SpaceJoist™
METAL OPEN WEB FLOOR SOLUTION

TECHNICAL GUIDE

CONSTRUCTION PRODUCTS

ALPINE

GANG-NAIL

www.itwcp-offsite.co.uk

FIRE SPREAD RESISTANT SOLUTION

Category C Fire Solution

NEW SpaceJoist Category C open web joists support the ideal solution to reduce the risk of fire spread.

Approved by STA and HSE.

Contact 01252 551960, option 5 or email quote@itwcp.com for more information.

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ITW CONSTRUCTION PRODUCTS

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TECHNICAL MANUAL

Front cover image courtesy of Aber Roof Truss

ITW CONSTRUCTION PRODUCTS

ITW Construction Products is one of seven major divisions of the Illinois Tool Works family, innovating, designing and manufacturing advanced industrial technology.

With five brands all at the forefront of technology and enterprise for their respective markets, ITW Construction Products are committed to providing advanced trade solutions for professional users.

A leader in technology, research and development

ITW Construction Products are known for their problem solving nature, and as such always remain a leader in technology, research and development; a trait that enhances our interaction and relationship with our customer and generates increased productivity for our end users.

PART OF A GLOBAL COMPANY - ITW

ITW - We are everywhere. With over 12,000 active patents ITW's products and solutions are at work all over the world, in deep-sea oil rigs, aerospace technology, bridges and wind turbines, supporting commercial buildings, healthcare, the spaces in which we live and work, the construction of those spaces, the cars we drive, and the mobile devices we rely on. We are never, whether we know it or not, more than a few steps from an innovative ITW solution.

You are never more than a few steps from an innovative ITW solution

We are committed to operational excellence and systematic new product development that helps our customers create the products and services that make our lives better.

OUR ENGINEERED WOOD PRODUCT BRANDS

ALPINE

GANG-NAIL

CULLEN

OUR CONSTRUCTION FIXINGS BRANDS

Paslode

spit

Tel: 01252 551960

ALPINE AND GANG-NAIL

For over 50 years, Alpine and Gang-Nail have been specialists and world leaders in the development, manufacture and marketing of timber connecting systems, software and equipment for the production of floor and roof solutions.

Designing and manufacturing a succinct range of open web products, nailplates and providing the software to design rafter and floor solutions, Alpine and Gang-Nail are industry leading partners for fabricators, and provide superior expansive solutions for housebuilders.

Brands synonymous with reliability, quality and customer service

Becoming a part of ITW Construction Products in 2008, Alpine has benefited from the expertise and resources of a global corporation allowing them to grow, invent and create more than ever before. Joining ITW a few years later, Gang-Nail added further to the roster of expertise and diversity of product solutions available to an ITW CP customer.

INNOVATION

At ITW CP we follow a customer focused approach to new product development which allows us to research and interpret the true needs of our customers and their industry. Our product development begins on site, not in a lab.

Thanks to our dedicated focus on innovation, ITW CP adds new products to its offering which are true problem solvers for the industry.

Product development begins on site, not in a lab

Our state of the art research facility in Glenrothes, Scotland includes a timber conditioning chamber, test rig and computer controlled turret press for prototype work.

QUALIFIED TECHNICAL SUPPORT

You can be confident with ITW CP that you are fully supported with any purchase of our products.

With over 50 years of experience, our highly qualified staff can offer advice, perform engineering load calculations or organise on-site support visits. Available from 8.30am - 5:00pm Monday to Friday.

All our technical documents, product certifications, approvals and safety data is in line with relevant safety standards and readily available online at itwcp.com

Call 01872 245456 option 3 or email helpdesk@itwcp.com

CUSTOMER SUPPORT

Our dedicated team of customer service advisors are always available to take your calls.
They can assist you with:

- Processing your orders
- Answering questions and queries
- Provide pricing and delivery information
- Putting you in touch with the correct member of our organisation

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Get in touch with us today to see how we can assist you.

SpaceJoist™
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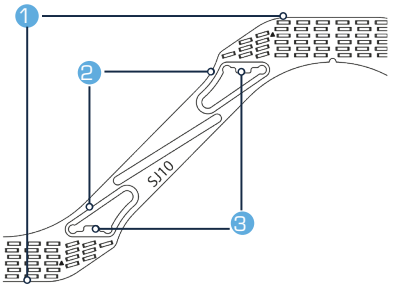
BENEFITS OF THE SPACEJOIST SYSTEM

Typically achieve greater maximum spans with less double webs and timber:

1. Extra teeth improve SpaceJoist stiffness and strength which reduces deflection
2. Burst-through holes increase web strength in compression
3. Contact tabs aid load transfer from webs to timber chords, increasing web capacity



Long Spans

Longer spans are achievable in comparison to solid timber. This may eliminate the need for intermediate load bearing internal walls, reducing a building's overall cost.

Reduced Wastage

Manufactured to size eliminates site alterations saving time on site.

Design Flexibility

SpaceJoist can be designed top hung to eliminate the rim board in timber frame construction, improving air tightness and reducing thermal bridging.

Less Timber and Fewer Webs

Tests show that the NEW SpaceJoist system requires less construction material, saving cost.

Sound Performance

SpaceJoist delivers outstanding acoustic performance to comfortably pass English and Welsh 40dB regulations. It even complies with the more stringent 43dB Scottish regulations without additional insulation, plasterboard or resilient bars. When tested with additional 100mm Rockwool insulation it achieves 44dB to meet Scottish Building Regulation Silver Standard.

Fire Performance

NEW SpaceJoist Category C open web floor solution is approved by the Structural Timber Association (STA) in their product paper 4 as an acceptable option to achieve a fire robust solution during the construction process.

Easy to Handle

Now even lighter, the lightweight construction makes SpaceJoist easy to individually move on site without the need for crane hire. Alternatively, floor and roof sections (cassettes) can be delivered to site and craned into position to save build time.

Wide Nailing Surface

Fixing of floor and ceiling materials is simpler and quicker due to the minimum chord width of 72mm.

Highly Engineered

SpaceJoist are manufactured off-site ensuring consistent quality and reliability.

Open Web Design

Fast and simple installation of services, without the need for drilling or notching. Joists can accommodate large services such as mechanical heat recovery systems.

Attic Bottom Chords

SpaceJoist can be incorporated into attic truss bottom chords to achieve greater spans, deeper insulation and provide a service void.

EC5 - GENERAL GUIDELINES

Eurocode 5 (EN 1995-1-1)

Currently timber designs in the UK can be carried out using national standards BS 5268 part 2 & 3 or using BS EN 1995-1-1.

In Ireland designs are carried out using IS EN 1995-1-1.

Eurocode 5 (EC5) is the harmonised European Standard covering the design of timber structures.

The purpose of the Eurocodes is to establish a common set of standards for the design of buildings across all European member states, although each member can have its own National Annex which is used in conjunction with the Eurocodes for design.

European technical approvals

All metal web joists are tested to meet the requirements of ETAG 011 (Guideline for European Technical Approval). Once completed, ETA-08/0370 was issued to ITW and this enables the completed SpaceJoist beam to be CE Marked.

What does this mean for SpaceJoist designs?

BS designs currently use permissible stress, whereby the failure load of the material or product has a safety factor applied to achieve a safe working load.

EC5 designs use ultimate limit state, whereby the material or product is given a characteristic load rating (effectively its failure load), and the loads are factored up to achieve a similar result as BS designs. This allows for more modification factors to be used, mainly for load duration.

You will often see load tables for hangers etc. stating both safe working loads and characteristic capacities.

EC5 also creates more design cases so design time can be increased. It groups these under 'Ultimate Limit State' (ULS) and 'Serviceability Limit State' (SLS). Essentially, ULS checks whether the structure will collapse under peak loads, whilst SLS checks that any brittle finishes like plasterboard will not crack.

Historically, BS floor designs have been limited in deflection to span/333, up to a maximum of 14mm when Strongback Bridging is used. EC5 designs use span/250 with no maximum, but require a vibration check to ensure the joist is not too bouncy.

The vibration check allows for a 1 kN point load (foot fall or heel drop) to be applied centrally to a floor span, and the deflection in this loadcase is limited to 1.8mm for spans ≤ 4000mm, and 16500/(Joist Length)$^{1.1}$ for spans > 4000mm. So, the longer the joist, the smaller the deflection permitted under this check to ensure joists are stiff enough to prevent excessive vibration, which is the main source of noise from a floor structure.

What does this mean for connections?

Timber to Timber Connectors (e.g. UH hanger)

$$\text{Design Value} = \frac{(F_k \times K_{mod})}{\gamma_m}$$

F_k = Characteristic Value

K_{mod} = Modification factor for duration of load and moisture content (Medium term 0.8 - EN 1995-1-1 table 3.1)

γ_m = Partial factors for material properties and resistance (1.3 for connections - EN 1995-1-1 table 2.3)

Looking at a standard Cullen UH hanger, the Characteristic Capacity is 13.23kN. Applying the above factors, the design value of this hanger is (13.23 x 0.8)/1.3 = 8.14kN.

Timber to Masonry Connectors (e.g. JHI hanger)

$$\text{Design Value} = \frac{F_k}{\gamma_m}$$

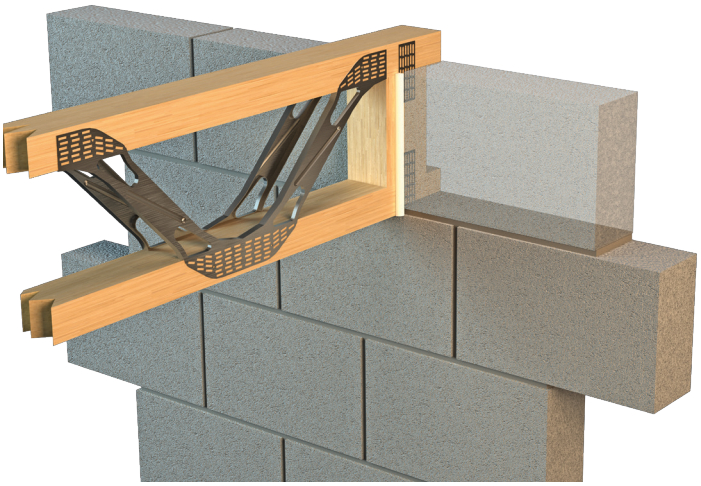
F_k = Characteristic Value

γ_m= Partial factors for material properties and resistance (1.5 for masonry - EN 845-1)

Looking at a standard Cullen JHI hanger, the Characteristic Capacity is 13.97kN (3.5N/mm² masonry strength). Applying the above factors, the design value of this hanger is 13.97/1.5 = 9.31kN.

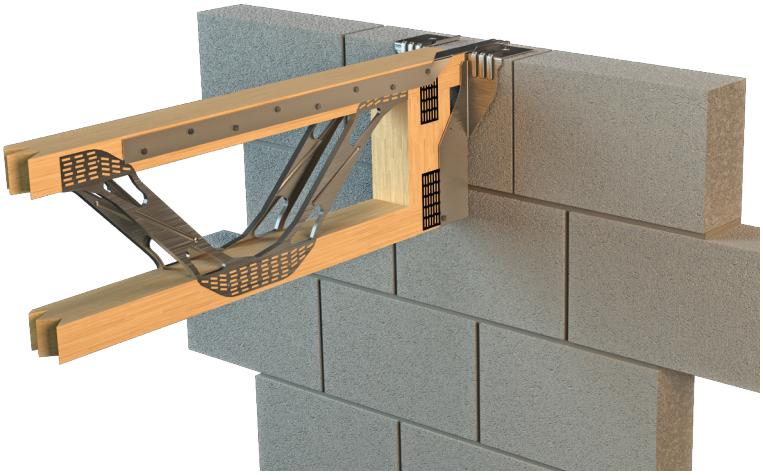
STANDARD DETAILS

SD1 - Horn for Airtightness



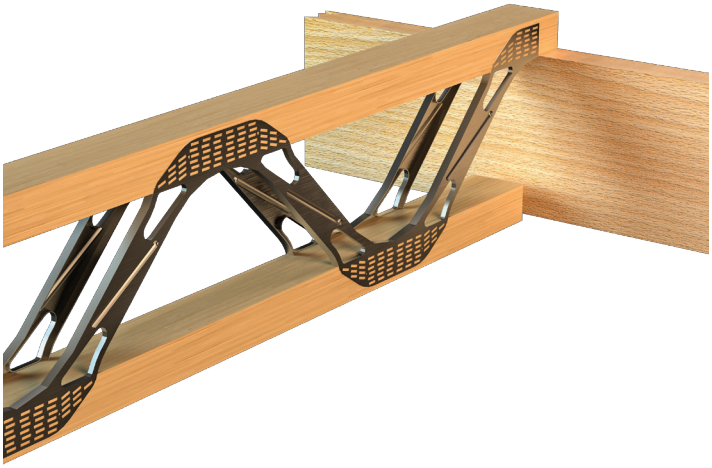
Part L Building regulations require houses to be airtight. Use the horn detail for easier sealing to brickwork with silicon sealant. Mortar to be struck first.

SD2 - Hanger Support onto Masonry



Hangers allow joists to be supported on brickwork. 3 courses or 675mm fully cured brickwork above to achieve maximum load rating. (PST strap provides restraint to wall, if needed.)

SD3 - Top Chord Support



Used mainly in timber frame, but also to trim around openings. Metal web needs to start from face of support.

SD4 - Hanger to Joist

Use correct sized face fix hanger for open web joists, e.g. Cullen UH hanger.

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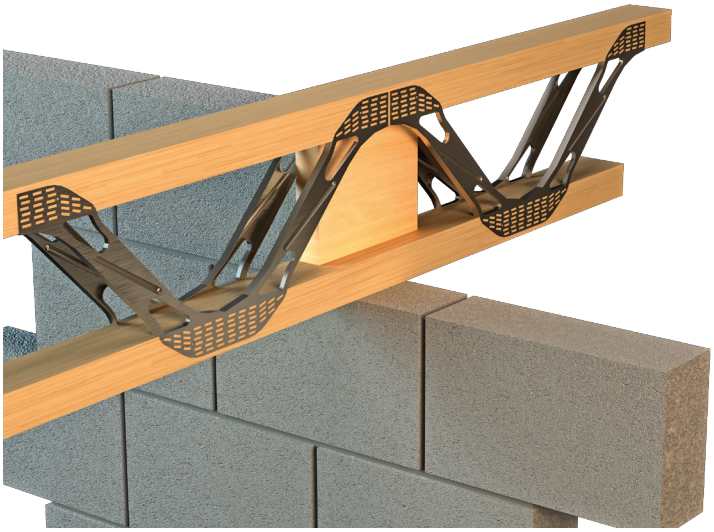
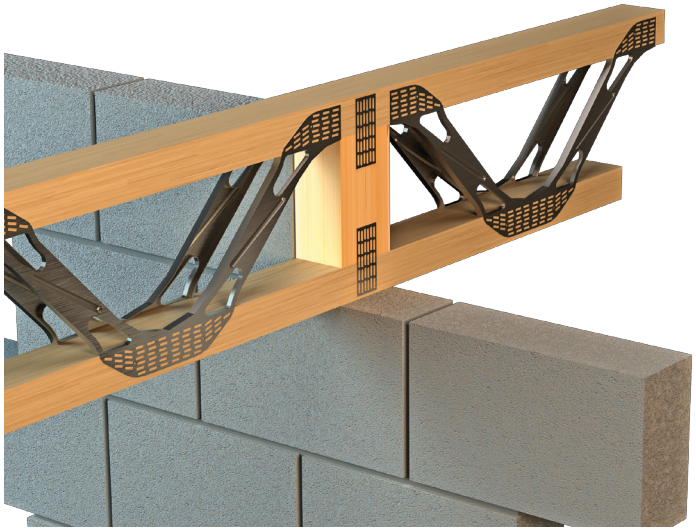
SD5 - Internal Bearing - Long Block



Allows for slight tolerance on wall position.

SD6 - Internal Bearing - Plated Verticals

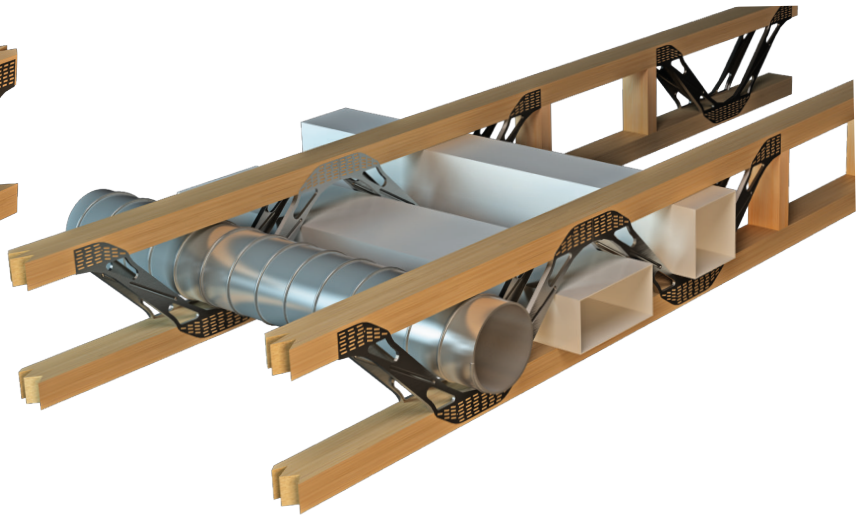


Less tolerance but easier to manufacture.

SD7 - Internal Bearing - Pocket

Use when continuous beam required over raised bearing.

SD8 - Aperture Details



Web	Depth	Circular	Rectangular		Square	Max height
TW8	195	120	73	208	107	125
SJ9	219	120	75	210	105	125
SJ10	254	154	97	208	133	158
SJ12	304	192	121	215	155	209
TW14	375	252	160	283	204	285
TW16	425	265	178	264	212	330

Dimensions shown in mm.

These dimensions include a 3mm clearance. Dimensions are approximate as discrepancies may occur in manufacture.

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SD9 - Strongback with Chase Verticals

Strongback typically attached to chase verticals. Minimum size 35 x 97mm TR26. Nail using 3 No. 3.1 x 90mm nails.

SD10 - Strongback with Additional Verticals

Strongback can be attached to additional verticals. Minimum size 35 x 97mm TR26. Nail using 3 No. 3.1 x 90mm nails.

SD11 - Strongback with Nailer Blocks

Additional verticals can be attached to the face of the joist to allow fixing. Minimum size 35 x 97mm TR26. Nail using 3 No. 3.1 x 90mm nails.

SD12 - Strongback Joined on Additional Verticals

If Strongback is to be lapped, it is over a minimum of 2 joists.

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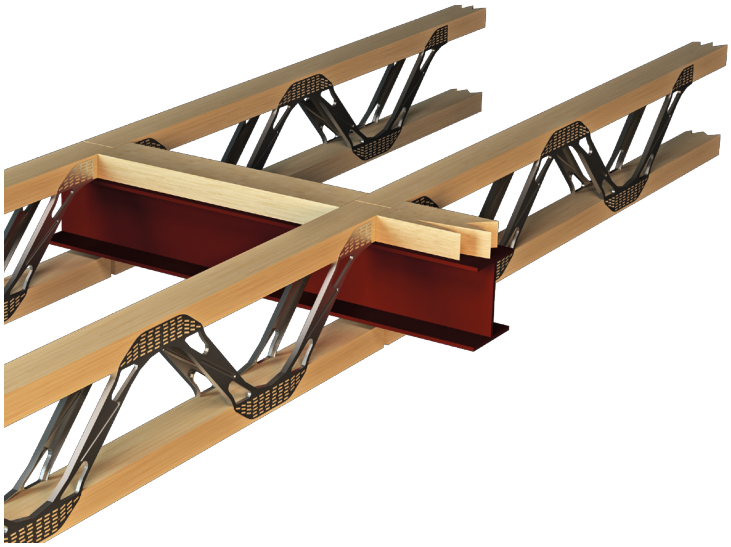
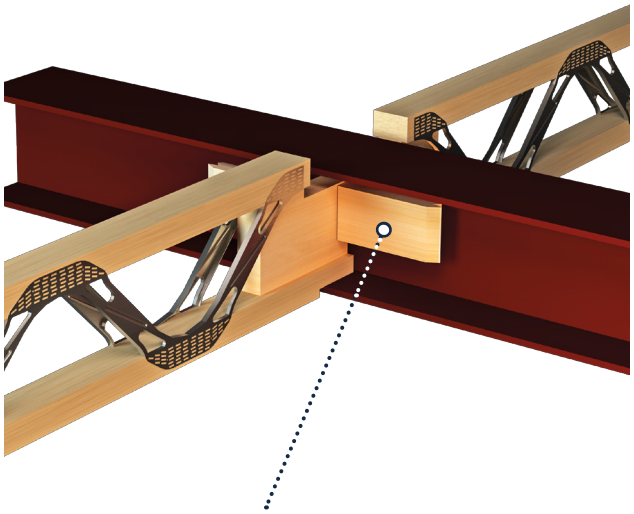
SD13 - Top Chord Support onto Steel



Use noggins between joists to prevent movement.

SD14 - Notching into Steel

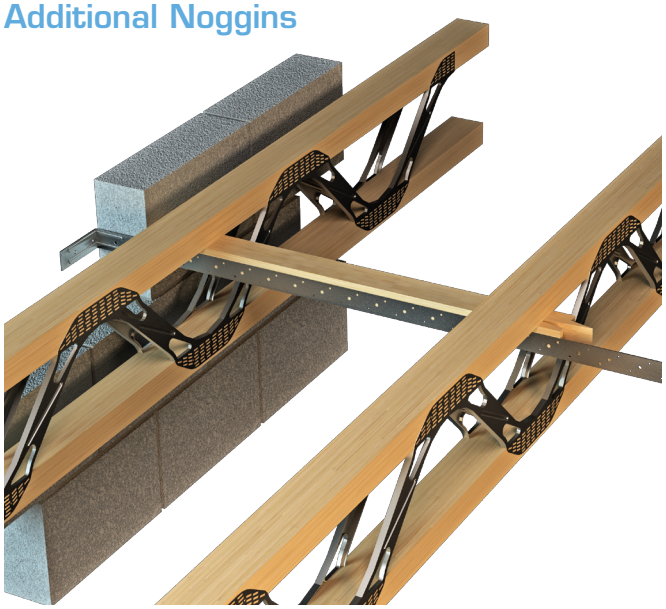


35 x 97mm solid blocking nailed between joists each side of beam.

Note: All nails to be 3.35 x 90mm long wire nails.

Bottom chord notched to allow plasterboard to run through (max. 15mm). Top chord notched accordingly. Use trimmable end detail and noggins between joists to prevent movement.

SD15 - Restraint Strap with Additional Noggins



Restraint straps use additional 72 x 47mm noggins if no Strongback near. Noggin/Strongback to span over minimum 3 joists.

Strongback and restraint strap requirement

Span	Strongback bridging	Restraint straps required
<4m	Non required	1
4-5m	1 piece	2
5-6m	2 pieces	2
6-7m	2 pieces	3
7-8m	3 pieces	3

SD16 - Restraint Strap with Chase Verticals

Restraint straps for masonry support can be attached to the side of the Strongback bridging if position is correct.

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TIMBER FRAME DETAILS

TF1 - Standard Bottom Chord Support - External Wall

TF2 - Standard Bottom Chord Support - Party Wall

Traditional arrangement for bottom chord supported joists on normal height panels. Rim board around outside closes off floor zone. Solid blocking in between joists provides support for panel above.

Decking will typically extend to back of rim boards to tie these in with the floor.

TF3 - Top Chord Support on Over-height Panel - External Wall

TF4 - Top Chord Support on Over-height Panel - Party Wall

Top chord supported joist eliminates the use of a rim board, but requires panels to be higher. Solid noggins on top of panel in between joists to provide support for panel above. Plasterboard needs to extend to top of panel, hence bottom chord held back.

Decking will typically extend to back of panel to tie these in to the floor.

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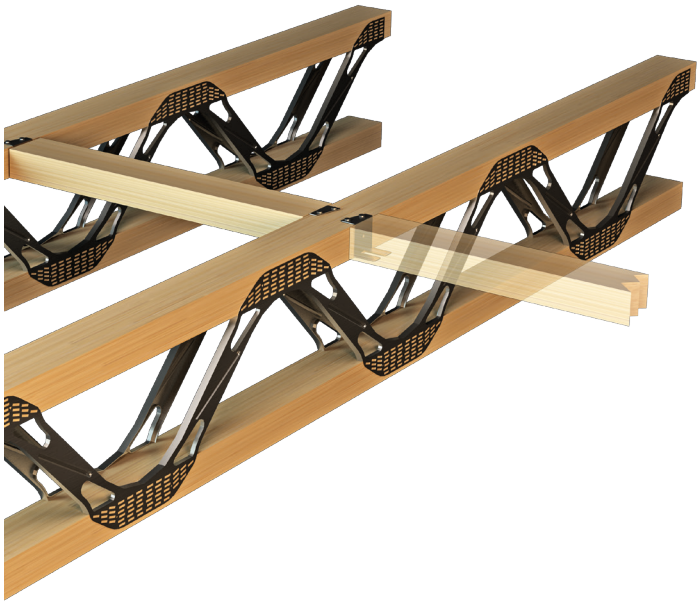
TF5 - Top Chord Support on Standard Panel with Rim Boards - External Wall

TF6 - Top Chord Support on Standard Panel with Rim Boards - Party Wall

Standard height panel, top chord supported joist. Rim board makes up the difference in height. Rim boards spaced apart on outer edges of panel. Solid noggins on top of rim board in between joists to provide support for panel above.

Decking will typically extend to back of noggins/end of joist to tie panels in with the floor.

SD17 - UZ-Clips



Noggins supported in clips provide local support for decking.

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CASSETTES

Cassettes are a method of off-site construction that lend themselves to timber frame construction, where typically there is a crane on site. They effectively move the labour element from the building site to the factory, where quality can be better controlled.

The four main variations of joining cassettes are shown below:

CD1 - Decking oversails to next cassette edge joist, joined along centre of joist

Pros: Minimum number of joists. Working deck safe once landed.

Cons: Decking oversail has potential to be damaged in transit. Cassettes need landing in correct order.

CD2 - Decking stopped at each cassette edge joist, infill strip used

Pros: Minimum number of joists.

Cons: Infill strip needs fitting before working deck is safe. More cutting required to supply strips and onerous to fit. Infill strip max width = 400mm.

CD3 - Adjacent joists, decking with small oversail

Pros: Working deck safe once landed.

Cons: Additional joist needed in every cassette. Cassettes need landing in correct order.

CD4 - Adjacent joists, no oversail

Pros: Working deck safe once landed.
Easy to land - cassettes simply land together, no order needed.

Cons: Additional joist needed in every cassette.

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METAL WORK

A variety of metalwork solutions are available for use within the construction of a SpaceJoist floor.

Timber Joist Hanger

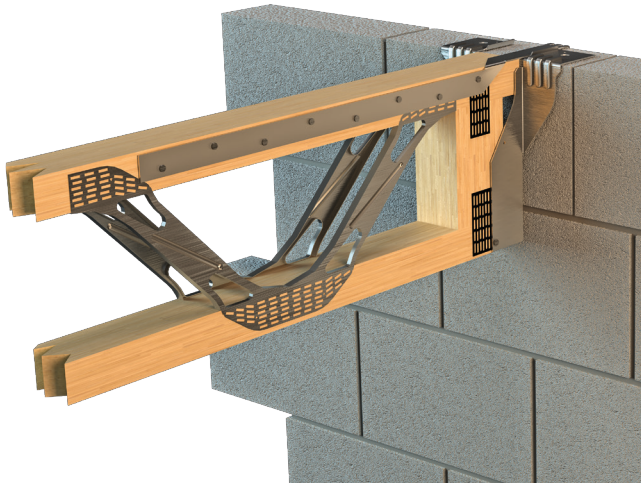
HUH

MHE

The UH Universal Hanger shown is designed for any joist to joist, joist to trimmer or joist to steel application.

A wider range of metalwork is available including the HUH Heavy Universal Hanger for heavier load applications & MHE Multi Hanger for solid headers.

Masonry Joist Hanger



RB-JHI

FMHI

The JHI Masonry Joist Hanger shown allows joists to be supported to blockwork.

The RB-JHI Rapid Build Masonry Joist Hanger provides a superior level of performance with no need for masonry above and the FMHI allows for higher load carrying capacity.

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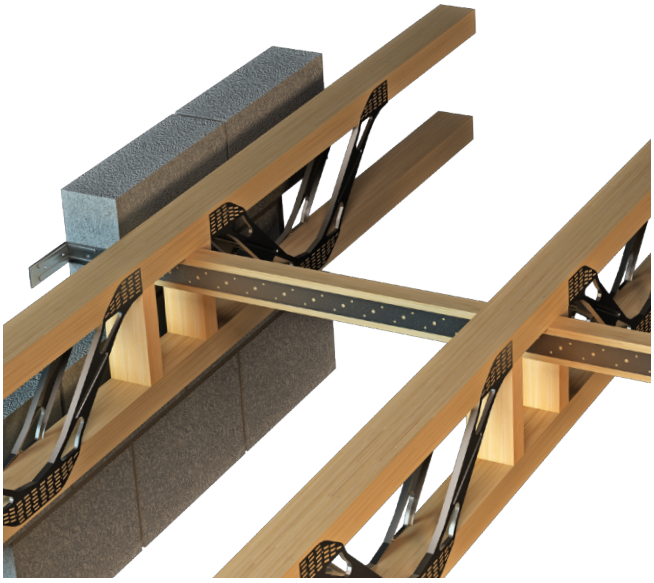
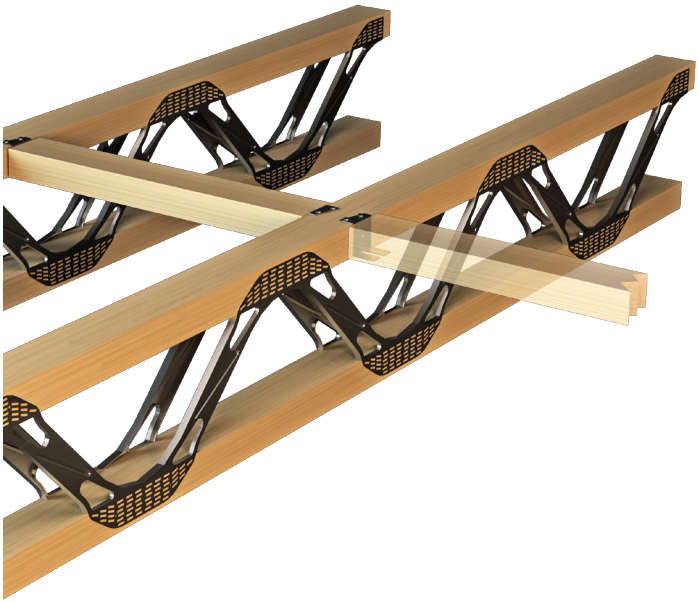
Restraint Strap



Lateral restraint of the walls can be provided by the floor. (PFS Strap shown)

Where required, restraint must be provided perpendicular to the floor joists using the PFS Strap. Restraint must also be provided parallel to the floor joists using the PST Strap or PSC for coursing where required

Noggin Support



The UZ-Clip is a multifunctional connector for supporting solid timber noggins. Various applications include support of decking, plasterboard and lightweight partitions.

UZ-Clip

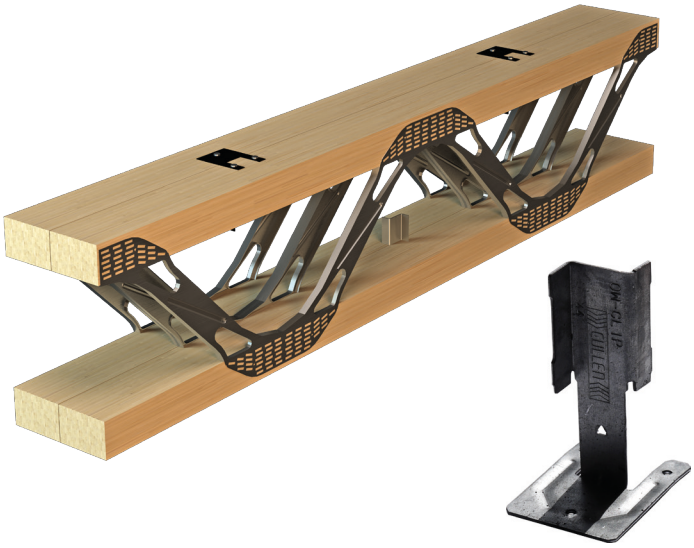
Multiple Joist Connections

2-ply joists are typically used around openings where greater stiffness is required for oncoming point loads etc.

It is essential that the correct connection detail is used to ensure this unit acts as one, rather than two halves moving against each other, which can cause excessive deflection in the floor.

Proprietary clips (Cullen OW-Clip) are available together with screws (Paslode PSTS).

Paslode Structural Timber Screws are for use in various applications including the connection of multiply timbers.



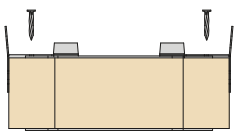
The OW-Clip enables the connection of 2 ply joists enabling them to act as a single unit.

3-ply joists are to be joined together using PSTS screws only. DO NOT use OW-Clips.

OW-Clips:

Installation Instructions

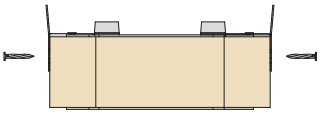
Stage 1



Lay joist flat and mark location of OW-Clips, press clips into position.

Fix clips to the face of the joist using 1No 3.4 x 35mm square twist nail per clip.

Stage 2

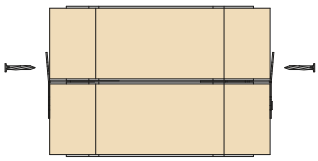


Fix clips to the top of the joist using 1No 3.4 x 35mm square twist nail per clip.

Stage 3

Position second ply of multiple joist on top of the OW-Clips and tap together with a hammer to ensure a tight fit.

Stage 4



Fix OW-Clips to top and bottom chords of the multiple joist using 2No 3.4 x 35mm square twist nails per clip, ensuring that joists are fitted tightly together.

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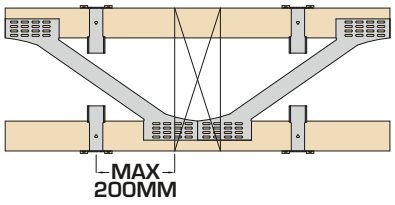
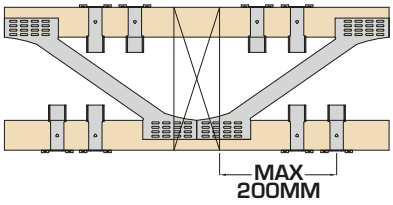
The location of any clips required on a 2-ply joist will be shown on the joist manufacturing output.

Generally speaking, it's a cluster of 4 or 8 around the oncoming point load, then every 600mm centres along the rest of the joist, or one in each metal web bay. Clips to be within 200mm of the oncoming point load.





No. of OW-Clips	Max load on hanger (kN)	Characteristic capacity (kN)
4	8	15.6
8	12	23.4

PSTS Screws:

Spacing of screws is the same as for the OW-Clips. Number of screws needed to be selected from the tables below. Screws to be installed at the vertical centre of each chord. Washer head to meet tightly to face of timber.

		4 screws		8 screws	
SpaceJoist configuration	Length of PSTS screw	Max load on hanger (kN)	Characteristic Capacity (kN)	Max load on hanger (kN)	Characteristic Capacity (kN)
2-ply 72mm	115mm	6	18.24	12	36.48
2-ply 97mm	150mm	6	18.24	12	36.48
2-ply 122mm	200mm	4.8	13.20	9.6	26.40

Please refer to the Cullen Technical Guide for more detailed information.

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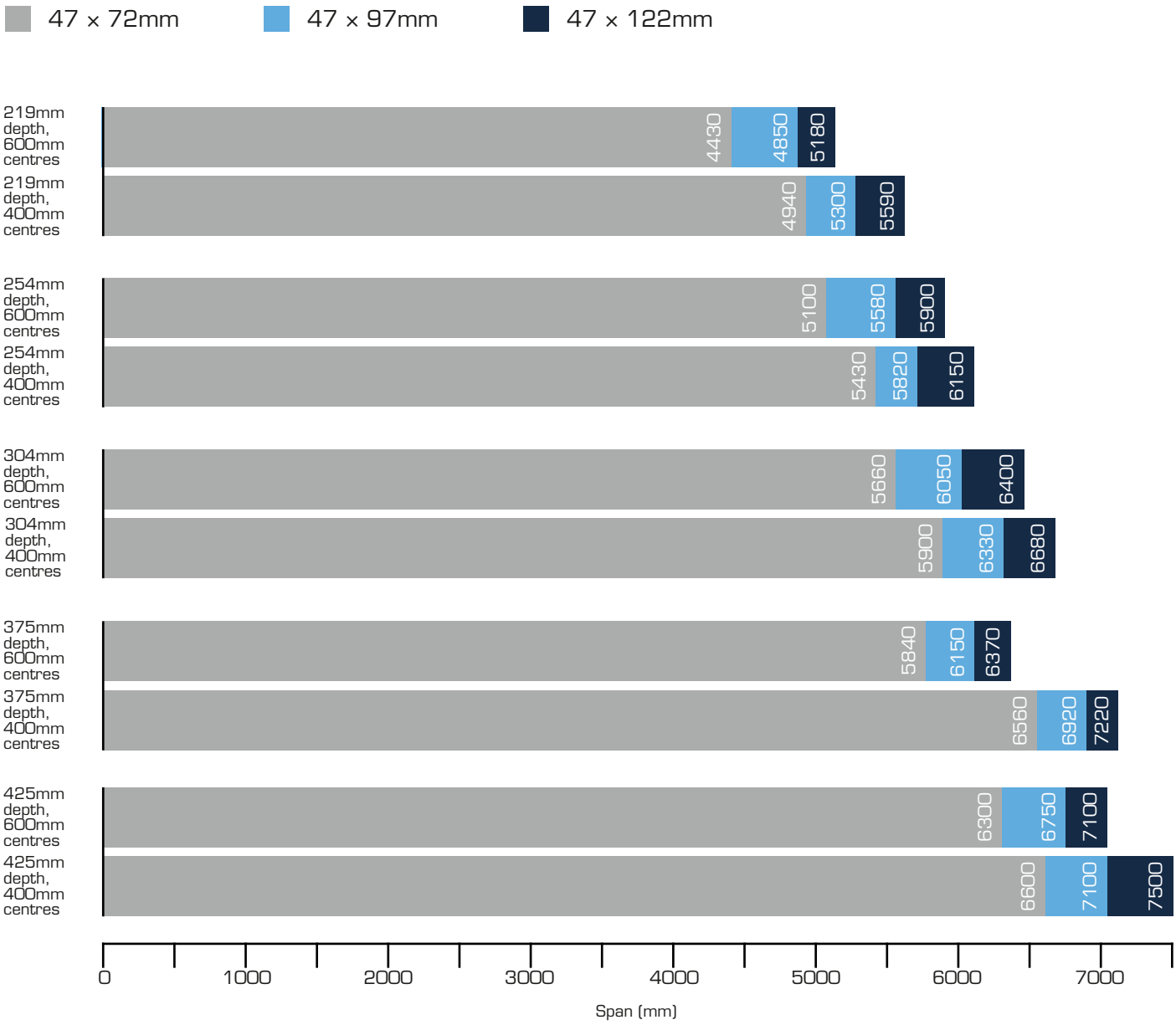
SPAN TABLES

SpaceJoist span tables for domestic floor loading (based on TR26 timber)



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Domestic floor loadings

Domestic floor loadings	
Top chord dead	550 N/m²
Bottom chord dead	200 N/m²
Live load	1500 N/m²

Includes an allowance of 350 N/m² for partition load. Spans governed by EC5 vibration check where applicable. Timber strength class - TR26. Self weight included. Spans include 100mm bearing at each end.

SJ9	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	4940
		47x97	5300
		47x122	5590
	600	47x72	4360
		47x97	4770
Depth: 219mm		47x122	5100

SJ10	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5430
		47x97	5820
		47x122	6150
	600	47x72	5010
		47x97	5490
Depth: 254mm		47x122	5880

SJ12	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5900
		47x97	6330
		47x122	6680
	600	47x72	5600
		47x97	6010
Depth: 304mm		47x122	6400

TW14	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	6600
		47x97	7100
		47x122	7500
	600	47x72	6240
		47x97	6780
Depth: 375mm		47x122	7150

TW16	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	7050
		47x97	7600
		47x122	8000
	600	47x72	6730
		47x97	7200
Depth: 425mm		47x122	7600

SpaceJoist™
METAL OPEN WEB FLOOR SOLUTION

Office floor loading

Office floor loadings	
Top chord dead	1200 N/m²
Bottom chord dead	200 N/m²
Live load	2500 N/m²

Includes an allowance of 1000 N/m² for partition load. Spans governed by EC5 vibration check where applicable.Timber strength class - TR26. Self weight included. Spans include 100mm bearing at each end.

SJ9	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	4140
		47x97	4520
		47x122	4840
	600	47x72	3550
		47x97	3780
Depth: 219mm		47x122	4020

SJ10	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	4770
		47x97	5220
		47x122	5580
	600	47x72	3800
		47x97	4400
Depth: 254mm		47x122	4800

SJ12	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5240
		47x97	5680
		47x122	6050
	600	47x72	4170
		47x97	4750
Depth: 304mm		47x122	5050

TW14	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5850
		47x97	6700
		47x122	7200
	600	47x72	4560
		47x97	5320
Depth: 375mm		47x122	6100

TW16	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	6050
		47x97	7150
		47x122	7750
	600	47x72	4900
		47x97	6050
Depth: 425mm		47x122	6600

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Robust Detail floor loadings (UK only)

Robust detail floor loadings	
Top chord dead	720 N/m²
Bottom chord dead	420 N/m²
Live load	1500 N/m²

Includes an allowance of 250 N/m² for partition load. Spans governed by EC5 vibration check where applicable. Timber strength class - TR26. Self weight included. Spans include 100mm bearing at each end.

SJ9	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	N/A
		47x97	N/A
		47x122	N/A
	600	47x72	N/A
		47x97	N/A
Depth: 219mm		47x122	N/A

TW14	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	6600
		47x97	7100
		47x122	7500
	600	47x72	5850
		47x97	6620
Depth: 375mm		47x122	7100

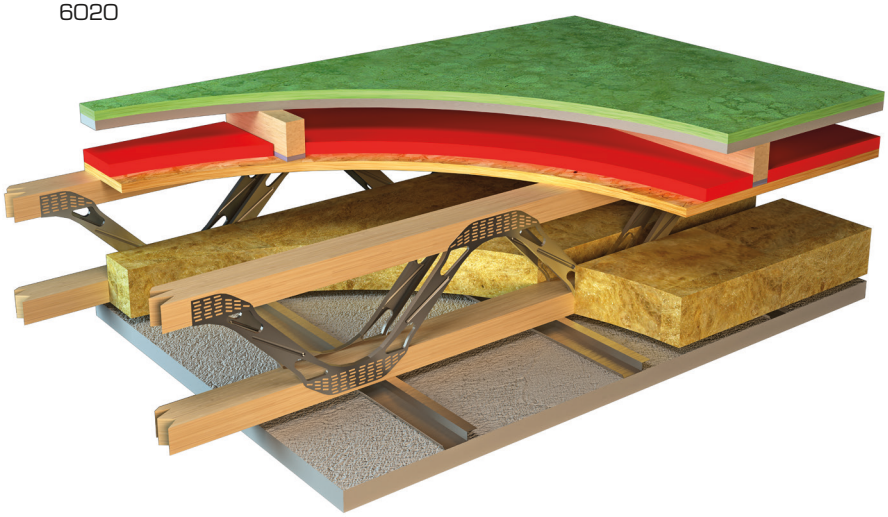
SJ10	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5400
		47x97	5820
		47x122	6150
	600	47x72	4750
		47x97	5200
Depth: 254mm		47x122	5550

TW16	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	7050
		47x97	7600
		47x122	8000
	600	47x72	6230
		47x97	7150
Depth: 425mm		47x122	7600

SJ12	Centres (mm)	Timber size (mm)	Span (mm)
	400	47x72	5900
		47x97	6330
		47x122	6680
	600	47x72	5200
		47x97	5620
Depth: 304mm		47x122	6020

SpaceJoists are approved for use in Robust Details E-FT-3 and E-FT-6.

To find out how to comply with the detail, visit www.robustdetails.com, or refer to the Robust Details Handbook.



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METAL OPEN WEB FLOOR SOLUTION

SpaceRafter span tables

Web type	Depth (mm)	Centres (mm)	Width (mm)	Flat roof span (<5°)	Pitched roof span (45°)
SJ9	219mm	600	47x72	5150	4500
			47x97	5650	4950
			47x122	6100	5350
SJ10	254mm	600	47x72	5900	5100
			47x97	6500	5650
			47x122	7000	6050
SJ12	304mm	600	47x72	6650	5800
			47x97	7300	6400
			47x122	7850	6900
TW14	375mm	600	47x72	7800	6750
			47x97	8550	7500
			47x122	9150	8050
TW16	425mm	600	47x72	8550	7350
			47x97	9350	8050
			47x122	10050	8800

This span table is indicative and to be used only as an estimating/feasibility tool. These spans have been calculated with typical roof loading applied using TR26 timber. Plywood is attached directly to the top of the joists to provide a rigid diaphragm

Pitched roof:

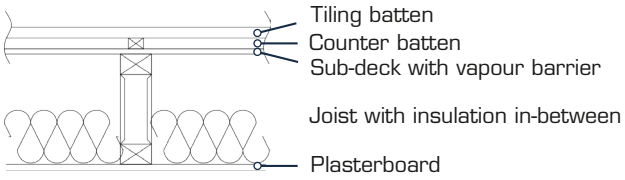
Top chord dead: 685 N/m²
Snow loads: 750 N/m²
Bottom chord dead: 200 N/m²

Flat roof:

Top chord dead: 500 N/m²
Snow loads: 750 N/m²
Bottom chord dead: 200 N/m²

Flipped timber orientation option		
Rafter overall depth (mm)	Flat roof span (<5°)	Pitched roof span (45°)
269	5700	5000
319	6850	6000
304	6400	5550
354	7600	6600

Typical roof section:



These are achieved by rotating the timber, so joist is only 47mm thick.

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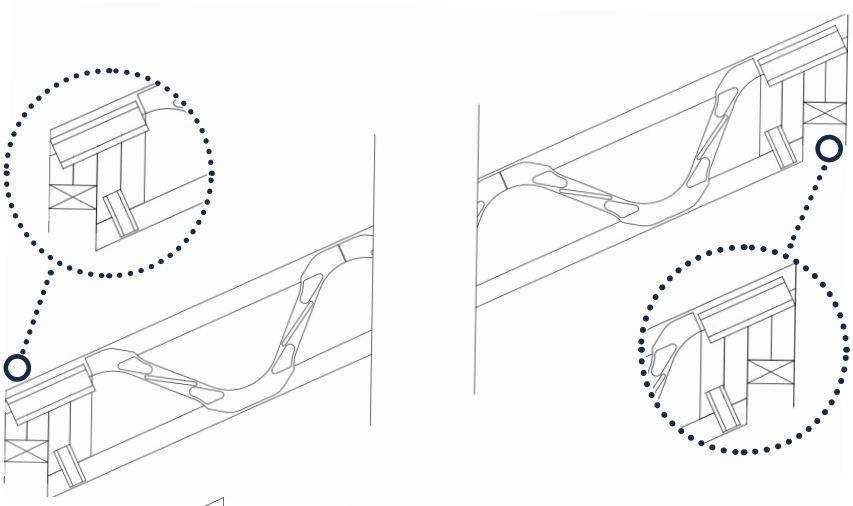
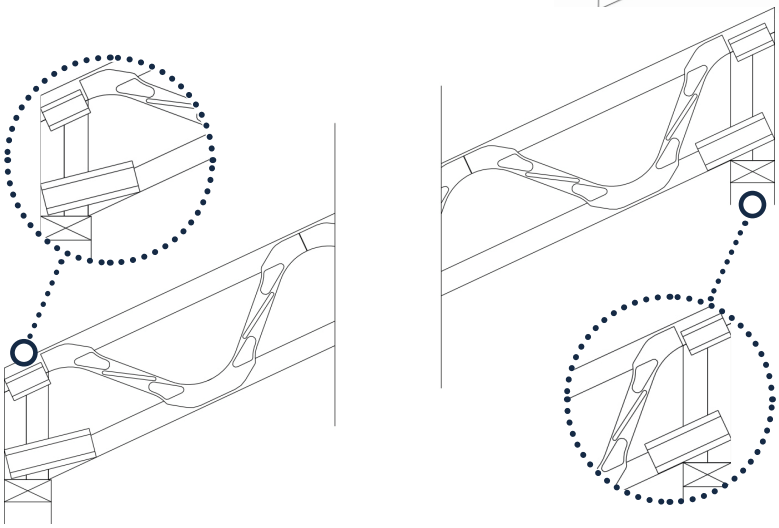
SPACERAFTER DETAILS

SpaceRafters are an efficient way of framing a roof using off-site construction. Using a variety of support details, any support can be incorporated into the design. SpaceRafters also lend themselves to cassettes, enabling a speedier installation time on site. Pre-insulating the joist element means a superior level of insulation be achieved as well.

Plated blocks allow for the support to be sunk into the joist, minimising downstand, particularly at the ridge. Using a structural ridge beam enables larger spans to be achieved.





End verticals carried on through the bottom chord to create a horizontal seat, removing any thrust and preventing the joist from sliding off the building. Also removes the need for a chamfered wallplate.

U-VALUES

Web type	Timber size (mm)	Overall joist depth (mm)	Insulate joist	Joist insulation	Main insulation	Main insulation depth	U-value at 600mm c/c
SJ9	72x47	269	Y	0.03	0.021	250mm	0.11
SJ9	97x47	319	N	N/A	0.021	319mm	0.10
SJ10	72x47	304	Y	0.03	0.021	304mm	0.10
SJ10	97x47	354	N	N/A	0.021	354mm	0.10

SpaceJoist™
METAL OPEN WEB FLOOR SOLUTION

LOADS AND WEIGHTS OF BUILDING MATERIALS

SpaceJoist can be designed to carry a wide range of loads. Below are the standard load categories used in floor designs.

The imposed load will depend on the type of use or occupancy of the dwelling. The appropriate value can be found in BS 6399 part 1 or EN 1991-1-1: an extract is shown in the table below.

Type of occupancy	Examples of usage	Uniformly distributed load kN/m²
Domestic and residential	1. All usage within self-contained dwelling units and communal areas (including kitchens) in blocks of flats with limited use*	1.5
	2. Bedrooms and dormitories except those in hotels and motels	1.5
	3. Bedrooms in hotels and motels, hospital wards and toilet areas	2.0
	4. Billiard and snooker rooms	2.0
	5. Communal kitchens except in flats covered by 1. above	3.0
Offices	6. General office use	2.5
	7. Kitchens, laundries and laboratories	3.0
Areas where people may congregate	8. Public, institutional and communal dining rooms, lounges, cafés and restaurants	2.0
	9. Classrooms	3.0
	10. Dance halls, studios, gyms and stages	5.0

* Communal areas in blocks of flats with limited use refers to blocks consisting of not more than three storeys and with not more than four self contained dwelling units per storey accessible from one staircase.

Partition walls

Lightweight partition walls are often built on top of suspended floors. Consequently their weight must be included when designing the joists. Timber studding faced with plasterboard each side is one method of forming partition walls but this has been superseded in popularity by the various types of proprietary partition systems available. Most systems use plasterboard either side of the framework, which should have a surface mass of 12.5kg/m² (if no mineral wool in between the studs is used) in order to satisfy the requirements of Part E of the Building Regulations. Typically the load associated with partition wall construction is 267 N/m². So, assuming the partition is 2.4m high, a load of 2.4 x 267 = 640 N/m should be included. (Note that this is a load per linear metre of partition).

An alternative way of accommodating partition loads is to apply a uniformly distributed load (global load) over the whole floor. The value of this load is equal to one third of the linear metre load of the partition. So using the example above, the UDL applied to the whole floor would be 640 ÷ 3 = 213 N/m². However the value most commonly used is 250 N/m².

EC5 designs require this figure to be spread over only two joists, so the load applied will be 640 ÷ 2 = 320 N/m², or rounded up to 350 N/m² for convenience.

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Weight of building materials

Listed below are the approximate weights of some commonly used building materials:

Asphalt roofing	2 layers	42kg/m²
Asphalt roofing	3 layers	63kg/m²
Chipboard flooring	18mm thick	14kg/m²
Chipboard flooring	22mm thick	18kg/m²
OSB3	15mm thick	9kg/m²
OSB3	18mm thick	10.8kg/m²
Plaster	1 skim coat	6.8kg/m²
Plasterboard	12.5mm thick	11.2kg/m²
Plasterboard	15mm thick	13.4kg/m²
Plasterboard	19.1mm thick	17.1kg/m²
Plywood	12mm thick	8.4kg/m²
Plywood	15mm thick	10.5kg/m²
Plywood	18mm thick	12.6kg/m²
Screed (sand/cement)	12.5mm thick	29.3kg/m²
Liquid screed	10mm thick	20kg/m²

Green roof generic loading, around 1kN/m² depending on make up.

In order to convert kg/m² to N/m² multiply by 9.81.

Stair loading

Wherever stairs are fixed to EWP floors the dead and imposed loads shall be applied to the floor.

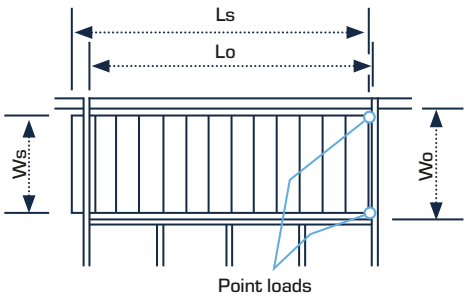

Figure 3.1 Definition of stair width and length.

Point loads for a straight flight of stairs are calculated as:

Dead load (Ws x Ls)/4 x 0.41 kN

Live load (Ws x Ls)/4 x 1.50 kN

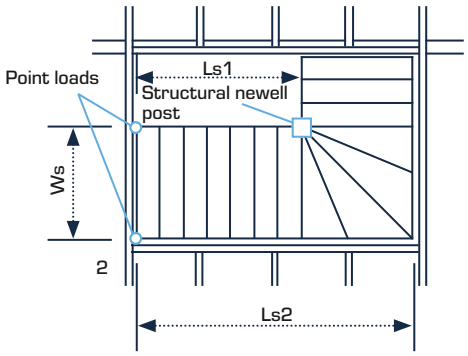

Figure 3.2 Definition of stair width and length for non-straight flights of stairs.

Point loads for a non-straight flight of stairs are calculated as:

Dead load (Ws x Ls1) x 0.41 kN and (Ws x Ls2) x 0.41 kN

Live load (Ws x Ls1) x 1.50 kN and (Ws x Ls2) x 1.50 kN

(Ls1 and Ls2 are the dimensions back to the newel post and corner respectively)

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SITE HANDLING AND INSTALLATION

Site storage

Site storage is intended to be temporary prior to erection. The fabrication and delivery of joists should, therefore, be arranged to minimise the storage time both at the manufacturer's premises and on site. ITW Construction Products recommend that the joists are delivered wrapped in protective plastic covering which will protect the joists from short term exposure to inclement weather. The joists should be stored horizontally, such that they are approximately 75mm clear of the ground and vegetation and supported in such a way as to prevent the likelihood of distortion.

Erection

1. After studying the joist designer's layout drawing, decide which area of the floor is to be erected first and from which end of the building
2. Place the required joists referring to SpaceJoist layout drawing next to the correct area of the building
3. Check to see if the joists require internal support and/or have differing end details. If any of these conditions exist, attention should be paid as to the correct orientation of the joist before hoisting onto the scaffold
4. Care should be taken not to damage the metal webs when hoisting onto the scaffold i.e. hoisting straps should be placed around timber chords and not around the metal webs
5. The first joist is normally positioned a dimension of 50mm from the inside face of the brickwork measured to the edge of the joist (see figure 1&2)
6. The remaining joists are positioned at the centres specified on the layout drawing (e.g. 600, 480 or 400mm) but set out from the inside face of the brickwork, thus making the distance from the 1st joist to the 2nd equal to the specified joist centres minus 50mm
7. Joists may be required to support stair trimmers and partition walls which, in most cases, will be in addition to the joists occurring at the specified centres
8. As an aid to setting the joists in their correct positions it is advisable to use a length of tiling batten positioned close to the external support brickwork and temporarily nailed to each joist (see figure 1&2)
9. Once the joists have been positioned the strongback bridging, partition noggins (if required) and restraint straps can be installed
10. If the joists are supported at 3 positions it is important to check that they are in contact with the supports at all locations. To achieve this it may be necessary to place packing (slate or similar) between the top of the brickwork and the underside of the joist
11. Care should be taken to ensure that adjacent joists are level with each other and that joists are level along their length

Figure 1

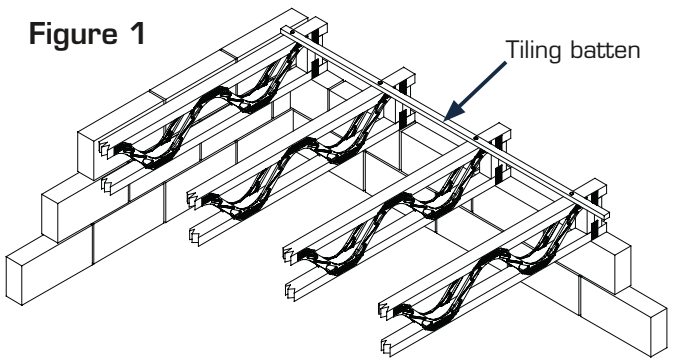
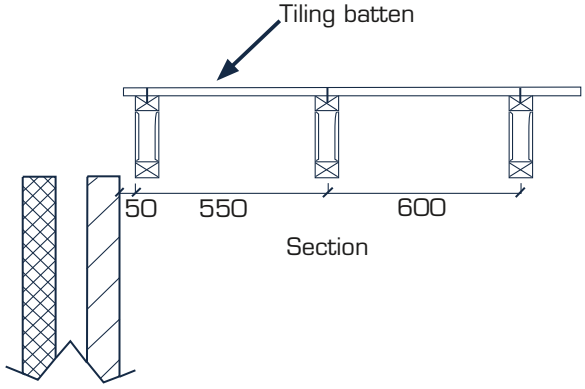


Figure 2



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Temporary safety bracing for floors

The builder is responsible for identifying and minimising the risks involved in erecting SpaceJoists to ensure the health and safety of all workers is maintained. Builders should be aware of the health and safety responsibilities imposed on them by the Construction (Design and Management) Regulations 2015. Proper erection procedures and bracing are vital to the safe construction of SpaceJoist floors.

The following notes may assist builders in preparing a safety assessment:

- Unbraced floors may be unstable
- DO NOT walk on unbraced joists
- DO NOT store building materials on unbraced floors
- SpaceJoists should be erected straight and vertical. Horizontal deviation no more than 10mm. Vertical deviation no more than 2mm
- Temporary bracing consists of diagonal brace, longitudinal brace and permanent Strongback Bridging
- All longitudinal braces, diagonal braces and Strongbacks should be completely installed and fully nailed
- Lateral strength should be provided by a diagonally braced system across a minimum of 3 joists as shown below
- Construction material may only be stored on joists when all bracing is in place. Material should be spread over at least 4 joists and not more than 1.5m from a support
- Decking / plasterboard may be stacked no higher than 250mm (150kg / joist @ 600mm centres, 100kg / joist @ 400mm centres) on fully braced floors
- Flooring should be fully fixed to the joists before additional loads are placed on the floor
- Temporary bracing can be progressively removed as decking is fixed

Figure 3

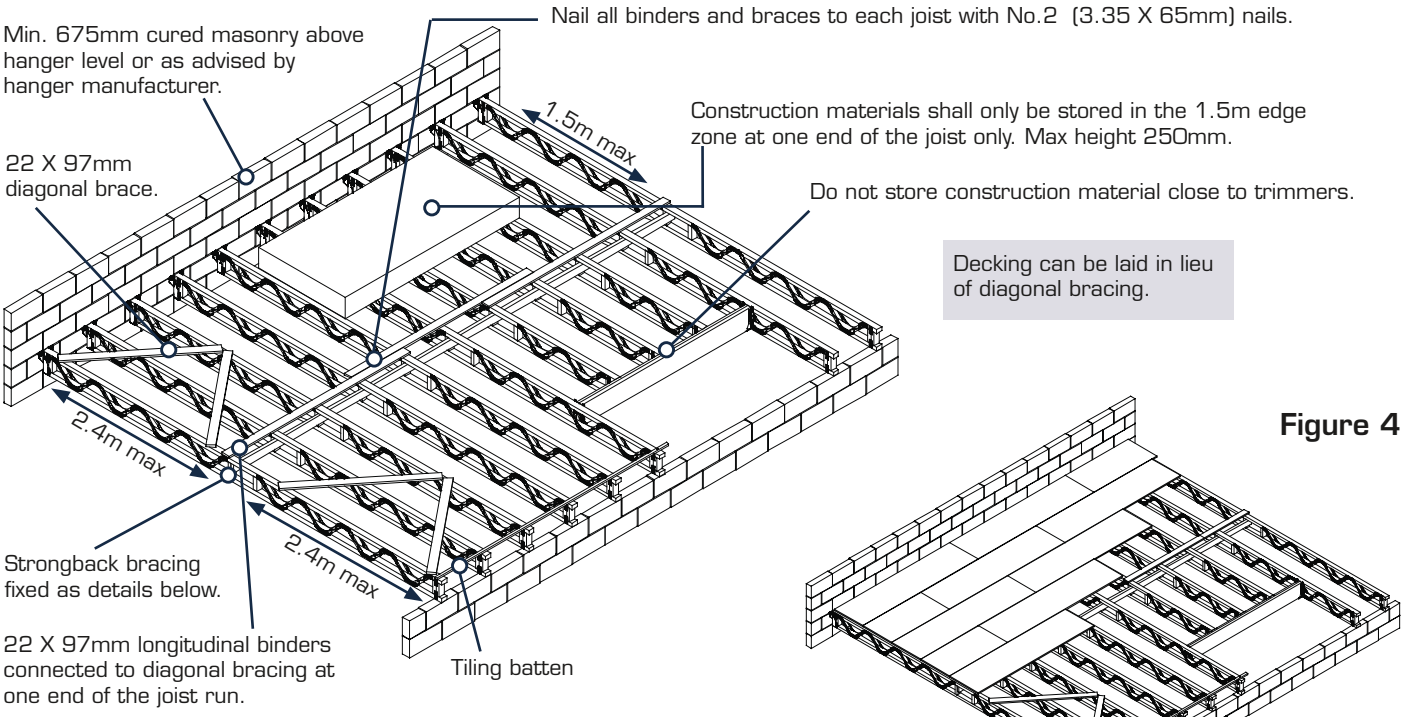


Figure 4

DECKING

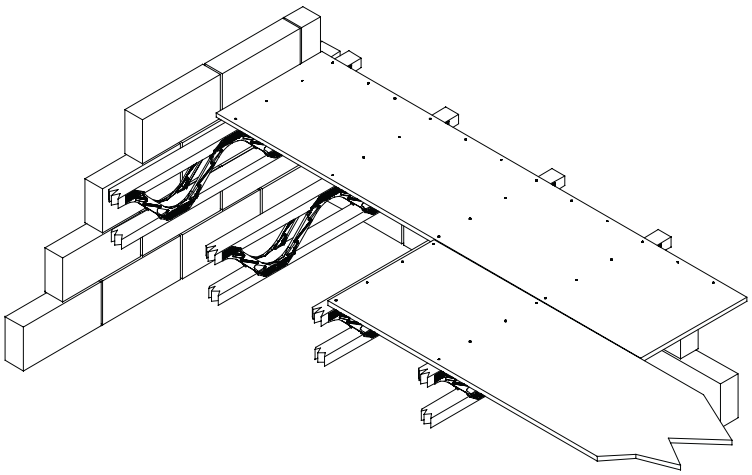
There are a variety of sheet products available which can be used as floor decking with the most popular being chipboard. Readily available sheet sizes are 2400mm x 600mm with thicknesses of 18mm and 22mm. Attention should always be paid to the particular manufacturer's instructions, but listed below are some good practice guidelines.

- Under domestic floor loads 18mm chipboard can be used on joist centres up to 450mm and 22mm chipboard can be used on joist centres up to 600mm
- Chipboard to be used in suspended domestic flooring applications should be marked P5 or P7 (conforming to EN 312-5 or EN 312-7). Other types are listed below:

Floor decking	400mm joist centres	450mm joist centres	600mm joist centres	Standard
Softwood boarding	16	16	19	1297
Moisture resistant chipboard	18	18	22	EN 312 - type P5
Plywood	15	15	18/19	EN 636
Oriented strand board	15	15	18/19	EN 300 - type OSB3

- Tongue and groove boards should be laid with their long edges running perpendicular to the joists, with the joint between the short edges occurring on the centreline of a joist
- Square edged boards need to be supported continuously along all edges. This is best achieved by positioning the joint between the long edges on the centreline of a joist and the joint between the short edges on a noggin fixed between the joists
- It is essential that boards are supported within 50mm of their edges at the perimeter of the floor by either joists or perimeter noggins
- Joints along the short edges of boards should be staggered and the length of any board should generally not be less than 2 x joist centres
- **Nail fixings** - 3mm ring shank nails with a minimum length equal to 2.5 x board thickness
- **Screw fixings** - minimum No. 8 (4.2mm) particle board screws with a minimum length equal to 2.5 x board thickness. Nails or screws should be positioned 9mm from the board edge and at 200mm centres along all supports and edges (see figure 5). Boards should be glued to the joists and the tongue and groove joints should also be glued. A PVAC adhesive conforming to durability class D1 of EN 204 should be sufficient for these applications
- Chipboard is similar to other timber products in that it will expand when exposed to moisture and high humidity. Consequently, allowances must be made to accommodate potential expansion. It is recommended to leave a perimeter gap of 10 - 12mm between the edge of the board and the face of the brickwork. It is also recommended to leave a gap of 2mm between edges of abutting boards

Figure 5



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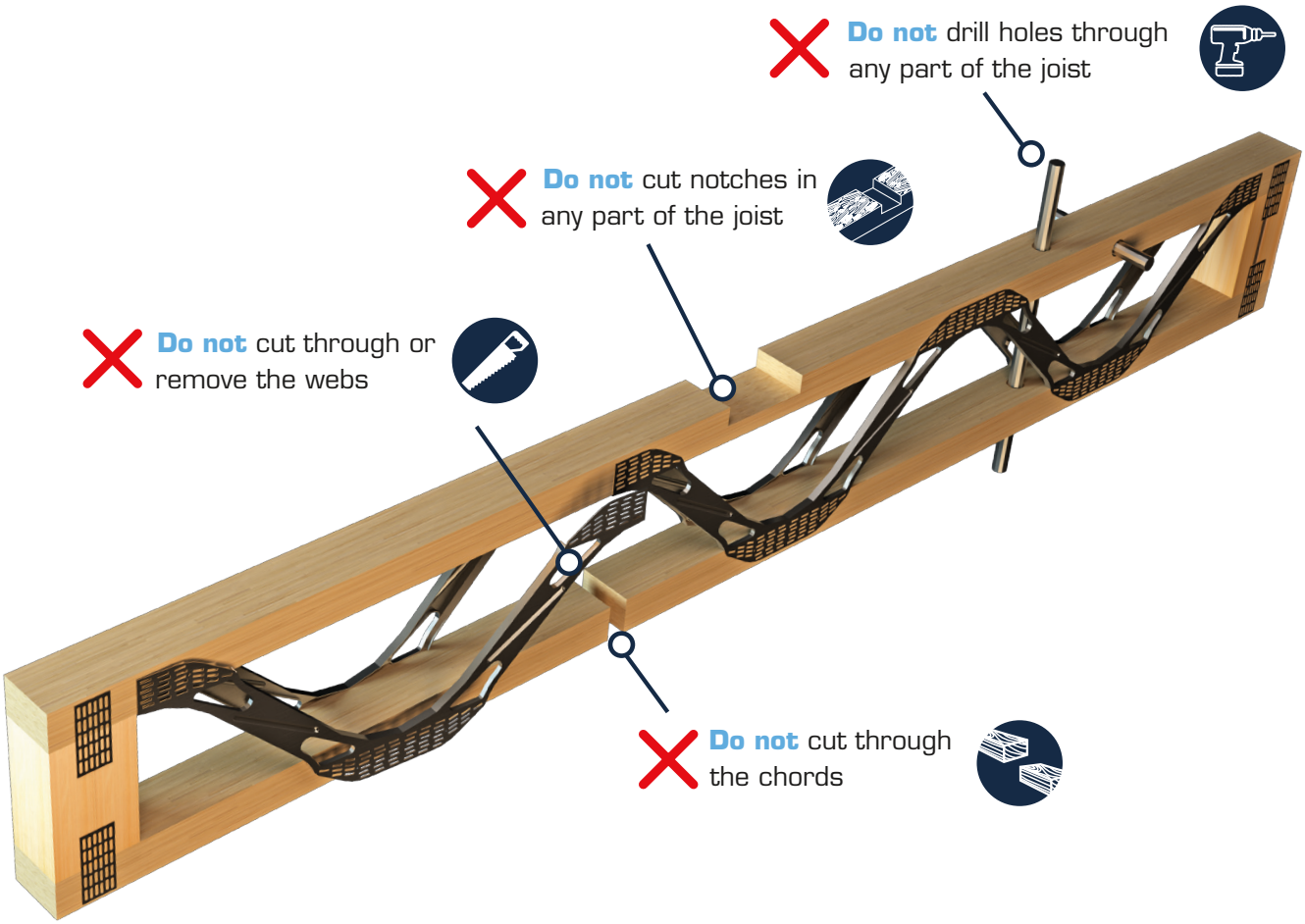
DO'S AND DON'TS ON SITE

Do's

- Store as described in page 26
- Protect joists from inclement weather
- Place hoisting straps around timber chords
- Install the joists as they have been designed: refer to the joist designer's drawings for the correct orientation, spacing etc.
- Use the open web feature for installation of services
- Lift the joists in a vertical position

Dont's

Do not walk on unbraced joists



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SOUND PERFORMANCE

Sound performance - intermediate floors

Independent testing proved the new SpaceJoist delivers outstanding acoustic performance to comfortably pass English and Welsh sound regulations. The joists even comply with the more stringent 43dB Scottish regulations without additional insulation, plasterboard or resilient bars.

SpaceJoist depth (mm)	Floor build-up	Scotland requirements for non-separate domestic floors (43db)	England and Wales requirements for non-separate domestic floors (40db)
219	22mm chipboard on 219mm SpaceJoist at 600mm centres lined to the underside with 15mm plasterboard (standard wall board)	✓	✓
254	22mm chipboard on 254mm SpaceJoist at 600mm centres lined to the underside with 15mm plasterboard (standard wall board)	✓ *	✓
304	22mm chipboard on 304mm SpaceJoist at 600mm centres lined to the underside with 15mm plasterboard (standard wall board)	✓	✓

***Tested with additional 100mm Rockwool insulation and achieves 44dB to meet Scottish Building Regulation Silver Standard.**

Robust details - separating floors (UK only)

SpaceJoist complies with robust detail "E-FT-3 separating floor - metal web joists." Floors built to this specification will require no pre-completion testing to comply with "Approved Document part E - resistance to the passage of sound", and helps avoid possible call backs.

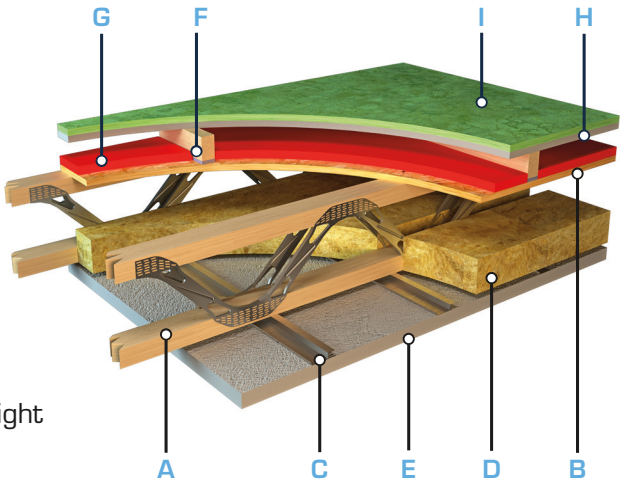
A. SpaceJoist - minimum 254mm deep

B. Minimum 18mm thick sub-deck with minimum density of 600kg/m³

C. Minimum 16mm resilient bars with laboratory performance of rdΔw + Ctr = 17dB and rdΔLw-16dB fixes at 400mm centres perpendicular to joists

D. Minimum 100mm thick mineral wool quilt insulation with density of 10-36kg/m³ laid between joists

E. Two layers of 15mm thick plasterboard with nominal weight of 11.7kg/m² fixed with 32mm long screws (first layer) and 42mm long screws (second layer)



F. Minimum 70mm deep composite resilient battens fixed at 600mm centres perpendicular to joists

G. Mineral wool quilt laid between battens, 25mm thick with density of 10 - 36kg/m³

H. 19mm thick plasterboard plank with nominal weight of 13.5kg/m²

I. Minimum 18mm thick tongue and groove floorboards

To find out how to comply with the detail, visit www.robustdetails.com, or refer to the Robust Details Handbook.

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FIRE PERFORMANCE

SpaceJoist has been independently tested in accordance with BS 476 part 2:1987 for both 30 and 60 minute fire resistance.

Fire resistance

Around 90% of fire resistance is provided by the plasterboard so it is important to specify this correctly. The required fire resistance for domestic floor structures is 30 minutes and for compartment floors is 60 minutes.

Based on data from full scale testing and calculated assessment the following tables can be used:

30 minute fire resistance

Joist depth	Web size	Joist centres	Board thickness and type	Screw fixing	Intermediate noggins required	Perimeter noggins required	Floorboard thickness
All joist depths	All web sizes	400	12.5mm fireline	150mm	No	Yes	18mm
		480	12.5mm fireline	150mm	Yes	Yes	22mm
		600	12.5mm fireline	150mm	Yes	Yes	22mm
		400	15mm wallboard	150mm	No	Yes	18mm
		480	15mm wallboard	150mm	No	Yes	22mm
		600	15mm wallboard	150mm	No	Yes	22mm

60 minute fire resistance

Joist depth	Web size	Joist centres	Board thickness and type	Screw fixing	Intermediate noggins required	Perimeter noggins required	Floorboard thickness
All joist depths	All web sizes	400	2x12.5mm fireline	150mm	No	Yes	22mm
		480	2x12.5mm fireline	150mm	No	Yes	22mm
		600	2x12.5mm fireline	150mm	No	Yes	22mm

Contact our Technical team on 01872 245456 option 3' for more details on data resulting from full scale testing and calculation assessment.

Plasterboard

Notes:

1. Ceiling boards are positioned so that their long edges run perpendicular to the joists. Where a second layer is used, it must be set out such that the joints do not occur at the same location as the first layer of board
2. The boards are fixed to the underside of the joist using 3.2 x 42mm long black phosphated steel screws positioned at 150mm centres. Where two layers are used 3.2 x 55mm long screws should be used for the second layer
3. All joints in both layers of board should be taped with 50mm wide glass fibre tape and filled using gypsum joint filler
4. Perimeter and intermediate noggins are required to support the boards at their edges. Perimeter noggins are required for all board thicknesses and joist centres, whereas intermediate noggins are only required for the thinner boards at larger centres. See fire resistance tables
5. The fixing and noggin details given here are based on the use of Gypsum Industries Ltd products and are minimum requirements
6. Where other products are used it should be established that their performance is equal to or better than those of Gypsum Industries Ltd
7. Flooring to be tongue and groove and fixed in accordance with good practice. If square edged boards are used, timber noggins are required under board edges that are not supported on joists

Category C

SpaceJoist open web joists are now available as a Category C fire solution. Approved by the Structural Timber Association (STA) as an acceptable option in their Product Paper 4, the “go-to guide” for fire robust solutions during the construction process.

Design professionals and clients can now select open web joists using SpaceJoist webs implementing the Category C solution, in order to achieve a fully compliant floor and/or flat roof assembly.

SpaceJoist Category C has been tested and approved using Paslode tools and 3.4mm x 35mm Hardened Galvanised Square Twist Nails. This system provides clients with a reliable solution from a leading manufacturer.

FAQ'S

How heavy are they?

As the weight of the webs is negligible, timber is the main element. Timber density is also significant.

For a 72mm wide joist, approximately 4.5kg/m length.

For a 97mm wide joist, approximately 6kg/m length.

For a 122mm wide joist, approximately 7.5kg/m length.

Can they be modified?

Joist cannot be modified without prior permission from ITW CP Design Office.

Can I drill a hole through my joist?

Holes are not to be drilled through joists without prior permission from ITW CP Design Office. Smaller holes are generally acceptable but a generic Yes or No cannot be given.

What does strongback bridging do?

Strongback Bridging (SB) is used as a load sharing element between the joists. When installed correctly, standing on one joist effectively spreads the load over 3 joists. As it is structural, it has to be graded timber, usually the same as what the SpaceJoist has been made from. It has to be installed in its vertical orientation, to a timber vertical either within the joist (chase vertical) or face fixed to the side of the joist. Minimum size is 35mm x 97mm TR26 but larger sections should be used on deeper joists. Using lower grade timber will have a lesser effect.

What is the minimum bearing?

Minimum bearings depend on what SpaceJoist are going into. From a practical point of view, anything less than 50mm should be avoided as it leaves little tolerance. If the joists are built into a wall with a bearing greater than 90mm, then they are deemed to provide restraint to that wall.

NHBC recommend:

Type of timber joist	Minimum bearing (mm)	
	End support	Intermediate support
Solid joist on masonry walls	90 (75)	90 (75)
Solid joist on timber wall plate	75	75
I-joist	90 (75)	90
Metal web joist	90 (75)	90

For notching into steel beams, the minimum bearing is 75mm.

How do I support them?

SpaceJoist are supported in the same way as normal timber joists, when bottom chord supported. They can be built into walls or supported in hangers. If building in it is advisable to use the horn detail so airtightness can be achieved more easily. Hangers have to be a minimum of 2/3 the depth of the joist to provide adequate top chord restraint, otherwise top chord noggins will be required.

What is the EC5 vibration check?

The EC5 vibration check allows the analysis of the joist deflection to EC5 rules, meaning they can span further providing the vibration check is satisfied. This takes the whole floor construction into account and adds together the joist, decking, plasterboard and strongback properties to see how the floor will perform under a point load, designed to represent a heel drop test. A vibration check % greater than around 80% means the joist will be fairly bouncy, particularly on longer joists.

What are Robust Details?

Robust Details are methods of construction in the UK that guarantee a level of sound attenuation between dwellings, mainly used in compartment floors (i.e. flats). Registering with Robust Details and constructing in strict accordance with their details means you can avoid sound testing, which can be expensive and time consuming. SpaceJoist are currently accredited with E-FT-3 and E-FT-6. Robust Details can only be used with timber frame, masonry construction has an issue with flanking noise. (Refer to page 30)

How do I protect against fire?

Around 90% of fire resistance is provided by the plasterboard so it is important to specify this correctly. The required fire resistance for domestic floor structures is 30 minutes and for compartment floors is 60 minutes. This is generally achieved by one layer of plasterboard for 30 minutes, 2 layers for 60 minutes. (Refer to page 31)

How do I join a 2-ply joist together?

Joists are to be connected together as specified by metalwork supplier's instructions only, using the referenced connectors. Joists are connected with either OW-Clips or PSTS screws. Typically a cluster of 4 around the point load, then 600mm centres along the rest of the joist, staggered top and bottom, with two at each end as well. OW-Clips can only be used on 2-ply joists; 3 plies have to be screwed if they are to be used. Screwing positions are the same as clips.

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NOTES

SpaceJoist™
METAL OPEN WEB FLOOR SOLUTION

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The information in this catalogue is intended for general guidance only and is given without engagement. Additional information and advice on specific applications is available from our Technical Support Team. For this however, we require a precise description of your particular application.

All the data in this catalogue concerning work with our fixing elements must be adapted to suit local conditions and the type of materials in use.

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