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more than underfloor

A GUIDE TO OXYGEN BARRIERS WITHIN UFH PIPES

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There is a significant difference between 1-layer, 3-layer and 5-layer underfloor heating pipework, due to the inclusion of an oxygen barrier. An oxygen barrier is like a very thin layer of flexible glass which prevents the ingress of gases. British standards, CIBSE, KIWI and other regulatory bodies have all stated that underfloor heating pipework requires an oxygen barrier due to the length of pipework laid in the floor resulting in a large surface area of pipework, and the risk of air permeating the pipe and causing corrosion within the central heating system. Below is a quick summary of 1, 3 and 5-layer pipes:

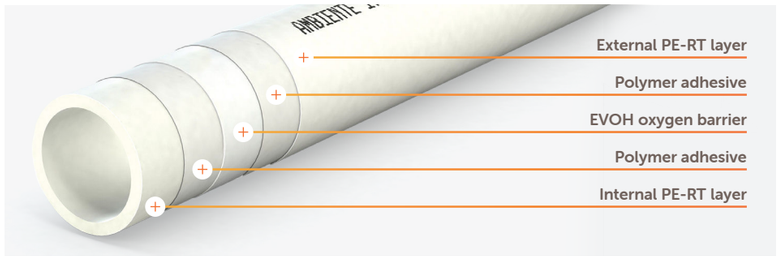
- A single-layer pipe does not have an oxygen barrier and will typically be made of either PERT, PEX or PB plastic.
- A 3-layer UFH pipe has an adhesive and oxygen barrier layer added to the outside of the core layer of plastic.
- A 5-layer UFH pipe builds upon the 3-layer by adding a further layer of adhesive and outside layer of plastic to sandwich the oxygen barrier in the middle of the pipe.

To add an oxygen barrier to a pipe it must be bonded with adhesive.

In the past, it was believed that the oxygen input into a piping system was negligible compared to other input possibilities. However, due to years of intensive research, there is now evidence that even the slightest damage to the diffusion barrier layer can mean the start of deposit corrosion. Therefore, the use of 5-layered pipes with a protected oxygen barrier in closed systems is recommended.

"EXTREMELY EFFECTIVE AND VERY POWERFUL"

Figure 1 - Ambiente 5-layer pipe



WHAT IS EVOH?

Ethylene-vinyl alcohol (EVOH) copolymer is the most commonly used oxygen barrier in plastic UFH pipework. Alternative ways of preventing oxygen ingress can be achieved with an aluminium layer within the pipe.

Why is EVOH a good oxygen barrier?
The sophisticated molecular, crystalline structure makes EVOH an extremely effective and powerful barrier against oxygen and other gases such as nitrogen, carbon dioxide and helium. The supply of oxygen is almost completely cut off.

Does EVOH lose its gas barrier properties when exposed to moisture/humidity?
When exposed to moisture, EVOH loses its good gas barrier properties. EVOH performs best at 0% relative humidity blocking virtually all gas transmission. However, according to research and testing, the gas barrier properties of EVOH reduce by over 100 times when exposed to high relative humidity. For this reason, EVOH is often used in multilayer co-extruded structures protected by materials which have moisture barrier properties such as PERT/PEX/PB.

This is why EVOH is sandwiched between two layers of polymers in a 5-layer UFH pipe, as this is the only way of guaranteeing optimum performance of the gas barrier and ensuring the air doesn't permeate into the heating system.

A guide to oxygen barriers within UFH pipes August 2022

CAN I USE A 1-LAYER PIPE FOR UFH?

No, as it would not be compliant with current regulations because it doesn't contain an oxygen barrier.

CAN I USE A 3-LAYER PIPE FOR UFH?

Technically, yes you can as this strictly meets the legal requirements, however it does bring with it certain risks as listed below:

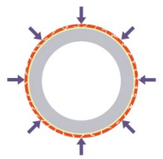
- The EVOH is exposed to external physical damage (ie. surface scratches - see figure 2 below).
- EVOH as a substance is affected by relative humidity making it vulnerable to external conditions (eg. the gas barrier qualities will be poor if exposed to water/high relative humidity). See figure 3 below.
- EVOH is a sensitive material and can delaminate and crack over time if not protected (see figure 4 below).
- EVOH is a sticky/shiny material that is prone to squeaking during heat-up/cool-down stages when in contact with certain materials (ie. in dry floor constructions/when in contact with aluminium plates).

"VULNERABLE IN EXTREME CONDITIONS"

Figure 2 - Surface scratches

This image shows deposit corrosion on the inside of a pipe which has been caused by surface scratches. This demonstrates the importance of an intact oxygen diffusion barrier. Basic monolayer pipes which are made from polyethylene are not diffusion resistant. Oxygen which is found in the ambient atmosphere can diffuse through the wall of the pipe. In heating installations, continuous oxygen diffusion into the system must be avoided because it will lead to corrosion of the metal parts within the system and cause corrosion inside the pipes.

Figure 3 - EVOH reaction to high humidity



This diagram shows the extreme sensitivity of the diffusion barrier layer to moisture. Contact with water leads to swelling and the destruction of the EVOH layer.

Figure 4 - EVOH sensitivity

This image demonstrates the brittleness, cracking and flaking of the EVOH layer which would ultimately lead to deposit corrosion and encrustation after years, if not protected from external conditions.

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