Tilling Timber Pty Ltd

Head office	Sydney	Brisbane	Perth	Adelaide
31-45 Orchard Street Kilsyth Vic 3137	109 Kurrajong Avenue Mt. Druitt NSW 2770	84 Magnesium Drive Crestmead QLD 4132	10 Cartwright Drive Forrestdale WA 6112	5-9 Woomera Avenue Edinburgh SA 5111
03 9725 0222 sales@tilling.com.au	02 9677 2600 nswsales@tilling.com.au	07 3440 5400 qldsales@tilling.com.au	08 9399 1609 wasales@tilling.com.au	08 8345 1966 sasales@tilling.com.au

SmartFrame Design Centre

1300 668 690

techsupport@tilling.com.au

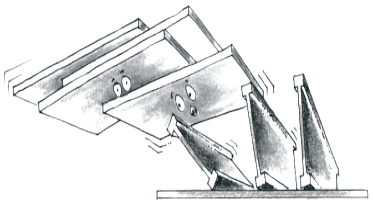
SmartJoist Installation Guide

General

Jobsite handling and storage, erection procedure and erection bracing are the responsibility of the installer.

Careful review of this installation guide, project plans and joist layout drawings (where supplied) should be undertaken prior to the installation of the joists.

The manufacturers warranty applies only to properly installed undamaged joists, adequately protected from the weather in the completed project.



DO NOT ALLOW WORKERS OR LOADS ON SMARTJOISTS UNTIL ALL BLOCKING, HANGERS, RIM JOISTS, NAILING AND TEMPORARY BRACING ARE INSTALLED AS SPECIFIED.

ACCIDENTS CAN BE AVOIDED UNDER NORMAL CONDITIONS BY FOLLOWING THESE GUIDELINES:

1. Brace each joist as it is erected. Joists must be nailed to supports and all hangers, blocking, rim joists. X - bridging at supports must be completely installed and properly nailed. (see general notes - page 5)

2. Brace the ends of cantilevers (overhangs) with closure panels, rim joist or x - bridging (see general notes - page 5)

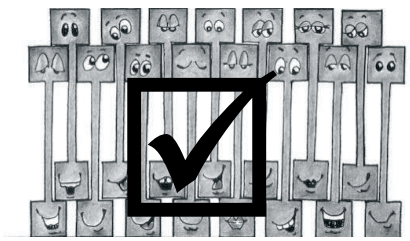
3. Lateral brace the top flange of each joist, to prevent sideways buckling or rollover which may occur under light construction loads, such as a worker and/or a layer of unnailed sheathing. Fully installed permanent sheathing or temporary struts to the top flange of each joist (see 'typical SmartJoist floor framing - page 6) can accomplish lateral bracing.

4. Temporary struts must be nailed to a lateral restraint at the end of bay such as a braced wall or temporary (or permanent) sheathing nailed to the first 1200 mm of the joist at the end of the bay (see typical floor framing - page 6)

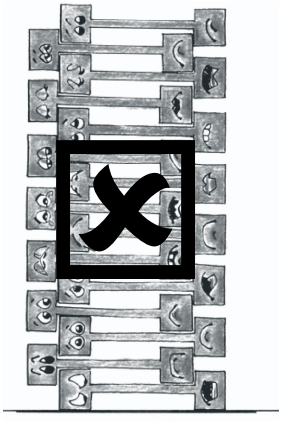
5. Permanent sheathing must be completely installed and properly nailed before additional loads can be placed on the system.

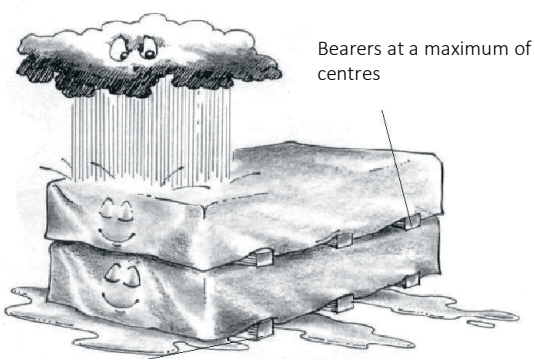
6. The integrity and safe use of these products can be seriously impaired if they are damaged. Do not install any damaged products. Contact your Tilling representative or the Tech Support Customer Helpline on 1300 668 690 if any product damage is noted.

Handling and storage of SmartJoists



SmartJoists should be stacked in the upright position to avoid any damage during handling or storage.





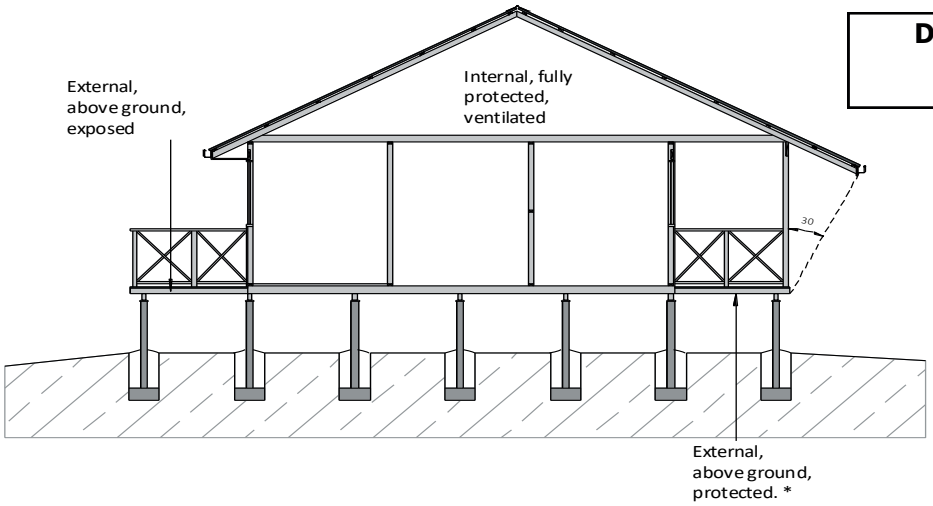
Bearers at a maximum of 4.0 metre centres

Use bearers to keep stacked material away from damp surfaces. align bearers vertically

Durability and exposure to moisture
- Untreated SmartFrame EWP

SmartLVL and SmartJoists are manufactured from softwoods and hardwoods having a durability rating of class 4, which is the same rating as some Ash type Eucalypts. Untreated SmartJoists and SmartLVL should not be used where the equilibrium moisture content is likely to remain above 20% for an extended period.

Untreated SmartLVL is suitable in the ***internal, fully protected, ventilated*** and the ***external above ground, protected*** zones of the structure as shown on the next page. Untreated SmartLVL is not suitable for ***external above ground, exposed*** or humid indoor conditions, such as swimming pool enclosures.

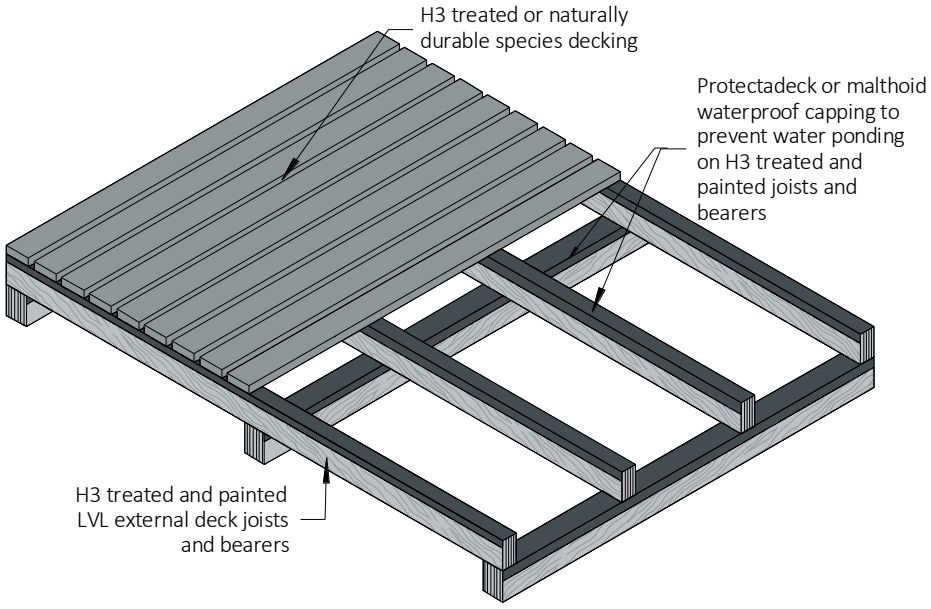


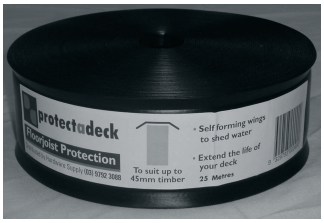
Definitions of exposure zones within a structure

* External timbers are regarded as protected in AS 1684 if they are covered by a roof projection (or similar) at 30° to the vertical and they are well detailed and maintained (painted and kept well ventilated).

H3 Deck bearers and joists

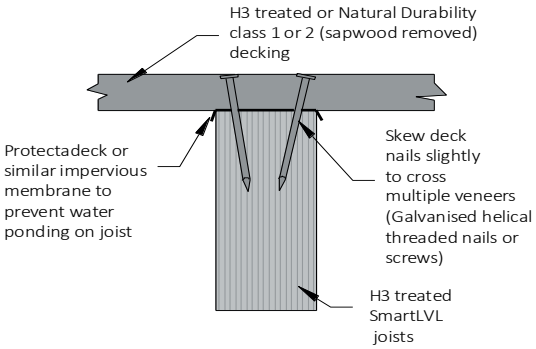
H3 Treated Deck joists and bearers are a common application for treated SmartLVL 15. The diagram demonstrates the minimum construction detailing for H3 treated joists and bearers. Failure to follow these guidelines may render treatment warranties void.





Recommended proprietary top protection for joists and bearers

It is a requirement that any cuts, notches or penetrations made in LOSP treated LVL be painted with a suitable "brush/spray on" preservative such as "Enseal". (Enseal is available as part of any SmartFrame H3 LOSP order)



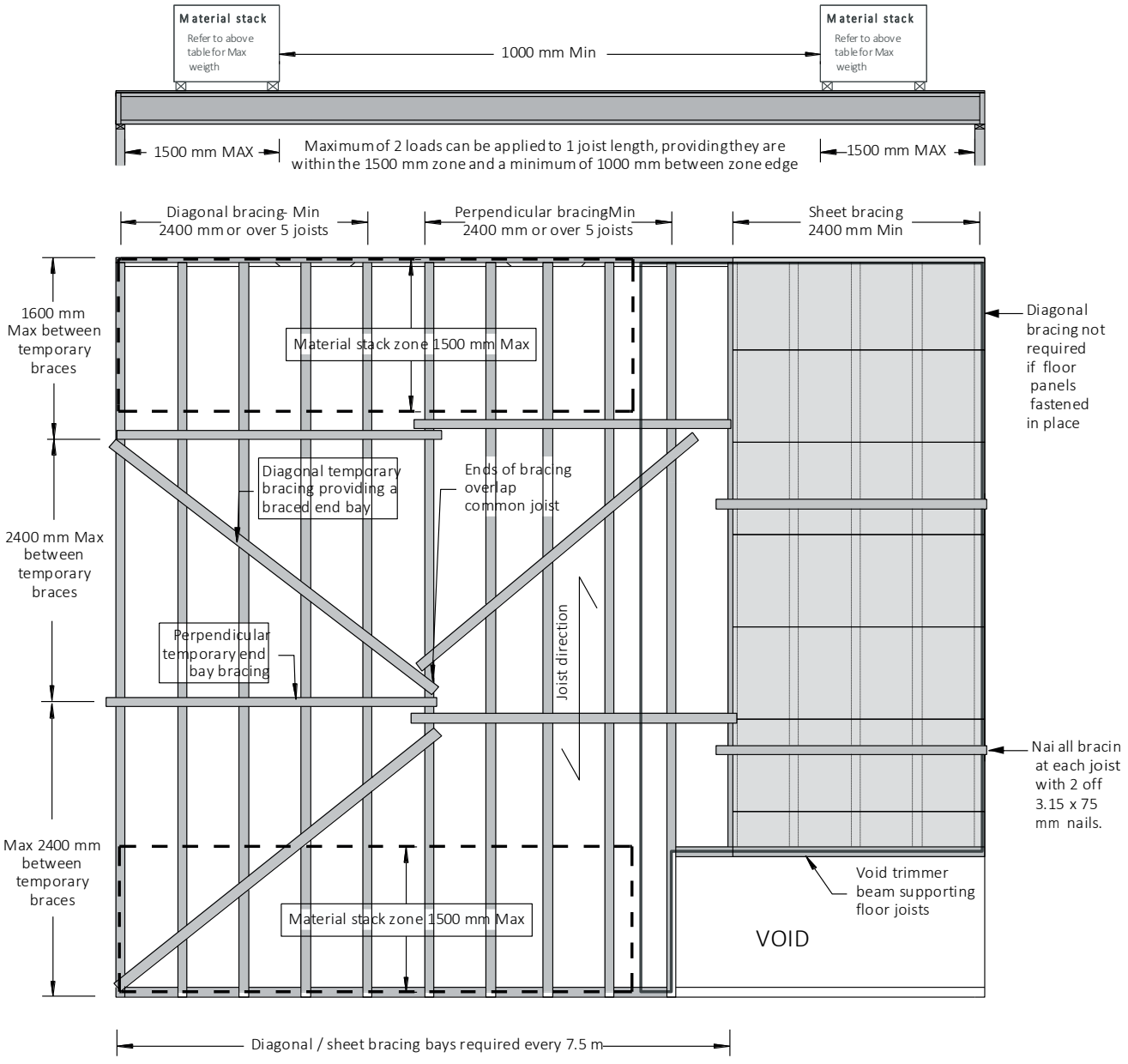
Recommended Fastening to SmartLVL Deck Joists.

* Painting as per "Painting of SmartGuard LOSP Treated SmartLVL 15" in the SmartLVL 15 Design Guide

Safe loading of materials on a SmartJoist working platform

IMPORTANT!! Joists must be fully braced or have floor sheeting installed before applying any of the following loads.

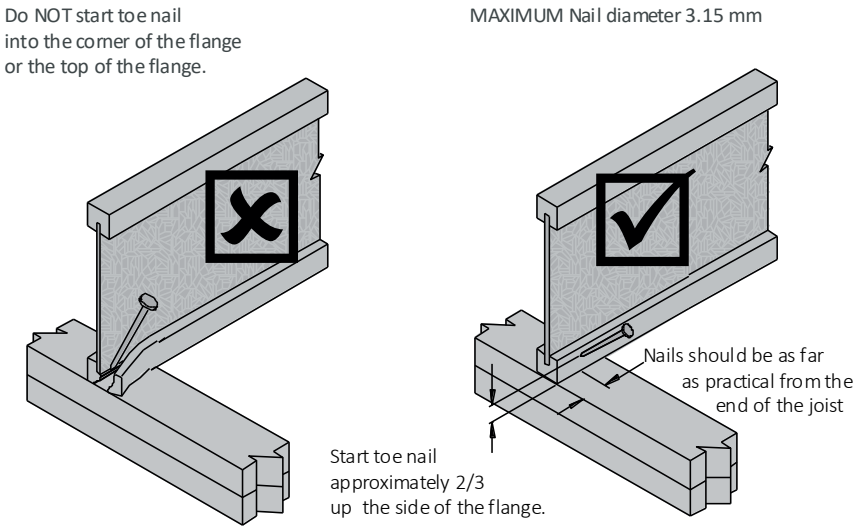
SmartJoist Code	Joist spacing up to 600 mm Max weight (kg) per joist	SmartJoist Code	Joist spacing up to 600 mm Max weight (kg) per joist
SJ20044	200	SJ30051	275
SJ24040	230	SJ30070	300
SJ24051	240	SJ30090	315
SJ24070	265	SJ36045	285
SJ24090	290	SJ36058	310
SJ25551	255	SJ36090	350
SJ25570	275	SJ40058	325
SJ30040	265	SJ40090	380



Notes:

1. Ensure studs are structurally adequate to support temporary loads
2. NO loads are to be stacked over any part of the lengths of the joists fixed to an opening header or trimmer joist such as a stair trimmer
3. All timber must be kept dry when applying maximum temporary loading
4. Loads are to be spread equally over a minimum of 2 joists, using timber bearers at a minimum of 1200 mm in length or a standard 1200 x 1200 pallet
5. If no plasterboard is in place under the joists, the bottom flange requires temporary bracing
6. Joists on hangers may require propping
7. At joist supports, blocking or rim board is to be nailed to the wall plate and joists
8. Bracing lines to be 90 x 35 MGP10 or similar
9. Perpendicular bracing to run full width of floor. Long lengths (2400 mm min.) are recommended with the ends overlapped at a common joist
10. The long dimension of the load shall be placed perpendicular to the framing and not parallel to SmartJoists
11. If unsure about stacking concentrated loads on SmartJoist working platforms, please contact the tech support helpline on 1300 668 690

SmartJoists - General notes



1. Except where otherwise noted, 30 mm minimum bearing is required at joist ends and 42 mm minimum bearing is required at intermediate supports.

2. Nail joists at each bearing with 2 of 3.15 Φ x 65 nails, using one each side placed 30 mm from the end to avoid splitting.

3. SmartJoist blocking or Rimboard - face nail to bearing plate with 3.15 Φ x 65 nails at 150 mm centres. Nail rim joist to the end of the top and bottom flange of each SmartJoist with 1 3.15 Φ x 65 nail, use 1 3.75 Φ x 75 nail top and bottom with joists with 58 or 90 mm wide flanges.

4. SmartRim - toe nail to bearing plate with 3.15 Φ x 65 nails at 150 centres or 4.5 Φ x 75 nails at 300 centres. Nail rim to the end of the top and bottom flanges of each SmartJoist with 1 3.15 Φ x 65 nails.

5. Sheathing nailing to top flange (Joists must be fully braced before sheathing is nailed)
   - Space 2.8 Φ x 65 and 3.15 Φ x 65 nails no closer than 50 mm per row.
   - Space 3.75 x 75 nails no closer than 75 mm.

   Maximum nail spacing: 300 mm

6. Backer blocks at hanger details:
   40 mm flanges - 15 mm ply
   44 & 51 mm flange - 19 mm ply
   58 mm flange - 2 pieces of 12 mm ply
   70 mm flange - 2 pieces of 15 mm ply
   90 mm flange - 2 pieces of 19 mm ply

7. See double SmartJoist detail F15 for filler blocks. Nail Joists together with two rows of 3.75 Φ x 75 nails on each side of double joist at 300 mm centres (Clinch if possible). A total of 4 nails per 300 mm is required. If nails can be clinched, only 2 nails per 300 mm is required.

8. All joists require lateral support at end bearings using blocking or rim material.

9. The top flanges must be kept straight within 10 mm of the true alignment.

10. See web stiffener detail F13 for web stiffener attachment at supports. Web stiffener requirements for concentrated loads in excess of 4.5 kN, applied at the top flange of the joist, requires additional consideration.

11. When required, install web stiffeners to joist (see detail F13) prior to placing joist in the hanger, then nail hanger to joist.

12. All roof details are valid to a maximum angle of 35° (as per AS1684 - 1999).

13. All nails are steel nails complying with AS 2334 - 1980 Steel nails - Metric series. Nail gun nails of similar length and diameter may be substituted for the above provided that they are manufactured with properties equivalent to the nails in the above code.

14. Install all hangers to the manufacturers installation instructions, taking particular attention to the use of the correct nails. Never use clouts or brads.

15. Prescriptive code requirements for mid span blocking of solid timber joists are not applicable to SmartJoists.

End blocking and SmartJoist

The end blocking of I-Joists performs three (3) essential functions, as well as being an invaluable component of the bracing of the structure as a whole unit. These functions include:

(1) Keeps joists upright and prevents rollover during construction

(2) Provides end reaction capacity to the I-Joists and

(3) Provides extra torsional resistance to the I-Joist to improve floor performance.

(A full description of the end blocking effects is contained in the SmartJoist Design Guide).

Two (2) end blocking options are provided on the following pages

SmartJoist blocking options

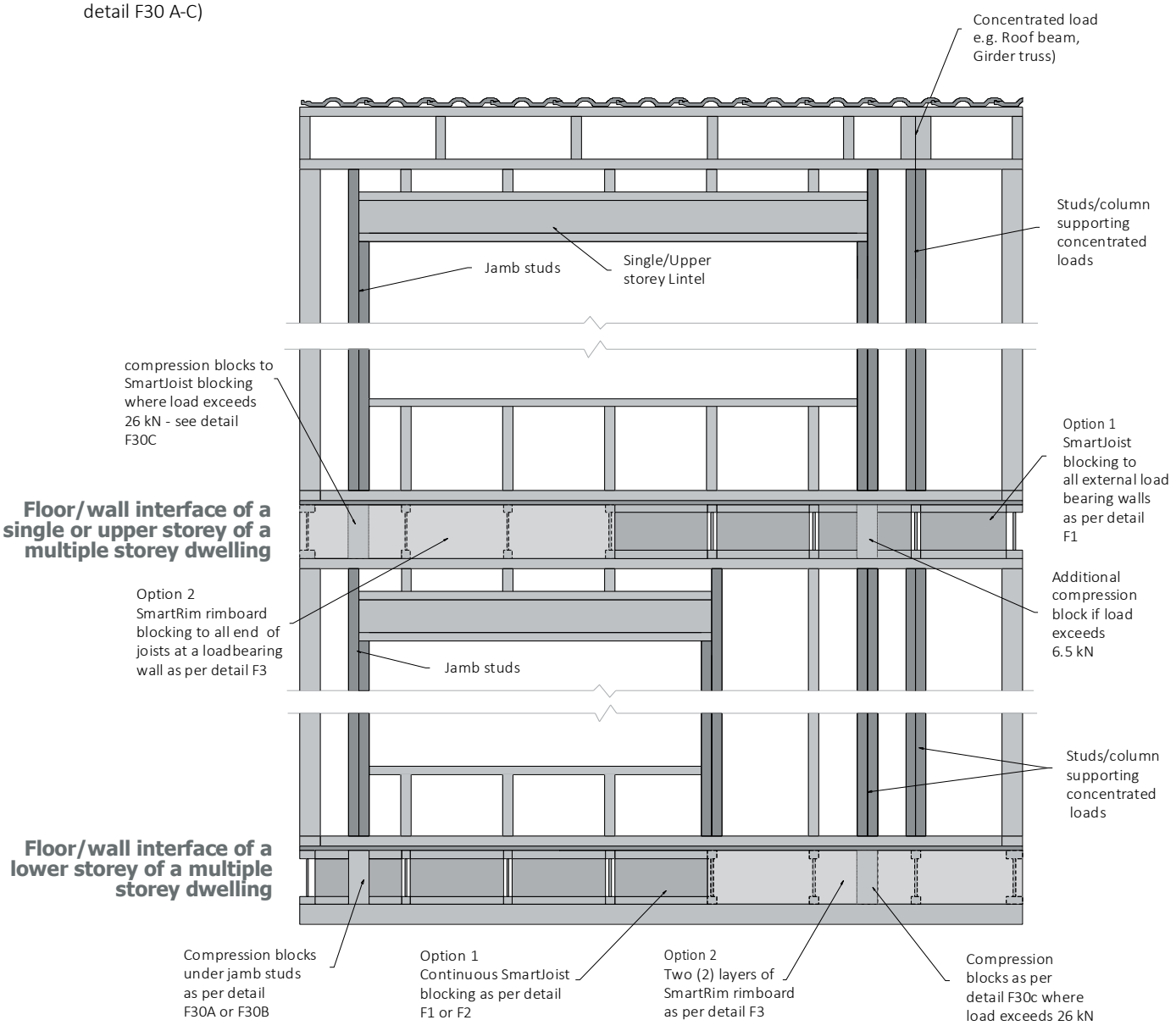
1. Simplified solution

The simplified solution for the end blocking of SmartJoists is to use SmartJoist blocking or SmartRim rimboard at the end of **ALL** joists that bear onto external loadbearing walls as per details F1-F3 and nailed as per "General Details" on page 7 of this Design Guide.

This method provides:

1. Transfer of vertical gravity loads through the floor plane (Except under heavily loaded columns and jamb studs see detail F30 A-C)
2. Provides adequate resistance to racking loads from wind
3. Prevents unsightly deflections of the edge of floor sheeting at the wall interface

Experience shows that a floor plane properly engineered to provide sufficient racking resistance and support for gravity loads, whether concentrated or uniformly distributed, requires a significant amount of blocking/rimboard, so to simply block the ends of all joists on exterior loadbearing walls is the simplest solution.

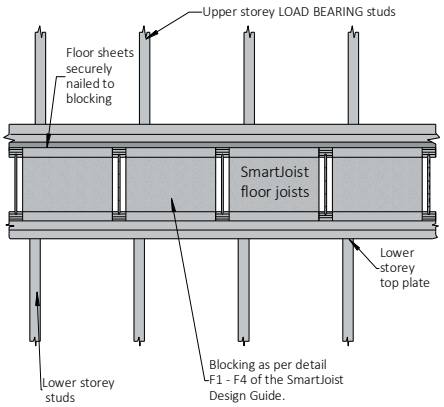


Fully blocked exterior walls

Wall plates in the frame are required to transfer vertical loads into the support structure below. These wall plates may be supported at 450 or 600 mm ctrs, thus acting as a beam between supports, bending about its weaker axis. When concentrated loads act at the centre of this wall plate, the bending and deflection effects can be quite significant.

The full blocking of external and load bearing walls, as shown in details F1-F4, can act as a beam transferring these loads to the support structure below, thus reducing the beam effect of the wall plates.

Unless there is a requirement for double wall plates for a reason OTHER than the beam effect between supports, walls blocked as per detail F1-F4 and general notes #2, #3, and #4 provide sufficient beam action to allow single wall plates



SmartJoist blocking options

2. Engineered Solution

A fully **Engineered Solution** MAY reduce the amount of end blocking of joists at an exterior wall, but requires engineering calculations and judgement to determine the correct number and type of blocking pieces to achieve the requires resistance.

To use this method, designers will need to meet the following criteria via the use of Table 1 on the next page, AND carry out racking/sliding resistance calculations as well .

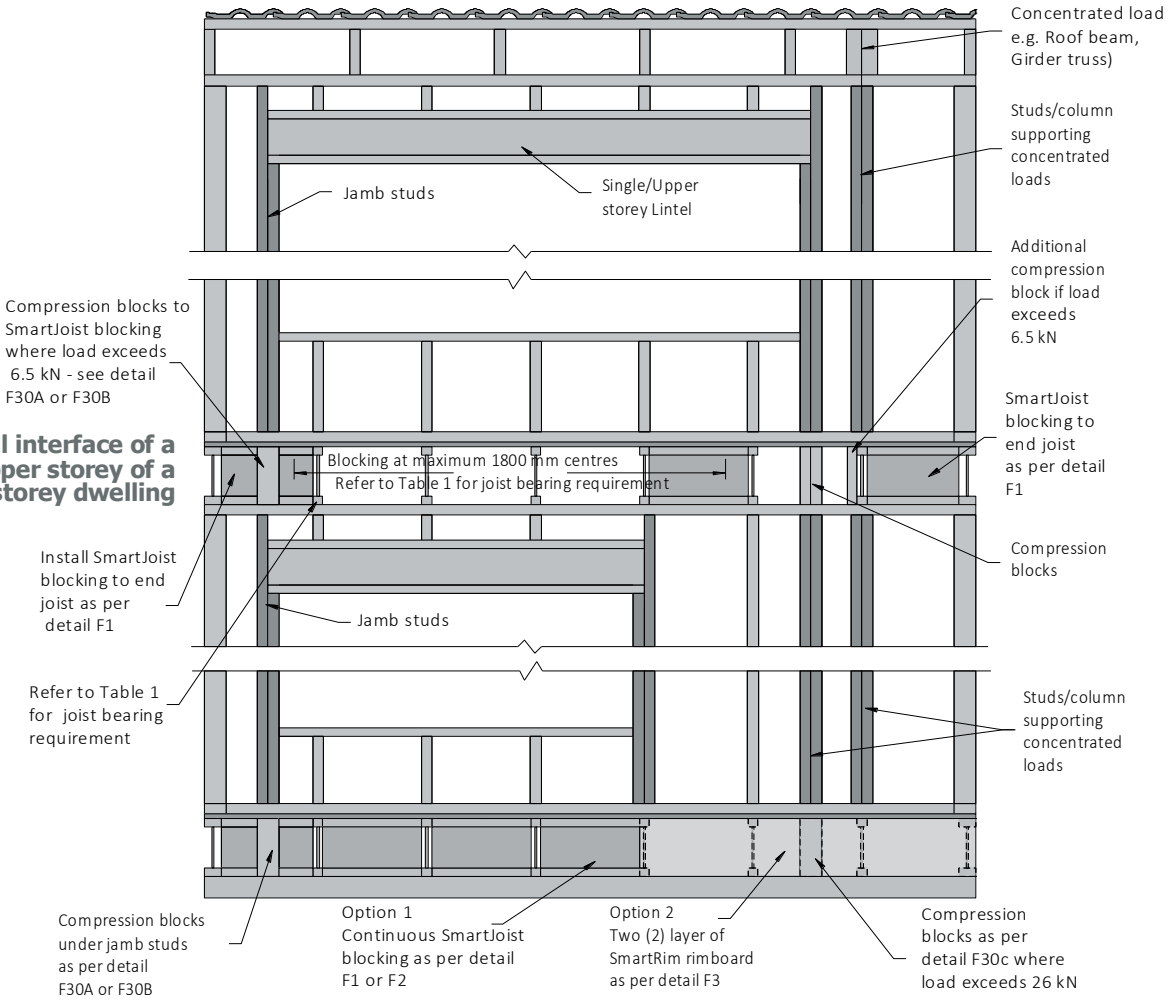
This method does NOT necessarily provide a solution to:

1. The link between fully blocked walls and the use of single wall plates. Unless fully blocked, the designer will need to consider the location of upper studs/in relation to lower studs/columns when considering to use one or multiple wall plates
2. The long term deflection of floor sheeting at walls (gap under the skirting board) when heavy furniture is placed against the wall.

The **Engineered Solution** involves a detailed analysis of the following :

1. The compression loads at both the ends of a SmartJoist at its support location, and in the case of a continuous span, the compression loads at the internal support
2. These loads vary considerably depending upon whether it involves:
    a. Floor loads only
    b. Floor loads plus compression loads from load bearing walls
    c. Floor loads, compression loads from load bearing walls and/or concentrated compression loads form jamb studs/posts
3. Use of the table on the next page to calculate:
    a. Minimum end and interior bearing lengths for the SmartJoists
    b. Associated SmartJoist blocking requirements to meet the design loads
    c. Requirement, where necessary, to add compression blocks.

Floor/wall interface of a single or upper storey of a multiple storey dwelling



SmartJoist blocking options

TABLE 1 – Minimum bearing and blocking at supports for Gravity Loads ONLY

<table>
<tr><td rowspan="3">Loads at supports</td><td colspan="2">End supports</td><td colspan="2">Intermediate supports</td></tr>
<tr><td colspan="2">Joist spacing (mm)</td><td colspan="2">Joist spacing (mm)</td></tr>
<tr><td>≤ 450 mm</td><td>600 mm</td><td>≥ 450 mm</td><td>600 mm</td></tr>
<tr><td rowspan="3">1. Floor loads ONLY</td><td colspan="4">Minimum bearing length (mm)</td></tr>
<tr><td>≥ 30 mm</td><td>≥ 45 mm</td><td>≥ 45 mm</td><td>≥ 65 mm</td></tr>
<tr><td colspan="4">Install intermittent blocking or equivalent</td></tr>
<tr><td rowspan="6">2. Floor loads plus compression load from a single storey load bearing wall supporting roof only</td><td colspan="4">Minimum bearing length (mm)</td></tr>
<tr><td colspan="2">Sheet Roof (up to 40 kg/m^2)</td><td rowspan="4">≥ 45 mm</td><td rowspan="4">≥ 65 mm</td></tr>
<tr><td>≥ 45 mm*</td><td>≥ 65 mm*</td></tr>
<tr><td colspan="2">Tile roof (up to 90 kg/m^2)</td></tr>
<tr><td>≥ 65 mm*</td><td>≥ 90 mm*</td></tr>
<tr><td colspan="2">*Install intermittent blocking or equivalent</td><td colspan="2">Install continuous SmartJoist blocking</td></tr>
<tr><td rowspan="3">3. Floor loads plus compression load from a two storey load bearing wall supporting roof and upper floor</td><td colspan="4">Minimum bearing length (mm)</td></tr>
<tr><td>≥ 65 mm</td><td>≥ 65 mm</td><td>≥ 65 mm</td><td>≥ 65 mm</td></tr>
<tr><td colspan="2">Install continuous SmartJoist blocking or two (2) layers of Rimboard</td><td colspan="2">Install continuous SmartJoist blocking</td></tr>
<tr><td>4. Concentrated loads from jamb studs or posts</td><td colspan="4">In addition to the above, install compression blocks as per Detail F8</td></tr>
</table>

* Or provide bearing as for joists supporting floor loads only, and install continuous SmartJoist blocking, Rimboard or Boundary joist to support roof and wall loads

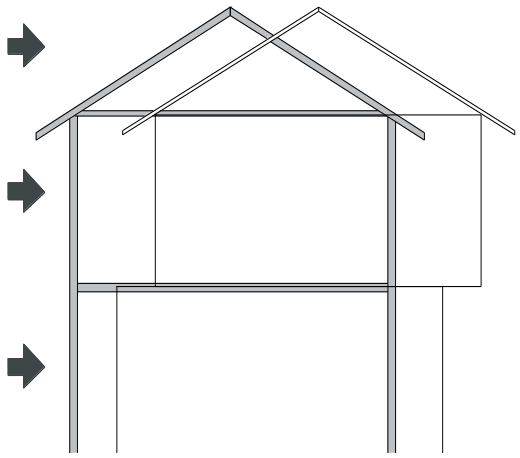
NOTE:

The Engineered Solution described in this table above considers vertical gravity loads only, and does NOT involve a calculation to determine whether the number and type of blocking selected to satisfy the vertical gravity load resistance will necessarily provide sufficient resistance to the lateral loads described as acting on the joists as shown opposite.

Section 8 of AS 1684.2—2010 (a simplified version in AS 1684.4—2010) is used to calculate the lateral wind forces to be transmitted through the floor.

Suitable details must be prepared by a engineer experienced in timber design and detailing that will effectively transfer the lateral loads through the floor system to the nominated ground floor bracing walls.

Full blocking using SmartJoist or SmartRim with the required fixing is a practical and easily installed option.



Mid span blocking

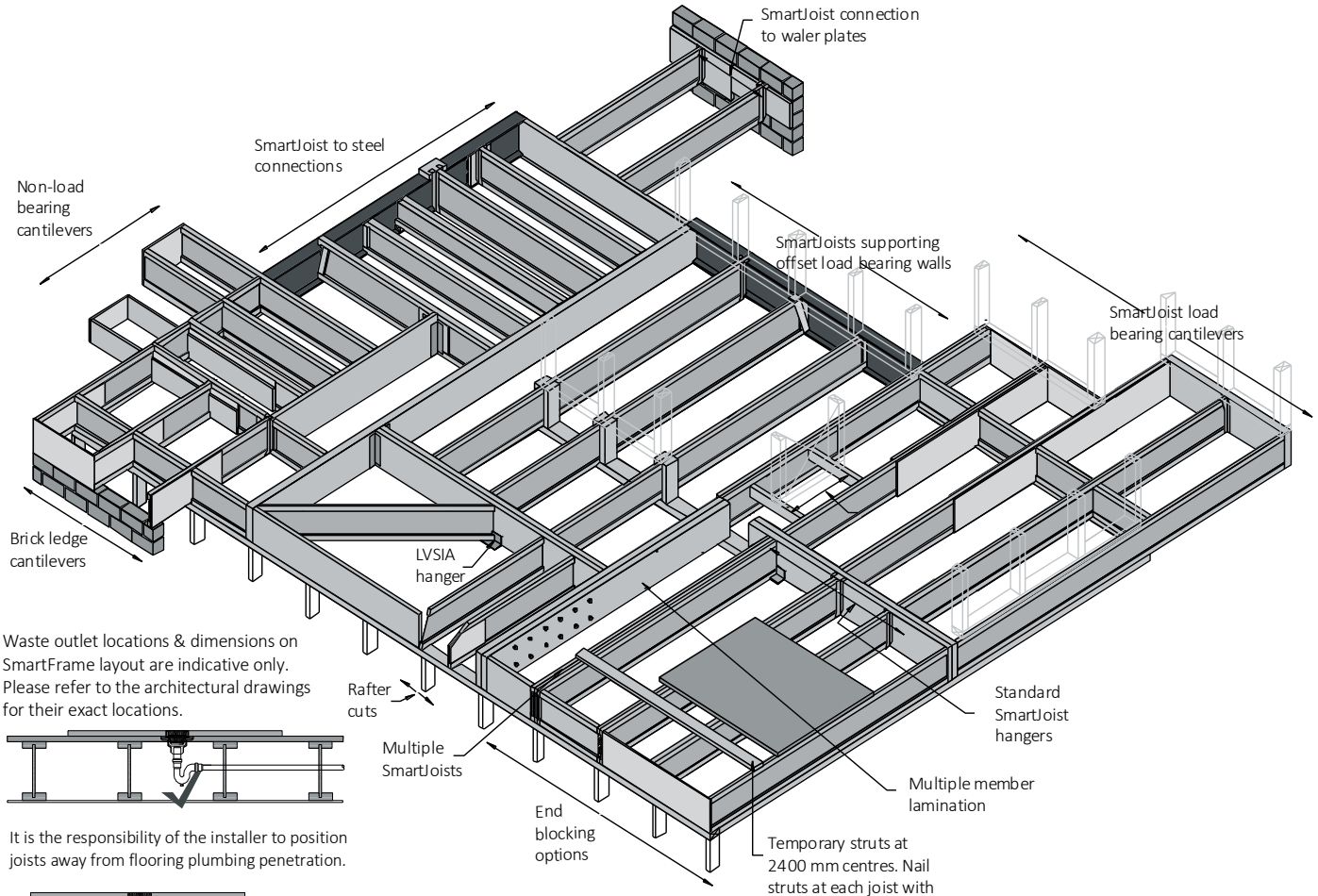
SmartJoists designed and constructed as per this Design Guide and installed with a direct fix ceiling do not require mid-span blocking.

Experience has shown that in rare cases there are some scenarios where properly installed joist bridging elements may be beneficial:

1. Subfloors where there is no lining to the underside of the joists
2. Suspended ceiling plaster systems that provide limited lateral support to the lower flange of the SmartJoists
3. Floor systems involving metal fixed plaster systems where normal live load deflections may cause metal to metal noise

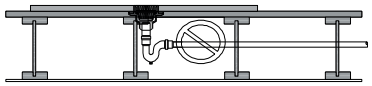
For further information on this topic or details of recommended SmartJoist bridging elements, contact the tech support helpline on 1300 668 690

Typical SmartJoist Floor Framing

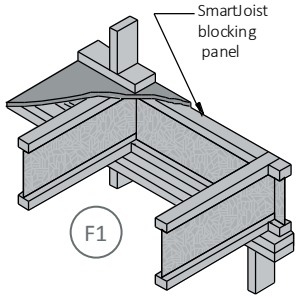


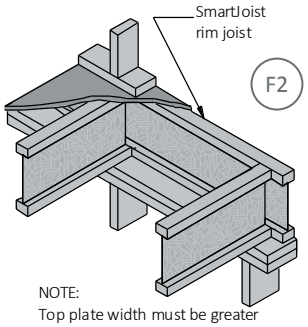
Waste outlet locations & dimensions on SmartFrame layout are indicative only. Please refer to the architectural drawings for their exact locations.

It is the responsibility of the installer to position joists away from flooring plumbing penetration.

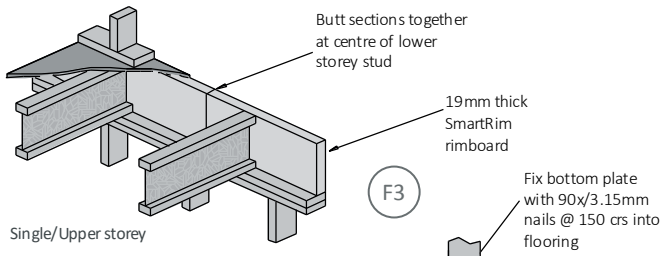


Typical SmartJoist Floor construction details

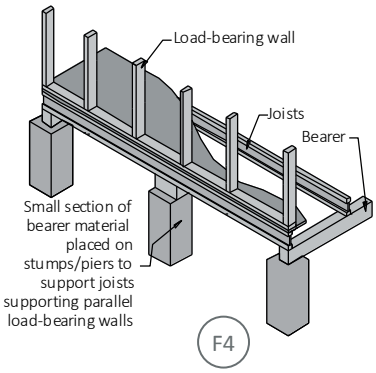


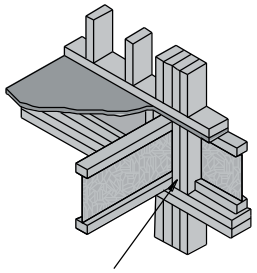


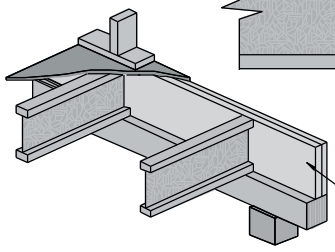
NOTE:
Top plate width must be greater than width of flange rim joist + 30 mm (min bearing length)



Single/Upper storey







Lower storey of two storey

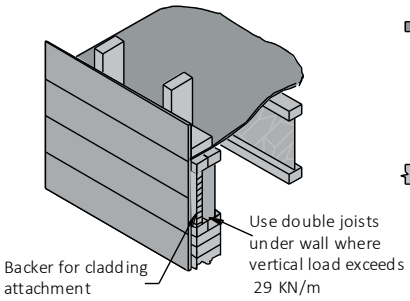
Concentrated Roof loads

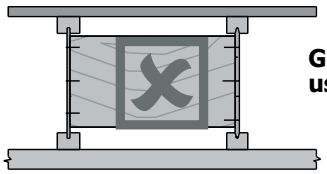
Note:
To achieve the necessary racking resistance through the floor diaphragm, it is important that the nailing provisions of the floor sheeting to the joists as described in AS 1684 (AS 1869 for particle board) be adopted to nail the floor sheeting to the Rim Joist or SmartRim in details F1-F3

Typical SmartJoist floor construction details (cont'd)

WARNING - Correct blocking for SmartJoists

F6



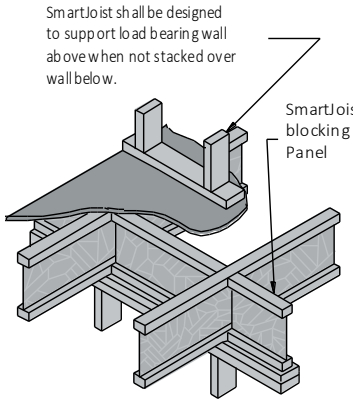


Green timber shall not be used under any circumstance

All blocking shall be carried out as per details F1-F3, with blocking to extend to both flanges and skew nailed with 3.15 Φ x 65 nails, one each side of top and bottom flange.

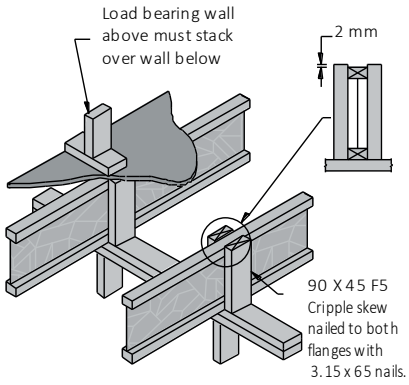
Interior loading bearing and bracing walls

F7



NOTE: Detail F7 with blocking panel is required for bracing walls.

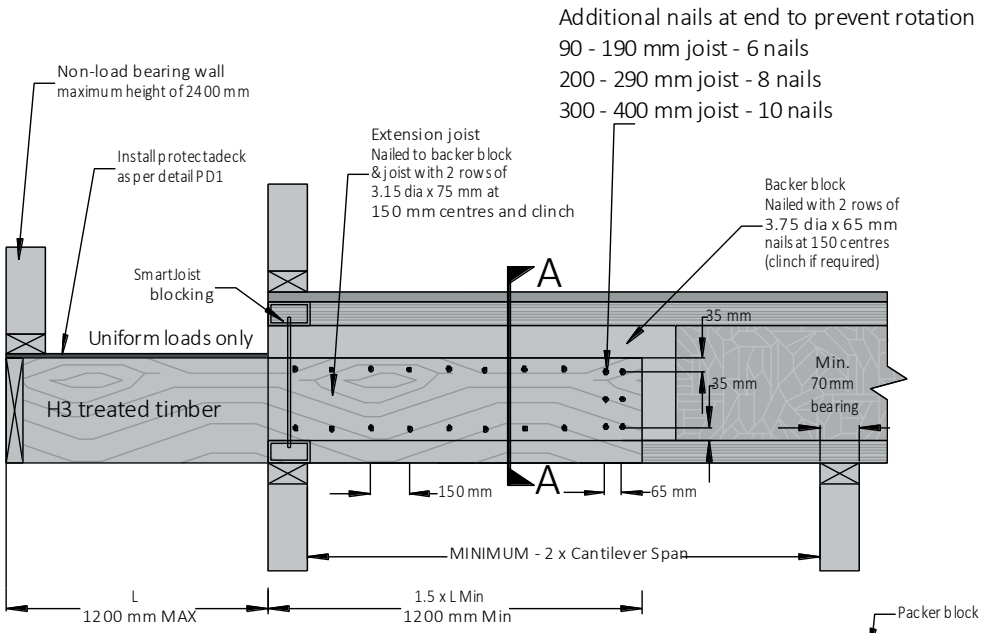
F8



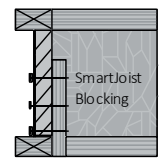
Non load bearing cantilevers (balconies)

Refer to detail C1, C2, C3, C4 OR CS1 for cantilevers supporting loadbearing walls

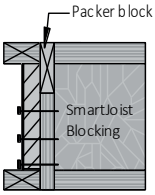
F9



IMPORTANT NOTES:
1) Flashing must be installed in accordance with BCA provisions to prevent water ingress into the internal floor system between deck joists.
2) Backer-block nails may be omitted if extension nails penetrate filler block and joist web and are clinched.



Section A-A
With notch-out blocking



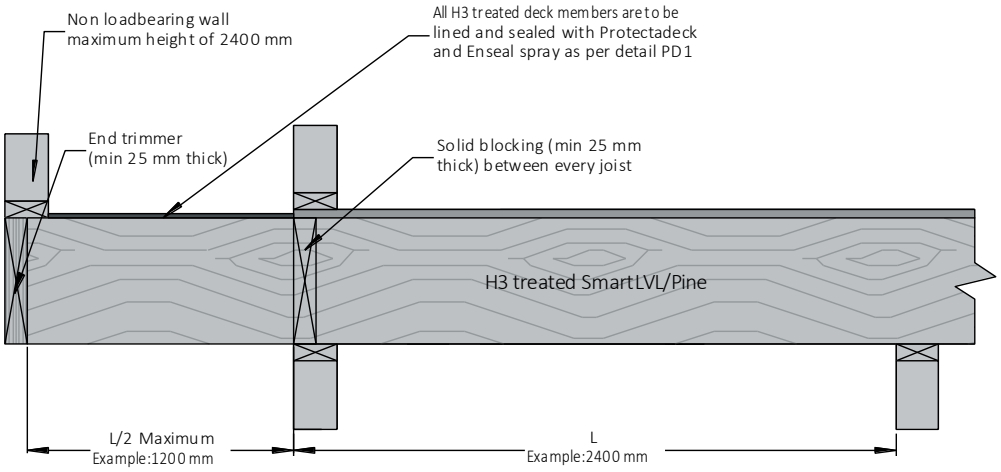
Section A-A
With compression block

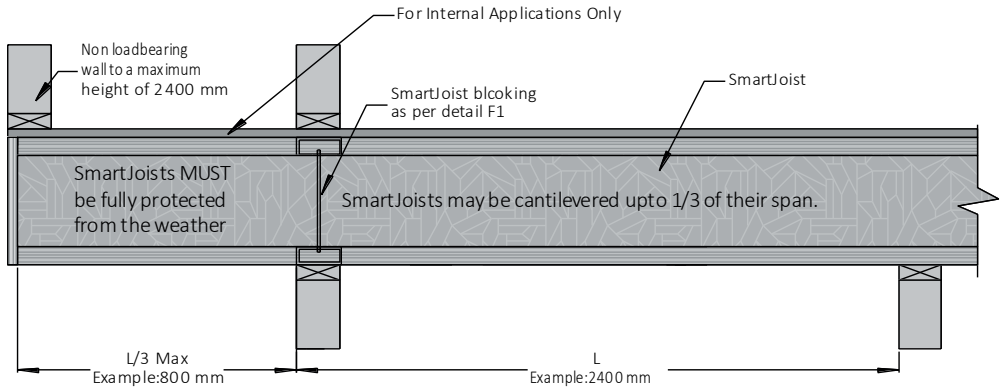
Cantilever bearing onto plate, adjacent to joist

Non load bearing cantilevers (balconies) (Cont'd)

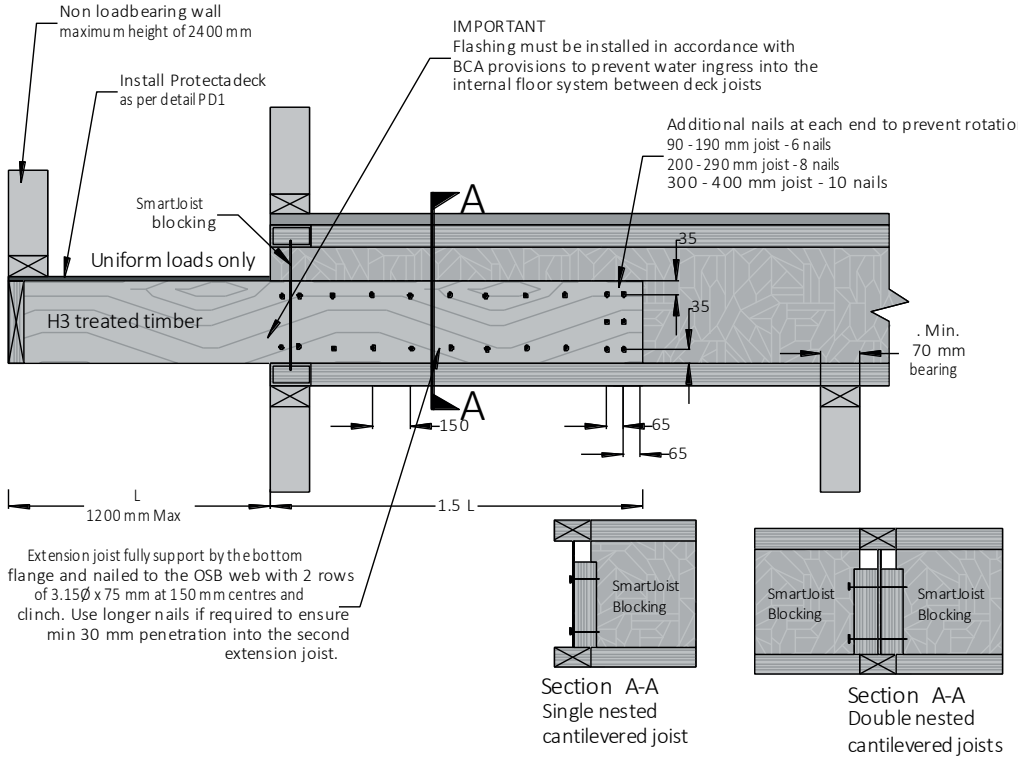
Refer to detail C1, C2, C3, C4 OR CS1 for cantilevers supporting loadbearing walls

F9A





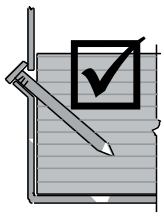
F9B



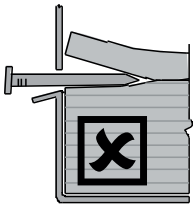
Cantilever bearing onto lower flange of SmartJoist

General connector installation details

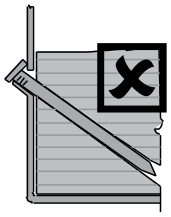
Positive angle nailing



Correct nailing

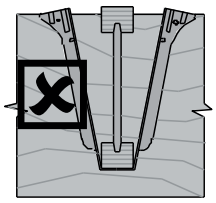


Nail at wrong angle

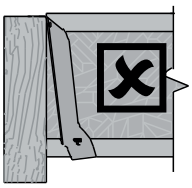


Nail too long

Top mount hangers



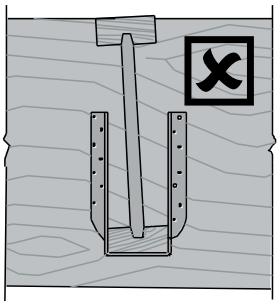
Hanger overspread
If hanger is overspread, I-Joist may be raised above header, also, NO support for top flange



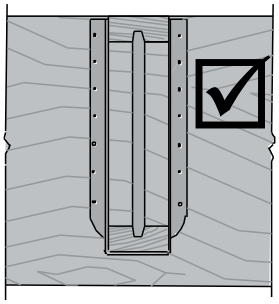
Hanger not plumb
A hanger kicked out from the header can cause uneven surfaces

Prevent rotation

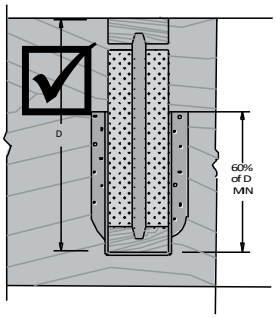
Hangers provide some joist rotation resistance; however, additional lateral restraint may be required for deep joists.



No web resistance
Results in rotation



No web stiffener required
Hanger side flange supports joist top flange



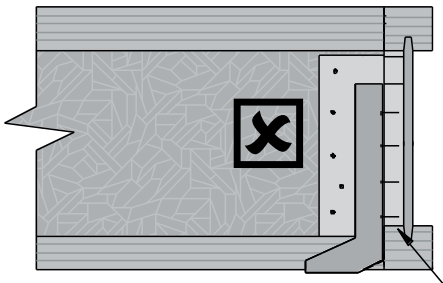
Web stiffener required
Hanger side flange should be at least 60% of joist depth or potential joist rotation must be addressed

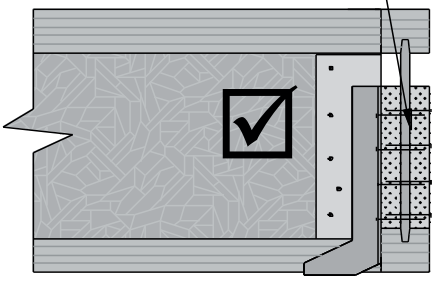
Correct fasteners

Bracket capacities are based upon using the correct bracket nail as per the table within the SmartJoist Design Guide. Bracket nails have special heads to provide strength. Clouts, brads etc. are NOT suitable as bracket nails

SmartJoist headers

Backer blocking each side, hanger nails must extend past the supporting joist's web member into the backer blocking.



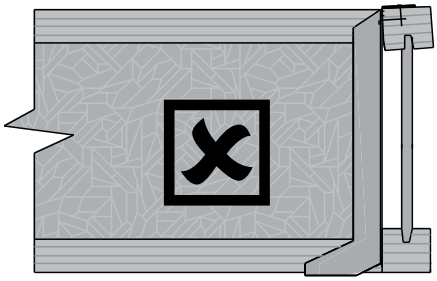


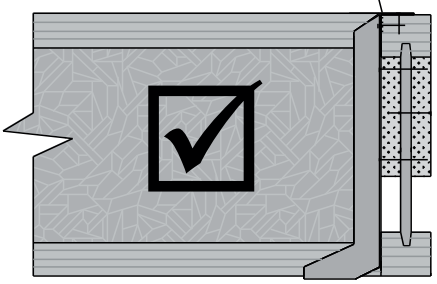
Face mount connection to web

Bottom flange pulling off when Backer block on one side only.

The top flange of the supporting joist must be supported by backer blocks to prevent cross grain bending and rotation.

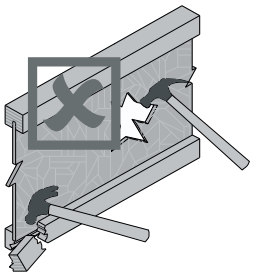
Top mount connection



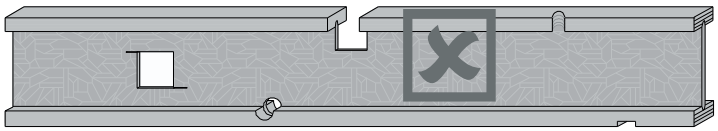


Field repair to damaged SmartJoists

Don't make holes with a hammer other than tapping out pre-punched knockouts



Don't hammer on flanges and damage joist



Do not cut or notch flanges
Do not overcut holes in web

SmartJoists are sophisticated Engineered Timber products, and must be treated accordingly. Damage to key components, while affecting only a small percentage of the cross section may be sufficient to render the SmartJoist unsuitable for the purpose.

It is therefore recommended that damage to joists and the possibility of repair be referred to the tech support helpline on 1300 668 690 or at techsupport@tilling.com.au for advice.

Flange damage

- Flange damage becomes more critical the nearer it is to mid-span or an interior support. Flange damage is less critical in close proximity to an end support.
- How much flange damage is acceptable? A rule of thumb is "If you have to ask, it's too much". A saw kerf that knicks the corner of a flange on one lightly-loaded joist could well be acceptable.
- A joist with unacceptable flange damage cannot be repaired, rather a new joist must be added to take it's place. The damaged joist does not have to be removed. Consult SmartJoist and SmartLVL tables to find an acceptable new joist that is shallower than the damaged joist so installation is easier. Consider double and triple joists. If the damaged joist is multi-span, the new joist only needs to go across the span(s) where the damage occurs.
- A single damaged joist can sometimes be trimmed off of adjacent undamaged joists (run a calculation within the SmartFrame software).

Web damage

- Web damage becomes more critical the nearer a support. Web damage is less critical near mid-span.
- Web holes can be too big to repair. A flange-to-flange rectangular hole longer than 450 mm located at mid-span probably warrants a new joist. A 150 mm round hole located right by a support probably warrants a new joist. Consult SmartJoist and SmartLVL tables to find an acceptable new joist that is shallower than the damaged joist so installation is easier. Consider double and triple joists. If the damaged joist is multi-span, the new joist only needs to go across the span(s) where the damage occurs.
- A single damaged joist can sometimes be trimmed off of adjacent undamaged joists (run a calculation within the SmartFrame software)
- Damage that could be confidently repaired in a single, isolated joist, might be judged too severe to repair if several, adjacent joists are involved
- If several small holes violate the 2x diameter proximity rule, but would fit inside a single acceptable hole, then the group of small holes is OK
- Hole repairs generally require a reinforcement that covers the full depth of the web and extends at least 300 mm past each side of the hole.

Damage report information required

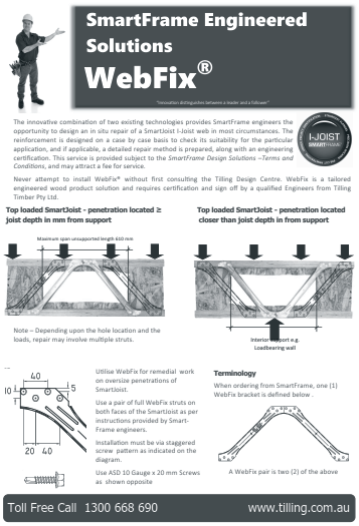
1. In order to design a repair, the SmartFrame engineer will have to know all of the design information that is required to run SmartFrame software.
2. Provide a sketch of the damage showing it's size, shape and location on the joist.
3. Indicate whether a pipe, duct, conduit, etc. must remain and be accommodated.
4. Indicate how many adjacent joists are affected in each case.

Field repairs to damaged SmartJoist webs

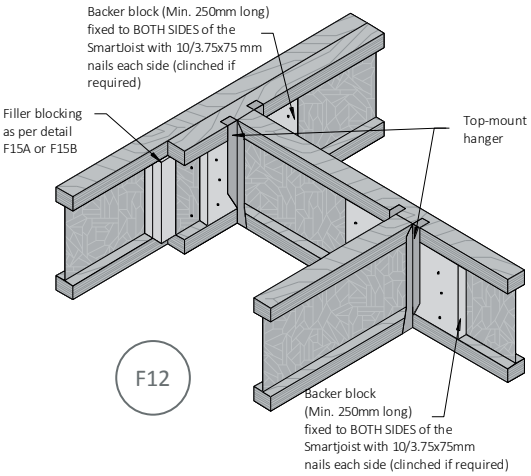
The SmartFrame system now includes the WebFix® (web reinforcement) developed to be a rapid "repair" to webs where penetrations have been placed at inappropriate locations, penetrations too large or other web damage which diminishes the strength of the member. This repair system is unique to SmartJoist applications.

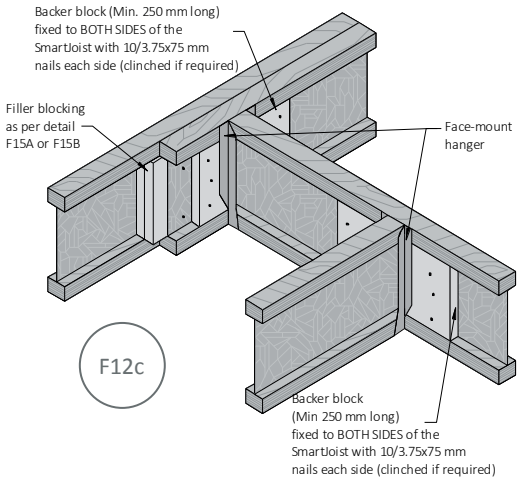
Tilling Timber is the SOLE Australian distributor of this PATENTED system, which in most cases can be fixed around services that have been installed through the web penetrations.

The WebFix® does need to be designed into each situation by SmartFrame engineers and can ONLY be purchased from Tilling offices after the structural design is completed.



Backer and filler blocks





Filler blocks and web stiffeners

SmartJoist code	Recommended filler block	Web stiffener material	
		stiffener	nails
SJ20044	120 x 35	15 x 60 mm ply	4-3.15 x 65
SJ24040	140 x 35	15 x 60 mm ply	4-3.15 x 65
SJ24051	140 x 45	19 x 60 mm ply	4-3.15 x 65
SJ24070	150 x 58 LVL	2/15 x 60 mm ply	4-3.15 x 65
SJ24090	2/140 x 45	2/19 x 60 mm ply	5-3.15 x 65
SJ25570	170 x 58 LVL	2/15 x 60 mm ply	4-3.15 x 65
SJ30040	190 x 35	15 x 60 mm ply	4-3.15 x 65
SJ30051	190 x 45	19 x 60 mm ply	4-3.15 x 65
SJ30070	150 x 58 LVL	2/15 x 60 mm ply	4-3.15 x 65
SJ30090	2/190 x 42 LVL	2/19 x 60 mm ply	5-3.15 x 65
SJ36058	250 x 50	2/12 x 60 mm ply	5-3.15 x 65
SJ36090	2/240 x 45	2/19 x 60 mm ply	5-3.15 x 65
SJ40090	2/240 x 45	2/ 19 x 60 mm ply	5-3.15 x 65

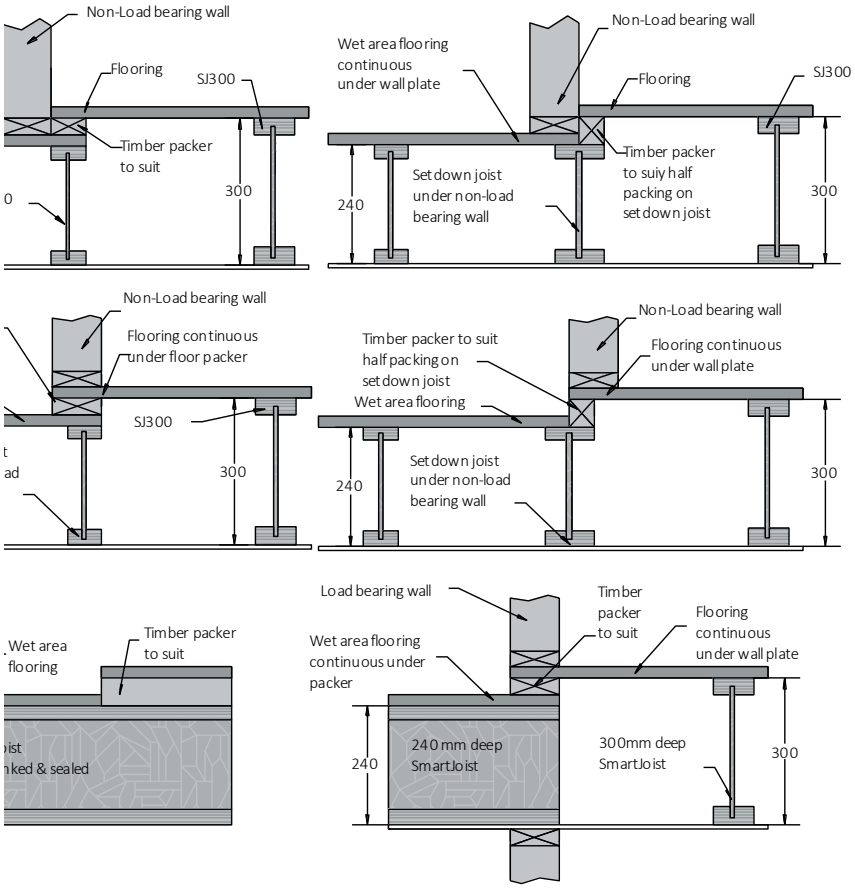
NOTES:

1. Use plywood sheathing for web stiffener with face grain parallel to long axis of the stiffener
2. Filler blocks noted are for the general requirements of the details within this design guide
3. Leave 3 mm gap between top of filler blocks and bottom of top flange
4. Support back of web during nailing to prevent damage to web/flange connection
5. Filler block is required full length of joist.

Balcony/wet area setdowns

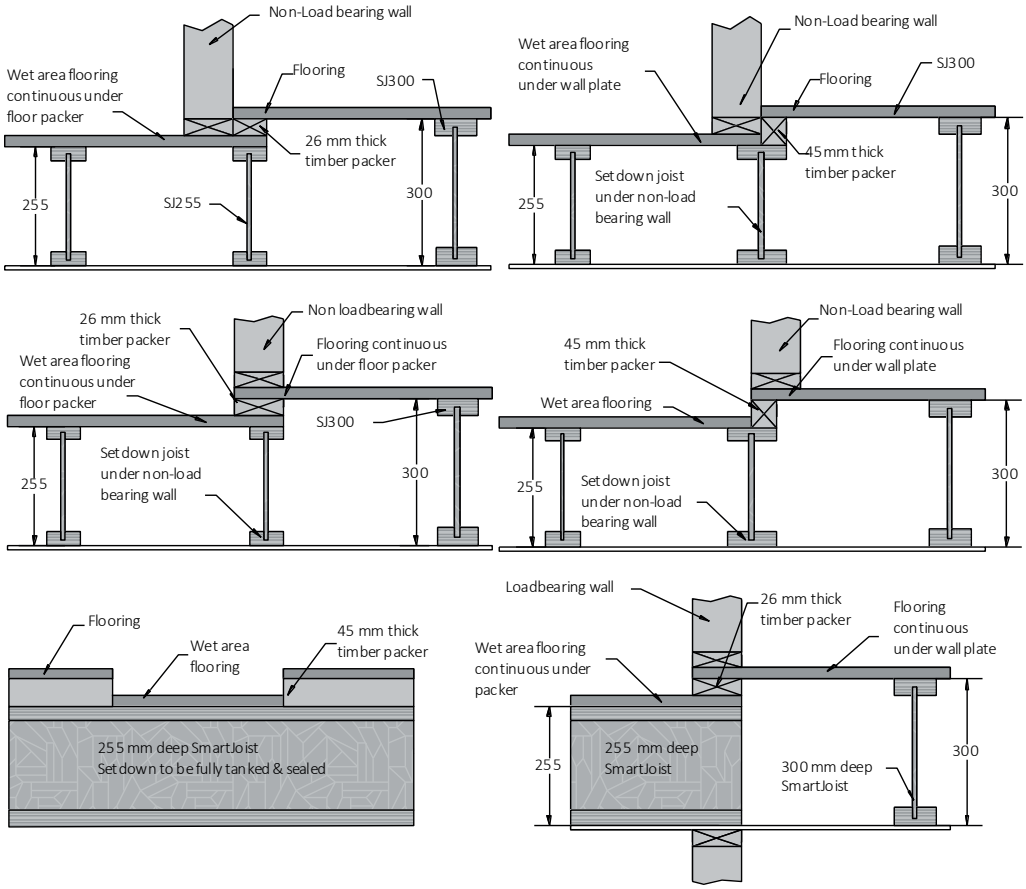
SJ240 & SJ300 SmartJoist

F12e



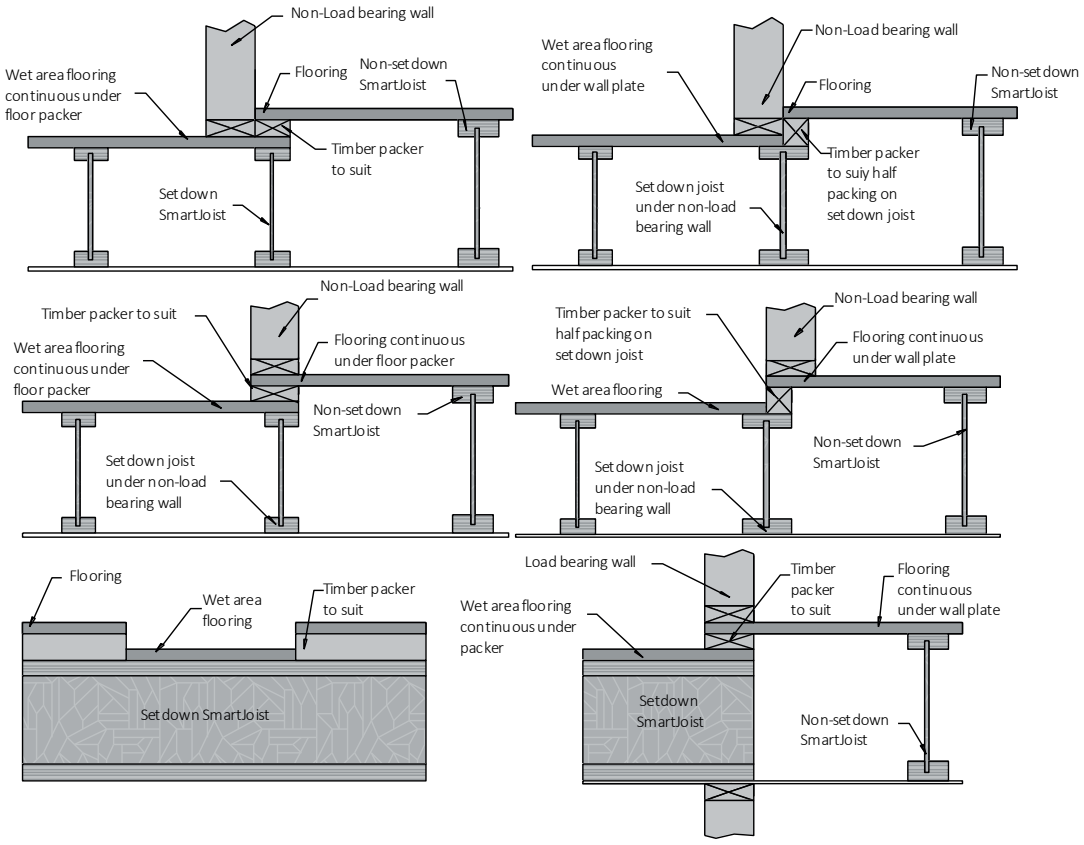
Balcony/wet area setdowns

SJ255 & SJ300 SmartJoist



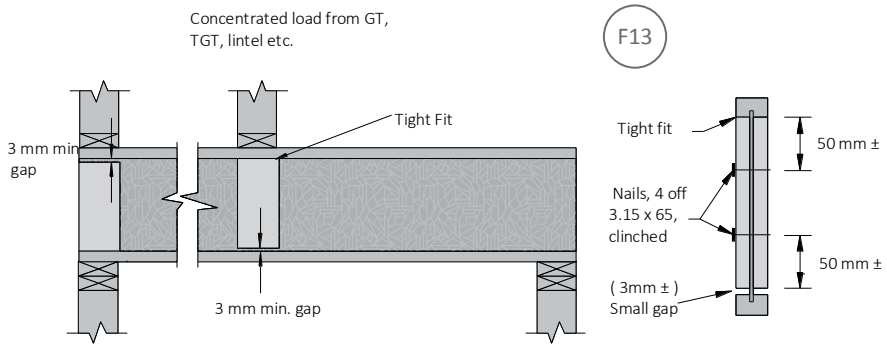
Balcony/wet area setdowns

SJ200 & SJ240 SmartJoist
SJ300 & SJ360 SmartJoist
SJ360 & SJ400 SmartJoist



Concentrated loads on SmartJoists

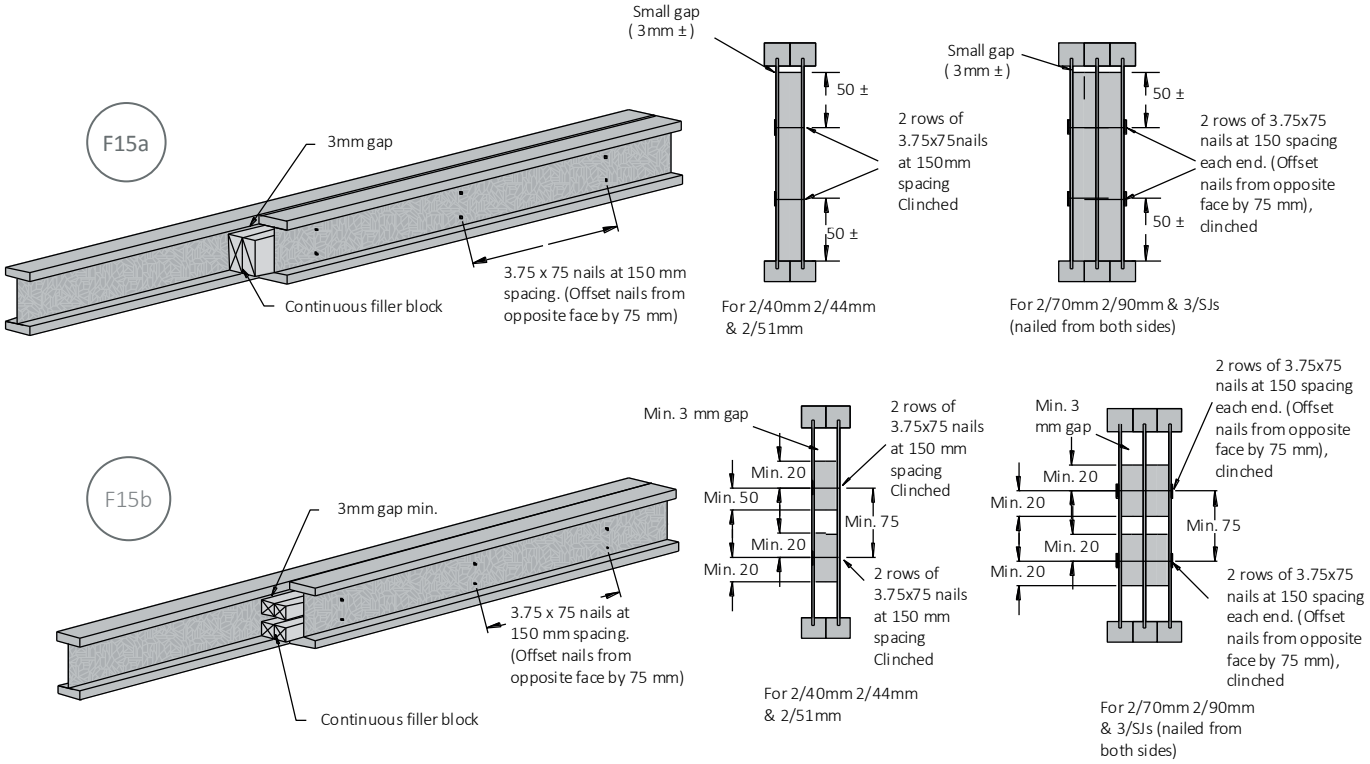
Web stiffeners under concentrated loads are required as shown below for concentrated loads that exceed 6.5 kN ONLY.



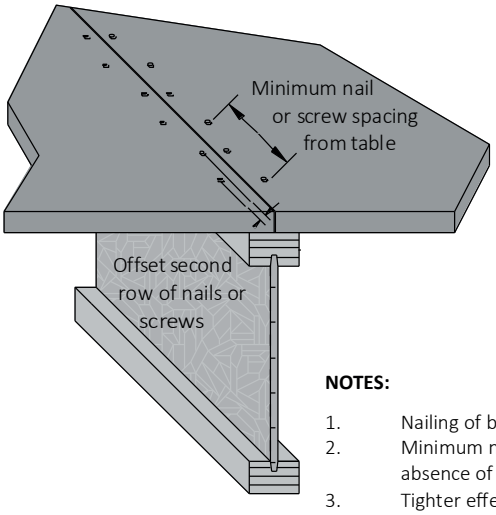
NOTE:

1. Web stiffeners are NOT required at end bearing supports when span length are taken from the SmartJoist Design Guide, except where they are required to prevent rotation if the joist hanger dos not laterally restrain the top flange
2. Web stiffeners may be required at inner supports under concentrated loads. Consult the appropriate tables.

Multiple SmartJoist members



Fastener spacing



Minimum single row fastener spacing into SmartJoist flanges					
Fastener type and size	SmartJoist flange width				
	40 mm flange	44 mm flange	51 mm flange	58-70 mm flange	90 mm flange
Nails					
2.8 x 60	75	75	50	50	50
3.15 x 60	100	90	75	75	75
Screws					
9g x 45	150	150	75	75	75
10g x 50	150	150	100	75	75

NOTES:

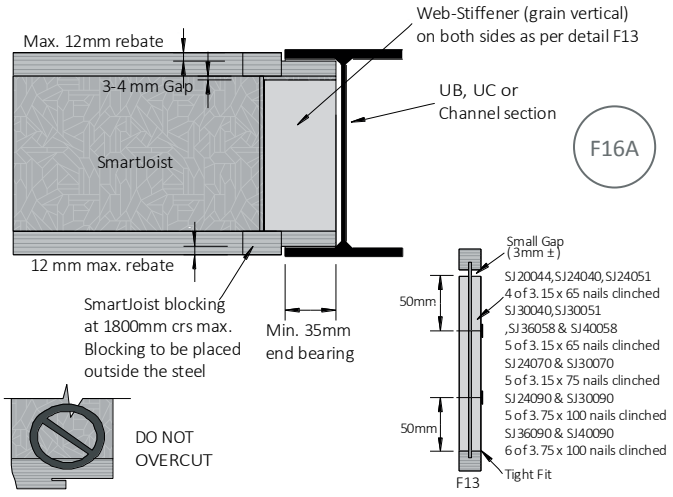
1. Nailing of bottom plate at 100 mm centres through floor sheathing and into top flange is permitted
2. Minimum nail/screw spacing is shown above, maximum nail/screw spacing is set by the flooring manufacturer, in absence of manufacturers data, 300 mm centres
3. Tighter effective nail spacing may be obtained by offsetting nail/screw rows a minimum of 12 mm and maintaining a 10 mm minimum edge distance.
4. Do not use nails/screws of a larger diameter than those shown above when attaching sheathing to SmartJoists

Limited end notching at supports

The cutting of notches in the ends of joists may reduce the allowable end reactions.

The amended end reaction capacities of SmartJoists with a 12 mm notch are as follows:

- Without web stiffeners - 80% of end reactions.
- With added web stiffeners (as per detail F13) - Full end reaction capacity



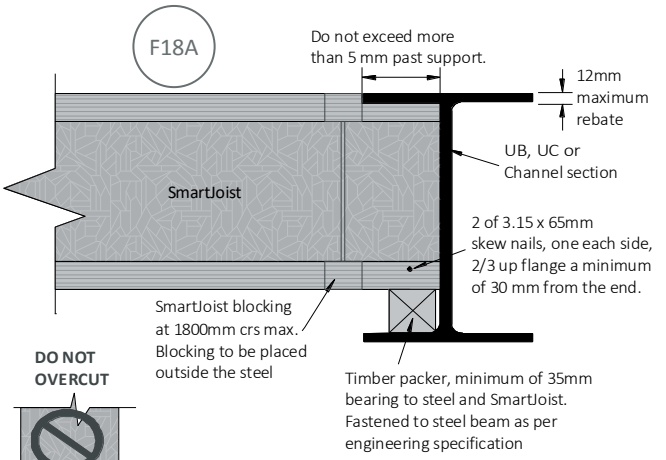
F16A

To maintain the End Reaction capacities above,
End notching of flanges at supports is limited to:
1. Notch depths no greater than 12 mm.
2. Notches are not over cut.
3. Notch does not exceed more than 5 mm past support.

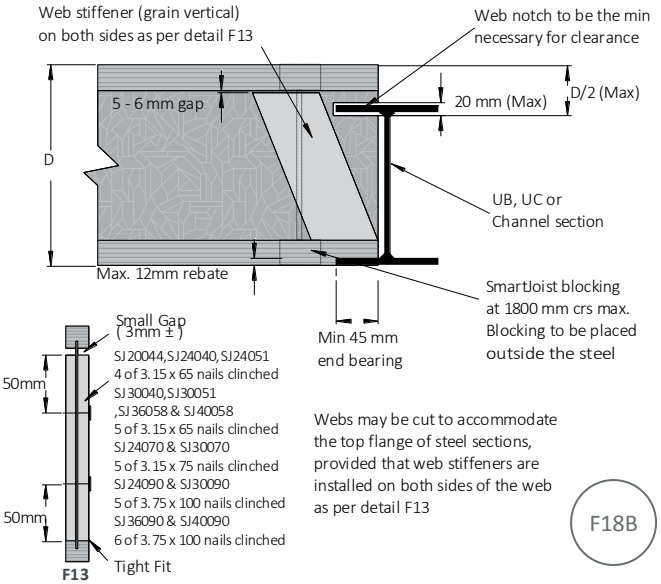
DO NOT OVER CUT FLANGES.
SUBSTANTIAL REDUCTIONS IN CAPACITY MAY OCCUR IF FLANGES ARE OVER CUT

To maintain the end reaction capacities above, end flange notching is strictly limited to:

1. Notch depths NOT greater than 12 mm
2. Notches cleanly cut - NO over cutting
3. Notch length not to exceed more than 5 mm past the support.



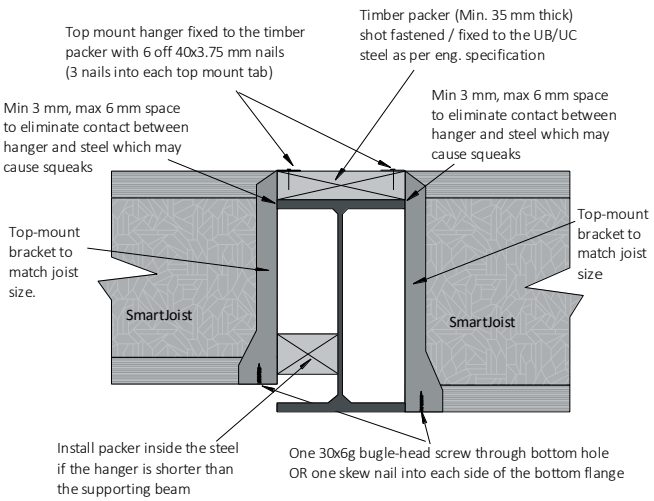
To maintain the End Reaction capacities above,
End notching of flanges at supports is limited to:
1. Notch depths no greater than 12 mm.
2. Notches are not over cut.
3. Notch does not exceed more than 5 mm past support.



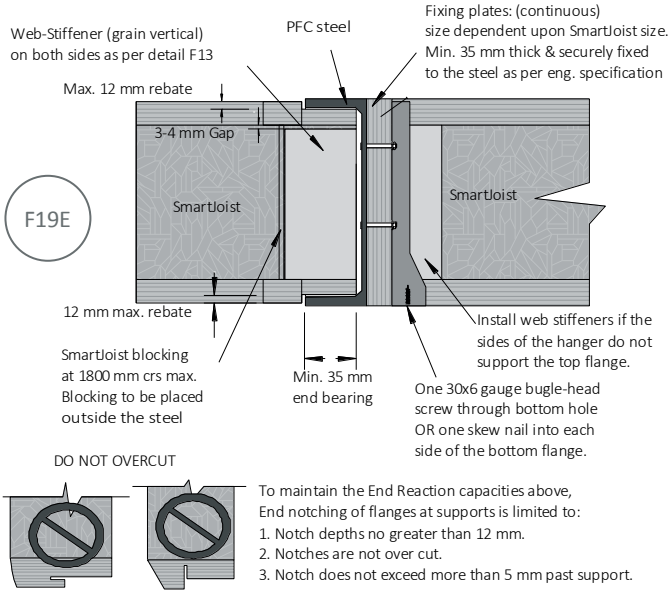
Webs may be cut to accommodate the top flange of steel sections, provided that web stiffeners are installed on both sides of the web as per detail F13

F18B

Example fixing of SmartJoists to steel beams



F17A



F19E

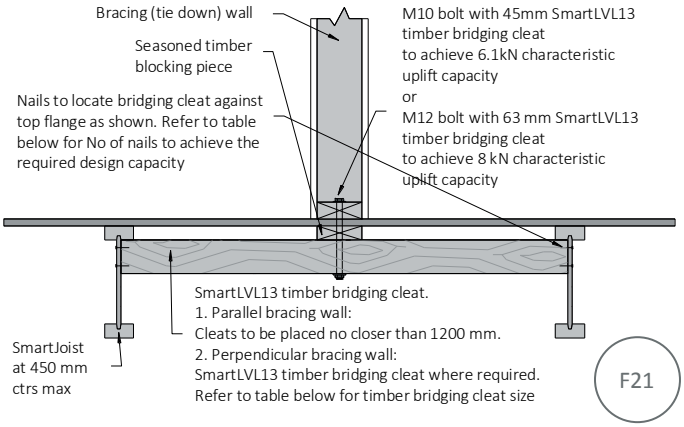
To maintain the End Reaction capacities above,
End notching of flanges at supports is limited to:
1. Notch depths no greater than 12 mm.
2. Notches are not over cut.
3. Notch does not exceed more than 5 mm past support.

Tie down (bracing wall) details

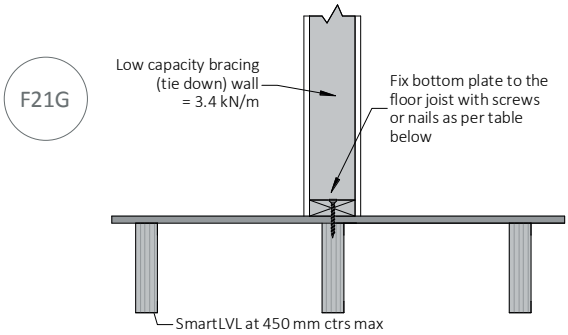
The tie-down needs of the structure are related to the applied wind loads. Reference should be made to AS 1684 for further guidance on this issue. The general details relating to the tie-down provisions of solid end section timber may be adopted for SmartJoists, except that under NO circumstances is it permitted to bolt through either the top or bottom flange, except when the joist is fully supported upon a wall plate or similar as shown below.

Bracing walls between parallel joists

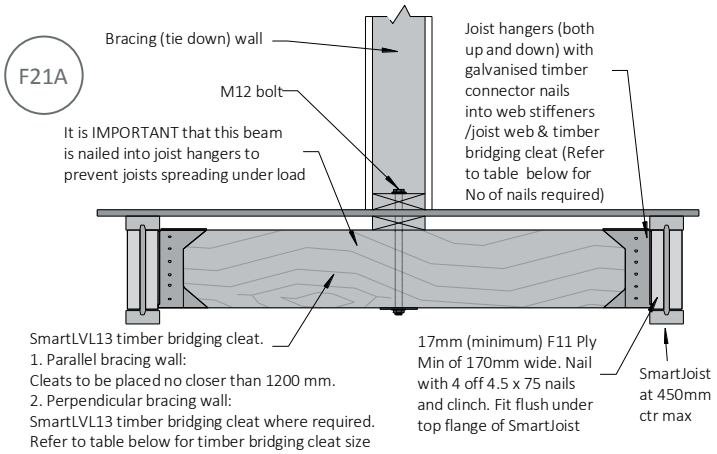
(a) Light duty



Nails or screws (detail F21F)	Design wind uplift capacity (kN)
2/3.05Ø screws, min 35 mm penetration into joist	0.5
1/12g Type 17 screw, min 35 mm penetration into joist	2.4
1/14g Type 17 screw, min 35 mm penetration into joist	2.7



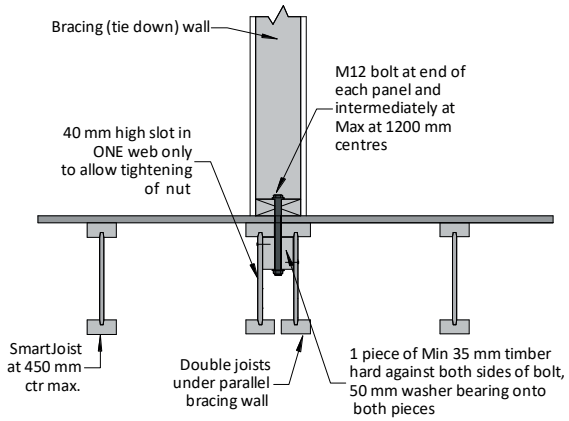
(b) Heavy duty



Timber bridging size (DxB mm)	Hanger code	No of hanger nails into joist	No of hanger nails into bridging	Design uplift and down-ward capacity (kN)
90 x 63 LVL 13	FB6390	8/3.15Ø x 35	4/3.15Ø x 35	7.4
130 x 63 LVL 13	FB63120	12/3.15Ø x 35	6/3.15Ø x 35	11.4
170 x 63 LVL13	FB63170	20/3.15Ø x 35	10/3.15Ø x 35	17.8

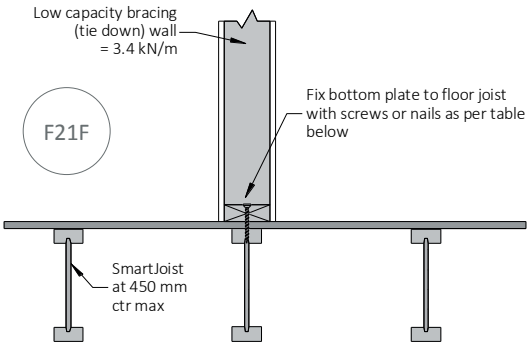
Nails or screws (detail F21G)	Design wind uplift capacity (kN)
2/3.05Ø screws, min 40 mm penetration into joist	0.15
1/12g Type 17 screw, min 40 mm penetration into joist	1.5
1/14g Type 17 screw, min 40 mm penetration into joist	1.7

(b) Heavy duty

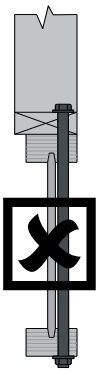


Bracing walls vertically above parallel joists

(a) Light duty

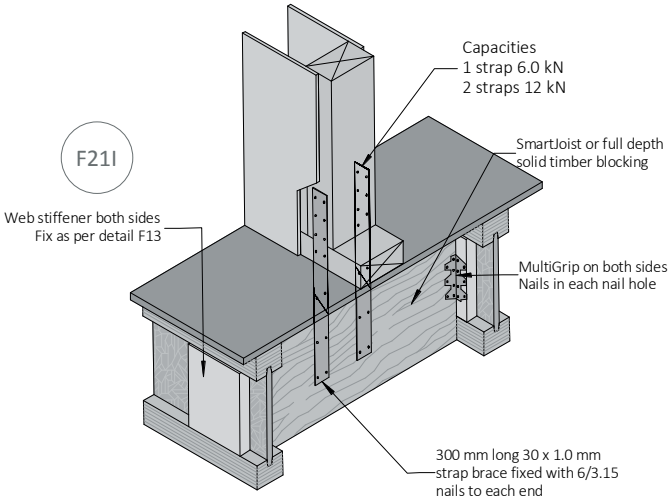


DO NOT DRILL THROUGH EITHER FLANGE OF SmartJoists unless they are fully supported on wall plate or similar

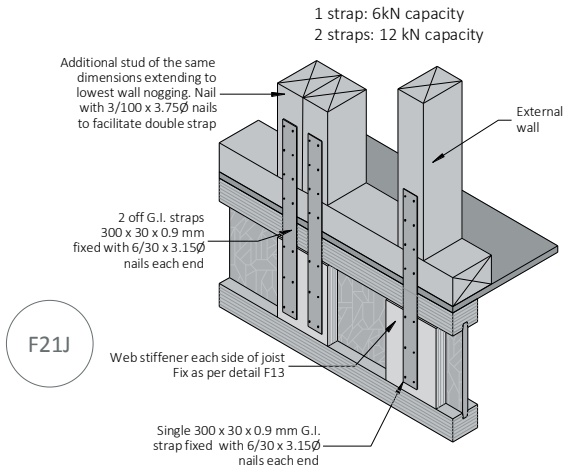


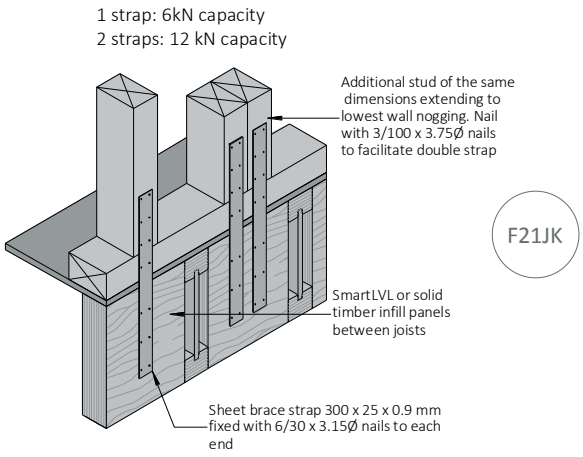
Tie down and bracing wall support details (cont'd)

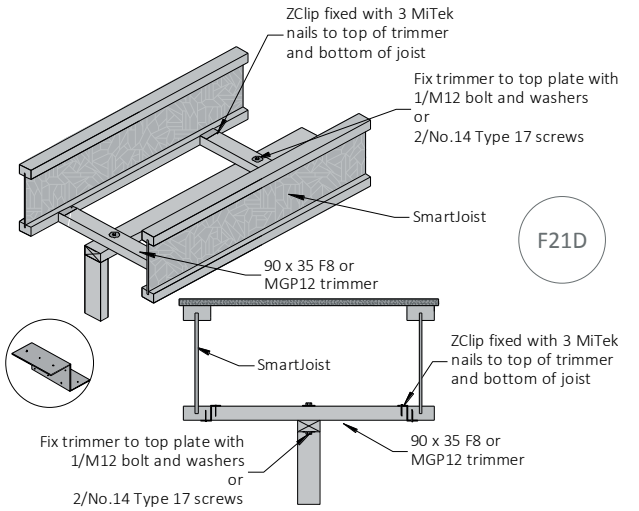
(a) SmartJoist perpendicular to upper bracing wall - via solid blocking and web stiffeners

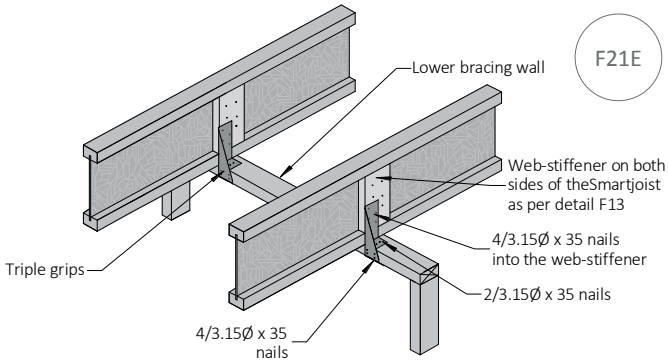


(b) **SmartJoist parallel to upper bracing wall - via SmartRim and web stiffeners**

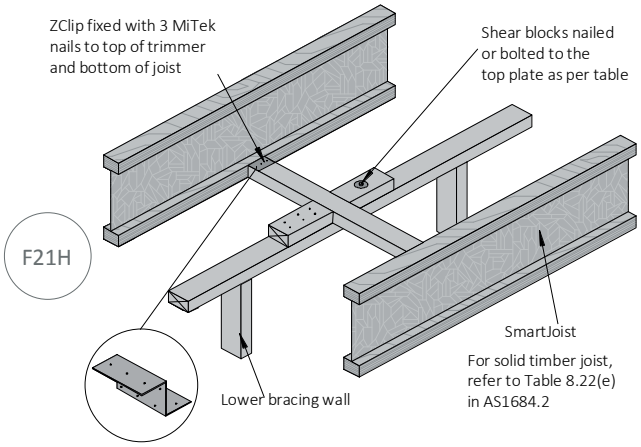








Limit State design shear capacity per Joist (kN)		
Joint group of joist/top plate	**JD4**	**JD5**
2/3.05 Ø skew nails as per AS 1684.2	1.1	0.9
2/3.3 Ø skew nails as per AS 1684.2	1.2	1.0
2/3.05 Ø skew nails + 1 Triple Grip	2.1	1.5
2/3.3 Ø skew nails + 1 Triple Grip	2.2	1.6
2/3.05 Ø skew nails + 2 Triple Grips	4.8	3.7
2/3.3 Ø skew nails + 2 Triple Grips	4.9	3.8

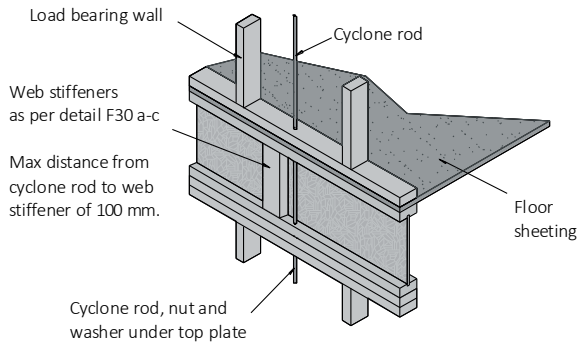


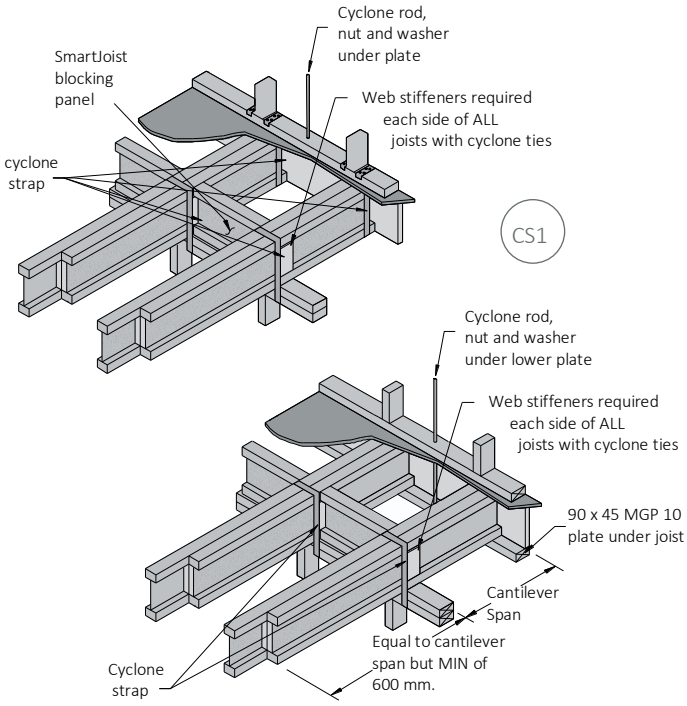
Fixing to the top of walls

Limit State design shear capacity per pair of Z clips Figure 21D		
Joint group of joist/top plate	**JD4**	**JD5**
Bracing shear (kN)	4.6	3.6

Limit State design shear capacity (kN)		
Nails/bolts	**JD4**	**JD5**
4/3.05 Ø nails	3.6	3.0
4/3.3 Ø nails	4.0	3.3
1 M10 bolt	4.3	3.0
1/M12 bolt	4.6	3.6

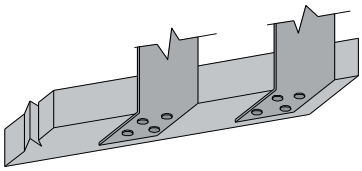
Cyclone rod tie down for cantilevered SmartJoist floors





Cyclone strap capacities

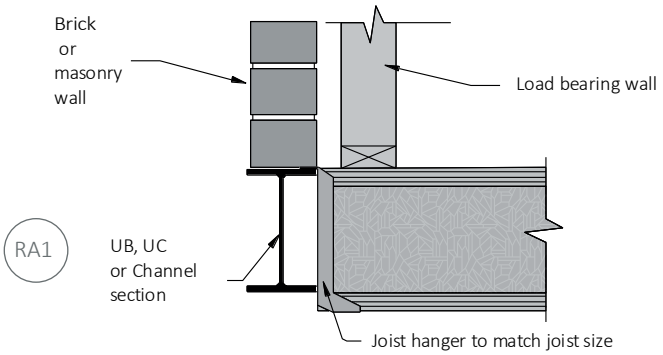
Where the strap ends of the cyclone strap are wrapped around the wall plate or other timber member and are fixed with 4 of 3.15 Ø x 35 nails, the design capacity $ØN_j$ of 15.3 kN is applicable, regardless of the timber joint group. Tests have proven that bending the legs of cyclone straps around the timber increases the ultimate load capacity.

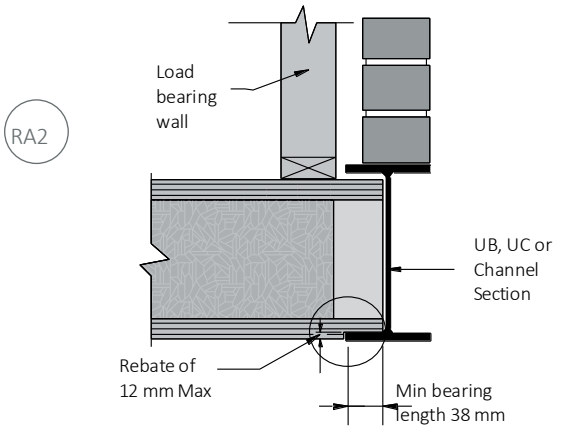


While double joists shown in the above diagram, it is only necessary when loads exceed the capacities of single joist cantilevers.

Joist/beam connections supporting offset load bearing walls

Modern building designs frequently call for the upper storey of a two storey dwelling to be set back from the lower wall to allow sufficient light access to all areas of the building. Provided that the SmartJoists have been designed to support this offset load, no special provisions need to be made for their support EXCEPT in the following support conditions:





Maximum Roof Area Supported (m^2)

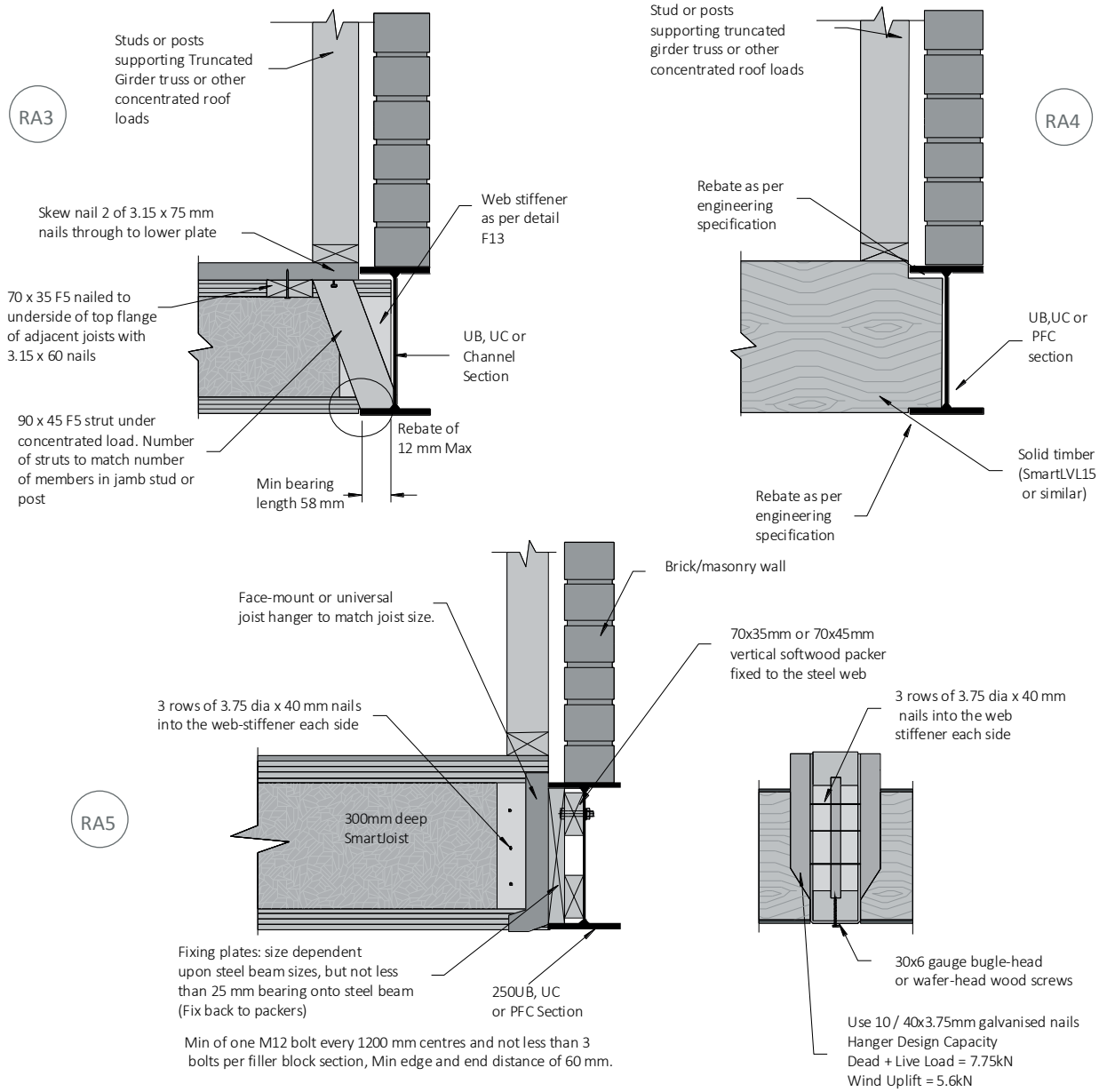
- based upon worst case of 40 mm flange width (conservative for wider flanged joists)

	Joist supported on joist hanger RA1								Lower flange bearing RA2							
Joist spacing (mm)	300	400	450	600	300	400	450	600	300	400	450	600	300	400	450	600
Joist span (mm)	Sheet				Tile				Sheet				Tile			
3500	21.7	15.0	12.8	8.2	9.6	6.7	5.7	3.6	6.9	6.4	6.2	5.3	3.1	2.9	2.8	2.4
4000	21.1	14.5	12.3	6.9	9.4	6.4	5.5	3.1	6.7	6.2	6.0	4.6	3.0	2.8	2.7	2.0
4500	20.5	13.9	11.7	5.7	9.1	6.2	5.2	2.5	6.6	6.0	5.7	3.9	2.9	2.7	2.5	1.7
5000	20.0	13.4	10.4	4.4	8.9	5.9	4.6	2.0	6.4	5.8	5.1	3.1	2.9	2.6	2.3	1.4
5500	19.4	12.1	9.1	3.2	8.6	5.4	4.1	1.4	6.3	5.3	4.6	2.4	2.8	2.4	2.0	1.1

Support for concentrated loads - joist/beam connections supporting offset load bearing walls

Concentrated loads from any source such as girder trusses MUST be transferred through the floor space WITHOUT adding extra vertical loads to the ends of the SmartJoist at its bearing support.

One example of transferring these loads is the use of inclined timber struts as shown below. Struts must be a tight fit and at a minimum angle of 60 º to the horizontal



Beams supporting SmartJoists – multiple member laminations

Vertical laminations may be achieved by adopting the procedures described in clause 2.3 of AS1684, however these procedures should be considered as the minimum requirements to achieve the desired effect.

Experience with SmartLVL beams indicates that this degree of fixing may not satisfactorily prevent cupping of individual components as a result of the ingress of moisture between laminates during construction. The suggested method of vertical lamination below provides a greater level of fixity between individual components, and with the use of an elastomeric adhesive, also prevents moisture penetration between the laminates.

Multiple member laminating of top loaded beams (symmetrical loading)

The edges of the individual sections must be carefully aligned to each other so that the composite beam is flat, allowing the applied loads to be equally shared.

- Depths up to and including 300 mm: 2 rows of nails as shown above at 300 mm centre
- Depths in excess of 300 mm: 3 rows of nails as shown above at 300 mm centres.

Beams supporting SmartJoists – Multiple member laminations (cont'd)

1. Nailing

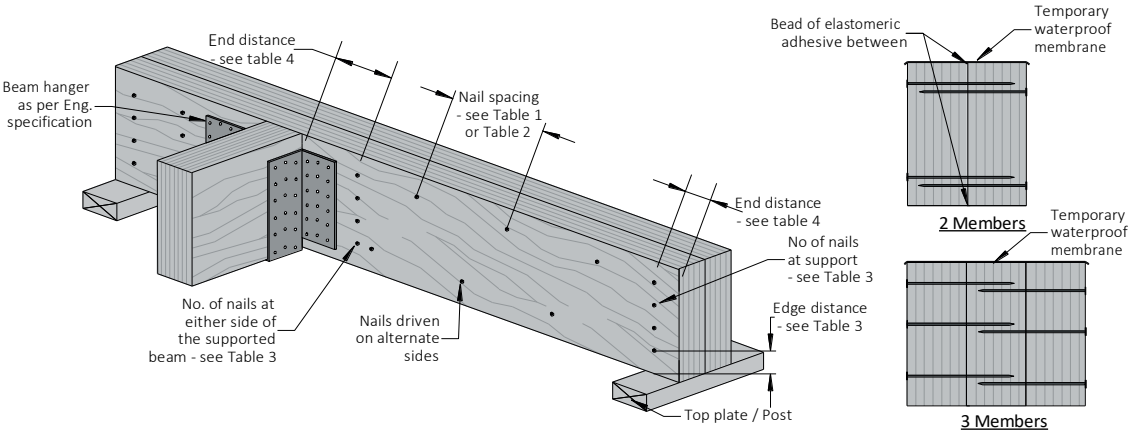


Table 1

Top (symmetrically) loaded beam			
Section width	Nail type	No of nail rows (both sides)	Nail spacing (mm)
2/35	3.15 x 65	2 or 3*	300
3/35 & 2/45	3.30 x 90	2 or 3*	300
2/42	3.06 x 75	2 or 3*	200
3/42, 3/45 & 2/58 3/58, 2/65 & 3/65	Nail lamination is not suitable, requires screws or bolts		

* Beam depth ≥ 300 mm 3 rows of nails

Table 2

Side (non-symmetrically) loaded beam					
Section width	Nail type	No of nail rows at 300mm ctrs (both sides)	Max. floor joist span supported by outer mem-ber (mm)*	No of nail rows at 300mm ctrs (both sides)	Max. floor joist span supported by outer member (mm)*
2/35	3.15 x 65	2	2150	3	3250
3/35	3.30 x 90	2	5100	3	7600
2/45	3.30 x 90	2	2550	3	3800
2/42	3.06 x 75	2	2300	3	3400
3/42 & 3/45	3.30 x 90	2	2550	3	3800
2/58 & 3/58	3.30 x 100	2	2500	3	3800
2/65 & 3/65	3.30 x 100	2	1350	3	2050

* Floor loads G = 62 kg/m^2, Q = 1.5 kPa

Table 3

Beam depth (mm)	Min. number of nails required	
	At support	At either side of supported beam
90 –150	3	3
160—300	5	6
> 300	6	8

Table 4

Nail dia. (mm)	Min. edge distance (mm)	Min. end distance (mm)	Min. distance between nails (across the grain) (mm)
3.06 & 3.15	20	70	40
3.30	20	75	45

2. Type 17 screws

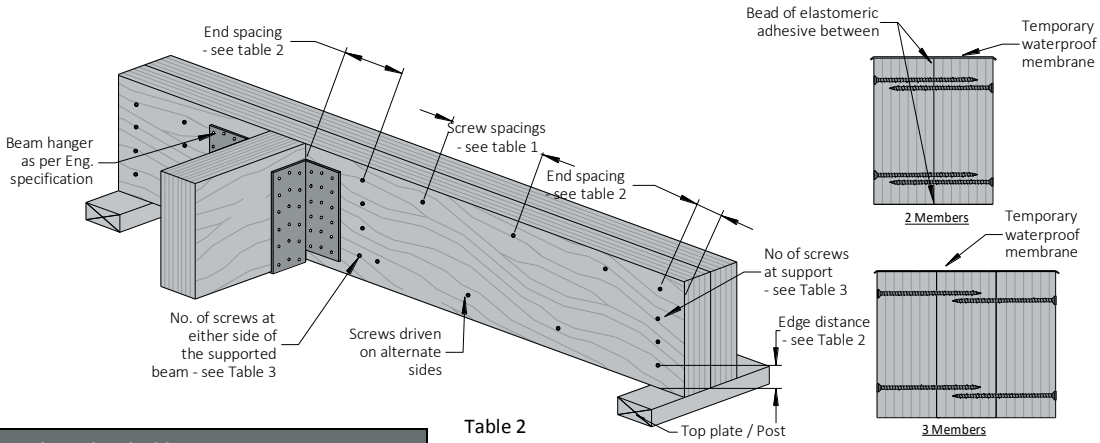


Table 1

Side (non-symmetrically) and top loaded beam				
Section width	Type 17 screw size	No of screw rows (both sides)	Screw spacing (mm)	Max. floor joist span supported by outer member (mm)**
2/35 & 3/35	10g x 65	2 or 3*	200	4500
2/42 & 3/42	12g x 75	2 or 3*	200	5900
2/45 & 3/45	12g x 90	2 or 3*	200	6400
2/58 & 3/58	14g x 100	2 or 3*	200	7100
2/65 & 3/65	14g x 125	2 or 3*	300	6000
* for beam depths ≥ 300 mm, use 3 rows of screws				
** Floor loads G = 1.25 kPa, Q = 2.0 kPa				

Table 2

Type 17 screw size	Min. edge distance (mm)	Min. end distance (mm)	Min. distance between screws (across the grain) (mm)
10g	30	50	20
12g	35	60	25
14g	40	70	30

Table 3

Beam depth (mm)	Min. number of screws required	
	At support	At either side of supported beam
90 –240	3	3
> 240	4	4

Multiple member lamination

3. Bolts

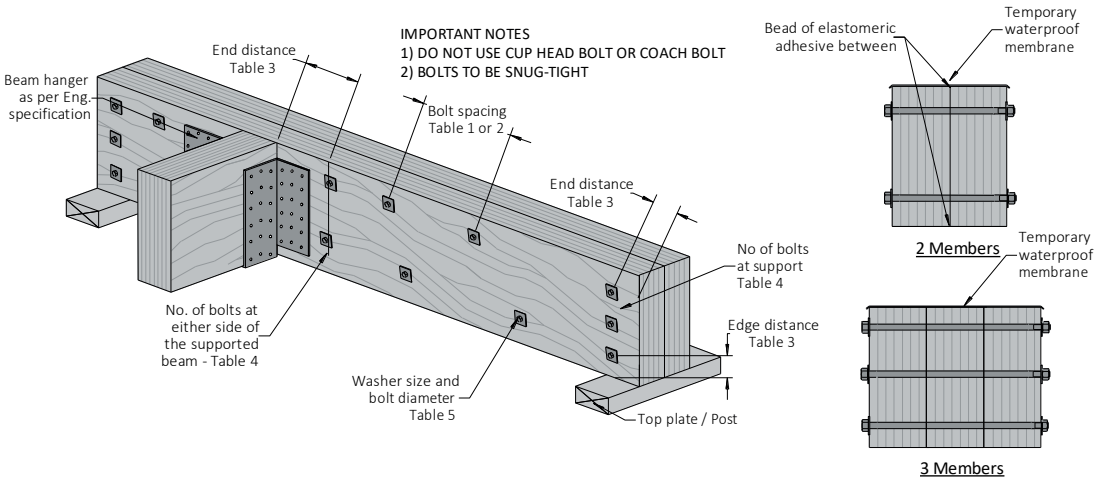


Table 1

Top (symmetrically) loaded beam - M12 Hex head bolt	
Beam depth ≤ 300 mm	**Beam depth > 300 mm**
2 rows of bolts at 300 mm ctrs	3 rows of bolts at 300 mm ctrs

Table 2

Side (Non symmetrically) loaded beam - M12 Hex head bolt		
Maximum floor joist span supported by the beam mm*		
2 rows at 600 mm ctrs	2 rows at 300 mm ctrs	3 rows at 600 mm ctrs
7200 mm	12,000 mm	10,800 mm

* based upon floor loads of G: 1.25 kPa Q: 2.0 kPa

Table 3

Bolt size	Min. edge distance	Min. end distance	Min. distance between bolts (across grain)
M12 Hex head	60 mm	60 mm	60 mm

Table 4

Beam depth (mm)	Min. number of bolts required	
	At support	At either side of supported beam
90 –150	1	1
160—240	2	2
> 240	3	3

Table 5

Bolt diameter (mm)	Washer dimensions		
	Thick-ness (mm)	Min. diameter of round washers (mm)	Min. side length of square washers (mm)
M12	3	55	50

SmartJoist/SmartRim® Characteristic blocking capacities

SmartRim®

SmartRim rimboard is an alternative solution to blocking with SmartJoists (either long length of cut to length) to support vertical and lateral wall loads as part of a floor or roof framing system.

SmartRim is a 19 or 21 mm LVL (2 veneers are cross laminated for stability) and is sold in 3.6 m lengths, precision ripped to match the height of the SmartJoist range up to and including 360 mm. (400 mm SmartRim in QLD only). Fixing of rimboard is described in detail in SmartJoists - GENERAL INFORMATION item 3 on page 9 of this Design Guide.

SmartRim has a joint strength group of JD4 on the wide face for nails, screws and bolts.

SmartJoist/SmartRim Characteristic capacity (see notes below)		
Vertical load capacity (kN/m) [1] [2]		**Horizontal load transfer capacity (kN/m) [3] [4]**
SmartJoist	SmartRim	6.9
29	21	6.9

1. Vertical load capacity above is for instantaneous load conditions and must be multiplied by the appropriate k_1 factor for load condition under consideration
2. Vertical load capacity above already includes the k_{12} factor for up to 400 mm depth as per clause I2.3 of AS 1720.1
3. Horizontal load capacity above is an instantaneous load condition, with the k_1 for lateral bracing loads usually 1.0
4. The above horizontal load capacity is limited by the fixing of the SmartJoist / SmartRim to the frame and can ONLY be achieve if the fixing detail on page 9 of this SmartJoist Design Guide is strictly adhered to.

Penetrations within SmartJoist and SmartRim

The maximum allowable hole size for a SmartJoist/SmartRim shall be ⅔ of the rim board depth as shown below.

The length of the SmartJoist/SmartRim segment containing a hole shall be at least 8 times the hole size.

SmartJoist hole sizes and minimum length

SmartJoist/SmartRim Depth (mm)	Maximum allowable hole size [a] [b] (mm)	Minimum length of SmartJoist/SmartRim board segment [c] for the maximum allowable hole size (mm)
200	130	1050
240	160	1280
300	200	1600
360	235	1900
400[d]	265	2100

(a) These hole provisions do not apply to SmartJoist/SmartRim installed over openings such as doors or windows
(b) The diameter of the round hole or the longer dimension of the rectangular hole
(c) The lengths of the SmartJoist/SmartRim segment per wall line. For multiple holes, the minimum length of SmartJoist/SmartRim segment shall be 8 times the sum of all hole sizes.

Application Notes

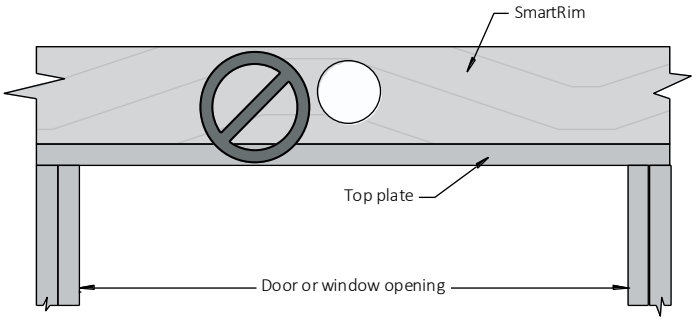
1. Do not cut holes in SmartRim installed over openings, such as doors or windows, where the SmartRim is not fully supported, except that holes of 40 mm or less in size are permitted provided they are positioned at the middle depth and in the middle ⅓ of the span (see note 5 for minimum hole spacing).

2. Field-cut holes should be vertically centred in SmartRim and at least one hole diameter or 150 mm whichever is less, clear distance away from the end of the wall line. Holes should never be placed such that they interfere with the attachment of the rim board to the ends of the floor joist, or any other code-required nailing.

3. While round holes are preferred, rectangular holes may be used providing the corners are not over-cut. Slightly rounding corners or pre-drilled corners with a 25 mm diameter bit is recommended.

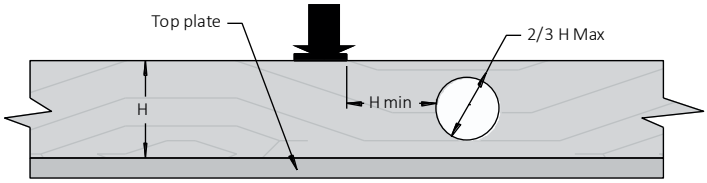
SmartRim over an opening

Do not cut holes in SmartRim over an opening except for holes of 40 mm or less in size (see note 1).



SmartJoist/SmartRim near concentrated vertical load

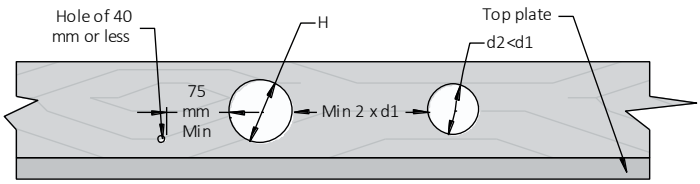
4. When concentrated loads are present on the SmartJoist/SmartRim (loads not supported by any other vertical-load-carrying members such as squash blocks), holes should not be placed in the SmartJoist/SmartRim within a distance equal to the depth of the SmartJoist/SmartRim from the area of loading.



5. For multiple holes, the clear spacing between holes shall be at least two times the diameter of the larger hole, or twice the length of the longest rectangular hole. This minimum hole spacing does not apply to holes of 40 mm or less in diameter, which can be placed anywhere in the rim board (see note 1 for holes over opening) except that the clear distance to the adjacent hole shall be 75 mm minimum.

Multiple holes for SmartJoist/SmartRim

6. All holes shall be cut in a workman-like manner in accordance with the limitations listed above.



Rafter cuts of SmartJoists

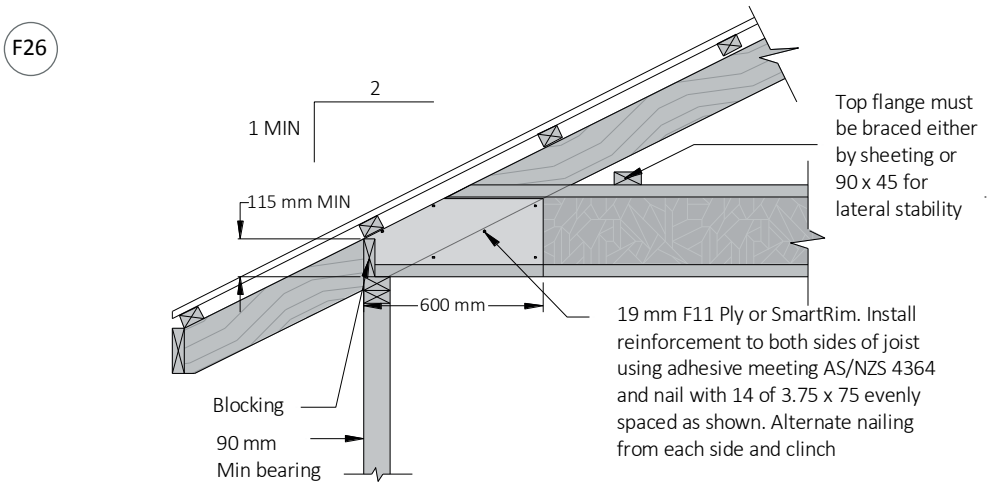
SmartJoists can be “rafter cut” but only within the limitation shown below.

Rafter cuts are limited to:

1) 115 mm MINIMUM end height
2) MINIMUM Roof Slopes of 1 in 2 (approximately 26.5^0),
   and
3) Must be blocked at the end to prevent rotation of the joist.

Joists without reinforcement are limited to design shear and end reactions up to 6.5 kN Ply reinforcement can be added to joists with rafter cuts to increase the shear and end reaction capacity of the joist. The detail below shows the proper installation of the reinforcement. With the reinforcement added, the end reaction and shear capacity increase to 12.7 kN

Duration of load increases are permitted as per AS:1720.1.



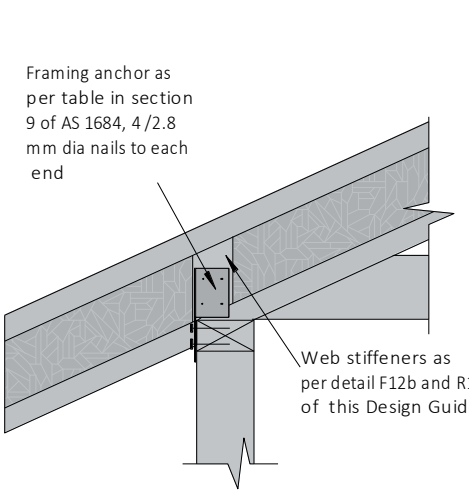
SmartJoist rafter tie-down

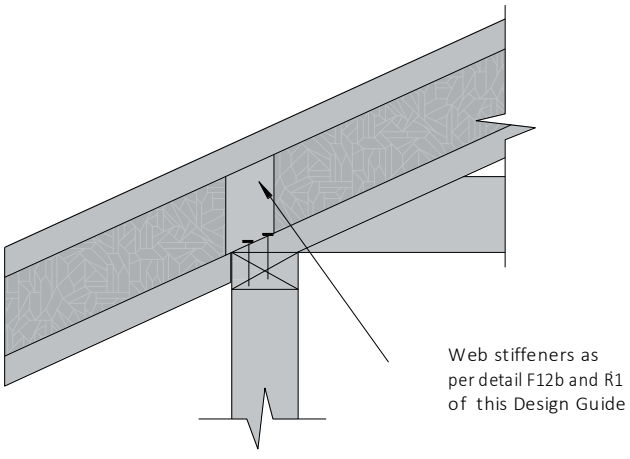
SmartJoist rafters need to be tied down in wind uplift situations in a similar manner to solid timber as shown in section 9 of AS 1684. it is beyond the scope of this document to show tie down requirements for every case.

The examples shown in this section are equally applicable to SmartJoists except that web stiffeners as per detail F12a and R1 must be installed to the SmartJoists where either skewed nails or framing anchors are chosen as the tie down method before the uplift capacities in the tables in section 9 of AS 1684 can be adopted.

All tie down types that involve a strap over the top of the SmartJoist rafters, or involving the bolting down of a member above the rafter running in the perpendicular direction, require no modification to the SmartJoist and therefore uplift capacities in the tables in section 9 of AS 1684 may be used.

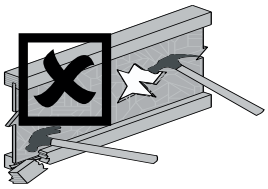
The SmartFrame software has a tie-down module in which the development of tie down systems complying with section 9 of AS 1684 can be easily designed.



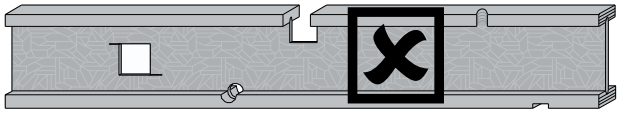


SmartJoist hole and duct charts

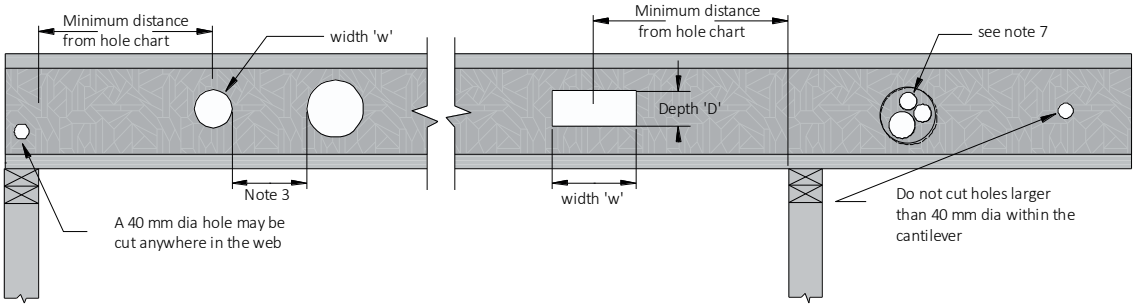
DON'T MAKE HOLES WITH HAMMER OTHER THAN PRE-PUNCHED KNOCKOUTS



DON'T HAMMER ON FLANGES AND DAMAGE JOINT



DO NOT CUT OR NOTCH FLANGES
DO NOT OVER CUT HOLES IN WEB



Note: The most accurate method to design the allowable web penetration size and distance from support for SmartJoists is to use the SmartFrame software. The table below will give conservative results in some instances. Also, advice on hole size and location may be obtained by contacting the Technical Support Helpline on 1300 668 690 or at techsupport@tilling.com.au.

Assumed loading (DL = 62 kg/m^2, FLL = 2 kPa, FPL = 1.8 kN)

Joist code	Joist span* (mm)	Joist spacing (mm)	Circular/square holes								Rectangular holes			
			Hole diameter/square hole width (mm)								Depth x wdth (mm)			
			75	100	125	150	175	200	225	250	125x150	150x300	175x350	200x400
			Minimum distance from any support to the centre of the hole (mm)											
SJ20044	600-999	300 to 600	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1500-1999		300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	2000-2499		300	600	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	2500-2999		300	800	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
	3000-3300		300	900	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
SJ24040	600-999	300 to 600	300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1500-1999		300	300	300	Span/2	ns	ns	ns	ns	750	Span/2	ns	ns
	2000-2499		300	300	300	Span/2	ns	ns	ns	ns	1000	Span/2	ns	ns
	2500-2999		300	300	500	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	3000-3500		300	300	800	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
SJ24051	600-999	300 to 600	300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1500-1999		300	300	300	Span/2	ns	ns	ns	ns	750	Span/2	ns	ns
	2000-2499		300	300	300	Span/2	ns	ns	ns	ns	1000	Span/2	ns	ns
	2500-2999		300	300	500	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	3000-3499		300	300	800	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	3500-3800		300	300	1000	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
SJ24070	600-999	300 to 600	300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	300	ns	ns	ns	ns	ns	300	ns	ns	ns
	1500-1999		300	300	300	Span/2	ns	ns	ns	ns	600	Span/2	ns	ns
	2000-2499		300	300	300	Span/2	ns	ns	ns	ns	900	Span/2	ns	ns
	2500-2999		300	300	500	Span/2	ns	ns	ns	ns	1250	Span/2	ns	ns
	3000-3499		300	300	800	Span/2	ns	ns	ns	ns	1500	Span/2	ns	ns
	3500-3999		300	300	1000	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	4000-4100		300	450	1100	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns

Assumed load (DL = 62 kg/m^2, FLL = 2 kPa, FPL = 1.8 kN)														
Joist code	Joist span* (mm)	Joist spacing (mm)	Circular/square holes								Rectangular holes			
			Hole diameter/square hole width (mm)								Depth x width (mm)			
			75	100	125	150	175	200	225	250	125x150	150x300	175x350	200x400
			Minimum distance from any support to the centre of the hole (mm)											
SJ24090	600-999	300 to 600	300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	300	ns	ns	ns	ns	ns	300	ns	ns	ns
	1500-1999		300	300	300	700	ns	ns	ns	ns	500	750	ns	ns
	2000-2499		300	300	300	1000	ns	ns	ns	ns	800	1000	ns	ns
	2500-2999		300	300	400	1150	ns	ns	ns	ns	1100	Span/2	ns	ns
	3000-3499		300	300	700	1400	ns	ns	ns	ns	1400	Span/2	ns	ns
	3500-3999		300	300	800	1550	ns	ns	ns	ns	1700	Span/2	ns	ns
	4000-4100		300	300	900	1600	ns	ns	ns	ns	1800	Span/2	ns	ns
SJ25551	600-999	300 to 600	300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1000-1499		300	300	300	ns	ns	ns	ns	ns	ns	ns	ns	ns
	1500-1999		300	300	300	Span/2	ns	ns	ns	ns	750	Span/2	ns	ns
	2000-2499		300	300	300	Span/2	ns	ns	ns	ns	1000	Span/2	ns	ns
	2500-2999		300	300	500	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	3000-3499		300	300	800	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	3500-3999		300	300	1000	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
	4000-4100		300	500	1200	Span/2	ns	ns	ns	ns	Span/2	Span/2	ns	ns
SJ25570	600-999	300 to 600	300	300	300	300	ns	ns	ns	ns	300	300	ns	ns
	1000-1499		300	300	300	300	ns	ns	ns	ns	300	500	ns	ns
	1500-1999		300	300	300	span/2	ns	ns	ns	ns	400	800	ns	ns
	2000-2499		300	300	600	span/2	ns	ns	ns	ns	700	1000	ns	ns
	2500-2999		300	300	900	span/2	ns	ns	ns	ns	1000	1300	ns	ns
	3000-3499		300	700	1300	span/2	ns	ns	ns	ns	1300	1600	ns	ns
	3500-3999		300	1100	1600	span/2	ns	ns	ns	ns	1700	1900	ns	ns
	4000-4300		300	1400	1800	span/2	ns	ns	ns	ns	1900	span/2	ns	ns
SJ30040	600-999	300 to 600	300	300	300	300	300	300	ns	ns	300	300	ns	ns
	1000-1499		300	300	300	300	300	300	ns	ns	300	500	Span/2	ns
	1500-1999		300	300	300	300	300	500	ns	ns	300	Span/2	Span/2	Span/2
	2000-2499		300	300	300	300	300	700	ns	ns	500	Span/2	Span/2	Span/2
	2500-2999		300	300	300	300	400	1000	ns	ns	900	Span/2	Span/2	Span/2
	3000-3499		300	300	300	300	600	1200	ns	ns	1300	Span/2	Span/2	Span/2
	3500-3999		300	300	300	300	900	1450	ns	ns	1750	Span/2	Span/2	Span/2
	4000-4100		300	300	300	400	1000	1500	ns	ns	Span/2	Span/2	Span/2	ns
SJ30051	600-999	300 to 600	300	300	300	300	300	300	ns	ns	300	300	ns	ns
	1000-1499		300	300	300	300	300	300	ns	ns	300	500	Span/2	ns
	1500-1999		300	300	300	300	300	500	ns	ns	300	750	Span/2	Span/2
	2000-2499		300	300	300	300	300	700	ns	ns	400	Span/2	Span/2	Span/2
	2500-2999		300	300	300	300	400	1000	ns	ns	800	Span/2	Span/2	Span/2
	3000-3499		300	300	300	300	600	1200	ns	ns	1200	Span/2	Span/2	Span/2
	3500-3999		300	300	300	300	900	1450	ns	ns	1600	Span/2	Span/2	Span/2
	4000-4300		300	300	300	400	1000	1600	ns	ns	1800	Span/2	Span/2	ns

SmartJoist hole charts (Cont'd)

Assumed load (DL = 62 kg/m^2, FLL = 2 kPa, FPL = 1.8 kN)

Joist code	Joist span (mm)	Joist* spacing (mm)	Circular/square holes								Rectangular holes			
			Hole diameter/square hole width (mm)								Depth x width (mm)			
			75	100	125	150	175	200	225	250	125x150	150x300	175x350	200x400
			Minimum distance from any support to the centre of the hole (mm)											
SJ30070	600-999	300 to 600	300	300	300	300	300	300	ns	ns	300	300	ns	ns
	1000-1499		300	300	300	300	300	300	ns	ns	300	500	Span/2	ns
	1500-1999		300	300	300	300	300	500	ns	ns	300	750	Span/2	Span/2
	2000-2499		300	300	300	300	300	700	ns	ns	400	1000	Span/2	Span/2
	2500-2999		300	300	300	300	400	950	ns	ns	700	1250	Span/2	Span/2
	3000-3499		300	300	300	300	600	1200	ns	ns	1000	Span/2	Span/2	Span/2
	3500-3999		300	300	300	300	900	1450	ns	ns	1400	Span/2	Span/2	Span/2
	4000-4499		300	300	300	500	1100	1700	ns	ns	1800	Span/2	Span/2	Span/2
	4500-4600		300	300	300	700	1200	1800	ns	ns	1900	Span/2	Span/2	Span/2
SJ30090	600-999	300 to 600	300	300	300	300	300	300	ns	ns	300	300	ns	ns
	1000-1499		300	300	300	300	300	300	ns	ns	300	400	Span/2	ns
	1500-1999		300	300	300	300	300	300	ns	ns	300	750	Span/2	Span/2
	2000-2499		300	300	300	300	300	600	ns	ns	300	950	Span/2	Span/2
	2500-2999		300	300	300	300	300	800	ns	ns	500	1200	Span/2	Span/2
	3000-3499		300	300	300	300	400	1100	ns	ns	800	1500	Span/2	Span/2
	3500-3999		300	300	300	300	700	1300	ns	ns	1200	1750	Span/2	Span/2
	4000-4499		300	300	300	300	950	1600	ns	ns	1600	Span/2	Span/2	Span/2
	4500-4900		300	300	300	500	1100	1800	ns	ns	1800	Span/2	Span/2	Span/2
SJ36045	600-999	300 to 600	300	300	300	300	300	300	ns	ns	Span/2	ns	ns	ns
	1000-1499		300	300	300	300	300	300	400	Span/2	300	300	Span/2	ns
	1500-1999		300	300	300	300	300	300	700	Span/2	300	600	Span/2	Span/2
	2000-2499		300	300	300	300	300	600	900	Span/2	300	800	Span/2	Span/2
	2500-2999		300	300	300	300	500	800	1200	Span/2	300	1100	Span/2	Span/2
	3000-3499		300	300	300	400	800	1100	1500	Span/2	300	1400	Span/2	Span/2
	3500-3999		300	300	300	600	1000	1300	1600	Span/2	400	1700	Span/2	Span/2
	4000-4499		300	300	600	900	1200	1500	1900	Span/2	800	2000	Span/2	Span/2
	4500-4900		300	300	700	1000	1300	1700	2000	Span/2	1100	2200	Span/2	Span/2
SJ36058	1000-1499	300 to 600	300	300	300	300	300	300	300	300	300	300	400	ns
	1500-1999		300	300	300	300	300	300	300	400	300	300	700	span/2
	2000-2499		300	300	300	300	300	300	300	700	300	550	900	span/2
	2500-2999		300	300	300	300	300	300	400	900	300	850	1200	span/2
	3000-3499		300	300	300	300	300	300	650	1200	300	1200	1500	span/2
	3500-3999		300	300	300	300	300	400	900	1400	300	1500	1750	span/2
	4000-4499		300	300	300	300	300	600	1100	1700	300	1800	span/2	span/2
	4500-5000		300	300	300	300	300	800	1400	1900	300	2200	span/2	span/2

SmartJoist hole charts (Cont'd)

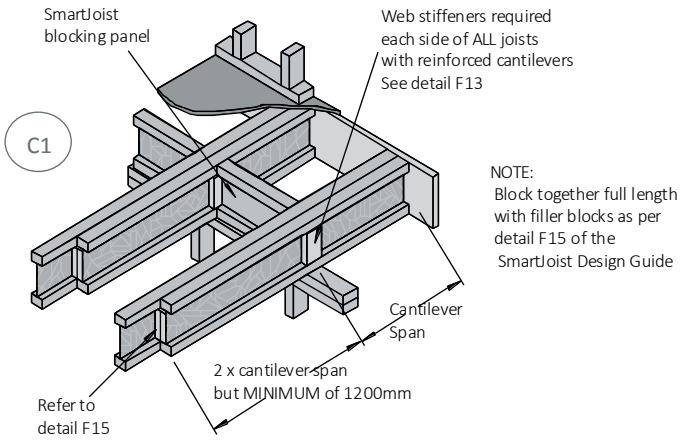
Assumed load (DL = 62 kg/m^2, FLL = 2 kPa, FPL = 1.8 kN)													
Joist code	Joist span (mm)	Joist* spacing (mm)	Circular/square holes								Rectangular holes			
			Hole diameter/square hole width (mm)								Depth x width (mm)			
			75	100	125	150	175	200	225	250	125x150	150x300	175x350	200x400
			Minimum distance from any support to the centre of the hole (mm)											
SJ40058	1500-1999	300 to 600	300	300	300	300	300	300	300	300	300	300	300	400
	2000-2499		300	300	300	300	300	300	300	300	300	300	300	700
	2500-2999		300	300	300	300	300	300	300	300	300	300	400	1000
	3000-3499		300	300	300	300	300	300	300	300	300	300	800	1300
	3500-3999		300	300	300	300	300	300	300	300	300	300	1100	1600
	4000-4499		300	300	300	300	300	300	300	300	300	500	1500	1900
	4500-4999		300	300	300	300	300	300	300	500	300	1000	1900	2300
	5000-5499		300	300	300	300	300	300	300	700	300	1600	2300	2600
	5500-6000		300	300	300	300	300	300	400	1000	300	1900	Span/2	Span/2
	1000-1499		300	300	300	300	300	300	300	300	300	300	300	300
	1500-1999		300	300	300	300	300	300	300	300	300	300	300	300
SJ40090	2000-2499	300 to 600	300	300	300	300	300	300	300	300	300	300	300	500
	2500-2999		300	300	300	300	300	300	300	300	300	300	300	800
	3000-3499		300	300	300	300	300	300	300	300	300	300	400	1100
	3500-3999		300	300	300	300	300	300	300	300	300	300	800	1400
	4000-4499		300	300	300	300	300	300	300	300	300	300	1100	1700
	4500-4999		300	300	300	300	300	300	300	500	300	300	1600	2100
	5000-5499		300	300	300	300	300	300	300	900	300	600	2000	2400
	5500-6000		300	300	300	300	300	300	400	1000	300	1300	2400	2800
	4500-4999		300	300	300	300	300	300	300	800	300	500	1700	2100
	5000-5499		300	300	300	300	300	300	400	900	300	1000	2000	2500
	5500-5700		300	300	300	300	300	300	500	1100	300	1200	2200	2750

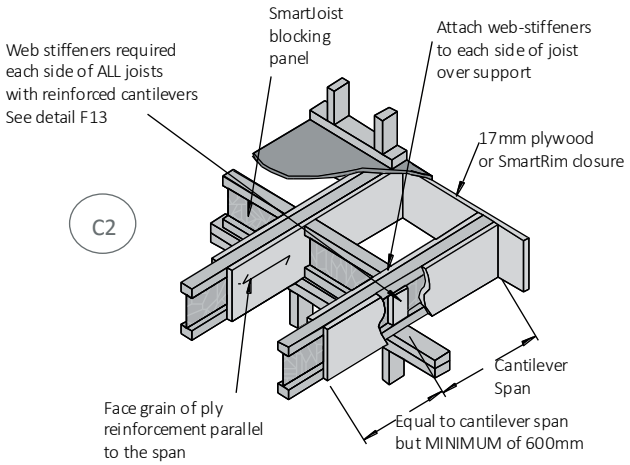
Notes:

1. The hole chart is generated on a maximum floor dead load of 62 kg/m^2 with no wall or roof loads. It therefore does not apply for joists supporting either parallel or perpendicular load bearing walls. These scenarios can be analysed by using the appropriate model within the SmartFrame software. Help can be obtained by contacting the SmartFrame Customer Helpline on 1300 668 690 or at techsupport@tilling.com.au
2. Hole locations are suitable for joist spacing's up to 600 mm centres. Holes may be permitted closer to supports for some members when spacing's of 450 or 300 mm are used
3. The clear distance between holes must equal or exceed twice the diameter of the largest hole, or twice the longest side of a rectangular hole and no more than 3 holes in excess of 75 mm are allowed in any span
4. Do not cut or damage flanges under any circumstances
5. Except as noted in 1 and 2 above, a 40 mm hole at a minimum of 450 mm centres is allowed to be drilled anywhere in the web EXCEPT in cantilevered spans
6. If possible, holes in web should be positioned mid height, minimum edge clearance from any flange is 6 mm
7. A group of round holes at approximately the same location shall be permitted if they meet the requirements for a single round hole circumscribed around them.

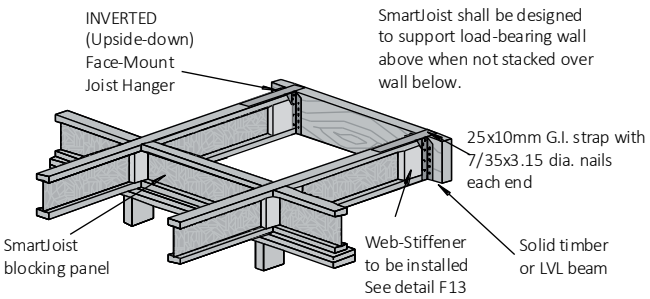
Example construction details for load bearing cantilevers

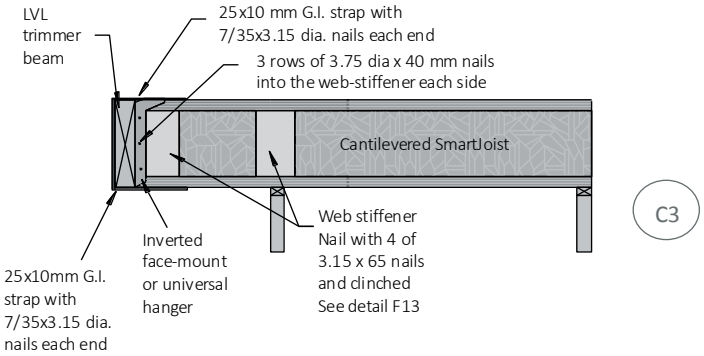
Note: Option 1 with cantilever reinforced with an extra SmartJoist is equivalent to option 2 with 2 sheets of plywood

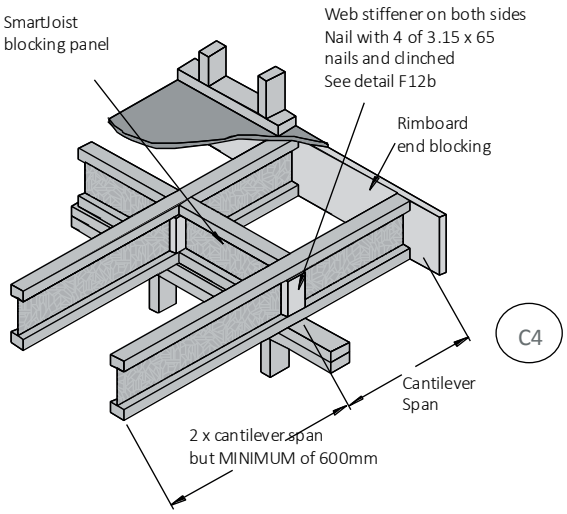




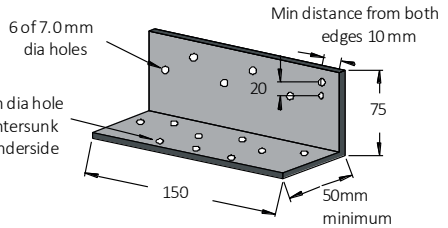
NOTE:
15mm F11 structural ply is required on one or both sides of the joist (See Tables). Depth shall match the full height of the Smartjoist. Nail with 3.15 x 65 nails at 100mm ctrs in a staggered pattern.

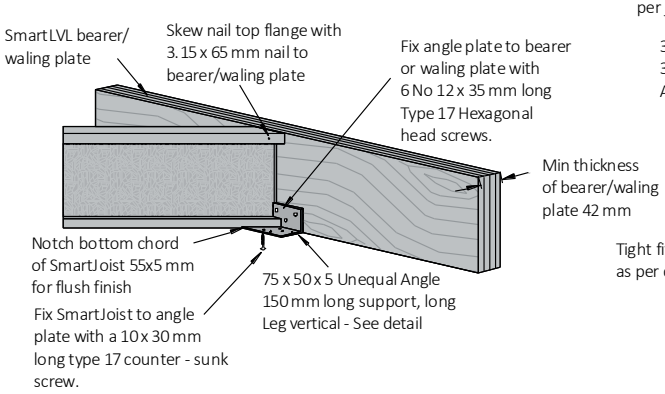


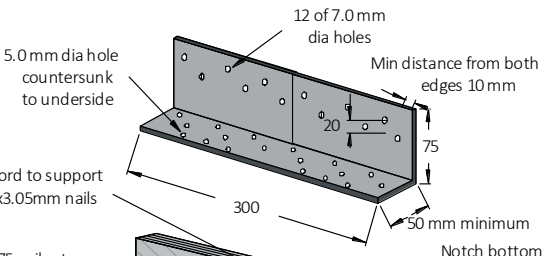


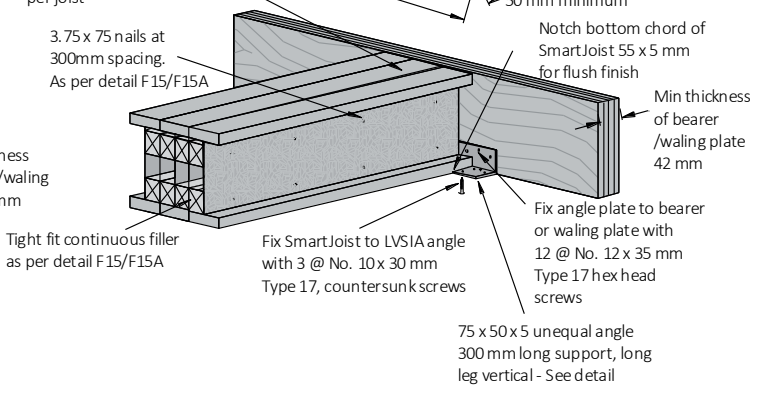


Oblique connection details

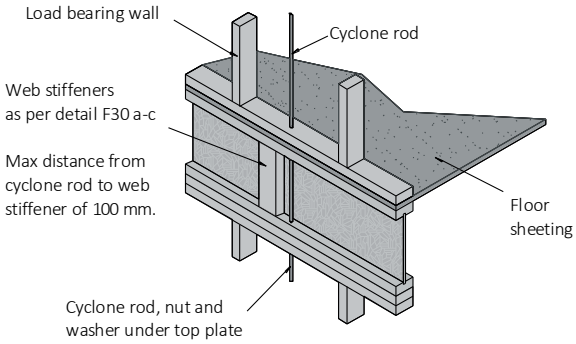






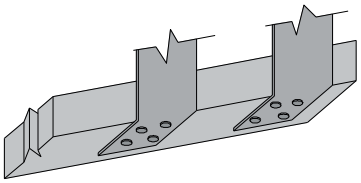


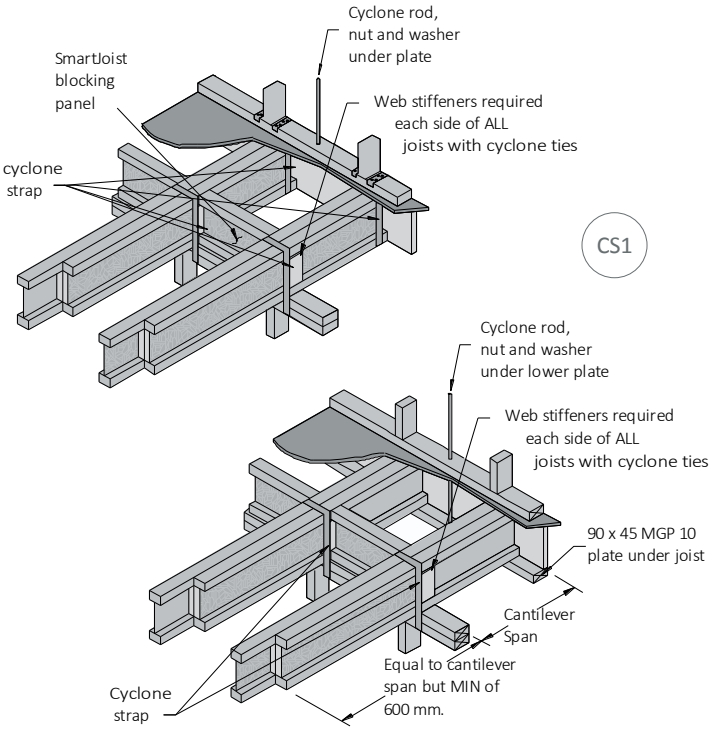
Cyclone rod tie down for cantilevered SmartJoist floors



Cyclone strap capacities

Where the strap ends of the cyclone strap are wrapped around the wall plate or other timber member and are fixed with 4 of 3.15 Ø x 35 nails, the design capacity $ØN_j$ of 15.3 kN is applicable, regardless of the timber joint group. Tests have proven that bending the legs of cyclone straps around the timber increases the ultimate load capacity.



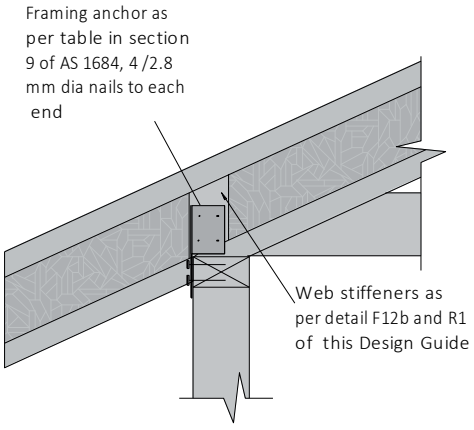


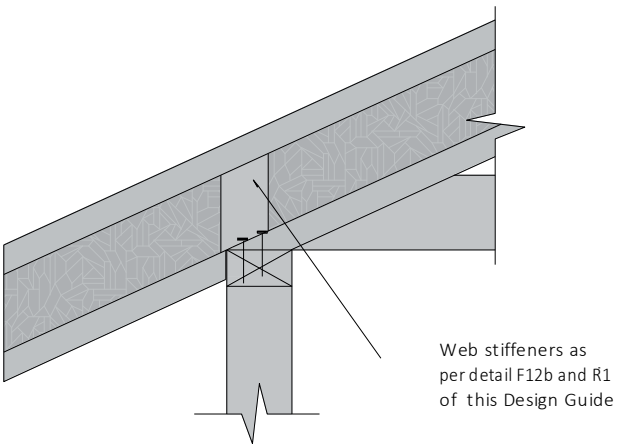
While double joists shown in the above diagram, it is only necessary when loads exceed the capacities of single joist cantilevers.

SmartJoist rafter tie-down

SmartJoist rafters need to be tied down in wind uplift situations in a similar manner to solid timber as shown in section 9 of AS 1684. The examples shown in this section are equally applicable to SmartJoists except that web stiffeners as per detail F13 and R1 must be installed to the SmartJoists where either skewed nails or framing anchors are chosen as the tie down method before the uplift capacities in the tables in section 9 of AS 1684 can be adopted.

All tie down types that involve a strap over the top of the SmartJoist rafters, or involving the bolting down of a member above the rafter running in the perpendicular direction, require no modification to the SmartJoist and the uplift capacities in the tables in section 9 of AS 1684 may be used.

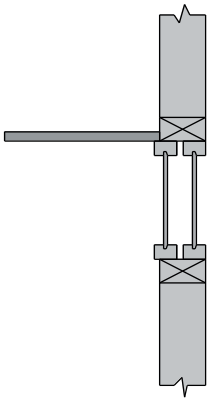




SmartJoists supporting parallel load bearing walls

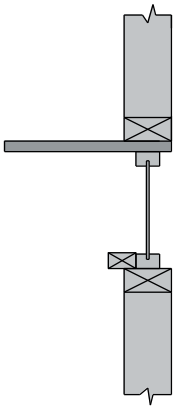
Fitted floors

Double SmartJoists required for fixing of floor and ceiling, and when required by table below
AND
for SmartJoists with 40 mm wide flanges

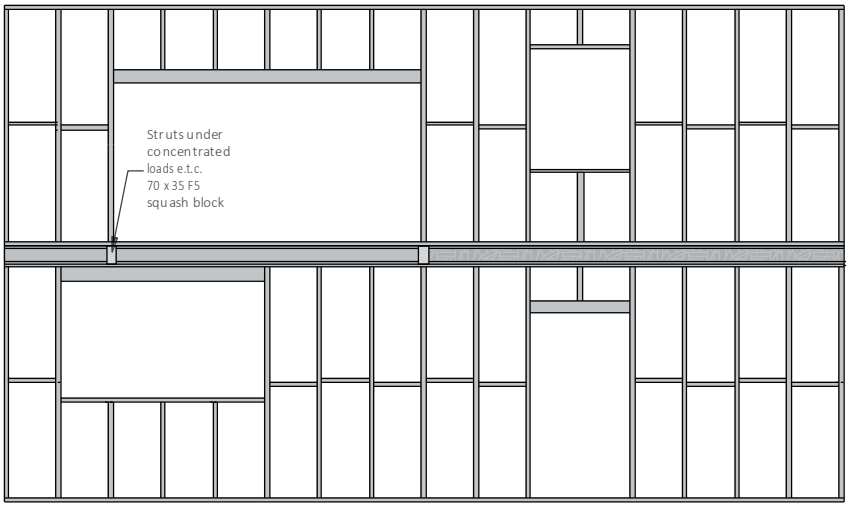


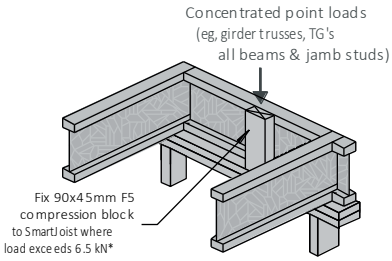
Platform floors

Single SmartJoist with flange > 50 mm may be used, but requires alternative fixing for ceiling.
NOT suitable for SmartJoists with 40 mm wide flanges e.g SJ 24040



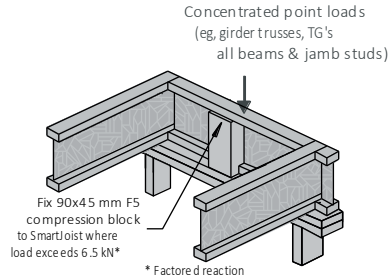
Joists continuously supported by lower walls





F30a

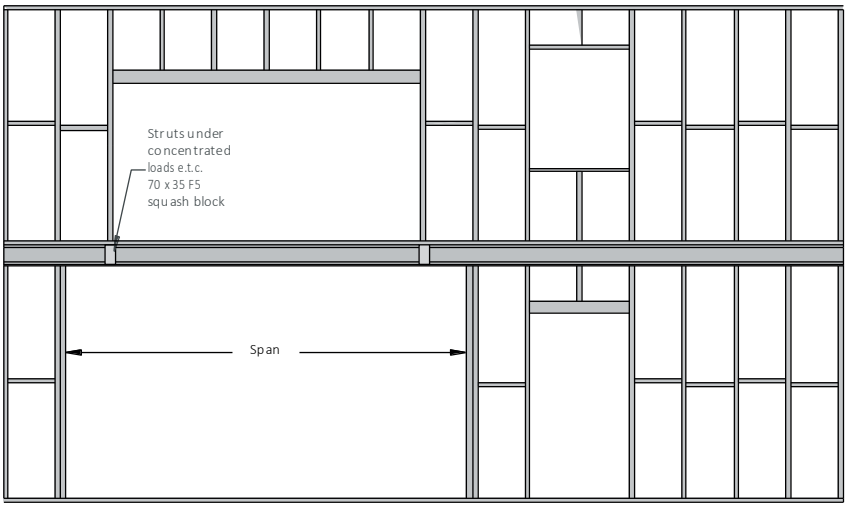
Single SmartJoists with flange width < plate width

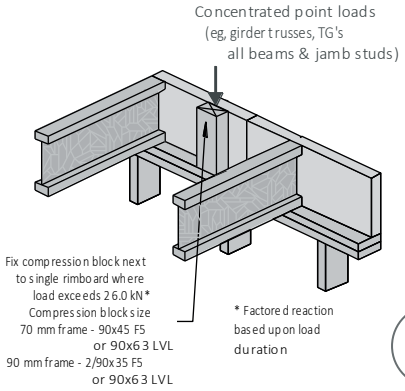


F30b

Single SmartJoists with flange width >= plate width

Joist non-continuously supported by lower wall





F30c

Single SmartRim

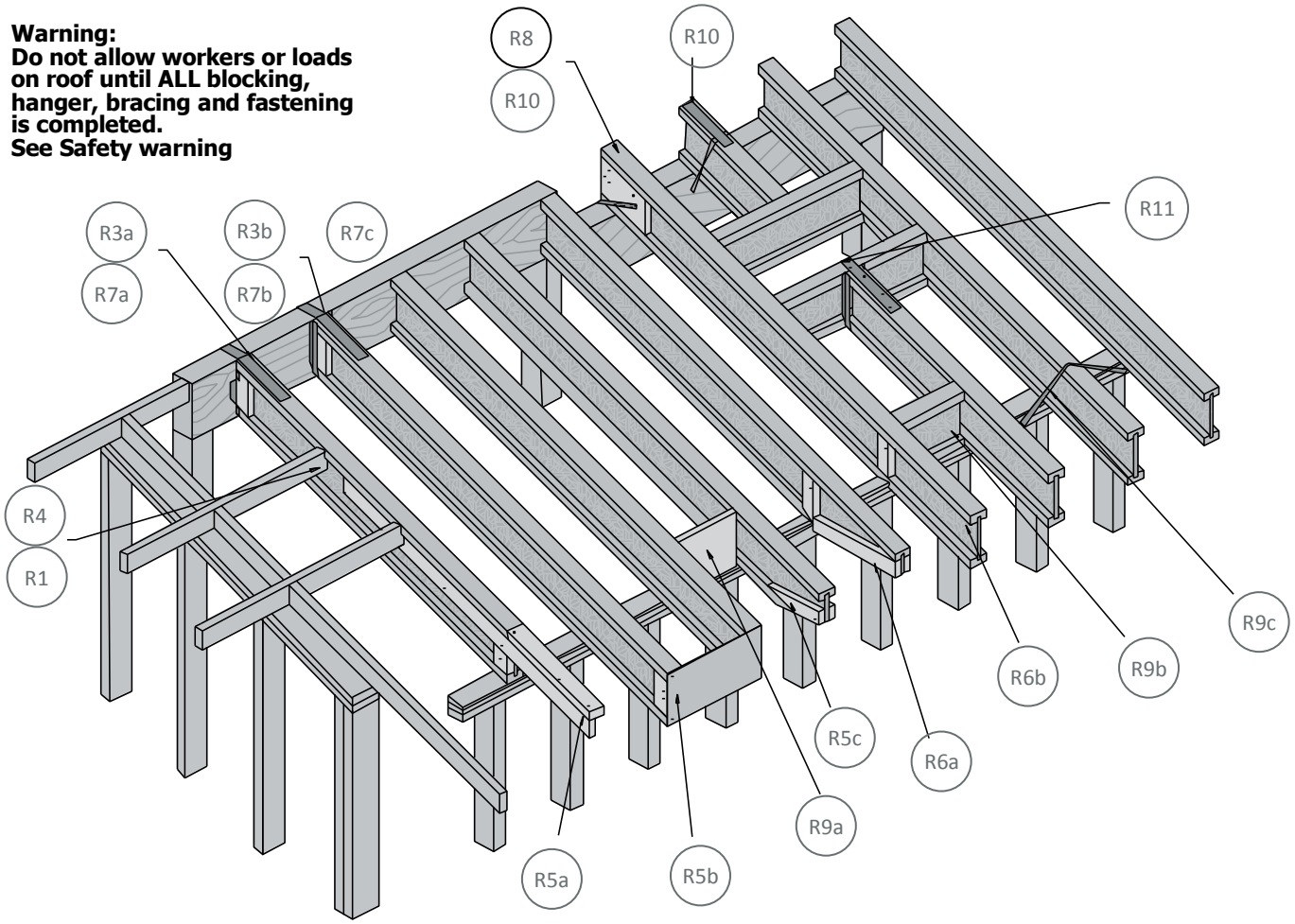
Single (and double) SmartJoists are adequate to transfer uniformly distributed compression loads up to 29 kN/m per joist from loadbearing walls to a continuous rigid support below.

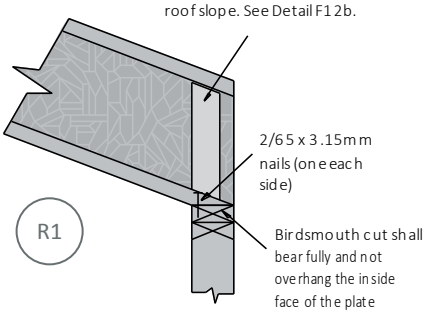
Detail F5 and F8 are used to transfer concentrated loads where walls are perpendicular to the joists. Details F30a, F30b and F30c above must be used to transfer concentrated loads through parallel SmartJoists where the instantaneous reaction exceeds 6.5 kN and exceeds 26.0 kN for single SmartRim (reaction needs to be factored for load duration)

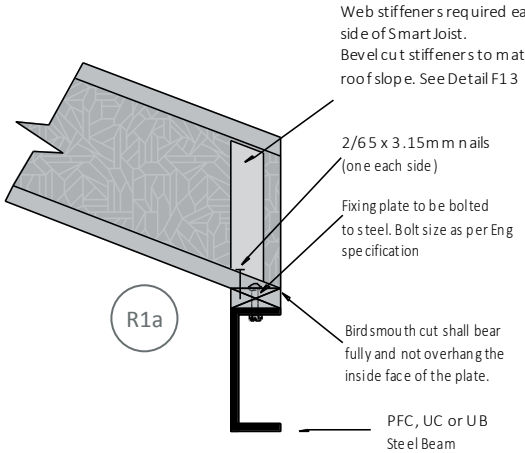
The table in the SmartJoist Design Guide gives allowable spans for single and double joists NOT continuously supported by a parallel wall. Care must always be taken to adequately support the web of the joists from concentrated point loads from above by adopting details F13.

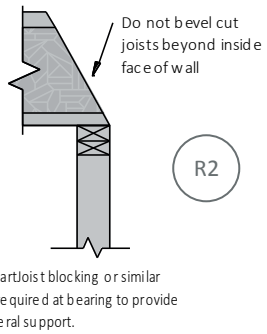
Typical SmartJoist Roof details

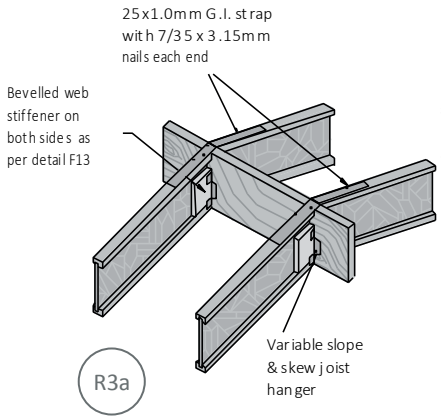
Warning:
Do not allow workers or loads on roof until ALL blocking, hanger, bracing and fastening is completed.
See Safety warning

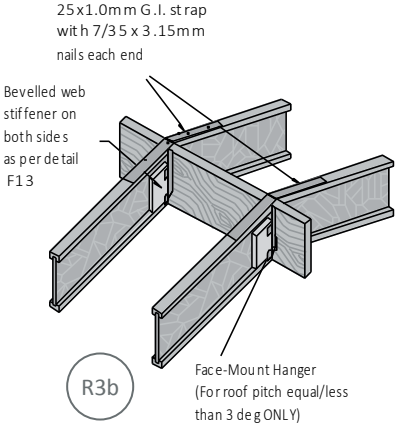


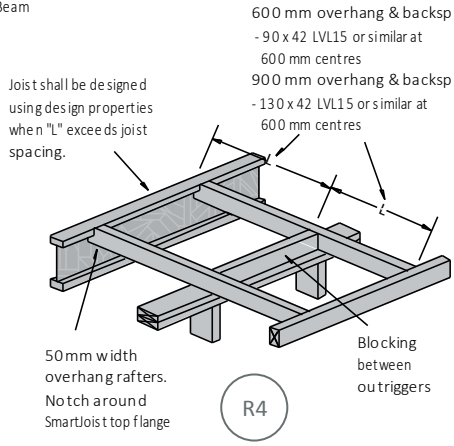






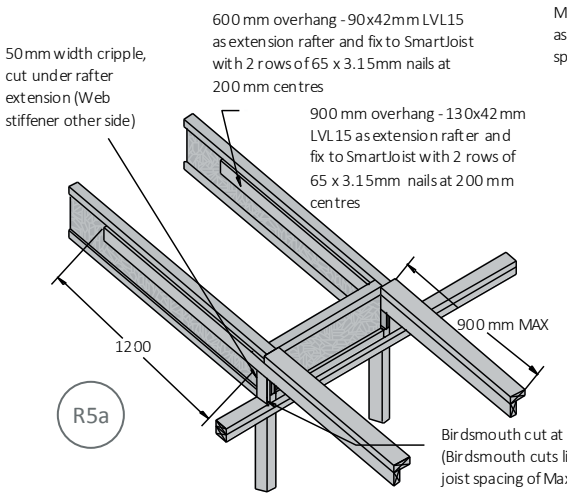


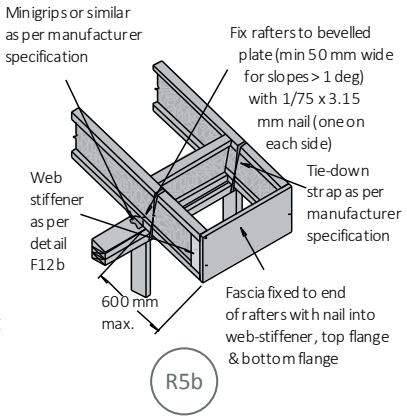


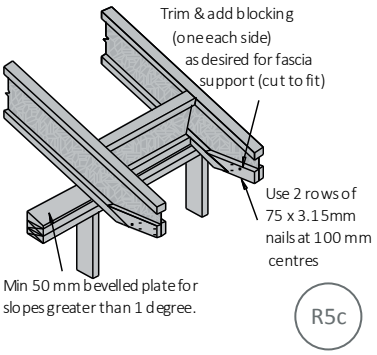


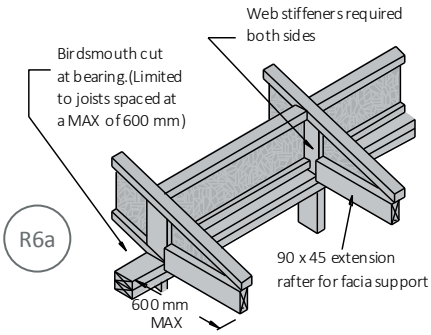
Note: Tie-down details to be designed to AS 1684.2 for the respective wind loads with the SmartFrame software

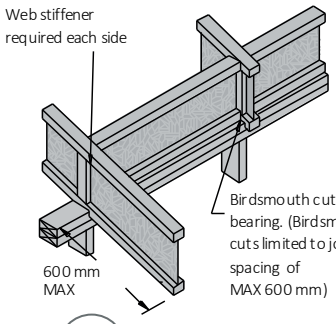
Typical SmartJoist roof details (cont'd)

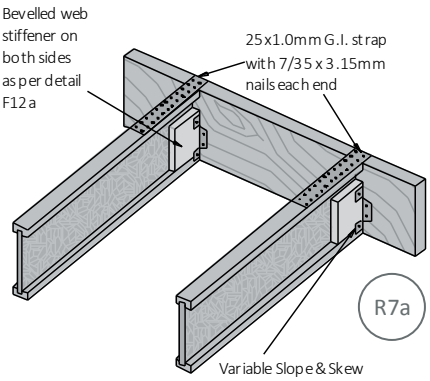


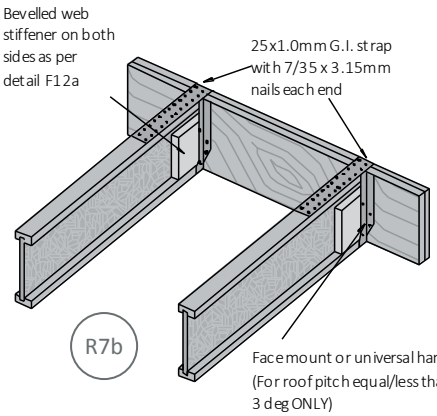


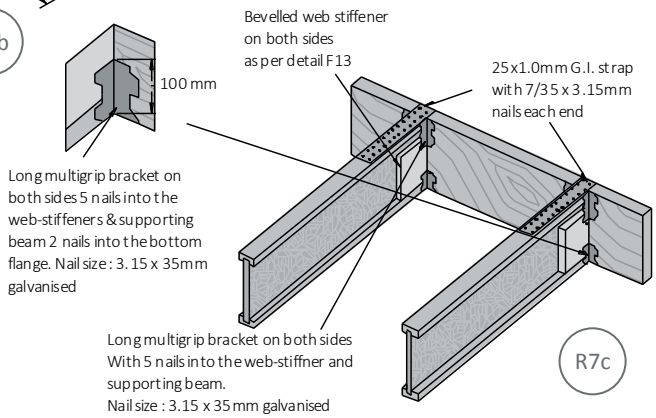




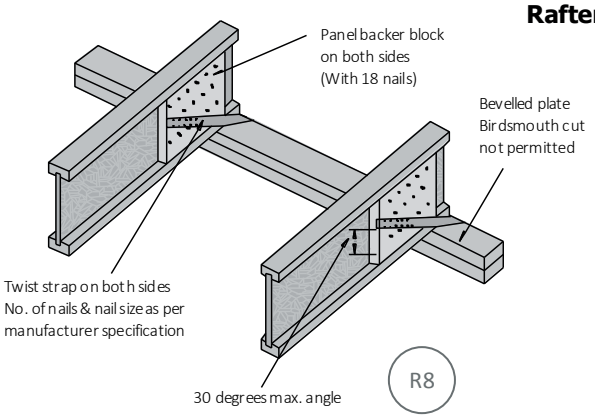


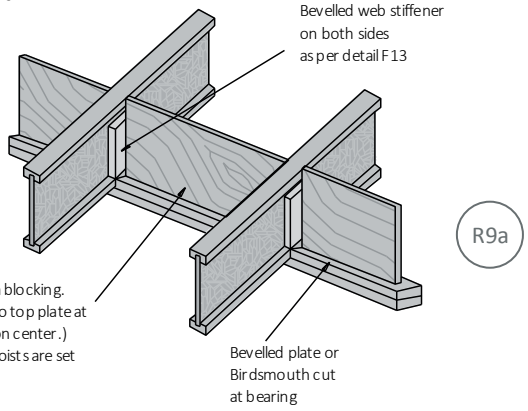




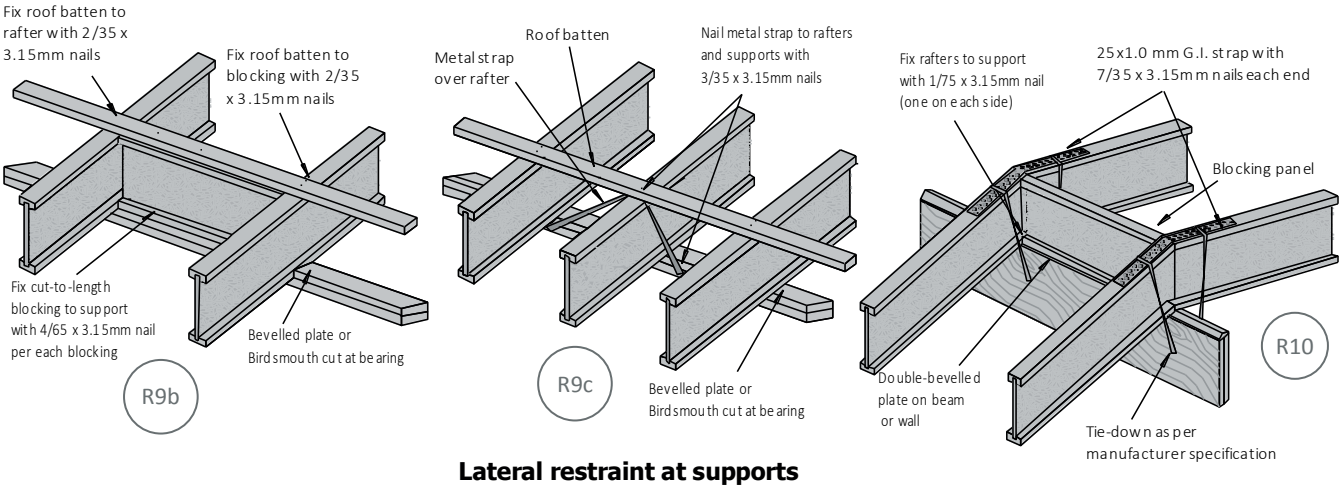


Rafter tie-down and blocking

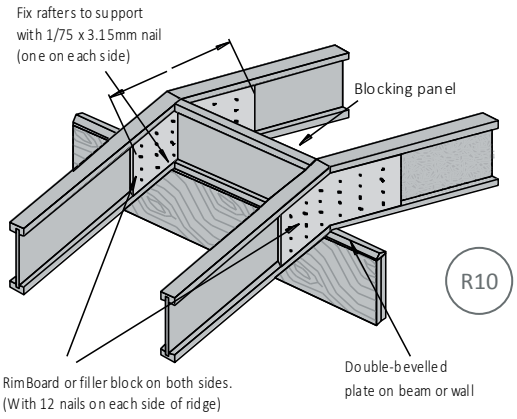


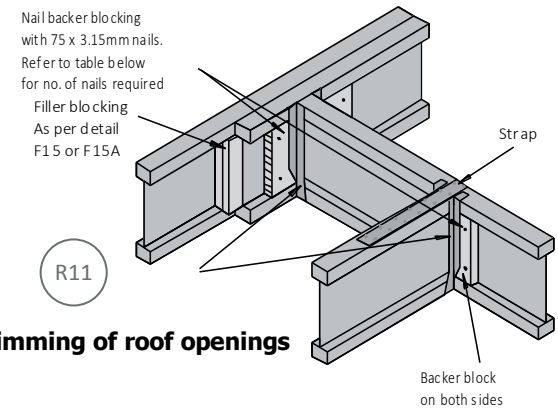


Typical SmartJoist Roof details (cont'd)

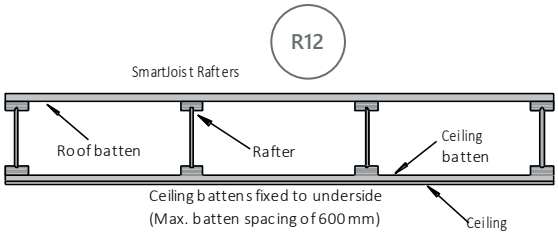


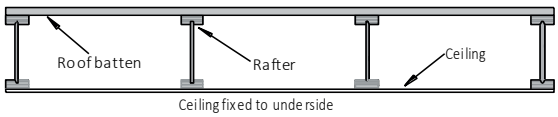
Lateral restraint at supports

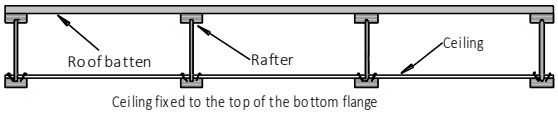




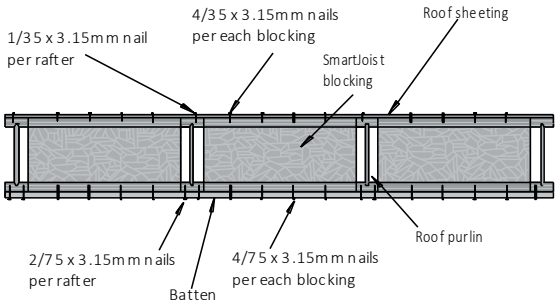
Trimming of roof openings



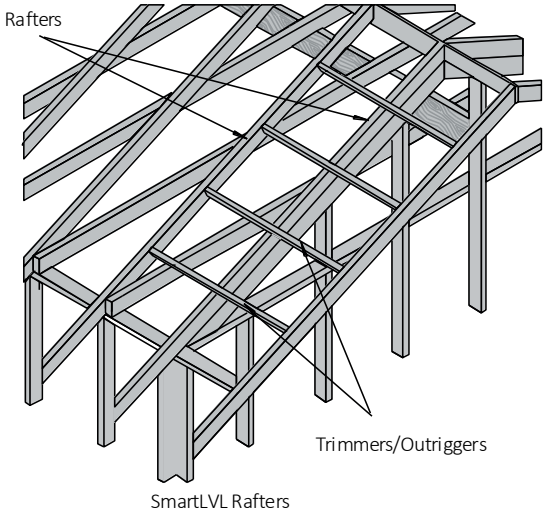




Lateral restraint for rafters -
Use of ceiling options to provide lateral support



Lateral restraint - SmartJoist blocking fixing



Outrigger rafters - LVL

Typical SmartJoist rafter box gutter rebate details

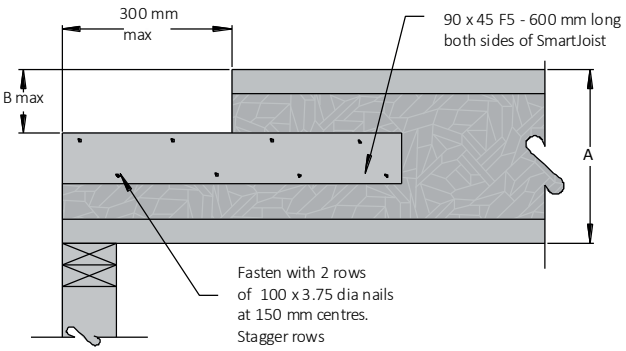
Box gutter rebates

Rebates for box gutters are permissible within a roof constructed with SmartJoist rafters to the MAXIMUM rebate limits as shown below.

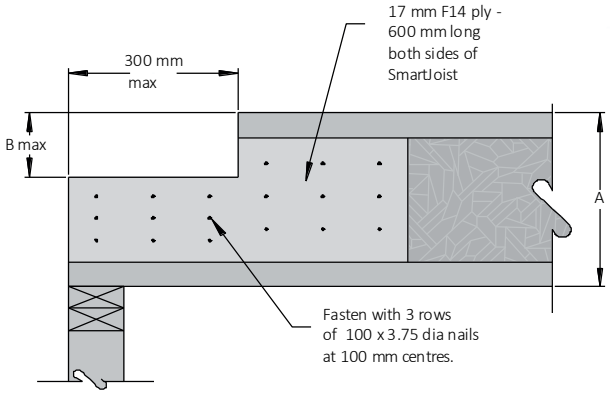
- Fig BG1 with 2 pieces of 90 x 45 nailed to the web reduces shear capacity by 40%
- Fig BG2 with 2 pieces of 17 mm F14 ply nailed to the web maintains full shear capacity

Given that the design shear values at the end of rafters with light weight roofs are usually very low compared to the allowable shear, in most instances fig BG1 is satisfactory to provide a box gutter rebate within the SmartJoist rafters, however the remaining shear capacity MUST be checked.

It is recommended that designers wishing to cut box gutter rebates in SmartJoist rafter contact the Technical Support Helpline on 1300 668 690 or at techsupport@tilling.com.au for further advice on this issue.



BG1



BG2

A = 200*, 240, 255 & 300 mm depth

B = 50 mm when A = 240 and 255 mm
B = 100 mm when A = 300 mm

200 mm - Requires ply infil, 90 x 45 solid timber reinforcement is not suitable

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