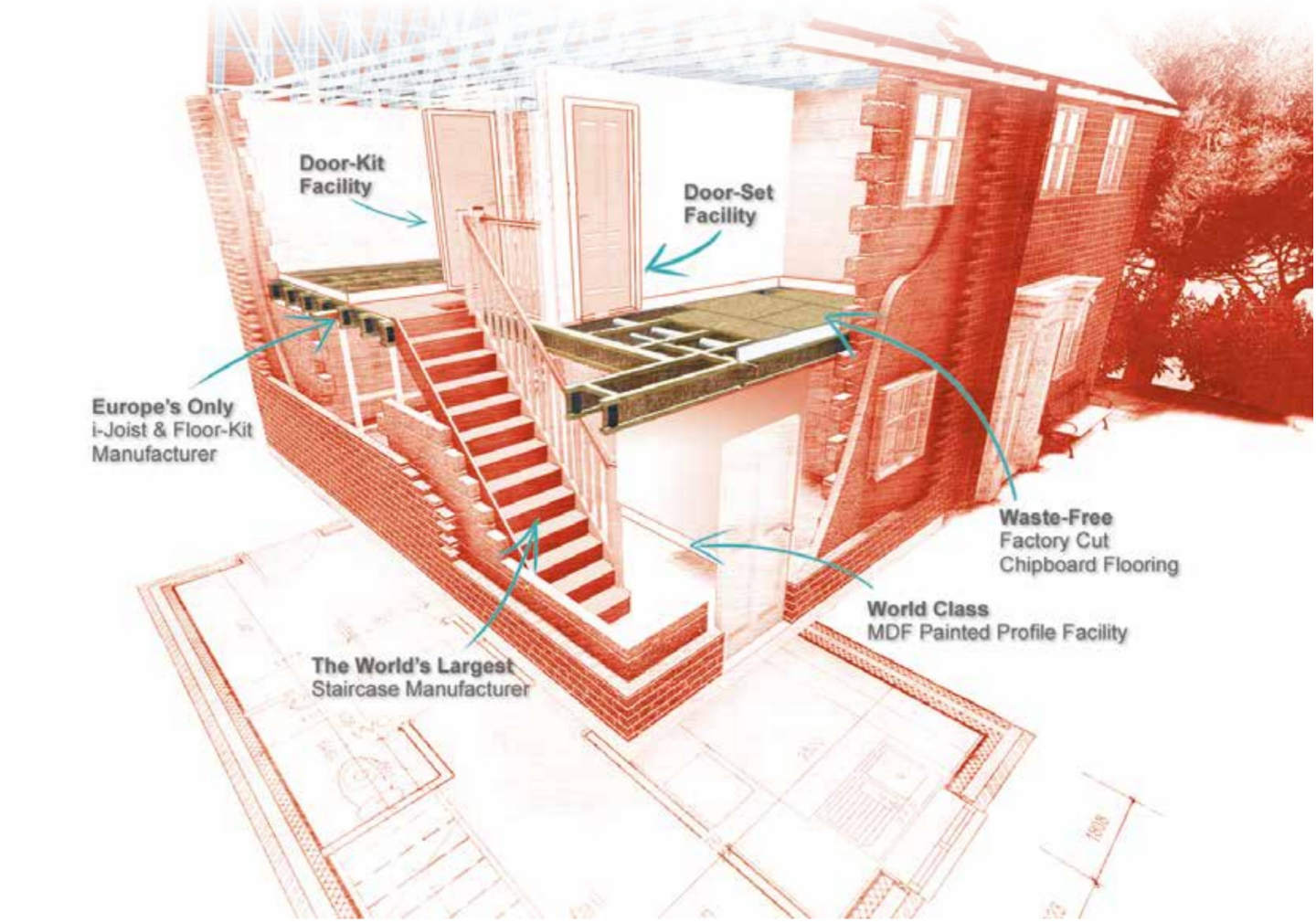
STAIRCRAFT®
Group




World Leading, Unique, Fully Integrated Stair, Floor & Door-Kit Solutions.

# Floor Technical Guide V2

TRUfloorsystems®
Part of the STAIRCRAFT Group

STAIRCRAFT Group

# Contents

## About this Guide

This *Floor Technical Guide* provides details of the technical properties, design parameters and regulatory compliance of floors constructed using Staircraft TFSi-joists. The information it contains is primarily aimed at Specifiers, Architects, Engineers, Building Designers and Building Authorities / Warranty Providers, and is intended to be of assistance in addressing any queries they might have.

## Contents

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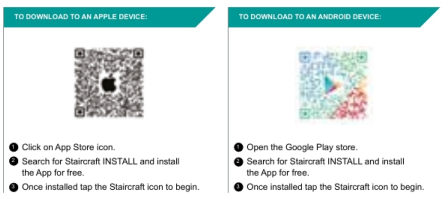
## Site Installation

Complementary information to that provided by this Guide can also be found in our Floor Installation Guide, which is intended for use by Construction/Production teams, Site Managers and Tradespeople involved in the installation of TFSi-joists. This includes information on common construction details, floor installation and site safety best practice, together with details of Staircrafts INSTALL APP, which enables our 3D construction details to be brought to life on your phone simply by scanning the QR codes printed on our layout drawings/joist labels.





# Who We Are & What We Do

## Founded in 1984 Staircraft are now:

- The World's largest manufacturer of staircases with a capacity to supply 1600 new build homes every week
- Europe's only Stair, i-Joist, Floor-Kit & Door-Kit Manufacturer
- Proud to be one of few companies listed in consecutive years of the Sunday Times Virgin Atlantic Fast Track 100 League Tables (2017 and 2018)

## The Staircraft Group consists of three divisions:

STAIRCRAFT Integrated Solutions

TRUbuildingsystems Part of the STAIRCRAFT Group

ICT (Independent Construction Technologies)

The Staircraft Integrated Solutions Division serve National House Builders and TRUbuildingsystems Division serve regional, timber frame and modular builders. Our ICT Division (Independent Construction Technologies) provides specialist design, performance and system testing services.

Our portfolio of products has expanded, resulting in Staircraft becoming the UK's first manufacturer of fully integrated staircases and i-Joist floor-kits.

We operate from multiple manufacturing facilities across 3 sites in the Midlands. Covering over 200,000 sq. ft. Our team are passionate about manufacturing products that improve site safety and provide hassle-free installation.

Our investment in CNC technology is market leading, specifically designed to create innovative, time saving and safe solutions for tradespeople.

**Introducing our brands**

TRUintegratedsolutions Part of the STAIRCRAFT Group

TRUstair Part of the STAIRCRAFT Group

TRUfloorsystems Part of the STAIRCRAFT Group

TRUprofile Part of the STAIRCRAFT Group

TRUdoor Part of the STAIRCRAFT Group

## Site Safety

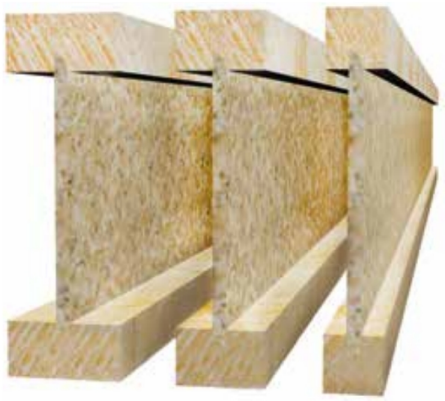
We are acutely aware of the safety risks faced every day on building sites so improved site safety is a key driver in our product development process. Our unique WellSafe™ stairwell fall protection system is an example - see page 18 of our TRUfloorsystems Floor Installation Guide for details.

INTRODUCTION

STAIRCRAFT Group

# TRUfloorsystems® TFSi-Joist

Part of the STAIRCRAFT Group



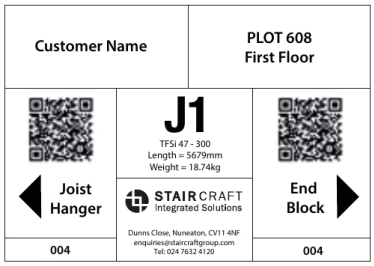
Over recent years i-Joists and floor decking/adhesives have been added to the product portfolio; often supplied with stairs for a fully integrated solution. Staircraft has, in a short period of time, become one of the largest engineered Floor Kit providers in the UK.

Our new technology i-Joist production plant is a natural progression for the business and is part of a massive investment programme, which will see the company enter new markets with innovative products. The high performance i-Joist is marketed in the UK under the TRUfloorsystems® TFSi brand which is part of a new family of TRU brands.

The TRUfloorsystems® i-Joists are produced in a new state of the art facility in Coventry, a few miles from the company's head office, door facility and principal stair factory. Additional factories are in West Bromwich, which service our TRUbuildingsystems® division.

Our precision made TFSi-Joists feature a high-quality timber flange combined with an enhanced OSB web. The joint between web and flange has been engineered to increase strength and there are no web joints, traditionally the weakest part of an i-Joist.






Printed labels are fixed to each joist to identify its location on the installation plan. The label carries bespoke information relating to each joist such as the customer and site details, joist length, weight and Staircraft contact details. Additionally the joist labels include a unique QR code, which when scanned by your phone will identify the installation detail relating to each end of the joist in question – this makes it easier to follow how the joist should be installed on site.

Use a QR Scanner to scan our TFS i-Joist labels and obtain an interactive 3D image on your phone of the construction details which apply to each i-Joist - see our Floor Installation Guide.

# Leaders In Innovation

The Staircraft Group are renowned for leading the industry in bringing innovations to market which give our customers a fully integrated, problem free installation. A practical example which improves site safety, and simplifies floor construction is our unique factory applied notch detail. This will typically save 1 hour per plot of installation time along with 20kg of site waste, by eliminating the need for old fashioned perimeter noggings and z-clips and replacing these products with the safety bracing installed in the notch provided.



## Quality and Environmental Credentials

The Staircraft Group operates a comprehensive ISO 14001 registered environmental policy which covers both the manufacture of its products and the sourcing of raw materials.

TRUfloorsystems® i-Joists utilise wood fibre, certified under PEFC with a full chain of custody.

The TRUfloorsystems® i-Joists carry TRADA Q-Mark Approval and are ISO 9001 Quality Assured. All TRUfloorsystems® i-Joists are approved for use in structural applications by the NHBC.

## Technical Support

Staircraft has established a Technical Services Division within its Group structure called Independent Construction Technologies Ltd (ICT) to provide underpinning technical and software development services to Group companies as well as technical consultancy services to the wider construction industry (www.ictinnovation.co.uk). Our technical support team in ICT possess over 150 years of industry experience between them, including expertise in structural engineering, timber design, product testing and assessment, thermal modelling and construction product development.

We offer excellent technical support and can advise on all aspects of product use in Floors, Stairs, Roofs and Walls. Value engineering can save customers a great deal of cost without compromising performance. Full software and after sales service is also part of the extensive customer support package.

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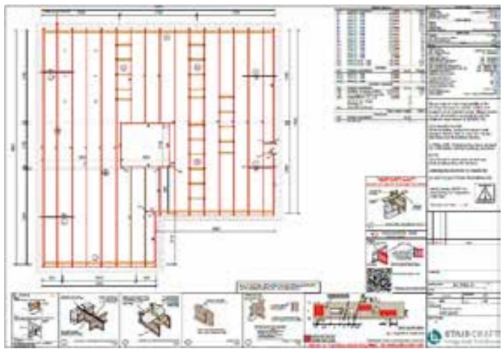
# Our Software

## *iPro*® Floor Design Software



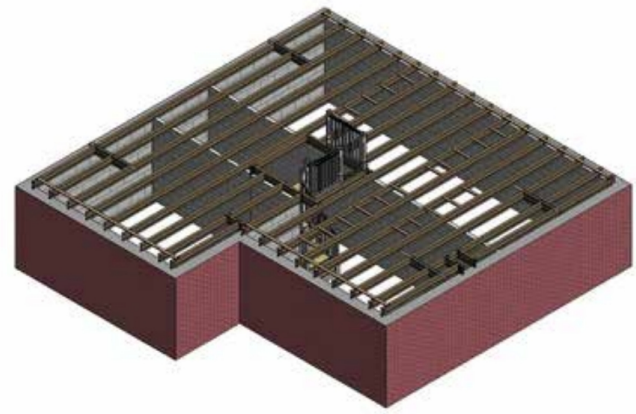
The Staircraft Group owns and develops its own market leading *iPro*® floor design software. Continuous development of this is undertaken by our in-house software programmers and structural engineers, backed up by our software testers to ensure it is simple and efficient for our design teams to use. Its output is as comprehensive as possible and fully indemnified via PI Insurance. Designs produced are fully compliant with EN1995-1-1 (Eurocode 5) requirements as well as relevant NHBC and Building Regulation guidelines.

SOFTWARE

## *Optima*™ - Optimisation software enabling CNC controlled cutting, hole routing, notching, and labelling

Our in-house software team has also developed and maintain a program called *Optima*™ which links the floor design output from *iPro*® to our factory cutting and labelling operations for both joists and decking. This software uses complex algorithms to help minimise and re-use waste offcuts wherever possible, and to keep track of the resulting stock inventories.

It also produces and feeds CNC data to our automatic saws allowing joists and deck boards to be cut to the correct sizes. This data also enables our routers to pre-drill notches and holes in joists to the designed size, shape and required position. Finally *Optima*™ sends our in-line label printer with data pertinent to the specific joist or deck board being cut. This label includes plot/site information, together with the joist number (showing its position on the joist layout), length, weight and relevant construction details/QR codes pertaining to the specific end details of the joist in question.



**All Our Designs Are Revit Compatible**

AUTODESK REVIT

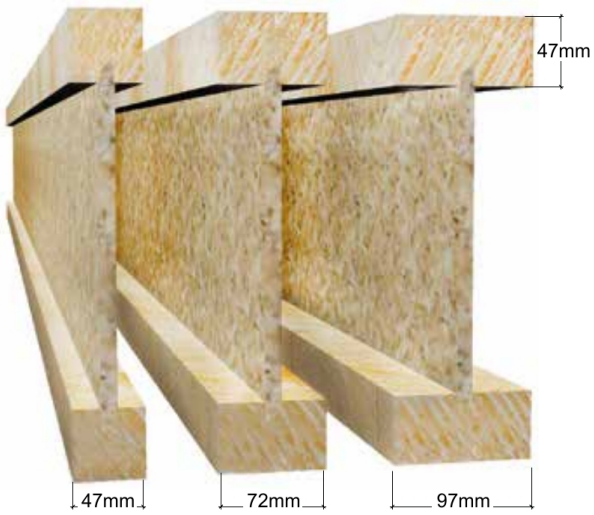
## Full native *REVIT* model output

Bespoke software modules written specifically for Staircraft and embedded within AutoCAD *Revit* enable our floor (and stair) design output to be automatically translated into full 3D BIM models. All joists and ancillary components in the floor are accurately represented as BIM objects (with associated notches, holes, reinforcements, noggings, metalwork, end blocks, bracing, pipe runs, etc.) Additional component information is also available, including for example structural output of individual joist end reactions, stresses and deflections, as well as allowable zones for pipes or duct routing.

# Standard TFSi-Joist Specifications

| | Type | 47mm Wide | 72mm Wide | 97mm Wide |
|---|---|---|---|---|
| **220mm Deep** | TFSi | ✓ | | |
| | TFSi Plus | ✓ | ✓ | |
| **240mm Deep** | TFSi | ✓ | | |
| | TFSi Plus | ✓ | ✓ | ✓ |
| **300mm Deep** | TFSi | ✓ | | |
| | TFSi Plus | ✓ | ✓ | |

Available in lengths up to 11m




Note:
The joists are clearly marked at regular intervals along their OSB webs indicating whether they are a TFSi or TFSi Plus joist type.

| Flange – Mechanical Properties | TFSi | TFSi *Plus* |
|---|---|---|
| $E_m$ [N/mm$^2$] | 11000 | 13500 |
| $f_{m,k}$ [N/mm$^2$] | 24 | 30 |
| $f_{t,0,k}$ [N/mm$^2$] | 14.5 | 19 |
| $f_{c,0,k}$ [N/mm$^2$] | 21 | 24 |
| $f_{v,k}$ [N/mm$^2$] | 4.0 | 4.0 |
| $\rho_k$ [kg/m$^3$] | 350 | 380 |

| Web – Mechanical Properties | TFSi & TFSi *Plus* |
|---|---|
| $E_{t,0,m}$ [N/mm$^2$] | 6300 |
| $G_{v,m}$ [N/mm$^2$] | 1500 |
| $f_{v,k}$ [N/mm$^2$] | 6.8 |
| $f_{r,k}$ [N/mm$^2$] | 1.84 |
| $\rho_k$ [kg/m$^3$] | 550 |

SPECIFICATIONS

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# TFSi-Joist Design Properties



## Characteristic Stiffness, Strength, Self-weight and Bearing Capacity for Standard Sizes.

| Joist Series | I-Joist depth [mm] | Self Weight [kg/m] | *EI* x $10^9$ [$Nmm^2$] | GA [kN] | Moment $M_k$ [kN.m] | Shear $V_k$ [kN] | End Bearing strength (kN) 45mm NS | 45mm WS | 90mm NS | 90mm WS |
|---|---|---|---|---|---|---|---|---|---|---|
| TFSi 47 | 220 | 2.74 | 378 | 3630 | 7.13 | 14.06 | 8.8 | 8.8 | 13.8 | 14.1 |
| | 240 | 2.88 | 471 | 3960 | 7.97 | 15.65 | | | | |
| | 300 | 3.29 | 822 | 4950 | 10.57 | 20.51 | | | | |
| TFSi *Plus* 47 | 220 | 2.91 | 460 | 3630 | 9.28 | 14.06 | 9.5 | 9.5 | 13.9 | 15.2 |
| | 240 | 3.05 | 573 | 3960 | 10.36 | 15.65 | | | | |
| | 300 | 3.46 | 994 | 4950 | 13.69 | 20.51 | | | | |
| TFSi *Plus* 72 | 220 | 3.99 | 703 | 3630 | 13.10 | 14.06 | 9.6 | 14.6 | 13.9 | 23.3 |
| | 240 | 4.13 | 874 | 3960 | 14.60 | 15.65 | | | | |
| | 300 | 4.54 | 1508 | 4950 | 19.19 | 20.51 | | | | |
| TFSi *Plus* 97 | 240 | 5.21 | 1175 | 3960 | 18.55 | 15.65 | 9.6 | 19.6 | 13.9 | 31.4 |

NS = No web stiffeners
WS= With web stiffeners

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# TFSi-Joist Design

## Strength

In accordance with EN1995-1-1 factors $\gamma_m$ and $k_{mod}$ are applied to the characteristic strength properties on Page 8 to obtain design strength values. $\gamma_m$ is dependent upon the material being used and $k_{mod}$ depends on the duration of load and service condition. Values for $\gamma_m$ and $k_{mod}$ applicable to TRUfloorsystems i-Joist design are given below.

| Material factor, $\gamma_m$ | | |
|---|---|---|
| Load Combination type | Bending and axial strength | Shear and bearing strength |
| Fundamental | 1.3 | 1.2 |
| Accidental | 1.0 | 1.0 |

1) Where TFSi Joists are supported by steel joist hangers the partial material factor for connection strength is set to 1.3.

**Partial factors are used to obtain design strengths $R_d$ from characteristic strengths $R_k$**

$$R_d = k_{mod} \, x \, \frac{R_k}{\gamma_m}$$

| Duration of load factor, $k_{mod}$ | | | | |
|---|---|---|---|---|
| Duration of load | Bending and axial strength | | Shear and bearing strength | |
| | SC1[1] | SC2[1] | SC1[1] | SC2[1] |
| Instantaneous | 1.1 | 1.1 | 1.1 | 0.9 |
| Short-term | 0.9 | 0.9 | 0.9 | 0.7 |
| Medium term[2] | 0.8 | 0.8 | 0.7 | 0.55 |
| Long-term | 0.7 | 0.7 | 0.5 | 0.4 |
| Permanent | 0.6 | 0.6 | 0.4 | 0.3 |

1) For unexposed intermediate floors use SC1 values. For ground floors and upper floors over unheated spaces use SC2 values.

2) The National Annex to EN 1995-1-1 states that imposed floor loading is taken as medium term.

## Stiffness

The stiffness contributions of the flange and web are defined by the values of elastic modulus EI and shear modulus GA values on Page 8. These values are used in common engineering equations to determine service deflections and the dynamic (vibration) response of the floor.

The final deformation of i-Joists should be calculated using elastic and shear moduli modified for creep and Service Class by dividing by the factor $(1+k_{def})$ depending on whether the loads are permanent or variable or $(1+\psi_2 k_{def})$ for deformations due to variable actions.

For bending deformation the appropriate $k_{def}$ value is that of the flanges, and for shear deformation it is that relating to the web.

| Deformation factor, $k_{def}$ | | |
|---|---|---|
| | SC1[1] | SC2[1] |
| Flange | 0.6 | 0.8 |
| Web | 1.50 | 2.25 |

1) For unexposed intermediate floors use SC1 values. For ground floors and upper floors over unheated spaces use SC2 values.

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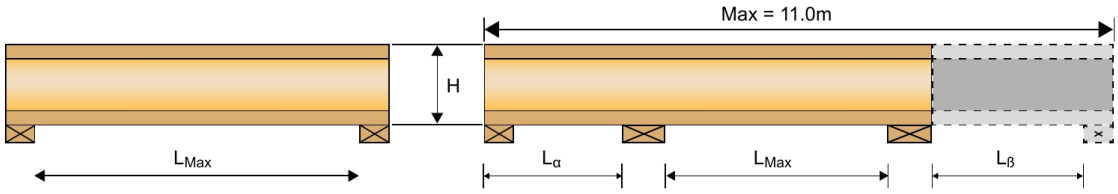
# TFSi-Joist Span Table



## Typical floor design spans for TRUfloorsystems i-Joists



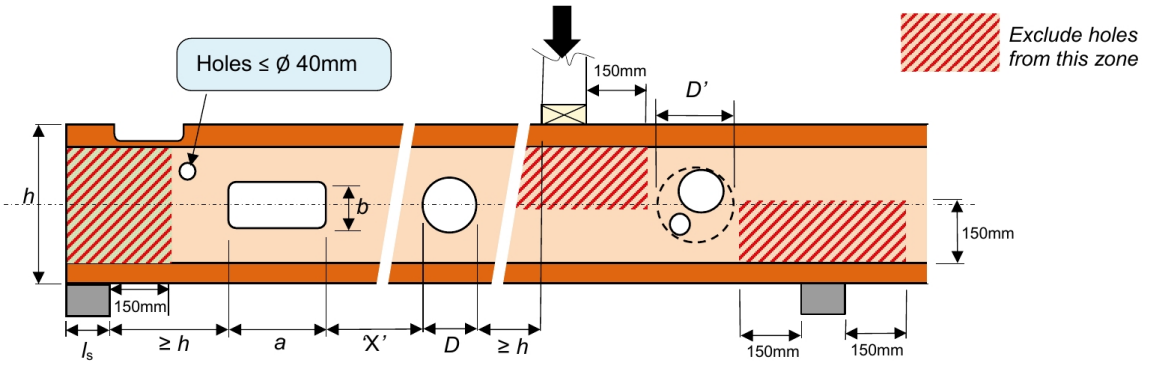

| Depth (H) (mm) | Type (mm) | Width (mm) | Maximum Clear Joist Span, Lmax (mm) | | |
|---|---|---|---|---|---|
| | | | @ 400mm c/c | @ 480mm c/c | @ 600mm c/c |
| 220 | TFSi | 47 | 4320 | 4145 | 3867 |
| | TFSi Plus | 47 | 4527 | 4345 | 4123 |
| | | 72 | 5004 | 4800 | 4599 |
| 240 | TFSi | 47 | 4559 | 4379 | 4166 |
| | TFSi Plus | 47 | 4777 | 4581 | 4393 |
| | | 72 | 5277 | 5060 | 4850 |
| | | 97 | 5655 | 5425 | 5194 |
| 300 | TFSi | 47 | 5224 | 5010 | 4805 |
| | TFSi Plus | 47 | 5464 | 5245 | 5024 |
| | | 72 | 6027 | 5785 | 5538 |

Notes:
The spans shown above are based on the following assumptions:

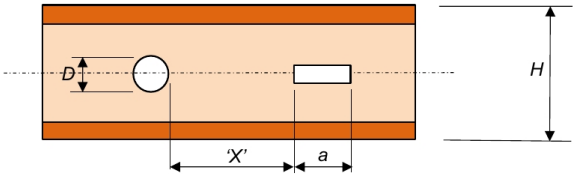
- Joist ends are simply supported on walls or joist hangers with a minimum bearing of 45mm.
- Intermediate supports are walls with a bearing length of 90mm.
- The spans are maximum clear distances between inside face of walls.
- Where there is an adjacent span it is at least 4H long. i.e. $L_\alpha \geq 4H$ and/or $L_\beta \geq 4H$. If adjacent spans are very short they may generate excessive shear force, bearing force or support uplift. Multiple span joists should always be checked using iPro® design software.
- Standard domestic (uniformly distributed) loading of 1.5kNm$^2$ live load; 0.4kN/m$^2$ dead load, 0.35kN/m$^2$ partition allowance have been assumed.
- Calculations in accordance with EN 1995-1-1 (Eurocode 5), its UK National Annex and PD6693-1.

# TFSi-Joist Allowable Hole Rules

## Permissible Web Hole Sizes and Locations

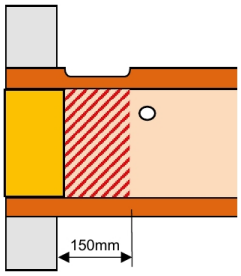



- Service holes must be cut out carefully (no overcutting) and must not be cut in to the TFSi-Joist flange.
- Irrespective of the following size limits for circular and rectangular service holes, a minimum of 3mm clearance to each flange must be maintained.
- Holes should be cut on the centre line of the web where possible.
- Circular holes of 40mm diameter or less are allowed anywhere on the web, whilst maintaining 120mm horizontal spacing centre to centre.

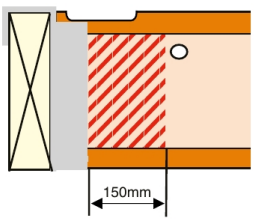



$$'X' = \text{greater of } \begin{cases} 2.a \\ 2.D \end{cases}$$

- Multiple holes that do not comply with the above spacing rules must be considered as a larger circular or rectangular hole which encloses the group
- Circular hole diameter is limited to TFSi joist depth minus 100mm
- Rectangular hole width (length, a) is limited to 300mm
- Rectangular hole depth (height, b) is limited to 200mm
- No service holes within 150mm of the edge of a bearing or load location, unless factory cut




**Masonry support**




**Joist hanger support**

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# TFSi-Joist Hole Design



The TFSi joist characteristic shear strength, $V_k$ is multiplied by a reduction factor, $k_{hole}$ to produce a characteristic shear strength at the hole location, $V_{k,hole}$, where;

$$V_{k,hole} = k_{hole} \times V_k \qquad [kN]$$

For circular holes:

$$k_{hole} = min\left\{0.9 \times \left(\frac{h - h_f - 0.9D}{h - h_f}\right); 0.89\right\}$$

For rectangular holes:

$$k_{hole} = min\left\{0.86 ; 0.23\left(\frac{h - 2h_f}{b}\right)^{0.22}\left(\frac{h - 2h_f}{a}\right)^{0.18}\left(\frac{b}{a}\right)^{0.34}\left(\frac{155}{h - 2h_f}\right)^{0.513}\right\}$$

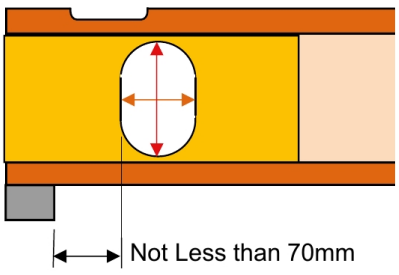
where:

| | | |
|---|---|---|
| $V_{k,joist}$ | is the characteristic shear capacity of the I-joist | [kN] |
| $V_{k,hole}$ | is the characteristic shear capacity of the I-joist at the hole | [kN] |
| $k_{hole}$ | is the hole shear reduction factor | |
| $h$ | is the joist depth | [mm] |
| $h_f$ | is the flange depth | [mm] |
| $D$ | Diameter of a circular hole | [mm] |
| $a$ | Length of a rectangular hole | [mm] |
| $b$ | Height of a rectangular hole | [mm] |

If the resulting TFSi joist shear capacity calculated at the hole ($V_{k,hole}$) is insufficient, for joists ≥240mm deep, Staircraft can supply factory-fitted hole reinforcements - either at the end of the joist where SVP pipe runs often occur, or in the main joist span to accommodate larger circular or rectangular HRV/MVHR ducts as follows:

**Obround SVP**

Factory fitted 18mm x 400mm long softwood plywood reinforcement blocks glued and nailed on both sides to approved Staircraft specifications



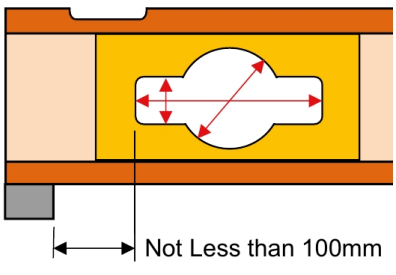

$V_{k,hole} = 11kN$

Note - The hole is slotted to enable SVP pipe falls

| Maximum Hole Dimensions | |
|---|---|
| Height | 136mm |
| Width | 118mm |

**HRV / MVHR (Circle and/or Slot)**

Factory fitted 25mm x 400mm long MDF reinforcement blocks glued and nailed on both sides to approved Staircraft specifications




$V_{k,hole} = 11.3kN$

| Maximum Hole Dimensions | |
|---|---|
| Diameter | 135mm (Circle) |
| Height | 70mm (Slot) |
| Width | 230mm |

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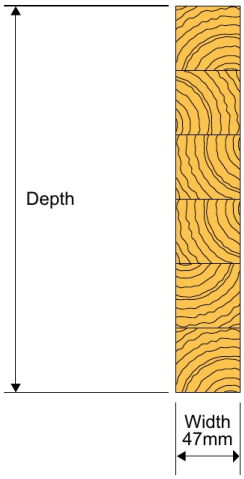
# Glulam Beams

Glulam beams used by Staircraft are manufactured from 40mm laminations of Nordic Spruce to GL24H grade under EN14080.

Glulam Beams provide primary structural floor framing on large floor areas, framing around openings and robust, fire resistant rim framing at floor perimeters.

Glulam beam depths match those of standard TRUfloorsystems i-Joists.




| Depth (h) mm | Width (b) 47mm |
|---|---|
| 220 | ✓ |
| 240 | ✓ |
| 300 | ✓ |

## Glulam Beam Design Properties

| No. of Plies | Width (mm) | Depth (mm) | Weight (kg/m) | EI x10$^9$ (Nmm$^2$) | GA (N) | Size factor, $k_h$ | $M_k$ (kNm) | $V_k$ (kN) |
|---|---|---|---|---|---|---|---|---|
| 1 | 47 | 220 | 4.72 | 483.77 | 7444800 | 1.10 | 9.10 | 12.47 |
| 1 | 47 | 240 | 5.14 | 628.07 | 8121600 | 1.10 | 10.83 | 13.60 |
| 1 | 47 | 300 | 6.43 | 1226.70 | 10152000 | 1.07 | 16.92 | 17.00 |
| 2 | 47 | 220 | 9.43 | 967.55 | 14889600 | 1.10 | 18.20 | 24.94 |
| 2 | 47 | 240 | 10.29 | 1256.14 | 16243200 | 1.10 | 21.66 | 27.21 |
| 2 | 47 | 300 | 12.86 | 2453.40 | 20304000 | 1.07 | 33.84 | 34.01 |
| 3 | 47 | 220 | 14.15 | 1451.32 | 22334400 | 1.10 | 27.30 | 37.41 |
| 3 | 47 | 240 | 15.43 | 1884.21 | 24364800 | 1.10 | 32.49 | 40.81 |
| 3 | 47 | 300 | 19.29 | 3680.10 | 30456000 | 1.07 | 50.76 | 51.01 |
| 4 | 47 | 220 | 18.86 | 1935.10 | 29779200 | 1.10 | 36.40 | 49.88 |
| 4 | 47 | 240 | 20.57 | 2512.28 | 32486400 | 1.10 | 43.32 | 54.41 |
| 4 | 47 | 300 | 25.72 | 4906.80 | 40608000 | 1.07 | 67.68 | 68.02 |

**Partial design factors for Glulam**

| $k_{mod}$ | SC1 | SC2 |
|---|---|---|
| Instantaneous | 1.10 | 1.10 |
| Short-term | 0.90 | 0.90 |
| Medium-term | 0.80 | 0.80 |
| Long-term | 0.70 | 0.70 |
| Permanent | 0.60 | 0.60 |

| | | |
|---|---|---|
| $k_{def}$ | 0.60 | 0.80 |

| | |
|---|---|
| $k_{cr}$ | 0.67 |
| $k_h$ | 1.1 |
| $\gamma_m$ | 1.25 |

where:

$M_k = n_p \left(\frac{bh^2}{6}\right) f_{m.k}$ $n_p$ = Number of plies

$V_k = n_p \left(\frac{2}{3}\right) b_{ef} h f_{v.k}$ $b_{ef} = k_{cr} b$

$f_{m.k}$ = 24.0 N/mm$^2$ (characteristic bending stress)

$f_{v.k}$ = 2.7 N/mm$^2$ (characteristic shear stress)

### Glulam Design Strength

Design Moment Capacity, $M_d = \frac{k_h k_{mod} M_k}{\gamma_m}$

Design Shear Capacity, $V_d = \frac{k_{mod} V_k}{\gamma_m}$

GLULAM BEAMS

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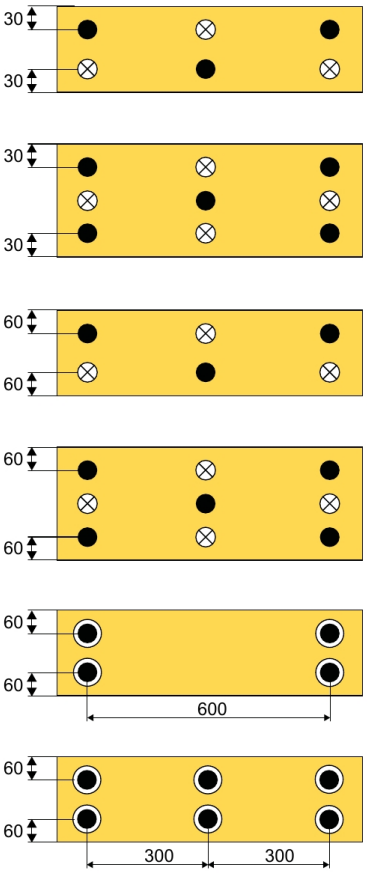
# Multi-ply Glulam Beams - Fixing Options

The maximum uniform load (kN/m) and point load (kN) design capacity that can be supported by multi-ply glulam fixings are listed below, assuming the loads are predominantly applied to one side of the beam.



## UNIFORM LOAD FIXING DETAILS

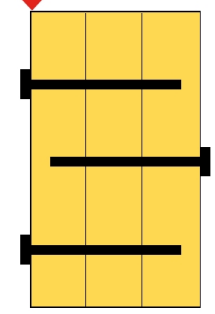
SC1 / SC2, Medium-term, $k_{mod}$ = 0.8; $\gamma_m$ = 1.3




| | UNIFORM LOAD DESIGN CAPACITY, $W_{Rd}$(kN/m) | | |
|---|---|---|---|
| | 2 Ply Members (2 x 47mm) | 3 Ply Members (3 x 47mm) | 4 Ply Members (4 x 47mm) |
| 2.90mm Ø Nails 300mm centres | **6.24 kN/m** 2.90 x 90mm | **4.68 kN/m** 2.90 x 90mm | – |
| 2.90mm Ø Nails 300mm centres | **9.37 kN/m** 2.90 x 90mm | **7.02 kN/m** 2.90 x 90mm | – |
| 5.5mm Ø Screws 300mm centres | **13.36 kN/m** 5.5 x 90mm | **10.02 kN/m** 5.5 x 135mm | **8.91 kN/m** 5.5 x 180mm |
| 5.5mm Ø Screws 300mm centres | **20.04 kN/m** 5.5 x 90mm | **15.03 kN/m** 5.5 x 135mm | **13.36 kN/m** 5.5 x 180mm |
| M12 Bolts 600mm centres | **21.46 kN/m** M12 x 115mm | **16.09 kN/m** M12 x 160mm | **14.30 kN/m** M12 x 220mm |
| M12 Bolts 300mm centres | **42.91 kN/m** M12 x 115mm | **32.18 kN/m** M12 x 160mm | **28.61 kN/m** M12 x 220mm |

$W_{R,d}$ (kN/m), Uniform Load

Side Loaded Beam



⊗ Nail /screw point. Head on opposite side

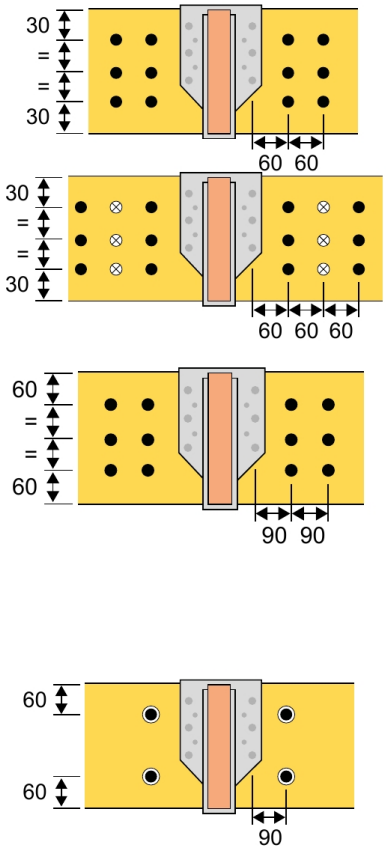
● Nail /screw head

◉ Through bolt

NOTE: DESIGN CAPACITY VALUES QUOTED HERE ARE FOR THE NAIL, SCREW OR BOLT CONNECTIONS ONLY. THE CAPACITY OF THE GLULAM BEAM ASSEMBLY MAY BE CONSIDERABLY LOWER.

## POINT LOAD FIXING DETAILS

SC1 / SC2, Medium-term, $k_{mod}$ = 0.8; $\gamma_m$ = 1.3

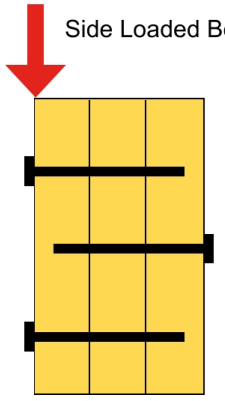


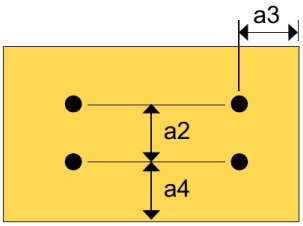

| | POINT LOAD DESIGN CAPACITY, $P_{Rd}$(kN) | | |
|---|---|---|---|
| | 2 Ply Members (2 x 47mm) | 3 Ply Members (3 x 47mm) | 4 Ply Members (4 x 47mm) |
| 2 Ply<br>2.90mm Ø Nails | **11.24 kN**<br>2.90 x 90mm | – | – |
| 3 Ply | – | **8.43 kN**<br>2.90 x 90mm | – |
| 5.5mm Ø Screws | **24.04 kN**<br>5.5 x 90mm | **18.03 kN**<br>5.5 x 135mm | **16.03 kN**<br>5.5 x 180mm |
| M12 Bolts | **25.75 kN**<br>M12 x 115mm | **19.31 kN**<br>M12 x 160mm | **17.16 kN**<br>M12 x 220mm |

MULTI-PLY GLULAM - FIXING OPTIONS

$P_{R,d}$ (kN/m), Point Load

Side Loaded Beam






Minimum spacing, end and edge distance (mm)

| | 2.90Ø Nail | 5.50Ø Screw | M12 Bolt |
|---|---|---|---|
| a2 min | 30 | 30 | 50 |
| a3 min | 30 | 60 | 80 |
| a4 min | 30 | 60 | 50 |

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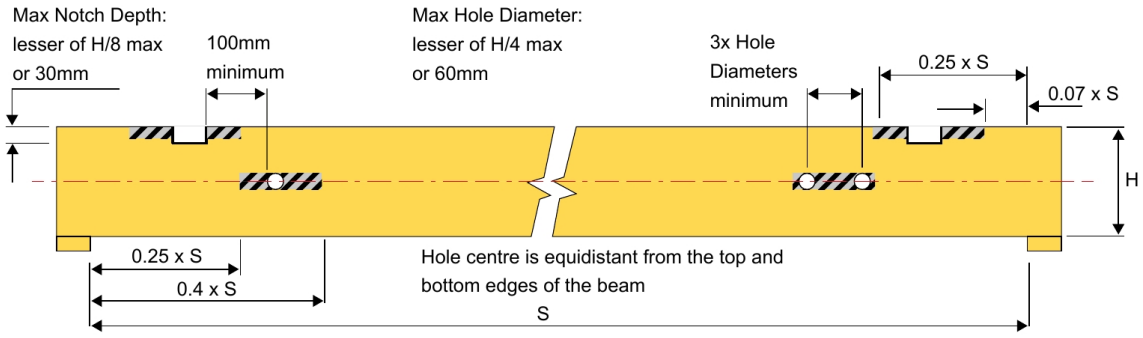
# Glulam Beam Design - Notches & Holes



Guidance in NHBC Standards and PD6693-1:2017 states that where beams are **simply supported**, supporting **uniformly distributed loading**, the effect of circular holes and notches need not be calculated if the conditions apply as shown in the following illustration:




## Hole Design Checks requiring calculation

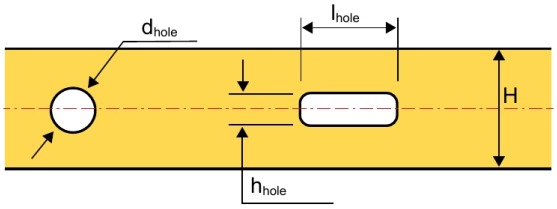
Where the above conditions do not apply, PD6693-1 provides additional guidance for checking beams with circular and rectangular holes. The following conditions must all apply:

a) The beam has a rectangular cross-section.
b) The axis of the hole is at 90° to the side face of the beam and not at a skew angle.

c) Circular hole: $d_{hole} \leq \min \begin{cases} 0.4H \\ 200mm \end{cases}$

Rectangular hole: $h_{hole} \leq \min \begin{cases} 0.2H \\ 200mm \end{cases}$

$l_{hole} \leq \min \begin{cases} 0.5H \\ 2.5\, h_{hole} \end{cases}$




d) The corners of rectangular holes are cut to a minimum radius of 15mm.
e) The hole centre is equidistant from the top and bottom edges of the beam. (If the hole centre is not equidistant from the top and bottom edges of the beam, then the calculation should be based on a larger hole whose centre is equidistant from the top and bottom edges of the beam and within which the actual hole is entirely contained.)
f) The distance from the hole centre to the nearest end of the beam is a minimum of $4d_{hole}$ (circular hole), $4l_{hole}$ (rectangular hole) or H (circular or rectangular).
g) The distance from the hole centre to an adjacent hole centre is a minimum of $4d_{hole}$ (circular hole), $4l_{hole}$ (rectangular hole) or 1.5H (circular hole), 2H (rectangular hole) or 300mm (circular or rectangular).

For both circular and rectangular holes the design tensile stress perpendicular to the grain at the hole location, $\sigma_{t,90,d}$ should be less than the perpendicular design tensile strength of the beam, $f_{t,90,d}$

$$\sigma_{t,90,d} \leq f_{t,90,d}$$

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## Hole Design Checks requiring calculation - continued

The design tensile stress perpendicular to grain at the hole location should be calculated as:

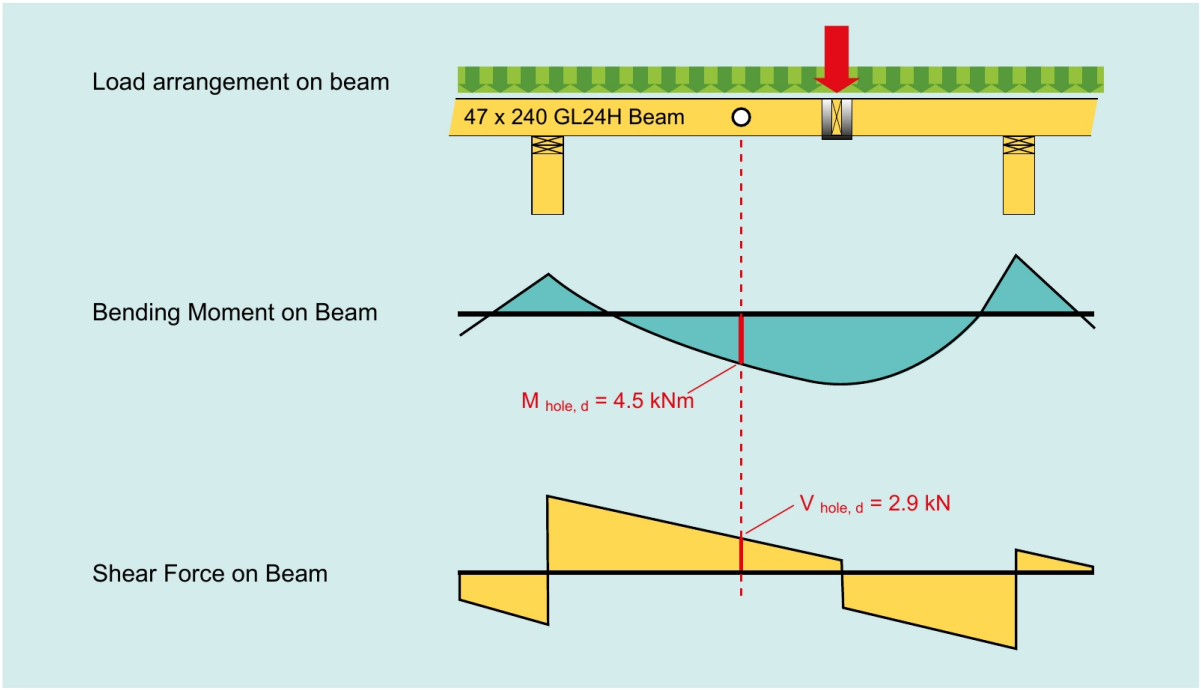
For Circular Holes: $$\sigma_{t,90,d} = \frac{1.8V_{hole,d}\, d_{hole} + 0.07M_{hole,d}}{bh^2}$$ Equation [A]

For Rectangular Holes: $$\sigma_{t,90,d} = \frac{2.7V_{hole,d}\, h_{hole} + 0.07M_{hole,d}}{bh^2}$$ Equation [B]

The charts on the next page use Equation [A] to show the limiting values of $V_{hole,d}$ and $M_{hole,d}$ for a range circular hole diameters from 'No Hole' (0%) up to $d_{hole}$ = 0.4H (Maximum 100%), with 25%, 50% and 75% increments.

The example taken from the diagram below shows that for a 47 x 240 GL24h beam, where the moment and shear force at a hole location are:

$M_{hole,d}$ = 4.5 kNm and $V_{hole,d}$ = 2.9 kN the maximum circular hole diameter, $d_{hole}$ = 72mm



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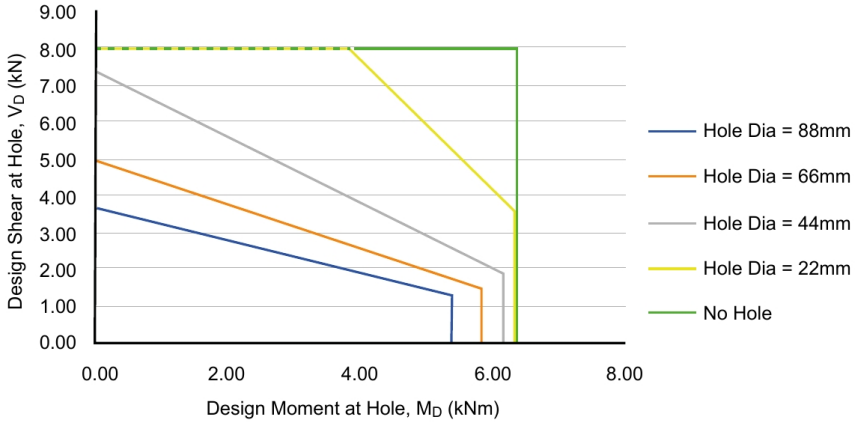
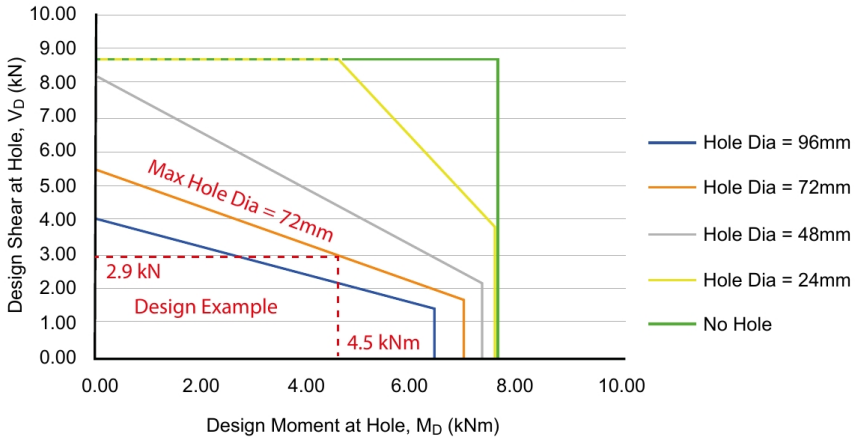
## Design charts for beams with circular holes subject to medium term design loads

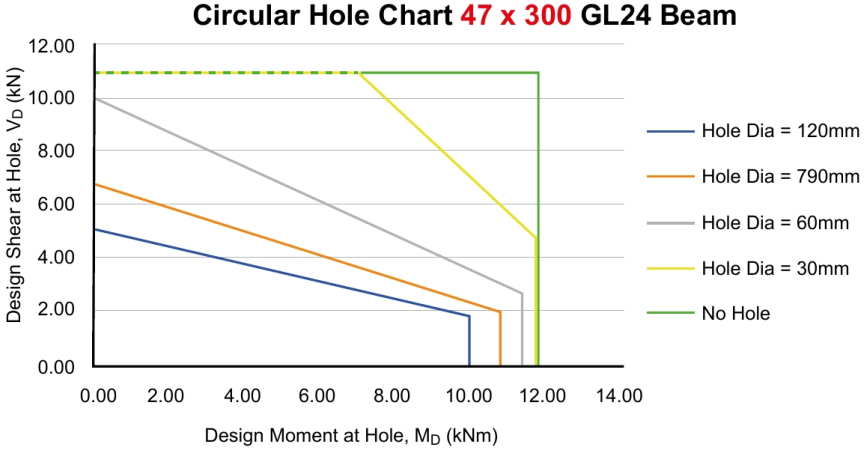
### Circular Hole Chart 47 x 220 GL24 Beam




### Circular Hole Chart 47 x 240 GL24 Beam



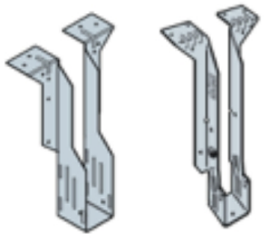

### Circular Hole Chart 47 x 300 GL24 Beam



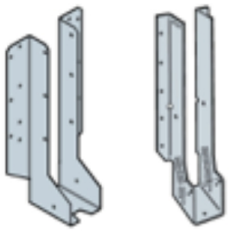
# Joist Hangers

Common types of i-Joist hanger are illustrated below. Some (backerless) Top Mount hangers can be used without backer blocks, but in all other cases for i-Joist to i-Joist connections backer blocks should be fitted to the web of the supporting i-Joist.

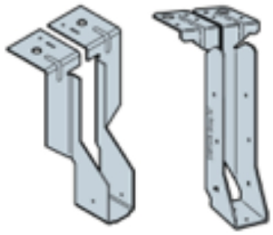
**Top Mount Hangers**



**Face Mount Hangers**



**Masonry Hangers**



## General Notes on Hanger Specification & Design

- *iPro*® design software contains a database of joist hangers from a range of manufacturers. The database has been populated only with hangers compatible with TRUfloorsystems® i-Joists and glulam beams.
- Consult the hanger manufacturer's installation instructions to ensure correct and safe installation.
- Fill all 'round' nail holes unless noted on the drawing.
- For i-Joist hangers, the hanger height must be at least 60% of the i-Joist depth depth unless web stiffeners are fitted to the incoming joist.
- Bend over and nail connector tabs (if provided) to the TRUfloorsystems® i-Joists flanges.
- DO NOT toenail TRUfloorsystems® i-Joists flanges to structural members or blockwork walls.
- If there is any doubt with respect to a particular joist hanger's compatibility or capacity contact Staircraft for advice:
  - Tel: 024 7632 4120
  - Email: technical@staircraftgroup.com



## These Conditions Are NOT Permitted

**DO NOT** use hangers shorter than 60% of the joist depth. Use web stiffeners when the sides of the hanger do not laterally support the TFSi Joist top flange.

**DO NOT** over-spread the hanger

**DO NOT** cut or notch the TFSi Joist bottom flange.

# Intermediate (Upper) Floor Construction

TRUfloorsystems® intermediate floors are specified, designed and tested to meet building regulation requirements

## Materials and workmanship

TFSi Joists carry Exova BMTRADA Q-Mark Approval and are ISO 9001 Quality Assured. All TRUfloorsystems® i-joist floor kits are approved for use in structural applications by the NHBC.

## Structural safety and stability

TFSi Joists are designed in accordance with EN 1995-1-1 (Eurocode 5), its UK National Annex and PD6693-1.

## Fire Safety

Typically, intermediate floor constructions are required to achieve 30 minutes of fire resistance. The following ceiling linings have been tested or assessed to achieve 30 minutes of fire resistance when using TFSi Joist intermediate floors.

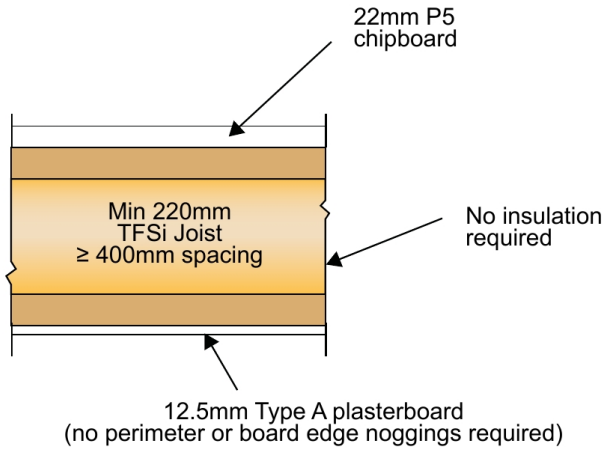
**Ceiling Lining Specification**
12.5mm (Type A) British Gypsum Gyproc Wallboard (ref. Puetz Report No. YA 1923-1E-RA-002).
15mm Type A gypsum plasterboard (ref. Puetz Report No. YA 1879-1E-RA-002).

Notes:

1. TFSi joists at max 600mm centres – min 220mm deep with min 47 x 47mm flanges.
2. 22mm thick P5 chipboard decking or equivalent.
3. No insulation necessary within the floor void.
4. No plasterboard perimeter noggings necessary.
5. No intermediate plasterboard edge noggings necessary.
6. Fix ceiling plasterboard using 3.5 x 38mm drywall screws at max 230mm centres.

✔ **Approved TFSi Joist 30min Fire Detail**

(41dB sound insulation)



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## Fire Safety (continued)

### Junction Details

The junction details shown on pages 23 to 25 will maintain the required fire resistance for the wall (30 minutes for an external wall, 60 minutes for a party wall)

### Optional fitment of Downlighters and recessed lighting

Downlighters or recessed lighting may be installed in the ceiling:

- in accordance with the manufacturer's instructions
- without hole size and spacing restrictions, if they are fire rated to match or exceed the fire rating of the ceiling (30 minutes or 60 minutes).
- where TFSi joists are used and the plasterboard is at least 12.5mm thick, hole size not greater than 85mm, max 2 downlighters/$m^2$ and no closer than 600mm apart

Note: TFSi joist floor constructions have been assessed and approved to provide 30 minute Fire Resistance with 16No popular types of downlighter supplied by Aurora Lighting Ltd and can be used in accordance with the rules stated in the bullet point above (ref. Puetz Report No. C 1847-4E-RA-001).



## Energy Conservation

### Air Leakage:

The main impact that an intermediate floor has on energy conservation is air leakage at the junction with an external wall.

Timber frame construction is inherently air-tight, having continuous vapour control layers, insulations and sheathings.

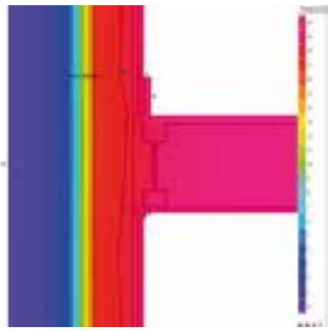
Where floor joists or framing beams bear onto the inner leaf of external masonry walls, they should be effectively sealed or, supported on masonry joist hangers.

Effective sealing of built in joist bearings can be achieved by the use of proprietary capping devices. Staircraft factory fitted end blocks DO NOT require sealant. See Detail i5 TRUfloorsystems Installation guide.

Independent air permeability tests to EN 12114 carried out on detail i5 by Lucideon Ltd indicate an air leakage rate only 4% greater than that of a plain masonry wall (ref. Lucideon Report No. 173954 (QT47238/1/GMB)/Ref. 1).

### Thermal bridges and Ψ-values

Where floors form junctions with the external walls of a dwelling there will an increase in net heat loss due to thermal bridging. The various UK building regulations have adopted a convention called a *PSI value (Ψ-value)* calculation to estimate the amount of heat loss at a junction. PSI value calculations are an integral part to producing Energy Performance Certificates for new dwellings and are therefore subject to controls and must be produced by a competent person.



Published Ψ-values are specific to the wall and floor construction, the junction detailing and minimum levels of workmanship.

A typical PSI value for TFSi joists built in to 100mm blockwork masonry walls using factory-fitted Staircraft end blocks is Ψ = 0.006 W/$m^2$K

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## Resistance to airborne sound

Proprietary iIntermediate domestic floor systems need to be Laboratory tested to achieve an airborne sound insulation, Rw ≥ 40dB, measured in accordance with BS EN ISO 10140-2:2010, and rated in accordance with BS EN ISO 717-1:2013. The TFSi joist floor constructions described on page 20 which provide a 30 minute fire resistance have also been verified by tests carried out at Sound Research Laboratories Ltd as meeting or exceeding this 40dB airborne sound resistance (ref. SRL Test Report Nos: C/24045/T02a and C/23828/T04).

### Junction Details – Air Paths

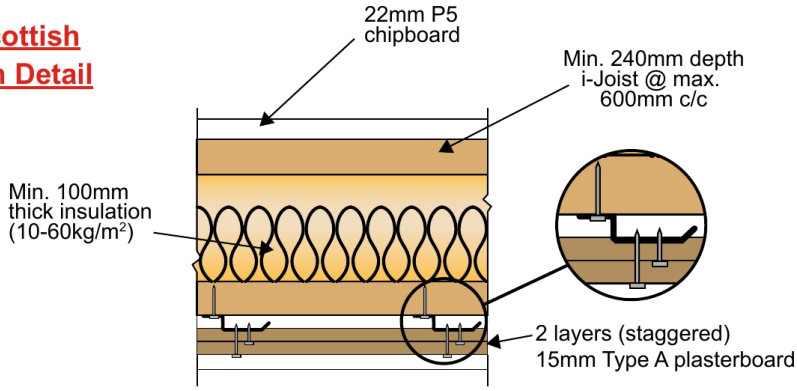
The Junction Details on pages 23 to 25 will maintain the required airtightness of party walls to minimise airborne sound transmission through air gaps. Staircraft factory fitted end blocks DO NOT require sealant (see Detail i5 TRUfloorsystems Installation guide).



### Acoustic Requirements in Scotland

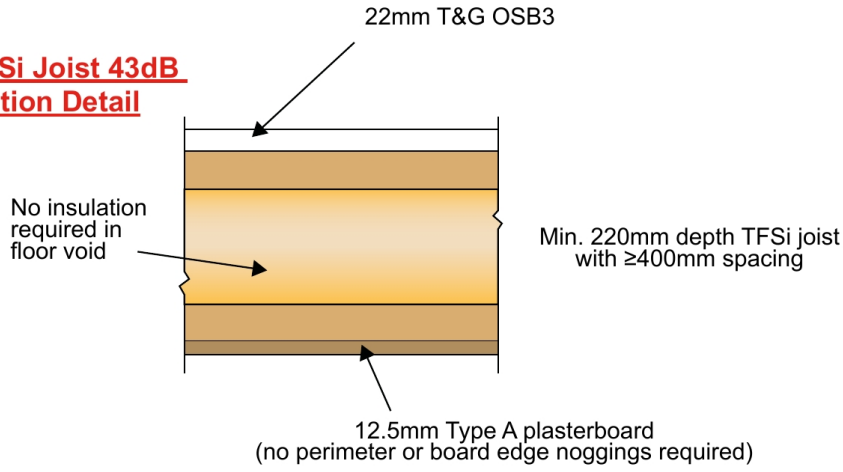
Scottish Standard 5.2 requires a minimum airborne sound insulation level of 43dB for internal floors. Proprietary metal resilient ceiling bars can be fitted between the joists and ceiling lining in order to enhance sound resistance by up to 5dB, without impairing the 30 minute fire resistance. The following default floor construction is referenced in Scottish guidance documents as meeting or exceeding this 43dB requirement.

**Generic 43dB Scottish Sound Insulation Detail**




Alternatively the following TFSi joist floor construction has been laboratory tested at Sound Research Laboratories Ltd as meeting this Scottish 43dB airborne sound resistance requirement (ref. SRL Test Report No. C/24045/T02a).

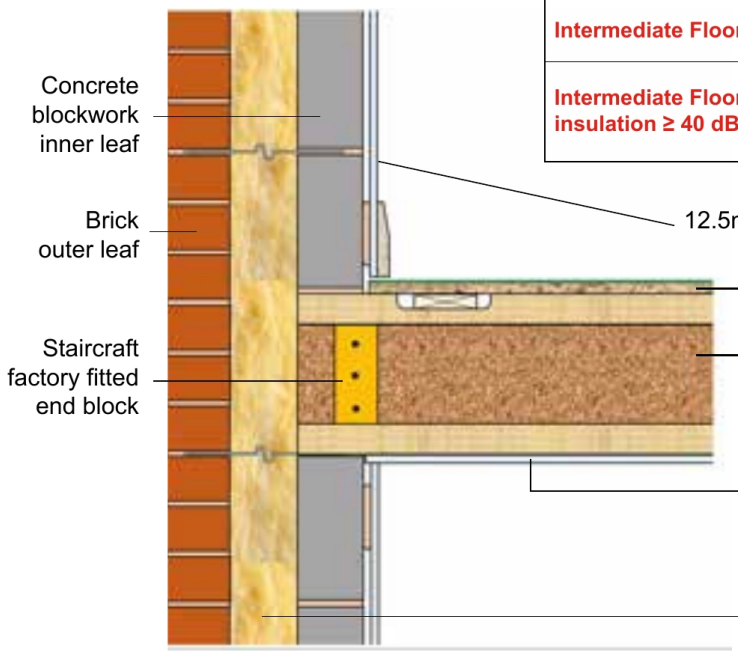
✔ **Approved TFSi Joist 43dB Sound Insulation Detail**



# Intermediate Floor Details - Masonry External Walls

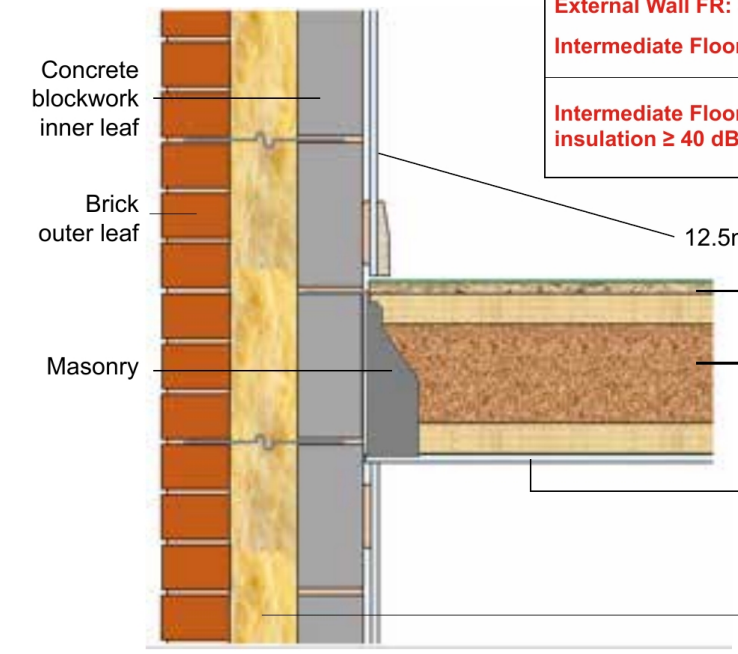
## External Masonry Cavity Wall (TFSi Joists built in)

| | |
|---|---|
| **External Wall FR: 30 Minutes**<br>**Intermediate Floor FR: 30 Minutes** | |
| **Intermediate Floor airborne sound insulation ≥ 40 dB** | |




## External Masonry Cavity Wall (TFSi Joists on joist hangers)

| | |
|---|---|
| **External Wall FR: 30 Minutes**<br>**Intermediate Floor FR: 30 Minutes** | |
| **Intermediate Floor airborne sound insulation ≥ 40 dB** | |

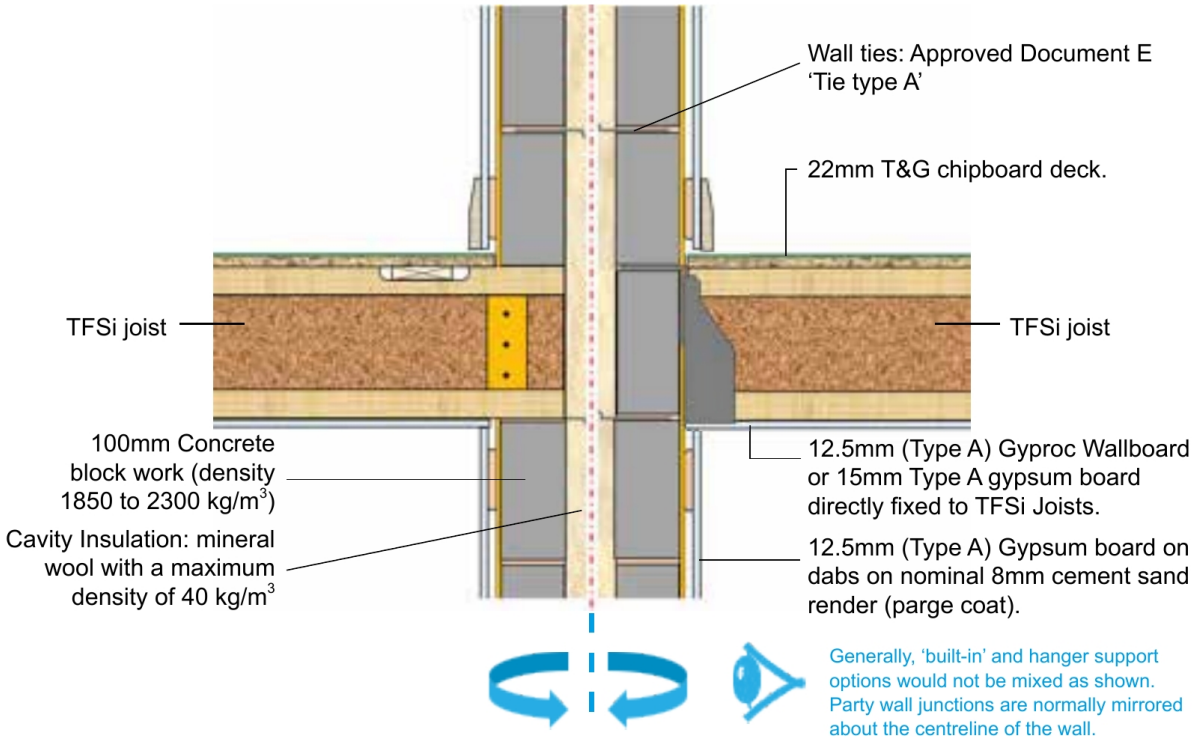


# Intermediate Floor Details - Masonry Party Walls



## Masonry Cavity Party Wall (TFSi Joists built in / On joist hangers)

| | |
|---|---|
| **Party Wall FR: 60 Minutes**<br>**Intermediate Floor FR: 30 Minutes** | |
| **Intermediate Floor airborne sound insulation ≥ 40 dB** | |




The illustrated party wall is representative of *robustdetails*® E-WM-3 to E-WM-6 inclusive. However, provided that the TRUfloorsystems internal floor is compliant with Building Regulations Requirement E2*, most junctions with masonry and timber frame separating wall *robustdetails*® will be acceptable.

* Laboratory tested, airborne sound insulation, *R*w ≥ 40 dB, measured in accordance with BS EN ISO 140-3:1995, and rated in accordance with BS EN ISO 717-1:1997

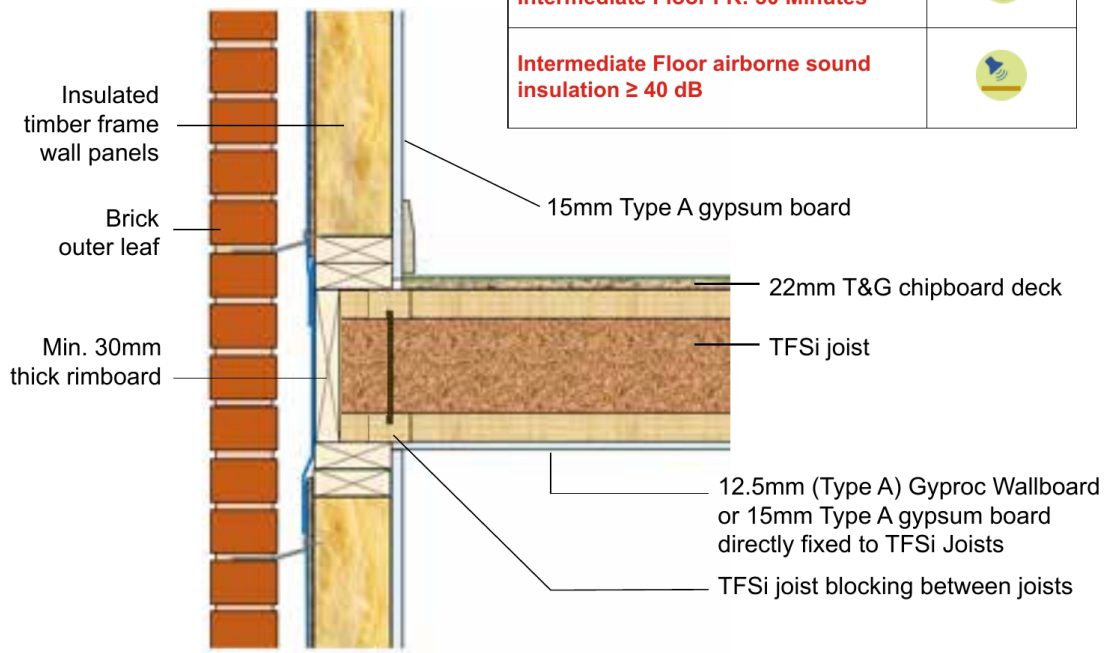
TRUfloorsystems E2 compliant Internal Floors.

| | |
|---|---|
| Floor deck: | 22mm chipboard |
| TFSi joist framing: | TFSi joist depth ≥ 220mm<br>TFSi joist centres ≥ 400mm |
| Ceiling linings: | 12.5mm British Gypsum Gyproc WallBoard<br>15mm Type A gypsum wallboard |
| Ceiling construction: | No plasterboard edge or perimeter noggings required |
| Floor void: | No insulation required |

# Intermediate Floor Details - Timber Frame External & Party Walls

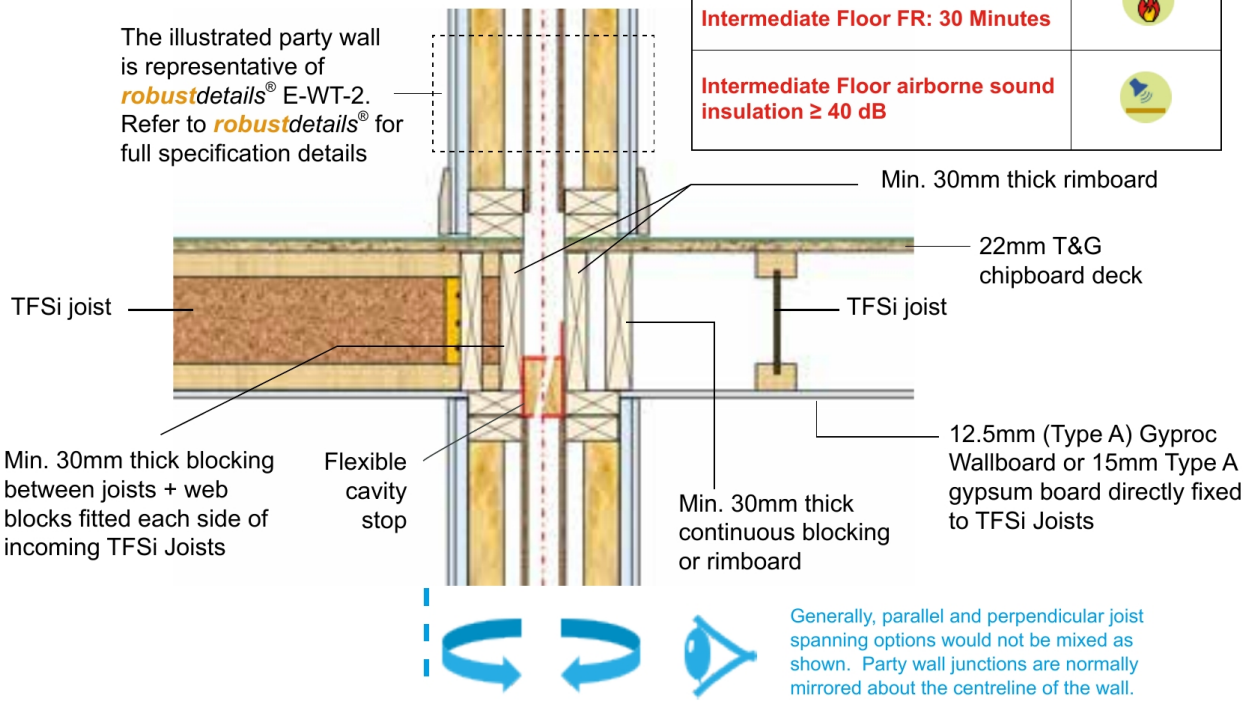
## External Timber Frame Wall

| | |
|---|---|
| **External Wall FR: 30 Minutes**<br>**Intermediate Floor FR: 30 Minutes** | |
| **Intermediate Floor airborne sound insulation ≥ 40 dB** | |




## Timber Frame Party Wall

| | |
|---|---|
| **Party Wall FR: 60 Minutes**<br>**Intermediate Floor FR: 30 Minutes** | |
| **Intermediate Floor airborne sound insulation ≥ 40 dB** | |






Generally, parallel and perpendicular joist spanning options would not be mixed as shown. Party wall junctions are normally mirrored about the centreline of the wall.

INTERMEDIATE FLOORS

# Separating (Party) Floor Construction

TRUfloorsystems® separating floors are specified, designed and tested to meet building regulation requirements.

## Materials and workmanship

TFSi Joists carry Exova BMTRADA Q-Mark Approval and are ISO 9001 Quality Assured. All TRUfloorsystems® i-joist floor kits are approved for use in structural applications by the NHBC.

## Structural safety and stability

TFSi Joists are designed in accordance with EN 1995-1-1 (Eurocode 5), its UK National Annex and PD6693-1.

## Fire Safety

Residential separating floor constructions are required to achieve 60 minutes of fire resistance. The following ceiling linings have been tested or assessed to achieve 60 minutes of fire resistance in conjunction with TFSi joist separating floors.

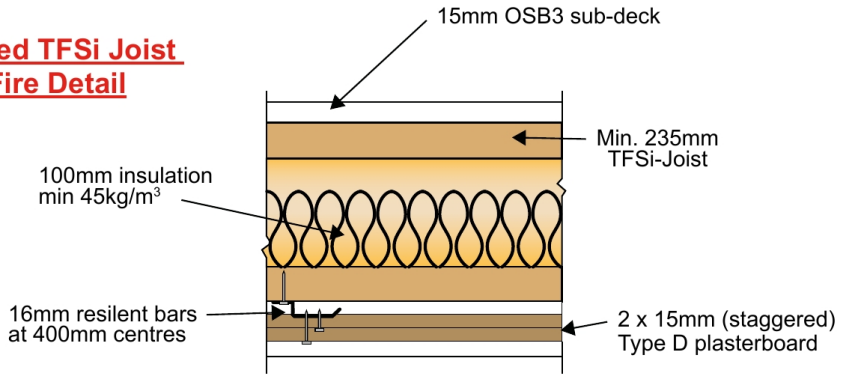
**Ceiling Lining Specification** (ref. Puetz Fire Classification Report No. YA 1924-1E-RA-001).

| Base Layer | Face Layer |
|---|---|
| 15mm Type D gypsum plasterboard | 15mm Type D gypsum plasterboard |

Notes:

1. Fix resilient bars at 90° (perpendicular) to the joists at 400mm centres using 3.5 x 25mm drywall screws at max 230mm centres.
2. Fix plasterboard layers to the resilient bars using 3.5mm drywall screws at max 230mm centres – 25mm long for 1st layer and 42mm long for 2nd layer.
3. TFSi joists at max 600mm centres – min 235mm deep with min 47 x 47mm flanges.
4. Min 15mm thick OSB3 decking or equivalent.
5. Min 100mm thick 45kg/m$^3$ density insulation within the floor void.

✔ **Approved TFSi Joist 60min Fire Detail**




SEPARATING FLOORS

## Fire Safety (continued)

### Junction Details:

The junction details shown on pages 29 to 31 will maintain the required fire resistance for the wall (30 minutes for an external wall, 60 minutes for a party wall)

### Optional fitment of Downlighters and recessed lighting

Downlighters or recessed lighting may be installed in the ceiling:

- in accordance with the manufacturer's instructions
- If they are fire rated to match or exceed the fire rating of the ceiling (60 minutes or 90 minutes)

Non-fire rated recessed lighting can be installed in a secondary ceiling suspended below the main ceiling. The fixings for the main ceiling resilient bars and plasterboards should be checked to ensure it can support the additional weight of the second ceiling and that there are no perforations in the main ceiling.



### Energy Conservation

Typically, the impact of separating floors on conservation of energy is the same as intermediate floors. See page 21 for Energy Conservation information.

### Resistance to airborne sound and impact sound

The requirements for sound resistance of separating floor constructions vary within the UK regions.

The required performance levels for separating floors are:

| | Airborne min. $D_{nT,w} + C_{tr}$ | Impact max. $L'_{nT,w}$ |
|---|---|---|
| England, Wales & NI: | 45 dB | 62 dB |
| Scotland: | 56 dB | 56 dB |

**Compliance:**
There are two main routes to compliance:

- Pre-Completion Testing (PCT) carried out on a representative sample of separating and flanking constructions on each development.
- Using pre-qualified separating and flanking constructions, subject to prescribed details, material specifications and minimum levels of workmanship. In England, Wales & NI these constructions are verified and managed by Robust Details Ltd and published in the *robustdetails*® Handbook. In Scotland, 'approved' separating and flanking constructions and guidance on detailing and workmanship are published in the Building Standards document: *Example Construction and Generic Internal Constructions*.

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## Resistance to airborne sound (continued)

### *robust*details®:

In common with all other timber separating floors, a TRUfloorsystems separating floor can only be fully *robust*details® compliant when used in combination with *robust*details® compliant timber frame party walls and flanking walls. When used in combination with masonry wall *robust*details® *PCT will be required*.

The following table summarises options for incorporating a TRUfloorsystems separating floor in masonry and timber frame construction:

| Separating Floor/Separating Wall Junctions – Combinations of *robust*details® | | | |
|---|---|---|---|
| Separating Walls | Separating Floors | Ceiling Treatment Options | Floating Floor Treatment Options |
| | E-FT-1 | CT1, CT2, CT3 (E-FT-1, section 5.) | FFT1 composite batten (E-FT-1, section 6.) |
| | E-FT-5 | CT1, CT2 <both include a second ceiling> CT3 <*Cellecta*® HP30 resilient bar> (E-FT-5, section 5.) | *Cellecta*® Screedboard® 28 |
| | E-FT-7 | CT1 (E-FT-7, section 5.) | FFT80 composite batten (E-FT-7, section 6.) |
| | | | |
| E-WT-1 | *robust*details® | The *robust*details® Online Handbook is available to view and download at: www.robustdetails.com | |
| E-WT-2 | *robust*details® | | |
| E-WT-3 | Requires Floor PCT** | | |
| E-WT-4 | Requires Floor PCT** | | |
| E-WM-1 to E-WM-31* | Requires Floor PCT** | | |
| | | | |
| *Excludes E-WM-7 which has been removed from *robust*details® ** PCT – Pre-completion sound testing | | | |

## Optional fitment of Downlighters and recessed lighting

Downlighters or recessed lighting may be installed in the ceiling:

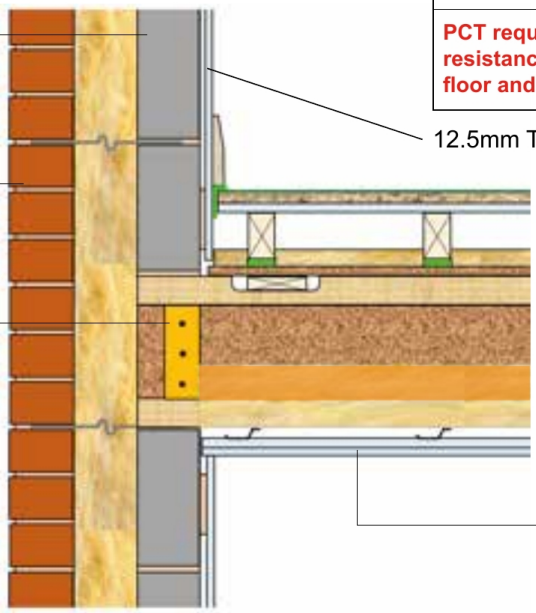
- in accordance with the manufacturer's instructions
- at no more than one light per 2m$^2$ of ceiling area in each room unless the use of a greater density of light fittings is supported by testing undertaken in accordance with Appendix F of the *robust*details® Handbook.
- at centres not less than 0.75m
- into openings not exceeding 100mm diameter or 100x100mm.

**Note: Only downlighters which have been satisfactorily assessed in accordance with the procedure described in the *robust*details® Handbook, Appendix F "Determination of the acoustic performance of downlighters and recessed lighting in timber separating floors" are acceptable.**

# Separating Floor Details - Masonry External Walls

## External Masonry Cavity Wall (TFSi Joists built in)

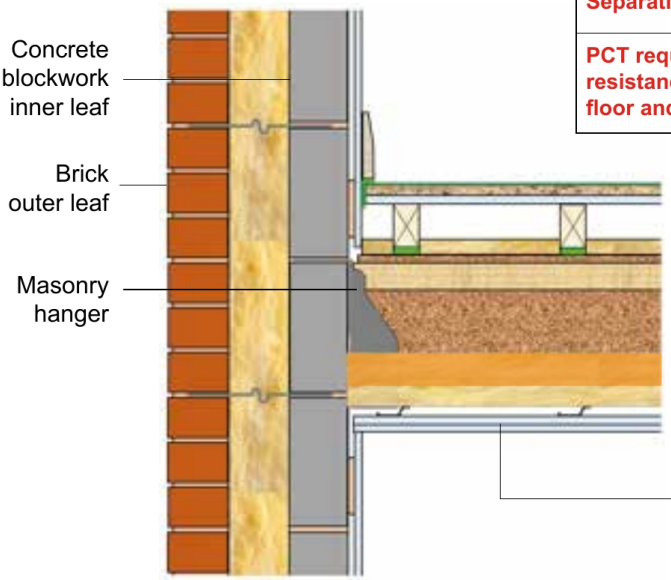
| | |
|---|---|
| **External Wall FR: 60 Minutes**<br>**Separating Floor FR: 60 Minutes** | |
| **PCT required to confirm the sound resistance of the combination of floor and flanking wall.** | |




Full-fill cavity insulation shown. Where partial-fill cavity insulation is specified ensure a minimum residual 50mm clear cavity between the insulation and the external leaf.

## External Masonry Cavity Wall (TFSi Joists on joist hangers)

| | |
|---|---|
| **External Wall FR: 60 Minutes**<br>**Separating Floor FR: 60 Minutes** | |
| **PCT required to confirm the sound resistance of the combination of floor and flanking wall.** | |




Full-fill cavity insulation shown. Where partial-fill cavity insulation is specified ensure a minimum residual 50mm clear cavity between the insulation and the external leaf.

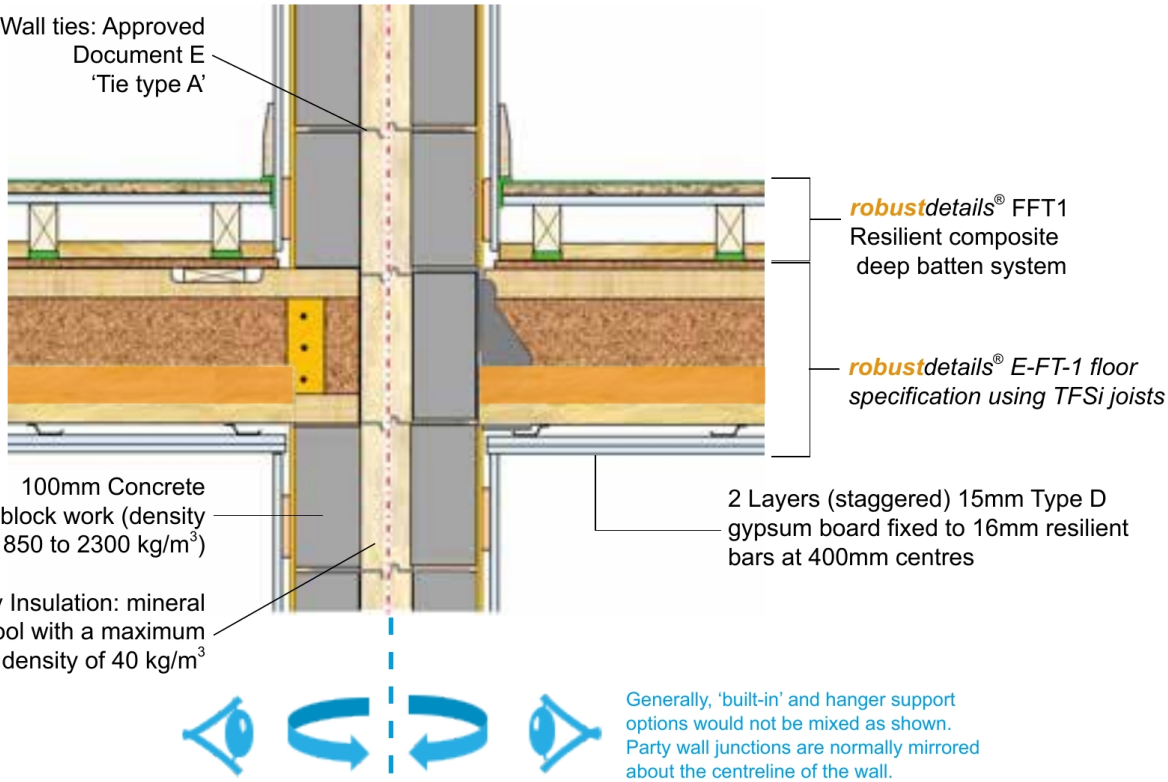
SEPARATING FLOORS

# Separating Floor Details - Masonry Party Walls

## Masonry Cavity Party Wall (TFSi Joists built in / On joist hangers

| | | |
|---|---|---|
| **External Wall FR: 60 Minutes**<br>**Separating Floor FR: 60 Minutes** | | |
| **PCT required to confirm the sound resistance of the combination of floor and flanking wall.** | | |

The illustrated party wall detail is representative of *robustdetails*® E-WM-3 to E-WM-6 inclusive.



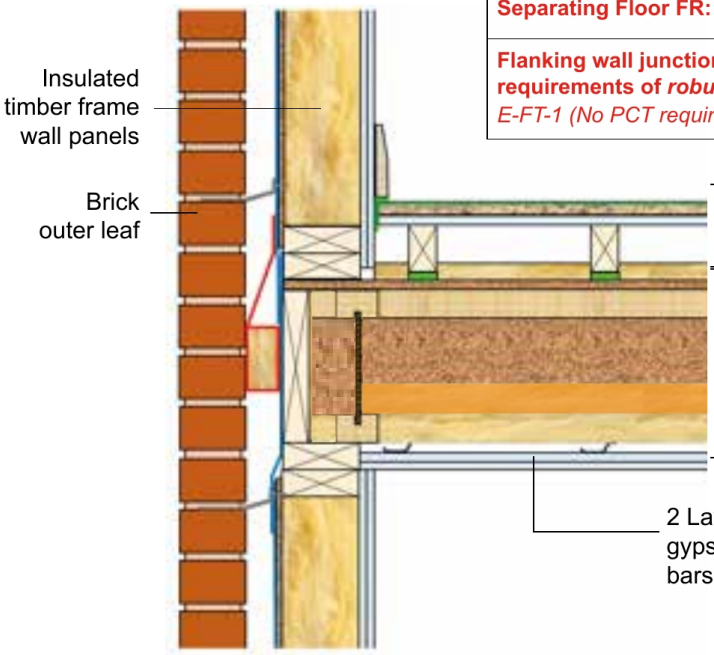

Generally, 'built-in' and hanger support options would not be mixed as shown. Party wall junctions are normally mirrored about the centreline of the wall.

SEPARATING FLOORS

# Separating Floor Details - Timber Frame External & Party Walls

## External Timber Frame Wall

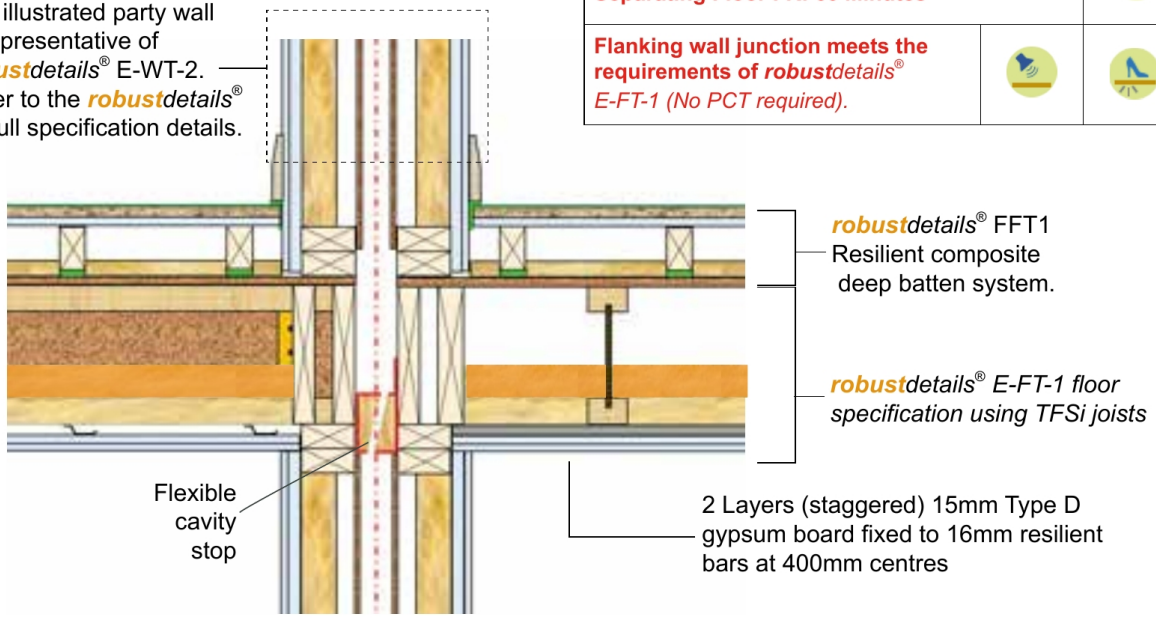
| | |
|---|---|
| **External Wall FR: 60 Minutes**<br>**Separating Floor FR: 60 Minutes** | |
| **Flanking wall junction meets the requirements of *robust*details®**<br>*E-FT-1 (No PCT required).* | |




## Timber Frame Party Wall

| | |
|---|---|
| **External Wall FR: 60 Minutes**<br>**Separating Floor FR: 60 Minutes** | |
| **Flanking wall junction meets the requirements of *robust*details®**<br>*E-FT-1 (No PCT required).* | |

The illustrated party wall is representative of *robust*details® E-WT-2. Refer to the *robust*details® for full specification details.




Generally, parallel and perpendicular joist spanning options would not be mixed as shown. Party wall junctions are normally mirrored about the centreline of the wall.

SEPARATING FLOORS

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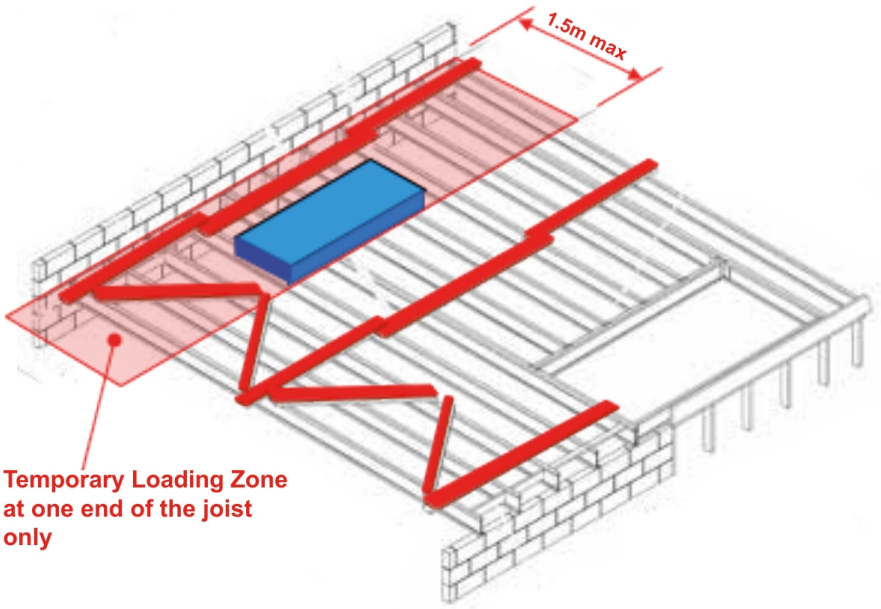
# Temporary Construction Loads



## With a propping system

Where a conventionally designed framed and decked floor is intended to be used as a general working platform, enabling access for personnel and transitional storage of construction materials, it is recommended that a designed propping system is placed beneath the joists.




## Without a propping system

Where a propping system is not installed beneath the joists, and the floor is conventionally designed using the recommended floor loadings for domestic occupation, storage of construction materials will be limited and subject to the guidance below.

If these allowable construction loads are insufficient and an alternative to propping is sought, then the floor must be designed specifically to carry the desired working loads as a separate and additional load case to that conventionally used for domestic floors. In the event the floor is explicitly designed as a safe working platform then it is recommended that the minimum imposed floor loading is assumed to be 2.5kN/m$^2$ in addition to a minimum concentrated load allowance of 3kN applied anywhere on the floor assuming a Service Class 2 moisture condition.

**Conventionally designed floors where joists are supported by masonry hangers:**

Where masonry hangers are used, the type of hanger and its load-bearing capacity should be checked before relying on the hangers to support personnel or stored material.

Generally, masonry hangers require a minimum of 3 courses (675mm) of standard masonry blockwork that has been cured for 28 days to achieve their full safe working loads. Some proprietary masonry hangers, subject to following the manufacturer's instructions, can provide limited load bearing capacity during the construction phase without the requirement for cured masonry above them.

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## Without a propping system (continued)

**Conventionally designed floors where joists are built in to walls:**

Where the floor is conventionally designed using the recommended floor loadings for domestic occupation, materials may be positioned and stored according to the rules described below:

**When only the temporary floor bracing is in place:**

1. Construction materials may only be stored on joists when all bracing is in place and the material is spread over at least 4 joists and within a loading out zone not more than 1.5m from a support. Only one loading out zone per set of joists.
2. As a guide, board material may be stored on braced floor joists as follows:

| Stored Material | Maximum depth of board stack |
|---|---|
| Plasterboard(1) | 250mm |
| Floor Deck Boards(2) | 600mm |
| (1) All common plasterboard types. Based on a board size of 1.2 x 2.4m.<br>(2) Chipboard, OSB and Plywood. Based on a board size of 0.6 x 2.4m. | |

With respect to other building materials limit the weight to 150kg per joist.

**When the floor deck has been completed/fitted:**

Once the floor deck has been completely installed and fixed to joists it can be used to temporarily support construction materials within the following limits:

AAC Blockwork (nominal density ≤ 800 kg/m$^3$) – see fig a) on page 34

- 1 stack of AAC blocks per joist:
  - Stack not more than 1.0m clear distance from the joist support
  - Not less than 1.0m clear distance between stacks.
  - Stack size not larger than 0.45m x 0.45m **x 1.5m high**
  - Where joists are supported on masonry hangers confirm that the proposed loading is acceptable to the joist hanger manufacturer before loading out the floor.
  - DO NOT place stacks on cantilever joist spans and covered stairwell openings.
- 2 stacks AAC blocks per joist:
  - As above for one stack, except stack size not larger than 0.45m x 0.45m **x 0.75m high**.
  - Each stack must be located not more than 1.0m clear distance from each end of the joist. i.e. one stack per joist end.

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TEMPORARY CONSTRUCTION LOADS

Lightweight Aggregate Blockwork (nominal density ≤ 1500 kg/m$^3$) – see fig b) on page 35

- 1 stack of AAC blocks per joist:
  - Stack not more than 1.0m clear distance from the joist support
  - Not less than 1.0m clear distance between stacks.
  - Stack size not larger than 0.45m x 0.45m **x 0.75m high**
  - DO NOT place stacks on cantilever joist spans or covered stairwell openings
  - Where joists are supported on masonry hangers confirm that the proposed loading is acceptable to the joist hanger manufacturer before loading out the floor.
- 2 stacks AAC blocks per joist:
  - As above for one stack, except stack size not larger than 0.45m x 0.45m **x 0.37m high**.
  - Each stack must be located not more than 1.0m clear distance from each end of the joist. i.e. one stack per joist end.

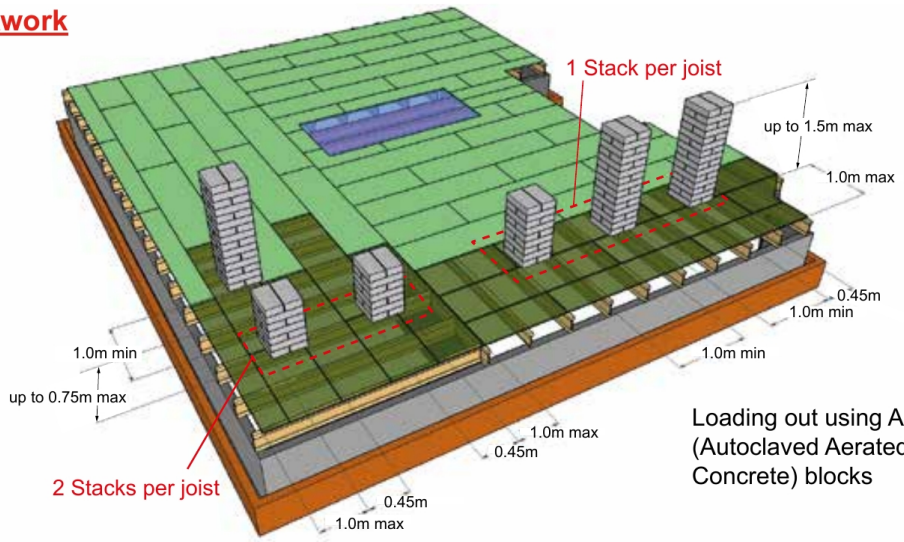
Chipboard decking – see fig c) on page 35

- Stack not more than 1.0m clear distance from the joist support.
- Stack size not larger than 0.6m x 2.4m **x 1.0m high**, spread across at least 4 joists
- DO NOT place any other loads on the same joists.
- Where joists are supported on masonry hangers confirm that the proposed loading is acceptable to the joist hanger manufacturer before loading out the floor.
- DO NOT place stacks on cantilever joist spans and covered stairwell openings.

Plasterboard – see fig d) on page 35

- Stack not more than 1.0m clear distance from the joist support.
- Stack size not larger than 1.2m x 2.5m **x 0.5m high**, spread across at least 4 joists
- DO NOT place any other loads on the same joists.
- Where joists are supported on masonry hangers confirm that the proposed loading is acceptable to the joist hanger manufacturer before loading out the floor.
- DO NOT place stacks on cantilever joist spans and covered stairwell openings.

## a) AAC blockwork




Loading out using AAC (Autoclaved Aerated Concrete) blocks

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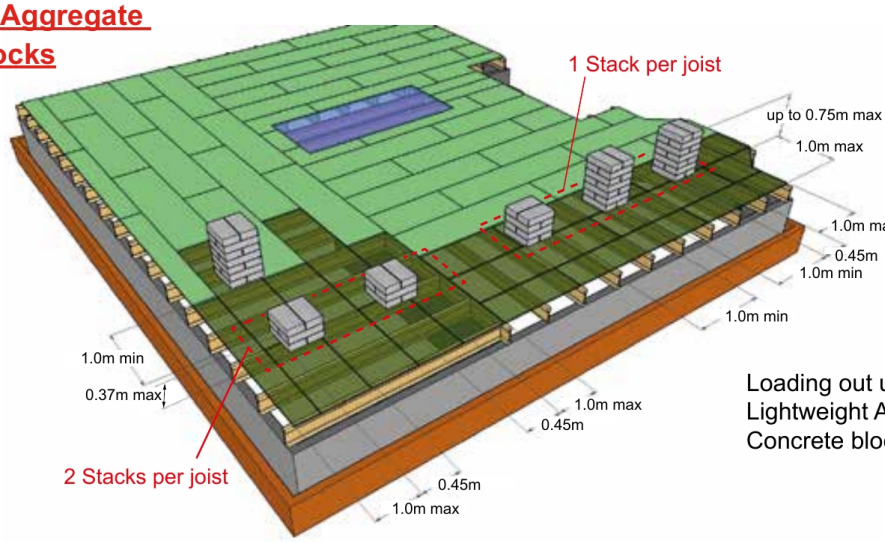
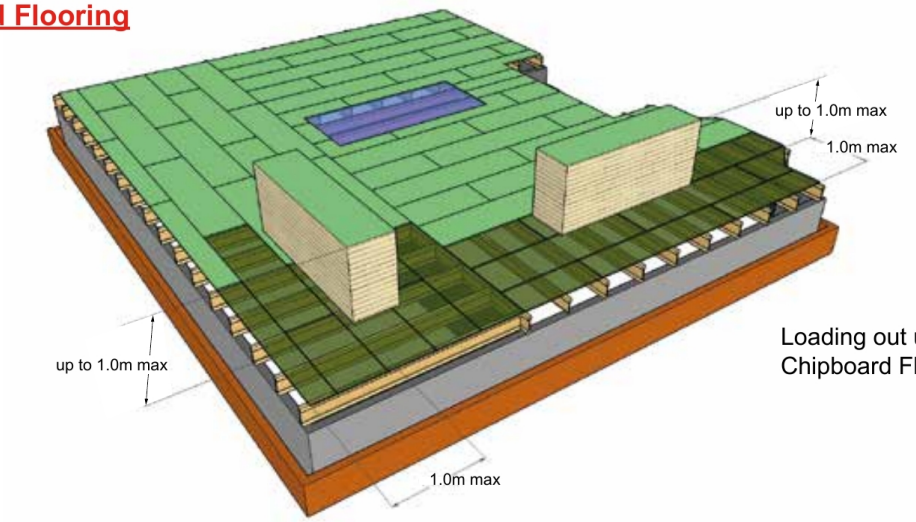
## b) Lightweight Aggregate Concrete blocks



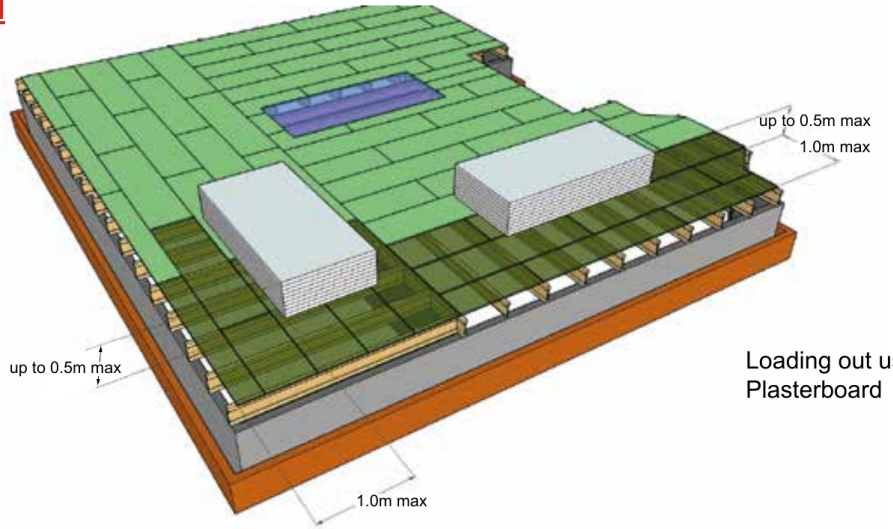

Loading out using Lightweight Aggregate Concrete blocks

## c) Chipboard Flooring




Loading out using Chipboard Flooring

## d) Plasterboard




Loading out using Plasterboard

TEMPORARY CONSTRUCTION LOADS

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# Floor Design Loads



## Material weights

| Decking | kN/m² |
|---|---|
| 12.5mm plywood | 0.08 |
| 15mm plywood | 0.10 |
| 18mm plywood | 0.12 |
| 18mm chipboard | 0.13 |
| 22mm chipboard | 0.16 |
| 9mm OSB | 0.07 |
| 15mm OSB | 0.11 |
| 18mm OSB | 0.13 |
| 15mm T&G softwood boards | 0.09 |
| 22mm T&G softwood boards | 0.12 |

| Insulation | kN/m² |
|---|---|
| Rock wool (per 25mm) | 0.01 |
| Glass fibre (per 50mm) | 0.01 |

| Ceilings | kN/m² |
|---|---|
| 9.5mm plasterboard | 0.07 |
| 12.5mm plasterboard | 0.09 |
| 15mm plasterboard | 0.11 |
| 19mm plasterboard plank | 0.15 |
| 12.5mm gypsum fibreboard | 0.11 |
| Plaster skim coat | 0.05 |
| Suspended fibreboard tiles | 0.05 |

| Floor Finishes | kN/m² |
|---|---|
| Carpet and underlay | 0.05 |
| Sheet vinyl | 0.03 |
| Acoustic mat | 0.04 |
| Ceramic floor tiles | 0.25 |
| Quarry tiles | 0.48 |
| Poured or laid cementitious screeds (per 10mm) | 0.22 |
| Hardwood parquet (10mm) | 0.08 |

## Partition walls

| | |
|---|---|
| Where the position of the partition is known: | Use the minimum of the actual partition weight or 0.65 kN/m to design the supporting joists. |
| Where the position of the partition is unknown (future renovation or change of use): | Design all floor joists for a permanent uniform floor load of 0.35 kN/m². The floor design will need to be checked if the weight of the proposed new partitions (including framing, insulation and finishes) exceeds 0.81 kN/m. |

## Residential floors

The dead weight of a residential floor within a dwelling (including deck and ceiling) is nominally taken as 0.4 kN/m².

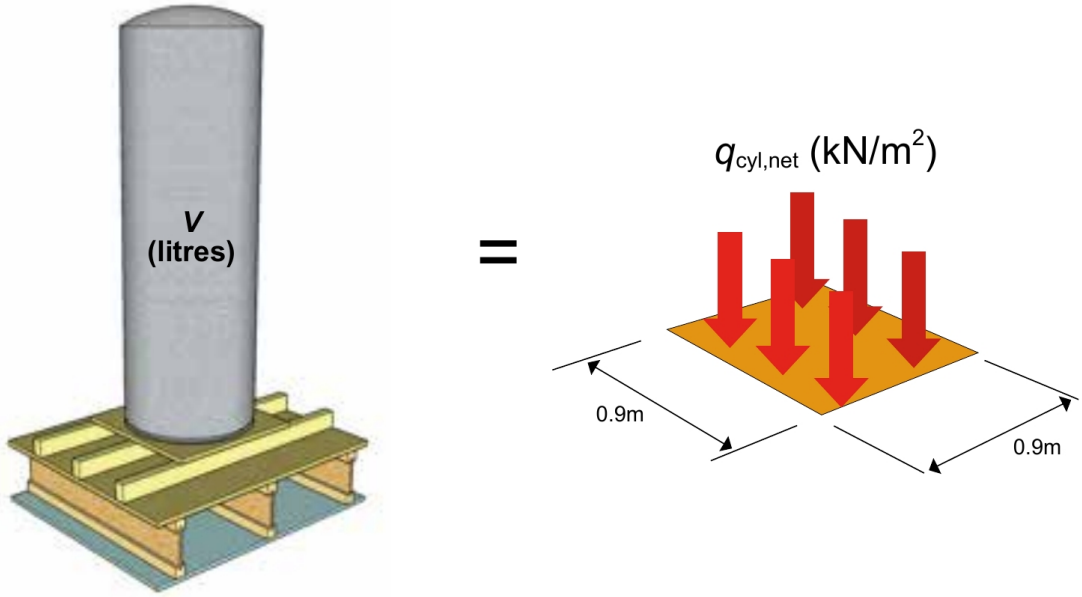
## Standard Imposed Floor Loads (BS EN1991-1-1 UK NA)

| Specific Use | Uniform (kN/m²) | Concentrated (kN) |
|---|---|---|
| Residential floor | 1.5 | 1.5 |
| Bedrooms in hotels and motels | 2.0 | 2.0 |
| Offices (general use) | 2.5 | 2.5 |

## Hot water storage cylinders

Every effort should be taken to determine the size and the location of any hot water storage cylinders supported by the floor. Failure to do so could cause noticeable floor deformation and possible damage to nearby ceiling and wall finishes.

The recommended design approach (as used by *iPro*®) is to add a net imposed patch load at the cylinder location.




| Tank Capacity ***V*** (litres) | Nett additional imposed load* $q_{cyl,net}$ (kN/m$^2$) |
|---|---|
| 120 | 0.2 |
| 144 | 0.52 |
| 166 | 0.82 |
| 200 | 1.27 |
| 210 | 1.41 |
| 300 | 2.6 |
| 400 | 3.93 |
| 500 | 5.26 |

* Note this load is additional to the imposed floor live load and partition load allowance

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# Glossary

GLOSSARY

| | |
|---|---|
| Backer Block | Wood based blocks used as backing plate where hangers are connected onto an I-Joist at 90°. |
| TFSi Joist | An i-Joist product produced exclusively by Staircraft using high grade solid timber as the flange material and OSB as the web material. |
| Beams | Structural members which act individually to support applied loads. |
| Cantilever | That part of a structural member that extends beyond the supporting superstructure. |
| Concentrated Load | Localised load applied at a specific location. |
| Dead Load | Permanent loads applied from the materials used in the building. |
| Deflection | The deformation of a member due to loads applied to it. |
| Engineering Span | Span measured between centres of bearing points – used as the basis for structural calculations on beams/joists. |
| EWP | Engineered Wood Products – Reconstituted timber products which use the principle of defect dispersal to improve strength and stability, and reduce the inherent variability of wood. |
| Filler Block | Wood based packs fitted between the webs of multi-ply i-Joists to enable them to be rigidly fixed together to form a compound element. |
| Flange | Top and bottom parts of an i-Joist which provide the majority of bending resistance when used as a beam. |
| Floor Performance | The "feel" of a floor which can be affected by many factors. |
| Framing Connectors | Metal hangers, clips or straps used to connect structural timber elements together, or to the supporting superstructure. |
| Glulam | Glued laminated timber – a reconstituted timber product consisting of layers of timber glued together with their grain laying parallel to each other to form a solid beam |
| Header | *See Trimmer.* |
| HRV | Heat recovery ventilator. |
| I-clips | Folded metal clips fixed between adjacent flanges of multi-ply i-Joists to fix them together as an alternative to using filler blocks. |
| Imposed Load | Loads arising from the occupancy and use of the building. |
| Joists | Structural members placed at regular centres to support floor loadings. |
| Live Load | *See Imposed Load.* |
| Load Sharing | An assembly of at least 4-no structural members spaced at centres no greater than 610mm and tied together by means of decking such that they act together to support a common load. |
| LVL | Laminated Veneer Lumber – a reconstituted timber product consisting of thin timber veneers glued together with their grain laying parallel to each other to form a solid beam. |
| Medium-Term Loading | Loads assumed to act for an accumulated period of no more than 6 months throughout the life of the structure (e.g. imposed floor loading) |
| MVHR | Mechanical Ventilator with Heat Recovery |
| Nogging | Timber battens fixed between joists to provide fixing points for other elements (e.g. plasterboard, restraint straps). |
| OSB | Orientated Strand Board – a reconstituted timber board material formed by gluing flakes of timer together with their orientation primarily parallel to the board direction. |
| Perimeter Nogging | Timber battens fixed adjacent to the external walls between joist ends to facilitate floor board fixing. |
| Permanent Loading | Loads assumed to act on the structure for a continuous period of 50 years or more (e.g. dead load and permanent imposed loads). |
| Rafters | Structural members spaced at regular centres to support roof loadings. |
| Rim Joist | A perimeter beam laid around the external load-bearing walls in timber frame construction to provide lateral stability and act as a closure for the purposes of fire/ moisture resistance as well as assisting in transferring vertical loads between upper and lower storeys.. |
| Service Holes | Site drilled/cut areas through webs of i-Joists which allow free passage of service pipes/ conduit. |
| Short-Term Loading | Loads assumed to act for a continuous period of no more than 1-week throughout the life of the structure (e.g. snow loading). |
| Squash Blocks | Timber blocks located beneath high concentrated loads, with their end grain vertical, which transfer these loads directly between upper and lower storeys, thus obviating the need for joists to perform this function. |
| Stud Wall Nogging | Timber battens placed between joists beneath non load-bearing walls to provide additional support and facilitate fixing of these walls. |
| SVP | Soil Vent Pipe. |
| Temporary Bracing | An arrangement of timber blocking together with diagonal and longitudinal timber members, used to provide temporary lateral restraint to structural floor or roof systems during construction. The principle employed is first to create a laterally "stiff bay" by means of blocking and diagonal members, and then to brace all the other joists/rafters back to that "bay" via longitudinal members. |
| Trimmer | Framing member spanning perpendicular to the main floor joists around openings. |
| Trimming Joist | Joists either side of a structural opening running parallel to the main floor joists, onto which Trimmer Joists are supported. |
| Uniform Loads | Load applied uniformly over a given length or area. |
| Web | Central portion of an I-Joist providing the majority of shear resistance when used as a beam. |
| Web Stiffener | Wood based blocks fixed to the webs of i-Joists to improve web shear or joist bearing resistance at bearing positions or points of high concentrated load, or used as a web packer to facilitate the fixing of certain types of hangers. |
| Z-clips | Folded metal clips fixed to i-Joist flanges to support stud wall noggings. |

# References

| European Codes and Standards: | |
|---|---|
| | |
| | BS EN 1990 (Eurocode 0) - Basis of Structural Design |
| | BS EN 1991-1-1 (Eurocode 1) - Actions on Structures - General Actions |
| | BS EN 1995-1-1 (Eurocode 5) - Design of Timber Structures |
| | BS EN 1995-1-1 UK National Annex |
| | PD6693-1 Recommendations for the design of timber structures to Eurocode 5 - Design of timber structures - General - Common rules and rules for Buildings |
| | |
| | ISO 9001 - Quality management systems - Requirements |
| | |
| | EN 520 - Gypsum plasterboards - Definitions, requirements and test methods |
| | |
| | Part E Robust Details Handbook |
| | |
| | NHBC Standards 2019 |

STAIRCRAFT Group

# The Staircraft Difference - Floors

## Our Unique *Floors*

### Features & Benefits

| | Cost benefit | Installation benefit | Performance benefit | Site H&S benefit | Site waste benefit |
|---|---|---|---|---|---|
| **Stiffest i-Joist on the market**<br>Longer spans; less deflection or bounce issues | ✓ | ✓ | ✓✓✓ | | |
| **Superior fire resistance**<br>The only i-Joist to permit 12.5mm plasterboard ceilings with no noggings | ✓✓✓ | ✓✓✓ | ✓✓ | ✓✓✓ | |
| **Pre-fitted end blocks**<br>End blocks are factory fixed where i-Joists are built-in to masonry (at no added cost) | ✓ | ✓✓ | ✓ | | ✓ |
| **Pre-drilled service holes**<br>Any size/shape holes for pipes and services can be pre-drilled in our factory (at no added cost) | ✓ | ✓✓✓ | | ✓ | ✓ |
| **Factory fixed hole reinforcement**<br>Where holes exceed design limits we factory-fit reinforcements to make them permissible | ✓✓✓ | ✓✓✓ | ✓✓✓ | | |
| **No perimeter noggings needed**<br>By factory end notching our i-Joists, perimeter bracing can act as a permanent floor nogging | ✓ | ✓✓✓ | ✓ | ✓✓ | ✓✓ |
| **Pre-cut floor decking**<br>Avoiding the need to cut floor decking on site and dispose of decking waste | | ✓ | ✓ | ✓✓ | ✓✓✓ |
| **No sacrificial i-Joists needed**<br>Our reusable 'WellSafe' system avoids the need for sacrificial i-Joist, hangers and decking | ✓ | ✓✓✓ | | ✓✓✓ | ✓✓✓ |
| **Integrated floor and stair design**<br>Ensuring the stairwell opening size is coordinated between the floor design and the stair design | ✓ | ✓ | ✓ | ✓ | ✓ |
| **'Working platform' design option**<br>Allows the floor to be used as a working platform without the need for propping beneath | ✓✓ | ✓✓ | ✓✓✓ | ✓✓ | |
| **Unique i-Joist labelling**<br>i-Joist labels indicate the relevant construction detail at each joist end, via QR code | | ✓✓ | | | |
| **Waterproof framing plans**<br>Site friendly framing plans which are weatherproof, tear proof and wipe clean | | ✓✓ | | | |
| **3D construction details via APP**<br>Access 3D details for each floor from QR codes on our framing plans and i-Joist labels | | ✓✓ | | | |
| **Downlight fire approved**<br>The only i-Joist with EN certified fire performance with downlights | ✓ | | ✓✓ | | |
| **60min fire resistance for flats**<br>EN certificated 60min fire resistance using 2x15mm plasterboard in flats | | | ✓ | | |
| **Superior acoustic performance**<br>43dB Scottish Regs can be satisfied without insulation or resilient bars | ✓✓ | ✓✓ | ✓ | | ✓ |
| **Technical and Installation Guides**<br>Including unique digital 3D construction details, downloadable via our APP | ✓ | ✓✓✓ | ✓✓ | ✓✓✓ | ✓ |
| **Automatic padstone design check**<br>Possible padstone requirements flagged for engineers approval | ✓ | | ✓ | | |
| **REVIT BIM model output**<br>Floor output as a 3D REVIT model as standard, enabling efficient resolution of design queries | ✓ | ✓ | ✓ | | |
| **i-Joists can be pre-cambered**<br>Large loads can be accommodated with small resulting deflections | ✓ | | ✓✓✓ | | |




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