WALL TO ROOF FIXINGS
For
METALCRAFT INSULATED PANELS
At
SITES WITHIN NEW ZEALAND

STRUCTURAL REPORT	Project No. **24340**	**Issue No. 1**
Prepared by: **David Barnard** BEng (Hons), MIStructE, CEng, CMEngNZ	Original Report Date: **18 September 2023**	
Reviewed by: **Jamie Macredie** BE PGDip (Fire) CMEngNZ CPEng Int PE	Date of Current Issue**: 18 September 2023**	
Signed by: **Jamie Macredie** BE PGDip (Fire) CMEngNZ CPEng Int PE	Approved by: Graham Rundle BE CMEngNZ	

DOCUMENT CONTROL

ISSUE NUMBER	DATE OF ISSUE	EXPIRATION OF PS1	PURPOSE OF ISSUE
1	18 September 2023	18 September 2024	Original Calculations

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

TABLE OF CONTENTS

PRODUCER STATEMENT – PS1
DESIGN

BUILDING CODE CLAUSE(S): B1 **JOB NUMBER:** 24340
ISSUED BY: Redco NZ Ltd
(Engineering Design Firm)
TO: Metalcraft Insulated Panels Limited
(Owner/Developer)
TO BE SUPPLIED TO: As required
(Building Consent Authority)
IN RESPECT OF: Panel Roof to Panel Wall Connection (Redco Project No. 24340)
(Description of Building Work)
AT: SITES WITHIN NEW ZEALAND **Town/City**
(Address, Town/City)
LEGAL DESCRIPTION: **LOT** **DP** **SO** **N/A** ☐

We have been engaged by the owner/developer referred to above to provide *(Extent of Engagement)*:
Structural Engineering
in respect of the requirements of the Clause(s) of the Building Code specified above for Part only , as specified in the Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- ☑ Compliance documents issued by the Ministry of Business, Innovation & Employment *(Verification method/acceptable solution)* B1/VM1, VM4 & AS1 and/or;
- ☐ Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

On behalf of the Engineering Design Firm, and subject to:

- Site verification of the following design assumptions: Site parameters within the scope of this report.
- All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that:

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM 1 level of **construction monitoring**.

I, *(Name of Engineering Design Professional)* J C Macredie, am:

- ☑ CPEng number 160766

and hold the following qualifications BE PGDip(Fire) CMEngNZ CPEng IntPE

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than $200,000
The Engineering Design Firm is not a member of ACE New Zealand.

SIGNED BY *(Name of Engineering Design Professional)*: J C Macredie
(Signature below):

J C Macredie.

ON BEHALF OF *(Engineering Design Firm)*: Redco NZ Ltd Date: 18/09/2023

Note: This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, is limited to the sum of $200,000.

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

SCHEDULE to PS1

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below:

The proposed building work covered by this producer statement is described on the drawings titled:

Metal Insulated Panels - Soffit Details

and numbered:

01/04 - 04/04 (incl) [4 sheets]

Reference documents or other supporting materials:

The calculation report appended to this PS1, and the limitations contained therein.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website
https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

PS1 DESIGN Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

PS2 DESIGN REVIEW Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

PS3 CONSTRUCTION Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011[2]

PS4 CONSTRUCTION REVIEW Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

Competence of Engineering Professional
This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

Professional Indemnity Insurance
As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

Professional Services during Construction Phase
There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers[3]). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4
Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Refer Also:

1. Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
2. NZIA Standard Conditions of Contract SCC 2011
3. Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
4. PN01 Guidelines on Producer Statements

www.acenz.org.nz
www.engineeringnz.org

DESIGN FEATURES REPORT

Project Description
An assessment of Metalcraft Insulated Panel Standard Fixings between their wall and roof panels.

Project Information

Site Address:	Sites withing New Zealand complying with the Design Limitations below
Project Client:	Metalcraft Insulated Panels Limited

Design Limitations

Importance Level:	1 and 2 only
Design Working Life	Maximum 50 years
Wind Zone:	Maximum Wind Zone "Extra High" as defined within NZS 3604
Design Wind Speed	Maximum Wind Speed 55 m/s (Extra High)
Snow Regions	N/A
Earthquake Zone:	N/A

Scope of this Report
- Fixings between insulated panel walls and insulated panel roofs, for wind uplift only.
- Structural Building Code clauses B1 and B2 only.
- The fixings within the scope of this report are applicable to the following Metalcraft products:
  - ThermoSpan EPS and ThermoPanel EPS
  - AspireSpan PIR and AspirePanel PIR
  - MetecnoSpan PIR and MetecnoPanel PIR

Exclusions of this Report
- The building design, including the sizing and selection of all panels.
- All uplift fixings for building structures which fall outside of the Design Limitations stated above.
- Fixing requirements for all lateral loads, such as bracing connections and roof diaphragms.
- All fixings between fire-rated wall and/ or roof panels, which must be specifically assessed for suitability.
- All non-structural Building Code clauses, such as but not limited to E2 and H1, which must be assessed for compliance by a suitably qualified building professional.

Design Standards and Codes Referenced
The structure has been designed in accordance with the following Standards and Codes.

AS/NZS 1170 (Loadings)	NZS 3404 (Steel)	NZS 3603 (Timber)
AS/NZS 1664 (Aluminium)	AS/NZS 4600 (Light Steel)	

Manufacturers' literature, span tables, testing or SED, where referenced or included herein.

Dead and Live Loads

Element	Dead Load (kPa)	Imposed Load (kPa/ kN)
Roof (lightweight)	Panel self-weight	0.25 / 1.4
Roof Services Allowance	No Allowance *(governs for uplift only)*	
Over-cladding & Ceiling Linings	No Allowance *(governs for uplift only)*	

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
- B2 – Refer to the Durability Statement herein.

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 SITE BEFORE ANY MONITORING CAN TAKE PLACE.
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**
All metal insulated panel fixings within the scope of this report	At the Council's Discretion

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.

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 DESIGN LOADS FOR UPLIFT

DESIGN PHILOSOPHY

- The uplift reaction from a roof panel increases with span; therefore, the thickest panel generally available (200mm) is adopted in the analysis of uplift loads.
- PIR panels have generally greater span characteristics compared to EPS; therefore, PIR is adopted in the analysis of uplift loads.
- The roof panel's maximum span is determined by iterating the panel's maximum bending capacity for 'Low' to 'Extra High' wind zones, from which the maximum roof panel uplift reaction is extracted for the fixing design.
- The governing design calculation is shown below in full, however, other iterations are only summarised below.
- For this assessment, external wind pressure coefficients are assumed as -0.9 and +0.4.
- The Building Designer for any given site is responsible for ensuring that the assumptions and limitations within this report are appropriate for their building.

Calculation for "Extra High" wind zone:

Polypanel Roof and Ceiling Design: Span = **6.100 m**

Panel Thickness, d = **200 mm**

Loading

Consider 1m width of panel:

Self	Permanent actions, P_G =	0.17 kPa x 1m	0.17 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 $p_{(Z)}$ =	**1.81 kPa**		K_a = 1.0	*Table 5.4*		
	Serviceability $p_{(z)}$ =	1.23 kPa		K_l = 1.5	*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 = 0.9	*5.4.3*		
	p_{Wmin} =	-2.20 kPa x 1m	-2.20 kN/m	C_{dyn} = 1.0	*Section 6*		
	p_{Wmax} =	1.47 kPa x 1m	1.47 kN/m				

Combination of Actions from AS/NZS 1170

Strength Limit State :

Ultimate:	**1.2G & 1.5Q**	w_u* = 0.58 kN/m	M*= 2.7 kNm	V* = 1.8 kN
Ultimate:	**1.35G**	w_u* = 0.23 kN/m	M*= 1.1 kNm	V* = 0.7 kN
Ultimate:	**1.2G & W**	w_u* = 1.67 kN/m	M*= 7.8 kNm	V* = 5.1 kN
Ultimate:	**0.9G & W**	w_u* = -2.04 kN/m	M*= -9.5 kNm	V* = -6.2 kN
			Max M* = 9.5 kNm	**Max V* = 6.2 kN**

Serviceability Limit State :

Serviceability: G + ψ_lQ	w_s = 0.17 kN/m
Serviceability: G + ψ_sQ	w_s = 0.35 kN/m
Serviceability: W_s	w_s = 1.49 kN/m

Strength

Bearing pressure on polystyrene for seating width of 75 mm = 83.1kPa **OK**

ϕ = 0.9

Moment capacity of panels $\phi M_n = \phi k f_y t d$ Skin thickness t = 0.59 mm (k is derived in load/span tests Metalcraft Product Testing)

ϕM_n = 9.6 kNm **OK**

k= 0.30

f_y = 300 MPa

$f_{bc} = kfy$ = 90 MPa

Panel Width b = 1000 mm

G = 1.856 MPa

GA= 371,200

$EI = E_s b t d^2/2$ = 2.36E+12

Deflection

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

Serviceability: G + ψ_lQ	$\delta_{G + \psi lQ}$ = 4 mm	**Span/ 1738**	**OK**
Serviceability: W_s	δ_W = 30 mm	**Span/ 203**	**OK**

Roof: δ < L/300 - G & ψ_l Q - sag

Ceiling: δ < L/200 - Ws

Iterated calculations for all wind zones:

ZONE	LOW	MED	HIGH	VHIGH	EHIGH
MAX SPAN	10.40	9.20	7.80	6.75	**6.10** m
SHEAR/m	3.66	4.02	4.89	5.62	**6.23 kN**

FOR WALL-PANEL CONNECTIONS WITHOUT AN EAVES OVERHANG

MAXIMUM UPLIFT REACTION FOR ROOF-WALL FIXING, V* = **6.23 kN (per m)**

FOR WALL-PANEL CONNECTIONS WITH AN EAVES OVERHANG

Maximum eaves overhang permitted by Metalcraft literature = +25% of span

Maximum overhang for governing case above, for 200mm PIR = 1.53 m
Assume Cpn = -1.50 for the overhang
Net additional uplift reaction from eaves overhang, V*(eaves) : **5.59 kN**

MAXIMUM UPLIFT REACTION FOR ROOF-WALL FIXING, V* = **11.82 kN (per m)**

2.0 SCREW FIXINGS INTO TIMBER

For roof panels without an eaves overhang:

Assume wood screw connection through panel at max. 200 mm centres.
= 5 screws per m
= **1.25 kN per screw**

Screwed Joint Timber Fixings.xltm

Connection designed to NZS 3603, Clause 4.3

For Shear Connections in Timber

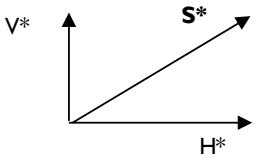
For 14g Type 17 screws in timber group **J5**

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

$S^* \le \phi Q_n$

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

$\phi Q_n = \phi\ n\ k_1\ k\ Q_k$



ϕ = 0.7
Q_k = 2.663 kN
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_1	Amount, n	ϕQ_n (kN)	
1.2G + 1.5Q			0.0	0.8	**2**	3.0	≥ **S* OK**
0.9G + Wu	**1.25**	0.0	1.25	1.0	2	3.7	≥ **S* OK**
1.2G + Wu			0.0	1.0	2	3.7	≥ **S* OK**

For Uplift Connections in Timber

For 14g Type 17 screws in timber group **J5** **in withdrawal**

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

$N^* \le \phi Q_n$

$\phi Q_n = \phi\ n\ k\ p\ Q_k$

ϕ = 0.7
Q_k = 79.5 N/mm
k = 1.00 Dry
k = 1.00 Side grain

	Design load effects		Design strength			
Load case	N* (kN)	Amount, n	k_1	Penetration, p (mm)	ϕQ_n (kN)	
1.2G + 1.5Q		1	0.8	35	1.56	≥ **N* OK**
0.9G + Wu	**1.25**	1	1.0	35	1.95	≥ **N* OK**
1.2G + Wu		1	1.0	35	1.95	≥ **N* OK**

For roof panels with an eaves overhang:

Assume wood screw connection through panel at max. 200 mm centres.
= 5 screws per m
= **2.36 kN per screw**

Screwed Joint Timber Fixings.xltm

Connection designed to NZS 3603, Clause 4.3

For Shear Connections in Timber

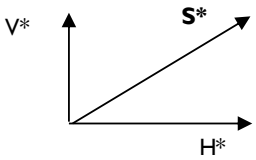
For 14g Type 17 screws in timber group **J5**

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

$S^* \le \phi Q_n$

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

$\phi Q_n = \phi\ n\ k_1\ k\ Q_k$



ϕ = 0.7
Q_k = 2.663 kN
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_1	Amount, n	ϕQ_n (kN)	
1.2G + 1.5Q			0.0	0.8	**2**	3.0	≥ **S* OK**
0.9G + Wu	**2.36**	0.0	2.36	1.0	2	3.7	≥ **S* OK**
1.2G + Wu			0.0	1.0	2	3.7	≥ **S* OK**

For Uplift Connections in Timber

For 14g Type 17 screws in timber group **J5** **in withdrawal**

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

$N^* \le \phi Q_n$

$\phi Q_n = \phi\ n\ k\ p\ Q_k$

ϕ = 0.7
Q_k = 79.5 N/mm
k = 1.00 Dry
k = 1.00 Side grain

	Design load effects		Design strength			
Load case	N* (kN)	Amount, n	k_1	Penetration, p (mm)	ϕQ_n (kN)	
1.2G + 1.5Q		1	0.8	43	1.91	≥ **N* OK**
0.9G + Wu	**2.36**	1	1.0	43	2.39	≥ **N* OK**
1.2G + Wu		1	1.0	43	2.39	≥ **N* OK**

3.0 RIVET FIXINGS THROUGH ANGLE BRACKETS

The capacity of a 4.8mm diameter rivet in an angle flashing is determined as 1.43 kN.

Ply Bearing Analysis
Ref *AISC Design Capacities Book, 7.1.4*

$\phi = 0.6$
Edge of ply to ctr of fixing, a_e = 14.4 mm
Thickness of ply, t_p = 0.59 mm
Tensile strength of ply, f_{up} = 280 MPa
Dia of fixing, d_t = 4.8 mm

$\phi Vb = f.a_e.t_p.f_{up}$ *Eqn 7.1.4 (a)*
= 1.43kN

$\phi Vb = \phi 3.2.d_t.t_p.f_{up}$ *Eqn 7.1.4 (b)*
= 1.52kN *Eq 9.3.2.4(1)*

ϕVb = 1.43kN

For roof panels without an eaves overhang:

Assume rivets through angle flashings on both side of the wall, ΦVb = 1.43 kN
Number of rivets required in total = 6 rivets
= 3 rivets per side
= **300 mm centres**

For roof panels with an eaves overhang:

Assume rivets through angle flashings on both side of the wall, ΦVb = 1.43 kN
Number of rivets required in total = 10 rivets
= 5 rivets per side
= **200 mm centres**

4.0 FIXING SUMMARY

	Compliance with Building Code Clause B1 has been assessed by Redco NZ Limited for the follow conditions and fixings:	
	Uplift Fixings for All NZS 3604 Wind Zones up to and including "Extra High"	
Eaves Overhang	Screws and Timber Wall Plates	Rivets and Flashings
None *(Soffit only [7])*	**14g Type 17 @ 200mm c/c**	**-**
None *(Soffit only [7])*	**-**	**4.8mm ϕ Rivets @ 300mm c/c**
Up to 25% of the Roof Span	**14g Type 17 @ 200mm c/c**	**-**
Up to 25% of the Roof Span	**-**	**4.8mm ϕ Rivets @ 200mm c/c**

NOTES

1. All fixings noted herein have been assessed for wind uplift only.
2. Fixings for all lateral load conditions, such as bracing and roof diaphragms, must be specifically assessed by the building designer.
3. The fixings noted herein may not be suitable for fire-rated walls and roofs and must be specifically assessed by the building designer.
4. Both aluminium and steel blind rivets with a minimum diameter of 4.8mm are acceptable.
5. Aluminium flashings used in structural connections must be a minimum 40 x 40 x 2.0mm.
6. Steel flashings used in structural connections must be a minimum 40 x 40 x 0.5mm pre-galvanised.
7. Soffits up to 300mm are not considered as an eaves overhang for the purpose of this assessment.
8. Panel metal skins must not be cut unless specifically assessed by the building designer, especially for eaves overhangs.
9. The fixings noted herein are suitable for use with Metalcraft Insulated Panels' -*Span* and -*Panel* product ranges with EPS and PIR cores.
10. Wind speeds exceeding 55m/s ("Extra High"), and all sites within Lee Zones must be specifically assessed by the building designer.

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:

Timber
Timber treatment has been selected in accordance with Table 1A of B2/AS1, and/ or Table 4.1 of NZS 3604.

Steel
All flashings, fixings and other proprietary elements shall be pre-galvanised and finished, such as Colorsteel.

Durability has been assessed for internal and external steel up to Atmospheric Corrosivity Category C3 - Medium in accordance with the "Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings" AS/NZS 2312 or Technical Specification SNT TS 3404. Both are on a time to first maintenance basis.

Aluminium
All naturally oxidised flashings and fixings in contact with Colorsteel, pre-finished metal insulated panels and other pre-finished steelwork is deemed to satisfy the durability requirements, on a time to first maintenance basis.

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.

For exposure requirements which exceed any of the above limitations, the durability of all components must be specifically assessed by the building designer.