



## 4.0 SOUND INSULATION

## Sound Insulation - An Introduction

Our product ranges provide an extensive number of block solutions for walls, to satisfy the performance standards of Part E of the Building Regulations, as well as project specific acoustic requirements.

The solutions presented offer high levels of performance and can achieve compliance through Robust Details and pre-completion testing.

Performance standards are also imposed by other guidance documents such as Building Bulletin 93 'Acoustic Design of Schools: performance standards'.

### ■ Background

The move towards higher density housing developments, coupled with a growing expectation from occupiers and other building users that reasonable standards of sound insulation should be provided, are embedded in the guidance provided by Approved Document E to the Building Regulations. The current edition is 2003 and incorporates amendments made in 2004, 2010, 2013 and 2015. The result is a much more rigorous specification for sound resisting elements as well as for workmanship on site. Compliance is enforced through on site pre-completion testing of separating floors and walls, although for housing the Robust Detail programme was developed to allow specifications that are sufficiently robust to be built without the need for pre-completion testing. Such specifications, known as Robust Details, are subject to ongoing monitoring to ensure the integrity of the scheme is maintained.

AD E applies to dwellings and to rooms for residential purposes. The latter is defined as a room, or a suite of rooms, which is not a dwelling house or flat and which is used by one or more persons to live and sleep. This will therefore include a room in a hostel, a hall of residence, an hotel, or a residential home. It will not include rooms in a hospital or other similar establishment used for patient care.

The scope of AD E also covers reverberation in the common areas of blocks of flats and acoustic requirements for schools.

The following regulations are specified in AD E:

- E1 Protection against Sound from other parts of the building and adjoining buildings Houses, flats and rooms for residential use shall be designed and constructed in such a way that they provide reasonable resistance to sound from other parts of the same building and from adjoining buildings.
- E2 Protection against sound within a dwelling – house, etc Houses, flats and rooms for residential use shall be designed and constructed in such a way that:
  - a) Internal walls between a bedroom or a room containing a water closet and any other rooms;
  - and
  - b) Internal floors, provide reasonable resistance to sound.

### ■ Performance Requirements

#### Limitations

Requirement E2 does not apply to:

- a) An internal wall which contains a door.
- b) An internal wall which separates an en suite toilet from the associated bedroom.
- c) Existing walls and floors in the building which are subject to a material change of use.

- E3 Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes.

The common internal parts of buildings which contain flats or rooms for residential use shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

#### Limitations

Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which provide access to the flat or room for residential use.

E4 – Acoustic conditions in schools

- 1. Each room or other space in a school shall be designed and constructed in such a way that it has the acoustic conditions and insulation against disturbance by noise appropriate to its intended use.
- 2. For the purpose of this part – 'school' has the same meaning as in Section 4 of the Education Act 1966 and 'school building' means any building forming a school or part of a school.

## ■ Performance Standards

The performance standards applicable to dwellings and to rooms for residential purposes are shown in Tables 4.1 and 4.2 respectively.

Table 4.1 - Performance requirements for dwellings

	Airborne sound insulation $D_{nT,w} + C_{tr}$ (dB) (minimum values)	Impact sound insulation $L'_{nT,w} + C_{tr}$ (dB) (maximum values)
Purpose built dwelling-houses and flats		
Separating walls	45	-
Separating floors and stairs	45	62
Dwelling-houses and flats formed by material change of use		
Separating walls	43	-
Separating floors and stairs	43	64

Table 4.2 - Performance requirements for rooms for residential purposes

	Airborne sound insulation $D_{nT,w} + C_{tr}$ (dB) (minimum values)	Impact sound insulation $L'_{nT,w} + C_{tr}$ (dB) (maximum values)
Purpose built rooms for residential purposes		
Separating walls	43	-
Separating floors and stairs	45	62
Rooms for residential purposes formed by material change of use		
Separating walls	43	-
Separating floors and stairs	43	64



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## ■ Solutions for Separating Walls - New Dwellings

Compliance can be based on one of a growing number of Robust Detail specifications whose use will avoid the need for pre-completion testing provided each plot is registered with Robust Details Limited.

Alternatively, AD E provides a number of compliant specifications for separating walls and floors in dwellings. These include solid and cavity separating walls which can be constructed using various block types. Use of these specifications will be subject to pre-completion testing.

Whichever specification is selected, it is essential that the surrounding flanking elements are constructed in accordance with the guidance given in the relevant Robust Detail specification or guidance in accordance with AD E.

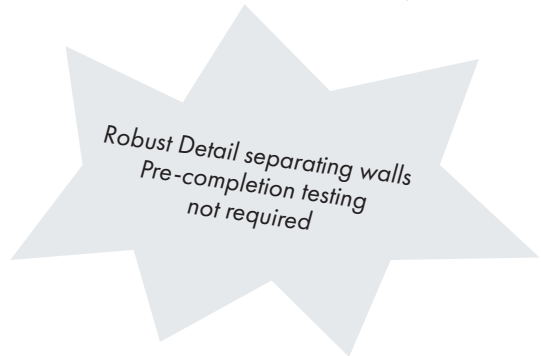
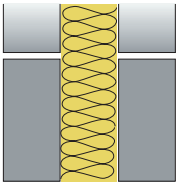
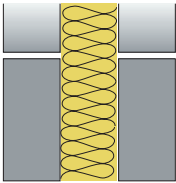
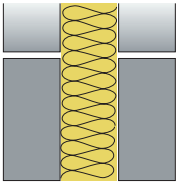
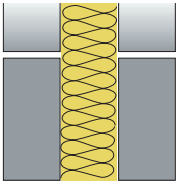
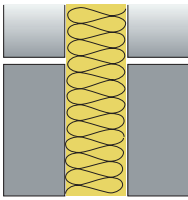
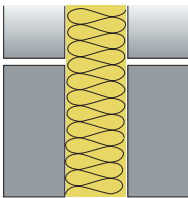
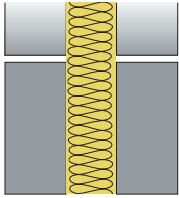
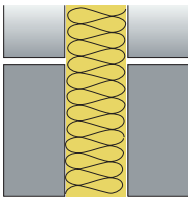
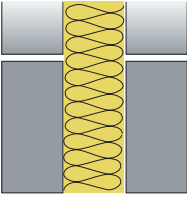


Table 4.3 - Robust Detail separating walls (housing and flats)

Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish - to both sides
E-WM-1 	Lignacrete Standard	75mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	13mm lightweight or dense plaster (minimum mass 10kg/m <sup>2</sup> ).
E-WM-2 	Lignacite GP	75mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	13mm lightweight or dense plaster (minimum mass 10kg/m <sup>2</sup> ).
E-WM-3 	Lignacrete Standard	75mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	Plasterboard (nominal 10kg/m <sup>2</sup> ), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-4 	Lignacite GP	75mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	Plasterboard (nominal 10kg/m <sup>2</sup> ), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.

Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish
E-WM-11	Lignacite GP	100mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-16	Lignacrete Standard	100mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	Plasterboard (nominal 9.8kg/m <sup>2</sup> ), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-17	Lignacite GP	75mm  With minimum 75mm Isover RD Party Wall Roll	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs.
E-WM-18	Lignacrete Standard	100mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	13mm lightweight or dense plaster (minimum mass 10kg/m <sup>2</sup> ), both sides.
E-WM-19	Lignacrete Standard Lignacite GP (Suitable for attached houses only).	100mm  With Monarfloor® Bridgestop® system. The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs on cement:sand render coat (nominal 8mm) with scratched finish.
E-WM-20	Lignacite GP	100mm  With 100mm Isover RD Party Wall Roll	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs.

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Robust Detail ref.	Suitable products 100mm minimum width, solid units	Minimum cavity width	Internal Finish
E-WM-21 	Lignacite GP	100mm  The cavity can be insulated using mineral wool with a maximum density of 40 kg/m <sup>3</sup>	13mm lightweight or dense plaster (minimum mass 10kg/m <sup>2</sup> ), both sides
E-WM-22 	Lignacite GP	100mm  With 100mm Knauf Earthwool Masonry Party Wall Slab or 100mm Superglass Party Wall Roll or URSA cavity Batt35	Plasterboard (nominal 10kg/m <sup>2</sup> ), on dabs.
E-WM-27 	Lignacite GP	75mm  With 75mm Superglass Party Wall Roll	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs.
E-WM-28 	Lignacite GP	100mm  With 100mm Knauf Supafill Party Wall - blown fibre	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs.
E-WM-33 	Lignacite GP	100mm  With 100mm Supaglass Superwhite 34 blown glass mineral wool insulation	Plasterboard (nominal 8kg/m <sup>2</sup> ), on dabs.

## Notes

1. Refer to the Robust Detail Handbook for details of suitable wall ties, flanking walls construction and suitable RD separating floors which can be used in conjunction with the wall specifications shown in the table.
2. Wall tiles in party walls should be Type !.
3. As a guide, Lignacite GP and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of Robust Detail concrete separating floors, as they all achieve the minimum specified density for aggregate blocks of 1350kg/m<sup>3</sup>.
4. Full fill insulation can be used to aid compliance with Part L1A of the Building Regulations.

## ■ Approve Document E Guidance Constructions

Alternative compliance can be met by using suitable Lignacite constructions that satisfy the guidance specifications given in AD E to the Building Regulations. These constructions are shown in Tables 4.4 and 4.5 and performance will have to be confirmed by pre-completion testing.



Table 4.4 - AD E cavity separating walls (housing and flats)

AD ref.	Suitable products - 100mm minimum width, solid units	Minimum cavity width	Internal Finish
Wall type 2.1	Lignacrete	50mm	13mm lightweight or dense plaster
Wall type 2.2	Lignacite GP, Lignacite Eco Range	75mm	13mm lightweight or dense plaster
Wall type 2.3*	Lignacite GP, Lignacite Eco Range	75mm	Plasterboard (nominal 10kg/m <sup>2</sup> )

\*For use with a step or stagger of at least 300mm.

### Notes

1. Refer to the AD E for details of suitable wall ties, flanking walls construction and suitable separating floors which can be used in conjunction with the wall specifications shown in the table.
2. As a guide, Lignacite GP, Lignacite Eco Range and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of AD E compliant concrete separating floors, as they all achieve the minimum specified mass of 120kg/m<sup>2</sup>.

Table 4.5 - AD E solid separating walls (housing and flats)

AD ref.	Suitable products	Construction	Internal Finish
Wall type 1.1	100mm Lignacrete solid units	100mm Lignacrete blocks laid flat to form a 215mm wall	13mm lightweight or dense plaster

### Notes

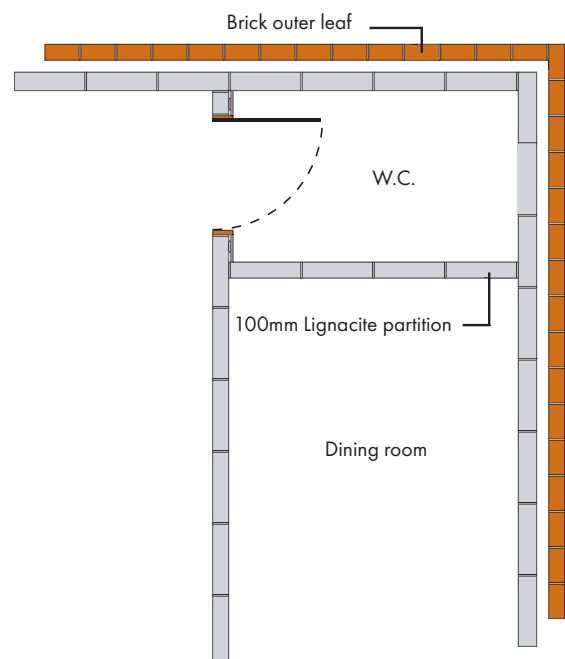
1. Refer to the AD E for details of suitable flanking construction walls and suitable separating floors which can be used in conjunction with the wall specifications shown in the table.
2. As a guide, Lignacite GP and Lignacrete blocks of minimum 100mm width can be used to the inner leaf flanking any of AD E compliant concrete separating floors, as they all achieve the minimum specified mass of 120kg/m<sup>2</sup>.

## ■ Solutions for Separating Walls - Rooms for residential purposes and dwellings formed by material change of use

The performance standard for separating walls for rooms for residential purposes and dwellings formed by material change of use, is 2dB lower than the standard for new build dwellings. Therefore any of the constructions recommended for new build dwellings can be used with confidence. In addition, solid Lignacrete walls (Table 4.5) can also be used with a plasterboard (10kg/m<sup>2</sup>) finish to both faces.

### ■ Protection against sound within a dwelling house, etc.

Regulation E2 requires dwelling-houses, flats and rooms for residential purposes to be designed and constructed in such a way that internal walls between a bedroom or a room containing a water closet and other rooms, and internal floors, provide reasonable resistance to sound.



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## Limits on application

Requirement E2 does not apply to:

- An internal wall which contains a door.
- An internal wall which separates an en suite toilet from the associated bedroom.
- Existing walls and floors in a building which is subject to a material change of use.

Internal walls and floors are not subject to pre-completion testing but do have to meet the laboratory sound insulation values in Table 4.6.

Where Robust Details are not employed, the mass per unit area of any load-bearing internal wall or any internal wall rigidly connected to a separating floor should be at least 120kg/m<sup>2</sup> excluding finish. As a guide this can be achieved using medium or dense units e.g Lignacite GP, Lignacite Eco Range or Lignacrete, of 100mm width.

Where Robust Details are employed, the internal wall should have a minimum mass per unit area of 120kg/m<sup>2</sup> including the finish OR at least that of the approved flanking wall inner leaf, if this is less. Again, this requirement can be met using medium or dense units e.g Lignacite GP, Lignacite Eco Range or Lignacrete, of 100mm width.

Table 4.6 - Laboratory values for new internal walls and floors within dwelling-houses, flats and rooms for residential purposes, whether purpose built or formed by material change of use.

	Airborne sound insulation R <sub>w</sub> dB (minimum values)	Recommended wall construction
Internal walls	40	✓ 100mm Fibo 850 ✓ 100mm Lignacite GP ✓ 100mm Lignacrete
Internal floors	40	-

The 40 R<sub>w</sub> dB requirement for partition walls can be met using any of the constructions shown in Table 4.6. For use in dwellings as well as other building types, the Product Data Sheets provide a comprehensive listing of the sound reduction values applicable to each block width.

See [www.lignacite.co.uk](http://www.lignacite.co.uk)

Note: The recommended wall construction can be used with a plaster or plasterboard finish.

## ■ Reverberation in the common internal parts of buildings containing flats or rooms for residential purposes

To satisfy requirement E3 the common internal parts of buildings which contain flats or rooms for residential purposes shall be designed and constructed in such a way as to prevent more reverberation around the common parts than is reasonable.

## Limits on application

Requirement E3 only applies to corridors, stairwells, hallways and entrance halls which give access to the flat or room for residential purposes.

To satisfy requirement E3, sound absorption measures detailed in section 7 of AD E should be employed.

## ■ Acoustic conditions in schools

- Each room or other space in a school shall be designed and constructed in such a way that it has the acoustic conditions and the insulation against disturbance by noise appropriate to its intended use.
- For the purpose of this Part - 'school' has the same meaning as in section 4 of the Education Act 1996 and 'school building' means any building forming a school or part of a school.

To satisfy requirement E4, refer to Building Bulletin 93 'Acoustic Design of Schools' produced by the DFES and published by the Stationery Office. Because of the complexity of the design process, BB93 states, 'In all but the simplest cases, it is advisable to appoint a suitably qualified acoustic consultant, who would normally be a corporate member of The Institute of Acoustics.'



BRE's Acoustics Centre has developed an Excel spreadsheet to help designers carry out calculations of façade insulation and reverberation times in rooms. This can be downloaded from: [http://projects.bre.co.uk/envdiv/school\\_acoustics](http://projects.bre.co.uk/envdiv/school_acoustics).

### Enhanced Sound Insulation of Blockwork

A good standard of sound insulation can be achieved using concrete blockwork. Our Product Data sheets provide a comprehensive listing of the Weighted Sound Reduction Index values,  $R_w$ , for all product sizes. Conventional blockwork internal walls can cater for performance levels of around 55  $R_w$  dB. In situations where a higher standard of sound insulation is required, Lignacite and Lignacrete blocks have been tested using a range of acoustic panel types, to one or both sides of the wall. Given the good base level performance of the blockwork, it is not surprising that high levels of sound insulation are obtained when applying further acoustic treatment. The enhanced performing constructions are shown as Solutions A-C.

Lignacite Wall with Acoustic Linings

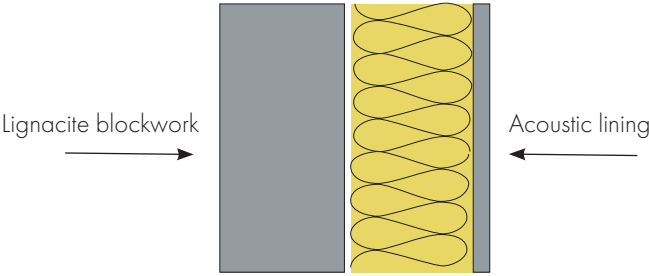


Table 4.7 - Enhanced sound insulation solutions

	Blockwork	Acoustic Panel	Acoustic Panel Description	Weighted Sound Reduction $R_w$ (dB)
Solution A	140mm Lignacite SP	To one side	50mm C stud built with 20mm gap from the blockwork face, 50mm acoustic quilt between studs, 12.5mm Soundbloc or similar plasterboard	65
Solution B	140mm Lignacrete	To one side	50mm steel C stud with 20mm gap from the blockwork face, 50mm acoustic quilt between studs. 12.5mm Soundbloc or similar plasterboard	65
Solution C	215mm Lignacite (100mm blocks laid flat)	To one side	50mm C stud built with 20mm gap from the blockwork face, 50mm acoustic quilt between studs, 12.5mm Soundbloc or similar plasterboard	66

Lignacrete Separating wall - title and image.



## ■ Glossary

When a figure in decibels is presented, it is always followed by one of these potentially confusing initials after it to tell you what is being measured and how. Without them, the number is ambiguous at best or even meaningless. All claims for performance should include these.

### ■ $R_w$ (dB) – Weighted Sound Reduction Index

A single-number quantity, expressed in decibels, which refers to how well a building element such as a wall or floor provides airborne sound insulation. It is derived from laboratory testing. The higher the number, the better the airborne sound insulation. Because this measurement is made favourable conditions, it is typically around 5 to 8dB more optimistic than the equivalent site measurement ( $D_{nT,w}$ ).

### ■ $D_{nT,w}$ (dB) – The Weighted Standardised Field Level Difference

A single-number quantity which characterises the airborne sound insulation between rooms. It is determined by onsite. It is presented as the difference in noise level on each side of a wall, floor or ceiling. Because it is an on-site test it will be subject to flanking transmission. Due to the inevitable variations that will occur on site this measurement will always be around 5 to 8 dB lower than the  $R_w$  of a similar construction.

### ■ Ctr

A correction made to onsite airborne measurements of sound insulation to add extra significance to low frequency noise.

### ■ $D_{nT,w} + C_{tr}$

A single-number quantity which characterises the airborne sound insulation between rooms using noise spectrum no. 2. This allows the  $D_{nT,w}$  figure to be adjusted for low frequency performance. Low frequency noise, such as bass music or traffic, carries more energy and so is more difficult to reduce. The  $C_{tr}$  figure is a negative number so the  $D_{nT,w} + C_{tr}$  figure will always be lower than the  $D_{nT,w}$  figure. The closer the  $C_{tr}$  number is to zero, the better the construction will be at reducing low frequency noise. This term is used in Approved Document E in England and Wales for the performance of separating walls.

### ■ $L'_{nT,w}$ (dB) – The Weighted Standardised Field Level Difference

A single-number quantity which characterises the impact sound insulation of floors. It is determined by testing onsite between rooms using a tapping machine on the floor above. Confusingly, a lower figure indicates better performance.

