



TECHNICAL SERVICE REPORT

Number 43

ASTM E-84 Steiner Tunnel Smoke Testing Of Custom Profile Extrusion Compounds

INTRODUCTION

Traditional building materials such as wood, glass, stone, metals and natural fabrics have existed for so long that building designers are familiar with them and their properties. They are much less familiar, however, with newer synthetic materials; thus, there has been growing interest in learning more about synthetic materials for building applications, including their performance in fire situations.

Custom profile extrusion compound is a very versatile material with physical properties which make it ideally suited for modern building material applications. Recognizing that building designers may desire information on flame and smoke properties, The Geon Company has initiated a program to define the fire performance characteristics of those products which it expects will find applications as building materials.

One test method which is used to determine the flammability performance characteristics of building materials is the ASTM E-84 Steiner Tunnel Test. This test provides information about a materials tendency to spread flames and produce smoke. The ASTM E-84 test specimen is mounted on the ceiling of a rectangular cross-section, fire-proof tunnel which has interior dimensions of 18 inches wide, 12 inches high, 25 feet long, and ignited at one end. The ignition source consists of a two-port natural gas burner. Test sample sizes are discussed further in the Experimental Protocol section.

The results of an ASTM E-84 Steiner Tunnel Test are reported in terms of a Flame Spread Index (FSI) and a Smoke Developed Index (SDI). The scale is defined arbitrarily at 0 for Cement Block and 100 for Red Oak. But a custom profile extrusion compound cannot have a single FSI or SDI value. Custom profile extrusion compounds are extruded into an unlimited number of different shapes, thicknesses and widths as dictated by the requirements of the specific building material application being considered. Also, the amount of material in the test available to burn affects the spread of fire and amount of smoke produced and the resulting FSI and SDI values. The FSI and SDI values depend on the composition of the compound; but because of the effect of the amount of material, they are unique to the dimensions of the sample being tested. IT IS NOT SUFFICIENT TO SIMPLY IDENTIFY THE COMPOUND IN ORDER TO ESTABLISH THE SDI AND FSI. Reputable ASTM E-84 Steiner Tunnel Test operators recognize this and always report the dimensions of the test article on the same page where the SDI and FSI results are reported.

The results of Geon and competitive, custom profile, ASTM E-84 Steiner Tunnel testing programs are given in the table at the end of this report. These results illustrate the flammability performance advantages of Geon custom profile extrusion compound products while appropriately considering the effects of test article dimensions. All testing was performed by Underwriters' Laboratories Inc., Northbrook, Illinois on February 16, 1993.

CUSTOM PROFILE EXTRUSION COMPOUND EXPERIMENTAL PROTOCOL

A series of Geon and competitive custom profile extrusion grade compounds has been tested for flame spread and smoke developed indices in the E-84 Steiner Tunnel Test. The shape of the test article was selected to be representative of a typical extruded profile and consisted of a single strip with dimensions 24 feet by a nominal width of 5 inches. The sample was supported in a tunnel with 2 inch mesh hardware wire. The strips were extruded at nominal thickness values representative of anticipated construction applications. All samples were cut to 24 feet in length, and the weight as it was to be tested was determined. The width, length and weight, along with a density value, was used to calculate a value for sample thickness. This method of assigning a thickness value is believed to provide the most representative value compared to other possible methods. The FSI and SDI results of the tests are reported in conjunction with the calculated thickness value.

DISCUSSION

The major model building codes recognize three classes of FSI values, the strictest being Class I (or A) with FSI less than 25. One outstanding performance characteristic of rigid PVC is its resistance to flame spread. All of the materials that have been tested have FSI values which are less than 25. To achieve classification within the major model building codes, building materials must have an SDI value which is less than 450. This was achieved for all of the materials tested. The results in the table demonstrate that Geon custom profile extrusion compound, when extruded into typical building materials shapes, meets the flame spread and smoke requirements of the major model building codes and would, therefore, be expected to be suitable for the corresponding applications.

Table

FLAME SPREAD INDEX AND SMOKE DEVELOPED INDEX RESULTS FROM THE E-84 TEST

Smoke Developed Index						
Thickness (Inches)	Geon 87256 Natural 021 Interior	Geon 8700A Natural 022 Interior	Competitor A Natural Interior	Geon 87611 White 141 Exterior	Geon 87416 White 141 Exterior	Competitor A White Exterior
0.028					40	
0.031				63		
0.035	158					76
0.061			300			
0.065						167
0.066		320		191	225	

Flame Spread Index						
0.028					6.4	
0.031				11.3		10.8
0.035	13.7					
0.061			11.3			
0.065						
0.066		13.0		13.4	12.5	13.4

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