FIXING TO UNDERSIDE OF METALCRAFT INSULATED PANELS
For
METALCRAFT INSULATED PANELS LIMITED

STRUCTURAL REPORT	Project No. **23950**	**Issue No. 5**
Prepared by: **Jamie Macredie** BE PGDip (Fire) CMEngNZ CPEng Int PE		Original Report Date: **4 May 2023**
		Date of Current Issue**: 25 March 2025**
		Approved by: Graham Rundle BE CMEngNZ

DOCUMENT CONTROL

ISSUE NUMBER	DATE OF ISSUE	PURPOSE OF ISSUE
1	21 March 2023	Original Calculations
2	4 May 2023	Updated Calculations
3	10 November 2023	Updated Title
4	3 September 2024	Executive Summary Added
5	25 March 2025	EPS Panels Added

adding 'enginuity' to building projects

Consulting Professional Engineers

Redco NZ Ltd
Redco House
470 Otumoetai Road
TAURANGA 3110
Telephone: 07 571 7070
Facsimile: 07 571 7080
Email: red@redco.co.nz
www.redco.co.nz

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1.2 METALCRAFT PANEL / LIGHT OR SERVICE DEAD LOAD

METALCRAFT PIR & EPS-core PANELS – OK 0.30kPa (30 kg/m^2) Services fixed to underside

2.0 UNDER LINED OR SERVICES FIXINGS

UNDER-PURLIN TO PANEL FIXINGS: ST12-14x35CL5N Screws at 1200x250mm centres

2.2 PANEL / LIGHT / SERVICES

CEILING DIRECT FIXINGS: 10g x 40mm Screws at 300mm x 300mm centres

SERVICES FIXING: 2No. ST12-14x35CL5N Screws or additional fixings to suit services layout.

DESIGN FEATURES REPORT

Project Description
Metalcraft insulated roof panels to be checked with underlined using GIB ceiling boards fixed to a proprietary GIB Rondo batten system or direct fixed to the panel skin. The fixing capacity are also checked for additional elements such as lights or other services.

Scope of Services Provided
Structural Engineering design of fixings to underside of the Panel.

Members Designed
Metalcraft roof panel span and fixing for the under-purlin or other suspended fittings.
GIB ceilings are secured in accordance with the manufacture's requirements and are not part of this scope.
The report excludes any assessment of the panels under additional loading, these should be assessed based on the applied distributed loads in the Metalcraft loadspan tables.

Design Standards and Codes Referenced
The structure has been designed in accordance with the following Standards and Codes.
Polystyrene panels by specific design, based on empirical testing by Redco NZ Ltd.

Software Used
Spreadsheets

Dead and Live Loads

Element	Dead Load (kPa)	Imposed Load (kPa/ kN)
Roof (lightweight)	0.35	0.25 / 1.4
Ceiling	0.25	-

Deflection Limits
In accordance with Metalcraft loadspan table and technical guidance.

Compliance Path for the Works
The elements have been designed in compliance with the New Zealand Building Code using the following design paths:

- B1/VM1 & VM4

HEALTH AND SAFETY

Redco NZ Ltd (Redco) has been engaged to carry out the structural engineering design for the Permanent Works only to the requirements of the NZ Building Code and within the scope of this Producer Statement – Design (PS1) and the structural drawings referenced herein.

Redco have not been engaged to design or assess any Temporary Works.

As a PCBU for the Permanent Works, as defined under the Health and Safety at Work Act (2015), Redco has modified the designs where practicable to mitigate risks as identified in the Designer's Risk Assessment below.

DESIGNER'S RISK ASSESSMENT

Risk	Practical Mitigating Actions (Permanent Works only)	Residual Risk	Further Considerations by other Project PCBU's
Falling from Height	Installing handrails or other barriers to heights over 1m in areas frequented by persons unfamiliar with the environment. Designing, for example, parapets or fall-arrest anchor points to resist adequate loads.	Risk of injury from lower heights. Access to areas for maintenance and repair where permanent barriers are not practicable.	It is recommended the Client considers installing additional barriers not required under the Building Act. It is expected that maintenance and repair is carried out by competent, appropriately trained persons.
Non-intended use of Permanent Works	Examples including designs subject to a design life less than 50 years, maximum wind speed, limitations in floor loads, limitations in storage height etc.	None – design parameters and limitations to be clearly noted in the PS1 and on the structural drawings.	The Client must ensure the building or structure is used within any limitations provided.
Heavy Lifting	Reducing large span structures is impracticable – use connections to split members into smaller units. Use of mechanical lifting aids is expected.	All types of construction pose a risk of injury from lifting.	The contractor is to ensure their nominated method of construction accounts for risk, and all temporary works are appropriately designed.
Stability of Earthworks and Excavations	It is impracticable to move the foundations or retaining walls as this does not meet the requirements of the Client or Architect. The construction type has been selected to meet the aesthetic requirements of the Client or Architect, whilst mitigating construction risks as far as is reasonably practicable.	Collapse of excavations and temporary batters. Risk of injury to persons. Risk of damage to adjacent property.	Where the residual risk cannot be reasonably mitigated, to modify the architectural design. The contractor should assume a minimum 1:3 slope in their design of temporary batters unless advised otherwise by an appropriately qualified engineer, or implement alternate systems for temporary support.
Fire	Avoid the use of site welding wherever practicable, using prefabricated bolted connections for example.	Sites where welding cannot be reasonably avoided.	The contractor is to ensure fire and safety mitigation measures are adequately implemented.
Dust and Noise	Use off-site construction where reasonably practicable, such as prefabricated connections.	All sites generate dust and noise.	The contractor to ensure dust and noise suppression and PPE is adequately implemented.

**PCBU's include other members of the design team such as Architects, Contractors (design and implementation of Temporary Works) and the Client. The Lead Project PCBU is deemed to be the Client where the role has not been formally delegated by the Client.*

Excavation Safety:

Prior to excavating, the site is to be assessed by a competent person as outlined in Worksafe's guidelines "Excavation Safety" in order to assess the conditions whether any surcharges or slope stability issues are present.

CONSTRUCTION MONITORING

LEVEL	REVIEW COMMENT	
CM1	Monitor the outputs from another party's quality assurance programme against the requirements of the plans and specifications. Visit the works at a frequency agreed with the client to review important materials of construction critical work procedures and/or completed plant or components. Be available to advise the constructor on the technical interpretation of the plans and specifications. ***This is a secondary service where another party, for example Council, is engaged to provide a higher level of construction monitoring. Where CM1 is selected, Redco do not expect to monitor the work or to provide a Producer Statement – Construction Review (PS4), but are available for technical queries.***	✓
CM2	Review, preferable at the earliest opportunity, a sample of each important work procedure, material of construction and component for compliance with the requirements of the plans and specifications and review a representative sample of each important completed work prior to enclosure or completion is appropriate. Be available to provide the constructor with technical interpretation of the plans and specification. ***This level of service is appropriate for smaller projects being carried out by a Competent Constructor. When CM2 is nominated, Redco expect to monitor principal structural components of the work as identified within the Inspection Schedule.***	
CM3	Review, to an extent agreed with the client, random samples of important work procedures, for compliance with the requirements of the plans and specifications and review important completed work prior to enclosure or on completion as appropriate. Be available to provide the constructor with technical interpretation of the plans and specifications. ***This level of service is appropriate for medium sized projects being carried out by a Competent Constructor. When CM3 is nominated, Redco expect to monitor principal structural components of the work as identified within the Inspection Schedule.***	
CM4	Review, at a frequency agreed with the client, regular samples of work procedures, materials of construction and components for compliance with the requirements of the plans and specifications and review the majority of completed work prior to the enclosure or on completion as appropriate. ***This level of service is appropriate for larger projects. When CM4 is nominated, Redco expect to monitor the works at least twice weekly, plus principal structural components of the work as identified within the Inspection Schedule.***	
CM5	Maintain personnel on site to constantly review work. ***This level of service is appropriate for significant projects where compliance is critical. When CM5 is nominated, Redco expect to monitor the work daily.***	

NOTES

1. For earthworks and foundations Redco will only test the soils to verify the bearing capacity used in our design. Sites subject to fill material and where a geotechnical investigation was deemed necessary must be inspected and certified by a Category 1 or 2 Geotechnical Engineer.
2. For reinforced concrete or masonry construction, e.g. foundation, retaining walls, floor slabs, tilt-up panels, block walls etc., we would typically expect to inspect the works after installation of the reinforcing, but prior to placement of concrete. We reserve the right to request concrete delivery tickets, and/ or site testing results if and as appropriate. For larger projects we may be required to monitor placement of the concrete.
3. For beams, columns, lintels and other super-structure elements we would typically expect to monitor the works after installation, erection and principal connections have been completed but prior to linings, coverings or claddings are fixed.

Where we are unable to monitor a particular item of works which has been cast, concealed or otherwise completed prior to our attendance and review, we may request that the item is uncovered to enable its review. Redco will not include any item of construction within our PS4 which has not been reviewed and approved by us. Please note that we are required by most Councils to submit photographic evidence and/ or site records to corroborate and support our Producer Statement PS4, together with a Producer Statement - Construction (PS3) which is to be provided to us by the Contractor(s).

Please note that it is a legal requirement for all consent documents to be held on site during the Works, and an offence for a Consultant to knowingly monitor and approve un-consented Works. Our Engineers are instructed to review the consent documents upon arrival. Where we are requested to monitor Works without Building Consent approval, we will leave the site and all time incurred will remain chargeable.

INSPECTION SCHEDULE (STRUCTURAL)

BUILDING CONSENT APPROVAL MUST HAVE BEEN GRANTED & SIGHTED BEFORE ANY MONITORING OCCURS.
The following items are to be reviewed by the Structural Engineer prior to issuance of a PS4. Additional elements may need to be reviewed where noted in the Building Consent conditions. Note: final authorisation to proceed with the works must still be obtained from the Building Inspector, irrespective of the Engineer's approval of structural items. The contractor's PS3 must be submitted to the Engineer prior to issuance of the PS4.

ELEMENT(S) TO BE REVIEWED PRIOR TO ISSUANCE OF A PS4	REVIEW EXPECTED BY:
Consented Documents MUST have been sited before proceeding further	**ALL PARTIES**
Specific design fixings within this report – pre-lining	Council

REDCO NZ Ltd. 07-571-7070 ***We request a minimum of 24 hours' notice please.***

IMPORTANT NOTES

1. Where Redco has nominated **CM1** as the expected level of monitoring, we do not expect to review the work ourselves, nor provide a Producer Statement – Construction Review (PS4). Onsite review of the construction elements may still be appropriate and is expected to be carried out by the Council, at their sole discretion.
Redco will be available for technical assistance if requested.

2. Where Redco has nominated **CM2 or above** as the expected level of monitoring, we MUST have been engaged for Construction Monitoring by the client before work commences, and MUST have reviewed the work on site(*).
It is the contractor's responsibility to notify us in advance of the required inspections. No on-site construction review = No PS4.
(*) The client may engage another Chartered Professional Engineer to both monitor and certify the Work, for example, where it may be impracticable for Redco to attend site due to excessive travel distance. Where another consultant is engaged for monitoring they must also provide the PS4.

3. Where Redco recommends or is required to provide a Producer Statement – Construction Review (PS4), this must be accompanied by the Contractors' Statement of Completion of the Work, typically a PS3 or LBP statement, for all elements to be included within our PS4. This may require statements from one or more contractors.

The above schedule does not necessarily represent the actual number of inspections to be undertaken. The number of inspections will depend upon the construction method, sequence of works and whether or not unforeseen conditions or difficulties are encountered on site. Failed inspections will also result in additional revisits to ensure compliance with the approved documents.

B1 - STRUCTURE

1.0 METALCRAFT PANEL / CEILING / LIGHTS / SERVICES

1.1 METALCRAFT PANEL / CEILING DEAD LOAD

Consider both PIR-core and EPS-core roof panel with a 0.25kPa ceiling dead load.

Polypanel Roof and Ceiling Design: Span = 6.000 m

Panel Thickness, d = 150 mm

Loading

Consider 1m width of panel:

Self	Permanent actions, P_G =	0.38 kPa x 1m	0.38 kN/m	ψ_l = 0.0		
	Imposed actions, P_Q =	0.25 kPa x 1m	0.25 kN/m	ψ_s = 0.7		
Wind	Ultimate $p_{(Z)}$ =	1.16 kPa		K_a = 1.0		*Table 5.4*
	Serviceability $p_{(z)}$ =	0.79 kPa		K_l = 1.0		*Table 5.6*
	C_{pi} = 0	-0.3	*Table 5.1*	K_p = 1.0		*Table 5.8*
	Up-wind, roof C_{pe} = -0.9	-0.4	*Table 5.3*	K_c = 1.0		*5.4.3*
	p_{Wmin} =	-1.04 kPa x 1m	-1.04 kN/m	C_{dyn} = 1.0		*Section 6*
	p_{Wmax} =	-0.12 kPa x 1m	-0.12 kN/m			

Combination of Actions from AS/NZS 1170

Strength Limit State :

Ultimate:	**1.2G & 1.5Q**	w_u* = 0.83 kN/m	M*= 3.8 kNm	V* = 2.5 kN
Ultimate:	**1.35G**	w_u* = 0.52 kN/m	M*= 2.3 kNm	V* = 1.5 kN
Ultimate:	**1.2G & W**	w_u* = 0.34 kN/m	M*= 1.5 kNm	V* = 1.0 kN
Ultimate:	**0.9G & W**	w_u* = -0.70 kN/m	M*= -3.1 kNm	V* = -2.1 kN
			Max M* = 3.8 kNm	**Max V* = 2.5 kN**

Serviceability Limit State :

Serviceability: G + ψ_lQ	w_s = 0.38 kN/m
Serviceability: G + ψ_sQ	w_s = 0.56 kN/m
Serviceability: W_s	w_s = 0.71 kN/m

Strength

Bearing pressure on polystyrene for seating width of 50 mm = 50.0kPa **OK**

ϕ = 0.9

Skin thickness t = 0.59 mm (k is derived in load/span tes

Moment capacity of panels $\phi M_n = \phi k f_y t d$ k= 0.22 Dukker and Potter report r

ϕM_n = 5.3 kNm **OK** f_y = 300 MPa

$f_{bc} = kfy$ = 66 MPa

Panel Width b = 1000 mm

G = 1.856 MPa

Deflection

$\delta = 5wL^4/(384\ EI) + wL^2/(8GA)$

GA= 278,400

$EI = E_s btd^2/2$ = 1.3275E+12

Serviceability: G + ψ_lQ	$\delta_{G+\psi lQ}$ = 11 mm	**Span/ 543**	**OK**
Serviceability: W_s	δ_W = 20 mm	**Span/ 294**	**OK**

Roof: δ < L/300 - G & ψ_l Q - sag

Ceiling: δ < L/200 - Ws

Thermal Bowing

$\delta t = \alpha\ \Delta T\ L^2 / 8d$ = 22 mm δL = 4 mm α = 0.0117 mm/(deg C m) ΔT = 64 deg C

METALCRAFT PIR & EPS-core PANELS – OK 0.25kPa (25 kg/m²) Ceiling fixed to underside

1.2 METALCRAFT PANEL / LIGHT OR SERVICE DEAD LOAD

Consider both PIR-core and EPS-core roof panel with a 0.30kPa services dead load.

Polypanel Roof and Ceiling Design: Span = 6.000 m

Panel Thickness, d = 150 mm

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Consider 1m width of panel:

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	p_{Wmin} =	-1.04 kPa x 1m	-1.04 kN/m		C_{dyn} = 1.0	*Section 6*
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Ultimate:	**0.9G & W**	w_u^* = -0.70 kN/m	M*= -3.1 kNm	V* = -2.1 kN
			Max M* = 3.8 kNm	**Max V* = 2.5 kN**

Serviceability Limit State :

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Serviceability: G + ψ_sQ	w_s = 0.56 kN/m
Serviceability: W_s	w_s = 0.71 kN/m

Strength

Bearing pressure on polystyrene for seating width of 50 mm = 50.0kPa **OK**

ϕ = 0.9

Skin thickness t = 0.59 mm (k is derived in load/span tests

Moment capacity of panels $\phi M_n = \phi k f_y t d$ k= 0.22 Dukker and Potter report ref 5

ϕM_n = 5.3 kNm **OK** f_y = 300 MPa

$f_{bc} = kfy$ = 66 MPa

Panel Width b = 1000 mm

G = 1.856 MPa

Deflection

$\delta = 5wL^4/(384\ EI) + wL^2/(8GA)$ GA= 278,400

$EI = E_s b t d^2/2$ = 1.3275E+12

Serviceability: G + ψ_lQ	$\delta_{G+\psi lQ}$ = 11 mm	**Span/ 543**	**OK**
Serviceability: W_s	δ_W = 20 mm	**Span/ 294**	**OK**

Roof: δ < L/300 - G & ψ_l Q - sag

Ceiling: δ < L/200 - Ws

Thermal Bowing

$\delta t = \alpha \Delta T L^2 / 8d$ δL = 4 mm α = 0.0117 mm/(deg C m)

= 22 mm ΔT = 64 deg C

2.0 UNDER LINED OR SERVICES FIXINGS

2.1 PANEL / CEILING

Panel to Under-Purlin Lateral Fixing

For 12g 14 x 35 CL5N screws in timber group **J5**

CHH recommendation that Type 17 screws are as reliable as nails in service

$S^* \leq \phi Q_n$ ϕ = 0.7

$S^* = (V^{*2} + H^{*2})^{0.5}$ Q_k = 2.14 kN

$Q_n = n.k.Q_k$ k = 1.00 Timber

k = 1.00 Dry

k = 1.00 Side grain

Effects of axial and shear loads significant compared with bending effects

	Design load effects			Design strength			
Load case	V* (kN)	H* (kN)	S* (kN)	k_l	n	ϕQ_n (kN)	
1.35G	0.1	0.1	0.1	0.8	57	68.3	**>= S* OK**

2.2 PANEL / LIGHT / SERVICES

Metalcraft PIR-core and EPS-core panels with a skin thickness not less than 0.59mm.

Results for ST12-14x 35CL5N screws in 0.59 skin

Test No.	Max Load N	Deviation
1	994	681
2	1087	4476
3	1090	4886
4	964	3147
5	943	5944
6	1073	2798
7	991	847
8	960	3612
9	1082	3832
10	1017	10
Mean	1020	55 Standard Deviation

Coefficient of Variation = 5%
From Table B1 at Appendix B, NZS 117
kt = 1.1
Design load = Min. test result/kt
= 943/1.1
= **857 N**
= **87.4kg**

Using 2 screws at each fixing, Max. loading = **1.71kN**
ST12-14x 35CL5N screws in 0.59 skin
By interpolation 10g x 41mm screw in 300mm x 300mm grid = **5.84kN**

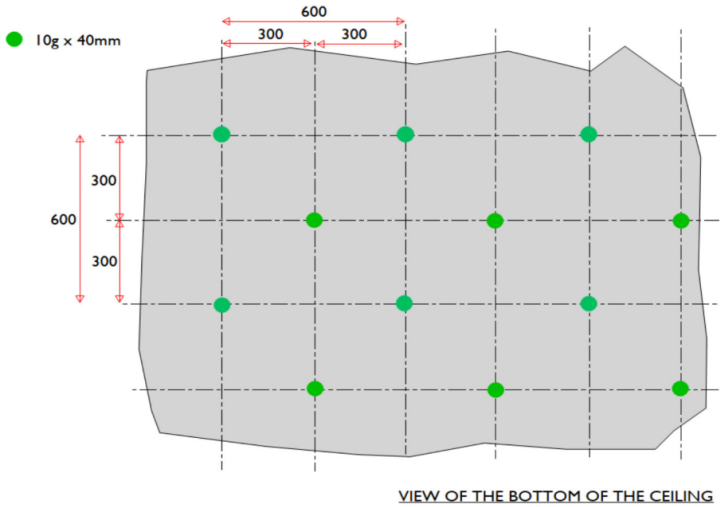
Using 2 screws at each fixing, Max. loading = 174.8kg

GIB	9.0kg/m2
SERVICES	30.0kg/m2

Consider GIB Ceiling fixed to underside of panel, with or without battens

GIB Ceiling 0.25kPa

Lights / Services 0.3kPa



VIEW OF THE BOTTOM OF THE CEILING

CEILING DIRECT FIXINGS: 10g x 40mm Screws at 300mm x 300mm centres

SERVICES FIXING: 2No. ST12-14x35CL5N Screws or additional fixings to suit services layout.

APPENDIX A MATERIALS AND TESTING SCREW FIXING TEST RESULTS

MATERIALS & TESTING LABORATORIES LIMITED
Destructive & Non-destructive Test House

TEST REPORT

MTL Report No.	J62806.1	**Order No.**	Neil Lilley – Metalcraft Panel Test	**Date Tested**	28/11/2022
Client Name	Konnect Shop			**Attention**	Neil Liley
Client Email	n.lilley@konnectshop.com				
Test Method	2 Insulation boards supplied by Konnect Shop with 2 sets of different screws. Screws were fastened to the joint on the board and the skin. Screws were then pulled out uniformly and max load in N is recorded.				
Test Equipment	Shimadzu Universal Grade 1 Testing Machine, Model No. UH 500 KNI, Serial No. 1210546000016.				

Sample Description			
Load rate (mm/min)	5	**Test temperature (°C)**	20.3

Test results

Sample ID: ST10-16x 40CL5N

	Skin		Joint	
Test No.	**Max Load N**	**Max Load kg**	**Max Load N**	**Max Load kg**
1	1119	114	3030	309
2	1129	115	2920	298
3	1215	124	3208	327
4	1019	104	3286	335
5	835	85	2883	294
6	1068	109	3100	316
7	982	100	3343	341
8	1176	120	3393	346
9	848	86	3393	346
10	1131	115	3285	335
Average	1052	107	3184	325

Sample ID: ST12-14x 35CL5N

	Skin		Joint	
Test No.	**Max Load N**	**Max Load kg**	**Max Load N**	**Max Load kg**
1	994	101	2695	275
2	1087	111	2982	304
3	1090	111	2171	221
4	964	98	2217	226
5	943	96	2370	242
6	1073	109	1547	158
7	991	101	2511	256
8	960	98	2573	262
9	1082	110	2217	226
10	1017	104	2636	269
Average	1020	104	2392	244

Sample photos:

10 Patrick Street Onehunga 1061 | www.mtlabs.co.nz
☎: (09) 579 0262 | 📠: (09) 579 0260 | 💻: sales@mtlabs.co.nz

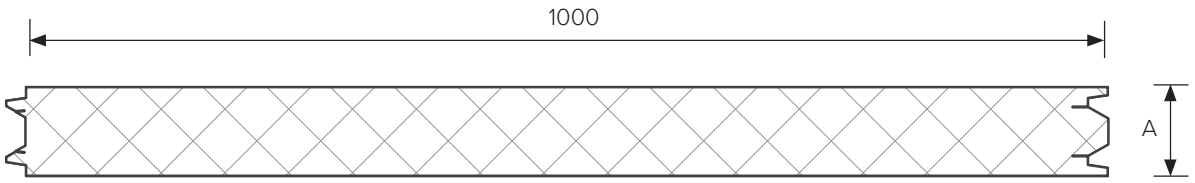
TEST REPORT

This report applies only to the sample/s as tested.			
Testing Technician	Michael Wu	**Date of Issue**	29/11/2022
Checked By	Rex Ong	**Approved by**	Michael Wu
Qualification	BSci, PgDip	**Qualification**	BEng Tech (Mechanical)
Signature	Rex Ong	**Signature**	

APPENDIX B ASPIRE PANEL

STYLE & PERFORMANCE

PANEL DIMENSIONS



Dimensions, cover and sheet widths are all nominal and may vary with manufacturing and installation tolerances. Line drawings are indicative only and should not be scaled, if other dimensions are required please ask for them from Metalcraft Insulated Panels.

Panel Thickness Options = A
50, 75, 100 & 150mm

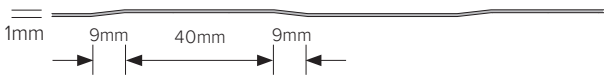
INNER PROFILE OPTIONS

AspirePanel™ consists of 0.59mm steel bonded to a PIR core with a ceiling panel sheet bonded to the underside. AspirePanel™ has a fire-retardant core and is available with a range of colour and ceiling profile finishes.

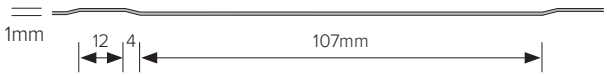
FLAT FINISH - AVAILABLE BOTH SIDES

SILKLINE FINISH - AVAILABLE 1 SIDE ONLY

MESA FINISH - AVAILABLE 1 SIDE ONLY



RIBBED FINISH - AVAILABLE BOTH SIDES



PRODUCT PROPERTIES	
Core	Polyisocyanurate (PIR) Density 37Kg/m3
External facing	0.59mm CP Grade Prepainted Galvanised Steel or Colorsteel® Endura® or Colorsteel® Maxx® The correct steel is dependent on the environmental category and corrosion zone, please consult Metalcraft Insulated Panels.
Internal Facing	0.59mm CP Grade Prepainted Galvanised Steel
Cover Width	1000mm
Length	*Manufactured in Auckland. Lengths are restricted by transportation to site. If longer than 15m check with Metalcraft Insulated Panels.
Thickness	50mm, 75mm, 100mm, 150mm
Fire Retardant Core	AspirePanel™ has a fire-retardant core.

B2 - DURABILITY

In accordance with the guidance provided by Engineering New Zealand, we are not able to provide a Producer Statement for durability because compliance needs to be shown on a material-by-material basis using a variety of compliance methods, and not all materials used have a clear compliance path.

Where practicable we have provided the durability requirements for the engineered materials.

Maintenance Requirements
The design life, as identified within this report, for all materials used herewith is specified on a Time to First Maintenance basis. The time to first maintenance is governed by the relevant manufacturer's durability statement and warranty, typically 10-15 years. Thereafter, for the balance of the nominated design life, all products must be regularly maintained including but not limited to washing down, re-painting and, for readily accessible or sacrificial elements (such as certain fixings and sealants), replacement.

We can confirm that for the structural elements shown in our documentation under Clause B1:

In accordance with the manufacturer's durability statement.

Metal Insulated Panels
The durability requirements of the panels, channels, angles, flashings, rivets and screws are deemed to be satisfied when installed in accordance with the Manufacturer's guidance and supported by the Manufacturer's Warranty, on a time to first maintenance basis.