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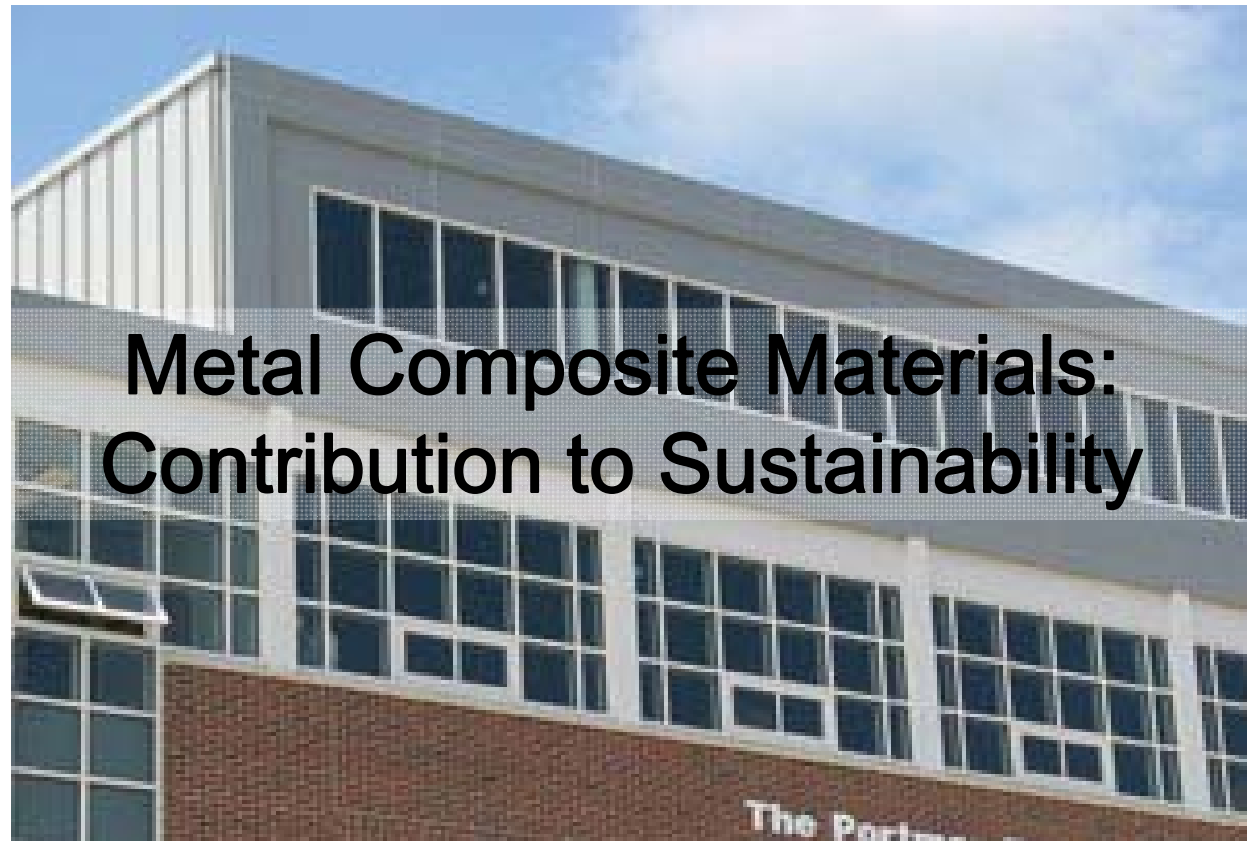
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# Metal Composite Materials: Contribution to Sustainability

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Presented By: Alpolic

Mitsubishi Plastics Composites America, Inc.  
401 Volvo Parkway  
Chesapeake, VA 23320

Description: This course covers metal composite panels, their components, range of finishes, and in particular, the ways in which they contribute to sustainable design.

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# Learning Objectives

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At the end of this program, participants will be able to:

- identify the components of an MCM panel and question manufacturers about those aspects of the components that reduce embodied energy
- list the natural metals used in MCM panels and describe their general and green characteristics
- recall the different paint types used on ACM panels and their relative durability, and
- describe maintenance and post-use options for the MCM panel.

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National Center for  
the Performing Arts  
Beijing, China

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## Metal Composite Materials

# Metal Composite Materials

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Metal composite materials are a prefinished, lightweight, high-strength cladding product that provide a variety of metal and finish options. These uninsulated panels are only 3-6mm in thickness and use 0.2-0.5mm thick metal skins, but have equivalent rigidity to a solid aluminum panel three times the thickness.

Known for its durability, ease of maintenance and high percentage of recycled content, this interior or exterior cladding system contributes to sustainable design.



# Metal Composite Materials

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MCM panels offer a smooth, flat surface; because of their thin profile, they are easily formable, allowing for crisp details or evocative curves. Very often seen used as the cladding of a curtain wall system, these materials are readily adaptable to interior and exterior applications from walls, ceilings, fascias and canopies, to beam and column wraps.

In this course, we'll take a look at metal composite panels, their components, range of finishes, and in particular, the ways in which they contribute to sustainable design.



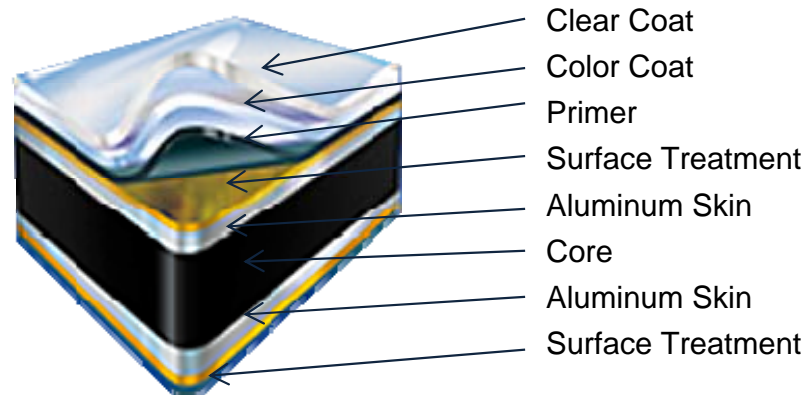
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## Components and Manufacturing of MCMs

# Components of an MCM

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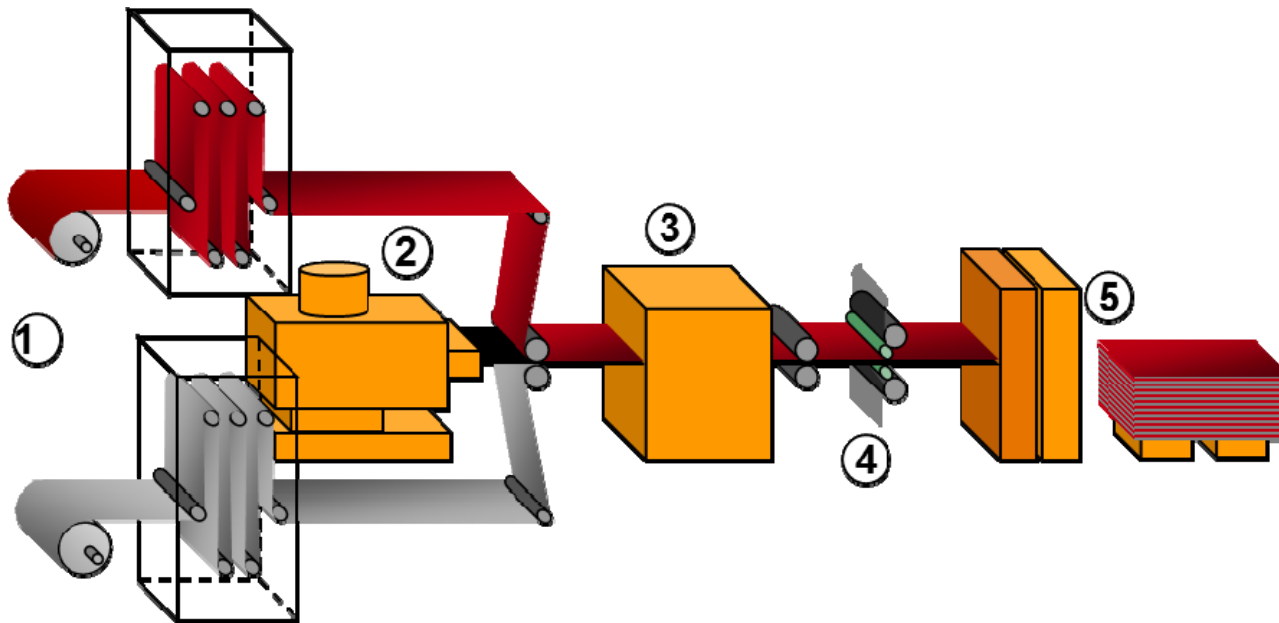
MCMs are made up of a metal skin ranging in thickness from 0.008" to 0.032". This skin is applied to both sides of a thermoplastic core. The metal skin was traditionally aluminum, as in aluminum composite panels, or ACMs. More recently, titanium, zinc, stainless steel and copper have been used as the skin of MCMs. There are benefits to both of these options. With the non-aluminum metals, the use of paint and other coatings can be avoided. However, with aluminum, the range of finishes, painted or anodized, is wider; if a durable paint is used, the finish will retain its original look for many years.



# MCM Manufacturing

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MCM panels are manufactured in a continuous laminating process. The aluminum/metal coils are introduced into the process from two pay-off reels. The laminating rollers bond the aluminum to the continuously extruded thermoplastic core. The laminated material then enters the cooling chamber and is constantly moved at a steady rate by the pulling rollers. A protective masking film is applied to the ACM/MCM to protect the surface finish. The ACM/MCM is trimmed to the required width, sheared to the required length, and stacked for inspection and final packaging.



# MCM Manufacturing

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Many manufacturers have instigated processes that are designed to minimize the impact on the environment through efficient use of raw materials and energy sources.

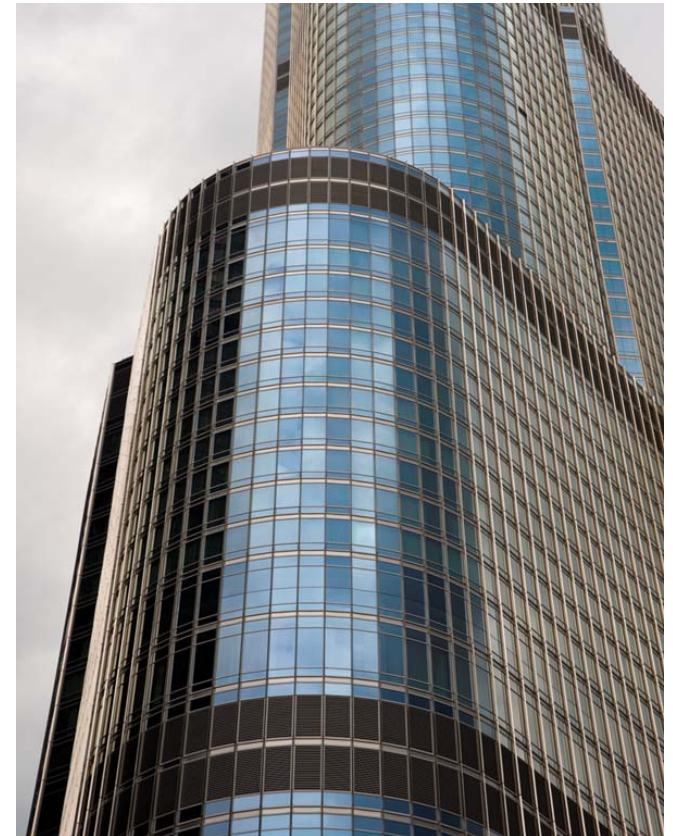
Each of the metals used in MCMs is manufactured in a similar way. A titanium metal composite is a little different, in that it has a stainless steel back skin. In the next few slides, we'll look at the natural metal skin composites.



# Metal Skin: Stainless Steel

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Stainless steel is a durable metal alloy with a high strength-to-weight ratio, allowing for thinner profiles and lower material use. Stainless steel will not corrode, rust or stain as easily as ordinary steel; however, it is not stain proof. The presence of chromium, molybdenum, niobium and nickel within the alloy enhances its corrosion resistance. Though more expensive than a painted finish, a stainless steel skin is harder than an aluminum skin, has improved impact resistance and is a long-lasting natural metal finish.



Trump Tower  
Chicago, IL

# Metal Skin: Stainless Steel

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About 60% of the world's stainless steel production comes from recycled scrap. The high value placed on this scrap ensures incentive programs are not necessary to maintain stainless steel recycling.

Although steel production is a fairly energy intensive process, many producers use pollution control technology in its manufacture.

# Metal Skin: Titanium

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A titanium MCM is typically composed of a titanium face skin and a stainless steel back skin. The thermal expansion coefficients of titanium and stainless steel are close enough that they can be used to produce a balanced panel. Titanium provides a high strength-to-weight ratio with a corrosion resistant natural metal surface.

Titanium is found most commonly as part of rutile (titanium dioxide,  $\text{TiO}_2$ ) and ilmenite (titanium iron oxide,  $\text{FeTiO}_3$ ). It is the ninth most abundant element in the earth's crust, and the fourth most abundant metallic element. Titanium comes from an abundant natural resource which is mined with minimal impact; no harmful by-products are generated in its production and 95% of its scrap is recycled. The relatively high value of the scrap ensures that end-of-use items are not sent to landfill.



National Center for the Performing Arts  
Beijing, China

# Metal Skin: Titanium

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The benefits of titanium are that it is both strong and lightweight. It naturally resists corrosion from acids, alkalis and seawater. It is a reactive metal, meaning it forms a hard oxide film when it comes into contact with oxygen—when scratched, it will heal itself if oxygen is present. As the thickness of this layer increases, light enters the transparent oxide layer and through absorption and refraction (multiple reflections within the layer), the color of the light being reflected off the surface will change. This change in the oxide layer thickness/color is a very slow process.

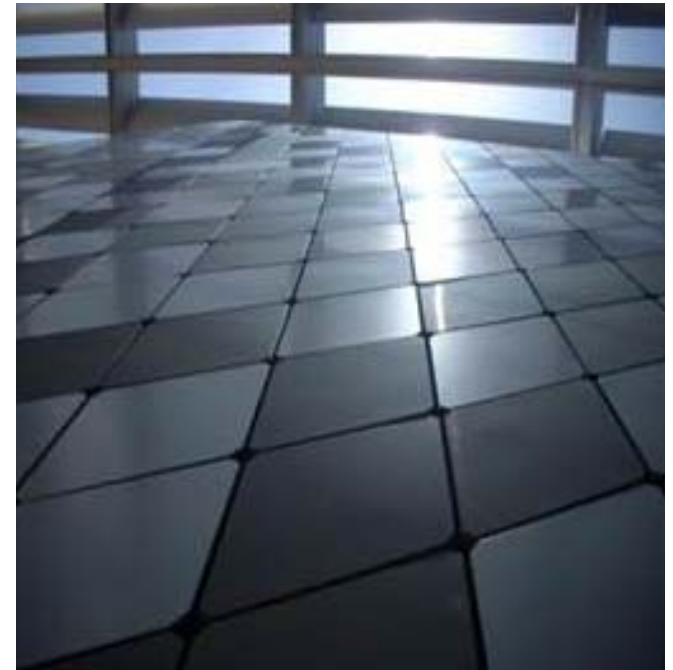
Titanium has a lower thermal conductivity than aluminum, meaning it will have a lower heat transfer, beneficial in cooling climates. Titanium skins are harder than aluminum skin materials and have improved impact resistance. They are low-maintenance and have a long-lasting natural metal finish, but are heavier than ACM and have the highest cost of all natural metal MCMs.

# Metal Skin: Zinc

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In a zinc metal composite material, the zinc used in the skin is composed of 17% post-consumer content. Use of scrap zinc is on the rise because of its high value as a metal. Currently, about one third of North America's zinc is recycled.

Architectural rolled zinc is a non-ferrous metal alloy that requires low maintenance. Natural zinc forms its own protective layer, or patina, when it is in contact over time with air (oxygen and carbon dioxide) and water. While a degree of zinc oxide runoff occurs in this natural weathering process, the oxide is invisible and does not stain surrounding materials. Architectural zinc composite materials are available with a mill finish that resembles the aged patina look of zinc.



Annette Strauss Artist Square  
Dallas, TX

# Metal Skin: Zinc

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Similar to the other natural metals, re-use of scrap zinc is on the rise due to its value as a recycled material. As in stainless steel and titanium production, there is substantial application of pollution control equipment in the manufacturing of commercially pure zinc.

Used in MCMs, this material is low-maintenance with a long-lasting metal finish. Zinc is somewhat softer and heavier than aluminum and is subject to fingerprints. A zinc MCM will be more expensive than a painted finish.

# Metal Skin: Copper

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Copper composite materials generally contain greater than 90% pre-consumer recycled content. With copper composite materials, care must be taken to isolate the copper skins from dissimilar metals to prevent galvanic corrosion from occurring. Stainless steel fasteners are recommended and an isolating coating or shims should be used with the mounting extrusions.



New England Biolabs  
Boston, MA

# Metals: Copper

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Care also should be taken when handling the copper materials after removal of the protective film to prevent fingerprints and hand marks.

CCM panels have natural copper skins which will oxidize and patina over time. The speed of the development of the patina depends on the humidity in the area and the concentration of the required salts in the environment.



This is a long-lasting, low-maintenance natural metal finish. It is more expensive than a painted ACM and softer and heavier than aluminum.

# Metal Skin: ACM

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With ACM panels, there is 12.5% post- and 64.2% pre-consumer content in the metal skin. Aluminum is sourced from bauxite, a rock that contains a high percentage of alumina, the primary ingredient in aluminum. The refining process of primary aluminum is energy intense even with a reduction of 70% of the energy consumption per unit of aluminum produced in the last century. However, the key to aluminum's sustainability lies with its ability to be endlessly recycled and re-used—in fact, 75% of all aluminum ever smelted is still in use.

Unlike some materials, aluminum does not suffer from down-cycling: it is infinitely recyclable with no loss in quality. Also, recycling aluminum uses 5% of the energy, and creates 5% of the emissions, of primary aluminum.

With ACM there are basically two finish options available: painted and anodized.

# Finishes: Anodized Finish

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An anodized finish is the creation of an anodic layer on the surface of the aluminum. This is done by passing a direct current through an electrolytic solution with the submerged aluminum composite panel as the positive electrode. The process releases hydrogen and oxygen at the aluminum surface, creating the anodic layer.

The anodic layer can be colored by incorporating dyes or metal salts into the pores of this layer. The colored appearance of clear anodized finishes is totally dependent on the trace metal components of the aluminum.



Florida State University Life Sciences Center, Tallahassee, FL

# Finishes: Anodized Finish

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The anodized finish provides a much harder surface than a painted surface, and as the surface is integral to the aluminum, there will therefore be no flaking. On the other hand, the surface is somewhat more brittle, and microcracking may occur during post-anodizing forming. The surface will be static resistant.

Color consistency may not be as good as with a painted finish, and the material cost is higher.

# Finishes: Painted Finish Durability

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The AAMA created a series of voluntary performance standards for the long-term durability of organic coating on aluminum. These standards, as shown in the chart below, identify three grades of factory-applied spray coatings. They are meant to help architects select organic coatings which will provide a good level of performance in terms of film integrity, exterior weatherability and general appearance over many years. Weatherability is determined by the three characteristics in the chart below.

	AAMA 2603	AAMA 2604	AAMA 2605
Attribute	Basic Pigmented Coatings	High Performance Coatings	Superior Coatings
Gloss Retention	No Specification	5 Years $\geq$ 30%	10 Years $\geq$ 30%
Color Retention	Slight Change	5 Year Fade Delta E $\leq$ 5	10 Year Fade Delta E $\leq$ 5
Chalking	1 Year Chalk $\leq$ 8	5 Year Chalk $\leq$ 8	10 Year Chalk $\leq$ 8 Colors $\leq$ 6 Whites

# Finishes: Painted Finish

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There are three basic families of paints which are commonly used for building panels: urethanes, polyesters and fluoropolymers. Urethanes are generally spray-applied and not coil-coated; paint is cured by chemical cross-linking of the resin chains. This type of paint achieves bright colors and high gloss, but weaker performance compared to polyester paints. Generally, this paint meets the AAMA 2603 performance standard.

Polyester paints are made from polyester and melamine resins. Paint is cured by chemical cross-linking of the resin chains. Three types of polyesters are basic, siliconized and high performance. Silicone is added to improve weatherability and durability; high performance polyesters contain various additives introduced to further improve paint performance.

This type of paint achieves bright colors and high gloss, but weaker performance compared to fluoropolymer paints. Generally, this paint meets the AAMA 2603 performance standard. Some high performance polyesters can meet AAMA 2604.

# Finishes: Painted Finish

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Latest of the paint systems to be introduced are PVDF resins and FEVE resins. Each of these resins contains a carbon (C) and fluorine (F) bond and are called fluoropolymer resins. The strength of this bond provides exceptional weatherability and durability based on high ultraviolet light and chemical resistance. These paints meet the AAMA 2605 performance standard.

The only exception to this rule is when a PVDF paint ratio is less than 70% PVDF resin. Then this paint only meets AAMA 2604. A PVDF paint is a dispersion of 70% PVDF resin and 30% acrylic resin. The acrylic resin is necessary in order to formulate PVDF into a coating. As the ratio of PVDF to acrylic resin drops, the crystallinity drops also. This crystallinity is what gives the paint film its durability properties. In this situation, under high temperature and pressure, the paint film can re-melt.

# Finishes: Painted Finish FEVE Resins

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FEVE resins, or fluoroethylene/vinyl ether copolymer (FEVE), comprises an alternating sequence of fluoroethylene and several specific vinyl ether units, and it is completely amorphous. This alternating sequence is responsible for the high weather resistance of the resultant paint finishes. The chemically stable fluoroethylene unit protects the neighbor vinyl ether unit, which can be easily attacked by UV rays and other corrosive factors.

This paint is a thermoset paint, and its components are cross-linked. The paint film, once set, will not re-melt under high temperatures and pressures. This resin is translucent and allows for an extensive, bright/clean, color palette including brighter, cleaner finishes.

The paint resin utilizing FEVE is sold under the trade name LUMIFLON®. Since the fluorocarbon component is integral to the resin's backbone, it does not act as a matting agent, and 60-degree glosses ranging from 30 to as high as 70 can be achieved.

This resin meets the AAMA Standard 2605.

# Finishes: Painted Finish

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FEVE and PVDF coatings are both factory-applied. In most situations an inline regenerative thermal oxidizer eliminates the release of the VOC content of the coating within the factory setting.

Factory coating of these materials also keeps the VOCs from the jobsite.



St. Mary's Medical Office Building  
Richmond, VA

# Finishes: Painted Finish

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Painted finishes for ACM panels come in many colors and patterns, among them mica, metallic, and prismatic finishes and stone and timber faux finishes.



Faux finish - timber



Painted finish - prismatic

# Finishes: Painted Finish Durability

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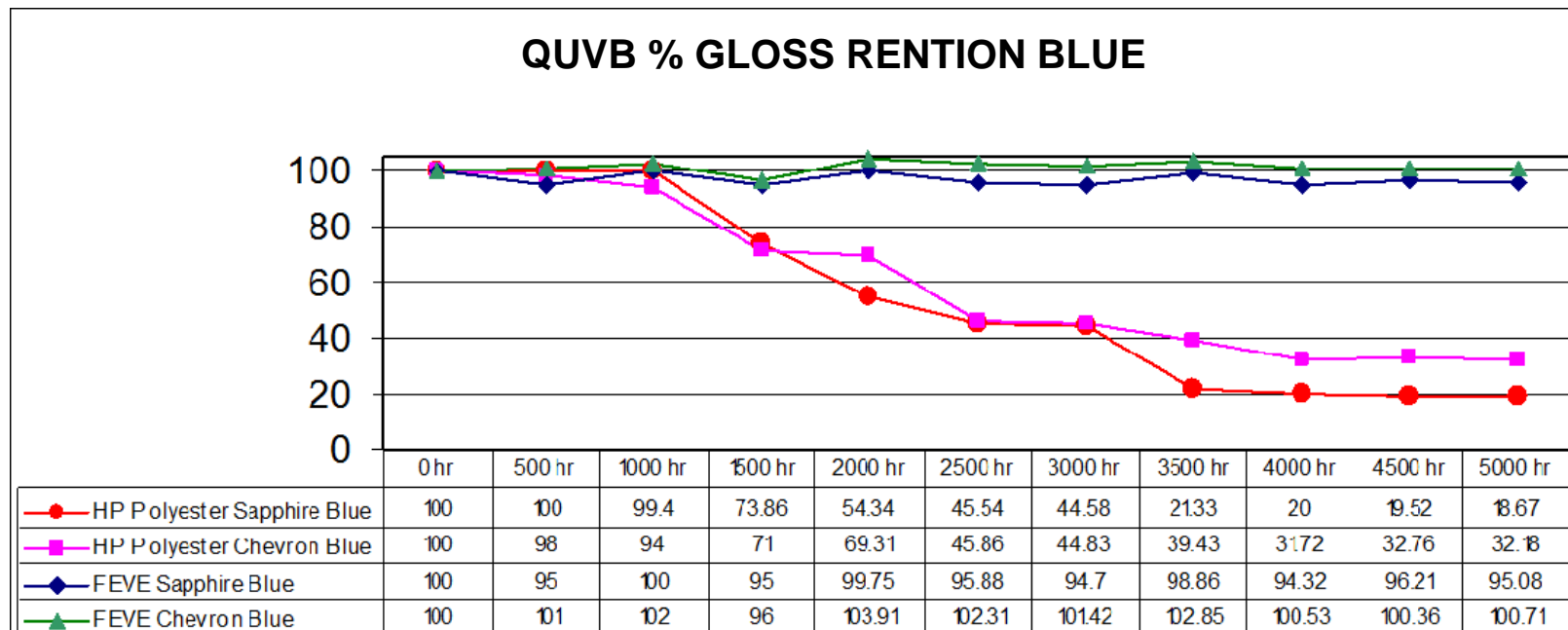
Paint performance is based on chemical and ultraviolet light resistance. Real-time South Florida exposure is the standard test method for determining a paint system's durability. Accelerated testing can be used as a relative comparison of products. The translation of accelerated testing to real-time performance is a matter of much debate.



# Finishes: Painted Finish Durability

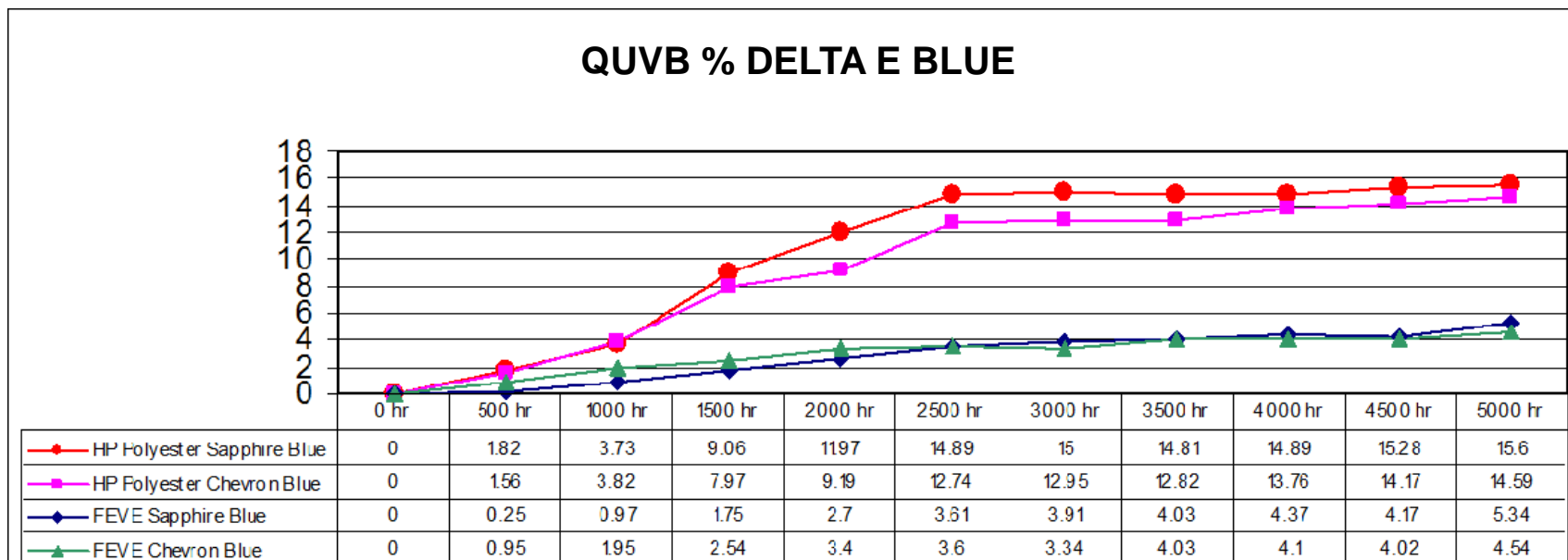
The three main quantitative measures of a paint system's durability performance are:

**% Gloss Retention:** When the surface of the paint film begins to break down, the gloss will tend to decrease. The percentage of gloss retention measures the integrity of the surface of the paint film.



# Finishes: Painted Finish Color Retention

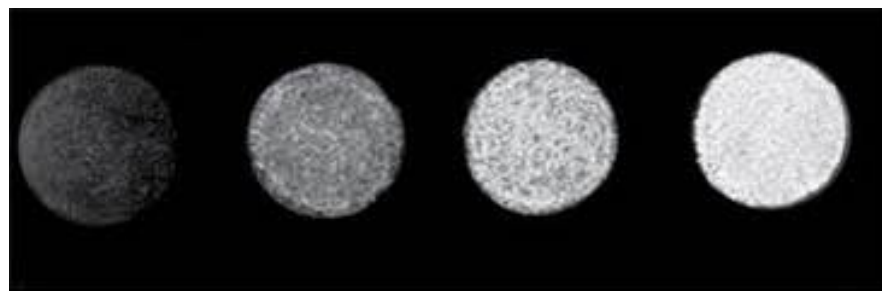
**Color Retention:** The exposure to the UV light and some chemicals can degrade the pigments, causing the color to fade. This is measured as the distance between the color of the sample prior to and after testing in a three-dimensional color space. It is expressed as Delta E.



# Finishes: Painted Finish Durability

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The final measure is **chalking**. As the paint degrades, the surface of the paint develops a white powder. This is wiped with a black cloth and compared to a series of visual standards from ASTM D4214 Standard Method for Evaluating the Degree of Chalking. A number 8 indicates minimal chalking and a number 2 indicates high level of chalking



No. 8

No. 6

No. 4

No. 2



# Core: Standard and Fire Resistant

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There are two types of core for MCM: a standard core and a fire resistant core. The standard core is solid polyethylene; the fire resistant core is composed typically of polyethylene and inorganic mineral fillers. The choice of core type is determined by local codes and/or the application. Both thermoplastic cores allow for uniform expansion and contraction of both metal skins, ensuring thermal stability and product performance.

Polyethylene comes from ethylene, a fairly energy intensive product that is used in a wide range of applications. The plastic recycling industry is not as far along as the aluminum industry; however, a report out of Europe indicates that the industry is growing and “the increase in mechanical recycling has reduced the need for primary plastic production by two million tons over the past ten years.” Similar to the aluminum industry, recycling polyethylene uses 20% of the energy used to create virgin polyethylene.



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## Use and Applications of MCMs

# Panel Characteristics

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One of the key features of MCM panels is their superior flatness. Thermal bowing does not occur in this material as the inner and outer skin is always at the same temperature. The panels should, however, be designed to accommodate thermal expansion.

MCM panels offer flatness and rigidity, but they also are formable. Most are curvable and can be joined with hot-melt adhesive to form complex shapes. Each panel type will have a specific minimum curve radius, but generally these panels can be curved to a radius ten times the thickness of the material and five times the thickness for titanium- and stainless steel-faced material.

Panel thicknesses range from 2-6mm. The thickness of the panels and the metal skin depends on the application or use. For instance, thicker panels increase flexural stiffness. Two mm and 3mm is used mostly for signage, canopy, interior, and corporate identity applications. Four mm is primary used in architectural cladding, with 6mm used for glazed-in applications.

# Workability

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Most metal composite material is as easily post-fabricated as wood—no special tools are required. It can be curved, bent, routed, drilled, sawed, sheared, punched, trimmed and molded into complex shapes with conventional woodworking or metalworking tools.

Complex shapes can be created in combination with polyethylene welding and support systems attached with structural adhesives.

With the exception of natural metals (copper, zinc, stainless steel and titanium), composite metal surfaces can be connected to one another or to other materials by such conventional methods of attachment as rivets, bolts or screws.

# Panel Strength

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As we mentioned earlier, ACM/MCM offers the rigidity, superior flatness and thermal stability of heavy-gauge metal sheet and an excellent strength-to-weight ratio. The material's strength is directly related to the thickness of the core.

The two skins connected by the thermoplastic core function as an I-beam, showing more structural stiffness than would be present if the skins were in direct contact. As the core thickness increases, this effect increases.

ACM			Solid Aluminum		Weight Ratio:
Thickness mm (inch)	Flexural Stiffness C-393 (PSI)	Weight PSF	Equivalent Thickness	Weight PSF	Solid Aluminum=100%
3 (.118)	$1.04 \times 10^9$	0.93	2.7 (.106)	1.50	62.0%
4 (.157)	$1.99 \times 10^9$	1.12	3.3 (.130)	1.82	61.5%
6 (.236)	$4.98 \times 10^9$	1.50	4.5 (.177)	2.50	60.0%

# Compared to Solid Aluminum

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MCMs are often used as an alternative to solid aluminum panels because they achieve equivalent rigidity using only one third to one fourth the amount of aluminum. This principle holds true for MCM products composed of aluminum, copper, stainless steel and titanium. The table below compares the amount of metal required in a solid metal panel with an MCM to achieve equivalent rigidity.

MCM Products	Total Metal Thickness in MCM Products	Metal Thickness with Equivalent Rigidity	% Metal Amount Required for MCM Products
3mm	Aluminum 1mm	Aluminum 2.7mm	37%
4mm	Aluminum 1mm	Aluminum 3.3mm	30%
6mm	Aluminum 1mm	Aluminum 4.5mm	22%
Fr 4mm	Aluminum 1mm	Aluminum 3.3mm	30%
Fr 6mm	Aluminum 1mm	Aluminum 4.5mm	22%
Copper 4mm	Copper 0.8mm	Copper 2.4mm	33%
SS 4mm	Stainless Steel 0.6mm	Stainless Steel 2.9mm	21%
Titanium 4mm	Titanium 0.6mm	Titanium 3.1mm	19%

# Alternative Materials

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When compared to monolithic metals or aluminum plate cladding, the MCM is lighter and prefinished. Factory finishing the cladding means better post-finish consistency.

Unlike batch laminated panels and sheet metal cladding, MCMs will not suffer from oil-canning, rust or delamination.



Delamination above  
and oil-canning below.

# Finishes: Durable and Innovative

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The durability of the materials and finishes adds greatly to the sustainable nature of this material. The latest technology of finishes, flouropolymers, are known for long-lasting color and gloss and weatherability. Lasting up to 30 years without fading, this type of coating eliminates the environmental impact and cost of repeated repainting and recoating.

By extending the life of wall systems, flouropolymer topcoats reduce waste created from disposal; avoid energy consumption in the production, transportation and installation of new systems; and maintain energy and equipment savings from continued high-performance of the building envelope.

This paint can also be formulated in a low-VOC version, further contributing to sustainable building.

# Cores

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The polyethylene and fire resistant cores both offer special advantages. The PE core is lighter and more flexible than the FR core, allowing for easier bending. The PE core is acceptable to the IBC for building heights of 40 feet or less. The FR core is required for buildings over 40 feet adhering to IBC. FR products are required to pass an intermediate scale, multi-story test (NFPA 285). The chart below shows the range of raw materials that make up the FR core MCM.

Manufacturers	Polyethylene	Fire Resistant (polyethylene with additives)
A	LDPE 2mm, 3mm, 4mm, 6mm	LLDPE with inorganic mineral fillers 4mm, 6mm
B	LDPE 2mm, 3mm, 4mm, 6mm	Polyolefin with inorganic mineral fillers 4mm
C	HDPE 3mm, 4mm, 6mm	HDPE with inorganic mineral fillers 4mm, 6mm

# Fire Resistant Core

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Most fire resistant MCM panels have been tested by independent testing laboratories, to meet a variety of standards. Check with the manufacturers to verify.

At right is the Intermediate Scale Multi-Story Apparatus (ISMA) test at 25 minutes in. During the 30-minute test, the flame height and wall temperature are checked. If the flame does not reach the second floor during the test time, the material passes.

ISMA Test (3)  
(NFPA 285) 25 minutes after ignition



# Attachment Systems

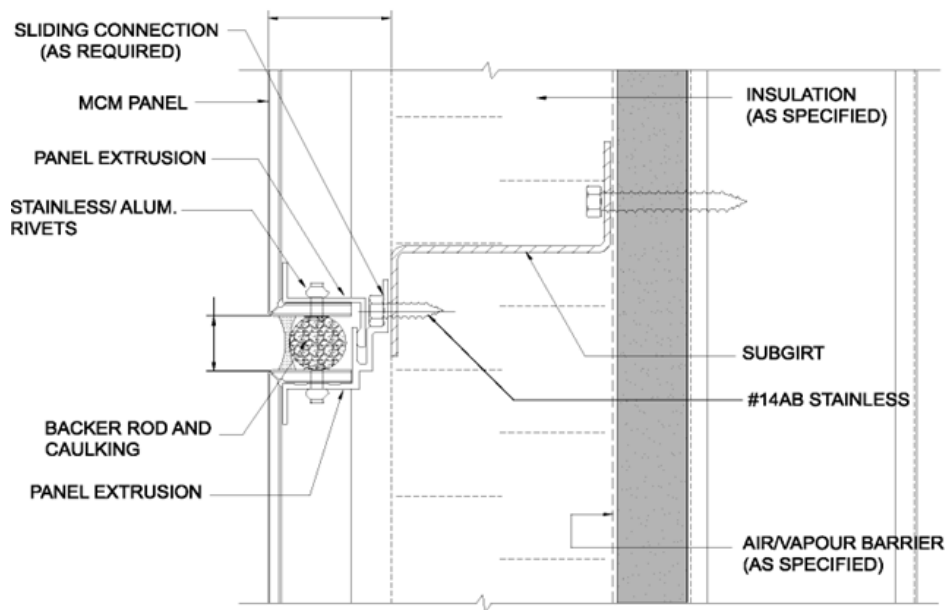
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There are a number of attachment systems in use for MCM panels. The attachment system choice depends on the project specific environment, aesthetics needs, wall performance requirements, code requirements, the complex detail requirements of the system and the project budget.

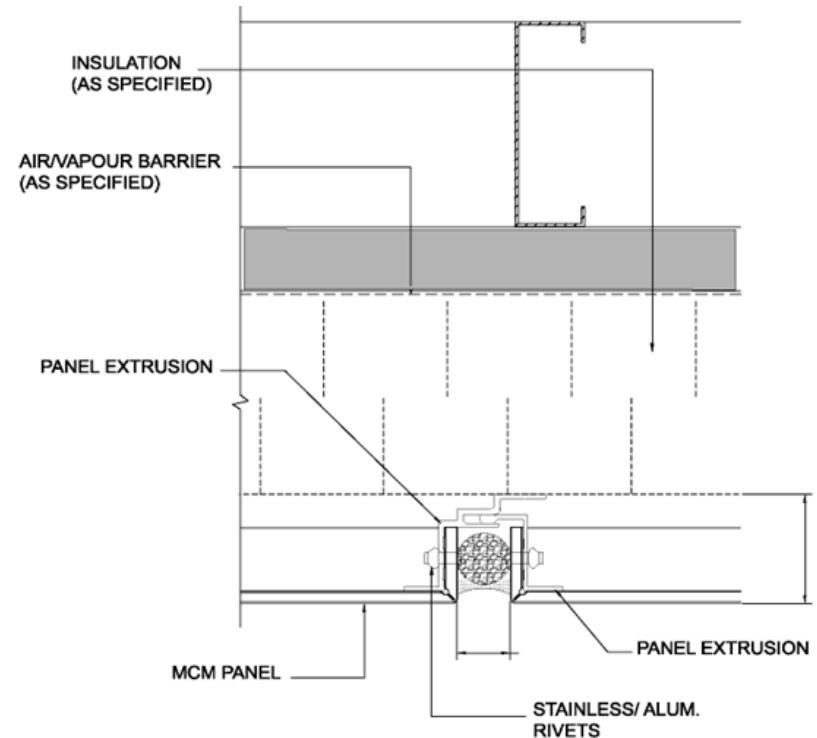


# Exterior Attachment Systems: Wet Seal

This system is an open-joint system sealed with caulk and backer rod. It is watertight and is the most economical of the three systems. Since this system is a barrier type system, the caulking between panels must have superior bonding to the panel and the gasket must be installed properly so that it remains in place during building movement.



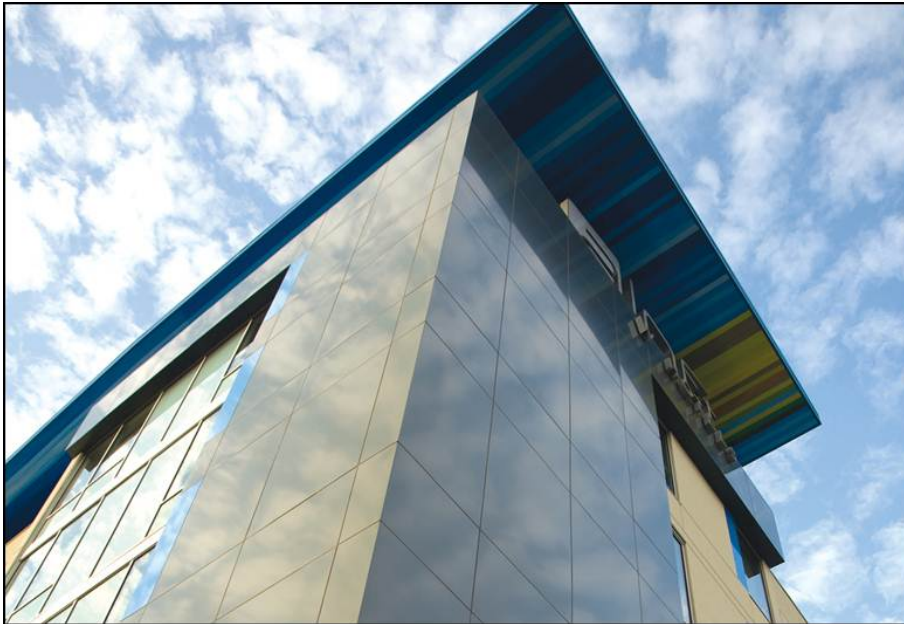
Horizontal Joint



Vertical Joint

# Exterior Attachment Systems: Wet Seal

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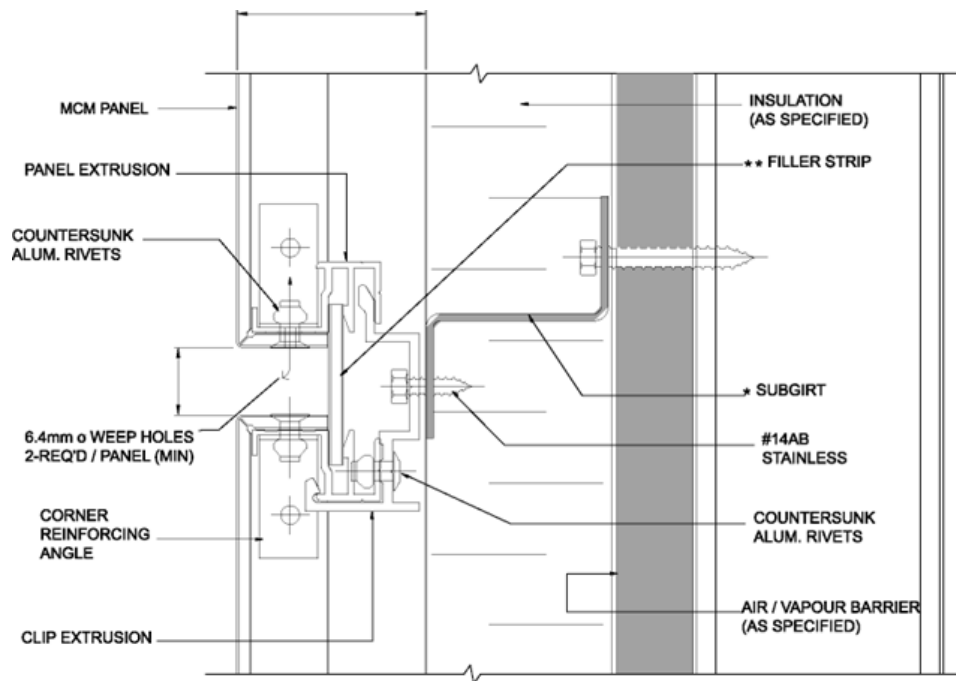
Aloft Hotel, Chesapeake, VA  
Architect: Jonathan Nehmer & Associates, Inc.  
Fabricator: Composite Wall Systems



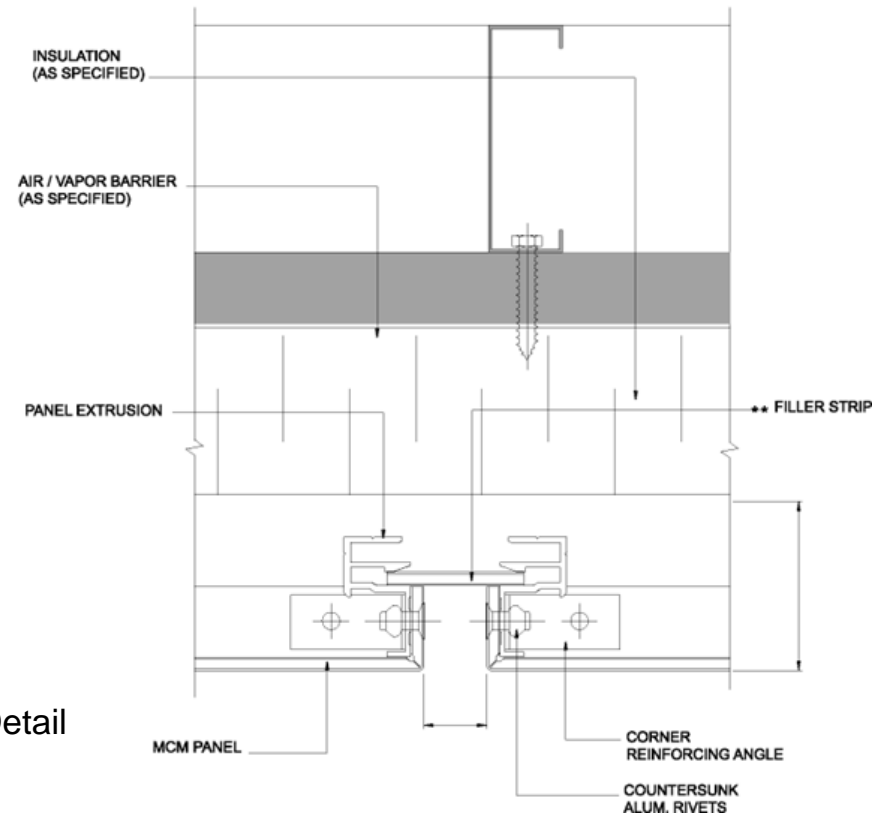
Bethel Korean Church, Irvine, CA  
Architect: Derevere & Associates  
Fabricator: Carvist

# Exterior Attachment Systems: Dry Seal

This is an open-joint system with gasket and/or filler strip. It is watertight and typically the most expensive system. All of the systems shown here should have a vapor permeable watertight moisture barrier behind the wall panels.



Horizontal Detail



Vertical Detail

# Exterior Attachment Systems: Dry Seal

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United Therapeutics, Durham, NC  
Architect: O'Neal  
Fabricator: Altech Panel Systems




St. Mary's Medical Office Building, Richmond, VA  
Architect: Odell Associates  
Fabricator: W.H. Stovall

# Exterior Attachment Systems: Rain Screen

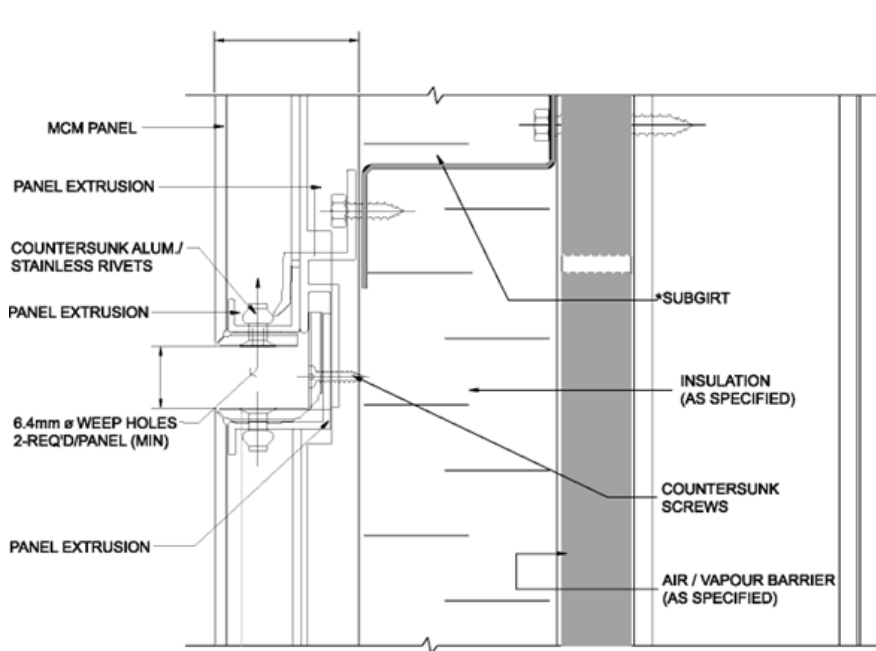
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There are two types of rain screen attachment systems. The pressure equalized system has minimized pressure differential on the inside and outside of the exterior cladding. This design allows for water and moisture to enter and drain from the wall cavity. AAMA 508 defines the requirements for a Pressure Equalized Rain Screen system.

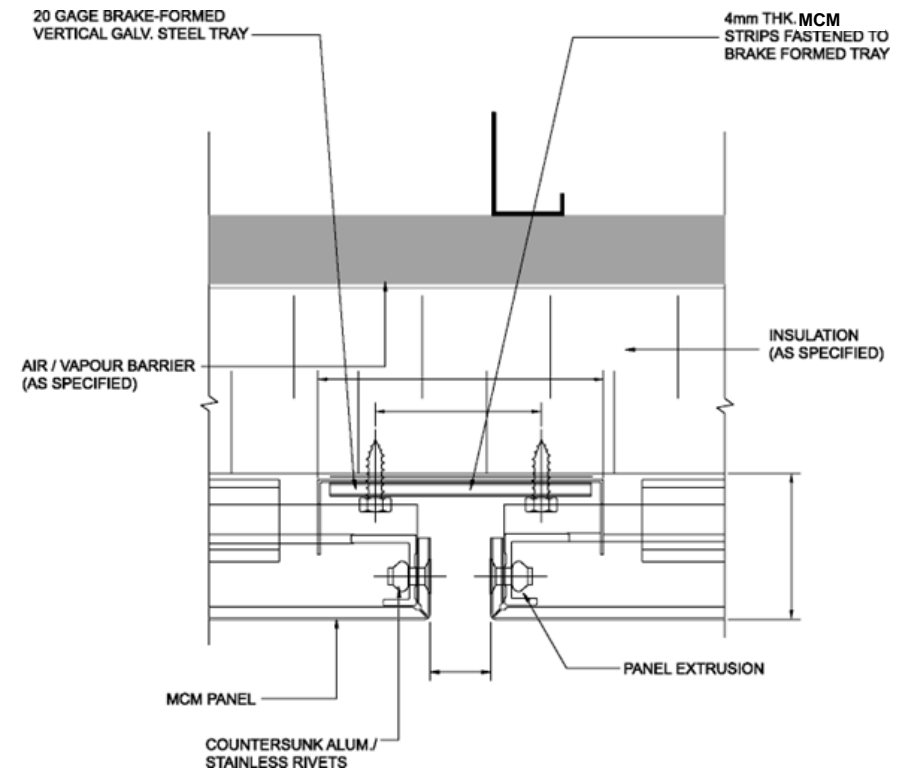
The drained back ventilated system allows for water and moisture to enter and drain from the wall cavity. In this case, AAMA 509 defines the system performance.

 Please remember the **exam password** CAVITY. You will be required to enter it in order to proceed with the on-line examination.

# Exterior Attachment Systems: Rain Screen



Horizontal Detail



Vertical Detail

# Exterior Attachment Systems: Rain Screen

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Bank of America, Tukwila, WA  
Architect: Gensler  
Fabricator: Bestworth – Rommel, Inc.



Coss Y Leon, Guadalajara, Mexico  
Architect: O'Neal  
Fabricator: Daissa

# Exterior Attachment Systems: Glazed In

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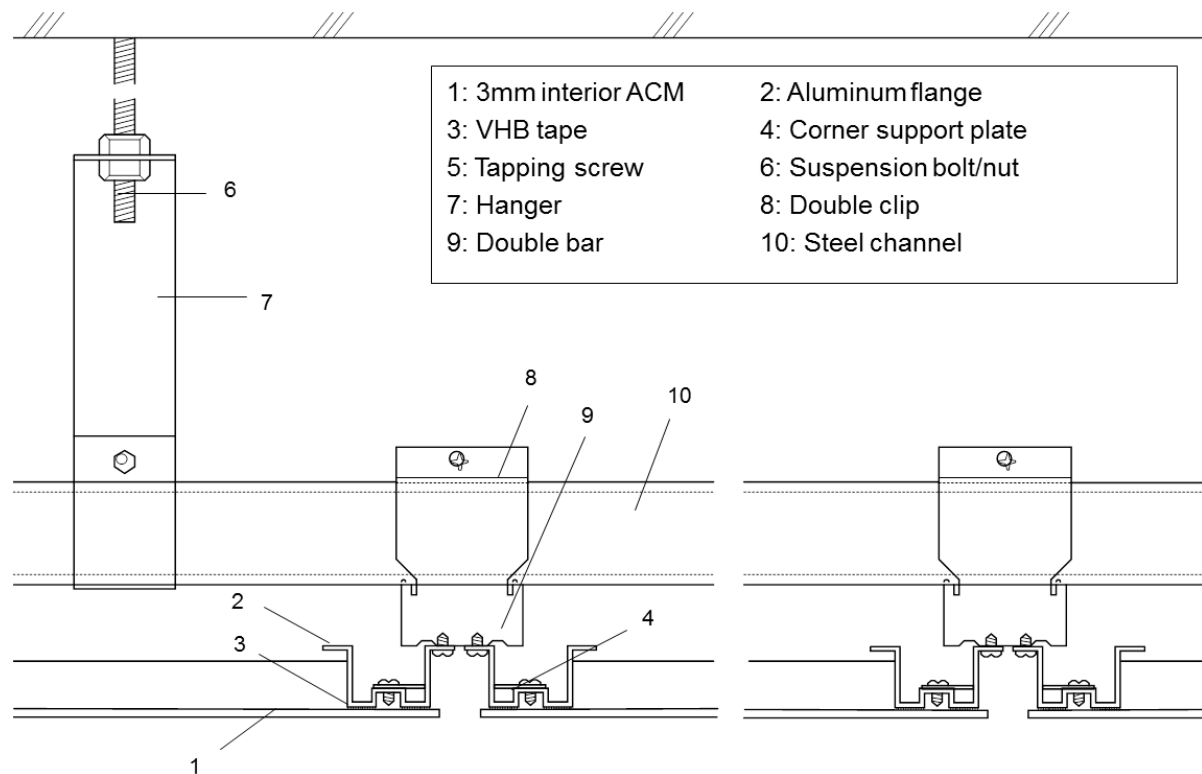
In this type of attachment system, ACM/MCM panels are used as infill panels and are glazed into a channel in the extrusion.



Winnie Palmer Hospital, Orlando, FL  
Architect: Jonathan Bailey Associates  
Fabricator: Kistler McDougall

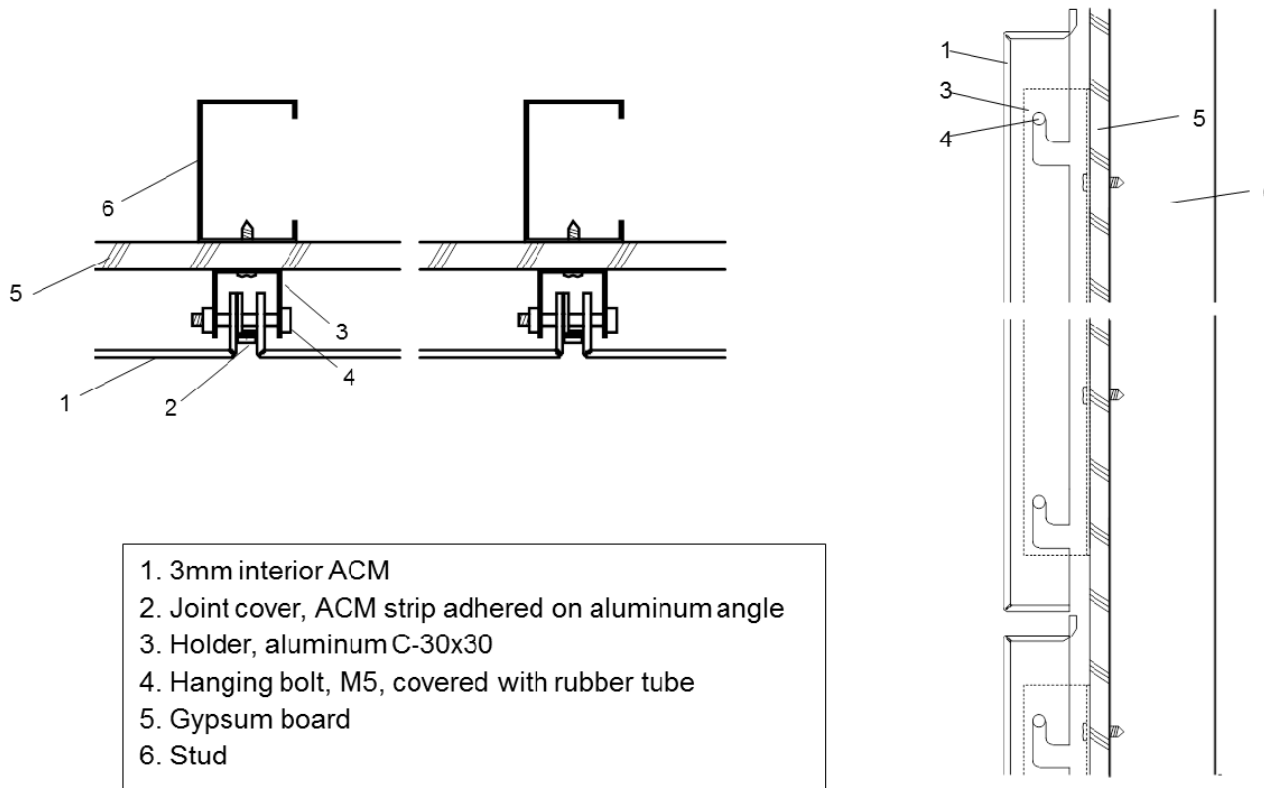
# Interior Attachment Systems

For interior installations, you can easily attach flat surfaces of MCM to such substrates as sheetrock and plasterboard with double-faced tape or a non-hardening adhesive.



# Interior Attachment Systems

MCM panels can also be hung as a suspended ceiling.



# Interior Attachment Systems

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# Overview: LEED® Certification

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The U.S. Green Building Council (USGBC) is a 501(c)(3) non-profit organization composed of leaders from every sector of the building industry working to promote buildings and communities that are environmentally responsible, profitable and healthy places to live and work. USGBC developed the LEED (Leadership in Energy and Environmental Design) green building certification program, the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings.

LEED credit requirements cover the performance of materials in aggregate, not the performance of individual products or brands. Therefore, products that meet the LEED performance criteria can only contribute toward earning points needed for LEED certification; they cannot earn points individually toward LEED certification.

For detailed information about the council, their principles and programs, please visit [www.usgbc.org](http://www.usgbc.org).



# Contribution to LEED Credits

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MCM panels will contribute to various LEED BD+C Rating System categories. For specific contributions, contact the panel manufacturers. Generally, the panels contribute to:

## **Materials & Resources**

MR Credit 4: 1 to 2 points

One point is awarded if the materials selected for the project have a recycled content of 10% based on total value. A second point can be earned if the recycled value reaches 20%. The recycled content is determined as the sum of the post-consumer recycled content plus one half of the pre-consumer recycled content. For material assemblies, such as cladding systems, the recycled content value shall be determined by weight.

Note: The total recycled content of the panels should be combined with the other components of the cladding system to determine the contribution of the wall cladding to the overall project point qualification.

# Contribution to LEED Credits

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## **Indoor Environmental Quality**

EQ Credit 4.2: 1 point

The intent of this credit is to reduce the harmful or irritating indoor air contaminants that the building occupants or installers are exposed to.

All coatings applied to the painted ACM panels are factory-applied using a coating line with an in-line regenerative thermal oxidizer, which eliminates the release of the VOC content of the coating. By factory-applying the coatings, the need for field painting and the exposure to the accompanying VOCs are eliminated.

## **Innovation in Design**

ID Credit 1.1 to 1.5:

Three points are available in this section for exceptional performance in meeting the requirements in other sections of the LEED for New Construction & Major Renovations rating system or for an innovative performance on green building categories which are not addressed in other sections of the rating system.

# Lovett Middle School, Atlanta, GA: LEED Silver

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Completed in July 2009, Lovett Middle School in Atlanta was designed to reflect the school's commitment to environmental stewardship. The school currently has LEED Silver certification and is seeking LEED Gold certification. The green middle school is also a teaching tool.

Teachers are able to use the school's 5,000-square-foot (465-m<sup>2</sup>) roof garden as an outdoor classroom and laboratory that will also showcase an innovative system for harvesting rainwater for irrigation. Solar hot water, bamboo flooring, carpet with recycled content and daylight sensors are some of the many sustainable features included in the school.



# Lovett Middle School, Atlanta, GA: LEED Silver

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“Used in conjunction with glass curtainwall, the metal panels convey a sense of transparency and lightness as the upper portion of the building emerges from its masonry base,” said Jeanne Carey, AIA, LEED AP, with Shepley Bulfinch Richardson and Abbott. “Metal panels are a versatile, modern and durable material. They provide good quality, ease of construction and ability to achieve an energy-efficient envelope.”



# Hubbell Lighting Headquarters: LEED Silver

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The Hubbell Lighting Headquarters in South Carolina was designed by McMillan, Smith & Partners. It is a LEED Silver building designed to showcase the Hubbell products within the building itself. This 25,000-sf building is clad with MCM panels with a mica finish.





Kijang Fire Station, S. Korea

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## Maintenance and Post-Use

# Maintenance

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Painted flouropolymer resin coatings are self-cleaning and should shed airborne dust and dirt in rain showers. However, depending on the local environment and conditions, the painted surfaces should be rinsed with water on a regular basis to prevent buildup of corrosive deposits. A rough guideline suggests rinsing the panels' surfaces at the same time the windows are cleaned.

For zinc and copper MCMs, the skins will change over time and cleaning is not recommended. To clean an anodized surface, follow the recommendations as detailed in the Voluntary Guide Specification for Cleaning and Maintenance of Architectural Anodized Aluminum AAMA 609.

Stainless steel and titanium MCMs should be cleaned as needed following the manufacturer's specifications.

# Post-Use Recycling

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Some manufacturers have their own post-consumer recycling programs where they separate the individual materials in the panel and place the components in the appropriate industry recycling streams.

Alternately, surplus MCM material is being used in socially important projects, such as shelters.



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# Summary

# Summary

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Selecting MCM panels for an interior or exterior application may be a result of their durability, ease of maintenance, high strength-to-weight ratio and ease of shaping; however, these materials are also capable of contributing to green building goals. Consider the following when selecting MCM panels for a sustainably designed building:

- Many manufacturers have instigated processes that are designed to minimize the impact on the environment through efficient use of raw materials and energy sources.
- What is the recycled content of the natural metals and the polyethylene or fire resistant core?
- Is the natural metal the most durable for the location and application? For instance, a titanium is resistant to salt corrosion.
- What painting system is being used and what is the relative durability and VOC content?
- Does the manufacturer have an end-of-life program for the materials?

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# Conclusion

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