Building Regulations 1997

Technical Guidance Document E

Sound

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Technical Guidance Document E - Sound

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E(i)	Transitional Arrangements:- Replace 1 January 1998 with 1 July 1998

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Introduction

This document has been published by the Minister for the Environment under article 7 of the Building Regulations, 1997. It provides guidance in relation to Part E of the Second Schedule to the Regulations. The document should be read in conjunction with the Building Regulations, 1997, and other documents published under these Regulations.

In general, Building Regulations apply to the construction of new buildings and to extensions and material alterations to buildings. In addition, certain parts of the Regulations apply to existing buildings where a material change of use takes place. Otherwise, Building Regulations do not apply to buildings constructed prior to 1 June, 1992.

Transitional Arrangements

In general, this document applies to works, or buildings in which a material change of use takes place, where the works or the change of use commence or takes place, as the case may be on or after 1 July, 1998. Technical Guidance Document E - **Sound**, dated 1991, also ceases to have effect from that date. However, the latter document may continue to be used in the case of works, or buildings in which a material change of use takes place -

- where the works or the change of use commence or takes place, as the case may be, before 1 July, 1998,

- in respect of which a Fire Safety Certificate under the Building Control Regulations, 1991 to 1994, has been granted, where the works or change of use commence or takes place, as the case may be, not later than 31 December, 2002.

The Guidance

The materials, methods of construction, standards and other specifications (including technical specifications) which are referred to in this document are those which are likely to be suitable for the purposes of the Regulations. Where works are carried out in accordance with the guidance in this document, this will, prima facie, indicate compliance with Part E of the Second Schedule to the Building Regulations. However, the adoption of an approach other than that outlined in the guidance is not precluded provided that the relevant requirements of the Regulations are complied with. Those involved in the design and construction of a building may be required by the relevant building control authority to provide such evidence as is necessary to establish that the requirements of the Building Regulations are being complied with.

Existing Buildings

In the case of material alterations or changes of use of existing buildings, the adoption without modification of the guidance in this document may not, in all circumstances, be appropriate. In particular, the adherence to guidance, including codes, standards or technical specifications, intended for application to new work may be unduly restrictive or impracticable. Buildings of architectural or historical interest are especially likely to give rise to such circumstances. In these situations, alternative approaches based on the principles contained in the document may be more relevant and should be considered.

Technical Specifications

Building Regulations are made for specific purposes, e.g. to provide, in relation to buildings, for the health, safety and welfare of persons, the conservation of energy and access for disabled persons. Technical specifications (including harmonised European Standards, European Technical Approvals, National Standards and Agrement Certificates) are relevant to the extent that they relate to these considerations. Any reference to a technical specification is a reference to so much of the specification as is relevant in the context in which it arises. Technical specifications may also address other aspects not covered by the Regulations.

A reference to a technical specification is to the latest edition (including any amendments, supplements or addenda) current at the date of publication of this Technical Guidance Document. However, if this version of the technical specification is subsequently revised or updated by the issuing body, the new version may be used as a source of guidance provided that it continues to address the relevant requirements of the Regulations.

Materials and Workmanship

Under Part D of the Second Schedule to the Building Regulations, building work to which the Regulations apply must be carried out with proper materials and in a workmanlike manner. Guidance in relation to compliance with Part D is contained in Technical Guidance Document D.

Interpretation

In this document, a reference to a section, sub-section, part, paragraph or diagram is, unless otherwise stated, a reference to a section, sub-section, part, paragraph or diagram, as the case may be, of this document. A reference to another Technical Guidance Document is a reference to the latest edition of a document published by the Minister for the Environment under article 7 of the Building Regulations, 1997. Diagrams are used in this document to illustrate particular aspects of construction - they may not show all the details of construction

Building Regulations - The Requirement

Part E of the Second Schedule to the Building Regulations, 1997, provides as follows:

Airborne sound (walls).	E1	(1) A wall which - (a) separates a dwelling from another dwelling or from another building, or (b) separates a habitable room within a dwelling from another part of the same building which is not used exclusively with the dwelling, shall have reasonable resistance to airborne sound. (2) The requirement of sub-paragraph (1) shall not apply to a wall falling within the description in sub-paragraph (1)(b) which separates a habitable room within a dwelling from another part of the same building if such part is used only occasionally for the inspection, maintenance or repair of the building, or of its services, fixed plant or machinery.
Airborne sound (floors).	E2	(1) A floor which separates a dwelling from another dwelling, or from another part of the same building which is not used exclusively with the dwelling, shall have reasonable resistance to airborne sound. (2) The requirement of sub-paragraph (1) shall not apply to a floor which separates a dwelling from another part of the same building if such part is used only occasionally for the inspection, maintenance or repair of the building, or of its services, fixed plant or machinery.
Impact sound (floors).	E3	(1) A floor above a dwelling which separates it from another dwelling or from another part of the same building which is not used exclusively with the dwelling, shall have reasonable resistance to impact sound. (2) The requirement of sub-paragraph (1) shall not apply to a floor which separates a dwelling from another part of the same building if such part is used only occasionally for the inspection, maintenance or repair of the building, or of its services, fixed plant or machinery.
Definitions for this Part.	E4	In this Part- "habitable room" means a room used for living or sleeping purposes but does not include a kitchen having a floor area of less than 6.5 m^2; "kitchen" means any room used primarily for the preparation or cooking of food or drink or the cleansing of utensils or appliances used in such preparation or cooking.

This Technical Guidance Document is divided into four sections.

Section 1 gives general information on sound.
Section 2 relates to the requirement in E1.
Section 3 relates to the requirements in E2 and E3.
Section 4 relates to requirements on similar construction.

Section 1
General

Sound

1.1 Sound is a form of energy which can be transmitted over a distance from its source through a medium, such as air or a solid element of construction e.g. a wall or a floor. For the purposes of Part E of the Second Schedule to the Regulations, the types of sound to be considered are airborne and impact sounds. In each case the sound may be transmitted directly or indirectly (flanking transmission) - (see Diagram 1).

1.2 The principal methods of isolating the receiver from the source of the sound are:

(a) eliminating pathways along which the sound can travel, and

(b) using barriers formed of materials of sufficiently high mass which will not easily vibrate.

In practice, sound insulation is usually achieved by using a combination of both methods.

1.3 This Document gives some guidance in relation to the achievement of reasonable sound insulation insofar as it relates to non-complex buildings of normal design and construction.

1.4 Walls and floors - The location of walls and floors which are required to have reasonable sound insulation are indicated in Diagrams 2 and 3.

Direct Transmission of Sound

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

The reduction in the level of airborne sound transmitted through a solid masonry wall depends on the mass of the wall - being heavy, it is not easily set into vibration. Walls with two or three leaves depend partly on their mass and partly on structural isolation between the leaves.

With masonry walls, the mass is the main factor but stiffness and damping (which turns sound energy into heat) are also important. Cavity masonry walls need at least as much mass as solid walls because their lower degree of stiffness offsets the benefit of isolation.

1.6 Floors should reduce airborne sound and also, if they are above a dwelling, impact sound. A heavy solid floor depends on its mass to reduce airborne sound and on a soft covering to reduce impact sound at source. A floating floor uses a resilient layer to isolate the walking surface from the base and this isolation contributes to both airborne and impact sound 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.

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

Flanking Transmission of Sound

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

Because a solid element may vibrate when exposed to sound waves in the air, it may cause sound waves in the air on both sides. Flanking transmission happens when there is a path along which sound can travel between elements on opposite sides of a wall or floor. This path may be through a continuous solid structure or through an air space (such as the cavity of an external wall). Usually, paths through structure are more important with solid masonry elements, while 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.

1.9 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

Diagram 1 **Sound transmission** *Par. 1.1*

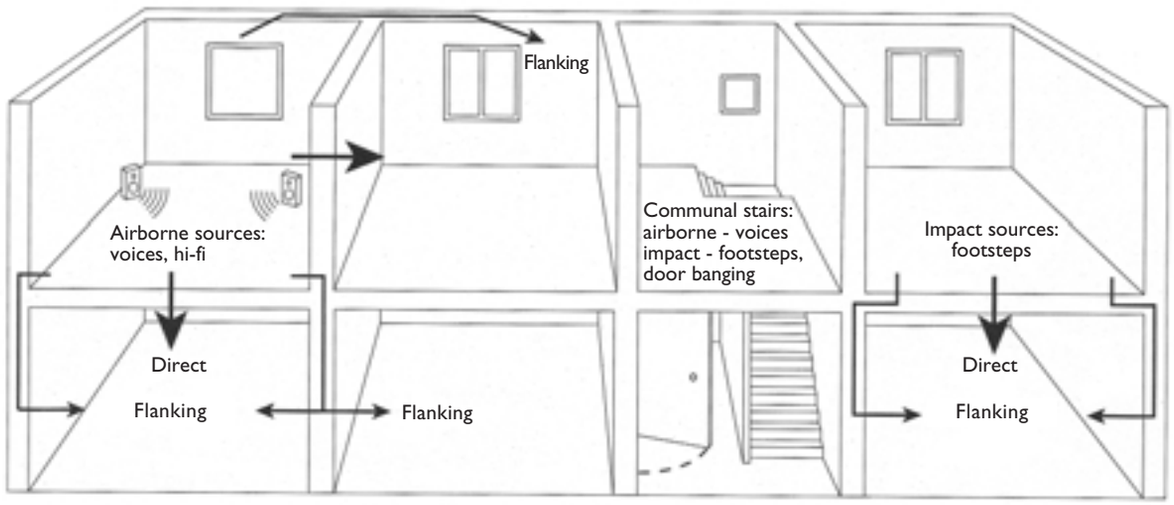


Diagram 2 **Sound resisting walls** *Par. 1.4*

SOUND RESISTING WALL (Airborne sound only)

Dwelling

Another dwelling or building

Habitable room

Another part of the same building which is not part of the dwelling.

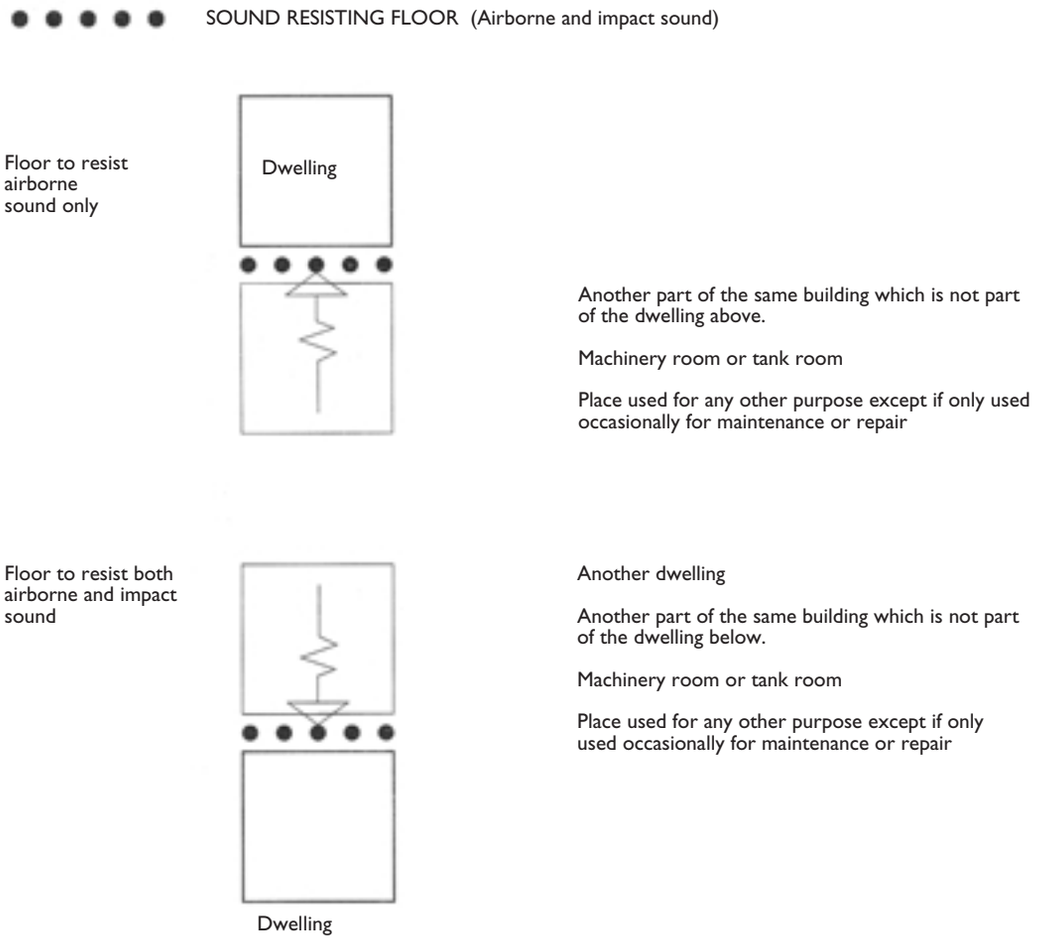
Machinery room or tank room

Place used for any other purpose except if used only occasionally for maintenance or repair

Any other room

Refuse chute in same building (see par. 2.5)

Diagram 3 **Sound resisting floors** *Par. 1.4*



over the ridge of the separating wall). The mass which is needed will be less if the path is blocked by non-porous material.

Special factors

1.10 In addition to the details of construction, matters such as the layout of rooms in a dwelling or the presence of steps or staggers between dwellings and adjoining dwellings or buildings are important factors to be considered. These must be taken into account when considering similar construction (see Section 4).

Section 2
Walls

Types of Wall

2.1 This Section describes widely used wall constructions as shown in Diagram 4.

Type 1
Solid masonry wall - The resistance to airborne sound depends mainly on the mass of the wall (see Diagram 5).

Type 2
Cavity masonry wall - The resistance to airborne sound depends mainly on the mass of the leaves and the degree of isolation provided by the cavity (see Diagram 7).

For both types, a selection of specifications for the wall itself is given and features to which special attention should be paid if the sound resistance is not to be greatly reduced are identified. The page opposite the specifications shows where the junctions between the wall and other parts of the construction are important and details some of the ways in which these junctions can be made (see Diagrams 6 and 8).

Mass of Masonry Walls

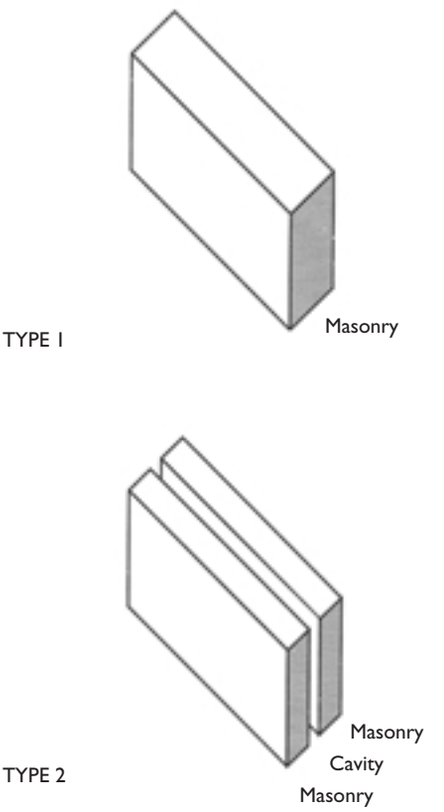
2.2 The mass of a wall is expressed in kilograms per square metre (kg/m^2).

2.3 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).

2.4 The density of a particular material may be taken from a current technical specification or from the manufacturer's trade literature.

2.5 Refuse chutes - A wall separating a habitable room and a refuse chute should have a mass (including any plaster finishes) of at least 1320 kg/m^2. A wall separating any other room which is in a dwelling from a refuse chute should have a mass (including any plaster finishes) of at least 220 kg/m^2.

Diagram 4 **Types of wall** *Par. 2.1*

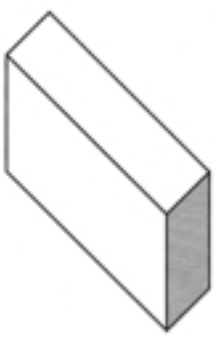


Timber Framed Separating Walls

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

Proprietary forms of construction underwritten by recognised testing houses, which include details of frame construction and connections, absorbent materials and linings to satisfy fire resistance, would be suitable methods of achieving the requirement of "reasonable resistance to airborne sound".

Diagram 5 **Wall type 1- solid masonry** *Par. 2.1*



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

POINTS TO WATCH

Fill the joints between the blocks or bricks with mortar, and seal the joints between the wall and the other parts of the construction (to achieve the mass and avoid air paths), including those behind plasterboard dry-linings.

Workmanship and detailing should be given special attention to limit the pathways between the walls and opposite sides of the sound resisting wall to reduce flanking transmission.

Plasterboard joints should be sealed.

SPECIFICATIONS

Specifications for common types of walls which will give suitable insulation against direct sound transmission are given opposite.

Constructional details showing how to limit flanking transmission between elements on opposite sides of the wall are given on the opposite page.

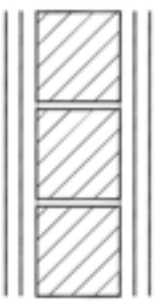
WALL SPECIFICATIONS

A concrete blockwork or concrete brickwork plastered on both faces

The average mass of the wall (including the plaster) should be at least 415 kg/m^2.
The thickness of the plaster should be at least 12.5 mm on each face.
Use blocks which extend to the full thickness of the wall, i.e. blocks laid on their flat.

Example
215 mm solid concrete block, 112.5 mm coursing, lightweight plaster; block density of 1860 kg/m^3 gives the required mass.

B concrete blockwork or concrete brickwork plastered on both faces, plasterboard dry-lining attached to plaster on both faces

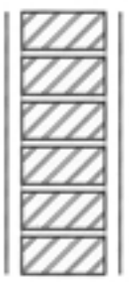


The average mass (including plaster and plasterboard) should be at least 415 kg/m^2. 12.5 mm plasterboard dry-lining attached directly to plaster (no cavity or air gaps). Use blocks which extend to the full thickness of the wall.

Example
215 mm block, 112.5 mm coursing lightweight plaster density of 1860 kg/m^3 gives the required mass.

Alternatively, block wall described above plastered on both sides with gypsum perlite plaster (or similar) not greater than 750 kg/m^3 with 12.5 mm plasterboard dry-lining fixed to battens.

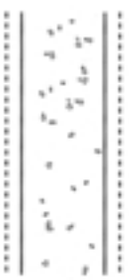
C clay brickwork plastered on both faces



The average mass of the wall (including the plaster) should be at least 375 kg/m^2.
The thickness of the plaster should be at least 12.5 mm on each face.
Lay the bricks in a bond which includes headers.

Example
215 mm brick, 75 mm coursing, lightweight plaster ; brick density of 1764 kg/m^3 gives the required mass.

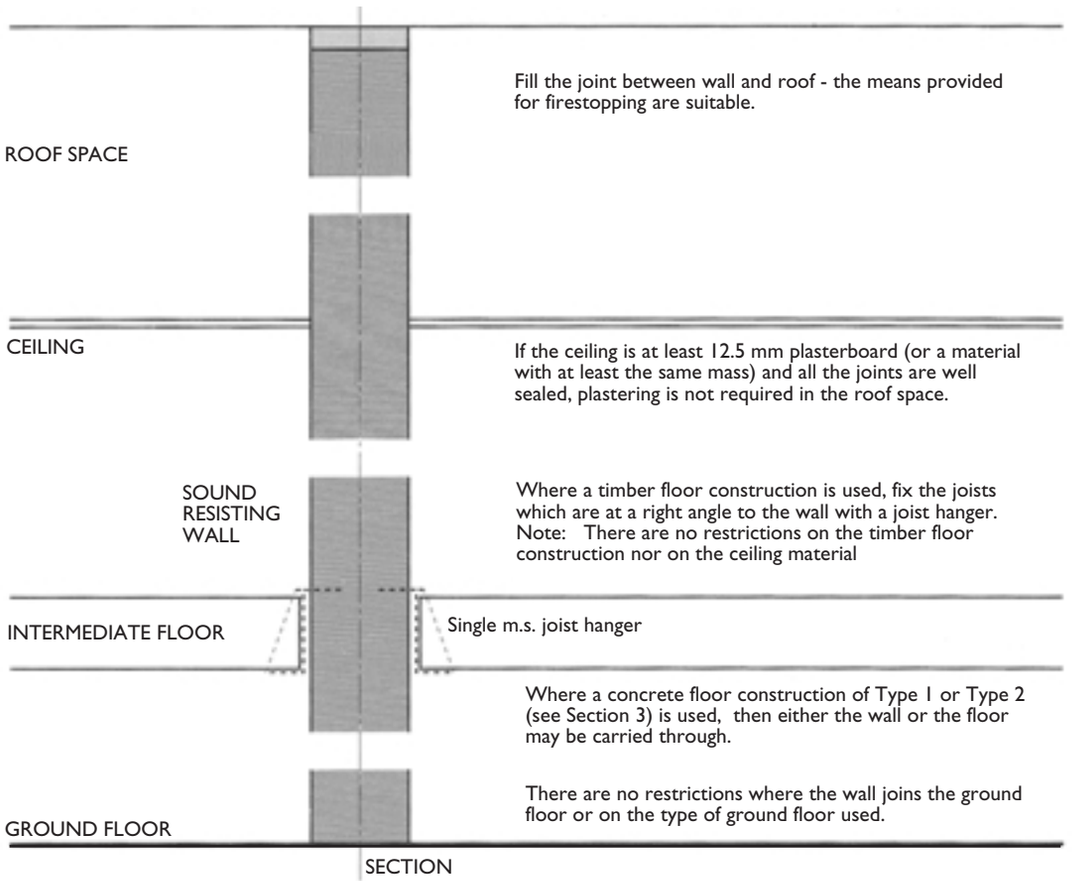
D dense concrete - minimum density 1500 kg/m^2 (in-situ or larger panels)



The average mass of the wall (including the plaster, if used) should be at least 415 kg/m^2.
Fill joints between panels with mortar.

Example
An unplastered wall of density 2200 kg/m^3; 190 mm thickness gives the required mass.

Diagram 6 **Key junctions in the construction - wall type 1** *Par. 2.1*



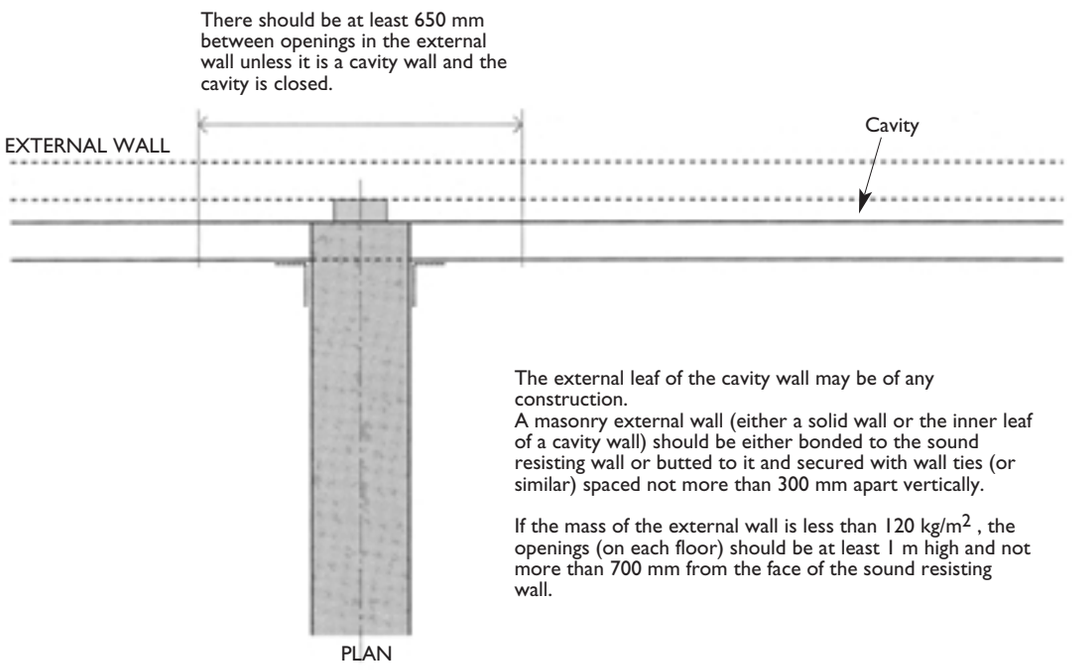
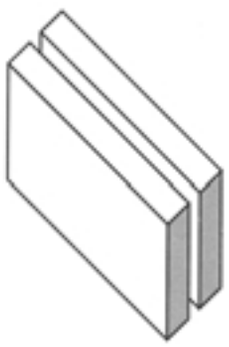


Diagram 7 **Wall type 2 - cavity masonry** *Par. 2.1*



The resistance to airborne sound depends mainly on the mass of the leaves and the degree of isolation provided.
In general, a cavity wall does not perform better than a solid wall of similar materials and mass.

POINTS TO WATCH

Fill the joints between the blocks or bricks with mortar and seal the joints between the wall and the other parts of the construction (to achieve the mass and to avoid air paths).

Maintain the separation of the leaves and space them at least 50 mm apart. Connect the leaves with butterfly pattern wall ties.

If a cavity in an external wall is completely filled with an insulating material other than loose fibre, care should be taken that the insulating material does not enter the cavity in the separating wall.

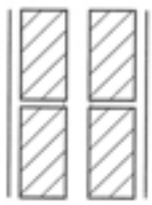
SPECIFICATIONS

Specifications for common types of wall are shown at A and B opposite.

Constructional details showing how to limit flanking transmission are given on the opposite page.

WALL SPECIFICATIONS

A two leaves of concrete blockwork or concrete brickwork plastered on the room faces



The width of the cavity should be at least 50 mm.
The average mass of the wall (including the plaster) should be at least 415 kg/m^2.
The thickness of the plaster should be at least 12.5 mm on each face.

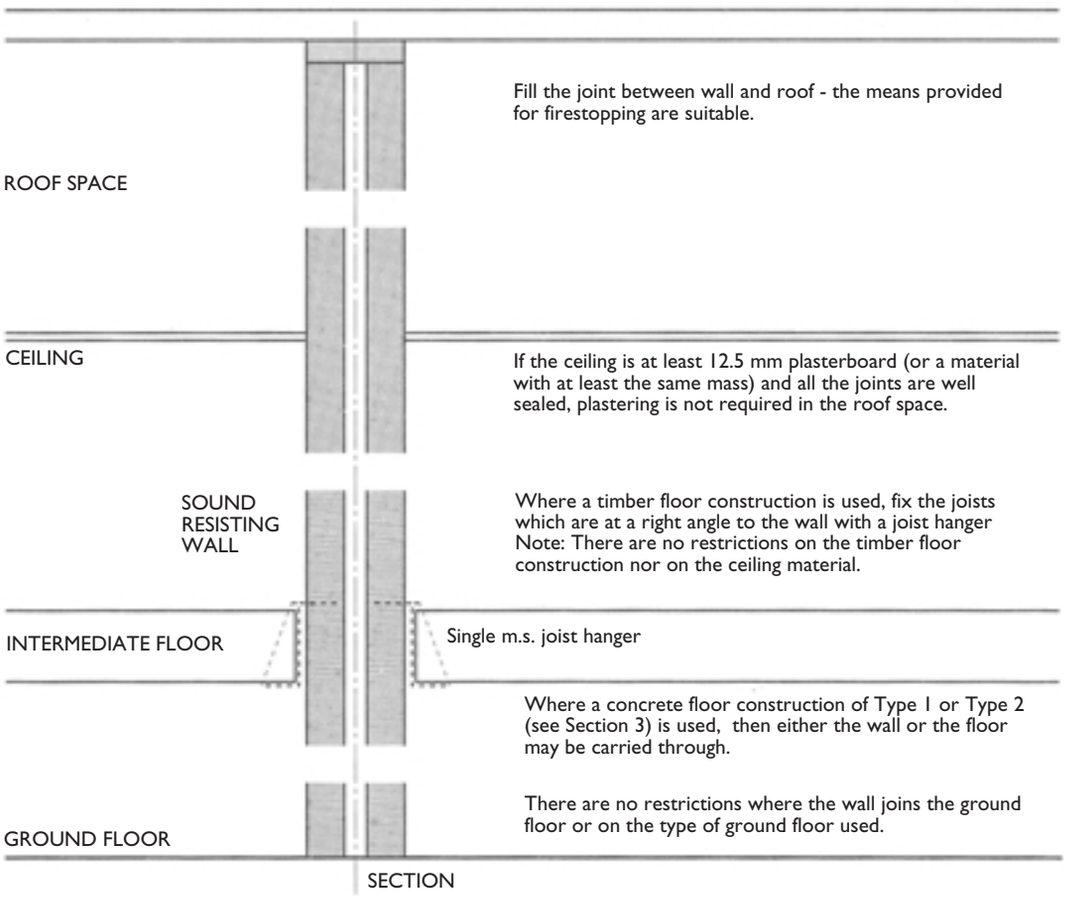
Example
102 mm leaves of concrete, 225 mm coursing, lightweight plaster; block density of 1965 kg/m^3 gives the required mass.

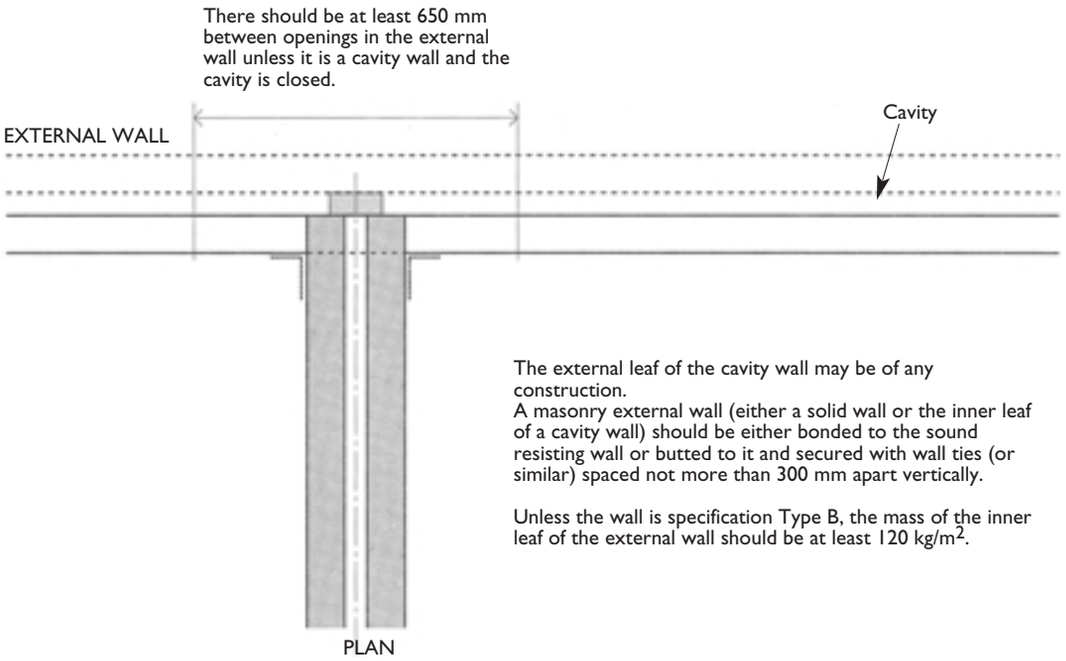
B two leaves of clay brickwork plastered on the room faces

The width of the cavity should be at least 50 mm.
The average mass of the wall (including the plaster) should be at least 375 kg/m^2.
The thickness of the plaster should be at least 12.5 mm on each face.

Example
102 mm leaves, 75 mm coursing, lightweight plaster; brick density of 1764 kg/m^3 gives the required mass.

Diagram 8 **Key junctions in the construction - wall type 2** *Par. 2.1*





Section 3
Floors

Types of Floor

3.1 This Section describes some of the more widely used floor constructions.

They are grouped into three main types, as shown in Diagram 9.

Type 1
Concrete base with a soft covering - The resistance to airborne sound depends on the mass of the concrete base. The soft covering reduces the impact sound at source (see Diagram 10).

Type 2
Concrete base with a 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 (see Diagram 12).

The floating layer also reduces the transmission of impact sound to the base and to the surrounding construction.

Type 3
Timber base with a floating layer - The resistance to airborne sound depends partly on the mass of the base with its pugging or absorbent blanket and partly on the mass of the floating layer (see Diagram 14).

The floating layer also reduces the transmission of impact sound to the base and to the surrounding construction.

A timber floor needs less mass than a concrete floor because the material is softer and radiates sound less efficiently.

3.2 For each type, a selection of specifications is given for the floor base and for the floating layer. Also identified are features to which special attention should be paid if the resistance is not to be greatly reduced.

The page facing the specifications shows where the junctions between the floor and the other parts of the construction are important and details how these junctions can be made (see Diagrams 11, 13 and 15).

Mass of Concrete Floors

3.3 The mass of a concrete floor is expressed in kilograms per square metre (kg/m^2).

3.4 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). The density of a particular material may be taken from a current technical specification or from the manufacturer's trade literature.

Diagram 9 **Types of floor** *Par. 3.1*

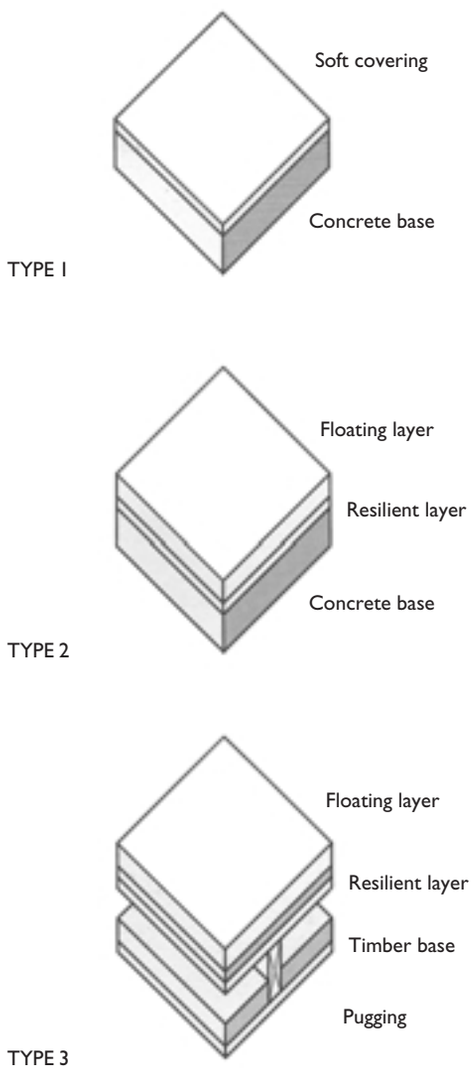
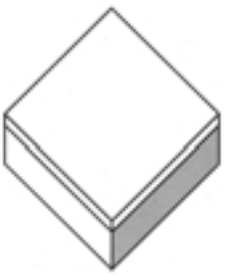


Diagram 10 **Floor type 1 - concrete base (with soft covering)** *Par. 3.1*



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

The mass of the floor should be calculated from the mass of the components and materials being used.

For insulation against airborne sound only, the soft covering may be omitted and any floor finish used. Leaving out any other part of the construction will make the insulation value inadequate.

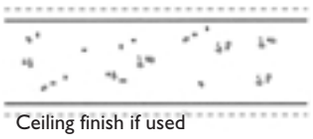
POINTS TO WATCH

Workmanship and detailing should be given special attention to limit the pathways between elements on opposite sides of the sound resisting floor to avoid flanking transmission.

FLOOR BASE SPECIFICATIONS

A SOLID CONCRETE SLAB (IN SITU)

Floor screed if used

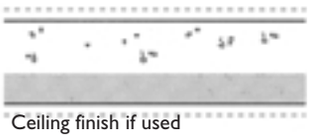


Ceiling finish if used

The average mass of the base (including any floor screed and any ceiling finish bonded to the concrete) should be at least 365 kg/m^2.

B SOLID CONCRETE SLAB WITH PERMANENT SHUTTERING

Floor screed if used

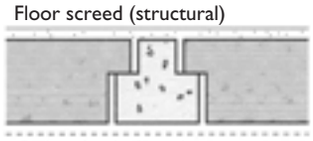


Ceiling finish if used

The average mass of the base (including the shuttering if it is solid concrete or metal, any floor screed and any ceiling finish bonded to the shuttering) should be at least 365 kg/m^2.

C CONCRETE BEAMS WITH IN FILLING BLOCKS

Floor screed (structural)

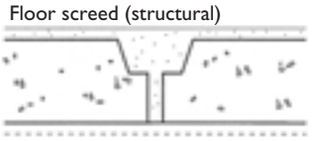


Ceiling finish if used

The average mass of the base (including the blocks if they are clay or concrete, floor screed, and any ceiling finish bonded to the beams or blocks) should be at least 365 kg/m^2.
Fill all joints between beams and blocks.

D CONCRETE PLANKS (SOLID OR HOLLOW)

Floor screed (structural)



Ceiling finish if used

The average mass of the base (including floor screed and any ceiling finish bonded to the beams) should be at least 365 kg/m^2.

Fill all joints between beams.

SOFT COVERING SPECIFICATIONS

Resilient material or a material with a resilient base is a material which returns to its original thickness after it has been compressed.

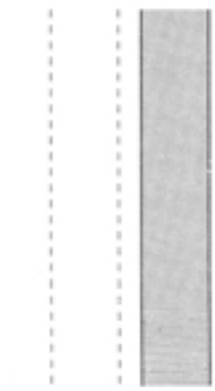
In general, the thickness of the material (including any backing) should be at least 4.5 mm to provide suitable resistance to impact sound transmission. However, where a floor covering having a weighted impact sound improvement (ΔLw) of not less than 17 dB, as calculated in Annex A to BS 5821 : Part 2 : 1984 (1993), is used, material of thickness less than 4.5 mm is suitable.

The soft covering should be bonded to the floor base.

IS/EN 429 : 1994 and BRE IP 9/88 contain further guidance relating to control and reduction of impact sound in buildings.

Diagram 11 **Key junctions in the construction - floor type 1** *Par. 3.2*

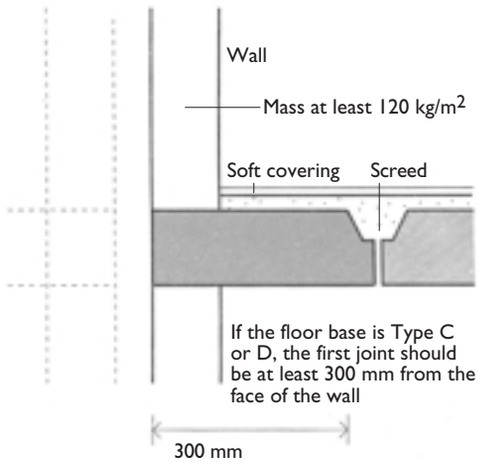
External wall - all types of floor base



The average mass of the external wall (or inner leaf of cavity wall) should be at least 120 kg/m^2 (including any plaster but not dry lining).

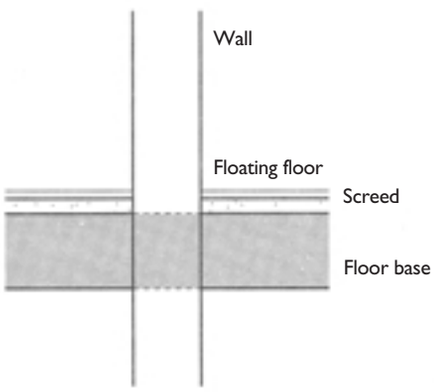
If the area of the openings in that wall is more than 20 per cent, there is no mass requirement.

Junction of floor with external wall or cavity separating wall



Where the floor meets an external wall or a cavity separating wall, the floor base and any structural screed should pass through whether it spans parallel with or at right angles to the wall. The cavity should not be bridged.

Junction of floor with sound resisting or internal solid wall

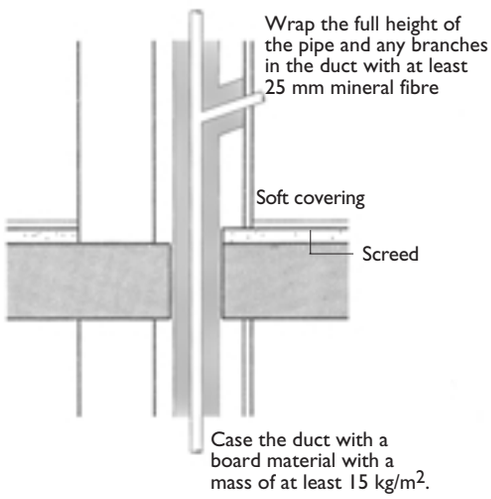


If the wall is a sound resisting or internal solid wall, with an average mass of less than 355 kg/m^2 (including any plaster finishes), the floor base including any structural screed should pass through.

If the wall is a sound resisting or internal solid wall with an average mass of 355 kg/m^2 or more, either the wall or the floor base including any structural screed may pass through. If the wall is passed through, tie the floor base to the wall and grout the joint.

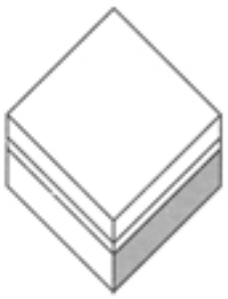
A structural screed is taken to be a concrete screed of 2350 kg/m^3 density and minimum characteristic strength equal of 30 N/mm^2.

Pipe (other than gas pipe) penetrating floor



Penetrations through a separating floor by ducts and pipes should also have fire protection in accordance with Technical Guidance Document B. Rigid contact between pipe and floor should be avoided.

Diagram 12 **Floor type 2 - concrete base (with floating layer)** *Par. 3.1*



The resistance to airborne sound depends mainly on the mass of the concrete base and partly on the mass of the floating layer.

The floating layer also reduces the transmission of impact sound to the base and the surrounding construction.

The mass of the floor should be calculated from the mass of the components and materials being used.

Any of the bases can be combined with either of the resilient layers and either of the floating layers.

POINTS TO WATCH

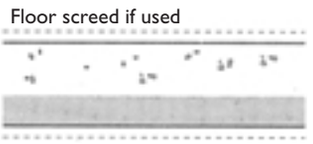
Workmanship and detailing should be given special attention to limit the pathways between elements on opposite sides of the sound resisting floor to avoid flanking transmission.

FLOOR BASE SPECIFICATIONS

A SOLID CONCRETE SLAB (IN SITU)

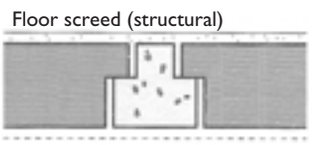
The average mass of the base (including floor screed and any ceiling finish bonded to the concrete) should be at least 220 kg/m^2.

B SOLID CONCRETE SLAB WITH PERMANENT SHUTTERING



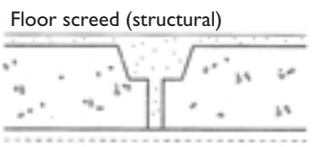
The average mass of the base (including the shuttering if it is solid concrete or metal, floor screed and any ceiling finish bonded to the shuttering) should be at least 220 kg/m^2.

C CONCRETE BEAMS WITH IN FILLING BLOCKS



The average mass of the base (including the blocks if they are clay or concrete, floor screed, and any ceiling finish bonded to the beams or blocks) should be at least 220 kg/m^2.
Fill all joints between beams and blocks.

D CONCRETE PLANKS (SOLID OR HOLLOW)

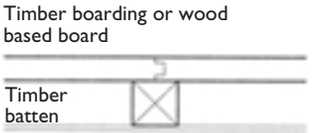


The average mass of the base (including floor screed, and any ceiling finish bonded to the beams) should be at least 220 kg/m^2.

Fill all joints between beams.

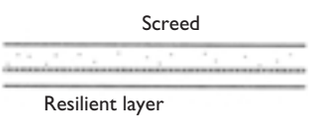
FLOATING FLOOR SPECIFICATIONS

E TIMBER RAFT



Timber boarding or wood based boards should be at least 18 mm thick and have tongued and grooved edges. Fix to 45 mm x 45 mm battens so that the nails do not go through the batten (to maintain isolation). Raft should be laid loose on a resilient layer.

F SCREED



65 mm cement sand screed with mesh underlay to protect the resilient layer while the screed is being laid.

RESILIENT LAYER SPECIFICATIONS

G FLEXIBLE MATERIAL

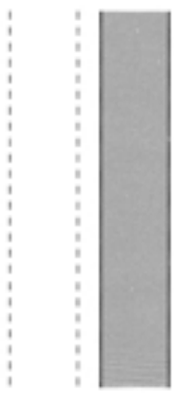
Mineral fibre with a thickness of at least 25 mm and a density of at least 36 kg/m^3.
Lay with rolls tightly butted (to avoid air paths)

H BOARD MATERIAL (ONLY FOR FLOOR SPECIFICATION F)

Pre-compressed expanded polystyrene 13 mm thick (impact sound duty grade).
Lay boards tightly butted (to avoid air paths).

Diagram 13 **Key junctions in the construction - floor type 2** *Par. 3.2*

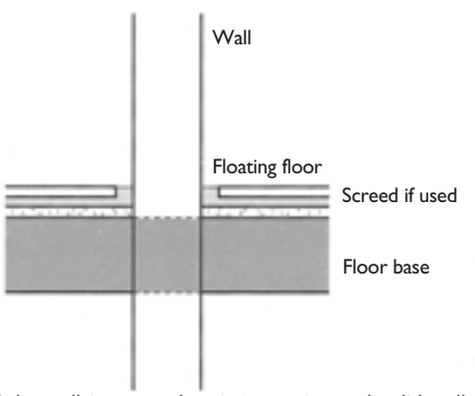
External wall - all types of floor base



The average mass of the external wall (or inner leaf of cavity wall) adjoining the floor should be at least 120 kg/m^2 (including any plaster but not dry lining).

If the area of the openings in that wall is more than 20 per cent, there is no mass requirement.

Junction of floor with sound resisting or internal solid wall

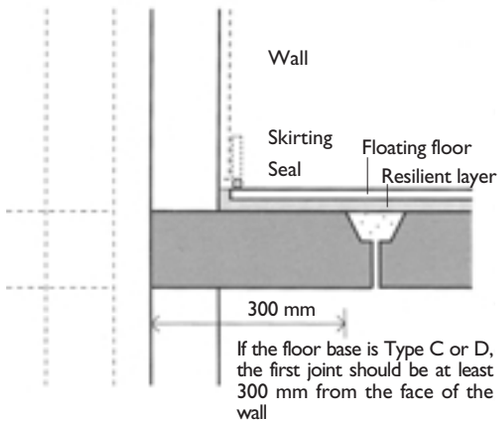


If the wall is a sound resisting or internal solid wall, with an average mass of less than 355 kg/m^2 (including any plaster finishes), the floor base including any structural screed should pass through.

If the wall is a sound resisting or internal solid wall with an average mass of 355 kg/m^2 or more, either the wall or the floor base including any structural screed may pass through. If the wall is passed through, tie the floor base to the wall and grout the joint.

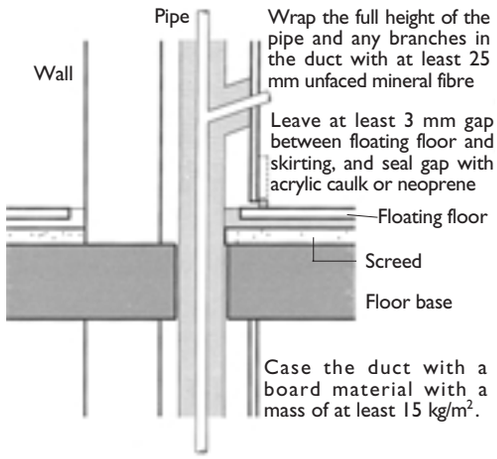
A structural screed is taken to be a concrete screed of 2350 kg/m^3 density and minimum characteristic strength equal of 30 N/mm^2.

Junction of floor with external wall or cavity separating wall



Carry the resilient layer up against the wall or isolate the floating floor.
Leave at least 3 mm gap between floating floor and skirting.
Where the floor meets an external wall or a cavity sound resisting wall, the floor base and any structural screed should pass through whether it spans parallel with or at right angles to the wall. Cavity should not be bridged.

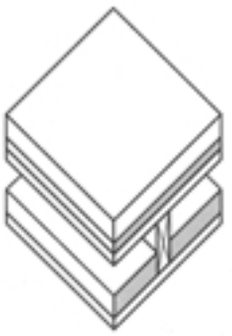
Pipe (other than gas pipe) penetrating floor



Whatever the mass of the wall, pass the floor base through.

Penetrations through a separating floor by ducts and pipes should also have fire protection in accordance with Technical Guidance Document B. Rigid contact between pipe and floor should be avoided.

Diagram 14 **Floor type 3 - timber base (with floating layer)** *Par. 3.1*



This type of floor is similar in concept to Floor Type 2 but the construction is entirely of timber.

Timber floors need less mass than concrete floors because the materials used radiate sound less efficiently.

The reduction of airborne sound depends partly on the structural floor and the absorbent blanket or pugging, and partly on the floating layer which reduces the transmission of impact sound to the floor and the surrounding construction.

POINTS TO WATCH

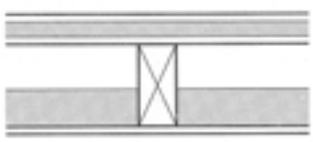
Workmanship and detailing should be given special attention to limit the pathways between elements on opposite sides of the sound resisting floor to avoid flanking transmission.

Care should be taken not to bridge between the floating layer and the base or surrounding walls (e.g. with fixing for or services which penetrate the resilient layer).

Take care that the nails fixing the timber of wood-based board layer do not go through the timber battens and pierce the resilient strip.

FLOOR BASE SPECIFICATIONS

A PLATFORM FLOOR WITH ABSORBENT MATERIAL



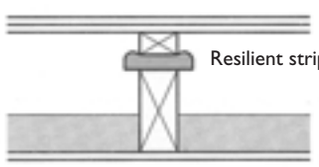
Floating layer
Resilient layer
Floor base

Absorbent material

Ceiling

Floating layer of at least 18 mm thick timber or wood-based board with tongue and grooved edges with all joints glued and spot bonded to substrate of at least 19 mm thick plasterboard, or material with at least the same mass, on resilient layer of at least 25 mm thick mineral fibre, density 60-80 kg/m^3.
Floor base of at least 12 mm thick timber or wood-based board deck nailed to timber joists with ceiling of at least 30 mm plasterboard in two layers with joints staggered and with an absorbent material of at least 100 mm thick mineral fibre laid on the ceiling.

B RIBBED FLOOR WITH ABSORBENT BLANKET



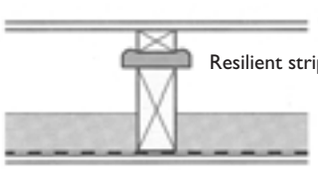
Floating layer

Absorbent blanket

Ceiling

Floating layer of at least 18 mm thick timber or wood-based board with tongue and grooved edges and all joints glued and spot bonded to substrate of at least 19 mm thick plasterboard, or material with at least the same mass, nailed to 45 mm x 45 mm timber battens placed over the joists. Resilient strip of at least 25 mm thick mineral fibre, density 80 - 140 kg/m^3 laid on joists.
Floor base of timber joists at least 50 mm (nominal) wide with ceiling of at least 30 mm plasterboard in two layers with joints staggered and with an absorbent blanket of at least 100 mm thick mineral fibre laid on the ceiling.

C RIBBED FLOOR WITH HEAVY PUGGING



Floating layer

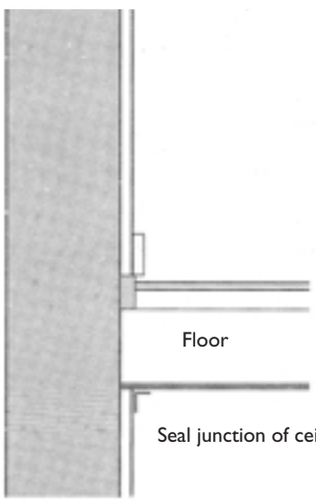
Pugging
Plastics sheet
Ceiling

Floating layer of at least 18 mm thick timber or wood-based board with tongue and grooved edges and all joints glued and nailed to 45 mm x 45 mm timber battens on a resilient strip of at least 25 mm thick mineral fibre, density 80 - 140 kg/m^3 laid on joists.
Floor base of timber joists at least 50 mm (nominal) wide with ceiling of at least 19 mm of dense plaster on expanded metal, or 6 mm plywood fixed under the joists plus two layers of plasterboard with joints staggered. Total thickness 25 mm and with pugging or dry sand or fine gravel with a mass at least 80 kg/m^2 laid on the ceiling on a polyethylene liner.

Diagram 15 **Key junctions in the construction - floor type 3** *Par. 3.2*

Junction of floor with heavy solid masonry (mass 355 kg/m^3 or more) external, internal or separating wall

Heavy masonry wall



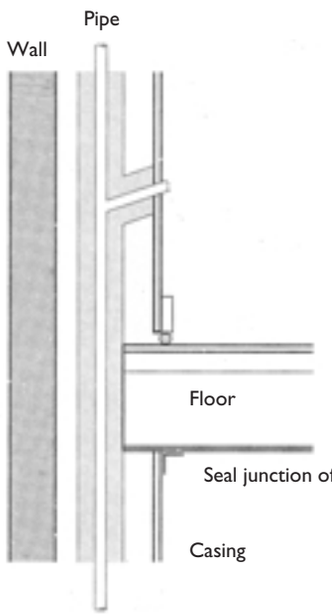
The wall finish may be plaster or dry lining.

Seal the gap between wall and floating layer with mineral wool or plastics foam strip.

Leave at least 3 mm gap between skirting and floating layer.

Use any method of connecting floors to wall, but on the separating wall, use m.s. joist hangers only.

Pipe (other than gas pipe) penetrating floor



Wrap the full height of the pipe and any branches in the duct with at least 25 mm unfaced mineral wool.

Case the duct with a board material with a mass of at least 15 kg/m^2.

Leave at least 3 mm gap between skirting and floating layer (or, alternatively, the floor base if the floor is Type A) and seal gap with acrylic caulk or neoprene.

Penetrations through a separating floor by ducts and pipes should be protected in acccordance with Technical Guidance Document - B. Rigid contact between pipe and floor should be avoided.

Section 4
Similar Construction

4.1 This Section describes methods by which a wall or floor, identical or similar to an existing construction, may satisfy the requirements in respect of airborne or impact sound resistance.

4.2 It will be necessary to show that the performance of the existing wall or floor is reasonable and that the existing and proposed design have sufficiently similar features.

Performance of the Existing Construction

4.3 The existing wall or floor should achieve the values given in Table 1 when the following test programme is carried out:

(a) test each wall or floor between at least four pairs of rooms. Each pair should include at least one habitable room, and

(b) take only one set of measurements between the rooms in each pair, and

(c) if both rooms in a pair are habitable rooms and one is larger, the sound source should be put in that room, and

(d) if one room in a pair is a non-habitable room, the sound source should be put in that room, and

(e) carry out the tests in accordance with the method given in

- BS 2750, Part 4: 1980 (1993) Field measurements of airborne sound insulation between rooms, and Part 7: 1980 (1993) Field measurements of impact sound insulation of floors

and determine the Standardised Level Differences (D_{nT}) for airborne sound transmission and Standardised Impact Sound Pressure Levels (L'_{nT}) for impact sound transmission, and

(f) calculate the Weighted Standardised Level Difference ($D_{nT,w}$) for airborne sound and the Weighted Standardised Sound Pressure Level ($L'_{nT,w}$) for impact sound as defined in BS 5821: Part 1: 1984 (1993) Method for rating the airborne sound insulation in buildings and of building elements, and Part 2: 1984 (1993) Methods for rating the impact sound insulation.

4.4 Table 1 gives the sound transmission values which should be achieved.

Similar Features

4.5 The sound insulation between walls on either side of a sound resisting 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 constructed in masonry, the positions of doors and windows may also be important in reducing flanking transmission.

4.6 For walls and floors, the following features in the proposed building should be similar to those in the existing building, but they do not need to be identical:

(a) the specification of the sound resisting walls and floors,

(b) the construction of other walls and floors adjacent to the sound resisting walls and floors,

(c) the general arrangement of windows and doors adjacent to the sound resisting wall or floor when in an external wall with a masonry inner leaf,

(d) the general shape and size of the rooms adjacent to the sound resisting wall.

4.7 For walls only, the extent of any step or stagger should be similar to that in the existing building. Where there is none in the existing building, one may be provided in the new building.

4.8 Tables 15 and 16 of BS 8233: 1987 Sound insulation and noise reduction for buildings, also give guidance in relation to wall and floor constructions and their sound insulation indices.

BRE Report 238 Sound control for homes 1993 also contains relevant guidance.

Table 1 **Sound transmission values**

Type of performance	Individual values	Mean values: Test in at least 4 pairs of rooms	Mean values: Test in at least 8 pairs of rooms
Airborne sound (minimum values)*	49 (walls) 48 (floors)	53 (walls) 52 (floors)	52 (walls) 51 (floors)
Impact sound (maximum values)**	65	61	62

Notes:

* Airborne sound - Weighted Standardised Level Difference ($D_{nT,w}$)

** Impact sound - Weighted Standardised Sound Pressure Level ($L'_{nT,w}$)

Allowable Differences

4.9 For walls and floors, the differences in the following can be allowed when considering paragraph 4.6:

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

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

4.10 For walls only, differences in the following can be allowed:

(a) the material and thickness of the flooring of a floor with a concrete base and a floating layer (Type 2) or a timber floor (Type 3) (see par. 3.1), and

(b) a small reduction in the size of step or stagger between dwellings in the proposed dwelling may be acceptable and an increase will be beneficial, and

(c) the type of timber floor where it is not a sound resisting floor.

4.11 Limits on the use of test evidence - The values in Table 1 are provided to enable an existing construction to be assessed before similar new construction is undertaken. A failure of 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.

Standards and other references

I.S./EN 429: 1994 Resilient Floor Coverings Determination of the Thickness of Layers

BS 2750 Measurement of sound insulation in buildings and of building elements Part 4: 1980 (1993) Field measurements of airborne sound insulation between rooms

BS 2750 Measurement of sound insulation in buildings and of building elements Part 7: 1980 (1993) Field measurements of impact sound insulation of floors

BS 5821 Methods for rating the sound insulation in buildings and of building elements Part 1: 1984 (1993) Method for rating the airborne sound insulation in buildings and of interior building elements

BS 5821 Methods for rating the sound insulation in buildings and of building elements Part 2: 1984 (1993) Method for rating the impact sound insulation

BS 8233: 1987 Code of practice for sound insulation and noise reduction for buildings AMD 6470

BRE Report 238 Sound control for homes 1993

BRE Information Paper IP 9/88 Methods for reducing impact sounds in buildings