

# Limitations of InsulStar<sup>®</sup> and Sealite<sup>™</sup> Insulation Thickness

## Introduction

Spray polyurethane foam (SPF) insulation thickness is often determined by the model building codes (referred to collectively as the “I Codes.”) On the one hand, the IECC (International Energy Conservation Code) advises the minimum amount of insulation thickness by controlling the amount of R-value required in any given climate zone. On the other hand, the IRC and IBC (International Residential Code and International Building Code, respectively) limit the maximum insulation thickness due to combustibility.

The net result is that the codes are often in conflict: The IECC may require more insulation for energy conservation than the IRC and/or IBC will allow for fire safety.

When covered with a 15-minute thermal barrier, maximum nominal thicknesses of NCFI Residential Insulation Systems are:

Insulation	Maximum Thickness Walls	Maximum Thickness Ceilings
InsulStar <sup>®</sup>	8 inches	12 inches
Sealite <sup>™</sup>	8 inches	12 inches

The IRC and IBC require that foam plastic insulation (spray polyurethane included) be tested in accordance with ASTM E 84 *Standard Test Method for Surface Burning Characteristics of Building Materials*. This test method employs a 25-foot tunnel in which the material to be evaluated is placed in the tunnel ceiling. A fire is introduced at one end of the tunnel and the rate of flame spread and smoke development is measured. Tunnels are calibrated using cement board and red oak flooring. A value of zero is assigned the flame spread index and smoke development index of the cement board while a value of 100 is assigned the flame spread index and smoke development index of the red oak flooring.

The IRC and IBC require foam plastics to exhibit a maximum flame spread index of 25 or 75 (depending on its use within the building) and a maximum smoke development index of 450.

## ASTM E 84 Limitations

However, there is a practical limitation of four inches on sample thickness that can be tested in ASTM

E 84 tunnels. (Some laboratories have attempted tunnel modifications to accept greater thicknesses than four inches but these techniques have not been verified by round-robin testing and are not widely accepted.)

For example, the prescriptive ceiling R-value requirement in Climate Zones 4-5 is R-38. To meet this requirement with InsulStar<sup>®</sup> would require a thickness of about 5.5 inches while Sealite<sup>™</sup> would require a thickness of about 10.5 inches. Both these thicknesses exceed the 4-inch limit of the ASTM E 84 tunnel. So, what do you do?

## Testing by NCFI

To address this difficulty, the IBC and the IRC recognize the limitations of ASTM E 84 and allow specific approval at greater thicknesses when fire tested in actual end-use configurations.

NCFI Polyurethanes in conjunction with Southwest Research Institute (SwRI) in San Antonio, TX conducted actual end-use configuration fire testing. Specifically, the tests followed UBC Standard 26-3 *Room Fire Test Standard for Interior of Foam Plastic Systems*. This standard

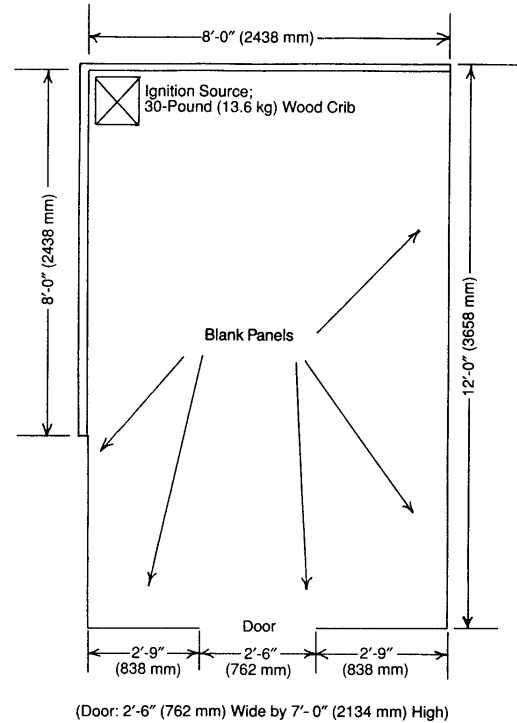


Figure 1: UBC Standard 26-3 small room corner test layout diagram.



**Figure 2:** Photo showing UBC 26-3 testing in progress (approximately 4 minutes into a 15 minute test). Note the wood crib which provide the ignition source, the thermocouple “tree” for measuring temperature response, and the door into the 8 ft x 12 ft room.

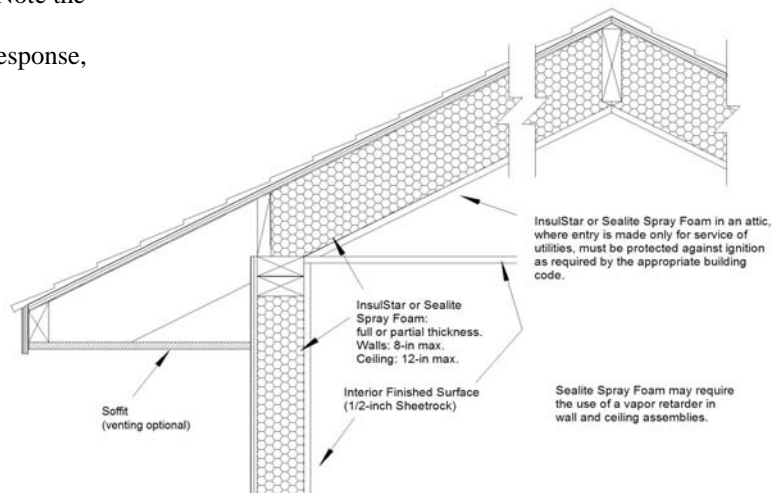
employs a 8-foot by 12-foot by 8-foot high room with a door at one end of the 12-foot length. The material to be tested is installed on the 8x8 back wall, on an 8x8 section of an adjoining side wall, and (optionally) on an 8x8 ceiling section. A 30-pound wood crib ignition source is place in the corner adjacent to the test panels and ignited. The test runs for 15 minutes. Acceptance (passing) is considered provided (1) no flashover occurs (flame out the door); (2) smoke levels generated are not considered excessive; and (3) charring of the foam plastic does not exceed 1/4-inch in depth at the extreme upper corners of the test panels.

NCFI tested both InsulStar and Sealite in the UBC 26-3 test configuration with the spray polyurethane insulations protected from the fire by 1/2-inch thick gypsum wall board. Both insulations were tested at 8-inch thickness in the walls and 12-inch thickness in the ceiling. Both InsulStar and Sealite passed the UBC 26-3 testing criteria.

## Conclusions & Recommendations

Based on the testing conducted by NCFI at Southwest Research Institute, we recommend installing InsulStar and Sealite polyurethane insulation systems at maximum thicknesses of 8 inches in walls and 12 inches in ceilings. As with all foam plastic insulations, be sure that these materials are properly protected by appropriate thermal barriers and ignition barriers as required by the appropriate building codes.

Contact NCFI Polyurethanes for specific recommendations.



**Figure 3:** Typical attic and wall detail. Building codes require foam plastic insulation to be separated from occupied spaces by a thermal barrier (such as 1/2-inch gypsum board) and to be protected from ignition in attics and crawlspaces.