



## Technical information

# Acoustic testing

### Building products

#### 01 What is acoustic testing?

Acoustic testing measures the ability of a building product and/or assembly to reduce the transmission of sound. Products that are commonly tested include doorsets, window assemblies, wall and partition systems, glass, floor systems and ceiling systems. Typically it applies to products that form separating walls and floors, for example between flats, houses, hotel rooms, hospital rooms and classrooms.

Sound is measured in decibels, expressed as dB, over a wide range of frequencies greater than that perceptible to the human ear. Acoustic test results are expressed as decibels of sound reduction i.e. by how much the product reduces the transmission of sound between rooms.

Measurements are made using pink noise (a controlled sound, similar to white noise). Noise is generated on one side of the test sample and measured using accurately calibrated microphones so that the level is known.

It is then measured on the other side of the sample to calculate the level of sound reduction. Measurements are taken in a range of prescribed positions with background noise and reverberation times being taken into account.

The test laboratory is designed to eliminate any background noise that could affect measurements. It consists of two chambers, a Source Room where noise is generated and a Receive Room that is used to measure the reduction of noise. The test chambers are completely isolated from the floor, the ceiling and of each other. This stops noise flanking around the test sample so any noise measured on the receive side can only have passed through the test specimen.

Between the chambers is a filler wall into which the tested product is installed. The sound reduction rating of the wall is such that the sound will only travel through the test sample.

## 02 Why test a product's acoustic performance?

Approved Document E of the Building Regulations requires party walls and floors to prove their sound insulation performance, either through on-site pre-completion testing or through the use of Robust Details (of known performance).

Products are often installed into separating walls and floors in buildings, such as hospitals and schools, and are therefore likely to need to demonstrate individual performance to confirm that they will not adversely impact the overall performance of the separating element. Manufacturers have greater assurance through testing with our UKAS accredited test laboratory that products will perform as expected in these situations, giving clients the confidence to use the product.

Increasingly, acoustic performance in excess of the minimum standards required by Approved Document E, is being specified to satisfy wider sustainability initiatives, such as Code for Sustainable Homes or BREEAM.

In addition, there is a specific stipulation in Part E that requires doors located within communal flats to achieve a rating of 29dB or more in an operational form, i.e. to be able to be opened and closed.

Furthermore, there are a number of acoustic design standards such as Building Bulletin 93 (BB93) for schools and Health Technical Memorandum 08-01 (HTM-08-01) for healthcare premises. Although the acoustic performance of individual projects is not typically specified, acousticians will calculate sound insulation values of façades, walls and floors based on acoustic laboratory test data for products that comprise these elements. If your product does not have this data it is less likely to be included in specifications for these type of developments as well as for other projects where noise may be an issue e.g. hotels, hospitals, care homes, schools, student accommodation and offices.

A typical specification for a school or hospital wall would be to achieve between 40dB and 50dB sound reduction. For sensitive areas, it could be increased to 55dB. An internal stud wall in a dwelling would typically achieve 40dB. Noise is also a key consideration in planning requirements for a number of locations e.g. where the property is close to roads, railways and airports. The findings of these environmental impact assessments may dictate that external windows and doors need to achieve a set level of acoustic performance. For instance, if a school building is situated close to a constant noise source, such as a road, railway or airport, the specification may need to be increased to reduce the ingress of external noise.

Products that claim to have acoustic properties will need to have evidence of such for CE marking purposes.

Finally, noise is likely to be a consideration in the buying decision for an individual or an organisation, for both residential and commercial properties. Products with proven acoustic performance are likely to be more attractive to purchasers than similar products which cannot demonstrate their sound insulation.



The specimen must be installed correctly.



Measurements are taken in a range of prescribed positions.



The sound insulation performance is calculated in decibels.



A technical officer is in attendance throughout the testing stage, to explain the testing procedure and review the results.



Test results are presented within a comprehensive report.

### 03 The acoustic testing process

The testing sample will have been delivered to the acoustic testing laboratory. In some cases the client can choose whether the sample is installed into a filler wall by themselves or by the testing laboratory. The product is installed in a very specific way, in accordance with BS EN ISO 10140-1.

It may be necessary to condition the sample to temperatures required by the standard for a period of time, as temperature can affect the acoustic characteristics of the sample. For example, a cold glazed panel will be much 'stiffer' which would change the critical frequency of the glass, making the sample appear slightly better or slightly worse.

Once the product is installed, the testing can begin. Testing is conducted in accordance with BS EN ISO 10140, which has superseded the previous test standard (BS EN ISO 140-3).

Pink noise is made and played out between 90dB and 100dB in the Source Room. The average sound pressure level is measured simultaneously in both rooms. The noise is stopped and the background noise level is measured in the Receive Room to rule out any contribution to the overall noise being measured.

Reverberation times are the last to be measured. This is a measure of how fast the sound decays (dies out) in the Receive Room, which can have an effect on the overall result. A higher reverberation time will allow sound to 'echo' around a room, taking much longer to die out. This creates a higher sound pressure level in the room which in turn could make the result appear worse. A very low reverberation time would allow sound to be absorbed before it got to the microphone, creating the impression that the sound pressure level in the receive room was less, therefore giving a better result.

The result expressed in decibels is not as simple as 40dB being twice as loud as 20dB. The decibel scale is a logarithmic scale which means every 10dB is a doubling or halving of sound energy. The human ear perceives a 10dB increase to be twice as loud. A 20dB increase would therefore be perceived as four times as loud.

Depending upon the work required to install products, in some cases it is possible to conduct multiple tests on a single day. Each test itself takes around 10 minutes, therefore it is possible to test between 5 to 10 samples in a visit, the limiting factor being the time it takes to change the samples over. Using simple hanging hinges, the same frame where possible, keeping products the same sizes and pre-planning the day are all ways to save time and get the most from the day.

Results are reported as a weighted reduction ( $R_w$ ) which is not to be confused with  $D_{nT,w}$  used for site testing. Typically, you should allow for an 8dB to 10dB reduction in the field relative to the laboratory testing due to the field testing having other factors such as background noise and flanking sound transmission that the laboratory does not.

It is important when specifying products to use on-site to understand the different acoustic testing terms. Data from a laboratory test is expressed as  $R_w$  (weighted sound reduction). Field based test results are expressed in  $D_{nT,w}$  (weighted, standardised level difference). For some tests, the result is given as  $D_{nT,w}+C_{tr}$  (weighted, standardised level difference with low frequency correction applied).

BM TRADA also offer testing to many other acoustic standards. Please contact BM TRADA if you have any specific requests.

### 04 What affects sound reduction performance?

Common areas to look out for before testing are:

- **Installation** – correct and accurate installation is key. A slightly twisted frame or large gaps could reduce performance.
- **Seals** – having the correct seal arrangement for the type of sample will give maximum performance.
- **Seal continuity** – any breaks in the seals will produce an air gap. Even the smallest gap could cause a 2dB to 20dB drop in performance.
- **Corners** – most acoustic performance is lost from weak points in corners. Air gaps and material breaks will reduce performance.
- **Thresholds** – consider the threshold that has to be sealed. A rough surface or uneven finish will leave small gaps.
- **Coincidence dips** – using the same material on both sides of a sample can lead to an acoustic phenomenon which causes dips in performance.
- **Glazing specification** – a product is only as good as its weakest component. If you have a high performance door, it is important to have equally high performance glazing.
- **Penetrations** – letter plates, handles and closers can all compromise performance if they are not correctly installed.

## 05 Commonly used acoustic terms

**Decibels (dB)** – A measurement of the loudness of sound, derived from the logarithm of the ratio between a value of a quantity and a reference value.

**Frequency** – Measured in Hertz (Hz) related to the pitch of a sound. High frequency noises are squeaks and squeals, low frequency noises are deep rumbles.

**$R_w$**  – The weighted sound reduction of the product expressed as a single number in decibels.  $R_w$  (Reduction, Weighted) is only used in a controlled environment such as an acoustics laboratory.

**$D_{nT,w}$**  – The weighted, standardised level difference.  $D_{nT,w}$  is used when measuring sound insulation outside of a laboratory environment, usually when testing for Approved Document E compliance.

**One third octave bands** – A band of frequencies in which the upper limit of the band is  $2^{1/3}$  times the frequency of the lower limit. There are 16 'bands' that are measured in the testing process.

**$C_{tr}$  correction** –  $C_{tr}$  is a correction applied to the  $R_w$  figures that reduce the weighted sound reduction level if low frequency noise is prominent in the measurements.  $C_{tr}$  is a calculation that is usually for traffic noise, but does apply to other low frequency noises (TVs, Radios, Discos etc.).

**Coincidence dip** – A sharp drop in performance at a specific frequency caused by using two materials of the same thickness and density with a space between them, such as double glazing or a plasterboard partition. Sound energy is able to cause both sides of the sample to vibrate at a specific frequency, allowing energy to be passed through the product.

**Reverberation time** – the time, measured in seconds, it takes for sound to decay (die down) 60dB. Reverberation times on-site are often measured over a 20dB drop and extrapolated to 60dB due to background noise.

## 06 About BM TRADA

BM TRADA provide a comprehensive suite of testing, assessment and certification services to clients around the world, to prove the performance of buildings and their components against a wide range of performance criteria including fire resistance testing, security, durability, weather testing and acoustic testing.

By having one test facility undertake all of the major performance criteria tests, clients receive a co-ordinated, cost-effective and convenient solution.

All major tests are accredited by the United Kingdom Accreditation Service (UKAS).

## 07 Related services

- Acoustic technical services, including environmental noise surveys (PPG 24), acoustic performance of schools (BB93), design analysis/advice
- Fire resistance testing
- Security, durability & weather testing of doors and windows
- Site-based air tightness testing
- Site-based acoustic testing
- Thermographic survey
- Thermal simulation of doors and windows
- BM TRADA Q-Mark acoustic window scheme

**BM TRADA provides independent certification, testing, inspection, training, technical services and information around the world. We help customers large and small to prove their business and product credentials and to improve performance and compliance.**



testing@bmtrada.com



bmtrada.com



+44 (0) 1494 569800