Introduction

General

This Technical Booklet has been prepared by the Department of the Environment for Northern Ireland and provides for certain methods and standards of building which, if followed, will satisfy the requirements of the Building Regulations (Northern Ireland) 1990 ("the Building Regulations").

There is no obligation to follow the methods or comply with the standards set out in this Technical Booklet.

If you prefer you may adopt another way of meeting the requirements of the Building Regulations but you will have to demonstrate that you have satisfied those requirements by other means.

Other regulations

This Technical Booklet relates only to the requirements of Regulation G2. The work will also have to comply with all other relevant Building Regulations.

British Standards and European Technical Specifications

In this introduction and throughout this Technical Booklet any reference to a British Standard shall be construed as a reference to a:

(a) British Standard or a British Standard Code of Practice, or

(b) national technical specification, of a Member State of the European Community, which provides an equivalent standard of protection or performance.

Materials and workmanship

Any work to which a requirement of the Building Regulations applies must, in accordance with Part B of the Building Regulations, be carried out with proper materials and in a workmanlike manner. You can comply with the requirements of Part B by following an appropriate British Standard or you may demonstrate that you have complied with those requirements by other suitable means, such as an acceptable British Board of Agrément Certificate, Quality Assurance Scheme, Independent Certification Scheme or Accredited Laboratory Test Certificate.

Diagrams

The diagrams in this Technical Booklet supplement the text. They do not show all the details of construction and are not intended to illustrate compliance with any other requirement of the Building Regulations. They are not necessarily to scale and should not be used as working details.

References

Any reference in this Technical Booklet to a publication shall, unless otherwise stated, be construed as a reference to the edition quoted, together with any amendments, supplements or addenda thereto current at 31st December 1988.

Contents

Foreword

0.1 This booklet describes 2 ways of meeting the requirements of Regulation G2. The first and simpler method is to follow one of the Acceptable Constructions detailed in Section 1. The second way is to repeat a construction which has already been built, tested as defined in the Similar Construction method and shown to achieve the specified performance level. When opting to use this method it will be necessary to provide evidence that the existing construction does meet the specified performance level and that the existing and proposed design have essentially similar features.

0.2 Two types of source produce the sounds which are heard in a neighbouring dwelling – airborne sources such as speech, musical instruments and loudspeakers and impact sources such as footsteps and the moving of furniture.

0.3 An airborne source sets up vibrations in the surrounding air which spread out and, in turn, set up vibrations in the enclosing walls and floors (called elements). An impact source sets up vibrations directly in the element it strikes. These vibrations spread out over the whole area of the element and into elements connected to it, such as internal walls, the inner leaves of external walls and floors. The vibrations in the elements force the air beside them to vibrate and it is these new airborne vibrations that are heard.

0.4 To achieve adequate sound insulation, the flow of sound energy through walls and floors should be restricted. The flow of energy may be by direct transmission or by flanking (indirect) transmission.

Direct transmission

0.5 Direct transmission means the transmission of sound directly through a wall or floor from one of its sides to the other.

0.6 Walls should reduce the level of airborne sound. The performance of the solid masonry wall (Type 1) depends on its mass – being heavy it is not easily set into vibration. The walls with two or three leaves depend partly on their mass and partly on isolation between the leaves. Timber framed walls (Type 4) generally provide the most isolation and they can be much lighter than masonry walls.

0.7 With masonry walls the mass per square metre is the main factor but stiffness and damping (which turns sound energy into heat) are also important. Consequently walls of the same type but made from materials with different mechanical properties may need a different mass to give the same insulation. Cavity masonry walls (Type 2) need at least as much mass as solid walls because their lower stiffness offsets the benefit of isolation.

0.8 Floors should reduce airborne sound and also, if they are above a dwelling, impact sound. The heavy solid floor (Type 1) depends on its mass to reduce airborne sound and on the soft covering to reduce impact sound at source. The floating floor (Types 2 and 3) contains a layer of highly porous spongy (resilient) material which largely isolates the walking surface from the base and this isolation contributes to both airborne and impact insulation. The resilient layer is only effective if it is not too stiff and so it is important to choose a suitable material and to make sure that it is not bypassed with rigid bridges such as fixings and pipes.

0.9 Air paths must be avoided – porous materials and gaps at joints in the structure must be sealed. Resonances must also be avoided – these may occur if some part of the structure (such as a dry lining) vibrates strongly at a particular sound frequency (pitch) and transmits more energy at this pitch.

Flanking transmission

0.10 Flanking transmission means the indirect transmission of sound from one side of a wall or floor to the other side.

0.11 Because solid elements vibrate when they are exposed to sound waves in the air they may cause sound waves in the air on both sides. Flanking transmission happens when there is a path along which sound can travel between elements on opposite sides of a wall or floor. This path may be through a continuous solid structure or through an air space (such as the cavity of an external wall). Usually paths through structure are more important with solid masonry elements and paths through an air space are more important with thin panels (such as studwork and ceilings) in which structural waves do not travel as freely.

0.12 The junction of a sound resisting element and a flanking element provides resistance to structural waves, but it may not be enough unless the flanking element is heavy or is divided by windows or similar openings into small sections which do not vibrate freely. Usually a minimum mass is also needed for thin panels connected by paths through air spaces (such as ceilings connected by air in roof spaces and over the top of a separating wall). The mass which is needed will be less if the path is blocked by non-porous material.

Special factors

0.13 In addition to the details of the construction, sound insulation is also affected by the layout of the rooms and by the presence of steps or staggers between neighbouring dwellings which can improve the performance. Because these factors are important, care must be taken to take them into account when considering essentially similar constructions.

0.14 Sound insulation may be reduced by careless detailing, careless workmanship and the use of unsuitable materials.

Diagram **1** **Walls which need to be sound resisting**

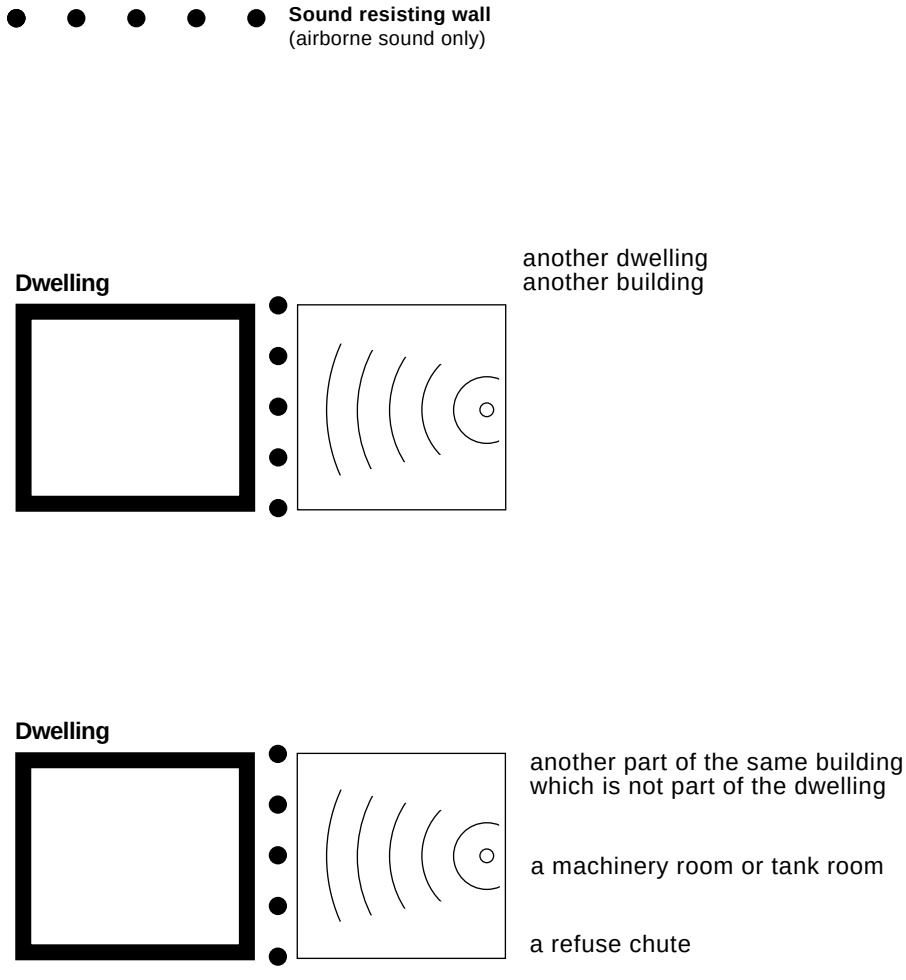
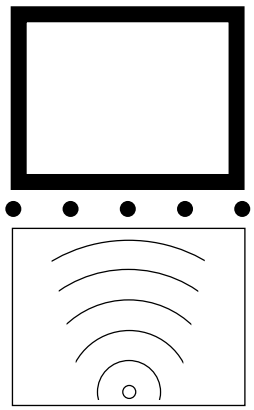


Diagram **2** **Floors which need to be sound resisting**

● ● ● ● ● **Sound resisting floor**

floor to resist airborne sound only

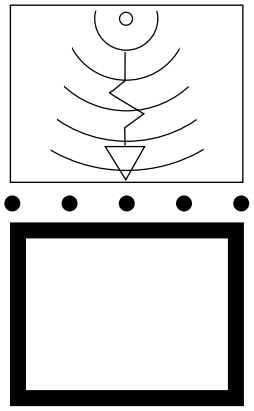


Dwelling above

another part of the same building which is not part of the dwelling above

a machinery room or tank room

floor to resist both airborne and impact sound



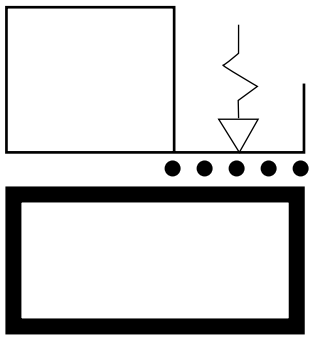
another dwelling

another part of the same building which is not part of the dwelling below

a machinery room or tank room

Dwelling below

floor to resist impact sound only



the floor of an open access balcony

Dwelling below

Section 1 – Acceptable construction method

1.1 There are 4 acceptable wall types and 3 acceptable floor types details of which are given in sub-sections 1.5 to 1.11.

1.2 Conditions on the use of the acceptable constructions

(a) A separating wall shall meet the following conditions –

(i) The standard of workmanship shall be of such quality that the wall will perform its functions.

(ii) In *Wall Types 1 and 2* the depth of any horizontal chase shall not exceed one-sixth of the thickness of the leaf and the depth of any vertical chase shall not exceed one-third of the thickness of the leaf. Chases or recesses back to back are not permitted.

In *Wall Type 3* services shall not pierce the core but may pierce the isolated panels provided that any gaps are sealed with tape or caulking.

In *Wall Type 4* services are not permitted.

(iii) Chimneys are only permitted in separating walls where the chimney is of masonry construction (including precast concrete flue blocks). Chimneys shall not be constructed in *Wall Type 4*.

(iv) No opening shall be permitted between a dwelling and stairway or passage other than a doorway having at least a ½ hr fire-resisting door.

(v) No service pipes or ducts shall pass through the wall except between a dwelling and a stairway, passage or duct where the opening is fire protected.

(vi) A wall separating a habitable room and a refuse chute shall have a mass (including any plaster finishes) of at least 1320 kg/m^2. A wall separating a non-habitable room from a refuse chute shall have a mass (including any plaster finishes) of at least 220 kg/m^2.

(b) A separating floor shall meet the following conditions –

(i) The standard of workmanship shall be of such quality that the floor will perform its functions.

(ii) It shall not have an opening other than a fire stopped opening for a service duct, pipe or flue which also satisfies the conditions for floor penetrations described under the relevant floor type.

1.3 Rules for measurement

The masses and dimensions specified throughout this Section are the minimum required unless otherwise stated. Timber sizes quoted are the minimum actual sizes required.

1.4 Rules for calculating mass and density

Where a mass is specified for walls it is expressed in kilogrammes per square metre of wall face area (kg/m^2). For floors the mass is expressed in kilogrammes per square metre on plan (kg/m^2).

(a) To calculate the minimum density of bricks or blocks the formulae in Table 1 shall be used. For co-ordinating course heights other than those quoted in Table 1 the formula for the nearest height shall be used. Include any finish of plaster, render or dry lining in calculating the mass unless otherwise stated.

(b) For in situ concrete or screeds calculate the mass by multiplying the density (kg/m^3) by the thickness (in metres). For slabs or composite floor bases where the density is not known divide the total mass of the element (kg) by the plan area of the element (m^2).

Table 1 **Formulae for calculating density**

Co-ordinating height of masonry course (mm)	Formula to be used
75	$D = \frac{(M - NP - 380)}{T \quad 0.79}$
100	$D = \frac{(M - NP - 255)}{T \quad 0.86}$
150	$D = \frac{(M - NP - 145)}{T \quad 0.92}$
200	$D = \frac{(M - NP - 125)}{T \quad 0.93}$

Where
- D = apparent density of masonry units in kg/m^3 (at 3% moisture content)
- M = mass of 1 m^2 of leaf in kg/m^2
- N = number of finished faces
- P = mass of 1 m^2 of wall finish in kg/m^2 (see below)
- T = thickness of masonry in metres (ie, unplastered thickness)

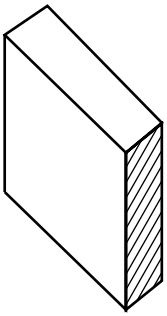
Mass of wall finish (assumed thickness 13 mm)

Cement render	29 kg/m^2
Gypsum plaster	17 kg/m^2
Lightweight plaster	10 kg/m^2
Plasterboard	10 kg/m^2

Note to Table – A mortar joint of 10 mm and a dry, set mortar density of 1800 kg/m^3 are assumed. Values within 10% of these figures are acceptable.

1.5 Wall Type 1: Solid masonry

The resistance to airborne sound depends mainly on the mass of the wall.



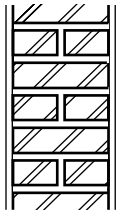
Points to watch

Fill masonry joints with mortar (to achieve the mass and to avoid air paths).
Limit the pathways around the wall (to reduce flanking transmission).

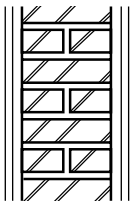
Constructions

Five wall constructions which give suitable resistance to direct transmission are specified below.

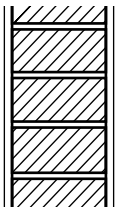
A. Brick, plastered both sides.
Mass of masonry including plaster 375 kg/m^2.
13 mm plaster each side.
Lay bricks in a bond which includes headers.
Example – 215 mm brick, lightweight plaster, 75 mm coursing; brick density of 1610 kg/m^3 gives the required mass.



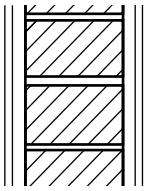
B. Brick, plasterboard both sides.
Mass of masonry including plasterboard 375 kg/m^2.
12.5 mm plasterboard each side, use any normal fixing method.
Lay bricks in a bond which includes headers.
Example – 215 mm brick, 75 mm coursing; brick density of 1610 kg/m^3 gives the required mass.



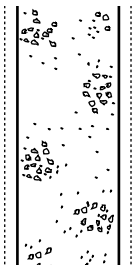
C. Concrete block, plastered both sides.
Mass of masonry including plaster 415 kg/m^2.
13 mm plaster each side.
Use blocks which extend to the full thickness of the wall.
Example – 215 mm block, lightweight plaster, 110 mm coursing; block density of 1840 kg/m^3 gives the required mass.



D. Concrete block, plasterboard both sides.
Mass of masonry alone 415 kg/m^2.
12.5 mm plasterboard each side, use any normal fixing method.
Use blocks which extend to the full thickness of the wall.
Example – 215 mm block, 150 mm coursing; block density of 1840 kg/m^3 gives the required mass.



E. Concrete (minimum density 1500 kg/m^3) in situ or large pre-cast panel.
Plaster optional.
Mass (including plaster if used) 415 kg/m^2.
Fill joints between panels with mortar.
Example – 190 mm concrete, unplastered; concrete density of 2200 kg/m^3 gives the required mass.



JUNCTIONS TO LIMIT FLANKING TRANSMISSION

Roof

Where the wall stops below the roof covering fire-stop the joint between the wall and the roof.

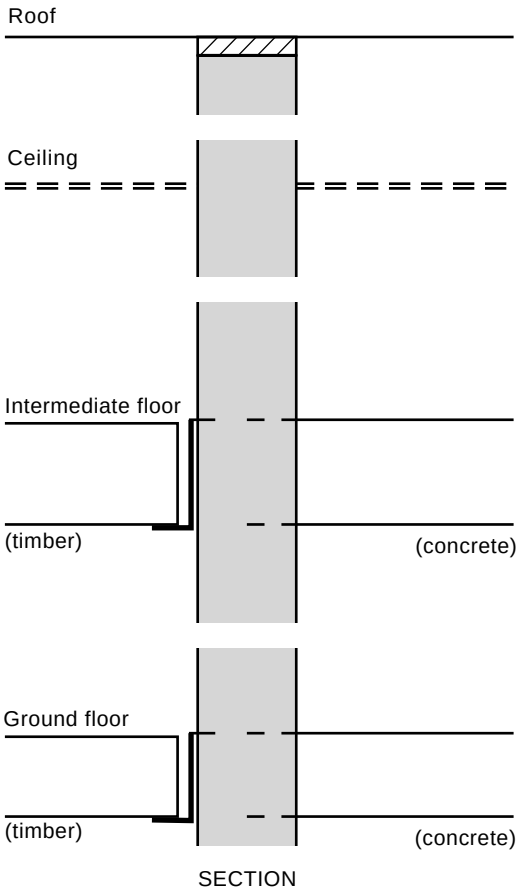
Ceiling and roof space

Where there is a heavy ceiling with sealed joints (12.5 mm plasterboard or equivalent), the mass of the wall above the ceiling may be reduced to 150 kg/m^2. If lightweight aggregate blocks are used to reduce mass seal one side with cement paint or plaster skim.

Intermediate and ground floors

With a timber floor do not build joists into the wall, use joist hangers.

With a concrete floor either the wall or the floor may be carried through.



SECTION

External wall

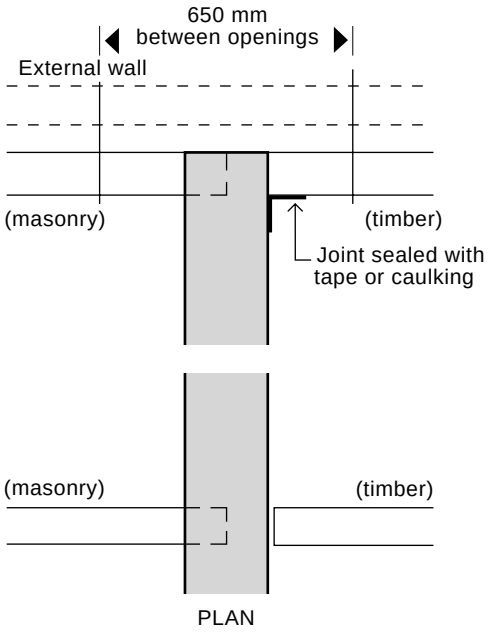
There must be 650 mm between openings which are on opposite sides of the separating wall.

The outer leaf of a cavity external wall may be of any construction.

An inner leaf or solid wall shall not extend past the end of the separating wall.

A masonry inner leaf or solid wall shall either be bonded to the separating wall or butted to it with ties no more than 300 mm apart vertically. A mass of 120 kg/m^2 is normally required except where large openings occur on both sides of the separating wall. If these openings are at least 1 m in height and within 700 mm of each side of the separating wall there is no minimum mass requirement. (Short lengths of wall do not vibrate to cause flanking transmission). However the minimum separation of 650 mm between openings still applies.

A timber inner leaf or external wall shall be butted tight against the separating wall and fixed with ties no more than 300 mm apart vertically. The joint between the lining to the external wall and the separating wall shall be sealed with tape or caulking.

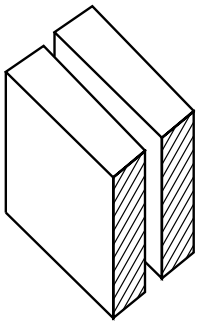


Partitions

There are no restrictions on partition walls meeting this wall type.

1.6 Wall Type 2: Cavity masonry

The resistance to airborne sound depends on the mass of the leaves and on the degree of isolation achieved.



Points to watch

With this wall type an intermediate or suspended ground floor shall not span between two dwellings.

Fill masonry joints with mortar (to achieve the mass and to avoid air paths).

Maintain the cavity up to the underside of the roof.

Maintain the separation of the leaves and space them at last 50 mm apart.

Connect the leaves only where necessary for structural reasons. For cavities up to 75 mm use only butterfly pattern ties, spaced at a maximum of 900 mm apart horizontally and 450 mm apart vertically.

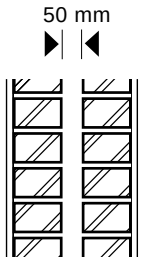
If external walls are to be filled with an insulating material other than loose fibre the insulating material shall be prevented from entering the cavity in the separating wall.

Constructions

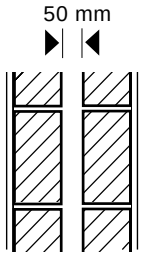
Two wall constructions (A and B) which give suitable resistance to direct transmission are described below.

Two other wall constructions (C and D) will be suitable only where a step and/or stagger is incorporated at the separating wall.

A. Two leaves of brick with 50 mm cavity, plastered on both room faces.
Mass including plaster 415 kg/m^2.
13 mm plaster each face.
Example – 102 mm leaves, lightweight plaster, 75 mm coursing; brick density of 1970 kg/m^3 gives the required mass.

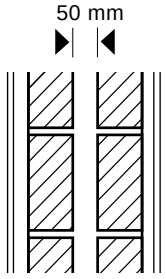


B. Two leaves of concrete block with 50 mm cavity, plastered on both room faces.
Mass including plaster 415 kg/m^2.
13 mm plaster each face.
Example – 100 mm leaves, lightweight plaster, 225 mm coursing; block density of 1990 kg/m^3 gives the required mass.

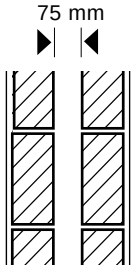


Additional constructions permitted only where a step and/or stagger of at least 300 mm is used.

C. Two leaves of concrete block with 50 mm cavity, plasterboard on both room faces.
Mass of masonry alone 415 kg/m^2.
12.5 mm plasterboard each face, use any normal fixing method.
Example – 100 mm leaves, 225 mm coursing; block density of 1990 kg/m^3 gives the required mass.



D. Two leaves of lightweight aggregate concrete block (maximum density 1500 kg/m^3) with 75 mm cavity, plastered on both room faces.
Mass including plaster 250 kg/m^2.
13 mm plaster each face.
Seal the face of the blockwork, with cement paint or plaster, through the full width and depth of any intermediate floor.
Example – 100 mm leaves, lightweight plaster, 225 mm coursing; block density of 1105 kg/m^3 gives the required mass.



JUNCTIONS TO LIMIT FLANKING TRANSMISSION

Roof

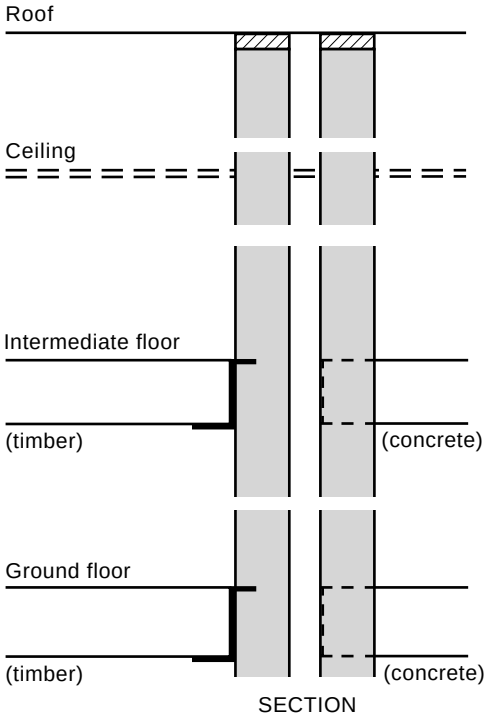
Where the wall stops below the roof covering fire-stop the joint between the wall and the roof.

Ceiling and roof space

Where there is a heavy ceiling with sealed joints (12.5 mm plasterboard or equivalent), the mass of the wall above the ceiling may be reduced to 150 kg/m^2. The cavity must still be maintained. If lightweight aggregate blocks are used to reduce mass seal one side with cement paint or plaster skim.

Intermediate and ground floors

With a timber floor use joist hangers for any joists supported on the wall.
With a concrete intermediate or suspended ground floor, the floor shall be carried through only to the cavity face of each leaf.
With a concrete ground floor either the wall or the floor may be carried through.



SECTION

External wall

There shall be 650 mm between openings which are on opposite sides of the separating wall.

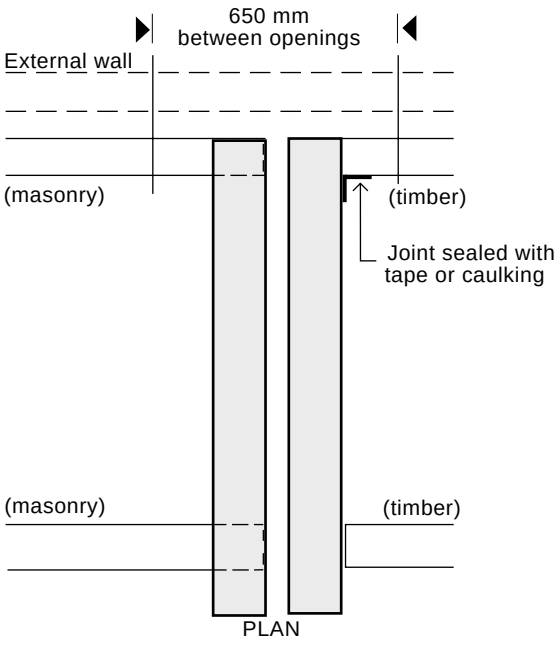
The outer leaf of a cavity external wall may be of any construction.

An inner leaf or solid wall shall not extend past the end of the separating wall.

A masonry inner leaf or solid wall shall either be bonded to the separating wall or butted to it with ties no more than 300 mm apart vertically, and shall have a mass of 120 kg/m^2 except where wall construction B is used, when there is no minimum mass requirement.

A timber inner leaf or external wall shall be butted tight against the separating wall with ties no more than 300 mm apart vertically. The joint between the lining to the external wall and the separating wall shall be sealed with tape or caulking.

The cavity in the separating wall shall not be sealed in any material other than mineral wool.

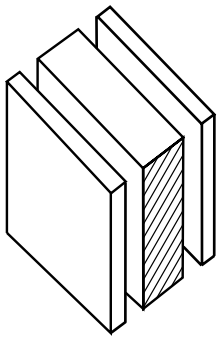


Partitions

There are no restrictions on partition walls meeting this wall type.

1.7 Wall Type 3: Solid masonry between isolated panels

The resistance to airborne sound depends on the mass and type of core and on the isolation and mass of the panels.



Points to watch

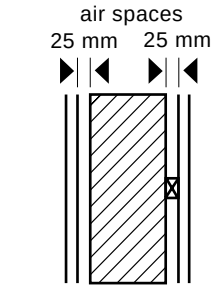
Fill masonry joints with mortar (to achieve the mass and to avoid air paths).
Support the panels only from floor and ceiling – do not fix or tie them to the masonry core (to maintain isolation).

Constructions

Four masonry cores and 2 panels are specified which in any combination of core plus panels give suitable resistance to direct transmission.

Basic arrangement

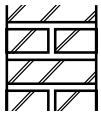
A masonry core, with an isolated panel on each side.
25 mm air space between panels and core.
Keep framing 5 mm clear of core.



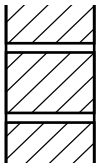
SECTION THROUGH
BASIC ARRANGEMENT

Masonry cores

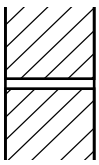
A. Brick.
Mass 300 kg/m^2.
Example – 215 mm core, 75 mm coursing; brick density of 1290 kg/m^3 gives the required mass.



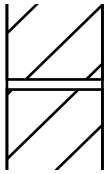
B. Concrete block.
Mass 300 kg/m^2.
Example – 140 mm core, 110 mm coursing; block density of 2200 kg/m^3 gives the required mass.



C. Lightweight aggregate concrete block.
(Maximum density 1500 kg/m^3)
Mass 200 kg/m^2.
Example – 140 mm core, 225 mm coursing; block density of 1405 kg/m^3 gives the required mass.
Example – 215 mm core, 150 mm coursing; block density of 855 kg/m^3 gives the required mass.

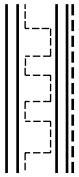


D. Autoclaved aerated concrete block.
Mass 160 kg/m^2.
Example – 200 mm core, 225 mm coursing; block density of 730 kg/m^3 gives the required mass.



Panels

E. Two sheets of plasterboard joined by a cellular core.
Mass (including plaster finish if used) 18 kg/m^2.
Fix to ceiling and floor only.
Tape joints between panels.



F. Two sheets of plasterboard with joints staggered.
Thickness of each sheet 12.5 mm if a supporting framework is used, or total thickness of 30 mm if no framework is used.

JUNCTIONS TO LIMIT FLANKING TRANSMISSION

Roof

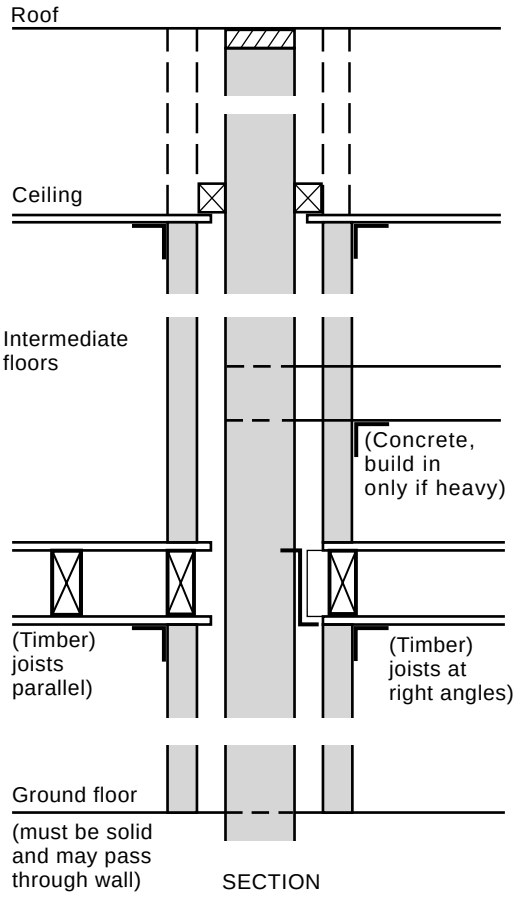
Where the wall stops below the roof covering fire-stop the joint between the masonry core and the roof.

Ceiling and roof space

Where there is a heavy ceiling with sealed joints (12.5 mm plasterboard or equivalent) the isolated panels may be omitted in the roof space and the mass of the core above the ceiling may be reduced to 150 kg/m^2. If lightweight aggregate blocks are used to reduce mass seal one side with cement paint or plaster skim. Seal the gap between the ceiling and the masonry core with a timber batten, and the gap between ceiling and isolated panels with tape or caulking.

Intermediate and ground floors

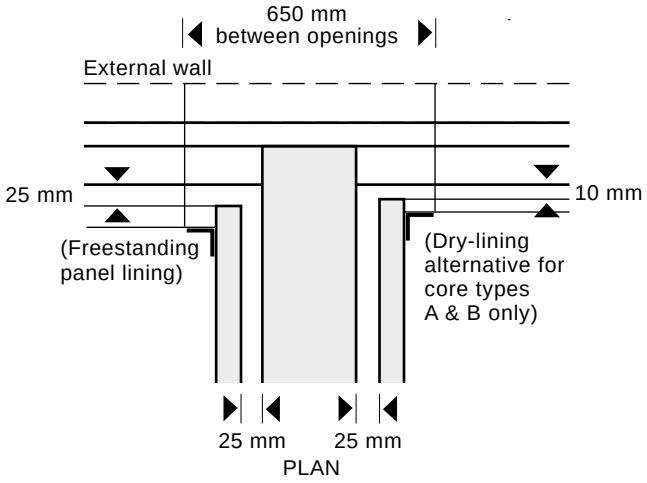
With a timber intermediate floor use joist hangers for any joist supported on the wall and seal the spaces between joists with full depth timber bridging.
With a concrete intermediate floor the floor base may only be carried through where it has a mass of 365 kg/m^2. Seal the gap between ceiling and panel with tape or caulking.
The ground floor shall be a solid slab, laid on the ground (to prevent air paths).



External wall

There shall be 650 mm between openings which are on opposite sides of the separating wall.

Internal finish to the external wall shall be isolated panels of the type specified for the separating wall except, for Cores A or B only, where plaster or dry-lining with joints sealed with tape or caulking may also be used. A layer of insulation may be added to panels lining the external wall provided the 25 mm and 10 mm gaps shown on the diagram are maintained. If isolated panels are used the external wall may be any material. If dry-lining is used, the external wall leaf shall be masonry with a mass of 120 kg/m^2, butt jointed to the separating wall core with ties no more than 300 mm apart vertically.



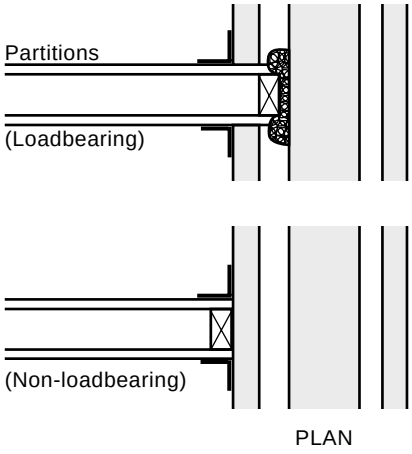
Partitions

Partitions of masonry construction shall not abut this wall type.

Other loadbearing partitions shall be fixed to the masonry core through a continuous pad of mineral fibre quilt.

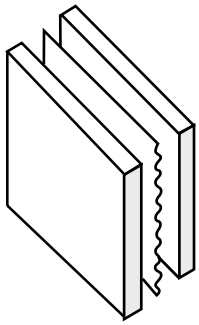
Non-loadbearing partitions shall be tight butted to the isolated panels.

All joints between partitions and panels shall be sealed with tape or caulking.



1.8 Wall Type 4: Timber frames with absorbent curtain

The resistance to airborne sound depends on the isolation of the frames plus absorption in the air space between.



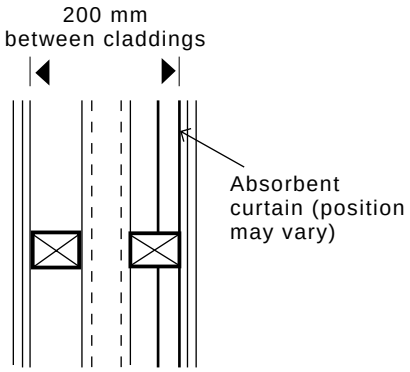
Points to watch

Only connect frames if necessary for structural reasons, and then use as few ties as possible – not more than 14-16 gauge (40 mm × 3 mm) metal straps fixed at or just below ceiling level 1.2 m apart.

Services shall not be contained in the wall thus avoiding the creation of air paths through the lining. Fire-stops are needed in the cavity between frames and shall be either flexible or fixed to only one frame.

Constructions

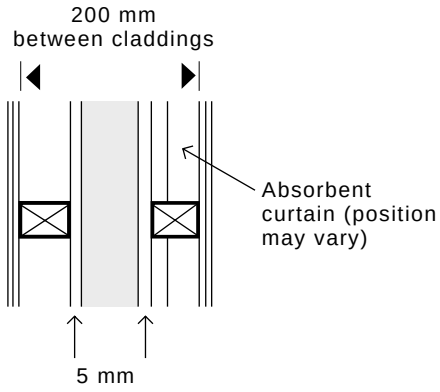
Two constructions which with appropriate cladding and absorbent curtain give suitable resistance to direct transmission are specified below.



Basic arrangement

A. Timber frames, 200 mm between claddings, plus absorbent curtain in cavity. Plywood sheathing may be used in the cavity as necessary for structural reasons.

B. Timber frames, masonry core, plus absorbent curtain in a cavity. Claddings 200 mm apart. Framing shall be 5 mm clear of core.



Masonry core

This does not normally improve sound resistance, but may be useful for support and in stepped or staggered situations. There are no restrictions on type but the core may be connected to only one frame.

Cladding

On each side: Two or more layers of plasterboard, combined thickness 30 mm, joints staggered to avoid air paths.

Absorbent curtain

Unfaced mineral fibre quilt (which may be wire reinforced), density 12-36 kg/m^3, thickness 25 mm if suspended in the cavity between frames, 50 mm if fixed to one frame, or 25 mm per quilt if one is fixed to each frame.

JUNCTIONS TO LIMIT FLANKING TRANSMISSION

Roof

Fire-stop the joint between the wall and the roof covering.

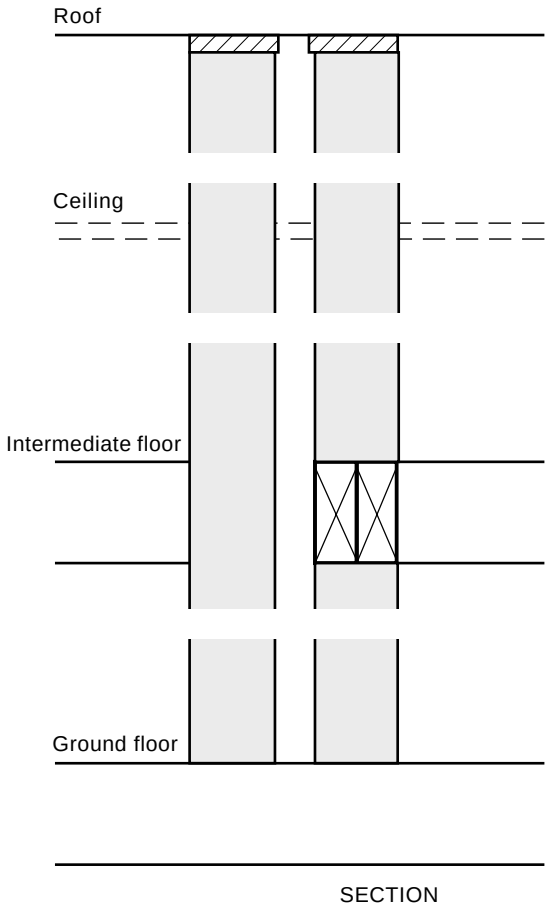
Ceiling and roof space

Carry the complete construction through to the underside of the roof covering irrespective of the presence of any type of ceiling.

Intermediate floor and ground floor

Block the air path to the wall cavity either by carrying the cladding through the floor or by using a solid timber edge or bridging to the floor.

The ground floor shall be a solid slab, laid on the ground (to prevent airpaths).



SECTION

External wall

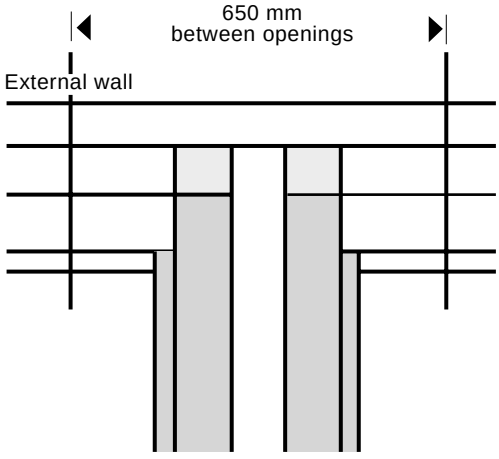
There shall be 650 mm between openings which are on opposite sides of the separating wall.

There are no restrictions on the external cladding to a timber frame wall leaf but if an external leaf is used the cavity between the end of the wall frames and the outer leaf shall be filled so as to seal air gaps.

For internal finishes to the external wall use a lining of 12.5 mm plasterboard or other equally heavy material. (Resilient layers for thermal insulation may be incorporated if desired).

Partitions

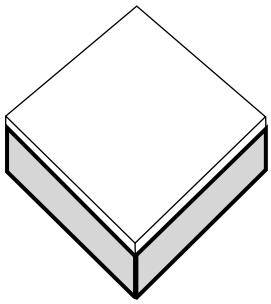
There are no restrictions on partitions meeting this wall type.



PLAN

1.9 Floor Type 1: Concrete base with soft covering

The resistance to airborne sound depends on the mass of the concrete base and on eliminating air paths. The soft covering reduces impact sound at source.



Limitations

Where resistance to airborne sound only is required the soft covering may be omitted. No other part of the construction may be omitted as this would reduce airborne sound resistance.

Points to watch

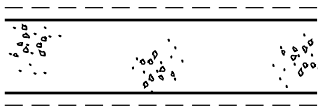
Fill all joints between parts of the floor (to avoid air paths).
Limit pathways around the floor (to reduce flanking transmission).
Workmanship and detailing shall be given special attention at the perimeter and wherever the floor is penetrated by a pipe or duct (to reduce flanking transmission and to avoid air paths).

Constructions

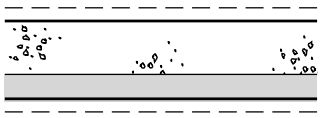
Four floor bases which give suitable resistance to direct transmission of airborne sound are specified, followed by the soft covering which shall be added to give suitable resistance to impact sound transmission.

Floor bases

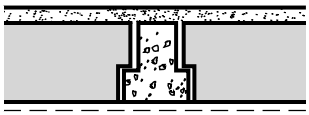
A. Solid concrete slab (in situ).
Floor screed and/or ceiling finish optional.
Mass (including any screed and/or ceiling finish) 365 kg/m^2.



B. Solid concrete slab with permanent shuttering.
Floor screed and/or ceiling finish optional.
Mass (including shuttering only if it is solid concrete or metal, and including any screed and/or ceiling finish) 365 kg/m^2.



C. Concrete beams with infilling blocks.
Floor screed or structural topping shall be used.
Ceiling finish optional.
Mass of beams, blocks, screed and/or structural topping (including any ceiling finish) 365 kg/m^2.



D. Concrete planks (solid or hollow).
Floor screed or structural topping shall be used.
Ceiling finish optional.
Mass of planks, screed and/or structural topping (including any bonded ceiling finish) 365 kg/m^2.

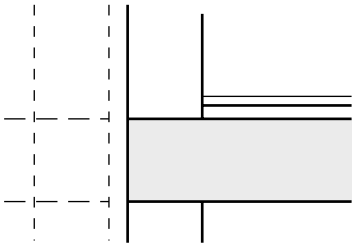
Soft covering

E. Any resilient material, or material with a resilient base, with an overall uncompressed thickness of 4.5 mm. Suitable resilience shall also be provided by a floor covering with a weighted impact sound improvement (ΔLw) of not less than 17 as calculated in Annex A to BS 5821: Part 2: 1984. The soft covering shall be bonded to the floor base.

JUNCTIONS TO LIMIT FLANKING TRANSMISSION

External wall or cavity separating wall

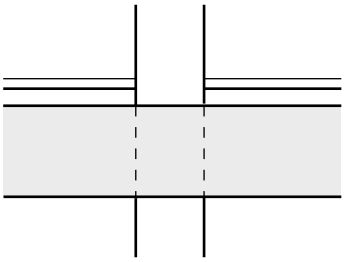
A mass of 120 kg/m^2 (including any plaster) is normally required in any external solid wall or cavity wall inner leaf adjoining the separating floor. If the external wall of a room adjoining the separating floor has an opening or openings in excess of 20% of its area there is no minimum mass requirement for that wall of that room.



The floor base (but not necessarily any screed) shall pass through the inner leaf of an external wall or abutting leaf of a cavity separating wall but shall not bridge a cavity.

Internal wall or solid separating wall

If the wall mass is less than 355 kg/m^2 (including any plaster) the floor base (but not necessarily any screed) shall pass through.



If the wall mass is more than 355 kg/m^2 (including any plaster) either the wall or the floor base (but not necessarily any screed) may pass through. Where the wall does pass through, tie the floor base to the wall and grout the joint.

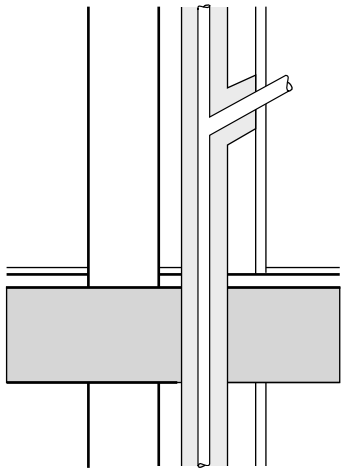
Floor penetrations

Ducts or pipes penetrating the floor shall be in an enclosure, both above and below the floor.

Either line the enclosure, or wrap the duct or pipe within the enclosure, with 25 mm unfaced mineral fibre.

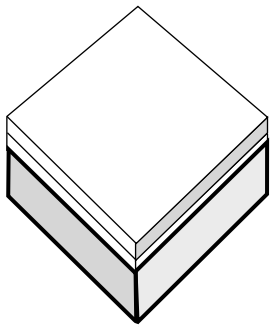
The material of the enclosure shall have a mass of 15 kg/m^2.

Flexible fire-stopping shall be used where the pipe or duct passes through the floor. Where a flue pipe penetrates the floor and does not discharge into a flue within a chimney carried by the floor, a non-combustible enclosing duct with mineral fibre absorbent lining shall be provided.



1.10 Floor Type 2: Concrete base with floating layer

The resistance to airborne sound depends mainly on the mass of the concrete base and partly on the mass of the floating layer.
Resistance to impact sound depends on a resilient layer isolating the floating layer from the base and from the surrounding construction.
Where resistance to airborne sound only is required the full construction shall still be used.
Resilient layers need not be used under kitchen or sanitary fittings, or in cupboards or wardrobes.



Points to watch

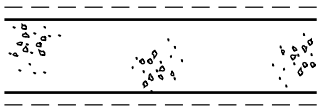
Fill all joints between parts of the floor base (to avoid air paths).
Limit the pathways around the floor (to reduce flanking transmission).
Workmanship and detailing shall be given special attention at the perimeter and wherever the floor is penetrated (to reduce flanking transmission and to avoid air paths).
Take care not to create a bridge between the floating layer and the base, surrounding walls, or adjacent screeds.
With bases C and D a screed is recommended to accommodate surface irregularities and prevent reduced resistance at joints.

Constructions

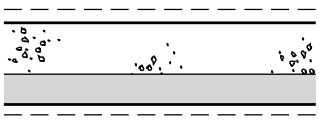
Four floor bases, two floating layers and one resilient layer are specified. Any combination of base, resilient layer and floating layer gives suitable resistance to direct transmission. Two additional resilient layers which may only be used under screeds are also specified.

Floor bases

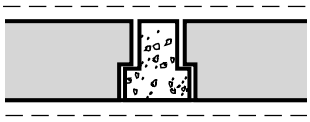
A. Solid concrete slab (in situ).
Floor screed and/or ceiling finish optional.
Mass (including any screed and/or ceiling finish) 300 kg/m^2.



B. Solid concrete slab with permanent shuttering.
Floor screed and/or ceiling finish optional.
Mass (including shuttering only if it is solid concrete or metal, and including any screed and/or ceiling finish) 300 kg/m^2.



C. Concrete beams with infilling blocks and including any structural topping.
Floor screed and/or ceiling finish optional.
Mass of beams, blocks and structural topping (including any screed or ceiling finish) 300 kg/m^2.



D. Concrete planks (solid or hollow).
Floor screed and/or ceiling finish optional.
Mass of planks and structural topping (including any screed or ceiling finish) 300 kg/m^2.

Floating Layers

E. Timber raft.
Timber boarding or wood based board, 18 mm thick and with tongued and grooved edges, fixed to 45 $\times$ 45 mm battens. The raft shall be laid loose on the resilient layer.

F. Screed.
65 mm sand/cement screed with chicken wire type underlay to protect the resilient layer while the screed is being laid.

Resilient Layer

G. 25 mm mineral fibre, density 36 kg/m^3, covering the whole area of the floor. A 13 mm thickness may be used under a timber raft if the battens used have an integral closed cell resilient foam strip.

Lay the fibre tightly butted, and turned up at the edges of the floating layer.

Under a timber raft fibre may be paper faced on the underside.

Under a screed fibre shall be paper faced on the upper side (to prevent the screed entering the layer).

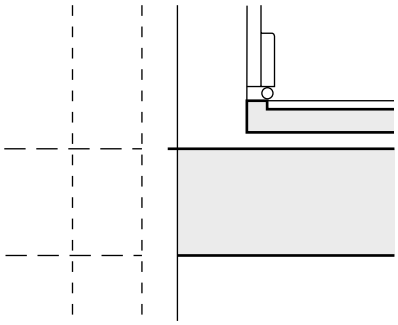
Additional resilient layers for use only under screeds

H. 13 mm pre-compressed expanded polystyrene board (impact sound duty grade). Lay boards tightly butted, use on edge as a resilient strip at edges of the floating screed.

J. 5 mm extruded (closed cell) polyethylene foam, density 30-45 kg/m^3. To prevent puncture the material should only be laid over a smooth surface. Lay with joints lapped and turn up at edges of the floating screed.

JUNCTIONS TO LIMIT FLANKING TRANSMISSION

External wall or cavity separating wall

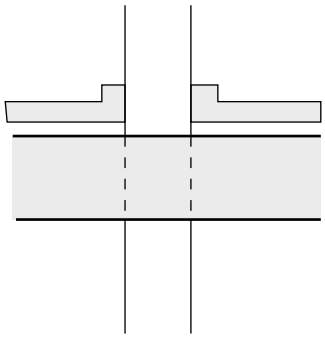


A mass of 120 kg/m^2 (including any plaster) is normally required in any external solid wall or cavity wall inner leaf adjoining the separating floor. If the external wall of a room adjoining the separating floor has an opening or openings in excess of 20% of its area there is no minimum mass requirement for that wall of that room. The floor base (but not necessarily any screed) shall pass through the inner leaf of an external wall or abutting leaf of a cavity separating wall but shall not bridge a cavity.

Carry the resilient layer up at all edges to isolate the floating layer.

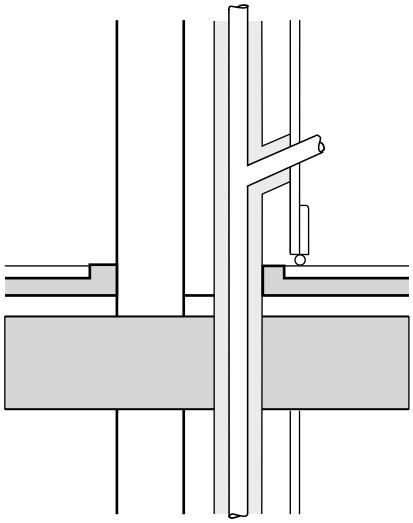
Leave a 3 mm gap between skirting and floating layer or turn resilient layer under skirting. A seal is not necessary but if used shall be flexible.

Internal wall or solid separating wall



If the wall mass is less than 355 kg/m^2 (including any plaster) the floor base (but not necessarily any screed) shall pass through. If the wall mass is more than 355 kg/m^2 (including any plaster) either the wall or the floor base (but not necessarily any screed) may pass through. Where the wall does pass through, tie the floor base to the wall and grout the joint.

Floor penetrations



Ducts or pipes penetrating the floor shall be in an enclosure, both above and below the floor. Either line the enclosure, or wrap the duct or pipe within the enclosure, with 25 mm unfaced mineral fibre.

The material of the enclosure shall have a mass of 15 kg/m^2.

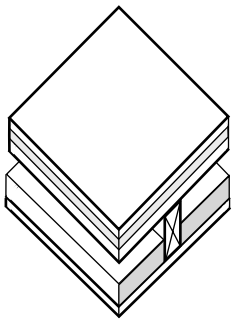
Leave a 3 mm gap between the enclosure and floating layer, and seal with acrylic caulking or neoprene.

Flexible fire-stopping shall be used where the pipe or duct passes through the floor.

Where a flue-pipe penetrates the floor and does not discharge into a flue within a chimney carried by the floor a non-combustible enclosing duct with mineral fibre absorbent lining shall be provided.

1.11 Floor Type 3: Timber base with floating layer

The resistance to airborne sound depends partly on the structural floor plus absorbent blanket or pugging and partly on the floating layer. Resistance to impact sound depends on a resilient layer isolating the floating layer from the base and the surrounding construction. Where resistance to airborne sound only is required the full construction shall still be used.



Limitations on use

Use is only permitted with appropriate adjoining walls (see “Junctions” below).

Points to watch

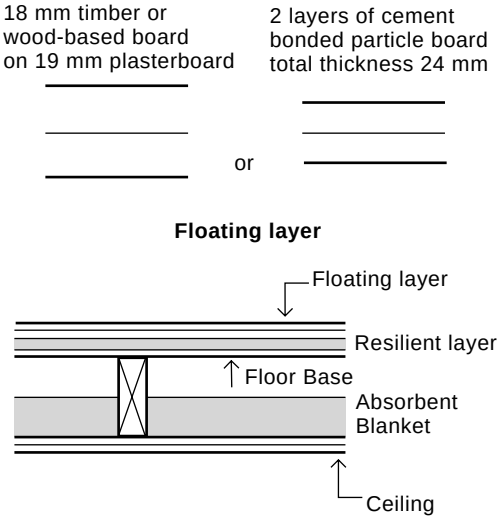
Limit the pathways around the floor (to reduce flanking transmission).
Workmanship and detailing shall be given special attention at the perimeter and wherever the floor is penetrated (to reduce flanking transmission and to avoid air paths).
Use the correct density of resilient layer. Take care not to bridge between the floating layer and the base or surrounding walls (eg, with services or fixings which penetrate the resilient layer). Allow for movement of materials, eg, expansion of chipboard after laying (to maintain isolation).

Constructions

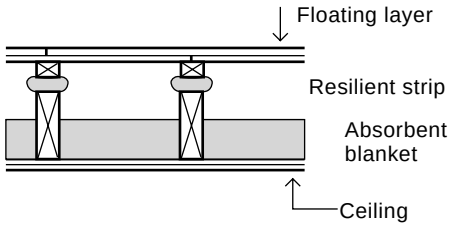
Three complete constructions which give suitable resistance to direct sound transmissions are specified. Note that there are some alternatives within each construction.

Floors

A. Platform floor with absorbent blanket.
Either a floating layer of timber or wood-based board, 18 mm thick, with tongued and grooved edges and all joints glued, spot bonded to a substrate of 19 mm plasterboard; or a floating layer of 2 thicknesses of cement bonded particle board with joints staggered, glued and screwed together, total thickness 24 mm.
Resilient layer of 25 mm mineral fibre, density 60-100 kg/m^3. A low figure gives better insulation but a soft floor.
Floor base of 12 mm timber boarding or wood-based board nailed to timber joists (size to suit structure).
Ceiling of 2 layers of plasterboard with joints staggered, total thickness 30 mm, with an absorbent blanket of 100 mm unfaced rock fibre, density 12-36 kg/m^3, laid on the ceiling.

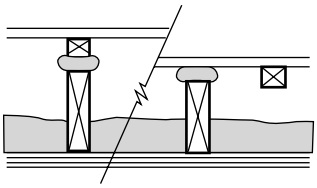


B. Ribbed floor with absorbent blanket.
Floating layer of timber or wood-based board, 18 mm thick, with tongued and grooved edges and all joints glued, on a substrate of 19 mm plasterboard nailed to 45 × 45 mm timber battens placed over the joists.
Resilient strips of 25 mm mineral fibre, density 80-140 kg/m^3, laid on joists.
Floor base of 45 mm thick timber joists (size to suit structure).
Ceiling of 2 layers of plasterboard with joints staggered, total thickness 30 mm, with an absorbent blanket of 100 mm unfaced rock fibre, density 12-36 kg/m^3, laid on the ceiling.



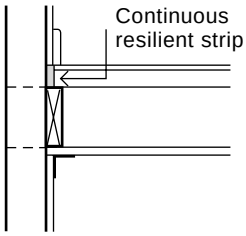
C. Ribbed floor with heavy pugging*.
Floating layer of timber or wood-based board, 18 mm thick, with tongued and grooved edges and all joints glued, nailed to 45 × 45 mm timber battens placed either on or between joists. (For sheet materials placing on joists is recommended).
Resilient strips of 25 mm mineral fibre, density 80-140 kg/m^3, laid on joists.
Floor base of 45 mm thick timber joists (size to suit structure).
Ceiling of either 19 mm dense plaster on expanded metal lath or alternatively 6 mm plywood fixed under the joists plus 2 layers of plasterboard with joints staggered, total thickness 25 mm. Both types of ceiling to have pugging of mass 80 kg/m^2 laid on a polyethylene liner.
Fixings should be adequate to carry the heavy pugging.

*Plugging may be of the following types—
Traditional ash (75 mm) or
2-10 mm limestone chips (60 mm) or
2-10 mm whin aggregate (60 mm) or
Dry sand (50 mm).
Figures in brackets show approximate thickness required to achieve 80 kg/m^2.
Do not use sand in kitchens, bathrooms or water closets.



JUNCTIONS TO LIMIT FLANKING TRANSMISSION

The following conditions apply to external, internal or separating walls which flank or pass through the separating floor.

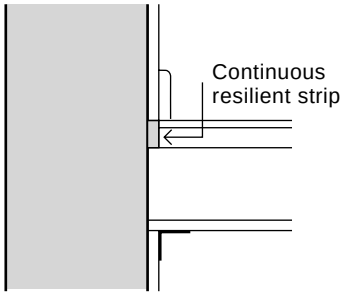


Timber frame wall

Seal the gap between wall and floating layer with a resilient strip glued to the wall.
Leave a 3 mm gap between skirting and floating layer. A seal is not necessary but if used shall be flexible.

Block air paths between the floor base and the wall, including the space between joists when joists are at right angles to the wall.

Seal the junction of ceiling and wall lining with tape or caulking.



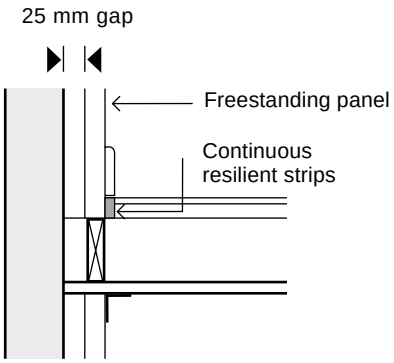
Heavy masonry leaf

Mass of leaf (including any plaster) 355 kg/m^2, both above and below floor.
Seal the gap between wall and floating layer with a resilient strip glued to the wall.

Leave a 3 mm gap between skirting and floating layer. A seal is not necessary but if used shall be flexible.

Use any normal method of connecting floor base to wall.

Seal the junction of ceiling and wall lining with tape or caulking.



Light masonry leaf

If the mass (including any plaster) is less than 355 kg/m^2 a freestanding panel as specified in Wall Type 3 shall be used.

Seal the gap between wall and floating layer with a resilient strip glued to the freestanding panel.

Leave a 3 mm gap between skirting and floating layer. A seal is not necessary but if used shall be flexible.

Use any normal method of connecting floor base to wall but block air paths between floor and wall cavities.

Take ceiling through to masonry, seal junction with freestanding panel with tape or caulking.

Floor penetrations

Ducts or pipes penetrating the floor shall be in an enclosure both above and below the floor.

Either line the enclosure, or wrap the duct or pipe within the enclosure, with 25 mm unfaced mineral fibre.

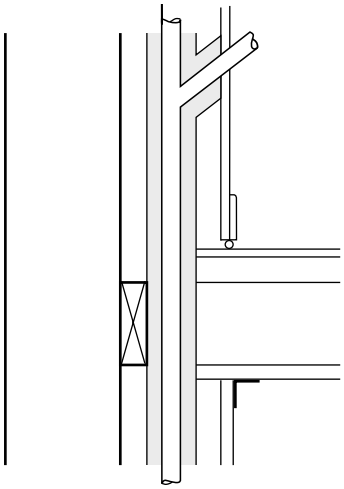
The material of the enclosure shall have a mass of 15 kg/m^2.

Leave a 3 mm gap between the enclosure and floating layer, seal with acrylic caulk or neoprene. (Enclosure may go down to the floor base if floor construction A is used, but keep isolation of enclosure from floating layer).

Flexible fire-stopping shall be used where the pipe or duct passes through the floor.

Where a flue-pipe penetrates the floor it shall be in a non-combustible enclosing duct with mineral fibre absorbent lining.

Seal the junction of ceiling and enclosure with tape or caulking.



Section 2 – Similar construction method

2.1 This method allows the repetition of a construction which has already been built elsewhere, tested as described under the heading "TESTING EXISTING CONSTRUCTION" and which achieved the sound transmission values given in Table 2. When proposing to use this method it will be necessary to provide evidence that the tested construction achieved the sound transmission values and that the proposed construction is essentially similar.

2.2 The sound insulation between rooms on either side of a separating wall or floor depends not only on the wall or floor specification but also on other factors, including the size and shape of the rooms. For buildings with masonry walls the position of doors and windows may also be important in reducing flanking transmission.

2.3 CONDITIONS ON THE USE OF A SIMILAR CONSTRUCTION

Similar features

(a) For separating walls and floors the following features in the proposed construction shall be similar to those in the tested construction, but they do not need to be identical—

(i) the construction of the separating walls and floors, provided that the mass per square metre is not reduced;

(ii) the construction of other walls and floors adjacent to the separating walls and floors;

(iii) the shape and size of the rooms adjacent to the separating walls and floors;

(iv) the general arrangement of windows and doors in an external wall adjacent to the separating wall or floor when the external wall has a masonry inner leaf.

(b) For separating walls only, the extent of any step or stagger shall be similar to that in the tested construction. Where there is none in the tested construction one may be provided in the proposed construction.

Allowable differences

(c) For separating walls and floors, differences in the following are allowed when considering paragraph 2.3(a)—

(i) the construction of the outer leaf of a masonry cavity wall; and

(ii) the construction of the inner leaf of a masonry cavity wall provided that the construction is of the same general type and that the mass of the inner leaf is not reduced.

(d) For separating walls only, differences in the following are allowed—

(i) the material and thickness of the floating layer of a floor with a concrete or a timber base (similar to Floor Types 2 or 3 in Section 1);

(ii) the size of a step or stagger between dwellings (an increase is beneficial but a small reduction may be acceptable); and

(iii) the construction of a timber floor where it is not a separating floor.

TESTING EXISTING CONSTRUCTION

2.4 Test method

(a) Tests shall be carried out to determine—

(i) the airborne sound insulation of a separating wall or floor in accordance with BS 2750: Part 4: 1980 (the tests determine the standardised level differences (D_{nT})); and

(ii) the impact sound transmission of a separating floor in accordance BS 2750: Part 7: 1980 (the tests determine the standardised impact sound pressure levels (L'_{nT})).

(b) Tests shall be conducted in completed but unfurnished dwellings. Doors and windows shall be closed.

(c) Each separating wall or floor shall be tested with 4 sets of measurements, or as close to 4 as possible. For each set of measurements—

(i) use a pair of rooms if possible;

(ii) use a pair consisting of a room and some other space only where necessary to make up the 4 sets;

(iii) use a pair consisting of spaces other than rooms only where no other measurement is possible,

and take only one set of measurements between each pair.

(d) When measuring airborne sound transmission between a pair of rooms of unequal volume, the sound source shall be in the larger room.

(e) When measuring airborne sound insulation between a room and some other space, the sound source shall be in the other space.

(f) It shall not be necessary to test that part of a separating wall which carries through into a roof space.

2.5 Calculation of results

From each set of measurements calculate—

(i) for airborne sound insulation, the weighted standardised level difference ($D_{nT, w}$) in accordance with BS 5821: Part 1: 1984; or

(ii) for impact sound transmission, the weighted standardised impact sound pressure level ($L'_{nT, w}$) in accordance with BS 5821: Part 2: 1984.

2.6 Assessment of results

(a) Separating walls and floors.
For airborne sound insulation the weighted standardised level difference ($D_{nT, w}$) shall be **not less** than that given in Table 2.

(b) Separating floors.
For impact sound transmission the weighted standardised impact sound pressure level ($L'_{nT, w}$) shall be **not more** than that given in Table 2.

(c) The mean of the 4 calculated values shall be no worse than that given in the "mean value" column in Table 2. Where only 2 or 3 sets of measurements have been possible the mean value shall still be achieved, and where only one set is possible the value achieved shall be no worse than the mean value.

Table 2— Sound transmission values

Airborne sound

Minimum values of weighted standardised level difference ($D_{nT, w}$) as defined in BS 5821: Part 1: 1984—

	Mean Value (dB)	Individual Value (dB)
Walls	53	49
Floors	52	48

Impact sound

Maximum values of weighted standardised impact sound pressure level ($L'_{nT, w}$) as defined in BS 5821: Part 2: 1984—

	Mean Value (dB)	Individual Value (dB)
Floors	61	65