

Insulation Insights

ASTM E84

QUESTION:

Explain why there may be differences in ASTM E84 flame spread and smoke developed values of foam insulations. Does a lower ASTM E84 value always convey better fire performance?

ANSWER:

Some insulation products may have a lower flame spread, but this does not necessarily imply that the product is more fire-resistant. It is important to understand the dynamics of the testing standard and how certain products behave during the test.

The ASTM E84 test is a tunnel test where a single layer of the product to be tested is installed horizontally to the ceiling of the tunnel, and then subjected to flame on one end. Temperature and smoke development performance values are then gathered as the flame travels.

Testing of materials that melt, drip, or delaminate to such a degree that the continuity of the flame front is destroyed results in low flame spread indices that do not directly relate to indices obtained by testing materials that remain in place. This is a common occurrence for thermoplastic insulations (e.g. XPS or EPS) during the ASTM E84 test. Thermoplastics tend to soften at temperatures nearing 165 degrees and melt/drip approaching 200 degrees. The test is then terminated because the product ceases to exist, and a flame spread measurement is then assigned.

From ASTM E84 Test Procedure:

X4.7.7 Some materials, such as cellular plastics and thermoplastic materials, can be difficult to evaluate. Thermoplastic materials not mechanically fastened will often fall to the floor of the tunnel. Accordingly, these materials as well as thermosetting cellular plastics can also receive relatively low fsi. (8,9) If supported on wire screen, rods, or other supports, some plastic materials can be completely engulfed in flame and a questionable comparison would result between the flame spread indices and smoke developed indices of these materials and those of materials that are unsupported.

X4.7.8 The materials described above, that is those that drip, melt, delaminate, draw away from the fire, or require artificial support present unique problems and require careful interpretation of the test results. Some of these materials that are assigned a low fsi based on this method may exhibit an increasing intensity of the fire exposure. The result, therefore, may not be indicative of their performance if evaluated under large-scale test procedures. Alternative means of testing may be necessary to fully evaluate some of these materials.

UL now notes via footnote that the results for thermoplastics testing were evaluated while material remained in the initial test position. The footnote then references measured flame spread and smoke developed values for molten residue that dripped to the floor of the test apparatus. These additional noted details result in values that are significantly higher than published ASTM E84 test values for the same material.

Flame Spread and smoke developed recorded while material remained in the original test position. Ignition of molten residue on the furnace floor resulted in flame travel equivalent to calculated flame spread Classification of 110 and smoke developed Classification of over 500.

Polyiso, by its thermoset nature, has superior fire performance properties over thermoplastic insulations. Thermosets can withstand a high temperature without losing physical properties and physical integrity. During the ASTM E84 test, polyiso stays intact and performs per the standard minimum value of <450 smoke developed and <25 or <75 flame spread depending on the product.

Comparison of Fire Resistance Properties for Polyiso and Other Foam Plastics

Fire Resistance Property	Polyiso	Other Foam Plastics (Polystyrenes)
Flame Spread Index (FSI) (ASTM E84)	25 or less for Types I-IV commercial structures or 75 or less for Types I-IV commercial structures if tested via large scale testing per IBC Section 2603.10 Special Approval. See Hunter Xci TER 1402-02	25 or less required for Type I-IV commercial structures 75 or less required for Type V commercial and all residential construction
Smoke Development Index (SDI) (ASTM E84)	450 or less required May be used in all building types	450 or less required May be used in all building types

Note: Polystyrenes tend to melt and "drip" during this test resulting in loss of material exposure to flame spread. Also, the values are for material in initial testing position only and do not take into account ignition of molten residue on the surface floor.

Example: The following EPS flame spread and smoke development caveat is included on EPS products in the marketing today. "Flame spread and smoke development recorded while material remained in the original test position. Ignition of molten residue on the surface floor resulted in flame travel equivalent to calculated flame spread index of 125 and smoke development index of over 500."

Energy Smart Polyiso

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