

Published Application Service Temperature Range Spike Temperatures

When selecting an insulation product, the temperature range of the application is a critical factor, and in many cases the most important factor in selecting the correct insulation. The maximum and minimum temperature the application will typically experience should be compared to the temperature range the insulation manufacturer states is acceptable for their product. In most applications, this is a fairly straight forward comparison, but when applications may experience spike temperatures (high temperatures for a short duration) as a result of equipment malfunction, maintenance etc., the selection of a suitable insulation becomes more challenging. This is because the test method to determine an insulation's service temperature range is more of a qualitative than quantitative and may not represent real life conditions. For this reason, thermoset insulation materials such as cross linked elastomeric insulation can withstand temperature spikes (infrequent rises in temperature of a short duration) above their stated use (application) temperature range. The manufacturer should be contacted to determine acceptability of spike temperatures.

Manufacturers usually state a maximum and minimum temperature range for their product. Some manufacturers will state a continuous and an intermittent range (usually associated with the high temperature value). To determine the temperature range, the most common test method used is ASTM C411 (Standard Test Method for Hot-Service Performance of High Temperature Thermal Insulation) in conjunction with ASTM C447 (Standard Practice for Estimating the Maximum Use Temperature of Thermal Insulations). ASTM C411 is a hot plate / pipe test, i.e. the sample is applied to a plate / pipe at a specified temperature.

This test determines the temperature range by examining the test specimens for property changes after a short heat soak (96 hours) in the following areas: cracking, delamination, warpage, sag, melting, dripping, flaming, glowing, smoldering, smoking and final thickness. These are catastrophic type failures generally associated with thermoplastic insulation materials or binder in non-thermoplastic materials. Since elastomeric insulation products are thermoset type materials, they do not melt, drip, warp etc. at any temperature. Although this Test Method is listed for determining the use temperature for elastomeric insulation, it is not definitive for this type of material.

Thermoset Elastomeric insulation materials react to temperature over a period of time. Their failure mechanism results in a hardening of the material closest to the high temperature plate or pipe. The higher the temperature, the faster this reaction period and the more the insulation will be effected. The material insulates itself so depending on the thickness of the insulation, the outer surface which is generally at room temperature (ambient) remains flexible even if the inner ID exhibits some hardening. This hardening of the ID does not affect its insulation capabilities (k Factor).

The published use temperature by manufacturers has been established more through historical knowledge based on successful application use and market acceptance than a specific test. The service temperature range for each insulation type is agreed to by the manufacturers and published in the ASTM standard for that particular type of insulation. The temperature range for elastomeric insulation (Type 1) is published in the ASTM C534 standard as -297°F to +220°F. The stated use temperature takes into account properties other than those listed in ASTM C411 such as shrinkage. It is common to state that high temperature spikes (depending on the duration and frequency) that exceed the stated use temperature are acceptable. During installation (brazing), normal temperature cycling (hot gas defrost), maintenance (steam cleaning of pipes, or equipment malfunctions (a temperature spike that may occur before the equipment shuts down) temperature spikes may occur but they are usually of such short duration or so infrequent they will not impair the long term performance of elastomeric insulation. This is not the case with a thermoplastic insulation or an insulation that has a thermoplastic binder as a component of the insulation which would have a more definitive temperature which if exceeded would result in a failure.

Conclusion:

Thermoset flexible closed cell elastomeric insulation products, K-Flex Insul-Tube and Insul-Sheet, K-Flex ECO, K-Flex Solar and K-Flex HT can withstand occasional spike temperatures above their stated maximum use temperature range. Consult the manufacturer on specific applications.

