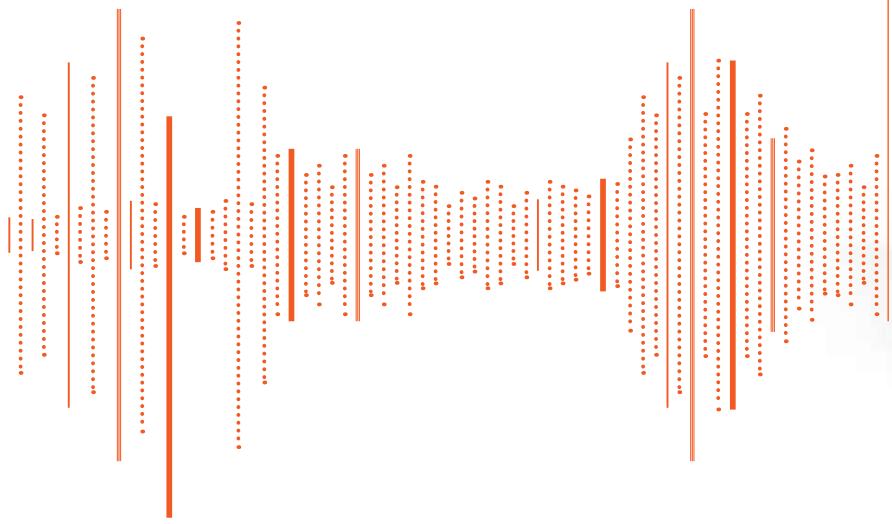
WHAT DO WE DO WITH THE NOISE?

Acoustic solutions

KÖNIG + NEURATH

GERMAN DESIGN AWARD WINNER 2020



We just have to block its path, and then it will stay outside!

IT'S ALL A QUESTION **OF ACOUSTICS**

Phones ringing, people on the phone, conversations between colleagues, the clicking of computer keyboards and the constant rhythmic buzz of printers and copiers. The backdrop of noise in the office – especially in the open space – can be extremely stressful and is stated as the number one distraction factor at work. There's even scientific evidence: noise disturbs concentration, which has a knock-on effect on efficiency at work. So doing something about office noise is worth it for all those affected. In this brochure you can find out all about acoustics in the workplace, and how to influence them positively.

CONTENTS

What exactly is meant by acoustics and what the characteristic features are

HAVE YOU HEARD ABOUT ACOUSTICS BEFORE? THEN READ MORE ON THE SUBJECT NOW

When people talk about the acoustics of a room, it's usually because they fall short of the ideal. The thing is, good acoustics in a room are usually perceived to be pleasant and therefore people don't notice them – so they generally aren't a topic for discussion. Not in this brochure: here we tell you all about how to design office space for an optimum effect in acoustic terms.

But what exactly are acoustics? It's simple: the word is derived from the Greek term for "to hear". In scientific terms it means the theory of sound and its spread – a broad field that encompasses areas from physics, engineering and medicine to music. The specific area of interest in the context of office noise is → Room acoustics, a sub-field of physics. This means the sound created in a room, as well as the potential to influence it in such a way as to create optimum acoustic conditions.

That means **acoustics are calculable**. You can work out exactly how the sound spreads and which materials have a positive or negative effect on the hearing experience. For instance there are materials that just absorb the sound, and others that intercept it. If both of these are combined in the right way depending on the room conditions, it is possible to counter the effects of unwelcome background noise to a significant extent.

For a start, what one person perceives as a distraction is subjective and depends on personal preferences and current circumstances. Almost everyone perceives an acoustic background of rustling leaves, sounds of the sea or birdsong as pleasant. Even if it sometimes gets loud, this can still be perceived as a positive experience: doesn't everyone enjoy turning the volume of their favourite music up from time to time? The neighbour on the other hand, who has to listen against his will, is probably more likely to feel disturbed.

But in any case a noise level of more than 70 → Decibels (dB) constitutes an absolute disturbance for the majority – for instance loud shouting, leaf blowers or intensive traffic noise. A level of more than 85 dB is a stress factor for all people and long term exposure to such high levels makes people ill; this category includes a circular saw with 90 dB or loud disco music with 110 dB. The pain threshold starts at approx. 130 dB, which is approximately equivalent to the volume of an aircraft engine.

Absolute calm – pure stress

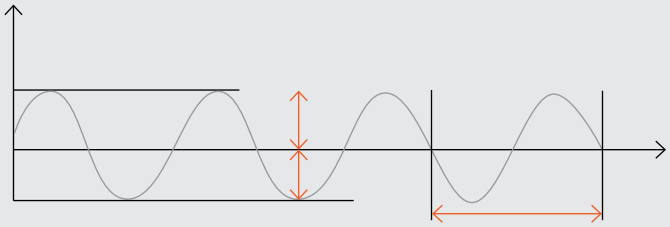
In a so-called "anechoic chamber", in which you really can't hear anything, people feel extremely uncomfortable. It causes high levels of irritation and stress if there is no acoustic orientation at all.

Highs and lows

Low sounds have long wavelengths, high sounds have short ones. The more frequently a sound wave oscillates, the higher the sound – the unit of measurement for this is → Hertz (Hz).

Hz

Wavelength



Sound spreads in waves. The interval between one highest (or lowest) point to the next is the wavelength. The height of the wave describes the volume.

How do people react?

The intensity of sound – the sound pressure level – is described using → Decibel (dB) as a unit of measurement. An increase of 10 dB is approximately equivalent to doubling the perceived volume.

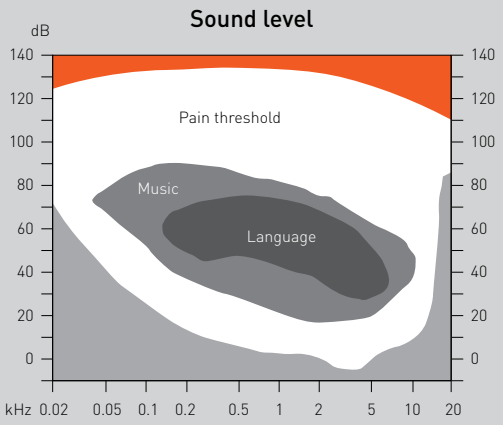
→ 30 – 65 dB
Psychological reaction

→ **65 – 90 dB**
Physical reaction
(e.g. increase in blood pressure)

→ **90 – 120 dB**
Hearing damage, pain

From sound to noise

Noise perception varies from person to person.
But in general higher-frequency sounds are perceived to be louder than mid-range and low sounds.



COMMUNICATION IS QUINTESSENTIAL IN THE WORKPLACE – AS LONG AS IT DOESN'T DISTRACT OTHERS

In the office there is a constant switch between concentrated working and communicative conversation. People work more creatively but more intensively – and mostly in team offices. Since the majority of modern office landscapes are designed with concrete, glass and aluminium, they do not exactly offer the optimum conditions for an atmosphere where sound is absorbed...

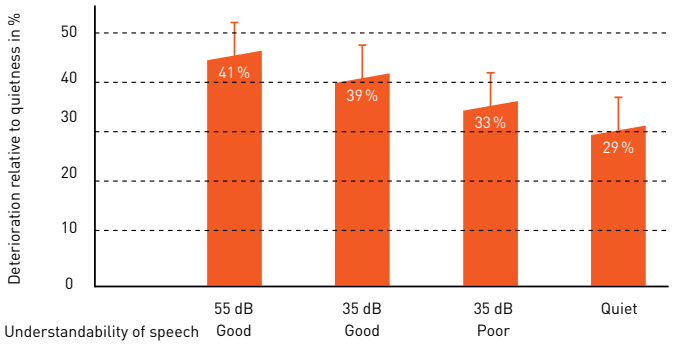
Whether the office is large or small: the most distracting thing is when other people are talking. In this situation it isn't just the volume of their speech that's important, it's the extent to which it can be understood. The more information people are obliged to hear involuntarily and the more complex the thought processes have to be, the more their performance capacity is reduced. This can apply even when the noise level is low. The noises emitted by technical equipment or background noise, for instance air-conditioning units, can also affect concentration.

Office acoustics are generally perceived to be pleasant when this kind of noise is reduced, and when people do not feel that they are disturbing others:

- Voices and work noises do not carry over from one workstation to the next, or at least are so quiet that they do not distract others.
- People can easily have a confidential discussion or make a confidential telephone call in a muffled voice.
- Sounds generated outside the office, as well as the noise made by technical equipment in the office, are not perceived to be a distraction at people's desks.

So the most important aspect of acoustic room planning is adapting acoustics to the modern way of working, and creating optimum conditions for each workstation depending on how it is used.

INFLUENCE OF THE SOUND PRESSURE LEVEL AND UNDERSTANDABILITY OF SPEECH ON MEMORY AT WORK



Noise can seriously compromise your ability to concentrate, even within current limits. Moderate levels of background conversation result in over 40 per cent more mistakes.

What different levels of distraction through noise are there?

DIN 1320 on the subject of acoustics defines noise:
Noise is defined as an undesired source of sound that can result in distraction, stress, negative effects or damage.

- Distraction: noise has a detrimental effect on mental activity, which is perceived consciously or unconsciously.
- Stress: noise is individually perceived to be a stress factor.
- Negative effects: noise compromises physical, psychological or social welfare.
- Damage: noise leads to a significant and possibly lasting impairment of the hearing and health.

What effect does noise have on productivity at work?

Scientific studies have shown that even a low level of noise without speech content during concentrated work causes a 10 per cent increase in errors. Speech within the acceptable limits up to 55 dB caused a reduction in productivity of over 30 per cent. If there are further visual distractions, the concentration ability drops by up to 50 per cent. The consequences: people tire more quickly, and in the long term there is more risk of burn-out.

What volume recommendations are there for the office?

55 dB(A) for mental activities
Scientific work, creating drafts, analysis, calculation, meetings, concentrated activities, screen-based work etc.

70 dB(A) for simple or mainly mechanically performed activities
Goods management, data entry, sales rooms, administrative offices, postroom

What can you do to create pleasant acoustics in the open space?

This goal can be achieved **in four steps**:

1. The reverberation time of sound in a room has a significant influence on the extent to which it is perceived as a distraction. That's why the → reverberation time has to be adapted depending on the type of activity in the room.
2. The spread of sound has to be reduced in areas where hearing it could be perceived as a stress factor.
3. The background noise level can be increased slightly using special equipment to make background speech less understandable.
4. And finally: the employees of course have to learn to be considerate to one another!

What you need to remember

BALANCE: HOW TO MAKE SURE THE OFFICE HAS GOOD ACOUSTICS

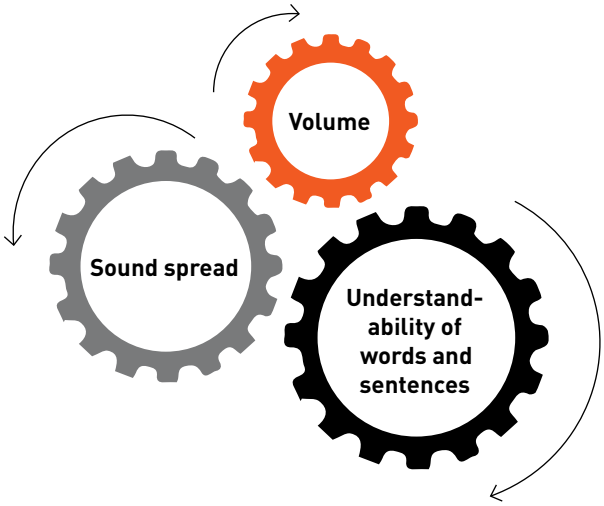
To achieve optimum room acoustics, you can't just turn the office volume down as you would with a radio – you always have to consider a variety of factors. As well as the background sound level, there are firstly elements that contribute to speech understandability, and on the other hand there are elements that affect the → reverberation time. The goal has to be to create a balanced relationship based on the structural conditions and the activities in the room.

That sounds complicated, but in practice it can easily be implemented. The thing is, you have precisely three options when it comes to taking control of sound. You can use → wall elements, screens or desk-top screens made from reverberant materials such as melamine or glass. The → sound waves are partially or completely diverted, reducing the sound spread.

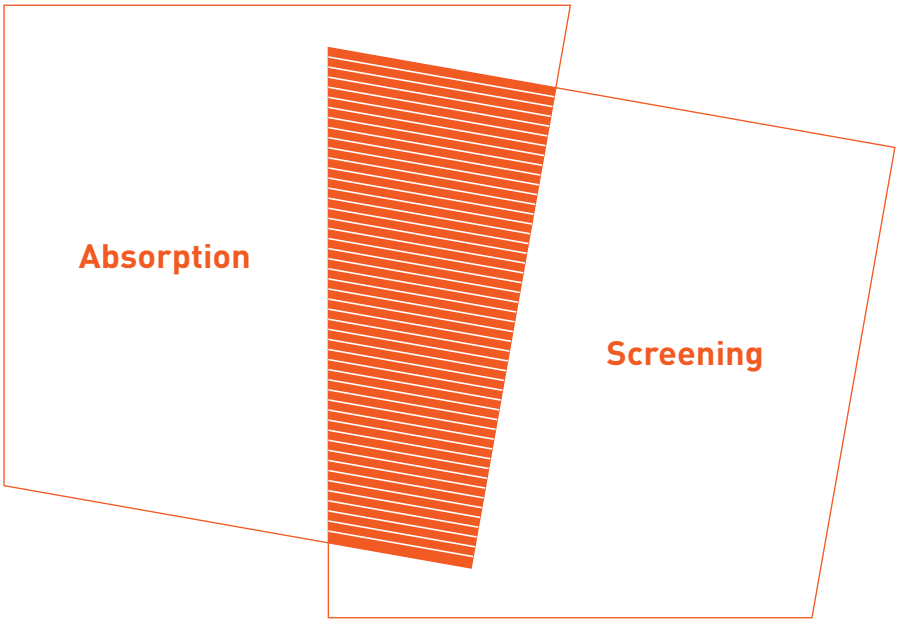
So-called absorbers absorb the sound – this function is performed by perforated cupboard doors or back panels, but also by screens, desk-top screens, wall cladding and ceiling canopies that are slotted, perforated or covered with fabric. This generally makes the office quieter.

Screening and absorption of sound can also be combined: furniture and elements with both properties reduce noise levels in general, as well as preventing sound from being carried from one room or workstation to the next (see graphic on p. 22).

Conclusion: for acoustic planning of an office space to be effective, you must have the overall picture of a room (in both visual and acoustic terms), as well as of the individual areas. There is no patent recipe for the perfect acoustics, because every room has rules of its own to follow – which are dependent on intended use, construction materials, number of employees etc. If sound baffles and absorbers are used properly, you can say that an office "sounds good".



The most important factors for a balanced room acoustic are mutually interactive.



When designing a room in acoustic terms it is important to consider the effects of Reverberation time (RT) of high and low-frequency sounds.
→ This influences how we perceive and understand speech.

RT low frequencies		RT high frequencies		Subjective speech impression
Too long	+	Too long	→	Indistinct, difficult to understand
Too long	+	Too short	→	Dull, but easy to understand
Too short	+	Too long	→	Shrill, blaring, piercing, difficult to understand
Too short	+	Too short	→	Dry, but easy to understand

The table shows what you need to take into account with → sound absorption.
For instance if the reverberation time for low frequency sounds is too long yet there is too much sound absorption for the high sounds, the overall impression for the room is a dull acoustic – but speech is easy to understand. However it is not possible to give a single answer when it comes to the ideal reverberation time: it depends on the cubic capacity of the room, and what it is used for. For instance the guideline value for a team office is 0.5 seconds, but for a concert hall the optimum reverberation time could be up to 2.2 seconds.

AN ACOUSTIC PROGNOSIS FOR A PLEASANT WORKPLACE

Although room acoustics planning for offices follows certain rules, it is still an individual matter: you see, every room is different in character and has other requirements to fulfil. As well as functions, work forms and the number of employees, it is also important to take into account the traffic routes in areas of varying user concentration, for instance. Furthermore it is of key importance to maintain a balanced relationship between economy of space and the employees' requirements in order to achieve efficiency at work.

AN OPTIMUM ROOM ACOUSTICS PLAN COVERS 5 STAGES:

1

Task
+ Requirements
+ Distraction factors
+ Volume

First of all it must be clarified what forms of work need to be carried out in the room, and what the acoustic requirements are with regard to communication and confidentiality.

2

Checklist
+ Dimensions
+ Materials
+ Furniture
+ People

In addition to the dimensions of the room, the desired functions, furniture requirements and any existing and planned materials are also recorded for each room.

3

Draft
+ Proposed solutions
+ Calculations

Possible solutions are developed and the corresponding acoustic calculations are carried out.

4

Coordination and implementation
+ Detail planning

The solution selected by the customer is planned and implemented precisely.

5

Visit
+ On-site appointment
+ Measurement

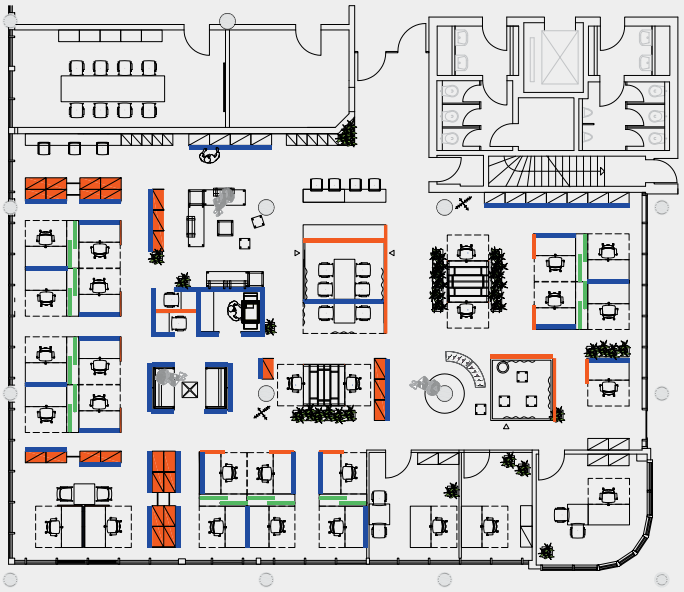
Subsequently, the acoustics of the room can be analysed on the basis of measurements and an on-site employee survey.

Example of acoustic planning for an open space office

THE CHALLENGE

One of the most challenging tasks when it comes to room acoustics in the office is to plan a team office with an open-space character – especially when the workstations have to be close to each other due to economy of space.

Team office solutions in principle aim to improve internal communication and encourage interaction and information exchange between individuals. So conversations are a good thing, but in an open space they mix with phone calls made by other colleagues and general noise from equipment to create a distracting noise backdrop. This often significantly reduces employee productivity and satisfaction.



- Sound propagation
- Sound absorption
- Sound absorption (can be used individually)

REQUIREMENTS AND CONDITIONS

Example: a team room is to be furnished with 20 permanent and a maximum of six freely available workstations. Zones for brief discussions and longer meetings are needed just as much in this project as areas for short spells of highly-concentrated solitary work. The room has a concrete cooling ceiling and a carpet-tiled floor; the windows are fitted with panel blinds.

Mobile acoustic elements can be used depending on individual circumstances.

Space to think, for brainstorming and meetings.

Have a quiet chat or make a phone call – the office noise stays outside.

A private place of retreat for concentrated work.

IMPLEMENTATION

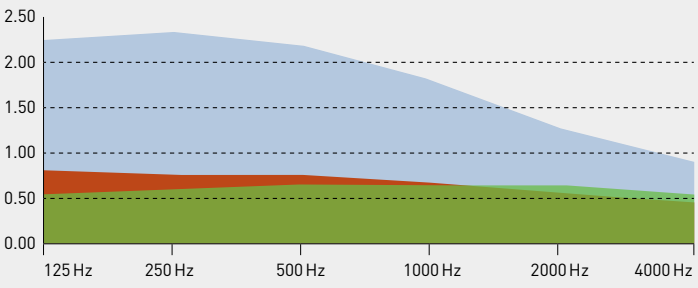
The permanent workstations are located along the façade. Each employee can screen off his or her workstation individually as required using freely movable screen elements, or leave it open.

THINK.TANKs serve as enclosed spaces for meetings and they divide up the central open area. There are bench sofas here as temporary workstations, too.

Additional meeting points with a variety of acoustically effective partitioning, as well as little hot desks, can be used as retreat areas.

A prognosis of the expected reverberation time shows that it is easy to achieve the optimum targets for the room based on the furnishing concept.

REVERBERATION TIME IN SECONDS



Frequency in line with speech range

Before After Target

OUR SOLUTIONS: PEACE AND QUIET

König + Neurath products and elements can be used to furnish offices for several people and open-space areas in such a way that the acoustics are suitable for all requirements and activities. The **INSIDE** screens are available with acoustically-effective fabric, and the **ACTA** storage range has acoustic doors and back panels. The new Phonebox and seat elements from the modular **NET.WORK.PLACE** range offer acoustic screening and damping, as do the **TEAM.WORK.SPACE** screens and absorbers. If offices are acoustically screened in this way, then there is space for concentrated work as well as for communication. Specific acoustic levels for individual products are shown on page 22.

THINK.TANK
A room-within-a-room to think, work, have discussions and retreat. Sound is screened and absorbed.

INSIDE.50
The screen provides visual privacy and effective sound absorption. It is made of fabric-covered and glazed elements.

QUIET.BOX
A modern-day phone box. Room to make phone calls or concentrate and collect your thoughts for a few moments. You can find the necessary peace and quiet - and don't disturb colleagues working in the office, either.

HORIZONTE acoustic screen
The elements offer visual and acoustic screening between working areas, or they can be used as room dividers or wall or ceiling-mounted sound-absorbers.

LIFE.S Interaction
Acoustic canopy for focused working in short meetings.

TEAM.WORK.SPACE
These elements block the view and provide acoustic screening, too. They can be positioned and combined freely.

QUIET.BOX Duo
Meeting area that takes up minimum space. One-to-one meetings or focused working - in the thick of it all. A small furnished room which is completely self-sufficient.

Here are the acoustic solutions from König + Neurath

HEAR IT
FOR YOURSELF!

König + Neurath has already implemented customised acoustics concepts for numerous companies. Workstations for open space offices, individual and double offices, boardrooms, conference halls or meeting areas: **optimum working conditions can be created if a structured and object-oriented acoustic consultation and planning process is carried out.** The decisive factor is how absorbers for high and mid-range frequencies, low-frequency absorbers and sound baffles are combined. The design can be tailored to company-specific requirements and corporate design. Panels, screens and room systems lend structure to the space, and are available in a variety of materials and finishes.

Our soft seating programme NET.WORK.PLACE Organic absorbs mid-range and high frequencies particularly well. A high level of importance has also been attached to acoustic screening.

The front and back panels of the ACTA.PLUS storage elements can be supplied with acoustically-effective materials.

The sound-absorbing elements in the HORIZONTE range are also optionally available perforated and with fleece and insulation material.

The QUIET.BOX provides a space to make phone calls or concentrate and collect your thoughts for a few moments.

The QUIET.BOX Duo is ideal for quick 1:1 meetings or focused working. The fabric-covered internal walls and acoustic ceiling ensure perfect acoustics.

The TEAM.WORK.SPACE screen absorbs mid-range and high frequencies effectively.

The desk-top screens in glass coordinate well with the linear design throughout the range, ensuring an unobstructed view whilst acting as a sound shield.

BLOCKING THE **PATH OF NOISE**

The acoustically effective screens in the **INSIDE** range are fabric-covered and filled with a special infill material. They partition the room, screen off distracting noises from adjacent workstations and at the same time improve the overall room acoustics. The **INSIDE** screens are also ideally suited for visual and acoustic screening of printers and copiers in the open space, too. Depending on the properties and functions of the room, a wide selection of elements in various thicknesses is available. The latest example is **INSIDE.50**: the elegant screen has B-absorbers on both sides for a quieter office. This works well as an acoustic design for changing situations.

INSIDE.50 is optionally available with a particularly effective acoustic infill, which is a combination of materials with different properties. With a thickness of 50 mm, this allows highly efficient sound absorption of mid-range and high frequencies. The screen is available in a wide selection of colours, so that it can be matched to any interior décor.

INSIDE.50

+ **B-absorber quality**
+ Absorbs over 90% sound
+ Can be wire-managed
+ Tool-free, removable panels
+ Acoustic properties

MORE PEACE AND QUIET IN THE OPEN SPACE

Our workstation programmes offer the right kind of furniture for every type of work and with **TEAM.WORK.SPACE** screens the acoustic elements to match. Individual workstations can be screened off to offer privacy from the person at the next desk and from the room, using screens of varying heights – without obstructing the view.

Modules from the flexible furniture system **NET.WORK.PLACE** complement this range perfectly: upholstered walls offer visual and acoustic protection, seating modules help to lower the general noise level. And the Phonebox provides a comfortable place to sit and make phone calls in peace – without distracting others.

At this workstation you have the peace and quiet you need, yet you are right where the action is.

The Phonebox with integral charging point is available as a one- or two-seater, and forms a little haven of tranquillity in the office.

IT'S PERFECTLY CLEAR: NOISE STAYS OUTSIDE!

Glazed walls are ideal as an acoustic screen if you need to partition rooms yet want to retain a transparent overview of the office space. In the **HORIZONTE** room system there is a choice of elements in various heights; with different levels of acoustic screening depending on the height and thickness of the glazed wall. The elegant perforated or slotted panels from the range form the perfect complement in both acoustic and visual terms: they also have sound-absorbing properties.

reddot award 2014
winner

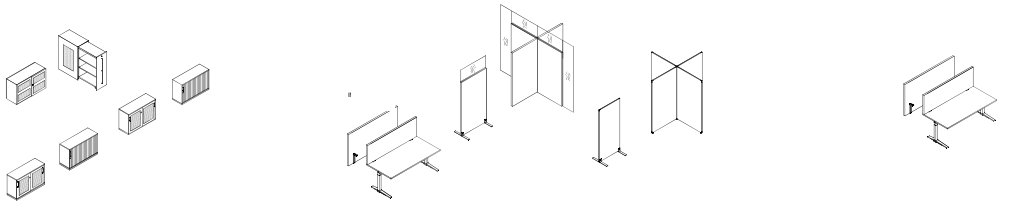
The THINK.TANK is a transparent room-within-a-room that is ideal for concentrated work, confidential meetings or small-scale conferences. It reduces and absorbs sound and has its own ventilation, lighting and electrics.

QUIET.BOX Duo:
Meeting area that takes up minimum space. One-to-one meetings or focused working - in the thick of it all. A small furnished room which is completely self-sufficient.

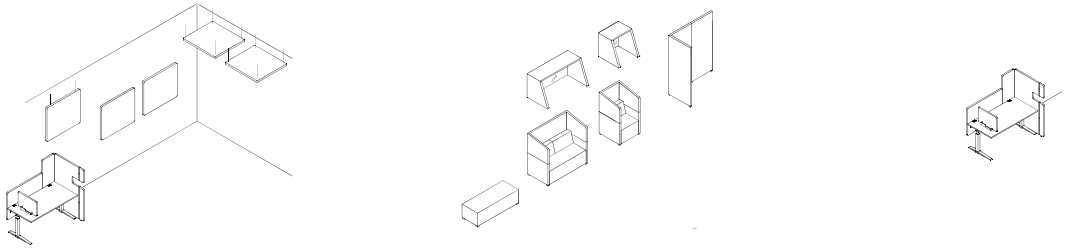
PRODUCT OVERVIEW
ACOUSTICS

Good screening | Good sound absorption | Good screening and absorption

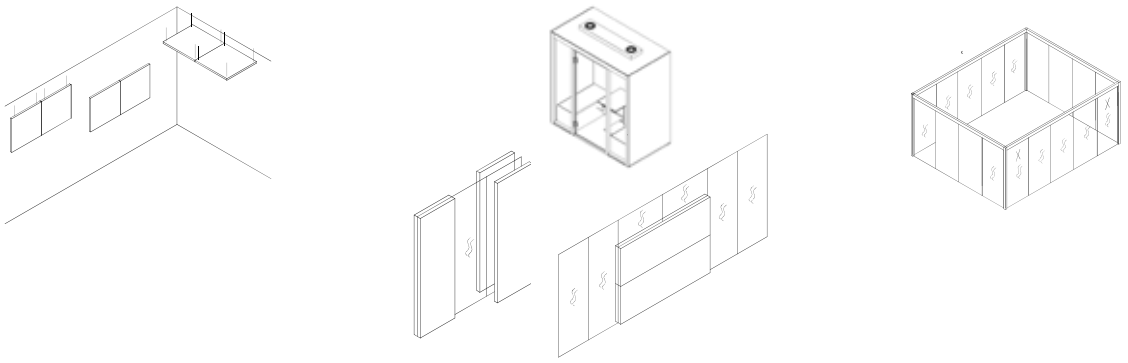
Storage/Screen



TEAM.WORK.SPACE / NET.WORK.PLACE

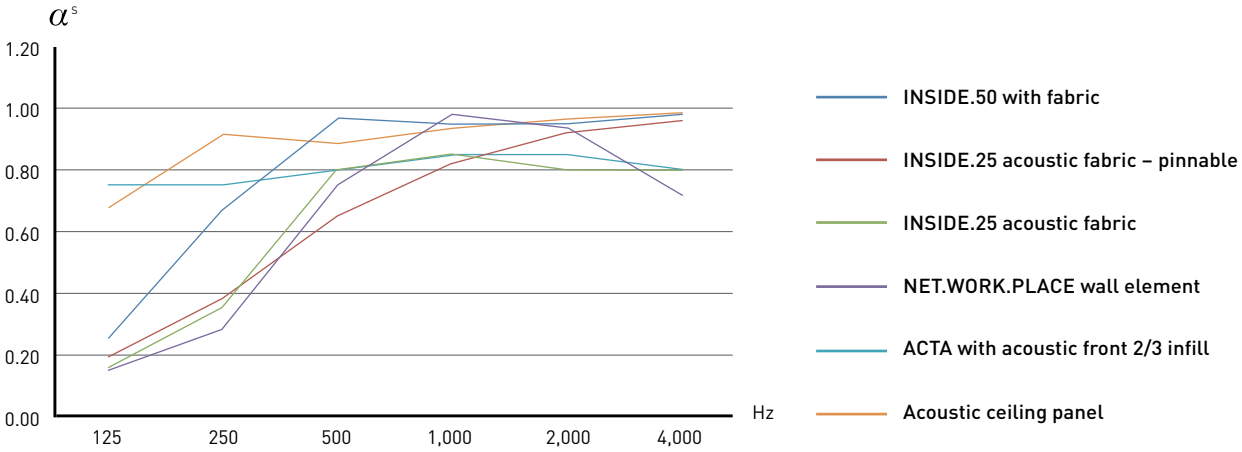


Room Systems



ACOUSTIC LEVELS OF PRODUCTS

Absorption levels by frequency



GLOSSARY: LISTEN TO REASON AND READ ALL ABOUT IT!

“Even a low level of noise leads to mistakes in concentrated work. Productivity can fall by 50 % if there is visual distraction, too.”

Peter H. Feldmann,
Expert for room acoustics

DECIBEL (dB)

Unit of measurement for the intensity of sound. Since the human ear senses different degrees of loudness for noises with the same sound pressure as a function of their pitch – high-pitched noises are perceived as louder than noises of medium or low pitch – measurements are normally made using the A-modified decibel, dB(A). This takes account of the properties of human hearing.

DIN 18041

This is an international standard for acoustical quality in small to medium-sized rooms. “Acoustical quality” denotes the effects of the acoustical properties of a room on the occupant. Among other matters, this standard lays down maximum → reverberation times, taking account of the understandability of speech and the volume of the room.

HERTZ (Hz)

Unit of measurement for the frequency of regularly occurring events. In acoustics, the number of oscillations per second of sound waves is measured in Hz. As the frequency of the sound wave rises, the sound is perceived at a higher pitch.

NOISE

Sounds of which the volume and structure are distracting, annoying or damaging for the person and the environment. On the one hand, the perception is dependent on factors which can be physically measured, e.g. the sound pressure and pitch. On the other hand, subjective factors such as the individual’s state of mind, preferences and mood can decide whether sounds are perceived as noise.

NOISE NUISANCE

Prevention or interruption of activities by noise. People become especially noise-sensitive when verbal communication is impaired, e.g. when a loud conversation at the neighbouring desk makes listening difficult. Noise is also a major distraction during sleep or concentrated work.

REVERBERATION TIME

Time taken for the sound pressure to sink by 60 dB after the noise source is switched off. It measures how long the sound echoes. The reverberation time can vary greatly as a function of the pitch.

ROOM ACOUSTICS

This part of acoustics is concerned with the effects of the structural conditions on the noise within a room. The main concern of room acoustics is to establish which materials should be used in which places to optimise hearing conditions within the space.

SOUND ABSORPTION

The conversion of acoustic energy into kinetic energy – in this case, heat – which is generated when the noise hits the absorber materials. Sound absorption is always the term used for conditions within a closed room with acoustic damping. In addition, it has an important role with ventilation plant and office machinery.

SOUND ABSORPTION COEFFICIENT

This measures the ability of materials to muffle sound. At 0, the sound is not absorbed at all, but is reflected 100%. With an absorption coefficient of 0.5, 50% of the acoustic energy is absorbed and 50% reflected. At 1, all the incoming noise is absorbed.

SOUND BAFFLE

An obstacle which interrupts the direct spread of the sound from its source to the receiver. Typical baffles are walls, floor-standing screens or desk-mounted screens, but cupboards or other furnishings with a large surface area are also effective. Sound baffles can be given a sound-absorbing surface which further reduces the spread of sound.

SOUND INSULATION

The spread of sound is hindered when an obstacle such as a wall is put in its path. The obstacle throws the sound back. So sound reduction is concerned with the relationship between adjoining rooms, for example between a noisy call centre and an adjoining quiet meeting room, in which confidential conversations can be held.

SOUND WAVES

Fluctuations in air pressure, produced by impulses. The length of the sound wave defines the frequency, while the amplitude of the wave defines the sound level. Long sound waves have a low frequency and are perceived as low-pitched. Short sound waves have a high frequency and are perceived as high-pitched. The oscillations of the sound waves are measured in Hertz.

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