BUILDING ACOUSTICS

Principles & Solutions Guide

isover.co.uk

ISOVER SAINT-GOBAIN

Introduction

48% of British people feel their home life is spoilt to some extent by noise*

*.GOV Noise Attitude Survey 2012

We are all sensitive to noise, whether at work or at home, alone or socially.

This well-known urban phenomenon causes numerous problems such as sleep disorders, stress or loss of concentration. Acoustic comfort is an essential element of the quality of life.

Isover has been conducting extensive research and development to achieve this goal for many years.

It is constantly improving and developing its products in order to enhance their performance and provide the best possible acoustic solution for the market.

To learn more visit: www.isoveracousticsolutions.co.uk

Contents

Understanding Sound & Noise

What is sound?

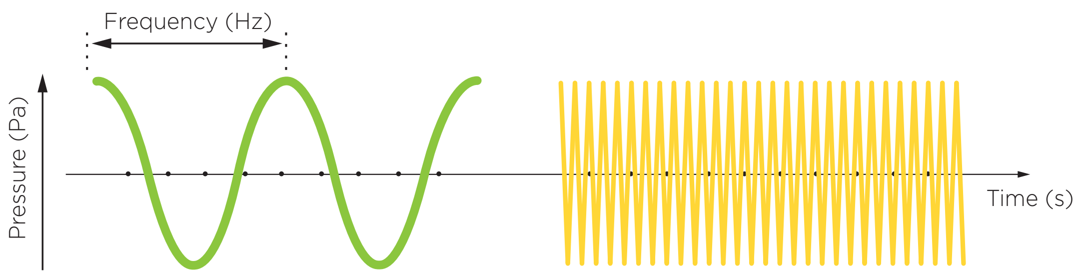
- Sound is an auditory sensation produced by an air pressure variation propagated in all ambient environments (water, air, gases, concrete, wood, glass, etc.) except in a vacuum.
- This sensation is perceived by our ear, from which the information is sent to the brain where it is analysed.
- In a building, sound can come from outside (road, rail or air traffic, or voices in the street), from equipment in the building, from neighbours or from ourselves.

Sound characteristics

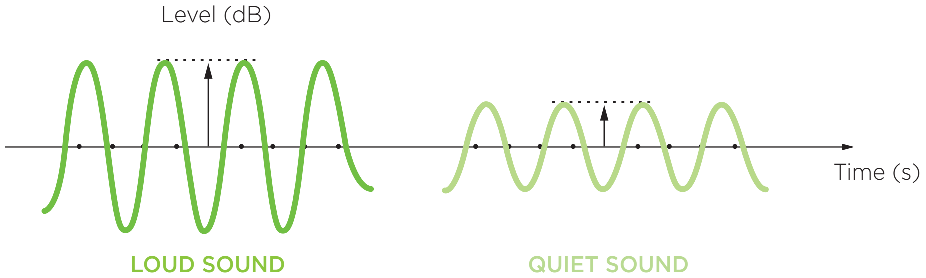
Sound is characterised by:

1. **ITS FREQUENCY**
2. **ITS SOUND LEVEL**
3. **ITS LENGTH**

1. **THE FREQUENCY** of a sound is the number of air pressure fluctuations per second and is expressed in Hertz (Hz). This frequency determines the pitch of the sound: a low frequency produces a deep sound, whereas a high frequency will give a high-pitched sound.



2 **THE SOUND LEVEL** characterises a sound's amplitude. A low amplitude produces a quiet sound; a high amplitude produces a loud sound. As the human ear has a very wide perception scale, in practice we use a logarithmic scale to represent the sound amplitude. This smaller scale is expressed in decibels (dB).



3 **LENGTH:** the ability to perceive a given sound varies depending on how long the sound is heard.

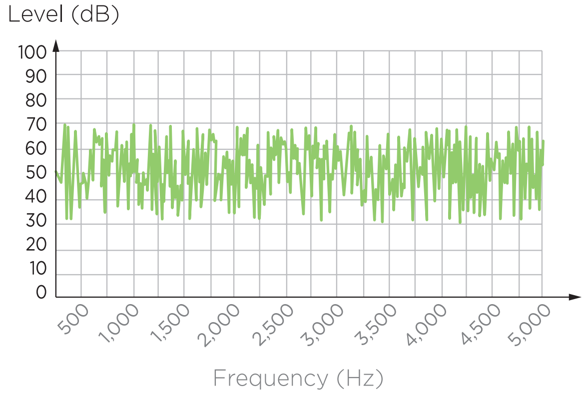
Noise and the human ear

Physically, a noise is a set of sounds of differing frequencies and power levels.

The human ear can detect sounds of frequencies between 20 and 20,000 Hz with various degrees of sensitivity depending on the frequency.

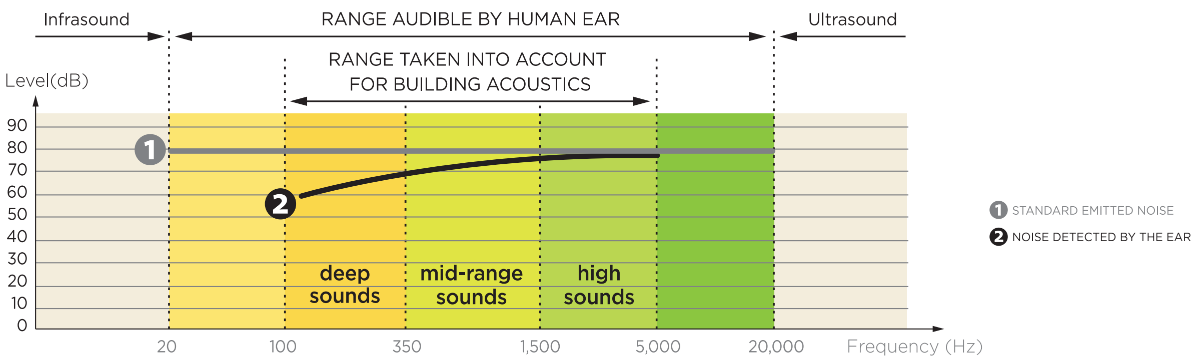
As a result, in some cases we use the dB(A), a scale representing more accurately the sensitivity of the human ear. The dB(A) scale minimises the sounds less easily noticed by the ear (notably deep ones) and, to a lesser degree, high-pitched sounds.

In terms of the sound level, the smallest variation liable to be detected by the ear is around 2–3 dB (A).



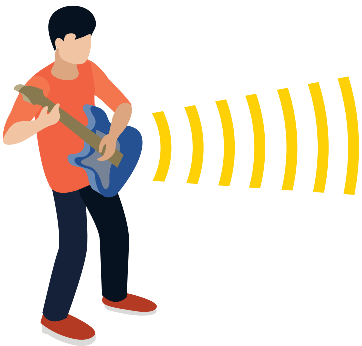
The noise spectrum represents the sound levels according to the frequency

In some cases, the regulations refer to this scale in order to take into account the "ear's sensitivity".

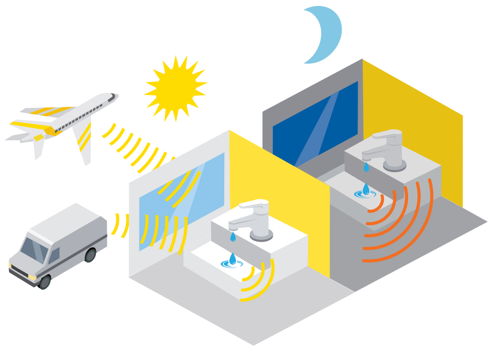


Understanding Sound & Noise

Physiologically, noise is a generally unpleasant or uncomfortable auditory sensation. This is a purely subjective concept. A noise may be perceived by a person as being a nuisance due to the length of time for which he or she is exposed to the noise, its appearance during a period of sleep or the memory associated with the noise.



Unwanted noise

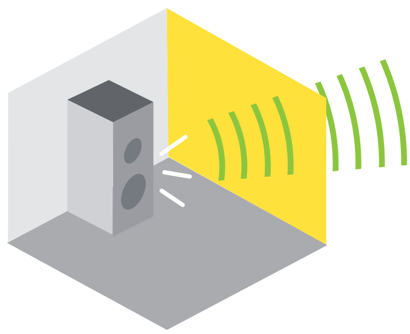


A noise hidden by other noises during the day might be disturbing at night

Cocktail effect: difficulty in understanding a conversation in a noisy internal environment, requiring the speaker to talk more loudly

Noises representing a danger or reminder

Exposure time



Filtering of noise: noises that are harmonious or acceptable when heard directly can become difficult to withstand when emitted behind a wall (filtering certain frequencies)

Noise level addition rules

As the sound level is expressed using a logarithmic scale, in decibels (dB), arithmetic addition rules do not apply to noise levels.

If the noise levels are similar (difference < 10dB):

If the noises are similar, the resulting noise level is evaluated by adding the value provided in the following table to the louder noise:

Difference between two sound levels (in dB)	0	1	2	3	4	5	6	7	8	9
Value to be added to the highest level (in dB)	3.0	2.6	2.1	1.8	1.5	1.2	1.0	0.8	0.6	0.5

83dB + 83dB ≠ **166dB** but **86dB**

83dB + 87dB ≠ **170dB** but **88.5dB**

If the noise levels are very different:

If the difference between the sound levels is at least 10 dB, the louder noise hides the weaker noise.

95dB + 80dB = **95dB**

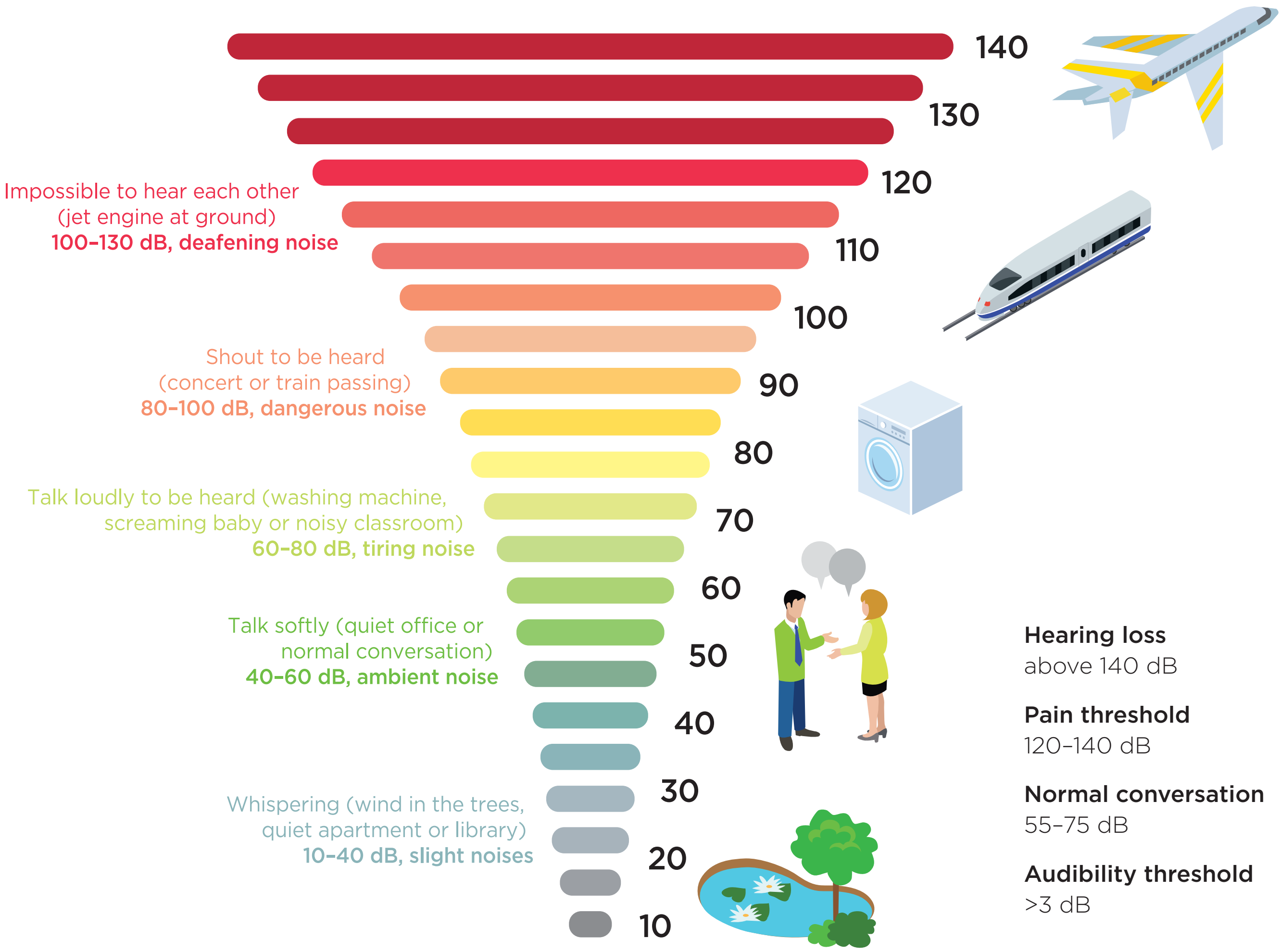
Understanding Sound & Noise

Noise sources

There are four noise sources in the building acoustics domain:

1. **Airborne noise from external sources: road, rail or aircraft noise, voices in the street, etc.**
2. **Airborne noise from internal sources: conversations, Hi-Fi, television, etc.**
3. **Impact noise: movements of people or furniture, falling objects, etc.**
4. **Equipment noise: elevators, valves, ventilation fans, etc.**

Noise level scale



Noise can cause cognitive disorders:

Increased tiredness and level of stress. As a result, recovery periods in a calm, quiet location are required.

Noise can directly affect personal health, depending on its intensity and exposure time:

This can consist of sleep disorders, effects upon the cardiovascular system (rapid heartbeat and raised blood pressure) and impaired hearing acuity.

Calm is a source of well-being.

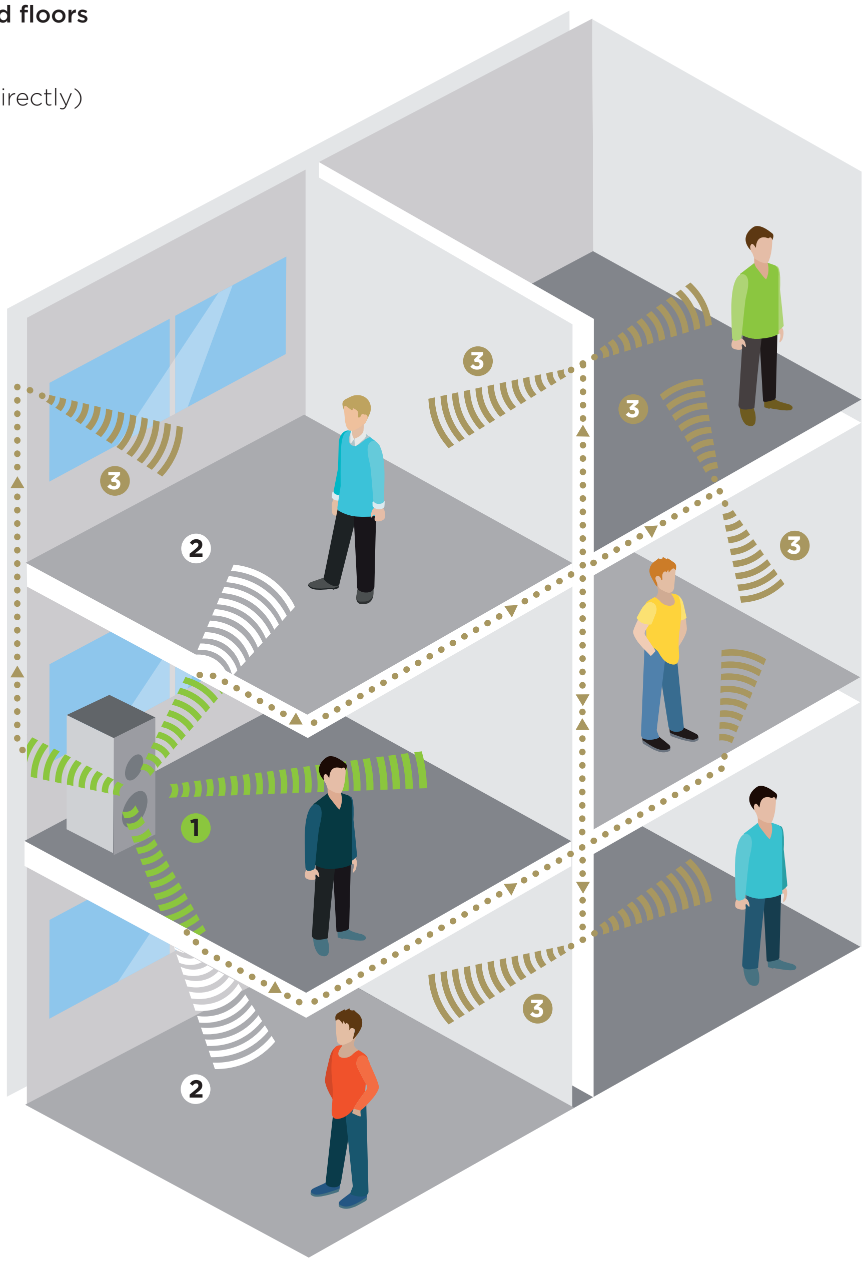
Building Acoustics

Passage of sound

There are three ways sound can pass through the fabric of a building.

1. **Direct emission**
2. **Direct transmission through walls and floors**
3. **Indirect transmission through walls and floors**

To reduce the transmission through walls, partitions, floors or ceilings (directly or indirectly) we implement a sound insulation solution.



Sound insulation

The aim of acoustic insulation is to reduce noise transmission from one room to another. As a result, the noise is reduced and comfort improved.

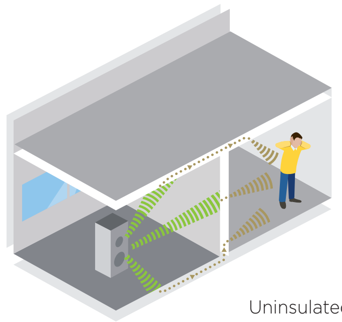
Three types of noise can be reduced by means of sound insulation:

1. **Airborne noise**
2. **Impact noise**
3. **Equipment noise**

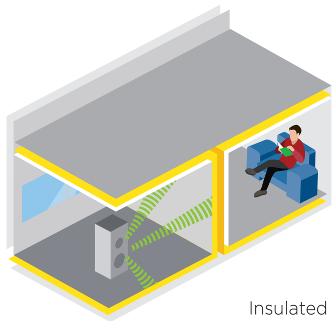
The acoustic performance expected from a room, in relationship to its neighbouring rooms, is achieved through insulation.

It depends on three parameters:

- The acoustic properties of the products and systems used
- The techniques implemented and the installation quality
- The architectural context: junctions between walls and structural materials used.



Uninsulated walls



Insulated walls

1. Airborne noise

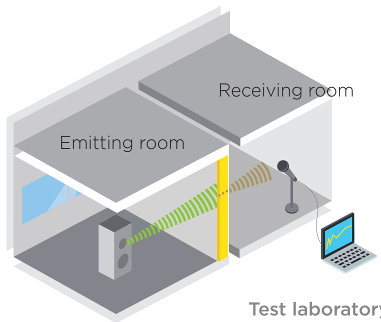
Two values are used to estimate sound insulation performance against airborne noise (in dB):

Sound Reduction Index (laboratory measurement):

R measures the quantity of sound stopped by the wall, taking into account solely direct transmission, at each frequency f (in Hz).

The overall value of the Sound Reduction Index is given by the index R_w.

The higher R_w is, the better the wall's sound insulation.



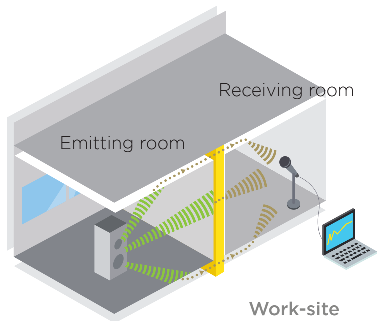
Test laboratory

Standardized level difference (field measurement):

D_{nT} measures the quantity of sound stopped between two rooms, taking into account all transmission (direct, lateral and parasite). The insulation D_{nT} varies depending on the frequency f (in Hz).

The overall value of the sound insulation is given by the index $D_{nT,w} + C_{tr}$.

The higher the $D_{nT,w}$ value, the more effective the insulation between the two rooms.



Work-site

Building Acoustics

2. Impact noise

It is important to handle impact noise from one room to another (footsteps on a floor or objects falling on the floor, for example), another source of discomfort in a room.

Direct transmission through the floor is often the main factor. However, the sound can also be transmitted through other walls, depending on their type and junctions.

1 Direct transmission through the floor
2 Indirect transmission through walls and floors

The regulatory value relating to impact noise is the Weighted Standardized Impact Sound Pressure Level $L'_{nT,w}$ (in dB).

This measurement is performed in the field, by using a standard tapping machine.

The lower the value is, the less the noise is noticed in the next room.

We often speak of the ΔL_w (or impact sound insulation improvement) to evaluate the performance of an insulated and uninsulated floor.

This value is the measured difference between an insulated and uninsulated floor.

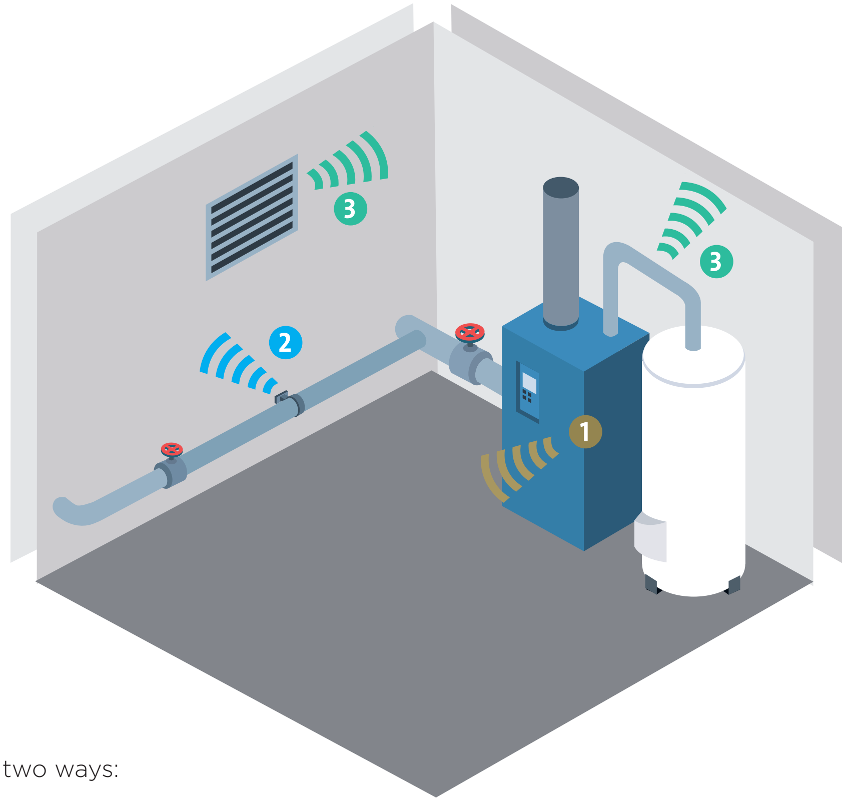
The result represents a product (or system) only in terms of direct transmission.

The higher the ΔL_w value, the more the insulation system attenuates impact noises.

3. Equipment noise

A building's equipment may be occasionally or continuously annoying and have different acoustic impacts in the building:

1. **The equipment may emit noise when operating, which we try to minimise (through insulation or absorption). An example of this is ventilator or motor noise.**
2. **The joint between the equipment and the mounting on which it is fixed can transmit this sound to other rooms. We then try to isolate the equipment from the mounting in order to reduce the vibrations.**
3. **Noise can radiate through pipes lines or ventilation ducts (in the case of ventilation ducts, for example, or noise in ducts).**



It is possible to act in two ways:

1. By reducing the noise generated by the equipment

A device's sound level, L_W in dB(A), is determined under laboratory conditions.

The lower the value L_W, the quieter the device.

2. By reducing the transmission of the noise emitted

The normalised sound pressure level , L_{nAT} in dB(A), represents the noise in a room when a device is operating.

The lower the value L_{nAT}, the quieter the device in the room.

Building Acoustics

Measuring airborne and impact noise

Below is a useful summary of the measurements and testing methods for airborne and impact noise across various applications.

Noise Source	Building Element	Performance Evaluation	Measurement	Laboratory or site
Airborne	Internal wall	Noise difference between two rooms	dB (R_w)	Laboratory
Airborne	Internal floor	Noise difference between two rooms	dB (R_w)	Laboratory
Airborne	Separating wall (England & Wales)	Noise difference between adjoining dwellings	dB ($D_{nT,w}+C_{tr}$)	Site
Airborne	Separating wall (Scotland)	Noise difference between adjoining dwellings	dB ($D_{nT,w}$)	Site
Airborne	Separating floor (England & Wales)	Noise difference between adjoining dwellings	dB ($D_{nT,w}+C_{tr}$)	Site
Airborne	Separating floor (Scotland)	Noise difference between adjoining dwellings	dB ($D_{nT,w}$)	Site
Impact	Separating floor (England & Wales)	Noise difference between adjoining dwellings	dB ($L'_{nT,w}$)	Site
Impact	Separating floor (Scotland)	Noise difference between adjoining dwellings	dB ($L'_{nT,w}$)	Site

More information

The following standards provide more information on the definition and measurement of these values:

Airborne sound insulation: BS EN ISO 10140-1, BS EN ISO 10140-2 and BS EN ISO 717-1

Impact sound insulation: BS EN ISO 10140-1, BS EN ISO 10140-3 and BS EN ISO 717-2

Airborne, impact and service equipment sound insulation (field measurements): BS EN ISO 10052

Achieving effective airborne sound insulation

Combating airborne noise is a two-stage process:

- Identifying the noise sources
- Treating the partition wall effectively by taking into account the frequencies emitted

Solid wall behaviour: the Mass Law

Principle:
Solid walls are composed of a single material. Their acoustic performance varies depending on its nature and surface weight. In this particular case, the heavier and thicker the wall, the better the sound insulation.

What performance do solid walls offer?
The critical frequency (frequency at which the sound insulation is the lowest) must be below 100 Hz for the wall to be acoustically effective.

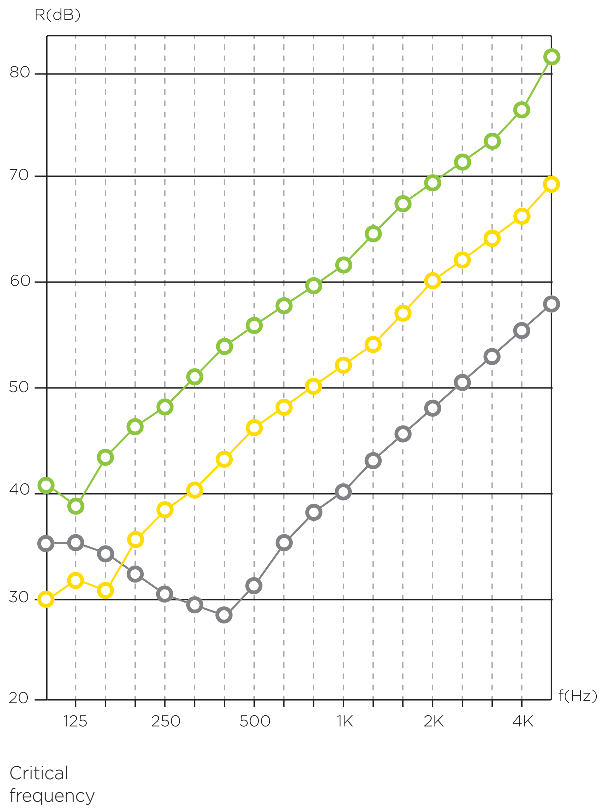
This frequency can be reduced by increasing the thickness of the solid wall.

ATTENUATION INDEX

- 10 cm concrete
- 16 cm concrete
- 10 cm gypsum board

	10 cm gypsum board	10 cm concrete	16 cm concrete
R_w $(C;C_{tr})$	38(-1 ;-3)	49(-2 ;-7)	59(-2 ;-6)

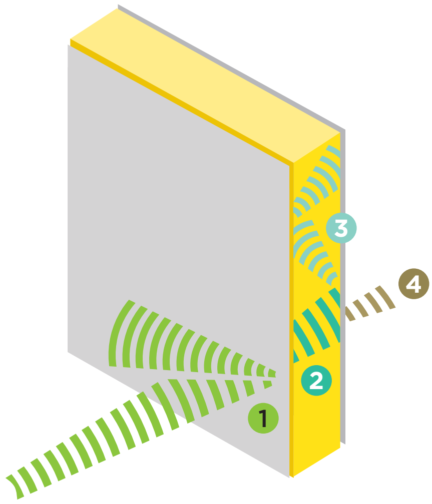
Increasing the concrete thickness from 10 to 16 cm increases the sound inpedance at all frequencies by around 10 dB. Changing the material also affects the attenuation by switching from a gypsum board 10 cm thick (surface weight 100 kg/m²) to concrete of the same thickness (surface weight 220 kg/m²) reduces the critical frequency from 400 Hz to 100 Hz while increasing the wall sound insulation.



More information on solid walls

According to an experimental law called the Mass Law, the Sound Reduction Index of solid walls varies with the frequency. The critical frequency is the frequency at which the wall's sound insulation is the lowest. Beyond this frequency, the attenuation index increases linearly.

Building Acoustics



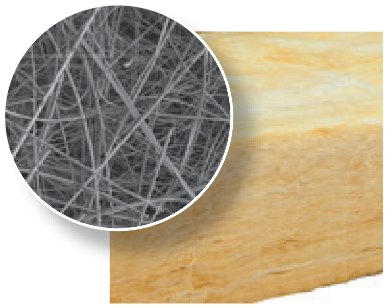
Mass-spring-mass systems and the effect of Isover mineral wools

Principle:

To optimise the acoustic performance of walls and reduce their weight and thickness, single frame partition systems may be used.

These are composed of two solid materials (often plasterboard) separated by a cavity.

In order to improve the sound insulation, the cavity between the two solids is filled with an acoustic mineral wool.



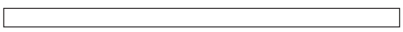
These partitions respect the so-called "mass-spring-mass" principle:

1. **The first solid serves as a mass: it reflects a part of the noise and allows the rest to pass.**
2. **The remaining noise is transmitted into the acoustic mineral wool, which absorbs it and so reduces the amplitude of the waves.**
3. **The second solid again reflects part of the noise back into the mineral wool (which absorbs more noise).**
4. **It finally transmits the attenuated noise into the adjoining room.**

Isover acoustic mineral wools are excellent sound absorbent materials. Thanks to its open-cell, porous structure, it traps the sound energy and dissipates it within its thickness.

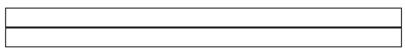
In practice:

Thanks to the mass law, the acoustic performance of a partition can be increased simply by adding mass to the system. As a general rule doubling the mass gives a 5-6dB reduction in sound transmission. However, in a building it is not always practical or cost effective to increase mass to deliver the required acoustic performance. Therefore, in real world terms mass-spring-mass systems are a much easier route to deliver increased acoustic comfort.



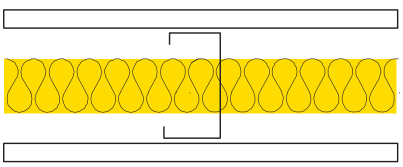
Single layer 12.5mm Plasterboard

25 dB (R_w)



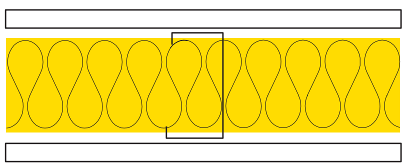
Double layer 12.5mm Plasterboard

30 dB (R_w)



70mm Metal Stud Wall with 25mm APR 1200
& 12.5mm Plasterboard

42 dB (R_w)



70mm Metal Stud Wall with 50mm APR 1200
& 12.5mm Plasterboard

43 dB (R_w)

Achieving proper impact sound insulation

Recommended action

In order to achieve the most effective floor insulation against impact noise, handling the noise at its source is recommended.

Treating the floor in the room in which the impacts occur is also recommended. This is done by separating the supporting structure from the finished floor, thereby reducing lateral transmission and ensuring that direct impact noise is partly absorbed by the insulating material between the two elements.

Due to its absorbency, mineral wool provides effective isolation between the screed and the concrete slab, for example. In this case, the mineral wool provides the mechanical link between the two claddings, serving as a spring to act as an intermediate or as spacing material that actively helps to increase the acoustic insulation.

The insulation used in this case must therefore be sufficiently absorbent to serve as a spring, yet sufficiently dense to ensure proper mechanical behaviour in the screed or load distribution surface. The insulating material's spring effect is characterised by its dynamic stiffness.

Supplementary action

If it is impossible to handle the noise when emitted, systems should be used to limit direct noise transmission (floor underlay) and indirect noise transmission (wall treatment). The best result is achieved by combining both actions.

Recommended action

Direct treatment of floor insulation

Further action

Direct and indirect treatment (ceiling and walls)

Building Acoustics

Acoustic correction

As well as reducing sound transmission through a partition, it may be useful to reduce or control sound propagation within a room.

This is the role of acoustic correction. This uses the sound absorption concept to reduce the amount of sound reflected by the surrounding partition.

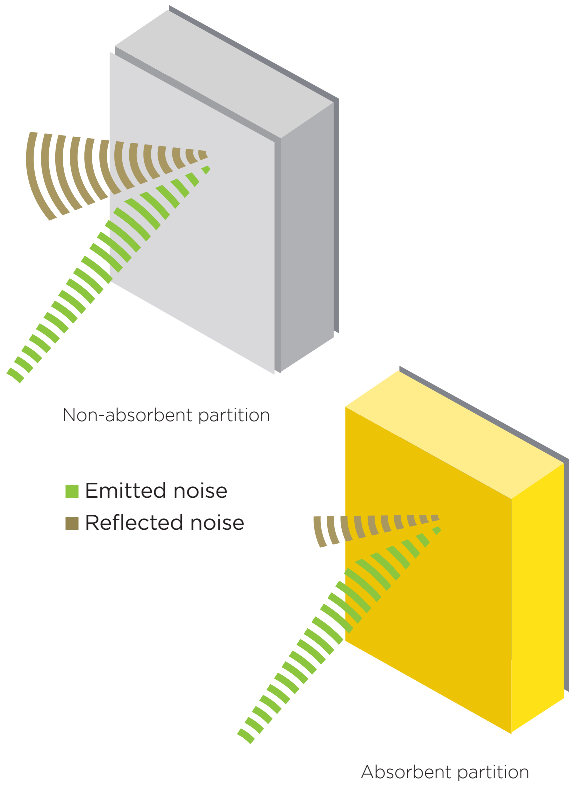
Acoustic correction reduces reverberation and so controls the sound level and optimises listening quality throughout the room (classroom, for example) and improves speech intelligibility.

Absorption coefficient

The absorption of insulating materials is characterised by an absorption coefficient, rated α_w. This coefficient is between 0 and 1.

The closer α_w is to 1, the more absorbent the material. On the contrary, the closer α_w is to 0, the less absorbent the material — in other words, the more it reflects noise in the room.

Isover acoustic glass wool, which is inherently porous, is an excellent sound absorbent material. Rigid insulating materials or surfaces have a lower absorption coefficient.



More information

α_w is a single coefficient that takes into account all frequencies and is deduced from the absorption measurements at various frequencies, in accordance with the BS EN ISO 354 standard. These frequency-related measurements are rated αs (Alpha Sabine) to avoid confusion and can take values greater than 1. The calculation of α_w is described in the BS EN ISO 11654 standard.

To be more specific, the sound absorption of porous materials depends on many parameters:

- Thickness: a greater thickness will have a significant positive effect upon the absorption of low frequencies
- Material airflow resistance: a higher AFr value will significantly increase absorption
- Material porosity and structure: the characteristics of mineral wool including non-fiberised content will be worse than those of mineral wool not including such particles.

Equivalent absorption area

The equivalent absorption area defines the absorbing power of a room and is expressed in m^2.

The higher this value, the more the room's walls absorb sound energy and the less the room echoes.

This area is calculated from the different wall surface areas multiplied by their respective sound absorption coefficients.

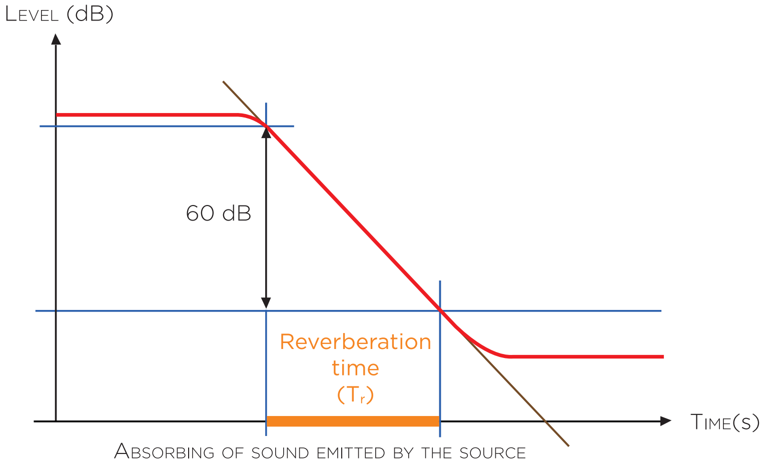
$A = \sum S_i.\alpha_i$

Surface area to treat	Absorption area fixed by the regulations (¼ of the floor area in collective housing)	Absorption coefficient α_w of the insulating material used	Equivalent area of absorbent insulating material to be used
$20m^2$	$5m^2$ (¼ of $20m^2$)	0,2	$25m^2$ (i.e., 5/0.2)
$20m^2$	$5m^2$ (¼ of $20m^2$)	0,9	$5{,}5m^2$ (i.e., 5/0.9)

The presence of acoustic glass wool behind a surface of which more than 20% of the surface area is perforated, offers an effective acoustic solution for providing acoustic correction, due to the high absorption coefficient of the wool (nearly 1).

Reverberation time

A room's resonance effect is represented by the reverberation time. This time, noted T_r is the time needed for the power of a noise to decrease by 60 dB from its initial value.



This reverberation time:

- varies depending on the frequencies,
- increases with the room's volume,
- decreases when the absorption area increases (furnished or unfurnished room),
- decreases when the absorption of the materials increases (room with or without carpet).

As a result, the more the room contains absorbing materials, the shorter the reverberation time.

Building Acoustics

A moderate reverberation time (of around a second) provides good speech intelligibility and comfortable listening. Its ideal value will therefore depend on the intended use of the room.

Activity	Typical Reverberation time
Bedroom or lounge	0.6 s
Recording studio	0.25 s to 0.9 s
Classroom or courtroom	0.5 s to 1.2 s
Office (open-plan)	0.6 s
Cinema	0.8 s to 1.2 s
Multipurpose hall	1 s to 1.5 s
Church or cathedral	2 s to 4 s

More information

The reverberation time is linked to the room volume and equivalent absorption area. In the case of simple room: $T_r = 0.16.V/A$ where V is the volume of the room and A is the equivalent absorption area of its walls.

For example: a $75m^3$ room with a $10m^2$ equivalent absorption area => $T_r = 0.16*75/10 = 1.2$ s

Index summary

Acoustic correction of buildings	
Weighted absorption coefficient	α_w
Room equivalent absorption area	A in m^2
Reverberation time	T_r in seconds

Choosing the right insulation solution

Before beginning any project, certain simple questions must be considered in the case of both new and renovation sound insulation projects.

Building structure

It is essential to consider the dimensions of floors, including the additional thickness of the implemented acoustic treatment solution, as early as the overall preliminary project stage.

The acoustic performance of floors is fixed for the entire life of the building. The solutions you choose can no longer be modified, particularly in the case of new buildings. Once built, the ceiling height — which is often 2.5 m in residential premises — can no longer be changed.

1. **Take into account the nature of the noises involved (impact noise, internal and external airborne noise and equipment noise)**
2. **Take into account direct and indirect noise transmission**
3. **Insulate the rooms by means of suitable sound insulation solutions for the construction context**
4. **Handle acoustic comfort within a room by means of suitable acoustic correction solutions**

New buildings

1. **Check the regulations applicable to the rooms to be treated**
2. **Aim for performance levels that exceed the actual requirements in order to take into account lateral losses and ensure occupant comfort**
3. **Choose the construction principles according to the required performance levels and building structure**
4. **Define the most suitable system for each application**

Renovated buildings

1. **Identify the nature of the noise (airborne noise coming from within or outside the building, impact noise or equipment noise)**
2. **Identify the walls to treat for noise transmission**
3. **Identify their nature: which material, and which joints with adjoining walls**
4. **Choose the insulation solution best suited to the objectives that ensure occupant comfort.**

Note:
It is recommended to choose insulation solutions with proven acoustic performance, such as any Isover acoustic insulation solution which has been tested as part of a system.

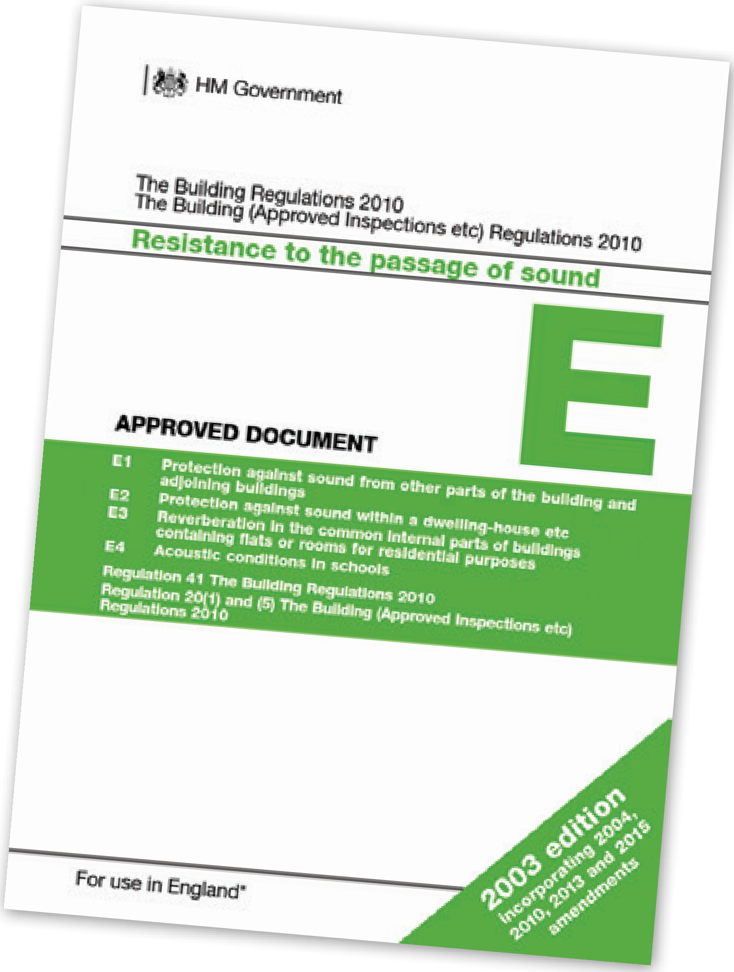
Acoustic Regulations

Summary of regulations

Acoustic regulations vary according to building type, as well as in terms of location (Scotland's regulations differ to those in England & Wales). Here is a useful summary of the regulations that are in place for residential buildings for both England, Wales & Scotland.

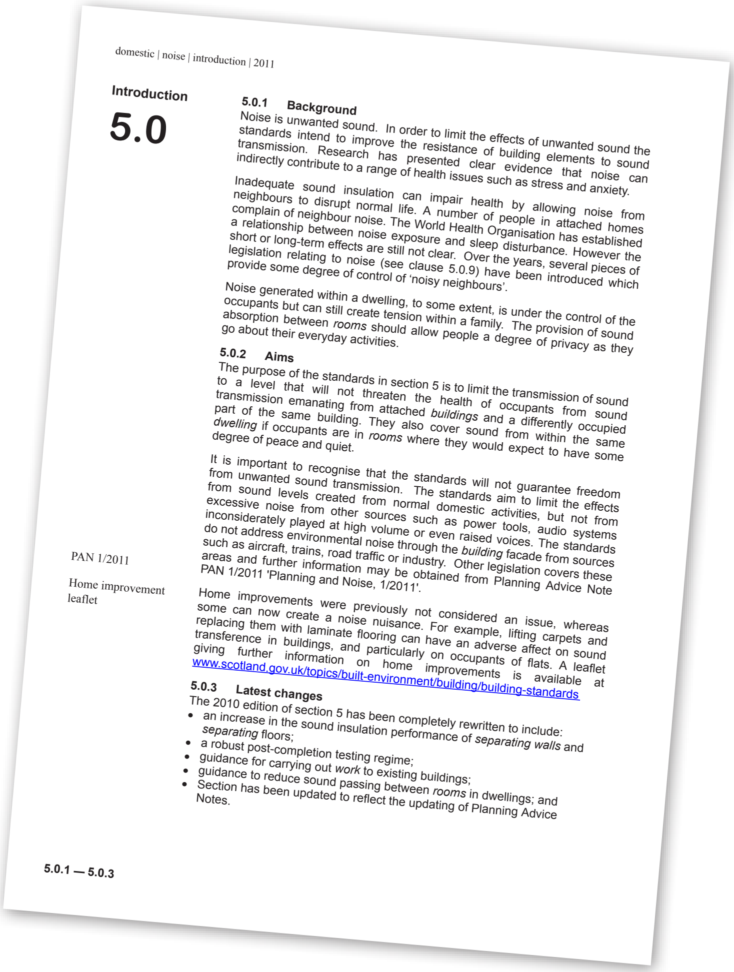
England & Wales

- ✔ Approved Document E - covers sound insulation requirements in dwelling-houses, flats, rooms for residential use and schools.
- ✔ On site sound insulation testing is required to demonstrate compliance with Requirement E1 as part of the construction process.
- ✔ From 1st July 2004 Robust Details in new houses and flats have been accepted as an alternative to pre-completion testing.
- ✔ Testing should be carried out once property is complete (except for decoration). Impact testing should be carried out prior to installing floor coverings.
- ✔ If any of the tests outlined in Approved Document E do not show a value equal to or above the minimum requirement, remedial works will be required, followed by a re-test before the building can be signed off.



Scotland

- ✔ Section 5 – Noise. There are two versions covering noise requirements in domestic and non-domestic respectively.
- ✔ Where any building contains both domestic and non-domestic, both sets of rules will need to be considered. Where a building falls into more than one category, the most stringent recommendation must be followed.
- ✔ Walls and floors between a dwelling and any accommodation ancillary to the same dwelling, such as a garage, is exempt from the legislation.
- ✔ Post-completion testing is not necessary should Robust Details (Scotland) be used. This is because Robust Details (Scotland) are designed and constructed to be an average of 5dB better than regulations require.
- ✔ Testing should be carried out on a minimum number of properties as defined in section 5.1.9 of the technical handbook for domestic properties.
- ✔ If the failure is attributed to the construction of the separating and/or associated flanking elements, other rooms that have not been tested may also fail to meet the test performance levels. Additional tests may be needed, over and above the number recommended in clause 5.1.9 to check that the work achieves the test performance levels.


domestic | noise | introduction | 2011

Introduction

5.0

5.0.1 Background

Noise is unwanted sound. In order to limit the effects of unwanted sound the standards intend to improve the resistance of building elements to sound transmission. Research has presented clear evidence that noise can indirectly contribute to a range of health issues such as stress and anxiety.

Inadequate sound insulation can impair health by allowing noise from neighbours to disrupt normal life. A number of people in attached homes complain of neighbour noise. The World Health Organisation has established a relationship between noise exposure and sleep disturbance. However the short or long-term effects are still not clear. Over the years, several pieces of legislation relating to noise (see clause 5.0.9) have been introduced which provide some degree of control of 'noisy neighbours'.

Noise generated within a dwelling, to some extent, is under the control of the occupants but can still create tension within a family. The provision of sound absorption between *rooms* should allow people a degree of privacy as they go about their everyday activities.

5.0.2 Aims

The purpose of the standards in section 5 is to limit the transmission of sound to a level that will not threaten the health of occupants from sound transmission emanating from attached *buildings* and a differently occupied part of the same building. They also cover sound from within the same *dwelling* if occupants are in *rooms* where they would expect to have some degree of peace and quiet.

PAN 1/2011

It is important to recognise that the standards will not guarantee freedom from unwanted sound transmission. The standards aim to limit the effects from sound levels created from normal domestic activities, but not from excessive noise from other sources such as power tools, audio systems inconsiderately played at high volume or even raised voices. The standards do not address environmental noise through the *building* facade from sources such as aircraft, trains, road traffic or industry. Other legislation covers these areas and further information may be obtained from Planning Advice Note PAN 1/2011 'Planning and Noise, 1/2011'.

Home improvement leaflet

Home improvements were previously not considered an issue, whereas some can now create a noise nuisance. For example, lifting carpets and replacing them with laminate flooring can have an adverse affect on sound transference in buildings, and particularly on occupants of flats. A leaflet giving further information on home improvements is available at www.scotland.gov.uk/topics/built-environment/building/building-standards

5.0.3 Latest changes

The 2010 edition of section 5 has been completely rewritten to include:

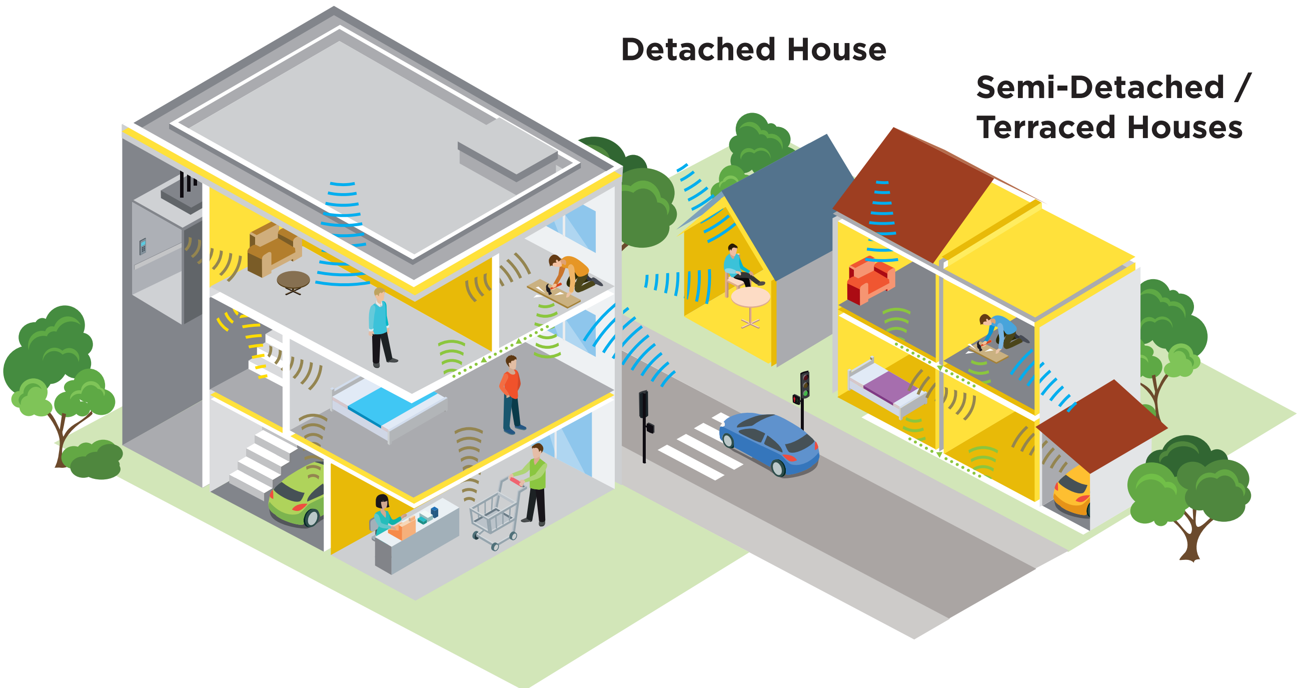
- an increase in the sound insulation performance of *separating walls* and *separating* floors;
- a robust post-completion testing regime;
- guidance for carrying out *work* to existing buildings;
- guidance to reduce sound passing between *rooms* in dwellings; and
- Section has been updated to reflect the updating of Planning Advice Notes.

5.0.1 — 5.0.3

Acoustic Regulations

Performance requirements

Below is a summary of the minimum acoustic performance for buildings in England, Wales & Scotland. Isover recommends choosing systems whose performance exceeds these requirements in order to improve comfort.



Airborne sound insulation (minimum values)

	Walls		Floors	
	Separating	Internal	Separating	Internal
New Dwellings				
England	45dB ($D_{nT,w}+C_{tr}$)	40dB (R_w)	45dB ($D_{nT,w}+C_{tr}$) (1)	40dB (R_w)
Scotland	56dB ($D_{nT,w}$)	40dB (R_w)	56dB ($D_{nT,w}$) (2)	43dB (R_w)
Wales	45dB ($D_{nT,w}+C_{tr}$)	40dB (R_w)	45dB ($D_{nT,w}+C_{tr}$) (1)	40dB (R_w)

(1) Maximum impact sound insulation of 62 dB ($L'_{nT,w}$) also required
(2) Maximum impact sound insulation of 56 dB ($L'_{nT,w}$) also required

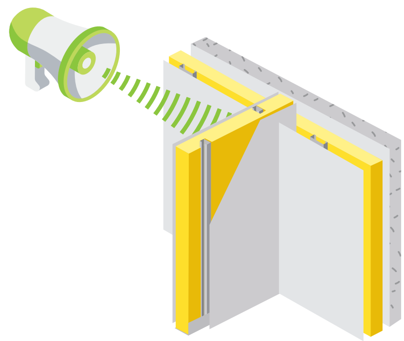
Implementation advice

The intended acoustic performance of a building will be determined early on in the design process. Factors such as poor workmanship and bad detailing can cause a building to function below its specified performance level.

One of the biggest factors is airtightness, so sealing the structure is critical in fighting airborne noise. This is because noise enters by any route open to it (lateral and parasite transmission).

As a result, a simple electrical socket, poorly-plugged panel hole or uninsulated piping route will become an acoustic bridge between two rooms.

Lofts and roofing



In order to obtain proper acoustic performance, insulation continuity must be carefully ensured around pillars and in triangular pitches. Eaves and purlins must also be insulated.

Insulating products must always be laid continuously and joined.

Airtightness is also a key factor in guaranteeing noise performance, notably at joints with windows, skylights, ventilation ducts, chimney pipes crossing walls and roof, etc.

Walls and partitions

Insulation continuity is essential, regardless of the type of wall. Mineral wool, thanks to its excellent sealing properties and flexibility, can easily provide this continuity.

Whenever possible, non-supporting partitions must be separated from the building's supporting structures (vertical walls or floors). This separation is achieved by fitting resilient strips at all points of contact or connection with the structure in order to reduce indirect noise transmission.

At the joint between a partition and cladding: the partition abuts the supporting wall. The cladding is then fitted at both sides of the supporting wall in order to avoid the creation of acoustic bridges. The same is true of the joint between a partition and a ceiling: the entire height of the partition is built before the ceiling is laid.

Acoustic Regulations

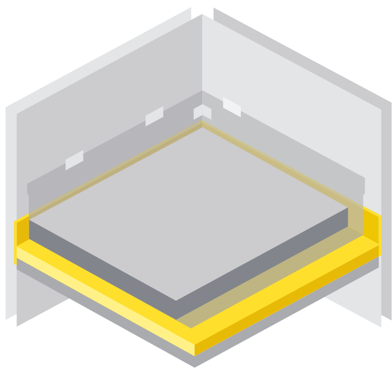
Floors

Floating floor

The floating floor must be completely separated from the load-bearing deck.

It is important not to create connections between the floating screed and the load-bearing deck, as these points would serve as an acoustic bridge transmitting noise. The following installation precautions should be followed:

- Lay polyethylene completely covering the area of the insulating material, extending 6-10 cm up the walls from the level of the finished floor or applying a separating tape extending 2 cm above the finished floor.
- Treat any crossing elements by fitting acoustic gaskets of the appropriate diameter around the ducts/pipes.



Equipment (electrical, plumbing, heating, etc.)

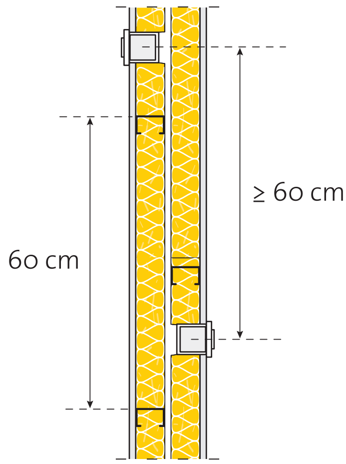
The installation of electricity socket boxes or switches must be planned in advance in order to avoid them being installed directly in line at each side of the partition/separation, which would result in noise transmission (due to the virtual absence of insulation between the two boxes) and interference.

It is essential to avoid any transmission channel, passage or cavity bringing two rooms into contact (pipes, ventilation ducts, etc.)

Equipment fixed to the wall, such as boilers, must be fixed with vibration-absorbing fixing brackets and suitable tightening collars for the piping in order to isolate it.

Installing a acoustic gasket around ducts in order to isolate them from the wall is advisory; the diameter and length chosen must be suitable for the piping.

Care must also be taken to ensure that the insulating material chosen is not too rigid in order to reduce the transmission of vibrations.



Acoustic Solutions

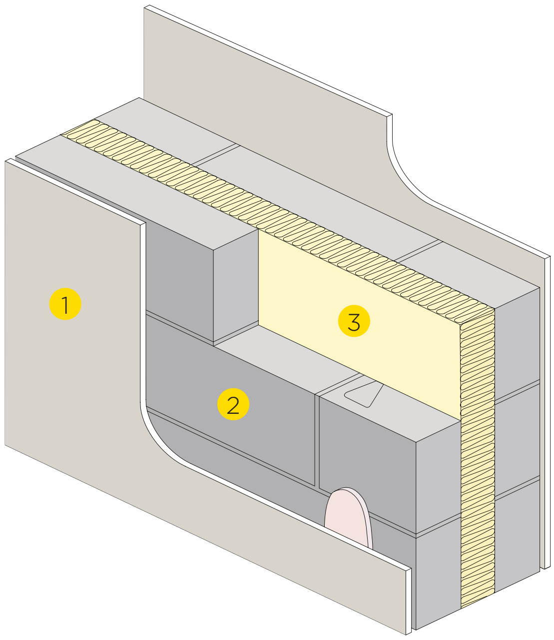
Separating Walls

Masonry

DESCRIPTION

Masonry Cavity Party Walls

1. 8 kg/m² plasterboard
2. Blockwork
3. Cavity fully-filled with Isover RD Party Wall Roll



robustdetails®

Masonry Party Wall	Code for Sustainable Homes Credits	Acoustic performance dB ($D_{nT,w} + C_{tr}$)	Minimum cavity (mm)	Block	Insulation	Zero U-value
E-WM-17	3	50	75	1350 to 1600 kg/m³ Aggregate	RD Party Wall Roll	YES (1)
E-WM-20*	3	50	100	1350 to 1600 kg/m³ Aggregate	RD Party Wall Roll	YES (1)
E-WM-24	3	50	100	600 to 800 kg/m³ Aircrete	RD Party Wall Roll	YES (1)

(1) When combined with effective edge sealing.

*Scotland V-WM-20.

The table above shows a selection of system details to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

Separating Walls

Timber

DESCRIPTION

Timber Frame Party Walls

1. 2 x gypsum boards
2. Isover Timber Frame Batt 40, 90mm between studs
3. Timber Party Wall Roll, 50mm
4. Isover Timber Frame Batt 40, 90mm between studs

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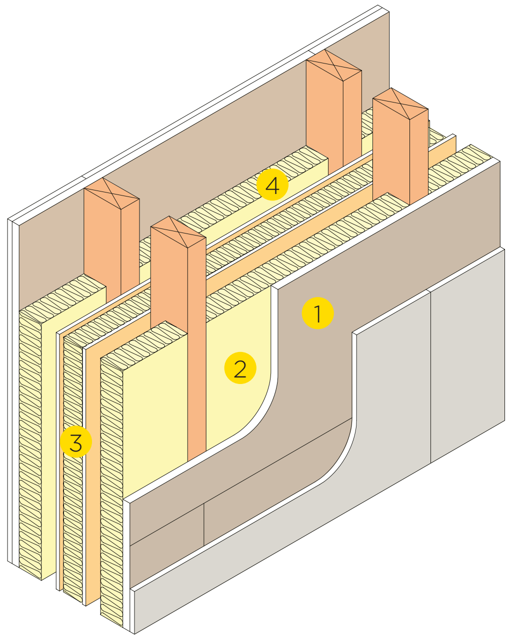


ENGLAND & WALES

Timber Party Wall	Acoustic performance dB ($D_{nT,w} + C_{tr}$)	Insulation within stud	Insulation in cavity	Minimum cavity width	Board lining**	Zero U-value
E-WT-2	≥45	Isover Timber Frame Batt 40 90mm	Timber Party Wall 50mm	50	2 x gypsum boards	YES (1)

SCOTLAND

Timber Party Wall	Acoustic performance dB ($D_{nT,w}$)	Insulation within stud	Insulation in cavity	Minimum cavity width	Board lining**	Zero U-value
V-WT-2	≥56	Isover Timber Frame Batt 40 90mm	Timber Party Wall 50mm	50	2 x gypsum boards	YES (1)

î **min mass 22kg/m²

(1) When combined with effective edge sealing.

The table above shows a selection of system details to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

Internal Walls

Metal Studs

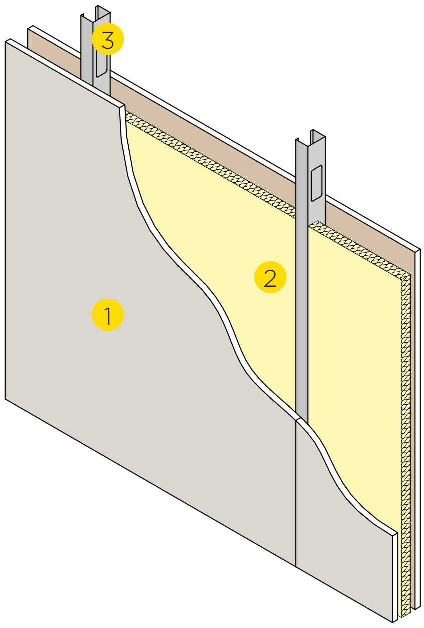
DESCRIPTION

Internal Partitions

1 Gyproc WallBoard

2 Isover Acoustic Partition Roll (APR 1200)

3 Gypframe metal studs



48MM METAL 'C' STUD

dB (R_w)	Partition thickness (mm)	Stud (mm)	Insulation within stud (mm)	WallBoard
40	75	Gypframe 48 S 50 'C' stud	Acoustic Partition Roll APR 1200 25mm	1x 12.5mm Gyproc WallBoard
41	75	Gypframe 48 S 50 'C' stud	Acoustic Partition Roll APR 1200 50mm	1x 12.5mm Gyproc WallBoard
49	110	Gypframe 48 S 50 'C' stud	Acoustic Partition Roll APR 1200 25mm	2x 15mm Gyproc WallBoard

70MM METAL 'C' STUD

dB (R_w)	Partition thickness (mm)	Stud (mm)	Insulation within stud (mm)	WallBoard
42	97	Gypframe 70 S 50 'C' stud	Acoustic Partition Roll APR 1200 25mm	1x 12.5mm Gyproc WallBoard
44	102	Gypframe 70 S 50 'C' stud	Acoustic Partition Roll APR 1200 50mm	1x 15mm Gyproc WallBoard
49	122	Gypframe 70 S 50 'C' stud	Acoustic Partition Roll APR 1200 25mm	2x 12.5mm Gyproc WallBoard
50	122	Gypframe 70 S 50 'C' stud	Acoustic Partition Roll APR 1200 50mm	2x 12.5mm Gyproc WallBoard
50	132	Gypframe 70 S 50 'C' stud	Acoustic Partition Roll APR 1200 25mm	2x 15mm Gyproc WallBoard

The table above shows a selection of system details to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

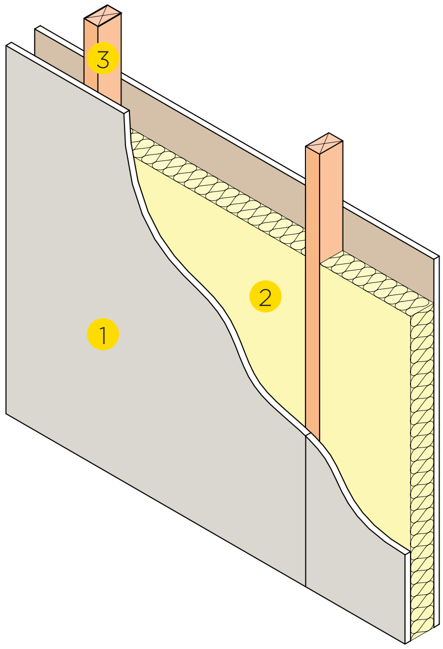
Internal Walls

Timber Studs

DESCRIPTION

Internal Partitions

1. Gyproc WallBoard / SoundBloc
2. Isover Acoustic Partition Roll (APR 1200) between studs
3. Timber studs



dB (R_w)	Partition thickness (mm)	Stud (mm)	Insulation within stud (mm)	WallBoard
41	88	63mm x 38mm timber stud	Acoustic Partition Roll APR 1200 65mm	1x 12.5mm Gyproc WallBoard
44	93	63mm x 38mm timber stud	Acoustic Partition Roll APR 1200 50mm	1x 15mm Gyproc WallBoard
56	141*	75mmx 38mm timber stud	Acoustic Partition Roll APR 1200 50mm	2x 12.5mm Gyproc SoundBloc
59	157*	75mm x 38mm timber stud	Acoustic Partition Roll APR 1200 50mm	2x 12.5mm Gyproc SoundBloc

*56dB and 59dB timber stud partitions use Resilient Bars to isolate the plasterboard from the stud.

The table above shows a selection of system details to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

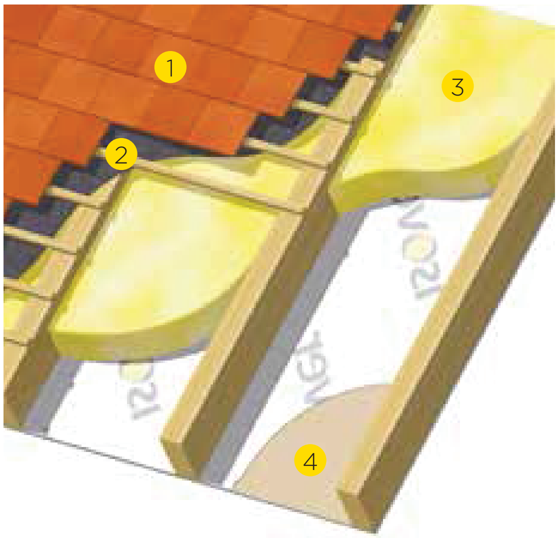
Pitched Roof

Rafter Level

DESCRIPTION

Insulation Between Rafters

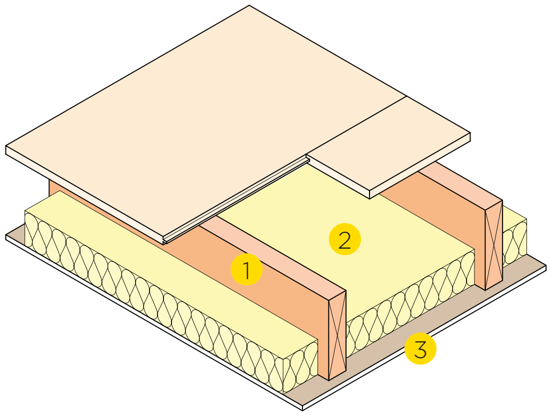
1. Tiled or slated roof on tiling battens
2. Breathable membrane
3. Isover Metac between the rafters
4. Board lining



dB (R_w)	Rafter size	Rafter centres	Insulation between rafters	Below rafters
49	200 x 50mm	600mm	175mm Metac	12.5mm Gyproc Wallboard

The table above shows system detail to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

Timber / Beam & Block



DESCRIPTION

1. Timber joist floor with wood based flooring (minimum 15kg/m^2)
2. 100mm Isover Acoustic Partition Roll (APR 1200)
3. 12.5mm Gyproc WallBoard TEN

dB (R_w) achieved	Insulation between joists	Board lining
40	APR 1200, 100mm	12.5mm Gyproc WallBoard TEN
43	APR 1200, 100mm	2 x 12.5mm Gyproc WallBoard TEN

The table above shows a selection of system details to illustrate performance.

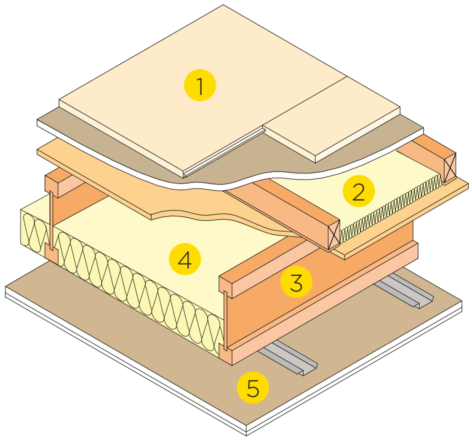
For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

Separating Floors

Timber

DESCRIPTION

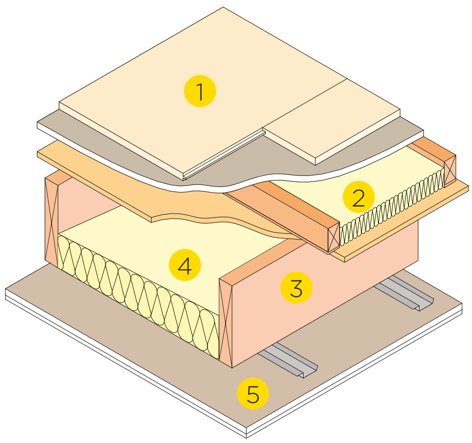
1. Floating floor
2. 25mm Isover APR 1200
3. 235mm (min) timber I-joists
4. 100mm Isover APR 1200
5. Ceiling treatment



Floor type A	Acoustic performance dB ($D_{nT,w} + C_{tr}$)	Acoustic performance dB ($D_{nT,w}$)	Insulation between I joists	Insulation between floating floor battens
E-FT-1 (England & Wales)	45		APR 1200, 100mm	APR 1200, 25mm
3B (Scotland)		56	APR 1200, 100mm	APR 1200, 25mm

DESCRIPTION

1. Floating floor
2. 65mm Isover APR 1200
3. 220mm (min) timber joists at maximum 400mm centres
4. 100mm Isover APR 1200
5. Ceiling treatment



Floor type B	Acoustic performance dB ($D_{nT,w} + C_{tr}$)	Acoustic performance dB ($D_{nT,w}$)	Insulation between I joists	Insulation between floating floor battens
E-FT-2 (England & Wales)	45		APR 1200, 100mm	APR 1200, 65mm
3a (Scotland)		56	APR 1200, 100mm	APR 1200, 65mm

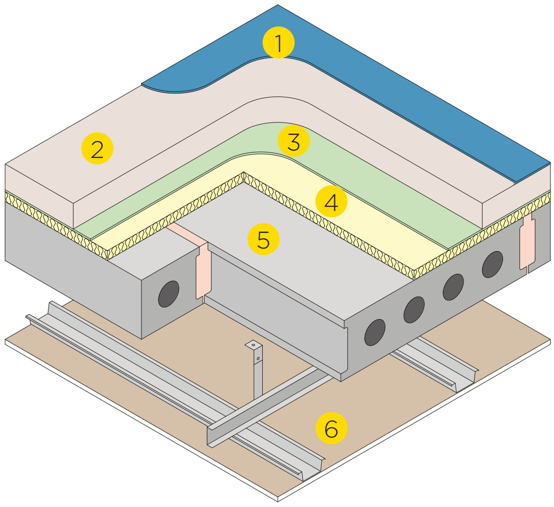
Maximum impact sound transmission, England and Wales 62 dB $L'_{nT,w}$ and Scotland 56 dB $L'_{nT,w}$ also required for Separating Floors.

The tables above show a selection of system details to illustrate performance. For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

Concrete

DESCRIPTION

1. 4.5mm bonded resilient floor covering
2. 65mm sand cement screed
3. 5mm foamed polythene layer
4. 25mm Isover RD Acoustic Floor Slab
5. Precast concrete plank, 150mm thick
6. One layer of Gyproc WallBoard TEN



Floor type	Acoustic performance dB ($D_{nT,w} + C_{tr}$)	Acoustic performance dB ($L'_{nT,w}$)	Insulation
E-FC-8	45	62	25mm Isover RD Acoustic Floor Slab

The table above shows system detail to illustrate performance.

For additional options, or for further guidance, please contact our Technical Advice Centre on 0115 945 1143.

SAINT-GOBAIN

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