Combustible Exterior Wall "Cladding" Systems: An ICC Perspective

The tragic Grenfell Tower fire in London brought extensive public focus on combustible exterior wall systems, often called "cladding," prompting many questions as to how these types of fires can occur and what the risks are of such a fire in the future. The focus of this short article is to briefly discuss the 2018 International Building Code® (IBC®) requirements in terms of fire safety and what to look for in plan review and inspections when cladding is used on a noncombustible wall. This document relates only to those buildings and jurisdictions that use the IBC, and as such do not pertain to the Grenfell Tower or other buildings which have not been constructed in strict compliance with the IBC. The International Code Council (ICC) cannot make comparisons between the design and construction of the Grenfell Tower or other non-IBC buildings relative to the provisions of the IBC as these buildings have not been built to our code provisions. This article is not intended to be a detailed list of all applicable code requirements — be sure to consult the IBC.

The current provisions for Metal Composite Materials (MCMs) in the 2018 IBC were updated in the 2012 IBC and remain virtually unchanged. The update process followed the rigors of ICC's Code Development Process, which includes the submittal of code change proposals, committee review and ultimate approval by the ICC Governmental Member Voting Representatives. The committee was comprised of a body of technical experts including fire protection engineers, members from the fire service, code consultants, architects, building officials, material industry representatives and testing laboratories. The committee unanimously approved the updated provisions in the 2012 IBC.

KEY ITEMS FOR PLAN REVIEW

1. What type of exterior wall covering, or cladding, has been specified?
   In the past, the exterior wall finishes on high-rise buildings were not a significant challenge from a fire safety perspective. Most exterior walls were masonry, concrete or glass. In the last 20-30 years, energy conservation and product innovation considerations have resulted in an increase in combustible materials being used as a cladding material.

2. Is the exterior wall cladding combustible or noncombustible?
   A material is noncombustible if it meets the criteria for noncombustibility based on the standard ASTM E136, "Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C." *Otherwise, it is considered a combustible material relative to code compliance.*

3. What is combustible cladding?
   Combustible cladding is a siding, panel or application that is composed all or in part of combustible materials used on the exterior side for aesthetics and to resist rain, sleet, snow and wind loads.

Two typical exterior wall claddings are (IBC definitions are noted):

- ***Exterior Insulation and Finish Systems (EIFS).*** *EIFS are nonstructural, nonload-bearing, exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat and a textured protective finish coat.*
- ***Metal Composite Material (MCM).*** *A factory-manufactured panel consisting of metal skins bonded to both faces of a solid plastic core.*
- ***Metal Composite Material (MCM) System.*** *An exterior wall covering fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.*

4. **Does the exterior wall system include foam plastic insulation? Are other materials/components included in the wall system such as combustible water resistive barriers?**
Foam plastic insulation can drastically change the fire performance of an exterior wall system. When foam plastic insulation is added to a wall system, compliance with IBC Chapter 26 entitled "Plastic" is necessary. Chapter 26 requires compliance with National Fire Protection Association standard 285 (NFPA 285, see page 4) for buildings of Types I – IV construction in excess of one story. Where the insulation is covered on each face by masonry or concrete, compliance with NFPA 285 is not required.

   Other materials such as combustible water resistive barriers add an additional combustible component that may alter the fire performance of an otherwise code complying product. A water-resistive barrier is defined as follows:

   Water-Resistive Barrier. *A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.*

5. **What factors limit the use of combustible materials on walls?**
The IBC limits combustible materials on exterior walls based upon the following factors:

   - *Type of exterior wall cladding.*
   - *Type of construction of the building. Buildings of Types I – IV construction are required to have noncombustible exterior walls. However, these walls can have combustible exterior cladding, such as MCMs.*
   - *Height of the cladding above grade. The installation height of combustible cladding on the exterior can have a considerable impact on firefighting operations.*
   - *The presence of an automatic sprinkler system throughout the building. The IBC requires all new high-rise buildings (buildings with occupied floors greater than 75 feet above the lowest level of fire department vehicle access) to be protected throughout with an automatic sprinkler system.*
   - *Percentage of the exterior wall covered with the combustible cladding.*
   - *The required fire-resistance rating of the exterior wall.*
   - *Fire separation distance of the exterior wall from adjacent buildings and lot lines.*
   - *Fire testing for the specific type of exterior wall cladding.*

METAL COMPOSITE MATERIALS (MCMS)

Here is a brief look at one type of cladding, Metal Composite Materials (MCMs) (see Section 1406 of the IBC), since they have been at the center of the discussion following the Grenfell Tower fire. The table below provides a snapshot as to what is permitted for MCM installations in Types I, II, III and IV construction. These requirements do not address the addition of foam plastic insulation in conjunction with the MCM system or within the MCM itself. Foam plastic would require testing to NFPA 285 as noted previously and compliance with IBC Chapter 26 for foam plastics.

Snapshot of MCM requirements for Type I, II, III and IV construction

Base requirements (Section 1406.10)	Alternative 1 (Section 1406.11.1)	Alternative 2 (Section 1406.11.2)	Alternative 3 (Section 1406.11.3)	Alternative 4 (Section 1406.11.4)
Unlimited height · *Flame spread index ≤ 25[a]* · *Smoke developed index ≤ 450[a]* · *Approved thermal barrier ½ inch (12.7 mm) gypsum or material meeting fire test NFPA 275[a,b]* · *Compliance with fire test NFPA 285[a]*	**Up to 40 feet above grade** · *Flame spread index ≤ 75[a]* · *Smoke developed index ≤ 450[a]* · *For fire separation distances 5 feet or less, MCM panel coverage limited to ≤ 10% of exterior wall* · *For fire separation distances greater than 5 feet unlimited MCM coverage is permitted*	**Up to 50 feet above grade** · *Flame spread index ≤ 75[a]* · *Smoke developed index ≤ 450[a]* · *Self ignition temperature≥ 650 ºF[a]* · *MCM panels limited to ≤ 300 sq feet in size* · *Minimum 4 feet vertical separation required*	**Up to 75 feet above grade[c]** · *Flame spread index ≤ 75[a]* · *Smoke developed index ≤ 450[a]* · *Prohibited on buildings of Group A-1, A-2, H, I-2 and I-3* · *Prohibited on buildings with a required exterior wall fire resistance rating* · *Self ignition temperature ≥ 650 ºF[a]* · *Combustibility rating CC1 or CC2[a]* · *Area limitations based upon combustibility rating[d]*	**Up to 75 feet above grade[c]** · *Flame spread index ≤ 75[a]* · *Smoke developed index ≤ 450[a]* · *Minimum fire separation of 30 feet required (20 feet for sprinklered buildings)* · *Self ignition temperature ≥ 650 ºF[a]* · *Combustibility rating CC1 or CC2[a]* · *Flame barriers between each story are required or a vertical separation of MCM panels ≥ 4 feet must be provided[e]* · *Area limitations based upon combustibility rating[f]*

Footnotes:

a. A fire test is required. See table on page 4 for a description of fire tests.
b. Thermal barriers are not required if the MCM passes specific test criteria (NFPA 286) that shows the panel will not contribute to fire growth.
c. Height of installation is unlimited where an automatic sprinkler system is installed throughout the building.
d. See Sections 1406.11.3.4 and 1406.11.3.5 of the IBC.
e. Where flame barriers are used, they must extend a minimum 30 inches beyond the exterior wall. Where an automatic sprinkler system is installed throughout the building, flame barriers and vertical separations are not required.
f. See Section 1406.11.4.3 of the IBC.

FIRE TESTS

The following table identifies the required fire tests for which MCMs must be tested as noted on page 3. These tests will apply depending upon which alternative noted on page 3 is used for the MCM installation.

Applicable Fire Test Standards for MCMs			
Test standard	**Type of Test**	**Title**	**Summary**
ASTM D635	Combustibility test	Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position	A fire test that measures the rate of combustion/burning of plastic, measured as either Class CC1 or CC2.
ASTM D1929	Self ignition test	Standard Test Method for Determining Ignition Temperature of Plastics	A fire test that measures self igniting temperatures of plastic.
ASTM E 84/ UL 723	Flame spread and smoke developed indicies	Standard Test Methods for Surface Burning Characteristics of Building Materials (ASTM E84) Test for Surface Burning Characteristics of Building Materials (UL 723)	A fire test that provides a comparative ranking of flame spread and smoke generation of a material.
NFPA 275	Thermal barrier performance	Standard Method of Fire Tests for the Evaluation of Thermal Barriers	A fire test that provides a quantitative method of identifying acceptable thermal barriers.
NFPA 285	Flame propagation test	Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components	A fire test that measures flame and fire propagation both horizontally and vertically of a test specimen that replicates end use installation.
NFPA 286	Interior finish test	Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	A fire test that measures the fuel contribution of interior finishes to a fire.

CONFORMITY ASSESSMENT

Prior to exterior wall finish and finish systems being approved for installation, there is a conformity assessment these products and systems must first undergo. The manufacturing and labeling process is critical to demonstrate compliance with the applicable fire tests and code requirements. This is typically done through an approved agency. An approved agency is defined as follows:

> ***Approved Agency.*** *An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been approved by the building official.*

A key component of this process is the requirement for proper labeling which includes: testing; inspection and identification; label information; and method of labeling.

INSPECTION PROCESS

Once the conformity assessment and approval process is complete, the exterior wall system is ready for installation. It is imperative that the inspector monitor the installation process. Some questions that need to be answered include:

1. *Is the system (and all of its component parts) labeled in order to ensure that the system has been evaluated through the conformity assessment process? Key to this assessment process is the demonstration of compliance with the required fire tests.*

   The purpose of the process is to make sure that the product specified is what has been shipped to the jobsite. The performance of cladding materials in a fire can vary significantly, but in appearance the products and systems can seem very similar. Without proper documentation through proper labeling, the only way to determine fire performance is to conduct tests on the product.

2. *Are the materials and systems being installed as specified and labeled?*

   Even minor changes to the tested wall system can change the performance of the system in a fire. If the approved construction documents specify an MCM system and foam plastic insulation is subsequently installed, then the exterior wall system needs further review, testing, labeling and approval.

3. *Is the exterior wall system being inspected during installation?*

   Once the exterior wall system is installed, it is difficult to identify the specific construction materials and installation details within the system. The timing of the inspection is very important as inspectors need to see what is installed in order to confirm that the installation complies with the approved installation instructions.

COMPLIANCE RESOURCES

Exterior wall systems have become more complex. Navigating through the exterior wall system testing requirements and limitations, verifying that testing was completed, and determining how products should be used can be onerous. ICC has two subsidiaries that can help with the approvals process: ICC Evaluation Service (ICC-ES) and the International Accreditation Service (IAS).

ICC-ES has developed acceptance criteria for products such as MCMs and EIFS that clearly outline what requirements the materials and systems must meet in order to comply with the IBC. The manufacturers work with ICC-ES to produce documentation to show that their products meet relevant code provisions and ICC-ES acceptance criteria in order for the evaluation report to be issued for their specific products, materials and systems. These reports also address the limitations of their use and confirm that proper testing of the system has occurred. Reports for exterior wall systems can be accessed on the ICC-ES website.

IAS provides accreditation services related to a variety of topics including public safety and sustainability. One of their key services is laboratory accreditation. Through IAS, jurisdictions can determine which laboratories are accredited for performing the necessary tests and provide the necessary confidence that the laboratories meet quality standards.

MOVING FORWARD

Exterior wall systems or “cladding” have become increasingly more complex with innovative construction techniques and the desire for energy efficient buildings. Balancing the objectives of weather protection, energy savings, structural requirements and fire safety is a challenge in the development of new products and exterior wall systems with combustible materials. The approvals process from initial design through final inspection is critical to ensure compliance with complex code requirements.

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