

E2 Evaluation

of Metal Design Solutions Hook Seam, Lock Seam and Flat Lock Vertical and Horizontal Architectural European Style Metal Tray Wall Cladding

Evaluation by The Building Business for Metal Design Solutions

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Introduction

The Metal Design Solutions Hook Seam, Lock Seam and Flat Lock Vertical and Horizontal Architectural European Style Metal Tray Wall Cladding profiles (Hook and Lock Seam Wall profiles) are long-run sheet-metal tray trough profiles supplied by Metal Design Solutions for use as wall cladding.

The profiles have wide panels that incorporate an interlocking seam that contrasts with the flat panel. The Hook Seam has once folded flat seams, the Lock Seam has expressed welted seams and the Flat Lock has three times folded seams at the panel edges. Panels are typically 500 mm in width.

This evaluation has been prepared to provide assurance of compliance with the NZ Building Code for the Hook and Lock Seam Wall profiles. Because the profiles are outside the scope of Acceptable Solution E2/AS1 and the New Zealand Metal Roofing Manufacturers New Zealand Metal Roof and Wall Cladding Code of Practice v23.12 (the Code of Practice), compliance with the Building Code must be demonstrated as an alternative solution.

Methodology

This evaluation is based on comparing and evaluating the profile and the installation details with Acceptable Solution E2/AS1 and the Code of Practice, the weathertightness principles of E2/AS1 and the relevant performance requirements of the Building Code.

This evaluation is limited to the scope of use described in the Metal Design Solutions Hook Seam, Lock Seam and Flat Lock Vertical and Horizontal Architectural European Style Metal Tray Wall Cladding pass™.



Relevant Building Code clauses and cited documents

This applicable Clause E2 requirements are:

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

Clause E2.3.5 Concealed spaces and cavities in buildings must be constructed in a way that prevents external moisture from being accumulated or transferred and causing condensation, fungal growth, or the degradation of building elements.

Clause E2.3.7 Building elements must be constructed in a way that makes due allowance for the following:

- a. the consequences of failure
- b. the effects of uncertainties resulting from construction or from the sequence in which different aspects of construction occur.
- c. variation in the properties of materials and in the characteristics of the site.

The Hook and Lock Seam Wall profile is outside the scope of E2/AS1, because E2/AS1 only provides solutions for corrugated or trapezoidal profiles.

This means key issues that need to be considered are deflection and deformation that may occur through thermal expansion. The wall profile is more susceptible to outward pressure (suction).

Weathertightness risk assessment

Compliance with the Building Code must, therefore, be demonstrated through an alternative solution.

As part of the risk assessment, applied loads, thermal expansion, design and installation have been considered.



A wall cladding is exposed to a number of applied loads that could damage or distort the metal profile and allow moisture to enter the building either through distortion of the laps, elongation around fastenings, and penetration or permanent damage of the metal due to deformation beyond its elastic state.

Based on data about the expansion and contraction of metals, distortion will be primarily along the length of the sheet.

Given the thermal expansion and contraction data at 0 °C to 82 °C of 1.00 mm/m, the likelihood of seam distortion across the width is negligible (Fielders, n.d.). Linear expansion has been estimated at 10 mm over a length of 40 m. In the unlikely event that a greater length is specified an expansion or step joint can be incorporated (refer to paragraph 7.3 of the Code of Practice).

Risks associated with the use of the Hook and Lock Seam Wall profile are the wall cladding profiles may:

- deform because flat panels facing widths may not provide adequate fixings to accommodate applied loads because of the greater distance between concealed clips
- deform because of lack of support resulting in rotation and deflection of the wall profile
- deform because of wind actions, inward and outward wind pressure
- have moisture condensation on the underside of the wall material because of limited air flow/ventilation
- have leaks due to poor installation.

Other risks include poor design and/or installation of the profiles.

Weathertightness mitigations

Mitigations for the identified risks are described in the following table.

Risk	Mitigations	Outcome
Wall cladding		



<p>Flat panel facing widths may not provide adequate fixings to accommodate applied loads because of the greater distance between concealed clips.</p>	<ul style="list-style-type: none"> • For larger flat panel widths, the frequency of concealed metal edge clips can be increased from, typically, 900 mm centres to 400 mm centres for Extra High Wind Zones (55 m/sec). • Must be installed over a drained cavity. 	<ul style="list-style-type: none"> • Distortion is minimal. • Decreases the likelihood of distortion and allows an increase in structural support. • Increased air flow for drying and drainage in the cavity in accordance with E2/AS1. • Consistent lap dictated by the clip support.
<p>Profiles may distort because of the greater flat panel facing width and have the potential for driven rain to enter the wall, particularly at cladding junctions in complex building designs.</p>	<ul style="list-style-type: none"> • Must be installed over a drained cavity. • Installation of an approved 2 layer building wrap (Table 23 of E2/AS1) in conjunction with a drained and ventilated cavity system to E2/AS1. • Scope of use restricted in accordance with E2/AS1 and the Code of Practice as per the pass™. • Must be installed over a rigid minimum 15 mm Plywood substrate 	<ul style="list-style-type: none"> • High volume air flow and radiant heat flow provided for condensation drying as well as drainage. • System meets the performance requirements of Clause E2. • Use limited in some situations.
<p>Leak due to poor installation.</p>	<ul style="list-style-type: none"> • Possibility of poor installation unlikely as the modular set-out is dictated by the placement of the hidden clips. • The profiles are required to be installed over a drained cavity in accordance with E2/AS1. • Building wrap will be installed that meets the performance requirements of Table 23 	<ul style="list-style-type: none"> • Adequate clearance to allow radiant drying and drainage in the event of condensation or minor leakage. • The design incorporates a drained cavity and a building wrap. • Hidden clips as well as modular set-out limits the possibility of poor installation. • Multitude of consistent fastenings because of the



	<p>of E2/AS1 and has the required lap at joints.</p> <ul style="list-style-type: none"> • Where H3.2 cavity battens are used an additional layer of wrap must be used between as a separation. • Like the E2/AS1 flashing systems, the MDS flashing systems are primarily designed to work as a back-flashings, which allows (at times) moisture to breach the metal cladding and drop to the base of the cladding. 	<p>17 mm rigid plywood substrate.</p>
<p>Poor design and/or installation.</p>	<ul style="list-style-type: none"> • The designer must use the tools provided by MDS which include indicative details MDS_W_HSH_001 – MDS_W_HSH_009, MDS_W_HSV_001 – MDS_W_HSV_009, MDS_W_LSH_001 – MDS_W_LSH_009, MDS_W_LSV_001 – MDS_W_LSV_009, MDS_W_FLH_001 – MDS_W_FLH_009 and MDS_W_FLV_001 – MDS_W_FLV_009 and must use E2/AS1 and the Code of Practice in accordance with the scope and limitations of the pass™. • The installer must hold a current LPB registration and be familiar with the 	<ul style="list-style-type: none"> • Provided the designer and installer follow MDS requirements the resulting completion of the work will meet the requirements of the Building Code.



	<p>MDS Hook and Lock Seam Wall system.</p> <ul style="list-style-type: none"> The installer must complete the installation in accordance with the building consent documentation. 	
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Details comparison – wall cladding

The following compares the details and installation requirements for the Hook and Lock Seam Wall profile with Acceptable Solution E2/AS1.

The E2/AS1 details are generic in nature. Therefore, the comparison of these details considers the weathertight principles of Clause E2 of the Building Code and E2/AS1 and the provision of flashing cover to prevent moisture penetration in accordance with the performance requirements of Clause E2 of the Building Code.

Paragraph 9.6 of E2/AS1 provides profiled metal wall cladding acceptable solutions. The Hook and Lock Seam Wall profile are outside the scope of E2/AS1 because E2/AS1 only provides solutions for corrugated or trapezoidal profiles. However, the principles adopted in the Hook and Lock Seam Wall profile wall cladding details (Issue 1.1) [MDS, 09/2020a, b, c, d, e, f] largely follow the E2/AS1 details.

Where reliance is placed on over flashings in and around wall junctions to limit moisture entry, generous back flashings are installed which either terminate within the hidden clip or are installed against the cavity batten to drain any moisture that may have breached the primary flashing away from the cavity.

The flashing profiles are manufactured and supplied as accessory components, which reduces the possibility of poor flashing specification and performance.

All clearances are in keeping with the principles of E2/AS1. This includes proximity to ground (paved 100 mm or unpaved 175 mm) and clearances for decks or roofs. All back flashings either meet or exceed the upstand heights, return lengths and cover required in E2/AS1.



The design of the system incorporates a nominal 20 mm drained cavity system in keeping with the principles of E2/AS1, with battens spaced at 600 mm centres for horizontal claddings, or up to a maximum of 1100 mm where vertical cladding is to be used. The batten spacing is subject to specific wind considerations.

The flashings are primarily folded formable grade 0.55mm BMT for galvanized, aluminium/zinc-coated and pre-painted steel, 0.7 mm Zinc and 0.9 BMT aluminium (or 0.7mm for small aluminium flashings) to the same standards as the profiled sheets, notched across the profile.

The Hook and Lock Seam Wall profile wall cladding details jointing methods incorporating a single overlapping clip system with anti-capillary swages, kick-outs, or hems.

The contact area of the profiles is minimal against the horizontal or vertical cavity battens, therefore maintaining high-volume air movement. The system's design incorporates a cavity system, overlaid with a building wrap. This allows for easy installation for additional fixings and minimises metal deflection (no trough ribs between pans) under wind loads.

The primary flashing system is the hidden clip or the double fold in the profiles recess. Both systems incorporate a very similar double lap system in the recess. There is adequate clearance in the recess lap to allow the cladding profiles to cater for wind driven rain and thermal expansion and contraction.

The window flashings are recessed and based on the profile set-out to ensure they finish on a complete board with the window comprising of a head flashing which ties in with the lap window facing and a secondary cover flashing. The same weathertight principles apply to the sill assembly. The flashing cover exceeds the requirements of E2/AS1.

The system must be set out, designed and executed in accordance with the relevant MDS details [MDS, 09/2020a, b, c, d].



Conclusion

The Hook and Lock Seam Wall profiles comply with Clause E2 of the Building Code as an alternative solution because appropriate mitigations have been applied with respect to the scope and limitations of use and the installation details to account for the differences in the profiles to the profiles covered by Acceptable Solution E2/AS1 and the details are essentially the same as the details provided by Acceptable Solution E2/AS1, notwithstanding that the profiles are out of scope.

This is on the basis that:

- the structural frame and substrate is in accordance with the Building Code.
- the use is within the scope and limitations of the Metal Design Solutions Hook Seam, Lock Seam and Flat Lock Architectural European-Style Metal Tray Wall Cladding pass™
- the design is in accordance with the MDS Hook and Lock Seam Wall details
- the construction is in accordance with the MDS Hook and Lock Seam Wall details
- the specified system components are not substituted.

References

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