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Fire Tests for Foamed Plastics Used for Decorative Purposes

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UL Standard for Safety for Fire Tests for Foamed Plastics Used for Decorative Purposes, UL 1975

Third Edition, Dated November 27, 2006

Summary of Topics

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New product submittals made prior to a specified future effective date will be judged under all of the requirements in this Standard including those requirements with a specified future effective date, unless the applicant specifically requests that the product be judged under the current requirements. However, if the applicant elects this option, it should be noted that compliance with all the requirements in this Standard will be required as a condition of continued Listing and Follow-Up Services after the effective date, and understanding of this should be signified in writing.

This Standard consists of pages dated as shown in the following checklist:

Page	Date
1-20	November 27, 2006

UL 1975

Standard for Fire Tests for Foamed Plastics Used for Decorative Purposes

First Edition – September, 1990
Second Edition – October, 1996

Third Edition

November 27, 2006

An effective date included as a note immediately following certain requirements is one established by Underwriters Laboratories Inc.

Revisions of this Standard will be made by issuing revised or additional pages bearing their date of issue. A UL Standard is current only if it incorporates the most recently adopted revisions, all of which are itemized on the transmittal notice that accompanies the latest set of revised requirements. Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

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INTRODUCTION

1 Scope

1.1 The purpose of this test method is to determine the ability of foamed plastics and products containing foamed plastics used for decorative purposes to resist rapid heat release when subjected to a flaming ignition source.

1.2 This test method is intended to apply to foamed plastics, and products containing foamed plastics, to be used for the following decorative purposes:

a) Typical open-ceiling, portable exhibit booth constructions incorporating manufactured panels.

b) Individual, manufactured decorative objects such as, but not limited to, mannequins, murals, and signs.

c) Theater, motion picture, and television stage settings, with or without horizontal projections.

1.3 This test method does not provide information concerning the fire performance of foamed plastics in other fire conditions or the contribution of foamed plastics to a developing fire condition. Also, the density of smoke produced and the toxicity of the products of combustion are not measured.

1.4 Appropriate identifications and examinations shall be conducted to provide additional information relative to the physical and chemical properties of the foamed plastics used.

1.5 A product that contains features, characteristics, components, materials, or systems new or different from those covered by the requirements in this standard, and that involve a risk of fire, electric shock, or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain the acceptable level of safety as originally anticipated by the intent of this standard. A product whose features, characteristics, components, materials, or systems conflict with specific requirements or provisions of this standard cannot be judged to comply with this standard. Where considered appropriate, revision of requirements shall be proposed and adopted in conformance with the methods employed for development, revision, and implementation of this standard.

2 General

2.1 When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

2.2 The term ″foamed plastics″ used in these requirements includes materials containing foamed plastics.

PERFORMANCE

3 General

3.1 Per the specifications in Calculations, Section 8, the rate of heat release of each test specimen shall be as specified in Table 3.1.

Table 3.1
Rate of heat release

Product type	Maximum allowable rate of heat release
a) Exhibit booth constructions	100 kilowatts
b) Decorative objects	150 kilowatts
c) Theater, motion picture, and television stage settings	100 kilowatts

3.2 A report of the test results is to be prepared as specified in Report (General), Section 9.

4 Test Equipment

4.1 General

4.1.1 The test equipment is to consist of the following components:

a) A wood crib ignition source;

b) A collection hood and exhaust duct;

c) Velocity and temperature measuring instruments;

d) Gas sampling and oxygen analysis equipment;

e) A data acquisition system; and

f) Photographic and video equipment.

4.1.2 The building in which the tests are conducted is to have vents for the discharge of the combustion products and have provisions for fresh air intake so that no oxygen-deficient air is introduced into the test configuration during the test.

4.2 Wood crib ignition source

4.2.1 The ignition source for the test is to consist of a 340 ±15 g (0.75 ±0.03 lb) wood crib and 20 ±1 g (0.04 ±0.002 lb) of wood excelsior placed in the interior cavity of the crib. The wood crib is to consist of the following:

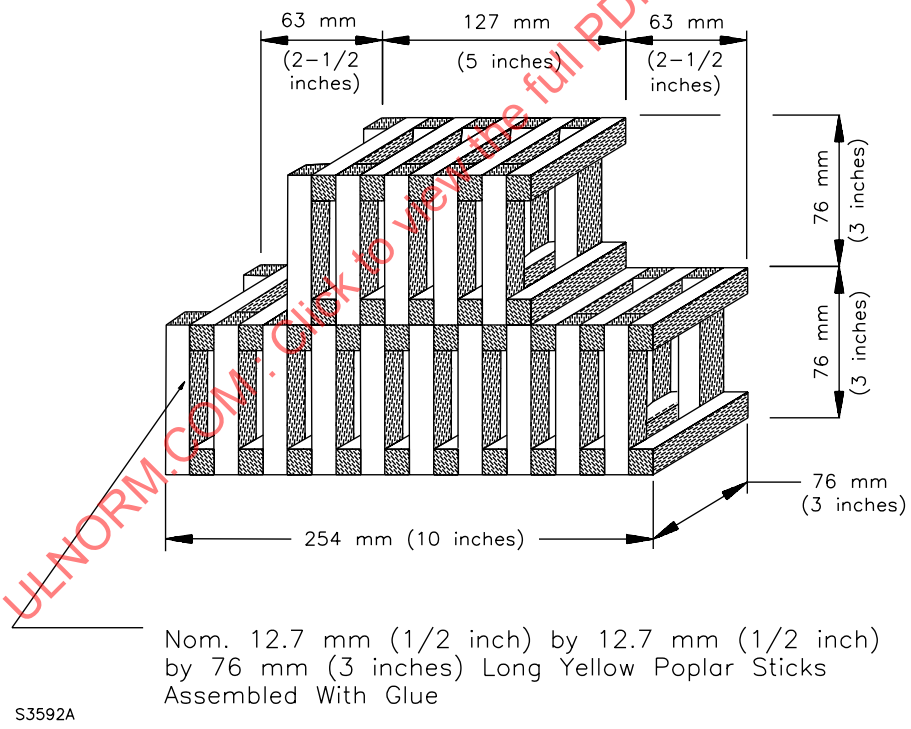
a) 12.7 by 12.7 by 76.2 mm (1/2 by 1/2 by 3 inch) long sticks of Yellow Poplar species lumber. Forty sticks are to form the bottom section and twenty are to form the top section.

b) Wood adhesive capable of being used for purposes of assembling the crib.

The wood excelsior is to consist of finely shredded SPF grade lumber.

4.2.2 The crib is to be assembled as shown in Figure 4.1. Two sticks are to be used in each row. The sticks in each row are to be parallel to one another and at right angles to the sticks in the adjacent row. The sticks are to be glued together at points of contact with adhesive. The top crib section is to rest on the center of the bottom crib section. No glue is to be used to secure the two sections together.

Figure 4.1
Wood crib details

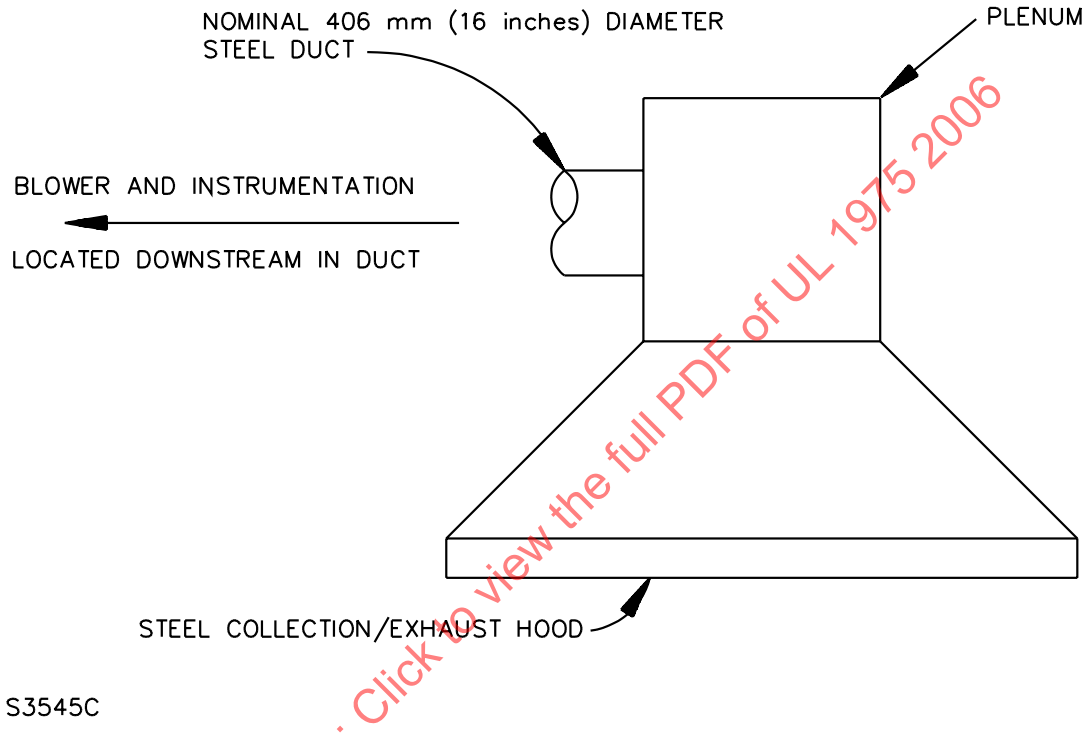


4.2.3 The wood crib and excelsior are to be conditioned at 49 ±5.5°C (120 ±10°F) and 20 ±5 percent relative humidity until constant weight is achieved.

4.3 Collection hood and exhaust duct

4.3.1 The hood is to be installed centrally above the test specimen. The face dimensions of the hood are to be at least 2.4 by 2.4 m (8 by 8 feet) and the depth is to be at least 1.07 m (3.5 feet). The hood is to exhaust into a plenum having a 0.9 by 0.9 m (3 by 3 foot) cross section. The distance between the lower edge of the hood and the floor is to be 1.8 – 3 m (6 – 10 feet). The system is shown in Figure 4.2.

Figure 4.2
Collection hood and exhaust duct



4.3.2 The exhaust duct is to be connected to the plenum. The duct is to run horizontally in length (10 diameters) downstream from the last turn or restriction prior to the location of instrumentation to provide for a fully developed gas flow. Mixing vanes are to be provided in the duct when concentration gradients are determined to exist. The outlet of the exhaust duct is to be connected to an exhaust plenum containing smoke abatement equipment.

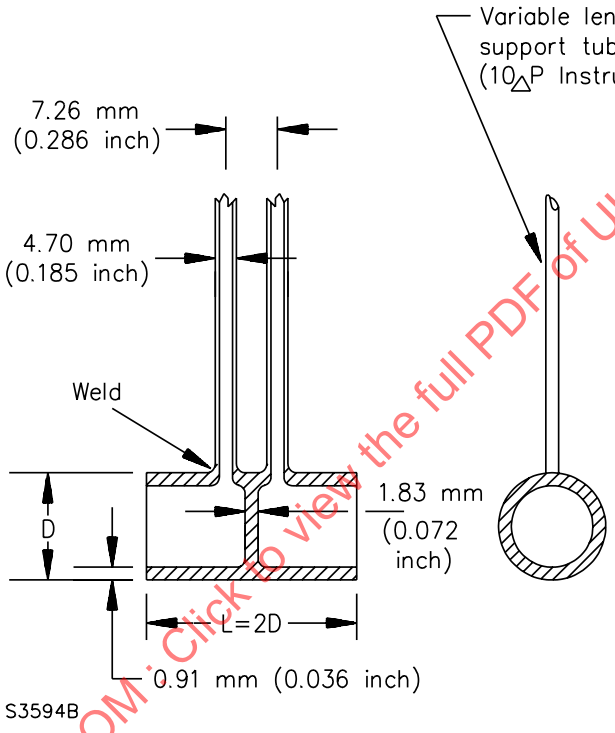
4.3.3 The exhaust system is to have sufficient draft to collect all products of combustion developed by the burning sample. The exhaust flow is to be variable from 0.47 – 2.35 m^3/s (1000 – 5000 cubic feet per minute).

4.3.4 An alternative hood and exhaust system design is capable of being used when it has been shown to produce equivalent results. Equivalency is demonstrated when the requirements specified in Calibration of Equipment, Section 5, have been met.

4.4 Velocity and temperature measuring instruments

4.4.1 The velocity in the exhaust duct is to be determined by measuring the differential pressure in the flow path with a bi-directional probe connected to an electronic pressure gauge or an equivalent measuring system. The probe is to consist of a stainless steel cylinder with a solid diaphragm in the center which divides the probe into two chambers. The probe is to be 44 mm (1.75 inches) long with a 22 mm (0.87 inch) inside diameter. The pressure taps on either side of the diaphragm are to support the probe. The bi-directional probe is shown in Figure 4.3.

Figure 4.3
Bi-directional probe



4.4.2 The axis of the probe is to be located at the centerline of the duct a minimum of 10 diameters downstream from the last turn in the duct. The pressure taps are to be connected to a pressure transducer having a minimum resolution of 0.25 Pa (0.001 inch H_2O).

4.4.3 The temperature of the exhaust gas is to be measured upstream 152 mm (6 inches) from the probe and at the centerline of the duct with a No. 28 gauge Type K thermocouple having an inconel sheath.

4.5 Gas sampling and oxygen analysis equipment

4.5.1 A stainless steel gas sampling tube is to be located 10 diameters downstream from the last turn in the duct, to obtain a continuously flowing sample for determining the oxygen concentration of the exhaust gas as a function of time. A suitable filter and a cold trap are to be placed in line ahead of the analyzer to remove particulates and water. The oxygen analyzer[a] is to be capable of measuring the oxygen concentration in the range from 0 to 21 percent with a precision of ±0.005 percent oxygen concentration. The signal from the oxygen analyzer is to be within 10 percent of its final value within 30 seconds after introducing a step change in the composition of the gas stream flowing past the inlet to the gas sampling tube.

[a]An analyzer capable of being used for this purpose is Siemens Oxymat 5F Type Oxygen Analyzer or its equivalent.

4.6 Data acquisition

4.6.1 A digital data acquisition system is to be used to collect and record oxygen analyzer measurements, pressure gauge measurements, and temperature measurements. The speed and capacity of the data system are to be sufficient to collect the data at 5 second or less intervals.

4.7 Photographic and video equipment

4.7.1 A still camera, camera video equipment, or both are to be used to record the test specimen performance throughout each test.

4.8 Weight measuring system (optional)

4.8.1 For the optional determination of weight loss, a weight measuring system may be used to continuously record the weight of the sample during each test. The system is to consist of a weight measuring device and a noncombustible platform on which the test specimen is mounted.

4.8.2 The weight measuring device is to incorporate a steel frame and load cells. The device is to have a capacity sufficient to record the weight of the test specimen and a precision sufficient to record the weight to the nearest 45 g (0.1 pound).

5 Calibration of Equipment

5.1 Heat release rate calibration

5.1.1 The heat release measurement instrumentation located in the exhaust duct is to be calibrated by burning propane or methane gas, and comparing the heat release rates measured from oxygen consumption and those calculated from the metered gas input. The value for effective heat of combustion is 50.0 MJ/kg for methane and 46.5 MJ/kg for propane. The calibration burner is to be placed in the same location that the specimen is to be placed during the test.

5.1.2 The calibration burner is to be a non-premixed diffusion burner. A suitable calibration burner is a sand diffusion burner with a 0.3 m by 0.3 m (12 inch by 12 inch) top surface and a 0.15 m (6 inch) depth.

5.1.3 The heat release measurement instrumentation is to be calibrated at a minimum of three theoretical heat release rates based upon metered gas input. Heat release rates of 50, 100, and 150 kW should be used.

5.1.4 Oxygen consumption measurements are to be made at 5-second intervals starting 60 seconds prior to burner ignition. The measured oxygen consumption at each gas input level is to be recorded and the corresponding rate of heat release calculations compared with the theoretical rate values. A least squares, best-fit curve is to be determined for each gas input level using the following equation:

$$Y = C_f X$$

in which:

Y is the theoretical heat release rate (kW),

C_f is the calorimeter calibration factor calculated by least squares regression analysis, and

X is the measured heat release rate (kW).

This equation is then to be employed to adjust the heat release rate measured during testing to obtain the actual heat release rate. The formula for calculating the rate of heat release is specified in Heat Release Rate Calculations, Section 8. The C_f value must be in the range of 0.8 to 1.20 in order for the system to comply with the requirements.

5.1.5 The delay time of the oxygen analyzer is to be determined at the flow velocities to be used during the test. The burner is to be ignited, allowed to reach steady state, and then turned off. The delay time of the analyzer is to be determined as the time difference between the time when steady state of the burner is reached and the time when the analyzer reading reaches 90 percent of the final reading. The delay time is to be used to time-shift all subsequent readings.

5.2 Pretest calibration

5.2.1 The oxygen analyzer is to be zeroed and spanned prior to the start of each day of testing. The analyzer is zeroed by introducing 100 percent nitrogen gas to the instrument at the same pressure and flow rate as set for sample gases. The analyzer is spanned by introducing ambient duct air via the sample probe and adjusting the span to 20.95 percent oxygen. The spanning and zeroing process is to be continued until adjustment-free accuracy is obtained. Following zeroing and spanning, linearity of the analyzer response curve is to be verified by introducing bottled gas of a known oxygen concentration (for example, 19 percent oxygen) to the analyzer. The delay time of the analyzer is to be checked by introducing ambient duct air to the analyzer and noting the time the analyzer readings reach 90 percent of the final reading.

6 Test Configuration

6.1 General

6.1.1 The test samples are to be representative of the construction to be investigated with regard to components and design.

6.2 Exhibit booth sample preparation

6.2.1 Foamed plastic panels intended for exhibit booth construction are to be constructed into a 2.4 by 2.4 m (8 by 8 foot) rear wall section and two 1.8 m (6 foot) long by 2.4 m (8 foot) high sidewall sections to encompass a 4.5 m^2 (48 foot square) floor area as shown in Figure 6.1. The booth is to be of an open-top, open-front assembly. The foamed plastic panels are to be mechanically fastened to 50.8 mm (2 inch) angle iron framework using machine screws and 50.8 mm flat steel washers, as shown in Figure 6.2, and using the spacings as shown in Figures 6.3 and 6.4.

Figure 6.1
Exhibit booth test configuration

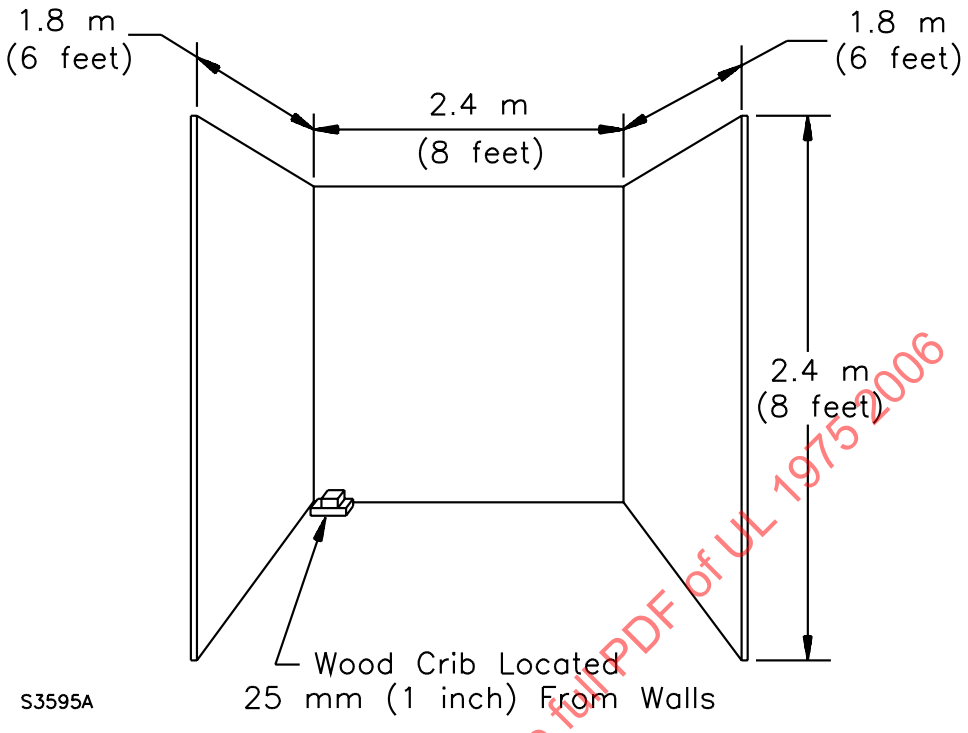


Figure 6.2
Exhibit booth material fastening technique

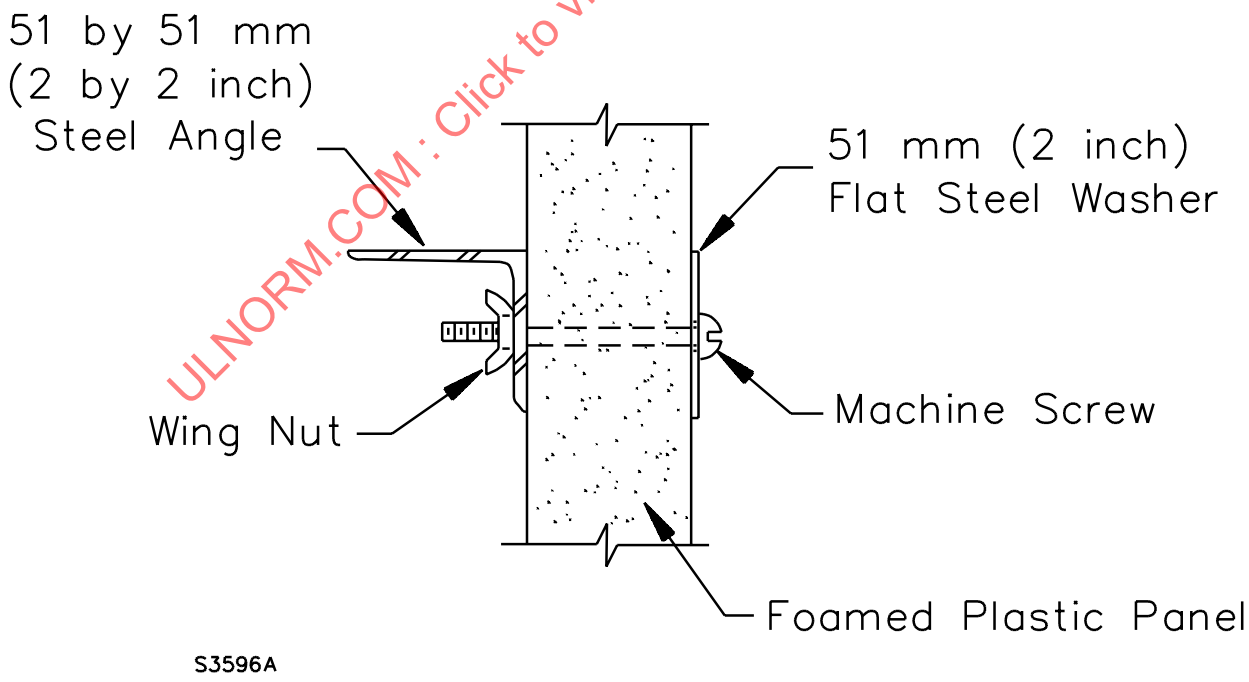


Figure 6.3
Exhibit booth backwall - typical mounting technique

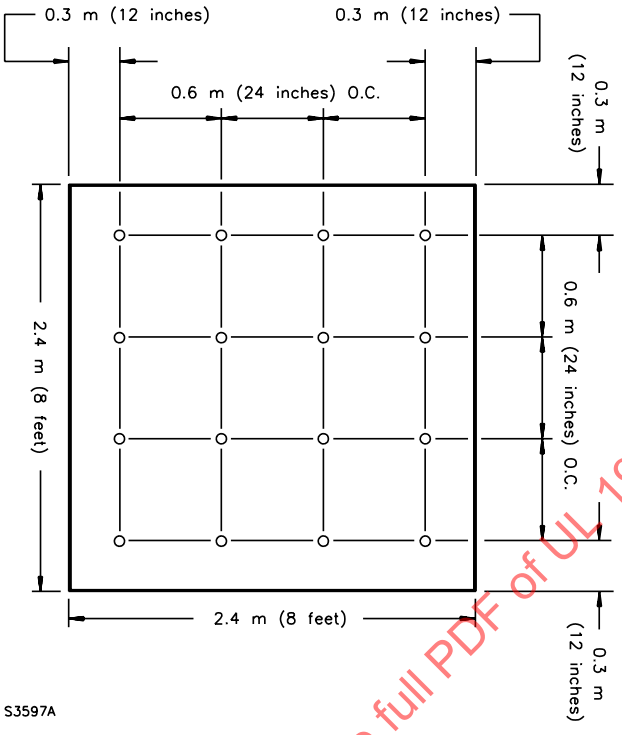
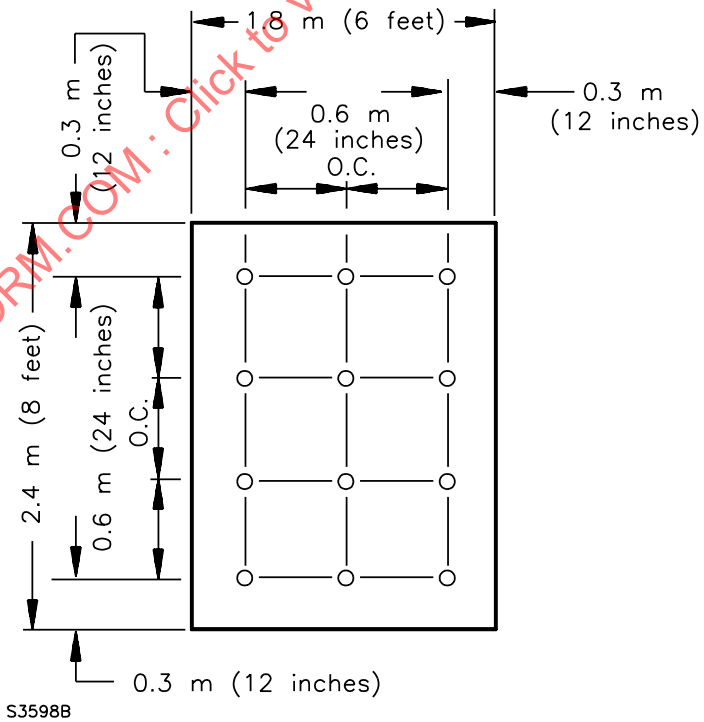


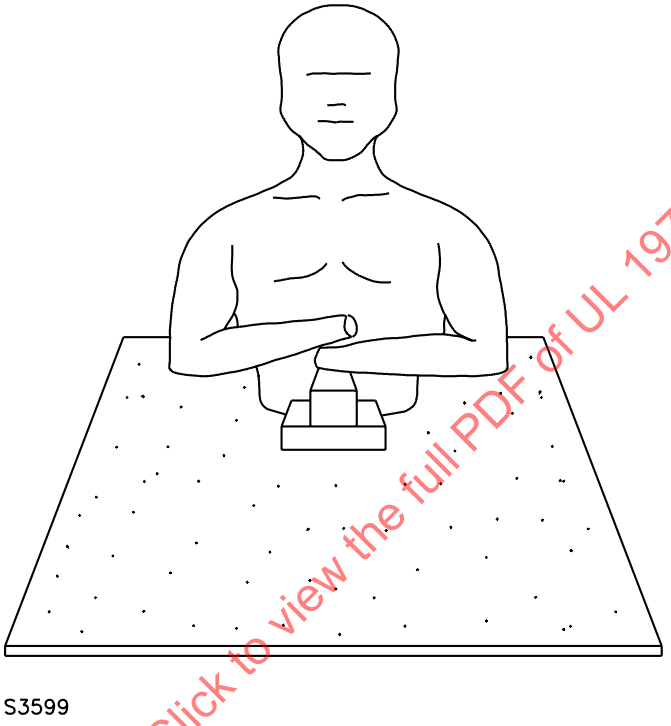
Figure 6.4
Exhibit booth sidewall - typical mounting technique



6.3 Decorative object sample preparation

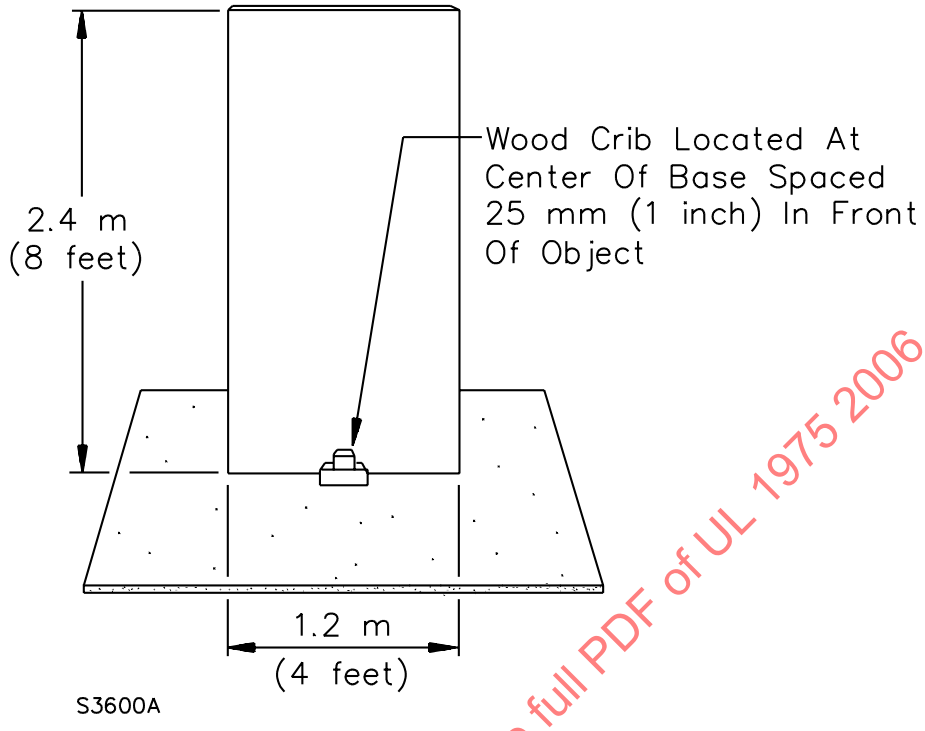
6.3.1 Foamed plastics intended for use in the manufacture of individual, irregular-shaped objects such as, but not limited to, mannequins and other such objects used for display purposes are to be tested in the size and shape intended for use. See Figure 6.5 for test configuration details.

Figure 6.5
Irregular shape – decorative object test configuration



6.3.2 Foamed plastics intended for use in the manufacture of objects that are planar in nature, such as, but not limited to, murals, wall hangings, and signs, are to be tested in the thickness and size intended for use. Objects intended to exceed width and height dimensions of 1.2 and 2.4 m (4 and 8 feet), respectively, are to be tested in maximum width and height dimensions of 1.2 and 2.4 meters. The specimen is to be mechanically supported on edge in such a manner that the support system does not interfere with the fire performance of the specimen. See Figure 6.6 for test configuration details.

Figure 6.6
Planar-shaped object test configuration



6.4 Theater, motion picture, and television stage setting sample preparation

6.4.1 Foamed plastic intended for use in the construction of theater, motion picture, and television stage settings such as, but not limited to, simulated backdrops, boulders, mountains, and caves shall be formed into 50.8-m (2-inch) thick panels and assembled into an open-front room with two side walls, a back wall, and ceiling, meeting at 90-degree angles in the corners. The interior dimensions of the room are to be 1.5 by 1.5 by 1.5 m (5 by 5 by 5 feet). See Figure 6.7 for test configuration details.