Effects of Moisture on K-Flex Elastomeric Insulation Performance

K-Flex USA manufactures flexible, closed cell elastomeric insulation materials in both preformed pipe and sheet / roll forms. Flexible, closed cell insulation materials are an ideal choice for use on cold piping systems and anywhere there is a possibility of water or moisture intrusion due to weather, humidity or condensation. Flexible, closed cell insulation materials have several distinct advantages over open cell products such as fiberglass, cotton fiber or moisture absorptive foams such as melamine, phenolic, polyisocyanurate and polystyrene.

Physical Properties – Absorption of moisture by insulation products can result in reduction of performance characteristics such as thermal conductivity, compression resistance, flexural strength, tensile strength and air erosion. Moisture may also result in delamination or loss of adhesion to a substrate. Wet insulation may cause corrosion of the piping system or substrate. Insulation materials that must rely on a vapor barrier or jacket for moisture resistance are susceptible to moisture intrusion due to improper installation or physical damage during or after installation. Many types of insulation materials must be removed, discarded and replaced once they become wet.

Microbial Growth – Growth of mold is dependent upon several factors: contaminant, food source, temperature range and presence of moisture. Mold and bacteria can thrive in a wide range of temperatures typically found in both indoor and outdoor environments and within air handling systems. Viable mold spores are found in the air, and food sources can either be components of the insulation or contaminants deposited on the insulation surface. Moisture can be the result of leaks, wind driven rain, snow or condensation. Insulation materials that absorb and wick moisture provide a potential growth medium for mold. Flexible, closed cell foams resist mold growth by removing moisture from the mold growth equation. Additionally, K-Flex USA elastomeric insulation products are manufactured with a Protective Antimicrobial Agent, which contains an EPA-registered integral mold inhibitor. Insul-Tube / Sheet and K-Flex Duct liner Gray are UL Validated as “mold resistant”.

Thermal Performance – Thermal performance is determined through test methods such as ASTM C177 or ASTM C518. Test samples are pre-conditioned and k-factors are determined using “dry” insulation. It is generally recognized that every 1% of water vapor intrusion into an insulation material may increase the thermal conductivity of the insulation by 7.5%. While fiberglass may have a better R-value than closed cell insulation when no moisture is present, the comparison changes quickly when moisture is introduced.

On cold systems where insulation thickness requirements have been calculated based on initial R-values to prevent condensation, moisture intrusion may reduce the insulation performance to the point where it is no longer capable of preventing condensation. The reduction in R-value will speed condensation formation, further reducing R-value.

Summary – Flexible, closed cell elastomeric insulation materials naturally resist moisture due to their closed cell structure. Because they resist moisture, they maintain their physical and thermal properties and are highly resistant to mold growth. Flexible, closed cell elastomeric insulation materials should be specified on cold piping systems to prevent condensation and in any applications where high humidity or water intrusion are possible, such as swimming pool areas, duct lining downstream from cooling coils and exterior (outdoor) piping and ductwork.