PLASTICS IN CONSTRUCTION

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1.0 SCOPE

This data sheet provides recommendations on the use, construction, and fire protection for select plastic building materials and their application, with respect to interior fire exposure, unless otherwise noted. This data sheet does not include natural hazard exposures and recommendations.

Examples of topics included in this data sheet are, but not limited to, the following:

- Single layer panels, including fiberglass reinforced (FRP) and polyvinyl chloride (PVC)
- Foil-faced insulation boards
- Insulated metal panels with polyurethane, polyisocyanurate and polystyrene cores
- Spray-applied foams
- Plastic skylights and plastic light bands
- Insulation on metal storage tanks containing noncombustible contents
- Polystyrene Geofoam
- Elastomeric insulations
- Insulated wall curtains

See Section 4.1 for other data sheets that could provide design information and guidance for plastics in construction. A list of FM Approval standards is provided by topic but is not considered all inclusive.

1.1 Hazards

The use of plastic materials in construction can provide many advantages over traditional construction materials (steel/wood/concrete), due to their lighter weight, cleanability and ability to resist decomposition, corrosion, or rust. The increased use of plastics is likely to continue.

While plastic construction materials can be beneficial, all plastic materials are combustible and burn with varying degrees of intensity. When plastic burns, it can produce copious amounts of thick black smoke. Some plastic products, such as PVC, also produce an acid byproduct that can be carried by smoke particles and deposited on surfaces. Surfaces such as electronics or metal components can be damaged by the deposition of these corrosive particles leading to increased cleanup time.

A false sense of fire safety may be provided by complying with building code requirements when it comes to plastic materials. Many of the fire tests required by building codes do not adequately test plastic products based on actual installation or performance in a fire.

Using FM Approved materials is a way to ensure resiliency in building design, as FM Approved materials will not propagate a fire. FM Approved materials are also available for use in smoke sensitive occupancies.

1.2 Changes

October 2026. Interim revision. The data sheet has been modified by relocating information related to specific categories of exterior wall assemblies and fire testing information to Data Sheet 1-64, *Exterior Wall Assemblies* and Data Sheet 1-4, *Construction Fire Tests*, respectively.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 General

2.1.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

2.1.2 When using FM Approved products or materials, provide sprinkler protection for the occupancy in accordance with the applicable data sheet.

2.1.3 Replace non-FM Approved materials where practical with FM Approved materials, including partial replacement or as part of repairs.

2.1.4 Protect existing non-FM Approved materials in accordance with this data sheet.

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2.1.5 Provide a thermal barrier, per Table 2.1.5-1, over exposed foam plastics (polyurethane, polyisocyanurate, polystyrene) or replace with FM Approved materials. The use of an intumescent paint is not considered a thermal barrier.

Table 2.1.5-1. Thermal Barrier and Sheathing Materials[1]

Material	*Thickness*	*Special Considerations and/or Fastening*
Thermal Barriers[2]		
Gypsum Board	½ in. (13 mm)	• Fasten per manufacturer recommendations (e.g., 16 fasteners per 4 ft x 8 ft [1.2 m x 2.4 m] board) or 1 fastener per 2 ft^2 (0.18 m^2). • Cover joints with tape and joint compound. • An alternative to taped joints is metal batten bars (minimum 1/2 in. [13 mm] overlap of joint) secured through the gypsum board into the substrate at maximum 3 ft (0.9 m) on center.
FM Approved Coatings[3]	In accordance with FM *Approval Guide* (for material to be covered)	
Portland Cement (e.g., stucco)	½ in. (13 mm)	• Secure metal lath to the substrate or structure. • Apply Portland cement over metal lath.
FM Approved Spray Applied Coatings[3]	In accordance with FM *Approval Guide*	• Not permitted in occupancies susceptible to an accumulation of combustible or oily deposits. • Do not use cellulose-based coatings in high humidity occupancies.
Sheathing materials		
Steel	26 gauge (0.5 mm)	• Provide sprinklers based on this data sheet or the occupancy specific data sheet, whichever is greater. Provide fastening per the data sheet.
Aluminum	0.032 in. (0.8 mm)	
Cement board	Minimum of ¼ inch	• Fasten directly into support structure every 16 in. (40 cm) on center
FM Specification Tested MCM panel		• Provide sprinklers adequate for the occupancy.

Note 1. Thermal barriers and sheathing must be in direct contact with plastic foam insulations. Use unfaced fiberglass or mineral wool to fill any voids. Thermal barriers are not a substitute for sprinklers required for the occupancy. Existing insulated metal panels are considered sheathed if they meet the minimum sheathing thickness requirements.
Note 2. When using a thermal barrier, the need for sprinklers is based on the occupancy.
Note 3. Some FM Approved coatings are not considered thermal barriers. Review Approval standards to determine if sprinklers are required as part of the Approval.

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2.1.6 Protect concealed spaces containing plastic materials with sprinklers, using the ceiling sprinkler protection in Table 2.1.6-1. See FM Loss Prevention Data Sheet 1-12, *Ceilings and Concealed Spaces*, for additional criteria.

Table 2.1.6-1. Ceiling Sprinklers, Perimeter Ceiling, and Intermediate Wall Sprinklers Design and Location[1]

Design Criteria for Ceiling Sprinklers			
Ceiling Sprinklers: Provide a minimum ceiling density of 0.2 gpm/ft^2 (8 mm/min) over 2,000 ft^2 (186 m^2)			
Design Criteria for Perimeter ceiling and intermediate wall sprinklers[2]			
	Number of Levels	Min. Design Flow per Sprinkler	Design Number of Sprinklers
Perimeter Ceiling Sprinklers (quick response sprinklers installed next to the wall) Needed for all ceiling heights	One	20 gpm [76 L/min] (all except EPS core)	10 sprinklers (all except EPS core)
Intermediate Wall Sprinklers (quick response sprinklers). In addition to perimeter ceiling sprinklers are needed for Ceiling heights greater than 30 ft (9.1 m)	One	20 gpm (76 L/min)	10 sprinklers
	Two or more	20 gpm (76 L/min)	20 sprinklers 14 sprinklers on top level and 6 sprinklers on next lower level
Location of Perimeter Ceiling and intermediate wall sprinklers			
Perimeter Ceiling Sprinklers	Locate perimeter ceiling sprinklers at the ceiling and within, 2 ft +/-3 in. (60 cm +/- 8 cm) from all walls and corners. Space a maximum of 10 ft (3 m) apart and stagger between sprinklers located in the main field of the ceiling sprinkler system. See Data Sheet 2-0, Installation Guidelines for Automatic Sprinklers, regarding spacing and mitigation.		
Intermediate Wall Sprinklers	Locate between the ceiling and floor every 30 ft (9.1m) or less vertically and a maximum of 1 ft (0.3 m) from the wall. For ceiling heights greater than 30 ft (9.1m), evenly space intermediate lines vertically, and not to exceed 30 ft (9.1 m) between lines). Place sprinklers under mid height supports or horizontal wall girts. If mid height supports or wall girts are not provided, use in-rack sprinklers with water shields.		

Note 1. Balance perimeter ceiling sprinklers or intermediate wall sprinkler system demands with ceiling protection, in-rack systems, and hose stream demand.
Note 2. Perimeter ceiling and intermediate wall sprinklers are based upon the installation of upright or pendent sprinklers.

2.1.7 Provide ceiling sprinklers, plus perimeter ceiling and intermediate wall sprinklers, per Table 2.1.6-1 when recommended elsewhere in this data sheet.

2.1.8 Installation of dry sprinkler system to protect plastic construction materials is acceptable when water delivery time does not exceed 30 seconds.

2.1.9 Provide a hose stream allowance of 250 gpm (950 L/min) in all designs for a minimum duration of 60 minutes.

2.2 Plastics in Construction

2.2.1 Insulated Metal Panels

A primary goal of this data sheet is to ensure insulated metal panel construction does not add fuel to an occupancy fuel load by ensuring the panel remains intact to work with sprinkler protection. Insulated metal panel protection and joint securement, plus sprinkler protection is provided to minimize the opportunity of fire getting behind the metal panel facing and into the foam insulation. Specifically:

- The metal facing will remain intact to cover the foam insulation.

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- Sprinklers operate quickly to control the fire.
- Panel securement keeps the panel in place and connected to the structure.
- Joints remain connected and intact to prevent fire entry

2.2.1.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4881, *Class 1 Exterior Wall Systems*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*

2.2.1.2 Protect existing non-FM Approved insulated metal panels with either polyurethane or polyisocyanurate core by meeting the following criteria:

- Provide sheathing materials per Table 2.1.5-1.
- Provide ceiling sprinklers, perimeter ceiling and intermediate wall sprinklers per Table 2.1.6-1.

2.2.1.3 When existing polyurethane or polyisocyanurate core non-FM Approved insulated metal panels are installed on the walls only and the occupancy does not require sprinkler protection, provide perimeter ceiling, and intermediate wall sprinklers per Table 2.1.6-1.

2.2.1.4 When existing non-FM Approved polyurethane or polyisocyanurate core insulated metal panels are installed on the ceiling only, provide ceiling sprinklers per Table 2.1.6-1.

2.2.1.5 Secure existing non-FM Approved insulated metal panel walls with either polyurethane or polyisocyanurate core in accordance with 2.2.1.7 **and** one of the options in Table 2.2.1.8, if applicable.



Fig. 2.2.1.5. Angles provided for securement

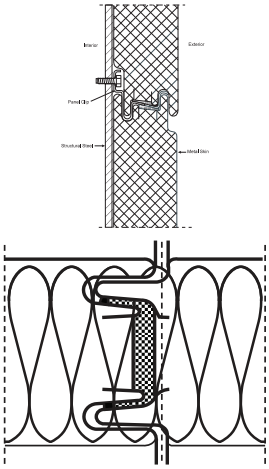
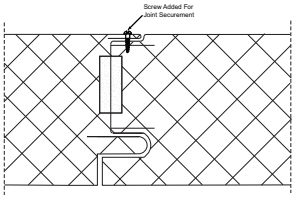
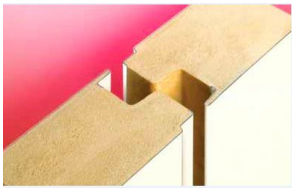
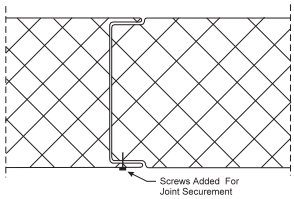
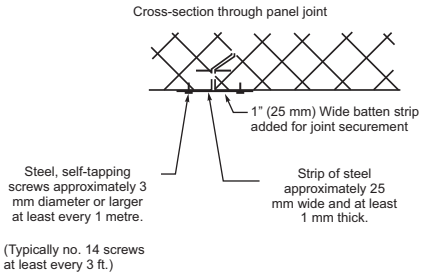
2.2.1.6 Protect existing non-FM Approved polystyrene core insulated metal panels by providing a thermal barrier in accordance with Table 2.1.5-1.

2.2.1.7 Secure insulated metal panels in accordance with Data Sheet 1-64, *Exterior Wall Assemblies*, by through fastening (bolts or screws), including at the intermediate level. If panels are not secured at the intermediate level, provide joint securement per this data sheet.

2.2.1.8 Provide joint securement per Table 2.2.1.8 when not secured in accordance with Data Sheet 1-64, *Exterior Wall Assemblies*, or as recommended elsewhere in this data sheet.

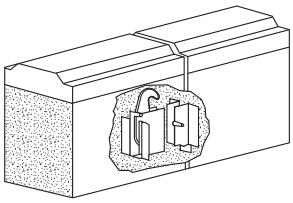
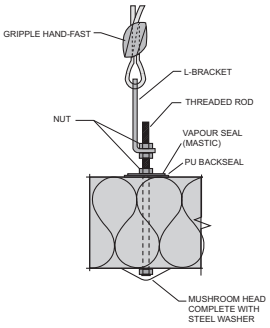
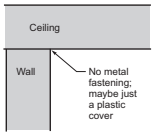
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Table 2.2.1.8. Panel Joint Securement Options

Type of Joint or Securement	*Examples*	*Securement Guidance*
Double Tongue & Groove or double overlap		No additional fastening required.
Single Tongue & Groove		**> 30 ft (9.1 m) in height:** Secure joints with self-tapping No. 6 screws (approximately 3 mm diameter) every 10 ft (3 m) vertically.
Overlap		**> 30 ft (9.1 m) in height:** Secure joints with self-tapping No. 6 screws (approximately 3 mm diameter) every 3 ft (0.9 m) vertically.
Butt Joint		**> 10 ft (3 m)** Provide a metal batten strip (minimum 1 in. [25 mm] wide) overlapping the joint on each side by at least ½ in. (13 mm). Secure in place on both sides of the joint vertically every 3 ft (0.9 m) using self-tapping metal screws No. 6 screws (approximately 3 mm diameter).

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Table 2.2.1.8. Panel Joint Securement Options (cont'd)

Type of Joint or Securement	*Examples*	*Securement Guidance*
Cam Locks		**> 30 ft (9.1 m) in height:** Secure joints per this table.
Ceiling Grid	 Above fastening of an insulated metal panel ceiling.  Figure on the left shows the ceiling sitting on top of the wall. It may or may not be secured. The use of angles at the top and bottom will provide wall securement up to 30 ft (9.1 m) in height. Beyond 30 ft (9.1 m) intermediate wall securement is necessary.	Secure the ceiling for the particular joint, a minimum of 10 ft (3 m) horizontally from the wall/ceiling intersection. Securement to the structure can be completed with threaded rod, wire or cable hanging system, angled steel or other structural system that will ensure the panel remains in place. This is accomplished by connecting the securement to the roof or floor framing or structure. No further assessment of the ceiling (> 10 ft [3 m]) is needed, if provided with adequate sprinkler protection.

2.2.1.9 Avoid the use of exposed plastic securement systems. For thermal bridging use a metal fastener with a thermal plastic sleeve (See Figure 2.2.1.9).

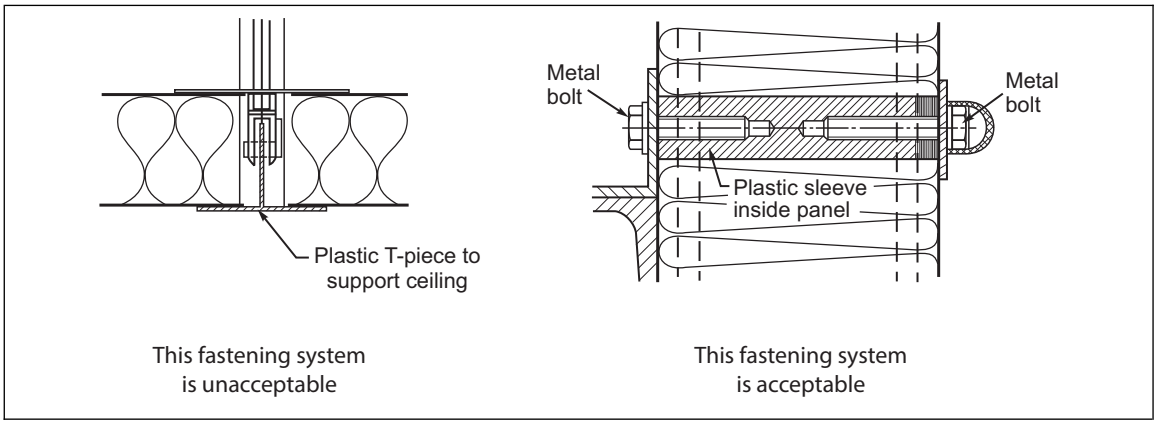


Fig. 2.2.1.9. Plastic securement components – acceptable and not acceptable

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2.2.1.10 Arrange the insulated metal panels to avoid obstructed or concealed spaces.

2.2.1.11 For existing non-FM Approved insulated metal panels with either polyurethane or polyisocyanurate core construction creating concealed spaces, provide adequate ceiling sprinkler protection. For shielded spaces, provide additional sprinkler protection to provide adequate water spray. Design sprinkler protection per Table 2.1.6-1 or a greater density per the appropriate data sheet if combustibles are present in the concealed space.

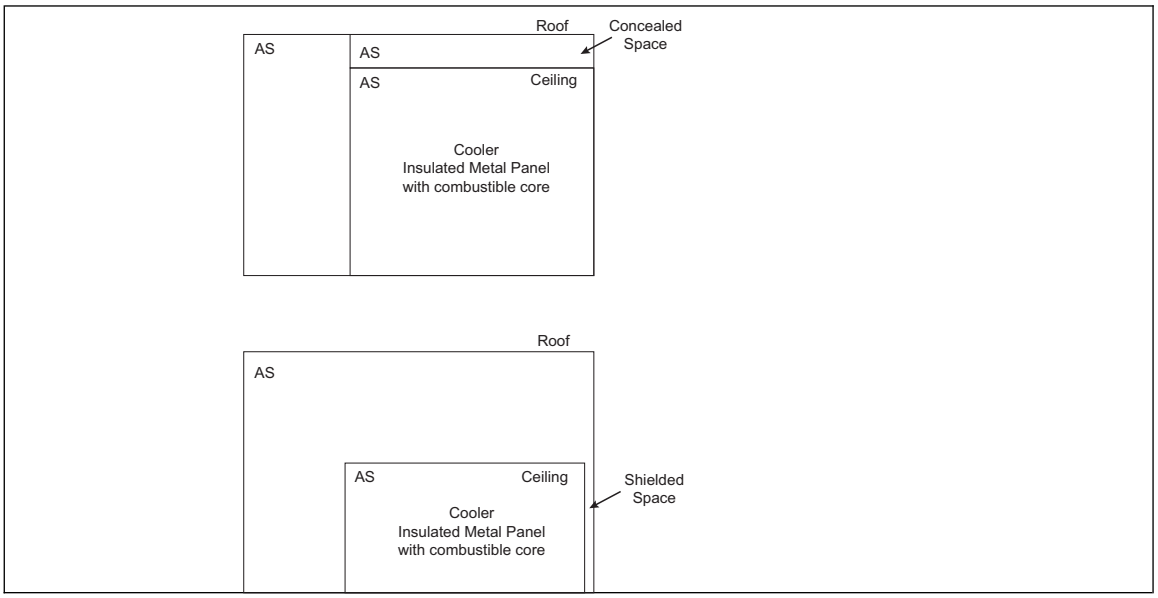


Fig. 2.2.1.11. Section view of concealed or shielded spaces in a building

2.2.2 Foil Faced Insulation Boards and Small Walk-in Coolers

Foil Faced Insulation Boards

2.2.2.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*

2.2.2.2 Provide a thermal barrier over foil-faced polystyrene insulation boards in accordance with Table 2.1.5-1.

2.2.2.3 For existing non-FM Approved construction limit foil faced insulation boards made of polyurethane or polyisocyanurate to less than 2 in. (50 mm) in thickness and installed on the ceiling only. Provide ceiling sprinklers per Table 2.1.6-1.

Small Walk-In Coolers

2.2.2.4 Small walk-in coolers less than 10 ft (3 m) high and 1,000 ft^2 (93 m^2) in plan area with varying heights of unobstructed space above may be protected in accordance with this section. Protect larger walk-in coolers in accordance with Section 2.2.1 for insulated metal panels.

2.2.2.5 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive* Occupancies

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2.2.2.6 Provide sprinkler protection inside the cooler based on the appropriate data sheet for the occupancy.

2.2.2.7 Provide ceiling sprinkler protection over the walk-in cooler and extending 20 ft (6 m) beyond. Design ceiling protection per Table 2.1.6-1 or the surrounding occupancy.

2.2.3 Single Layer Unbacked FRP or PVC Panels

2.2.3.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

- FM Approval 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM Approval 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*
- FM Approval 4910, *Cleanroom Materials*

2.2.3.2 Secure existing non-FM Approved single layer unbacked FRP or PVC panels to the structural framing system with corrosion-resistant metal fasteners. Provide at least two fasteners per panel and one every 16 in. (40 cm) in width (horizontally), along all structural members.

2.2.3.3 For existing non-FM Approved single layer FRP or PVC panels provide ceiling sprinklers, plus perimeter ceiling and intermediate wall sprinklers per Table 2.1.6-1.

2.2.3.4 Provide a specially designed escutcheon plate around ceiling sprinklers to provide protection from deforming PVC ceiling panels. Design escutcheon plates to meet the following criteria:

- Construct the plate from stainless steel, a minimum of 1/16 in. (1.6 mm) thick
- Ensure minimum outside diameter of 6.5 in. (195 mm) and inside diameter of 2.6 in. (80 mm)
- Secure the plate to the backing material with a minimum of four evenly spaced screws

2.2.4 Single Layer Backed FRP or Backed PVC Panels

2.2.4.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*
- FM 4910, *Cleanroom Materials*

2.2.4.2 Protect existing non-FM Approved single layer FRP or PVC panels installed on noncombustible backing with ceiling sprinklers, plus perimeter ceiling and intermediate wall sprinklers in accordance with Table 2.1.6-1.

2.2.4.3 Provide a specially designed escutcheon plate around ceiling sprinklers to provide protection from deforming PVC ceiling panels. Design escutcheon plates to meet the following criteria:

- Construct the plate from stainless steel, a minimum of 1/16 in. (1.6 mm) thick.
- Ensure minimum outside diameter of 6.5 in. (195 mm) and inside diameter of 2.6 in. (80 mm).
- Secure the plate to the backing material with a minimum of four evenly spaced screws.

2.2.4.4 Mechanically fasten non-FM Approved panels to a noncombustible backing using corrosion-resistant metal fasteners. Drive fasteners through the single layer panel into the noncombustible backing at 16 in. (406 mm) on center, resulting in a total of 18 fasteners (3 along the short side and 6 along the long side of a 4 ft x 8 ft (1.2 m x 2.4 m) panel. Provide metal batten bars overlapping the joints by ½ in. (13 mm) on each side. Secure the batten bar on both sides of the joint vertically every 3 ft (0.9 m) using No. 6 (approximately 3 mm) self-tapping metal screws.

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2.2.5 Double Layer FRP/PVC Panels and Insulated FRP/PVC Panels

2.2.5.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive* Occupancies
- FM 4884, *Panels Used in Data Processing Center Hot and Cold Aisle Containment Systems*
- FM 4910, *Cleanroom Materials*

2.2.5.2 Replace existing non-FM Approved double layer FRP or PVC panels (two panels with an air space between) and insulated single layer FRP or PVC panels with FM Approved panels or noncombustible panels. An alternative is to provide a thermal barrier per Table 2.1.5-1.

2.2.6 Spray Applied Foam

Treat spray applied products such as polyurethane, icynene and other spray-applied insulation products the same.

2.2.6.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM 4881, *Class 1 Exterior Wall Systems*
- FM 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*
- FM 4910, *Cleanroom Materials*
- FM 4924, *Pipe and Duct Insulation*

2.2.6.2 Protect existing non-FM Approved exposed spray applied foam with a thermal barrier per Table 2.1.5-1 or sheathing and sprinklers in accordance with Tables 2.1.5-1 and 2.1.6-1.

2.2.6.3 When using spray applied foam roof covers, use FM Approved materials (FM Approval 4470). See Data Sheet 1-15, *Roof-Mounted Solar Photovoltaic Panels*, for exterior fire exposure from roof mounted solar panels when using spray applied foam roof covers.

2.2.7 Plastic Light Bands and Skylights

2.2.7.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approvals Examination Standards:

- FM 4431, *Skylights*

2.2.7.2 Replace non-FM Approved PMMA (acrylic) or non-FR-treated FRP for wall light bands. The flammability characteristics (low critical heat flux) show these materials are easy to ignite and rapidly spread fire.

2.2.8 Insulated Wall Curtains

2.2.8.1 Use noncombustible or FM Approved products for new installations and install in accordance with the listing.

FM Approvals Examination Standards:

- FM 4883, *Insulated Wall Curtains*

2.2.8.2 Replace existing non-FM Approved insulated wall curtains containing polyethylene bubble wrap with FM Approved insulated wall curtains.

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2.2.8.3 Protect existing non-FM Approved insulated wall curtains ≤ 30 ft (9.1 m) high with perimeter ceiling sprinklers on both sides in accordance with Table 2.1.6-1.

2.2.8.4 Provide at least 10 ft (3 m) of clearance to any storage and manufacturing on both sides of non-FM Approved insulated wall curtain.

2.2.8.5 Do not install non-FM Approved insulated wall curtains greater than 30 ft (9.1 m) in height.

2.2.8.6 Do not install non-FM Approved insulated wall curtains under combustible ceiling construction.

2.2.8.7 Do not install non-FM Approved insulated wall curtains against walls.

2.2.9 Acoustical Panels

Acoustic panels are strategically placed in rooms to improve sound quality by absorbing or mitigating background noise transmission. These panels can be made from impregnated fiberglass, polyurethane foams, PET, polyester, tectum material or recycled plastic. Avoid acoustical sound panels constructed of plastic materials.

For Anechoic Chamber panels, see Data Sheet 1-53, *Anechoic Chambers*.

2.2.9.1 For new installations use noncombustible or limited combustible materials for acoustical panels, provide sprinklers and do not obstruct sprinklers. Do not use plastic materials, such as PET (polyethylene terephthalate) or polyester.

2.2.9.2 Replace existing acoustical panels if constructed of plastic materials, such as covered foams, PET or polyester.

2.2.10 Cellulosic Insulation

Cellulosic insulation sprayed on walls and ceilings is treated similar to other combustible insulations. Do not use in high humidity areas or occupancies that would allow for an accumulation of combustible deposits on the surface. This section does not cover cellulosic insulation blown into attics.

2.2.10.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approval Standard:

- FM Approval 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*

2.2.10.2 Cover existing non-FM Approved cellulosic insulation with a thermal barrier in accordance with Tables 2.1.5-1 or sheathing material per Table 2.2.10.2-1 and sprinklers per Table 2.1.6-1.

2.2.10.2.1 Cover existing non-FM Approved cellulosic insulation with a FM Approved fire-retardant coating and install in accordance with the listing.

Table 2.2.10.2-1. Sheathing Material Securement for Cellulosic and Elastomeric Insulations

Sheathing Material	*Fastening Criteria[1]*
Steel minimum of 26 gauge (0.5 mm)	• Overlap sheathing materials material or joints with batten bars by at least 1 in. (25 mm) • Fasten sheathing or batten bars vertically every 3 ft (0.9 m) on center. Fasten batten bars on both sides of the joint
Aluminum 0.032 in (0.8 mm)	

Note 1. Ensure there are no voids from wrapping or overlapping materials. Add extra fasteners, as necessary.

2.2.11 Elastomeric Insulation

2.2.11.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approved Standards:

- FM Approval 4910, *Cleanroom Materials*

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- FM Approval 4924, *Pipe and Duct Insulation*

2.2.11.2 Replace existing non-FM Approved elastomeric insulation with FM Approved products or materials

2.2.12 Insulation of Outdoor and Indoor Metal Storage Tanks with Noncombustible Contents

2.2.12.1 Use noncombustible or FM Approved products for new installations and install FM Approved products in accordance with their listing.

FM Approved Standards:

- FM Approval 4880, *Class 1 Fire Rating of Building Panels or Interior Finish Materials*
- FM Approval 4881, *Class 1 Exterior Wall Systems*
- FM Approval 4882, *Class 1 Interior Wall and Ceiling Materials or System for Smoke Sensitive Occupancies*

2.2.12.2 For existing non-FM Approved installations provide a thermal barrier in accordance with Table 2.1.5-1.

2.2.13 Polystyrene Geofoam Fill

2.2.13.1 Protect Polystyrene Geofoam materials with a layer of aggregate material. Do not leave Polystyrene Geofoam exposed.

2.2.13.2 Do not install or use Polystyrene Geofoam fill blocks in areas exposed to:

- High-water table
- 100-year or 500-year flood zone or
- Storm water runoff collection areas

See Data Sheet 1-40, *Flood*, for additional information

2.2.13.3 See Data Sheet 1-35, *Vegetative Roof Systems, Occupied Roof Areas and Decks* for guidance when installing Polystyrene Geofoam as part of a vegetative roof.

2.2.14 Metal Composite Material (MCM) Interior Wall Panels

2.2.14.1 Use noncombustible, FM Approved products or FM Specification Tested materials for new installations and install FM Approved products in accordance with their listing.

FM Specification Tested Materials:

- Building Materials, FM Approvals Cleanroom Materials Flammability Test Protocol (Class Number 4910) - (e.g., MCM Interior Wall Panels).

2.2.14.2 Provide sprinklers for the occupancy.

2.2.15 FRP Grating

2.2.15.1 Sprinkler protection is not necessary if the only combustible material is an FRP grating for walkways.

2.2.16 Polyester Batt Insulating Materials

2.2.16.1 Protect vertical unfaced polyester batt insulation with a thermal barrier or sheathing in accordance with Table 2.1.5-1 and ceiling sprinklers per Table 2.1.6-1.

2.2.17 Heating, Ventilation and Air Conditioning (HVAC) Systems

FM Approvals Examination Standards:

- FM 4924, *Pipe and Duct Insulation* (exterior of duct)
- FM 4925, *Fabric Ducts and Insulation Lined HVAC Ducts* (interior of duct, including anti-microbial or other materials)

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2.2.17.1 Use noncombustible or FM Approved products for new ductwork installations, including liners. Install FM Approved products in accordance with their listing.

The installation of noncombustible or FM Approved products includes the insulation and liners installed on either the exterior or interior of ducts.

The use of anti-microbial, acrylic or other coatings can substantially change the fire performance. Ensure these coatings have been tested as part of an FM Approved product.

2.2.17.2 Do not use prefabricated or pre-insulated ducts.

2.2.17.3 Fabric Ducts

2.2.17.3.1 Fabric ducts can be a potential obstruction to ceiling sprinkler discharge during a fire. Install fabric ducts as close to the ceiling as possible and centered between adjacent sprinklers. See Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*, for additional recommendations.

2.2.17.4 Combustible Filters Used in HVAC Systems

2.2.17.4.1 Provide sprinkler protection in large combustible filter systems with capacities of 5,000 ft^3/min (142 m^3/min) or greater. Arrange the sprinklers to wet the entire surface of the filters. Provide drainage to a safe location, if necessary.

2.2.17.5 Fire Protection of HVAC Ducts

2.2.17.5.1 Provide protection in accordance with Table 2.2.17.5 for non-FM Approved ducts, fabric ducts, exterior insulation and liners based upon their hazard.

Table 2.2.17.5. Fire Protection for HVAC Duct Systems

Class A (FM Approved or metal)*	*Duct with Interior Fire Hazard (nonmetallic or ducts with linings)*	*Duct with Exterior Fire Hazard (fabric ducts /exterior insulation)*	*Prefabricated or Pre-Insulated Ducts or Similar*
	• Provide fire and smoke dampers actuated by duct smoke detectors to limit fire and smoke, and • Provide interior sprinklers (8 sprinklers operating at 15 gpm [57L/min]).	• Provide exterior ceiling sprinklers per Table 2.1.6-1.	• Replace material or: • Provide fire and smoke dampers actuated by duct smoke detectors to limit fire and smoke, and • Provide exterior ceiling sprinklers per Table 2.1.6-1.
* Duct is metal with no insulation, or liners. Follow other guidance, as applicable, in Data Sheet 1-57, *Plastics in Construction*. See Data Sheet 5-40 for additional guidance on smoke detector placement/installation.			

2.2.17.6 Provide screens for fresh air intakes when required by Data Sheet 9-19, *Wildland Fire*.

2.2.18 Phenolic Insulation (Reserved)

2.3 Operations and Maintenance

2.3.1 Maintain thermal and sheathing material barriers free of punctures, holes or other damage that exposes the insulation.

2.3.2 Repair thermal barriers and sheathing materials by placing a similar material or a metal plate over the damaged area. If using sheathing materials, overlap the damaged area by at least 1 in. (2.54 cm) and secure in place with self-tapping screws. Fill small penetrations with an FM Approved firestopping material.

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2.4 Human Factor

2.4.1 For buildings under construction, limit storage of plastic building materials, as outlined in Data Sheet 1-0, *Safeguards During Construction, Alteration, and Demolition*. Store any combustible materials away from building as outlined in Data Sheet 1-20, *Protection Against Exterior Fire Exposure*.

2.4.2 Do not use temporary fencing constructed of self-supporting steel and polystyrene panels.

2.5 Ignition Source Control

2.5.1 Do not conduct hot work around plastic construction materials since these areas are considered a high risk. Use the FM Hot Work Permit System to supervise hot work operations in accordance with Data Sheet 10-3, *Hot Work Management*.

2.5.2 Do not place electrical equipment directly on plastic construction materials or insulated metal panels. Provide a noncombustible material, such as gypsum board or cement board between the equipment and plastic construction materials or insulated metal panels. See Data Sheet 5-4, *Transformers*, 5-19 *Switchgear and Circuit Breakers*, 7-39, *Material Handling Vehicles*, for guidance on spacing and mounting on or near plastics or combustible construction.

3.0 SUPPORT FOR RECOMMENDATIONS

Plastics are commonly used in building construction and in some cases have certain advantages in particular uses. Non-FM Approved plastics are considered to be highly combustible. Once ignited, plastic material will burn vigorously and release large amounts of heat and black smoke. The smoke development and spread are as much a concern as the fire spread. While the use of sprinklers is important to control a fire, sprinklers are generally designed for occupancy fires and not for building construction materials. In some cases, the sprinklers, although activated may not be able to control the high heat release from burning plastic, allowing the fire to propagate faster than ceiling sprinklers can operate. This could result in extensive property damage or loss of an entire facility.

Many building codes and standards accept the use of plastic construction features subject to achieving an ASTM E84 flame-spread rating in the US and other small-scale tests in other countries. Many of these tests are used to determine flame spread in a small-scale test, and the results are not representative of the way a plastic material behaves in an actual fire. Consequently, claims for fire retardancy based on the ASTM E84 and other similar comparative tests should be disregarded.

Intumescent Paint Over Spray Polyurethane Foam

The use of intumescent paints over foam plastics is growing in the United States. The buildings codes allow this product to be installed over foam, as a barrier. We do not recognize the use of intumescent paints over foam for the following reasons:

- There is no FM Approved intumescent paint for use over foam plastics.
- It is a barrier product, not a thermal barrier. The paints are designed to provide a 10 to 15-minute barrier against ignition.
  - To be effective per the manufacturer testing, it requires a minimum wet film thickness. This thickness is generally not measured. At best it is based on gallons per square foot (sq m) of area.
- Typically, the paints do not adhere well over time. Some manufacturers require a primer to be used first.
- These are tested to NFPA 286, Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth or ISO 9705, Reaction to fire tests − Room corner test for wall and ceiling lining products, which is a room corner test. The ceiling height is 8 ft (2.4 m), which is usually much lower than installed.
- Any work that requires removal or cutting of the spray foam will require re-application of intumescent paint to protect it.

Burning Behavior of Plastics

Polyurethane can be supplied as prefabricated boards or can be sprayed-in-place; the end products are chemically the same. Polyurethane is produced by an exothermic reaction of a polyisocyanurate and a polyol

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resin. Increasing the ratio of polyisocyanurate to polyol resin and adding various catalysts produces polyisocyanurate foam, which contains varying amounts of polyurethane. The properties of spray-applied polyurethane can be affected by the application method and conditions at the time of application. Density can vary from 1.7 to 4 pcf (27.2 to 64 kg/m^3).

Polyurethane and polyisocyanurate are thermoset materials, which ignite in the range of 650°F to 1000°F (340°C to 525°C) and tend to burn and char. Dense, acrid smoke is produced, and flames may spread quickly across the material's surface.

Fire-retardant additives can markedly improve the performance of foamed plastic in comparative fire tests such as ASTM E84. Large-scale corner testing has indicated, however, that the performance of foamed plastic under actual fire conditions is not significantly affected by the use of these additives.

The use of inert facings, such as steel 26 gauge (0.032 in.) or aluminum (0.8 mm), in FM Approved polyurethane insulated panels will allow a properly formulated core to char when exposed to an ignition source. This charring helps protect the remaining foam and keeps fire propagation to within acceptable limits.

Polystyrene is a thermoplastic and will typically melt at temperatures lower than 400°F (205°C), forming an ignitable liquid. The peak rate of polystyrene decomposition and volatilization occurs around 687°F (364°C), and the vapor release will cause rapid flame spread across the exposed surface. Polystyrene does not tend to smolder or char.

Polystyrene has a heat content in the range of 16,000 to 18,000 Btu/lb (37-42,000 kJ/kg). As it melts, it forms an ignitable liquid pool fire; the amount of fuel available to a building fire from polystyrene products is directly related to the amount of polystyrene present. As with polyurethane, additives do not significantly affect the burning characteristics, except that they may delay ignition.

Polystyrene achieves a low flame-spread rating in many U.S. and international fire tests because of its tendency to shrink away from the small heat source. In larger fires, such as a fire involving a building's contents, polystyrene burns intensely with rapid flame spread across its surface and melts and flows like an ignitable liquid pool fire. As it burns, it generates thick, black smoke, leaving oily particles on exposed surfaces. For this reason, a relatively small fire involving polystyrene in food warehouses, freezers, or electronic equipment areas can result in contamination of a large area.

Expanded polystyrene typically is white with a bead-like structure molded to the desired shape with a density in the range of 1.0-1.25 lb/ft^3 (16-20 kg/m^3). Extruded polystyrene typically is blue, gray, pink or green with a more uniform (foam) texture and a density in the range of 1.8-2.0 lb/ft^3 (29-32 kg/m^3).

Polystyrene is commonly used for building insulation and ceiling panels. It is supplied as board stock at densities of 0.8 to 3.0 pcf (12.8 to 48.0 kg/m^3). Polystyrene boards often are used to insulate freezers and cold storage rooms. They usually are installed in one or more layers on walls, floors, and ceiling (or roofs).

3.1 Loss Experience

Losses involving plastic construction material from a recent 10-year period showed that FM clients had more than 106 fire losses involving plastic in construction with sprinkler protection that operated, and the average gross loss was US$5.7 million. In the same period, FM clients had 419 fires involving plastics in construction without sprinkler protection and the average gross loss dollar was US$8.56 million.

3.1.1 Illustrative Losses

3.1.1.1 A fire occurred at sprinklered testing lab, but the fire occurred in a non-sprinklered salt fog test chamber. The fire appears to have been caused by a portable charger undergoing testing. The salt fog test chamber was approximately 10 ft X 9 ft X 8.5 ft (3 m x 2.7 m x 2.5 m). The salt fog test chamber was constructed of insulated metal panels with polyurethane foam. The interior of the test chamber was lined with fiberglass reinforced plastic and contained PVC piping. Fire did not appear to involve the insulated metal panels and polyurethane foam. The fire involved the fiberglass reinforced plastic panels and PVC piping. Two suppression mode ceiling sprinklers operated outside the test chamber and helped contain the fire from spreading beyond the salt fog test chamber. The fire department fought the fire with hose streams and sprinklers for approximately two hours.

3.1.1.2 A fire occurred in this unsprinklered bio converter-composting plant. The fire was believed to have started in a fan. The post-composting building had polyurethane foam panels with a thin foil covering installed on the ceiling and walls. The polyurethane foam panels were installed 12 in. (30 cm) from the wall and roof,

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which created a void space. These panels and the void space played a crucial role in the fire spread. The noncombustible construction of adjacent buildings and lack of combustible loading helped limit fire spread to some of the adjacent buildings.

3.1.1.3 A fire occurred in this unsprinklered food manufacturing facility. The fire was believed to have started on a plastic conveying line. As the product proceeded into the cooling cell, which was constructed of insulated metal panels the fire spread. Additional combustible walls and plastic skylights contributed to the fire. The fire spread throughout the facility causing significant damage.

3.1.1.4 A fire occurred in this unsprinklered automatic nickel-plating line and adjacent buildings. The fire is believed to have started in or around the plastic tanks and baths. The fire was spread by the plastic ductwork and scrubber, to the combustible roof construction, insulated metal panels and plastic skylights. The installation of plastic construction materials significantly contributed to the fire spread.

3.1.1.5 A fire occurred in this unsprinklered food processing facility. The ceiling was constructed of fiberglass reinforced plastic panels attached to the underside of the steel roof joists. The roof is concrete on exposed steel and the walls are of concrete block. The equipment in the room was noncombustible. The fire started in the ductwork for the oven and spread igniting the fiberglass reinforced plastic panels attached to the underside of the steel joists. Prior to the arrival of the fire department, the fire was out because the panels were completely consumed. The fire did not spread further due to the noncombustibility in the area.

3.1.1.6 A fire occurred in this unsprinklered floor-covering products manufacturing facility. This manufacturing facility included: a spinning mill, tufting and weaving, dyeing, finishing and warehousing areas. The fire started in an enclosure constructed of FM Approved insulated metal panels, which did not extend to the roof deck leaving an opening to the building. The enclosure contained storage of waste rags, minor rack storage, old UPS (Uninterruptible Power Supply) batteries and old computer equipment. The fire started in this enclosure; the most probably cause was the storage of waste rags in a plastic bin. This facility was unattended over the weekend. The smoke detection operated around 1pm on Saturday, but the alarm was never transmitted and was discovered by an employee around 5 am on Sunday morning. The fire did not spread outside this enclosure. Other plastic materials melted adjacent, but did not ignite. The use of FM Approved panels, noncombustible roof and limited adjacent combustibles help prevent a devastating fire.

3.2 Plastics in Construction

3.2.1 Insulated Metal Panels

Metal-faced insulated panels can be deceiving because they may all look the same once installed. However, based on the actual construction they can react and behave very differently in a fire. Once installed, determining the insulation used in the core, type of joints and overall securement of the panels to the building structure is difficult. These are all important and can affect fire performance. The core, joint and securement to the building are all components and part of understanding the fire hazard.

3.2.1.1 Thermal, Sheathing Material Barriers Polyurethane, Polyisocyanurate, and EPS Foam Cores

The intent of a sheathing material in sprinklered applications is to delay ignition of the plastic core to allow sprinklers time to control a fire. In noncombustible occupancies, the thermal barrier (Table 2.1.5-1) allows non-FM Approved plastic building materials to remain in place without sprinkler protection.

Approved plastic building materials can remain in place without sprinkler protection.

Single layer plastic laminate sheets (FRP or PVC) can be adhered directly to a foam core, such as polystyrene, polyisocyanurate or polyurethane core, which will provide a clean, washable surface. The use of FRP or PVC laminate over the foam core does not provide a barrier. The laminate itself may be prone to rapid flame spread and the combination may be particularly hazardous. Occupancy sprinkler protection used in full-scale tests have been unable to control fires involving some plastic laminates on foam plastic.

When determining the core material, look for areas of damage and the color of the core material. If a sample needs to be cut from the insulated panel to determine the core, consider taking the sample over a joint. This will provide information about the joint and the insulation at the same time. Taking the sample over a joint will identify not only the insulation material used in the core but will clarify the type of joint used in the panels. This core sample can generally be taken using a drill and a 4-in. (10 cm) drill coring bit. Figure 3.2.1.1-1 is an example of a polyurethane foam, Figure 3.2.1.1-2 is an example of polystyrene and Figure 3.2.1.1-3 is an example of polyisocyanurate.

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Fig. 3.2.1.1-1. Polyurethane foam core example (usually a yellow color)



Fig. 3.2.1.1-2. Expanded Polystyrene Foam Core Example (usually white in color)

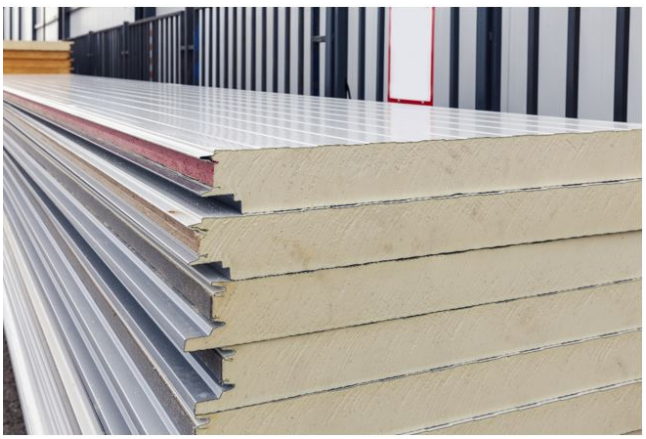


Fig. 3.2.1.1-3. Polyisocyanurate Foam Core Example (usually off-white in color)

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3.2.1.4 Concealed Spaces

3.2.1.4.1 (Reserved)

3.2.1.5 Foil Faced Insulation Boards

A thin aluminum foil is sometimes used to cover foam insulation boards, which are referred to as foil faced insulation boards. This thin foil can sometimes act as a barrier with a limited thickness of foam insulation. Foil faced polystyrene is not acceptable. Automatic sprinkler protection is necessary to protect foil faced foam.

3.2.2 Small Walk-in Coolers

Small walk-in coolers are typically installed inside of buildings, as a box-within-a-box arrangement. This generally leaves a large unobstructed space above the small walk-in cooler open to a ceiling sprinkler system. These coolers are generally limited in size, and typically no taller than 10 ft (3 m) high. The unobstructed space above small walk-in coolers can vary in size.

3.2.3 Single Layer Plastic Building Panels (FRP/PVC)

All plastic panels (FRP/PVC), whether treated with fire retardant or not, are combustible. Full-scale tests by FM showed that many non-FM Approved panels ignite easily and burn rapidly, producing intense flames and high ceiling temperatures, even with sprinklers. Single layer panels (unbacked) that burn through within approximately 2 minutes after ignition allow heat to escape. Once the temperature at the ceiling drops, flame propagation stops. Analysis of the successful tests indicates the following factors contributed to acceptable performance of unbacked panels:

- Backing: Backings prevent heat dissipation, negating the main method by which the rapid flame spread is usually controlled.
- Automatic sprinklers: Sprinklers slow the horizontal flame spread, lower ceiling temperatures, and provide rapid extinguishment after the heat is dissipated.
- Fire retardants: Even though the flame spread is initially very rapid, fire retardants prevent even faster spread. They also help burning to stall once the heat is dissipated.
- Panel thickness: Panels must be 1/16 in. (1.6 mm) or less and weigh approximately 8 oz/ft^2 (2.4 kg/m^2) or less. This combination allows for fairly rapid burn-through. Thicker sheets delay burn-through, generally resulting in more extensive flame spread.

A plastic panel laminated onto a gypsum board, wood, cellulose, or mineral board backing is not a sandwich panel but a backed plastic panel. Also, a thin film such as a vinyl of a few mils (not mms) thickness on a backer is considered to have the combustibility of the backer.

FRP/PVC panels are sometimes fastened using a drive rivet, which has a short mandrel that protrudes from the head. Once the drive rivet is inserted into a hole, the mandrel is driven in with a hammer or other implement to flare out the end of the rivet to provide securement.

Single layer or rigid plastic panels have been FM Approved for two end uses: interior finish materials and plastic building panels. Interior finish panels typically are used in the food processing industry. FM Approved interior finish materials consist of flat sheets that are installed over a noncombustible backing. Plastic building panels are popular in the papermaking and chemical process industries. Plastic building panels usually are corrugated and typically are fastened directly to the exterior of the building framing. These panels may be reinforced (FRP) or unreinforced (PVC based). They are not intended nor FM Approved for use against a backing.

Fiberglass reinforced panels are generally thin, flexible plastic panels made from resins reinforced with fiberglass. These can be installed by themselves or with a backing, such as gypsum board. These panels are available in a variety of colors and textures and are generally used in wet environments or areas required to be wet cleaned. FRP panels are commonly found in kitchens, restaurants, food processing plants, and cleanrooms.

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3.2.4 Single Layer Backed

3.2.4.1 (Reserved)

3.2.5 Double Layer FRP/PVC and Insulated FRP/PVC Panels

3.2.5.1 (Reserved)

3.2.6 Spray-Applied Foam

3.2.6.1 (Reserved)

3.2.7 Plastic Light Bands and Skylights

Light bands are typically installed to allow additional day light into manufacturing and storage buildings. These light bands are typically near the eave line and limited in vertical length.

3.2.8 Insulated Wall Curtains

3.2.8.1 Insulated wall curtains have two external faces and a core. Typically, the outside is constructed of a PVC, fabric, or similar facing material and a core material of polyester, thermoplastic bubble wrap, fiberglass, carbon fiber or other insulating material. These are commonly used as dividers in areas needing different temperatures (e.g., food processing) or to separate warehouse areas such as automatic storage and retrieval systems from areas that employees occupy. Insulated wall curtains may be used on a temporary or permanent basis, as a less expensive and more flexible alternative to constructing a solid wall or partition. Some insulated wall curtains provide access for forklifts and can have overhead doors installed. Insulated wall curtains are not expected to be installed along walls as extra insulation or in a room with a suspended ceiling.

3.2.9 Acoustical Panels

3.2.9.1 Virgin and recycled plastics (especially polyester and PET) are now being used for acoustical purposes. These plastic materials are required to pass ASTM E84 comparative testing. Due to the nature of this test, these materials easily pass. The ASTM E84 test does not accurately predict the fire spread in these materials and installations.

3.2.10 Cellulosic Insulation

Cellulose insulation is typically made by milling wastepaper, treating it with flame retardant chemicals (generally boric acid), mixing it with water, and spraying it onto a wall or ceiling. When installed on the walls or ceiling, spray-applied cellulosic insulation behaves similar to plastics and is therefore covered in this standard. Spray-applied cellulosic insulation can collect combustibles in the air turning a fire-retardant material into a combustible coating. Therefore, it should not be used in areas with fine oil mists (machine shops) which would impregnate the material.

Blown-in cellulosic insulation, typically found in attics, is not evaluated in this operating standard.

3.2.11 Elastomeric Insulation

Elastomeric insulation is commonly used to insulate water pipes or heating, ventilating and air condition pipes and/or ducts. Elastomeric insulation provides a great R value and is generally not affected by moisture. Elastomeric insulation is considered non-absorbent and fiber-free, so it resists mold growth.

3.2.12 Insulation of Outdoor and Indoor Metal Storage Tanks

Polyurethane and polystyrene can be used to insulate outdoor storage tanks. Tanks containing an ignitable liquid are not covered by this standard.

A fire involving tank insulation could raise the temperature of the contents and affect temperature-sensitive materials (i.e., wine, grape juice). This is especially a concern with polystyrene insulation which might fully burn away but create a pool fire. Slight changes in temperature can ruin contents (food products) even if the insulation chars and does not fully burn away.

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Instrumentation and process control equipment, along with its wiring, cables, cable trays, control tubing, and other components can receive damage due to fire exposure, which can result in an interruption to production.

3.2.13 Polystyrene Geofoam Fill

Polystyrene Geofoam blocks are made of polystyrene and are typically about 100 ft^3 (2.8 m^3) in size. These blocks are used for fill material in a variety of locations, such as tiered seating, courtyards, bridges, roof top parks, etc. They are lightweight and easy to move. These are far more inexpensive than normal fill materials. The typical block can be carried and placed by hand. The foam blocks are buoyant, so they present concerns when used below the water table, in a known flood zone, or in areas of storm water run-off.

3.2.14 Metal Composite Material (MCM) Interior Wall Panels

MCM interior walls are becoming popular in the clean room or pharmaceutical environment. These are easy to install, maintain and clean. Building codes require passing the ASTM E84 test. The use of MCM interior walls in clean room environment can lead to a large loss due to the smoke release associated with the plastic core materials. Use FM specification tested MCM panels for interior application.

3.2.15 Fiber-Reinforced Plastic (FRP) Grating

FRP grating is generally used in corrosive environments as walkways or equipment platforms where metal grating would corrode. FRP grating is tested to ASTM D635, *Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position*. Building codes require FRP grating to pass E84 testing, which is a comparative test, not indicative of fire performance.

3.2.16 Polyester Batt Insulation Materials

3.2.16.1 (Reserved)

3.2.17 Heating, Ventilation and Air Conditioning Systems

3.2.17.1 This data sheet applies to air duct systems that move air mechanically and are used for heating, cooling and ventilation. It does not apply to systems used for the removal of fumes, particulates or hazardous materials (see Data Sheet 7-78).

An air conditioning system consists of fans, ducts, controls, dampers, filters, intakes, and heating and/or cooling apparatus that remove used air from occupied spaces and recondition it. The air is then circulatedback to occupied spaces to provide comfort to occupants or to provide a specific set of environmental conditions within the conditioned space. The air conditioning system provides the simultaneous control of temperature, humidity, air motion, noise level, air cleanliness and quality of ventilation.

3.2.17.2 Fire and Smoke Hazards

The principal hazard associated with air-handling systems is the propagation of fire and/or smoke through the air movement channels.

3.2.17.2.1 Smoke in untenable concentrations can migrate to remote parts of a building in a matter of minutes via air-handling systems. On numerous occasions, fire has been confined to its area of origin with limited fire damage; but smoke has spread through the air conditioning system to other areas, causing extensive damage and hampering manual fire-fighting efforts. Central systems, therefore, have the potential to spread smoke far beyond the origin of the fire.

3.2.17.3 Pre-Fabricated and Pre-Insulated Ducts

3.2.17.3.1 Fibrous glass duct materials (a.k.a. pre-fabricated ducts) of low combustibility have previously been FM Approved. Some of the fire tests conducted on this material have shown that, under fire exposure, the duct will spread fire and collapse.

Prefabricated ducts can consist of low-density, noncombustible glass fibers and a small quantity of resin binder, preformed or prefabricated into units of circular and rectangular cross-sections, having an exterior jacket of aluminum foil or pigmented film. Today, prefabricated ducts can also be constructed of polyisocyanurate, phenolic or other combustible insulations, thereby increasing the fire hazard.

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Fig. 3.2.17.3-1. Pre-insulated board duct.

3.2.17.4 Fabric Ducts (Reserved)

3.2.17.5 Dampers (Reserved)

3.2.17.6 Ducts (Reserved)

3.2.17.7 Filters (Reserved)

3.2.18 Phenolic Insulation

Phenolic insulation is used for pipe insulation, roof insulation, and insulated wall panels. However, phenolic insulation can corrode metal products that touch it. As such is not appropriate as a roof insulation because of the metal roof fasteners.

4.0 REFERENCES

4.1 FM

Data Sheet 1-0, *Safeguards During Construction, Alteration and Demolition*
Data Sheet 1-4, *Fire Tests*
Data Sheet 1-12, *Ceilings and Concealed Spaces*
Data Sheet 1-17, *Reflective Wall and Ceiling Insulation*
Data Sheet 1-20, *Protection Against Exterior Fire Exposure*
Data Sheet 1-28, *Wind Design*
Data Sheet 1-29, *Roof Deck Securement and Above-Deck Roof Components*
Data Sheet 1-31, *Panel Roof Systems*
Data Sheet 1-64, *Exterior Wall Assemblies*
Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*
Data Sheet 3-26, *Fire Protection for Nonstorage Occupancies*
Data Sheet 7-6, *Heated Plastic and Plastic-Lined Tanks*
Data Sheet 7-7, *Semiconductor Fabrication Facilities*
Data Sheet 7-78, *Industrial Exhaust Systems*
Data Sheet 7-88, *Outdoor Ignitable Liquid Storage Tanks*
Data Sheet 8-1, *Commodity Classification*
Data Sheet 10-3, *Hot Work Management*

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4.2 Others

ANSI/ASHRAE/IES Standard 90.1, *Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings*.

ANSI/ASHRAE/IES Standard 90.2, *Energy-Efficient Design of Low-Rise Residential Buildings*.

British Standards Institute (BSI). BS 8414, *Fire Performance of External Cladding Systems*.

National Fire Protection Association (NFPA). NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*.

National Fire Protection Association (NFPA). NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*.

National Fire Protection Association (NFPA). NFPA 285, *Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components*.

Underwriters Laboratories (UL). UL 586, *Standard for High Efficiency, Particulate, Air Filter Units*.

Underwriters Laboratories (UL). UL 900, *Standard for Air Filter Units*.

APPENDIX A GLOSSARY OF TERMS

Approval Guide: An online resource of FM Approvals that lists FM Approved products and services.

Backed: Any solid material, combustible or noncombustible, to which plastic interior finish materials are applied. Examples are FRP, or PVC panel adhered or mechanically fastened to plywood, gypsum board or FM Approved insulation board.

Barrel vault: A curved roof light. Typically, the vertical rise is 1/6 of the span.

Cast: The term used to describe the solid form of PMMA sheet material. The manufacturing process is either continuous cast or cell cast.

Ceiling sprinklers: (As referenced in FM Data Sheet 1-57) A sprinkler system installed at the ceiling level, providing the minimum density outlined in Table 2.1.6-1.

Cement board: A combination of cement and reinforcing fibers formed into sheets.

Double glazed: Two sheets of material separated by an air gap and assembled as a roof light unit, e.g., double glazed barrel vault roof light.

Elastomeric insulation: A polymer with the property of elasticity. The term is often used interchangeably with the term rubber and has a primary use for seals, adhesives, and molded flexible parts.

Expanded polystyrene (EPS) insulation: A rigid foam-plastic insulation made from small polystyrene beads that are expanded with steam and fused together.

Extruded polystyrene (XPS) insulation: A rigid, foam-plastic insulation known for its high compressive strength, which is manufactured by melting polystyrene and compressing it into board form. Expanded polystyrene (EPS) insulation: A rigid foam-plastic insulation made from small polystyrene beads that are expanded with steam and fused together.

FM Approved: Products and services that have satisfied the criteria for FM Approval. Refer to the *Approval Guide*, an online resource of FM Approvals, for a complete listing of products and services that are FM Approved.

Free standing sandwich panel: Panel systems that do not use separate structural supports. Typically used for walk-in coolers/freezers constructed within a building, they often incorporate locking devices within the panel joints (see Figure A-1). The ceiling panels, however, may be suspended on rods.

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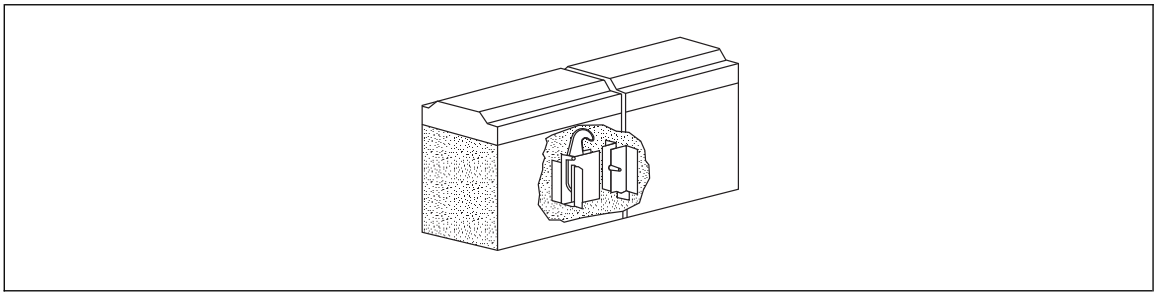


Fig. A-1. Cooler panel locking joint (Courtesy of Mid-South Industries)

Foamed plastic: Materials including polyurethane, polyisocyanurate, foamed melamine, phenolic foam, and EPS.

FRP: Fiberglass reinforced plastic, one type of interior finish or building panel consisting of a glass reinforcement and resin. FRP is a thermoset material. In some countries this is referred to as GRP (glass reinforced plastic).

Geofoam: A lightweight polystyrene product used in place of fill (usually obtained in 4 ft X 4 ft X 8 ft [1.2 m X 1.2 m X 2.4 m] pieces). Geofoam is light enough to be placed without the use of machinery.

Gypsum board: A product mainly composed of gypsum as its core with a paper facing on both sides of the core. Gypsum provides a natural fire resistive material. (See ASTM C11, *Standard Terminology Relating to Gypsum and Related Building Materials and Systems* for more information).

Intermediate sprinklers: (As referenced in FM Data Sheet 1-57) A wall-mounted sprinkler system installed between the ceiling sprinklers and the floor level, providing the minimum requirements outlined in Table 2.1.6-1.

Limited combustible: A material meeting one of the following (1) or (2) conditions:

(1) The material meets criteria a and either b or c below.

a. The material, in the form in which it is used, exhibits a potential heat value not exceeding 3,500 Btu/lb (8141 kJ/kg) when tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials*; and

b. The material shall have a structural base of noncombustible material with a surface coating not exceeding a thickness of 1/8 in (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials* (e.g., gypsum board with a paper facing) or

c. The material shall be composed of materials that in the form and thickness used neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested with ASTM E84. The composition of all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84.

(2) Where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter*, at an incident heat flux of 75 kW/m^2 for a 20-minute exposure, and both the following conditions are satisfied.

a. The peak heat release rate shall not exceed 150 kW/m^2 for longer than 10 seconds.
b. The total heat released shall not exceed 8 MJ/m^2.

Metal insulated panel: A sandwich panel that forms the building envelope (outside surface of the building) or can be used for internal wall partition. A foam core is faced with a metal panel on both sides. They are secured to horizontal and/or vertical structural members. Compare to free-standing sandwich panels.

Multi-wall: Used to describe acrylic and polycarbonate extruded sheet materials that have a cellular structure. The most common type is twin wall, which is extruded in thicknesses ranging from 0.24 to 0.64 in. (6 to 16 mm) thick. Multi-wall can be extruded as tri-wall, four-wall, five-wall, and six-wall in thicknesses up to 1.4 in. (35 mm) thick.

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Noncombustible material: A material that complies with any one of the following:

(1) The material, in the form in which it is used, and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.

(2) The material is reported as passing ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*.

(3) The material is reported as complying with the pass/fail criteria of ASTM E136, *Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer*, at 750°C.

Northlight: The glazed section of a saw-tooth roof. It is referred to as a northlight in the northern hemisphere, as the glazed section points approximately north to avoid direct sunlight entering the building.

PC: Polycarbonate. This is made in extruded multi-wall and solid sheet form.

Perimeter sprinklers: (As referenced in FM Data Sheet 1-57) A sprinkler system installed at the ceiling level within 2 ft (60 cm) +/- of the wall, providing the minimum requirements outlined in Table 2.1.6-1.

PET: Polyethylene terephthalate. Made only in a solid sheet form.

Plastic building panel: Plastic building panel: a rigid plastic sheet (fiber reinforced plastic, polycarbonate, or PVC), usually corrugated, applied to the exterior of the structural framing without backing. It forms the building envelope; see Figures A-2 and A-3. Compared to plastic interior finish material.

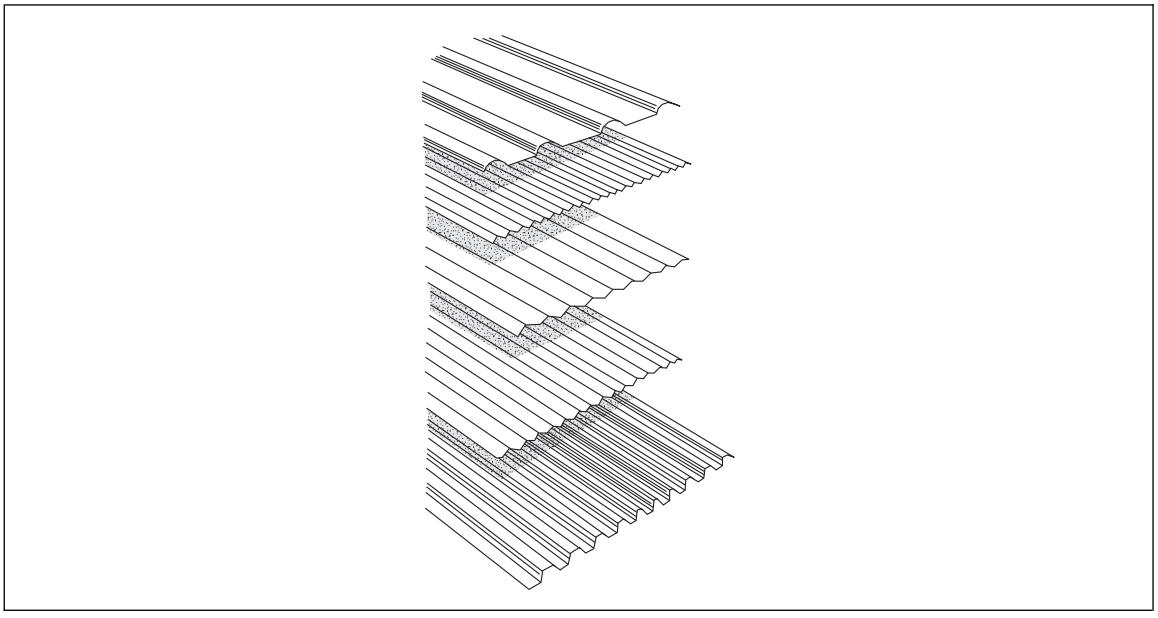


Fig. A-2. Typical plastic building panels

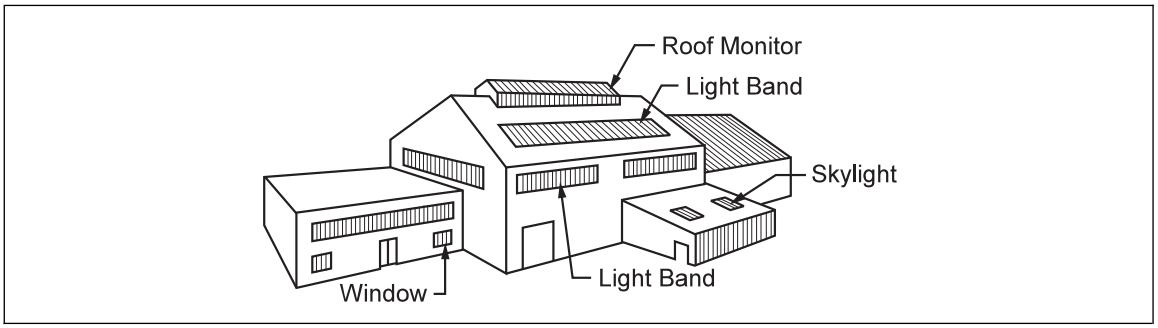


Fig. A-3. Typical usage of reinforced plastic building panels

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Plastic interior finish material: Rigid (not foamed or expanded) plastic sheets (usually fiber reinforced plastic or PVC) that are applied to a backing material such as concrete block. Compare to plastic building panel.

PMMA: Polymethyl methacrylate. Also commonly referred to as acrylic. This is made in extruded multi-wall and solid sheet, and also in continuous and cell cast form.

Prefabricated or pre-insulated ducts: A prefabricated or pre-insulated duct system has insulation already integrated into it. They are often made from rigid materials like fiberglass, foam boards, mineral wool, phenolic or rubber insulation. These ducts are often wrapped on the outside with a lightweight aluminum facer. This facer is sometimes found on the inside but can be replaced with antimicrobial cloths or other materials.

PVC: Polyvinyl chloride, a thermoplastic polymer used as the basis for some interior finish or building panels. PVC-based panels are usually not reinforced. Made only in solid sheet form. In some countries, the term UPVC, is used, as the PVC has low plasticizer content. In this data sheet, the generic term PVC has been adopted.

Sheathing material: A board stock material or coating material applied over a combustible foam insulation. It is designed to delay ignition of the insulation for 10 to 15 minutes in a sprinklered application.

Solid: Sheet material that does not have a cellular structure.

Thermoplastic: Materials that soften when heated and harden when cooled. This process is reversible provided the material is not heated sufficiently to decompose. Examples are polyvinyl chloride, polystyrene, polycarbonate, polyethylene terephthalate, polymethyl methacrylate, polypropylene, and polyethylene.

Thermoset: Materials that cure or “set” irreversibly when heated during manufacture. Examples are polyurethane, polyisocyanurate, fiber reinforced plastic, phenolic foam, melamine, and unsaturated polyester.

Thermal barrier: A material that will prevent ignition.

Unbacked: Any solid plastic panel that is not attached to any substrate and can freely vent in a fire.

APPENDIX B DOCUMENT REVISION HISTORY

The purpose of this appendix is to capture the changes that were made to this document each time it was published. Please note that section numbers refer specifically to those in the version published on the date shown (i.e., the section numbers are not always the same from version to version).

October 2026. Interim revision. The data sheet has been modified by relocating information related to specific categories of exterior wall assemblies and fire testing information to Data Sheet 1-64, *Exterior Wall Assemblies* and Data Sheet 1-4, *Construction Fire Tests*, respectively.

April 2026. Interim revision. The data sheet has been modified to provide guidance on Wall-Mounted, Building-Integrated Photovoltaic (BIPV) Façade Systems. Additional definitions have been added to Appendix A.

April 2025. Interim revision. The data sheet has been modified to provide guidance and new information relative to liners and insulated ducts for heating, ventilation and air conditioning systems. Guidance has been provided for high-pressure laminates (HPL) and high-performance building envelopes.

January 2024. Interim revision. The data sheet has been modified to provide clarifications and add new information on concrete walls filled with foam and polyester batt insulation.

January 2023. The data sheet has been reformatted for ease of use, reconfigured for new and existing construction protection options and protection criteria has been updated.

January 2018. This document has been completely revised. The following significant changes were made:

A. Clarified recommendations to emphasize the use of FM Approved plastic construction materials.

B. Simplified recommendations for intermediate wall sprinklers.

July 2015. Interim revision. Clarification was provided for the securement of metal faced plastic sandwich panels.

April 2014. Clarification was provided for protection of spray-on polyurethane insulation covered with an FM Approved fire-retardant coating.

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February 2013. Revised protection guidance for both backed FRP panels and backed PVC panels as a result of research and testing. In addition, PVC panels are now permitted to be installed on ceilings under certain conditions. Other clarification points for various recommendations were added.

April 2012. Terminology related to ignitable liquids has been revised to provide increased clarity and consistency with regard to FM Global's loss prevention recommendations for ignitable liquid hazards.

May 2010. Replaced all references to Data Sheet 2-8N, *Installation of Sprinkler Systems (NFPA)*, with references to Data Sheet 2-0, *Installation Guidelines for Automatic Sprinklers*.

January 2009. Extensive revisions were made to differentiate between various plastic construction materials, and revised recommendations were developed for the protection of FRP Faced/foam Plastic Core insulation panels. Recommendations were added on protection of elastomeric insulation.

November 2008. Extensive revisions were made to differentiate better between various plastic construction materials, and revised guidance was developed for the protection of FRP faced/foam plastic core insulation panels. Guidance was added on protection of elastomeric insulation.

May 2008. Minor editorial changes were made.

September 2007. Minor editorial changes were made.

May 2007. This document was revised to clarify guidance on PVC panels and include minor editorial changes.

May 2005. This document received various editorial corrections and was reorganized for easier usability. Zonolite 3306 fire retardant coating is now FM Approved. Partial solutions for EPS panels using baffles and the acceptability of perimeter ceiling sprinklers under certain conditions have also been highlighted.

Section 3.0, Support for Recommendations, was expanded to include additional detail on the hazards associated with plastics in construction.

May 2004. Clarification was made to recommendation 2.3.1(a).

September 2003. The guidelines for dry perimeter ceiling sprinklers to protect EPS wall and ceiling panels were added.

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