

FOR A BETTER WORLD

Sound Solutions

Acoustic Excellence Creates Better Buildings

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create.
care.

KNAUFINSULATION

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Photo: Jan de Vries

Cover: Knauf Insulation solutions contribute to acoustic excellence at the Amare cultural centre in the Netherlands. See page 16.

INTRODUCTION

WE ALL DESERVE A QUIET LIFE IN AN INCREASINGLY NOISY WORLD

Noise pollution disturbs sleep, causes annoyance, disrupts concentration as well as productivity and causes serious health problems for millions.

Unfortunately, noise is everywhere, from traffic outside and noisy neighbours next door to clanking air-conditioning in buildings and the loud television in our homes.

At home, in the office, school, hospital, cinema, public building... wherever we are, the secret to good acoustic health and well-being is to focus on the sources of noise pollution — external and internal — and tackle each area individually.

And the solution? Our Mineral Wool solutions can dramatically improve acoustic well-being, especially when combined with our sound-absorbing boards, partitions or façades.

And if you need help, we have the technical expertise to meet any acoustic challenge.



AT A GLANCE

KNAUF INSULATION'S SOUND SOLUTIONS



Rock Mineral Wool

Our Rock Mineral Wool automatically contributes to dampening sound thanks to its high-level, noise-blocking fibre structure. Rock Mineral Wool also offers great thermal and fire performance.

Glass Mineral Wool

Our Glass Mineral Wool is lightweight, easily installed and provides outstanding thermal insulation as well as great acoustic performance.

Plasterboards

Our partition wall systems incorporating sound-absorbing Mineral Wool and sound-deflecting Knauf plasterboards offer a range of solutions that can be combined to manage sound according to requirements.

Heraklith® Wood Wool

Our Heraklith Wood Wool systems offer an ideal acoustic solution for applications such as garages, ceilings, external walls, loft floors or pitched roofs. Architects and designers are particularly fond of Heraklith because it offers a wide range of aesthetically appealing solutions.

Customised combinations

We offer combinations of solutions for maximum performance. For example, by combining our Mineral Wool and Wood Wool materials in a variety of thicknesses — ensuring the correct treatment of sound-transferring elements such as studs — great acoustic performance can be achieved.

Urbanscape®

Urbanscape® is our Green Roof Solution which not only dramatically contributes to noise reduction in large cities, near industrial areas and airports, but also provides excellent climate-friendly thermal insulation.

SPECIALIST SUPPORT

Knauf Insulation's acoustic specialists can help customers understand good acoustic performance and how our solutions can make a difference.

HOW TO ENHANCE ACOUSTIC WELL-BEING IN BUILDINGS

Noisy neighbours? Rumbling traffic? Echoing conference calls? Or the nuisance of a barking dog? Whatever the reason, if you want to improve the acoustic performance of your building, Knauf Insulation's Maro Puljizević can help.

Maro is Acoustics Project Manager at the company's Core Research and Development Department. He has been in the acoustics business for decades and over the years has dealt with challenges involving offices, public buildings, airports, residential blocks, non-residential complexes, restaurants, hotels, hospitals among other building types. This is his key advice.

First, understand what is 'too noisy'?

A pneumatic drill at 10 metres measures up to 100 db makes us instinctively clutch our ears and make them ring. Constant exposure to sound over 85 db is damaging. To put decibels in context, a vacuum cleaner achieves around 75 db, normal conversation is about 60 db and a whisper is 30 db or less. At least 20% of Europeans are exposed to high levels of noise pollution — 60 db or higher — mainly from traffic.

Are acoustic solutions expensive?

No. But it is best to factor in acoustics from the beginning. If you don't and the building users later complain about hearing the elevator in their bedroom, you have an expensive problem.

What's the difference between sound insulation and sound absorption and why does it matter?

Sound insulation stops sounds going from one space to another. Sound absorption absorbs sounds in a space and stops them echoing around. A system that combines both elements can be transformational in terms of acoustic well-being. A space with just sound insulation will create reverberation, a space with just absorption will still allow sound to impact spaces next door.

Don't fix acoustic boards directly on flat surfaces

Even the best acoustic board in the world will not live up to its expectations if it is fixed directly to a flat surface such as concrete. These heavy and rigid boards are excellent sound insulators but fixing them directly to a wall can eventually reduce the sound insulation thanks to complicated resonance effects. To improve the sound insulation, Mineral Wool should be installed to act as a separating layer between the wall and acoustic board.

Do not jeopardise quality of sound on account of good sound insulation

Boards which are good sound insulators are acoustically reflective which means they bounce sound back rather than absorbing it. In a space with such ceiling and walls, sound will reverberate. Neighbours next door may not be able to hear you, but you will not be able to understand those in the boarded room. Board isolates sound and stops it leaving the room, but you need sound absorption as well. So, add absorptive surfaces, like clouds or baffles.

Learn about bad sound from public address systems

Everyone has experienced PA announcements that have been difficult to understand. Often this is because the building interior is one vast volume of flat reflective surfaces bouncing sound around. When I go to airports I check if the ceiling features small holes. A board that combines insulation above needs to have perforations to allow the sound to be absorbed by the insulation. With perforations the sound quality is transformed.

Look up to find hidden problems

When I'm helping people with acoustic challenges, the first thing I do is open the false ceiling. Below the fold everything is good... above, the range of mistakes is unbelievable — cables added, holes drilled, lights installed — it's always the penetrations, the services, the add-ons. People always think that things can simply be hidden in the ceiling, but if we consistently damage the sound solution of a ceiling it is no longer effective.

Don't mix and match quality

You buy the best possible acoustic system for your wall which delivers 60 db of insulation and this has been verified. You then buy a door from somewhere and you have no idea what its performance is. The result? The overall performance goes down. Combining poor elements happens every day. Focus on installing quality acoustic solutions, everywhere.

What are your options if you need acoustic support?

Check out our extensive range of products. Knauf Insulation has sound solutions to tackle external and internal noise in every type of building and all the expertise you need to make an informed choice.





CHALLENGE OF EXTERNAL AND INTERNAL NOISE

At least **one in five people** in Europe are exposed to external noise levels that are harmful to health, according to the European Environment Agency.

This research found that **22 million Europeans suffered** chronic 'high annoyance' ranging from irritation to distress and 6.5 million endured significant sleep disturbance both of which can trigger health issues such as stress or cardiovascular problems.

The challenges of **internal noise** are equally disruptive for well-being — from echoing conference calls, arguing children and high-volume entertainment systems to noisy neighbours, clanking water and air-conditioning systems and distracting domestic appliances.

In addition to well-being issues, **noise pollution impacts productivity** and **alertness levels in schools** and **at work** and can **damage the success** of businesses such as **restaurants** and **hotels**.

EXCESSIVE NOISE AT WORK IMPACTS PRODUCTIVITY

Whether at home, in the office or a combination of both, we all deserve a space where we can work effectively free of noisy distractions.

Excessive noise is a key concern whether we are working from home or commuting to work in an office. Novelty ringtones, loud paper shredders, colleagues eating at desks, shouting into conference calls or trying to be heard in an echoing room — work can be challenging without good sound insulation.

There is plenty of research that underlines the importance of a good work soundscape. For example, one study by the British Journal of Psychology found that if you can hear talking while you are reading or writing your productivity falls by up to 66%.

In another study, a group of students were asked to carry out arithmetic tasks while exposed to office noise and then in silence. They performed better when conditions were quiet.



Importance of acoustic privacy

In France, 57% of office workers claimed that their ability to focus was impacted by one or several noise sources, while in the US, research into the working habits of 40,000 office workers found there was no evidence that open plan offices offered benefits over closed alternatives. In fact, open plan workers complained more about sound privacy. And privacy is vital, especially for video calls. People want peace and they don't want others to hear their conversations.

For those working at home, there may not be noisy colleagues around, but there could be loud neighbours, noisy traffic, distractions from other people in the house or apartment, clanking heating or cooling systems, televisions and other entertainment devices that are too loud and perhaps the occasional barking dog.





EFFECTIVE SOLUTIONS TO IMPROVE WORKING LIFE

Maro Puljizević is Acoustics Project Manager at Knauf Insulation's Core Research and Development Department. As an expert who has visited numerous workspaces to help customers improve their acoustic well-being, he has developed golden rules for individual and open office work areas.

"For individual areas, separate workspaces from surrounding areas with wall and ceiling elements of high-sound insulating performance. Mineral Wool in wall cavities and above ceiling tiles is indispensable," he says.

"For open office areas, use a lot of acoustically absorbing elements and think about smart office layouts. For example, separate chatty marketing teams from focused accountants. Separating different groups with cabinets, pinboards or other moveable sound barriers will certainly contribute to productivity improvements."

KNAUF INSULATION REDUCES DISTRACTING NOISE AT WORK

Wherever we work, the secret to good acoustic health and well-being is to focus on the three sources of noise pollution — external, internal and mechanical — and tackle each individually.

At Knauf Insulation we offer applications that can acoustically improve the full interior work space envelope from ceilings and floors to walls and partitions.

We have solutions for every possible office or home construction element from brick walls, wooden floors and attics to plasterboard partitions, cavities or concrete walls and timber frames.

The fibre structure of our Mineral Wool is highly effective at absorbing noise and we offer a range of sound insulation densities and thickness which can be used for any application.

For exceptional performance our Mineral Wool is best combined with Knauf plasterboard or Heraklith Wood Wool board.

These solutions have been developed to work together effectively and can be fine-tuned for maximum performance.

The fibre structure of Knauf Insulation's Mineral Wool is highly effective at absorbing noise





A total of 10,000 m² of Knauf Insulation TP 138 Natural Mineral Boards was installed in Orbit office building partitions in Athens, Greece, as well as 5,000 m² of Knauf Insulation Ultracoustic Natural Mineral Board and 5,000 m² of NaturRoll Plus

Customised workplace solutions

In office or apartment blocks the impact of noise from a floor above, for example, can be absorbed by installing Knauf plasterboard and our Mineral Wool to the ceiling below and tuning the air separation to make a crucial difference.

Combinations of our gypsum board and Mineral Wool are also ideal for upgrading existing walls and a decrease of 10 decibels is easily achieved which means you will not be able to hear a conversation or shouting next door and be unable to distinguish sounds from entertainment systems.

Knauf Insulation solutions can be customised to meet any acoustic requirement. In addition to excellent sound insulation, they provide exceptional fire and thermal performance. These solutions include:

- Our DRS Sound Supreme Board which has been specially developed for the insulation core of wooden doors and is popular with office developers as well as acoustically demanding homeowners that work from home.
- Our Rock Mineral Wool is often used as the core of sandwich panels in prefabricated office partition walls and roof elements due to its great sound insulation properties.
- Our Heraklith Wood Wool sound insulation is attractive, easy to install and made from sustainable natural materials.
- Our SUPAFIL Blowing Wool is ideal for new offices, renovated offices and for prefabricated buildings with applications for lofts, cavity walls and timber frames.

Want to learn how great acoustics can earn points in Green Building Rating Systems?

Simply click on any of links below to access documents that show how Knauf Insulation products contribute points in a wide range of Green Building Rating System categories including Acoustic Comfort.

Request BREEAM documentation [HERE](#)

Request LEED documentation [HERE](#)

Request DGNB documentation [HERE](#)

Request WELL documentation [HERE](#)

SCHOOLS NEED LESSONS IN NOISE REDUCTION

Every student deserves a noise-free environment where they can learn effectively and focus productively to achieve their best possible results.

Students and teachers face enough challenges at school or college without having to cope with the stress of excessive noise.

However, for many schools around the world, noise pollution is a serious challenge that disturbs learning, disrupts classes and impacts student well-being.

For instance, schools close to major airports face unique challenges. Take the example of Heathrow airport in the UK which handles up to 80 million passengers and 475,000 flights every year.

During peak holiday season, nearby schools are subjected to the sound of 1,300 flights roaring over their buildings every day with a flight every minute during busy periods.

To tackle the issue Heathrow allocated almost five million pounds through its Community Building Noise Insulation Scheme to thoroughly soundproof 24 local schools impacted by its flights including installing what are known as adobe buildings — eco-friendly domes which provide a child-friendly escape from aircraft noise in playgrounds.

Maro Puljizević, Knauf Insulation's Acoustics Project Manager at our Core Research and Development Department, says: "Children need to learn in a noise-free environment to ensure they can thrive at school.

"Excessive noise in class rooms, tutorial rooms or lecture halls can reduce the ability to hear lessons clearly and reduce understanding. This in turn can provoke annoyance and disturbance, leading to restlessness and disruption in class."

Heraklith® Tektalan A2 panels installed at a school in Radotin, Prague, Czech Republic





Impact of noise on reading levels

A study published in the American Journal of Epidemiology examined the reading comprehension of 2,000 students aged between nine and 10 in schools near airports in the Netherlands, Spain and the UK and found that a 20 dB increase in aircraft noise was enough to delay a student's reading level by up to eight months.

Studies examined by the World Health Organisation (WHO) have found that children exposed to continuous disruptive noise can experience poorer reading ability, memory and academic performance.

In one research paper, the average classroom noise level was found to

be 72 dB in the UK — almost vacuum cleaner level — meaning pupils at the back of the room could not hear everything teachers said.

Without sound insulation, music lessons next to a language class can ruin comprehension.

Heavy rain on a flat roof can make a tutorial reverberate like a drum and school hall gym classes or assemblies can be lost in translation.

Many schools may also use online classes and video calls will suffer if acoustics are substandard.

Inevitably, excessive noise also has an impact on teaching staff who are forced to raise their voice to be heard.

In a study of teachers in Denmark, researchers found that average class noise was 72 dB with an increase of 6.6 dB for indoor sports activities.

Teachers were talking with a raised voice 61% of the time, which not only further increased noise levels, but was found to provide "evidence for an association between noise exposure and cognitive fatigue after work".

To ensure good acoustic health and well-being for both those who are teaching and those who are learning, it is essential to focus on the three sources of noise pollution — external, internal and mechanical — and tackle each area individually

HOW SCHOOLS GET TOP MARKS FOR ACOUSTICS

Knauf Insulation's Mineral Wool solutions exceed the acoustic standards of Building Bulletin 93 — recognised standards in the UK for school noise levels, reverberation times and sound insulation.

These standards also set minimum noise levels for new build schools and schools under renovation and cover every educational aspect from primary school rooms, music areas and lecture halls to libraries, pools and dining areas.

Rock Mineral Wool

Our Rock Mineral Wool automatically contributes to dampening sound thanks to its high-level, noise-blocking fibre structure. Rock Mineral Wool also offers great thermal and fire performance.

Glass Mineral Wool

Our Glass Mineral Wool is lightweight, easily installed and provides outstanding thermal insulation as well as great acoustic performance.

Plasterboards

Our partition wall systems incorporating sound-absorbing Mineral Wool and sound-deflecting Knauf plasterboards offer a range of solutions that can be combined to manage sound according to requirements.

Ceiling systems

Our ceiling systems incorporate Knauf Insulation Mineral Wool and Knauf plasterboards ensuring that complete sound insulation is possible both horizontally and vertically.

Heraklith® Wood Wool

Our Heraklith® Wood Wool systems offer an ideal acoustic solution for applications such as garages and ceilings. For example, at Da Vinci College, pictured below, in the Netherlands, Heraklith A2 Wood Wool Panels were installed in the campus practice rooms to minimise noise from adjoining classes. Architects are particularly fond of Heraklith because it offers a range of aesthetically appealing solutions.

Heraklith® A2 panels were installed in Da Vinci College in the Netherlands to reduce noise from adjoining classes





Gym classes at this Budapest school in Hungary were difficult to hear until Knauf Insulation acoustic solutions were installed

Benefit of customised solutions

Knauf Insulation can provide combinations of solutions for maximum acoustic performance. For example, by combining our Mineral Wool and Wood Wool materials in a variety of thicknesses, exceptional acoustic performance can be achieved in areas such as school halls or gyms.

At the British International School of Budapest, for instance, students could not hear their teachers in the school's 535 m² gym. The space was renovated using Tektalan and Heraklith® boards. This improved the gym from 'bad' to 'good' in the Room Acoustics Speech Transmission Index as well as provided an impact-resistant, pleasing appearance.

Urbanscape® lessons in sustainability

Urbanscape® is a Green Roof Solution that offers great insulation against, for instance, external noise pollution caused by traffic or aircraft. On schools or colleges, green roofs also offer potential lessons in climate action or biodiversity.

Flat roof insulation solutions for schools

Our insulation solutions for flat roofs offer excellent acoustic performance for schools, colleges and other educational centres as well as high levels of thermal performance. Visit knaufinsulation.com to learn more.

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SECRET OF A GREAT NOISY NIGHT OUT? GREAT ACOUSTICS

Knauf Insulation can help venues find sound solutions to anti-social noise.

What have nightclubs, karaoke bars, live music venues, gaming arcades and bowling alleys got in common?

They all offer a chance to enjoy a great night of noisy entertainment that could still be ringing in your ears the next day. Still, if that noise becomes an issue and is not managed effectively, there is a serious risk that venue owners could be forced to close by local regulation.

Maro Puljizević, Project Manager for Acoustics at Knauf Insulation's Core R&D Department, says: "Excessive noise from a bar or club, for example, can be incredibly challenging outside the venue if it is not managed properly.

"That means two key acoustic challenges need to be addressed at the development stage of any entertainment venue and not left until the last minute as an afterthought — tackling impact noise and airborne noise."





How to keep music where it belongs — inside the club

Commit to reducing impact noise

If there are a thousand people on a dance floor and the bass is powerful and the structure rigid, that sound will travel through floors and walls for very long distances.

Knauf Insulation offers solutions that are ideal for what are known as floating floors. If a dance floor, a gym floor or bar floor — the walking surface — is attached directly to a concrete floor or in contact with a wall, the sound energy of its impact noise will reverberate through the entire building.

It is important to create a space between the two floors and fill that space with Mineral Wool. As this material is flexible and elastic, it is highly effective at dissipating noise energy and preventing it from transmitting to the building's structure.

Use Knauf Insulation solutions

At Knauf Insulation we offer solutions such as NaturBoard which meets a wide range of technical specifications that provide the fibre density and 'dynamic stiffness' or elasticity required to absorb impact noise

The elasticity of Mineral Wool enables the sound-absorbing material to be structurally strong enough to bear changing high loads such as people jumping up and down as well as static loads such as flooring. These solutions are ideal for music venues or facilities such as gyms or bowling alleys.

Pay attention to detail

Detail is everything. Once the Mineral Wool is in place, a layer of cement can be applied for the installation of the walking surface. It is important that this surface floats in the

cradle of acoustic insulation and does not connect with walls to avoid side sound transmission.

Knauf Insulation provides perimeter Mineral Wool strips to create a sound barrier at the entire edge of the walking surface which prevents sound travelling through walls. If there is break in the perimeter — a bridge for sound such as a connecting pipe — this will undermine acoustic performance.

Tackle airborne noise

Venues must also make airborne noise a priority. Most urban areas have strict regulation in place to prevent noise externally as well as sound transmission to adjacent habitable spaces, so it is essential that a venue puts in place the most effective acoustic management solutions possible.

Knauf Insulation's Mineral Wool and Wood Wool materials are effective at absorbing sound and slowing down noise. Mineral Plus, for example, offers a fibre structure that is easily cut to fit any gaps that allow noise transfer, while Heraklith Wood Wool is popular with noisy bars, music venues and busy restaurants and provides an uneven surface that looks great and offers great sound absorption.

Focus on the origin of sound

When it comes to airborne sound, the focus must be on its origin. For instance, in clubs and cinemas it is normally low bass frequencies that can travel long distances. However, in every case it is important to understand the range of frequency which needs isolating and the range of acoustic solutions that are most effective.



PHOTOGRAPHER: JAN DE VRIES FOTOGRAFIE [HTTPS://WWW.JDV.NL/](https://www.jdv.nl/)

A wide range of Knauf Insulation solutions ensure acoustic excellence at the Dutch Amare cultural centre in The Hague

PUTTING ACOUSTIC EXCELLENCE CENTRE STAGE IN THEATRES

Knauf Insulation's acoustic expert discusses the fine art of refining theatre soundscapes — one of the most demanding challenges for any sound specialist.

Maro Puljizević, Knauf Insulation's Acoustics Project Manager at the company's Core Research and Development Department, regards theatre acoustics as one of the most exciting challenges of any acoustic specialist.

"In a theatre space every member of the audience should be able to hear a performance clearly and that is why creating the best acoustic environment is an art in itself shaping the light and shade of sound by combining different thickness of Mineral Wool with the most effective board and acoustic spaces," he says.

"If you don't add enough insulation the space becomes echoic if you put in too much the space is deadened."

There is the geometry of space, carpets, seating and finding the right balance and optimisation for each solution. Every surface contributes to acoustic performance — for example balcony designs are not just aesthetically pleasing they also

play a role in dispersing sound — so it is essential to combine solutions using different thicknesses of Mineral Wool, different size cavities and different types of panels.

Theatres offer hundreds of unique acoustic challenges, says Maro. For example, the intended number of people in the audience will define the volume, the volume will define how seats are arranged.

The stage plays a role impacted by motorised elements, curtains, scenery or 360-degree spaces needing specific requirements, orchestra members need to communicate amongst as well as be heard by audiences and so on...

Acoustic consultants are constantly balancing and recalibrating levels of sound absorption, reflection and diffusion to refine a near perfect experience. Often performances are recorded for posterity so there is no space to accommodate rogue noises from, for instance, an external waterpipe or air-conditioning unit.

EXPERTISE TAKES STAR ROLE AT AMARE CULTURE CENTRE

The Amare in The Hague is a triumph of acoustic achievement. Top of the bill are great performances by Knauf Insulation and Knauf Group solutions.

The Amare building in the heart of The Hague is a showcase for some of the most outstanding artistic talent in the Netherlands and, having achieved BREEAM Excellence certification, a celebration of sustainable building.

It is also a tribute to the art of acoustic engineering.

The building, owned by the Municipality of The Hague, was designed as a multi-purpose replacement for the Dr Anton Philipszaal and Lucent Danstheater venues on the Spui and the Royal Conservatoire.

The cultural hub houses a 1,300-seat theatre, a concert hall for 1,500, an ensemble hall for 600, a 200-seat rehearsal space, as well as classrooms and studios.

Naturally, as a home to artistic excellence, it was essential that sublime acoustics were put centre stage from the start with every detail featuring Knauf and Knauf Insulation solutions.

The challenges were enormous. Many of the walls were thick with some up to 12 metres high, many non-load-bearing partition walls had to be easily moveable, not a single

ceiling surface was completely straight, and every acoustic element had to be capable of decoupling without causing sound leakage. Building Information Modelling was used extensively, more than 300 acoustic measurements were taken for each wall and giant mock-up spaces took up two floors to test different solutions.

Furthermore, prefabricated ceiling elements had to be created offsite and assembled at the arts venue where 20,000 m² of Knauf panels were installed.

Meanwhile, Knauf Insulation and Knauf solutions were customised for walls according to specific requirements featuring 100,000 m² of Acoustifit Mineral Wool which ranged in thickness from 250 mm to 600 mm as well as 270,000 m² of lightweight Knauf Diamond Board.

This landmark project brought together expertise from Knauf Insulation, the Knauf Group, acoustic designers LBP|Sight, architects NOAHH Network Oriented Architecture, Architects & Urbanists as well as the building consortium Cadanz.

20,000 m² of Knauf panels, 100,000 m² of Acoustifit and 270,000 m² of Knauf Diamond Board were installed in The Amare



Photo: Jan de Vries

HOW TO AVOID HORROR FILM ACOUSTICS AT THE CINEMA

Acoustics play a key role in transporting cinema-goers to imaginary worlds.

Picture the scene. You are in the cinema enjoying a great romantic comedy laughing along with your favourite actors. Then the pace of the movie slows, the actors get close, the music becomes quieter, romance is blossoming and...

All you can hear is the screech of helicopters, screaming soldiers and gun fire from the action film next door.

"Bad acoustics can turn an incredible cinema experience into a real horror film," says Maro Puljizević, Acoustics Project Manager at Knauf Insulation's Core Research and Development Department. "The whole point of theatre or cinema is the user experience, the illusion.

"You want to be in a space where you enter an imaginary world and for this illusion to be successful you need to be insulated from the surrounding real world. I remember watching Lord of the Rings and in the quiet moments all

I could hear was a distracting hum of air-conditioning."

Acoustic challenges include external sources, such as noise from the movie next door, road noise outside or a noisy lobby. Then there are interior sources such as loud air-conditioning, projectors or uninsulated walls next to beeping elevators, says Maro.

Whether the cinema is housed in a complex, shopping mall or historic building, the focus should always be on maximising the performance of the sound system to ensure all members of the audience enjoy their acoustic experience equally wherever they sit.

"It is no good if some members of the audience are deafened and others struggle to catch dialogue. That is why every surface requires attention to acoustic detail from the theatre's airlock double doors, walls and ceilings to the canopies, carpets and seat upholstery," says Maro.

The new Pathé cinema in the Dutch city of Maastricht features two underground theatres where Acoustifit was installed





Knauf Insulation's Acoustifit was used extensively in the Haarlem six-theatre Kinopolis cinema in the Netherlands

Great sound solutions cast a spell when it comes to movie magic

So how do you manage sound solutions to ensure cinema-goers are truly immersed in the imaginary worlds they are experiencing on the big screen?

You need to avoid echoes, you need to avoid deadening sound, you need to isolate low, mid and low frequencies... ultimately it is all about orchestrating acoustic combinations with different thicknesses, different densities and different spaces to create a completely immersive experience.

The Knauf Group and Knauf Insulation has decades of experience tackling the acoustic challenge of cinemas and engineering the customised systems that will ensure audiences are lost in their favourite film rather than sounds from the lobby popcorn stand.

From cinema ceilings, walls, floors and roofing to HVAC systems and everything in between, the companies can help. For example, Knauf Group's dedicated laboratory in Germany has been offering customised acoustic solutions since the 1970s and has achieved remarkable results such as creating cinema partitions that can cut sound by 83 dB (the sound of a pneumatic drill measures 100 dB at

a distance of 10 metres). The companies have also worked on several unique cinema projects. The new Pathé cinema in the historic Dutch city of Maastricht, pictured left, for example, features two side-by-side underground theatres in acoustically challenging sunken steel and concrete chambers.

Knauf Insulation provided 40,000 m² of Acoustifit and Naturoll solutions for these unique spaces with 300 mm Acoustifit installed in the floating ceilings of the cinema rooms and two layers of 60 mm Acoustifit in the theatres' steel hulls to achieve a sound insulation of 63 dB. The same system was also applied to partition walls between the foyer, external rooms and the Dolby sound room.

Meanwhile, in the new Kinopolis cinema in the heart of Haarlem in the Netherlands, Acoustifit was used extensively in the complex's six theatres to ensure the perfect sound experience for the 934-seat maximum capacity.

Good cinema acoustics are important. If cinemas deliver an experience where customers feel engaged they will come back and that is good for business and good for everyone.

WHY NOISY HOSPITALS ARE BAD FOR OUR HEALTH

We need to look at new ways of improving hospitals to maximise recovery and healing — ideally we should be prescribing better acoustics.

Constantly beeping machines, coughing patients, noisy visitors, banging doors, the murmur of nurses' voices, squeaky trolleys, ambulance sirens and arriving visitors, hospitals might not always be the most peaceful place to recover from an illness or operation.

The World Health Organisation (WHO) has highlighted the vital role that sleep plays in medical recovery and recommends that sound levels should not exceed 35 dB — the volume of a loud whisper — for hospital wards, recovery rooms and treatment centres.

Research by WHO highlights how excessive noise can have a detrimental impact on vulnerable patients such as those with mental health challenges, high blood pressure, those with hearing impairments, those who are blind, babies, young children and the elderly.

"Since patients have less ability to cope with stress, levels should not exceed 35dB in most rooms where patients are being treated or observed. Attention should also be given to the sound levels in intensive care units and operating theatres," says WHO.

Unfortunately, sound levels can be much higher in many hospitals. Research by King's College London found 40% of patients surveyed in the UK had been irritated by noise at night.

Even worse, the research reported that noise levels in UK intensive care — where the most vulnerable are treated — regularly exceeded 100 dB as loud as a lawnmower.

Excessive noise not only impacts patients. In operation rooms sound insulation is critical to ensure quiet concentration, while on wards excessive noise can be stressful for nurses and doctors who may feel increased fatigue, less alert, more stress and ultimately less productive.

Crucially, there may also be mis-communication which compromises healthcare or important discussions with patients or their families that are distorted.

Dr Andreas Xyrichis, lead author of the King's report, told the BBC: "Hospital soundscapes need to be considered as a whole not just the noisiest elements such as machinery and alarms but also low intrusive sounds such as squeaky doors."

Maro Puljizević, Knauf Insulation's Acoustics Project Manager at our Core Research and Development Department, says: "Hospitals, health centres or any building that houses the elderly, vulnerable or sick faces a constant challenge of providing a comfortable nurturing environment while still remaining efficient, functional, clean and hygienic. Often this will mean hard, shiny surfaces that are easy to clean but bounce reverberating noise along corridors and rooms."





PHOTOGRAPHER: JAN DE VRIES FOTOGRAFIE HTTPS://WWW.JDVFNL/

A total of 40,000 m² of Acoustifit with ECOSE Technology was installed in the Prinses Máxima Centrum hospital in Utrecht

Knauf Insulation sound solutions are just what the doctor ordered

Knauf Insulation has specialised sound solutions for every area of the hospital envelope from the façade, roof and basement to partition walls, dividing walls, ceilings and flooring, wet room areas and operating theatres.

The company has also worked closely with hospitals around the world to provide sound insulation.

In **Turkey**, for example, Knauf Insulation provided a total of 500,000 m² of Mineral Plus IPB series Partition Wall Board in two emergency government COVID-19 hospitals in Istanbul.

In **Sweden** our Urbanscape Green Roof solution can be found on the country's second biggest hospital Karolinska in Stockholm covering a surface area of 26,000 m².

In **Serbia** we developed our own Rock Mineral Wool lamella to meet acoustic demand in the Balkans, already 1,900 m² of this solution has been installed in a hospital in Belgrade.

In the **Netherlands**, Haga Hospital was the first hospital in the country to achieve BREEAM Excellence certification. Optimal sound insulation was critical and this is why Knauf Insulation's Acoustifit system with ECOSE Technology® was selected.

A total of 40,000 m² of Acoustifit was also installed in the Prinses Máxima Centrum in Utrecht, along with 3,500 m² of Naturoll 032 to meet the Dutch hospital's demanding energy efficiency and acoustic standards.

Want to learn how great acoustics can earn points in Green Building Rating Systems?

Simply click on any of links below to access documents that show how Knauf Insulation products contribute points in a wide range of Green Building Rating System categories including Acoustic Comfort.

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WANT A QUIET HOTEL NIGHT? BOOK AN INSULATED ROOM

Nothing spoils a summer holiday or business trip faster than a noisy hotel. That is why installing insulation with outstanding acoustic performance is good for guests, good for employees and great for business.

One of the first things that any would-be holiday maker does before booking their hotel is check a comparison website. And even a cursory glance at these sites will quickly reveal what is really important to these potential hotel guests — a good night's sleep.

A noisy hotel is not great for guests or hotel employees and it is definitely not good for business. Guests are unlikely to return and more likely to voice noisy opinions online if their hotel room peace was shattered.

Noise pollution can be external and internal to a hotel building and a combination of both combined with poorly insulated rooms can be deeply irritating for guests.

When we become irritated it has social implications for everyone, we cannot focus on any work in our hotel room, we cannot relax and traffic noise, trains or construction drilling, for example, can disrupt sleep and trigger stress or even cardiovascular problems.

Internal hotel factors are equally challenging such as noisy guests next door, loud entertainment systems, rattling room service trolleys, loud staff, echoing stairways and banging

doors or simply the relentless clanking of air-conditioning or heating systems.

Poor acoustic performance may not be restricted to rooms and suites. Hotel conference and meeting rooms may suffer from echoic challenges that distort speech and impact understanding, while restaurants may be so noisy that it is impossible to hear fellow diners.

The result is that travel organisers, guests and restaurant customers are not just going online to voice their disappointment on social media, new communication channels are also calling for a more relaxed audio life.

For example, Quiethotelroom.org offers a worldwide certification of hotel acoustic comfort, the Soundprint app allows users to make noise-friendly restaurant choices, while the Acoustical Society of New Zealand rates the acoustic comfort of all the country's eating venues.

Of course, the key to a quieter hotel world is good acoustic insulation combined with the latest triple glazing — ideally installed as the hotel rooms, conference rooms and restaurants are being built.

Soundproof double doors featuring Knauf Insulation's DRS Sound Supreme were installed in the Kempinski, Muscat, Oman





Knauf Insulation's Earthwool was installed in internal partitions and external walls of the Auckland Park Hyatt in New Zealand

Five-star sound solutions worth checking out when you check in

The fibre structure of Knauf Insulation's Mineral Wool is highly effective at absorbing sound and is available in a variety of different thickness and densities making it an ideal acoustic solution for hotels around the world.

For example, the first Motel One hotel to open in **the Netherlands** features Acoustifit from Knauf Insulation with double Knauf A cladding in every room-dividing wall.

In Muscat, **Oman**, more than 2,500 doors were installed featuring Knauf Insulation's DRS Supreme Board and in **New Zealand**, the Park Hyatt Hotel Auckland features Earthwool in internal partitions and on external walls.

Other Knauf Insulation solutions used extensively in hotels worldwide include external wall systems such as ventilated façade systems and Heraklith Wood Wool panels for service rooms, lift shafts, service corridors, conference spaces or carparking garages.

In addition, our Technical Solutions can produce customised Mineral Wool insulation for HVAC systems to ensure noisy ducts are silenced.

For rooms, hotels can combine our Knauf plasterboard and Heraklith with Mineral Wool to maximise acoustic performance, while our DRS Sound Supreme Board has been specially developed for the insulation core of wooden doors.



Acoustifit was used extensively in the first Motel One hotel to open in the Netherlands

HEALTH HAZARD OF INDUSTRIAL NOISE

Loud levels of industrial noise can impact worker's health and threaten safety. Reliable acoustic solutions are essential to ensure a workplace that is safe and sound.

The Center for Disease Control estimates that 22 million workers in North America are exposed to potentially damaging noise at work every year.

The tragedy is that consistently enduring loud noise can irreversibly damage the nerve endings of the inner ear resulting in permanent hearing loss that can never be recovered.

"About 24% of hearing difficulty among North American workers is caused by occupational exposures," says the US National Institute for Occupational Safety and Health.

The sources of industrial noise are endless from grinding machinery, machine presses, generators, drills, punch presses, saws, fans and lathes. Constant noise such as a generator hum

is difficult enough for anyone to handle, but it is intermittent noise that pushes up stress levels such as a press that punches out metal every 30 seconds or bursts of loud steam from piping.

In addition to the danger of hearing loss, excessive industrial noise has a psychological impact causing stress and annoyance.

Noise also has the potential to cause high blood pressure, a loss of productivity and make it difficult to hear safety alarms or warnings from colleagues which could lead to accidents.

Most countries have regulations in place to protect workers from excessive noise at work. In the US, for example, this means that if noise exposure is 85 dB or above —

averaged over eight working hours — measures need to be taken.

And 85 dB sounds a lot, but as the Occupational Safety and Health Administration (OSHA) points out: "If you need to raise your voice to speak to someone one metre away noise levels might be over 85 decibels."

So what can be done to keep people safe?

When it comes to noise you can isolate equipment or isolate people — and it is hard for people to wear ear-protectors for eight hours. The most efficient way is to reduce noise at the source by putting an acoustic enclosure around a machine. If the machinery is too complex for that, there are acoustic curtains or barriers that are effective.

Power-teK solutions were used to provide industrial insulation for a minus-160°C cold box developed by BASF and Linde Engineering in Ludwigshafen in Germany.





Sound solutions to make industry safer

Knauf Insulation and its parent company the Knauf Group offers a wide range of customised solutions to tackle industrial noise.

The noise-blocking fibre structure of Rock Mineral Wool and Glass Mineral Wool can be combined with sound-deflecting Knauf plasterboards which can be fine-tuned for maximum acoustic impact.

Such combinations are ideal for the noise reduction of individual machines or for the creation of protective booths inside a plant where workers can work in relative peace isolated from the industrial cacophony outside.

Meanwhile, Knauf Insulation's Technical Solutions division which has worked with companies worldwide — from paper mills in Finland to nuclear power plants in France — can provide Power-teK acoustic combinations for highly specific industrial purposes.

Power-teK is ideal for pipes, storage vessels and tanks, boilers, furnaces or storage tanks up to a maximum

application temperature of 700°C. Power-teK solutions can cut down unwanted source noise significantly. For example, noise can travel along kilometres of plant piping which magnifies sound like a trumpet.

Good pipe insulation can make an acoustic difference as well as significantly improve energy costs.

Another area of management involves tackling the space that encompasses industrial noise. Giant buildings filled with machinery are highly echoic with reflective surfaces that bounce sound around.

Hanging insulation baffles from the ceiling or incorporating insulated panels in strategic wall spaces can help reduce the decibel level and every reduction will be an improvement in communication for the people who work there.

A popular choice in this area is Knauf Insulation's Heraklith Wood Wool which is ideal for insulating ceilings, walls and floors and is often used to reduce unwanted noise from technical rooms, storage spaces and parking areas.

EUROPE'S UNIQUE CHANCE TO IMPROVE ACOUSTIC WELL-BEING

Well-being should be put at the heart of new plans to renovate Europe's public buildings. Knauf Insulation's acoustic specialist explains why.

The European Commission's plan to renovate 3% of all Europe's public buildings every year offers an unmissable opportunity to radically improve public acoustics for everyone, says Maro Puljizević of Knauf Insulation's Acoustic Core Research & Development Department.

The Commission's new proposal included in a major revision of the Energy Efficiency Directive (EED) is seen as a significant milestone on the road to achieve the European Union's ambition to be the first zero carbon continent in the world by 2050.

Buildings are responsible for generating 36% of Europe's CO₂ but only around 1% of buildings are renovated every year. The EED revision aims to accelerate this renovation rate and is focused on retrofitting all public buildings — from village, town and city properties to municipal and regional buildings — to ensure they achieve near

zero energy standards (NZEB).

"There has never been a better time to improve our acoustic well-being on an international scale," says Maro. "In addition to making our public buildings more efficient and reducing their environmental impact, this is an opportunity to find solutions to many of the acoustic challenges facing these buildings."

Publicly owned properties make up an estimated 20% of Europe's building stock ranging from office space, hospitals, prisons and museums to community centres and schools.

"The acoustic insulation challenges of public buildings are as significant and are varied as the buildings themselves and we are all familiar with their challenges," says Maro. "In sports halls or venues there may be too much reverberation so it is hard to hear properly."

"At stations, public address systems may be distorted, in museums it may be impossible to hear your guide, in mosques or churches sound may be garbled and in schools, lessons may be ruined by poor sound proof insulation."

"In a multi-functional building such as a town hall there may be a wide range of challenges from the need for privacy in public-facing facilities, to efficient work spaces for public office work to good acoustics in meeting rooms and public spaces."

"The Energy Efficiency Directive's widespread renovation of public buildings is a unique opportunity to improve public well-being," says Maro. "We should grasp this opportunity. Our hope is that this revision paves the way for showcase buildings that are renovated to the very highest sustainable standards. These buildings should provide a legacy of well-being of which we can all be proud."

Heraklith Tekalan A2 was installed in the ÖAMTC Centre in Vienna, Austria — the country's largest mobility club — acoustic performance, aesthetic appearance, thermal performance and fire safety were key considerations



Future vision of buildings...

The 40,000 m² Bosco Verticale (Vertical Forest) towers feature 800 trees and 20,000 plants. In addition to stunning green infrastructure, a total of 10,000 m² of Knauf Insulation's Rock Mineral Wool DP6 (NaturBoard Timber) slabs were installed in the towers. The towers were built to the highest standards of performance when it came energy-saving, air quality, fire safety and, of course, acoustics. The towers are certified LEED NC GOLD



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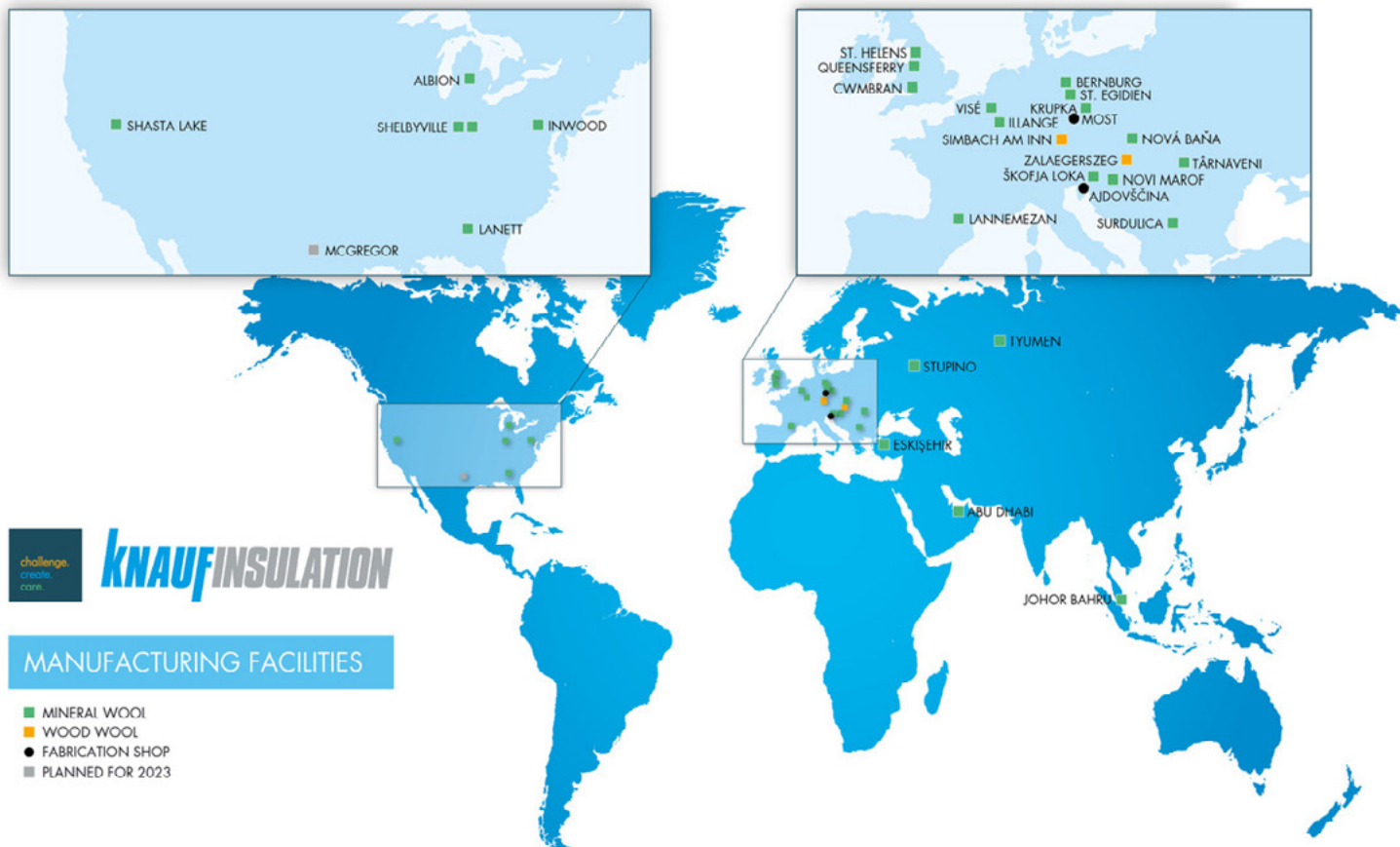
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ABOUT KNAUF INSULATION

Knauf Insulation has more than 40 years of experience in the insulation industry. Today the company employs over 5,500 people across more than 40 countries and has 30 manufacturing sites in 16 countries.

Knauf Insulation is part of the Knauf Group which has around 40,000 employees worldwide with more than 250 factories in over 90 countries and sales of 10.5 billion Euro (in 2020). The Knauf Group was founded in 1932 and remains an independent family-owned company driven by the values of Partnership, Commitment, Entrepreneurship and Menschlichkeit (humanity).

OUR MISSION

Our mission is to challenge conventional thinking and create innovative insulation solutions that shape the way we live and build in the future, with care for the people who make them, the people who use them and the world we all depend on.

OUR VISION

We lead the change in smarter insulation solutions for a better world.

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challenge.
create.
care.