Tekton Consulting
Tekton Group Ltd, PO Box 45045, Lower Hutt 5042, ph: +64 27 2300120

Maxispan® Roof and Wall Claddings

Compliance with the Building Code for E2 External Moisture

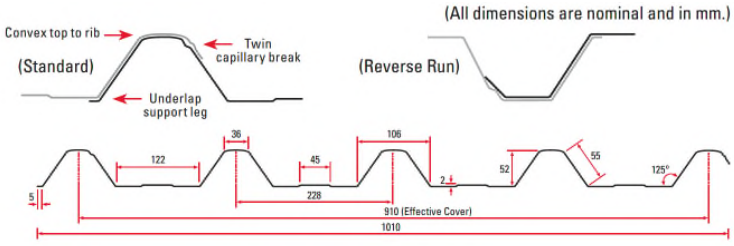
Executive Summary

This report presents arguments supporting the use of **Maxispan®** profile as roofing and vertically fixed wall cladding complying with the requirements of the Building Code regarding E2 External Moisture.

Background

Maxispan® is an asymmetric trapezoidal profile roofing and cladding.

Maxispan lap



Maxispan (Roofing and Wall Cladding)
Dimensioned Drawing of Maxispan

Acceptable Solution E2/AS1 provides for trapezoidal profile roofing with a minimum crest height of 19 mm and 210 mm maximum between crests.

It also provides for metal cladding of corrugate or trapezoidal profiles to be used as wall cladding when fixed vertically (Risk Score 0- 6 Corrugated and symmetrical trapezoidal; Risk Score 7-20 Corrugated only). It also allows horizontal fixing over a drained and ventilated cavity. It does not provide for vertical fixing on cavity. Vertical fixing on cavity is not provided for because solid cavity battens would compromise the ventilation and drainage of the cavity. However, using castellated battens (as an alternative solution) overcomes this and is widely accepted.

Compliance with the Building code Clause E2 External Moisture for different profiles and use in alternative applications requires analysis of the profile and its use in those applications.

Maxispan® profile and E2/AS1

Acceptable Solution E2/AS1 covers a range of profiles:

> **8.4.4 Profiles**
> Profiles covered in this Acceptable Solution are shown in Figure 38, and consist of:
> a) **Corrugated** – curved with a crest height of 16.5 mm minimum,
> b) **Trapezoidal** – symmetrical or asymmetrical with a minimum crest height of 19 mm, and for asymmetrical a flat or lightly profiled pan width of 210 mm maximum between crests, and
> c) **Trough profile** – with vertical ribs at a minimum height of 38 mm, and flat or lightly profiled pans of 210 mm maximum between crests.

E2/AS1 para 8.4.4	**Multispan**	
minimum crest height of 19 mm	52 mm	Complies
pan width of 210 mm maximum between crests	228 mm	Slightly exceeds

It also applies to particular grades of material:

> **8.4.3.2 Steel**

> Materials for the manufacture of profiled steel roof cladding shall:
> a) have a BMT of 0.4 mm minimum
> b) be grade G550, or G300 for rolled, crimped, or trough profile roofing
> c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

(The same requirements are repeated for profiled steel cladding, in para 9.6.3.2)

E2/AS1 paras 8.4.3.2/9.6.3.2	**Multispan**	
BMT 0.4 mm minimum	0.40 or 0.55 mm	Complies
Grade G550 or G300	G550	Complies
be selected for corrosion protection according to the intended exposure zone……	Various coating options available.	Complies

Because the distance between crests slightly exceeds the maximum specified in para 8.4.4 it is necessary to treat the use of **Maxispan®** as an alternative solution. But in all other respects the profile meets the characteristics specified in E2/AS1 and comparison with "compliant" profiles and applications is a valid methodology to establish compliance with the code clause E2 External Moisture.

This report examines how compliance with performance requirements of clause E2 External Moisture of the Building Code could be argued for **Maxispan®** roof and wall cladding as an alternative solution.

The relevant Building Code requirement is cl E2.3.2:

> E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements, or both.

Analysis

Roofing

The Acceptable Solution differentiates between trapezoidal profiles (which provide a flat area in contact at the point of fixing) and corrugated profiles, and trough profiles only with respect to roof pitch. The differentiation is driven by the crest height of the profile and the risk of the channels being overfilled with water in heavy rainfall, leading to possible entry through the side laps.

The profile depth for **Maxispan®** is 52 mm, well in excess of the minimum 19 mm specified in E2/AS1.

The crest spacing does not materially affect the capacity of the roof to carry and discharge rainwater.

Taking into account the crest spacing and height to the capillary break at edge laps, the profile has an effective capacity of approximately 24 mm across the whole profile, well in

excess of the equivalent for a trapezoidal profile meeting the minimum 19 mm specified crest height.

The crest spacing of **Maxispan®** has only a minor effect on the number of fixing screws, which the manufacturer's technical literature addresses in its instructions regarding span and fixing patterns, to comply with B1 Structure.

Wall Cladding

The Acceptable Solution provides insight into the perceived risks associated with the profile type and differentiates risk on the basis of the profile. It differentiates between trapezoidal profiles (which provide a flat area in contact at the point of fixing) and corrugated profiles, and also between symmetrical and asymmetrical trapezoidal profiles.

This analysis compares **Maxispan®** with the characteristics of corrugated and trapezoidal profiles with respect to the building physics behind these profiles installed vertically directly to the framing as wall cladding.

It considers

- comparative likelihood of ingress of external moisture
- mechanisms for drainage and ventilation
- the characteristics of underlay between the profile and timber framing

Ingress of moisture behind the cladding:

The **Maxispan®** profile is no more likely to allow penetration of external moisture than a corrugated profile. Penetration can be considered under three scenarios:

> Penetrations – such as windows etc. Flashing details etc are no more complex for **Maxispan®** than they are for corrugated or other trapezoidal profiles.
>
> Profile sidelaps – this can be discounted as the channels do not run with any significant depth of water (unlike, potentially, a roofing application). The side lap incorporates a capillary break that provides a drainage path down the lap joint for moisture. In the unlikely event that external moisture did migrate to the underlay, the underlay characteristics are such that the framing is protected.
>
> Fixings – wall claddings are typically fixed through the pan of the profile. **Maxispan®** is fixed with screws using wafer TEK screws with an EPDM washer. The risk of water penetration is mitigated by the EPDM washers.

There is no reason to believe **Maxispan®** is any more likely to allow the ingress of external moisture than corrugate, which is allowed as an acceptable solution.

Mechanisms for drainage and ventilation

Ventilation and drainage generally are provided by the cavities formed by the **Maxispan®** profile. The cross-sectional area of each void formed by the profile against underlay or RAB is approximately 3690 mm2, compared with a void of 685mm2 for a standard corrugated profile. (For **Maxispan® Reverse Run** the cross sectional rea of the void is even greater). So

Maxispan® provides drainage and ventilation well in excess of that provided by a standard corrugated profile.

Characteristics of the Cladding/Fixing interface

When a profile is direct fixed there is direct contact between the profile and the building underlay or RAB. The area of this contact is greater for a trapezoidal profile or a trough profile than it is for a corrugate profile. For **Maxispan®** the width of profile in contact with the fixing framing is about 36 mm. For **Maxispan® Reverse Run** the width of profile in contact with the fixing framing is about 122 mm.

There is also direct contact between the underlay and the fixing framing. The issue is whether moisture is likely to migrate to and be retained within the underlay or RAB where the profile is fixed to the framing, and what the effect of that moisture would be.

Ideally, the underlay/RAB should:

a) have a high resistance to liquid water – to minimise passage of liquid water through the underlay, and

b) be highly permeable to water vapour – to facilitate the diffusion of water from the underlay over time, minimising moisture gain by the fixing framing timbers.

NZS2295 provides some insights into the appropriate characteristics of underlays. For direct fixing non-absorbent cladding on timber it specifies Type W2 (Heavy Kraft) or W4 (Absorbent Synthetic) underlay. It does not limit the "non-absorbent cladding" to any particular profile, and **Maxispan®** would be classified as this.

The relevant requirements of NZS2295 for wall and roofing underlays are tabulated below:

Property	**Wall Underlay**	**Roof Underlay**
Water vapour resistance	7 MN s/g or less	Kraft: 7 MN s/g or less Synthetic: 0.5 MN s/g or less
Resistance to water penetration	20mm or greater	100mm or greater
Absorbency	100g/m2 or greater	150g/m2 or greater

The parameters of underlays relevant to the management of external moisture are more critical for roofing underlay than for wall underlay, and the properties exceed the requirements for wall underlays. The use of a roofing underlay in the place of a wall underlay could provide an even more conservative option.

Designers and specifiers should refer to the manufacturer's technical literature for instructions for the installation of **Maxispan®** and to the NZ Metal Roof and Cladding Code of Practice.

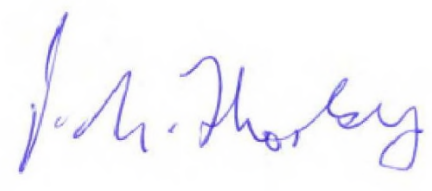
Conclusions

Maxispan® roofing can be expected to meet the performance requirements of E2 External Moisture as well as asymmetric trapezoidal profile metal roofing as provided for in Acceptable Solution E2/AS1.

Maxispan® (and **Maxispan® Reverse Run**) direct fixed vertically as cladding can be expected to meet the performance requirements of E2 External Moisture as well as standard corrugated profile as provided for in Acceptable Solution E2/AS1, with respect to ingress of external moisture and drainage and ventilation of the voids formed by the profile.

Maxispan® (and **Maxispan® Reverse Run**) horizontally fixed as cladding over a nominal 20 mm drained cavity can be expected to meet the performance requirements of E2 External Moisture as well as trapezoidal profiles provided for in Acceptable Solution E2/AS1.

Absorbent synthetic wall underlay Type W4 or heavy kraft wall underlay Type W2 specified in NZS2295 allows the direct fixing of a non-absorbent cladding, such as **Maxispan®**, on timber framing. A roofing underlay (Types R1, R2, R3, or R4) in the place of wall underlay would provide at least equivalent performance.



P N Thorby