# Acoustics

The continuous increase of noise levels in everyday life give sound protection an ever more important role, particularly in modern high rise developments. We are all entitled to live and work in a comfortable acoustic environment and to achieve this all project partners should be involved in the planning.

OWAcoustic® Ceiling Systems can be used to provide a number of acoustic benefits. The following simple chart shows the dual acoustic functions that can be provided by the installation of the correct OWAcoustic® Ceiling System.

**Acoustics**

↙ **Room acoustics** | **Building acoustics** ↘

Room acoustics:

- To optimize reverberation time
- To decrease noise levels $\Delta L$ [dB] in production workshops areas

Building acoustics:

- To increase the airborne sound insulation $R_w$ [dB] of solid and timber beam soffits as well as simple roof constructions
- To improve the linear airborne sound reduction $D_{n,c,w}$ [dB] between adjacent areas
- To reduce noise intrusion from the ceiling cavity

The following describes the areas of use for OWAcoustic® Ceiling Systems greater detail.

## Room acoustics

As a division of acoustics, room acoustics are concerned with the internal characteristics of specific areas. Wherever possible the proposed use of the room should be taken into account at the design stage. If the primary use requires good speech intelligibility, the interior design of the room will be different from that of a room whose primary use is music practice or recital. Where a room is to be used for both purposes a degree of compromise is required.

The most important factors which influence the acoustic quality of an area:

**1.** Location of the room within the building

**2.** Sound insulation of the adjacent construction

**3.** Sound generation from services

**4.** Area shape and size (primary structure)

**5.** Sound absorption characteristic of all surfaces (secondary structure)

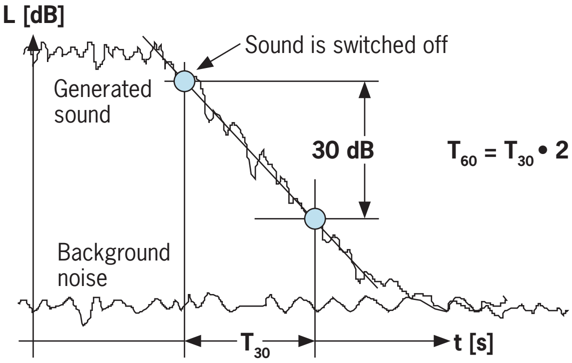
**6.** Furniture and equipment within the room (secondary structure)

**7.** Dimensions and spatial distribution of sound absorbing and reflective surfaces

# Area acoustics

## Reverberation time

The reverberation time is the oldest and best known criterion in the field of acoustics. It is measured in seconds and is defined as the time taken for generated sound to decay by 60 dB after the sound source has been stopped.




## Reverberation time and equivalent sound absorption

$$T = 0.163 \cdot \frac{V}{A}$$

Reverberation time = 0.163 • $\frac{\text{Area volume}}{\text{Equivalent sound absorbing surfaces}}$

$A = \alpha_{Floor} \cdot \text{Surface}_{Floor} + \alpha_{Wall} \cdot \text{Surface}_{Wall} + \alpha_{Ceiling} \cdot \text{Surface}_{Ceiling}$ + Absorbing contents

A... Equivalent sound absorption surface A is the total sound absorption situated in the entire area

In 1920 W. C. Sabine published an article concerning the relationship between reverberation time, volume and sound absorption. Although complex computer programmes and simulations are now available, the principles of room acoustics still revolve around this simple equation.

**The equation:**

It is important to remember that the equation is based on a diffused sound field, i.e. an evenly distributed sound field in a room of equal proportions and not exceeding 2000 $m^3$ in volume.

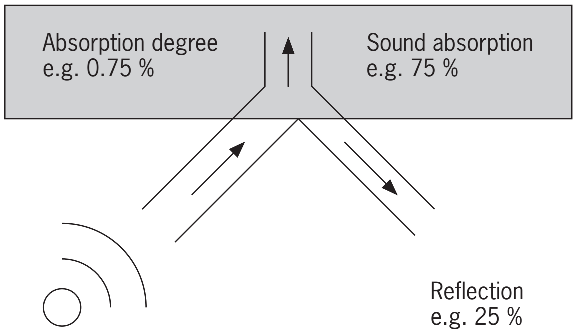
## Sound absorption

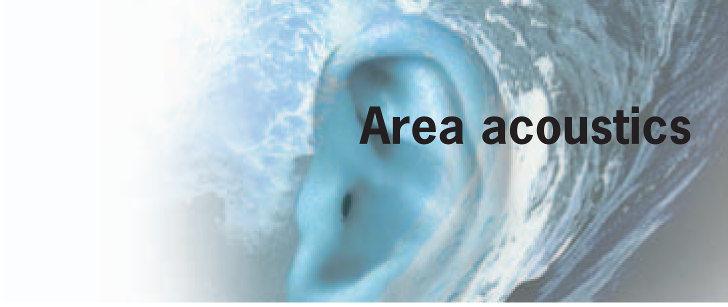
Sound absorption describes the reduction of sound energy. The so called degree of sound absorption defines the relationship of reflected to absorbed sound energy. A value of 0 corresponds to total reflection - a value of 1 to complete absorption. If the degree of sound absorption is multiplied by 100, it provides the percentage of absorbed sound.

$\alpha$ = 0.65 means

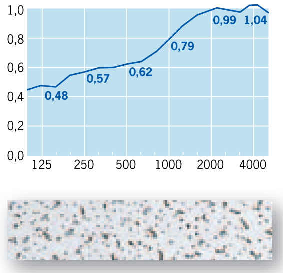
$\alpha$ = 0.65 x 100 % = 65 % of sound absorption

(the residual 35 % is sound reflection)

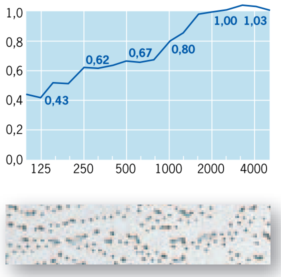




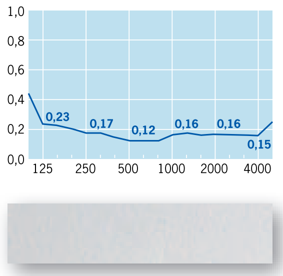
# Area acoustics



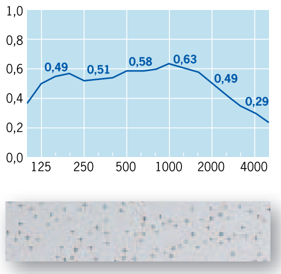

Futura $\alpha_w$ = 0.70 / NRC = 0.70



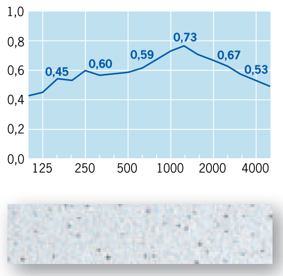

Harmony $\alpha_w$ = 0.75 / NRC = 0.75



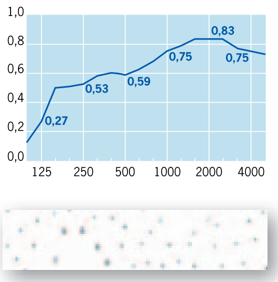

Plain $\alpha_w$ = 0.15 / NRC = 0.15




Universal $\alpha_w$ = 0.50 / NRC = 0.55




Cosmos 68/N $\alpha_w$ = 0.65 / NRC = 0.65




Constellation
$\alpha_w$ = 0.70 / NRC = 0.70

**1. Degree of sound absorption $\alpha_s$**
The degree of sound absorption describes how well a material can absorb sound. Testing a materials ability to absorb sound is measured in a reverberation chamber and carried out in accordance with DIN EN ISO 354.

The test is carried out over 18 separate frequencies from 100 Hz to 5000 Hz and provides an absorption value for each of between 0 (total reflection) and 1 (total absorption). There are 6 frequencies generally used in the calculation of a room‘s acoustic characteristics, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz.

**2. Single figure sound absorption**
There are different reasons for using a single figure (e.g. $\alpha_w$ =0.70):

1. Using the single figure result allows an easy product comparison and the selection of equivalent performing products.

2. By using the single figure result products can be put into performance classifications.

**The disadvantages:**

1. Even though the lab measurement obtains 18 different frequencies, the product will be selected due to the single figure of sound absorption, e. g. $\alpha_w$.

2. When searching for high absorbing products (e. g. Class A), it has to be taken into consideration not to acoustically over-correct a room. Practical testing turned out that products with $\alpha_w$ = 0.90 don't achieve a much better reverberation time than products with $\alpha_w$ = 0.70.

**2.1 Measured Degrees of Sound Absorption $\alpha_w$**
The international standard ISO 354 does not provide a method of deriving a single figure result from the 18 frequencies tested. For this we use ISO 11654 which provides the method of calculating the single figure result with the use of a predetermined reference curve at 500 Hz.

Appendix B of ISO 11654 also provides a simple classification system to allow simple comparison of the single number value $\alpha_w$:

| Absorption Class | $\alpha_w$-Value [-] |
|---|---|
| A | 0.90; 0.95; 1.00 |
| B | 0.80; 0.85 |
| C | 0.60; 0.65; 0.70; 0.75 |
| D | 0.30; 0.35; 0.40; 0.45; 0.50; 0.55 |
| E | 0.15; 0.20; 0.25 |
| Non-Classified | 0.00; 0.05; 0.10 |

# Area acoustics

## 2.2 Noise Reduction Coefficient

The U.S. Standard ASTM C 423 corresponds with the International Standard ISO 354. However, ASTM C 423 also provides a method of calculating a single figure result. The single figure is known as the Noise Reduction Coefficient and is calculated using the following equation.

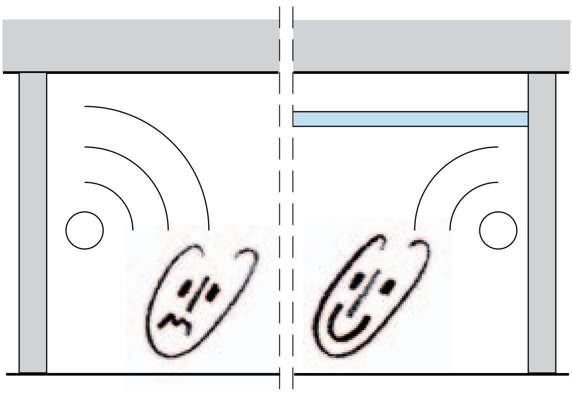
$$NRC = \frac{\alpha_{250Hz} + \alpha_{500Hz} + \alpha_{1000Hz} + \alpha_{2000Hz}}{4}$$

The result is reported in increments of 0.05.

Example:

$$NRC = \frac{0.39+0.58+0.73+0.61}{4} = 0.58 \rightarrow NRC = 0.60$$

**Noise reduction (production areas and factory buildings)**

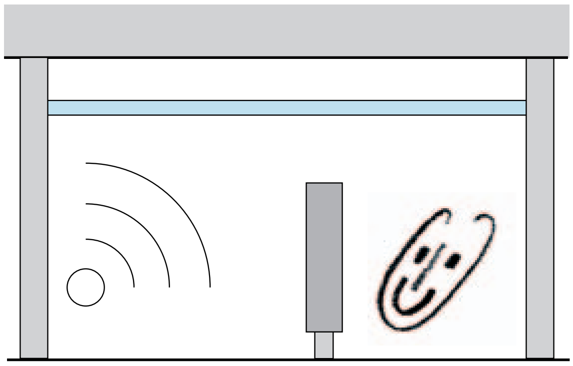


The average noise level in a room is dependent on the sound source and the sound absorption. Increasing the absorption within the room will generally reduce the noise level, in practice by approximately 3 to 10 dB.

**Double or Nothing**

To achieve an audible improvement the absorption within a room has to be increased by a factor of 2. Therefore, an increase of the absorption of the ceiling from 20 % to 40 % or from 40 % to 80 % is advisable, an increase from 70 % to 80 % will show very little, if any, noticeable improvement.

**Acoustic comfort (Offices, Retail and Public areas)**

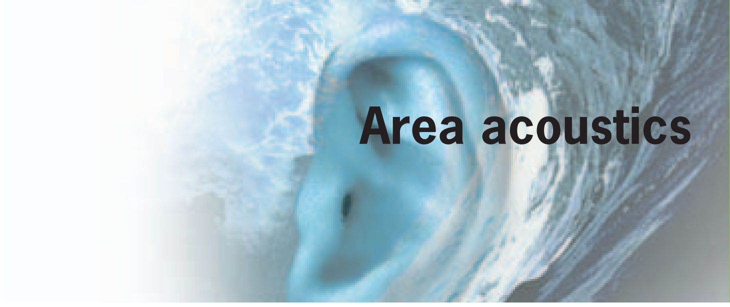


Speech can only be heard clearly if background noise is controlled or kept to a minimum. The best way to achieve this is to ensure the correct balance between sound and reverberation.

**Office Dividers/Half Height Partitions**

If used in conjunction with a hard, acoustically reflective ceiling, acoustic screens may be ineffective and have little effect in providing any privacy. However an absorbent ceiling will complement the screen and assist in maintaining a much higher degree of acoustic separation when installed in an office where screens are used.

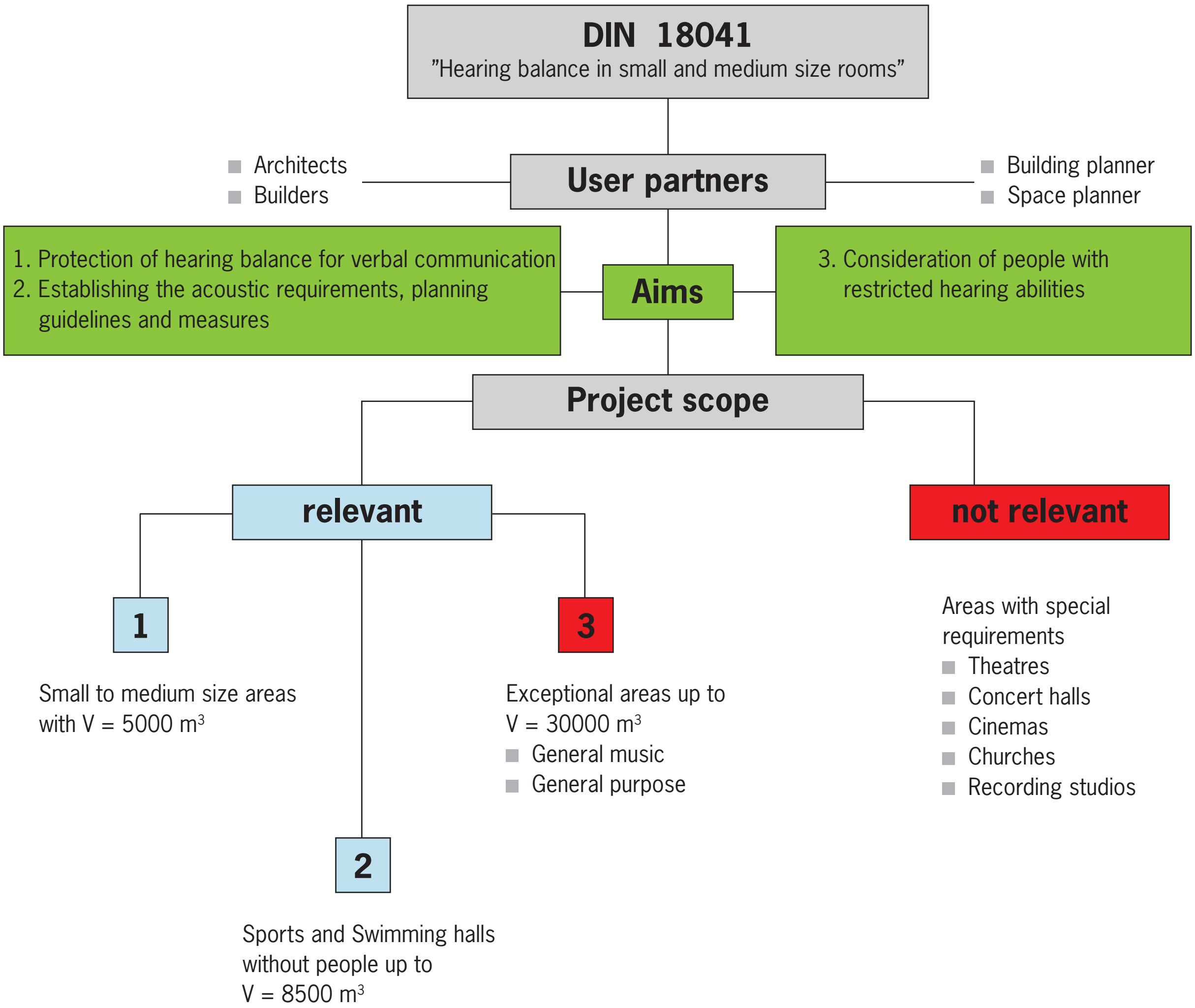
# Area acoustics



**Room acoustic planning with help from DIN 18041:**
Since May 2004 the revised setting of DIN 18041 "Hearing balance" in small and medium sized rooms has been available for acoustic planning.

The following overview should help to understand the structure of DIN 18041. Users of this standard should essentially concentrate on the relevant areas under "points 1 and 2".

## Overview



# Area acoustics

The relevant areas are subsequently structured as follows:

## Overview

**DIN 18041**
"Hearing balance in small and medium size rooms"

**Arrangement**

### Rooms in Group A
**Hearing balance over medium and longer distances**

**Music**
- Classrooms with active music and singing
- Ballroom for instruction and musical performances

**Speech**
- Court and council chambers
- Community hall, meeting areas
- Music rehearsal area in music schools
- Sport- and Swimming halls with public

**Teaching**
- Classrooms (other than music), lecture rooms
- Music classrooms with audio-visual performance
- Group areas in Nursery schools, Senior Day Care centres
- Seminar area, Inter-action areas
- Lecture halls
- Areas for Tele-Teaching
- Meeting and conference areas
- Performance area for electro acoustic utilization (e.g. Revue theatre)

**Sport 1**
- Sports and Swimming halls active, without people – single course

**Sport 2**
- Sports and Swimming Halls without people, more activity – several courses

### Rooms in Group B
**Hearing balance over short distances**

- High occupancy and open plan offices
- Call Centres
- Sales areas, restaurants
- Audience areas, ticket sales areas
- Consulting areas Doctors/Lawyers offices
- Citizens Advise Bureaus
- Operating, treatment and recovery areas
- Reading and lending areas in libraries
- Work areas (e.g. teaching workshop)
- Busy public areas
- Foyers, showrooms and stairwells

In what way do the two area groups differ?

**Areas in Group A**
Definite **requirements** are fixed.

**Areas in Group B**
Only **estimates** "in respect of" are given.

# Area acoustics

**Rooms in Group A**
Group A rooms are categorized by their use (music, speech, teaching, sport 1 and sport 2). The optimum reverberation time T [s] is dependent on the room volume and is shown as an acceptable time zone for each category in Group A.

**Music:** $T_R = [0.45 \cdot \lg(V) + 0.07]\,s$

**Speech:** $T_R = [0.37 \cdot \lg(V) - 0.14]\,s$

**Teaching:** $T_R = [0.32 \cdot \lg(V) - 0.17]\,s$

The required reverberation time T [s] is based on furnished, occupied areas. When unoccupied the reverberation time should be no more than 0.2 s over the required time.

For Sports and swimming halls with
$2000\ m^3 \leq V \leq 8500\ m^3$ is valid:

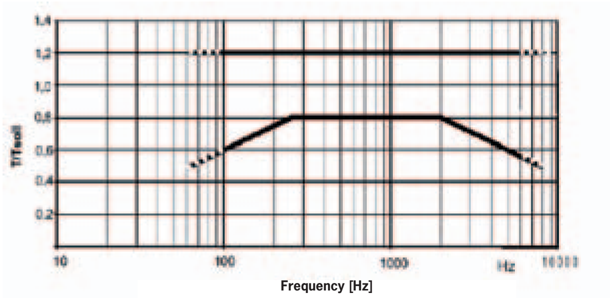
**Sport 1:** $T_R = [1.27 \cdot \lg(V) - 2.49]\,s$

Sports and swimming halls for normal use without people for a single class (a class or sport group, with uniform communication content).

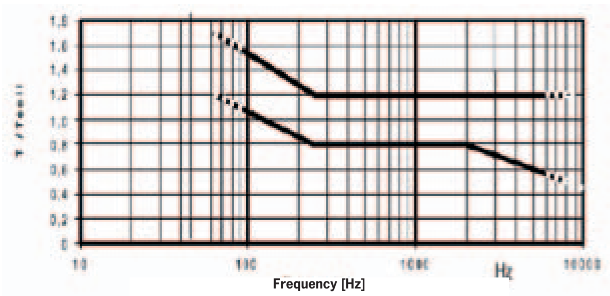
**Sport 2:** $T_R = [0.95 \cdot \lg(V) - 1.74]\,s$

Sports and swimming halls without people for several classes (sport groups parallel with different communication content).

The reverberation time is a frequency dependent measurement. Because of this DIN 18041 provides an acceptable tolerance range for the use of "Speech and Music".




The frequency depending RT (Reverberation Time) range for speech.




The frequency depending RT (Reverberation Time) range for music.

**Example:**
Classrooms fall into the 'educational use' and have a predetermined performance requirement. For example, if we take a classroom with a volume of 180 m³ the required rever-beration time $T_R$ [s] is calculated from the following formula:

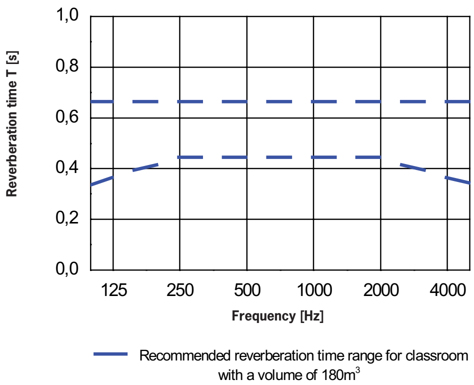
**Teaching:** $T_R = [0.32 \cdot \lg(V) - 0.17]\,s$

$$T_R = [0.32 \cdot \lg(180\ m^3) - 0.17]\,s$$

$$T_R = 0.55\,s$$

In practice there is a degree of tolerance and the reverberation time can vary by up to ± 20 % in the frequency range 250 Hz to 2000 Hz.

The recommended RT range for a classroom with V = 180 m³:




| Frequency [Hz] | 100 | **125** | 160 | 200 | **250** | 315 | 400 | **500** | 630 | 800 | **1000** | 1250 | 1600 | **2000** | 2500 | 3150 | **4000** | 5000 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_{R,\ upper}$ | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| $T_{R,\ lower}$ | 0.33 | 0.36 | 0.39 | 0.41 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.44 | 0.41 | 0.39 | 0.36 | 0.33 |

# Area acoustics

**Rooms in Group B**
Rooms that fall within Group B require good speech intelligibility over short distances and are described in accordance with DIN 18041.

Through effective use of absorbing materials the total sound level and reverberation time in an area can be lowered. However, the reverberation time may not be in accordance with DIN 18041.

The table below can be used as a simplified aid to estimate the action required in areas that belong to Group B.

Read across from the appropriated 'Type of room' until you reach the column with the sound absorption $\alpha_w$ of the proposed product. This intersection will show a factor value (ideally no more than 1.0) which can be used to calculate the amount of surface area that needs to be covered (ceilings and walls).

| **Type of room** | **Orientation values with sound absorber application to untreated ceiling and wall surfaces as a multiple of the floor area with a normal area height of approx. 2.50 m and with application of sound absorbers with one $\alpha_w$** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1.00 | 0.95 | 0.90 | 0.85 | 0.80 | 0.75 | 0.70 | 0.65 | 0.60 | 0.55 | 0.50 | 0.45 | 0.40 | 0.35 |
| Call Centres with heavy communication traffic, work areas, ticketing and Banking areas, reception areas with public traffic | 0.90 | 0.90 | 1.0 | 1.1 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | – | – |
| Single or higher occupancy offices, large open plan offices with office machines, consulting rooms in Lawyers or Doctors offices, operating theatres | 0.70 | 0.70 | 0.80 | 0.80 | 0.90 | 0.90 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.6 | 1.8 | 2.0 |
| Restaurants, dining areas with a floor area over 50 $m^2$ | 0.50 | 0.50 | 0.60 | 0.60 | 0.60 | 0.70 | 0.70 | 0.80 | 0.80 | 0.90 | 1.0 | 1.1 | 1.3 | 1.4 |
| Stairwells, foyers, showrooms, counter halls, lobbies with heavy public traffic | 0.20 | 0.20 | 0.20 | 0.20 | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 | 0.40 | 0.40 | 0.40 | 0.50 | 0.60 |

**Example:**

Area type: Open-plan office (column 1, line 2)

Solution concept 1: We would like to use a product with a sound absorption coefficient starting at $\alpha_w$ = 0.50 e.g. (50 %).

Assessment 1: From the table, one gets the sum factor ⇒ 1.4
With a product of $\alpha_w$ = 0.50 approximately 140 % of the total ceilings and wall areas must be covered with absorbing material.

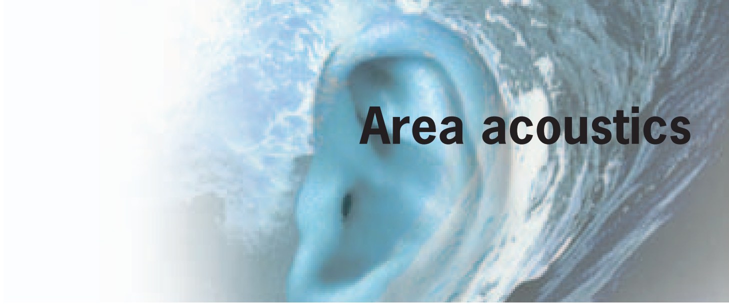
➔ **Unrealistic**

Area type: Open-plan office (column 1, line 2)

Solution concept 2: We would like to use a product with a sound absorption coefficient starting at $\alpha_w$ = 0.70 e.g. (70 %).

Assessment 2: From the table, one gets the sum factor ⇒ 1.0
With a product of $\alpha_w$ = 0.70 approximately 100 % of the total ceilings and wall areas must be covered with absorbing material.

➔ **Realistic**



# Area acoustics

**Building acoustics**
Building acoustics is a division of acoustics that is concerned with the passage of sound through the structure of the building.

OWAcoustic® suspended ceilings can be used to:

- to increase the airborne sound reduction $R_w$ [dB] of
  - solid soffits
  - timber beam soffits
  - simple roof constructions
- to improve the linear sound reduction $D_{n,c,w}$ [dB] between adjacent areas
- to reduce sound transmissions from the ceiling cavity

Sound will always travel from A to B taking the simplest route of the least resistance. Therefore, building acoustics should also be taken into account when designing or providing an acoustic solution for a project.

**Airborne Sound Reduction**
This is about preventing as much sound energy escaping from one area and intruding into another.

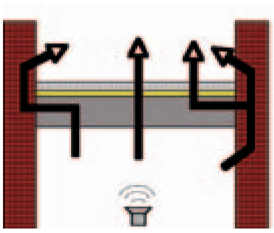
Sound will always try to escape however; its spread will be restricted by the acoustic effectiveness of the perimeter (floors, walls, ceilings, doors and windows, etc).

If the airborne sound insulation of the soffit (steel reinforced concrete, timber beams etc.) needs to be improved, it can be achieved with an OWAcoustic® suspended ceiling which will function as a resolution barrier below the soffit.

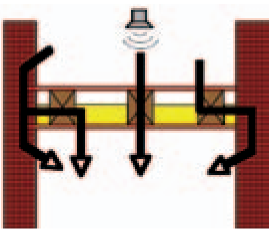
Laboratory tests were carried out at the Fraunhofer institute for Building Physics (IBP) in Stuttgart to establish the airborne sound improvement measurements $\Delta R_w$ [dB] between adjacent areas for different OWAcoustic® ceilings. The tests were carried out using standard 140 mm thick steel reinforced concrete soffit:

**Sound passages and different soffits**

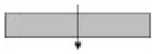
Solid soffits



Timber beam soffits

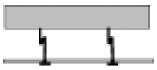
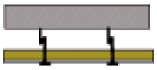


**Tested variations**

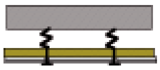
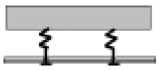
| Testing variations | Sound insulation values $R_w$ [dB] | Impact noise values $L_{n,w}$ [dB] |
|---|---|---|
| **source room**  **receiving room**<br>140 mm thick standard steel reinforced concrete soffit without a suspended ceiling. In the laboratory, the sound transfer takes place only from above to below as the sound passage over the partition walls are blocked (by using Gypsum - resolution barriers on the walls) | **56 dB** | **78 dB** |

# Building acoustics

**Tested variations**

| Testing variations | Sound insulation values $R_w$ [dB] | Impact noise level $L_{n,w}$ [dB] |
|---|---|---|
|  S 3 exposed grid system 600x600 mm module 15 mm OWA-coustic® premium tiles with Constellation design. Depth H = 300 mm using adjustable hanger No. 12/30/2. No mineral wool overlay. | **65 dB** | **62 dB** |
|  S 3 exposed grid system 600x600mm module 15 mm OWA-coustic® premium tiles with Constellation design. Depth H = 300 mm using adjustable hanger No. 12/30/2. 80 mm ISOVER TP1 acoustic mineral wool overlay. | **68 dB** | **61 dB** |

**Tested variations**

| Testing variations | Sound insulation values $R_w$ [dB] | Impact noise level $L_{n,w}$ [dB] |
|---|---|---|
|  S 3 exposed grid system in 600x 600 mm module. 33 mm OWAcoustic® janus-tiles with Constellation design. Depth H = 300 mm using Fa.Kimmel anti vibration hanger. 80 mm ISOVER TP1 acoustic mineral wool overlay. | **70 dB** | **– dB** |
|  S 3 exposed grid system in 600x 600 mm module. 33 mm OWAcoustic® janus-tiles with Constellation design. Depth H = 300 mm using Fa.Kimmel anti vibration hanger. No mineral wool overlay. | **65 dB** | **– dB** |

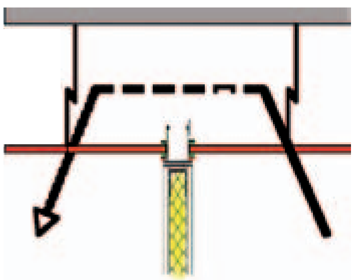
**Sound reduction between adjacent areas**

In many buildings the partition walls are not installed up to the soffit, but extend only to the suspended ceiling level. This procedure allows a quick and flexible adaptation of the room dimensions by moving the partitions to the new requirement.

In this case the "sound transfer to the ceiling cavity" must be considered very carefully whilst planning the suspended ceiling, to avoid an "acoustical short-circuit", that means noises between two rooms are inevitable, the necessary discretion is not sustained.

Sketch:

Ceiling cavity



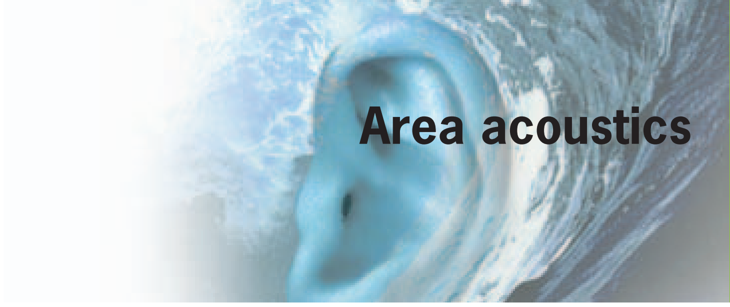
Office 1 Office 2

The sound reduction between two areas is determined by the whole construction. Walls and ceilings are part of this as well as flanking passages through shafts, ducts, cavities and joints. If the ceiling is to work well in the total system it must possess a good value of sound insulation.





OWA

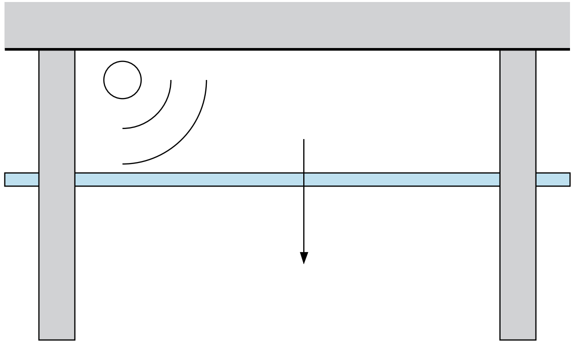


# Area acoustics

The sound attenuation value $D_{n,c,w}$ [dB] of a suspended ceiling is influenced by different parameters:

- Tile thickness, e.g.15 mm tiles against 33 mm Janus tiles
- Tile surface e.g. Harmony design, $D_{n,c,w}$ = 31 dB, against Plain, $D_{n,c,w}$ = 35 dB,
- Suspension systems, e.g. system S 3 exposed grid system and system S 1 concealed tile system
- Suspension height H = 700 mm ($D_{n,c,w}$ = 31 dB) H = 400 mm ($D_{n,c,w}$ = 33 dB)
- Full or partial mineral wool overlays
  By adding a full-flat mineral wool overlay to the ceiling the sound insulation can be improved by about 2 dB per cm. The wool used must be a Fibre Insulation material complying with DIN 18165 part 1 and possessing a flow resistance of $\Xi \geq 5$ kNs / m$^4$.
- Partial wool overlay in wall areas
- Additional back painting
- Sound barriers over walls
- Building material class

**Sounds from the ceiling cavity**



Sounds from water pipes, ventilation, air-conditioning and services of all types from the ceiling cavity can be greatly reduced by using OWA ceilings. The Sound reduction of OWAcoustic® tiles is between 18 to 36 dB. according to type used.

**Attention to installations:**
The installation of light fittings, light troughs or air conditioning outlets can seriously affect the sound insulation of the suspended ceiling. Care must be taken not to leave any open holes or gaps.

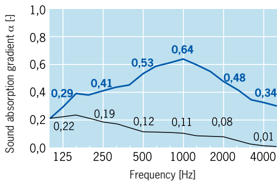
**Solution concepts comparison for an S 3 system:**

| No. | OWAcoustic® premium Design | Additional overlays | System | Suspension H [mm] | Sound attenuation $D_{n,c,w}$ [dB] (Lab. values) |
|---|---|---|---|---|---|
| 1 | 15 mm perforated tile | – | S 3 | 710 | 31 dB |
| 2 | 15 mm unperforated tile | – | S 3 | 710 | 35 dB |
| 3 | 15 mm perforated tile | 25 mm Rock wool | S 3 | 710 | 37 dB |
| 4 | 15 mm perforated tile | second 15 mm tile | S 3 | 710 | 40 dB |
| 5 | 33 mm perforated tile | – | S 3 | 750 | 40 dB |
| 6 | 15 mm perforated tile | 25 mm Rock wool + 15 mm unperforated tile | S 3 | 710 | 49 dB |

# Sound absorption values*

## OWAcoustic® premium designs

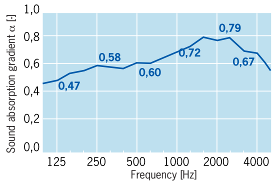
### Sandila 70




Mid value: $\alpha_w = 0.10$
NRC = 0.10 (Un-needled)

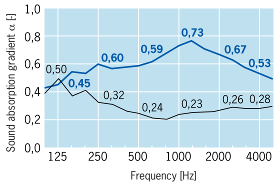
Mid value: $\alpha_w = 0.55$
NRC = 0.50 (Needled)

### Finetta 62




Mid value: $\alpha_w = 0.70$
NRC = 0.65

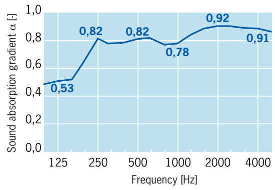
### Cosmos 68




Mid value: $\alpha_w = 0.25$
NRC = 0.25 (Un-needled)

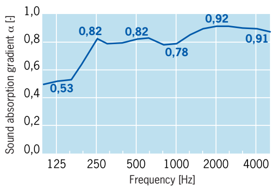
Mid value: $\alpha_w = 0.65$
NRC = 0.65 (Needled)

### Bolero



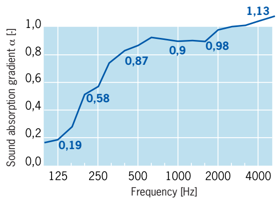

Mid value: $\alpha_w = 0.85$
NRC = 0.85

### Sinfonia



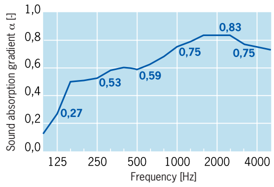

Mid value: $\alpha_w = 0.85$
NRC = 0.85

### Sinfonia A



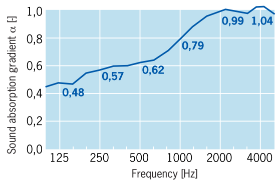

Mid value: $\alpha_w = 0.90$
NRC = 0.85

### Constellation 3



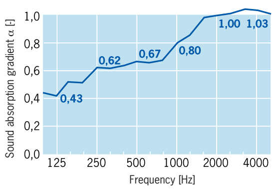

Mid value: $\alpha_w = 0.70$
NRC = 0.70

### Futura 60



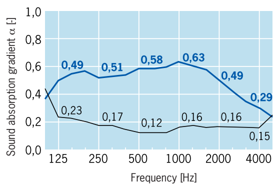

Mid value: $\alpha_w = 0.70$
NRC = 0.75

### Harmony 72




Mid value: $\alpha_w = 0.75$
NRC = 0.75

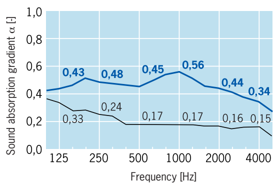
### Plain 9 / Universal 65




Mid value: $\alpha_w = 0.50$
NRC = 0.55 (Universal)

Mid value: $\alpha_w = 0.15$
NRC = 0.15 (Plain)

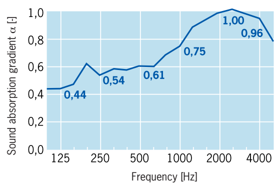
### Combed 6




Mid value: $\alpha_w = 0.15$
NRC = 0.20 (Un-needled)

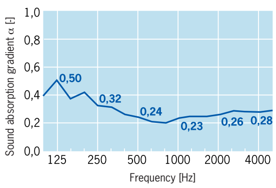
Mid value: $\alpha_w = 0.45$
NRC = 0.50 (Needled)

### Regular peforated 1



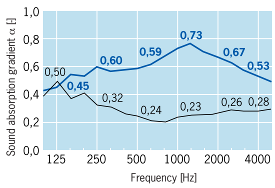

Mid value: $\alpha_w = 0.70$
NRC = 0.75

### Graphite 69




Mid value: $\alpha_w = 0.25$
NRC = 0.25

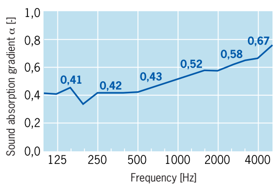
### Molinari 74




Mid value: $\alpha_w = 0.65$
NRC = 0.65 (Cosmos 68/N)

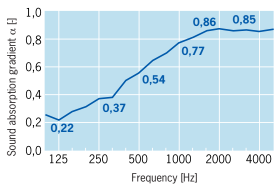
Mid value: $\alpha_w = 0.25$
NRC = 0.25 (Cosmos 68/O)

### Rilled 67




Mid value: $\alpha_w = 0.50$
NRC = 0.50

### OWAplan




Mid value: $\alpha_w = 0.60$
NRC = 0.65

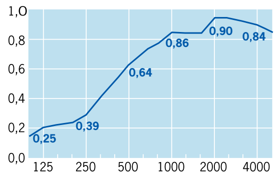
Others on request

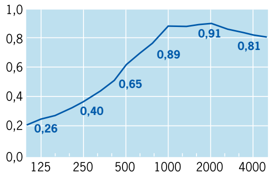
* The published sound absorption coefficients were determined with a cavity depth of H=200mm

# OWAcoustic® janus

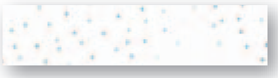
## Seven Functions – one Ceiling

OWAcoustic® janus is a double layer ceiling tile that was developed for use in areas with special acoustic requirements; in offices and restaurants for example, and also in any areas that require high levels of privacy.



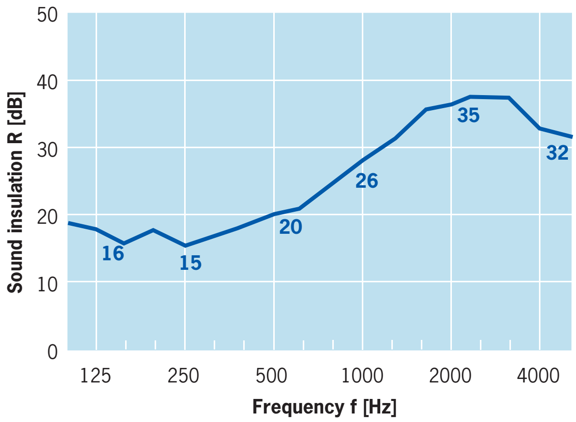




Harmony $\alpha_w$ = 0.65 / NRC = 0.70



Constellation $\alpha_w$ = 0.65 / NRC = 0.70

### OWAcoustic® janus, 33 mm




Sound insulation: $\mathbf{R_w}$ **= 25,4 dB** (Tested)

For areas in which sound absorption and sound reduction need to be reduced to a common denominator. Seven important functions are fulfilled by these special ceiling tiles:

**Optimization of the reverberation time.**
Where reverberation times are too long, auditory information reverberates in the area. OWAcoustic® janus ceiling tiles prevent this sound problem and essentially contribute to the optimization of the room acoustics.

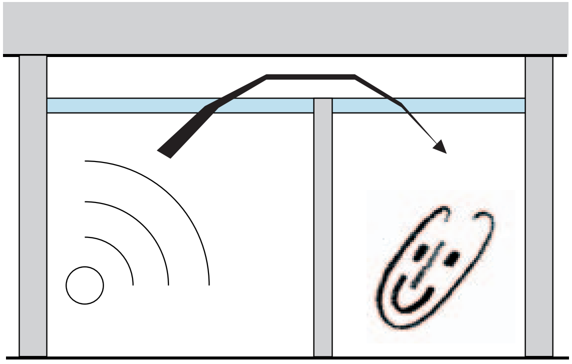
**Sound insulation.**
Another function is the reduction of sounds which come and go through the ceiling. The double layer tile construction reduces the sound transit. This is applicable to steel reinforced concrete and timber beam soffits as well as where simple roof constructions are used.

This investigated value is based on window testing. It is a pure material value without consideration of the metal suspension.

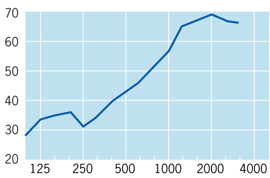
# OWAcoustic® janus

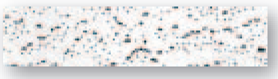
## Seven functions – one ceiling

### Sound insulation



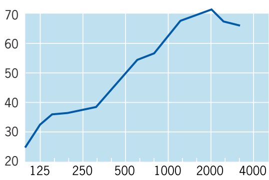
### OWAcoustic® janus with System S 3

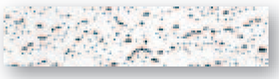


Harmony sound attenuation:
**$D_{n,c,w}$ = 43 bzw. 40 dB**
(Tested)

### OWAcoustic® janus with System S 18



Harmony sound attenuation:
**$D_{n,c,w}$ = 49 dB**
(Tested)

For further information see brochure No. 570.

**Reduction of sound spread**
A Janus ceiling will inhibit the transfer of sound between rooms.

**Reduction of sound from ceiling cavity**
The use of the ceiling cavity as a carrier of service installations such as air conditioning and water supply systems creates noise. An OWAcoustic® janus ceiling will damp such noises.

**Design**
OWAcoustic® janus can be supplied in several surface designs and edge details that are compatible with other types of tiles in the OWA range of products.

**Integration of service elements**
Lighting and other service or functional elements can be easily incorporated within the Janus tiles with minimum effect on function.

**Access to ceiling cavity**
Many services within the ceiling void require free access for maintenance and repair. No problem with a Janus ceiling from OWA.

# Ball impact resistant ceiling

System S 3 bws: Top acoustics with a sporty flair

The S 3 bws system is made of lightweight mineral wool tiles that can resist the hardest ball throws while providing excellent room acoustics. Marking an end to reverberant noises in nurseries, schools and colleges, the ball impact resistant system allows sports halls to become multifunctional areas that can be used for a wide range of activities from music to speech and badminton to basketball. This system is also ideal for areas such as classrooms, school foyers and nursery playrooms where acoustic ceilings are very important but there is a need to be resistant to impact from high flying objects.

OWA has designed its OWAconstruct® S 3 type „s" exposed grid suspension system to meet new stability standards which forms the basis of the impact resistant system S 3 bws. When subjected to the Ball Impact Test as defined in EN 13964 Annex D the S 3 bws system achieved Class 1A, the highest rating in the test programme. Compared to some other impact resistant ceiling this system offers a light weight, easy to install, fire resistant ceiling with the added bonus of excellent acoustic performance.

## Technical Data

| | |
|---|---|
| **Material** | Mineral wool tile |
| **Building material class** | A2-s1, d0 according to EN 13501-1 |
| **Thickness** | approx. 15 mm |
| **Colour** | white |
| **Light reflection** | approx. 88 (ISO 7724-2, ISO 7724-3, Constallation pat.)<br>approx. 88 (ISO 7724-2, ISO 7724-3, Cosmos/N pat.) |
| **Sound reduction*** | from 31 dB to 49 dB (depending on pattern) |
| **Sound absorption** | $\alpha_w$ = 0.70 / NRC = 0.65 (with perforated backing panel, Constellation pattern)<br>$\alpha_w$ = 0.75 / NRC = 0.70 (with perforated backing panel and 50 mm mineral wool overlay, Constellation pat.) |
| **Moisture resistance** | up to 95 % |
| **Fire resistance*** | on request |

* depending on system, structural slab and other additional measures

## Constellation 3

$\alpha_w$ = 0.70 / NRC = 0.65
(without mineral wool overlay)

## Cosmos 68/N

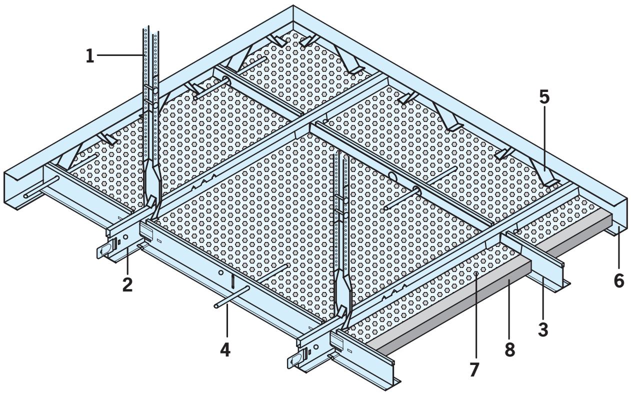
$\alpha_w$ = 0.60 / NRC = 0.60
(without mineral wool overlay)

## Bolero

$\alpha_w$ = 0.85 / NRC = 0.85
(without mineral wool overlay)

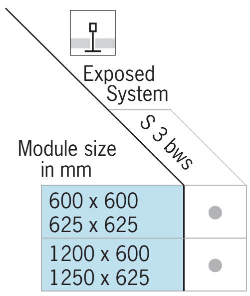
## Sinfonia

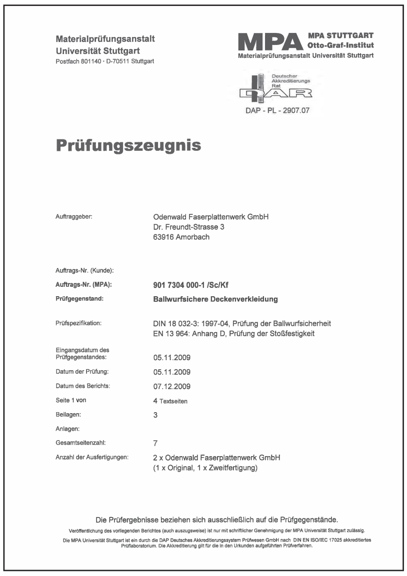
$\alpha_w$ = 0.85 / NRC = 0.85
(without mineral wool overlay)




**1** Nonius hanger and extension each with 2 safety pins or nails
**2** Main tee
**3** Cross tee
**4** Securing rod
**5** Wall spring clip
**6** Perimeter trim
**7** Metal preforated tile
**8** OWAcoustic® premium tile

## System



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Otto-Graf-Institut
Materialprüfungsanstalt Universität Stuttgart

Deutscher Akkreditierungs Rat
DAR
DAP - PL - 2907.07

**Prüfungszeugnis**

| | |
|---|---|
| Auftraggeber: | Odenwald Faserplattenwerk GmbH<br>Dr. Freundt-Strasse 3<br>63916 Amorbach |
| Auftrags-Nr. (Kunde): | |
| **Auftrags-Nr. (MPA):** | **901 7304 000-1 /Sc/Kf** |
| **Prüfgegenstand:** | **Ballwurfsichere Deckenverkleidung** |
| Prüfspezifikation: | DIN 18 032-3: 1997-04, Prüfung der Ballwurfsicherheit<br>EN 13 964: Anhang D, Prüfung der Stoßfestigkeit |
| Eingangsdatum des Prüfgegenstandes: | 05.11.2009 |
| Datum der Prüfung: | 05.11.2009 |
| Datum des Berichts: | 07.12.2009 |
| Seite 1 von | 4 Textseiten |
| Beilagen: | 3 |
| Anlagen: | |
| Gesamtseitenzahl: | 7 |
| Anzahl der Ausfertigungen: | 2 x Odenwald Faserplattenwerk GmbH<br>(1 x Original, 1 x Zweitfertigung) |

Die Prüfergebnisse beziehen sich ausschließlich auf die Prüfgegenstände.

Veröffentlichung des vorliegenden Berichtes (auch auszugsweise) ist nur mit schriftlicher Genehmigung der MPA Universität Stuttgart zulässig.

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Ball impact test carried out in accordance with DIN 18032-3:1997-04 application area: ceiling; also tested in accordance with EN 13964, appendix D achieving class 1A (impact speed 16.5 m/sec ± 0,8).