

# specification criteria

acoustic comfort  
design aesthetics  
accessibility and maintenance  
paint finish  
integration

prefabrication  
installation  
sustainability  
product sustainability  
fire performance  
quality standards



The science of acoustics, and its application within buildings can often be a confusing experience, with a seemingly endless array of different criteria and rating methods. This section will explain the acoustic issues affecting suspended ceilings. There are two acoustic properties relevant to suspended ceilings; sound absorption and sound attenuation.

## Sound Absorption

Is a measure of the ability of a surface to absorb sound, minimising the reflection of sound energy back into a space. This is important as a predominance of acoustically reflective surfaces in enclosed spaces, such as a classroom, can lead to an overly reverberant environment; the sound of a single voice can be less intelligible due to the many reflections of sound from the room surfaces. These reflections occur with a time delay compared to the sound energy that reaches a listeners ear directly and cause the sound to become less clear.

The room characteristic that defines this feature is “reverberation time” – the length of time (in seconds) that it takes for a sound source to decay by 60 dB. Different environments have differing demands, depending upon the use of the space, and there are differing subjective terms used to describe the different characteristics. Two extreme examples are; a radio broadcast studio, where a reverberation

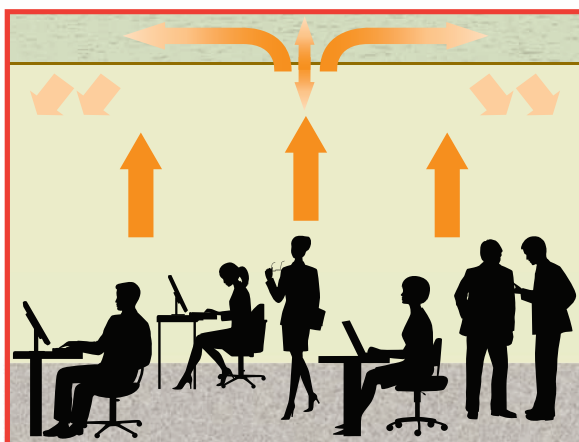
time of around 0.2 seconds is required, the sound is described as “dry” or “dead”, or, a swimming pool with a reverberation time that could be as long as 3.0 seconds, with a “bright”, “live” or “reverberant” sound.

Sound absorption is defined as a co-efficient, ranging from 0.0 for total reflection, to 1.0 for total absorption. The sound absorptive properties of a material are defined in BS EN ISO 11654:1997, which gives three relevant properties:

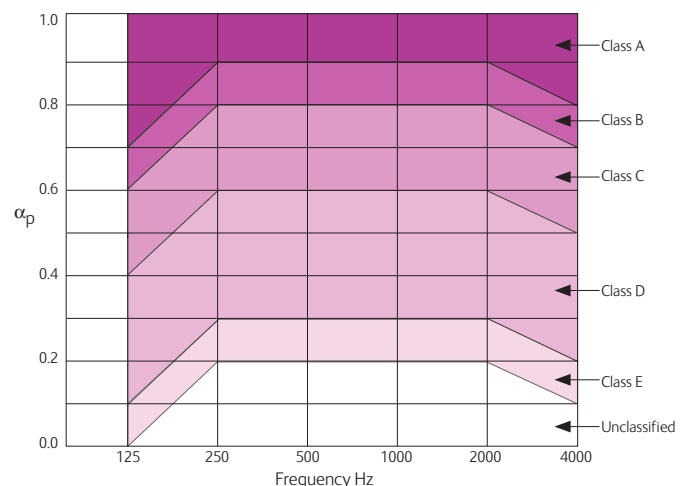
- **Sound Absorption Coefficient  $\alpha_s$**   
Individual sound absorption figures quoted in third octave frequency bands
- **Practical Sound Absorption Coefficient  $\alpha_p$**   
Sound absorption figures quoted in single octave frequency bands
- **Sound Absorption Rating  $\alpha_w$**   
A single figure rating based upon the values of  $\alpha_p$ , compared to a reference weighting curve

Of these values, the most convenient term is the single figure sound absorption rating,  $\alpha_w$ , as this allows straightforward comparison between two different products. For most environments, specification in terms of the value of  $\alpha_w$  will be sufficient. The first two parameters are used by acousticians in the detailed modelling of a space to accurately determine its acoustic characteristics.

Sound Absorption



Sound Absorption Class



BS EN ISO 11654:1997 also introduced the concept of **Sound Absorption Class**, with five categories of sound absorption ranging from Class A to Class E, with Class A offering the higher level of sound absorption. Sound Absorption Class can be roughly equated to the value of  $\alpha_{\omega}$ , however is more properly assessed by plotting the values of  $\alpha_p$  against a series of reference curves between 250 Hz to 4000 Hz.

An alternative and more traditional method of defining sound absorption is Noise Reduction Coefficient (NRC), which is an arithmetic average of octave band absorption over a limited frequency range. This is no longer the preferred unit of choice being superseded by  $\alpha_{\omega}$ .

### Sound Attenuation

Sound attenuation is used to describe the reduction in sound between two spaces separated by a dividing element, with two basic sound transmission paths that will affect the eventual perceived sound level difference. Direct sound transmission is the level of sound passing through the dividing element, and flanking sound transmission is the level of sound passing through surrounding structures.

Sound attenuation is measured in accordance with procedures set out in BS EN ISO 140, and defined in BS EN ISO 717. Performance is assessed in terms of third octave band values, with weighted single figure ratings provided to allow ease of comparison. For suspended ceilings, the relevant single figure characteristics are:

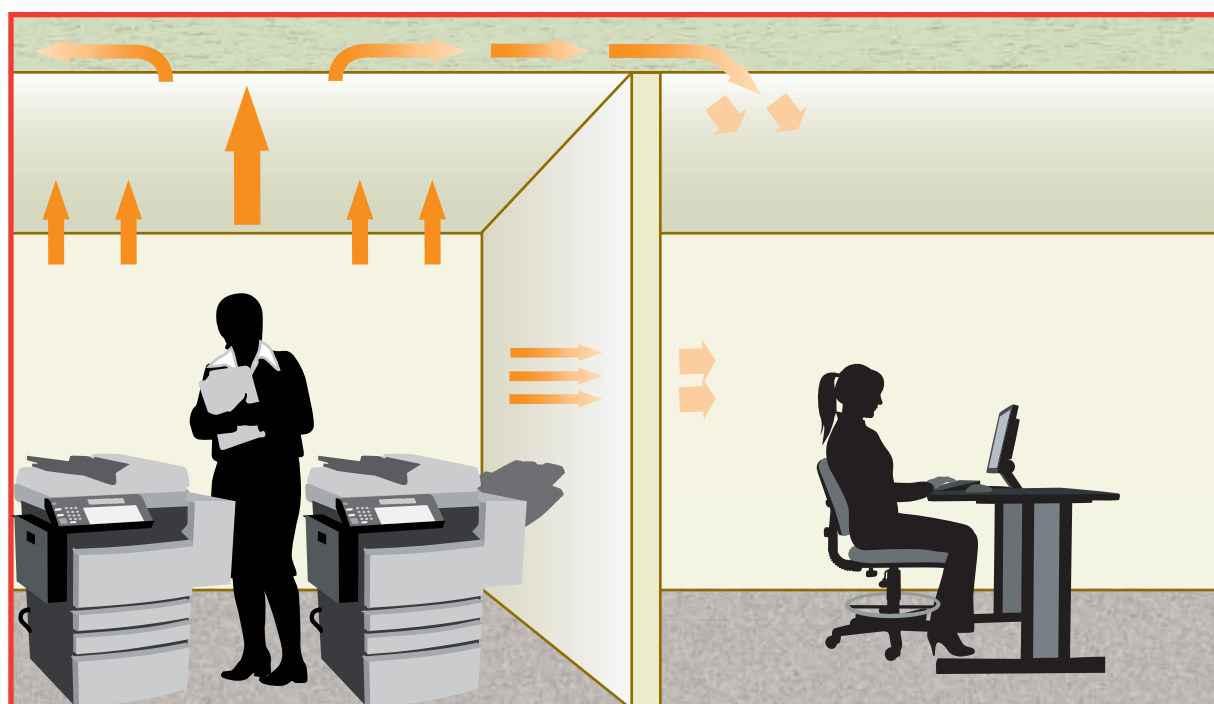
### Dnfw

Defines the sound insulation value from room to room, where a dividing partition abuts the underside of the ceiling with a plenum (void) above. The laboratory test procedure involves use of a massive partition wall, such that the derived performance is that of the ceiling alone, with no flanking paths.

### Rw

This rating defines the level of sound insulation directly through a single layer of material. Whereas **Dnfw** is a “double-pass” value, **Rw** can be considered the “single-pass” value, although suspended ceilings are rarely tested to determine this parameter.

### Sound Attenuation



## Relevant standards

There are many different standards that determine acoustic performance in buildings, be they legislative or guidance. The following list describes the most important areas in relation to the acoustic properties of suspended ceiling systems.

## Offices



The British Council for Offices provide two relevant documents that include reference to acoustic issues related to suspended ceilings.

The “Office Fit-Out Guide” concentrates on the issue of acoustic privacy between cellular office spaces, with guidance on cell office construction techniques with ceiling sound insulation values of 25dB or 35dB. It also notes that reverberation in offices, particularly large function spaces, can be controlled by use of

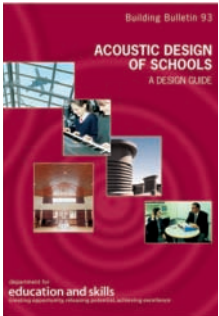
sound absorbent suspended ceilings, and that the suspended ceiling is the principle means of absorbing sound within an office.

The “Best Practice in the Specification for Offices” provides some objective criteria, by way of reference to the recommendations set out in BS 8233:1999, which state that reverberation times in office areas, or other adjacent circulation spaces, should not exceed 0.4 seconds for fully fitted small rooms of 50m<sup>3</sup> or 0.7 seconds for fully fitted rooms of 500m<sup>3</sup>.

The acoustic characteristics of open plan spaces do not follow normal rules for regular proportioned rooms, and the measurement of reverberation time in an open plan office can be misleading. It is better to follow the rule that optimum acoustic conditions in open plan office spaces are achieved when the suspended ceiling offers as much sound absorption as possible and certainly not less than  $0.7\alpha_{\omega}$ .



## Schools



Building Bulletin 93 (BB93) published in 2003 by the DfES provides a guide for the acoustic design of schools. Its requirements are mandatory, being referenced under regulation E4 of the Building Regulations 2000. Compliance with this regulation must be proved to the Building Control Officer by issue of a comprehensive design report.

BB93 applies to all primary and secondary schools. It does not apply to nurseries (unless part of a school), sixth form colleges (unless established as a school) or higher education facilities. Table 1.5 of Part 1 schedules reverberation time targets that must be achieved in all school spaces, in the most part represented as limiting maximum values (except for corridors and stairwells where appropriate areas of sound absorption are defined by calculation).

Suspended ceilings or acoustic lighting rafts and modules with sound absorbent properties

can be used as part of the overall interior design strategy to meet these targets, in combination with other room surface finishes.

Design for good speech intelligibility in classrooms and lecture theatres is recognised as one of the key aspects of BB93, this is important not only for the obvious issue of pupil comprehension, but also to limit teacher fatigue. A mix of sound absorbent and reflective surfaces is recommended in order to promote good speech intelligibility.

## Hospitals



Health and Technical Memorandum 2045 (HTM 2045) published by NHS Estates sets out acoustic performance criteria for sound insulation and sound absorption within hospitals, although there is no direct reference within the document to the contribution of suspended acoustic ceilings. Clearly, depending upon the specific design, such ceiling properties are relevant, however this is a complex document and specialist advice should be sought from an acoustic consultant.



## Field vs. Laboratory

It is always important to remember that published acoustic performance data is normally derived from laboratory tests, under controlled conditions. When applying this data, there are several factors that need to be remembered, so that expectations of performance are not unrealistic.

## Sound Absorption

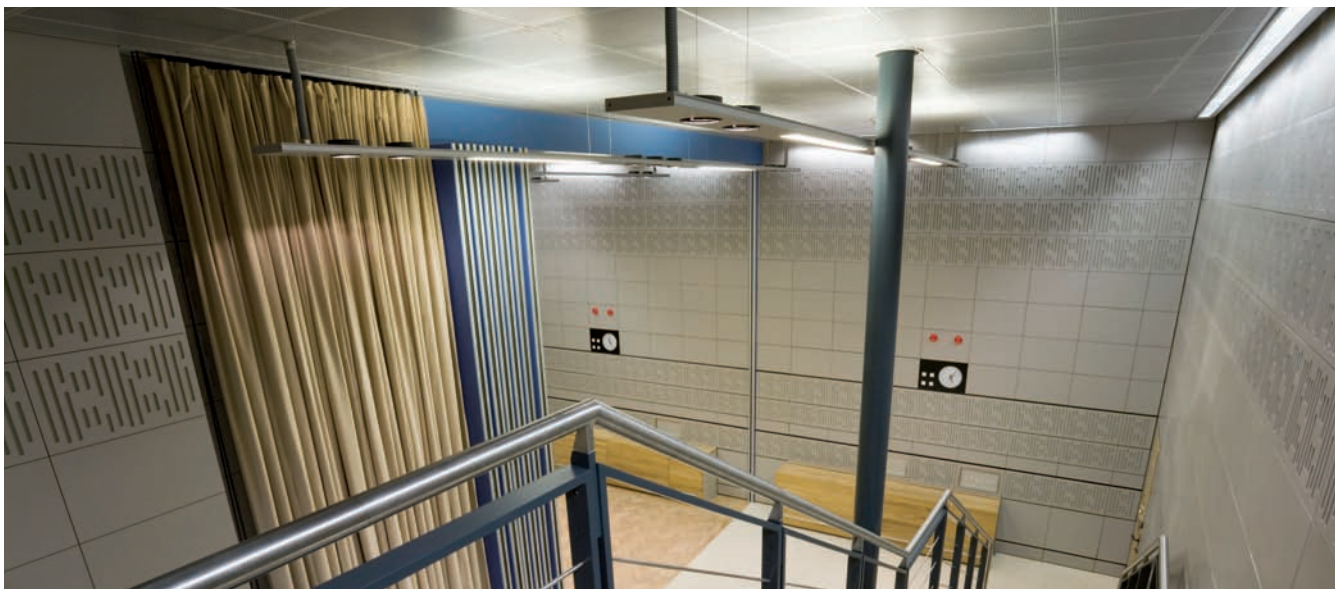
Unless stated otherwise, sound absorption data will always relate to the basic ceiling system, based on a sample size of around 10 m<sup>2</sup>. This sample will include the relevant amount of ceiling grid as well as the basic ceiling tiles, although it will not include any secondary ceiling features, such as light fittings, air diffusers or loudspeakers. When these are added they will clearly affect the overall level of sound absorption offered by the entire ceiling surface, and any negative effect may need to be taken into account.

For an open plan office ceiling, the effect is probably negligible and can be ignored; however, for ceiling area calculations to BB93 or the Building Regulations, the absorbent surface area is critical and the effect should be accounted for by omitting the relevant surface area of feature from the calculation.

## Sound Attenuation

Unless stated otherwise, published sound insulation data is derived from a laboratory test to a defined standard under controlled conditions, and applies only to the element of concern, in this case the suspended ceiling. When this ceiling is installed as part of a system including partitions and raised floors, the composite effect of the elements together needs to be considered. In addition, any ceiling features such as light fittings or air diffusers may contrive to lower performance.

Specific advice on this matter should be sought from an acoustic consultant, however as a rule of thumb, installed ceilings on site offer between 3–5dB less performance than laboratory test figures state. This accounts for sound flanking paths and potential installation tolerances.



### Sound Absorption: Practical Advice

Suspended ceilings absorb sound by the passage of sound waves through the perforated face of the ceiling tile, which then interact with the material within the back of the tile. The higher the inherent sound absorption of this material, the better the level of sound absorption will be. Thus an 18mm acoustic pad performs better than an 8mm pad – pad density also has an effect.

The size and pattern of perforations within the tile face also contributes to the overall performance of the tile, with an optimum free area range of between 15% to 22% – beyond this, greater free area does not offer any worthwhile improvement.

Ceiling tile perforation patterns are not important within rooms of normal proportion. Sound absorption data for a particular tile can be taken as published. For open plan office spaces, the normal room acoustic rules do not strictly apply, and the concept of a reverberant field as occurs in normal rooms is not relevant.

It is nevertheless important that the tile should provide optimum sound absorption, with as great a free area as possible. For tiles with a small perforation pattern and/or a low free area, there is a risk of sound over long distances impinging upon the ceiling with “grazing incidence”, such that the sound is not absorbed, and there is less attenuation across the open plan office space that might otherwise have been expected.

### Sound Insulation: Practical Advice

Where partitions abut the underside of a suspended ceiling, the quality of acoustic seal at the junction between the two will be critical. Remember that in the laboratory test this weakness is avoided by use of a massive partition and a level of head seal that would be visually unacceptable in an occupied environment.

There may be small sound paths through the ceiling grid to be sealed, as well as shadow gaps against plaster margins. In any event, the partition head must be very well sealed against the ceiling grid (NB: Self adhesive tape may be not be sufficient).

Where partitions are placed “off-grid”, (i.e. the partition junction runs across the centre of a tile as opposed to along a ceiling grid line), the level of sound insulation offered may not match the laboratory test data even after applying the 3–5dB field performance allowance. This is because sound can pass through the body of the ceiling tile via the perforated face, acting as a sound flanking path over the top of the partition head junction.

If such junctions are unavoidable, and sound insulation is important, then you should replace the partition head tiles with non-perforated plain tiles, or replace the tile insulation with a solid sheet material into which the partition head can be positively fixed.



When designing for any project, different options can affect the aesthetic finish of a suspended ceiling, complimenting and reflecting other architectural features.

Ceiling systems either have a concealed or exposed grid. Exposed grids can be flush with the ceiling plane or recessed, tiles can be modular or manufactured to planning modules. Concealed grids design can produce a monolithic ceiling plane.

Client requirements can play a large part of the process, some have international corporate styles while others require office flexibility.

In addition to the overall aesthetic 'look' of a ceiling system, different design options are available that incorporate the integration details.

**Perforations** – play the most important role in providing acoustic comfort, there are many different perforation patterns available, with varying degrees of open area from 2% to 50%. Larger perforations can allow heating and cooling products to be installed behind the ceiling leaving a clean flush finish, see page 103 for perforation details.

**Size of Tile** – tiles can be modular in traditional sizes of 500 x 500mm, 600 x 600mm or 750 x 750mm, other sizes are available.

System 330 can be manufactured in any size to match building module sizes. Mega panels can be manufactured in sizes up to 1500 x 1500mm.

**Shape of Tile** – in addition to square and rectangular ceiling tiles other design options are available. Triangular and trapezoidal tiles can be manufactured in addition to curved and waveform panels.

**Building Module Size** – the module size of a building and shape can impact upon the design of the ceiling. Tiles can be manufactured to work with standard and non-standard module sizes.

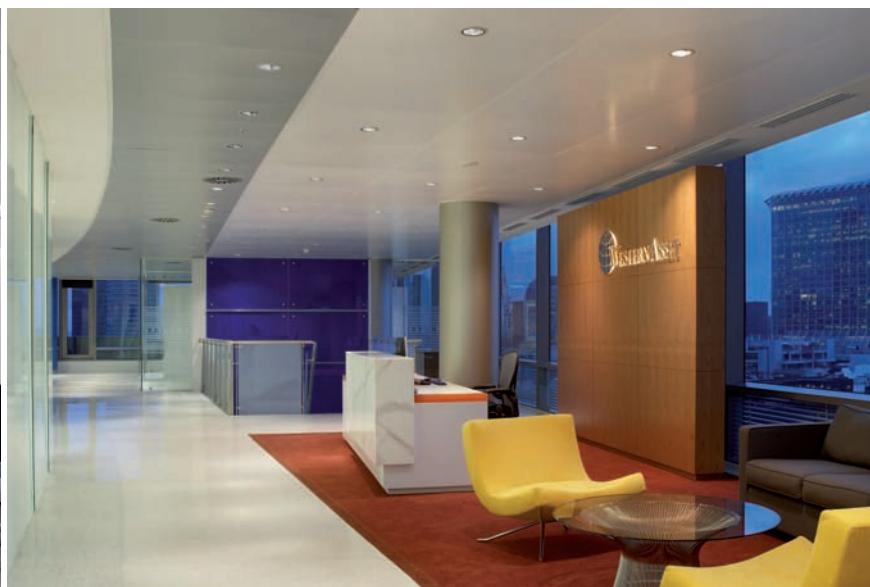
**Borders and Trims** – to ‘finish’ the ceiling the design of borders and trims answer many aesthetic questions including: how the ceiling

plane integrates with the surrounding building components? Will the suspended ceiling be surrounded by a plasterboard margin? Will it have a shadow gap or floating edge detail? If the ceiling is run to the edge of the building it may be necessary to have a trim to hold any cut tiles, see page 115 for trims and perimeters.

**Finish** – metal ceilings may have various finishes. The ceiling does not necessarily have to be white, it could be coloured, finished with a clear lacquer, have a textured finish or anti bacterial coating, see page 36 for paint finish options.

**Apertures** – are formed during manufacturing for luminaires and other M&E services leaving a flush ceiling line. They do not have to be integrated into tiles. System 330 can allow service apertures to be formed in the suspension profile, see page 38-40 for integration and prefabrication demands.

**Heating and Cooling Products** – if the ceiling needs to incorporate air conditioning and air handling, how will these be integrated? SAS systems allow chilled elements to be installed behind the tile removing the need for separate modular heating and cooling units. Multi-service tiles using differing SAS perforation patterns allow for swirl diffusers to be installed within the ceiling void, see page 171 for SAS Room Comfort products.





With the number of services that are present in a ceiling void there is a need for regular access without causing tile damage.

The frequency of access is dependent on the environment and the number of services included.

In some environments, including schools and airports, void access must be limited. Maintaining security is a requirement while still offering access to services for maintenance.

A clip-in ceiling system requires the use of an access tool to remove tiles, while security clips can be added to the rear of a lay-in tile.

A range of ceiling access options are available using different ceiling systems. Full details can be found within each product page, they include:

**Downward Demountable** (SAS System 120)  
– see page 59.

**Lift Up** (SAS System 130)  
– see page 63.

**Hinge and Slide** (SAS System 150)  
– see page 69.

**Hinge Down** (SAS System 330)  
– see page 77.



The preferred solution for opening large areas of the ceiling void has traditionally been System 150, a downward demountable solution with a hinge and slide facility to retain the tile within the ceiling plane. The main benefit is that ceiling tiles do not have to be physically removed from the supporting grid.

The maintenance of the ceiling should be limited to regular cleaning. The frequency of cleaning is dependent on the environment, function and application within the building. Recommended maintenance can be found on the web site at [www.sasint.co.uk/maintenance](http://www.sasint.co.uk/maintenance).

Ceilings need to be extremely robust and claims made by some suppliers on the suitability of their products and technical composition of the ceiling for cleaning is varied. Unlike other suspended ceilings metal ceiling tiles are not limited to a fixed number of wash cycles and can be cleaned regularly. No components in the ceiling can be dislodged using normal methods or pressurised cleaning equipment.

Although the ceiling is manufactured with a durable paint finish, strong chemical detergents should not be used. A mild detergent diluted in warm water, applied with a soft cloth, rinsed and finally wiped off with a chamois leather, will maintain the ceiling in good condition. Oily stubborn stains if not removed by washing, can be wiped with a mild solvent, but care is necessary to avoid affecting the surface by harsh rubbing.

An **SAS AB**, anti-bacterial coating inhibits the growth of micro-organisms. It does not remove the need for regular cleaning, but contributes to established infection control and cleaning procedures, helping to prevent the contamination of a working environment.

# paint finish

All SAS ceiling tiles are finished with a polyester powder coating. Tiles are generally supplied with a smooth finish in RAL 9010, White, with a 20% gloss. Alternatively they can be specified with a number of different options.

The polyester powder coating is applied as the requirements set out in BS EN 13964 ("Suspended ceilings – requirements and test methods"). The gloss finish to our ceiling tiles meets the tolerance set out in this document and according to EN ISO 2813.

In high humidity environments, for example kitchens and public conveniences, we recommend that both sides of the tile are painted to increase product durability.

**SAS AB** provides active anti bacteria properties. The active ingredient is a proven anti-microbial agent that is bound into the coating during

production. In demanding environments, such as laboratories, clean rooms, hospitals and schools, there is the need to inhibit the risk of contamination that could threaten the building's occupants.

Our paint line processes have been accredited to ISO 14001, including a 5 stage chrome free pre-treatment process that is environmentally sustainable.

SAS paint finishes are in accordance with ISO 9227 to achieve a 1,000 hour salt spray test for aluminium and 1,000 hours for steel, giving visual performance for a minimum of 25 years in normal interior conditions. For exterior conditions aluminium should always be specified as the raw material – further information is available from our technical department.





### Colour Range

SAS metal ceiling tiles and grid can be supplied in over 200 RAL Colours and are available in conjunction with SAS AB and SAS FT. The differing options can reflect corporate brands, define retail environments and provide innovative lighting environments. For further details please contact the SAS technical department.

### Galvanised Finish

Providing a natural finish galvanised steel and aluminium can be coated with a clear lacquer to protect it from scratching and other damage.

### Fine Textured Finish

SAS FT is a fine textured paint finish that offers a semi-matt/low-gloss appearance, which is visually very similar to emulsioned plasterboard, but with the durability and functionality of a metal ceiling. It negates the chance of lighting 'hot spots' and glare occurring.

### Wood Effect Finishes

SAS are able to offer a range of wood effect metal ceilings in different finishes. Wood effect ceilings offer the aesthetic finish of a natural wood product on a lighter and more durable material. Maintenance costs that are traditionally associated with a wooden ceiling are removed.

### Anti-Bacterial Coating

SAS AB is a paint finish that effectively inhibit the growth of bacteria and micro-organisms. SAS AB is currently independently tested to JIS Z 2801: 2000 and ASTM E2180-0, independent testing is ongoing. Full details of SAS AB can be found in the SAS Anti-Bacterial Brochure, (which can be downloaded from [www.sasint.co.uk](http://www.sasint.co.uk)).

# integration



The way products integrate with ceiling systems plays an important part in any ceiling design. Building services can be incorporated into a ceiling and each of these can require apertures to be formed in a tile.

The ceiling integrates with structural elements of the building including walls and columns. The full range of SAS trims and perimeters are detailed on pages 115-141. A number of design options are available to meet any integration requirement.

Apertures are formed during manufacturing for luminaires and other services, reducing on site waste and installation time. By integrating products efficiently, cost and time savings can be made on projects.

The SAS pattrass system allows the integration of lighting by suspending the lighting directly from the Emac primary grid. This reduces the need to support luminaires directly from the soffit, see pages 62 and 72 for further details.

When specifying a suspended ceiling it is necessary to consider integration with:

**Luminaires** – Their size and shape in relation to the ceiling tile. Is the luminaire to be suspended below, surface mounted or recessed in relation to the ceiling plane? Will the luminaire be supported from the tile, soffit or from the primary grid using a pattress?

**Partitioning** – Is relocatable partitioning part of the design of the project? If so, the grid should feature a M6 thread form to avoid any damage to tiles, see System 130, page 63, and System 330, page 77, for details.

**Bulkhead Panels** – How will the ceiling interact with vertical changes in height? Will bulkhead panels be required and what services will be integrated within? See System 150, page 69, and Architectural Metalwork, page 189.

**Column Rings** – Trims and perimeters allow the ceiling to integrate with vertical structural elements. The SAS range of fabricated trims and perimeters can be rolled to allow ceiling integration around columns, see page 115.

**Fire Detection and Control** – Apertures can be manufactured for smoke detectors and sprinkler systems. The apertures can be formed in luminaire tiles creating a multi-service tile or in a separate field tile.

**Speakers** – Apertures for detectors and sprinklers are factory formed. Integrating services into a profile grid reduces the number of differing tiles that need to be manufactured and installed.

**Grilles/Diffusers** – The integration of air handling can be designed within tiles or even within the suspension grid. Curved linear grilles can be manufactured to meet design requirements. Swirl diffusers can be accommodated with a subtle change of perforation.

**Signage** – If signage is to be supported from the ceiling any load weight must be taken into consideration.

**Chilled Ceilings** – Is there a requirement for an energy efficient Chilled Ceiling to be integrated? Unlike modular units the design of the ceiling may not affect the integration of a Chilled Ceiling, see page 173 for further details.

**Chilled Beams** – Will the perimeter of the building require Chilled Beams to offset any solar gain? How will the ceiling integrate with the open area design demanded below a Chilled Beam? See pages 177–184 for Chilled Beams and ISMs.

**Modular Air Conditioning Units** – Integrating with modular units requires compromise with the aesthetic design of the ceiling. Large apertures across multiple tiles can be accommodated.



# prefabrication

Where possible SAS endeavour to offer added value options. In addition to prefabricating apertures for M&E services, SAS are able to provide an off-site prefabrication service.

## M&E Services

M&E services, such as luminaires and air diffusers, can be factory fitted off-site. Installing these services in a factory environment ensures correct fitting without the risk of damage caused to either the ceiling tile or service.

The benefits of prefabrication are:

**Installation Time:** a general suspended ceiling would have the aperture tiles delivered, the services would be fitted and connected, then the 'field' tiles are delivered and fitted. With pre-installed services installation time can be significantly reduced.

**Cost:** time to install services on-site allowing for wastage due to site damage adds cost to a project. Delivering the service already in the tile, ready for installation, can provide a more cost-effective solution.

## ISMs

ISMs (Integrated Service Modules) are rafts and modules that contain either active or passive Chilled Beams. They are generally manufactured and tested off-site before they are delivered and installed on site.

ISMs integrate a number of building services in addition to heating and cooling including; lighting, fire detection and control systems, data cabling, passive infra red sensors, white noise emitters and acoustic insulation, see page 181.

BSRIA (The Building Services Research and Information Association) highlighted that SAS ISMs typically take 75 per cent less time to install than traditional installation methods with fan coil units. This fast installation time was utilised at the Vodafone HQ, Newbury. The BSRIA report highlighted the high quality and aesthetic appearance of SAS ISMs, whilst providing real cost and time savings.

Suspended directly from the soffit, ISMs and System 600 acoustic lighting rafts, enable natural mass cooling to be achieved, see page 43 for further details.





All SAS ceilings should be installed in accordance with:

BS EN 13964:2004 Suspended ceilings, Requirements and test methods.

AIS (Association of Interiors Specialists) Guide No.1, Good Practice For The Installation Of Suspended Ceilings .

Installation time can be reduced on-site by utilising Emac hangers from the ceiling soffit, see page 17 for further details.

Due to the durability of metal ceiling tiles, damage occurred during transit, installation of the ceiling and the installation and commissioning of services is minimal.

On-site installation time can be reduced and controlled using many different logistic options.

These can include:

- 1) Factory formed apertures for lighting and other services.
- 2) Prefabrication, see page 40, of M&E services, reducing on-site installation time.
- 3) Deliveries in accordance with BREEAM requirements, delivery pallets can be collected and reused for the next delivery.
- 4) For larger projects and those that roll out nationally it is possible to arrange storage and/or call-offs for individual sites or build stages.

SAS International works and maintains contact with main and sub contractors to ensure that all elements of the delivery requirements are met. If you require further information please visit our web site [www.sasint.co.uk](http://www.sasint.co.uk) or contact our dedicated sales order processing department.

SAS Metal Ceilings and associated products are manufactured from steel and aluminium. Steel is the world's most recycled product, it has a residual value at the end of life; there are no landfill costs associated with disposal as there is a well established infrastructure for scrap steel recycling.

Ceiling tiles manufactured from steel offer many environmental credentials. Throughout the manufacturing process waste is minimised and recycled. Steel contains at least 20% recycled content as standard but is 100% recyclable at end of life.

Scrap steel is an essential part of the production process and accounts for up to 60% of the raw material used in structural steel. The scrap steel can be used in the manufacturing of any steel product; as a result there is a genuine demand for recovered steel, which allows the recycling loop to be closed.

Suspended metal ceiling tiles are classed AAA in the "Green Guide to Specification" by the BRE (Building Research Establishment) for having an A rating for recyclability, current recycled levels and the energy saved by recycling.

Every tonne of steel recycled makes the following environmental saving:

- 1.5 tonnes of iron ore
- 0.5 tonnes of coal
- 40% of the water required in production
- 75% of the energy needed to make steel from virgin material
- 1.28 tonnes of solid waste
- Reduction of air emission by 86%
- Reduction of water pollution by 76%

Construction products that are manufactured off-site under factory-controlled conditions are subject to better quality-control regimes. This ensures their compliance with tolerances and other performance criteria. Factory working is safer, faster and more efficient than site working.

Most processes are fully or semi-automated with advanced computer design and manufacturing software used to further improve material and production efficiencies.

Further details on SAS prefabrication and installation can be found on pages 40–41.



The SAS approach to design and manufacturing ensures that sustainability is consistently considered and evaluated throughout the production process.

Working with the project team, including client requirements, SAS are able to develop and adopt best practice for the project. This can include establishing a sustainable logistics procedure re-utilising delivery packaging.

Apertures for luminaires and other services are designed and formed during manufacturing with any wastage recycled, this in turn reduces on site wastage.

The durability and performance of a SAS metal tile compared to alternatives ensures that on site installation damage is minimised.

With a 25 year product life guarantee the costs associated with metal tiles are significantly lower than other suspended ceilings. At the end of life the product can be fully recycled.

### Thermal Mass Cooling

Utilisation of a building's thermal mass cooling potential can significantly reduce internal ambient temperatures. This natural process centres on the building's thermal mass, provided by exposed concrete slabs. It is increasingly being adopted as a sustainable

low energy solution and works by utilising the natural properties of concrete which has a high specific heat capacity and conductivity.

Concrete acts as a thermal sponge, passively absorbing heat from the air during the day when the ambient temperature is higher, cooling and moderating the daytime peak temperatures. This heat is then passively released from the concrete when the ambient air temperature is lower, generally at night time.

A number of studies have indicated that the amount of cooling available to the space in a naturally ventilated building with exposed thermal mass will be almost twice that of a simple low thermal mass building, with a cooling potential up to 25 W/m<sup>2</sup>.

Suspended beam solutions such as SAS Acoustic Lighting Rafts (System 600) and SAS Integrated Service Modules (ISMs), leave the concrete soffit open, enabling thermal mass cooling to take place. ISMs, an alternative to traditional air conditioning methods, have the ability to supplement the passive cooling provided by thermal mass through the incorporation of passive or active Chilled Beam technology.

See page 83 for full details on System 600 and page 181 for Integrated Service Modules.



# fire performance

SAS Metal Ceilings are tested and certified in accordance with UK and European standards under BS 476-23 and EN13501.

The Building Regulations, Approved Document B, for Fire Safety sets out minimum requirements for the performance of ceilings within buildings. The requirements are either UK tested by BS 476, (class 0, class 1, class 3) or the European Class tested to EN 13501 (“Fire behaviour, smoke production, flaming droplets or debris”).

The harmonised European class system will phase out the individual European countries classes over time. The national classifications do not automatically equate an equivalent in the European Class, unless they have been tested accordingly.

EN13964-2004, Suspended ceilings: requirements and test methods, requires that suspended ceilings pass the specific provisions of the test standards set out in EN13501.

SAS Ceiling tiles meet the requirements of Class 0 as set out in BS 476. The European class equivalent to Class 0 is **B-s3, d2**. Class 1 is equivalent to **C-s3, d2**.

It must be noted that SAS do not recommend that **any** suspended ceiling should be relied upon to protect the structural elements of a building.

A fire statement can be downloaded from our website, please visit [www.sasint.co.uk/fire](http://www.sasint.co.uk/fire) for full details.

If you require any further information please do not hesitate to contact our technical department.

SAS ceiling tiles have a European Class performance of:

A2-s1, d0

The first figure sets out the fire behaviour of the product, with a result ranging from A to F. Class ‘A1’ products do not contribute in any stage of the fire. Class ‘A2’ products do not significantly contribute to the fire load and fire growth. Class ‘B’ products have limited lateral spread of flame with sufficiently delayed and limited heat release.

The second figure ‘s’ relates to the smoke behaviour, with three classifications ‘s1’ to ‘s3’. An ‘s3’ classification requirement sets no limitation to the smoke production required. ‘s2’ states and limits the total smoke production as well as the ratio of increase in smoke production. ‘s1’ sets out more stringent criteria to ‘s2’.

The third figure relates to the volume of flaming droplets or particles, with classifications of d0-d2. A ‘d2’ classification requirement does not limit the performance required. ‘d1’ sets a given time that no flaming droplets or particles can persist for. The ‘d0’ classification requires that no droplets or particles occur.

SAS International has a committed program to obtain ISO 9001, ISO 14001 and OHSAS 18001 across the entire group's facilities: Apollo Park, Bridgend, Maybole and Reading.

ISO 9001 (Quality Management System) accreditation has been achieved throughout SAS International. It ensures that quality procedures are met and maintained. The system ensures consistency and improvement of working practices.

ISO 14001 (Environmental Quality System) accreditation has been achieved at all SAS manufacturing facilities, Apollo Park, Bridgend and Maybole. An Environmental Management System (EMS) ensures that we reduce our environmental impact of manufacturing processes with regular management reviews.

OHSAS 18001 (Occupational Health and Safety Management System) is the next target

stage of accreditation for SAS International factories. Promoting a safe and healthy working environment has been key to ensuring product quality; the accreditation should provide an independent confirmation of existing practices.

Each site has a manager solely responsible for implementing, auditing and maintaining production and environmental control systems. If you require any further information please visit our website.

CE Marking BS EN 13964:2004, implemented under European Union Council Directive 93/68/EC, requires that the CE mark should be shown on all accompanying commercial documents. The document should carry the manufacturers name, trade mark or identification mark.

CE Marking has been implemented by SAS International.



