



TECHNICAL MANUAL

VERSION 10

10: UPPER FLOORS

10.

Upper Floors

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ADDITIONAL FUNCTIONAL REQUIREMENTS

Workmanship

1. Fire stopping and cavity barriers are to be completed by a third-party approved contractor for all flats and apartments with a floor 4.5m above the lowest external ground level, OR; A suitable quality assurance process to be provided to evidence the fire stopping and cavity barriers, installed for all flats and apartments with a floor 4.5m above the lowest external ground level

Materials

No additional requirements.

Design

1. Party floors between buildings must achieve satisfactory levels of sound insulation to meet the relevant requirements of the Building Regulations.
2. Layouts indicating the positions of compartment walls/floors and other lines of fire resistance must be provided for all flats and apartments with a floor 4.5m above the lowest external ground level and must demonstrate compliance with the Building Regulations.
3. Upper floors - (including separating floors) shall be designed and constructed so that they:
 - a. Are structurally sound;
 - b. Are durable and resistant to moisture;
 - c. Have adequate resistance to the effects of fire and surface spread of flame;
4. A floor between the dwelling area and an integral garage or outside shall be designed and constructed so that they:
 - a. Have adequate resistance to the spread of fire between garage, and dwelling area;
 - b. Prevent undue heat losses from the dwelling area to unheated garage or outside.

10.

Upper Floors

10.1

Suspended Timber

Floor Joists

For advice on sizing of certain timber members of floors, the Designer should refer to the following sources:

- Span tables for solid timber members in floors, ceilings and roofs (excluding trussed rafter roofs) for dwellings. Published by BM TRADA. Note: Reference should be made to the version of the BM TRADA document current at the time of construction of the floor/ceiling or roof.
- BS 8103-3, Structure design of low rise buildings, Code of Practice for timber floors and roofs for dwellings.
- BS EN 1995, Eurocode 5 design of timber structures. General. Common rules and rules for buildings.

It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer.

The floor joists must be laid reasonably level and onto suitable solid and level bearings.

Joists should be restrained at supports using tightly fitted strutting. Joists should have a minimum end bearing of 90mm, unless joist hangers are used, where a 35mm bearing is acceptable (subject to the manufacturer's details).

Steel beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

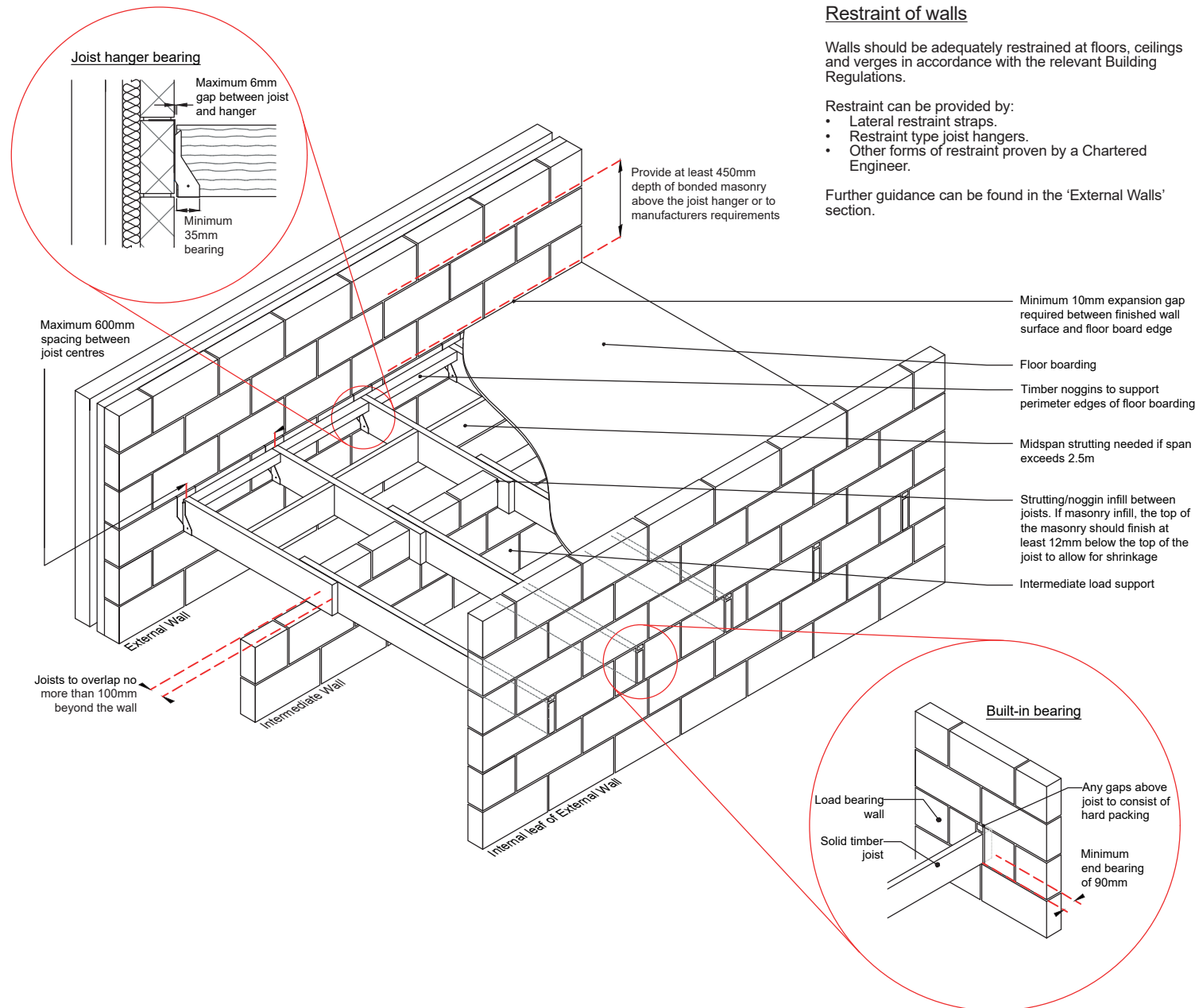
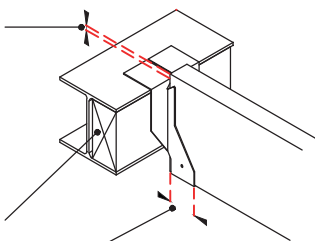
Steel beam bearing

Where floor boarding continues over the floor joist and steel beam, the timber joist should finish not less than 12mm above the top of the steel beam to allow for shrinkage of the timber

Where ceiling finishes continue across the joist and steel beam, the floor joist must extend at least 2mm below the steel beam to allow for shrinkage

Solid timber infill in web of beam. Joists should not be notched into the web of the steel beam

Minimum 35mm bearing



Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

- Lateral restraint straps.
- Restraint type joist hangers.
- Other forms of restraint proven by a Chartered Engineer.

Further guidance can be found in the 'External Walls' section.

10.1.2 SUSPENDED TIMBER: Layout of joists and bearing requirements on to a timber frame

Floor Joists

For advice on sizing of certain timber members of floors, the Designer should refer to the following sources:

- Span tables for solid timber members in floors, ceilings and roofs (excluding trussed rafter roofs) for dwellings. Published by BM TRADA. Note: Reference should be made to the version of the BM TRADA document current at the time of construction of the floor/ceiling or roof.
- BS 8103-3, Structure design of low rise buildings, Code of Practice for timber floors and roofs for dwellings.
- BS EN 1995, Eurocode 5 design of timber structures. General. Common rules and rules for buildings.

It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer.

The floor joists must be laid reasonably level and onto suitable solid and level bearings.

Joists should be restrained at supports using tightly fitted strutting. Joists should have a minimum end bearing of 90mm, unless joist hangers are used, where a 35mm bearing is acceptable (subject to the manufacturer's details).

Steel beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

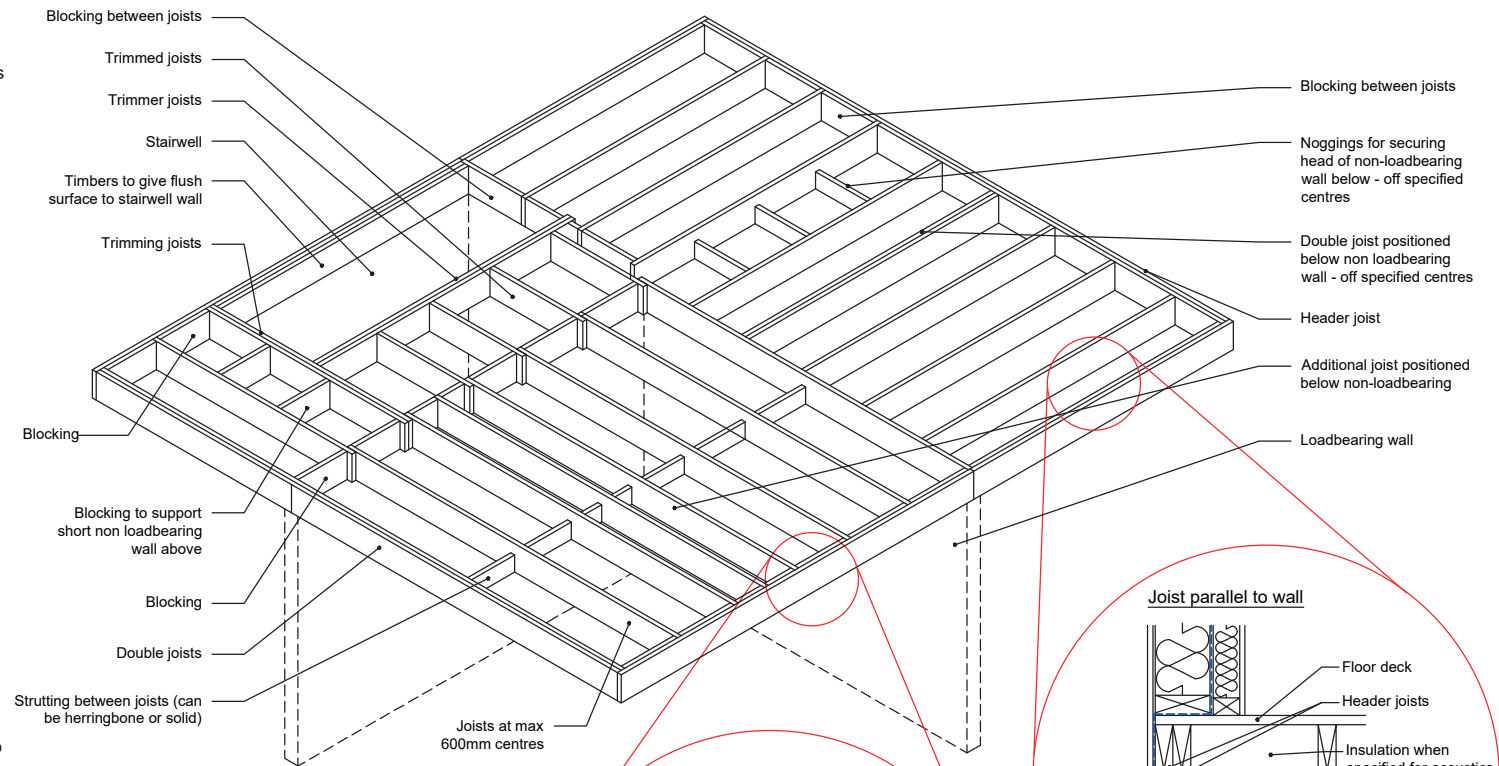
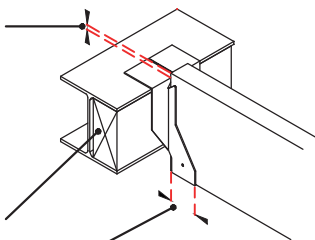
Steel beam bearing

Where floor boarding continues over the floor joist and steel beam, the timber joist should finish not less than 12mm above the top of the steel beam to allow for shrinkage of the timber

Where ceiling finishes continue across the joist and steel beam, the floor joist must extend at least 2mm below the steel beam to allow for shrinkage

Solid timber infill in web of beam. Joists should not be notched into the web of the steel beam

Minimum 35mm bearing

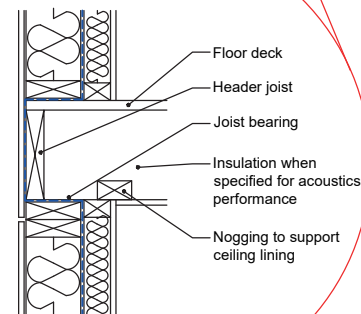


Restraint of walls

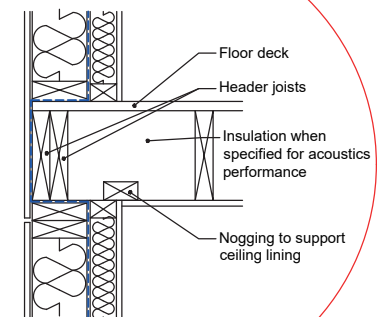
Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Further guidance can be found in the 'External Walls' section.

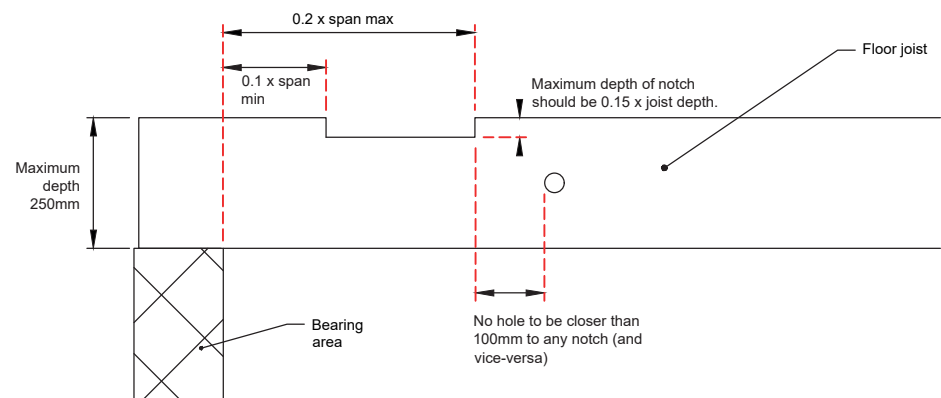
Joist at right angle to wall



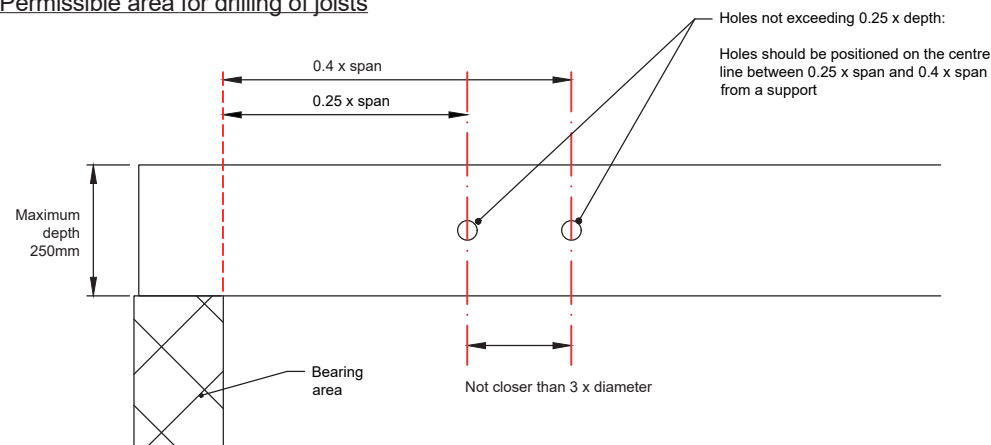
Joist parallel to wall



Permissible area for notching of joists



Permissible area for drilling of joists



Notching and drilling in solid timber joists basic guide

Requirements for notching and drilling of solid timber joists (further guidance can be found in BS 8103, TRADA span tables, BS EN 1996 and PD 6693 - 1), this guidance is for joists up to 250mm deep, notching and drilling for joists exceeding this depth should be designed by a Structural Engineer.

Notches: Notches should be made in between 0.1 and 0.2 x span. Notches should be no deeper than 0.15 x depth of the joists in this area e.g. For a 250mm deep joist, the maximum notch depth should not exceed 35mm.

Holes: Holes should be drilled on the centre line of the joist. Holes should be between 0.25 and 0.4 x the span. Holes should be a maximum diameter of 0.25 x the joists depth and kept apart by at least 3x the diameter. The maximum hole diameter should not exceed 65mm.

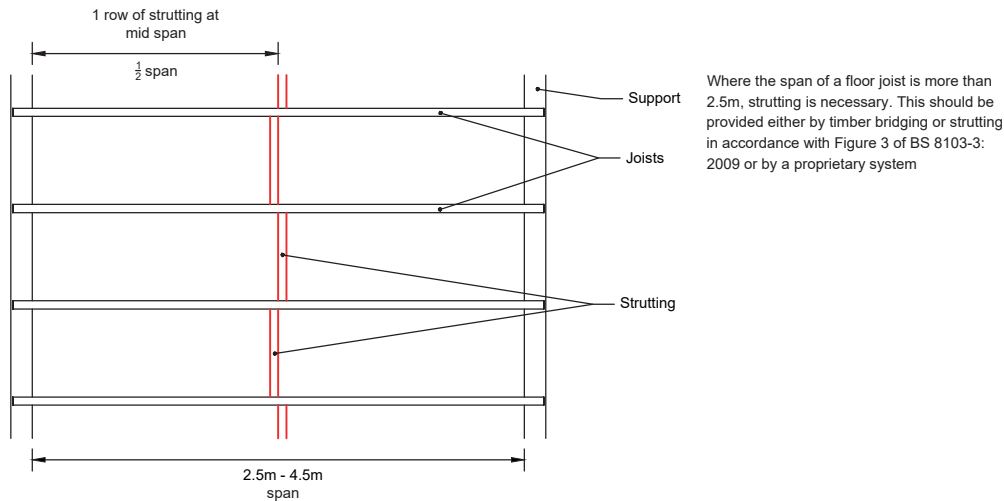
Note: Notches and holes should be a minimum of 100mm apart.

The table below gives an indication of the areas in a joist which are suitable for notching and drilling.

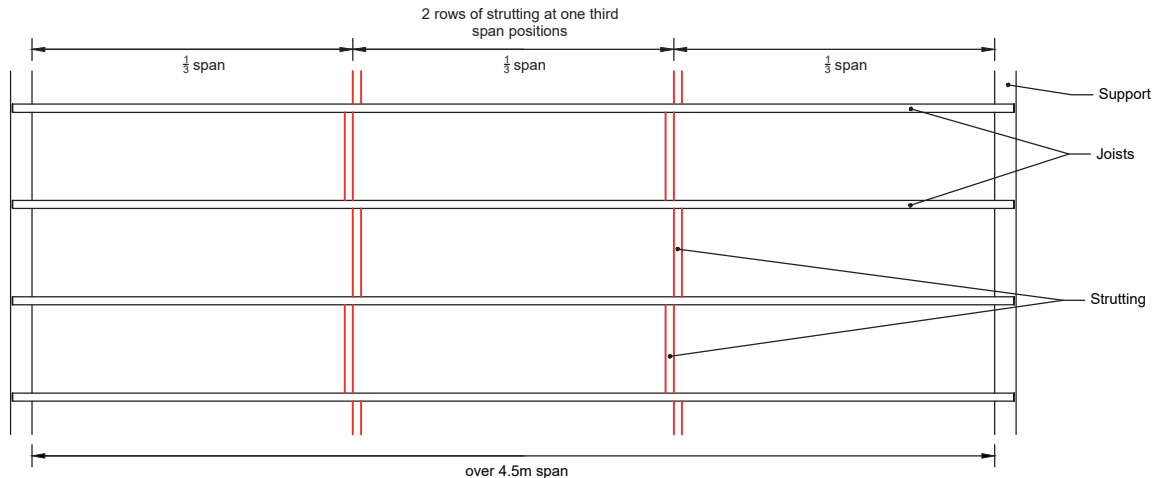
Typical permissible zones for notching and drilling of solid timber joists

Span (m)	Notches to be taken out only within these zones (m)		Holes only to be drilled within these zones (m)	
1.5	0.15	0.30	0.375	0.6
2	0.2	0.4	0.5	0.8
2.5	0.25	0.5	0.625	1
3.0	0.3	0.6	0.75	1.2
3.5	0.35	0.7	0.875	1.4
4	0.4	0.8	1	1.6
4.5	0.45	0.9	1.125	1.8
5	0.5	1	1.25	2

Strutting of joists with a span between 2.5m and 4.5m



Strutting of joists with a span over 4.5m



Where the span of a floor joist or flat roof joist is more than 4.5m, two rows of strutting at 1/3rd the span position will be necessary

Strutting or bridging of solid timber floor joists

Where the span of a floor joist is more than 2.5m, strutting is necessary. This should be provided either by timber bridging or strutting in accordance with Figure 3 of BS 8103-3: 2009 or by a proprietary system.

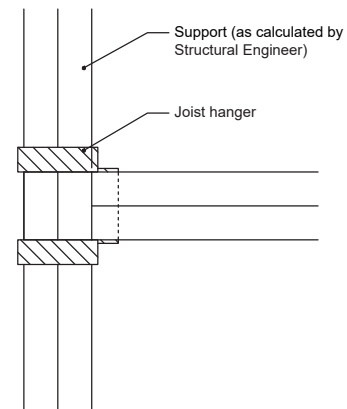
Timber strutting can be in the form of solid bridging of at least 38mm basic thickness and with a depth equal to at least three-quarters of the depth of the joists; or it can consist of herringbone strutting with members of at least 38mm by 38mm basic size. Herringbone strutting should not be used where the distance between the joists is more than approximately three times the depth of the joists.

Deflection of floors

For upper floors (intermediate floors), designers and engineers must observe our tolerance requirements for levelness of floors. Please refer to the 'Tolerances' section for further guidance.

There may be an instance where a joist might be designed to meet permissible deflections with a relevant British Standard; however, our tolerance requirements will take precedence.

Typical trimming detail (plan)



Double joists should be bolted together at 600mm centres using minimum 10mm diameter bolts with large washers that will prevent the bolt head and nut from penetrating the joist. It is recommended that the bolting of double joists is along the centre line of joists. Suitably sized trimmer joists shall be provided around floor openings

Trimmed openings may be needed around staircase openings and chimneys. Solid trimmed joists may be supported using either joist hangers or a structurally designed connection; timber trimmers around openings should consist of at least two members and be designed by a Structural Engineer

10.

**Upper
Floors**

**10.2
I-joists**

10.2.1 I-JOISTS: Layout of joists and bearing requirements on to masonry walls

I-joists

I-joists must be laid reasonably level and onto suitable solid and level bearings.

Engineered timber I-joists include a timber flange (usually solid timber or laminated veneer lumber (LVL)) and a panel product web (usually OSB). They are manufactured in an assortment of depths and flange widths under controlled factory conditions to low and uniform moisture contents.

I-joists should be designed in accordance with BS EN 1995, Eurocode 5 design of Timber Structures. General: Common rules and rules for buildings. I-joists should be appropriately CE marked and comply with ETAG 011 or hold independent third party certification.

It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer.

Joists should be restrained at supports using tightly fitted strutting.

Joists should have a minimum end bearing of 90mm, unless joist hangers are used, where the minimum bearing should be to the manufacturers specifications.

Joist hangers should be detailed in the design, including confirmation that the joist hangers have the equivalent to restraint straps at 2m centres where required to provide restraint.

Steel beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

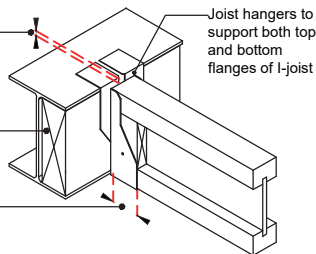
To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

Steel Bearing

When constructing floor finishes: Allow for a 12mm reduction in level due to shrinkage of the joist

Solid infill in web of beam

Minimum bearing to I-joist manufacturers specifications



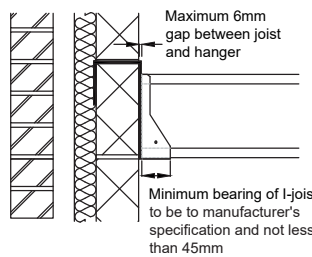
Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

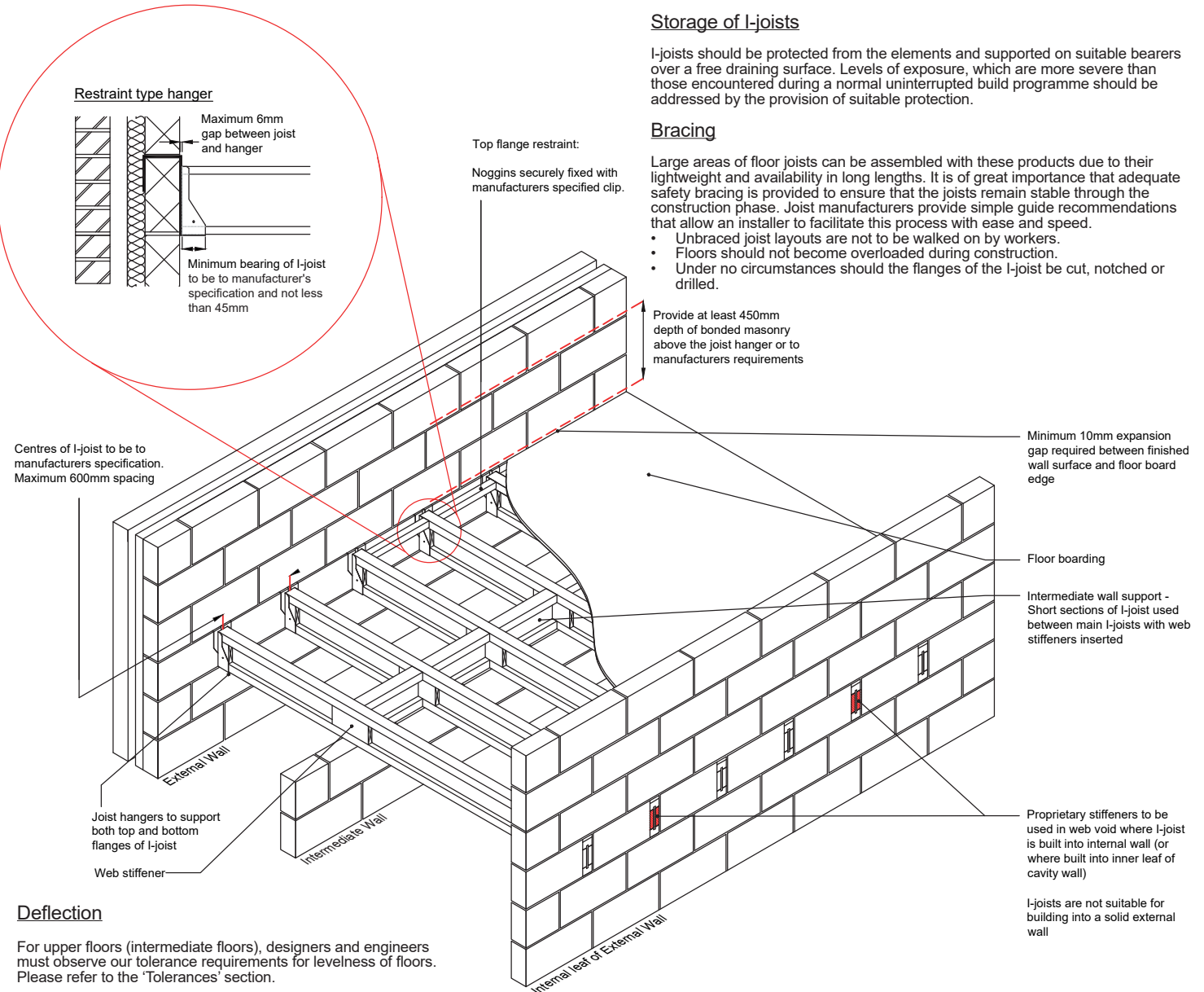
- Restraint type joist hangers
- Lateral restraint straps
- Other forms of restraint proven by a Chartered Engineer

Restraint type hanger



Top flange restraint:

Noggins securely fixed with manufacturers specified clip.



The top and bottom flanges **must not** be notched. Where ceiling and floor boards are nailed to the flanges, care must be taken to avoid splitting of the flange member.

Storage of I-joists

I-joists should be protected from the elements and supported on suitable bearers over a free draining surface. Levels of exposure, which are more severe than those encountered during a normal uninterrupted build programme should be addressed by the provision of suitable protection.

Bracing

Large areas of floor joists can be assembled with these products due to their lightweight and availability in long lengths. It is of great importance that adequate safety bracing is provided to ensure that the joists remain stable through the construction phase. Joist manufacturers provide simple guide recommendations that allow an installer to facilitate this process with ease and speed.

- Unbraced joist layouts are not to be walked on by workers.
- Floors should not become overloaded during construction.
- Under no circumstances should the flanges of the I-joist be cut, notched or drilled.

Deflection

For upper floors (intermediate floors), designers and engineers must observe our tolerance requirements for levelness of floors. Please refer to the 'Tolerances' section.

There may be an instance where a joist might be designed to meet permissible deflections within a relevant British Standard; however, our tolerance requirements will take precedence.

10.2.2 I-JOISTS: Layout of joists and bearing requirements on to a timber frame

I-joists

I-joists must be laid reasonably level and onto suitable solid and level bearings.

Engineered timber I-joists include a timber flange (usually solid timber or laminated veneer lumber (LVL)) and a panel product web (usually OSB). They are manufactured in an assortment of depths and flange widths under controlled factory conditions to low and uniform moisture contents.

I-joists should be designed in accordance with BS EN 1995, Eurocode 5 design of Timber Structures. General: Common rules and rules for buildings. I-joists should be appropriately CE marked comply with ETAG 011 or hold independent third party certification.

It is essential that joists are not overloaded during construction. Joints in joists, rafters and purlins should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer.

Joists should be restrained at supports using tightly fitted strutting.

Joists should have a minimum end bearing of 90mm, unless joist hangers are used, where the minimum bearing should be to the manufacturers specifications.

Joist hangers should be detailed in the design, including confirmation that the joist hangers have the equivalent to restraint straps at 2m centres where required to provide restraint.

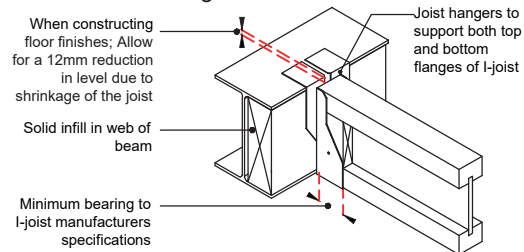
Steel Beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

Steel beam bearing

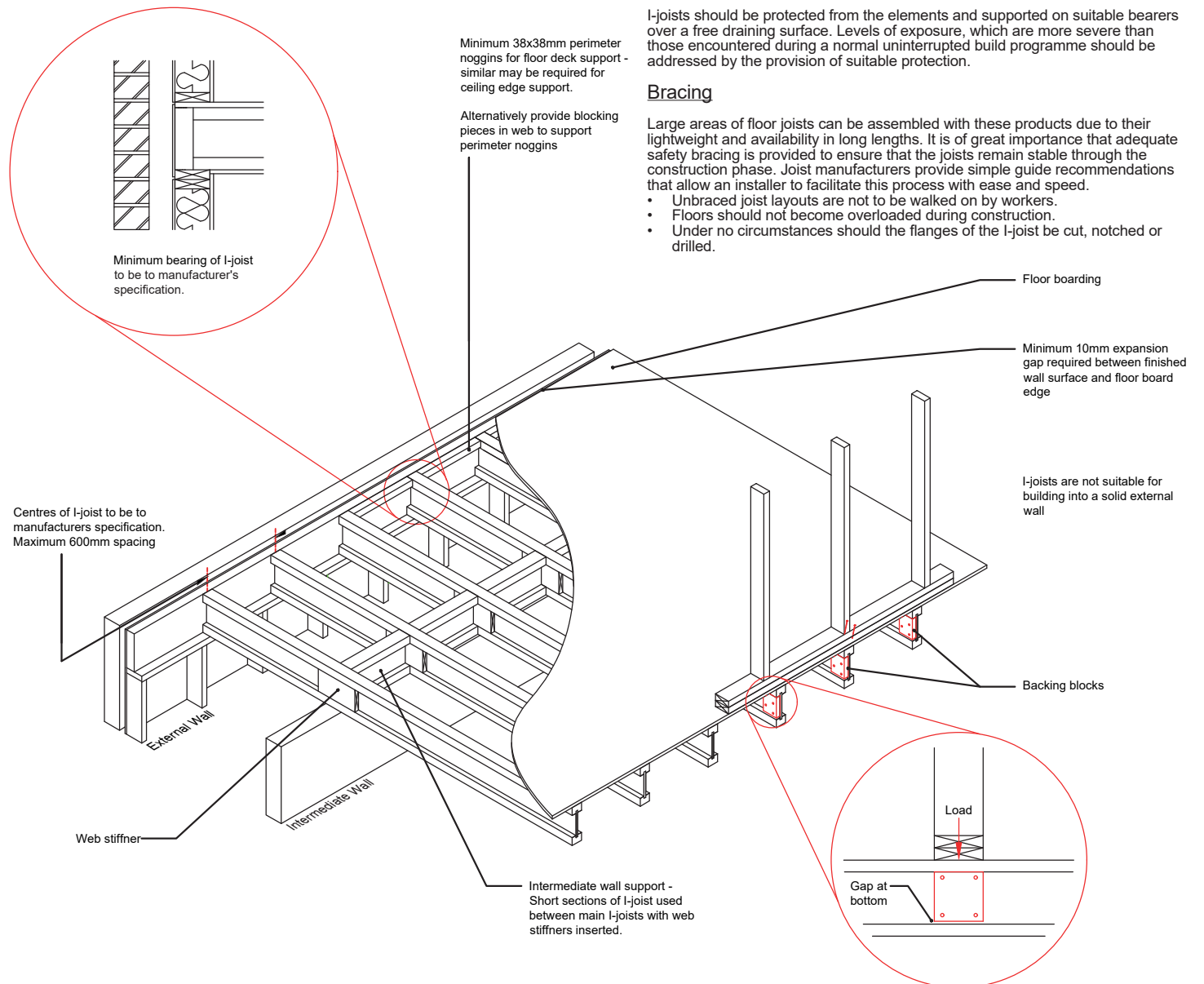


Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

- Restraint type joist hangers
- Lateral restraint straps
- Other forms of restraint proven by a Chartered Engineer



The top and bottom flanges **must not** be notched. Where ceiling and floor boards are nailed to the flanges, care must be taken to avoid splitting of the flange member.

Storage of I-joists

I-joists should be protected from the elements and supported on suitable bearers over a free draining surface. Levels of exposure, which are more severe than those encountered during a normal uninterrupted build programme should be addressed by the provision of suitable protection.

Bracing

Large areas of floor joists can be assembled with these products due to their lightweight and availability in long lengths. It is of great importance that adequate safety bracing is provided to ensure that the joists remain stable through the construction phase. Joist manufacturers provide simple guide recommendations that allow an installer to facilitate this process with ease and speed.

- Unbraced joist layouts are not to be walked on by workers.
- Floors should not become overloaded during construction.
- Under no circumstances should the flanges of the I-joist be cut, notched or drilled.

10.2.3 I-JOISTS: Lateral restraint, support of non load bearing partitions, and fixing of multiple i-joists

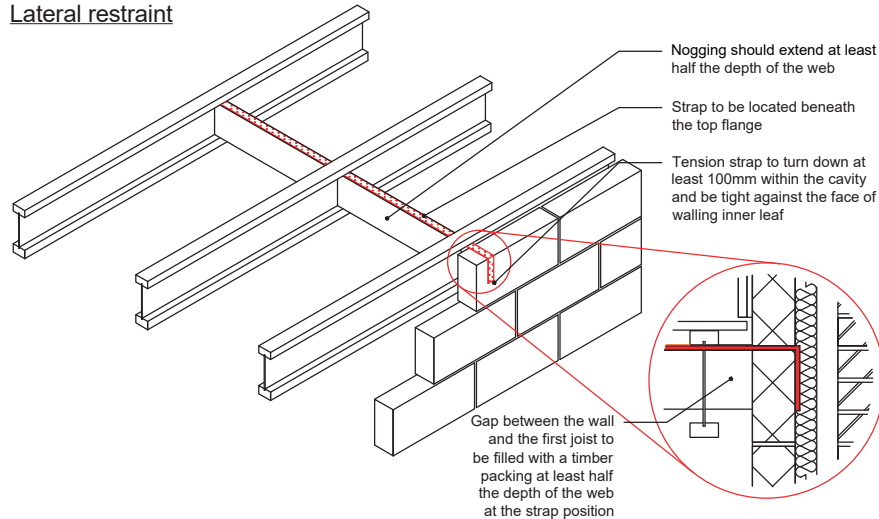
I-joist installation

The installation of I-joists must follow the manufacturer's guidance and specification for the project.

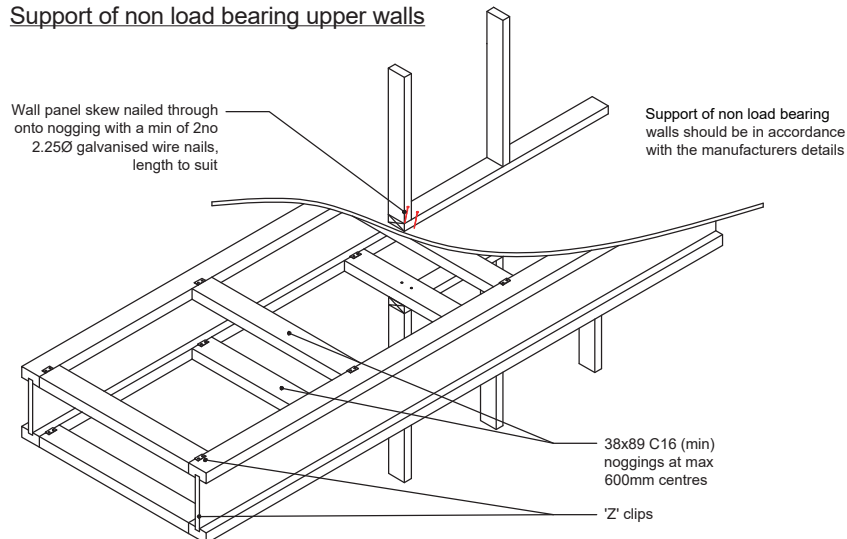
Lateral restraint straps

Floors should provide lateral restraint to all walls running parallel to them by means of 30mm x 5mm galvanized or stainless steel restraint straps at 2m centres.

Lateral restraint



Support of non load bearing upper walls

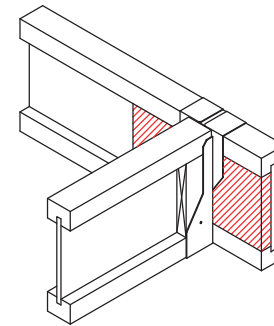


Straps need not be provided to floors at, or about, the same level on each side of a supported wall and at the following locations:

Timber floors in two storey dwellings where:

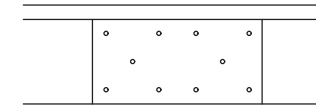
- Joists are at maximum 1.2m centres and have at least 90mm bearing on supported walls or 75mm bearing on to a timber wall plate.
- Carried by the supported wall by restraint type joist hangers as described in BS 5268: 7.1.

Backer blocks



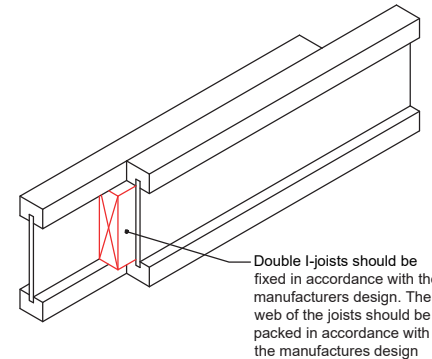
Trimmed openings may be needed around staircase openings and chimneys. Solid trimmed joists may be supported using joist hangers. Timber trimmers around openings should consist of at least two members and be designed and installed in accordance with the manufacturer's instructions. Where an I-joist is faced fixed to another I-joists backer blocks should be provided on both sides of the web of the trimmer.

Fixing of I-joists should be in accordance with the engineer's design and specification. A timber filler block should be installed between I-joists.

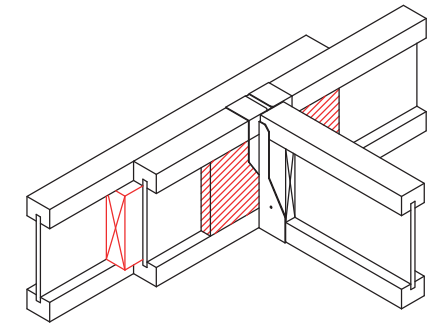


Backer blocks should be fixed in accordance with the manufacturer's design.

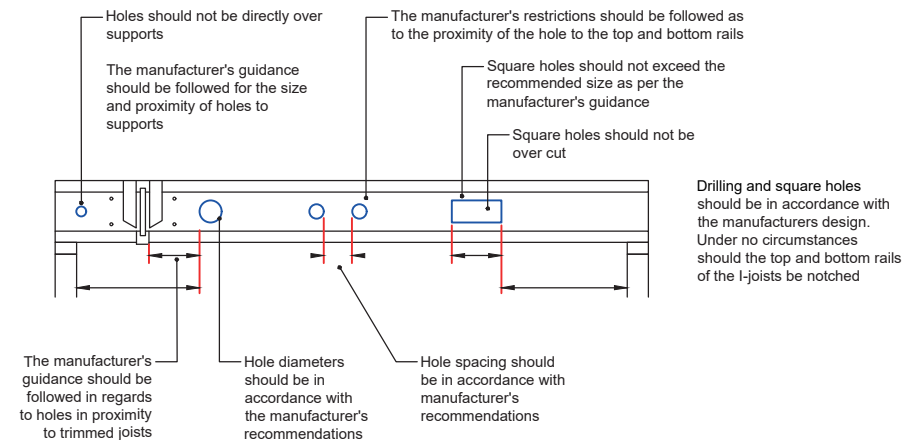
Fixing of multiple I-joists



Fixing of multiple I-joists

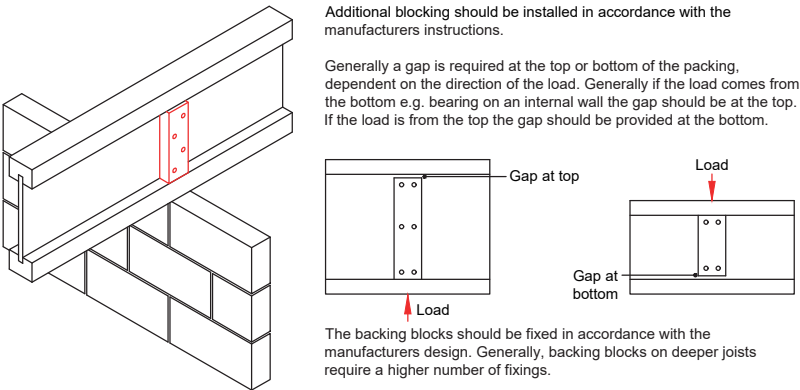


Notching and drilling of I-joists



Building in of I-joists over internal walls

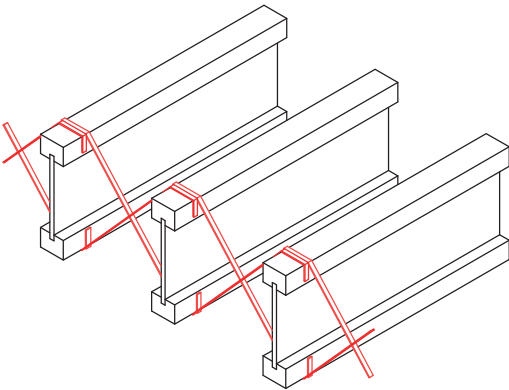
To reduce shrinkage, all mortar should be adequately dry and solidly packed in, but it should not be packed up tight to the underside of the top flange. Before the floor decking is fixed, all continuous joists must be packed down to the intermediate bearing wall.



Proprietary strutting devices

Solid strutting is difficult to install between I-joists and propriety strutting maybe used as an alternative.

The most widely used types of proprietary strutting device are steel herringbone systems. These are generally pressed lengths of galvanized mild steel, usually 1mm thickness and are produced in a variety of lengths to suit differing joist depths and spacing's.

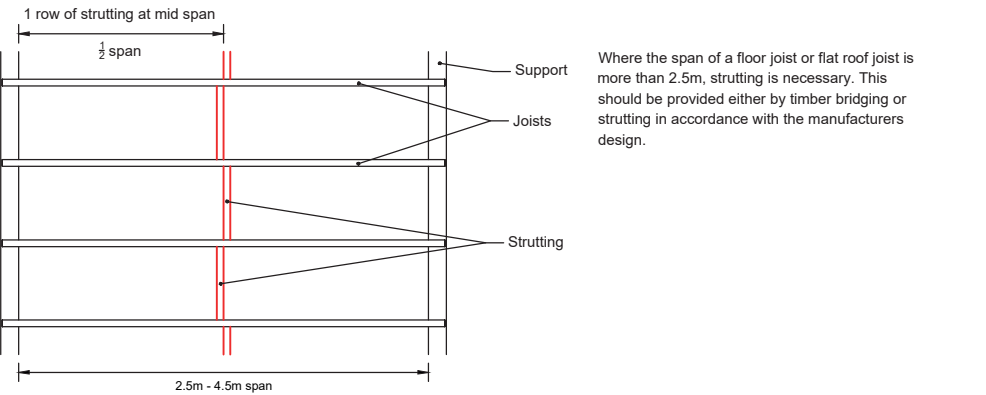


Strutting or bridging

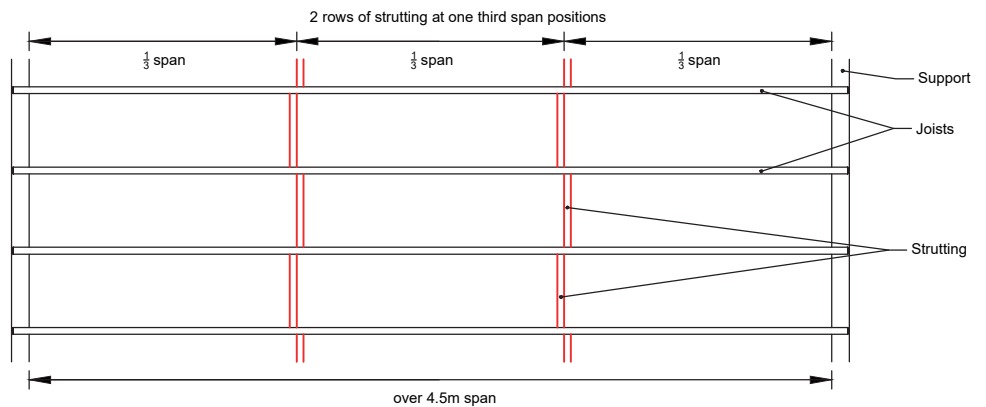
Strutting or bridging of I-joists should be installed in accordance with the manufacturers requirements at centres no greater than those recommended in the Eurocode 5 span tables.

Joist span (m)	Rows of strutting
up to 2.5	None
2.5 - 4.5	1 at mid-span
over 4.5	2 at 1/3 points

Strutting of joists with a span between 2.5m and 4.5m



Strutting of joists with a span over 4.5m



Where the span of a floor joist or flat roof joist is more than 4.5m, two rows of strutting at 1/3rd the span position will be necessary.

10.

Upper Floors

10.3

Metal Web

Metal web joists

Consists of parallel stress graded timber flanges joined together with V-shaped galvanised steel webs. The webs are fixed to the flanges via nail plates. The open web design gives great flexibility in running through services.

Metal web joists should be designed in accordance with BS EN 1995, Eurocode 5 design of Timber Structures. General: Common rules and rules for buildings.

Metal web joists should be appropriately CE marked comply with ETAG 011 or hold independent third party certification.

Metal web joists must be laid reasonably level and onto suitable solid and level bearings.

It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the joint be designed by a qualified Structural Engineer.

Joists should be restrained at supports using tightly fitted strutting.

The minimum end bearing of the joists should be in accordance with the manufacturers instruction and the site specific design. Generally the minimum end bearing should be no less than 90mm, unless joist hangers are used, where the minimum bearing should be to the manufacturers specifications.

Steel beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

Steel beam bearing

Metal web joists may be top hung subject to the manufacturers site specific design

Storage of Metal web

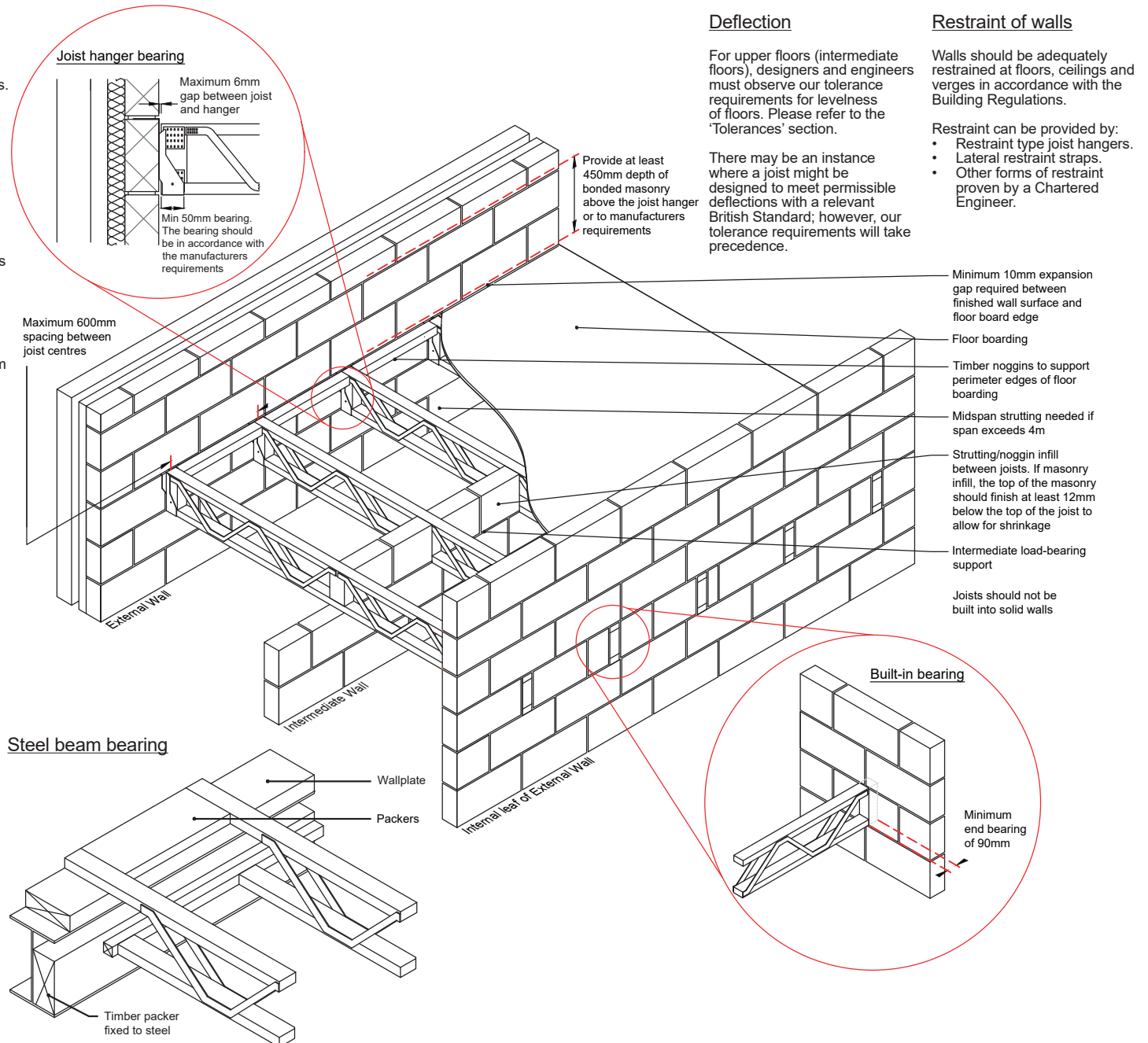
Metal web joists should be protected from the elements and supported on suitable bearers over a free draining surface. Levels of exposure which are more severe than those encountered during a normal uninterrupted build programme should be addressed by the provision of suitable protection.

Bracing

Large areas of floor joists can be assembled with these products due to their light weight and availability in long lengths. It is of great importance that adequate safety bracing is provided to ensure that the joists remain stable through the construction phase. Joist manufacturers provide simple guide recommendations that allow an installer to facilitate this process with ease and speed.

Unbraced joist layouts are not to be walked on by workers.

Floors should not become overloaded during construction.



Deflection

For upper floors (intermediate floors), designers and engineers must observe our tolerance requirements for levelness of floors. Please refer to the 'Tolerances' section.

There may be an instance where a joist might be designed to meet permissible deflections with a relevant British Standard; however, our tolerance requirements will take precedence.

Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the Building Regulations.

Restraint can be provided by:

- Restraint type joist hangers.
- Lateral restraint straps.
- Other forms of restraint proven by a Chartered Engineer.

10.3.2 METAL WEB: Layout of joists and bearing requirements on to a timber frame

Metal web joists

Consists of parallel stress graded timber flanges joined together with V-shaped galvanised steel webs. The webs are fixed to the flanges via nail plates. The open web design gives great flexibility in running through services.

Metal web joists should be designed in accordance with BS EN 1995, Eurocode 5 design of Timber Structures. General: Common rules and rules for buildings.

Metal web joists should be appropriately CE marked comply with ETAG 011 or hold independent third party certification.

Metal web joists must be laid reasonably level and onto suitable solid and level bearings.

It is essential that joists are not overloaded during construction. Joints in joists should only be in place over a load-bearing support, or the be designed by a qualified Structural Engineer.

Joists should be restrained at supports using tightly fitted strutting.

The minimum end bearing of the joists should be in accordance with the manufacturers instruction and the site specific design. Generally the minimum end bearing should be no less than 90mm, unless joist hangers are used, where the minimum bearing should be to the manufacturers specifications.

Steel beams

Steel beams should be designed by a suitably qualified Structural Engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft) please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.

To prevent the distortion of finishes, joists should be stopped from twisting over supports and provision provided to accommodate up to 12mm of drying shrinkage in floor joists supported by steel beams.

Storage of Metal web

Metal web joists should be protected from the elements and supported on suitable bearers over a free draining surface. Levels of exposure which are more severe than those encountered during a normal uninterrupted build programme should be addressed by the provision of suitable protection.

Bracing

Large areas of floor joists can be assembled with these products due to their light weight and availability in long lengths. It is of great importance that adequate safety bracing is provided to ensure that the joists remain stable through the construction phase. Joist manufacturers provide simple guide recommendations that allow an installer to facilitate this process with ease and speed.

Unbraced joist layouts are not to be walked on by workers and floors should not become overloaded during construction.

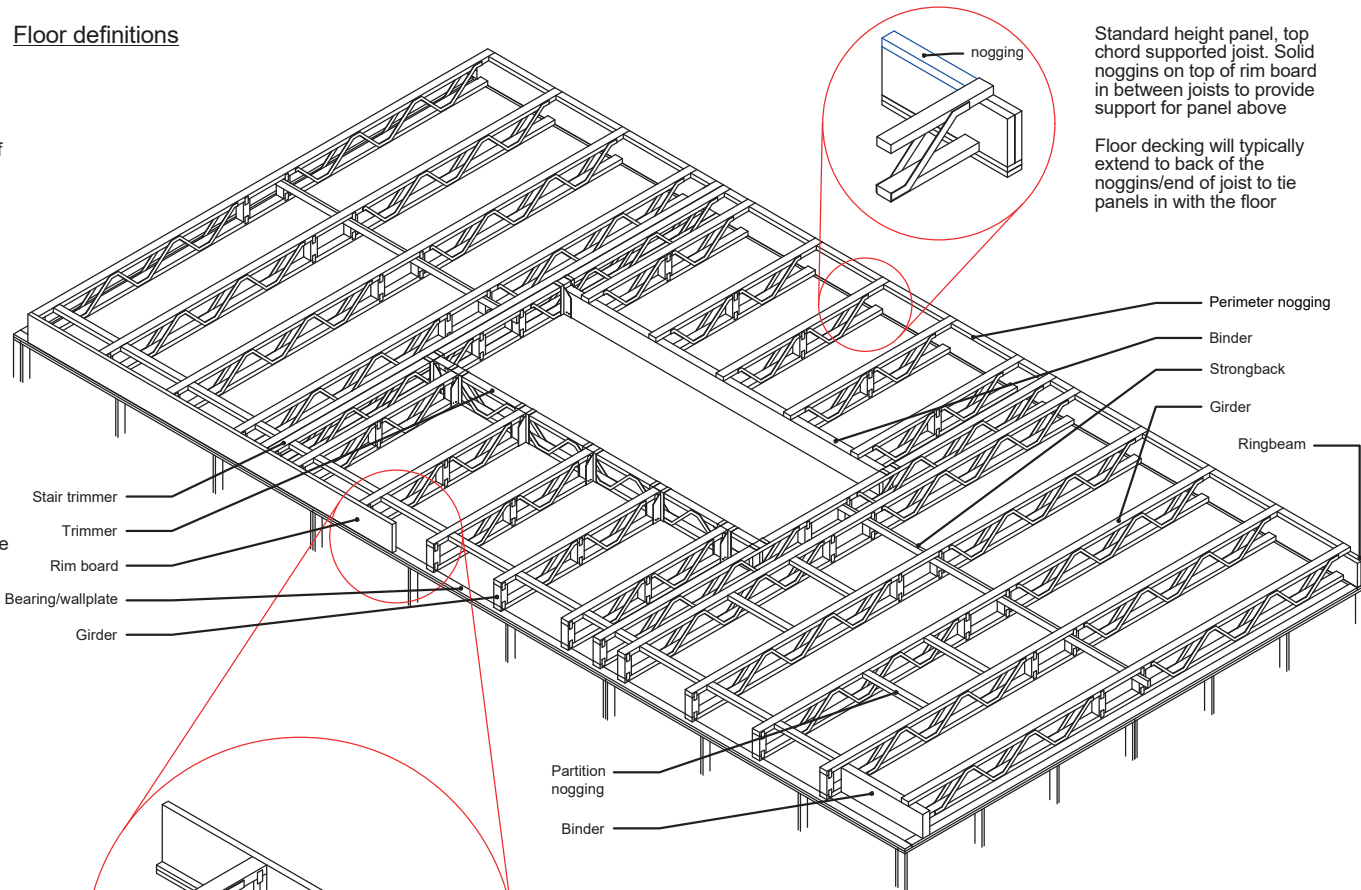
Deflection

For upper floors (intermediate floors), designers and engineers must observe our tolerance requirements for levelness of floors. Please refer to the 'Tolerances' section. There may be an instance where a joist might be designed to meet permissible deflections with a relevant British Standard; however, our tolerance requirements will take precedence.

Restraint of walls

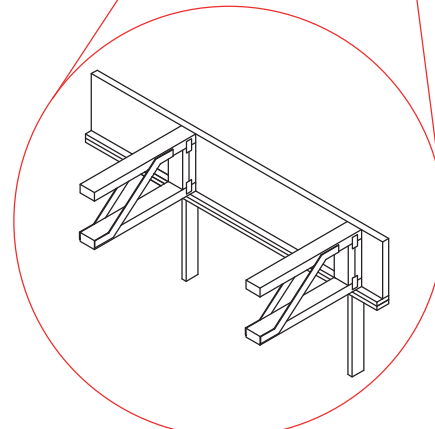
Walls should be adequately restrained at floors, ceilings and verges in accordance with the Building Regulations.

Floor definitions



Standard height panel, top chord supported joist. Solid noggins on top of rim board in between joists to provide support for panel above

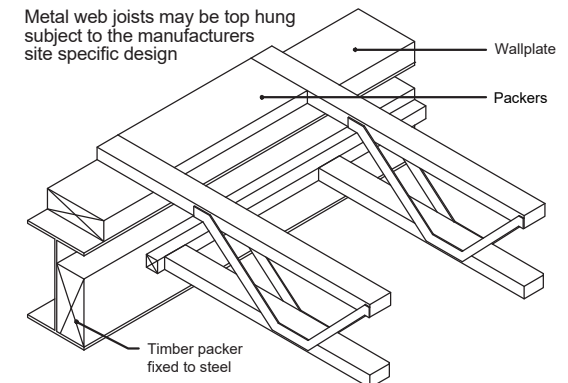
Floor decking will typically extend to back of the noggins/end of joist to tie panels in with the floor

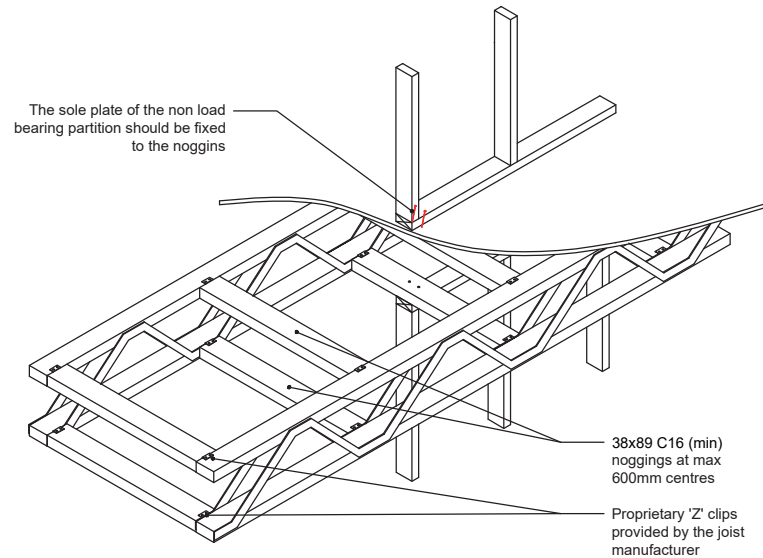


Traditional arrangement - bottom chord supported joists on normal height panels. Rim board around outside closes off floor zone. Solid blocking in between joists provides support for panel above

Steel beam bearing

Metal web joists may be top hung subject to the manufacturers site specific design



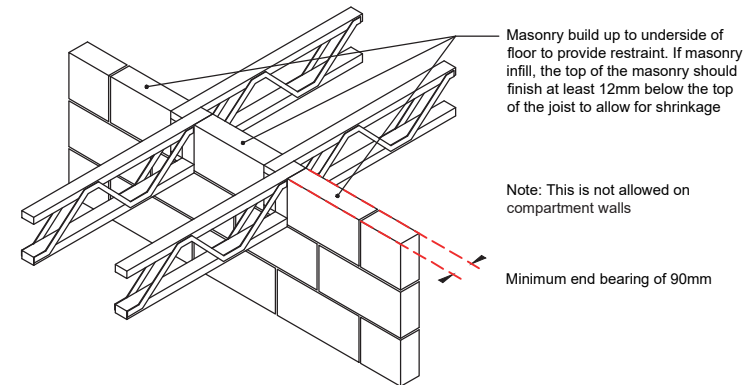
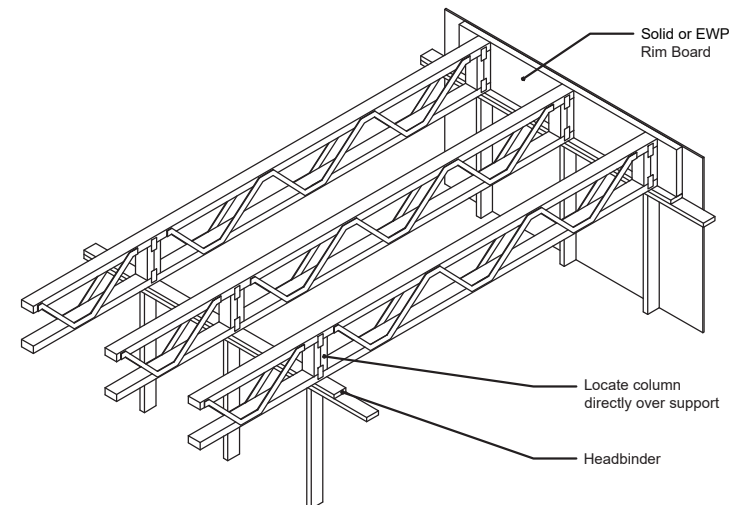
Support of light-weight non load bearing partitions

Where light weight non load bearing partition are parallel to the joists, they should be suitably supported in accordance with the manufacturers design.

Where metal web joists are used they should be:

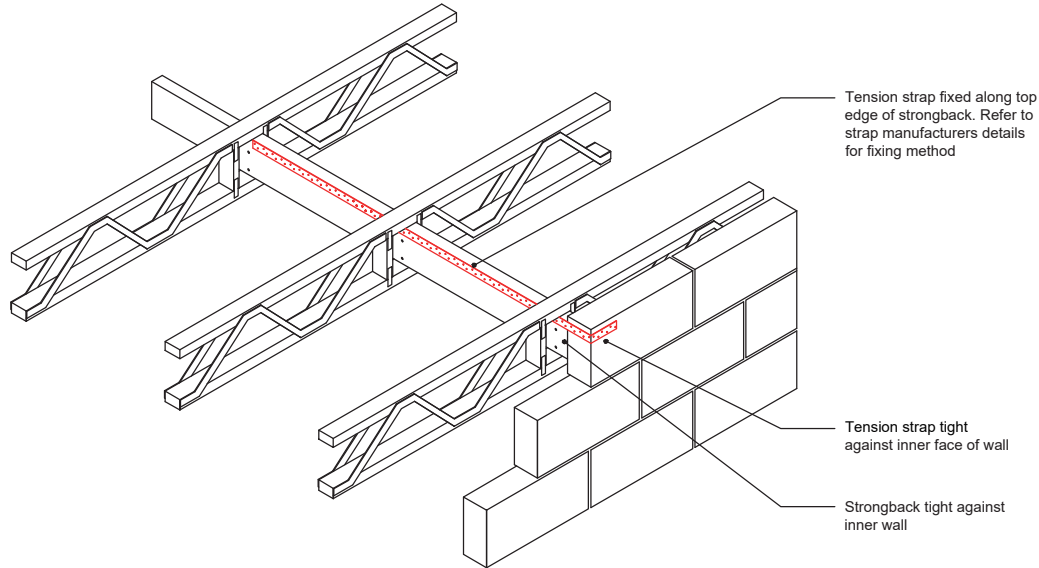
- Positioned centrally below a non load bearing partition. Double or triple joists should be provided in accordance with the manufacturers details and fixed with proprietary fixings in accordance with the manufactures design.
- Or the weight of the partition should be supported by noggins or bearers fixed to joists with the floor systems propitiatory fixings on either side. The noggins should be at a maximum of 600mm centres and should be 38mm x 90mm unless designed otherwise.

Sole plates should be fixed to the noggins or joists.

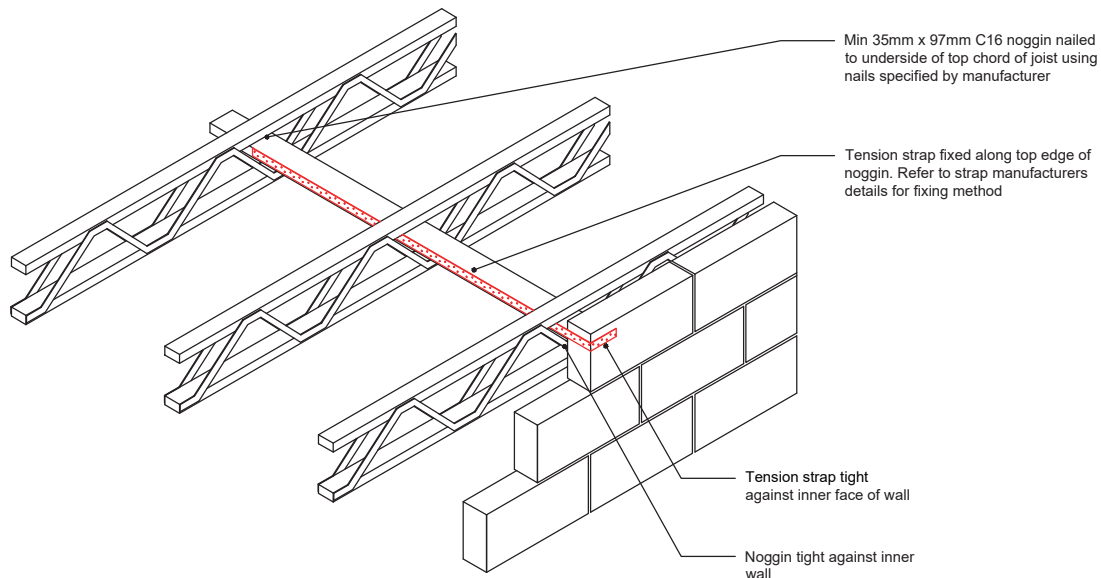
Metal web joists supported on load bearing masonry internal wallMetal web joists supported on load bearing timber internal wall

Example of metal web joists bearing on intermediate load bearing wall. Column within the metal web joist should be located directly over the support. In accordance with the manufacturers design

Horizontal restraint strap fixed to strongback



Horizontal restraint strap fixed to continuous noggin



Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

- Restraint type joist hangers.
- Other forms of restraint proven by a Chartered Engineer.
- Lateral restraint floor straps, provided at no more than 2m centres.

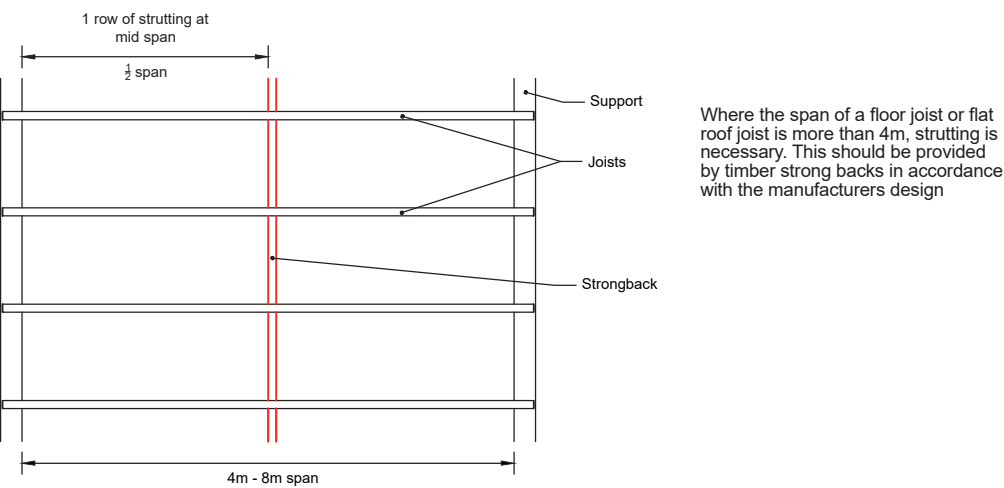
Lateral restraint straps

Floors should provide lateral restraint to all walls running parallel to them by means of 30mm x 5mm galvanised or stainless steel restraint straps at 2m centres. Straps need not be provided to floors at, or about, the same level on each side of a supported wall and at the following locations:

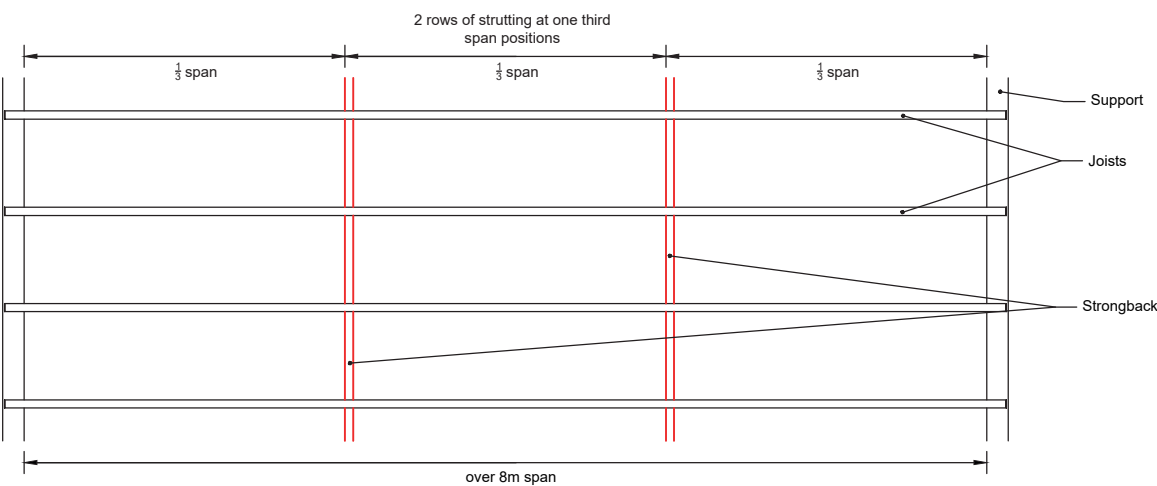
Timber floors in two storey dwellings where:

- Joists are at maximum 1.2m centres and have at least 90mm bearing on supported walls or 75mm bearing on to a timber wall plate.
- Carried by the supported wall by restraint type joist hangers as described in BS 5268: 7.1.

Strutting of joists with a span between 4m and 8m



Strutting of joists with a span over 8m



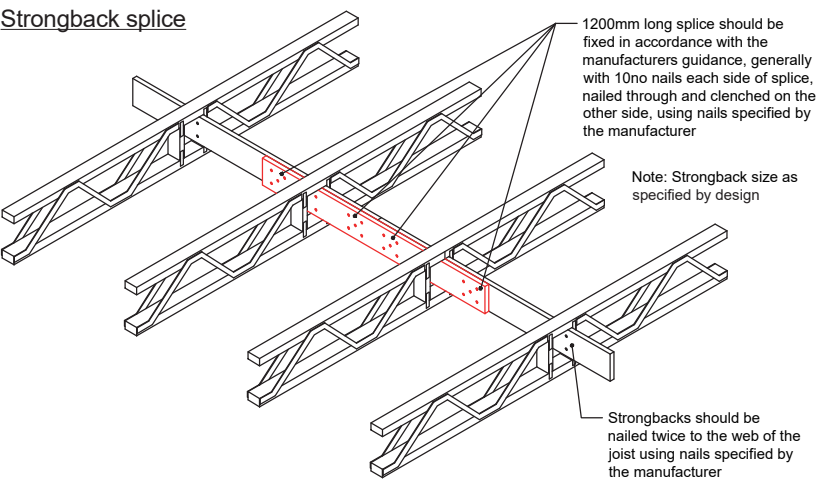
Metal web joists

Strutting to metal web joists should be provided in accordance with the manufacturers guidance and the table below.

Strutting of joists

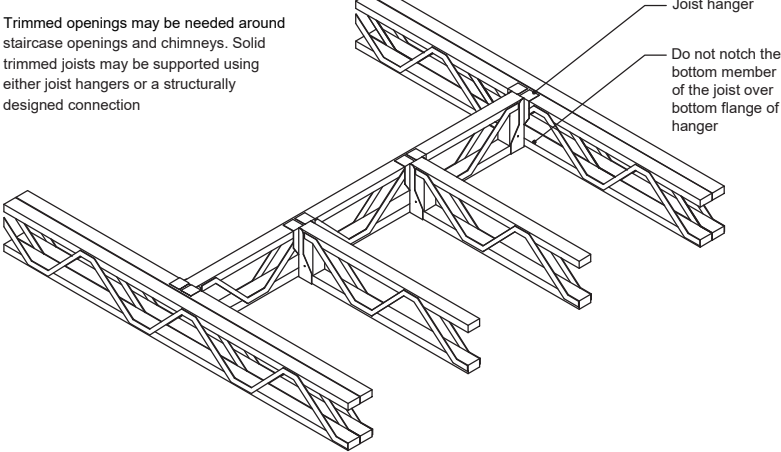
Joint span (m)	Rows of strutting
4-8	1 (at centre of span)
over 8	2 (at equal spacing)

Strongback splice



Typical trimming detail

Double joists should be fixed as per the manufactures design, this can be with a propriety clip or fixed at specified centres with fixings provided by the manufacturer. It is important to ensure that the work on site is in accordance with the manufacturers design.



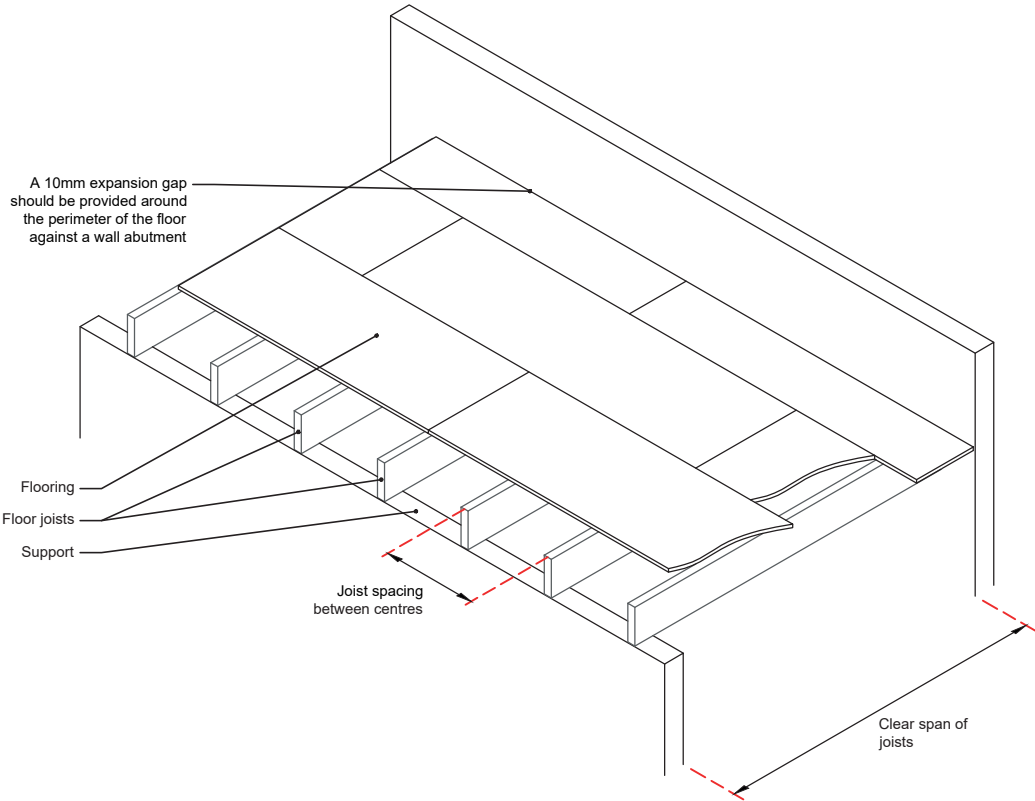
10.

Upper Floors

10.4

Structural Floor Boarding for Timber Upper Floors

Floor joists arrangement



Structural floor boarding

Suitable floor boards include tongue and grooved softwood flooring with a minimum moisture content at the time of fixing of between 16%-20% and in accordance with BS 1297. All boards must be double nailed or secret nailed to each joist using nails that are at least three times the depth of the board. Floor coverings should be fixed in accordance with BS 8103-3. Boards must have a minimum thickness, as indicated in the table below.

Softwood floor boarding: Minimum thickness and centres of support

Finished board thickness (mm)	Maximum centres of joist (mm)	Typical nail fixings (mm)
15	Max 450	45mm lost head nail
18	Max 600	60mm lost head nail

Particle boarding

Acceptable particle boards consist of Oriented Strand Board (OSB) or chipboard. Chipboard should be tongue and grooved and all joints glued. The boards should be laid so that the shortest length is laid parallel to the span. OSB boards should be type 3 or 4 to BS EN 300, and should be laid with the major axis at right angles to the joists (the major axis is indicated on the OSB board by a series of arrows). Boards must have a minimum thickness, as indicated in the table below.

Particle boards should be either screwed or nailed to the joists at 250mm centres. Nails should be annular ring shanks that are at least three times the depth of the board.

A 10mm expansion gap should be provided around the perimeter of the floor against a wall abutment.

Particle floor boarding: Minimum thickness and centres of support

Thickness (mm) (chipboard)	Thickness (mm) (OSB)	Maximum span (mm)	Typical nail fixing (mm)
18 and 19	15	450	60mm annular ring shank
22	18 and 19	600	65mm annular ring shank

Sound resistance

Internal floors shall, where necessary, be designed and constructed to have adequate resistance to the transmission of sound to meet the requirements of the regional Building Regulations.

The resilient insulation layers where required should be fitted as per manufacturers instructions.

The resilient layer and subsequent floor makeup should be suitable to support the design loads. Any point loads or additional loading may have special requirements.

Floor makeup laid above a resilient layer must be isolated from the walls and skirtings by the insertion of a resilient layer to meet the requirements of the sound resistance design.

10.

Upper Floors

10.5

Plaster Boarding for Timber Upper Floors

Plastered finishes

Workmanship of plastered finishes to ceilings should be applied to a certain standard to receive a suitable decorative finish. It should be durable enough to prevent surface cracking and, if applicable as part of the whole element, meet the required levels of fire and sound insulation in accordance with current Building Regulations.

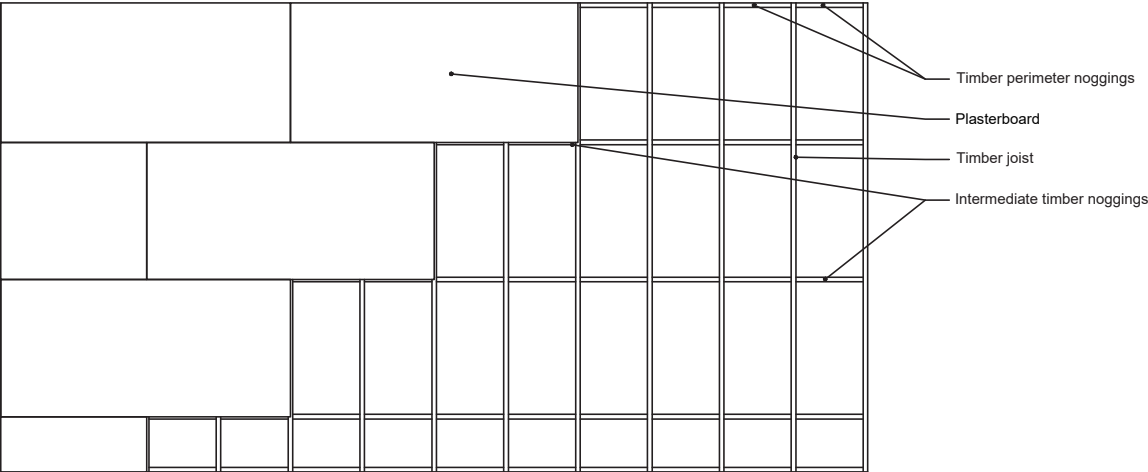
Substrate and background

Plasterwork should be applied to suitable substrates. The substrate may also require additional sealing or bonding agents, in accordance with the requirements set out in BS 8481.

Plaster mixes

Plaster mix ratios should be in accordance with manufacturer's recommendations and be appropriate for the intended use.

Ceiling plan - plasterboard fixed to timber joists



Minimum plaster thicknesses

The thickness of plaster will vary depending on the evenness of the substrate. The finished element must meet the tolerances identified in this Technical Manual, and be of a suitable quality so that a decorative finish can be applied. Minimum thickness should be in accordance with the table below.

Element	Minimum number of coats	Typical thickness
Ceiling - plasterboard	1	Skim to provide suitable and durable finish

Support of plasterboard

Supports for plasterboard should be designed so that the following span limits are not exceeded:

Board thickness (mm)	Timber support centres (mm)	Intermediate noggings required	Perimeter noggings required*
9.5	400	No	Yes
	450	Yes	Yes
12.5	400	No	Yes
	450	No	Yes
	600	Yes	Yes
15	600	No	Yes

* Fire resisting plasterboard should be fully supported at edges by noggings if the floor joist are not against the wall.

When fixing plaster boarding:

- Fix boards with decorative side out to receive joint treatment or a skim plaster finish.
- Lightly butt boards together and never force boards into position.
- Install fixings no closer than 13mm from cut edges and 10mm from bound edges.
- Position cut edges to internal angles whenever possible, removing paper burrs with fine sandpaper.
- Stagger horizontal and vertical board joints between layers by a minimum of 600mm.
- Locate boards to the centre line of framing where this supports board edges or ends.
- Fix to timber joists using dry-wall screws.

Gaps between boards should not exceed 3mm and consideration should be given to sealing all gaps to improve building air tightness.

10.

Upper Floors

10.6

Suspended Beam and Block

Pre cast concrete floor units

Precast beams are proprietary products, which the design and construction are specific to the manufacturer of the product. Projects incorporating precast beams must be provided with full manufacturers design, structural calculations and specifications including fixings specific for the project.

Precast concrete units and infill blocks are to be carefully stored and handled on-site, preventing damage occurring before, during and after incorporation into the structure. Units should be lifted as near as possible to their ends.

The installation of pre cast concrete floor beams and blocks must follow the manufacturer's guidance and specification for the project.

The bearing surface of walls, beams and other supports to receive precast units are to be smooth and level.

Infill blocks and slabs should fully bear onto supporting beams and walls.

Precast suspended beam and block floors

Ensure that precast concrete beam and block floors are fully supported by load-bearing walls.

Similar beams of the same size may have differing strength properties because of their varying reinforcement size, so it is important to check beam reference numbers and their layout. It is also essential sometimes to provide two or more beams adjacent to each other where spans are excessive or in heavily loaded areas. Suitable infill bricks or blocks are to be properly bedded on mortar and provided between pre cast (PC) beams where bearing onto supporting walls.

Beams and blocks are to be grouted together with a 1:6 cement to sand mix in accordance with the manufacturer's instructions.

Load-bearing walls are to continue through the beam and block floor.

Holes for service pipes are properly filled by laying non-timber formwork between PC joists and filling with good quality concrete (ST2 mix) prior to screeding.

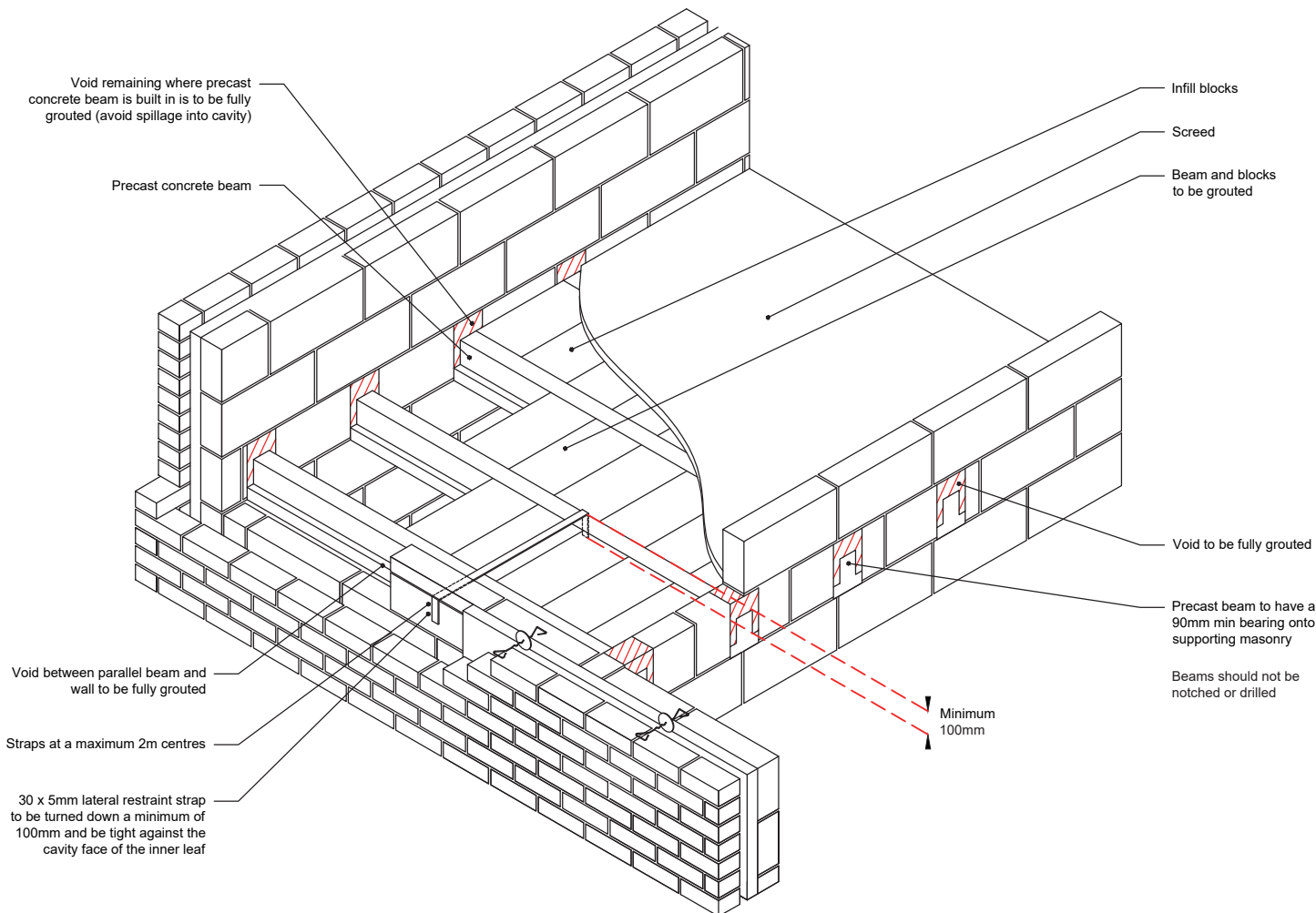
Beams should bear onto masonry with a minimum 90mm bearing, and steelwork with a minimum 70mm bearing.

Provide restraint straps to walls where the beams run parallel.

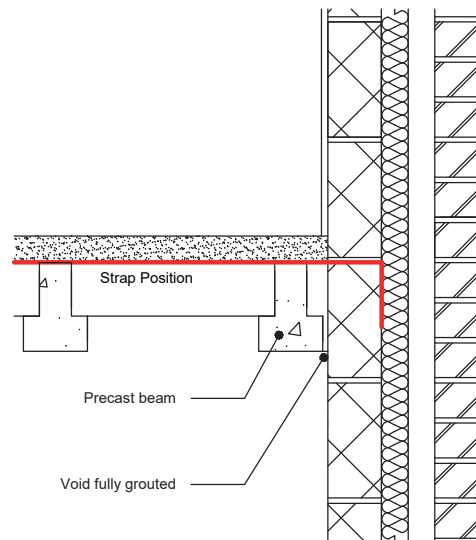
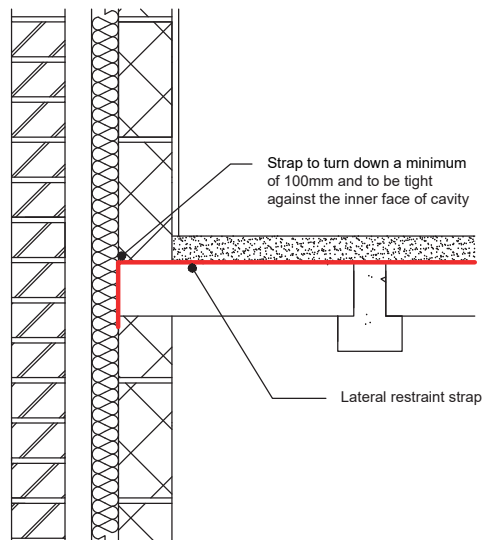
Ensure that the blockwork carrying the beam and block flooring has sufficient compressive strength.

Levels

Precast beams or beam and block floor constructions must be laid reasonably level and onto suitable solid and level bearings.



Lateral restraint of walls



Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

- Lateral restraint straps.
- Other forms of restraint proven by a Chartered Engineer.

Lateral restraint straps

Beam and block floors should provide lateral restraint to all walls running parallel to them by means of 30mm x 5mm galvanised or stainless steel restraint straps at 2m maximum centres.

Straps need not be provided to floors at, or about, the same level on each side of a supported wall and in two storey dwellings where concrete floors have a minimum 90mm bearing on supported wall.

Deflection of floors

For upper floors (intermediate floors), designers and engineers must observe our Tolerance requirements, for levelness of floors. Please refer to the Tolerances.

There may be an instance where a joist might be designed to meet permissible deflections with a relevant British Standard; however, our tolerance requirements will take precedence.

Sound resistance

Internal floors shall, where necessary, have adequate resistance to the transmission of sound to meet the requirements of the regional Building Regulations.

Resilient layers where required should be fitted as per manufactures instructions.

The resilient layer and subsequent floor makeup should be suitable to support the design loads, any point loads or additional loading may have special requirements.

Plastered finishes

Workmanship of plastered finishes to ceilings should be applied to a certain standard to receive a suitable decorative finish. It should be durable enough to prevent surface cracking and, if applicable as part of the whole element, meet the required levels of fire and sound insulation in accordance with current Building Regulations.

Substrate and background

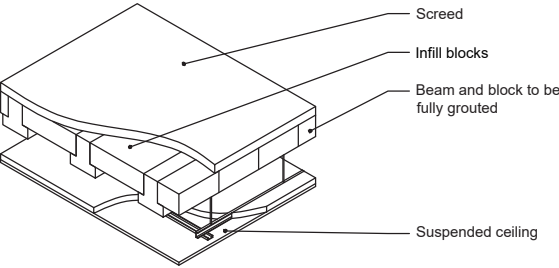
Plasterwork should be applied to suitable substrates. The substrate may also require additional sealing or bonding agents, in accordance with the requirements set out in BS 8481.

Plaster mixes

Plaster mix ratios should be in accordance with manufacturer’s recommendations and be appropriate for the intended use.

Suspended ceilings

Suspended ceilings should be designed and constructed in accordance with BS EN 13964.



Fixing requirements

Fixings should be appropriate for the site conditions and the loads to be supported. They must also be installed in accordance with the manufacturer’s specifications. Fixings to suspended beam and blocks should be at the correct designated centres using the correct wires/ brackets that are compatible with the suspended ceiling (and the intended environmental conditions - see below). Pull tests should be carried out on ceilings with an area exceeding 100m² and a factor of safety of 2 is applicable.

Ceiling grid layouts and fixing schedule and method of fixing to soffit, should be provided.

Confirmation that the weight of the ceiling construction and any additional fire/sound insulation loads has been taken account of in the supporting structure design calculations.

Where there is any doubt regarding the adequacy or installation or variation from the initial design a manufacturer’s inspection and certification will be required.

High humidity or external environment or specialised conditions

Where the ceiling is above a high humidity area or is an external suspended ceiling; third party certification should be provided to demonstrate the product is suitable for the specified environment.

Where suspended ceilings are designed to give a minimum period of fire resistance, fire test certification will be required to confirm the periods of fire resistance given. This should also take into account any recessed light fittings which may bypass the fire resistant layer.

The additional weight of materials used to achieve fire resistant specifications or where sound insulation requirements occur; must also be taken account of in the structural design of the supporting structure and the fixings of the ceiling construction.

Fire resistance

Where suspended ceilings are designed to give a minimum period of fire resistance, fire test certification will be required to confirm the periods of fire resistance given. This should also take into account any recessed light fittings which may bypass the fire resistant layer. Consideration should also be given to the quality of workmanship in these installations, and a manufacturer approved installer be used.

The additional weight of materials used to achieve fire resistant specifications or where sound insulation requirements occur must also be taken account of in the structural design of the supporting structure and the fixings of the ceiling construction.

Minimum plaster thicknesses

The thickness of plaster will vary depending on the evenness of the substrate. The finished element must meet the tolerances identified in this Technical Manual, and be of a suitable quality so that a decorative finish can be applied. Minimum thickness should be in accordance with the table below.

Element	Minimum number of coats	Typical thickness
Ceiling - plasterboard	1	Skim to provide suitable and durable finish

Support of plasterboard

Supports for plasterboard should be designed so that the following span limits are not exceeded:

Board thickness (mm)	Timber support centres (mm)	Intermediate noggings required	Perimeter noggings required
9.5	400	No	Yes
	450	Yes	Yes
12.5	400	No	Yes
	450	No	Yes
	600	Yes	Yes
15	600	No	No

When fixing plaster boarding:

- Fix boards with decorative side out to receive joint treatment or a skim plaster finish.
- Lightly butt boards together and never force boards into position.
- Install fixings no closer than 13mm from cut edges and 10mm from bound edges.
- Position cut edges to internal angles whenever possible, removing paper burrs with fine sandpaper.
- Stagger horizontal and vertical board joints between layers by a minimum of 600mm.
- Locate boards to the centre line of framing where this supports board edges or ends.
- Fix to timber joists using dry-wall screws.

Gaps between boards should not exceed 3mm and consideration should be given to sealing all gaps to improve building air tightness.

10.

Upper Floors

10.7

Concrete Plank

Precast concrete floor units

Precast concrete floor units are proprietary products, which the design and construction are specific to the manufacturer of the product. Projects incorporating precast concrete planks must be provided with full manufacturers design, structural calculations and specifications including fixings specific for the project.

Precast concrete units are to be carefully stored and handled on-site, preventing damage occurring before, during and after incorporation into the structure. Units should be lifted as near as possible to their ends.

The installation of precast concrete floor units must follow the manufacturer's guidance and specification for the project.

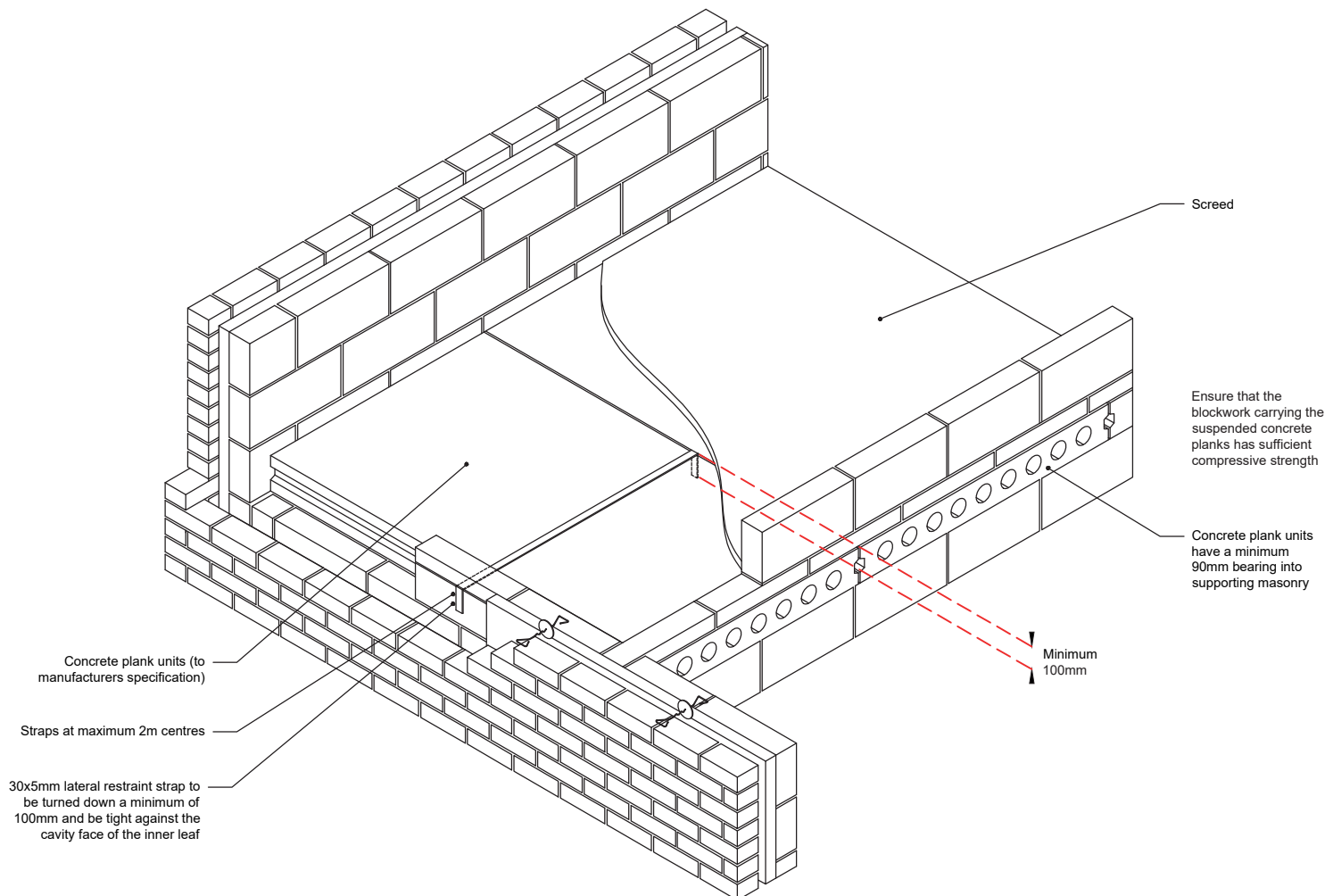
The bearing surface of walls, beams and other supports to receive precast units should be smooth and level.

Infill blocks and slabs should fully bear onto supporting beams and walls.

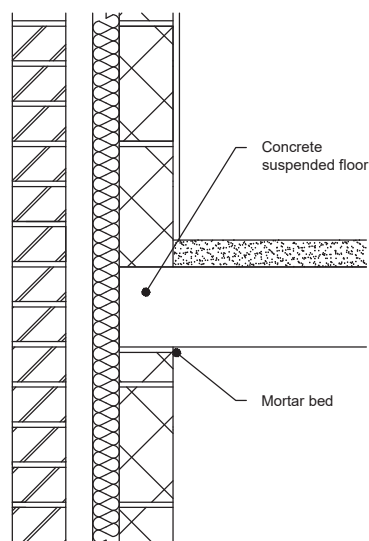
Ensure that precast suspended concrete plank floors are fully supported by load-bearing walls.

It is important to check the plank reference numbers and their layout. Similar units of the same size may have differing strength properties because of their varying reinforcement size, so it is important to check unit reference numbers and their layout. Suspended concrete planks should be grouted in accordance with the manufacturer's instructions ensuring the correct strength and aggregate size is used.

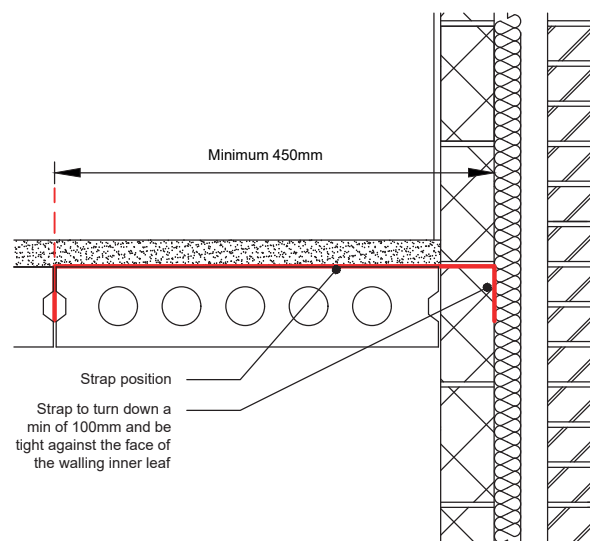
Holes for service pipes are to be properly filled by laying non-timber formwork between PC joists and filling with good quality concrete (ST2 mix) prior to screeding.



Lateral restraint of walls



The floor units should bear onto masonry with a minimum 90mm bearing, and steelwork at a minimum 70mm



Provide restraint straps to walls where the suspended concrete planks run parallel

Restraint of walls

Walls should be adequately restrained at floors, ceilings and verges in accordance with the relevant Building Regulations.

Restraint can be provided by:

- Lateral restraint straps.
- Other forms of restraint proven by a Chartered Engineer.

Lateral restraint straps

Concrete plank floors should provide lateral restraint to all walls running parallel to them by means of 30mm x 5mm galvanised or stainless steel restraint straps at maximum 2m centres.

Straps need not be provided to floors at, or about, the same level on each side of a supported wall and in two storey dwellings where concrete floors have a minimum 90mm bearing on supported wall.

Deflection of floors

For upper floors (intermediate floors), designers and engineers must observe our tolerance requirements, for levelness of floors.

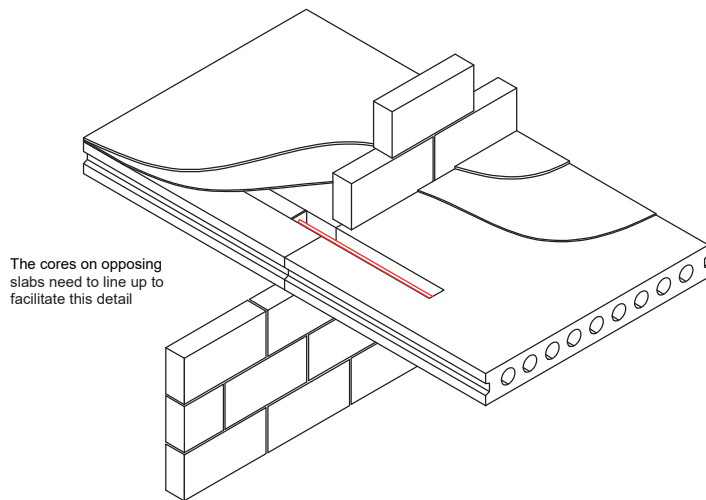
There may be an instance where a floor might be designed to meet permissible deflections with a relevant British Standard; however, our tolerance requirements will take precedence.

Sound resistance

Internal floors shall, where necessary, have adequate resistance to the transmission of sound to meet the requirements of the regional Building Regulations.

Resilient layers where required should be fitted as per manufactures instructions.

The resilient layer and subsequent floor makeup should be suitable to support the design loads, any point loads or additional loading may have special requirements.

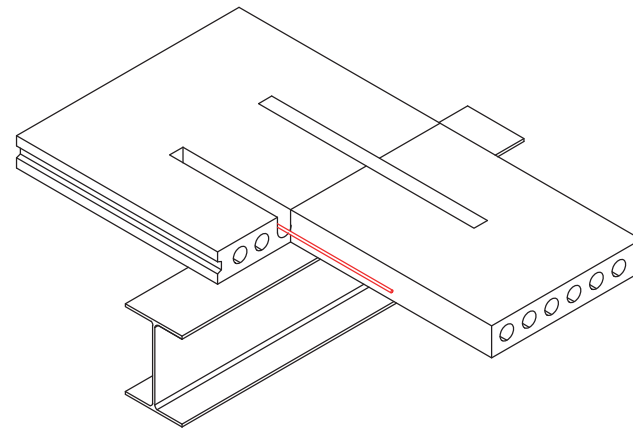


The cores on opposing slabs need to line up to facilitate this detail

Narrow wall bearing

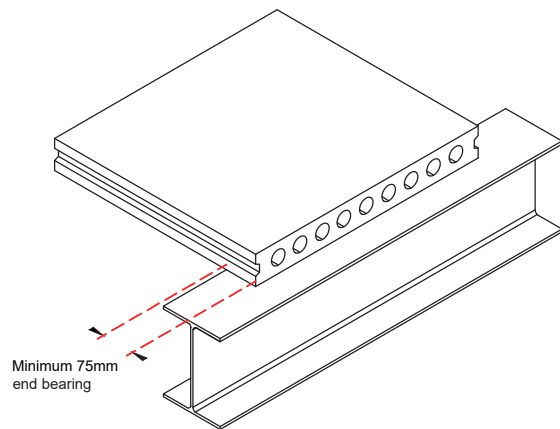
Generally for walls narrower than 190mm the slabs should be tied together in accordance with the manufacturers instructions.

Typically this is achieved by two cores per 1200mm wide slab are formed open so that a reinforcement bar can be inserted across to form the tie detail, however this should be constructed in accordance with the manufacturers site specific design.



Continuity over steelwork

When continuing over steel work the slabs may also require tying together in accordance with the manufacturers recommendations.



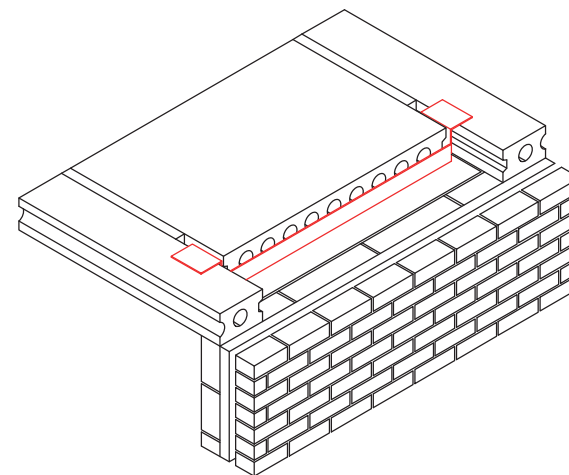
Minimum 75mm end bearing

Bearing on top of steelwork

A minimum of 75mm bearing should be provided on steel beams. Planks may require mechanical restraint to the steel beam in accordance with the manufacturers specification.

Steel beams should be designed by a suitably qualified structural engineer and should have appropriate fire resistance to meet the requirements of the regional Building Regulations.

Where steel beams and columns are used to support the upper floor construction on a project in a coastal location, and maybe exposed to an aggressive external environment (e.g. undercroft), please follow the requirements for additional corrosion protection in 'Appendix B - Coastal Locations' and 'Appendix C - Materials, Products, and Building Systems'.



Holes and notches

Openings to accommodate service voids and column notches should be preformed. Large openings may require steel trimming supports. Holes of less than 100mm can be formed on site in accordance with the manufacturers design.

All holes/openings should be in accordance with the manufacturers design.

Plastered finishes

Workmanship of plastered finishes to ceilings should be applied to a certain standard to receive a suitable decorative finish. It should be durable enough to prevent surface cracking and, if applicable as part of the whole element, meet the required levels of fire and sound insulation in accordance with current Building Regulations.

Substrate and background

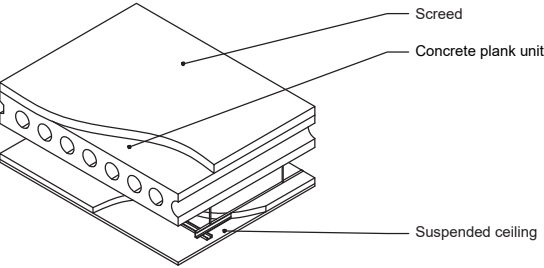
Plasterwork should be applied to suitable substrates. The substrate may also require additional sealing or bonding agents, in accordance with the requirements set out in BS 8481.

Plaster mixes

Plaster mix ratios should be in accordance with manufacturer’s recommendations and be appropriate for the intended use.

Suspended ceilings

Suspended ceilings should be designed and constructed in accordance with BS EN 13964.



Fixing requirements

Fixings should be appropriate for the site conditions and the loads to be supported. They must also be installed in accordance with the manufacturer’s specifications. Fixings to the concrete plank should be at the correct designated centres using the correct wires/brackets that are compatible with the suspended ceiling (and the intended environmental conditions - see below). Pull tests should be carried out on ceilings with an area exceeding 100m² and a factor of safety of 2 is applicable.

Ceiling grid layouts and fixing schedule and method of fixing to soffit, should be provided.

Confirmation that the weight of the ceiling construction and any additional fire/sound insulation loads has been taken account of in the supporting structure design calculations.

Where there is any doubt regarding the adequacy or installation or variation from the initial design a manufacturer’s inspection and certification will be required.

High humidity or external environment or specialised conditions

Where the ceiling is above a high humidity area or is an external suspended ceiling; third party certification should be provided to demonstrate the product is suitable for the specified environment.

Where suspended ceilings are designed to give a minimum period of fire resistance, fire test certification will be required to confirm the periods of fire resistance given. This should also take into account any recessed light fittings which may bypass the fire resistant layer.

The additional weight of materials used to achieve fire resistant specifications or where sound insulation requirements occur; must also be taken account of in the structural design of the supporting structure and the fixings of the ceiling construction.

Fire resistance

Where suspended ceilings are designed to give a minimum period of fire resistance, fire test certification will be required to confirm the periods of fire resistance given. This should also take into account any recessed light fittings which may bypass the fire resistant layer. Consideration should also be given to the quality of workmanship in these installations and a manufacturer approved installer be used.

The additional weight of materials used to achieve fire resistant specifications or where sound insulation requirements occur must also be taken account of in the structural design of the supporting structure and the fixings of the ceiling construction.

Minimum plaster thicknesses

The thickness of plaster will vary depending on the evenness of the substrate. The finished element must meet the tolerances identified in this Technical Manual, and be of a suitable quality so that a decorative finish can be applied. Minimum thickness should be in accordance with the table below.

Element	Minimum number of coats	Typical thickness
Ceiling - plasterboard	1	Skim to provide suitable and durable finish

Support of plasterboard

Supports for plasterboard should be designed so that the following span limits are not exceeded:

Board thickness (mm)	Timber support centres (mm)	Intermediate noggings required	Perimeter noggings required
9.5	400	No	Yes
	450	Yes	Yes
12.5	400	No	Yes
	450	No	Yes
	600	Yes	Yes
15	600	No	No

When fixing plaster boarding:

- Fix boards with decorative side out to receive joint treatment or a skim plaster finish.
- Lightly butt boards together and never force boards into position.
- Install fixings no closer than 13mm from cut edges and 10mm from bound edges.
- Position cut edges to internal angles whenever possible, removing paper burrs with fine sandpaper.
- Stagger horizontal and vertical board joints between layers by a minimum of 600mm.
- Locate boards to the centre line of framing where this supports board edges or ends.
- Fix using dry-wall screws.

Gaps between boards should not exceed 3mm and consideration should be given to sealing all gaps to improve building air tightness.

10.

Upper Floors

10.8

General Requirements for Concrete Upper Floors

Floor screeds

Screeding

Traditional floor screeds consist of sand and cement. If the ratios and properties of these screeds are not correctly controlled; cracking, peeling or collapse of the screed will occur (due to being too strong/weak).

Proprietary screeds typically are pre-blended to achieve greater consistency and strength and more suitable over larger areas. As such where the floor area exceeds 50m² only a proprietary screed installed by the screed manufacturers trained installers will be accepted.

Screeds should be fit for purpose, have a suitable finish and be of an appropriate thickness.

Curing

Screeds should be cured naturally and should not be covered for at least three weeks.

Background surfaces

Background surfaces where screeds are being supported should meet the following requirements:

- **Bond**
Background surfaces for bonded screeds should provide an adequate mechanical key. If necessary, cement grouting or a bonding agent should be specified to provide adequate adhesion. Where bonded screeds are used, mechanical means of preparing the concrete should be used to create an adequate bond between the substrate and the screed.
- **Moisture protection**
The floor design should ensure that moisture from the ground does not enter the dwelling.
- **Adequate support**
Substrate structures must be adequately constructed to provide adequate support to the screed. (Note: Timber floor constructions are not suitable to support screeded finishes.)
- **Screed mix**
Cement and sand screeds should have a mix ratio of between 1:3 and 1:4½.

Proprietary additives should have been assessed and have third-party certification.

The minimum thicknesses of screeds are as follows:

Screed thickness requirements

Surface	Minimum thickness at any point (mm)
Laid monolithically with base	12
Laid and bonded to a set and hardened base	20
Laid on a separating membrane (e.g. 1000g polyethylene)	50
Laid on resilient slabs or quilts (screed reinforced with galvanised wire mesh)	65

Where service pipes are bedded in the screed, the screed should be deep enough to provide at least 25mm of screed cover over service pipes, insulation and reinforcing.

Maximum areas of screed

Screeds should be laid room by room. Unreinforced screeds should have a maximum area of 40m². Expansion joints should be provided and consistent with joints in the floor slab below.

Finishing of screeds

Screed should provide an even surface as appropriate, as defined in the Tolerance section. Concrete floor slabs may be suitably finished to serve directly as a wearing surface without the need for an additional topping, in accordance with the recommendations of BS 8204. If required, surface sealers or hardeners should only be used in accordance with the manufacturer's instructions.

Anhydrite screeds

If an anhydrite screed is used, it must be sealed before the application of any cement based floor finish adhesive is proposed. Anhydrite screeds can be difficult to identify once laid, if the screed type cannot be identified the screed should be fully sealed as a precaution to prevent the possibility of the floor finish adhesive de-bonding from the screed.

The floor screed should be fully dry before the sealant is applied. The screed drying time will depend on the thickness and type of screed.

A decoupling membrane is also recommended as this can reduce the stress on the fixed floor finish layer.

Insulation

Insulation below screeds should have enough compressive strength to support the screed. DPM's should be installed in the correct positions, as indicated by the insulation manufacturer's instructions. Sound insulation should be installed in accordance with the manufacturer's instructions.

Constructing screeds over all substrates:

- Substrates must be level with no pockets or high spots to ensure the thickness of the screed remains even.
- Where screeds are laid over insulation; the insulation must be tightly butted together and level.
- Screeds must be correctly mixed.
- Screeds must not be walked on during the drying period.
- Screeds must not be constructed during cold periods (below 5 degrees).
- Movement joints will be required across door thresholds.
- Movement joints are required if bay sizes exceed 40m² with a maximum of 8m on any one side.
- Movement joints are also required where joints exist or a change of span occurs e.g. beam and block floors.
- The screed must be ready to accept any floor finishes (see guidance below for over insulated substrates).

Drying times

- With cementitious levelling screeds, one day should be allowed for each millimetre of thickness for the first 50 mm, followed by an increasing time for each millimetre above this thickness (BS 8204).
- Polymer modified screeds: strictly follow the manufacturer's specifications and recommendations.
- The developer should keep an accurate record of the screed drying times elapsed before any fixed floor finish is constructed on top is laid and the Warranty surveyor may ask for this information.

Note: The moisture contents of levelling screeds onto which particular floorings are to be laid and methods for measuring moisture content are given in BS 5325, BS 8201, BS 8203 and BS 8425.

Building services

Where building services pass through the screed e.g. underfloor heating, allowance should be made for thermal movement between the screed and the service (so that service pipes can resist chemical attack from the screed).

Additional steps where constructing screeds over concrete substrates

Where a concrete slab is insulated from below and a finishing screed is required to the top surface:

- The concrete substrate slab must be of the correct thickness and not less than 100mm thick.
- Concrete substrate must be adequately dried out and not wet. See drying time guidance.
- Surfaces of hardened in situ concrete bases for bonded screeds should be roughened (Scrabbled) and cleaned to remove laitance and to expose cleanly, but not loosen, the coarse aggregate particles.
- Brushing to remove laitance from a fresh concrete base is inadequate preparation before laying a bonded screed and is not recommended.
- Remove all loose debris, dirt and dust by appropriate means, preferably with vacuum equipment.
- Carry out the preparation of the surface with as little delay as is practicable before the screed is laid so as to reduce the risk of contamination.
- The surface of the prepared slab must be reasonably level to avoid deviations in thickness's of the screed.

Constructing screeds over insulated substrates with under floor heating (UFH) system

1. Provision and construction of movement joints

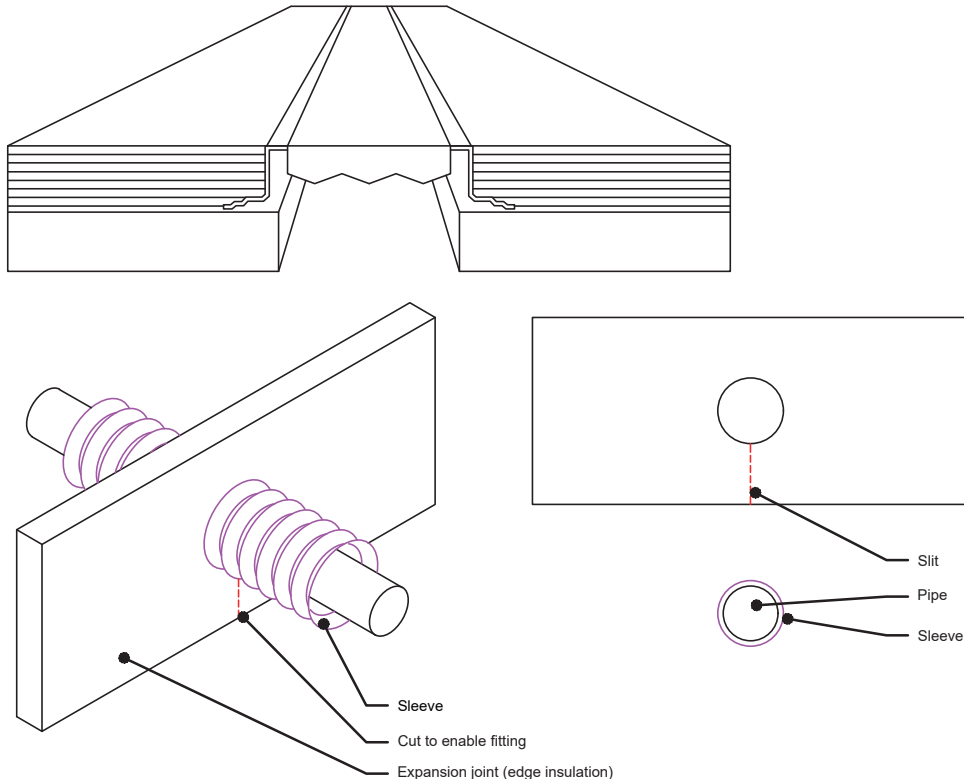
Movement joints should be provided in the floor screed / fixed floor finish where floor heating is provided in the following places:

- Between independently controlled heating zones.
- Between heated and unheated areas of screed.
- Additional joints should be considered in areas of high thermal gain e.g. large conservatories or glass atria.

Bay joints should be formed using rigid joint formers where possible, which can be placed during the preparation phase and will remain in place during operation. The joint former should be 5mm lower than the finished screed depth to allow a smooth transition in height between bays.

- All joints in the screed should extend through to any subsequent bonded floor covering.
- Joint positions should be specified prior to the installation of the screed and full consultation between all parties including the main contractor, underfloor heating installer, finished flooring installer and the screed installer should take place to determine appropriate locations.
- Movement joints should be carried through the subfloor to the floor finish and all applied layers terminated either side of the joint.
- The joint should be filled with a suitable flexible filler and a proprietary cover strip applied to cover the joint. Grout must not be used.
- Movement joints should not be bridged by any resilient, textile or other adhered floor finish.
- Movement joint covers may be flush, surface mounted or bedded in mortar and metal, metal with a rubber insert or PVC (see typical detail below).

Typical movement joint covers



2. Provision of edge strip perimeter expansion joint

When incorporating under floor heating (UFH):

- Screeds should be isolated at all edges, abutments and columns to allow for movement due to thermal loadings.
- The floor screed and finished floor manufacturers guidance to be followed particularly when incorporating under-floor heating to determine the minimum thickness of edge strip required to allow for expansion. Typically, between 6-15mm may be required.
- The joint can be concealed by the skirting.
- These joints must be left empty, or else filled with a compressible material.
- Movement joints must not be filled with grout.

3. Screed drying time

- The drying time allowed must be calculated for the proposed depth of screed, taking account of the environmental conditions present e.g. temperature and humidity. Where polymer modified type screeds are being used the manufacturer's requirements must be strictly followed for the actual depth of screed. Surface finishes placed on a screed too early will fail.
- Drying times for polymer modified screeds could potentially be different to cementitious screeds.
- All subcontractors involved with the screed and floor finishes (including installation of underfloor heating systems) must follow the installation requirements and not deviate or change materials.
- The screed should not be walked on until fully cured.

4. UFH testing and commissioning

- Ensure there are no joints in the heating system loops.
- UFH systems should be commissioned before floor finishes are applied. This will add to the total time before any floor finish can be applied.
Note: If floor finishes are installed prior to the UFH being turned on and commissioned, any residual moisture in the floor is driven to the surface of the screed and can potentially cause delamination of the floor finish.
- Pressure testing of the system does not constitute commissioning of the system. The heat source has to be in place and operating in order to deliver the correct temperatures.
- The UFH system must be commissioned in accordance with the manufacturer's recommendations by their approved installers. A commissioning certificate will be required.

5. Moisture testing of the screed where floor finishes are proposed

- Moisture testing should be carried out after the commissioning of the UFH system but before any floor finishes are laid.
- Where UFH is not installed, moisture testing of the screed should still be carried out before floor finishes are installed.
- Moisture testing is carried out using a suitable approved method such as a flooring hygrometer or carbide bomb test. Due to the potential inaccuracies of using hygrometers at high humidity levels, a direct measurement should be used such as Carbide Bomb or oven dried sample.
- The base is deemed to be sufficiently dry when the relative humidity, as measured by a surface mounted flooring hygrometer/probe is 75% RH or less. For the use of a flooring hygrometer, reference should be made to Dampness testing in BS 5325, BS 8203, BS 8425 and BS 8201.
- If underfloor heating is present in the base, the heating must be switched off 96 hours prior to any hygrometer test being carried out.
- The hygrometer must be allowed to remain in position until full equilibrium has been established. This is generally considered to be 72 hours but could be longer over thick sections and considerably longer on power floated concrete.

6. Screed preparation for finishes

- The top surface of screeds may require to be scored, sanded or keyed in preparation to accept the primer and floor finish.
- Sanding, keying etc. of the screed surface allows the penetration of primers. It also provides a "key" for the adhesive to grip onto.
- The surface must then be cleared of dirt and debris prior to primers being applied.
- Any primers and adhesives must not be applied until the screed has fully hardened and dried out. Drying times vary depending on the type of screed.
- Surfaces to receive fixed floor finishes should be rigid, dimensionally stable, flat with no dips and rises, sound, clean and free from laitance, paints, salts, grease, dust and any contamination which may prevent adhesion.

7. Adhering to the manufacturers' process during the installation of the flooring finish.

All the relevant manufacturers recommendations should be followed which will identify timelines to adhere i.e.:

- Removing the laitance by sanding to provide a key for the primer and/or adhesive.
- Commissioning the underfloor heating before installing the fixed floor finish.
- Allowing the UFH system to cool down for at least 48 hours before installing the fixed floor finish.
- Moisture testing to confirm the dryness of the screed before installing the fixed floor finish.
- Ensuring the time from screed completion to installing the fixed floor finish commencement is calculated and adhered to.
- Ensure the fixing of the finished floor finish has stabilized before walking on. Some finishes require typically 12 -24 hours dependent on environmental conditions.
- Ensure the UFH system is not turned on for at least 48 hours after any adhered floor finish is completed.
- If an anhydrite screed is used, it must be sealed before the application of a cement based floor finish adhesive if proposed in conjunction with a finished floor surface covering.

8. Exceeding the Maximum 27°C floor temperature

The underfloor heating system must be correctly commissioned to ensure temperature fluctuations are avoided and potential damage to the floor finishes.

BS 8203 Code of Practice for the Installation of Resilient Floorcoverings states: When used with many flooring materials underfloor heating can cause problems if the temperature at the interface between the subfloor and flooring exceeds 27°C, or is subject to rapid fluctuations in temperature.

Where a resilient floor covering is proposed: 'the temperature should never exceed the agreed maximum of 27°C at the underside of the floorcovering (the adhesive line).

Note: UFH designers may refer to this as the 'interface' temperature.

Please Note: BS EN 1264 - 2 refers to a max 29°C however for Warranty purposes a maximum 27°C is to be followed.

9. End user information

End users must be aware of how to use an UFH system, as these need to be operated differently than other heating systems both for in use and to avoid damage to screeds and finishes.

10.

Upper Floors

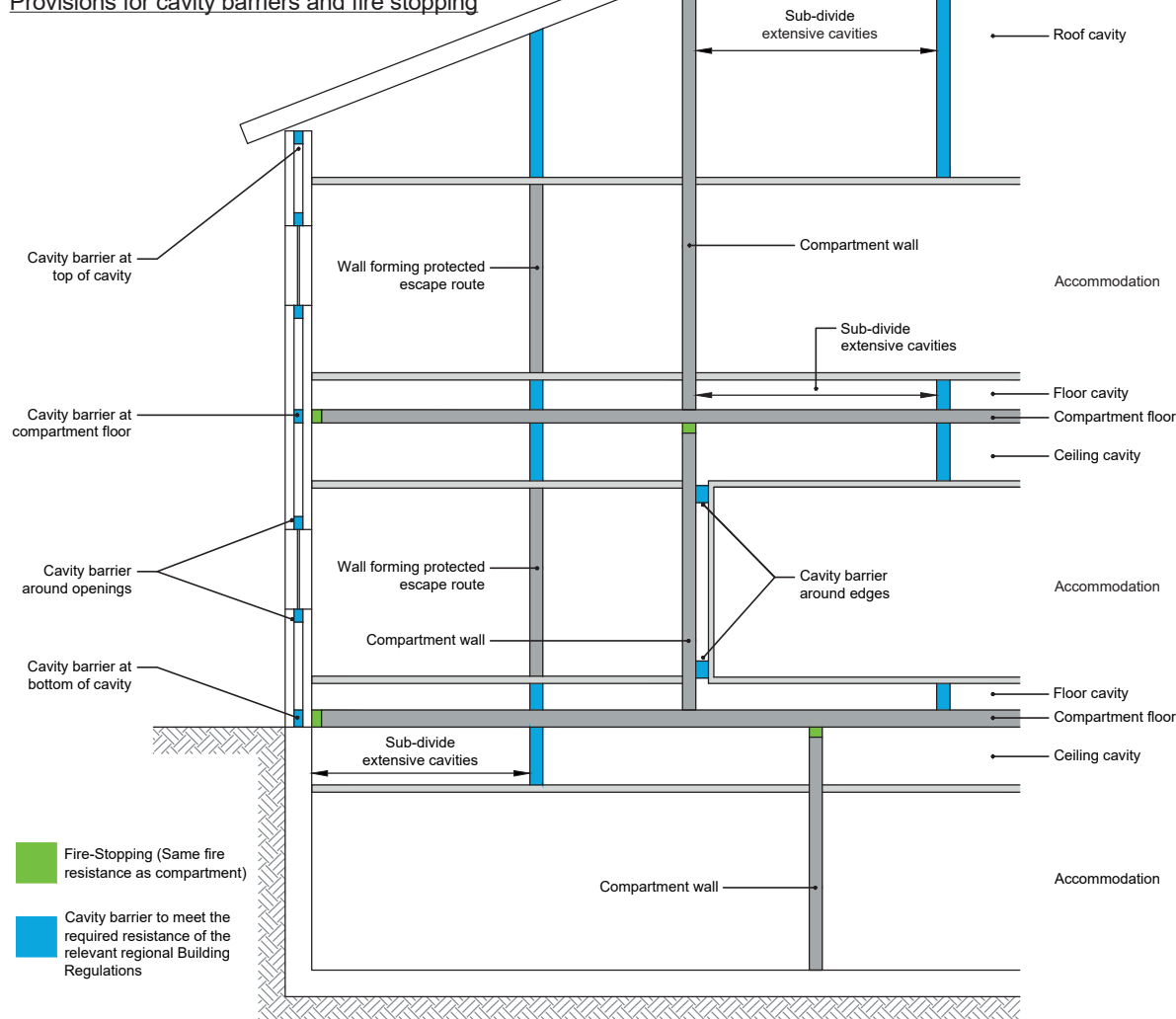
10.9

General Requirements - Cavity Barriers and Fire Stopping

Openings for pipes in separating elements

- Pipes which pass through fire separating elements (unless in a protected shaft) shall:
- Have an approved proprietary sealing system that has a UKAS accredited test to prove it will maintain the fire resistance of the wall. Note: It should only be installed as per the test requirements, or
 - Where an approved proprietary sealing system is not used; the pipes penetrating the fire separating element should be restricted in diameter to a maximum size shown in the relevant regional Building Regulations and fire stopping used around the pipe, or
 - A sleeving system with a maximum 160mm internal diameter is used as specified in the relevant regional Building Regulations.

Provisions for cavity barriers and fire stopping



Note: Diagrams courtesy of the approved documents for England

Fire resistance general

All floors should have the fire resistance required by the relevant Building Regulations. To achieve the same fire resistance, I-joists and metal web joists may require a different specification for the ceiling than that for solid timber joists. Holes should not be made in the ceilings, e.g. for down lighters, unless it can be proven that the floor construction achieves the required fire resistance.

Fire stopping

Penetrations in floors between buildings shall be fire stopped, there are to be no holes or gaps for smoke to pass through once the fire stopping has been fitted. Where down lighters are incorporated in a ceiling they should be fitted in accordance with the manufacturer's instructions.

Further additional requirements for internal fire stopping and fire protection for compartment floors, walls, and roof junctions to flats and apartments with a floor 4.5m or more above the ground

The following additional guidance applies to internal fire stopping and fire protection only to buildings with a floor 4.5m or more above the ground that contain flats or apartments.

Although building legislation is robust in applying provisions for fire protection and fire stopping, it can often be difficult to implement high standards of fire stopping in complex buildings. This can lead to significant safety risks if the building does not have the correct levels of fire protection and if holes in compartment walls are not sealed correctly. This guidance assists Developers in providing good standards of fire stopping and fire protection.

It is not the intention to enhance the requirements of the Building Regulations, but more to ensure that the statutory requirements are applied correctly to the construction. It is therefore deemed that the requirements of Part B of the Building Regulations in England and Wales, or Section 2 of the Scottish Building Standards (whichever is appropriate depending on region), that apply to fire stopping, separating walls, service penetrations, minimum periods of fire resistance and concealed spaces will also meet the requirements of this guidance.

1. Fire stopping

Design information

Drawings showing the lines of compartmentation and the lines of fire-resisting construction should be provided to the Surveyor and the Builder. The drawings should also give the required level of fire resistance for each element. Drawings to show the position of cavity barriers should be provided, and the specification of cavity barriers included.

Materials for fire stopping and cavity barriers

All materials used to form a fire barrier must have relevant third-party certification or be CE marked in accordance with the Construction Products Regulations. The materials must be installed in accordance with the manufacturer's instructions and recommendations.

Installation

The fire stopping material or cavity barriers should be installed by a person who is deemed competent to install such products. A competent person is deemed to be a third-party approved contractor specialising in fire stopping and passive fire protection.

2. Fire protection in buildings

Design information

The design details must show the correct level of fire resistance for the building, in accordance with Part B of the Building Regulations or Section 2 of the Scottish Building Standards, depending on region.

Materials for fire protection

All materials used to form a fire barrier must have relevant third-party certification, or be CE marked in accordance with the Construction Products Regulations. The materials must be installed in accordance with the manufacturer's instructions and recommendations.

Installation

The fire stopping material or cavity barriers should be installed by a person who is deemed competent to install such products.

Where intumescent paints are used to provide the required level of fire protection, certification confirming that the paint applied will achieve the correct level of fire protection is required.

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