Y Swyddfa Gymreig
Welsh Office

DETR
Environment
Transport
Regions

The Building Regulations 1991

Resistance to the passage of sound

E

APPROVED DOCUMENT

E1 Airborne sound (walls)
E2 Airborne sound (floors and stairs)
E3 Impact sound (floors and stairs)

The Stationery Office

1992 EDITION
Second impression (with amendments) 1992

MAIN CHANGES IN THE 1992 EDITION

This edition of Approved Document E: Resistance to the passage of sound replaces the 1985 edition. The main changes are:

a. **Conversions:** The requirements have been extended to include material change of use to a dwelling, e.g. a conversion to flats, and specific guidance is included in the Approved Document.

b. **Kitchens:** The requirement for walls now includes walls separating a kitchen in a dwelling from another part of the same building not used exclusively by that dwelling - such as when it adjoins a common circulation space in a block of flats.

c. **Stairs:** The requirements for floors have been clarified to include stairs where they form part of the separating element between dwellings.

d. **Performance:** The guidance relating to new dwellings has been improved to achieve a greater equivalence of performance for different types of construction. In particular, it recommends an increase in the mass of certain precast separating floors and concrete block separating walls.

e. **Test procedures:** The guidance includes a new laboratory test procedure as an alternative to other ways of demonstrating compliance.

Contents

Use of guidance

THE APPROVED DOCUMENTS

The Building Regulations 1991, which come into operation on 1 June 1992, replace the Building Regulations 1985 (SI 1985 No. 1065) and consolidate all subsequent revisions to those regulations. This document is one of a series that has been approved by the Secretary of State as practical guidance on meeting the requirements of Schedule 1 and regulation 7 of the Building Regulations.

At the back of this document is a list of those documents currently published by the Department of the Environment and the Welsh Office which have been approved for the purpose of the Building Regulations 1991.

The detailed provisions contained in the Approved Documents are intended to provide guidance for some of the more common building situations. In other circumstances, alternative ways of demonstrating compliance with the requirements may be appropriate.

Evidence supporting compliance

There is no obligation to adopt any particular solution contained in an Approved Document if you prefer to meet the relevant requirement in some other way. However, should a contravention of a requirement be alleged then, if you have followed the guidance in the relevant Approved Documents, that will be evidence tending to show that you have complied with the Regulations. If you have not followed the guidance then that will be evidence tending to show that you have not complied. It will then be for you to demonstrate by other means that you have satisfied the requirement.

Other requirements

The guidance contained in an Approved Document relates only to the particular requirements of the Regulations which that document addresses. The building work will also have to comply with the requirements of any other relevant paragraphs in Schedule 1 to the Regulations. There are Approved Documents which give guidance on each of the other requirements in Schedule 1 and on regulation 7.

LIMITATION ON REQUIREMENTS

In accordance with regulation 8, the requirements in Parts A to K and N of Schedule 1 to the Building Regulations do not require anything to be done except for the purpose of securing reasonable standards of health and safety for persons in or about the building.

MATERIALS AND WORKMANSHIP

Any building work which is subject to requirements imposed by Schedule 1 of the Building Regulations should, in accordance with regulation 7, be carried out with proper materials and in a workmanlike manner.

You may show that you have complied with regulation 7 in a number of ways, for example, by the appropriate use of a product bearing an EC mark in accordance with the Construction Products Directive (89/106/EEC), or by following an appropriate technical specification (as defined in that Directive), a British Standard, a British Board of Agrément Certificate, or an alternative national technical specification of any member state of the European Community which, in use, is equivalent. You will find further guidance in the Approved Document supporting regulation 7 on materials and workmanship.

Technical specifications

Building Regulations are made for specific purposes; health and safety, energy conservation and the welfare and convenience of disabled people. Standards and technical approvals are relevant guidance to the extent that they relate to these considerations. However, they may also address other aspects of performance such as serviceability or aspects which although they relate to health and safety are not covered by the Regulations.

When an approved document makes reference to a named standard, the relevant version of the standard is the one listed at the end of the publication. However, if this version of the standard has been revised or updated by the issuing standards body, the new version may be used as a source of guidance provided it continues to address the relevant requirements of the Regulations.

The Secretary of State has agreed with the British Board of Agrément on the aspects of performance which it needs to assess in preparing its Certificates in order that the Board may demonstrate the compliance of a product or system which has an Agrément Certificate with the requirements of the Regulations. An Agrément Certificate issued by the Board under these arrangements will give assurance that the product or system to which the Certificate relates, if properly used in accordance with the terms of the Certificate, will meet the relevant requirements.

Similarly, the appropriate use of a product which complies with a European Technical Approval as defined in the Construction Products Directive will also meet the relevant requirements.

The Requirements

This Approved Document, which takes effect on 1 June 1992, deals with the following Requirements from Part E of Schedule 1 to the Building Regulations 1991:

Requirement	*Limits on application*
Airborne sound (walls)	
E1.-A wall which- (a) separates a dwelling from another building or from another dwelling, or (b) separates a habitable room or kitchen within a dwelling from another part of the same building which is not used exclusively as part of the dwelling, shall resist the transmission of airborne sound.	
Airborne sound (floors and stairs)	
E2.-A floor or a stair which separates a dwelling from another dwelling, or from another part of the same building which is not used exclusively as part of the dwelling, shall resist the transmission of airborne sound.	
Impact sound (floors and stairs)	
E3.-A floor or a stair above a dwelling which separates it from another dwelling, or from another part of the same building which is not used exclusively as part of the dwelling, shall resist the transmission of impact sound.	

Note: attention is drawn to the following extracts from the Building Regulations 1991.

Regulation 5 (Meaning of material change of use)

"....there is a material change of use where there is a change in the purposes for which or the circumstances in which a building is used, so that after that change-

(a) the building is used as a dwelling where previously it was not;

(b) the building contains a flat where previously it did not;"

Regulation 6 (Requirements related to material change of use)

"(1) Where there is a material change of use of the whole building, such work, if any shall be carried out as is necessary to ensure that the building complies with the relevant requirements of the following paragraphs of Schedule 1".

"(e) in the case of a material change of use as described in regulation 5(a) or (b), E1 to E3 (Resistance to the passage of sound)".

Clarification - Where a material change of use occurs and a dwelling is formed adjacent to or within another building type the requirement will apply.

Guidance

Performance

In the Secretary of State's view the requirements E 1,2 and 3 will be met if the relevant parts of the dwelling are designed and built in such a way that noise from normal domestic activities in an adjoining dwelling or other building is kept down to a level that will not threaten the health of the occupants of the dwelling and will allow them to sleep, rest and engage in normal domestic activities in satisfactory conditions.

The relevant parts of the dwelling that should be protected from:

a. airborne sound through walls floors and stairs are shown in Diagrams 1,and 2 and;

b. impact sound through floors and stairs are shown in Diagram 2.

Diagram 1 **Sound resisting walls**

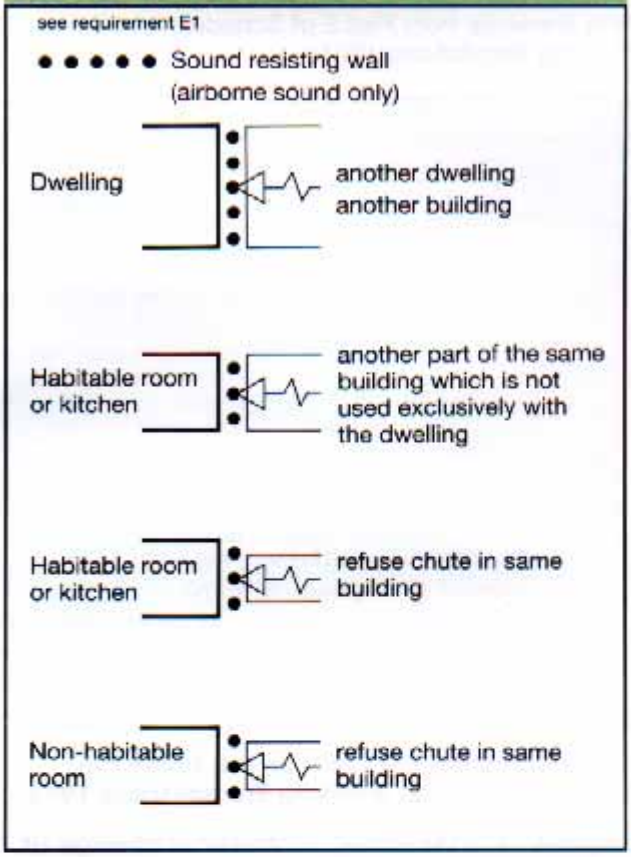
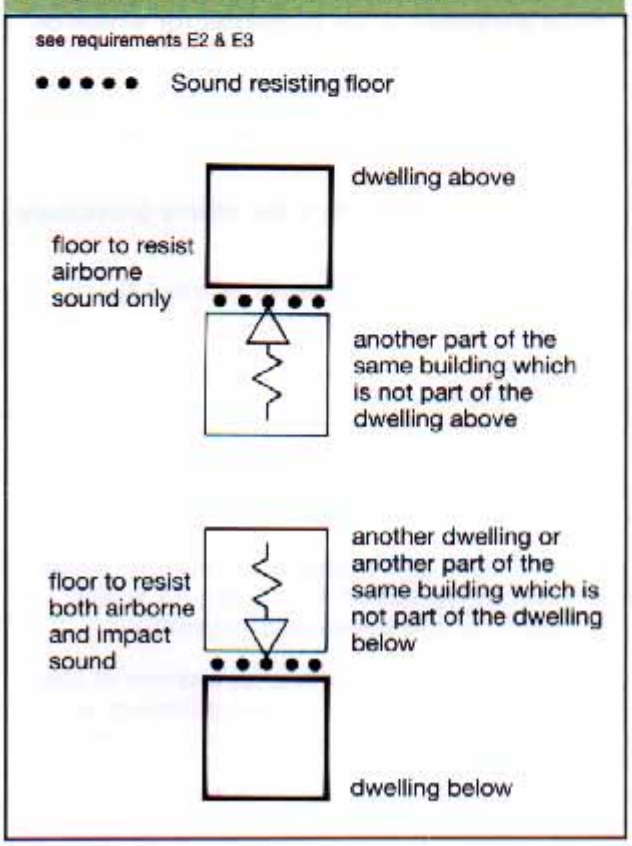


Diagram 2 **Sound resisting floors**



Introduction

0.1 This introduction explains the basic considerations which have to be taken into account when dealing with sound insulation in both new construction and conversion work. Sections 1,2,3 & 4 give guidance on constructions in relation to new buildings and Sections 5 & 6 relate to conversion work.

0.2 Three methods are described in this Approved Document to demonstrate that a proposed construction complies with the requirements.

1) by adopting the widely used forms of construction including the junction details described in this document (Sections 1,2 & 5).

2) by adopting a form of construction that is similar to one that has been shown by field tests to comply with the requirements (Sections 3 & 6).

3) by testing a part of the construction in a specified type of acoustic chamber (section 4 and 6).

0.3 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 furniture moving.

0.4 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. The walls that are required to provide reasonable resistance to airborne sound are shown in Diagram 1.

0.5 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

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

0.7 **Walls** should reduce the level of airborne sound. 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 structural isolation between the leaves. Timber framed walls (type 4) generally provide the most isolation and they can be much lighter than masonry walls. The figures given for mass are minimum values.

0.8 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 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.

0.9 **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 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. The figures given for mass are minimum values.

0.10 Airpaths, including those due to shrinkage, 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

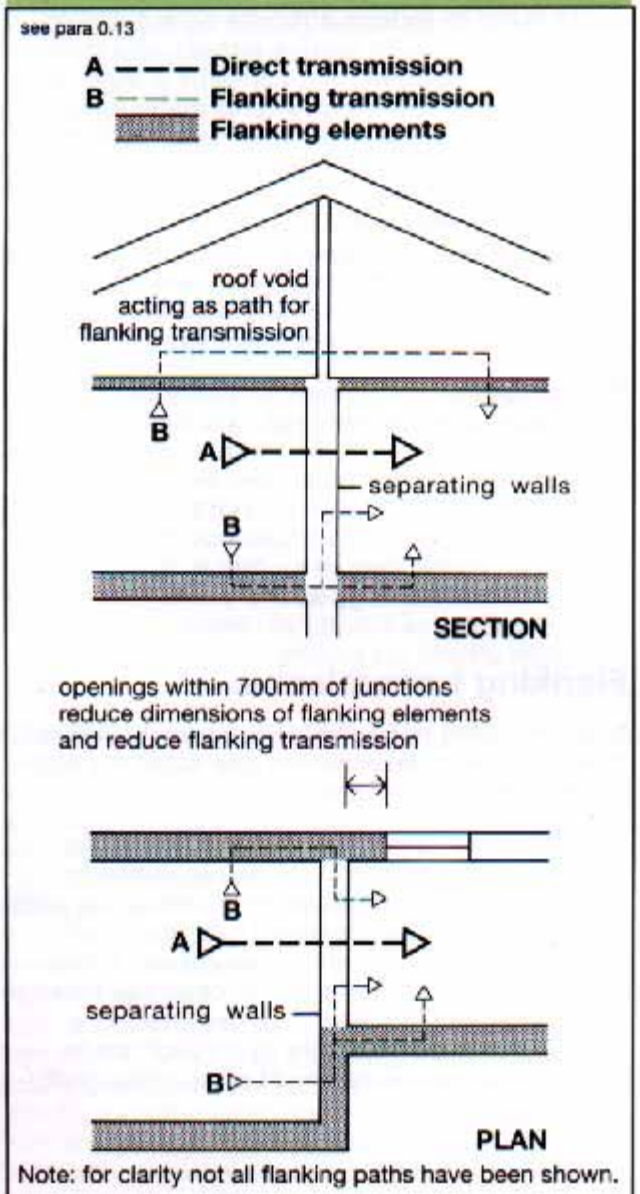
0.11 Flanking transmission means the indirect transmission of sound from one side of a wall or floor to the other side.

0.12 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 flanking 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 the 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.

0.13 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 the separating wall).

Diagram 3
Direct and flanking transmission



Note: for clarity not all flanking paths have been shown.

The mass which is needed will be less if the path is blocked by non- porous material. Some of the paths along which flanking sound is transmitted are shown in Diagram 3.

Conversion work

0.14 Although it is desirable to apply the same level as new build in conversion work it is not always practicable to improve the resistance to flanking sound transmission. The suggested constructions and test procedures for conversion work reflect this difficulty and the sound insulation achieved may not equal that for new building.

Special factors

0.15 In addition to the details of the construction, sound insulation is also affected by the presence of steps or staggers between neighbouring dwellings, which can improve the performances, and by the layout of the rooms.

Section 1

SEPARATING WALLS FOR NEW BUILDING

1.1 This Section describes some of the more widely used wall constructions. They are grouped into four main types, as shown in Diagram 4

Wall type 1:
Solid Masonry - The resistance to airborne sound depends mainly on the mass of the wall.

Wall type 2:
Cavity masonry - The resistance to airborne sound depends mainly on the mass of the leaves and the degree of isolation achieved.

Wall type 3:
Masonry between isolated panels - The resistance to airborne sound depends partly on the mass and type of core and partly on the isolation and mass of the panels.

Wall type 4:
Timber frames with absorbent material - The resistance to airborne sound depends on the mass of leaves, isolation of the frames, plus absorption in the air space between.

1.2 For each of the main wall types described in this section, examples of construction are given that can achieve a reasonable level of sound insulation. However, in order for the construction to be fully effective care should be taken to detail the junctions between the separating wall and other elements, such as floors, roofs, external walls and partitions. Notes and diagrams explain what is necessary at the junctions for each of the four wall types.

Refuse chutes

1.3 A wall separating a habitable room or kitchen and a refuse chute should have mass (including any finishes) of at least 1320kg/m^2. A wall separating a non-habitable room, which is in a dwelling, from a refuse chute should have a mass (including any finishes) of at least 220kg/m^2.

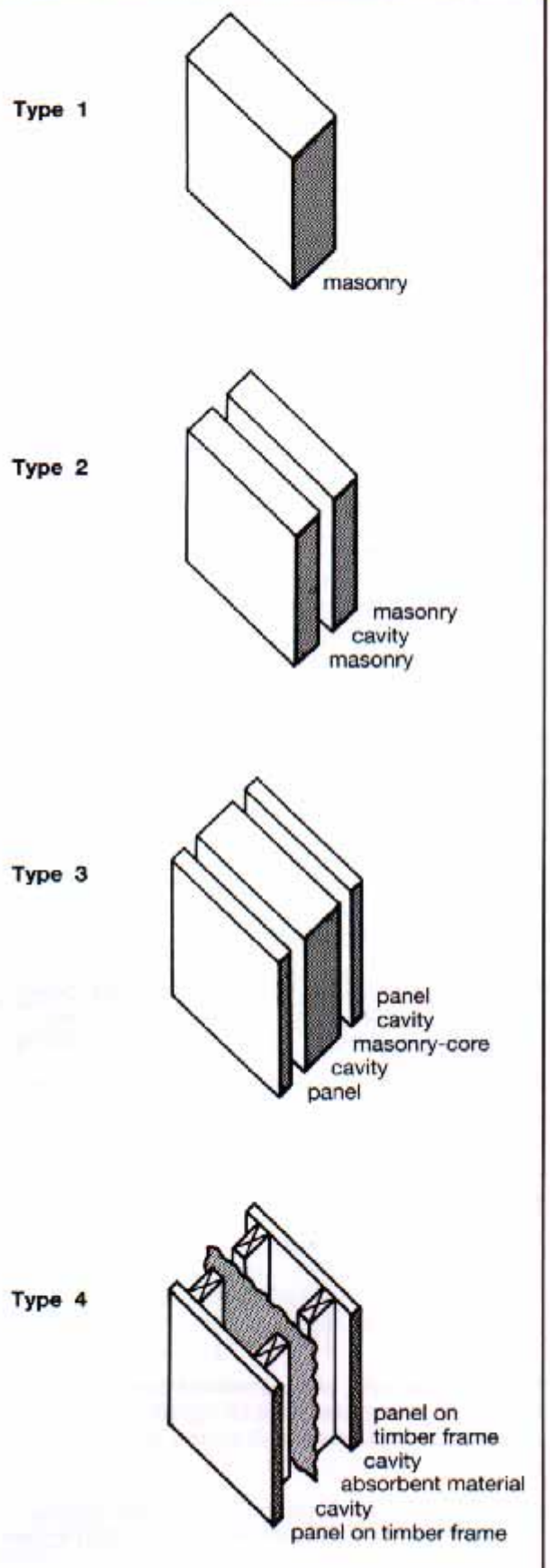
Mass of walls

1.4 The mass of a wall is expressed in kilograms per square metre (kg/m^2). The method for calculating mass is shown in Appendix A.

1.5 The density of the materials used (and on which the mass of the wall depends) is expressed in kilograms per cubic metre (kg/m^3).

1.6 The density of a particular material may be taken from a current Agrément Certificate, a European Technical Approval or from the manufacturer. In the latter case the Building Control Authority may ask for confirmation.

Diagram 4 **Types of wall**



Wall type 1: Solid masonry

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

Points to watch
Fill masonry joints, seal all joints with mortar and lay bricks frog up (to achieve the mass and avoid air paths).

Control sound paths around the wall (to reduce flanking transmission).

Note: Where plaster or plasterboard finish is specified, wall lining laminates of plasterboard and mineral wool may be used instead.

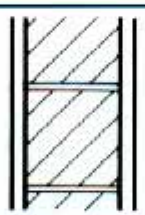
Constructions
Five wall constructions (A, B, C, D and E) which give reasonable resistance to direct transmission are shown below. Details of how junctions should be made to limit flanking transmission follow.

A

Brick, plastered on both room faces. Mass including plaster 375 kg/m². 13mm plaster. Lay bricks in a bond which includes headers.

Example:* 215mm brick, lightweight plaster, 75mm coursing; brick density of 1610 kg/m³ gives the required mass.

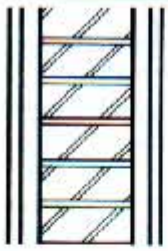
B



Concrete block, plastered on both room faces. Mass including plaster 415 kg/m². 13mm plaster. Use blocks which extend to the full thickness of the wall.

Example* 215mm block, lightweight plaster, 110mm coursing; block density of 1840 kg/m³ gives the required mass.

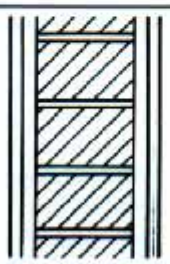
C



Brick, plasterboard on both room faces. Mass including plasterboard 375 kg/m². 12.5mm plasterboard, use any normal fixing method. Lay bricks in a bond which includes headers.

Example:* 215mm brick, 75mm coursing; brick density of 1610 kg/m³ gives the required mass.

D



Concrete block, plasterboard on both room faces. Mass including plasterboard 415kg/m². 12.5mm plasterboard, use any normal fixing method.
Use blocks which extend to the full thickness of the wall.

Example:* 215mm block, 150mm coursing; block density of 1840 kg/m³ gives the required mass.

E

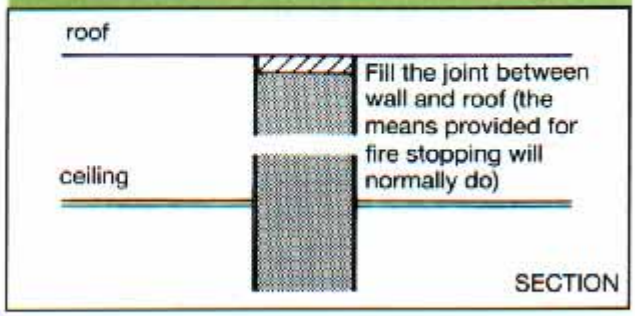
Concrete in-situ or large panel, (minimum density 1500 kg/m³), plaster optional. Mass including plaster if used, 415 kg/m². Fill joints between panels with mortar.

Example:* an unplastered wall of density 2200 kg/m³; 190mm thickness gives the required mass.

* For other examples, Appendix A gives a simplified method for calculating mass, alternatively use manufacturer's actual figures.

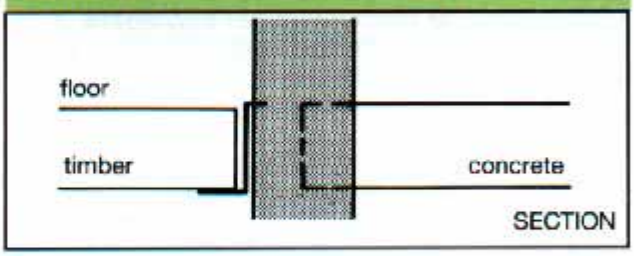
Junctions for wall type 1:

Diagram 5 Roof junctions, wall type 1



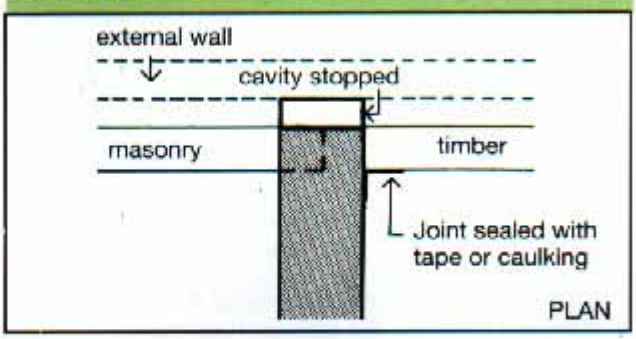
Ceiling and roof space
Where there is a heavy ceiling with sealed joints (12.5mm plasterboard or equivalent), the mass of the wall above the ceiling may be reduced to 150 kg/m². If lightweight aggregate blocks of density less than 1200 kg/m³ are used, seal one side with cement paint or plaster skim.

Diagram 6 Floor junctions, wall type 1



Intermediate and ground floors
Floor joists may be supported on hangers or built in. They may only be built in if good workmanship can be assured and care should be taken to ensure that there are no airpaths through the wall. All gaps should be sealed. With a concrete floor of types 1 or 2 either the wall or the floor may be carried through.

Diagram 7 External wall junctions, wall type 1



External wall
The outer leaf of a cavity wall may be of any construction. Where a cavity wall has an inner leaf of masonry or where the external wall is of solid masonry:

a.
i the masonry of the walls should be bonded together, or
ii the masonry of the external wall should abut the separating wall and be tied to it with ties at no more than 300mm centres vertically, to create a homogeneous unit; and

b. the masonry should have a mass of 120 kg/m² unless the length of the external wall is limited by openings:
i of not less than 1 metre high
ii on both sides of the separating wall at every storey, and
iii not more than 700mm from the face of the separating wall on both sides.

(A short length of wall will not vibrate strongly at low frequences to cause flanking transmissions)

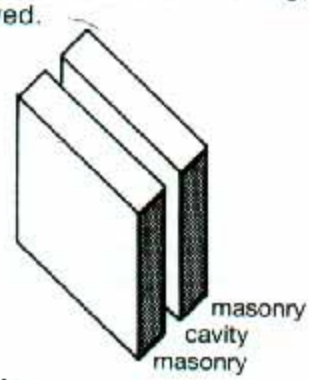
Where the external wall has a cavity, the cavity should be stopped with a flexible closer (e.g. mineral wool).

Where a cavity wall has an inner leaf of timber construction it should:
a. abut the separating wall,
b. be tied to it with ties at no more than 300mm centres vertically; and
c. have the joints sealed with tape or caulking.

Partitions
There are no restrictions on partition walls meeting a type 1 separating wall.

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

Fill masonry joints with mortar and lay bricks frog up (to achieve the mass and to avoid air paths). Where plaster or plasterboard is specified a wall lining laminate of plasterboard and mineral wool may be used instead.

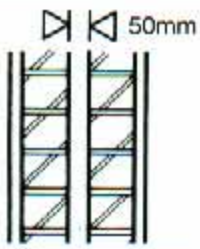
Maintain the cavity up to the underside of the roof.

Connect the leaves only where necessary by butterfly pattern ties spaced as required for structural purposes. (BS 5628: *Code of practice for use of masonry*, Part 3: 1985 *Materials and components, design and workmanship* limits this tie type and spacing to cavities of 50mm to 75mm with a minimum masonry leaf thickness of 90mm). If external walls are to be filled with an insulating material other than unbonded particles or fibres the insulating material should be prevented from entering the cavity in the separating wall by a flexible closer (e.g. mineral wool).

Constructions

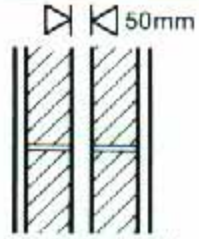
Three wall constructions (A, B and C) which give reasonable resistance to direct transmission are shown below. Two other wall constructions (D and E) will be suitable between dwellings provided a step in elevation and/or a stagger in plan is incorporated at the separating wall. Details of how junctions should be made to limit flanking transmission follow.

A



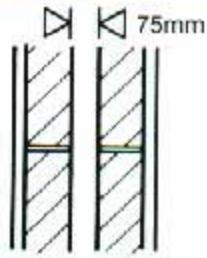
Two leaves of brick with 50mm cavity, plastered on both room faces. Mass including plaster 415 kg/m². 13mm plaster. Example:*102mm leaves, lightweight plaster, 75mm coursing; brick density of 1970 kg/m³ gives the required mass.

B



Two leaves of concrete block with 50mm cavity, plastered on both room faces.Mass including plaster 415 kg/m². 13 mm plaster. Example: *100mm leaves, lightweight plaster, 225mm coursing; block density of 1990 kg/m³ gives the required mass.

C



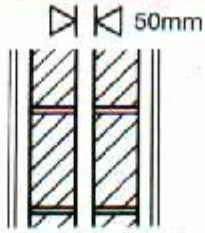
Two leaves of lightweight aggregate block, (maximum density 1600 kg/m³) with 75mm cavity, plastered or dry lined on both room faces.Mass including finish 300 kg/m². 13mm plaster or 12.5mm plasterboard. The composition of the lightweight aggregate blocks contributes to the performance of this construction when it is dry-lined and it may not give reasonable insulation if a denser block is used.

Example:*100mm leaves with lightweight plaster, 225mm coursing; a block density of 1371 kg/m³ gives the required mass.

*For other examples, Appendix A gives a simplified method for calculating mass, alternatively use manufacturer's actual figures.

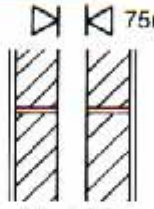
Additional constructions for use only where a step and/or stagger of at least 300mm is used.

D



Two leaves of concrete block with 50mm cavity, plasterboard on both room faces. Mass of masonry alone 415 kg/m². 12.5mm plasterboard, use any normal fixing method. Example:*100mm leaves, 225mm coursing; block density of 1990 kg/m³ gives the required mass.

E

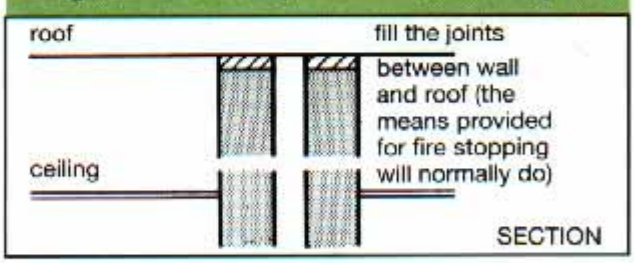


Two leaves of lightweight aggregate concrete block (maximum density 1600 kg/m³) with 75mm cavity, plastered or dry-lined on both room faces.

Mass including finish 250 kg/m². 13mm plaster or 12.5mm plasterboard.
Example:*100mm leaves, lightweight plaster, 225mm coursing; block density of 1105 kg/m³ gives the required mass.

Junctions for wall type 2

Diagram 8 Roof junctions, wall type 2

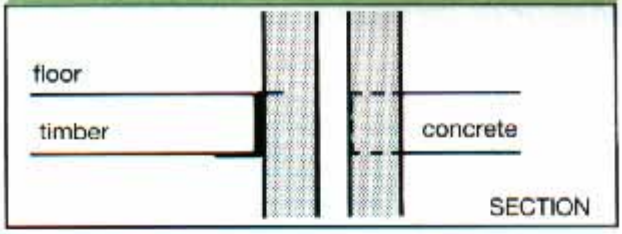


Ceiling and roof space

Where there is a heavy ceiling with sealed joints (12.5mm plasterboard or equivalent). The mass of the wall above the ceiling may be reduced to 150 kg/m². The cavity should still be maintained. If lightweight aggregate blocks density less than 1200 kg/m³ are used, seal one side with cement paint or plaster skim.

*For other examples, Appendix A gives a simplified method for calculating mass, alternatively use manufacturer's actual figures.

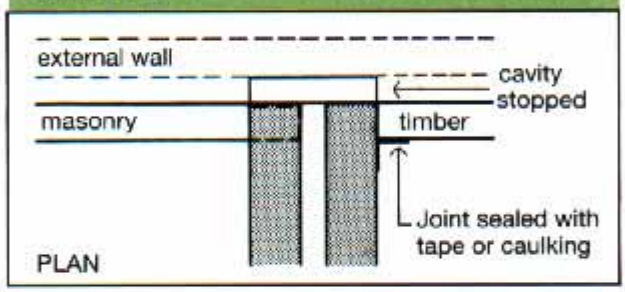
Diagram 9 Floor junctions, wall type 2



Intermediate and ground floors

Floor joists may be supported on hangers or built in. They may only be built in if good workmanship can be assured and care should be taken to ensure that there are no airpaths through the wall. A suspended concrete intermediate or ground floor should be carried through to the cavity face of each leaf. A concrete slab on the ground may be continuous.

Diagram 10 External wall junctions, wall type 2



External Wall

The outer leaf of a cavity wall may be of any construction. Where a cavity wall has an inner leaf of masonry:

a.
i the masonry of the walls should be bonded together, or
ii the masonry of the external wall should abut the separating wall and be tied to it with ties at no more than 300mm centres vertically, to create a homogeneous unit; and

b. the masonry should have a mass of 120kg/m² except where separating wall type B is used when there is no minimum required mass.

Where a cavity wall has an inner leaf of timber construction it should:
a. abut the separating wall
b. be tied to it with ties at no more than 300mm centres vertically; and
c. have the joints sealed with tape or caulking.

Where the external wall has a cavity, the cavity should be stopped with a flexible closer.

The cavity in the separating wall should not be stopped by any material which connects the leaves together rigidly. Mineral wool is acceptable.

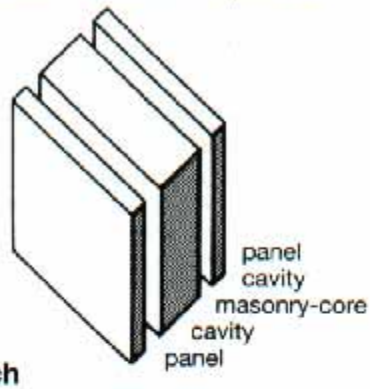
Partitions

There are no restrictions on partition walls meeting a type 2 separating wall.

Wall type 3:

Masonry between isolated panels

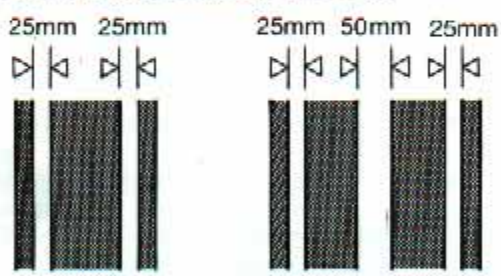
The resistance to airborne sound depends partly on the mass and type of core and partly on the isolation and mass of the panels.



Points to watch
Fill masonry joints, seal all joints with mortar, lay bricks frog up (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).

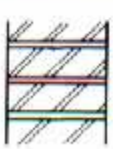
Constructions
Four masonry cores (A, B, C & D) and two panels (E & F) are shown below which, in any combination of core plus panels, should give reasonable resistance to direct transmission. Details of how junctions should be made to limit flanking transmission follow.



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

Masonry Cores

A



Brick
Mass 300 kg/m²
Example:*215mm core, 75mm coursing; brick density of 1290 kg/m³ gives the required mass.

B

Concrete Block
Mass 300 kg/m²

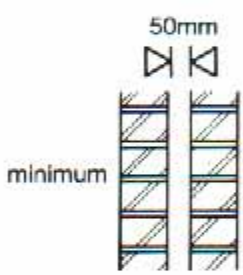
Example:*140mm core, 110mm coursing; block density of 2200 kg/m³ gives the required mass.

C

Lightweight concrete block (max density 1600 kg/m³). Mass 160 kg/m²

Example: 200mm core, 225mm coursing; block density of 730 kg/m³ gives the required mass.

D



Cavity brickwork or blockwork of any mass.

Example:* Two leaves of brickwork or blockwork, each leaf at least 100mm thick with a cavity at least 50mm wide. Only butterfly type ties should be used to connect the leaves where necessary.

Panels

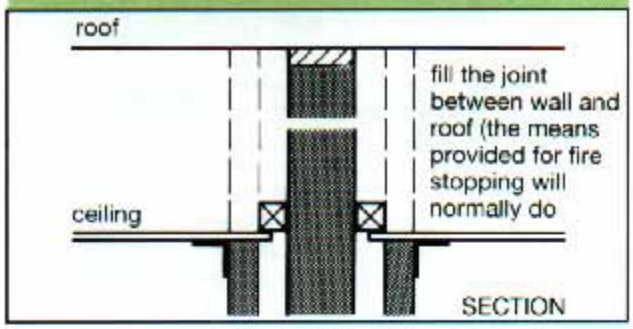
E Two sheets of plasterboard joined by a cellular core.
Mass including plaster finish if used 18 kg/m².
Fix to ceiling and floor only.
Tape joints between panels.

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

* For other examples, Appendix A gives a simplified method of calculating mass, alternatively use manufacturers actual figures.

Junctions for wall type 3

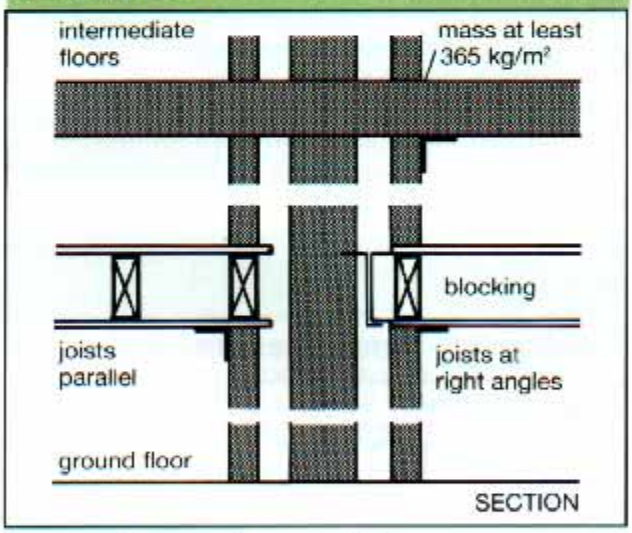
Diagram 11 Roof junctions, wall type 3



Ceiling and roof space

Where there is a heavy ceiling with sealed joints (12.5mm plasterboard or equivalent), the free-standing panels may be omitted in the roof space and the mass of the core above the ceiling may be reduced to 150 kg/m² but if core Type (D) is used the cavity should be maintained. If open textured lightweight aggregate blocks less than 1200 kg/m³ are used to reduce mass, seal one side with cement paint or plaster skim. Seal the junction between ceiling and freestanding panels with tape or caulking.

Diagram 12 Floor junctions, wall type 3



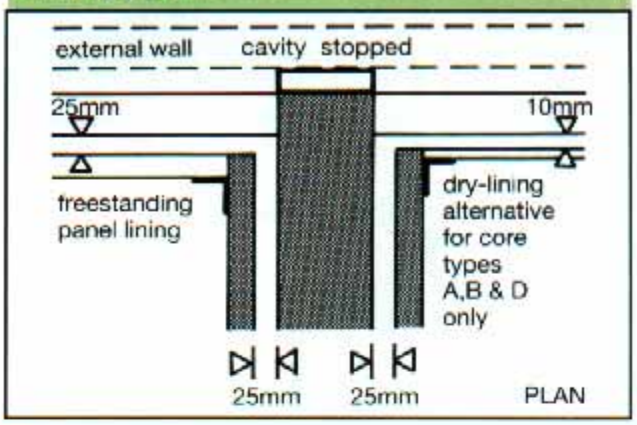
Intermediate and ground floors

Timber: with a timber intermediate floor use joist hangers for any joists supported on the wall and seal the spaces between joists with full depth timber blocking.

Concrete: with a concrete intermediate floor the floor base may only be carried through if it has a mass of at least 365 kg/m². If core type D is used the cavity should not be bridged. Seal the junction between ceiling and panel with tape or caulking.

The ground floor may be a solid slab, laid on the ground, or a suspended concrete floor. If it is suspended it may only pass through the wall if it has a mass of at least 365 kg/m². Concrete floors with a mass of less than 365 kg/m² should not bear on the core.

Diagram 13 External wall junctions, wall type 3



External wall

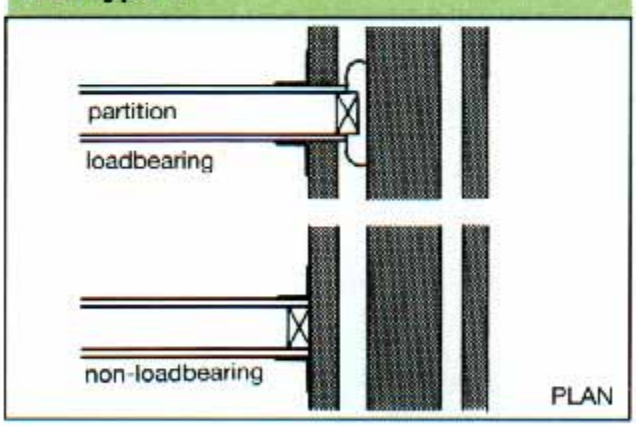
The outer leaf of a cavity wall may be of any construction.

With core type C the inner leaf of a cavity external wall should have an internal finish of isolated panels as shown for the separating walls. Where the separating wall has core A, B or D, plaster or dry-lining with joints sealed with tape or caulking may be used. A layer of insulation may be added to a dry-lining internal finish provided the 25mm and 10mm gaps shown in Diagram 13 are maintained.

The inner leaf may be of any construction if it is lined with isolated panels.

If the inner leaf is plastered or dry-lined it should have a total mass of 120 kg/m² and be butt jointed to the separating wall core with ties at no more than 300mm centres, vertically.

Diagram 14 Partition junctions, wall type 3



Partitions

Partitions that abut a type 3 separating wall should not be of masonry construction.

Other loadbearing partitions should be fixed to the masonry core through a continuous pad of mineral wool.

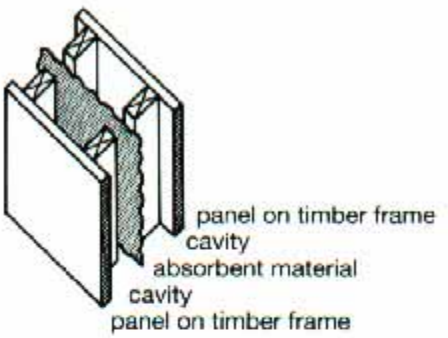
Non-loadbearing partitions should be tight butted to the isolated panels.

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

Wall type 4:

Timber frames with absorbent material

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 14-15 gauge (40mm x 3mm) metal straps fixed at or just below ceiling level 1.2m apart.

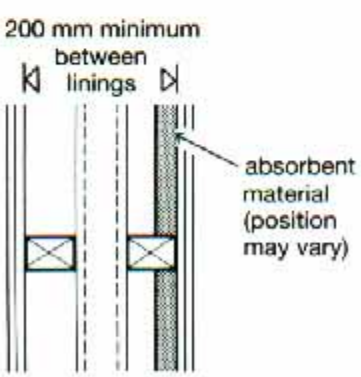
Power points may be set in the linings provided there is a similar thickness of cladding behind the socket box. Power points should not be placed back to back across the wall.

Where fire-stops are needed in the cavity between frames they should either be flexible or fixed to only one frame.

Constructions

Two constructions (A & B below) which with appropriate lining (C) and absorbent material (D) give suitable resistance to direct transmission are specified. Details of how junctions should be made to limit flanking transmission are shown.

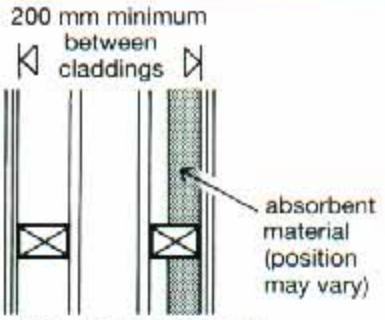
A



Timber frames

200mm between linings, plus absorbent material in cavity.
Plywood sheathing may be used in the cavity as necessary for structural reasons.

B



Timber frames, masonry core

Absorbent material (D) in cavity. Claddings 200mm apart (ignore core). Framing should be clear of core.

A masonry core 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 should be connected to only one frame.

Linings

C Lining on each side

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

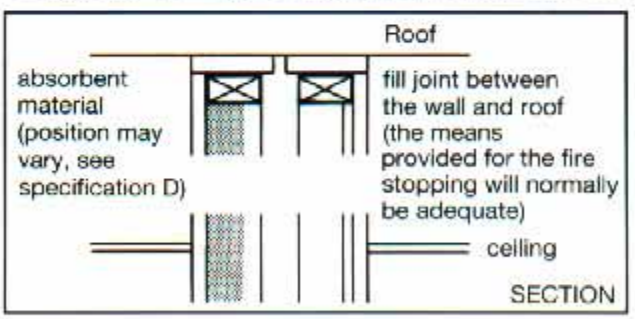
Absorbent material

D Unfaced mineral fibre batts or quilt (which may be wire reinforced)

Density at least 10kg/m³ thickness 25mm if suspended in the cavity between frames, 50mm if fixed to one frame, or 25mm per quilt if one fixed to each frame.

Junctions for wall type 4

Diagram 15 **Roof junctions, wall type 4**



Roof

Fire-stop the joint between wall and roof (see Approved Document B, Fire safety)

Ceiling and roof space

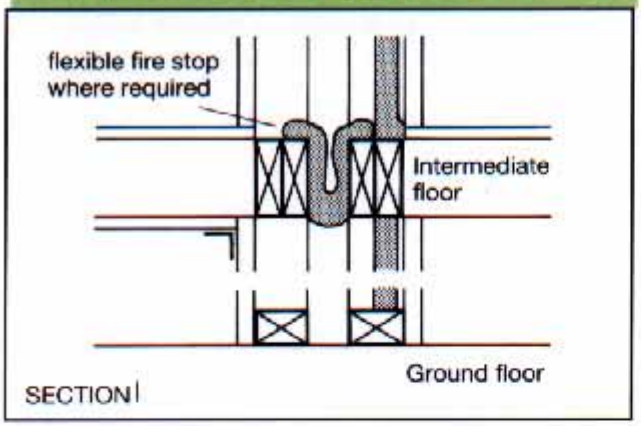
Between the ceiling level and the underside of the roof either:

a) carry both frames through- the cladding on each frame may be reduced to not less than 25mm or

b) close the cavity at ceiling level without connecting the two frames rigidly together and

use one frame with at least 25mm cladding on both sides. In each case seal the space between frame and roof finish.

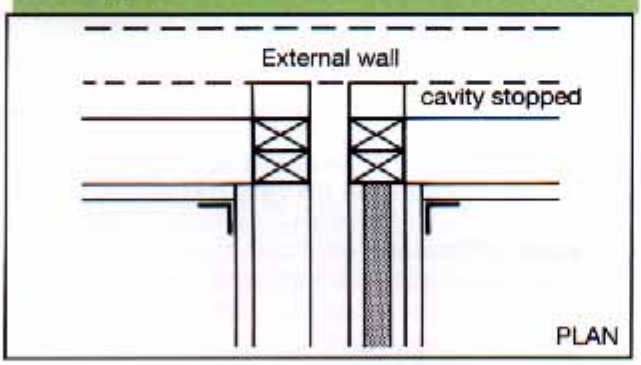
Diagram 16 **Intermediate and ground floor junctions, wall type 4**



Intermediate floor and ground floor
Block the air paths to the wall cavity either by carrying the cladding through the floor or by using a solid timber edge to the floor. Where the joists are at right angles to the wall, seal spaces between joists with full depth timber blocking.

The ground floor may be a ground bearing concrete slab or a suspended concrete slab. If suspended the mass should be at least 365 kg/m².

Diagram 17 **External wall junctions, wall type 4**



External wall
There are no restrictions on a traditional timber framed wall but if the wall is of cavity construction, the cavity should be sealed between the ends of the separating wall and the outer leaf to prevent sound paths.

The internal finish should be 12.5mm plasterboard or other equally heavy material (resilient layers for thermal insulation may be incorporated if desired).

Partitions
There are no restrictions on internal partitions meeting a type 4 separating wall.

Section 2

SEPARATING FLOORS FOR NEW BUILDING

2.1 This section describes some of the more widely used floor constructions.

They are grouped in three main types as shown in Diagram 18.

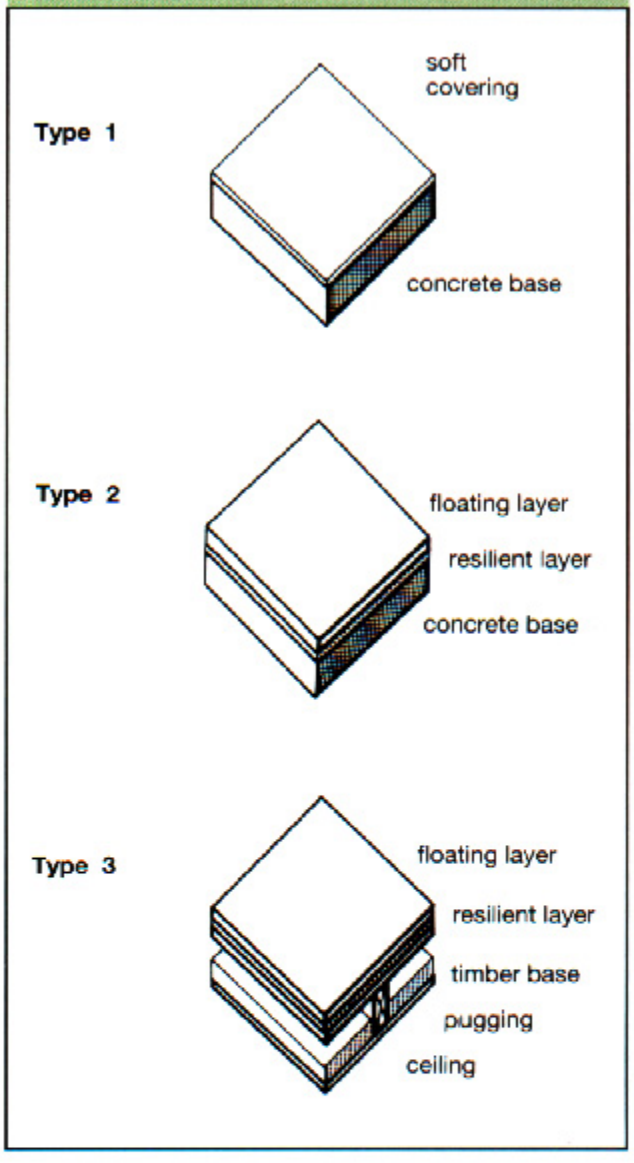
Floor type 1:
Concrete base with soft covering - The resistance to airborne sound depends on the mass of the concrete base and on eliminating air paths. The soft covering reduces impact sound at source.

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.

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.

2.2 For each of the main floor types described in this section examples of constructions are given that can achieve a reasonable level of sound insulation. However, in order for the construction to be fully effective care must be taken to detail the junctions between the separating floor and other elements.

Diagram 18 **Types of floor**



Mass of floors

2.3 The mass of a floor is expressed in kilograms per square metre (kg/m^2). The method shown for calculating mass is shown in Appendix A.

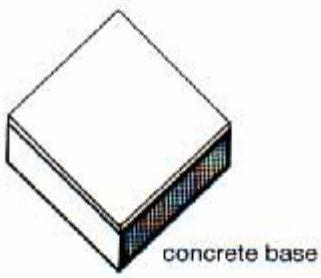
2.4 The density of the materials used (and on which the mass of the floor depends) is expressed in kilograms per cubic metre (kg/m^3)

2.5 The density of a particular material may be taken from a current Agrément Certificate, a European Technical Approval, or from the manufacturer. In the latter case the Building Control Authority may ask for confirmation.

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

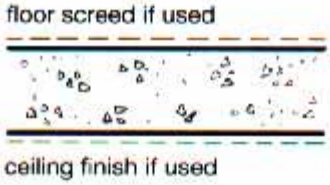
Fill all joints between parts of the floor to avoid air paths. Control sound paths around the floor to reduce flanking transmission. Workmanship and detailing must be given special attention at the perimeter and wherever the floor is penetrated by a pipe or duct(to reduce flanking transmission and to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

Constructions

Four examples of floor bases (A,B,C & D) which give suitable resistance to direct transmission of airborne sound are shown, followed by examples of soft covering (E) which should be added to give suitable resistance to impact sound transmission. Details of how junctions should be made to limit flanking transmission follow.

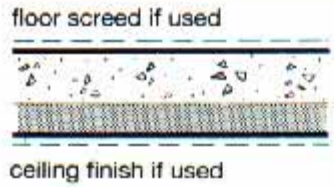
Floor bases

A



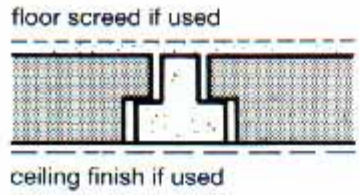
Solid concrete slab (in-situ)
Floor screed and/or ceiling finish optional.
Mass (including any screed and/or ceiling finish) 365 kg/m².

B



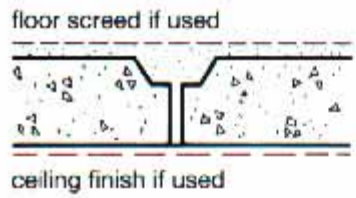
Solid concrete slab with permanent shuttering
Floor screed and/or ceiling finish optional.
Mass (including shuttering only if it is solid concrete or metal and including any screed and/or ceiling finish) 365 kg/m².

C



Concrete beams with infilling blocks
Floor surface should be level and a levelling screed may be necessary. Ceiling finish optional.
Mass of beams, blocks, screed and ceiling finish 365 kg/m².

D



Concrete planks (solid or hollow)
Floor surface should be level and a levelling screed may be necessary. Ceiling finish optional.
Mass of planks screed and ceiling finish 365 kg/m².

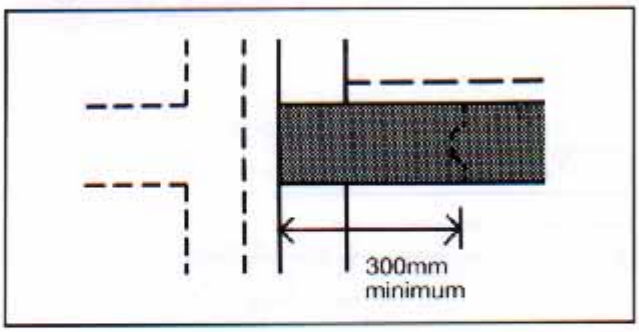
Soft covering

E **Any resilient material, or material with a resilient base, with an overall uncompressed thickness of at least 4.5mm**

Suitable resilience will also be provided by a floor covering with a weighted impact sound improvement (ΔL_w) of not less than 17dB as calculated in Annex A to BS 5821: *Method for rating the sound insulation in buildings and building elements* Part 2: 1984. *Method for rating the impact sound insulation.*

Junctions for floor type 1:

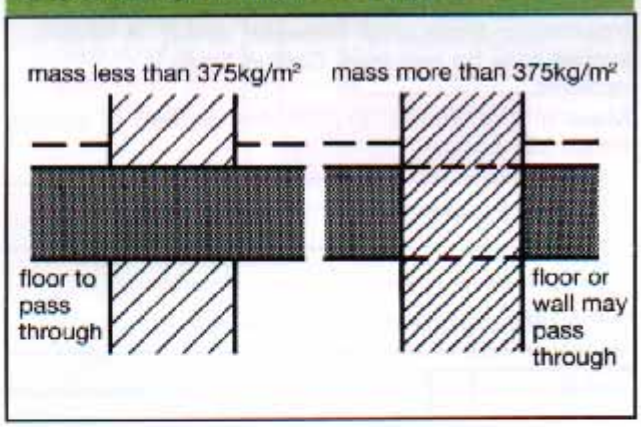
Diagram 19 **External walls or cavity separating walls, floor type 1**



External wall or cavity separating wall
The mass of the wall leaf adjoining the floor should be at least 120 kg/m² (including any finish), unless it is an external wall having openings of at least 20% of its area in each room, in which case there is no minimum requirement.

The floor base (excluding any screed even in C and D) should pass through the leaf whether spanning parallel to or at right angles to the wall. The cavity should not be bridged. If the floor base is type C or D, where the beams are parallel to the wall the first joint should be 300mm from the cavity face of the wall leaf.

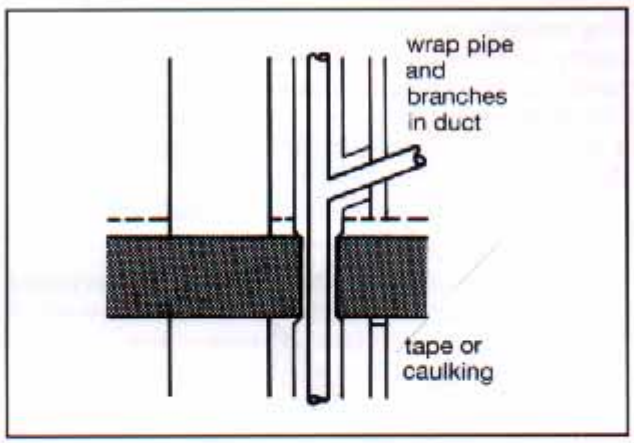
Diagram 20 **Internal walls or solid separating walls, floor type 1**



Internal wall or solid separating wall
If the wall mass is less than 375 kg/m² including any plaster or plasterboard then the floor base excluding any screed should pass through.

If the wall mass is more than 375 kg/m² including any plaster or plasterboard either the wall excluding any finishes or the floor base excluding any screed may pass through. Where the wall does pass through, tie the floor base to the wall and grout the joint.

Diagram 21 **Floor penetrations, floor type 1**



Floor penetrations (excluding gas pipes)
Ducts or pipes which penetrate a floor separating habitable rooms should be in an enclosure, both above and below the floor. The material of the enclosure should have a mass of 15 kg/m².

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

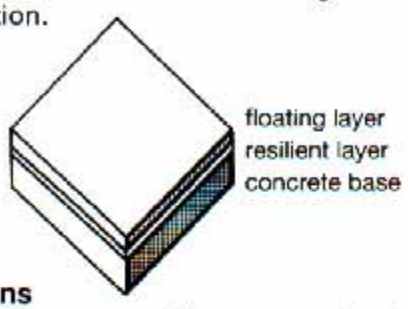
Penetrations through a separating floor by ducts and pipes should have fire protection in accordance with Approved Document B, Fire safety. Fire stopping should be flexible and also prevent rigid contact between the pipe and floor.

Note: In the Gas Safety Regulations 1972 (SI. 1972/1178) and the Gas Safety (installation and use) Regulations 1984 (SI. 1984/1358) there are requirements for ventilation of ducts at each floor where they contain gas pipes. Gas pipes may be contained in a separate ventilated duct or they can remain unducted.

Floor type 2:

Concrete base with floating layer

The resistance to airborne sound depends partly on the mass of the concrete base and partly on the mass of the floating layer. Resistance to impact sound depends mainly on a resilient layer isolating the floating layer from the base and from the surrounding construction.



Limitations

Where resistance to airborne sound only is required the full construction should still be used.

Points to watch

Fill all joints between parts of the floor base to avoid air paths.

Control sound paths round the floor to reduce flanking transmission.

Workmanship and detailing should 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 screed.

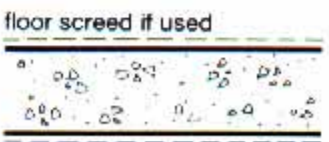
With bases C and D a screed may be required to seal the floor and to accommodate surface irregularities.

Construction

Four floor bases (A,B,C & D) two floating layers (E & F) and one resilient layer (G) are shown. Any combination of base, resilient layer and floating layer will give suitable resistance to direct transmission. Two additional resilient layers which may be used under screeds only are also specified (H and I). Details of how junctions should be made to limit flanking transmission follow.

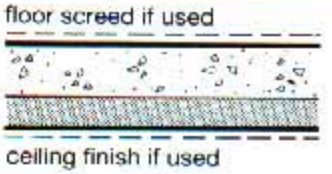
Floor bases

A



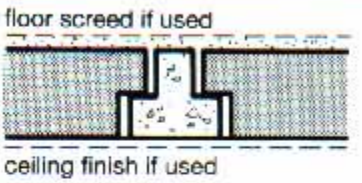
Solid concrete slab (in-situ)
Floor screed and/or ceiling finish optional.
Mass (including any bonded screed and/or ceiling finish) 300kg/m².

B



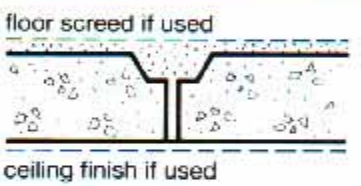
Solid concrete slab with permanent shuttering
Floor screed and/or ceiling finish optional.
Mass (including shuttering only if it is solid concrete or metal, and including any bonded screed and/or ceiling finish) 300kg/m².

C



Concrete beams with infilling blocks
The floor base should be reasonably level (maximum 5mm step between units). A levelling screed may be required. Ceiling finish is optional.
Mass of beams, blocks and any bonded screed or ceiling finish 300 kg/m².

D



Concrete planks (solid or hollow)
The floor base should be reasonably level (maximum 5mm step between units). A levelling screed may be required. Ceiling finish is optional.
Mass of planks and any bonded screed or ceiling finish 300 kg/m².

Floating layers

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

F **Screed**
65mm cement sand screed, with 20 - 50mm wire mesh to protect the resilient layer while the screed is being laid.

Resilient layers

G **25mm mineral fibre density 36 kg/m³**
A 13mm 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, the fibre may be paper faced on the underside.
Under a screed, fibre should be paper faced on the upper side to prevent screed entering the layer.

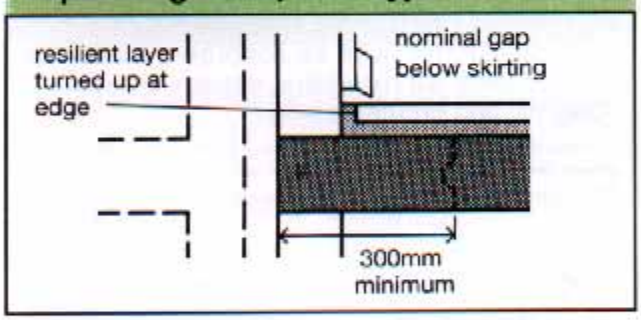
Additional resilient layers for use under screeds only.

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

I **5mm extruded (closed cell) polyethylene foam, density 30 - 45 kg/m³**
To protect the material from puncture it should be laid over a levelling screed. Lay with joints lapped and turn up at edges of the floating screed.

Junctions for floor type 2

Diagram 22 **External walls or cavity separating walls, floor type 2**



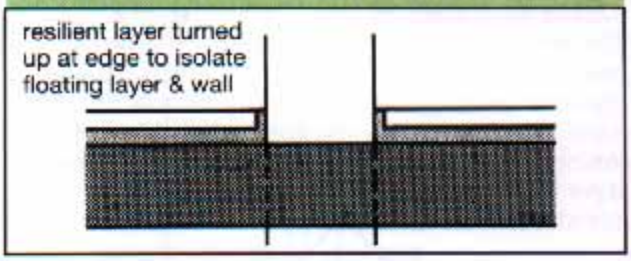
External wall or cavity separating wall
The mass of the leaf adjoining the floor should be 120 kg/m² (including any finish) unless it is an external wall having openings of at least 20% of its area in each room, in which case there is no minimum requirement.

The floor base (excluding any screed) should pass through the leaf whether spanning parallel to or at right angles to the wall. The cavity should not be bridged. If the floor base is Type C or D, where the beams are parallel to the wall the first joint should be 300mm from the cavity face of the wall leaf.

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

Leave a nominal gap between skirting and floating layer or turn resilient layer under skirting. A seal is not necessary but if used it should be flexible.

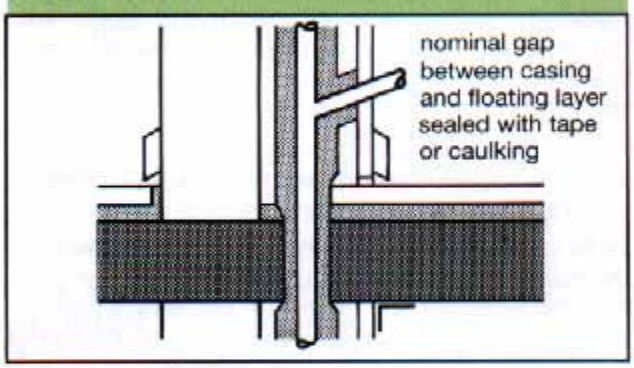
Diagram 23 **Internal walls or solid separating walls, floor type 2**



Internal wall or solid separating wall
If the wall mass is less than 375 kg/m² including any plaster or plasterboard then the floor base excluding any screed should pass through.

If the wall mass is more than 375 kg/m² including any plaster or plasterboard either the wall excluding any finishes or the floor base excluding any screed may pass through. Where the wall does pass through, tie floor base to the wall and grout the joint.

Diagram 24 **Floor penetrations, floor type 2**



Floor penetrations (excluding gas pipes)
Ducts or pipes penetrating a floor separating habitable rooms should be in an enclosure, both above and below the floor.

The material of the enclosure should have a mass of 15 kg/m².

Either line the enclosure, or wrap the duct or pipe within the enclosure, with 25mm unfaced mineral wool. Leave a nominal gap between enclosure and floating layer and seal with acrylic caulking or neoprene.

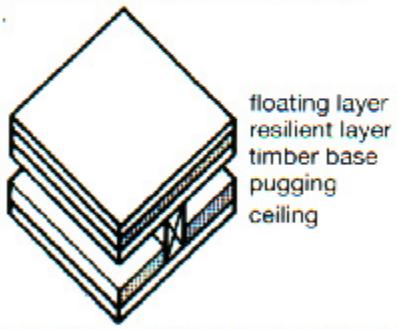
Penetrations through a separating floor by ducts and pipes should have fire protection in accordance with Approved Document B: Fire safety. The fire stopping should be flexible and also prevent rigid contact between the pipe and floor.

Note: In the Gas Safety Regulations 1972 (SI. 1972/1178) and the Gas Safety (Installation and use) Regulations 1984 (SI. 1984/1358) there are requirements for ventilation of ducts at each floor where they contain gas pipes. Gas pipes may be contained in a separate ventilated duct or they can remain unducted.

Floor type 3:

Timber base with floating layer

The resistance to airborne sound depends partly on the structural floor plus absorbent material or pugging, and partly on the floating layer. Resistance to impact sound depends mainly on a resilient layer isolating the floating layer from the base and the surrounding construction.



Limitations

Where resistance to airborne sound only is required the full construction should still be used.

Points to watch

Control sound paths around the floor to reduce flanking transmission. Workmanship and detailing should 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 and ensure it can carry the anticipated load.

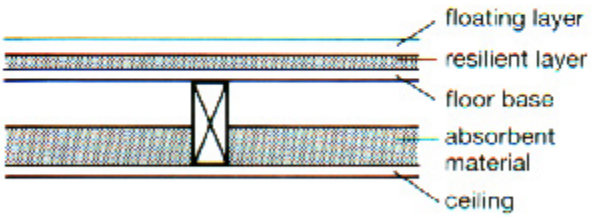
Take care not to bridge between the floating layer and the base or surrounding walls (e.g. with services or fixings which penetrate the resilient layer). Allow for movement of materials e.g. expansion of chipboard after laying (to maintain isolation).

Constructions

Three complete constructions (A,B & C) which give suitable resistance to direct sound transmission are shown. Note that there are some options within each of these constructions. Types of pugging are described (D). Details of how junctions should be made to limit flanking transmission follow.

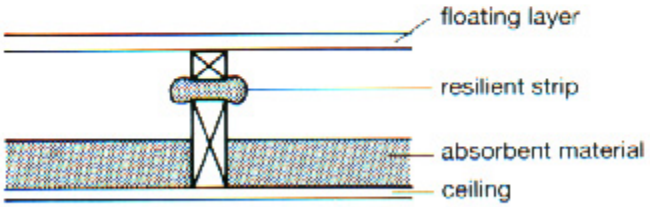
Floors

A



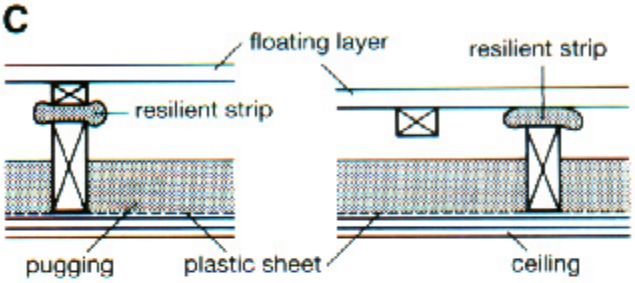
Platform floor with absorbent material.
Either a floating layer of timber or wood based board 18mm thick with tongued and grooved edges, all joints glued, spot bonded to substrate of 19mm plaster board; or a floating layer of two thicknesses of cement bonded particle board with joints staggered, glued and screwed together, total thickness 24mm. Resilient layer of 25mm mineral fibre, density 60 – 100kg/m³. (Note that the low figure gives the best insulation but a "softer" floor, in such cases additional support can be provided around the perimeter of the floor by a timber batten with a foam strip along the top attached to the wall.) Floor base of 12mm timber boarding or wood-based board nailed to timber joists (size to suit structure). Ceiling of two layers of plasterboard with joints staggered, total thickness 30mm with an absorbent material, 100mm unfaced mineral wool, density at least 10kg/m³ laid on the ceiling.

B



Ribbed floor with absorbent material
Floating layer of timber or wood based board 18mm thick with tongued and grooved edges and all joints glued, spot bonded to substrate of 19mm plasterboard, nailed to 45mm x 45mm timber battens placed over the joists. Resilient strips of 25mm mineral fibre, density 80 – 140kg/m³ laid on joists. Floor base of 45mm wide timber joists. Ceiling of two layers of plasterboard with joints staggered, total thickness 30mm, with an absorbent blanket of 100mm unfaced rock fibre, density at least 10kg/m³ laid on the ceiling.

C



Ribbed floor with heavy pugging
Floating layer of timber or wood based board 18mm thick with tongued and grooved edges and all joints glued, nailed or screwed to 45mm x 45mm timber battens placed either on or between joists (for sheet materials, placing on joists is recommended). Resilient strips of 25mm mineral fibre density 80 – 140kg/m³ laid on joists. Floor base of 45mm wide timber joists. Ceiling of either 19mm dense plaster on expanded metal lath or 6mm plywood fixed under the joists plus two layers of plasterboard with joints staggered, total thickness 25mm. Both types of ceiling to have pugging of mass 80kg/m² laid on a polyethylene liner.

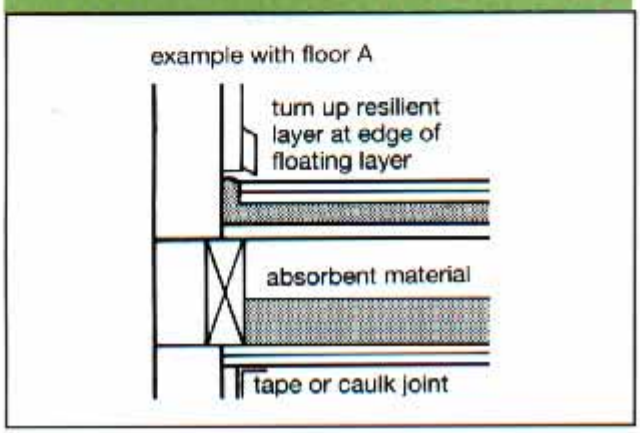
D Pugging

The pugging between joists may be of the following types.

Traditional ash (75mm), or 2mm–10mm, limestone chips (60mm), or 2mm–10mm whin aggregate (60mm), or dry sand (50mm). Figures in brackets show approximate thickness required to achieve 80kg/m² (other figures denote sieve size). Do not use sand in kitchens, bathrooms, shower rooms or watercloset compartments where it may become wet and overload the ceiling.

Junctions for floor type 3

Diagram 25 Timber frame walls, floor type 3



Timber frame wall

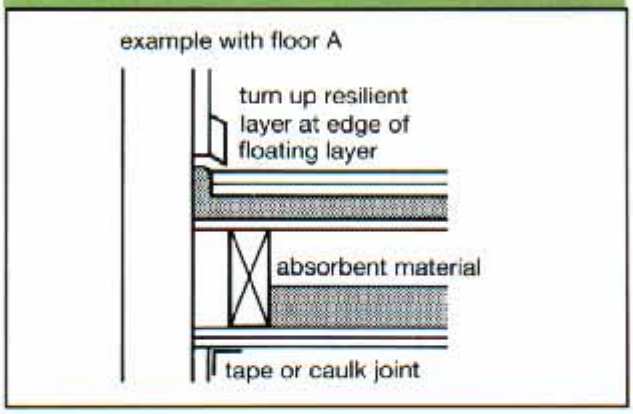
Seal the gap between wall and floating layer with a resilient strip glued to the wall.

Leave a 3mm gap between skirting and floating layer. A seal is not necessary but if used it should 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.

Diagram 26 Heavy masonry leaf, floor type 3



Heavy masonry leaf

Mass of leaf (including any finish) 375 kg/m², both above and below floor.

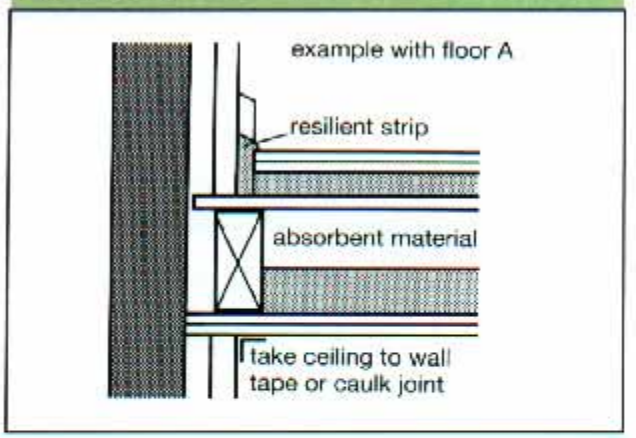
Seal the gap between wall and floating layer with a resilient strip.

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

Use any normal method of connecting floor base to wall.

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

Diagram 27 Light masonry leaf, floor type 3



Light masonry leaf

If the mass including any plaster or plasterboard is less than 375 kg/m² a free-standing panel as specified in wall type 3 should be used.

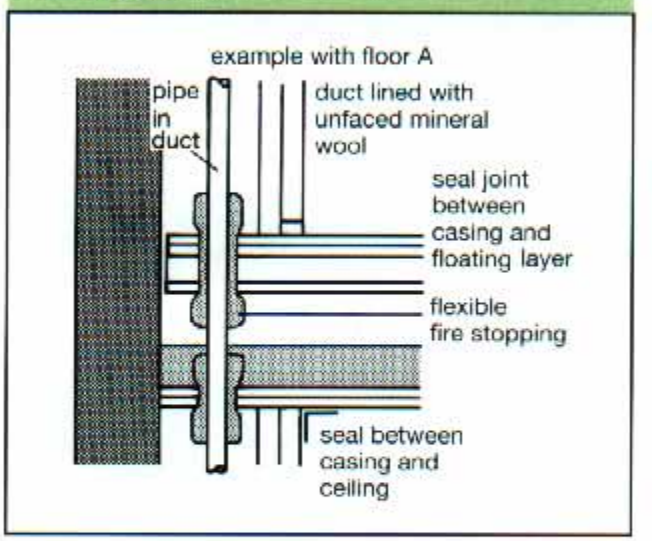
Seal the gap between panel and floating layer with a resilient strip.

Leave a 3mm gap between skirting and floating layer. A seal is not necessary but if used it should 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.

Diagram 28 Floor penetrations, floor type 3



Floor penetrations (excluding gas pipes)

Ducts or pipes penetrating the floor separating habitable rooms to be in an enclosure both above and below the floor.

The material of the enclosure should have a mass of at least 15 kg/m².

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

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

Penetrations of a separating floor by ducts and pipes should have fire protection in accordance with the Approved Document B, Fire safety. The fire stopping should be flexible and also prevent rigid contact between the pipe and the floor.

Note: In the Gas Safety Regulations 1972 (SI. 1972/1178) and the Gas Safety (Installation and use) Regulations 1984 (SI. 1984/1358) there are requirements for ventilation of ducts at each floor where they contain gas pipes. Gas pipes may be contained in a separate ventilated duct or they can remain unducted.

Section 3

SIMILAR CONSTRUCTION METHOD FOR NEW BUILDING

3.1 This method allows the repetition of a construction which has already been built elsewhere, tested as described under the heading in paragraph 3.5 - 3.7 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.

3.2 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.

For the purpose of this Section the term "floor" should be taken to include a stair that performs the same separating function.

Conditions on the use of a similar construction

Similar Features

3.3 When proposing to use a construction that is essentially similar to an existing construction that has been found by testing, to be satisfactory, the following proposed features should be similar to those of the tested construction but they do not need to be identical.

a. For dwellings which include separating walls and/or floors the following features should 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 dwellings which include separating walls, the extent of any step or stagger should be similar to that in the tested construction (an increase is beneficial but a small decrease may be acceptable). Where there is no step or stagger in the tested construction one may be provided in the proposed construction.

Allowable differences

3.4 For dwellings which include separating walls and/or floors, differences in the following are allowed when considering paragraph 3.3(a):

a. the construction of the outer leaf of an external masonry cavity wall;

b. the construction of the inner leaf of an external masonry cavity wall provided that the construction is of the same general type and that the mass of the inner leaf is not reduced;

c. the material and thickness of the floating layer of a separating floor with a concrete base similar to Floor Type 2 in Section 2.

d. the construction of a timber floor where it is not a separating floor.

Testing existing construction

Test method

3.5 Tests shall be carried out to determine:

a. 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

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

Tests should be conducted in completed but unfurnished dwellings. Doors and windows should be closed.

Where possible each separating wall or floor should be tested with 8 sets of measurements. Where 8 pairs of rooms are not available for testing the test may be carried out in 4 pairs of rooms or as close to 4 as possible. For each set of measurements:

a. use pairs of large rooms if possible;

b. use pairs consisting of a room and some other space only where necessary to make up the sets of four;

c. take only one set of measurements between each pair.

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

When measuring airborne sound insulation between a room and some other space, the sound source should be in the other space.

A test report should be provided which describes the performance of the existing construction (see paragraphs 3.6, 3.7 and 3.8) and includes the details set out in Table 1.

Table 1 Test report details: Test of existing construction

1. Organisation conducting test:
   a. name;
   b. address;
   c. NAMAS accreditation number (if appropriate).
2. Name of person in charge of test
3. Date of test
4. Address of building tested
5. Brief details of test:
   a. equipment;
   b. test procedures.
6. Description of building:
   a. sketch showing relationship and dimensions of rooms tested;
   b. description of external and separating walls, partitions and floors including details of materials used for their construction and finishes;
   c. estimate of surface mass kg/m^2 of external and separating walls, partitions and floors;
   d. dimensions of any step and stagger between rooms tested;
   e. approximate dimensions of any windows or doors in external walls within 700mm of the separating wall.
7. Results of test, shown in tabular and graphical form:
   a. single number rating;
   b. underlying data from measurements on which the single number rating is based.

From each set of measurements calculate:

a. for airborne sound insulation, the weighted standardised level difference ($D_{nT,w}$) in accordance with BS 5821: *Methods for rating the sound insulation in buildings and building elements.* Part 1: 1984 *Method for rating the airborne sound insulation in buildings and interior building elements* or

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

Assessment of results

3.6 Individual values

For airborne sound insulation individual values of the weighted standardised level difference ($D_{nT,w}$) should be not less than that given in the individual value column in Table 2.

For impact sound transmission individual values of the weighted standardised impact sound pressure level ($L'_{nT,w}$) should be not more than that given in the individual value column of Table 2.

3.7 Mean values

The arithmetic mean of individual values should be no worse than that given in the appropriate "mean value" column in Table 2. Where only 2 or 3 sets of measurements have been possible the mean value for up to four sets should still be achieved, and where only one set is possible the value achieved should be no worse than the mean value.

Limits on use of test evidence

3.8 The test procedure is intended to enable satisfactory evidence to be provided by a person intending to use the method of similar construction and the values in Table 2 are provided to enable an existing construction to be assessed before new construction is undertaken. A failure of a new construction to achieve the values in the Table is not in itself evidence of a failure to comply with the requirements of the Regulations.

Table 2 Sound insulation values

a. Airborne sound tests in up to 4 pairs of rooms

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 tests in up to 4 pairs of rooms

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

b. Airborne sound tests in at least 8 pairs of rooms

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	52	49
Floors	51	48

Impact sound tests in at least 8 pairs of rooms

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	62	65

Section 4

TEST CHAMBER EVALUATION FOR NEW CONSTRUCTION

4.1 This section describes a way of meeting the functional requirements for walls by means of tests in an approved type of test chamber*.

4.2 It is necessary to show that the sound insulation between at least two pairs of rooms separated by the proposed type of wall and flanking construction is not less than a prescribed value.

Test procedure

4.3 The insulation against airborne sound should be measured both between the lower pair of rooms and between the upper pair of rooms in accordance with BS 2750: Part 4: 1980. Measurement should be made in the 1/3 octave bands between 100 Hz and 3150 Hz, and standardised to a reverberation time of 0.5 seconds.

Sound insulation value required

4.4 The modified weighted standardised level difference value obtained from each measurement should be not less than 55 dB.

The modified weighted standardised level difference value is affected by room dimensions. It should be calculated by adding a constant K to the weighted standardised level difference value. This constant is given by $K = 10 \log_{10} (3/L) + 1$ where L in metres is the length of the room perpendicular to the separating wall.

Limit on use of test results

4.5 A test report containing the information specified in Table 3 may be accepted as evidence tending to show compliance with the Regulation. This evidence is only valid for the specific type of construction tested, except for the following features which may be changed:

a. Dimensions of separating wall and flank wall;
b. Door and/or window openings may be positioned in the flank wall;
c. Internal partitions may be attached to the separating wall.

* For details of test chamber construction consult the Building Research Establishment, Watford, WD2 7JR.

Table 3 Test report details: Test chamber evaluation

1. Organisation operating the test chamber:
   a. name;
   b. address;
   c. NAMAS accreditation number, if appropriate.
2. Organisation conducting the acoustic measurements (if different from above):
   a. name;
   b. address;
   c. NAMAS accreditation number, if appropriate.
3. Date of test
4. Description of test chamber including method of attaching the test construction
5. Brief details of test:
   a. equipment;
   b. procedure.
6. Full details of materials and test construction:
   a. separating wall;
   b. flank wall;
   c. junction between separating wall and flank wall (e.g. bonded or tied);
   d. surface finish;
   e. mass/m^2 of walls;
   f. intermediate floor;
   g. separating wall in loft space;
   h. dimensions;
   j. any other special features.
7. Results of test:
   a. for each measurement the standardised level difference ($D_{n,T}$), the weighted standardised level difference, ($D_{nT,w}$), and weighted apparent sound reduction index (R'_w) all according to BS 5821: Part 1 1984.
   b. the two modified weighted standardised level differences obtained by adding the correction K (see para 4.4) to the weighted standardised level difference.
   c. statement saying that both values determined in 7b of this Section meet the requirements given in paragraph 4.4.

Section 5

REMEDIAL WORK IN CONVERSIONS.

5.1 It may be that an existing wall, floor or stair in a building that is to be converted into separate dwellings will meet the requirements for sound insulation without the need for remedial work. This would be the case if:
a. the construction was generally similar to one of the constructions in sections 1 and 2 (eg within 15% of the mass of a construction listed there). Flanking construction need not be considered except for floor penetration and sealing joints,
b. the construction was of a type that met the test requirements of Section 6.

5.2 For situations where it cannot be shown that the existing construction meets the sound insulation requirements this section describes one wall treatment, three floor treatments and one stair treatment to improve the level of sound insulation. See diagram 29.

Wall treatment
Independent lining with absorbent material in cavity.
The resistance to airborne sound depends on:
a. form of existing construction;
b. mass of independent leaf;
c. isolation of independent leaf;
d. absorbent material.

Floor treatment 1
Independent ceiling with absorbent material.
The resistance to airborne and impact sound depends on:
a. the combined mass of the existing floor and independent ceiling;
b. the absorbent material;
c. the isolation of the independent ceiling;
d. the airtightness of the whole construction.

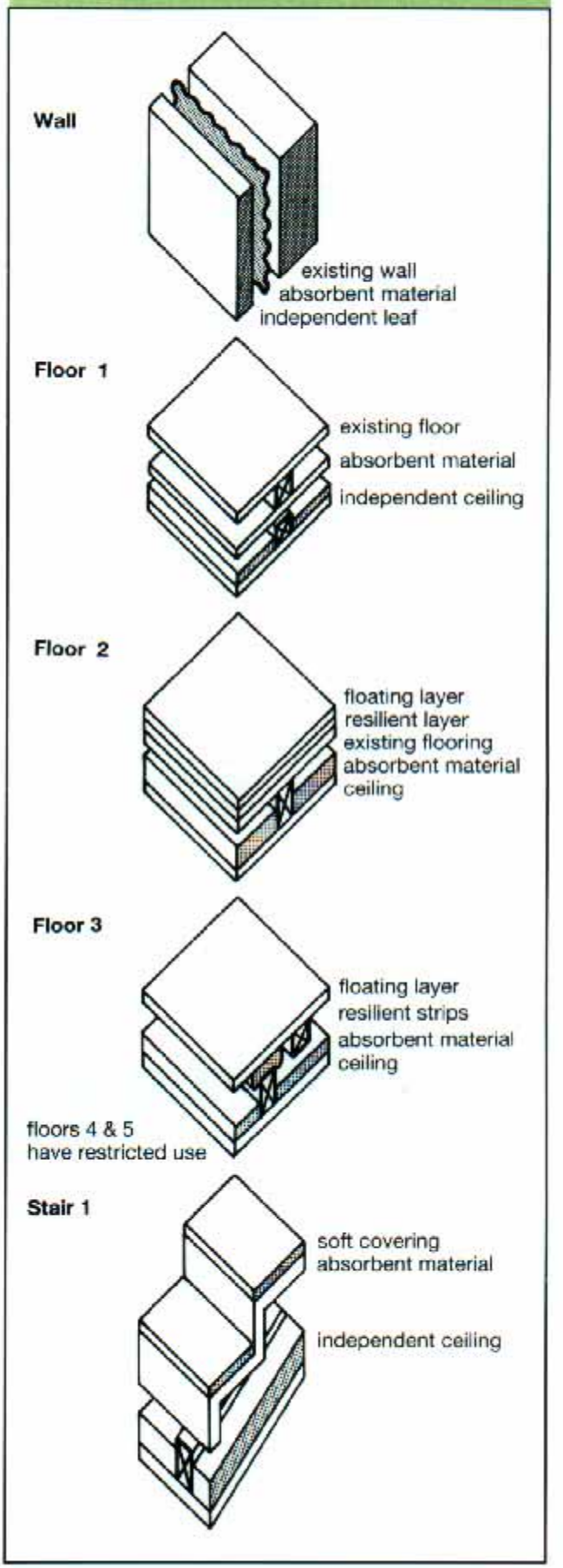
Floor treatment 2
Floating layer (platform floor). The sound insulation depends on the total mass of the floor and the effectiveness of the resilient layer.

Floor treatment 3
Floating layer with absorbent material between joists (raft floor). The sound insulation depends on the total mass of the floor, the effectiveness of the resilient strips and the absorbent material.

The following floor treatments are only to be used when a strong case can be made for not using floor treatments 1,2 and 3.

Floor treatment 4
Alternative independent ceiling with absorbent material. This treatment gives less reduction in ceiling height but also a lower level of sound insulation.

Diagram 29 **Treatments for conversions**



Floor treatment 5
Alternative floating layer (platform floor). This treatment gives a lower floor level but also a lower level of sound insulation.

Stair treatment 1
Stair covering and independent ceiling with absorbent material - to be used where a timber stair performs a separating function between dwellings.

5.3 The implementation of upgrading measures will impose additional loads on the existing structure. The structure should be assessed to ensure that the additional loading can be carried safely with appropriate strengthening where necessary.

5.4 When undertaking sound insulation treatment of walls and floors in buildings with architectural features such as cornices, decorative ceilings or floor coverings, the guidance in this document should be treated flexibly with regard to what is reasonable in such circumstances.

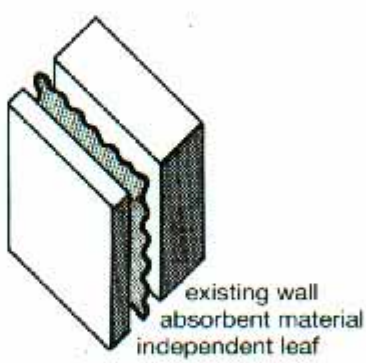
5.5 Piped services passing through separating floors in conversions can reduce the level of sound insulation. Guidance on the treatment of piped services is given at the end of this section.

Wall treatment

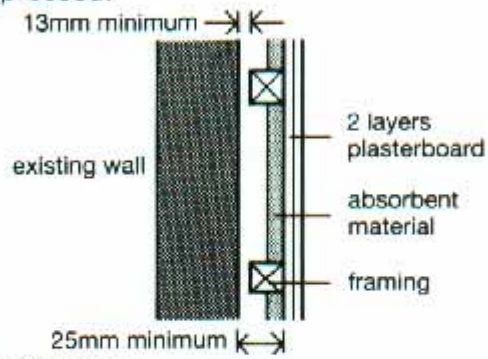
Independent leaf and absorbent material

The resistance to airborne sound depends on the form of the existing construction, the mass of the independent leaf, its isolation from the existing wall and the absorbent material in the cavity.

The construction may be used on one side of the existing wall only where the existing wall is masonry, has a thickness of at least 100mm and is plastered on both faces. With other types of existing wall the construction should be built on both sides



Points to watch
Ensure that the independent leaf and its supporting frame are not in contact with the existing wall. The absorbent material may bridge the cavity but should not be tightly compressed.

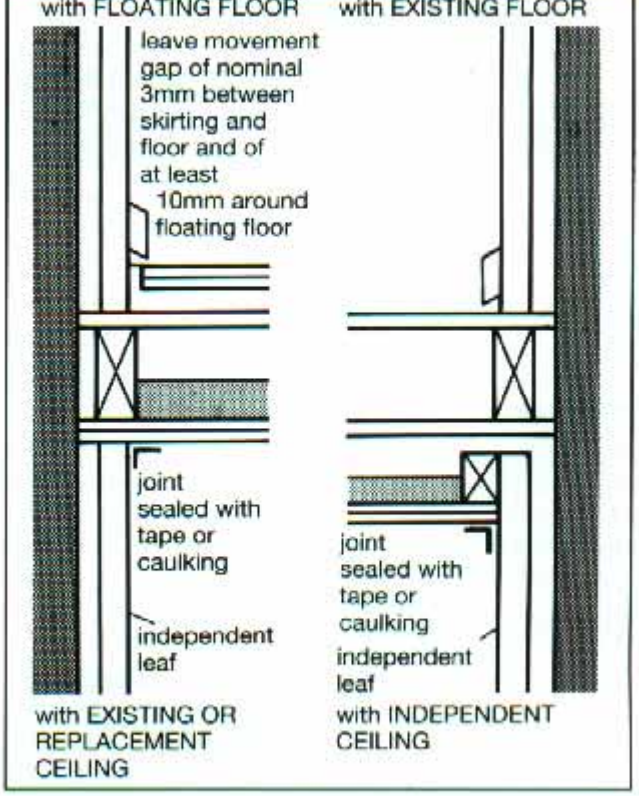


Construction
The independent leaf should be two layers of plasterboard each at least 12.5mm thick fixed to any type of framing or a plasterboard lining with a total thickness of 30mm if no framework is used. The plasterboard joints should be staggered, and a gap of at least 25mm left between the inside face of the plasterboard and the face of the existing wall, and of at least 13mm between the framing and the face of the existing wall.

The perimeter of the independent leaf should be sealed with tape or mastic.

The absorbent material should be mineral wool at least 25mm thick with a density of at least 10 kg/m^3.

Diagram 30 **Wall treatment 1, typical junction details**

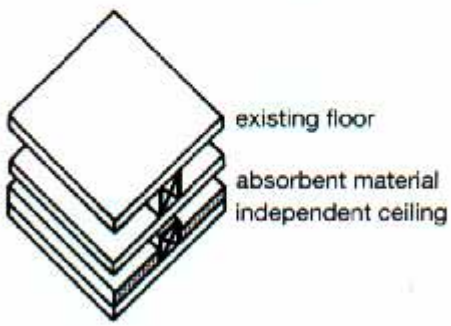


Floor treatment 1:

Independent ceiling with absorbent material

The resistance to airborne and impact sounds depends on:

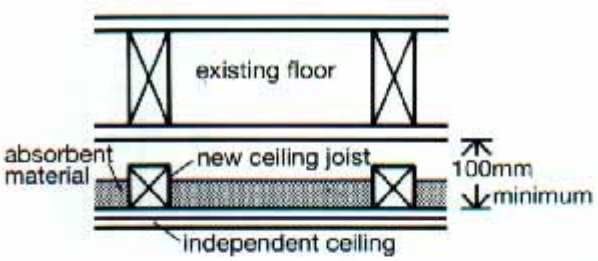
a. the combined mass of the existing floor and independent ceiling;
b. the absorbent material;
c. the isolation of the independent ceiling;
d. the airtightness of the whole construction.



Points to watch

If existing ceiling is lath and plaster it may be retained if it provides acceptable fire resistance. See Approved Document B: Fire safety.

A gap of 25mm should be provided between the top of the independent ceiling joists and the underside of the existing floor construction.



Work to existing construction

Gaps in floor boarding should be sealed either with caulking or by overlaying the floor with hardboard.

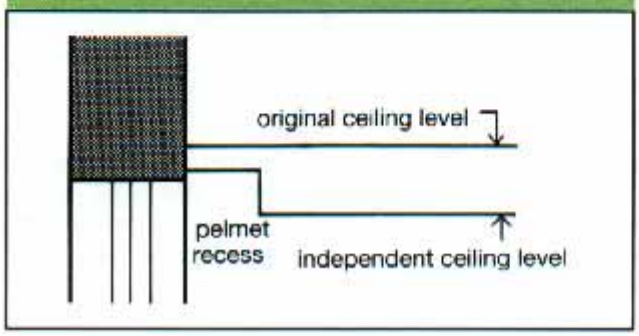
Where the existing ceiling is not lath and plaster it should be upgraded to a thickness of 30mm plasterboard in 2 or 3 layers with joints staggered.

Construction

The independent ceiling should comprise two layers of plasterboard having a total thickness of at least 30mm with the joints staggered, fixed to independent joists. The perimeter of the independent ceiling should be sealed with tape or mastic. The independent ceiling should be at least 100mm below the existing ceiling. Where a window head is near to the existing ceiling, the new independent ceiling may be raised to form a pelmet recess (see Diagram 31).

The mineral wool absorbent material should be at least 100mm thick and have a density of at least 10 kg/m^3.

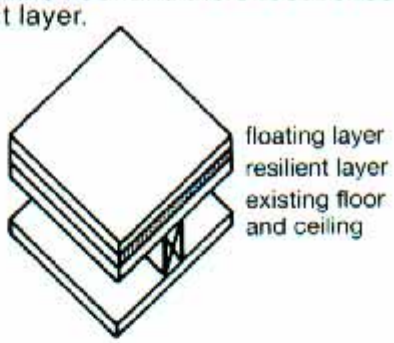
Diagram 31 **Floor treatment 1, high window head detail**



Floor treatment 2:

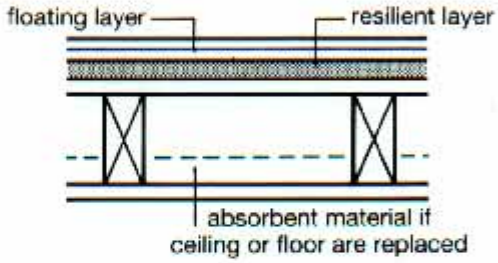
Floating layer (platform floor)

The sound insulation depends on the total mass of the floor and the effectiveness of the resilient layer.



Points to watch

If the existing ceiling is lath and plaster it may be retained if it provides acceptable fire resistance. Use correct density of resilient layer and ensure it can carry the anticipated load.



Work to existing construction

Where the existing ceiling is not lath and plaster the ceiling should be upgraded to a thickness of 30mm of plasterboard in 2 or 3 layers with joints staggered. Where possible insert a 100mm thick absorbent layer of mineral wool between the joists.

Where the existing floor boards are removed they should be replaced with 12mm thick boarding with a 100mm thick absorbent layer of mineral wool laid between the joists (if not already done during the ceiling replacement).

Construction

A floating layer of either:

a. timber or wood-based board 18mm thick with tongued and grooved edges and all joints glued, spot bonded to a substrate of 19mm plasterboard, or

b. a single or double layer of material having a mass of at least 25kg/m^2 and with all joints glued.

The loadbearing resilient layer should be 25mm thick mineral wool having a density of between 60 and 100kg/m^3. (Note that the low figure gives the best insulation but a "softer" floor, in such cases additional support can be provided around the perimeter of the floor by a timber batten with a foam strip along the top attached to the wall.)

Junctions with abutting construction

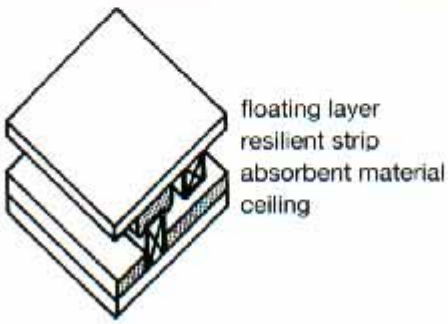
A movement gap of 10mm should be left around the floating layer and should be filled with resilient material. A 3mm gap should be left between the skirting and the floating layer. A seal is not necessary but if used it should be flexible.

The perimeter of any new ceiling should be sealed with tape or caulking.

Floor treatment 3:

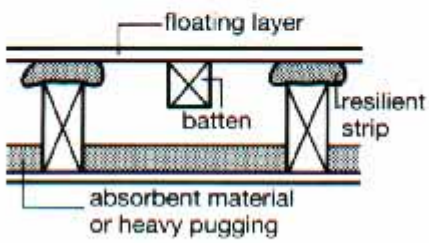
Ribbed floor with absorbent material or heavy pugging.

The sound insulation depends on the mass of the floor, the effectiveness of the resilient strips and the absorbent material or pugging.



Points to watch
If the existing ceiling is lath and plaster it may be retained if it provides acceptable fire resistance.

The existing joists should be 45mm wide. Additional strutting may be needed between the existing joists to ensure stability of the floor after removal of the floor boarding. Use the correct density of resilient layer and ensure it can carry the anticipated load.



Work to existing construction
Where the existing ceiling is not lath and plaster it should be upgraded to a thickness of 30mm plasterboard in 2 or 3 layers with joints staggered. Special precautions may be necessary if heavy pugging is used.

Construction
Either construction a. or b. can be used (a.ii or b. can be used where floor levels are critical). Construction b. is suitable only where the existing structure can support the additional loading imposed by the heavy pugging.

a. A floating layer of either:-

i. timber or wood-based board, 18mm thick, with tongued and grooved edges and all joints glued, spot bonded to a substrate of 19mm plasterboard; or

ii. a single or double layer of material having a mass of at least 25kg/m^2, and with all joints glued.

The floating layer should be nailed or screwed to 45mm x 45mm timber battens. Where the floating layer incorporates plasterboard, the timber battens should be placed directly over the joists. The resilient strips should be 25mm thick mineral fibre, with a density between 80 and 140kg/m^3 laid on the joists. The absorbent material laid between the joists should be 100mm thick mineral wool of 10 kg/m^3 density.

b. The floating layer should be of timber or wood based board, 18mm thick, with tongued and grooved edges and all joints glued, nailed or screwed to 45mm x 45mm timber battens. The battens should run in the direction of and between or directly over the joists.

The resilient strips should be of 25mm thick mineral fibre, density between 80 and 140 kg/m^3, laid on the joists.

The pugging between joists may be of the following types.
Traditional ash (75mm), or 2mm-10mm, limestone chips (60mm), or 2mm-10mm whin aggregate (60mm), or dry sand (50mm). Figures in brackets show approximate thickness required to achieve 80kg/m^2 (other figures denote sieve size). Do not use sand in kitchens, bathrooms, shower rooms or water closet compartments where it may become wet and overload the ceiling.

Junctions with abutting construction
A movement gap of 10mm should be left around the floating layer and should be filled with resilient material.

A gap of 3mm should be left between the skirting and the floating layer. A seal is not necessary but if used should be flexible.

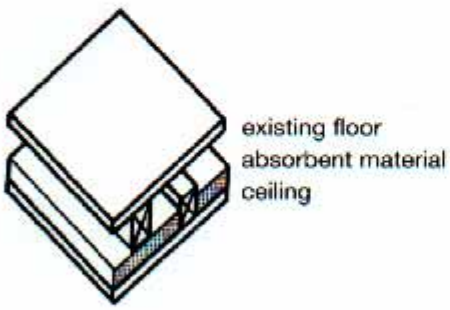
The perimeter of any new ceiling should be sealed with tape or caulking.

Floor Treatment 4:

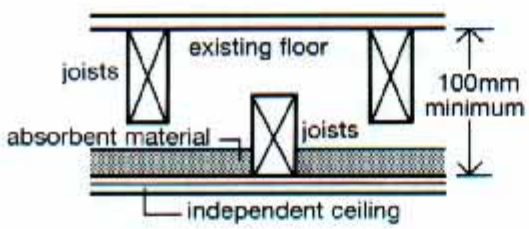
Alternative independent ceiling with absorbent material.

Only to be used when treatments 1,2 and 3 are not practical.

This construction allows less reduction in ceiling height than treatment 1, but the sound insulation will be lower.



Work to existing construction
Gaps in floorboarding should be sealed either



with caulking or by overlaying with hardboard.

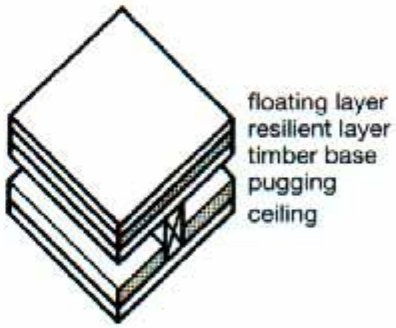
Construction
The ceiling should consist of two or three layers of plasterboard with staggered joints of at least 30mm overall thickness. The perimeter should be sealed with tape or mastic. The new ceiling may be supported on new ceiling joists or suspended from the original joists by wire hangers not more than 2mm in diameter or by metal straps not more than 25mm x 0.5mm. In either case there should not be more than 1 fixing per square metre. The absorbent material should be mineral wool of at least 100mm thickness with a density of at least 10 kg/m^3.

Floor treatment 5:

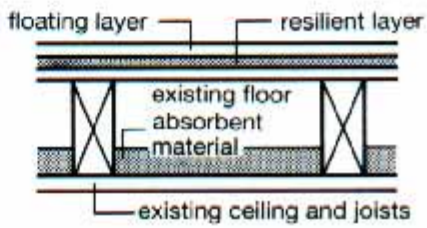
Alternative floating layer (platform floor)

Only to be used when floor treatments 1,2 and 3 are not practical.

This treatment is similar to treatment 2, but results in a lower floor level.



Points to watch
Where the existing ceiling is lath and plaster it may be retained if it provides acceptable fire resistance.



Work to existing construction
If floor boards are to be replaced, boarding at least 12mm thick should be used.

Where the existing ceiling is not lath and plaster it should be upgraded to a thickness of 30mm of plasterboard in two or three layers with joints staggered, suspended from timber cross battens or suitable resilient hangers.

Construction
The floating layer should be at least 18mm thick t and g boards or other boards with glued joints.

The resilient layer should be wood fibre insulation board at least 13mm thick, ref. BS 1142: *Specifications for fibre building boards:* Part 3: 1989 *Insulating board (softboard) 1989.*

The absorbent material should be mineral wool at least 50mm thick. The absorbent layer need not be installed unless floorboards or ceilings are to be removed for other reasons.

A gap of at least 10mm should be left around the floating layer and then filled with resilient material.

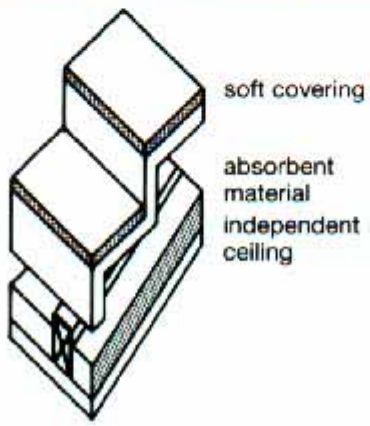
Seal perimeter of ceiling with tape or mastic.

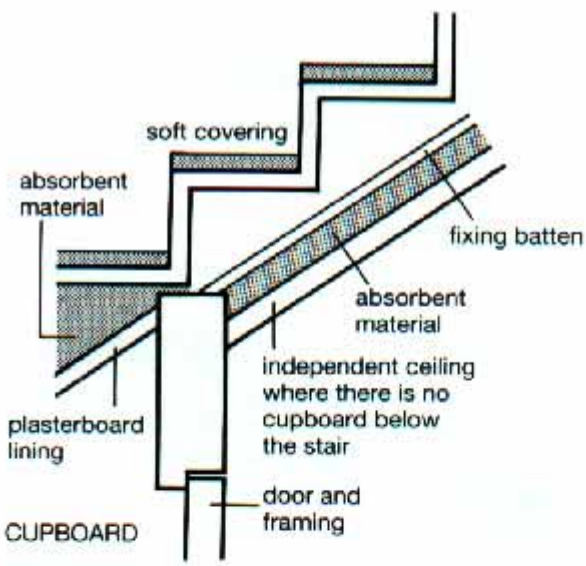
Stair treatment 1:

Stair covering and independent ceiling with absorbent material.

Timber stairs are subject to the same sound insulation requirements as floors where they perform a separating function. For fire resisting requirements see Approved Document, B: Fire safety.

The sound insulation depends on the resilience of the stair covering, the mass of the stair, the mass and isolation of the independent ceiling or airtightness of the cupboard enclosure.





Construction

Lay soft covering (e.g. carpet) of at least 6mm thickness over the stair treads.
If there is a cupboard under all, or part, of the stair:

a. line the underside of the stair within the cupboard with plasterboard of at least 12.5mm thickness with mineral wool within the space above the lining.

b. build cupboard walls from two layers of plasterboard of at least 12.5mm thickness or material of an equivalent mass/m².

c. use a small, heavy, well fitted door for the cupboard.

Where there is no cupboard under the stair construct an independent ceiling below the stair (see floor treatment 1).

For fire separating requirements refer to Approved Document B: Fire safety.

Piped services:

Piped services (excluding gas pipes) and ducts which pass through separating floors in conversions should be surrounded with sound absorbent material for their full height and enclosed in a duct above and below the floor.

Construction

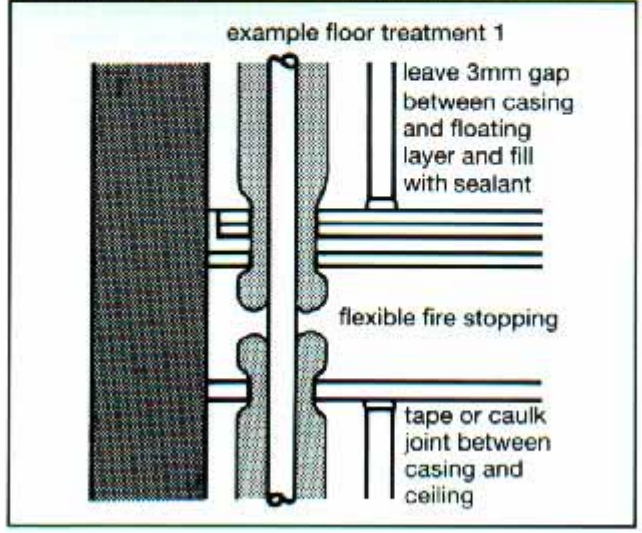
Pipes and ducts that penetrate a floor separating habitable rooms in different dwellings should be enclosed above and below the floor. The material used to form the enclosure should have a mass of at least 15kg/m². Either line the enclosure or wrap the pipe or duct within the enclosure with 25mm of unfaced mineral wool.

Leave a 3mm gap between the enclosure and floating layer of the floor, seal with caulking or neoprene. The enclosure may go down to the floor base if floor treatment 2 is used but ensure isolation from the floating layer.

Penetrations of a separating floor by ducts and pipes should have fire protection in accordance with Approved Document B: Fire safety. The fire stopping should be flexible and should also prevent rigid contact between the pipe and the floor.

Note: In the Gas Safety Regulations (full titles page 18) there are requirements for ventilation of ducts at each floor where they contain gas pipes. Gas pipes may be contained in a separate ventilated duct or they can remain unducted.

Diagram 32 **Piped services, casing and floor penetrations**



Section 6

FIELD AND LABORATORY TESTS FOR CONVERSIONS

6.1 This section describes ways of meeting the requirements for sound insulation in conversions by repeating a construction that has been built and tested in a building or a laboratory. Proposed wall or floor treatments may either be tested in the field or in the laboratory. Laboratories used should comply with BS 2750 *Measurement of sound insulation in buildings and of building elements.* Part 1:*1980 Recommendation for laboratories.*

6.2 Laboratory measurements are made with minimal flanking transmission and when the construction is used in a real building the insulation against airborne sound may be lower. Because of this an allowance has been made for flanking transmission which is the reason why better performance is required from laboratory tests than field tests.

6.3 For conversion work a typical masonry wall may be assumed to comprise a half brick wall, plastered on both sides, having a total mass not exceeding 200kg/m², and a timber floor to comprise 22mm plain edged boards and joists at 400mm centres with a ceiling of lath and plaster or of plasterboard of not more than 30mm thickness.

Validity of tests

6.4 The test results will only be applicable in situations which are similar to those that have been tested.
If the remedial treatment is intended for use with base floors or walls which are likely to have lower resistance to sound than those described in 6.3, then the treatment must be tested in conjunction with an appropriate base wall or floor.
Details required in the test report are listed in Table 4.

Field tests

6.5 Separating walls: the remedial method should be tested in conjunction with at least two different half brick walls plastered on both sides or other appropriate construction (see Section 6.4). The original walls should be tested alone and then with the remedial treatment. Both sets of results should be provided. The tests should be conducted according to BS 2750: Part 4: 1980: *Field measurement of airborne sound insulation between rooms.* The insulation values should be calculated according to BS 5821: Part 1: 1984. The weighted standardised level difference achieved by both examples of the wall with remedial treatment should be not less than $D_{n^T,w}$=49 dB.

6.6 Separating floors: for floors at least two examples of the remedial treatment should be tested. If the remedial treatment uses parts of the original floor (other than the joists) the original floor should be tested alone and then with the remedial treatment. Both results should be provided for each type of original floor tested. If the remedial treatment replaces all the original floor elements (the joists may be retained) then at least two typical installations of the remedial treatment should be tested.

6.7 The insulation against both airborne and impact sounds for floors should be measured unless the improvement is only to either impact or to airborne sound insulation. If the improvement is only to impact or to airborne sound insulation this should be clearly stated in the test report.

Table 4 Test report details: Tests of remedial treatments for separating walls, floors and stairs.

1.	Organisations conducting test: a. name; b. address; c. NAMAS accreditation number (if appropriate).
2.	Name of person in charge of test
3.	Date of test
4.	Brief details of test: a. equipment; b. test procedures.
5.	Description of treatment tested: a. sketch showing the relationship and dimensions of rooms tested; b. dimensions of any step or stagger between rooms tested; c. description of the existing construction (separating and abutting elements); d. details of opening (if any) within 700mm of the separating element; e. the mass/m² of the existing construction; f. description of the materials and methods used to upgrade the existing construction.
6.	Results of test shown in graphical and tabular form (including single number rating) for: a. the existing construction; b. the upgraded construction.

6.8 The tests for insulation against airborne sound for floors should be conducted according to BS 2750: Part 4: 1980. The tests for insulation against impact sounds should be conducted according to BS 2750: Part 7: 1980: *Field measurement of impact sound insulation of floors.* The insulation values for airborne insulation should be calculated according to BS 5821: Part 1: 1984, and the values achieved by the floors with remedial measure should be not less than $D_{nT,w}$ = 48 dB. The values for impact insulation should be calculated according to BS 5821: Part 2: 1984 and the values achieved by the floors with remedial treatment should be not more than $L'_{nT,w}$ = 65.

Laboratory tests

6.9 Separating walls: The basic wall or walls (see Section 6.3 and 6.4) should be tested alone and then with the remedial treatment. Both results should be provided for each basic wall tested. The tests should be conducted according to BS 2750: Part 3: 1980: *Laboratory measurement of airborne sound insulation of building elements.* The insulation values should be calculated according to BS 5821: Part 1: 1984. The insulation value achieved by each combined wall and remedial treatment should be not less than R_w = 53dB.

6.10 Separating floors: If the remedial treatment uses parts of an original floor (other than the joists), a suitable reproduction of the original floor (see Section 6.3 and 6.4) should be tested alone and then with the remedial treatment. Both results should be provided for each type of original floor tested. If the remedial treatments replaces all the original floor elements (the joists may be retained), then only the remedial treatments need be tested.

6.11 The insulation against both airborne and impact sounds for floors should be measured unless the improvement is only either to impact or to airborne sound insulation. If the improvement is only to impact or to airborne sound insulation this should be clearly stated in the test report.

6.12 The tests for insulation against airborne sound for floors should be conducted according to BS 2750: Part 3: 1980. The tests for insulation against impact sounds should be conducted according to BS 2750: Part 6: 1980: *Laboratory measurement of impact sound insulation of floors.* The weighted standardised level difference for airborne sound insulation should be calculated according to BS 5821: Part 1: 1984 and the value achieved by the floor with remedial treatment should be not less than R_w = 52 dB. The weighted impact sound pressure level for impact insulation should be calculated according to BS 5821: Part 2: 1984 and the value achieved by the floor with remedial treatment should be not more than $L_{n,w}$ = 65.

Table 5 **Test report details: Laboratory tests of remedial treatments**

1. Organisation conducting test:
   a. name
   b. address
   c. NAMAS accreditation number (if appropriate).
2. Name of person in charge of test
3. Date of test
4. Brief details of test:
   a. equipment;
   b. test procedures.
5. Description of the construction tested, including:
   a. description of the base construction, including:
   b. mass/m^2 of base construction,
   c. description and sketch of the upgraded construction.
6. Results of tests shown in tabular and graphical form (including single number rating) for:
   a. the base construction;
   b. the upgraded construction. Single number ratings should be stated for airborne and impact sound as appropriate.

Appendix A

METHOD FOR CALCULATING MASS

A1
Where a mass is specified for walls or floors, it is expressed in kg/m².

The mass may be obtained from actual figures given by the manufacturers or it may be calculated by the method given in this appendix. To calculate the mass of a masonry leaf use the formulae from table A1. These formulae are not exact but are accurate enough for this purpose. For coordinating heights other than those given in Table A1 use the formula for the nearest height.

A2
Densities of bricks or blocks (at 3% moisture content) may be taken from a current BBA or ETA Certificate or from the manufacturer's literature in which case the Building Control Authority may ask for confirmation e.g. that the measurement was done by an accredited test house. Note that the quoted density of bricks or blocks is normally the apparent density, i.e. the weight divided by the volume including perforations, voids or frogs. This is the density appropriate to the formulae for the nearest height. Include any finish of plaster, render or dry lining in calculating the mass unless otherwise stated.

A3
A mortar joint of 10mm and a dry set mortar density of 1800 kg/m³ are assumed values. Values within 10% of these figures are acceptable.

A4
For in-situ concrete or screeds calculate the mass by multiplying the density (kg/m³) by the thickness in metres. For slabs or composite floor bases divide the total mass of the element (kg) by the plan area of the element (m²).

Table A1 Formulae for calculation of wall leaf mass

Coordinating height of Masonry course (mm)	Formulae to be used
75	M=T (0.79D + 380) + NP
100	M=T (0.86D + 255) + NP
150	M=T (0.92D + 145) + NP
200	M=T (0.93D + 125) + NP

Where

M = Mass of 1m² of leaf in kg/m²

T = Thickness of masonry in metres (i.e. unplastered thickness)

D = Density of masonry units in kg/m³ (at 3% moisture content)

N = Number of finished faces (If no finish N = 0, if finish on one side only N = 1, if finish on both sides N = 2).

P = Mass of 1 m² of wall finish in kg/m² (see below)

Finishes

Mass of plaster (assumed thickness 13 mm)

Cement Render	29 kg/m²
Gypsum	17 kg/m²
Lightweight	10 kg/m²
Plasterboard	10 kg/m²

E

Standards referred to

BS 1142: 1989 *Specification for fibre boards.*

BS 2750: *Measurement of sound insulation in buildings and of building elements:*
Part 1: 1980 *Recommendations for laboratories.*
Part 3: 1980 *Laboratory measurement of airborne sound insulation of building elements*
Part 4: 1980 *Field measurement of airborne sound insulation between rooms.*
Part 6: 1980 *Laboratory measurement of impact sound insulation of floors.*
Part 7: 1980 *Field measurements of impact sound insulation of floors.*

BS 5628: *Code of practice for use of masonry:*
Part: 3 1985 *Materials and components, design and workmanship.*

BS 5821: *Methods for rating the sound insulation in building elements.*
Part 1: 1984 *Method for rating the airborne sound insulation in buildings and interior building elements.*
Part 2: 1984 *Method for rating the impact sound insulation.*

Approved documents published by the Department of the Environment and the Welsh Office as at October 1991

The following Approved Documents have been revised in conjunction with the Building Regulations 1991 and will take effect on 1 June 1992

A Structure
B Fire safety
C Site preparation and resistance to moisture
E Resistance to the passage of sound
G Hygiene
K Stairs, ramps and guards
M Access and facilities for disabled people
N Glazing - materials and protection
Reg 7 Materials and workmanship

The following Approved Documents, originally approved for the purpose of the Building Regulations 1985, have not been revised, and will continue to be approved for the purposes of the Building Regulations 1991 with effect from 1 June 1992:

D Toxic substances, 1985 edition
F Ventilation, 1990 edition
H Drainage and waste disposal, 1990 edition
J Heat producing appliances, 1990 edition
L Conservation of fuel and power, 1990 edition

Note that the Manual to the Building Regulations 1985 has been withdrawn.

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APPROVED DOCUMENT E

Resistance to the passage of sound