

## Fire Performance Test Methods

There are a variety of test methods used to establish the fire performance characteristics of insulation products. Flammability test methods are very specific and the results are generally dependent on the thickness tested. Meeting the requirements of one test does not indicate passage of another test, regardless of how “similar” they may be. Small-scale, medium-scale, or even large-scale fire tests do not necessarily represent how a material will perform under actual fire conditions. Caveats to this effect are generally given after test results. The primary fire performance test methods used to specify insulation products are:

**ASTM E84** - Surface Burning Characteristics of Building Materials

**CAN / ULC S-102 / S102.2** – Surface Burning Characteristics (Canadian version)

**UL 94** - Test for Flammability of Plastic Materials for Parts in Devices and Appliances

**FMRC** - Pipe Chase Test / Room Corner Wall Test

**NFPA 259**

**ASTM E162** - Surface Flammability of Materials Using a Radiant Heat Energy Source

**ASTM E662** - Specific Optical Density of Smoke Generated by Solid Materials

**ASTM D2863** - Limited Oxygen Index Test (LOI) Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics.

**FMVSS 302** - Federal Motor Vehicle Safety Standard

### **ASTM E84 – Surface Burning Characteristics of Building Materials (Steiner tunnel test)**

ASTM E84 is a measure of the relative burning characteristics of building materials as measured by flame spread and smoke density developed. The test fixture is comprised of a test chamber or box approximately 2 feet wide x 1 foot high and 25 feet long. The sample is mounted on the ceiling of the chamber. At one end of the chamber is the flame source (two gas burners), delivering flame upward against the surface of the sample. The gas burners release heat at a rate of approximately 5,000 btu / min and create gas temperatures near the specimen surface of up to 1600°F. The test duration is 10 minutes. The maximum flame spread is measured by visual observation. The smoke is directed to the end of the tunnel where it passes through an optical measuring device (photometer system). The measurements are compared to those of 1/2” thick, select grade red oak, which is rated as 100. A product with a flame spread rating of 25 and a smoke developed rating of 50 is commonly referred to as a 25/50 rated material. ASTM E84 is considered to be a medium-scale test and has been widely adopted for use by the building code authorities to regulate the use of interior finish materials.

It should be noted that methods and devices used for mounting and supporting the test specimen could influence the flame spread and smoke developed ratings. Testing of materials that drip, melt or delaminate to such a degree that the continuity of the flame front is destroyed results in low flame spread indices that do not relate directly to indices obtained by testing materials that remain in place. NFPA 255 and UL 723 are similar to ASTM E84.

## **CAN / ULC S-102 / S-102.2**

CAN / ULC S102 is similar to ASTM E 84 but with a significant difference in air flow rate and minor differences in the flame and smoke indices calculation methods. S-102.2 is specifically intended for materials that melt or drip and calls for mounting of the test specimen on the floor of the furnace instead of the roof.

## **EMRC / Large Scale Testing**

Large scale testing is intended to more closely reflect actual fire situations. Examples of such testing would be the Factory Mutual Pipe Chase Test and the Uniform Building Code Room Fire Test (UBC Standard 26-3). During these tests, fire properties such as heat release, mass loss and optical smoke density are measured as a function of time.

## **Underwriter Laboratories Inc. (UL) 94**

Underwriter Labs (UL) 94 small-scale test is divided into twelve flame categories, nine of which could relate to our products. The HB (horizontal mounted) and V-0 (vertical mounted) flame rating indicates that the material was tested in the specified mounting position and found to burn at a rate less than a specified maximum. The ratings also indicate whether the specimen dripped flaming particles that ignited a combustible indicator (cotton) located below the specimen. A material tested for a 94-5-V rating is subjected to a more severe ignition source and must also meet the requirements of the 94-V0 test. UL 94 ratings are generally required for household use appliance enclosures, acoustical foams, or other non-structural applications. Elastomeric insulation products carry a UL-94-HBF, VO and 5V classification rating (Recognition No. E300774) for 1/8" thickness and above. The K-Flex USA listing can be verified by going to UL web site, [www.UL.com](http://www.UL.com), selecting "Online Certification Directory" and entering our recognition number. Recognition by Underwriters Labs includes a follow-up service program. At least quarterly, UL representatives perform unannounced audits of our manufacturing locations, selecting samples for confirmation testing. Most K-Flex and K-Tek products are UL listed – at 1/8" thickness and above. See specific product data sheets for actual listing.

## **ASTM E162 (radiant panel test) Test Method for Surface Flammability of Materials Using a Radiant Heat Source**

The radiant panel test is a small-scale test method (sample size 6"x 18") that determines a flame spread index. It is often required for mass transit, railway and some building applications. ASTM E162 is only a test method and the requirements must be supplied by the end user. A flame spread index of 25 is a typical requirement. Elastomeric insulation products meet this requirement.

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## **ASTM E662 (NBS Smoke Chamber Test) Test Method for Specific Optical Density of Smoke Generated by Solid Materials.**

The smoke chamber test method measures the attenuation of a light beam by smoke accumulated within a closed chamber. It is a small-scale test (sample size 3”x 3”) and has two modes (flaming and non-flaming). It is often required for mass transit, railway and some military applications. ASTM E662 is only a test method and the requirements must be supplied by the end user. A typical smoke density requirement for either the flaming or non-flaming modes would be Ds 90 of 100 and Ds 4 min. of 200 or 100 depending on where the product is used in the application.

## **ASTM D2863 Limited Oxygen Index Test (LOI) Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics.**

The Limited Oxygen Index test method measures the minimum amount of oxygen needed to sustain combustion of a material.

## **Federal Motor Vehicle Safety Standard (FMVSS 302)**

The Federal Motor Vehicle Safety Standard (FMVSS 302) is a horizontal burn test, somewhat similar to UL 94 HBF. The test requires that the sample burn slower than 4” per minute or be self-extinguishing. As with many flammability tests, the thinner the sample, the more difficult it is to pass the test. Most NBR/PVC elastomeric based products will pass this test at 1/8” and above.

## **Surface Burning Characteristic Test Methods of Building Materials in Europe / Asia**

Customers will sometimes request information on fire test methods for locations outside North America. They may be shipping materials to a job in that area or may be manufacturing equipment that would be sold there. The fire test requirements for countries outside of N. America may be different. Not necessarily better or worse, just different. K-Flex is a global company supplying materials around the world, so no matter what the requirements, K-Flex can supply the product. Latin America generally follows USA standards. Europe / Asia follow test methods / requirements established by the British Standards Institute (BSI) and adopted by ISO (International Standards Organization). Specifically BS 476 Part 7 with a requirement of Class 0. K-Flex ST, manufactured in Europe meets the class 0 requirement. K-Flex Insul-Tube / Sheet does not meet BS 476 Class 0, however it does meet the USA standard of 25 Flame Spread / 50 Smoke Development when tested according to ASTM E 84. Conversely, K-Flex ST does not meet the USA Standard.

We sometimes get requests to ship material to a foreign country to be used on a US military base. In this situation, the material generally must meet US building code requirements, thus the need to order and ship it from the United States.

For copies of test reports on K-Flex USA insulation products, please contact the Technical Service Group at 800-765-6475.

