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SPECIFIERS' GUIDE **CEILINGS AND ACOUSTIC ABSORBERS**



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FINISHES & INTERIORS SECTOR

SPECIFIERS' GUIDE

CEILING AND ACOUSTIC ABSORBERS

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FOREWORD



Specifying ceilings seems, on the face of it, simple enough: consider the look, performance and cost, and there it is. If only it were that simple there would not be cases where fire compartmentation could fail, partial and full collapses occur, or ceilings fail to perform because the issue wasn't apparent during the specification process.

This guide, written by industry specialists, pulls together decades of experience from specification managers who almost instinctively know the questions on all aspects – from performance, material characteristics, sustainability and environmental, conformity marking, installation, maintenance and end of life.

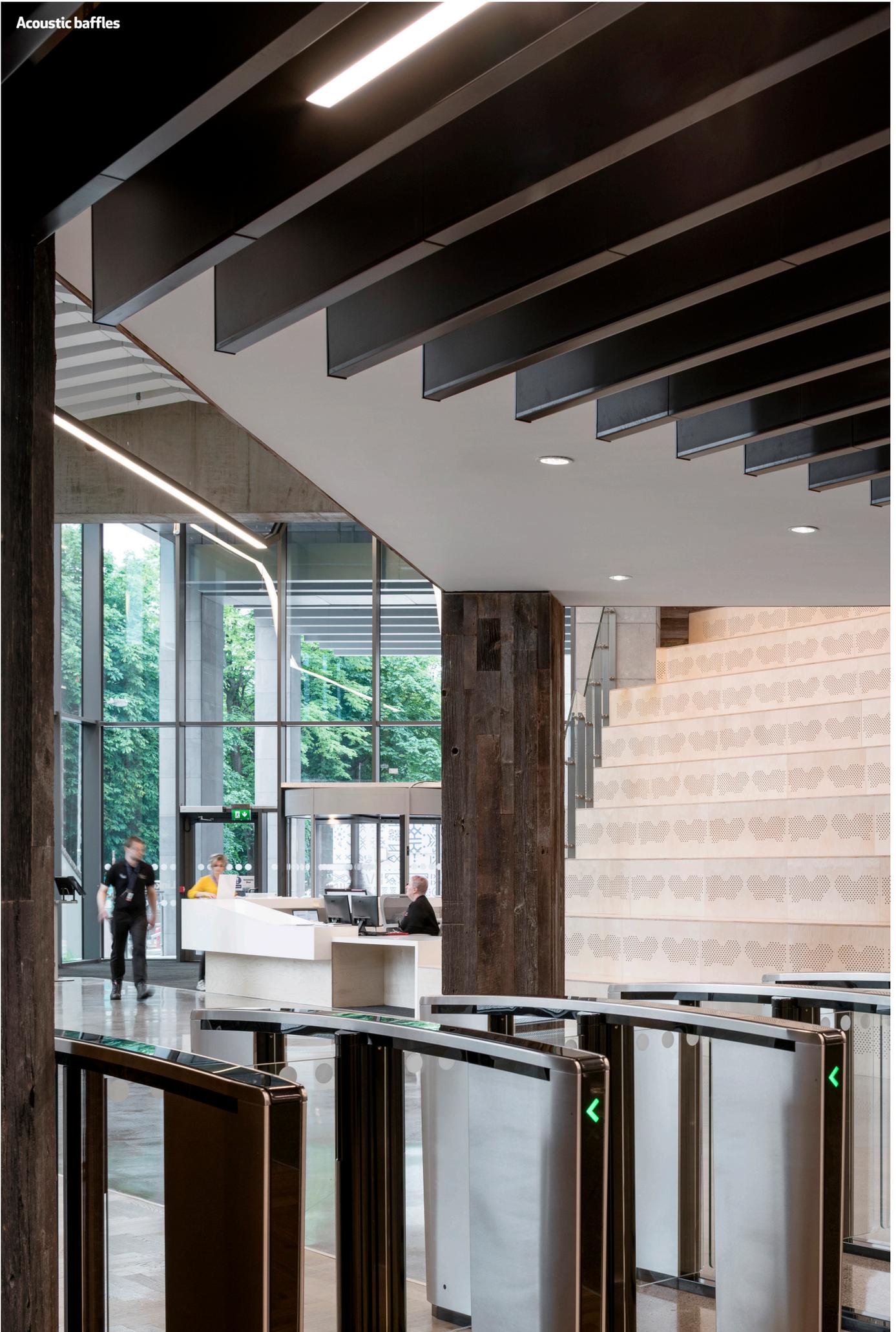
In total, there are 36 parameters to consider to ensure a safe, compliant and complete specification. This is crucial if the specification is not to be misinterpreted and any alternatives assessed and checked as equal before approving them.

There has never been a time in construction when the specification has been more important. This first specification guide from FIS sets out our desire to help everyone involved in the specification of products and systems, and our commitment to improving the safety of residents, occupiers and those who use the built environment.

NEIL MILLER, CHAIR,
FIS CEILINGS AND ABSORBERS
WORKING GROUP

FIS is the trade body representing manufacturers, suppliers and installers in the fit-out sector, including ceilings and absorbers. The Ceilings and Absorbers Working Group is an inclusive body with the following objectives:

- Develop technical standards as required
- Promote best practice in the market
- Educate and inform clients and specifiers about (working group) work
- Promote the products and skills of FIS members in this field
- Monitor and support risk on behalf of the community
- Shape the market so that the correct adherence to standards is recognised and adhered to by all, to the benefit of clients.



INTRODUCTION

The purpose of this publication is to highlight and guide you through some of the key criteria that should be taken into account when writing a specification for a suspended ceiling or acoustic absorber.

Guidance is provided on the generic types of continuous and discontinuous ceilings and the performance standards shown in BS EN 13964:2014 (Suspended ceilings - requirements and test methods) and regulations that may apply.

A well written specification not only ensures the installation meets the client's requirements, but it also means the specifier's requirements are less open to interpretation, prices at tender stage are more accurate and performance needs are clear.

SCOPE

This guide has been produced to assist the selection and specification of a suspended ceiling and acoustic absorbers for internal applications. Its aim is to help you select a ceiling or acoustic absorber that will satisfy the performance needs of the room or space while providing the desired visual effect.

It is not a definitive list of standards, regulations or product types. Importantly, it is not a replacement for professional consultation on critical performance requirements or discussions with manufacturers on specific product use.

Ceilings and acoustic absorbers should be specified, procured, supervised, installed and maintained by people who are competent.

This guide is primarily aimed at:

- Architects
- Specifiers
- Interior designers
- Specialist ceiling installers
- Complementary trades
- Those who have or are about to have a ceiling installed.

"A well written specification not only ensures the installation meets the client's requirements, but it also means the specifier's requirements are less open to interpretation..."

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THE SPECIFICATION

WHAT IS A SPECIFICATION?

A specification is a detailed description of the dimensions, construction, workmanship, materials etc., of work done or to be done on a project, prepared by an architect, engineer or designer, often referred to as specifiers.

TOP TIPS ON SPECIFYING CEILINGS AND ABSORBERS

On your next project, do not be tempted to cut and paste from the last project, but take a fresh look and see for yourself the benefits of following this simple guidance.

These are the key points that we think will help you write a smart specification:

1 TALK TO THE MANUFACTURER

Manufacturers have the expertise, competency and relevant test evidence to interpret your designs and find the most cost-effective solution to meet all aspects of the brief. They can also help develop solutions to meet specific requirements.

2 PERFORMANCE IS KING

Performance is probably the most important aspect of a specification (fire, sound etc). Performance is key to getting a smart specification. A product may look great and be under budget, yet it will be useless if it can't perform in the way you want.

It's important that you convey the performance requirement unambiguously, stating what standard the product should have been tested to and specifying systems rather than individual products that may not have been tested together.

Building Regulations Approved Document B states people who are responsible for building work (eg agent, designer, builder or installer) must ensure that the work complies with all applicable requirements of the Building Regulations.

3 CONSIDER THE INTERFACE WITH OTHER ELEMENTS AND JUNCTIONS

It has been said that the edge is the most important element of a construction project, which means interaction and interface are crucial, as well as tolerances between abutting elements.

4 UNDERSTAND THE USE OF THE SPACE NOW AND IN THE FUTURE

Operational and working practices are changing rapidly to accommodate a new, more agile workforce, so a flexible approach may be required to lighting and service positions, which should be considered during the specification.

5 UNDERSTAND THE BUDGET

Budgets will vary greatly from project to project depending on the performance levels required on the installation in question. Specifiers can make their budget work harder for them by speaking to a specialist contractor, who should be able to suggest where cost savings can be made without compromising the result.

6 UNDERSTAND THE PROGRAMME AND SITE CONDITIONS

Although careful planning and budgeting can account for most things, the availability of the selected system and the site conditions during installation can hold up the completion of the project and have an impact on the final finishes.

7 UNDERSTAND THE VISION AND CLIENT ASPIRATION

This can be in terms of aesthetics or how the space works. For example, can I hold a private meeting, or can my teams work collaboratively? Is it a good acoustic space?

8 ENSURE THE PERFORMANCE AND WORKMANSHIP REQUIREMENTS AND STANDARDS ARE CLEARLY INCLUDED

Specifying a product is only halfway there if you don't state the standard of workmanship and quality expected at handover, particularly where you are specifying finishes.

A number of British standards refer to workmanship on site in the BS 8000 series, and we always recommend asking for a benchmark against which the completed work can be measured.

THE SPECIFICATION

9 UNDERSTAND THE IMPLICATIONS OF MAINTENANCE

A product in a high-traffic area will undoubtedly require a different maintenance regime to, say, a boardroom. Products that can meet the need with minimum maintenance and cost should be a first choice.

10 UNDERSTAND THE ENVIRONMENTAL IMPLICATIONS AND WHAT WILL HAPPEN AT END OF LIFE

Specification considerations may in some cases be steered by where the ceiling will be installed – for example, a ceiling used in a high humidity environment may be different to one that is suitable for use in a classroom. There may also be a need to meet a good BREEAM or SKA Rating which will impact the initial specification process.

11 DO NOT BE SCARED OF SPECIFYING NEW PRODUCTS – THAT'S HOW NEW PRODUCTS ARE DEVELOPED

The person specifying a performance product to meet the requirements of the Building Regulations is responsible for ensuring compliance. Therefore, a specification should state 'any alternative must be equal AND approved' not 'similar/equal OR approved'.

WRITING A SPECIFICATION

In order to provide a clear and unambiguous statement of what is required, a specification should be produced by the designer/specifier, ideally with assistance from the manufacturer.

WHAT'S INCLUDED AND WHAT'S NOT INCLUDED IN A SPECIFICATION?

The website of the National Building Specification body NBS says this about specifications:

"Populated by the specifier, a specification document describes in words what cannot be visualised or explained on a drawing or model. This document can be incredibly wide-ranging – covering the establishment of the site, the type of contract to be used, the performance criteria

of the asset, the quality of the systems and products, which standards are applicable and how they should be executed, and even the products to be used.

"Specifications do not include information on cost, product availability, quantity or drawn/visualised information, so need to be read in conjunction with documents detailing quantities, schedules and drawings. For this reason, if a product is unavailable and a substitution is required, the specification document should be adhered to when choosing an alternative."

thenbs.com/knowledge/what-are-architectural-specifications

TYPES AND ADVANTAGES OF WRITING A SPECIFICATION

The production of a specification should happen in tandem with design work – with ever greater level of detail added as the design progresses.

Initially, an 'outline specification' serves as a reference guide for clients and for contractors looking to price the project.

Then, by defining what is expected in a 'performance specification', manufacturers are able to offer similar or more innovative solutions, as well as acting as a design brief for specialist subcontractors involved in the tender process.

The 'full specification' should provide a detailed description of the product and/or systems in relation to the specific project and include the performance levels required.

HOW SHOULD SPECIFICATIONS BE STRUCTURED?

The structuring of specifications will vary from project to project but should reflect the work packages on a particular project and any subcontracts. This structuring should make it easier for contractors to price a job and provide a more accurate tender.

The use of a standard classification system, such as Uniclass 2015, is encouraged as it should reduce the potential for confusion or ambiguity.

Leaving specifications until the last minute – when production information is being prepared – is not advised.

THE SPECIFICATION

NATIONAL BUILDING SPECIFICATION (NBS)

NBS provides libraries of pre-written clauses, guidance on regulations/standards and manufacturer product information. To ensure consistency, these are all written by NBS's in-house team and cover virtually all aspects of building design.

They are accessed through the NBS subscription service and have been developed over a long period of time. Starting out as NBS Clauses, the basic versions have been updated and added to with NBS Create and now NBS Chorus.

Each main clause is followed with a number of sub clauses ** to refine the type of ceiling / absorber / product.

NBS Building Ceiling clauses

K10 Gypsum board dry linings / partitions / ceilings

K40 Demountable suspended ceilings

20-10-10 Non-demountable suspended ceiling and soffit lining systems

20-10-20 Demountable suspended ceiling systems

NBS Chorus (Uniclass 2015)

Ss_30_25_10 -** Board and sheet ceiling systems (**with more defined sub clauses)
toolkit.thenbs.com/Uniclass/Ss_30_25_10/

Ss_30_25_22 - ** Demountable suspended ceiling systems (with more defined sub clauses)
toolkit.thenbs.com/Uniclass/Ss_30_25_22/

It is important that manufacturers are consulted on projects. This will help to ensure that what you write in your specification is what will be installed on site. Most will also be more than happy not only to help you write the specification but also to build in performance, regulatory and any other requirements that should be taken into account when pricing or installing the ceiling system.

Although the manufacturer can draft a specification for consideration, the designer/specifier is ultimately responsible and accountable for ensuring the final specification is compliant and in line with the project requirements and Building Regulations.

600x600 mineral wool ceiling in a healthcare setting



DESIGN CONSIDERATIONS

Application – Identify the main characteristics that your ceiling should provide for the use of the space:

Aesthetics – to make a visual statement

Satisfy performance requirements for specific applications with important requirements such as:

- Health / clinical – MRI rooms (only non-ferrous products); anti-ligature ceilings (prevention of self-harm and suicide in hospitals and prisons); pathology (smooth ceilings that can be easily cleaned and disinfected); wards / streets (pleasant, quiet environments)
- Educational – making sure the environmental aspects and acoustics are fit for purpose
- Cinemas – requirement for mass barrier construction and acoustic control
- Clean rooms – strictly controlled environments using compatible products
- Sports hall – acoustics / ball impact
- Swimming pool – ensuring the installation components meet the need for corrosion resistance
- Thermal mass construction – ensuring airflow matches the M&E requirements
- Environmental accreditation schemes – ensuring the project meets the environmental and corporate social responsibility (CSR) standards of the client.

Wall / partition / ceiling interface – ensure that the design intent is clear at specification stage.

- Type of perimeter trim
- Metal Furring (MF) margin to allow for undulating wall or to balance the room to allow for a full tile detail
- Detail any transition trim.

Integration of services into the ceiling void (lighting, sprinklers, air conditioning, smoke detectors, wifi).

Whichever selection is made, there will be a number of key performance criteria that should be met –some that need to be met to ensure the space is fit for its intended purpose and those that are desirable but not essential.

Note: under the Construction (Design and Management) Regulations (CDM), the designer is responsible for ensuring the installation can be delivered and is safe. A designer must take account of pre-construction information the client or principal designer provides when making decisions about the extent to which they can eliminate foreseeable risks through the designs they produce. And, where these risks cannot be eliminated, they should set out the steps they take to reduce or control them.

When designing, a designer must consider the risks people may be exposed to through the course of constructing a building and when using it once completed.



Perimeter trim

PERFORMANCE

This section outlines some of the performance characteristics that ceiling systems and acoustic absorbers can provide. The performance tests for most suspended ceilings are specified in BS EN 13964:2014 (Suspended ceilings - requirements and test methods). Stretch ceilings are covered by BS EN 14716.

Note: links to Approved Document B refer to English Building Regulations. Links to building regulations or standards for Scotland, Northern Ireland and Wales can be found in the Appendix on page 39.

FIRE

Fire performance includes 'reaction to fire' and 'fire resistance'.

To be valid, reaction to fire and fire resistance tests to EN standards must be carried out by a European Commission approved test laboratory known as a 'notified body' whereas tests to BS standards are carried out by UKAS approved test laboratories.

REACTION TO FIRE

Reaction to fire is the measurement of a materials contribution to the development and spread of fire, generation of smoke and the production of flaming droplets. All are major factors in the rate of development of a fire and thereby the risk to people and property. With the exception of A1 non-combustible, ceiling products have a classification with three references – for example, 'A2-s1, d0'.

Reaction to fire is classified under BS EN 13501-1. Products are tested using a number of standards depending on the required or predicted performance.

The required reaction to fire classifications for materials used in commercial buildings are shown in Approved Document B.

assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441669/BR_PDF_AD_B2_2013.pdf

Reaction to fire is a material test and as such the tests are carried out under very strict criteria.

B s1, d0

B

The main part of a classification is its letter: A1, A2, B, C, D, E or F. A1 represents the highest level of performance. F represents the lowest level of 'No performance determined'.

s1

There is a smoke classification of s1, s2 or s3. s1 represents the highest level of performance. s3 represents the lowest level of performance.

d0

There is a classification for flaming droplets and particles during the tests of d0 to d2. d0 represents the highest level of performance. d2 represents the lowest level of performance.

The classification system under BS EN 13501-1

FIRE RESISTANCE

Fire resistance is a system's ability to resist the passage of fire and excessive heat transfer from one area to another.

Fire resistance is shown in the test report as minutes: 30, 60 etc. This refers to the ability of the whole construction to satisfy the (loadbearing capacity, integrity and insulation). referred to as REI

Note: some products or systems may be required to be tested under load.

While the criteria for fire resistance tests are also very specific, there are many variables that can be included in the structural test construction, which can influence the test and installed performance. Variable items – type of floor, void depth, hanger centres, load, for example – will all affect the test result and performance when installed in the project.

The person specifying the product should examine the test report and satisfy themselves that the product meets performance requirements and can be constructed in accordance with the test certificate and field of application.

The specification should be explicit in requiring that the system is installed strictly in accordance with the system owner's instructions.

PERFORMANCE

Where there are other elements that will perforate the ceiling, such as lights and services, the specifier should check that the fire performance of the ceiling can be maintained using mitigation solutions provided by the lighting or services manufacturer, and that any evidence of performance is to the same standard as the ceiling.

There should be no additional loads applied to the ceiling unless mitigated by installing sufficient additional or independent hangers to support the load. This should be included in the assessment.

Fire resistance for a loaded floor construction is reported in BS 476: part 21 tests as minutes for each element of the three test requirements. The BS EN 1365-2 test results are shown as an REI classification in accordance with BS EN 13501-2 – for example, REI30 (30 minutes), REI60 (60 minutes) etc. The three requirements for both BS and BS EN tests are the ability of the whole construction to satisfy the loadbearing capacity (R), integrity (E) and insulation (I). When any one of those requirements is not met, the test is concluded.

The whole test construction is generally made up of the floor assembly, suspended ceiling, any services included in the ceiling plane and a floor load where applied.

As well as the final result, both test reports should show the overall construction, details of components used in construction, floor loading, floor load capacity, data from the test and the test officer's observations during the test.

Ceilings can also be tested under both BS EN and BS test standards as an element providing fire resistance in a loadbearing floor construction, as non-loadbearing ceiling membrane for compartmentation and to structural elements such as steel beams. See table 1 (page 14) and Standards in the Appendix (page 39) for these and other related test standards.

COMPARTMENTATION

Where compartmentation is required, the ceiling must be capable of satisfying the insulation and integrity requirements of Building Regulations for the stated period. To ensure adequate compartmentation, visible and concealed openings

or cavities in raised floors, walls and ceilings, along with any service penetration, must be protected to the required standard to ensure the construction meets the Building Regulations requirement.

Compartmentation is providing a level of performance that is critical to the safety of the building occupants and subdividing the building into areas of manageable risk.

Where compartmentation is required, ensure that a test report is provided showing the ceilings systems suitability and where the installation varies from the test, professional assessments are provided.

Note: the ceiling should not be easily demountable and, depending on the type of ceiling system, may require positive clipping to prevent tiles being removed. Where access into the void is required, lockable, fire rated access traps should be provided. These should be compliant with the ceiling system and have test evidence to support their use. Similarly, any services or penetrations should provide the same level of fire resistance as the ceiling. See Building Regulations Approved Document B for compliance requirements.

assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441669/BR_PDF_AD_B2_2013.pdf

CAVITY BARRIERS

Vertical or horizontal barriers should be installed to restrict the spread of smoke and flames through cavities. See Building Regulations Approved Document B.

FIRESTOPPING

Firestopping is the provision of seals to restrict the passage of fire and smoke through penetrations and fire-resistant elements. See Building Regulations Approved Document B.

The installation of service elements such as modular luminaires, downlights and air conditioning units into suspended ceilings without additional/independent suspension and fire continuance measures of the same standard as the ceiling can lead to a breach of the compartmentation line in a fire. If in doubt, speak to the manufacturer or a specialist consultant.

PERFORMANCE

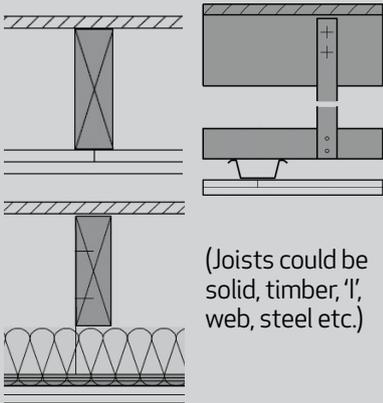
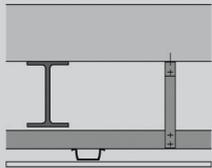
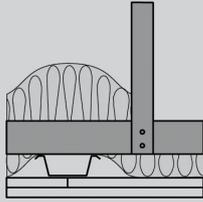
ELECTRICAL SAFETY

Poor electrical installations above a ceiling can pose a risk of electrocution and a serious fire risk.

Although aimed at the domestic market, this publication provides an overview of areas of risks in many construction projects.

electricalsafetyfirst.org.uk/media/1199/best-practice-guide-5-issue-2.pdf

Table 1

FIRE RESISTANCE SEPARATING ELEMENT TYPE	EXAMPLE CROSS SECTIONS	CURRENT UK FIRE RESISTANCE TEST STANDARDS / CLASSIFICATION
<p>Loadbearing floor joist systems (typically timber or steel) which use ceilings as part of the system.</p> <p>In terms of resistance to fire this is testing the whole loaded floor system from below ceiling to above floor deck.</p> <p>Testing to BS 476 part 21 (giving a result in minutes for loadbearing capacity, integrity and insulation) or EN 1365-2 (for EN then classified to EN 13501-2 to get the REI classification).</p> <p>The tested imposed UDL should also be stated in the report and/or third-party approval.</p>	 <p>(Joists could be solid, timber, 'I', web, steel etc.)</p>	<p>BS 476 part 21 will express the test results of the system within the test report in terms of loadbearing capacity, integrity and insulation. Results are shown in complete minutes.</p> <p>EN 1365-2 reports must be classified in accordance with EN 13501-2.</p> <p>The EN 13501-2 classification report will classify the system in terms of R, E and I (in specific class periods set within EN 13501-2 e.g. 30, 60, 90).</p>
<p>Ceilings used to protect structural steel beams reaching critical failure temperature.</p> <p>Tested to BS 476 part 23 (the steel beams can be tested loadbearing or non-loadbearing).</p>		<p>BS 476 part 23 will express the test results of the system within the test report in terms of loadbearing capacity (in accordance with BS 476 part 20 clause 10.2.3 if loaded during the test) and steel beam temperature maintained below 400°C (if non-loaded during the test). Results are shown in complete minutes.</p> <p>No EN test method</p>
<p>Non-loadbearing ceiling membranes used as a fire resistance element in its own right.</p> <p>This is fire resistance performance from below the ceiling to above the ceiling system.</p> <p>Tested to BS 476 part 22 (test report results state integrity and insulation times) or EN 1364-2 (for EN then classified to EN 13501-2 to get the EI classification).</p>		<p>BS 476 part 22 will express the test results of the system within the test report in terms of integrity and insulation. Results are shown in complete minutes.</p> <p>EN 1364-2 reports must be classified in accordance with EN 13501-2.</p> <p>The EN 13501-2 classification report will classify the system in terms of E and I (in specific class periods set within EN 13501-2 e.g. 30, 60, 90, 120).</p>

ACOUSTICS

A GUIDE TO OFFICE ACOUSTICS

thefis.org/membership-hub/publications/guide-office-acoustics/



ROOM ACOUSTICS

Research has shown that ceilings have the biggest impact on the acoustic quality of a room by providing a surface that can either be sound absorbing or sound insulating or a combination of the two.

To ensure that the room acoustics are fit for purpose, the level of reverberation within the room should be controlled.

REVERBERATION

Acoustic problems and disturbance in a room are often derived from long reverberation times, which give a room an echoey feel.

The acoustic quality of a room can be expressed by measuring the reverberation time (**RT**) – the length of time it takes for reverberation to die down. If a room has a long reverberation time, one spoken word does not have time to die out before the next reaches the listener. With this overlapping of sound, speech intelligibility is poor. Generally, the shorter the reverberation time the better the speech intelligibility.

The optimum reverberation time for a room or space is dependent on its intended use, be it office, conference room, classroom, cafeteria, cinema or library.

Measured in seconds, **RT** is defined as the time taken for a generated sound to decay by 60dB once the sound source has been stopped.

Measurement of the room's **RT** and any subsequent calculations will depend on a number of the room's physical attributes – the dimensions and shape of the room, the construction and

materials used for the interior surfaces and the type and position of any other materials or objects used in the room. Surface materials and objects with good, proven levels of sound absorption will reduce reverberation time.

As well as providing the right balance between reflection and absorption, the selection quantity and positioning of sound absorbing materials are key factors in achieving the correct reverberation time for the room's intended use. Acoustic products in the ceiling and upper parts of the walls provide a more consistent level of absorption/reflection as they are free from obstructions such as desks, chairs and furniture.

SOUND ABSORPTION

A ceiling's sound absorbing properties are described in sound absorption classes (A-E), class A being the highest level of sound absorption.

Materials are tested for their ability to absorb sound by being placed in a reverberation chamber and tested in accordance with EN ISO 354. The test is carried out over 18 separate frequencies, from 100-5,000Hz, and the results reported individually as sound absorption coefficients (**α_s**) between 0.00 (total reflection) and 1.00 (total absorption).

Note: while being tested to the same ISO standard, continuous ceilings and discontinuous ceilings (acoustic absorbers/rafts/islands, wall absorbers, etc) are tested using different layouts, reflecting the way they are each normally used in a room setting.

Continuous ceilings are tested in a closed frame of 10-12m² with the ceiling and frame height set at the declared overall depth of system (ODS) shown on the test report.

Table 2

CLASS	A	B	C	D	E	NOT CLASSIFIED
α_w value	0.90, 0.95, 1.00	0.80, 0.85	0.60, 0.65, 0.70, 0.75	0.30, 0.35, 0.40, 0.45, 0.50, 0.55	0.15, 0.20, 0.25	0.00, 0.05, 0.10



Wall mounted absorbers

ACOUSTICS

To allow simple comparison of products, the sound absorption performance is also shown as an α_w , a single, weighted sound absorption coefficient figure between 0 and 1. This single-figure result is also used to place the material in one of the absorption classes shown in table 2 (page 15).

DISCONTINUOUS CEILINGS

Also referred to as islands, baffles, rafts, discontinuous wall linings, acoustic absorbers and discrete objects, individual elements are tested in clusters for sound absorption by placing them on the floor of a test chamber decorative face up and then testing them at a variety of distances from the floor to replicate different suspension depths. As this distance can make a significant impact on the absorber's performance, most manufacturers test at a range of depths.

The test results are reported for each frequency, but unlike a continuous ceiling they are reported as an 'equivalent area per object m^2 ' (**A**).

The 'equivalent sound absorption area' (**A**) is the amount of a chosen product or object that would be required to equal $1m^2$ of a notional material (or open window) that has a sound absorption coefficient (α) of 1.00 (100% absorption) at all frequencies.

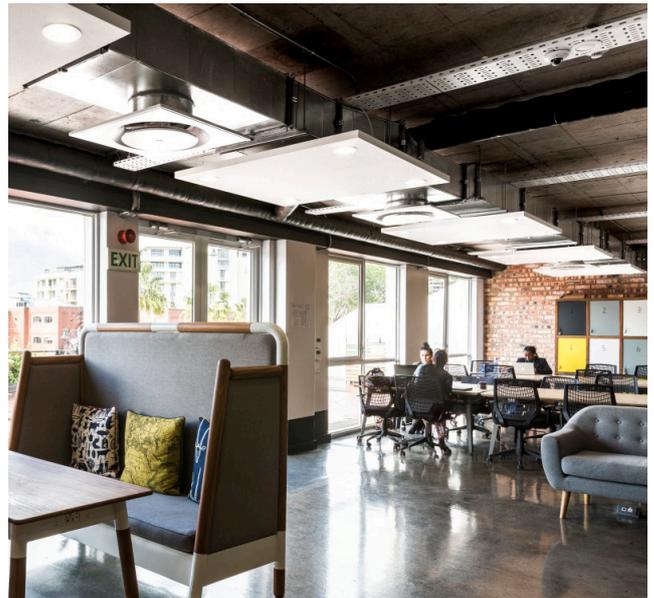
Note: as there is no single weighted figure for these results, the best comparison is to calculate the reverberation time for each room or consult an acoustician, who will compare products and calculate the quantity you require to achieve the optimum reverberation time in each room. They can also advise on the optimum positioning of the absorbers.

INTELLIGIBILITY

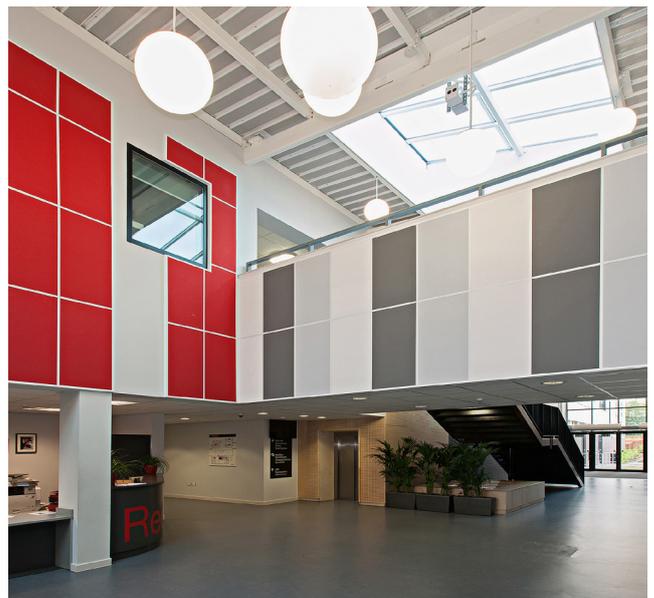
It is important that speech can be understood, so in addition to working towards achieving a reverberation time, some additional acoustic engineering may be required by adding reflective and absorbent surfaces in strategic places.

BUILDING ACOUSTICS

The reduction or control of airborne sound between adjacent spaces.



Discontinuous ceiling



Wall absorbers

Flanking transmission is the indirect transfer of sound energy around an element such as a partition wall.

Demountable and relocatable partitions are often installed to the underside of a suspended ceiling to facilitate flexibility in the layout with a reduced amount of disturbance. This continuous void provides a flanking path for the sound energy to transfer from one space to an adjoining space.

Some ceiling systems are designed and tested to provide a level of airborne sound insulation to reduce some of this flanking sound.

ACOUSTICS

To allow specifiers to compare the sound insulation performance of a ceiling, a single weighted D_{nfw} value is shown in the test report and in the manufacturer's literature.

The flanking sound above the line of the partitioning can be reduced by installing a vertical sound barrier ensuring that the barrier is draped at least 600mm either side of the dividing line.

SOUND REDUCTION INDEX

A ceiling's ability to reduce airborne sound is tested in a laboratory. The measurement is based on the absence of flanking transmission and is measured over a specified range of frequencies to allow professional evaluation.

To allow specifiers to compare the sound insulation performance of a ceiling, a single weighted R_w value is shown in the test report and in the manufacturer's literature.

RAIN NOISE

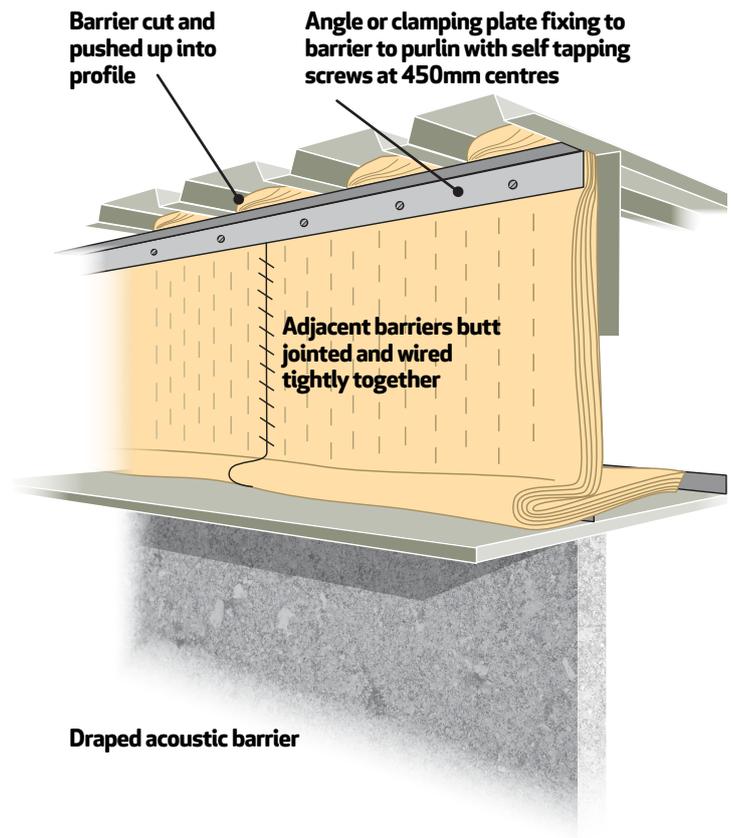
Some rooms can suffer from the sound generated by rainfall on the roof. If this is not addressed in the design and specification stage, it can be so loud that it prevents the rooms from being used for their intended purpose, such as teaching.

Ceilings that are tested to BS EN ISO 140-18 (Measurement of sound insulation in buildings and of building elements. Laboratory measurement of sound generated by rainfall on building elements.) can provide acousticians with relevant data when advising what ceilings could mitigate the issue.

Note: sound insulation figures are measured in a laboratory where the conditions are controlled to enable specifiers to compare products' performance.

Note: as site conditions will vary, an acoustician should be consulted to interpret the laboratory results and advise on the anticipated on-site performance.

Note: any penetrations in the ceiling or partitions for services will have an impact on the elements' ability to perform and it may lead to significant loss of performance.



Draped acoustic barrier

STRUCTURAL SOUND TRANSMISSION

Structural sound caused by footfall, machinery such as air conditioning units or lifts is primarily controlled by isolation and/or the absorption of vibration, suspended ceilings and acoustic absorbers have minimal effect on its reduction.

OTHER MATERIAL CHARACTERISTICS

VOLATILE ORGANIC COMPOUNDS (VOCS)

Products that release very low levels of formaldehyde are required to achieve credits in most environmental schemes. The current method of assessing formaldehyde content in ceilings is described in BS EN 13964 and is based on EN 717-1, which has two classifications: E1 release ≤ 0.124 mg/m³ and E2 release > 0.124 mg/m³.

COLOUR / GLOSS

The colour and gloss of exposed grid and trims may differ between manufacturers but are generally based on RAL numbers. Where the colour and finish of grills and other components are required to match, coordination between the suppliers will be required.

Note: where ceilings provide an uninterrupted surface, they may be subject to changing and glancing light; minor shade, gloss or background variation may be visible despite the ceiling being within tolerance.

LIGHT REFLECTANCE (LRV)

This is expressed as a figure between 0 and 100, with 0 being absolute black with total absorption and 100 being perfect white providing total reflection.

CORROSION RESISTANCE

It is important to identify any environmental conditions, such as high humidity in leisure facilities or exposure to sea air in canopies, to ensure that the materials specified are robust in these conditions.

BS EN 13964 identifies four classes of exposure: A = exposure to RH of up to 70% and up to 25°C without corrosive pollutants; B = exposure to RH of up to 90% and up to 30°C without corrosive pollutants; C = exposure to RH of 95% and up to 30°C and accompanied by the risk of condensation but without corrosive pollutants; D = more severe than preceding classes.

Extreme environments, such as swimming pools and other areas that fall into category D, require that the suspension system, infill panels, hangers, top fixings and associated fixings are all specified

with products suitable for the conditions and anticipated exposure levels expected during the building's life. The corrosive elements of the environment may necessitate frequent and regular access into the ceiling void to inspect the ceiling and associated components and look for signs of corrosion.

IMPACT RESISTANCE

Where there is a likelihood of impact on the ceiling, such as a sports hall or an area where ball sports are played, BS EN 13964 provides a laboratory test method and three classifications: 1A, 2A and 3A, depending on the speed of the ball to help product selection.

AIR PERMEABILITY

The ability of a product or system to resist the passage of air can be a requirement within operating theatres, clean rooms and laboratories where rooms may require a positive or negative room pressure.

Ceilings can be classified using ISO 14644-1:2015 Cleanrooms and associated controlled environments – Part 1: Classification of air cleanliness by particle concentration.

WIND LOADING / AIR TIGHTNESS

Air pressure variations can be caused by the normal opening and closing of doors and windows, so the move to airtight buildings may increase the pressure exerted on ceilings. It is important to identify if the risk could occur and, if so, to what extent.

To reduce detrimental movement, the ceiling system may require additional or different types of hangers, bracing or additional elements to enable the ceiling to resist the anticipated upward/downward loads. This should be discussed with the suppliers at the earliest stage.

RESISTANCE TO BACTERIAL / FUNGAL GROWTH

Clinical, laboratory and food preparation areas will have specific requirements to resist bacterial and fungal growth which must be considered at the specification stage.

600x600 mineral wool ceiling in a leisure setting



SUSTAINABILITY

The sustainability of ceilings can be measured using an Environmental Product Declaration (EPD) using ISO 14025 or BS EN 15804 to understand the embodied carbon and environmental impacts, as well as understanding how manufacturers are actively engaged in recycling and reducing their carbon footprint.

RESOURCE EFFICIENCY ACTION PLANS

Offcuts produced on site during the installation process can be recycled at the end of the project as well as at the end of the project life.

Specifiers should discuss this with manufacturers/suppliers during the specification process to ensure the best results.

See the Resource Efficiency Action Plan (REAP) for mineral ceilings tiles

thefis.org/knowledge-hub/sustainability

ENVIRONMENTAL SCHEMES AND PRODUCT ACCREDITATIONS

There are number of environmental schemes, such as the Well Building Standard, SKA Rating and BREEAM, whose goal is to assess the impact on our wellbeing and the environment of both construction and use of the project when completed. Some of these also assess the impact of refurbishment and refit of older projects.

standard.wellcertified.com/well

breeam.com

CONFORMITY MARKS

UKCA MARKING

FOR PRODUCTS PLACED ON THE MARKET IN ENGLAND, WALES AND SCOTLAND

The UK has adopted current (2021) harmonised European norms as designated standards, requiring products placed on the market in England, Scotland and Wales to have a declaration of performance produced by a designated body in the UK and to affix a UKCA mark.

[gov.uk/guidance/prepare-to-use-the-ukca-mark-after-brexit](https://www.gov.uk/guidance/prepare-to-use-the-ukca-mark-after-brexit)

UKNI MARKING

FOR PRODUCTS PRODUCED IN THE UK AND PLACED ON THE MARKET IN NORTHERN IRELAND

The UK has adopted current (2021) harmonised European norms as designated standards, requiring products placed on the market in England, Scotland and Wales to have a declaration of performance produced by a designated body in the UK and to affix a UKCA mark where the product is put on the market in England Wales and Scotland and UKNI mark when manufactured in the UK but put on the market in Northern Ireland.

[gov.uk/guidance/using-the-ukni-marking](https://www.gov.uk/guidance/using-the-ukni-marking)

CE MARKING

FOR PRODUCTS PLACED ON THE MARKET IN THE EU, OR PRODUCED IN THE EU AND PUT ON THE MARKET IN NORTHERN IRELAND

Where a harmonised standard exists for a product, the Construction Products Regulation (CPR) places obligations on manufacturers, distributors and importers (known collectively as economic operators) of that product when it is placed on the market. The product must have a declaration of performance and have been affixed with CE marking.

In compliance with the Construction Product Regulation (CPR 305/2011), ceiling systems are CE marked according to the European harmonised standard EN 13964:2014.

The standard consolidates methods for product testing, product classification and performance declaration for suspended ceilings.

To improve transparency in terms of product performance, CE-marked construction products are covered by a Declaration of Performance (DOP) to enable customers and users to easily compare the performance of products available on the European market.



Timber ceiling in a commercial setting

MATERIAL TYPES

CEILING

Ceilings have developed from lath and plaster and basic wood fibre insulation board to a complex and critical element that can satisfy many key requirements in today's commercial, health, retail and educational projects. Today our choices are considerably wider and have expanded more to include wall, ceiling and shaped acoustic absorbers.

ABSORBERS

These are installed to reduce reverberation as a result of hard surfaces in a space. They are designed to be suspended from the soffit or fixed to the walls and can be installed during construction/ refurbishment or retrospectively.

Where a reverberation problem already exists in a room, absorbers can help provide an easy solution. An acoustician should be consulted to identify the problem and advise the correct number of absorbers required and where to place them for the best performance.

MATERIALS

Table 3 shows the most common materials used for ceiling systems and sound absorbers. It is not a definitive list and is continuously expanding as manufacturers develop new products to meet the demands of architects and designers.

Table 3

MATERIAL	FORMAT>	Tile	Panel	Plank	Board	Monolithic	Suspension systems	Baffle	Island	Raft	Wall absorber	3D shapes
Gypsum board		✓	✓		✓	✓			✓	✓		
Metal		✓	✓	✓			✓	✓	✓	✓	✓	
High density mineral wool		✓	✓	✓		✓		✓	✓	✓	✓	
Resin bonded stone wool		✓	✓	✓		✓		✓	✓	✓	✓	
Resin bonded glass wool		✓	✓	✓		✓		✓	✓	✓	✓	
Cement fibre			✓		✓							
Calcium silicate		✓	✓		✓							
Magnesium oxide		✓	✓		✓							
Timber		✓	✓	✓				✓				
Wood wool		✓	✓					✓	✓	✓	✓	
Polyester (PET)		✓	✓					✓	✓	✓	✓	✓
Foam / fabric / wool								✓	✓	✓	✓	✓
Lightweight PVC stretch fabric			✓			✓			✓			



Discontinuous ceiling in a commercial setting

CEILING SYSTEMS

A ceiling is defined as a construction covering the underside of a floor or roof, providing the overhead surface for the room or space.

A suspended ceiling is a membrane hung by a suspension from or by a directly fixed substructure or perimeter trim to the load-bearing structure (floor, roof, beam and walls) at a distance from the floor or roof above.

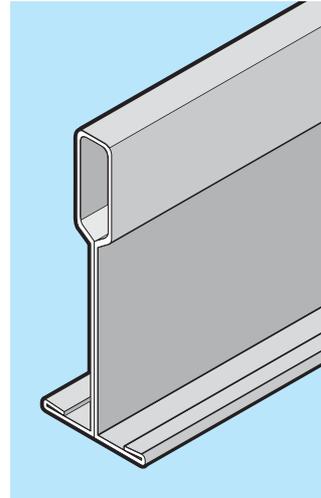
CONTINUOUS CEILING

This involves a ceiling membrane suspended from the soffit from hangers, with boards, tiles or planks installed to or within a grid that goes from wall to wall.

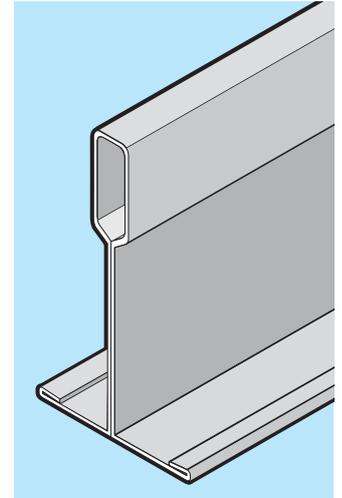
Corridor systems are ceilings designed to be installed between the walls (clear span) with planks/reinforcing profiles supported from specified wall trims.

EXPOSED OR LAY-IN GRID SUSPENSION SYSTEM

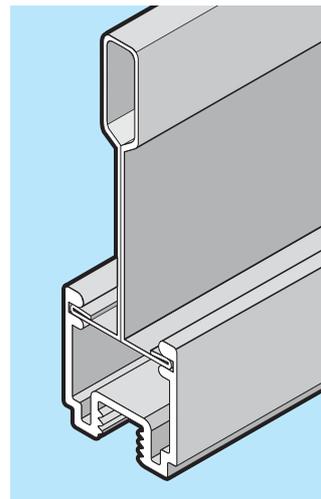
- An inverted tee system with a visible width of 24mm or 15mm, also available with a profiled visible face – generic systems are based on 600x600 and 1,200x600 modules
- Standard bandraster systems have a wider visible width of 50, 75, 100 and 150mm
- C bandraster systems are again available in a range of widths but used primarily for metal ceiling systems.



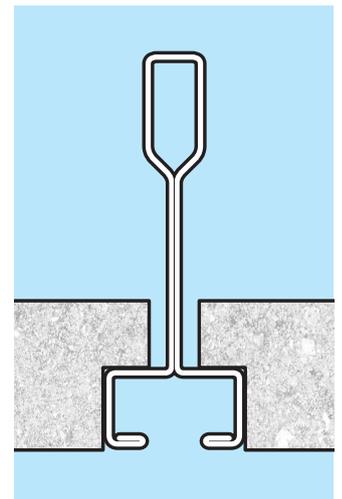
15mm wide exposed tee



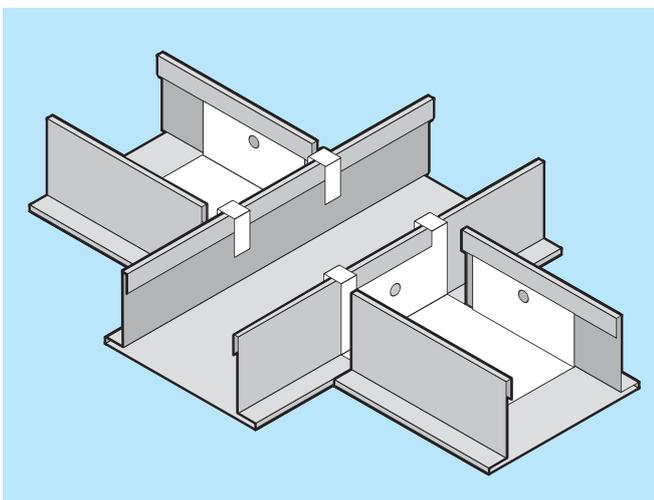
24mm wide exposed tee



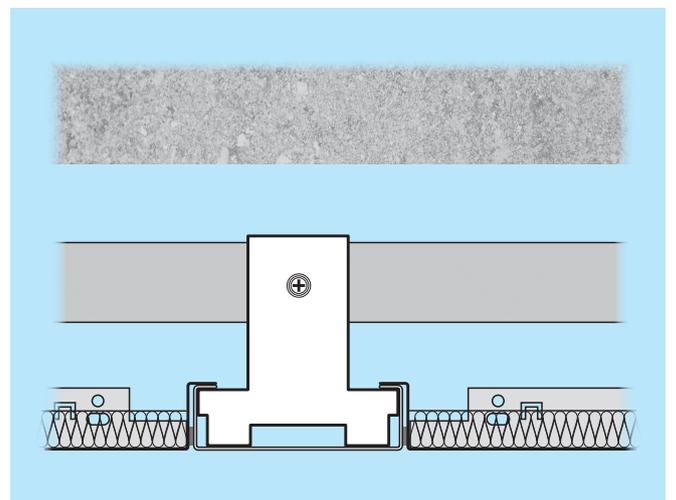
15mm wide profiled tee



15 mm wide tee with screw thread capping



Bandraster exposed profile



C Bandraster exposed profile

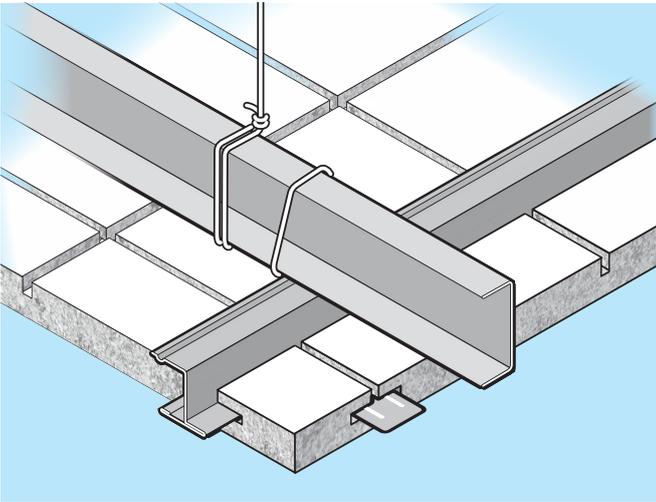
CEILING SYSTEMS

CONCEALED SUSPENSION SYSTEMS

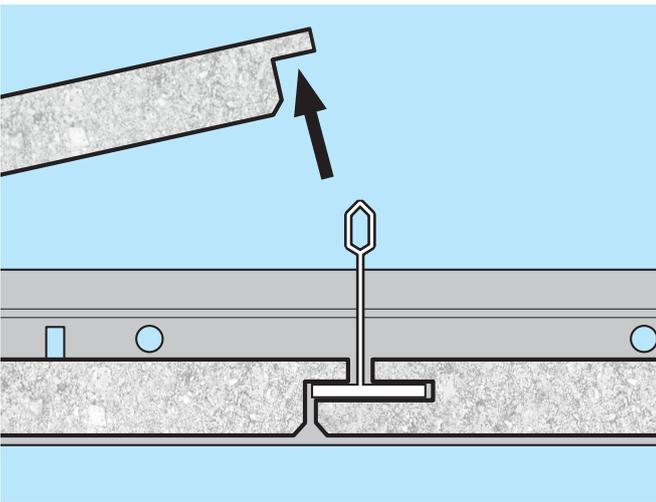
An arrangement where tile, panels or planks are installed onto and conceal the suspension system.

When used in conjunction with encapsulated mineral wool pads, perforated metal ceilings can provide high levels of sound absorption and airborne sound reduction.

These systems are designed for mineral wool, resin bonded glass wool or stone wool tiles or planks

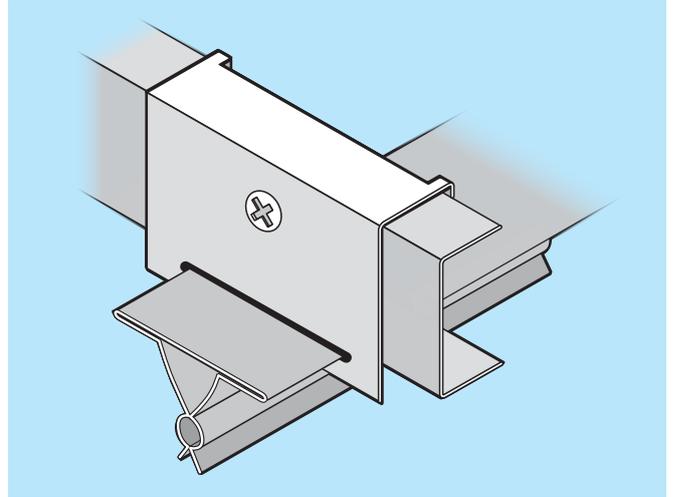


Non accessible system for mineral wool tiles

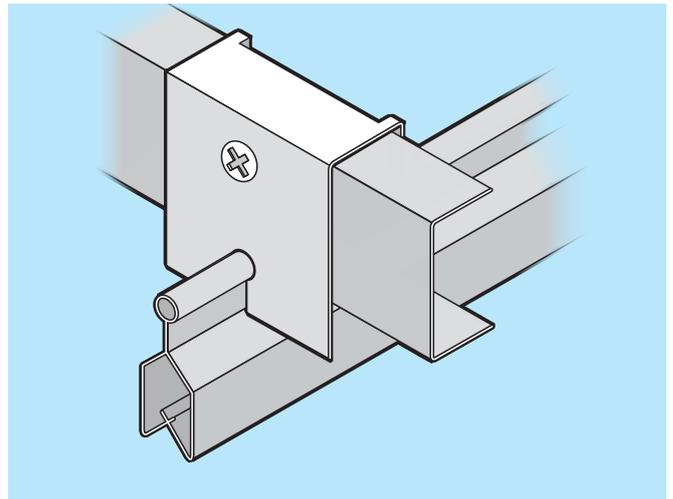


Shiplap demountable system for mineral wool tiles

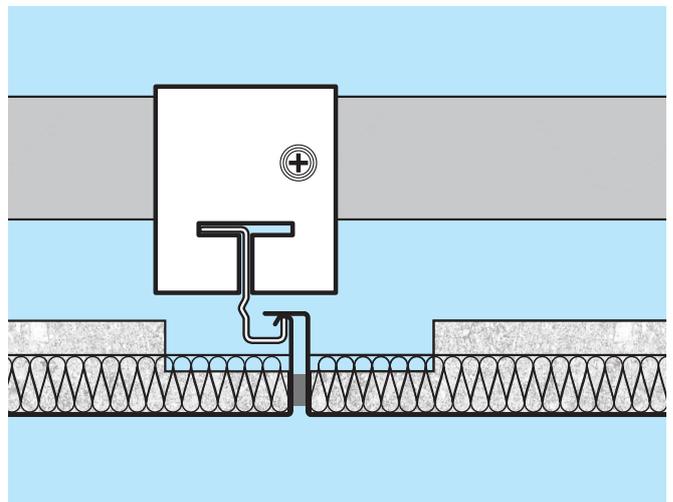
Designed for metal tiles, these systems allow access from below



Spring tee clip-in system for metal tiles



Omega bar clip-in system for metal tiles



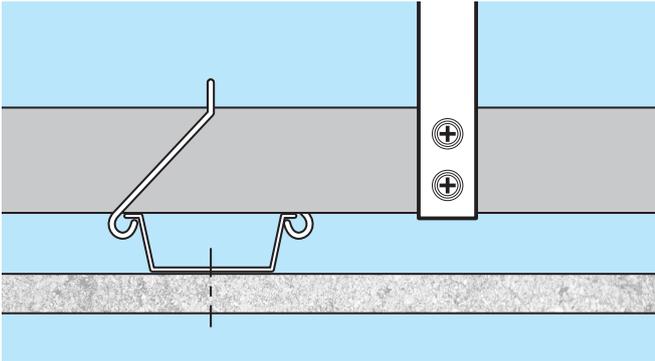
Hook on system for metal tiles

CEILING SYSTEMS

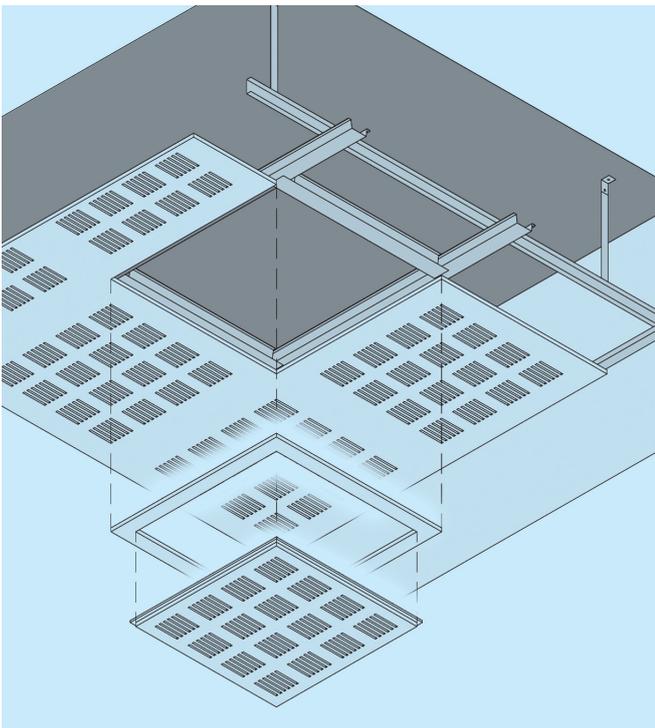
METAL FURRING SYSTEMS

These provide a near monolithic finish, using boards jointed and finished prior to decoration.

They are generally imperforate and can provide good levels of sound insulation and/or absorption with the specification of specialist plasters and boards with sound-absorbent properties.



Metal furring system (MF)



European MF

SECURE SYSTEMS

MF continuous ceiling systems can provide a secure system with access created by installing proprietary secure access traps.

Metal clip-in concealed systems can be made secure, again with access by propriety secure access traps.

Both provide little opportunity for the attachment of ligatures, so can be considered for use in hospitals, prisons and police stations.

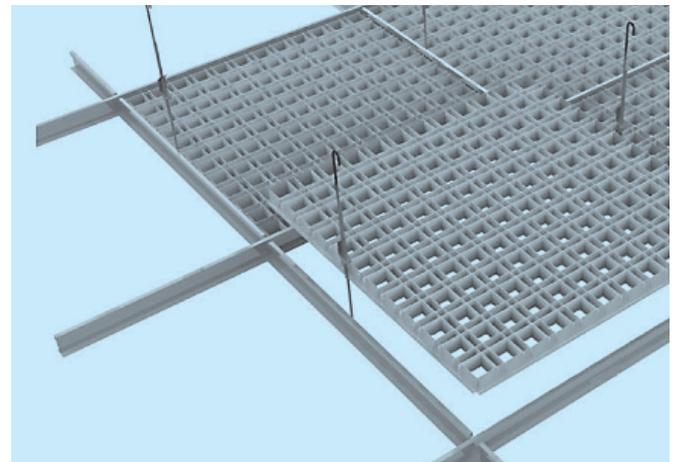
Some exposed grid systems can be positively clipped to prevent easy access or concealment of contraband.

OPEN CELL AND OPEN LINEAR CEILINGS

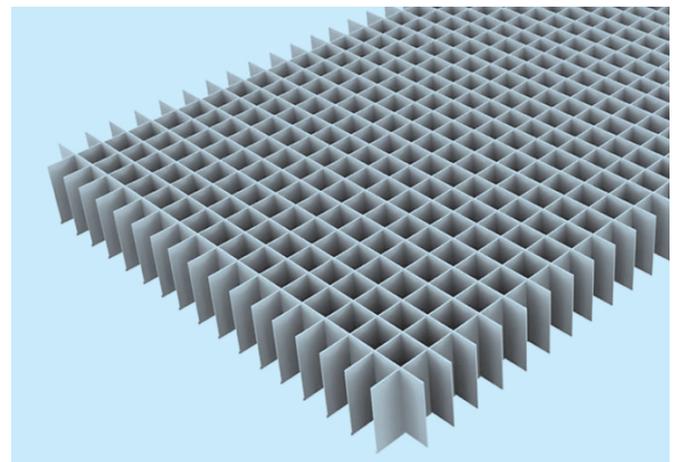
Although visually these ceilings can provide a continuous appearance, they can also be used to provide a varying level of acoustic absorption, as well as allow air flow into the void.

Depending on the specific requirements, this can make them suitable for use in thermal mass projects, as well as large public areas such as shopping complexes and airports, and are aesthetically appealing.

Available in metal, high-density mineral wool, GRG etc.

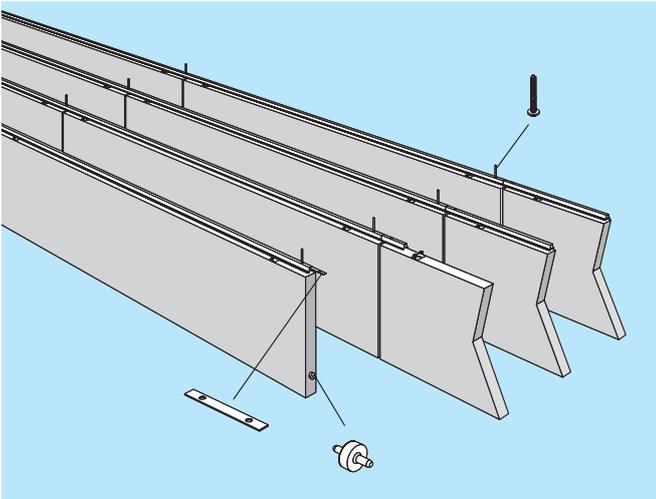


U profile open cell

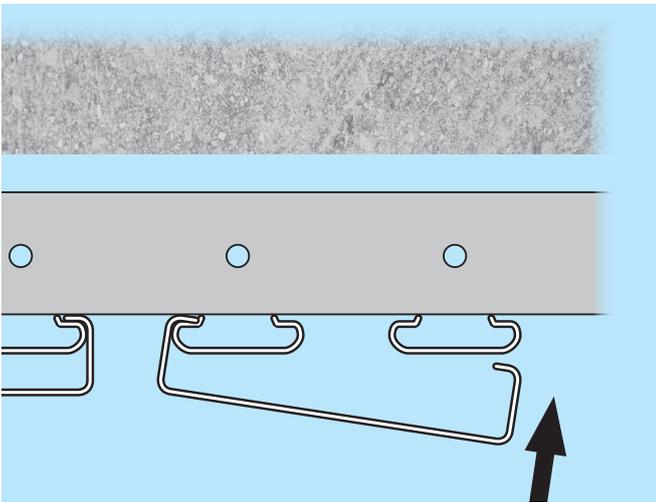


Mono blade open cell

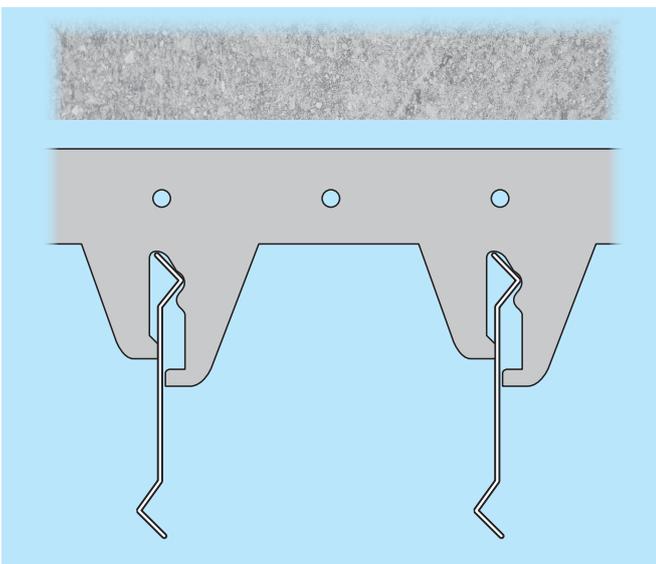
CEILING SYSTEMS



Baffles in a variety of materials



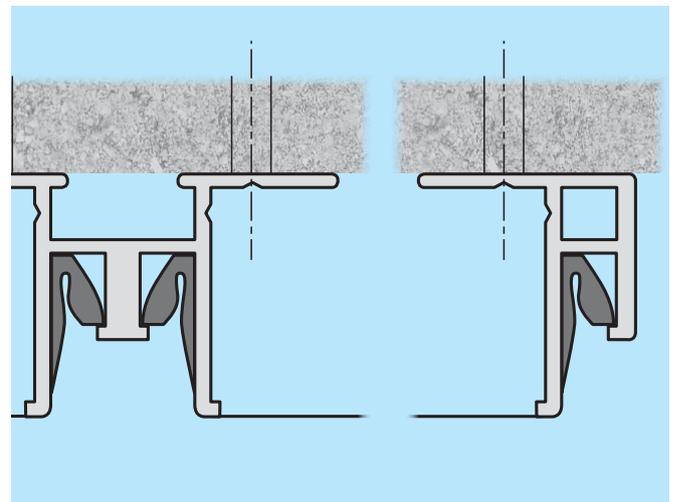
Linear metal strip



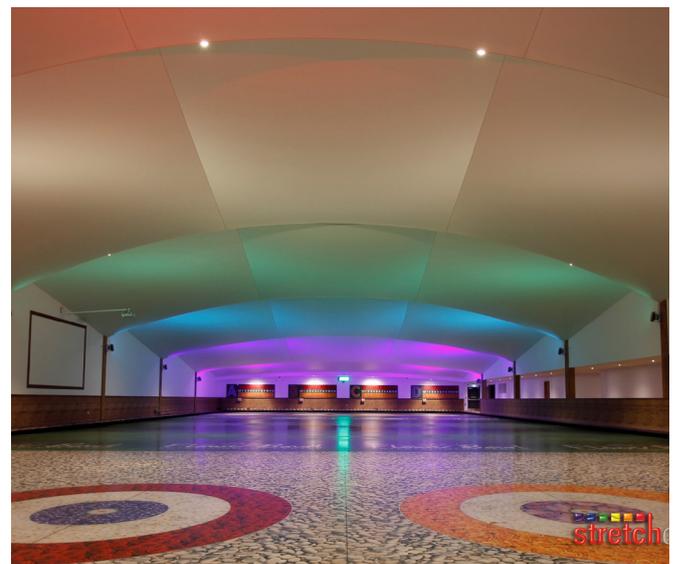
Metal mono blade

STRETCH CEILING

A fixed perimeter track and a membrane that is stretched and clipped into the track before having heat applied, which shrinks the membrane to leave a taut finish. BS EN 14716 (Stretched Ceilings Requirements and Test Methods) covers stretch ceilings.

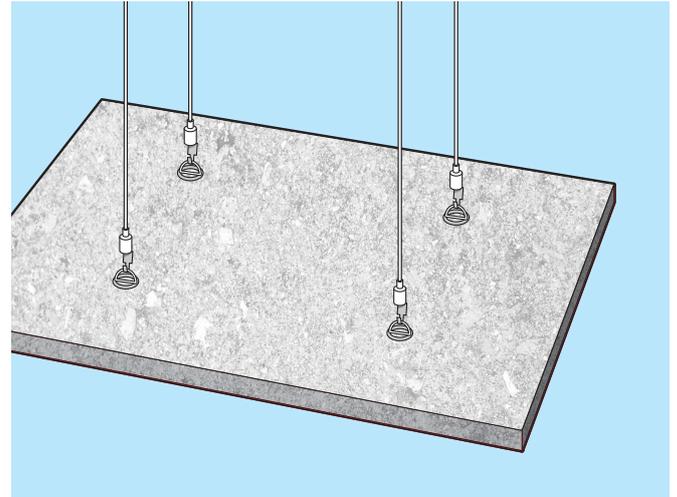


Stretch

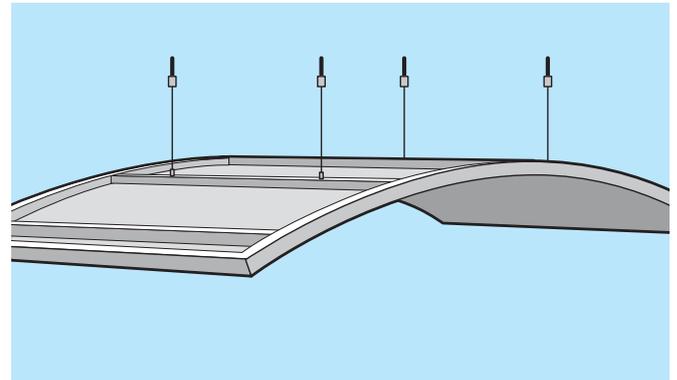


Stretch ceiling in a leisure setting

CEILING SYSTEMS



Pre-made raft



Kit form raft

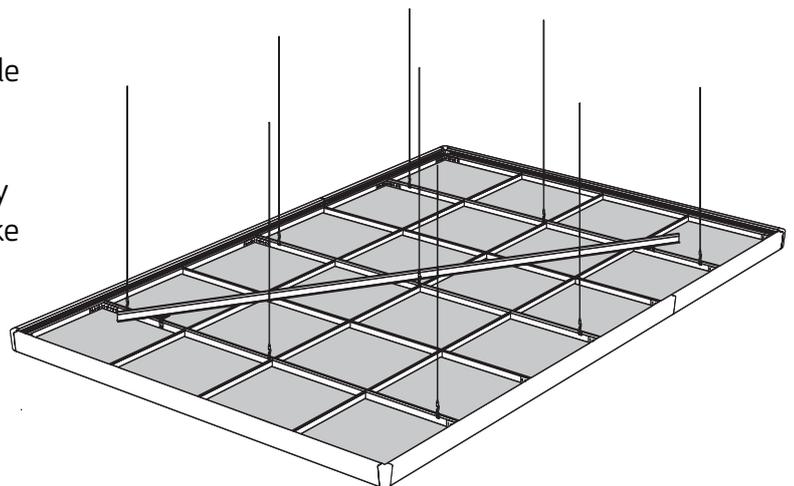
DISCONTINUOUS CEILING

A ceiling element that is hung or fixed to the soffit as single independent units and is not connected to perimeter walls or partitions.

Depending on the element, they can be installed vertically or horizontally.

Normally referred to as islands, canopies or rafts, they come in a number of forms, as single elements or kits.

These are normally supplied as a kit and constructed on site. Often designed using many standard components, they can be used to make large islands within a room or space.



Site constructed raft

CEILING SYSTEMS



Discontinuous ceiling

ACOUSTIC ABSORBERS

Formed from single or multiple elements, acoustic absorbers can be suspended from the soffit/ceiling, fixed to walls/partitions or supplied as a standalone screen. To achieve the best acoustic performance, they should be installed as per the test report, with an appropriate gap/void depth behind the product if required. See 'Installation depth' (page 33).

Where suspended from an existing soffit, ensure that the correct top fixings are used. If suspended below an existing suspended ceiling, ensure that the original ceiling and existing top fixing can carry both loads. See page 17 for more examples of acoustic absorbers.



Baffles in a commercial setting

INSTALLATION CONSIDERATIONS

FIS BEST PRACTICE GUIDE: INSTALLATION OF SUSPENDED CEILINGS

FIS BEST PRACTICE GUIDE: SELECTION AND INSTALLATION OF TOP FIXINGS FOR SUSPENDED CEILINGS

thefis.org/membership-hub/publications/best-practice-guides/



Although this guide is written to provide guidance on the specification of suspended ceilings and acoustic absorbers, specifiers should ensure that the systems selected can be safely and correctly installed and will achieve the required performance.

For further guidance please refer to:

- BS EN 13964 – Appendix A – Guidance for Installation
- The FIS Best Practice Guide: Installation of Suspended Ceilings.

LOAD CAPACITY

For ceiling systems, the maximum recommended load for a suspension system is based on its capacity to support a uniformly distributed load (UDL). This is normally based on main suspension profiles being suspended at 1,200mm centres with hangers at 1,200mm along their length.

The maximum UDL is expressed in kilos per square metre and is normally based on the system achieving a Class 1 level of deflection, as shown in BS EN 13964.

Note: the stated UDL does not normally include the weight of ceiling tiles / infill units as they can vary. For example, if the declared suspension system UDL is 10kg/m² and the weight of the ceiling tiles /infill units is 4.5kg/m², the additional UDL it can carry to maintain a Class 1 deflection is 5.5kg/m².

The UDL of a system can be increased by reducing the installation centres of the main profiles; increasing the frequency of the hangers; independently supporting the additional elements. Many manufacturers also offer their suspension profiles in a range of different heights that can be used to provide a larger span between hangers or

increase the systems load capacity.

Although additional elements placed in or on the ceiling system may not cause it to exceed the system UDL, it is important to establish whether the tiles / planks / infill units are able to support the load in their own right or if there is a need to provide additional support in the form of pattresses and / or independent suspension.

Where the ceiling infill panel is manufactured from a hygroscopic material and used in high-humidity environments such as shower areas and

hydrotherapy pools, some products may dramatically increase in weight. This eventuality should be allowed for in load calculations for both the ceiling system and method of top fix.

Consult the manufacturer to ensure that the anticipated design load can be accommodated.

TOP FIXINGS

The selection and installation of the correct top fixing method is critical and should be noted on the relevant drawings (BS EN 13964 A.5.7). With so many different types of soffit, this is a specialist area and FIS, working in conjunction with the Construction Fixings Association, produced the following publication based on three ceilings loads:

Light weight – a ceiling with a maximum dead load of less than 10kg/m²

Medium weight – a ceiling with a dead load between 10kg/m² and 30kg/m²

Heavy weight – a ceiling with a dead load in excess of 30kg/m² (eg multilayer plasterboard)

Note: incorrect specification or incorrect installation of top fixings (anchors) are the most common reasons for ceiling collapses.

Note: fluctuations in air pressure caused by wind or large opening doors may increase the load on the fixings.

The FIS Best Practice Guide: Selection and Installation of Top Fixings for Suspended Ceilings provides specific guidance.

Note: BS EN 13964 A.5.7 states: “The chosen (selected) top fixing method shall be detailed on the relevant drawings.”

1,200x600 mineral wool ceiling and wall absorbers in an education setting



INSTALLATION CONSIDERATIONS

In addition, as a specialist association, the Construction Fixings Association has put together a number of How to Guides to help you understand the selection, installation and testing of fixings based on BS 8539 – the code of practice for the selection and installation of post-installed anchors in concrete and masonry. Proof testing is not complicated and is important – it is the only safe way to find out if the selection and installation are correct for the project.

These, along with other important information, can be found at:

The Construction Fixings Association

provides information about drilled-in fixings and anchors for concrete, masonry and plasterboard.

the-cfa.co.uk

CIRIA (Construction Industry Research and Information Association) has produced guidance on construction fixings in its publication *General fixings – selection and whole-life management (C777)*. This includes a fixings rating system based on the consequences of failure, called RAG, which stands for Red (critical fixing), Amber (less critical) and Green (important but not critical).

ciria.org

SER Scotland (Structural Engineers Registration) has been appointed by the Scottish Government's Building Standards Division to administer a scheme for Certification of Design (Building Structures). ser-ltd.com/ser-scotland/resources/certification-performance-criteria/b6-1-internal-partitions-and-ceilings

SER Jersey has been appointed by the Government of Jersey Planning and Environmental Department to administer a scheme for Certification of Design (Building Structures).

HANGERS

There are a number of generic as well as special hanger types available and selection will depend on:

- Ceiling system / acoustic absorber requirements eg a metal concealed system would require a rigid metal hanger
- Other forces acting on the ceiling eg lateral movement, deflection and project environment. Ensure that the top fixing and hanger type are compatible and that they can provide the correct carrying capacity.

The manufacturers should advise the correct type of hanger for their system.

See table 4 (page 34) for common hanger types.

INSTALLATION DEPTH

When selecting a ceiling, consider the void depth requirements to meet the acoustic / fire performance and the height required to install and remove ceiling tiles, especially where services run through the void and access into the void is required.

Note: service elements can also adversely affect hanger spacing.

Where access into the void is required, the general consensus suggests that an exposed grid system should be installed with a minimum depth of 120–150mm. This will depend on the size and thickness of the ceiling infill panel and assumes no restrictions in the void, such as joists beams or services, which may hinder access.

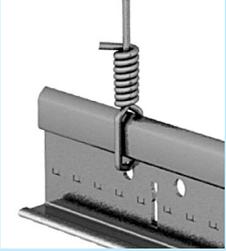
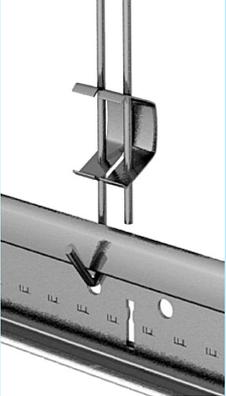
Where the ceiling or acoustic absorber is providing fire, acoustic or other proven levels of performance, the installation depth should as per the relevant test certificate/report. Ignoring the test installation depth without consulting the manufacturer or a consultant may cause a significant reduction in acoustic performance and/or a significant reduction in the required level of fire resistance, thereby posing a serious risk to life and property.

Note: void depth is critical as the space between the back of the product and the soffit / wall will impact performance.

Note: the void depth can be found in the test report provided by the manufacturers.

INSTALLATION CONSIDERATIONS

Table 4 Common hanger types

	<p>2mm diameter galvanised steel wire – normally supplied in coils of around 200 linear metres and cut to length on site. The wire must be pre-tensioned prior to use and be tied off with a minimum of three turns on top and bottom connections.</p>		<p>19x19mm or 25x25mm galvanised steel or aluminium angle – supplied in 3,000mm lengths and various thickness and gauges (minimum 0.8mm), depending on the requirement, and cut to size on site. Mechanically fixed to hanger and ceiling profiles.</p>
	<p>4mm diameter adjustable steel rods – supplied with top and bottom rods along with a connecting 'butterfly'. The butterfly provides the fine adjustment and connection of the two rods. The top and bottom rods are normally available with the choice of a hook or eye on one end and supplied in a number of fixed lengths. Some manufacturers also offer the option of a snap or slide-on connection on the bottom rod.</p>		<p>Nonius hangers are formed from a lower channel that has a bottom pressing formed to slide over or into the ceiling profile and an upper channel that is mechanically fixed into the soffit. The channels are designed to nestle together and are fixed and adjusted using securing pin(s) pushed through holes in the legs of the channels.</p>
	<p>Threaded rod used for suspending heavy weight ceilings.</p>		<p>Wire hanging kit for rafts, islands etc.</p>
	<p>Resilient or acoustic hangers designed to reduce the transmission of sound and vibrations into and from the building structure or services.</p>		<p>Soffit cleats, a fixing point for the hangers used in conjunction with a suitable top fixing.</p>

INSTALLATION CONSIDERATIONS

INTERSECTION OF WALLS / PARTITIONS / CEILINGS

WALL / PARTITION TRIMS

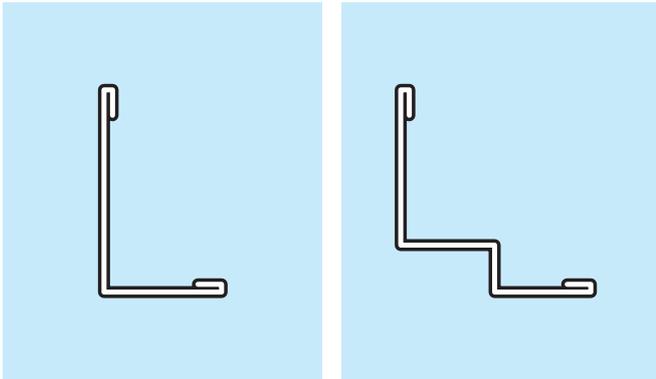
A ceiling trim is applied to the walls to take up variations in room dimensions and to form a neat and secure intersection with the wall/partition.

The shape, size and composition will be reliant on the ceiling system and design requirements. Ceiling trims are manufactured primarily in aluminium and pre-painted steel.

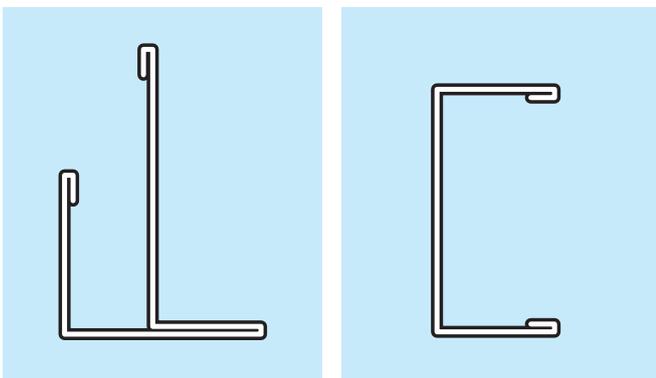
STANDARD STEEL TRIMS

L-shaped trims made from 0.5mm pre-painted steel.

All trims should be installed in accordance with the manufacturer's instructions and/or in the case of performance ceilings, in accordance with the method shown in the test report.



L-shaped trims produced from 0.5mm pre-painted steel



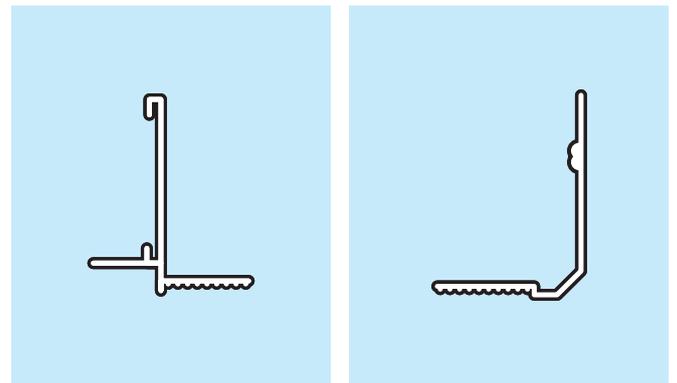
ALUMINIUM TRANSITION AND STANDARD WALL TRIMS

Aluminium trims provide a comprehensive selection of standard and specialised profiles. Transition trims are primarily designed for use at the interface of upstands and different types of ceiling systems.

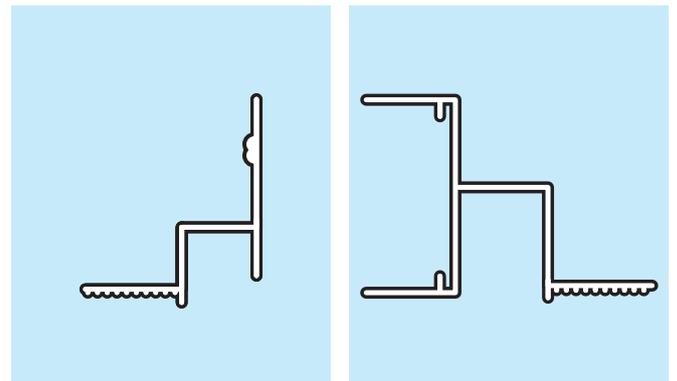
The most common example of this is where a perimeter margin or narrow band of an independently suspended ceiling, such as gypsum MF, has been included in the room design to address variations in a room size and shape allowing the use of full tiles in the main field area.

The use of a suitable transition trim at the interface of the two ceilings provides a neat detail between the tiles and the metal furring ceiling and eliminates the need to cut tiles and so reduces waste.

It is imperative that these margins are properly co-ordinated with the main suspended ceilings and all elements are independently suspended and installed in accordance with manufacturer's instructions.



Aluminium transition and standard wall trims



PARTITIONS

If partitions are installed full height – from floor to structural soffit – pre-painted steel or aluminium perimeter trims should be used, ensuring that the manufacturer's installation recommendations are followed.

It can be acceptable to install non-loadbearing mid-weight partitioning to the underside of a suspended ceiling, provided that the fixing is

INSTALLATION CONSIDERATIONS

FIS BEST PRACTICE GUIDE: INSTALLATION OF PARTITIONING

thefis.org/membership-hub/publications/best-practice-guides/



directly into the ceiling grid main tee/framework. In addition, the performance of the partition should be maintained in the ceiling void by installing fire and acoustic barriers where necessary, and the installation should be strictly in accordance with the manufacturer's instructions and test certification.

The partitioning stability is gained from the partition layout and should not add any loading to the ceiling. The ceiling grid main tee / framework to which the top track of the partition is fixed should be considered to provide location only. See the FIS Best Practice Guide: Installation of Partitioning, section 6.1.

Where operable walls are being installed, there will be a need to construct suitable framing behind the suspended ceiling to carry the necessary weight and load requirements of the wall.



Typical example of service integration

INTEGRATION OF SERVICES

It is important that the types, loadings and dimensions of service elements are discussed with the specialist ceiling contractor/ceiling manufacturer at the tender stage.

The colour of service elements such as grilles and speakers should be checked against the colour of the grid and tiles.

Note: all cables should be independently supported and not left to lie on the back of the ceiling.

PROJECT PLANNING

Sufficient time should be allocated for the procurement delivery and installation of the suspended ceiling.

Meetings should be held as early as practical with the specialist contractors to ensure all aspects of the specification are understood and the programming is achievable.

SITE CONDITIONS / ENVIRONMENT

Suspended ceilings and acoustic absorbers are essentially a finishing trade and the building should be in a suitable condition before systems are installed.

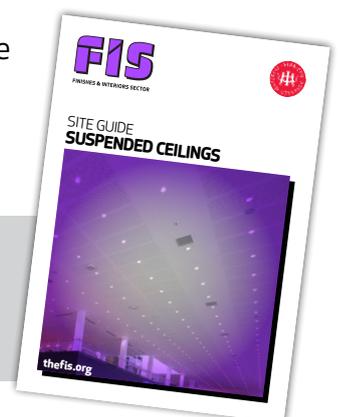
The manufacturer's recommended site conditions for the installation of its materials should be followed.

Suspended ceiling work is normally carried out in one operation. The prior fixing of hangers or main grids as a separate operation from the fixing of the panels will add to the cost of the installation. Where mobile platforms are used, areas required for installation should be clean and clear of equipment and materials of other trades to provide an adequate and safe working space. The specialist contractor should leave these areas in a clean state after installation of the ceiling.

See the FIS Site Guide: Suspended Ceilings for more information about project planning and site requirements.

FIS SITE GUIDE: SUSPENDED CEILINGS

thefis.org/membership-hub/publications/site-guides/



INSTALLATION CONSIDERATIONS

FIS BEST PRACTICE GUIDE: RECOMMENDATIONS FOR THE SAFE INGRESS OF PLASTERBOARD

[thefis.org/membership-hub/
publications/best-practice-guides/](https://thefis.org/membership-hub/publications/best-practice-guides/)



MATERIAL HANDLING

Meetings should be held with the main contractor and specialist contractors as early as practical to ensure that consideration is made for the safe ingress of materials and storage of materials on site in accordance with the manufacturer's recommendations.

The FIS Best Practice Guide: Recommendations for the Safe Ingress of Plasterboard has a number of recommendations that are designed to reduce the risk of injury and damage to the materials.

MANUFACTURER RECOMMENDATIONS

The manufacturer's installation recommendations should always be followed. This is especially important where the ceiling is expected to satisfy performance criteria.

Note: although different components from different suppliers may look similar, it does not mean that they will provide the same level of performance.

Note: if components in systems are changed, or the recommended installation methods not adhered to, the design and performance levels become the responsibility of the person or organisation that changed them.

The manufacturer or systems owner should be consulted if you are considering changing any aspect of the installation or design.

MANUFACTURER INSTALLER SCHEMES

Many systems owners can provide a list of contractors who are trained in installing their systems. Where possible, and where warranties are required, these contractors should be approached to provide a cost to supply and install the system.

FIS is the trade body representing the sector. Its members are vetted before joining and then every three years. Members agree to comply with the code of conduct and install products in accordance with FIS best practice guides.

A list of vetted members who supply and install suspended ceilings and absorbers can be found at thefis.org/member-directory/?businessstype=contractors-specialist

PEOPLE

COMPETENCY FRAMEWORK

A competency framework based on skills, attitude, knowledge and experience – or SAKE – was referenced in the CIC Raising the Bar report. Working Group 12 (WG12) has identified that there are four factors that come together to describe competence: SAKE – Skills, Attitude, Knowledge and Experience.

These factors – defined, attained, acknowledged, and verified – create a formal framework for product competence.

INSPECTION

Inspection of suspended ceilings should be carried out from the floor in natural lighting conditions.

MAINTENANCE - ACCESS INTO THE VOID

Where access is required to the void between the ceiling and soffit – for example, to maintain the M&E – then removal of the tiles should be carried out by a suitably qualified and competent person. This is particularly important where concealed and semi-concealed ceilings are installed.

See the FIS Best Practice Guide: Maintenance and Access into Suspended Ceilings.

TOP 10 REASONS WHY CEILINGS FAIL

- 1 Incorrect selection of fixing
- 2 Incorrect installation of fixing
- 3 Additional load applied
- 4 Insufficient number of fixings
- 5 People working in the ceiling void inappropriately
- 6 Failure to follow manufacturers' guidance/instructions
- 7 Modification by other trades
- 8 Insufficient supervision/training
- 9 Structural vibration causing fixings to fail
- 10 Substitution of specified components

Steel ceiling tiles in a retail setting

APPENDIX

REGULATIONS AND GUIDANCE DOCUMENTS

EDUCATION

Building Bulletin 93: Acoustic Design of schools – performance standards
gov.uk/government/publications/bb93-acoustic-design-of-schools-performance-standards

Building Bulletin 100: Design for fire safety in schools (under review)

HEALTHCARE

Health Building Note: HTN 00-10 Part B: Walls and ceilings

Health Technical Memorandum: HTM 08-01:

Acoustics

Health Technical Memorandum: HTM 05-02:
Firecode

Health Technical Memorandum: SHTM 60
(Scotland) Ceilings

FIS BEST PRACTICE GUIDES

thefis.org/membership-hub/publications/best-practice-guides/

Installation of Suspended Ceilings

Installation of Drylining

Installation of Partitioning

Selection and Installation of Top Fixings for

Suspended Ceilings

Maintenance and Access into Suspended Ceilings.

A Guide to Office Acoustics

FIXINGS

CIRIA (Construction Industry Research and Information Association)
General fixings – Selection and whole life management (C777)
ciria.org

TAIM (Association of Industrial Metal Ceiling Manufacturers)
Members of TAIM undertake to comply with the TMMC Technical Manual for Metal Ceiling Systems.
taim.info

ENGLAND – BUILDING REGULATIONS

gov.uk/government/collections/approved-documents

Approved documents

B Fire Safety volume 1: Dwellings

B Fire Safety volume 2: Buildings other than dwellings

E Resistance to the passage of sound

L2A Conservation of fuel and power in new buildings other than dwellings

L2B Conservation of fuel and power in existing buildings other than dwellings

SCOTLAND – BUILDING STANDARDS

gov.scot/publications/building-standards-technical-handbook-2019-non-domestic/

Building standards technical handbook 2019: non-domestic

NORTHERN IRELAND – TECHNICAL BOOKLETS

buildingcontrol-ni.com/regulations/technical-booklets

E Fire safety

G Resistance to the passage of sound

F2 Conservation of fuel and power in buildings other than dwellings

WALES – APPROVED DOCUMENTS

labc.co.uk/professionals/building-regulations-guidance-documents/approved-documents-and-technical-guidance-wales

B Fire Safety volume 1: Dwellings

B Fire Safety volume 2: Buildings other than dwellings

E Resistance to the passage of sound

L2A Conservation of fuel and power in new buildings other than dwellings

L2B Conservation of fuel and power in existing buildings other than dwellings

APPENDIX

STANDARDS

BS EN 13964

Suspended ceilings. Requirements and test methods

BS EN 14716

Stretched ceilings. Requirements and test methods

BS EN ISO 9001

Quality management systems. Requirements

BS EN ISO 14001

Environmental management systems. Requirements with guidance for use

BS ISO 45001

Occupational health and safety management systems. Requirements with guidance for use

FIRE

BS 9999

Fire safety in the design, management and use of buildings. Code of practice

FIRE TESTS ON BUILDING MATERIALS AND STRUCTURES

BS 476-4

Non-combustibility test for materials

BS 476-6

Method of test for fire propagation for products

BS 476 - 7

Method of test to determine the classification of the surface spread of flame of products

BS 476-11

Method for assessing the heat emission from building materials

BS 476-20

Method for determination of the fire resistance of elements of construction (general principles).

BS 476-21

Methods for determination of the fire resistance of loadbearing elements of construction

BS 476-22

Method for determination of the fire resistance of non-loadbearing elements of construction

BS 476-23

Methods for determination of the contribution of components to the fire resistance of a structure

BS EN 1182

Reaction to fire tests for products. Non-combustibility test

BS EN 1716

Reaction to fire tests for products. Determination of the gross heat of combustion (calorific value)

BS EN 11925-2

Reaction to fire tests. Ignitability of products subjected to direct impingement of flame. Single-flame source test

BS EN 13823

Reaction to fire tests for building products. Building products excluding floorings exposed to the thermal attack by a single burning item

BS EN 13501-1

Fire classification of construction products and building elements. Classification using data from reaction to fire tests

BS EN 1365-1

Fire resistance tests for loadbearing elements. Walls

BS EN 1365-2

Fire resistance tests for loadbearing elements. Floors and roof

BS EN 1364-2

Fire resistance tests for non-loadbearing elements. Ceilings

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BS EN 13501-2
Fire classification of construction products and building elements. Classification using data from fire resistance tests, excluding ventilation services

ACOUSTICS

BS EN 12354-6
Estimation of acoustic performance of buildings from the performance of elements. Sound absorption in enclosed spaces

BS EN ISO 717-1
Rating of sound insulation in buildings and of building elements

BS EN ISO 354
Measurement of sound absorption in a reverberation room

BS EN ISO 11654
Sound absorbers for use in buildings. Rating of sound absorption

BS EN ISO 10140-3
Measurement of sound insulation in buildings and of building elements. Laboratory measurement of airborne sound insulation of building elements

BS EN ISO 10848-2
Laboratory and field measurement of flanking transmission for airborne, impact and building service equipment sound between adjoining rooms. Application to Type B elements when the junction has a small influence

BS EN ISO 140-18
Measurement of sound insulation in buildings and of building elements. Laboratory measurement of sound generated by rainfall on building elements

COLOUR / GLOSS / LIGHT REFLECTANCE

ISO 12944-3
Paints and varnishes. Corrosion protection of steel structures by protective paint systems. Design considerations

BS EN ISO 2813
Paints and varnishes. Determination of gloss value at 20 degrees, 60 degrees and 85 degrees

BS 8493
Light reflectance value (LRV) of a surface. Method of test

THERMAL

BS EN ISO 10456
Building materials and products. Hygrothermal properties. Tabulated design values and procedures for determining declared and design thermal values

BS EN ISO 10211
Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations

BS EN ISO 6946
Thermal bridges in building construction. Heat flows and surface temperatures. Detailed calculations

BS EN 13162
Thermal insulation products for buildings. Factory made mineral wool (MW) products. Specification

BS EN 13171
Thermal insulation products for buildings. Factory made wood fibre (WF) products. Specification

BS EN 12664
Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Dry and moist products of medium and low thermal resistance

BS EN 12667
Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Products of high and medium thermal resistance

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BS EN 12939

Thermal performance of building materials and products. Determination of thermal resistance by means of guarded hot plate and heat flow meter methods. Thick products of high and medium thermal resistance

BS EN 10456

Building materials and products. Hygrothermal properties. Tabulated design values and procedures for determining declared and design thermal values

UPVC

BS EN 13245-1

Plastics. Unplasticized poly(vinyl chloride) (PVC-U) profiles for building applications. Designation of PVC-U profiles

BS EN 13245-2

Plastics. Unplasticized poly(vinyl chloride) (PVC-U) profiles for building applications. PVC-U profiles and PVC-UE profiles for internal and external wall and ceiling finishes

METAL

BS EN 573-3

Aluminium and aluminium alloys. Chemical composition and form of wrought products. Chemical composition and form of products

BS EN 1396

Aluminium and aluminium alloys. Coil coated sheet and strip for general applications. Specifications

BS EN 10143

Continuously hot-dip coated steel sheet and strip. Tolerances on dimensions and shape

BS EN 10152

Electrolytically zinc coated cold rolled steel flat products for cold forming. Technical delivery conditions

BS EN 10169

Continuously organic coated (coil coated) steel flat products. Technical delivery conditions

BS EN 10346

Continuously hot-dip coated steel flat products for cold forming. Technical delivery conditions

BS EN 10211

Chemical analysis of ferrous materials. Determination of titanium in steels and cast irons. Flame atomic absorption spectrometric method

TIMBER / PARTICLE / FIBRE BOARDS

BS EN 622-1

Fibreboards. Specifications. General requirement

BS EN 312

Particleboards. Specifications

BS EN 335

Durability of wood and wood-based products. Use classes: definitions, application to solid wood and wood-based products

BS EN 350

Durability of wood and wood-based products. Testing and classification of the durability to biological agents of wood and wood-based materials

BS EN 351-1

Durability of wood and wood-based products. Preservative-treated solid wood. Classification of preservative penetration and retention

BS EN 351-2

Durability of wood and wood-based products. Preservative-treated solid wood. Guidance on sampling for the analysis of preservative-treated wood

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BS EN 460

Durability of wood and wood-based products. Natural durability of solid wood. Guide to the durability requirements for wood to be used in hazard classes

BS EN 1912

Structural Timber. Strength classes. Assignment of visual grades and species

BS EN 599-1

Durability of wood and wood-based products. Efficacy of preventive wood preservatives as determined by biological tests. Specification according to use class

BS EN 599-2

Durability of wood and wood-based products. Efficacy of preventive wood preservatives as determined by biological tests. Labelling

BS EN 1912

Structural Timber. Strength classes. Assignment of visual grades and species

BS EN 1991-1-6

Eurocode 1. Actions on structures. General actions. Actions during execution

BS EN 1995-1-2

Eurocode 5. Design of timber structures. General. Structural fire design

ENVIRONMENTAL

BS EN ISO14025

Environmental labels and declarations. Type III environmental declarations. Principles and procedures

BS EN 15804

Sustainability of construction works. Environmental product declarations. Core rules for the product category of construction products

BS EN 12460-5

Wood based panels. Determination of formaldehyde content. Extraction method called the perforator method

BS EN 717

Wood-based panels. Determination of formaldehyde release. Formaldehyde emission by the chamber method

BS EN 16000-9

Indoor air. Determination of the emission of volatile organic compounds from building products and furnishing. Emission test chamber method

OTHERS

BS 8000-0

Workmanship on construction sites. Introduction and general principles

NA to BS EN 1998-1

UK National Annex to Eurocode 8. Design of structures for earthquake resistance. General rules, seismic actions and rules for buildings

BS EN ISO 14644-1

Cleanrooms and associated controlled environments. Classification of air cleanliness by particle concentration

BS 8539

Code of practice for the selection and installation of post-installed anchors in concrete and masonry

BS7671:2018+A1:2020

Requirements for Electrical Installations. IET Wiring Regulations

APPENDIX

Table 5 Standard method of publishing performance data for suspended ceiling and absorbers

MANUFACTURER				PRODUCT NAME		REFERENCE	
	Parameter	Value	Standard	Specification requirement		Test report number	Assessment report number and expiry
				Regulation	Other		
1	Acoustics	α_w 0-1.00 Absorption classes A-E	Absorption BS EN ISO 354 (under review) BS EN ISO 11654	Approved Document E Common Parts Education BB93 CPR CE marking	LEED, SKA Rating, BREEAM, Well Building standard Health HTM 0801		(include air gap behind panels during test)
		D_{nfw} double pass	Attenuation (sound insulation) BS EN 140-3 BS EN ISO 10140 BS EN ISO 717-1 BS EN ISO 10848-2	Education BB93 Health HTM 0801	LEED, SKA Rating, BREEAM, Well Building standard		
		R_w single pass					
2	Fire		Reaction to Fire EN13501-1	Approved Document B CPR CE marking	BS 9999 BS 9991		
		In minutes R Resistance / load bearing capacity E Integrity I nsulation	Resistance to fire BS476-20-21-22-23 BS EN 13501 EN1365-2 EN13381 EN 1364-2	Approved Document B CPR CE marking	BS 9999 BS 9991		
3	VOC	E1 rating	BS EN 717	CPR CE marking	LEED, SKA Rating, BREEAM, Well Building standard		
4	Sustainability		Environmental Product Declaration (EPD) ISO 14025 BS EN 15804	LEED, SKA Rating, BREEAM, Well Building standard			
5	Recycled content		Environmental Product Declaration (EPD) ISO 14025 BS EN 15804	LEED, SKA Rating, BREEAM, Well Building standard			
6	LRV	%	ISO 7724-2-3 BS 8493		LEED, SKA Rating, BREEAM, Well Building standard		
7	Humidity	% RH Class A, B, C, D	BS EN 13964				
8	Hygiene	Class 1-12	ISO 14644:1		Health HTM 0801		
9	Clean room	Class 1-12	ISO 14644:1	Euro codes			
10	Corrosion	A, B, C, D	BS EN 13964 BS EN ISO 12944-2(1) Note: needs more clarification		SCI		
11	Thermal conductivity	(W/Mk)	BS EN 12664 BS EN 12667 BS EN 12939	Building Approved document L			
12	Impact resistance	Class 1a 2a 3a	BS EN 13964	CPR CE marking	Education leisure and sports		
13	Wind loading		Individual engineered solution				
14	Tolerances		BS EN 13964	CPR CE marking			



Concealed grid of steel tiles in a commercial setting



FINISHES & INTERIORS SECTOR

SPECIFIERS' GUIDE CEILING AND ACOUSTIC ABSORBERS



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