

KNOW-HOW

INSULATION BASICS

This guide simplifies three basic engineering terms and explains its relevance to insulation. At Armacell, we help you make better and informed choices about the right insulation solution for your projects. **Engineering foam technologies since 1954.**

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MAKING A DIFFERENCE AROUND THE WORLD

Insulation Basics

What is thermal insulation?

Thermal insulation refers to the material or assembly of materials used to reduce heat flow between adjacent surfaces. By insulating energy-intensive equipment such as a building's heating and cooling system, unnecessary heat loss is prevented. Since heat is thermal energy, the prevention of heat loss means that energy can be effectively conserved.



The importance of an insulated system is often appreciated only when it stops performing, especially in cold applications. This is because ice could have formed on the insulation surface, or condensed water can be observed dripping from the ceiling. At this point, energy consumption would have risen significantly. Replacement works could disrupt daily operations and incur renovation costs.

What are some key terms you should know?

DEW POINT TEMPERATURE

// Definition

Dew point temperature is the temperature at which condensation happens because the surrounding air is 100% saturated with water vapour.

// What does this mean for insulation?

The goal is to consistently keep the surface temperature on the insulation as high, if not higher, than the dew point temperature to prevent condensation from occurring on the insulation surface. This is because when condensation happens, the insulated material can get wet and cause an increase in thermal conductivity. Also, condensation can lead to corrosion under insulation.

THERMAL CONDUCTIVITY

// Definition

Thermal conductivity, also known as the k-value, refers to the rate of steady-state heat flow through a unit thickness of a unit area of a homogeneous material, induced by a unit temperature increase. It is a temperature-dependent material constant, expressed in Btu-ft/(h-ft²-F) or W/(m·K). Reliable insulation manufacturers always state their product's thermal conductivity with the line temperature written as an index. For example, the thermal conductivity of ArmaFlex Class 0 is $\lambda_{0^\circ\text{C}} \leq 0.034 \text{ W/(m}\cdot\text{K)}$.



// What does this mean for insulation?

In general, the lower the thermal conductivity, the better the insulation property of the material. Hence, from figure 1, it can be seen that an aerogel material such as ArmaGel has offers better thermal insulation than a flexible elastomeric foam (FEF) material such as ArmaFlex at the same temperature. The thermal conductivity of water is much higher than glass fibre. This means that if the glass fibre material is wet, its thermal conductivity is increased significantly, and its insulation effect will decline.

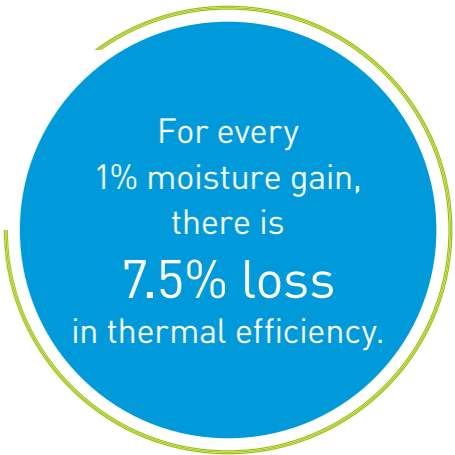
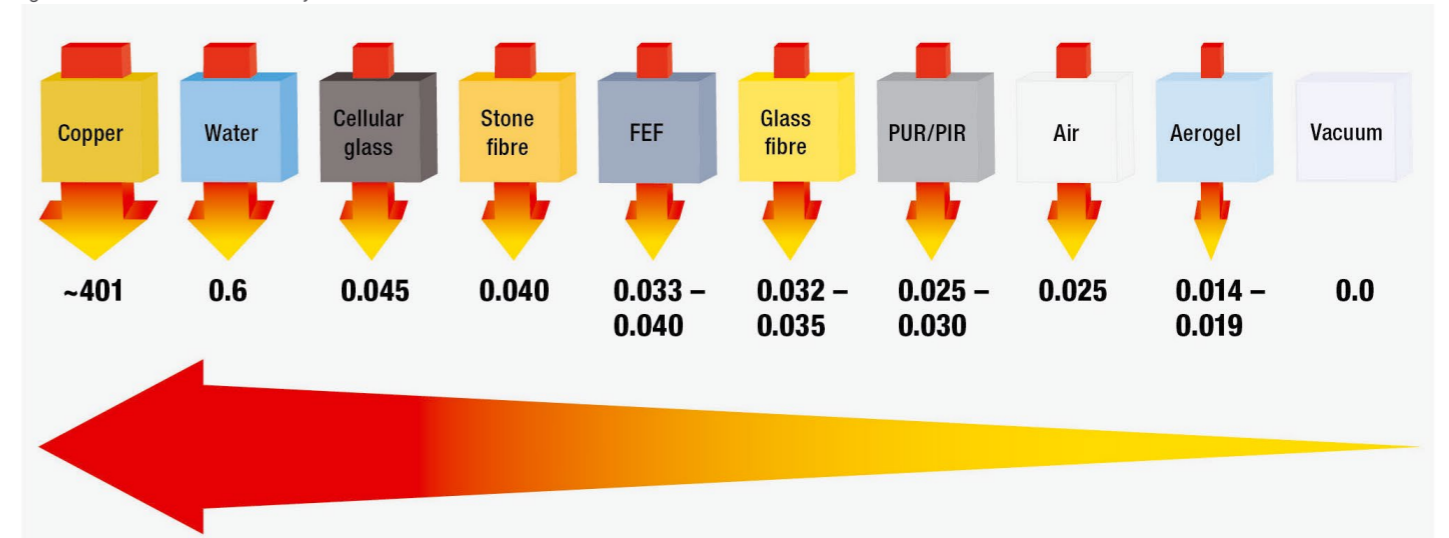


Figure 1. Thermal conductivity of different materials



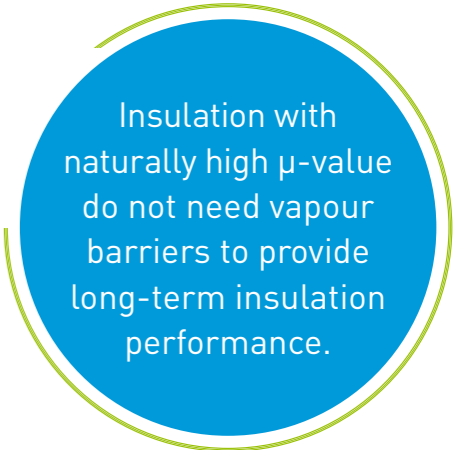
WATER VAPOUR DIFFUSION RESISTANCE FACTOR

// Definition

Water vapour diffusion resistance is a measure of the material's reluctance to let water vapour pass through, taking into account the material's thickness. Commonly referred to as the μ -value (pronounced "mu-value"), it is a temperature-dependent, dimensionless material property.

// What does this mean for insulation?

The higher the μ -value, the better the insulation material is at limiting water vapour ingress over time. Unlike materials that require an external vapour barrier to achieve high μ -values, different ArmaFlex foam materials have been tested to achieve μ -values beyond 10,000. Therefore, selecting the right insulation material is essential in ensuring long-term insulation performance.



DAMP INSULATION DOES NOT INSULATE!
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As the inventors of flexible foam for equipment insulation and a leading provider of engineered foams, Armacell develops innovative and safe thermal, acoustic and mechanical solutions that create sustainable value for its customers. Armacell's products significantly contribute to global energy efficiency making a difference around the world every day. With 3,100 employees and 24 production plants in 16 countries, the company operates two main businesses, Advanced Insulation and Engineered Foams. Armacell focuses on insulation materials for technical equipment, high-performance foams for high-tech and lightweight applications and next generation aerogel blanket technology.

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