

K-Flex Compliance and General Description of Key Physical Properties As Described in ASTM C1534

ASTM C1534 - Standard Specification for Flexible Polymeric Foam Sheet Insulation Used as a Thermal and Sound Absorbing Liner for Duct Systems

ASTM C1534 is a standard specification that covers the composition, dimensions and physical properties of flexible unfaced foam sheet used to insulate interior surfaces of HVAC ducts, plenums and equipment used for the distribution of conditioned air with a temperature range of up to 250°F.

K-Flex USA elastomeric sheet products (Insul-Sheet® and K-Flex Duct® Liner Gray) meet the requirements of ASTM C1534 *Type 1* (closed cell foam). *Type 2* is specific to open cell foam.

This standard outlines the requirements for the following physical properties:

Thermal conductivity, surface burning characteristics, hot surface performance, water vapor sorption, water absorption, dimensional stability, odor emission, corrosiveness, fungi resistance, air erosion resistance and sound absorption.

These properties and the requirements specified in ASTM C1534 are outlined below:

Thermal Conductivity (k-factor)

Requirement - 0.30 Btu-in/hr-ftsq-F max. per ASTM C177

The thermal conductivity, commonly referred to as the k-factor, is a measure of a material's ability to conduct heat. Since the purpose of insulation is to retard heat loss or gain, the lower the k-factor the better the insulation. K-factor is measured in units of *BTU-inch/hour square-foot thickness*. That is, it measures the steady state heat flux in BTU (British Thermal Units) for 1 inch of insulation in a 1-hour time period over a square foot area. This value is multiplied by the difference in the temperature between the two surfaces (degrees F) to obtain the total BTU loss per square foot. Thus the lower the k-factor, the fewer BTUs are lost.

Thermal conductivity is measured by several test methods, all employing the same basic principle. The insulation material is placed between two heated platens of different temperatures and the heat gain of one of the platens is measured. ASTM C177 (Guarded Hot Plate Method) and ASTM C518 (Heat Flow Meter Method) are widely used for flat sheet. The measurements are commonly conducted at a 75°F mean temperature.

Water Vapor Sorption wt % gain by vol.

Requirement – 0.0% per ASTM C1104

This test method covers the determination of the amount of water vapor gained by an insulation product exposed to high humidity conditions. Sorption in this situation refers to the taking up and holding of water vapor by various processes such as absorption and adsorption. The insulation is weighed and exposed to a high humidity condition (95%) for 96 hours at a temperature of 120°F. The weight gain expressed in terms of volume is recorded.

All K-Flex USA insulation products are closed cell foams. This closed cell structure is an inherent moisture vapor retarder. No additional facer or coating is required.



Water Absorption wt % gain by volume

Requirement - 0.20 % max per ASTM C209

Water absorption is the measure of the product's ability to absorb water after immersion over a set period of time and under specific conditions. It is typically measured in units of percentage weight gain based on the product's original weight as in ASTM test method D1056 or as a percentage of the volume as in C209. Water is an excellent conductor of heat (conducts heat 25 times greater than air), thus if a product absorbs water it will correspondingly lose its insulation value. It is advantageous to use insulation products that do not readily absorb water. All K-Flex USA closed cell insulation products have low water absorption values.

ASTM C1534 recommends the use of ASTM C209 (Test Methods for Cellulosic Fiber Insulating Board) as the method to measure water absorption that utilizes a unit of measure as weight gain per given volume.

Dimensional Stability

Requirement - 7.0 % max. per ASTM C356

Dimensional stability is a measure of a product's resistance to shrinkage when exposed to elevated temperatures. ASTM C1534 calls for a 24 hour test period at 250°F test and requires less than 7% shrinkage in length, width or thickness. This is a critical property when considering the stresses that may be seen on joints and seams. Linear shrinkage and the tensile modulus of the product must be considered together.

Other requirements are as follows:

Odor Emission – No objectionable odor per ASTM C1304

Corrosiveness – Shall be defined by ASTM C665

Fungi Resistance – Shall be defined by ASTM G21

Air Erosion Resistance – Shall be defined in accordance with ASTM C1071

Sound Absorption Coefficient – Minimum NRC value of .25 at 1" thickness per ASTM C423

Surface Flammability – 25 / 50 maximum flame spread / smoke developed at thickness used per ASTM E84

Hot Surface Performance – Shall not flame, smoke, smolder or glow per ASTM C411

K-Flex Insul-Sheet and K-Flex Duct Liner Gray meet or exceed all of the ASTM C1534 requirements.