DESSO SoundMaster®
The carpet that improves acoustics
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Innovation to improve the quality of everyday life

At Desso, we are always asking ourselves how our carpet solutions can do more for people in their daily lives. The development of products that make a difference is at the heart of our business.

Desso is committed to delivering superior products and developing pioneering solutions through continuous innovation. Our innovation strategy is concentrated in 3 key areas:

Creativity   Spearheaded by Desso’s design philosophy CARPETECTURE® and our international concept Circles of Architects®
Functionality   Pioneering solutions that make a difference, such as DESSO SoundMaster®, DESSO AirMaster®, DESSO Light Reflection Master®
Cradle to Cradle®   Developing products and processes that will contribute towards a better environment and indoor quality

Our carpet solutions already contribute to providing outstanding performance qualities for enhanced human well-being. However, we keep looking for improvements to go one step further. DESSO SoundMaster® is a key example of an innovative solution that takes design and functionality to the next level. It contributes to better working and living conditions in offices, schools, care centres and other commercial environments.
The impact of noise

Sound is all around us; with a distinction to be made between the sound we want and the sound we have to put up with. Sound can be functional and pleasant, but when sound becomes noise, it can be disturbing or even affecting human health.

Noise can have an adverse impact on people in offices, classrooms, hospitals and other commercial buildings\(^1\), interfering with their daily activities at work or school and at home. People’s performance levels and ability to concentrate can be negatively affected by noise and it can make it harder for them to share knowledge with one another. It can also reduce their levels of comfort and well-being, and even cause health problems\(^2\)\(^3\)\(^4\) such as hearing impairment (e.g., tinnitus or hearing loss), voice problems, cardiovascular diseases, sleep disturbance and increased stress levels.

The impact of noise has long been underestimated, but is now a growing concern among both the general public and policy-makers. The World Health Organisation (WHO) even indicates that at least one million healthy life years are lost annually from environmental and occupational noise in Western Europe\(^2\). In addition to existing international legislation (e.g., EU Directive 2003/10/EC), WHO has started to develop suitable guidelines\(^5\) on noise to protect people against its impact.

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\(^1\) Noise in figures, European Agency for Safety and Health at Work 2005.
\(^2\) Burden of disease from environmental noise, World Health Organisation, 2011
\(^3\) Environmental noise and health in the UK, Health Protection Agency, 2010
\(^4\) Center for Hearing and Communication, US, www.chchearing.org
\(^5\) As part of the Health 2020 project; developing the new European health policy, together with Member States and other partners
What is noise?

Noise is an unwanted sound; its intensity is measured in decibels [dB(A)]. The decibel scale is logarithmic, so a three decibel increase already represents a doubling of the noise intensity. Duration of exposure is another important factor to determine the potential risk of noise.

We are not used to seeing noise as a problem, but the unwanted type of noise is unfortunately all around us, often 24 hours a day. It comes from many sources and can cause health problems even when it is not particularly loud. Furthermore, there is the cocktail party effect, where people feel the need to raise their voices or turn up the volume of their devices above the existing noise, making the overall problem worse.

Some common sounds and their decibel levels:

- Rock concert, jet take-off, gun shot: 120 to 140 [dB(A)]
- Power tools, motorcycle, manufacturing plant: 90 to 100 [dB(A)]
- Dishwasher, computer room, busy restaurant: 75 to 90 [dB(A)]
- City traffic, office equipment, cell phone, loud radio: 70 to 80 [dB(A)]
- Normal conversation: 50 to 70 [dB(A)]

Some occupation / workplace recommended limit [dB(A)]:

<table>
<thead>
<tr>
<th>Occupation / workplace</th>
<th>Recommended limit [dB(A)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>School rooms</td>
<td>30 - 40</td>
</tr>
<tr>
<td>Offices</td>
<td>30 - 40</td>
</tr>
<tr>
<td>Open plan offices</td>
<td>35 - 45</td>
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<tr>
<td>Laboratories with routine work</td>
<td>35 - 50</td>
</tr>
<tr>
<td>Manufacturing workplaces, workshops</td>
<td>65 - 70</td>
</tr>
<tr>
<td>Health sector</td>
<td>30 - 45</td>
</tr>
</tbody>
</table>

⁶ Four hours noise exposure at 88 [dB(A)] is estimated to deliver the same noise intensity as eight hours at 85 [dB(A)]; Noise in figures, European Agency for Safety and Health at Work (2005)
Sound absorption
Sound absorption indicates the noise and echo effect in an area and is expressed by the (weighted) α value (\(\alpha_W\)). An \(\alpha_W\) of 0.00 means no sound will be absorbed by the material; a value of 1.00 means all sound has been absorbed. Sound absorption positively affects both intensity and duration of noise.

Impact sound insulation
Impact sound insulation relates to the acoustical impact of noise such as the sound of footsteps in an adjoining room or a room underneath. The \(\Delta L_w\) value is measured in decibels (dB); this relates to the actual number of decibels reduced by the floor covering.

Signal-to-Noise Ratio
Signal-to-Noise Ratio (SNR) assesses the intelligibility of spoken information by comparing the loudness of the voice (signal) to the background sound level (noise). Experts have concluded that an SNR of +12 dB to +15 dB throughout the classroom provides the acoustical environment necessary for all students to fully understand oral messages.

Reverberation
Reverberation is defined as the persistence of sound in a room after the source has stopped. It is commonly known as an echo. The time it takes for reverberations to stop is called the reverberation time. Some reverberation is needed to reinforce the original signal, but too many reverberations negatively affect the intelligibility of speech, as it becomes difficult to distinguish between different words.

Dimensions of acoustics
Acoustics is the interdisciplinary science that deals with the study of sound/noise. Acoustics can be measured in the following ways:
- Sound absorption (\(\alpha_W\))
- Impact sound insulation (\(\Delta L_w\))
- Signal-to-noise ratio
- Reverberation

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In general, carpet can contribute to improving the acoustics in many environments, such as offices, schools and care homes. DESSO SoundMaster® performs even better against all acoustic measures.

DESSO SoundMaster® offers an impact sound insulation value ($\Delta L$) up to +15 dB above the standard value\(^{10}\), thereby setting a new industry standard in carpet performance. Carpet in general reduces the impact of sound by between 20 and 30 decibel\(^{11}\).

DESSO SoundMaster® achieves an improvement in sound absorption performance up to +0.15 ($\alpha$\(^{10}\)), equivalent to up to +100% improvement in comparison to standard carpet designs ($\alpha$ value between 0.15 and 0.20)\(^{12}\).

Through these two improvements, DESSO SoundMaster® also positively influences the signal-to-noise ratio and the reverberation effect by lowering the background noise.

\(^{10}\) Tests performed at SWA (Schall- und Wärmemessstelle Aachen GmbH) – Institut fuer schalltechnische und wärmetechnische Prüfungen-Beratung-Planung

\(^{11}\) To compare: other flooring solutions (non-carpet) generally give a value between 5 and 10 dB.

\(^{12}\) To compare: other flooring solutions (non-carpet) generally give a value between 0.05 and 0.10.
DESSO SoundMaster® helps to create a productive and calm environment in offices, schools, hospitals and other commercial buildings. The layered design of the carpet tile, and especially the SoundMaster® backing, optimises the sound absorption and sound insulation. This felt backing is made from 100% polyester (80% recycled) and is specifically chosen for its advanced sound insulation and absorption properties. Additionally, it offers an even more comfortable underfoot feel than standard carpet.

On top of its expertly designed functionality, the SoundMaster® backing is a clear example of up-cycling with its 80% recycled content from used PET bottles.
DESSO SoundMaster®
Proven effectiveness in improving acoustics

The acoustic tests are performed under laboratory conditions by the independent, accredited German test institute SWA\(^{13}\), which specialises in acoustic and heat technical tests and consultancy.

The carpet is tested on impact sound insulation on a concrete floor\(^{14}\), dropping a small standardized metal ball from a given height (simulating foot steps) and measuring the sound in the room underneath. The test results measured at different frequencies are weighted into one single value $\Delta L_w$. DESSO SoundMaster\(^{\circledR}\) delivers results up to +15 dB.

For sound absorption measurements, the carpet is installed in a small standardized reverberation room where a test sound is played at various frequencies. The test results are weighted into one single value ($\alpha_w$). DESSO SoundMaster\(^{\circledR}\) produces an average result of up to +0.15 ($\alpha_w$), or an improvement of up to +100% compared to standard carpet. However, as the graph on the right page shows, it performs best at frequencies between 125 and 1000 Hz, typically the range that covers many common sounds (such as human speech\(^{15}\)).

Examples of such test results are presented in the graphs on the right page\(^{13},16\).

DESSO SoundMaster\(^{\circledR}\) offers an impact sound insulation value ($\Delta L_w$) of up to +15dB above the standard value and an improvement up to +0.15 in sound absorption performance ($\alpha_w$), or up to +100%, in comparison to our standard carpet designs\(^{13}\).

\(^{13}\) SWA (Schall- und Wärmemessstelle Aachen GmbH) – Institut für schalltechnische und wärmetechnische Prüfungen-Beratung-Planung

\(^{14}\) 140 mm reinforced


\(^{16}\) Results depend on multiple aspects, including structure, density and pile fibre material
DESSO SoundMaster®
A sound solution

Further tests performed by the acoustical engineering agency Bureau De Fonseca (based in Belgium) provided more evidence that DESSO SoundMaster® carpet tile backing helps to improve acoustics and therefore the learning environment in the classroom17). Both specialised software analysis18)19) and on-site measurements in a real classroom situation show that carpet with SoundMaster® backing achieves a shortening of the reverberation time and a reduction of the background noise in comparison to ceramic tiles and linoleum. This achievement is based on the improvement in both sound absorption and impact sound insulation by using DESSO SoundMaster®.

Additionally, the sound (i.e. simulating the teacher’s voice) was shown to be better distributed across the room when fitted with carpet tiles with SoundMaster® backing20). This is visualised in the graphics above.

Speech intelligibility in the classroom with various floor coverings

17) The influence of floor coverings on acoustic quality in classrooms, De Fonseca & van de Merckt, 2010
18) CATT Acoustic software for room acoustics simulations and predictions in a specific room simulation (54 sqm, with 24 student desks and one teacher’s desk, and windows, doors, walls, ceiling and blackboard identified as acoustic hard surfaces).
19) The acoustic quality of the classroom was evaluated with three different floor coverings: ceramic tiles, linoleum and carpet with SoundMaster® backing.
20) The spatial distribution of speech improved from “limited” (with ceramic tiles or linoleum) to “fair” (with DESSO SoundMaster®) as the improvement in acoustic quality is uniformly distributed across the room.
According to the additional research by Bureau De Fonseca, DESSO SoundMaster® improves the acoustic environment in three ways:

1. It limits the reverberation time by reducing acoustic reflections (improved sound absorption).
2. It reduces the generation of disruptive sounds within the room, such as the scraping of chairs and the sound of footsteps (improved impact sound insulation).
3. It reduces the background noise caused by external sounds (improved sound absorption and improved sound insulation).

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Less noise means more productive workforces. Quieter environments prevent health problems occurring\textsuperscript{22,23}, reduce stress levels and improve concentration. This is especially important in open plan offices (a growing trend in the “office of the future”) where people need a space both for quiet concentration and open communication and where they need a place for private conversations as well as large scale meetings.

Additional noise from external factors such as traffic, heating and air conditioning and computer equipment make it hard for managers to achieve the optimum level of noise within buildings\textsuperscript{24}. That is why good sound absorption and sound insulation is so important. And the best and most cost effective option comes with a SoundMaster\textsuperscript{\textregistered} carpet tile backing as opposed to the other often more expensive options such as ceilings, walls and panels.

\textsuperscript{22} Environmental Noise and Health in the UK, Health Protection Agency, p.57-58
\textsuperscript{23} Noise in figures, European Agency for Safety and Health at Work, p.70-73
\textsuperscript{24} According to the European Agency for Safety and Health at Work the recommended noise level is 30-45 dB(A) while even in “quiet” offices the average noise level is often between 40-45 dB
A bad sound environment can be a major problem for teachers, especially today when classes are designed to be more interactive. Many teachers are having to try to teach effectively in a noisy environment and suffer from health problems such as sore throats, leading in some cases to absenteeism. In a German study amongst teachers, 50% of the respondents reported voice problems, with 16% even experiencing temporary voice loss (about three times higher when compared to other professions). A US study found that 20% of the respondents had missed work in the past year as a result of voice problems.

Noise is also perceived as a disturbing factor in the learning process of pupils and students, affecting their concentration levels and ultimately their performance.

Using a carpet, and especially one with the sound absorption and sound insulation properties of DESSO SoundMaster®, can be a very good way to improve the effectiveness of teaching and learning.

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25) Voice Problems of Classroom Teachers: Incidence, Symptoms, and Associated Factors, Philips, Gillespie, Thompson, University of Montevallo, 2004
26) Relationship between subjective voice complaints and acoustical parameters in female teachers’ voices, Rantala & Vilkman, 1999
A quiet environment is crucial for patients in hospitals and people living in care homes. Using carpet tiles with DESSO SoundMaster® can reduce the noise that can negatively affect people’s health and well-being when they are at their most vulnerable.

The improved sound insulation of SoundMaster® reduces noise from footsteps and trolleys in the hallway as well as on adjoining floors, while the sound of voices and other external factors such as heating, air conditioning and (medical) equipment is absorbed more effectively than is the case with other flooring types (especially the more commonly used hard floors, including even those that have features to improve the acoustics).

Additionally, carpet contributes to a higher standard of comfort with softer underfoot feel and causes fewer accidents with its firmer surface. If a patient should fall, the chance of injury is much lower when compared to hard floors (1.5% instead of 4%)(29).

Installing carpet also improves the indoor air quality: carpet captures fine dust from the air twice as effectively as hard floors(30), so there is less chance any patient will inhale it. And you can improve the indoor environment even more with DESSO AirMaster® which is eight times more effective at capturing and retaining fine dust than hard floors(31). This is also available with SoundMaster® backing, so you can significantly improve both the air and sound quality with the one product.

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(28) WHO recommends 30–45 dB(A), with 30 dB(A) during the night (Noise in figures, European Agency for Safety and Health at Work, p.48)

(29) 4 mm loop pile carpet (Booth et al., BJR Orth. Res. Soc. Proc., Sept.)

(30) Study performed by Deutscher Allergie- und Asthmabund e.V. in 2005

(31) Study performed by GUI (Germany) and TNO (Netherlands)
DESSO SoundMaster®

The carpet that improves acoustics

Generally, Desso carpet improves acoustics and reduces noise. DESSO SoundMaster® takes this functionality to a new level – making a vital contribution to your personal health, wellness and well-being.

Numerous factors determine the sound levels in a room. Where the building is situated, the size and shape of the room, where it is relative to other interior spaces and the construction of the ceiling, walls, and floor.

However, with its large surface and all-over presence, the floor is a key element for improved acoustics.

The installation of DESSO SoundMaster® offers a significant acoustical improvement in offices, schools and hospitals, for better working, learning and healing environments and the enhanced health, wellness and well-being of its users.
Desso, a Tarkett company, is a leading carpets, carpet tiles and sport pitches business, active in more than 100 countries. Its products are supplied to corporate offices, education, healthcare, government, homes and also hotels, cruise liners, airlines and premier football clubs.

Desso’s mission is to develop unique products that deliver a much improved indoor environment, helping to maximise people’s health and wellbeing. This is driven by the company’s innovation programme based on the three pillars of Creativity, Functionality and Cradle to Cradle® design which underpins the shift to the regenerative circular economy.

For more information please visit: www.desso.com