



# COMMERCIAL TESTING COMPANY

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Standard Test Method for  
Specific Optical Density of Smoke  
Generated by Solid Materials

ASTM International E 662-09

**Highline 1100 Mod 750**

Report Number 10-07021

Test Number 4152-0253-B  
July 1, 2010

ege Carpets  
Herning, Denmark

Commercial Testing Company

(Authorized Signature)

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## INTRODUCTION

This report is a presentation of results of a test for specific optical density of smoke on a material submitted for testing by ege Carpets, Herning, Denmark. The test was conducted in accordance with the ASTM International Standard Test Method E 662-09, *Specific Optical Density of Smoke Generated by Solid Materials*. This test is referred to as the smoke chamber and is similar to the method described in NFPA No. 258.

This method provides a means of determining specific optical density of smoke generated by materials mounted in the vertical position under specific exposure conditions. It is intended for use in research and development and not as a basis for regulatory purposes. Values determined are specific to the specimen tested and not to be considered inherent fundamental properties of the material. Measurement is made of the attenuation of a light beam by smoke accumulating in a closed chamber due to flaming combustion and non-flaming pyrolytic decomposition. Test results are expressed in terms of Specific Optical Density,  $D_m$  Corrected.

This standard should be used to measure and describe the properties of materials, products, or assemblies in response to heat and flame under controlled laboratory conditions. It should not be used to describe or appraise the fire hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire risk assessment which takes into account all factors which are pertinent to an assessment of the fire hazard of a particular end use.

## TEST PROCEDURE

The non-flaming mode employs an electric radiant heat energy source with an irradiance level of 2.50 W/cm<sup>2</sup>. For flaming combustion, a 6-tube burner, fueled with a propane and air mixture, is used in combination with the radiant heat to apply a row of flamelets across the specimen's lower edge and into the specimen holder trough. A photometric system with a vertical light path is used to measure varying light transmittance as smoke accumulates in the chamber. Light transmission measurements are used to calculate specific optical density, derived from a geometrical factor associated with the physical dimensions of the test chamber and the specimen, and the measured optical density, a measurement characteristic of smoke concentration. The photometric scale used is similar to the optical density scale for human vision.

The test consists of three exposures in each of the flaming and non-flaming modes. Three-inch square test specimens are dried for 24 hours at 140°F, and conditioned to equilibrium at 69 to 73°F and 47 to 53 percent relative humidity.

After the chamber operating conditions are verified and the photometric system calibrated, the specimens are tested until minimum light transmission is obtained or until 20 minutes have elapsed, whichever occurs first. The test chamber is evacuated of the accumulated smoke and another light transmission measurement made and recorded as the clear beam reading,  $D_c$ . It is the accumulation of soot and other deposits on the optical system and is used as a correction factor.

## TERMINOLOGY

The abbreviations used in this report and their definitions are as follows and may be useful in interpretation of the test data.

- %T is the percent light transmission ranging from a maximum of 100% down to a minimum of 0%.
- $D_s$  is the specific optical density.
- $D_c$  is the value of the clear beam reading and is used as a correction factor.
- $D_s @ 1.5$  and  $@ 4.0$  minutes are shown because some agencies require these criteria in judging the performance of a material. {NOTE:  $D_s @ 4.0$  minutes may be higher than  $D_m$  (corrected) because no allowance can be made for the accumulation of deposits on the photometer system.}

- D<sub>m</sub> (corrected) is the corrected maximum specific optical density, the number which, when averaged, is the final test result.

[**Note:** Section 8.2 of the method specifies that materials with a process-induced surface, be tested in each orientation in each mode. Carpet is exempt because data are available to show that specimen orientation in terms of length and width has no statistically significant effect on the specific optical density obtained using this test method (Reference: Hirschler, Dr. Marcelo M., "Smoke Results from a Set of Over 100 Carpets in the NBS Smoke Chamber, Statistical Analysis and Investigation of Affecting Factors," *Fire and Materials*, Vol. 16, No. 3, 1992, pp. 127-133.)].

**TABLE I. MATERIAL TESTED**

Identification: Highline 1100 Mod 750  
 Construction: Cut Pile Modular Tile  
 Backing: MOD 750  
 Total Weight: 105.30 oz/yd<sup>2</sup>

**TABLE II. TEST DATA**

	Flaming			Non-Flaming		
	1	2	3	1	2	3
D <sub>s</sub> , 1.5 minutes	1	0	0	2	1	2
D <sub>s</sub> , 4.0 minutes	191	249	264	21	22	22
D <sub>s</sub>	205	249	264	264	274	280
Time D <sub>s</sub>	9.6	4.0	4.0	12.0	20.0	0.0
D <sub>c</sub>	25	16	19	2	20	3
D <sub>m</sub> (corrected)	180	232	245	262	254	278

**TABLE III. TEST RESULT**

	Flaming	Non-Flaming
Average D <sub>s</sub> , 1.5 minutes	0	2
Average D <sub>s</sub> , 4.0 minutes	235	22
Average D <sub>m</sub>	239	273
<b>Average D<sub>m</sub> (corrected)</b>	<b>219</b>	<b>265</b>