American National Standard for Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials

ANSI/FM 4880-2024

Revision of ANSI/FM 4880-2017

Approved: 8/27/2024

August 2024

Foreword

NOTE: This foreword is introductory only and is not part of American National Standard FM 4880.

This standard is intended to be used to evaluate the fire performance of insulated building panel assemblies and interior finish materials. The standard covers constructions installed to maximum heights of 30 ft (9.1 m), 50 ft (15.2 m), or unlimited heights. The combustibility of a core insulation or interior finish materials shall be identified as combustible or noncombustible when exposed to an ignition source simulating a building fire as described herein.

Appendix A to this American National Standard lists the required performance requirements based on the product type and the desired ratings. Appendix B to this American National Standard is informative and is not part of the requirements of the standard. Appendix C - F are test procedures and are informative for the performance of the tests and associated pass/fail criteria.

ANSI/FM 4880 was originally published in April 2001, re-affirmed in December 2007 and revised in 2017. Changes in this edition are as follows:

- Updated references and applicable documents;
- General editorial changes;
- Added doors to the scope.

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FM Approvals
One Technology Way
P. O. Box 9102
Norwood, MA 02062
U. S. A.

Phone: 781-762-4300
Fax: 781-762-9375
E-mail: information@fmapprovals.com

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1. INTRODUCTION

1.1 Purpose

This standard states the test requirements for building panels or interior finish materials for interior applications where a Class 1 fire rating is needed for wall and/or ceiling constructions.

1.2 Scope

1.2.1 This standard sets the fire performance requirements for a Class 1 fire rating of building panel assemblies or interior finish materials with specific height installation requirements and combustibility ratings.

1.2.2 Building panels or interior finish materials shall be tested for installations:

- with a maximum height restriction of 30 ft (9.1 m),
- with a maximum height restriction of 50 ft (15.2 m), or
- without height restrictions (i.e. unlimited height).

1.2.3 The combustibility of a core insulation or interior finish materials shall be identified as combustible or noncombustible.

1.2.4 Building panels or interior finish materials include, but are not limited to:

- insulated or non-insulated wall and/or ceiling panels with an inert or non-inert facer and combustible core or noncombustible core;
- doors manufactured with the same facers and core as wall panels included in the scope, used to access partition or enclosure assemblies made with wall panels included in the scope; and
- interior finish materials:
  - thermoplastic panels,
  - thermoset panels, and
  - coatings systems and exposed interior insulations.

1.2.5 Any component which may be used in the installation of a building panel or interior finish material such as, fasteners, adhesives, sealants, flashing, substrates, or any other accessories, is considered part of the scope of the product and must be evaluated in conjunction with the product. Any component that may affect the test performance must be included in the test sample construction.

1.2.6 This standard evaluates building panels or interior finish materials for an interior installation application only.

1.2.7 The results of tests conducted under the controlled conditions required by this standard shall not be used to describe or appraise performance under actual fire conditions.

1.3 Basis for Requirements

1.3.1 The requirements of this standard are based on experience, research and testing and/or the standards of other national and international organizations. The advice of manufacturers, users, trade associations and loss control specialists has also been considered.

1.3.2 The requirements of this standard reflect tests and practices used to examine characteristics of building panels and interior finish materials.

1.4 System of Units

Units of measurement are United States (U.S.) customary units. These are followed by their

arithmetic equivalents in International System (SI) units, enclosed in parentheses. The first value stated shall be regarded as the requirement. The converted equivalent value may be approximate. Appendix B lists some of the selected units used in testing these products; conversions to SI units are included. Conversion of U.S. customary units is in accordance with ANSI/ IEEE/ASTM SI 10.

2. GENERAL INFORMATION

2.1 Product Information/Application

2.1.1 Insulated or non-insulated wall and/or ceiling panels and doors are supplied in the form of field or factory fabricated panels. They consist of a core material and are faced with steel, aluminum (including foil), gypsum wallboard, plastic, masonry, or other materials. When assembled the panels are connected to one another and to the substrate with various types of closures and joint treatments.

The panels and doors can be secured to a structural framework or designed as free-standing. Insulated wall and/or ceiling panels are installed to reduce heat (and sound) transmission through wall and/or ceiling constructions. They are not intended as, but may be, fire resistive structures. Insulated or non-insulated wall and/or ceiling panels shall be tested with the most critical composition (e.g. facer thickness, panel thickness, joint type, etc.) and most critical panel test assembly.

2.1.2 Interior finish materials include:

2.1.2.1 Thermoplastic or thermoset plastics/panels, which are usually supplied in sheet form and may be reinforced or unreinforced. They are usually installed over combustible materials such as thermoplastic or thermoset plastic foams, or noncombustible materials such as masonry block, brick, precast concrete, or gypsum board where a smooth washable surface is required to comply with sanitary requirements. They are not intended as fire barriers. They are usually secured through the substrate over which they are installed to a structural framework or directly to the substrate and are therefore not designed as load bearing members. Interior finish materials shall be tested with the most critical composition (e.g. thickness) over the most critical substrate.

2.1.2.2 Coating systems and exposed interior insulations include; fire retardant treated cellulose, mineral or glass fiber insulations, and intumescent paints and mastics. They are typically used as interior finish or insulation to reduce heat or sound transmission through a wall and/or ceiling assemblies. They are applied over combustible or noncombustible substrates by trowel, brush, spray, or roller. Installers are typically licensed or approved by the coating manufacturer. The protection afforded to combustible substrates is generally proportional to the thickness of the application but the coatings are not intended as long-term fire barriers. Their use over combustible substrates is particularly applicable to low hazard areas containing limited combustible materials. Interior wall/ceiling coating systems shall be tested with the most critical composition (e.g. thickness) over the most critical substrate.

2.2 Requirements

Class 1 fire rated building panel or interior finish material shall satisfy the performance requirements which are based on the type of product(s) and desired ratings. Testing requirements for each type of product and rating are outlined in Appendix A.

3. APPLICABLE DOCUMENTS AND GLOSSARY

3.1 Applicable Documents

The following are standards, test methods and practices referenced in this standard.

3.1.1 National Fire Protection Association, NFPA, 1 Batterymarch Park, Quincy, MA 02169

NFPA 265, Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls

NFPA 286, Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

3.1.2 International Organization for Standardization, Case Postale 56, CH1211 Geneva 20, Switzerland

ISO 1716, Reaction-To-Fire Tests for Building Products - Determination of the Heat of Combustion

ISO 9705, Fire Tests – Full Scale Room Test for Surface Products

ISO 12136, Reaction to Fire Tests - Measurement of Material Properties Using a Fire Propagation Apparatus.

3.1.3 Annual Book of ASTM Standards, ASTM, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, Current edition of Standard

ANSI/IEEE/ASTM SI 10, Standard for Use of the International System of Units (SI): The Modern Metric System

ASTM C167, Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations

ASTM C303, Standard Test Method for Dimensions and Density of Preformed Block or Broad-Type Thermal Insulation

ASTM D1622, Standard Test Method for Apparent Density of Rigid Cellular Plastics

ASTM D482, Standard Test Method for Ash of Petroleum Products.

ASTM D4809, Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Intermediate Precision Method)

ASTM E711, Standard Test Method for Gross Calorific Value of Refuse-Derived Fuel by the Bomb Calorimeter

ASTM D792, Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM D1505, Test Method for Density of Plastics by the Density-Gradient Technique

ASTM E2058, Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA)

3.2 Terminology

For purposes of this standard, the following terms apply:

Caulking

A filler used to seal openings and joints in wall and/or ceiling assemblies. Caulking is typically not intended for fire-resistance and typically does not react with heat from a fire.

Combustible Core or Combustible Interior Finish Material

A combustible core or combustible interior finish material is one that has not been tested for or does not pass the requirements listed in Appendix A for a noncombustible rating.

Combustibility of Core or Interior Finish Material

The combustibility of a core insulation or interior finish material will be identified as "Combustible" or "Noncombustible." A rating shall only be obtaining from successfully completing the requirements listed in Appendix A.

Component

A component is a part or element of a building panel, interior finish material, foam system, etc., and/or part or element of an assembly of a building panel or interior finish material. Examples of components are, but not limited to, foam systems, ingredients of foam systems (e.g. polyol or isocyanate), noncombustible cores, and/or joint sealants.

Door

A hinged or slide mounted panel on a frame used to access a partition or enclosure that can include components such as latch, sill, inside release, ventilator port, sweep, and gasket. A hinged door frame usually includes a hinge jamb, latch jamb, and header. A slide door frame usually includes a sliding track, bottom guides, top glide rollers, and a header.

Fire-resistant Caulking, Gaskets, or Sealants

Fire-resistant caulking, gaskets, or sealants are made of various components and may be used to seal openings and/or joints in wall and/or ceiling assemblies. Fire- resistant caulking, gaskets, or sealants may react with heat from a fire. Examples include, but are not limited to, firestops and intumescent materials.

EPS

Expanded polystyrene (EPS) is a thermoplastic, rigid cellular plastic or closed-cell foam which can be used as an insulation for insulated wall and/or ceiling panels.

FSP_C

The convective flame spread parameter (FSP_C). The $FSP_C = Q_C/(TRP*a)$ where Q_C is the 5 second average peak convective heat release rate and TRP is the thermal response parameter determined per ASTM E2058 and a is the total surface area of the combustion sample used to determine Q_C.

Gasket

A shaped piece of rubber or other material used to seal openings and/or joints in wall and/or ceiling assemblies. A gasket is typically not intended for fire-resistance and typically does not react with heat from a fire.

Inert Faced

Faced with a material which is considered noncombustible (e.g. steel, aluminum, gypsum wall board, cement board, masonry).

Intumescent

The act of swelling when heated by a fire. Intumescent materials (e.g. firestop sealant) are typically used with the intention of sealing an opening and/or joint in order to protect the material underneath.

Joint Treatment

A material used for sealing joints in wall and/or ceiling assemblies. Examples for joint treatments are caulking, gaskets, and/or sealants.

Multiple Ingredient Change

A multiple ingredient change is two or more significant component changes from the original formulation utilized for satisfying all required performance tests. One component change may be considered a multiple ingredient change if it is the second ingredient change from the original formulation utilized for satisfying all required performance tests. Insignificant changes are not considered a multiple ingredient change.

Noncombustible Core or Noncombustible Interior Finish Material

A noncombustible core or noncombustible interior finish material is one that has met the requirements listed in Appendix A for a noncombustible rating.

Non-Intumescent

Materials which do not expand when exposed to heat from a fire. Non-intumescent materials (e.g. silicone or butyl sealant) are typically used with the intention of sealing an opening and/or joints.

PIR

Polyisocyanurate (PIR) is a thermoset plastic commonly used as an insulation for insulated wall and/or ceiling panels.

PUR

Polyurethane (PUR) is a thermoset plastic commonly used as an insulation for insulated wall and/or ceiling panels.

Sealant

A material made of one or more components used for sealing openings and/or joints in wall and/or ceiling assemblies. A sealant may or may not be intended for fire-resistant.

Significant Ingredient Change

A change to a formulation which has been categorized as either a single ingredient change or a multiple ingredient change. Significant ingredient changes include, but are not limited to, changing an ingredient, changing a supplier of an ingredient, and/or changing manufacturing tolerances of ingredients.

Silicone

A synthetic material made of one or more components used to seal openings and/or joints in wall and/or ceiling assemblies. Silicone is not intended for fire-resistance and does not react with heat from a fire.

Single Ingredient Change

A single ingredient change is one significant component change from the original formulation utilized for satisfying all required performance tests. Insignificant changes are not considered a single ingredient change.

Thermoset

Capable of becoming permanently rigid when heated or cured. (e.g. PIR or PUR insulated foam system)

Thermoplastic

Capable of softening when heated and of hardening again when cooled. (e.g. EPS)

Wall and/or Ceiling Panels

Building panels or interior finish materials that are installed to form adjoining wall and/or ceiling surfaces.

Wall/Ceiling Coatings

Coatings that are installed over adjoining wall and/or ceiling surfaces.

4. GENERAL REQUIREMENTS

4.1 Markings

4.1.1 Markings on the product or, if not possible, on its packaging or label accompanying the product, shall include the following information:

- name and address of the manufacturer or marking traceable to the manufacturer,
- date of manufacture or code traceable to date of manufacture or lot identification, and
- model number or product identification.

4.1.2 When hazard warnings are needed, the markings shall be universally recognizable.

4.1.3 All markings shall be legible and durable until installation.

4.2 Instructions

The manufacturer shall provide the user with:

- instructions for the installation, maintenance, and operation of the product; and
- services to ensure proper installation, inspection, or maintenance for products of such nature that it would not be unreasonable to expect the average user to be able to provide such installation, inspection, or maintenance.

4.3 Drawings/Formulations/Specifications Required

The manufacturer shall provide assembly drawings, materials lists, brochures, sales literature, specification sheets, technical data sheets, and safety data sheets for each building panel or interior finish material, and all components of the product (e.g. foam systems, sealants, etc.).

4.4 Use of Sealants, Gaskets, and/or Caulking

4.4.1 All sealants, gaskets, and/or caulking that may be used in the installation of a building panel or interior finish material assembly shall be evaluated in conjunction of the product.

4.4.2 Sealants, gaskets, and/or caulking may affect the results of the test performance and shall be included in the test sample construction as detailed in Table 4.4.2 for the following Performance Test assemblies:

- Section 5.1/Appendix C - Room Test
- Section 5.3/Appendix D - 16 ft (4.9 m) High Parallel Panel Test
- Section 5.4/Appendix E - 25 ft (7.6 m) High Corner Test
- Section 5.5/Appendix F - 50 ft (15.2 m) High Corner Test

Table 4.4.2. Test samples and installation requirements for sealant, gaskets, and/or caulking

Sealant, Gasket, and/or Caulking Product Type	Included in Test Sample Assemblies	Installations Requirements
Non-intumescent or non-fire resistant (e.g. butyl, silicone)	Yes	Must be used in all installations
	No	Optional use
Intumescent or fire-resistant	Yes	Must be used in all installations
	No	Not permitted for use

4.4.3 If multiple sealants, gaskets, and/or caulking are desired, an insulated pan combustion test per ASTM E2058 shall be used to determine the most critical sealant, gasket, and/or caulking. The most critical must be used for the test listed in Section 4.4.2.

4.4.4 Application instructions and requirements of sealants, gaskets, and/or caulking must be detailed in an building panel or interior finish material manufacturer's installation and operation instructions.

4.5 Formulation Changes

4.5.1 All formulation changes of a previously tested building panel or interior finish material shall be evaluated prior to implementing a change. Formulation changes include, but are not limited to:

- ingredient change(s),
- changing manufacturing tolerances of ingredients of a previously tested formulation more than +/- 5% of the original quantity.

All formulation changes shall be categorized as either a single or multiple ingredient change.

4.5.1.1 A single ingredient change is one significant component change from the original formulation utilized for satisfying all required performance tests. A single ingredient change shall require:

- a flammability characterization test, and
- a density of panel insulating cores test or density of plastic panels or panel facings test (as applicable).

The convective flame spread parameter (FSPc) from the Flammability Characterization test shall be less than or equal to the FSPc of the original formulation utilized for satisfying all required performance tests. If the single ingredient change results in a greater FSP_c than the original formulation, all remaining performance tests (applicable to product type) are required.

In addition, the density test results shall be +/- 5% of the original formulation density utilized for satisfying all required performance tests. If the density test results varies beyond the original formulation density by +/- 5%, all remaining performance tests (applicable to product type) are required.

Only one single significant ingredient change shall be allowed from the original formulation utilized for satisfying all required performance tests. Any further ingredient changes shall be considered a multiple ingredient change.

4.5.1.2 A multiple ingredient change is two or more significant components changes from the original formulation utilized for satisfying all required performance tests. A multiple ingredient change requires all performance tests (applicable to product type) to be conducted.

5. PERFORMANCE REQUIREMENTS

Performance requirements are based on product type and the desired ratings. Not all tests listed under this section are applicable to every product type and/or rating. The requirements for each product type and rating covered are listed in Appendix A, "Performance Requirements Based on Product Type and Desire Ratings."

5.1 Room Test

5.1.1 Requirement:

Assemblies covered by this standard shall be subjected to a room test or an ISO 9705 room test.

When tested in accordance with a room test:

When exposed to heat from a simulated internal fire for a period of 15 minutes with flames impinging directly on the internal corner of an 8 x 8 x 8 ft (2.44 x 2.44 x 2.44 m) construction, assemblies covered by this standard shall satisfy the following requirements:

- charring of the panel core (or panel for single skin) shall not extend to the outer extremities of the test area. Discoloration extending up to 1/4 in. (6.4 mm) into the core is not considered to be charring, and
- structural panels (if applicable) must sustain the applied load during the test period.

When tested in accordance with ISO 9705, an assembly shall:

- not support a self-propagating fire which extends to the outer extremities of the test area within the 20 minute test as evidenced by flaming or material damage (including charring of core materials), and
- structural panels (if applicable) must sustain the applied load during the test period.

5.1.2 Test/Verification:

Room test as described in Appendix C or ISO 9705, *Fire Tests - Full-Scale Room Test for Surface Products.*

5.2 Flammability Characterization

5.2.1 Requirement:

The chemical heat of combustion (ΔH_{CH}), critical heat flux for ignition ($\dot{q}''_{cr}$), thermal response parameter (TRP), and convective flame spread parameter (FSP_C) shall be determined and reported.

Note: This test is conducted to establish a base from which requests for formulation revisions are evaluated. There are no limits on the values obtained, with the exception of thermoset plastic foam cores with an inert faced with a 30 ft (9.1 m) height restriction as details in Appendix A.

5.2.2 Test/Verification:

Flammability Characterization using a 50 kW Scale Flammability Apparatus per ASTM E2058, *Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA)* or ISO 12136, *Reaction to Fire Tests - Measurement of Material Properties Using a Fire Propagation Apparatus*.

5.3 16 ft (4.9 m) High Parallel Panel Test

5.3.1 Requirement:

For no height restriction, the maximum gross chemical heat release rate (PCHRR) during a 16 ft (4.9 m) High Parallel Panel fire test with a propane gas ignition source of 360 kW shall be less than, or equal to, 830 kW.

For a maximum height of 50 ft (15.2 m) for combustible walls with a noncombustible ceiling, the maximum gross chemical heat release rate (PCHRR) during a 16 ft (4.9 m) High Parallel Panel fire test with a propane gas ignition source of 360 kW shall be less than, or equal to, 1100 kW.

5.3.2 Test/Verification:

16 ft (4.9 m) High Parallel Panel Test as described in Appendix D.

5.4 25 ft (7.6 m) High Corner Test

5.4.1 Requirement:

For a maximum height of 30 ft (9.1 m), assemblies covered by this standard shall not support a self-propagating fire which reaches any of the limits of the 25 ft (7.6 m) high corner test structure as evidenced by flaming or material damage.

5.4.2 Test/Verification:

25 ft (7.6 m) High Corner Test as described in Appendix E.

5.5 50 ft (15.2 m) High Corner Test

5.5.1 Requirement:

For a maximum height of 50 ft (15.2 m), assemblies shall not support a self-propagating fire which extends to the outer extremities of the 50 ft (15.2 m) high corner test structure as evidenced by flaming or material damage.

For no height restriction, ignition of the ceiling of the assembly in the 50 ft (15.2 m) high corner test shall not occur, and assemblies shall not support a self-propagating fire which extends to the outer extremities of the 50 ft (15.2 m) high corner test structure as evidenced by flaming or material damage

5.5.2 Test/Verification:

50 ft (15.2 m) High Corner Test as described in Appendix F.

5.6 Density of Insulating Cores

5.6.1 Requirement:

The density of the insulating core (with no adhesives or facers) shall be determined and reported.

5.6.2 Test/Verification:

ASTM C167, *Standard Test Methods for Thickness and Density of Blanket or Batt Thermal Insulations*, ASTM C303, *Standard Test Method for Dimensions and Density of Preformed Block or Broad-Type Thermal Insulation* or ASTM D1622, *Standard Test Method for Apparent Density of Rigid Cellular Plastics.*

5.7 Density of Plastic Panels or Panel Facings

5.7.1 Requirement:

The density of the plastic panel or plastic panel facings shall be determined and reported.

5.7.2 Test/Verification:

ASTM D792, *Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement* or ASTM D1505, *Test Method for Density of Plastics by the Density-Gradient Technique.*

5.8 Heat Content

5.8.1 Requirement:

The heat content of a core material or facer shall be determined by oxygen bomb calorimetry and reported.

For a noncombustible rating, the core material shall have a maximum gross heat of combustion of 2.0 kJ/g (860 BTU/lb) when tested without adhesive or facers. Three tests shall be conducted and the test results shall be averaged.

Note: With the exception of noncombustible products, this test is conducted for identification purposes. There are no limits on the values obtained.

5.8.2 Test/Verification:

ISO 1716, *Reaction-To-Fire Tests for Building Products - Determination of the Heat of Combustion*, ASTM D4809, *Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Intermediate Precision Method)* or ASTM E711, *Standard Test Method for Gross Calorific Value of Refuse-Derived Fuel by the Bomb Calorimeter.*

5.9 Ash Content

5.9.1 Requirement:

The total ash content of a core material or facer shall be determined and reported.

For a noncombustible rating, the core material shall have a minimum ash content of 90% when tested without adhesive or facers.

Note: With the exception of noncombustible products, this test is conducted for identification purposes. There are no limits on the values obtained.

5.9.2 Test/Verification:

ASTM D482, *Standard Test Method for Ash of Petroleum Products.*

5.10 Combustion

5.10.1 Requirement:

For a noncombustible rating, the core material shall shows no visible flaming when tested at an applied heat flux of 50 kW/m2 in air enriched to 40% oxygen without adhesive or facers:

- for 15 minutes from the start of the combustion test or

- until mass loss from the sample has ceased if mass loss from the sample has not ceased by 15 minutes after the start of the combustion test or
- until visible vapors have ceased to be generated if visible vapors are being generated by the sample 15 minutes after the start of the combustion test at an applied heat flux of 50 kW/m2 in air enriched to 40% oxygen.

If the use of multiple sealant, gaskets, and/or caulking is desired for use in product assemblies, an insulated pan combustion test per ASTM E2058 shall be used to determine the most critical sealant, gaskets, and/or caulking. The most critical shall be used for performance tests listing in Section 4.4.2.

5.10.2 Test/Verification:

ASTM E2058, *Standard Test Methods for Measurement of Synthetic Polymer Material Flammability Using a Fire Propagation Apparatus (FPA) for the combustion or insulated pan combustion test.*

APPENDIX A: PERFORMANCE REQUIREMENTS BASED ON PRODUCT TYPE AND DESIRED RATINGS

Panel Type		Desired Rating		Required Tests									
Core Type	Facer	Combustibility of Core or Interior Finish Materials	Height Limitation	Room Test	Flammability Characterization	16ft (4.9 m) High Parallel Panel Test	25 ft (7.6 m) High Corner Test	50 ft (15.2 m) High Corner Test	Density of Insulating Cores	Density of Plastic Panels or Plastic Facings	Heat Content	Ash Content	Combustion
Thermoset (e.g. PIR, PUR)	Inert (e.g. Metal)	Combustible	30 ft (9.1 m)	R	R[1]		A		R				
			Unlimited[3]	R	R	R	A	A	R				
	Non-Inert		30 ft (9.1 m)	R	R		R		R	R[4]			
			Unlimited[3]	R	R		R	R	R	R[4]			
Thermoplastic (e.g. EPS)	Inert (e.g. Metal)		30 ft (9.1 m)	R			R		R				
			Unlimited[3]	R			R	R	R				
	Non-Inert		30 ft (9.1 m)	R			R		R	R[4]			
			Unlimited[3]	R			R	R	R	R[4]			
Mineral wool, Glass Fiber, or Similar type cores	Inert (e.g. Metal)	Combustible	30 ft (9.1 m)	R			R		R				
			Unlimited[3]	R		R	A	A	R				
		Noncombustible	Unlimited[3]	R					R		R	R	R
	Non-Inert ≤ 0.010 in (0.25 mm)	Combustible	30 ft (9.1 m)	R	R[4]		R		R	R[4]			
			Unlimited[3]	R	R[4]		R	R	R	R[4]			
		Noncombustible[2]	Unlimited[3]	R					R	R[4]	R	R	R
	Non-Inert > 0.010 in (0.25 mm)	Combustible	30 ft (9.1 m)	R	R[4]		R		R	R[4]			
			Unlimited[3]	R	R[4]		R	R	R	R[4]			
		Noncombustible	30 ft (9.1 m)	R			R		R	R[4]	R	R	R
			Unlimited[3]	R			R	R	R	R[4]	R	R	R
Single Skin (i.e. no core)	N/A	N/A	30 ft (9.1 m)	R	R[1,4]		A			R[4]			
			Unlimited[3]	R	R[4]	R	A	A		R[4]			

R = Required A= Alternative Test

[1] Maximum height of 30 ft (9.1 m) shall be granted with an FSP_c less than or equal to 0.39 $s^{-1/2}$. For an FSP_c greater than 0.39 $s^{-1/2}$ or if the Flammability Characterization Test cannot be conducted, the following heights shall be granted with one of the alternate tests;

- a successful 25 ft (7.6 m) High Corner for a 30 ft (9.1 m) height restriction,
- a successful 16 ft (4.9 m) Parallel Panel Test for a 50 ft (9.1 m) height restriction or unlimited height, or
- a successful 50 ft (15.2 m) High Corner Test for a 50 ft (15.2 m) height restriction or unlimited height.

[2] Applies to low density batts or blankets with adhered thin [≤0.010 in. (0.25 mm) thick] facings consisting of various plastic films, aluminum foil, Kraft papers, fabrics and/or reinforcements laminated together with an adhesive or adhesives.

[3] Testing requirements for a 50 ft (15.2 m) height restriction are the same as the unlimited height. The results of the 50 ft (15.2 m) High Corner Test or 16 ft (4.9 m) High Parallel Panel Test may restrict installations to 50 ft (15.2 m) and/or restrict installations to a noncombustible ceiling (see applicable performance requirements for details).

[4] Required only for plastic materials (plastic facers and/or single skin plastic panels) which are applicable for each of the ASTM or ISO standards listed in the performance requirements.

APPENDIX B: CONVERSION OF MEASUREMENT UNITS

LENGTH:	in. -‘‘inch’’ (mm -‘‘millimeter’’)
	mm = in. × 25.40
	ft -‘‘feet’’ (m -‘‘meter’’)
	m=ft × 0.3048
PRESSURE:	psi -‘‘pounds per square inch’’ (kPa -‘‘kilopascal’’)
	kPa = psi × 6.895
HEAT:	Btu -‘‘British thermal unit’’ (J -‘‘joule’’)
	J = Btu × 1055
TEMPERATURE:	°F-‘‘degree Fahrenheit’’ (°C-‘‘degree Celsius’’)
	°C=(°F -32) × 5/9
MASS:	lb -‘‘pound’’ (kg -‘‘kilogram’’)
	kg=lb × 0.4536
FORCE:	lbf -‘‘pound force’’ (N -‘‘newton’’)
	N = lbf × 4.448
TORQUE or MOMENT:	lbf·ft -‘‘pound force feet’’ (N•m-‘‘newton meter’’) N•m = lbf•ft × 1.356

APPENDIX C: ROOM TEST

C-1. Test Equipment and Supplies

C-1.1 Thermocouples - precalibrated 12 in. long type K chromel/alumel stainless-steel sheathed thermocouples

C-1.2 Data recorder - data logger capable of recording and storing input data from the thermocouples at intervals not exceeding 10 seconds, and able to provide a hard copy of the data.

C-1.3 Fire Pan - a 24 by 24 (610 by 610 mm) by 1/2 in. (13 mm) deep pan fabricated from sheet steel.

C-1.4 Starter Material - One pound of shredded, fluffed wood excelsior and four ounces of reagent ethyl alcohol or absolute ethyl alcohol.

C-1.5 Wood crib - The fuel for the room test is a wood crib constructed of 15 in. (380 mm) long by 1-1/2 in. (38 mm) square white fir, Douglas fir or spruce-pine fir sticks. At a moisture content of 12 %, the crib shall weigh 30 lbs. (13.6 kg) and be 15 in. (380 mm) square in plan. One 8d nail is driven at each corner of each tier. Each interior stick is attached at each end to a perimeter stick with one 8d nail. Approximately 45 to 50 sticks will be used per crib and they must be assembles in nine or ten tiers with five sticks per tier. The sticks in each tier are oriented at 90 degrees to the sticks in adjacent tiers. After fabrication, the crib is to be conditioned to a maximum constant moisture content of 8%.

C-1.6 Timing device - stopwatch or clock with 1 second divisions or equivalent.

C-2. Fire Test Structure & Test Specimen

C-2.1 The room fire test (see Figure C-2) is conducted in a room sheathed on the ceiling and all four walls with glass fiber faced gypsum board secured to wood framing. The floor of the test room is steel. A 2 ft 6 in. (760 mm) wide by 7 ft 0 in. (2135 mm) high door is located in the front 8 by 8 ft (2440 by 2440 mm) wall. Sample wall panels are installed vertically or horizontally per manufacturers recommendations on the 8 by 8 ft (2440 by 2440 mm) back wall (wall opposite the wall with the door) and the first 8 ft (2440 mm) of the adjacent 12 by 8 ft (3660 by 2440 mm) left wall. Where applicable, sample ceiling panels are installed on the first 8 ft (2440 mm) of the 8 ft (2440 mm) high ceiling adjacent to the left and back walls. The front and right walls and both sections of the ceiling are adjustable so that the finished interior of the room after sample installation can be adjusted to 12 ft (3660 mm) long by 8 ft (2440 mm) wide by 8 ft (2440 mm) high.

C-2.2 The test specimen consists of the requisite number of panels required for the test to be performed. The test specimen shall be representative of that used in practice, both in construction and materials where practical. All construction details of joints, securement, etc., shall be reproduced and positioned in the test specimen as in practice as far as possible.

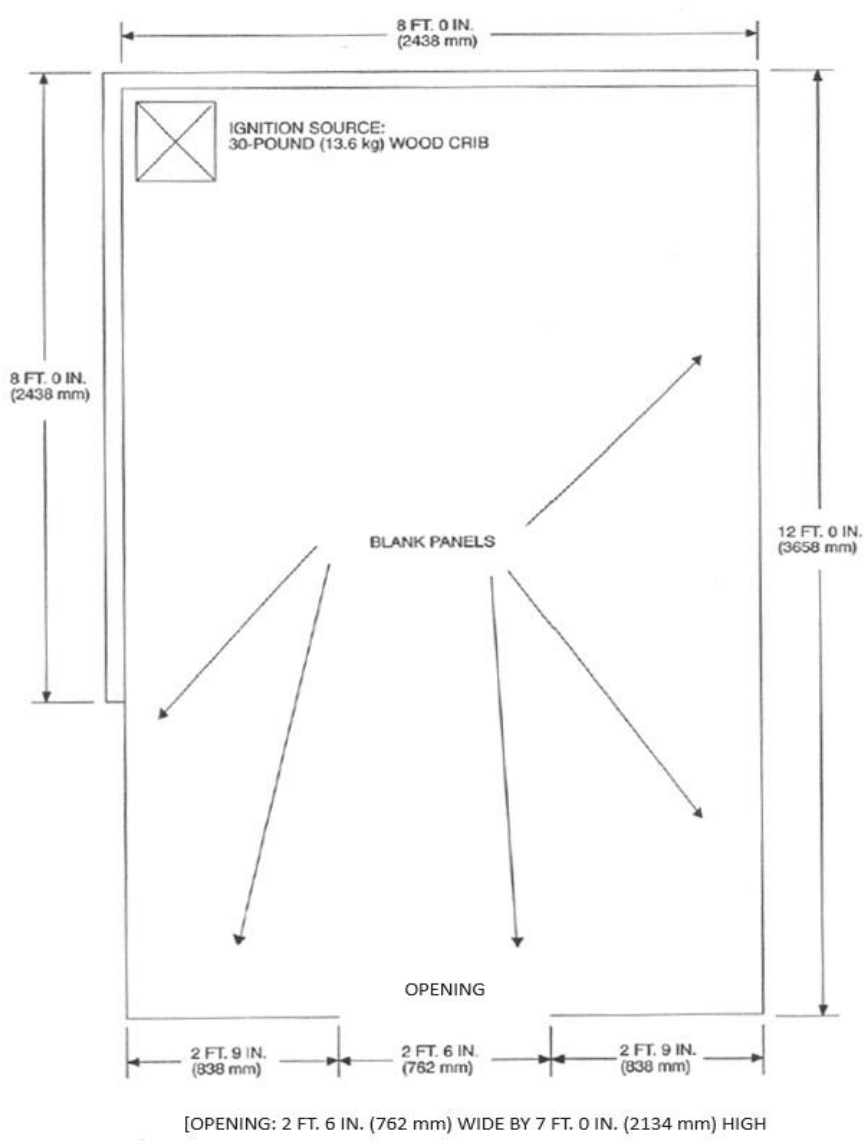

Figure C-2. Plan view of Test Room

C-2.3 Test panels are secured per manufacturers recommendations where installation is possible using those recommendations. Where manufacturers recommendations cannot be followed (many panels are fastened from the exterior side of the panels into the structure but the test room does not allow for this type of installation) the panels are secured through both facers to the wood framing behind the gypsum sheathing with two rows of self-drilling screws and washers approximately 1 ft from the floor of the test room and 1 ft from the finished ceiling of the test room where the panels are installed vertically or 1 ft from both ends of the panels where the panels are installed horizontally or as ceiling panels. The number of fasteners in each row depends on the panel width as indicated below.

Panel Width	≥36 in. (915 mm)	<36 in. (915 mm) ≥18 in. (455 mm)	<18 in. (455 mm)
Fasteners/Row	3	2	1*

* may be omitted with permission of test sponsor

C-2.4 If, in practice, ceiling panels are different from wall panels, the test should be performed with the correct combination of wall and ceiling panels.

C-2.5 If a door is included, the door or door assembly is installed on the left wall with the right edge of the door installed maximum 6 in. (152 mm) from the corner. The door is hinged per manufacturers specifications. The hinged side of the door is placed against the gypsum sheathing. To allow the door or door assembly to lay flat on the room test gypsum sheathing, hinges on the exterior side of the door are replaced with rectangular shaped 16 gauge sheet metal, of the same height as any hinges, and fastened through the same holes as any hinges. The door shall include all combustible components, typical industry specifications such as gasket, plastic ventilator port, plastic inside release, weatherproof electrical box, bottom sweep, latch, etc. No fasteners described in paragraph C-2.3 are installed through the door, but are included in any door header from a door assembly.

C-2.6 If the panels are intended for use with decorative paint or film facings, these shall be present on the test specimen.

C-2.7 The test specimen is to be built by those suitably qualified in the construction of this type of structure.

C-2.8 The test specimen is to be installed in accordance with full and detailed drawings of the various elements of construction (including all jointing details and any framework required with attachment details) provided by the test sponsor.

C-3. Thermocouple Locations

C-3.1 Four thermocouples (see Figure C3.1 and C-3.2) are installed through the panels from the exterior such that the thermocouple junctions are located 3 (TC1), 5 (TC2) and 7 (TC3) ft (915, 1525 and 2135 mm) above the floor of the test room 3 in. (76 mm) from the adjacent interior wall surfaces above the exposure fire and 1 in. below the ceiling at the center of the 8 by 8 ft (2440 by 2440 mm) sample ceiling area (TC4). TC4 is to be installed regardless of whether or not a sample ceiling is to be installed.

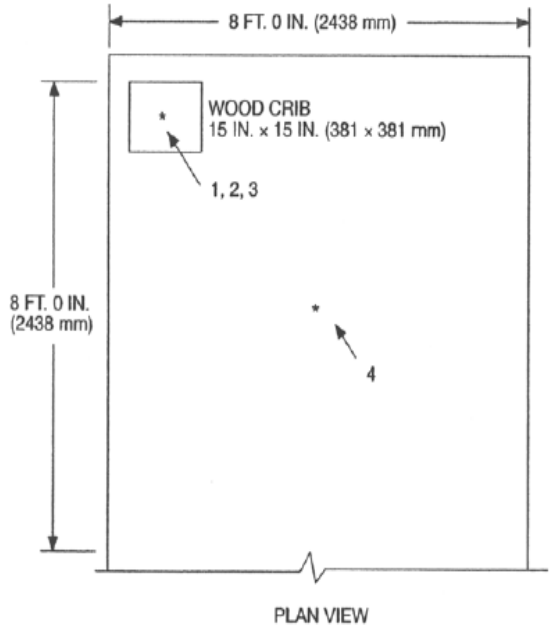

Figure C-3.1 Thermocouple locations

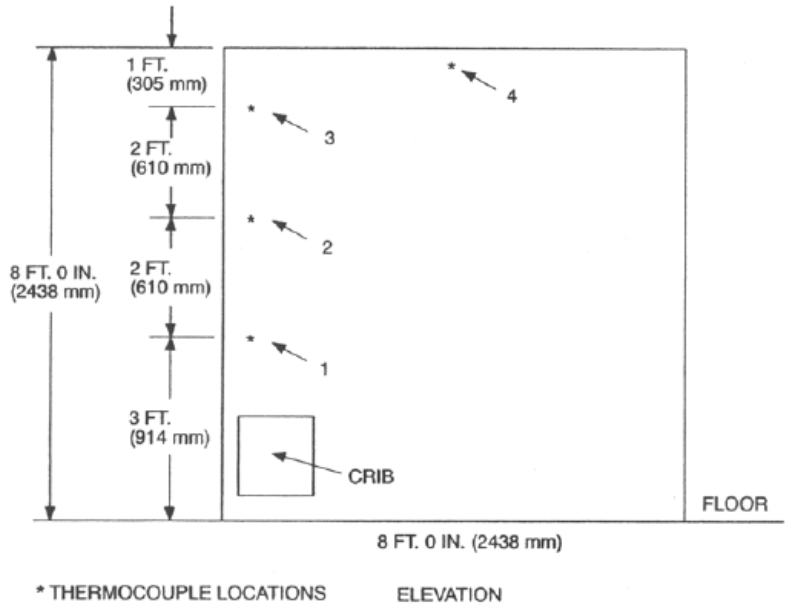

Figure C-3.2 Thermocouple locations

C-3.2 When installing thermocouples, the openings through which the thermocouples are inserted should be sealed, as these openings can influence the fire performance of the panels.

C-4. Test Procedure

C-4.1 Initial Conditions

C-4.1.1 After installing the test specimen per paragraph C-2, adjust the movable right and front walls and the two sections of the movable ceiling so that the finished interior of the room after sample installation is 12 ft. ± 1 in. (3660 ± 25 mm) long by 8 ft. ± 1 in. (2440 mm± 25) wide by 8 ft. ± 1 in. (2440 ± 25 mm) high.

C-4.1.2 The temperature at the start of the test in the room where the test room is located shall be between 60°F (16°C) and 90°F (32°C).

C-4.1.3 The fire pan, starter material and wood crib are placed into in the corner formed by the two sample cover walls as follows:

C-4.1.3.1 The fire pan (C-1.3) is placed so that it touches both sample walls.

C-4.1.3.2 One pound of shredded, fluffed wood excelsior (C-1.4. is spread over the fire pan and four ounces of reagent ethyl alcohol or absolute ethyl alcohol (C-1.4) are spread over the wood excelsior.

C-4.1.3.2 The weight and moisture content of a conditioned wood crib (C-1.5) shall be recorded before placing the wood crib on 4 half bricks over the starter materials in the fire pan so that the crib is at least 3 in. (75 mm) above the fire pan and 1 in. (25 mm) from both walls.

C-4.1.4 The test set-up is to be photographed or videotaped prior to testing.

C-4.2 Test

C-4.2.1 Start the data recorder and record data for a minimum of 2 minutes prior to ignition of the wood crib.

C-4.2.2 Ignite the starter material underneath the wood crib and leave the test room.

C-4.2.3 Make a photographic and a videotape record of the test. The video camera should be as low as possible and as close as possible to the doorway in the front wall (making provision for the safety of the cameral and operator) and should be aimed at the corner with the wood crib. The view from the cameral should include the entire door opening and 6 to 12 in. (150 to 310 mm) of the area immediately above the door.

C-4.2.4 During the test, observations and the time shall be recorded at which each occurs (usually directly to the video tape):

a) ignition of the specimen
b) spread of flame on surface of panels (if any)
c) openings, cracks, damage or gaps appearing in specimen
d) opening joints and flaming from joints
e) delamination, falling debris, flaming droplets
f) smoke intensity and color (visual)
g) flames emerging through doorway
h) flashover
i) any other unusual behavior

C-4.2.5 Conduct the test for 15 minutes from ignition of the starter material, until flashover occurs as indicated by flaming out the doorway or until the safety of test personnel is compromised, whichever occurs first, by extinguishing the fire with water from one or more hoses. Charring of the test panels must not be affected by the extinguishing procedure.

C-4.2.6 Examine the test panels furthest from the wood crib for charring of the face of the plastic or foam plastic after removing and interior metal facers.

C-4.2.7 Photograph and videotape the test specimen after the test has been terminated and the fire extinguished.

APPENDIX D: 16 FT (4.9 M) HIGH PARALLEL PANEL TEST

D-1. Test Equipment

D-1.1 The 16 ft (4.9 m) parallel panel test apparatus consists of two 192 in.(4875 mm) high by 42 in. (1065 mm) wide parallel panels 21 in. (535 mm) apart (face to face with test samples in place) and a 42 in. (1065 mm) long by 21 in. (535 mm) wide by 12 in. (305 mm) high sand burner located at the bottom of the panels under a 5 MW calorimeter with gas flow control equipment for the sand burner and smoke measurement equipment located in the exhaust duct for the 5 MW calorimeter.

D-1.2 The 16 ft (4.9 m) parallel panel test structure (Figure D.1) consists of two 210 in.(5335 mm) high by 42 in. (1065 mm) wide angle iron frames sheathed on one side with 1 in. (25 mm) thick Marinite I refractory over 1/2 in. (13 mm) thick plywood from the top of each frame to 18 in. (455 mm) above the bottom of each frame.

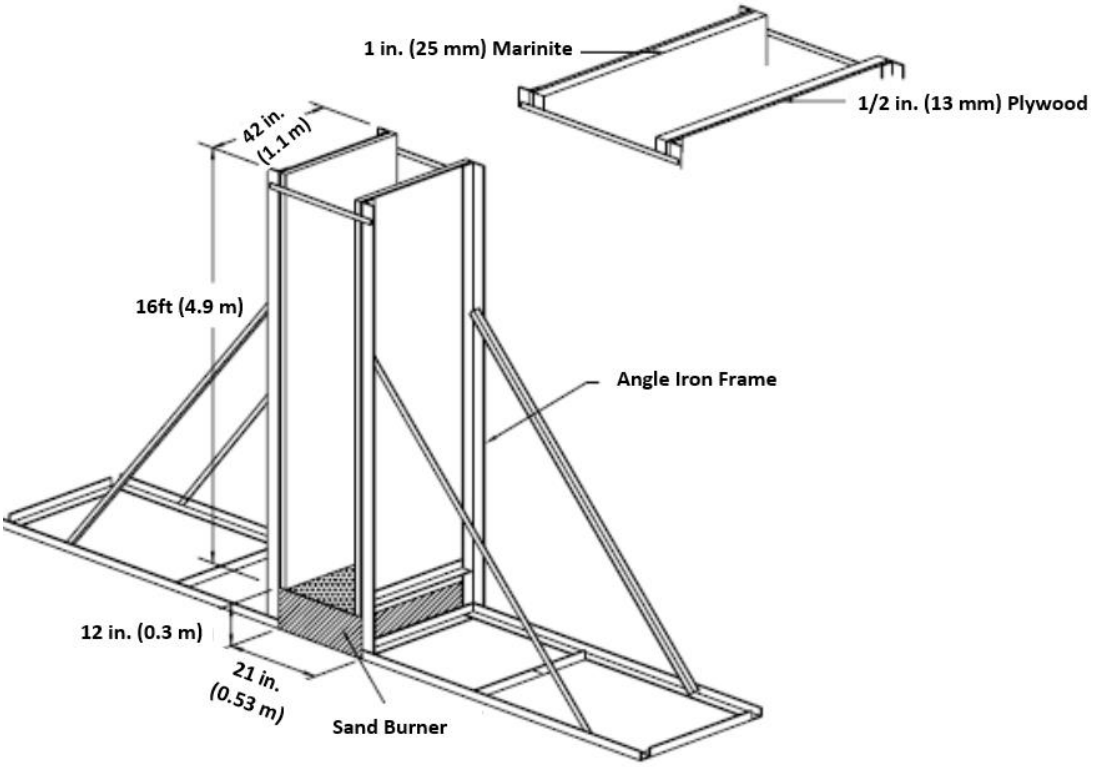

Figure D.1 – 16ft (4.9 m) parallel panel test structure

D-1.3 The ignition source is a 42 in. (1065 mm) long by 21 in. (535 mm) wide by 12 in. (305 mm) high sand burner (Figure D.2) connected to a flexible 2 in. (50 mm) diameter high pressure hose. The hose is connected through a gas flow control panel which is in turn connected to a 2 in. (50 mm) diameter propane gas line. The flexible 2 in. (50 mm) hose is connected through a reducer to a 1 in. (25 mm) stainless steel pipe burner at the entrance to the sand burner. There are 104 holes around the perimeter of the pipe burner. These 1/4 in. (6.4 mm) diameter holes are 1in. (25 mm) on center. The center of the pipe is located 2 in. (50 mm) above the bottom of the sand burner in the center of 4 in. (100 mm) airspace between the bottom of the sand burner and steel mesh with 3/16 in. (5 mm) holes on 5/16 in. (8 mm) staggered centers (33% open area). A 4 in. (100 mm) deep layer of crushed stone with an average size of 1 to 1.5 in. (25 to 38 mm) covers the steel mesh followed by a second steel mesh with 9/64 in. (4 mm) holes on 3/16 in. (5 mm) staggered centers (51% open area). A 2 in. (50 mm) deep layer of crushed stone with an average size of 1/4 to1/2 in. (6 to 13 mm) covers the second steel mesh and is

covered by a 30 mesh steel screen 0.012 in. (0.3 mm) wire size (40.8% open area) followed by a 2 in. (50 mm) deep layer of sand with an average diameter of 0.038 in. (1 mm).

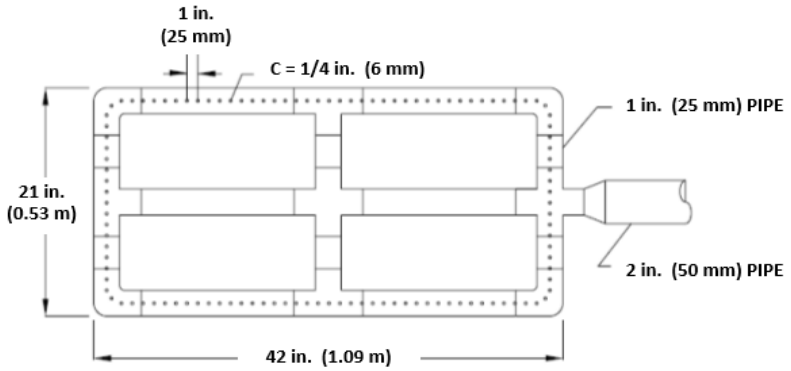

Figure D.2 - Top view of pipe burner

D-1.4 The output of the sand burner is set by controlling the propane gas flow rate to the burner with a gas flow control panel. The propane is to be of commercial grade with a minimum of 85% propane content. The 2-in. main gas supply pipe providing propane at 20 psi is connected to a tee which splits the gas line into two 1 in. piping systems. There are two Hasting flow meters, each controlling flow through one of the 1 in. piping systems. The Model 305 flow meter has a range of 0 to 600 SLPM of propane while the Model 301 flow meter has a range of 0 to 260 SLPM of propane. The Model 305 flow meter is used with the Model 301 flow meter blocked using a by-pass valve. An "Easy-Read" 1-in. control needle valve controls the gas flow to maintain the specified burner output of 360 ± 10 kW. After leaving the control valve, the gas supply is connected to the intake of the sand burner with a 500 psi rated 2-in. diameter flexible hose.

D-1.5 Data recorder - data logger capable of recording and storing duct thermocouple data, gas flow meter data, smoke measurement data and mass flow in the duct of the 5 MW calorimeter at intervals not exceeding 0.1 second, and able to provide both electronic and hard copies of the data.

D-1.6 Timing device - stopwatch or clock with 1 second divisions or equivalent.

D-2. Test Sample

D-2.1 One test assembly is required.

D-2.2 Samples are mounted to cover the 1 in. (25 mm) thick Marinite I refractory on the two 210 in.(5335 mm) high by 42 in. (1065 mm) wide angle iron frames to 18 in. (455 mm) above the bottom of each frame. Samples are to be installed in a manner that is typical of actual practice as much as possible. The following sample installations are intended to illustrate the principles to be used during sample installation as specific installation methods cannot be realistically anticipated.

D-2.2.1 Interlocking insulated composite panels with metal or plastic facers are through fastened through the Marinite I into the plywood with fasteners at intervals typical of actual practice following the manufacturer's instructions and include a central vertical joint the full length (192 in.) of both frames. Horizontal joints may be included but are not required. Vertical joints and horizontal joints (if included) are to

be finished as they are in field installations. The long dimension of such wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. Panel edges on the top, bottom and both sides must be enclosed with 16 gauge stainless steel channel such that any vaporized or liquefied material is forced out of the central seam on the panel. The stainless steel channel is welded at all connections, except the top.

D-2.2.2 Thin plastic materials that are intended to be adhered to a masonry or gypsum board substrate are adhered to gypsum board with the adhesive and/or adhesive tapes used in field installations following the manufacturer's instructions and include a central vertical joint the full length (192 in.) of both frames. Horizontal joints may be included but are not required. Vertical joints and horizontal joints (if included) are to be finished as they are in field installations. The long dimension of such wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. Panel edges on the top, bottom and both sides must be enclosed with 16 gauge stainless steel channel such that any vaporized or liquefied material is forced out of the central seam on the panel. The stainless steel channel is welded at all connections, except the top The test panels may be through fastened through the Marinite I into the plywood to prevent sagging of thermoplastic samples during the test.

D-2.2.3 Thin plastic materials that are intended to be mechanically fastened to either a noncombustible substrate or to noncombustible framing are secured through the Marinite I to the plywood with fasteners at intervals typical of actual practice following the manufacturer's instructions and include a central vertical joint the full length (192 in.) of both frames. Horizontal joints may be included but are not required. Vertical joints and horizontal joints (if included) are to be finished as they are in field installations. The long dimension of such wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. Panel edges on the top, bottom and both sides must be enclosed with 16 gauge stainless steel channel such that any vaporized or liquefied material is forced out of the central seam on the panel. The stainless steel channel is welded at all connections, except the top

D-2.3 The test assembly shall be installed on the test structure as required above and allowed to condition for up to 28 days.

D-3. Test Procedure

D-3.1 The temperature in the test room at the start of the test shall be between 32°F and 95°F (0°C and 35°C).

D-3.2 The mass flow through the exhaust duct of the 5 MW calorimeter is established before the test and maintained during the test at 20 kg/s (19 - 23 kg/s).

D-3.3 Thermocouple, mass flow through the exhaust duct, propane mass flow, calorimetry and smoke obscuration readings shall be recorded for 120 seconds prior to the test, during the 900 seconds of the test and for 300 seconds after the test at intervals not exceeding 0.1 second.

D-3.4 A video recording of the test specimen shall be made prior to, during and after the test.

D-3.5 Digital color photographs of the test specimen shall be taken prior to the test, at maximum 60 second intervals during the test, and after the smoke has cleared and the test assembly has cooled.

D-3.6 Detailed observations of the test specimen shall be written and/or recorded before the test, at significant events during the test, and after the smoke has cleared and the test assembly has cooled.

D-3.7 The propane supply is activated and set to the required 251 SLPM. The propane exiting the burner is ignited by means of a hand-held propane torch positioned above the sand burner. Time 0 is taken as the moment the sand burner ignites. The test shall continue for 15 minutes (900 s) after ignition of the sand burner at which time the propane flow to the sand burner is deactivated. Any burning panels are extinguished with water 5 minutes (300 s) after the propane supply is deactivated.

APPENDIX E: 25 FT (7.6 M) HIGH CORNER TEST

E-1. Corner Test Structure

E-1.1 The wall framework (see Figure E.1) consists of columns and horizontal girts to which sample wall panels or sample coating or finish substrates are attached. The roof/ceiling framework consists of steel bar joists and metal furring strips to which sample ceiling or roof/ceiling assemblies, sample coating or finish substrates or a standard ceiling are attached.

E-1.1.1 The east (long) wall frame is 51 ft 6 in. (15.70 m) long, the south (short) wall frame is 39 ft 3 in. (11.96 m) long. The distance between the concrete floor and the bottom of the ceiling furring strips is 24 ft 9 in. (7.54 m).

E-1.1.2 The ceiling frame extends 31 ft 6 in. (9.60 m) west from the east wall along the entire length of the wall. Additional ceiling framing extends 15 ft 9 in. (4.80 m) north from the westernmost 7 ft 9 in. (2.36 m) of the south wall.

E-1.1.3 For tests intended to evaluate wall assemblies only, 0.0179 in. (0.045 mm) thick corrugated steel form deck shall be secured to the underside of the ceiling frame furring strips and 1 in. (25 mm) perlite roof insulation installed between the furring strips over the form deck.

E-1.1.4 For tests intended to evaluate ceiling assemblies only, 0.0179 in. (0.045 mm) thick corrugated steel form deck shall be installed over the entire inside surfaces of both wall frames with the long dimension vertical. Two layers of ½ in. (13 mm) thick gypsum wallboard shall be installed over the form deck full height out to 12 ft (3.66 m) from the corner created by the intersection of the walls, 36 in. (915 mm) from the ceiling down from 12 ft (3.66 m) out to 16 ft (4.88 m) and 12 in. (305 mm) from the ceiling down from 16 ft (4.88 m) out to 38 ft (11.58 m) on the south wall and 50 ft (15.24 m) on the east wall.

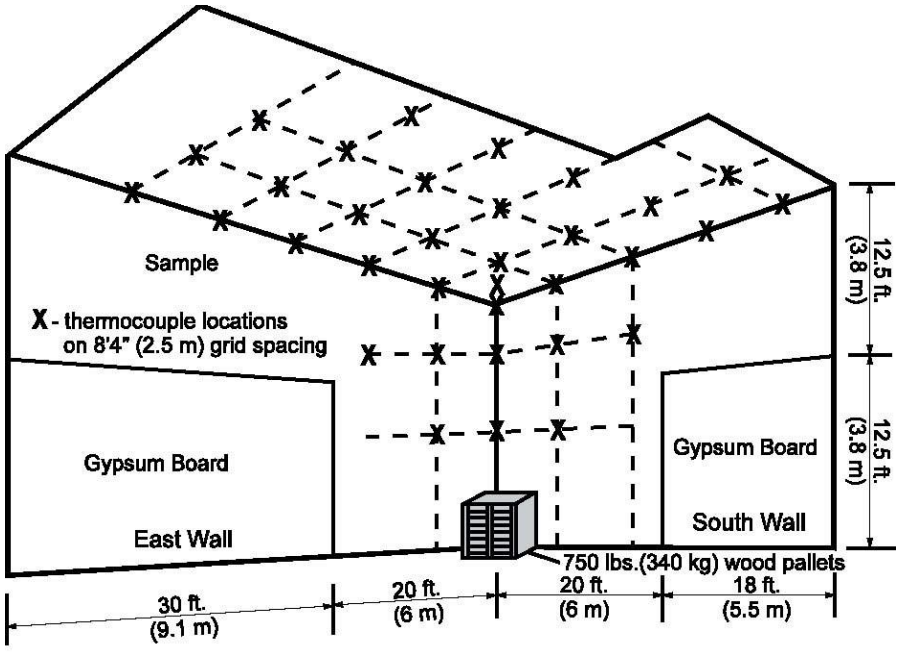

Figure E.1 25ft (7.6 m) Corner Test Structure

E-2. Sample Mounting

E-2.1 To provide an uninterrupted test surface, samples are installed on the inside of the corner test structure. For many test constructions, this will result in the unconventional location of structural members.

E-2.2 0.0179 in. (0.045 mm) thick corrugated steel form deck shall be installed over the entire inside surfaces of both wall frames and the entire bottom surface of the ceiling frame with the long dimension vertical on both walls and parallel to the south wall on the ceiling. Where interlocking insulated panels with minimum 0.0179 in. (0.045 mm) thick steel or aluminum facers are to be installed, the form deck may be omitted.

E-2.3 Samples shall be mounted to cover the wall frames full height out to 20 ft (6.10 m) from the corner created by the intersection of the sample walls and half height from the ceiling down from 20 ft (6.10 m) out to 38 ft (11.58 m) on the south wall and 50 ft (15.24 m) on the east wall. 5/8 in. (16 mm) thick gypsum wall board (Type X core) shall be mounted to cover the remaining lower sections of both walls. Samples or a standard ceiling (see 1.1.3) shall be mounted to cover the ceiling frame in the 30 by 50 ft (9.14 by 15.24 m) area adjacent to the east wall and in the 15 by 8 ft (4.57 by 2.44 m) area adjacent to the last 8 ft (2.44 m) of the south wall.

E-2.3.1 Interlocking insulated panels with minimum 0.0179 in. (0.045 mm) thick steel or aluminum facers shall be through fastened directly to the wall and ceiling (if applicable) framing at intervals typical of actual practice. The long dimension of wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. The long dimension of roof/ceiling assemblies shall be parallel to the south wall.

E-2.3.2 Interlocking insulated panels with plastic facings shall be through fastened through the steel form deck to the steel wall and ceiling (if applicable) framing at intervals typical of actual practice. The long dimension of wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. The long dimension of roof/ ceiling panels shall be parallel to the south wall.

E-2.3.3 Insulations with less than 0.0179 in. (0.045 mm) thick steel or aluminum facers, plastic interior finish panels, plastic exterior panels and substrates for interior or exterior finish systems or wall/ceiling coating systems shall be installed over2x2in.(51x51mm) wood furring strips fastened through the steel form deck to the steel wall and ceiling (if applicable) framing. The spacing and orientation of furring strips and securement to the furring strips shall be typical of actual practice. Interior or exterior finish systems or wall/ceiling coating systems shall be installed over the installed substrate in a manner typical of actual practice.

E-2.4 Panel end joints and panel joints at both ceiling/wall intersections shall be covered with 0.0239 in. (0.61 mm) thick sheet metal closures.

E-3. Procedure

E-3.1 Test samples shall be installed on the test structure as required above and allowed to cure for up to 28 days.

E-3.2 20 ga. (0.81 mm) Chromel-Alumel thermocouples shall be installed at the locations indicated in Figure E-1, 1 in. (25 mm) from the test assembly wall and ceiling surfaces.

E-3.3 Within 1 hour of the start of the test, 750 ±10 lb (340 ±4.5 kg) of 42 by 42 in. (1065 by 1065 mm) conditioned oak pallets shall be checked for moisture and weight. Moisture content shall be 6 ±1% as measured by a resistance type moisture meter. The pallets shall be stacked maximum 5 ft (1.5 m) high at the intersection of the assembly walls, 1 ft (305 mm) from each wall. Pallets necessary to meet the mass requirement that would result in violation of the maximum height shall be placed vertically adjacent to the north side of the pallet stack in contact with the stack or the next pallet.

E-3.4 The stack of pallets shall be ignited using two cellucotton rolls soaked in 8 oz. (0.24 L) of gasoline in a plastic bag placed inside the bottom pallet in the stack. The test shall continue for 15 minutes after ignition of the gasoline soaked cellucotton or until flames reach any of the limits of the corner test structure, whichever occurs first.

E-3.4.1 Thermocouple readings shall be recorded during the test at intervals not exceeding 10 seconds.

E-3.4.2 A video recording of the test structure shall be made prior to, during and after the test.

E-3.4.3 Photographs of the test structure shall be taken prior to the test, at maximum one minute intervals during the test, and after the smoke has cleared and the test assembly has cooled.

E-3.4.4 Detailed observations of the test structure shall be written and/or recorded before the test, during the test, and after the smoke has cleared and the test assembly has cooled.

E-3.5 Venting through the walls or roof/ceiling shall not occur during the test. The graphs of the thermocouple readings shall be inspected for locations with sudden temperature drops if venting is suspected. Confirmation of venting shall be made by examination of the test structure after termination of the test and cooling of the test structure.

APPENDIX F: 50 FT (15.2 M) HIGH CORNER TEST

F-1. Corner Test Structure

The wall framework consists of vertical and horizontal steel framing to which sample wall panels or sample coating or finish substrates are attached. The roof/ceiling framework consists of a grid of steel framing to which sample ceiling or roof/ceiling assemblies, sample coating or finish substrates or a standard ceiling are attached.

Both wall frames are 20 ft (6.10 m) long forming a 90 degree angle where they intersect. The distance between the concrete floor and bottom of the ceiling framing grid is 50 ft 0 in. (15.24 m). See Figure F-1.

The ceiling frame forms a right isosceles triangle with two 20 ft (6.10 m) long sides adjacent to the wall frames. See Figure F-1.

For tests intended to evaluate wall assemblies only, 0.0179 in. (0.045 mm) thick corrugated form deck shall be secured to the underside of the ceiling frame furring strips and 1 in. (25 mm) perlite roof insulation installed between the furring strips over the form deck.

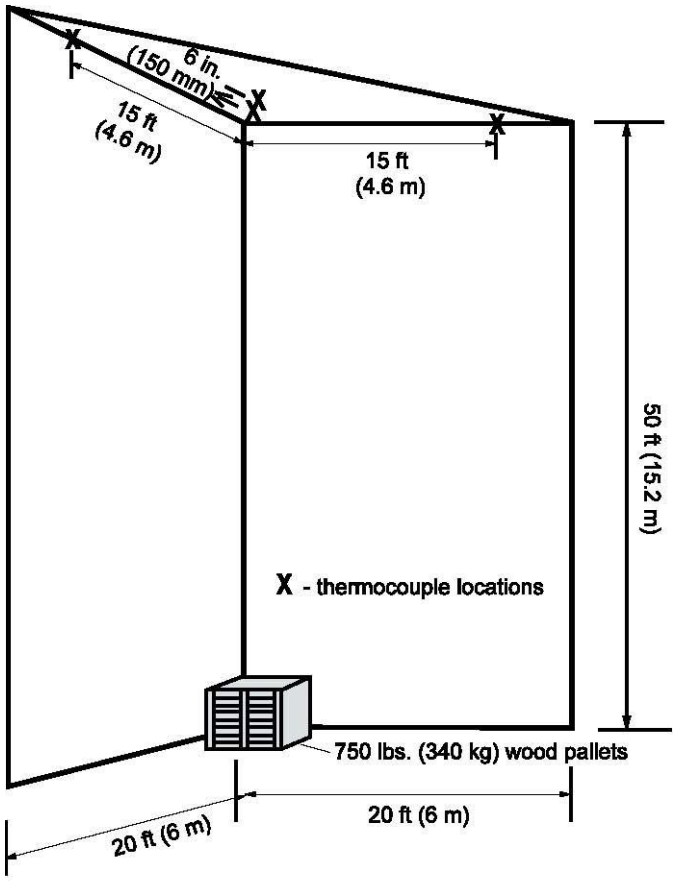

Figure F.1 50 ft (15.2 m) Corner Test Structure

F-2. Sample Mounting

F-2.1 To provide an uninterrupted test surface, samples are installed on the inside of the corner test structure. For many test constructions, this will result in the unconventional location of structural members.

F-2.2 Corrugated steel form deck, 0.0179 in. (0.45 mm) thick, shall be installed over the entire inside surfaces of both wall frames and the entire bottom surface of the ceiling frame with the long dimension vertical on both walls and parallel one wall on the ceiling. Where interlocking insulated panels with minimum 0.0179 in. (0.045 mm) thick steel or aluminum facers are to be installed, the steel form deck may be omitted.

F-2.3 Samples shall be mounted to cover the wall frames full height out to 20 ft (6.10 m) from the corner created by the intersection of the sample walls. Samples or a standard ceiling (see Section D.1 above) shall be mounted to cover the ceiling frame in the triangular area adjacent to the walls.

F-2.3.1 Interlocking insulated panels with minimum 0.0179 in. (0.45 mm) thick steel or aluminum facers shall be through fastened directly to the steel wall and ceiling (if applicable) framing at intervals typical of actual practice. The long dimension of wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. The long dimension of roof/ceiling panels shall be parallel to one wall.

F-2.3.2 Interlocking insulated panels with plastic facings shall be through fastened through the steel form deck to the steel wall and ceiling (if applicable) framing at intervals typical of actual practice. The long dimension of wall panels shall be vertical unless the panels are normally installed in actual practice with their long dimension horizontal. The long dimension of roof/ ceiling assemblies shall be parallel to one wall.

F-2.3.3 Insulations with less than 0.0179 in. (0.45 mm) thick steel or aluminum facers, plastic interior finish panels, plastic exterior panels and substrates for interior or exterior finish systems or wall/ceiling coating systems shall be installed over 2 by 2 in. (51 by 51 mm) wood furring strips fastened through the steel form deck to the steel wall and ceiling (if applicable) framing. The spacing and orientation of furring strips and securement to the furring strips shall be typical of actual practice. Interior or exterior finish systems or wall/ceiling coating systems shall be installed over the installed substrate in a manner typical of actual practice.

F-2.4 Panel end joints and panel joints at both ceiling/wall intersections shall be covered with 0.0239 in. (0.61 mm) thick sheet steel closures.

F-3. Procedure

F-3.1 Test samples shall be installed on the test structure as required above and allowed to condition for up to 28 days.

F-3.2 20 ga. (0.81 mm) Chromel-Alumel Thermocouples shall be installed at the following locations: 1 in. (25 mm) from the ceiling surface and 1 in. (25 mm) from the wall surface 15 ft (4.57 m) from the corner in both directions and 1 in. (25 mm) from the ceiling 6 in. (150 mm) and 12 in. (305 mm) from the corner in the plane bisecting the corner.

F-3.3 Within 1 hour of the start of the test, 750±10 lb (340±4.5 kg) of 42 by 42 in. (1065 by 1065 mm) conditioned oak pallets shall be checked for moisture and weight. Moisture content shall

be 6 ± 1% as measured by a resistance type moisture meter. The pallets shall be stacked maximum 5 ft (1.5 m) high at the intersection of the assembly walls, 1 ft (305 mm) from each wall. Pallets necessary to meet the mass requirement that would result in violation of the maximum height shall be placed vertically adjacent to the north side of the pallet stack in contact with the stack or the next pallet.

F-3.4 The stack of pallets shall be ignited using two cellucotton rolls soaked in 8 oz. (0.24 L) of gasoline in a plastic bag placed inside the bottom pallet in the stack. The test shall continue for 15 minutes after ignition of the gasoline soaked cellucotton or until flames reach any of the limits of the corner test structure, whichever occurs first.

F-3.4.1 Thermocouple readings shall be recorded during the test at intervals not exceeding 10 seconds.

F-3.4.2 A video recording of the test structure shall be made prior to, during and after the test.

F-3.4.3 Photographs of the test structure shall be taken prior to the test, at maximum one minute intervals during the test, and after the smoke has cleared and the test assembly has cooled.

F-3.4.4 Detailed observations of the test structure shall be written and/or recorded before the test, during the test, and after the smoke has cleared and the test assembly has cooled.

F-3.5 Venting through the walls or roof/ceiling shall not occur during the test. The graphs of the thermocouple readings shall be inspected for locations with sudden temperature drops if venting is suspected. An examination of the test structure for evidence of venting shall be made after termination of the test and cooling of the test structure if venting is suspected.