

APPROVAL REPORT

SHELTER GRID EXPANDED POLYSTYRENE (EPS)
SUSPENDED CEILING PANELS

Prepared For:

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FACTORY MUTUAL



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(FMRC Standard 4651)

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from

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I INTRODUCTION

1.1 Shelter Enterprises, Inc. submitted their Shelter Grid expanded polystyrene (EPS) suspended ceiling panels manufactured from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B resin beads for physical property testing and fire performance testing to determine if they would qualify for Factory Mutual Research Corporation (FMRC) Standard 4651 (1978) Approval requirements for low fire hazard suspended ceiling panels for installation below automatic sprinklers.

1.2 Tests conducted on the material were as follows: density, flammability, flexural strength, and melt-out/drop-out behavior.

1.3 Test results show that Shelter Grid expanded polystyrene (EPS) suspended ceiling panels, when manufactured from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B resin beads as tested would not significantly interfere with the operation and distribution of sprinklers installed above the suspended ceiling and would not contribute to a spreading fire over its surface. Test results indicate that Shelter Grid expanded polystyrene (EPS) suspended ceiling panels, when manufactured from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B resin beads as tested meets FMRC Standard 4651 (1978) Approval requirements for use as a suspended ceiling panel when installed as specified in the CONCLUSIONS of this report.

II MATERIAL DESCRIPTION

2.1 Shelter Enterprises, Inc. Shelter Grid expanded polystyrene (EPS) suspended ceiling panel are a rigid expanded polystyrene suspended ceiling panel manufactured from Approved NOVA Chemicals Dylite M77B modified polystyrene resin beads. The formulation is on file at Factory Mutual Research Corporation. Shelter Grid EPS suspended ceiling panels shall only be manufactured from Approved NOVA Chemicals Dylite M77B modified polystyrene resin beads.

2.1.1 Shelter Grid EPS suspended ceiling panels manufactured from Approved NOVA Chemicals Dylite M77B modified polystyrene resin beads shall have a nominal density of 1.0 lb/ft³ (16 kg/m³), shall be nominal 2 x 2 or 2 x 4 ft (0.6 x 0.6 or 0.6 x 1.2 m), and may range from 0.5 - 1.0 in. (13 - 25 mm) thick.

III TEST AND PROCEDURES

3.1 A series of four tests were performed to determine physical properties and fire performance properties of Shelter Enterprises, Inc. Shelter Grid expanded polystyrene (EPS) suspended ceiling panels manufactured from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B resin beads (see Approval Guide).

3.2 Density

3.2.1 Density of the suspended ceiling panels was determined by cutting three specimens from suspended ceiling panels molded from the Approved resin in a shape whose volume can be calculated and not less than 1 in.³ (16.4 cm³). Each specimen was weighed on a scale to an accuracy of ±1%:

3.2.2 The volume of the specimen was determined by measuring the dimensions using a dial gage, a sliding caliper gage, or a steel tape. The density was then calculated using the formula:

$$D = W/V \times 3.81$$

Where D = density of specimen, lb/ft³
W = weight of specimen, g
V = volume of specimen, in. ³

Actual density should be with ± 10% of the desired nominal density.

3.3 Surface Flammability

3.3.1 Tests were performed to verify the presence of a fire retardant additive and to determine that the suspended ceiling panels would not contribute to a spreading fire over their surface. For each test, two 6 in. x 18 in. (152.4 mm x 457.2 mm) pieces of EPS suspended ceiling panels were positioned vertically 1/2 in. (12.7 mm) apart, and the flame from a propane torch was placed between the panels at their base and held for a 15 sec. duration. The exposure flame was then removed and observations are made to determine if the panels support combustion. When the exposure was removed, the flame shall not spread to the top of the panels either during or after exposure to the test flame and may not continue for more than 10 seconds after the test flame is removed. Three tests were conducted on each nominal density suspended ceiling panel manufactured from the Approved resin beads.

3.4 Flexural Strength

3.4.1 Tests were conducted to determine the calculated flexural strength of the rigid expanded polystyrene suspended ceiling panel molded from the Approved resin beads.

3.4.2 Three specimens, 12 in. x 16 in. (305 mm x 406 mm) x 1 in. (25.4 mm) thick, were cut from EPS suspended ceiling panels manufactured from the Approved resin. Each specimen was placed in a jig and is tested, employing the use of a Tinius Olsen Testing Machine. Bearing edges of the jig were 5/16 in. (7.9 mm) diameter rod and provide a span of 14 in. (355.6 mm). Force was applied at a rate of 0.5 in./min. (12.7 mm/min.) at mid-span of the specimen, uniformly across its width until failure occurs. The flexural strength was calculated by the formula:

$$R = 3WL/2bd^2$$

Where R = flexural strength, psi (kPa)
W = load at which the specimen failed, lb (kg)
L = distance between the supports, in. (m)
b = width of the specimen, in. (m)
d = thickness of the specimen, in. (m)

3.5 Melt-Out/Drop-Out Behavior

3.5.1 Tests were conducted to determine the effect of heat on the suspended ceiling panels when installed in a standard exposed grid suspension frame system and their ability to melt out quickly so as not to interfere with automatic sprinkler operation.

3.5.2 The test enclosure was 4 by 4 ft (1.2 x 1.2 m) by 2 ft (0.6 m) high constructed of mineral fiber reinforced cement board and steel angles. The top of the test enclosure consists of a 2 by 4 ft (0.6 x 1.2 m) by 1/2 in. (13 mm) thick mineral fiber reinforced cement board adjacent to a 2 by 4 ft (0.6 x 1.2 m) section of a standard exposed grid suspension frame. The bottom of the test enclosure is open and 12 in. (305 mm) above the non-combustible floor. A radiant heat source is located centrally under the center of the mineral fiber cement board. A thermocouple was located 1 in. (25 mm) below the mineral fiber reinforced cement board, 1 in. (25 mm) from its intersection with the standard exposed grid suspension frame and centered along its 4 ft (1.2 m) dimension.

3.5.3 With mineral fiber reinforced cement board "ceiling panels" in the standard exposed grid suspension frame, the air supply fully open and the gas pressure set to 13 in. of water (3.2 kPa), the test enclosure was preheated to a temperature of 575°F (302°C) as indicated by the thermocouple. The gas pressure was then adjusted to maintain a temperature of 575°F (302°C) with the mineral fiber reinforced cement board "ceiling panels" in place.

3.5.4 The mineral fiber reinforced cement board "ceiling panels" were removed and the temperature of the test enclosure as indicated by the thermocouple was allowed to drop below 250°F (121°C) without adjusting the gas or air supplies. Two nominal 2 by 2 ft (0.6 x 0.6 m) by 1 in. (25 mm) plastic suspended ceiling panel samples were then placed in the suspension frame and observed until they dropped from the suspension frame. Subsequent tests were run in the same manner, removing the previous test samples, allowing the temperature of the test enclosure as indicated by the thermocouple to drop below 250°F (121°C) without adjusting the gas or air supplies and placing new plastic suspended ceiling panel samples in the suspension frame.

3.5.5 Plastic suspended ceiling panels must drop from the suspension frame at a temperature less than 500°F (288°C) as measured by the thermocouple.

VI TEST SAMPLES

4.1 Density

Samples prepared for the flexural strength tests were utilized (see 4.3).

4.2 Surface Flammability

Three sample sets consisting of two pieces 6.0 by 18.0 by 1.0 in. (152 by 457 by 25 mm) samples were prepared from Shelter Grid expanded polystyrene (EPS) suspended ceiling panels produced from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B expandable polystyrene.

4.3 Flexural Strength

Six 12.0 by 16.0 by 1.0 in. (305 by 406 by 25 mm) samples were prepared from Shelter Grid expanded polystyrene (EPS) suspended ceiling panels produced from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B expandable polystyrene.

4.4 Melt-Out/Drop-Out Behavior

Three sample sets consisting of Shelter Grid expanded polystyrene (EPS) suspended ceiling panels produced from NOVA Chemicals Approved 1.0 lb/ft³ (16 kg/m³) Dylite M77B expandable polystyrene were selected. Each sample set consisted of two nominal 2 by 2 ft (0.6 by 0.6 m) by 1 in. (25 mm) suspended ceiling panels.

V TEST RESULTS

5.1 Density

The average density for the nominal 1.0 lb/ft³ (16 kg/m³) specimens was determined to be 0.95 lb/ft³ (15.2 kg/m³). Minimum density indicated in ASTM C578-92 is 0.90 lb/ft³ (14.4 kg/m³) for Type I nominal 1.0 lb/ft³ (16 kg/m³) material, and minimum density indicated in ASTM C578-92 is 1.10 lb/ft³ (17.6 kg/m³) for Type I nominal 1.0 lb/ft³ (16 kg/m³) material.

5.2 Surface Flammability

When the exposure fire was removed, there was no surface flaming on any of the nominal 1.0 lb/ft³ (16 kg/m³) specimens.

5.3 Flexural Strength

Average flexural strength for the nominal 1.0 lb/ft³ (16 kg/m³) specimen of 1 in. (25.4 mm) thickness was 28.6 psi (198 kPa). Minimum flexural strength indicated in ASTM C203-91 is 25.0 psi (172 kPa) for Type I nominal 1.0 lb/ft³ (16 kg/m³) material.

5.4 Melt-Out/Drop-Out Behavior

The sample EPS suspended ceiling panels produced from NOVA Chemicals Approved Dylite M77B 1.0 lb/ft³ (16 kg/m³) resin beads distorted and dropped out of the exposed grid suspension frame at 430, 425 and 415°F (222, 218 and 213°C) as recorded by the test thermocouple.

VI CONCLUSIONS

6.1 Test results show that a suspended ceiling composed of nominal 2 by 2 ft (0.6 by 0.6 m) by 1 in. (25 mm) thick Shelter Enterprises, Inc. Shelter Grid expanded polystyrene (EPS) suspended ceiling panels manufactured from Approved NOVA Chemicals Dylite M77B modified polystyrene resin beads with a nominal density of 1.0 lb/ft³ (16 kg/m³), installed in a metal suspension system will not significantly affect the action of automatic sprinklers installed above and will not produce a spreading fire over its surface when installed as summarized below. Prior testing has shown that 2 by 4 ft (0.6 by 1.2 m) by 1 in. (25 mm) thick and 2 by 2 and 2 by 4 ft (0.6 by 0.6 and 0.6 by 1.2 m) by 1/2 in. (13 mm) thick EPS plastic suspended ceiling panels would perform as well when tested in the same manner. Suspended ceiling panels manufactured at different thicknesses, panel dimensions or from other resins, whether FMRC Approved or not, shall not be considered FMRC Approved. The use of regrind or scrap materials shall not be permitted.

6.2 Tests results indicate that the tested EPS plastic suspended ceiling panels in and of themselves would not create a need for automatic sprinklers when produced as described above and installed as described below in noncombustible buildings with an occupancy that does not require automatic sprinkler protection.

6.3 Shelter Enterprises, Inc. Shelter Grid expanded polystyrene (EPS) suspended ceiling panel dimensions must be maintained during manufacture to insure that they will not bind in a standard steel-suspension framework and adversely alter their melt-out/drop-out performance.