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EMH DESIGN MANUAL

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1 OVERVIEW OF THE EMH SYSTEM

The EMH system is a timber framed construction system consisting of panelised, prefabricated elements assembled on site. The timber framed construction is consistent with light timber framed construction which is widely understood in the New Zealand construction industry, and well documented by the New Zealand Standard NZS3604. The principles of the EMH system are consistent with that of NZS3604 type construction.

The system incorporates wall, floor, ceiling and roof panels which are assembled on site to form the structural system. The system comprises of exterior claddings, UPVC double glazed joinery, insulation with internal plasterboard linings if requested.

1.1 Panel types

The panels offered comprise:

- External wall
- External wall (fire rated)
- Internal non-load bearing wall
- Internal load bearing wall
- Sub-Floor/Ground Floor
- Two types of Ceiling panels (insulated and not)
- Floor/Ceiling
- Two types of Roof panels (insulated and not)
- Intertency Wall (Fire rated)
- Glulam beams are used to provide additional structural performance.

2 BUILDING CODE CLAUSES

If designed, installed and maintained in accordance with all EMH requirements, the EMH System will be “deemed to comply” with 3604:2011 or contribute to compliance with the following Code Clauses of the NZBC:

- B1 Structure - B1.3.1, B1.3.2, B1.3.3(a, b, f, g, h, j, l, m, q), B1.3.4 (a, b, c, d, e)
- B2 Durability - B2.3.1(a, b, c), B2.3.2 (a)
- C3 Fire Affecting Areas Beyond the Fire Source – C3.4(a), C3.6,
- C6 Structural Stability - C6.2
- E2 External Moisture - E2.3.2, E2.3.5, E2.3.7(a, b, c)
- E3 Internal Moisture - E3.3.1
- F2 Hazardous Building Materials - F2.3.1, F2.3.3 (a, b)
- G4 Ventilation - G4.3.1
- G6 Airborne and Impact Sound - G6.3.1,
- H1 Energy Efficiency - H1.3.1 (a, b), H1.3.2E, H1.3.3



3 SCOPE AND INTERPRETATION

This document provides guidance on the design, selection and management of structural components for the European Modular Homes (EMH) System. Sizing of structural elements within the scope of this document have been demonstrated to comply with Clause B1 of the New Zealand Building Code. Structural elements falling outside the prescriptions of design tables in this design manual shall comply with the requirements of NZS3604:2011, or be the subject of Specific Engineering Design (SED), requiring input from a suitably qualified Structural Engineer.

This design guide shall only apply to buildings within the following limits:

- Stand-alone residential dwellings and terraced houses up to two stories;
- Total height from lowest ground level to highest point of the roof up to 10m;
- Buildings shall comprise standard EMH panels;
- Buildings with light wall cladding (mass of cladding not exceeding 30 kg/m²);
- Building with light roofs (mass of roofing material & substrate not exceeding 10 kg/m²);
- Importance Level 1 & 2 buildings (defined in Table 1.1 of NZS3604:2011);
- Risk matrix score <20
- Open ground snow loading up to 1.5 kPa;
- Buildings with floor live loads not exceeding 1.5 kPa (i.e. self-contained dwellings);
- Buildings shall be supported on any one or combination of the following foundation structures:
 - i Piles
 - ii Foundation walls
 - iii Concrete slab-on-ground;
 - iv Engineered concrete raft foundations;
- The slope of any roof plane shall not be steeper than 45 degrees to the horizontal and a minimum of no less than 5 degrees;
- The building wind zone (determined in accordance from Clause 5.2.1 and Table 5.1 of NZS3604) shall be Low, Medium, High, Very High or Extra High. Specific Engineering Design (SED) notation indicates the application is outside the scope of this design guide;
- Load bearing walls supporting roof and ceiling panels shall have studs aligned with the supported rafter or joist where possible. If this is not achieved then the loaded dimension of the wall shall be limited to 4.2m.
- In all exposure zones as defined in NZS3604:2011 (except microclimates)
- Buildings with distinct parts (e.g. wings, block, pavilions or units separated by fire rated inter-tenancy walls) shall be designed as if each part was a separate building.
- Earthquake zones up to and including Zone 3 as defined in NZS3604:2011
- All panels must fit inside a shipping container with a maximum internal height of 2.5m



4 BRACING DESIGN

This section provides design guidance for the design of bracing systems to resist lateral loads imposed on the building (wind and earthquake loading).

4.1 Calculation of Bracing Demand

Horizontal wind and earthquake forces are quantified in “Bracing Unit” (BUs). They shall be determined in accordance with the bracing demands given in Section 5.2 (wind) & 5.3 (earthquake) of NZS3604:2011.

For buildings within the scope of this design guide the following assumptions can be made in determining the bracing demand:

- Floor loads = 1.5 kPa
- Light roof
- Light cladding to all walls

Calculation of building bracing demands, and verification of the required bracing capacity can be carried out using readily available bracing design spreadsheets which follow the method outlined in NZS3604.

4.2 Wall Bracing Design

Wall bracing design shall be carried out in accordance with Section 5.4 of NZS3604:2011. The designer’s attention is drawn to the following points:

- Designer to identify load bearing walls and bracing walls in plans
- Bracing elements shall extend from the bottom plate at floor level to the top plate at ceiling level.
- Wall bracing shall be located as close as possible to the corners of external walls and distributed evenly throughout the building.
- Bracing lines shall be parallel to the external walls of the building.
- Bracing lines shall be spaced at not more than 6m centres in each direction, unless the area is covered by a diaphragm. EMH mid-floor panels can be considered as a floor diaphragm complying with the requirements of NZS3604:2011, with a maximum length of 12m and an aspect ratio of no greater than 2.
- EMH ceiling panels cannot be considered to act as a diaphragm, however proprietary ceiling diaphragms (e.g. GIB ceiling diaphragms) can be utilised in this scenario if bracing lines require spacing of greater than 6m.

4.3 Bracing Capacity of EMH wall panels

The bracing capacity of EMH wall panels is summarised in **Table 1**



Table 1 - EMH Bracing table

European Modular Homes (EMH) – OSB Wall Bracing Elements (BU/m, ULS)		
Element size & bottom plate anchor	Wind (BU/m)	Earthquake (BU/m)
400 mm width (M12 Bolts - 85mm in from brace ends)	73	82
600 mm width (M12 Bolts - 85mm in from brace ends)	87	89
1200 mm width (M12 Bolts - 85mm in from brace ends)	120	110
<p>Wall assembly based on the following:</p> <ul style="list-style-type: none"> • Brace wall height 2400mm • 90 x 45 SG8, H3.1 studs @ 400mm centres • 9 mm Egger OSB panel on one face • 50mm Factory staples @ 150mm centres to studs. Top plate and lower bottom plate & upper bottom plate then @ 75 mm centres • 90mm x 6g angle screws between bottom plate at 300mm centres • Bottom plate anchor as specified above 		
<p>Testing carried out by Scion (Forest*Products*Innovation) BRANZ technical Paper P.21:2010 Dated 1 March 2019</p>		
<p>Adjustment of bracing element for length Wall bracing elements longer than those tested shall have their bracing capacity determined by multiplying the test bracing rating per metre by the length of the element. The end studs of the longer wall shall be provided with the equivalent hold down details to those used in the wall test.</p>		
<p>Adjustment of the bracing elements in height Adjustment of bracing capacity of walls of different heights and walls with different sloping top plates shall be obtained by the following method:</p> <p>a) For wall bracing elements of heights greater than 2.4m, the bracing rating determined by test shall be multiplied by:</p> $2.4 / \text{element height in metres}$ <p>Elements less than 2.4m high shall be rated as if they were 2.4m high</p> <p>b) Walls of varying heights shall have their bracing capacity adjusted using the average height</p>		

4.4 Roof Bracing

Bracing shall be provided in the roof plane in accordance with Section 10.4.2.2 (b) of NZS3604:2011. This can be achieved by providing a diagonally opposing pair of continuous steel strips which are installed from each corner of the roof panel, to the diagonally opposite corner.



A Simpson Strong-Tie BAN wind bracing strap (25mm wide x 2mm thick) is an acceptable strip bracing product to achieve this. The end of each strip shall be anchored in accordance with the manufacturers specification, using (4x) CAN 4mm diam. x 40mm nails.

5 FOUNDATION AND SUBFLOOR FRAMING

Foundation and sub-floor framing is outside the scope of this design manual.

The EMH panel system is to be supported on any one or a combination of the following foundation structures:

- i Piles
- ii Foundation walls
- iii Concrete slab-on-ground;
- iv Engineering concrete raft foundation

Where the site complies with the definition of good ground, defined in Section 3.1.3 of NZS3604:2011, subfloor and foundation structure can be selected from Section 6 of NZS3604:2011.

Bracing of sub-floor structure shall be designed in accordance with NZS3604:2011. The EMH floor panels supported to the subfloor structure shall be fixed to bearers with a 6kN joist-to-bearer connection at the locations required by Section 6 of NZS3604:2011.

Where the site does not comply with the definition of good ground in NZS3604:2011, the foundations shall be the subject of Specific Engineering Design (SED) by a suitably qualified Structural Engineer.

5.1 Sole plate

The EMH system requires placement of external walls sole plates to be inline with the edge of the foundations. See [Appendix G](#) for an example

6 FLOORS

This section provides design tables for selection of suspended floor structure for both ground floors over timber subfloor structure and mid-floors in two-storey construction. Floor joists selection from this section can be applied to EMH Floor panels shown in [Appendix A](#)

6.1 Floor Joists

Floor joist span tables 2 & 3 can be used to select the floor joists for the span required. The design tables are appropriate for the following design conditions:

- 1.5 kPa floor live loads (suitable for self-contained dwellings).
- Joists supporting floor loads only. Refer to additional design notes for requirements where load bearing walls are supported on floor joists. If load bearing walls fall outside these limits, the supporting joists shall be the subject of Specific Engineering Design (SED).
- Light weight floor coverings (e.g. carpet or vinyl).
- Interior floors only (not exposed to external moisture in service).
- Cantilevered floor joists are outside the scope of this design manual.



Table 2 – Span Table for grade C16 floor joists

Floor Joist size (mm)	Joist Spacing (mm)	Maximum Span (m)
195 x 45*	600	3.2
220 x 45	600	3.6
245 x 45	600	4.0
(2x) 195 x 45* (doubled joists)	600	4.0
(2x) 220 x 45 (doubled joists)	600	4.5
(2x) 245 x 45 (doubled joists)	600	5.0

*Due to insulation requirements, ground floor joists must be no less than 220mm deep

Table 3 - Span Table for grade C24 Floor Joists

Floor Joist size (mm)	Joist Spacing (mm)	Maximum Span (m)
195 x 45*	600	3.6
220 x 45	600	4.0
245 x 45	600	4.4
(2x) 195 x 45* (doubled joists)	600	4.5
(2x) 220 x 45 (doubled joists)	600	5.0
(2x) 245 x 45 (doubled joists)	600	5.2

*Due to insulation requirements, ground floor joists must be no less than 220mm deep

Additional Design Notes:

- Where a loadbearing wall runs parallel to the line of the floor joists beneath, it shall be supported by a pair of joists located directly below the load bearing wall. Where the supported wall has a trimmer stud for an opening in the wall, the requirements of clause 7.1.3.2 of NZS3604:2011 shall be complied with.
- Where a load bearing wall crosses floor joists at right angles to the line of the joists, the wall shall be located at not more than 200mm centre-to-centre from a support line below the joists (e.g. bearer or load bearing wall below) as required by clause 7.1.3.3 of NZS3604:2011.
- Joints in floor joists shall only be made over support lines (i.e. supporting beam or wall).



- All floor joists to be laid to a common level. If a step in the floor level is required this shall be the subject of Specific Engineering Design (SED).

7 WALLS AND LINTELS

This section provides design tables for selection of wall studs and lintels in loadbearing and non-loadbearing timber framed walls. The wall studs and lintels selected from this section can be applied to wall panels as shown in [Appendix B](#)

The wall stud and lintel design tables in this section are appropriate to the following design scenarios:

- Walls at any proximity to a relevant (notional) boundary when specific fire engineering is used. Post fire stability is site specific and will require Specific Engineering Design (SED).
- All wall studs shall be structural grade C24.
- Lintels supporting point loads from roof or floor beams shall be the subject of Specific Engineering Design (SED).

7.1 Wall Studs

Stud size and spacing can be selected from the design tables in this section. Refer to NZS3604:2001 for definition of loaded dimension.

Table 4 – Studs in loadbearing walls (single or top storey)

Wind Zone	Stud Requirements	Maximum Loaded Dimension (m)
All Wind Zones	95x45 @ 600 crs	6.0m
Internal walls (all wind zones)	95x45 @ 600 crs	6.0m

Table 5 – Studs in loadbearing walls (lower of two storeys)

Wind Zone	Stud Requirements	Maximum Loaded Dimension (m)
Extra High	(2x) 95x45 @ 600 crs (doubled studs)	6.0m
Very High, High, Medium & Low	95x45 @ 600 crs	6.0m
Internal walls (all wind zones)	95x45 @ 600 crs	6.0m



Table 6 – Studs in non-loadbearing walls

Wind Zone	Stud Requirements
All Zones	70x45 @ 600 crs

Table 7 – Studs in Over-height walls (supporting roof only)

Wind Zone	Maximum Loaded Dimension (m)	Stud Size for max height (m) (all studs @ 600 crs):					
		2.5	2.7	3	3.6	4.2	4.8
Extra High	6	95 x 45	(2x) 95 x 45 or 145 x 95	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45	-
Very High	6	95 x 45	95 x 45	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45	-
High	6	95 x 45	95 x 45	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45	-
Medium	6	95 x 45	95 x 45	95 x 45	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45
Low	6	95 x 45	95 x 45	95 x 45	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45
Internal walls for all wind zones	6	95 x 45	95 x 45	95 x 45	(2x) 95 x 45 or 145 x 95	145 x 45	(2x) 145 x 45



7.2 Lintels

Lintels over window and door openings can be selected from the tables in this section. Refer to NZS3604:2001 for definition of loaded dimension. Important Note: Eaves with an overhang dimension of greater than 750mm must be included in the loaded dimension selected when sizing lintels from the tables below.

Table 8 – Grade C16 Lintels supporting roof only (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)				
	Lintel size – depth x width (mm)				
	95 x 90	145 x 90	195 x 90	220 x 90	245 x 90
2	1.5	2.4	3.2	3.6	3.9
3	1.3	2.1	2.8	3.1	3.5
4	1.2	1.8	2.5	2.8	3.1
6	1.0	1.5	2.0	2.3	2.6

Table 9 – Grade C24 Lintels supporting roof only (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)				
	Lintel size – depth x width (mm)				
	95 x 90	145 x 90	195 x 90	220 x 90	245 x 90
2	1.7	2.6	3.5	3.9	4.2
3	1.5	2.3	3.1	3.5	3.8
4	1.4	2.1	2.8	3.2	3.5
6	1.2	1.8	2.5	2.8	3.1

Table 10 – Grade C16 Lintels supporting roof & second storey wall (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)				
	Lintel size – depth x width (mm)				
	95 x 90	145 x 90	195 x 90	220 x 90	245 x 90
2	1.3	2.0	2.7	3.1	3.4
3	1.2	1.8	2.5	2.8	3.1
4	1.1	1.7	2.3	2.6	2.9
6	0.9	1.4	1.9	2.2	2.4



Table 11 – Grade C24 Lintels supporting roof & second storey wall (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)				
	Lintel size – depth x width (mm)				
	95 x 90	145 x 90	195 x 90	220 x 90	245 x 90
2	1.5	2.2	3.0	3.4	3.8
3	1.3	2.1	2.8	3.1	3.5
4	1.2	1.9	2.6	2.9	3.3
6	1.1	1.7	2.3	2.6	2.9

Table 12– Grade C16 Lintels supporting roof, second storey wall & mid-floor (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	1.6	2.2	2.5	2.8
3	1.3	1.8	2.1	2.3
4	1.2	1.6	1.8	2.0
6	1.0	1.3	1.5	1.7



Table 13 – Grade C24 Lintels supporting roof, second storey wall & mid-floor (all wind zones)

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	2.0	2.6	3.0	3.3
3	1.7	2.2	2.5	2.8
4	1.4	2.0	2.2	2.5
6	1.2	1.6	1.8	2.0

Table 14 – Grade C16 Lintels supporting floor only

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	1.8	2.4	2.8	3.1
3	1.5	2.0	2.2	2.5
4	1.3	1.7	1.9	2.2
6	1.0	1.4	1.6	1.8

Table 15 – Grade C24 Lintels supporting floor only

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	2.2	3.0	3.3	3.7
3	1.8	2.4	2.8	3.1
4	1.6	2.1	2.4	2.7
6	1.3	1.7	1.9	2.2



Table 16 – Grade C16 Lintels supporting gable wall and roof

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	1.8	2.5	2.8	3.1
3	1.7	2.3	2.6	2.9
4	1.6	2.2	2.4	2.7
6	1.4	1.8	2.1	2.3

Table 7 – Grade C24 Lintels supporting gable wall and roof

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	2.0	2.7	3.1	3.4
3	1.9	2.6	2.9	3.2
4	1.8	2.4	2.7	3.0
6	1.6	2.2	2.5	2.8

Table 18 – Grade C16 Lintels supporting mid-floor, gable wall and roof

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	1.1	1.5	1.7	1.9
3	1.1	1.4	1.6	1.8
4	1.0	1.4	1.6	1.7
6	0.9	1.3	1.4	1.6



Table 19 – Grade C24 Lintels supporting mid-floor, gable wall and roof

Loaded Dimension of Lintel (m)	Maximum span for lintel sizes listed below (m)			
	Lintel size – depth x width (mm)			
	145 x 90	195 x 90	220 x 90	245 x 90
2	1.4	1.9	2.1	2.3
3	1.3	1.8	2.0	2.2
4	1.2	1.7	1.9	2.1
6	1.2	1.6	1.8	2.0



8 ROOF FRAMING

This section provides design tables for selection of rafters and ridge beams for roofs within the scope of this design manual. The roof framing sizes selected from the design tables in this section can be applied to roof panel types to 11.5 in [Appendix C](#)

Rafter span table in this section is appropriate for the following design scenarios:

- Gable and mono pitch roof construction only. Hipped roofs are outside the scope of this design manual.
- Light weight roofs only with roofing material having a mass not exceeding 20 kg/m² of roof area. Heavier roofs are possible however they will require specific engineering design to verify their compliance.
- Roof with up to 45 degree roof pitch. Steeper roof pitches are achievable but will require specific engineering design to verify.
- Span tables are applicable to either skillion roofs (ceiling weight supported by rafters), or roof panels within a roof space (ceiling weight not supported by rafters).
- Refer to NZS3604:2011 for definition of loaded dimension

Table 20 – Grade C16 Common rafter span table

Rafter selection	Maximum Span (m)	Maximum Eaves Overhang (m)
195x45 @ 600	4.1	1.2
220x45 @ 600	4.6	1.5
245x45 @ 600	5.2	1.5

Table 8 – Grade C24 Common rafter span table

Rafter selection	Maximum Span (m)	Maximum Eaves Overhang (m)
195x45 @ 600	4.6	1.2
220x45 @ 600	5.1	1.5
245x45 @ 600	5.6	1.5

Table 22 – Grade GL24h ridge beams

Loaded Dimension of Ridge Beam (m)	Maximum span for ridge beam sizes listed below (m)	
	Ridge beam size – depth x width (mm)	
	200 x 160	320 x 160
4	3.8	6.1
6	3.3	5.4



9 CEILINGS

This section provides design tables for selection of ceiling joists. The roof framing sizes selected from the design tables in this section can be applied to EMH Ceiling Panel 11.11 & 11.12 in [Appendix D](#)

The ceiling joist span tables in this section are appropriate for the following design scenarios:

- Mass of supported plasterboard ceiling is no more than 10 kg/m² of ceiling area.
- Non-habitable roof space only above the ceiling panels.

Table 23 – Ceiling Joist span table for grade C16 floor joists

Ceiling Joist size (mm)	Joist Spacing (mm)	Maximum Span (m)
195 x 45	600	3.8
220 x 45	600	4.2
245 x 45	600	4.7
(2x) 195 x 45 (doubled joists)	600	4.6
(2x) 220 x 45 (doubled joists)	600	5.1
(2x) 245 x 45 (doubled joists)	600	5.6

Table 24 – Ceiling Joist span table for grade C24 floor joists

Ceiling Joist size (mm)	Joist Spacing (mm)	Maximum Span (m)
195 x 45	600	4.2
220 x 45	600	4.7
245 x 45	600	5.2
(2x) 195 x 45 (doubled joists)	600	5.1
(2x) 220 x 45 (doubled joists)	600	5.7
(2x) 245 x 45 (doubled joists)	600	6.2

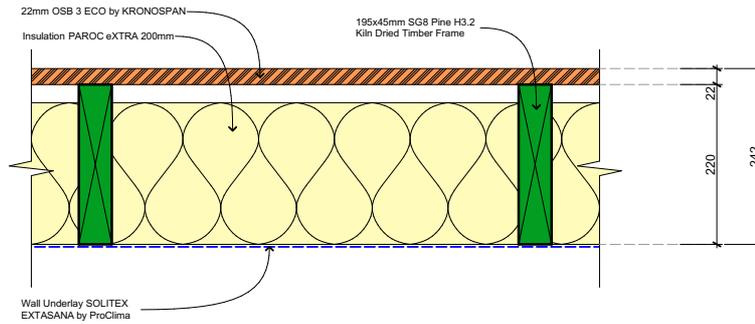


DESIGN MANUAL

Appendix A – Floor panels

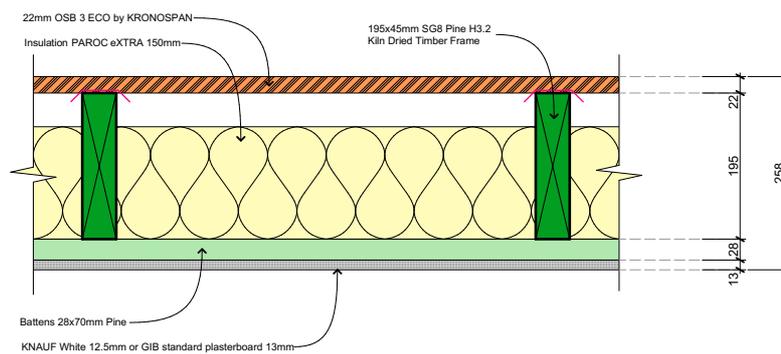
(Timber grade SG8, as referenced in the below drawings, is interchangeable with C16 or C24, as per the span tables)

Ground floor panel GF-1



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Ground (sub) Floor Panel (for wooden piles foundation)	DETAIL CODE:	GF-1
		ISSUE DATE: 16-Aug-19		SCALE @ A4:	1:5

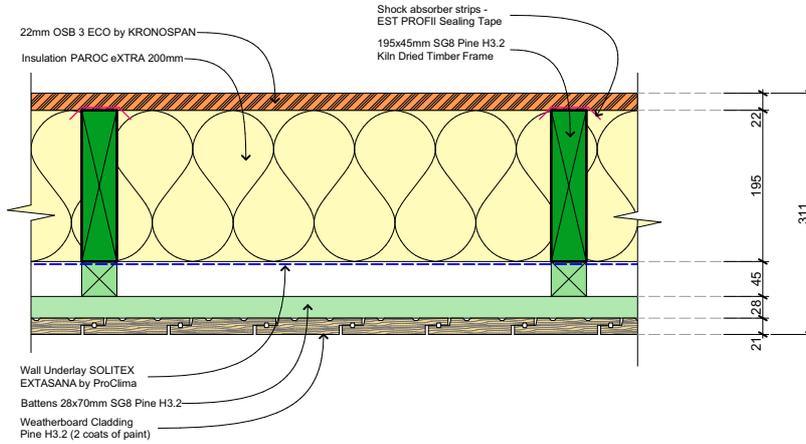
Mid floor panel MF-1 (with battens)



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Mid-Floor Panel - Load Bearing, Non Fire Rated, Non Sound Proofed	DETAIL CODE:	MF-1
		ISSUE DATE: 18-Aug-19		SCALE @ A4:	1:5



Mid floor panel MF-2 (exposed panel)

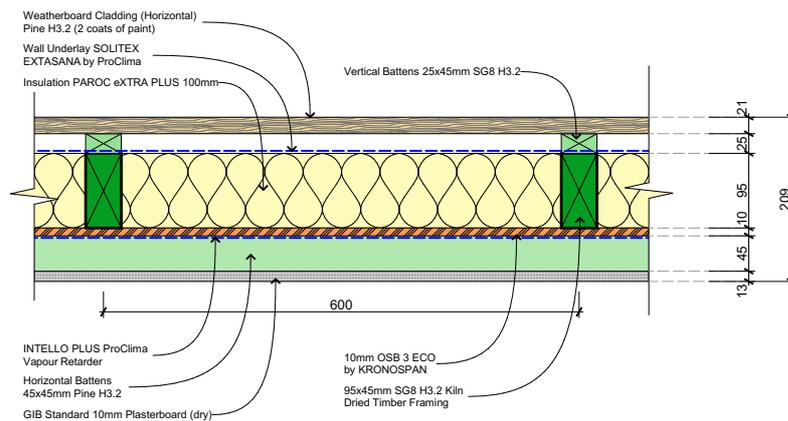


	EUROPEAN MODULAR HOMES	Modular Panel Detail	Mid-Floor Panel - Exposed Soffit, Non Fire Rated, Non Acoustic rated	DETAIL CODE: MF-2
	ISSUE DATE: 18-Aug-19	SCALE @ A4: 1:5		

Appendix B – Wall and lintel panels

(Timber grade SG8, as referenced in the below drawings, is interchangeable with C16 or C24, as per the span tables)

External wall – Horizontal cladding EW-1

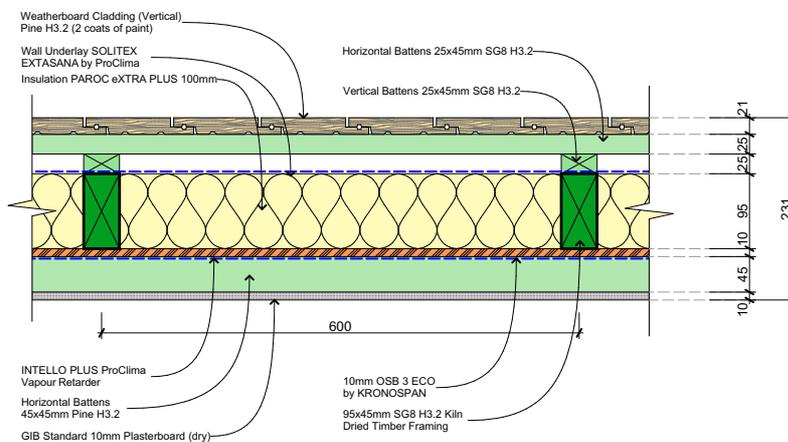


	EUROPEAN MODULAR HOMES	Modular Panel Detail	External Wall Load Bearing Horizontal Cladding Non Firerated	DETAIL CODE: EW-1
	ISSUE DATE: 16-Aug-19	SCALE @ A4: 1:5		



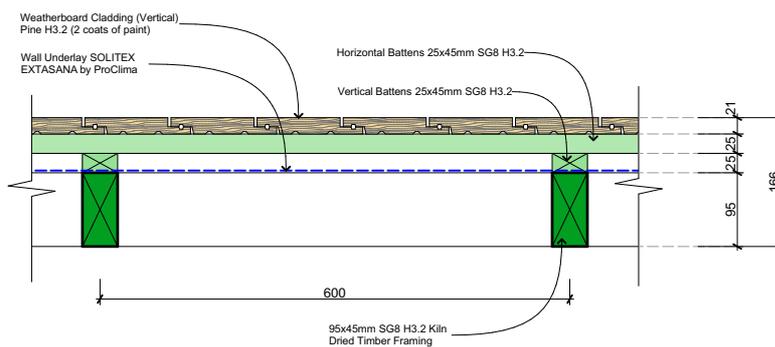
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External wall – Vertical cladding EW-2



	EUROPEAN MODULAR HOMES	Modular Panel Detail	External Wall Load Bearing Vertical Cladding Non Firerated	DETAIL CODE: EW-2
		ISSUE DATE: 16-Aug-19		SCALE @ A4: 1:5

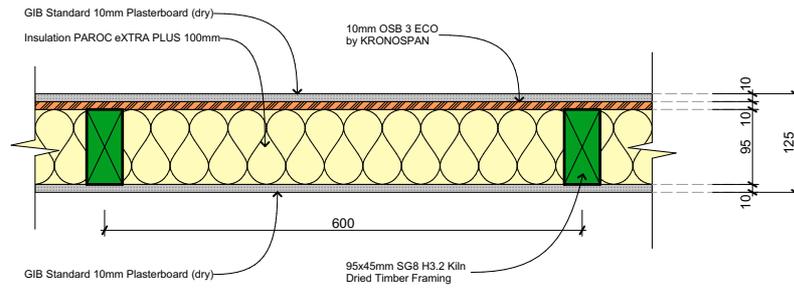
External gable wall EW-3



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Uninsulated Gable Panel	DETAIL CODE: EW-3
		ISSUE DATE: 16-Aug-19		SCALE @ A4: 1:5

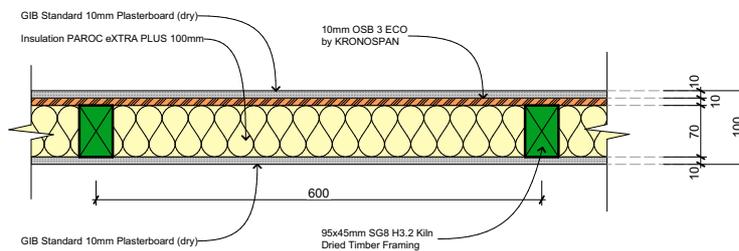


Internal wall load bearing IW-1



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Internal Wall - Load bearing	DETAIL CODE:	IW-1
		ISSUE DATE: 16-Aug-19		SCALE @ A4:	1:5

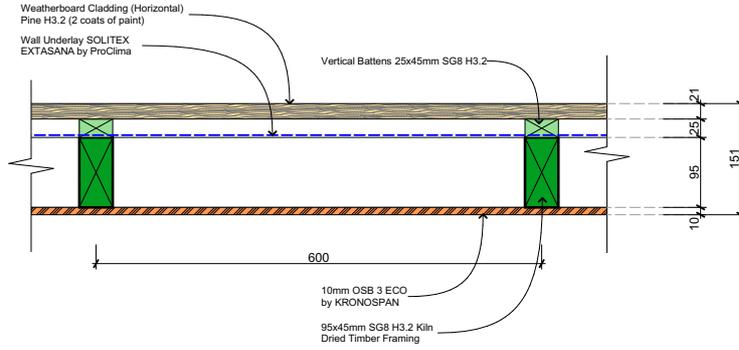
Internal wall non-load bearing IW-2



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Internal Wall - Non-load bearing	DETAIL CODE:	IW-2
		ISSUE DATE: 16-Aug-19		SCALE @ A4:	1:5

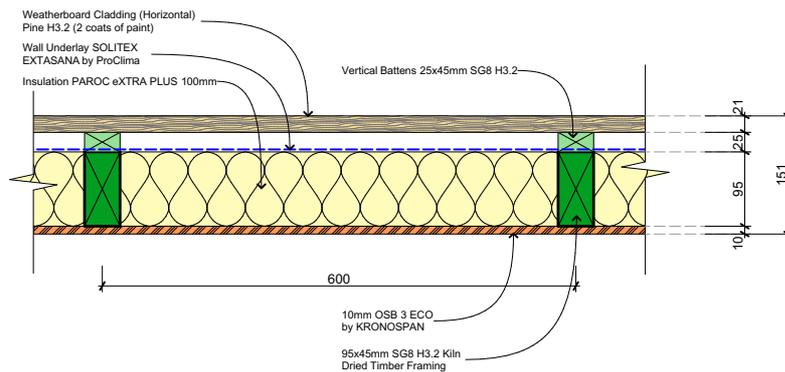


Garage wall external– uninsulated GW-1



	EUROPEAN MODULAR HOMES	Modular Panel Detail	External Garage Wall (Uninsulated)	DETAIL CODE: GW-1
	ISSUE DATE: 18-Aug-19	SCALE @ A4: 1:5		

Garage wall external – insulated GW-2

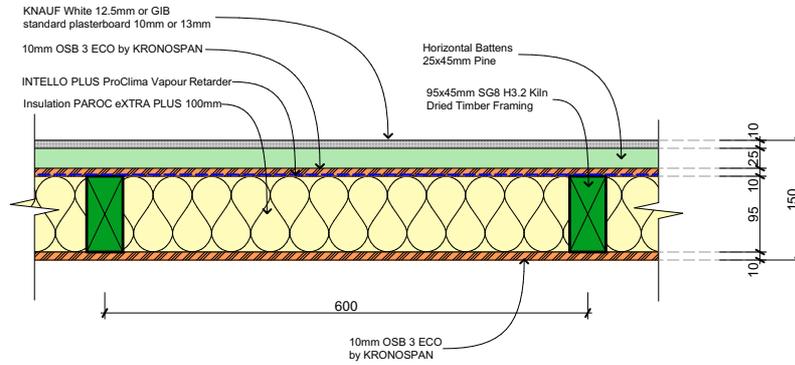


	EUROPEAN MODULAR HOMES	Modular Panel Detail	Garage Wall Insulated	DETAIL CODE: GW-2
	ISSUE DATE: 18-Aug-19	SCALE @ A4: 1:5		



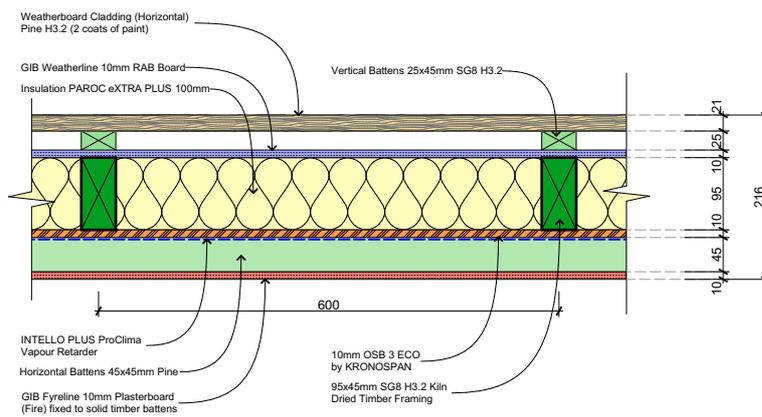
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Garage wall internal - Living area wall GW-3



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Internal Garage-Living Area wall	DETAIL CODE: GW-3
		ISSUE DATE: 18-Aug-19		SCALE @ A4: 1:5

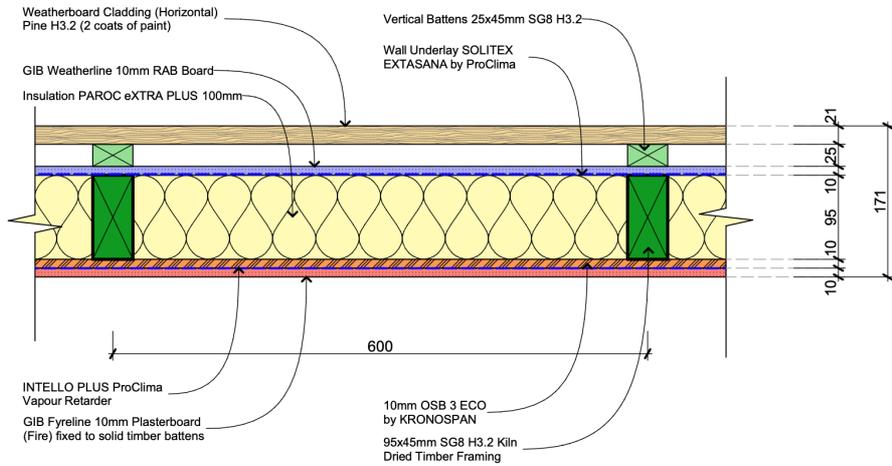
External wall fire rated FW-1



	EUROPEAN MODULAR HOMES	Modular Panel Detail	External Fire Wall - 30/30/30 FRR, Load bearing	DETAIL CODE: FW-1
		ISSUE DATE: 18-Aug-19		SCALE @ A4: 1:5



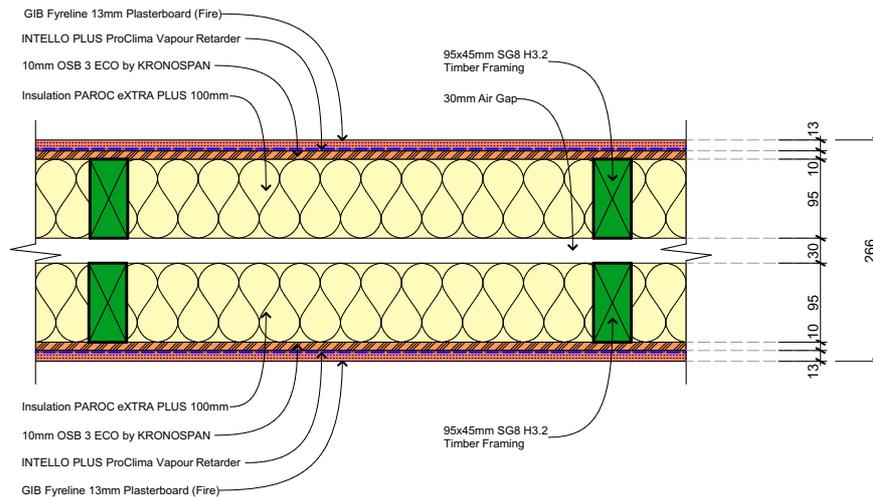
External wall fire rated - Garage FW-2



FW-2 External Fire Wall - Garage 30/30/30 FRR, Load bearing

	EUROPEAN MODULAR HOMES	Modular Panel Detail	External Fire Wall - Garage - 30/30/30 FRR, Load bearing	DETAIL CODE: FW-2
	ISSUE DATE: 23/09/2019	SCALE @ A4: 1:5		

Intertency wall fire rated II-FW

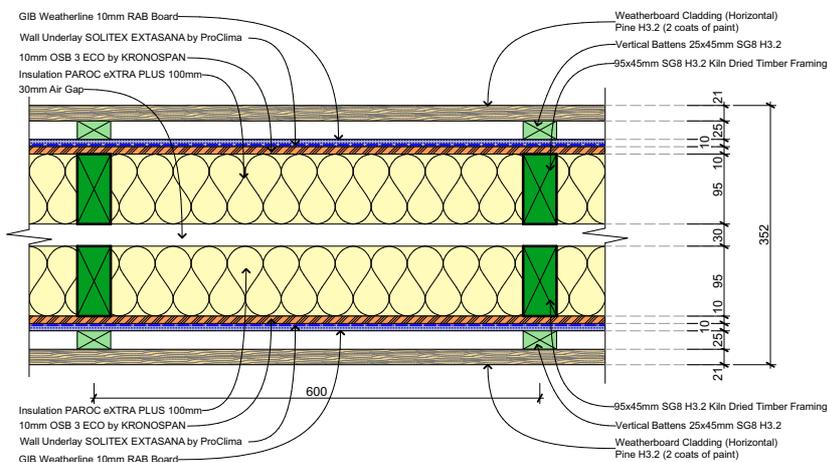


	EUROPEAN MODULAR HOMES	Modular Panel Detail	Intertency Wall Internal - Load Bearing, 60/60/60 FRR, Minimum 60STC	DETAIL CODE: II-FW
	ISSUE DATE: 18-Aug-19	SCALE @ A4: 1:5		



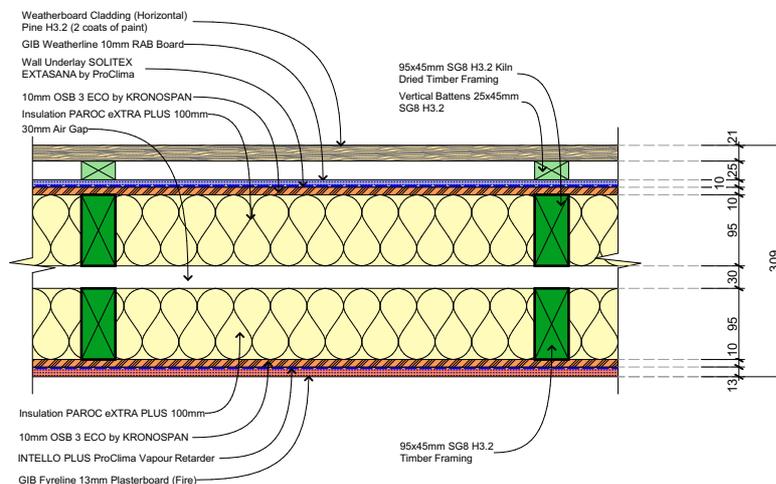
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Intertency wall – External / External EE-FW



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Intertency Wall - External Extension, Load Bearing, 60/60/60 FRR	DETAIL CODE: EE-FW
	ISSUE DATE: 16-Aug-19	SCALE @ A4: 1:5		

Intertency fire rated wall – External / internal EI-FW



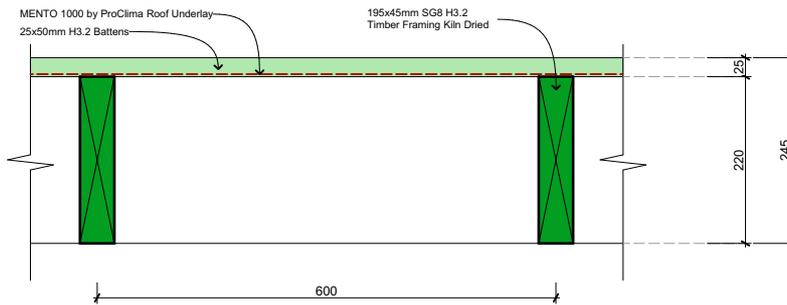
	EUROPEAN MODULAR HOMES	Modular Panel Detail	Intertency Wall - Load Bearing, 60/60/60 FRR, Minimum 60 STC	DETAIL CODE: EI-FW
	ISSUE DATE: 18-Aug-19	SCALE @ A4: 1:5		



Appendix C – Roof panels

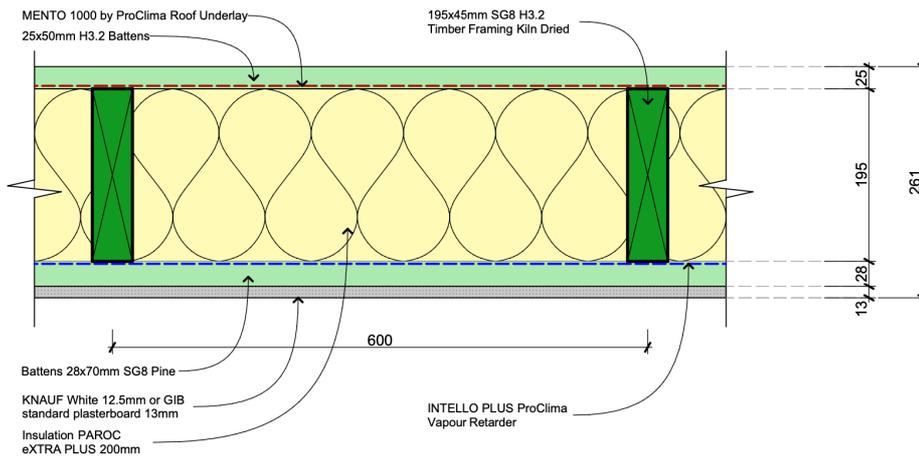
(Timber grade SG8, as referenced in the below drawings, is interchangeable with C16 or C24, as per the span tables)

Uninsulated roof panel R-1



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Uninsulated Roof Panel	DETAIL CODE: R-1
		ISSUE DATE: 16-Aug-19		SCALE @ A4: 1:5

Insulated roof panel R-2



	EUROPEAN MODULAR HOMES	Modular Panel Detail	Insulated Roof Panel	DETAIL CODE: R-2
		ISSUE DATE: 18-Aug-19		SCALE @ A4: 1:5

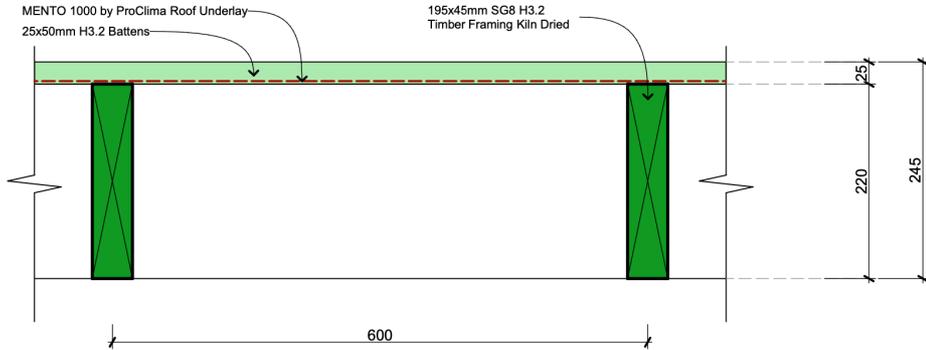


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Appendix D – Ceiling panels

(Timber grade SG8, as referenced in the below drawings, is interchangeable with C16 or C24, as per the span tables)

Uninsulated ceiling panels C-1



EUROPEAN
MODULAR
HOMES

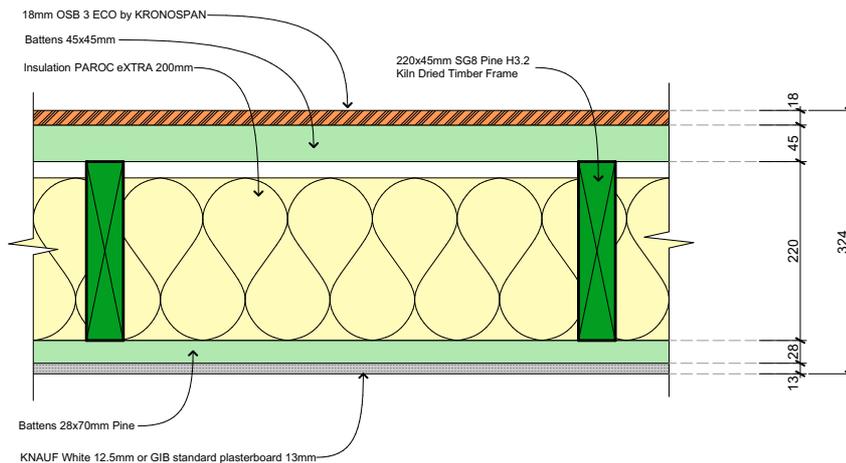
Modular Panel Detail
ISSUE DATE: 18-Aug-19

Uninsulated Roof Panel

DETAIL CODE: **R-1**

SCALE @ A4: 1:5

Insulated ceiling panel C-2



EUROPEAN
MODULAR
HOMES

Modular Panel Detail
ISSUE DATE: 18-Aug-19

Ceiling Panel (Insulated)

DETAIL CODE: **C-2**

SCALE @ A4: 1:5

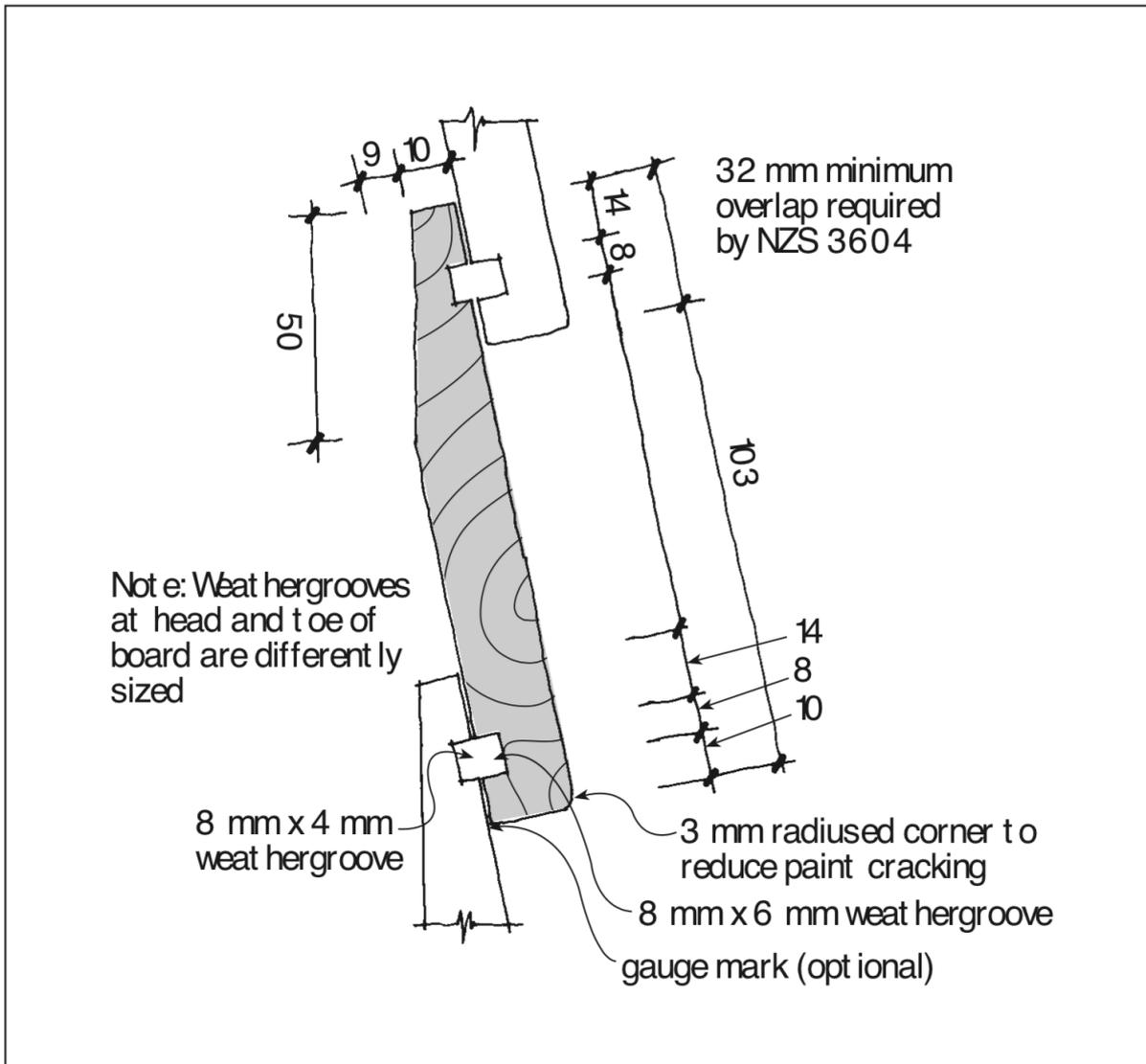


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Appendix E - Cladding options

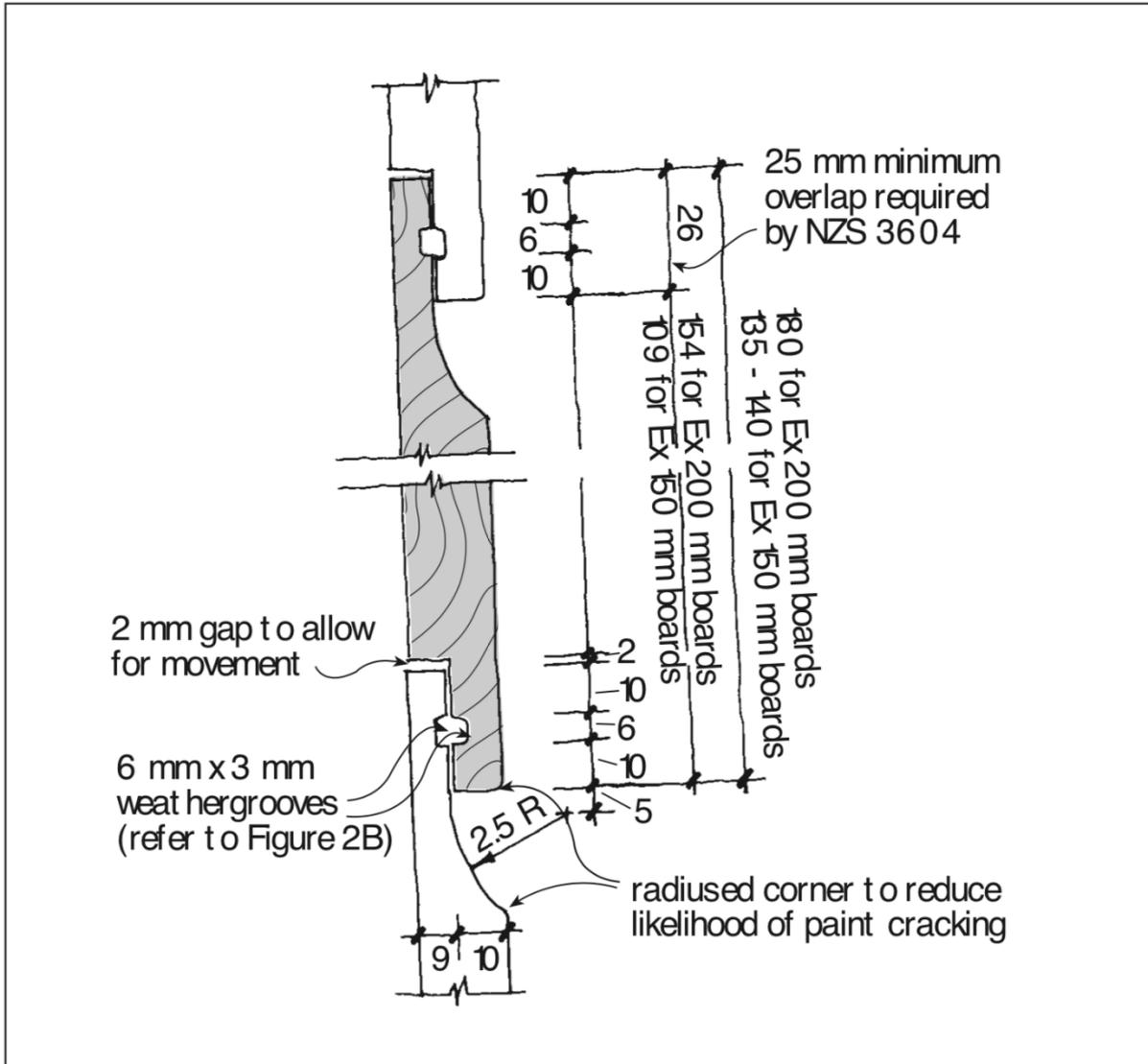
The following cladding profiles apply to the EMH Codemark as per Acceptable cladding options BRANZ 211. Claddings are Pine H3.2, pre primed with a top coat.

Ex 150 x 25 mm bevel-back horizontal weatherboards - Smooth and Rough sawn



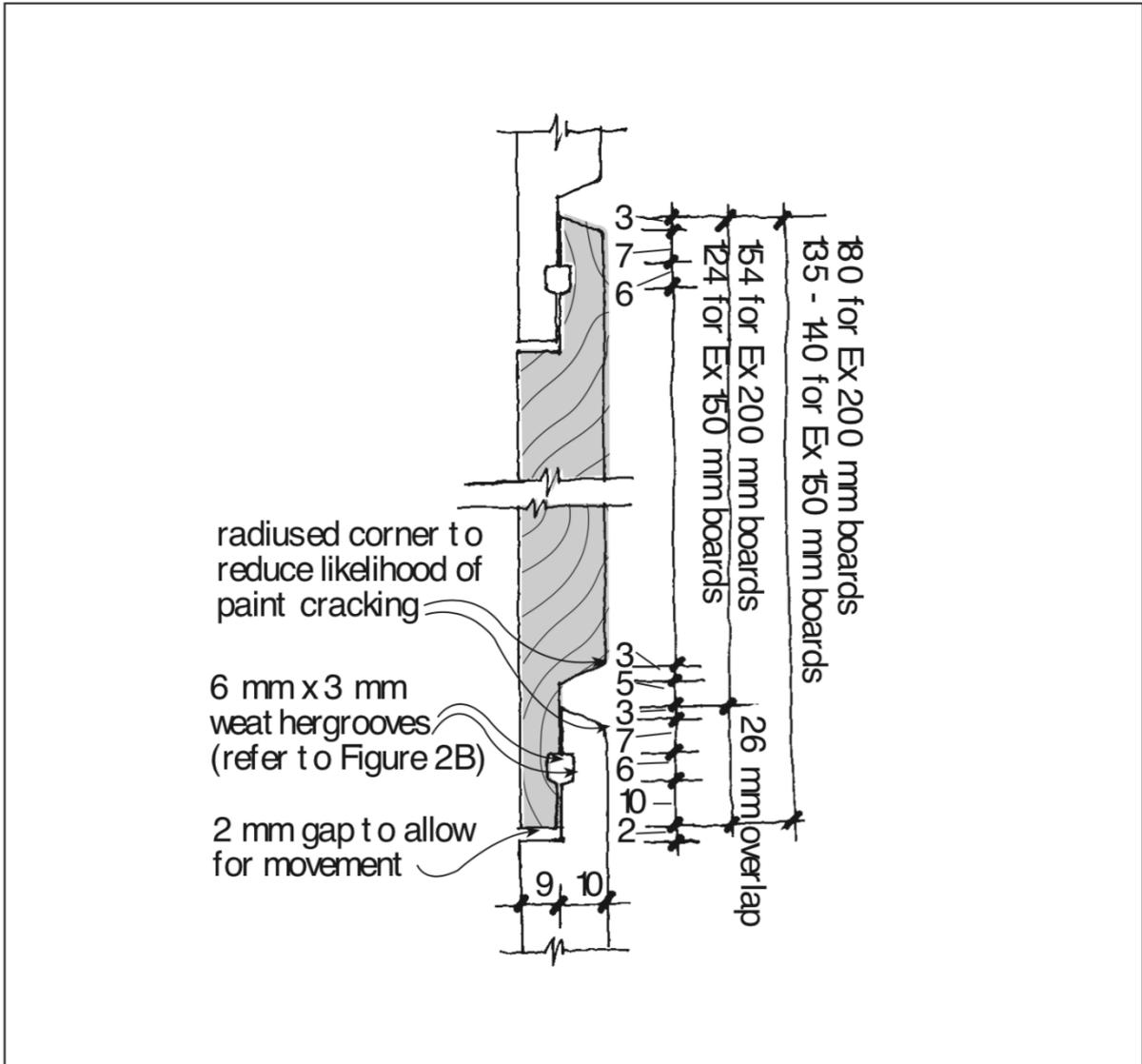


Ex 150 x 25 mm rusticated horizontal weatherboards - Smooth and Rough sawn





Ex 150 x 25mm vertical shiplap - Smooth and Rough sawn





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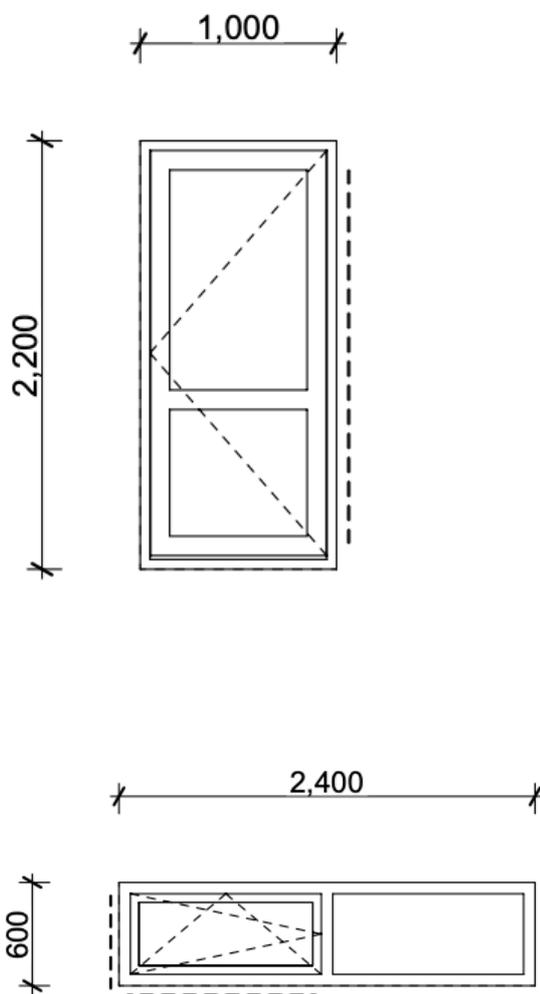
Appendix F – Windows and doors

Door and Windows opening specifications

Any European doors and windows provided by EMH will have openings detailed on the clients architectural plans, to align with European suppliers.

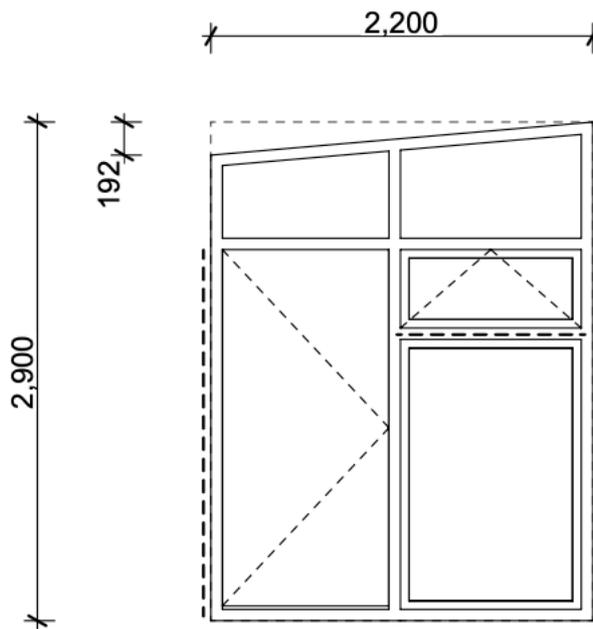
To suit the European supplier, exterior window and door hinge lines point to the handle. Show hinge side dashed for clarification. (See examples below)

Any New Zealand doors supplied locally, (outside of this contract) will use standard New Zealand architectural references.





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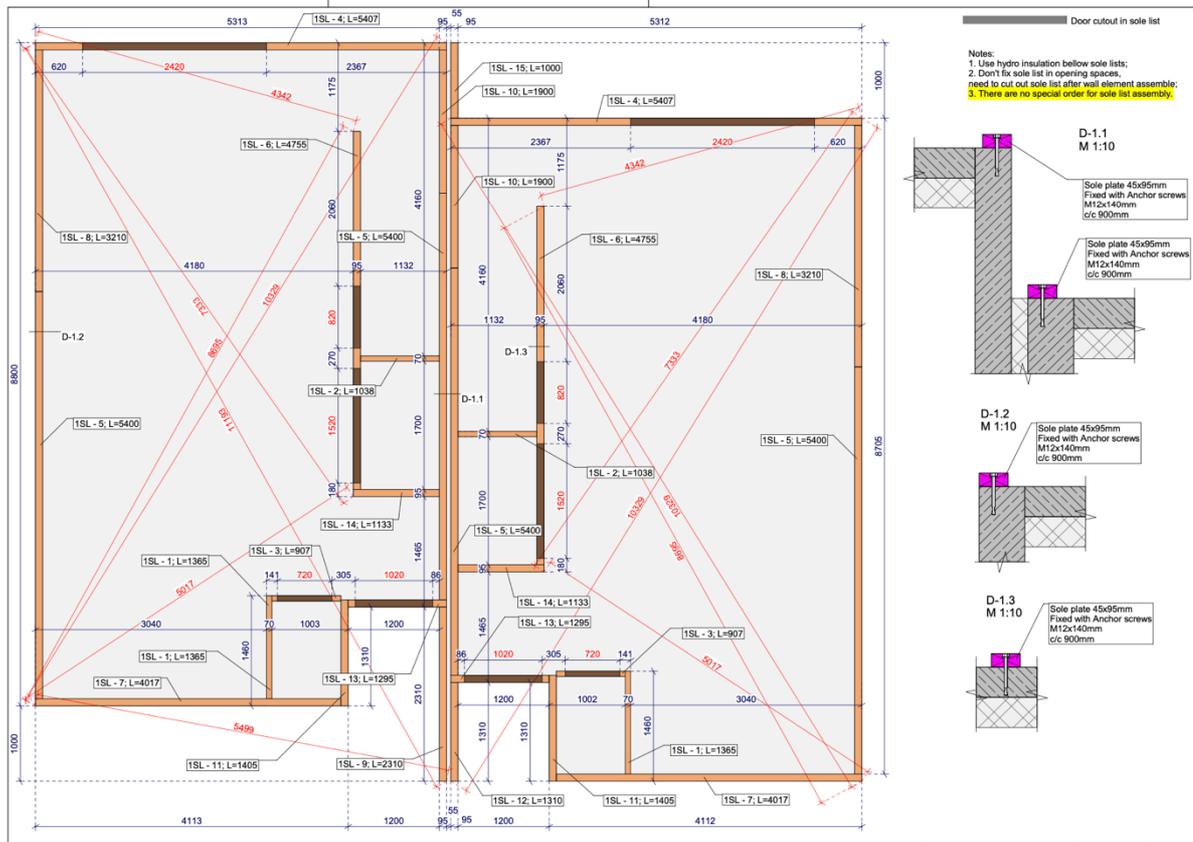
Window design

Tilt and turn and turn only designs for windows and doors (Double or triple glazed)
refer: <https://www.gealan.de/en/products/systems/s-9000>

Sliding doors and windows (Double or triple glazed)
refer: <https://www.gealan.de/en/products/systems/gealan-smoovio>



Appendix G – Sole plate placement



Appendix H - Supplementary information

The following additional project information / documentation is required by EMH before technical documentation can be produced and the house assembled onsite:

Services installation:

- Drainage – technical design drawings
- Water supply – technical design drawings
- Electric power supply – technical design drawings
- Ventilation system – technical design drawings
- Heating system – technical design drawings
- Foundations – technical design drawings for ground floor foundations

Please provide EMH with details of any connections passing through the timber floor/wall/ceiling panels.

Foundations for load bearing walls – loading places/spots in foundations should be reinforced. Calculations of reinforcement are done based on EMH supplied loads.