

# CLASS 1 AND CLASS A ROOF ASSEMBLIES

## are NOT the Same

By Jared Blum

*PIMA issued this technical bulletin to assist architects, specifiers, and consultants in their decision making regarding fire performance in the roof systems they may design or install.*

**W**hen selecting roof assemblies containing foam plastic insulation such as polyiso or polystyrene, specifiers, contractors, and consultants should confirm that all applicable specifications, building codes, and insurance requirements of the job are met. It is important to note that substitution of other types of foam plastic for polyiso insulation in tested roof assemblies may result in violation of building codes and/or required insurance ratings.

Below are some key points to understanding the differences between a Class 1 and a Class A roof assembly containing foam plastic:

- A Class A rating is only for external fire performance and is governed by compliance to either the UL 790 standard or ASTM E-108 standard. A Class A rating does not ensure building code compliance.
- FM Class 1 requires that a roof deck assembly is subjected to a series of tests – internal fire, external fire, wind uplift resistance, foot traffic, corrosion resistance, impact resistance, and susceptibility to heat damage – as described in FM 4470 Approval Standard for Class 1 Roof Covers. A roof assembly must pass all these tests in order to gain a Class 1 designation. For insulated

steel roof deck assemblies, FM Class 1 includes FM 4470 and FM 4450 Approval Standard for Class 1 Insulated Steel Deck Roofs.

- Because the testing requirements are more stringent for a Class 1 assembly, it can be substituted for a Class A, B, or C roof assembly. However, a Class A, B, or C assembly cannot be substituted for a Class 1 roof assembly.
- Remember that in all cases the roof assembly must be installed as tested. Substitution of any component (such as insulation type or thickness) in tested roof assemblies can only be granted by FM or UL and may require additional testing. Failure to gain approval for the component substitution from FM or UL may impact insurance coverage and could result in violation of the applicable local building codes.
- Polyiso roof insulation is the only foam plastic roof insulation board product that meets the strict standards of both FM Approvals (Standard 4450) and UL (UL 1256)

without the use of an additional thermal barrier layer between the insulation and the supporting steel roof deck.



*FM's Calorimeter in use. (Photo, courtesy Factory Mutual.)*

### FIRE TESTING AND ROOF ASSEMBLIES

There are two important fire assessments regarding steel deck roof assemblies: external spread of flame on the roof covering surface and below-roof deck spread of flame.

**Table 1: ASTM E-108 and UL 790**

	Fire Exposure*	Allowable Flame Spread
<b>Class A</b>	<b>1400 F/10 minutes</b>	<b>6 feet maximum</b>
<b>Class B</b>	<b>1400 F/10 minutes</b>	<b>8 feet maximum</b>
<b>Class C</b>	<b>1300 F/4 minutes</b>	<b>13 feet maximum</b>

\*All tests conducted at 12 mph wind

**Table 2: Comparison of FM 4450 and UL 1256 Thermal Barrier**

	<b>FM 4450 Approval Standard for Class I Insulated Steel Decks</b>	<b>UL 1256 Fire Test of Roof Deck Constructions</b>
Roof Assembly Test	Yes	Yes
Tested Properties	Under-deck fire; Wind uplift; Live load resistances; Corrosion of metal parts; Fatigue of plastic parts	Under-deck fire only
Decks	Steel	Metallic & Non-metallic
Ratings	Class I if all tested properties meet test criteria	“Pass” or “Fail”
Component	Only if approved by FM	Only if classified as such by UL

**External Spread of Flame**

The exterior spread of flame fire test on a complete roof assembly is determined using either ASTM E-108 or UL 790. The result of this fire test is expressed as Class A, B, or C, with Class A described as “effective against severe fire exposure.”<sup>1</sup>

ASTM E-108 and UL 790 include three test procedures: Spread of Flame, Intermittent Flame, and the Burning Brand. During all fire tests, there can be no flaming or glowing wood particles falling off the underside of the test deck, the roof deck cannot become exposed, and portions of the deck must not fall or break away in the form of glowing particles.

The spread of flame portion of the test is only conducted on roof assemblies with noncombustible (concrete, steel, or gypsum) decks. Test conditions and pass criteria are shown in *Table 1*.

For roof assemblies with combustible decks (wood, plank, tongue and groove), ASTM E-108 and UL 790 require two additional fire tests: 1) an intermittent flame test, in which the flame is turned on and off during the duration of the test, and 2) the “burning brand test,” which measures the ability of the roof assembly to resist fire from flaming embers.

**Below Roof Deck Spread of Flame**

FM 4450 and UL 1256 are used to judge the contribution of the roof assembly components to the spread of fire within a building. An examination of the scope of each test method shows that FM 4450 is a much more stringent and extensive test than UL 1256. See *Table 2* for a summary of the test parameters.


**Elimination of Thermal Barrier**

According to building codes, roof assemblies incorporating foam plastic insulation installed on a steel deck must include a thermal barrier – typically 1/2-inch gypsum board or equivalent – between the deck and the foam plastic insulation. The thermal barrier may be eliminated if the complete roof assembly passes either FM 4450 or UL 1256.

Note that although both FM 4450 and UL 1256 are conducted on a specific roof assembly, passing either test without a thermal barrier in one tested roof assembly does not mean the thermal barrier may be eliminated in all roof assemblies. Specific roof assemblies that have passed FM 4450

may be found in the *FM Approval Guide* or the web-based FM RoofNav roof assembly search tool. Those that have passed UL 1256 may be found in the *UL Roofing Materials & Systems Directory*.

**For More Information**

Class 1 and Class A roof assemblies are not the same. For additional details, please see the PIMA Web site ([www.pima.org](http://www.pima.org)) or contact a polyiso insulation manufacturer. 

1 Sloan, D. E. (2005, May). “The UL Story: Part 1.” *Professional Roofing*. Retrieved on July 25, 2005, from the Internet: ([www.professionalroofing.net/article.aspx?A\\_ID=641](http://www.professionalroofing.net/article.aspx?A_ID=641))

**GLOSSARY**

ASTM E-108, Standard Test Methods for Fire Tests of Roof Coverings

FM – Factory Mutual Global; [www.fmglobal.com](http://www.fmglobal.com)

FM 4450 Approval Standard for Class I Insulated Steel Deck Roofs

FM 4470 Approval Standard for Class I Roof Covers

UL – Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com)

UL 1256 Fire Test of Roof Deck Constructions

UL 790 Standard for Standard Test Methods for Fire Tests of Roof Covering

**Jared O. Blum**

Jared O. Blum is the president of the Polyisocyanurate Insulation Manufacturers Association (PIMA), the Washington-based national trade association representing manufacturers of polyiso foam insulation. The association is committed to working independently and with public and private organizations to educate Americans about the critical importance of national energy conservation. To learn more about polyiso and PIMA, visit their Web site at [www.pima.org](http://www.pima.org).

