon emissions is to preserve and protect existing resources, existing buildings and their existing roofs. When a flat roof membrane is at the end of its lifespan, depending on the vintage and the condition, there are often a few different ways to replace or upgrade the waterproofing membrane. This section covers the main types of reroofing projects, and how to do it right.

Ellen Melville Centre Refurbishment by Stevens Lawson Architects

Old roofs are cold roofs

Old roofs are cold roofs! An old roof in New Zealand will be a cold roof. With reroofing, the opportunity presents to upgrade thermally to a warm roof. This can be as simple as installing the warm roof directly over the existing, and it also offers a chance to achieve greater fall with a tapered warm roof.

ALSO REFER TO: Roof Renewal & Specifying for 90 Years on page 22.

Risk(s): Replacing a roof with like for like? Not all reroofing projects will fall under maintenance work.

Solution(s): If unclear, check with your local Council about the scope of work that requires a building consent.

ECO NOTE: Ideally, the existing membrane and substrate can be left in place to avoid disruptive demolition work. Or, the product can be removed and recycled. Both options are desirable because they will prevent additional waste to our landfills.

NURALITE SOLUTION:

Design for the Nuraply 3PM 90-year renewal cycle. This allows two renewals, one after 30 years and one at 60 years (totalling 90 years before any invasive reroofing, recycling or diversion to landfill is required!)

MEMBRANE COMPATIBILITY

Harmonious and easy reroof projects are often the ones where there is minimum disruption to the building occupants. To add a new membrane over the top of an existing membrane seems the obvious solution, but without thought it can prove a quick fix that ends up failing.

We have seen numerous existing membrane roofs where all sorts of combinations of incompatible membranes and patches have been overlaid poorly over the years, from mastic asphalts, paints, liquid membranes, butyl, EPDM, and single-layer systems. This is a result of the quick-and-easy fix strategy without consultation, which turns out to be a short-lived solution that makes a proper and effective reroof more challenging.

New membrane systems should be confirmed as compatible over time with the existing membrane. Some membranes will hold dampness and sweat and cause problems if they are encased by another membrane. And some simply do not bond well to each other.

NURALITE SOLUTION:

If the substrate beneath a bituminous membrane is in sound and dry condition, Nuralite will offer an overlay methodology that bonds a new bituminous two-layer system over the existing. Nuraply 3PV is a ventilated base sheet that safeguards against localised amounts of moisture by allowing it to disperse if needed.

UNEVEN SURFACES

One way to mitigate uneven old surfaces can be to fix down a thin, rigid board over the existing. This will provide a suitable surface to install the new membrane system. This panelised rigid sheet solution is typically a non-structural board that still relies on the existing substrate for structural performance.

NURALITE SOLUTION:

If the substrate is not smooth and even Nuraboard can be laid first to create a suitable surface for the Nuraply 3PM membrane system.

ECO NOTE: This solution can be installed over an incompatible existing membrane and remove the need for demolition and landfill.

Nuraboard mechanically fixed in place and awaiting membrane install

LEAKS & WATER DAMAGE

If the existing membrane has been leaking, we can expect there to be unacceptable moisture content in the existing roof substate, perhaps even significant moisture damage. This can result in the most costly and invasive solution – to remove and replace the roof substrate, sometimes also the roof structure. When this is unavoidable, it can pose opportunities for new or sustainable design interventions that can utilise the outdoor rooftop area.

NURALITE SOLUTION:

It is important to have the roof structure and substrate inspected by a suitably qualified expert. If not sound, then the reroof can be treated very much like a new-build situation.

NON-COMPLIANT FALLS IN EXISTING ROOFS

Buildings that were designed decades ago often do not meet our current Building Code simply because of the pitch or fall. In extreme cases, this will have resulted in ponding on the roof deck. So, when investing in a reroof, whether as maintenance or as a wider scope of works, it will give peace of mind to make the roof pitch compliant.

Crowne Plaza

If the existing substrate is sound, then the most advantageous way to create a compliant fall is to overlay with a tapered, warm roof system. If done properly, the reroof will then have these key benefits:

1. Code compliant falls and effective roof drainage;
2. Additional insulation and better thermal performance;
3. No disruption to spaces below; and
4. A lightweight solution that does not add risk to older concrete roofs or earthquake-prone structures.

Risk(s): An old roof with parapet or balustrade height may be made non-compliant by the additional slope added to a roof. Roof access and door step can also be made non-compliant by adding additional fall.

Solution(s): Accurately survey existing levels to anticipate further compliance and safety concerns.

NURALITE SOLUTION:

Nuraply 3PM membrane system is CodeMark compliant to less than one degree fall (1:80). A Nuratherm tapered warm roof will give an additional one degree of fall, making almost any rooftop compliant.

LONG RUN METAL ROOFS BELOW THREE DEGREES

Another roof type that lends itself to a warm roof overlay is the classic 1960's metal trough profile. Some of these roofs are in sound enough condition but have a fall less than three degrees. A metal roofer cannot simply reroof and achieve compliance.

Here we have another smart environmental means to extend the use of existing resources: the existing roofing can become the substrate for the new membrane warm roof! But there are some important factors to be aware of for using a Nuratherm warm roof overlay in this instance:

- The condition of the existing roof structure and roofing;
- The span of the existing pan (crest to crest) and how it is fixed;
- Packing up the long-run pans to protect the PIR; and
- Detailing to existing or new gutter and edge conditions.

NURALITE SOLUTION:

Nuratherm Warm Roof Membrane System. When installed over Metal Tray it must be mechanically fixed rather than adhesive bonded (which is common over concrete). Insulation values are as follows: 70mm R3.15, 80mm R3.6, 100mm R4.55. Consult your local Nuralite representative first, as not all existing types of membrane are suitable.

ENCAPSULATING ASBESTOS

Some older mastic and bitumen-based membrane systems contained asbestos fibres. When reroofing, a good general policy is to safely remove and dispose of any old asbestos materials. However, Nuralite has developed a methodology for their older bitumen roofs that enable the existing roof to be encapsulated and left in place.

This is a robust two-layer and compatible system that will give a long-lasting upgrade, while reducing the need for hazardous materials handling of waste to landfill. Contact Nuralite and ask us about the asbestos membrane roof rebirth methodology.

RENOVATION WORK & FIRE PRECAUTION

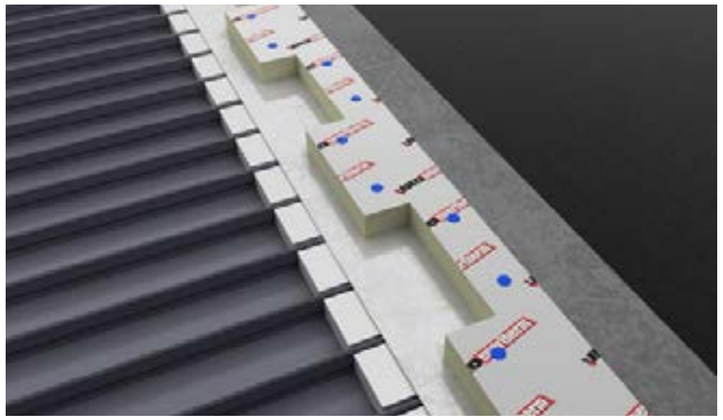
Reroofing can require installing new membrane to the base of existing walls and junctions with other building elements. If the existing is an old timber building, or if there is a risk of existing materials catching fire, some basic fire precaution is required with the membrane specification.

NURALITE SOLUTION:

Consider using Nuraply TPO. This still involves welding of the joints but is vulcanised with a heat gun, and no flames are required. For new-build situations, Nuralite has recently developed a fire safety plan for safe practice with torch welding on-site.

View the Upgrade Existing Roofs Webinar for more information.

Use the existing roofing as a substrate



Nuratherm Warm Roof Membrane System overlay over existing Metal Tray

Scott's Hut, reroofed by Cheshire Architects

» The Dacha Lodge by Eliska Lewis Architects

References & Supplementary Information

Our maxim:
FLAT ROOFS | BUILT RIGHT

LIST OF FIGURES

LIST OF FIGURES con't...

LIST OF TABLES

LIST OF GRAPHS

FLAT ROOF DESIGN CHECKLIST:

- The proposed substrate is rigid and suitable for selected membrane.
- A durable and suitable membrane is selected.
- A system supplier committed to Net Carbon Zero emissions and a safer future has been identified.
- Understood the benefits of CodeMark as means of compliance.
- Considered the benefits of warm roof design.
- Warm roof thickness meets or exceeds dew point analysis for local thermal conditions.
- Roof space ventilation is designed for (if cold roof).
- The installation has been designed with understanding of interstitial condensation.
- Considered a green (living) or brown (ballast) roof.
- Considered a functional rooftop space (floating deck systems).
- Considered future-proofing for solar energy generation equipment.
- Designed for rainwater storage and re-use.
- Specified a system understanding the Red-List and Volatile Organic Compounds (VOCs).
- Considered design for disassembly and re-use.
- Considered life cycle of materials and options for reducing waste to landfill.
- Adequate fall/slope is achievable.
- The drainage design avoids internal gutters and penetrations if possible.
- The drainage design includes overflows as required.
- The drainage design meets required capacity.
- Raised platforms in the roof have drainage crickets.
- Considered exceeding thermal code minimums for R-value.
- The roof system meets acoustic requirements.
- The roof system meets fire requirements.
- Detailed edges to meet dynamic wind conditions.
- The installation has been designed with control and seismic joints as required.
- Safety from falling has been considered.
- The design includes means for roof maintenance access.
- Compatible components and accessories are selected.
- Detail designs are technically reviewed by supplier before building consent.
- The roof specification is provided and reviewed by system suppliers.
- Educated the client on the value of durable, long-lasting roof membranes.
- Educated the client on the importance of maintenance routines.
- Inspected suppliers' warranty details carefully.
- Prepared an owner's manual and maintenance schedule.
- Proposed that the contractor and membrane applicator meet on-site before work commences.
- Scheduled a roof shout.

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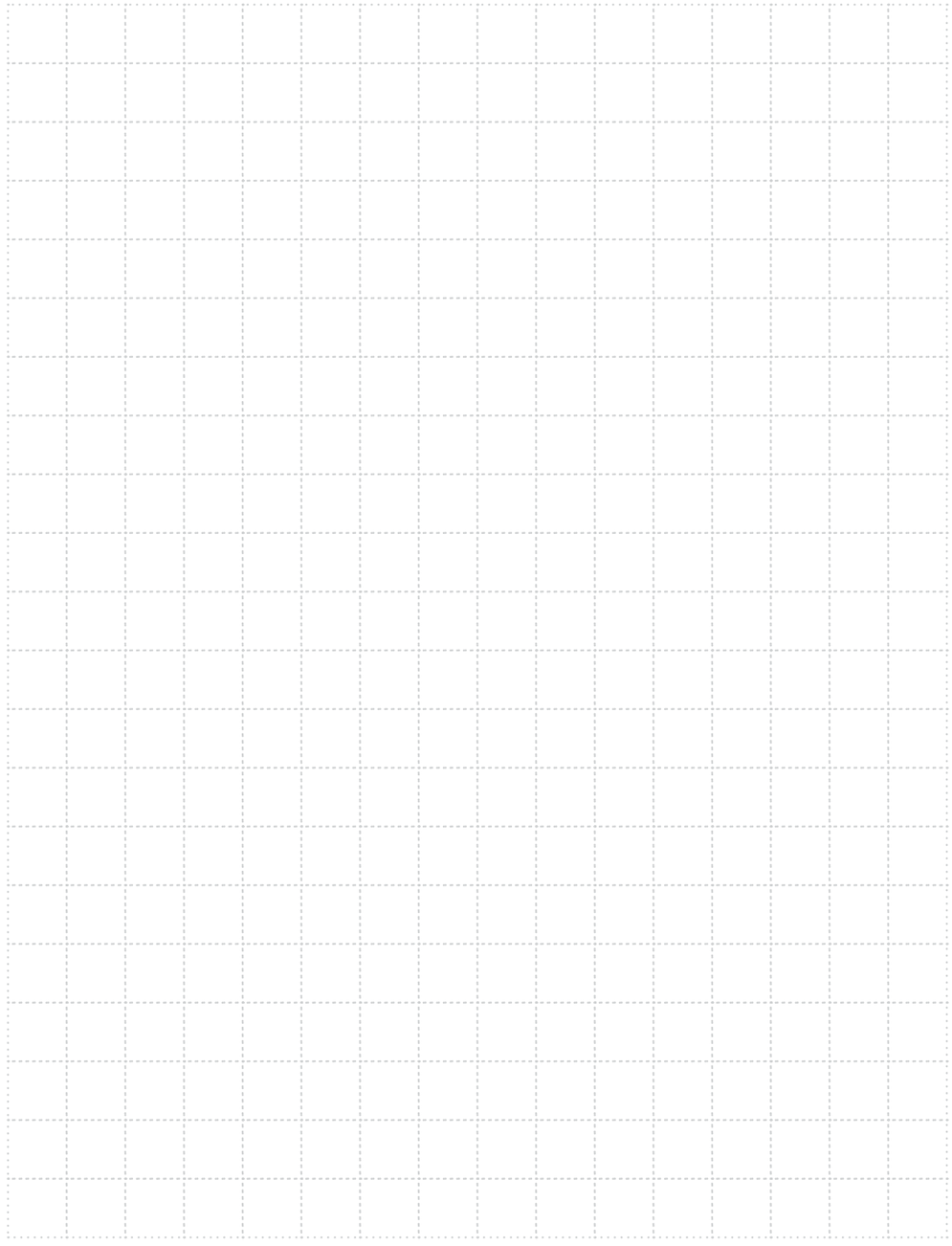
Scale 10mm grid

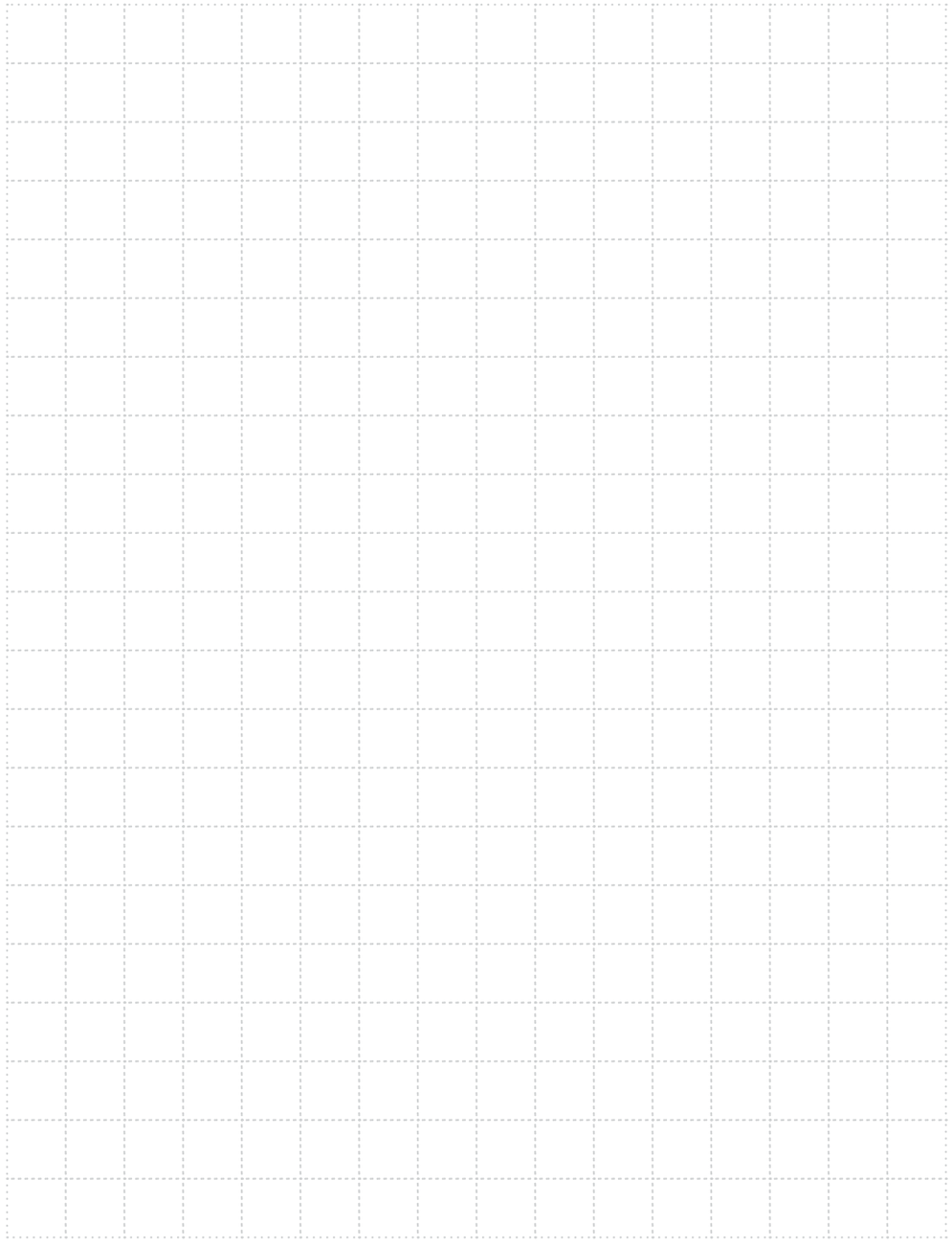
NOTES...

Scale 10mm grid



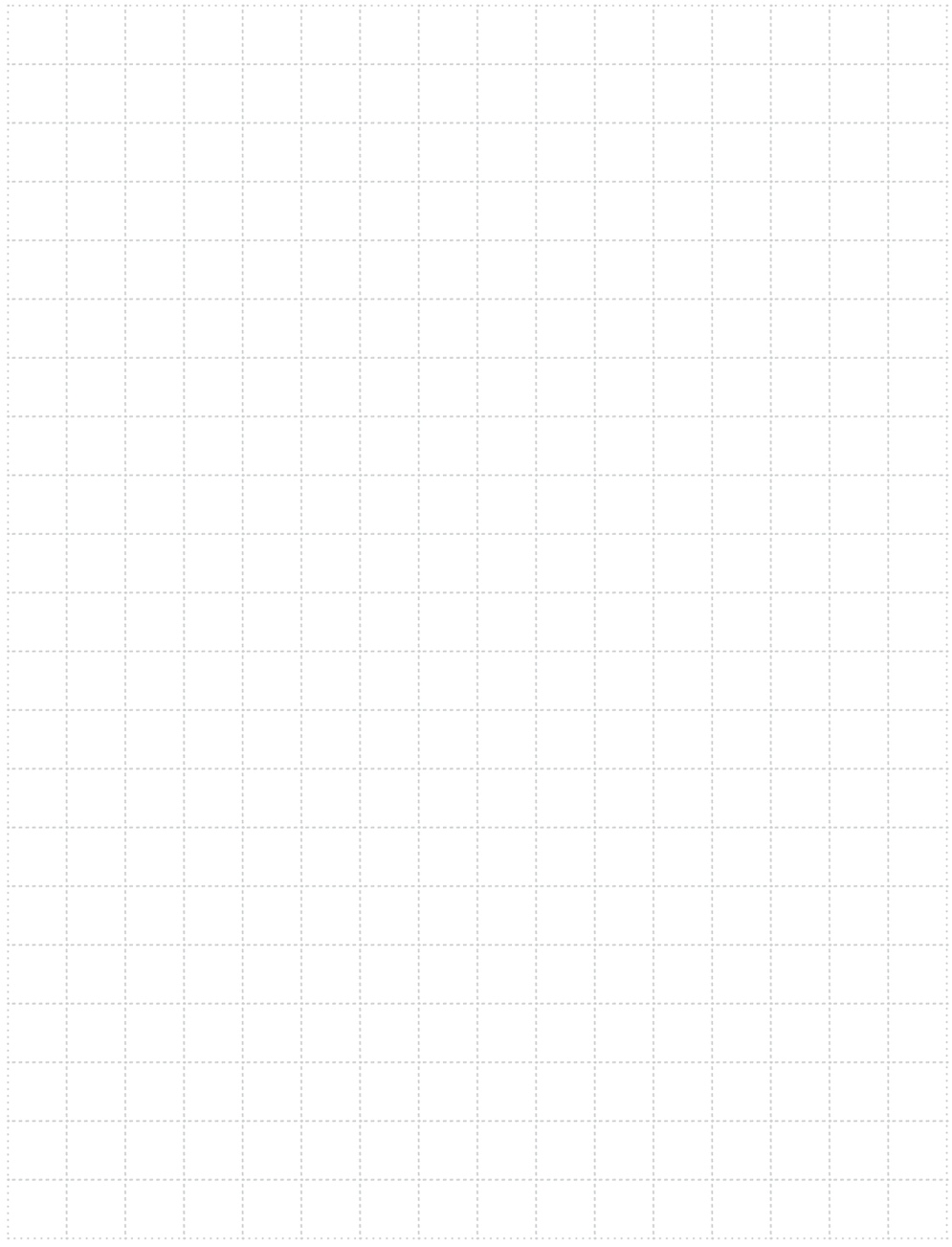
NOTES...

Scale 10mm grid



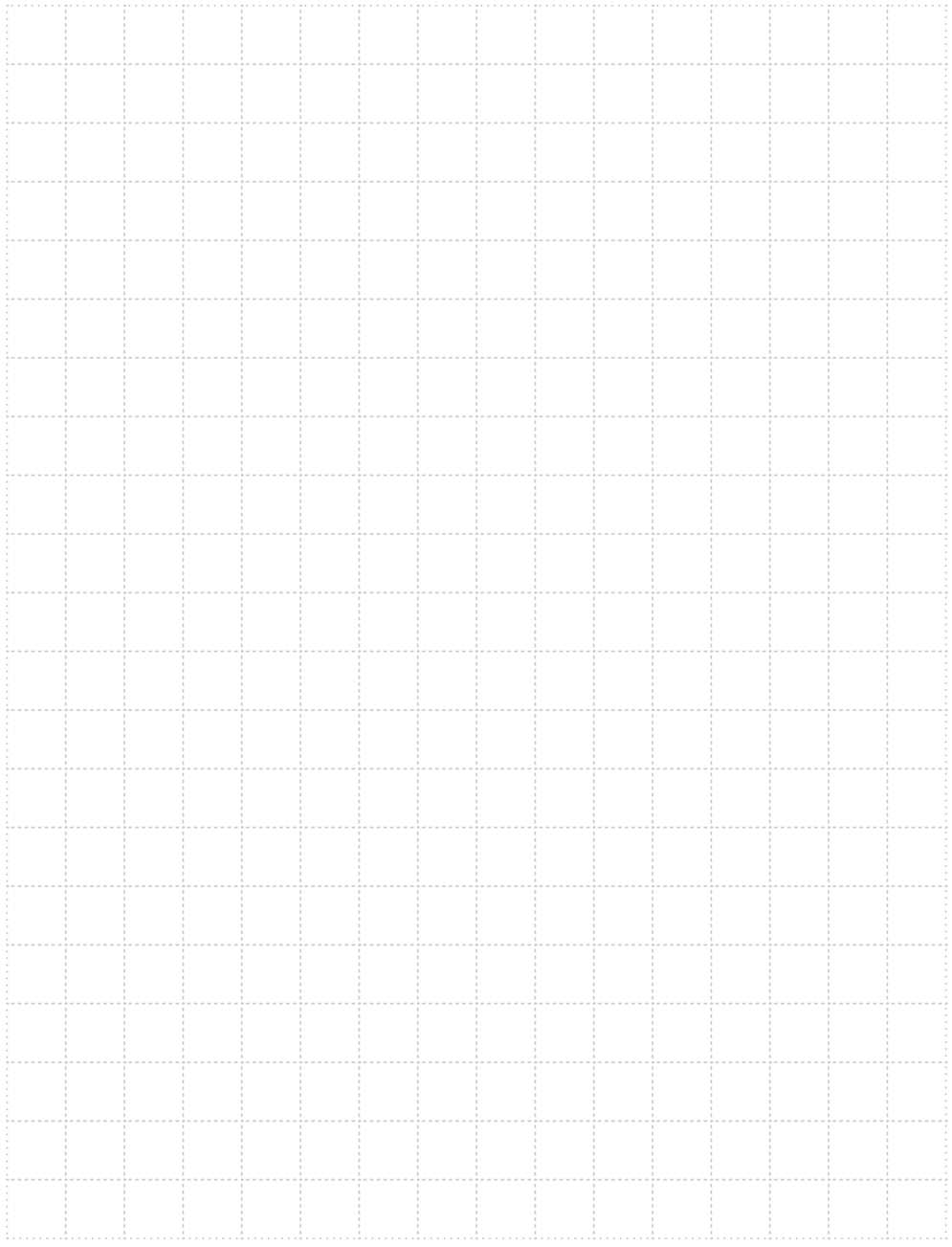
NOTES...

Scale 10mm grid



NOTES...

Scale 10mm grid



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