Fletcher Insulation
Building Better, Together

WHITEPAPER

Designing spaces that promote comfort and wellness

How insulation contributes to indoor environmental quality


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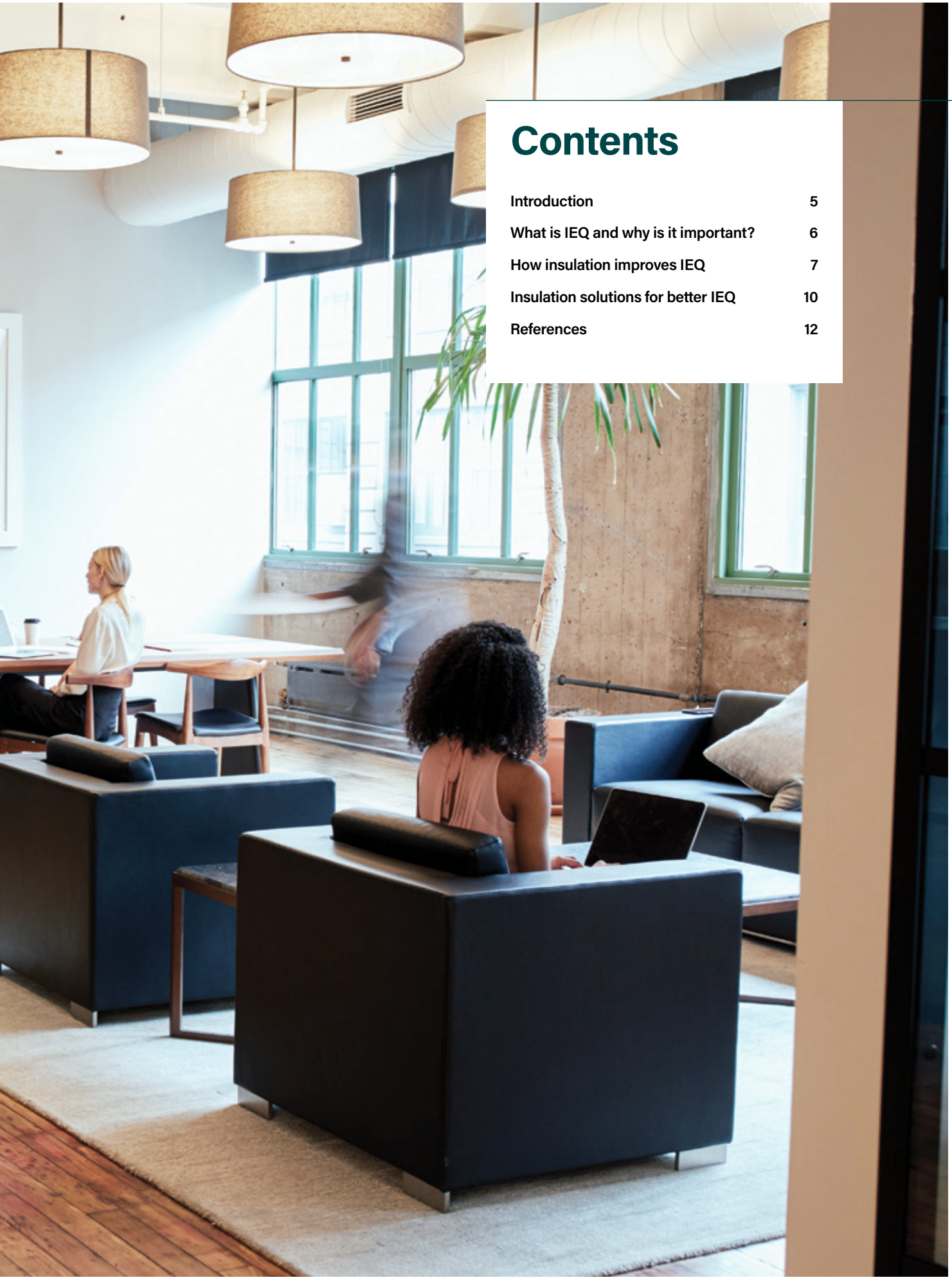

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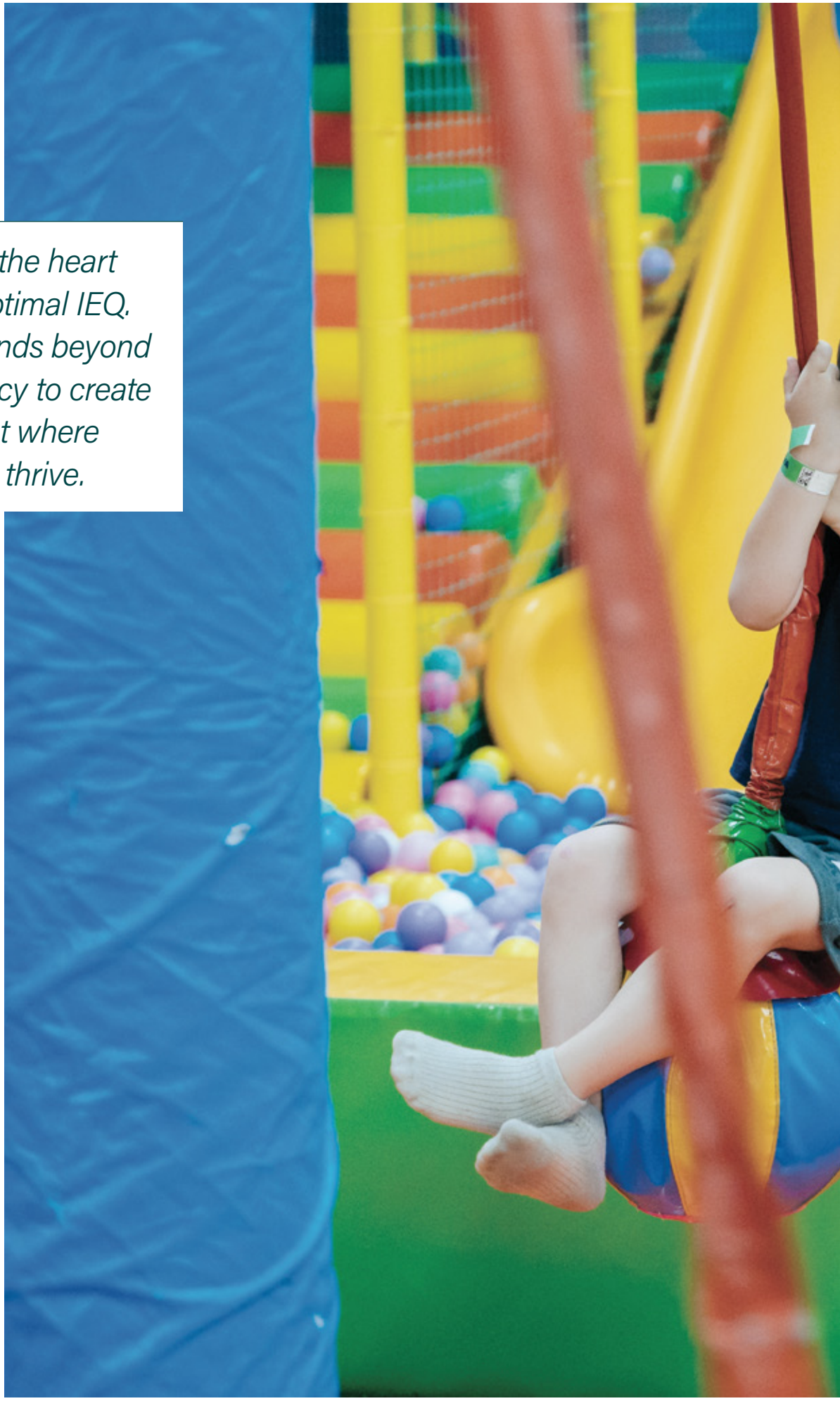


Introduction

The concept of Indoor Environmental Quality (IEQ) provides a holistic framework that integrates various factors influencing indoor environments and how they affect building occupants, including thermal and acoustic comfort, air quality, and moisture control. Many of these elements are now incorporated into modern building codes and standards.

Insulation is at the heart of achieving optimal IEQ. Its impact extends beyond energy efficiency to create an environment where occupants can thrive. By acting as a barrier to heat flow, insulation stabilises indoor temperatures and minimises energy consumption. It helps absorb and reduce sound, enhancing the acoustic quality of a space. Its role in managing moisture and improving air quality through temperature regulation further underscores its importance.

In this whitepaper, we will explore the relationship between insulation and IEQ, focusing on how it contributes to building performance and occupant health, comfort and wellbeing. Specifically, we will examine how insulation addresses key IEQ parameters, including thermal comfort, acoustic comfort, indoor air quality, and moisture and condensation management.

By understanding these connections, architects can specify insulation solutions that not only meet regulatory requirements but also create healthier and more comfortable interiors for a wide range of building types.

What is IEQ and why is it important?

IEQ refers to the combination of indoor environment factors that interact with occupants of that environment.[1] These factors typically include indoor air quality, which ensures the air is free from pollutants and allergens; thermal conditions, which provide consistent and comfortable temperatures; and acoustic conditions, which minimise noise disruptions and promote a quiet environment; and lighting conditions, which balance natural and artificial light to enhance comfort and functionality.[2]

Together, these elements create an environment that can have significant impacts on occupant health, comfort, and productivity.[3] While there are many ways to measure the different components that make up IEQ, generally speaking, when one or more of these factors is suboptimal—whether excessive or insufficient—IEQ can deteriorate, negatively affecting the psychological and physical health of occupants. For example, studies show that indoor air quality and uncomfortable thermal conditions can contribute to increased health issues, discomfort, and diminished cognitive performance in workplace settings.[4]

Poor IEQ also disrupts learning in educational environments. A 2003 study found a strong correlation between high CO_2 levels in schools and symptoms like headaches, tiredness, and difficulty concentrating.[5] These conditions not only harm students' health but also contribute to absences and decreased academic performance.

Similarly, the effects of IEQ extend to residential settings. For example, studies have identified indoor air pollution as a significant contributor to health issues.[6] Thermal comfort at home has been shown to contribute to relaxation, quality of sleep, and overall health and wellbeing.[7] In high-density living environments, such as multi-residential buildings, the importance of acoustic quality has gained attention as designers aim to mitigate the challenges of noise pollution.[8]

How insulation improves IEQ

Insulation is a material or assembly designed to resist the transfer of heat, sound, or moisture between different areas of a building. Technically, it is comprised of materials with low thermal conductivity, often incorporating air pockets, fibres, or specialised foams to trap heat or sound waves. Insulation is applied in walls, roofs, floors, and HVAC systems.

Insulation is essential for achieving optimal IEQ, addressing key factors such as thermal comfort, acoustic performance, air quality, and moisture control. When properly specified, it helps architects design spaces with stable indoor temperatures, reduced noise transfer, and effective moisture management, meeting both regulatory standards and occupant needs.

Thermal comfort

Thermal comfort refers to the state in which a user feels satisfied with the temperature of their environment. It is a subjective and complex concept, as perceptions of comfort vary widely among individuals. According to the World Health Organization (WHO), indoor temperatures between 18–24°C are generally comfortable and pose no significant health risks for healthy adults when other factors such as appropriate clothing and humidity levels are accounted for.[9]

Exposure to cold indoor temperatures outside the recommended ranges poses significant risks to occupant health and wellbeing. The WHO has cited evidence that colder temperatures can be linked to respiratory issues and high blood pressure.[10] Colder homes with inadequate insulation are also associated with increased mortality rates.[11]

High indoor temperatures, particularly those exceeding 28°C, can also have significant health implications. Prolonged exposure to excessive heat can lead to dehydration, heatstroke, poor sleep quality, and emotional distress. Research indicates that elevated temperatures are correlated with higher rates of general mortality, cardiovascular mortality, and emergency hospitalisations.[12]

By reducing heat transfer between indoor and outdoor environments, insulation ensures a more stable thermal environment, which is key to thermal comfort. Insulating external walls prevents heat loss in winter and heat gain in summer. Roof and ceiling insulation is critical, as heat naturally rises; without proper insulation, warm air escapes during colder months, while in summer, excessive heat penetrates through the roof, increasing cooling demands. These elements support the efficient operation of HVAC systems, allowing them to maintain consistent and comfortable temperatures with less energy use.

The temperature regulation provided by insulation has other IEQ benefits. For example, insulation helps regulate humidity levels by minimising rapid temperature fluctuations that can lead to condensation or excessive dryness, both of which can impact indoor air quality and health. Insulation also indirectly supports better airflow by stabilising indoor temperatures, reducing the temperature extremes that can lead to uneven heating or cooling within a space.

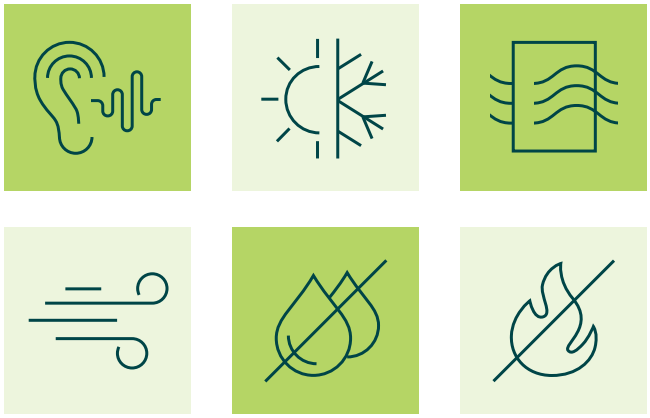
Acoustic comfort

Acoustic comfort refers to the quality of sound within an indoor space and its effect on occupants. Key factors influencing acoustic comfort include noise levels, sound quality, and reverberation or echo, all of which affect how sound is experienced by occupants.

The importance of acoustic comfort for health and wellbeing is well-documented. Excessive noise, or noise pollution, has been linked to serious health issues, including elevated anxiety, depression, high blood pressure, disturbed sleep, heart disease, and stroke.[13] In healthcare settings, poor acoustic conditions not only disrupt patient recovery but also compromise privacy, as patients may withhold critical information if they feel they might be overheard.[14] In office environments, studies show that noisy environments negatively impact workers' concentration, productivity, and creativity.[15]

Achieving acoustic comfort requires the use of building materials and acoustic treatments to manage noise levels and improve sound quality. Managing noise levels requires blocking unwanted sounds from entering a space. Improving sound quality refers to creating a clear and pleasant auditory experience. Controlling reverberation and echo is vital to sound quality within a space, as excessive reflection of sound can amplify noise and reduce speech intelligibility.

From a design perspective, insulation is a critical tool for enhancing acoustic comfort. Insulation is typically made from porous or fibrous materials like glasswool, stonewool or open-cell foam. It works by converting sound energy into a small amount of heat energy through a process of friction as the sound waves pass through the material's fibres, pores, or cells. This capability reduces sound infiltration between adjacent spaces, which is especially important in open-plan layouts, high-traffic areas, and multi-residential buildings where noise control is vital for privacy and comfort.



Insulation also plays a key role in addressing impact noise, such as footsteps, dropped objects, or vibrations from machinery. By dispersing and dampening the energy of these sounds, insulation minimises their transmission through walls, floors, and ceilings.

While insulation does not directly reduce reverberation and echo, it minimises external noise intrusion or sound transfer between rooms, which can make it easier to address reverberation with additional acoustic treatments inside the room. For comprehensive acoustic design, combining sound-absorbing insulation in walls, ceilings and floors with surface treatments for reverberation control is the best approach.

Indoor air quality

Indoor air quality (IAQ) refers to the condition of the air within a building and its impact on the health and wellbeing of occupants. Several factors influence IAQ, directly impacting occupant health and comfort. Poor ventilation restricts the flow of fresh outdoor air, allowing pollutants such as CO_2, harmful levels of VOCs, and particulate matter to accumulate. Temperature extremes also affect IAQ, with high temperatures exacerbating pollutant activity and increasing CO_2 concentrations. Additionally, indoor materials such as paints, carpets, adhesives, and furnishings may emit VOCs, further contributing to poor air quality if not properly managed.

Humidity levels play a critical role in relation to IAQ; excessive humidity fosters mould growth, while low humidity can cause skin irritation, dry eyes, sore throats, and respiratory discomfort, as well as increase airborne dust and allergens. Maintaining a humidity range of 30–50% is typically recommended for optimal air quality.[16]

Insulation plays a vital role in enhancing indoor air quality in several ways. Properly installed insulation helps seal the building envelope, minimising the infiltration of outdoor pollutants such as dust, pollen, and other airborne contaminants. This is especially important in urban or high-traffic areas where external pollution levels are high.

Insulation also helps control moisture and humidity levels, which are critical for preventing mould growth. Its role in regulating temperature ensures that surfaces remain dry, reducing conditions that promote mould and mildew.

Additionally, insulation supports the efficiency of HVAC systems by maintaining stable indoor temperatures, reducing the workload on heating and cooling systems. This enables HVAC systems to maintain consistent and healthy airflow. Selecting insulation materials without harmful levels of VOC emissions further enhances air quality by minimising off-gassing of harmful chemicals.

Moisture and condensation management

Moisture and condensation management encompasses strategies to control and prevent the buildup of moisture and condensation within buildings. Moisture management addresses both external sources, such as rain or humidity, and internal sources, like cooking, bathing, or occupant activity, by minimising water infiltration and controlling humidity levels. Condensation management focuses on preventing water vapour from turning into liquid on cold surfaces, which occurs when warm, humid air contacts cooler surfaces below the dew point.

Effective moisture and condensation management is essential for occupant health and wellbeing, as uncontrolled moisture promotes mould growth, which can exacerbate respiratory issues like asthma and allergies, and potentially lead to chronic health conditions. High moisture levels also degrade indoor air quality by fostering the growth of bacteria, fungi, and dust mites, contributing to symptoms such as headaches, fatigue, and irritation of the eyes, nose, and throat. According to the WHO, poorly managed moisture is strongly linked to increased prevalence of respiratory symptoms, allergies, asthma, and immune system issues.[17]

Insulation is an essential component of any moisture and condensation management strategy. It stabilises indoor temperatures, reducing the presence of cold surfaces where condensation can form, which is critical for maintaining a dry and comfortable environment. Proper insulation in walls, roofs, and floors also controls water and vapour movement. Some insulation systems incorporate a permeable vapour barrier layer, designed to allow water vapour from inside the building structure to escape while preventing moisture vapour from passing through walls, ceilings, or floors, further minimising the risk of moisture infiltration and buildup that could compromise building integrity and air quality.

Find out more online at
insulation.com.au

Insulation solutions for better IEQ

FLETCHER INSULATION

Insulation plays a vital role in IEQ by addressing critical factors such as noise control, temperature stability, moisture management, and air quality. Fletcher Insulation's innovative solutions are designed to support architects and specifiers in creating high performance residential and commercial environments, focusing on occupant health, comfort and wellbeing.

Roofing Solutions

Fletcher Insulation's Permastop® building blankets deliver exceptional thermal and acoustic performance while minimising condensation risks under metal roofing. Combined with Roof Razor, these solutions reduce thermal bridging, ensuring consistent insulation coverage and enhancing energy efficiency. For concrete roof structures, Pink® Thermal Slab provides superior thermal and acoustic absorption, driving energy efficiency and minimising temperature fluctuations. Its fire performance credentials (AS 5637.1 Group 1 NCC fire classification) also contribute to safer indoor spaces.

External Walls

In metal framed stud walls, Pink® Partition glasswool insulation provides excellent acoustic and sustainability performance, along with proven non-combustibility. In colder climates, combining Sisalation® Vapawrap Wall Wrap with Pink® Partition insulation ensures robust thermal and air quality performance. For hotter, more humid environments, Sisalation® Multipurpose EHD (456) Sarking paired with Pink® Partition delivers superior moisture management.

Properly specified insulation enables architects to create spaces that maintain stable indoor temperatures, reduce noise transfer, and manage moisture effectively, aligning with both regulatory standards and occupant expectations.

Concrete Slabs and Soffits

Pink® Thermal Slab offers outstanding thermal and acoustic performance for concrete soffits, combining a semi-rigid glasswool board made from recycled glass with Sisalation® Heavy Duty 450 Facing Foil for condensation control. This solution is ideal for reducing noise and maintaining temperature stability.

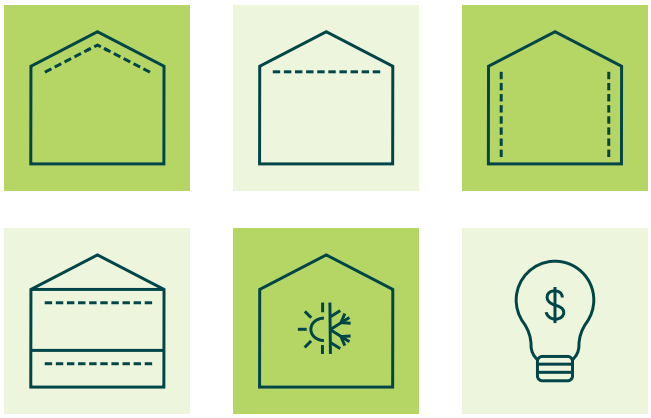
Fit-Out Applications

For metal-framed partition walls and suspended ceilings, Pink® Partition insulation ensures optimal acoustic control. In high-performance areas like plant rooms, FI48 Rigid Insulation provides superior thermal and acoustic benefits while maintaining non-combustibility. Additionally, Soundlag 4525C minimises noise breakout from mechanical systems like pipes, valves, and ductwork, ensuring a quieter indoor environment.

HVAC Systems

Fletcher Insulation's HVAC solutions enhance thermal efficiency and noise attenuation, helping businesses reduce heating and cooling costs while maintaining comfortable indoor temperatures. These products not only support sustainability but also contribute to a quieter, more productive workspace by minimising noise from HVAC systems.

By integrating Fletcher Insulation's tailored solutions, architects and designers can address key IEQ parameters, creating spaces that prioritise comfort, productivity, and sustainability.



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