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e-joist for use as Rafters in Residential Construction

e-joist
engineered timber joists

CONTENTS

01 OVERVIEW

e-joist is the premier I-joist product available in Australia. e-joist has many advantages over traditional building products, including its uniformity of engineering properties, its high strength to weight ratio and its availability in longer lengths of up to 12.6m.

e-joist is available in a range of depths and flange widths as presented below:-

Flange Width	e-joist Depth (mm)			
	200	240	300	360
45	ej20045	ej24045	ej30045	-
63	-	ej24063	ej30063	ej36063
90	-	ej24090	ej30090	ej36090

Note: Availability of e-joist sizes and lengths varies by state. Check with your local Wesbeam office or approved Wesbeam distributor for available stock sizes.

About e-joist

e-joist utilises a Laminated Veneer Lumber (LVL) flange and a structural web. Flanges are manufactured by laminating timber veneers using phenolic adhesive in a continuous assembly in which the grain direction of all veneers runs longitudinally.

e-joist is manufactured from sustainably sourced timbers, making it an environmentally sustainable resource.

Safety Data Sheets (SDS)

SDS information on the LVL flange and web materials is available at **www.wesbeam.com**

Use of e-joist Data

The tables and other technical data provided in this publication are only applicable to e-joist manufactured by Wesbeam. This data should not be used for look-alike or substitute products. Use of the e-joist data for look-alike or substitute products can result in unsafe or unsatisfactory performance.

02 DESIGN CRITERIA

Terminology, Definitions and Notations

The terminology, definitions and notations used in this publication are similar to and consistent with those used and listed in *AS1684.2 - Residential timber framed construction, Part 2:Non-cyclonic areas.*

Continuous span table values apply to rafters that are continuous over three or more supports; if adjacent spans are unequal, the major span is not greater than twice the adjacent minor span.

Consider as continuous span if Span 1 (major) is not greater than 2 times Span 2. If it is, use the recommended e-joist Rafter Spans for Single Span. Refer to D1.

Diagram D1 – Continuous spans

Structural Design Methodology

The Span Tables in this publication have been developed in accordance with the structural models and action categories/load combinations outlined in *AS 1720.3 – Timber structures, Part 3: Design criteria for timber-framed residential buildings* except where noted below.

These tables are designed to be used for residential housing only. For use in other applications, including school buildings, offices, and a range of commercial applications, please refer to Wesbeam technical staff.

Design Loads and Deflection Criteria

Design loads used in these Span Tables represent common loads for residential roof structures. The designer can choose a weight that allows for roofing material (sheet metal or tiled roofs), ceiling material and any additional loads that may be present due to PV panels, insulation etc.

AS 1720.3 specifies a long-term deflection limit for rafters of Span/300 or 20mm. Given many rafters are directly supporting ceiling lining, Wesbeam adopts a more stringent long-term deflection criteria that algins with the deflection criteria of floor joists supporting ceiling lining; that is Span/300 or 15mm. Software with e-joists may be used to determine sizes and deflections outside the span table.

The list of engineering design criteria and limitations used in the development of these Tables are as follows:

- Long Term Deflection Limit = Span / 300 or 15mm (whichever is lesser)
- Short Term Deflection Limit = Span / 250 or 20mm (whichever is lesser)
- Min 45mm end bearing (unless noted otherwise)
- Min 45mm intermediate bearing

Limitations of use

- Roof pitch shall be less than 30 degrees
- Wind category to be maximum **N3** in accordance with AS 4055 – Wind loads for housing
- Enclosed and protected from weather
- Installation is in accordance with this installation guide and building practices as shown in AS1684.2.

Restraint to Top and Bottom Flanges

e-joist rafters shall be laterally restrained along their top and bottom flanges. Restraint should be provided by ceiling/roof battens, direct fixing of roof sheeting/ceiling lining, or other forms of restraint including underbattens or graded battens.

Where suspended ceiling are used, restraint to the bottom flange shall be provided via one of the methods above with spacings not exceeding that listed in this section

Where rafter are designed on flat, graded battens over are required to achieve the desired roof pitch. Graded battens shall provide appropriate restraint to the top flange.

The following restraint conditions have been used for the development of the Span Tables and required where values from the span tables are used directly:

- Restraint to top flange = max 1200mm spacing (20-40kg/m^2 roof weight; i.e. sheet roof)
- Restraint to top flange = max 330mm spacing (60-70kg/m^2 roof weight; i.e. tiled roof)
- Restraint to bottom flange = max 600mm spacing
- Penetrations through e-joist rafter webs are to be in accordance with Wesbeam e-joist Holes guide (wesbeam.com)
- Refer to e-joist installation guide (wesbeam.com) for on-site storage requirements and temporary bracing requirements during installation.

03 SPAN TABLES

TABLE 1: E-JOIST RAFTER MAXIMUM SPAN - SINGLE & CONTINUOUS SPAN (M)

e-joist Size	Roof Weight (kg/m²)	Single Span				Continuous Span			
		Rafter Spacing (mm)				Rafter Spacing (mm)			
		450	600	900	1200	450	600	900	1200
ej20045	20	5.9	5.6	5.1	4.8	6.7	6.7	6.4	5.5
	30	5.4	5.1	4.7	4.3	6.7	6.4	5.8	5.4
	40	5.1	4.8	4.3	3.9	6.4	6.0	5.4	5.1
	60	4.7	4.3	NR(1)	NR(1)	5.8	5.4	NR(1)	NR(1)
	70	4.5	4.1	NR(1)	NR(1)	5.6	5.2	NR(1)	NR(1)
ej24045	20	6.5	6.2	5.5	4.8	7.7	7.7	7.1	6.1
	30	6.0	5.6	5.1	4.6	7.5	7.1	6.5	6.0
	40	5.6	5.3	4.8	4.4	7.1	6.6	6.0	5.6
	60	5.1	4.8	NR(1)	NR(1)	6.5	6.0	NR(1)	NR(1)
	70	5.0	4.6	NR(1)	NR(1)	6.2	5.8	NR(1)	NR(1)
ej24063	20	7.1	6.7	6.2	5.8	8.2	8.2	7.7	7.3
	30	6.5	6.2	5.6	5.3	8.2	7.7	7.1	6.6
	40	6.2	5.8	5.3	4.9	7.7	7.3	6.6	6.2
	60	5.6	5.3	NR(1)	NR(1)	7.1	6.6	NR(1)	NR(1)
	70	5.5	5.1	NR(1)	NR(1)	6.8	6.4	NR(1)	NR(1)
ej24090	20	7.5	7.2	6.6	6.2	8.2	8.2	8.2	7.8
	30	7.0	6.6	6.1	5.7	8.2	8.2	7.6	7.1
	40	6.6	6.2	5.7	5.3	8.2	7.8	7.1	6.7
	60	6.1	5.7	NR(1)	NR(1)	7.6	7.1	NR(1)	NR(1)
	70	5.9	5.5	NR(1)	NR(1)	7.4	6.9	NR(1)	NR(1)
ej30045	20	7.3	6.6	5.5	4.7	8.2	8.2	8.0	7.1
	30	6.7	6.3	5.2	4.5	8.2	8.0	7.3	6.8
	40	6.3	5.9	5.0	4.3	8.0	7.5	6.8	6.4
	60	5.8	5.4	NR(1)	NR(1)	7.3	6.8	NR(1)	NR(1)
	70	5.6	5.2	NR(1)	NR(1)	7.1	6.6	NR(1)	NR(1)
ej30063	20	7.9	7.5	6.9	6.5	8.2	8.2	8.2	8.2
	30	7.4	6.9	6.4	6.0	8.2	8.2	8.0	7.5
	40	6.9	6.5	6.0	5.6	8.2	8.2	7.5	7.0
	60	6.4	6.0	NR(1)	NR(1)	8.0	7.5	NR(1)	NR(1)
	70	6.1	5.7	NR(1)	NR(1)	7.7	7.2	NR(1)	NR(1)
ej30090	20	8.5	8.1	7.5	7.1	8.2	8.2	8.2	8.2
	30	7.9	7.5	6.9	6.5	8.2	8.2	8.2	8.1
	40	7.5	7.1	6.5	6.0	8.2	8.2	8.1	7.6
	60	6.9	6.5	NR(1)	NR(1)	8.2	8.1	NR(1)	NR(1)
	70	6.7	6.2	NR(1)	NR(1)	8.2	7.8	NR(1)	NR(1)
ej36063	20	8.7	8.2	7.6	6.9	8.2	8.2	8.2	8.2
	30	8.0	7.6	7.0	6.5	8.2	8.2	8.2	8.2
	40	7.6	7.1	6.5	6.1	8.2	8.2	8.2	7.7
	60	7.0	6.5	NR(1)	NR(1)	8.2	8.2	NR(1)	NR(1)
	70	6.7	6.3	NR(1)	NR(1)	8.2	8.0	NR(1)	NR(1)
ej36090	20	9.3	8.9	8.2	7.8	8.2	8.2	8.2	8.2
	30	8.7	8.2	7.6	7.1	8.2	8.2	8.2	8.2
	40	8.2	7.8	7.1	6.5	8.2	8.2	8.2	8.2
	60	7.6	7.1	NR(1)	NR(1)	8.2	8.2	NR(1)	NR(1)
	70	7.3	6.8	NR(1)	NR(1)	8.2	8.2	NR(1)	NR(1)

(1) NR (not recommended)
For continuous, max span is listed as 8.2m due to max product length of 12.6m.

04 E-JOIST RAFTER INSTALLATION DIAGRAMS

BEARING AT SUPPORTS

i. Bevelled Ribbon Plate

The ribbon plate shall be the full width of the top plate and a minimum of 45mm thick. The ribbon plate shall be bevelled to suit the desired roof pitch; either on site or through the wall frame manufacturing process.

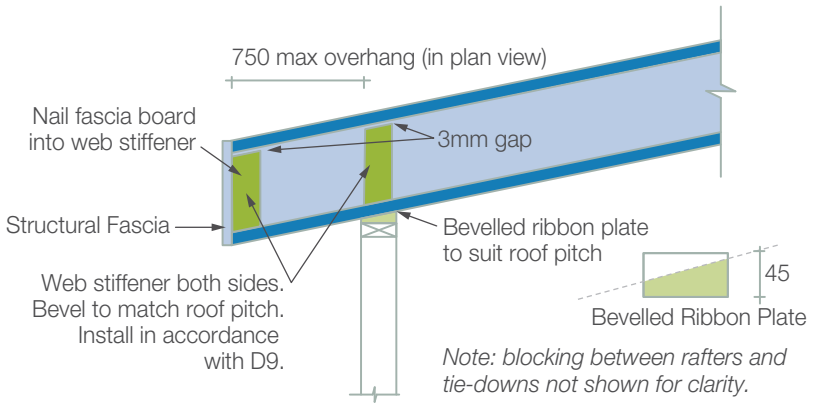

Diagram D2 - Bevelled Ribbon Plate

ii. Birdsmouth Cuts for Seated Rafters

Where e-joist rafters are to be seated on the external walls, birdsmouth cuts shall be in accordance with Diagram D3.

Care must be taken to ensure flanges are not over-cut, and that the flange fully bears onto the top plate. Web stiffeners are to be as per Web Stiffener specifications and shall be bevel-cut at the top of the e-joist rafter to match the roof pitch.

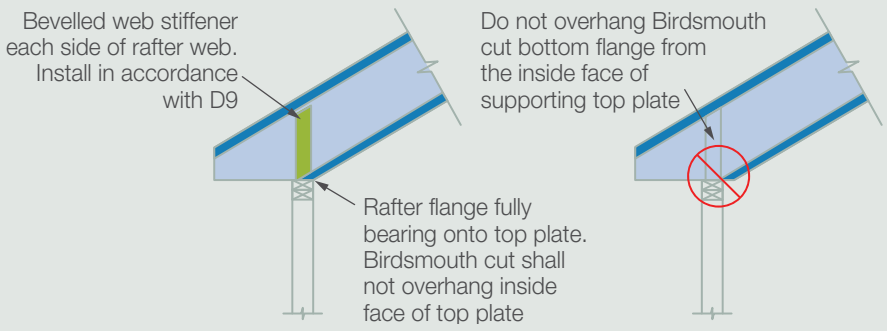

Diagram D3 - Detail for Birdsmouth Seating of e-joist Rafters

iii. Flush Cut Rafters

e-joist rafters may be “Flush cut” in-line with external walls when using the web stiffeners and nailing as specified in Diagram D9. The bevel-cut bottom flange of the e-joist shall bear over the complete top plate (must not extend beyond top plate) as illustrated in Diagram D3.

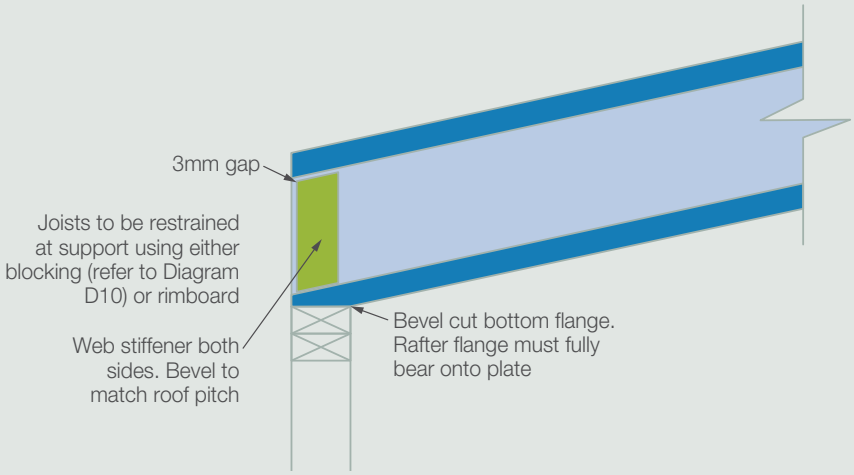

Diagram D4 - Flush Cut Rafters

iv. Rafter Overhangs

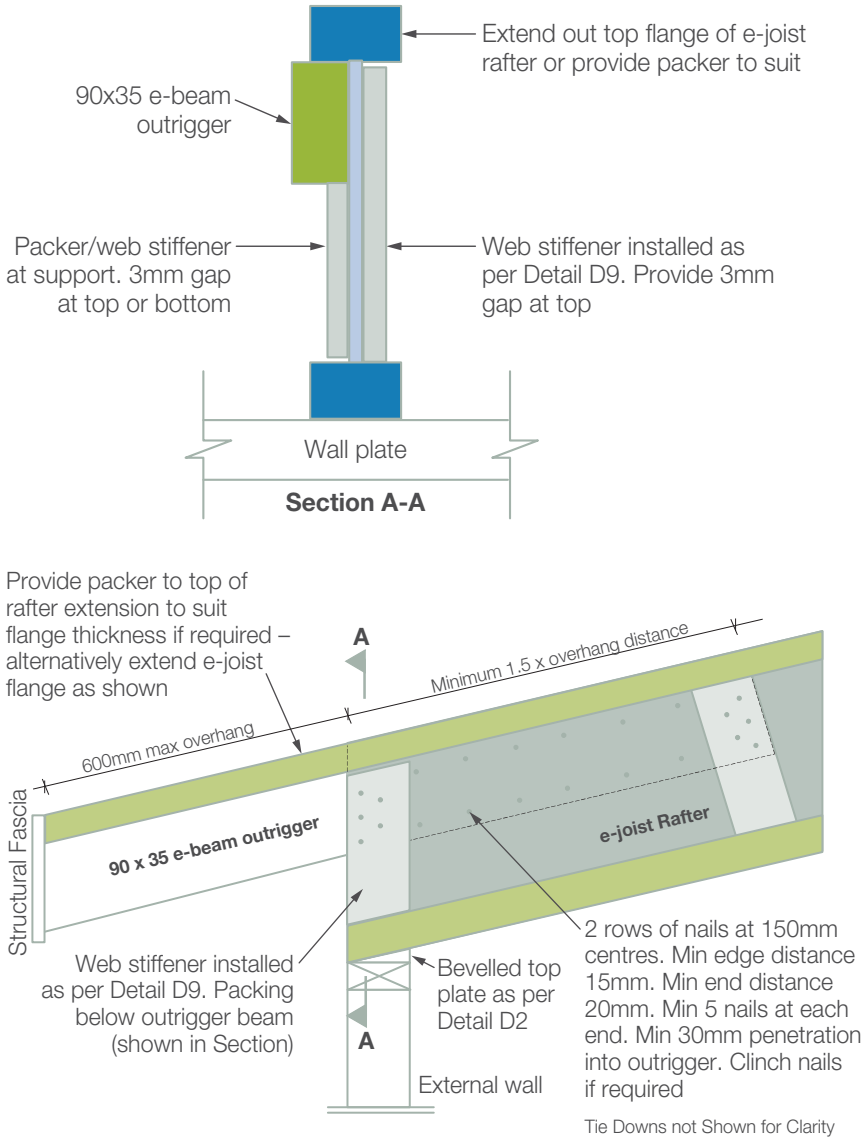

Diagram D5 - Rafter Overhangs

TIEDOWN AT SUPPORTS

An e-joist rafter roof system shall be tied down in accordance with AS1684.2 Section 9. Tiedown must be provided as a continuous load path to the foundations of the building.

i. Skew Nailed at Supports

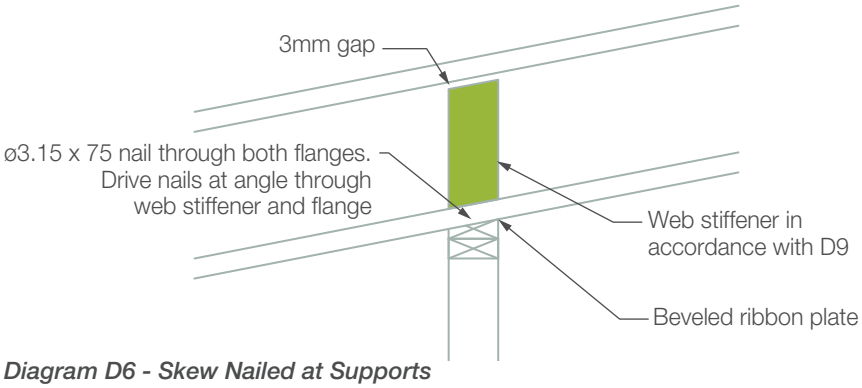

Diagram D6 - Skew Nailed at Supports

ii. Framing Anchor

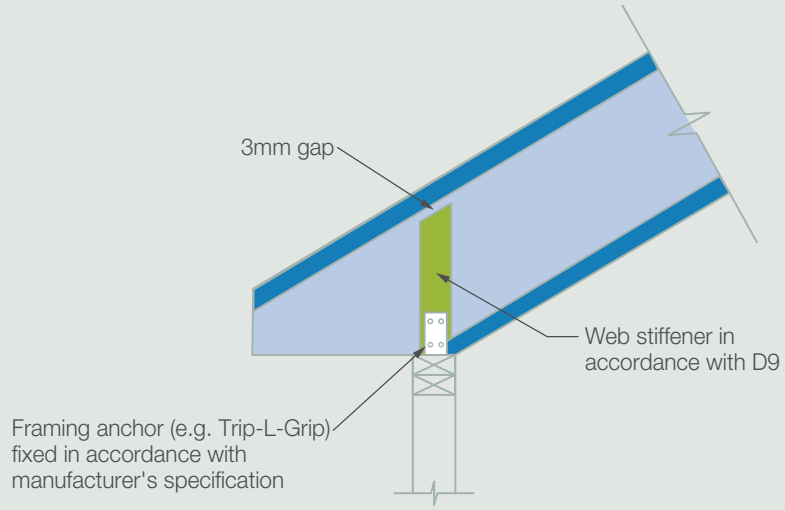

Diagram D7 - Framing Anchor

iii. Strap Brace Over

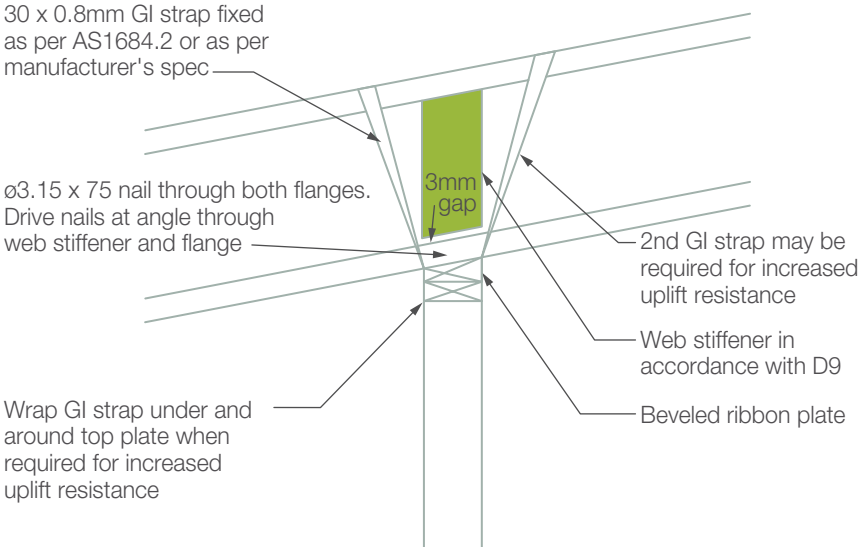

Diagram D8 - Strap Brace Over

WEB STIFFENERS AND BLOCKING AT SUPPORTS

i. Web Stiffeners

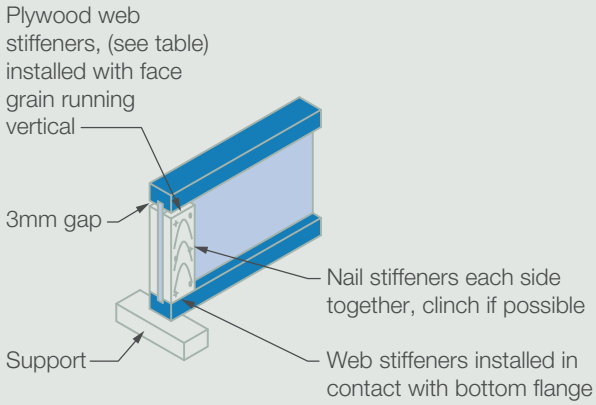

Diagram D9 - Web Stiffener Installation

e-joist Flange Width	Stiffener	Nail Length
45mm	17 x 60mm ply	65mm
63mm	27 x 60mm ply	65mm
90mm	2/19 x 60mm ply 39 x 60mm solid timber	90mm
e-joist Depth	**Stiffener Nailing Requirements**	
200 240	3 x ø3.15 nails each side clinched where possible	
300 360	4 x ø3.15 nails each side clinched where possible	

ii. Rafter Blocking

Where e-joist rafters bear onto walls or beams, intermediate blocking is required for lateral restraint. Blocking is required every 1800mm or every three rafters (whichever is smaller) as well as at each end of the rafter set.

Blocking can be provided by using sawn timber, e-beam or e-joist and shall provide restraint to the top and bottom flanges. The bottom edge of the blocking is to be skew nailed to the beam/top plate as illustrated.

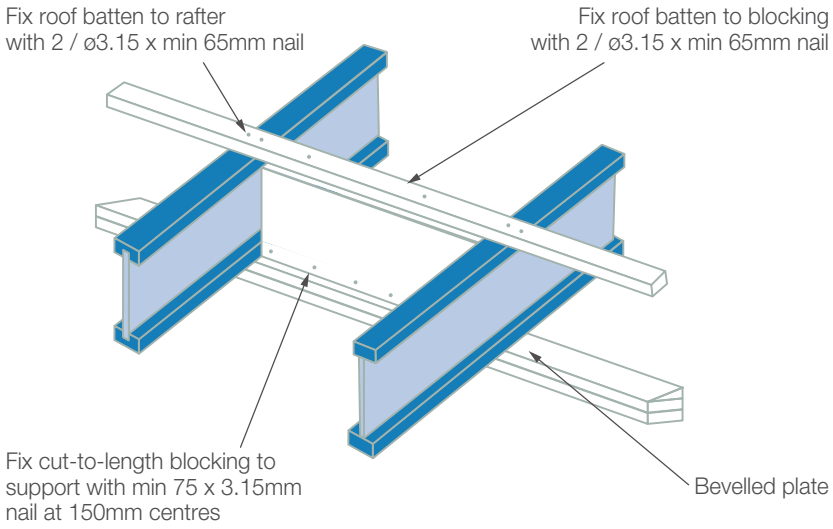

Diagram D10 - e-joist Rafter Blocking

RIDGE CONNECTIONS

i. Rafter to Ridge Beam – Maximum 3 Degree Roof Pitch

For rafters in pitched roofs, the ridge beam (e.g. e-beam LVL) must be designed to transfer the loads of the rafters back down to the supporting structure.

For rafters with a roof pitch no more than 3 degrees, e-joist rafters can be fixed into the side of the ridge beam using a standard face-mounted hanging bracket. Face-mounted hanging brackets do not provide tie-down against uplift forces, so a tie-down connection must be provided over the top flange and fixed to the ridge beam (steel strap or similar as per consulting engineer's specifications) or AS1684.2 requirements.

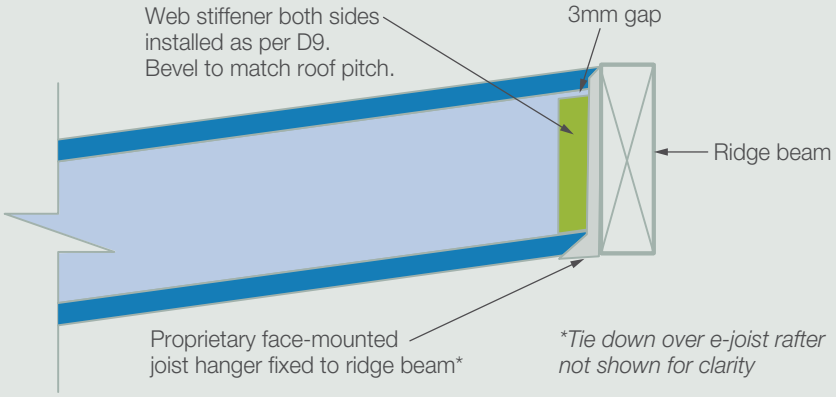

Diagram D11 - Rafter to Ridge Beam

ii. Rafter to Ridge Beam – Greater than 3 Degree Roof Pitch

Rafters on a slope greater than 3 degrees may not be fixed with a standard face-mounted joist hanger. A bevelled pole-plate fixed into the side of the ridge beam may be designed to support the e-joist rafters. This will allow the rafters to bear onto the pole plate and be flush cut in accordance with the details shown in Diagram D12.

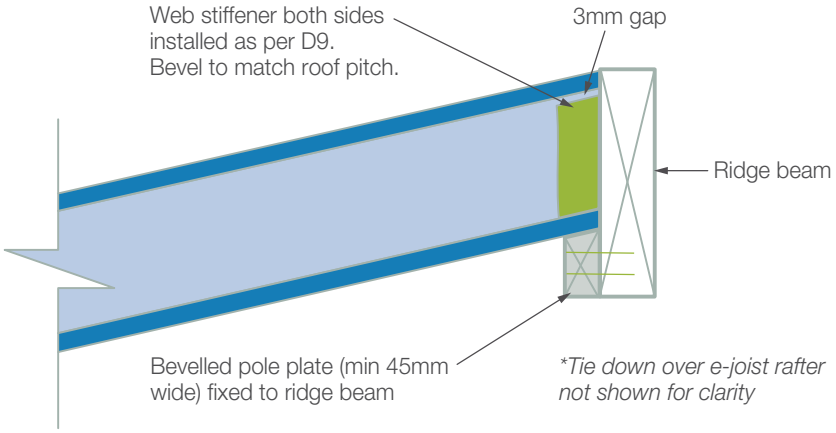

Diagram D12 - Rafter to Ridge Beam

Alternatively there are proprietary 'variable slope' joist hangers are also available to suit a range of different e-joist sizes when connecting sloping rafters into the ridge beam. Any proprietary bracket must be installed in strict accordance with the manufacturer's specifications.

BOX GUTTER INSTALLATION

Notches for box gutters at the ends of e-joist rafters are permitted provided the end of the e-joist is reinforced as per Diagram D13.

The notch can be up to 300mm in length. The maximum depth of the notch is:

- 50mm for the 200mm and 240mm deep e-joist range
- 100mm for the 300mm and 360mm deep e-joist range

The reinforcement at the notched location is to consist of the following:

- 600mm long ply stiffeners (see table below for ply stiffener thickness) each side of web. Ply stiffener to match notch size of e-joist rafter.
- Fasten the ply stiffeners to web with ∅3.75 x 100 nails (number of rows as shown below)
- Nails to be spaced at 100mm and installed from alternate grid centres
- Nails to be installed from alternate sides of the web
- Nails to be clinched

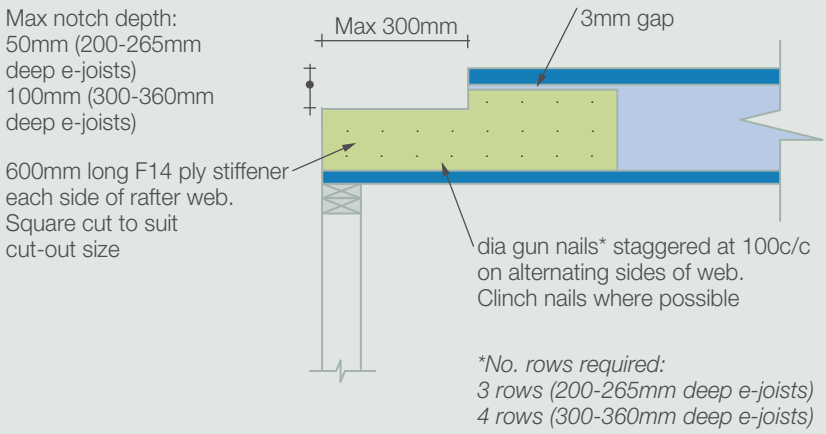

Diagram D13 - Box Gutter Installation

e-joist Flange Width	Ply Stiffener
45mm	17mm
63mm	27mm
90mm	2/19mm 39mm

NOTES

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