Technical Handbook - Domestic

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Technical Handbook - Domestic

Noise

5.0 Introduction

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 other people 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.

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 things 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'.

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 http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

5.0.3 Latest changes

The following is a summary of the main changes that have been introduced since 1 October 2010.

- Standard 5.1 - removal of guidance regarding the phased introduction of sound tests.
- Standard 5.2 - guidance on sound insulation level between rooms in dwellings.

5.0.4 Explanation of terms

There are a number of terms used in this section some are included below, these and other useful terms are included in Annex A of the Example Constructions.

Airborne sound is sound which is propagated from a noise source through the medium of air. Examples of these are speech and sound from a television.

Airborne sound transmission is direct transmission of airborne sound through walls or floors. When sound energy is created in a room, for instance by conversation, some of the energy is reflected or absorbed by room surfaces but some may set up vibrations in the walls and floor. Depending on both the amount of energy and the type of construction, this can result in sound being transmitted to adjacent parts of the building.

Direct transmission refers to the path of either airborne or impact sound through elements of construction.

$\mathbf{D_{nT,w}}$ is the weighted standardised level difference. A single-number quantity (weighted) which characterises the airborne sound insulation between two rooms, in accordance with BS EN ISO 717-1: 1997.

Flanking transmission is airborne or impact transmission between rooms that is transmitted via flanking elements and/or in flanking elements in conjunction with the main separating elements. An example of a flanking element is the inner leaf of an external wall that connects to the separating ‘core’ of a wall or floor.

Impact sound is sound which is propagated from a noise source through a direct medium. An example of this is footfall on a floor.

Impact sound transmission is sound which is spread from an impact noise source in direct contact with a building element.

$\mathbf{L'_{nT,w}}$ is the weighted standardised impact sound pressure level. A single-number quantity (weighted) to characterise the impact sound insulation of floors, in accordance with BS EN ISO 717-2: 1997.

$\mathbf{R_w}$ is a single number quantity (weighted) which characterises the airborne sound insulation of a building element from measurements undertaken in a laboratory, in accordance with BS EN ISO 717-1: 1997.

5.0.5 Reduction of sound transmission

The reduction of sound transmission from attached buildings, or part of the same building, and sound from within the same dwelling can be provided through different mechanisms which involve; mass, isolation, absorption, resilience and stiffness (see annex A of the Example Constructions). Wall and floor constructions that provide a combination of such mechanisms generally provide better sound insulation.

Good design incorporates at least 2 or more of the above mechanisms and can reduce a range of sound frequencies typically found in attached dwellings.

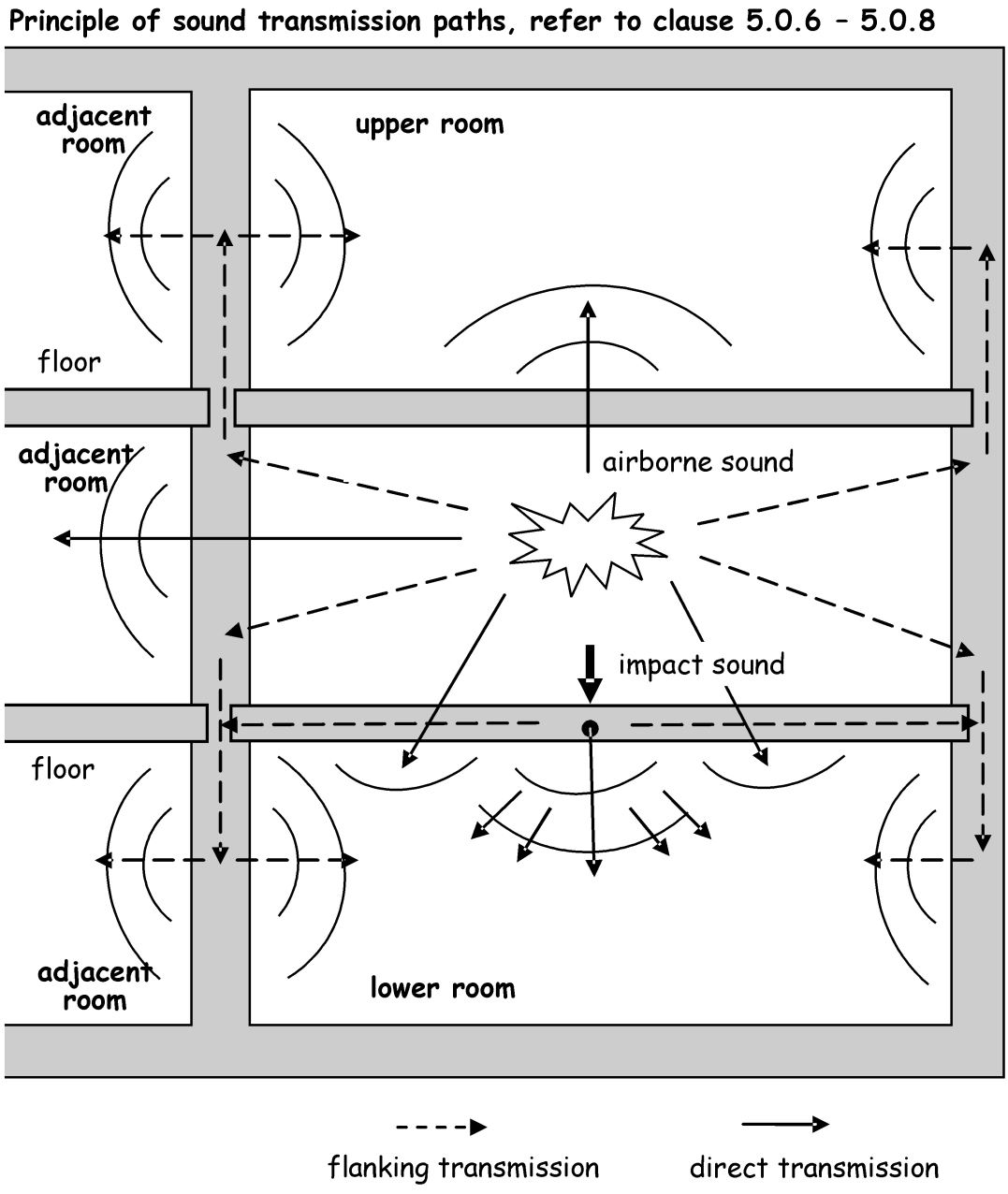
The effects these variables can have in predicting both sound transmission and insulation are as follows:

- through a heavyweight wall or floor it is its mass per unit area. A reduction in sound transmission and increase in sound insulation are expected with increasing mass, as the heavier the wall or floor, the less it vibrates in response to sound waves and hence the less sound energy is radiated. For example, heavyweight constructions such as masonry cavity walls provide mass and isolation
- through a lightweight wall or floor it is the use of cavities, isolation and absorption. A reduction in sound transmission and an increase in sound insulation are expected by the use of cavities with fewer and less stiff connections, while absorptive material hung in the wall cavity will absorb mid to high frequency sound energy. The formation of narrow cavities, such as dry linings on dabs, can also create an unwelcome ‘drum’ effect at low frequencies and filling or lining them with absorbing material can help to reduce this.

For example in lightweight constructions such as timber frame walls, the twin stud of the timber frame provides isolation, stiffness and absorption

- resilience is needed for separating floors in flats where there is direct vibration impact such as footfall noise. Resilience reduces the impact vibration by dynamic movement and also converts the energy into heat. Examples of resilient elements for floors include floating floor treatments such as battens and cradles, resilient bars and resilient floor coverings, other than carpet
- mass and stiffness help to reduce significantly low frequency sound transmission whereas absorption and resilience predominantly reduce mid and high frequency sound transmission
- isolation has the most influence over all frequencies of sound but can be limited by structural connections such as wall ties, straps and fixings that may bridge isolated leafs or elements.

Figure 5.1 principle of sound transmission paths



5.0.6 Principles of airborne sound transmission

When sound waves strike a wall or floor, the pressure variations cause the construction to vibrate. A portion of the vibrational energy on the sound source side will be transferred through the wall or floor where it is radiated as airborne sound on the other side. There is a loss in sound transmission as the frequency of the incident sound (sound waves produced from striking against a wall or floor for example) increases. This also varies with the direction of the sound waves, and is usually assumed to be the average for all possible angles of incidence.

5.0.7 Principles of impact sound transmission

Impact sound is sound that is spread from an impact or vibrational source in direct contact with a building element such as a floor. A structural vibration is transmitted from the point of impact through the structure causing vibration leading to the radiation of sound into an adjacent room below. In a building this is commonly caused by an object hitting the floor, from where the vibration is transferred into the structure. Usually the vibration path will lead to the ceiling and perimeter walls below. The amount of impact sound heard below will depend upon many factors including the force of the impact, the vibration transmission characteristics of the floor construction and the floor covering.

5.0.8 Principles of flanking sound transmission

Flanking sound transmission occurs when there is an indirect path for sound to travel along elements adjacent to walls and floors. If the flanking construction and its connections with the separating structure are not correctly detailed, flanking transmission can equal, or even exceed, sound levels perceived as a result of direct transmission. Flanking transmission can occur, for instance, when a wall abuts the face of the inner leaf of an external cavity wall, and the walls are insufficiently tied or bonded together, thus allowing the noise to travel along the inner leaf.

5.0.9 Relevant legislation

Listed below are some pieces of legislation and guidance that may be relevant and/or helpful to those using the guidance in this particular section.

The Common Law of Nuisance recognises that an occupant has the right to the free and absolute use of the property, but only to the extent that such use does not discomfort or annoy a neighbour.

Part IV of the Civic Government (Scotland) Act 1982 sets out a range of public nuisance offences.

The Environmental Protection Act 1990 as it relates to noise, states that ‘any premises in such a state as to be prejudicial to health or a nuisance ranks as a statutory nuisance’.

The Human Rights Act 1998 (as it relates to noise) Article 8 guarantees the right to respect for private and family life.

The Antisocial Behaviour etc. (Scotland) Act 2004 empowers the local authority to serve a warning notice in relation to noise which exceeds the permitted level.

The Planning Advice Note PAN 1/2011 ‘Planning and Noise', provides advice on the role of the planning system in helping to prevent and limit the adverse effects of noise.

5.0.10 Certification

Scottish Ministers can, under Section 7 of the Building (Scotland) Act 2003, approve schemes for the certification of design or construction for compliance with the mandatory

functional standards. Such schemes are approved on the basis that the procedures adopted by the scheme will take account of the need to co-ordinate the work of various designers and specialist contractors. Individuals approved to provide certification services under the scheme are assessed to ensure that they have the qualifications, skills and experience required to certify compliance for the work covered by the scope of the scheme. Checking procedures adopted by Approved Certifiers will deliver design or installation reliability in accordance with legislation.

5.1 Noise separation

Mandatory Standard

Standard 5.1

Every building, which is divided into more than one area of different occupation, must be designed and constructed in such a way to limit the transmission of source noise from normal domestic type activities, between such areas, to a level that will not threaten the health of, or cause inconvenience to the building occupants.

Limitation:

This standard only applies to a building in different occupation incorporating:

a. attached dwellings

b. attached residential buildings, or

c. a roof, walkway or access deck located directly above an area that is either a dwelling or a residential building.

5.1.0 Introduction

Noise nuisance outwith the control of dwelling occupants has increased substantially over the last decade. This is mainly as a result of people's changing lifestyles, greater numbers and use of sound-producing equipment and household appliances.

There has been a dramatic increase in the use of electrical goods, particularly sound producing equipment such as audio and TV. Music can be more bass orientated and played at higher volumes, whilst speakers mounted on walls may improve the quality to the listener, they can create a disturbance to others. The intention is not to prevent all sound from being heard, but to limit noise nuisance by achieving levels of sound insulation that will help to reduce the effects of sound on people in their home.

Complaints regarding noisy services do occur. Dealing with the varying levels of sound produced by service equipment, such as lifts, heat pumps or air conditioning units in buildings is a complex task. Guidance is given on the care that should be taken at the design stage in the choice of service equipment, installation and location within the building.

Designers should be aware that some Local Authorities may also set noise reduction targets. This is usually enforced through environmental health and planning legislation for noise emanating from commercial premises to dwellings, and more information on this is contained in PAN 1/2011.

Conversions - in the case of conversions as specified in regulation 4, the building as converted shall meet the requirement of this standard (regulation 12, schedule 6).

5.1.1 Scope of standard

Airborne sound insulation should be provided where any separating wall or separating floor is formed between areas in different occupation. For example:

- between dwellings
- between a dwelling and a non-domestic building
- between a dwelling and other parts of the same building, e.g. common stair or corridor, communal lounge, or car parking garage.

Airborne sound insulation need not be provided for:

a. a separating wall dividing any 2 buildings, such as garages, conservatories or porches, or a combination of these, where each building is attached and ancillary to a dwelling

b. an external wall such as a wall dividing a dwelling from an access deck, since it is not a separating wall

c. a wall or floor between a dwelling and any accommodation that is ancillary to the same dwelling, such as a garage.

Impact sound insulation should be provided where any separating floor is formed between areas in different occupation. For example:

- between dwellings
- between a dwelling and a non-domestic building with rooms intended to be used for sleeping
- between a dwelling, and other parts of the same building directly above e.g. common stair or corridor, communal lounge, or car parking garage
- between a dwelling and a non-domestic building other than where it meets the conditions of (c) below
- a roof, walkway or access deck located directly above a dwelling and to which there is access, other than where it meets the conditions of (d) and (e) below.

Impact sound insulation need not be provided for:

a. a roof above a non-habitable space, such as a roof space

b. a floor between a dwelling and any accommodation that is ancillary to the dwellings such as a garage

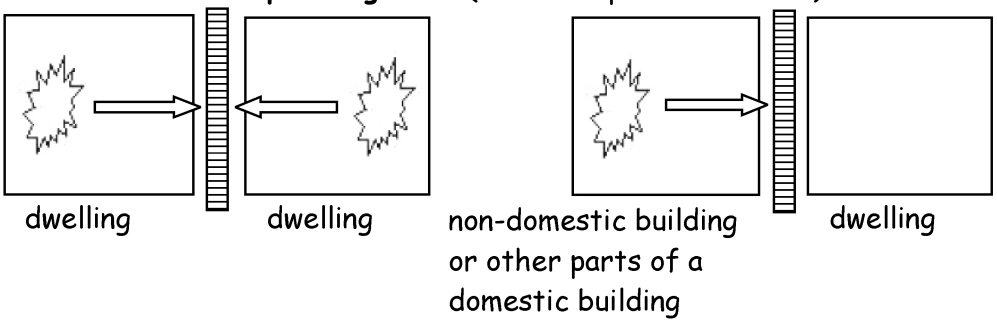
c. a separating floor between a dwelling and a non-residential non-domestic building directly below

d. a roof, walkway or access deck located directly above a dwelling and to which there is access for maintenance purposes only

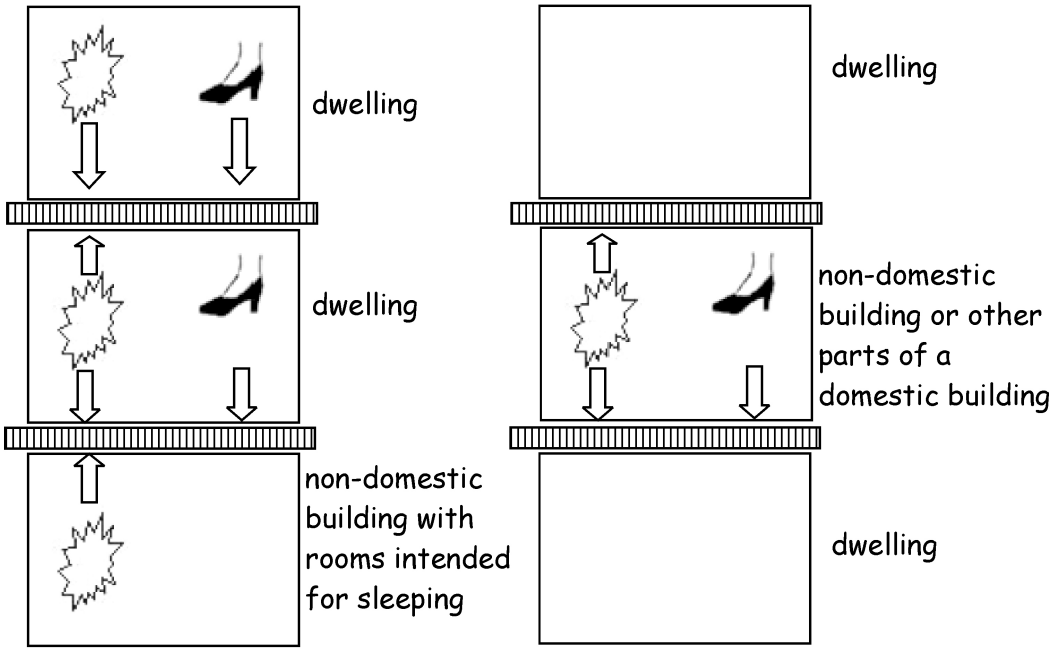
e. a roof, walkway or access deck located directly above a dwelling and to which there is access, where it is for the sole use of the residents of the dwelling.

The following diagrams show only direct transmission paths. Flanking transmission is also an important consideration. (see clause 5.0.8)

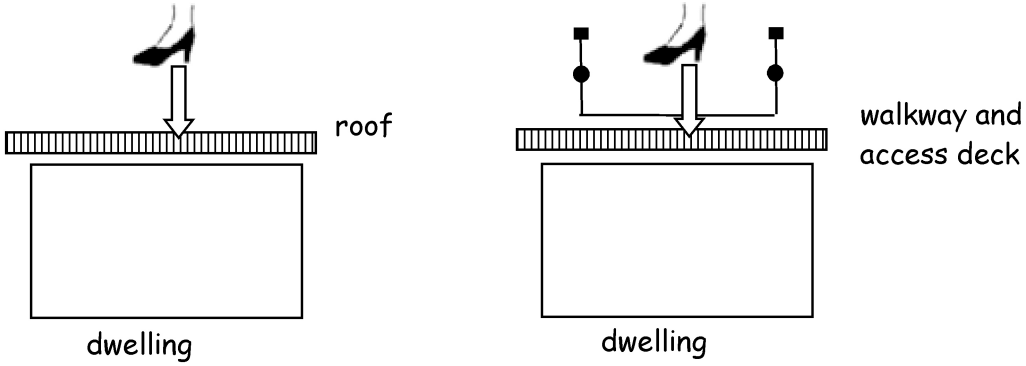
Airborne sound: separating walls (viewed in plan or section)



Airborne and impact sound: separating floors (viewed in section)



Impact sound: roofs, walkways and access decks (viewed in section)

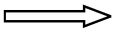


Legend


noise source: airborne sound


noise source: airborne sound


separating wall or separating floor


noise source: airborne sound

5.1.2 Design performance levels

The following design performance levels are given for the control of sound through separating walls and separating floors. The levels have been developed from research covering sound and perceived sound in dwellings. They have been identified as levels, based on normal domestic activities that have been shown to produce few noise complaints.

However experience shows that the performance of a construction is dependent upon:

- achieving a high quality of workmanship on site
- supervision throughout the construction process
- the relationship between separating and adjoining elements (e.g. external walls, roofs and windows) to combat flanking transmission

and these factors should be carefully considered at the design stage.

All work should be designed to the levels in the following table:

Table 5.1 Design performance levels in dB [1]

Design performance	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Additional information:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see clause 5.0.4.
2. Notice should be taken of the guidance on conversions in clause 5.1.5.
3. See clause 5.1.1 for application of these performance levels to separating walls and separating floors.

Two methods are provided on ways to achieve these levels which can lead to meeting the standard. They are by the use of:

a. Example Constructions (see clause 5.1.3), or

b. other constructions (see clause 5.1.4).

These methods are to be used in conjunction with the testing arrangements (see clause 5.1.8 to 5.1.10).

5.1.3 Example Constructions

Example Constructions have been developed that will repeatedly achieve the design performance levels in the table to clause 5.1.2. They have also been developed from constructions that are in general use in the UK, and that are known to reduce the range of sound frequencies that can generate complaints.

The Example Constructions are available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

5.1.4 Other constructions

Clause 5.1.3 provides guidance on constructions that have been designed and tested to repeatedly achieve the performance levels in the table to clause 5.1.2. However it may be necessary, preferable or desirable, to include new or innovative constructions into a proposed design.

Where constructions that have not been tested previously are used, the services of an acoustic specialist may be obtained, who should be able to offer design guidance on constructions that are capable of achieving the performance levels in the table to clause 5.1.2.

5.1.5 Conversions

Achieving the design performance levels for conversions can present challenges to a designer. The presence of hidden voids within constructions, back to back fireplaces, cupboards and gaps between construction elements in walls and floors, mean that it may not be possible to use ‘pattern book’ type constructions to achieve the design performance levels. When conversions are undertaken, the adaption of the existing building should be considered at the design stage. Conversions and conversions of traditional buildings should achieve the performance levels in the table to clause 5.1.2.

With older buildings achieving the performance levels in clause 5.1.2 becomes more difficult, therefore the levels for traditional buildings are less demanding than for new build and conversions.

The design proposals for the conversion of a traditional building should be considered carefully so that any measures taken will improve the sound insulation. The performance levels in the table to clause 5.1.2 should be considered as a benchmark, but it may not be possible to achieve these levels in all circumstances. Consultation on such matters at an early stage with both the verifier and the planning officer of the relevant authority is advisable.

Historic and Listed buildings will, prior to conversion, display unique characteristics as far as sound insulation is concerned. The original building design and construction will influence the level of sound insulation achievable for the separating walls and separating floors. For this reason, specific prescriptive guidance on such buildings is not appropriate. The relevant authority may, at their discretion, agree measures that respect the character of the building.

Advice on the general principles of sound insulation in Historic and Listed buildings can be obtained from the Building Performance Centre, Napier University booklet 'Housing and Sound Insulation – Improving existing attached dwellings and designing for conversions' http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

The conversion of a roof space into a habitable area, although very common, can present problems as it is unlikely that access to the roof space in the adjoining dwelling can be assured. Where an existing separating wall in a roof space is constructed of a single leaf of masonry only, it would be appropriate to provide one leaf of a free-standing framed construction next to the existing wall as each attic is developed. Example Constructions - detail 3: timber frame twin stud wall; gives a typical arrangement.

The building owner may wish to carry out a pre-conversion sound test prior to the start of any conversion, ideally during the building survey process. The acoustic performance of the existing construction can then be established and problems identified that will allow the design of a tailored acoustic solution to be determined at an early stage.

For larger or more complex work, advice on conversions may be sought from an acoustic specialist who should be able to offer appropriate design guidance.

5.1.6 Doors in a separating wall

A door in a separating wall dividing a dwelling from a common area of a building can create an acoustic weak point in the wall allowing unwelcome noise into the dwelling. As entrance doors to dwellings from common areas must comply with the relevant standards in Section 2: Fire, Section 4: Safety and Section 6: Energy the doorset will be relatively robust, and the weakest point for noise to enter the dwelling will be through the gap between the door frame and the door.

Entrance doors to flats and maisonettes located in a separating wall should be fitted with a perimeter seal, including the threshold, to minimise noise transmittance through the doorset.

A compressible type of seal may be used such as a rubber strip. Where the seal is of a type that combines a smoke and noise seal, the product literature should be consulted to confirm the seal will achieve the desired effect. The seal should not interfere with the closing mechanisms of a fire door and provide a positive seal between the door frame and the door.

5.1.7 Noise from services

Building service installations serving common areas in domestic buildings have the potential to cause noise nuisance. For example, common plant such as lifts, air conditioning units, ventilation systems, and drainage pipes running the height of a block of flats have all been known to be a source of complaint.

Therefore, it is important that the design of building services, their position in the building and the building structure should be considered at an early stage in the design process.

Services passing through separating walls or separating floors must comply with the relevant standards in Section 2: Fire.

Service pipes or ducts should not pass through a separating wall, unless they are of small diameter, such as lateral pipework from network risers such as gas, electricity, water and telecom. These pipes or ducts may pass through a separating wall from a common into a single dwelling only.

Custom-built or system chimneys should not be built into timber-framed separating walls. Only masonry chimneys (including precast concrete flue-blocks) may be included as an integral part of a separating wall. However, some thickening of the construction may be necessary to achieve the performance levels in clause 5.1.2.

Only service openings for ducts, service pipework or chimneys may be formed in separating floors. These services should be enclosed above and below the floor with a construction that will maintain the levels of noise reduction recommended for a separating floor in the table to clause 5.1.2.

Service equipment rooms should not be located next to quiet areas such as rooms intended for sleeping. Locating plant in a larger space can help dissipate sound. Also, plant machinery and equipment such as lift rails should be isolated from the walls and floor to reduce vibrations and the resulting sound transmission to rooms intended for sleeping. Vibration from mechanical equipment can be reduced with the use of inertia blocks and resilient mounts.

Structure borne noise is the most common cause of complaints and the most effective approach is to structurally de-couple service installations and mechanical equipment from

separating walls and separating floors. Lightweight structures need special consideration and it may be necessary to support noisy plant on a separate, rigid structure. The installation of an independent wall or ceiling lining may help achieve the performance levels in clause 5.1.2.

A report 'Limit noise transmission to dwellings from services' includes several useful design guide annexes. http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Annex H of BS EN 12354-5: 2009 provides more detailed guidance on the reduction of service noise transmittance through separating walls and separating floors.

Design guides covering low carbon equipment, such as air source heat pumps, contain advice on sound reduction measures and are available at http://www.scotland.gov.uk/topics/built-environment/building/building-standards.

5.1.8 Post-completion performance test levels

The effectiveness of a construction to reduce sound transmission depends on several factors; the design, the buildings within which it is formed and the quality of the workmanship.

The use of either of the methods listed in clause 5.1.2 alone will not guarantee that the performance levels will be achieved. Good workmanship is essential to their performance, and post-completion testing will confirm these levels have been achieved.

Table 5.2 Test levels for Example and other constructions in dB [1]

Design performance	New build and conversions not including traditional buildings	Conversions of traditional buildings [2]
Minimum airborne sound insulation [3]	56 $D_{nT,w}$	53 $D_{nT,w}$
Maximum impact sound transmission [3]	56 $L'_{nT,w}$	58 $L'_{nT,w}$

Additional information:

1. For the definition of $D_{nT,w}$ and $L'_{nT,w}$ see clause 5.0.4.
2. Notice should be taken of the guidance on conversions in clause 5.1.5.
3. See clause 5.1.1 for application of these performance levels to separating walls and separating floors.

5.1.9 Post-completion testing

On completion, new buildings and conversions should be tested in accordance with the tables in this clause.

Table 5.3 Recommended minimum number of tests for new build [1, 2]

Construction Type	No. of attached dwellings	No. of tests for separating walls [houses]	No. of tests for separating walls [flats or maisonettes]	No. of tests for separating floors [flats or maisonettes]
New build using Example Constructions	2 - 20	2	2	2
	21 - 40	3	3	3

Construction Type	No. of attached dwellings	No. of tests for separating walls [houses]	No. of tests for separating walls [flats or maisonettes]	No. of tests for separating floors [flats or maisonettes]
	Over 40	1 extra for every 20 houses, or part thereof	1 extra for every 20 flats or maisonettes, or part thereof	1 extra for every 20 flats or maisonettes, or part thereof
New build using other constructions	2 - 10	2	2	2
	11 - 20	3	3	3
	21 - 30	4	4	4
	Over 30	1 extra for every 10 houses, or part thereof	1 extra for every 10 flats or maisonettes, or part thereof	1 extra for every 10 flats or maisonettes, or part thereof

Table 5.4 Recommended minimum number of tests for conversions [1,2]

Construction Type	No. of attached dwellings formed by conversion	No. of tests for separating walls [houses]	No. of tests for separating walls [flats or maisonettes]	No. of tests for separating floors [flats or maisonettes]
Conversions	1 - 5	2	2	2
	6 - 10	3	3	3
	Over 10	1 extra for every 5 dwellings, or part thereof	1 extra for every 5 dwellings, or part thereof	1 extra for every 5 dwellings, or part thereof

Note

Additional information:

1. Where a separating wall forms a junction with a ground floor or roof a weak point in the construction is created affecting the sound performance. For this reason 1 test should be carried out on a separating wall at ground and first floor level for attached houses.

2. Each different construction in a development should be tested.

When a conversion of an attached building occurs, for example to a mid terrace dwelling, it may not be possible to gain access to the adjacent dwelling or part of the same building, to carry out tests to the separating wall. In this case, it may not be appropriate to request testing to be carried out. The conversion of a roof space into habitable space, although very common can also present problems. Since it is unlikely that access to the roof space in the adjoining dwelling can be assured it may not be appropriate to test

Sound tests should only be carried out on a building that is complete and when doors, access hatches and windows are fitted. Carpet, should not be used as bonded resilient floor covering or laid before an impact test for separating floors. Sound testing should be carried out in accordance with:

a. BS EN ISO 140-4: 1998 and BS EN ISO 717-1: 1997, for airborne sound transmission, and

b. BS EN ISO 140-7: 1998 and BS EN ISO 717-2: 1997, for impact sound transmission.

Airborne sound insulation testing - at least two different loudspeaker positions should be used for the source noise, in accordance with BS EN ISO 140-4: 1998.

Methods using a single source - for each source position, the average sound pressure level in the source and receiving rooms is measured in one-third-octave bands using either fixed microphone positions (and averaging these values on an energy basis), or using a moving microphone.

For the source room measurements, the difference between the average sound pressure levels in adjacent one-third-octave bands should be not more than 6dB. If this condition is not met, the source spectrum should be adjusted and the source room measurement repeated. If the condition is met, the average sound pressure level in the receiving room, and hence a level difference, should be determined.

It is essential that all measurements made in the source and receiving rooms to determine a level difference should be made without moving the sound source or changing the output level of the sound source, once its spectrum has been correctly adjusted (where necessary).

The sound source should now be moved to the next position in the source room and the above procedure repeated to determine another level difference. At least two positions should be used for the source. The level differences obtained from each source position should be arithmetically averaged, D as defined in BS EN ISO 140-4: 1998.

Airbourne and sound impact insulation testing - for both types of testing it is possible to use fixed microphone positions, rotating booms or manual moving microphones (mmm), in accordance with BS EN ISO 140-4: 1998 and BS EN ISO 140-7: 1998.

Doors - it is not normal practise to undertake sound insulation tests where there is a door in a separating wall, such as an entrance door to a flat from a common stair. Allowance should be made if a test is needed for such a separating wall as the door will not achieve the same 'design performance level' as a separating wall, as the door will allow sound transmission through the gaps and affect the sound test results.

Professional expertise - testing should be carried out by persons who can demonstrate relevant, recognised expertise in acoustics for sound insulation testing. This should include membership of a professional organisation which accredits its members as competent to both test and confirm the results.

5.1.10 Remedial action following a test failure

Noise transmission in buildings is a complex subject and it is difficult to provide definitive guidance on resolving specific problems that have occurred in individual buildings. It may be prudent to seek advice from a specialist who, through experience of sound testing, may be able to identify and resolve any problems.

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.

5.2 Noise reduction between rooms

Mandatory Standard

Standard 5.2

Every building, must be designed and constructed in such a way to limit the transmission of source noise from normal domestic type activities, through a wall or floor, between a room and internal space where noise is likely to occur, to a level that will not cause inconvenience to the building occupants.

Limitation:

This standard only applies to a wall or floor forming an apartment in a dwelling and a room in a residential building which is capable of being used for sleeping; other than:

a. a wall between an en-suite bathroom and the apartment or room it serves

b. a hospital

c. a place of lawful detention.

5.2.0 Introduction

Changing lifestyles has altered the way rooms are used in dwellings. Bedrooms are more often used as areas where people spend time watching television, playing computer games and listening to music. Shouting from room to room, running up and down stairs, using noisy appliances and banging doors, can all be heard throughout a dwelling and can create unwanted noise. At night, any noise made when generally there is little background noise, is often perceived as excessive.

Although noise within a dwelling, can be more easily controlled than noise from outwith the dwelling itself, this can still be a nuisance. The increase in noise level from speech and music within dwellings may indirectly lead to anxiety and stress.

Conversions - in the case of conversions as specified in regulation 4, the building as converted shall meet the requirements of this standard (regulation 12, schedule 6).

5.2.1 Design performance level

Internal walls are normally built off the structural floor. A door located in such a wall provides a path for sound to bypass a wall under test. On-site sound testing of internal walls and intermediate floors cannot be relied upon due to excessive flanking sound transmission through doors. For this reason a laboratory test is used. A laboratory test result is termed dB R_w (see 5.0.4).

As disturbance to occupants can occur from other areas within the dwelling, the level of sound heard should be reduced in the rooms in which people may sleep. Therefore it is the internal walls between apartments, an apartment and an internal space where noise is likely to occur, that should achieve the sound performance level below. An internal wall between an en-suite bathroom and the apartment it serves need not have sound insulation.

The design performance levels for internal walls and intermediate floors covered by this standard should achieve minimum airborne sound insulation levels indicated in the following table:

Table 5.5 Table 5.5 Design performance levels

Design performance	Minimum airborne insulation level
Internal walls	40 dB R_w
Intermediate floors	43 dB R_w

5.2.2 Internal walls

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

5.2.3 Intermediate floors

Improving the sound insulation over parts of an intermediate floor only above or below apartments is not reasonably practicable and could lead to expensive remedial measures if an area is missed or if future alteration work is carried out. It is therefore recommended that sound insulation should be provided across the entire area of each intermediate floor in a dwelling if there is an apartment located directly or below the floor.

The design performance levels in clause 5.2.1 can be achieved by using the Generic Internal Constructions available on the BSD website http://www.scotland.gov.uk/topics/built-environment/building/building-standards. Alternatively, product manufacturers may have solutions that will achieve the design performance level.

Although setting impact sound insulation design levels for intermediate floors is not reasonably practicable, insulation against impact noise can be improved by adding a soft covering such as a carpet or foam-backed vinyl. However a carpet or foam-backed vinyl is a floor covering and should not be included as part of the construction used to achieve the design levels in clause 5.2.1.

5.2.4 Conversions

Many of the existing wall and floor constructions within a traditional building, will be constructed from materials generally not still in use, for example lathe and plaster. In such cases the sound insulation level will not be known therefore, it is not reasonably practicable for the existing walls or floors to meet the performance levels in clause 5.2.1.