

AIA PRESENTATION



Insulated Metal Wall and Roof Panels for Sustainability and Energy Efficiency IMP001

1 LU/HSW Hour



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Best Practice

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Learning Objectives

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

- explain how IMPs lower building energy costs, prevent moisture intrusion and improve the thermal comfort of the occupants
- compare the insulating values of IMPs to traditional systems and illustrate how IMPs reduce the carbon footprint of a building
- analyze the sustainability and performance criteria of IMPs relative to qualifying for credits under today's green building rating programs
- discuss how IMPs serve as walls, ceilings and roofs in new and retrofit construction, and how they can be easily adapted to pre-engineered metal building designs, and
- differentiate various types of IMPs based on their performance attributes and aesthetics

Why Insulate?

To create a wall with high thermal performance the following issues must be controlled:

- air leakage and infiltration
- thermal bridging
- gaps in insulation*
- condensation

*In 2013, ASHRAE 90.1 2010 will require continuous insulation in all regions.

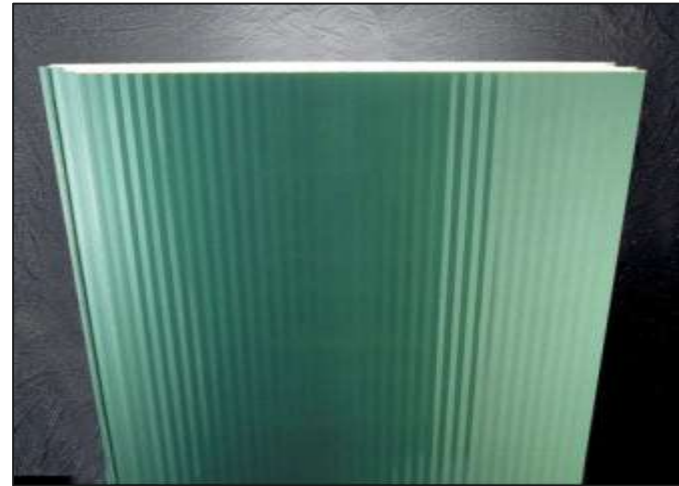


Insulated Metal Panels

- A form of continuous insulation - rigid urethane foam sandwiched between two sheets of coated metal
- IMPs serve as walls, ceilings and roofs for commercial and industrial buildings, in new and retrofit construction



Roof panel



Wall panel

Applications

- Schools, hospitals, religious facilities, office buildings, aircraft hangars, manufacturing facilities, distribution warehouses, equipment screens and maintenance buildings, mechanical penthouses, prison units



Lapel High School



Gary Jet Center



Nanaimo Ice Center



Million Air Charleston

IMP Systems Compared to Other Panel Systems

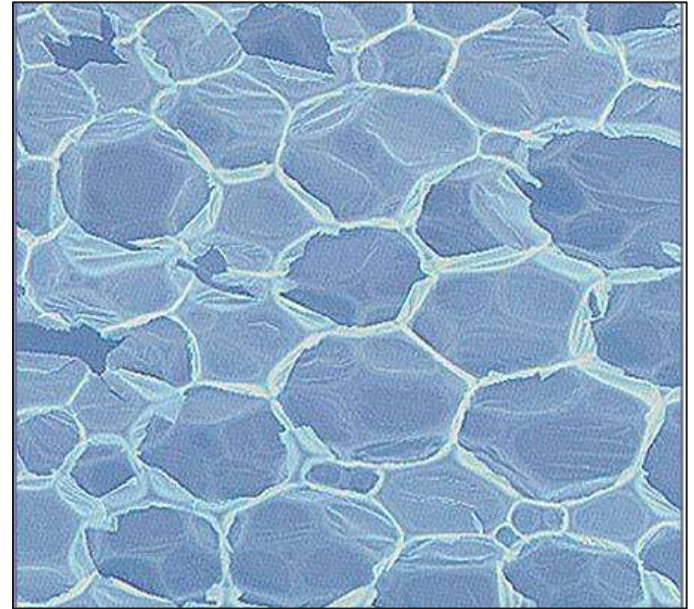
- IMP systems provide many of the same benefits found with other metal wall and roof systems, plus some unique benefits found only with IMPs
- IMPs are composite, factory-insulated, all-in-one, single-element panels with factory-applied coatings
- IMPs are lighter in weight, easy to install, and allow for faster building completion, all year round in almost any kind of weather
- No risk to system integrity since IMPs have few field-assembled components with no multiple installation steps

Core Insulation

Polyurethane and polyisocyanurate have similar physical properties for:

- compressive strength
- tensile strength
- shear strength
- minimum closed cell content
- foam density

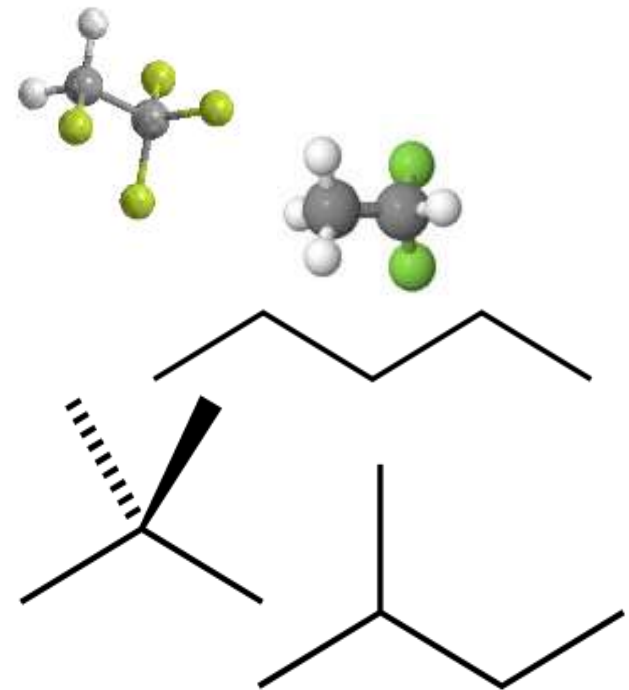
Type of blowing agent used will impact whether polyurethane or polyisocyanurate foam is used to make IMPs.



Cell structure

Blowing Agents

- Common hydrocarbon (HC) blowing agents are pentane isomers (Neopentane, Isopentane and Cyclopentane)
- Pentane isomers have zero ozone depleting potential and provide good thermal performance
- HFCs are non-volatile organic compounds, and provide superior dimensional stability and a high thermal performance



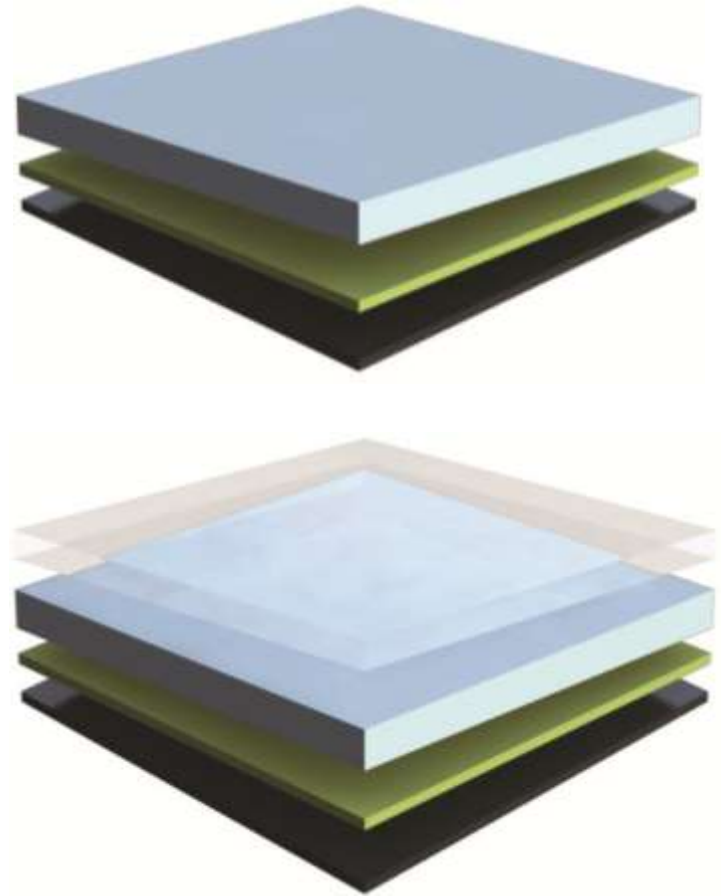
Panel Facings: Recycled Content

- Standard gauge for roof panels is 24 or 26
- Steel faces contain more than 30% recycled content
- Foam core contains 7% pre-consumer recycled content
- Panels can be disassembled, moved, and reused



Finish and Coatings

- Panels are prefinished on both the interior and exterior faces
- Coatings provide protection against UV rays, corrosion, humidity, acid rain, and a wide range of chemicals and other pollutants
- Coatings provide gloss retention, and resist chalking, fading, chipping, and dirt



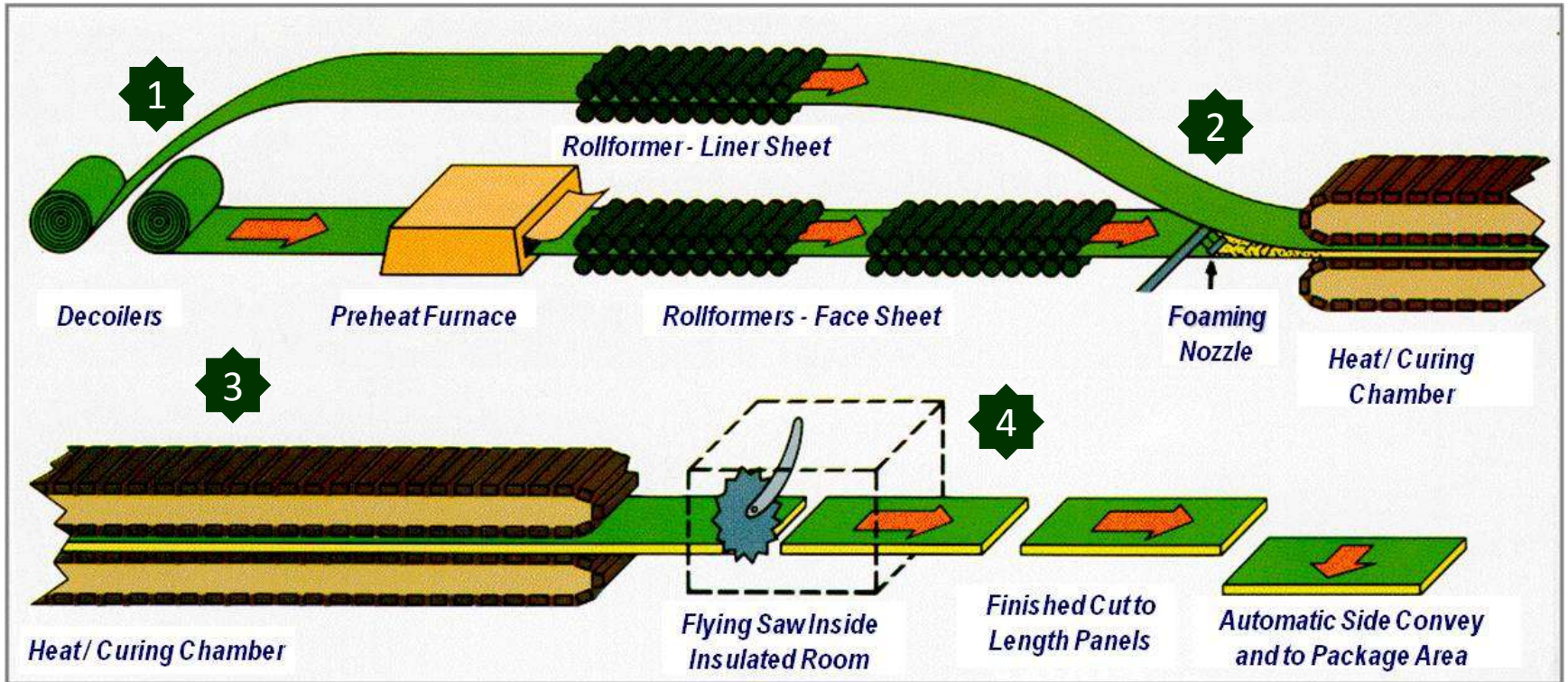
Cool Roofs

- Cool roofs help mitigate global warming and reduce urban heat islands and smog
 - they reflect (solar reflectance) and radiate (thermal emittance) the sun's heat away from a building
- Insulated metal roof panels with a white Fluoropon[®] exterior skin meet the definition of cool roofing for low-slope roofing under Title 24, Part 6 of the California Energy Code in 2005



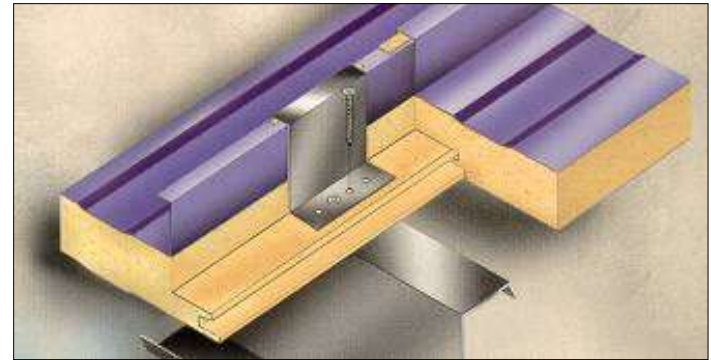
Cool Roof Rating Council,
www.coolroofs.org

Panel Production



Panel Description and Installation

- Installation savings – single-element panels, fewer side joints
- Weather-tight performance
- Installation from top side of roof
- Engineered end laps for long runs from ridge to eave

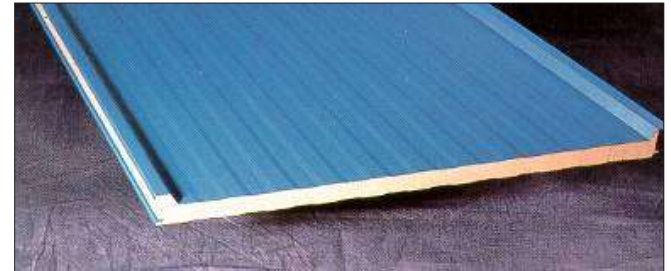


- Foam core 2" to 6"
- Module widths 30", 36", 42"
- Standing seam mechanically closed
- Concealed fastening
- Engineered end lap
- Low pitch $\frac{1}{2}$ " in 12"



Panel Description and Installation

- Self-contained units of roof weather membrane, roof insulation, and liner/decking
- Batten lap seams and ribbed panel widths range from 1m to 40"
- Standard max. panel length is 50'
- End of panel supported by roof structure
- Lapped faces use gasket-type joints



Lap seam



Ribbed



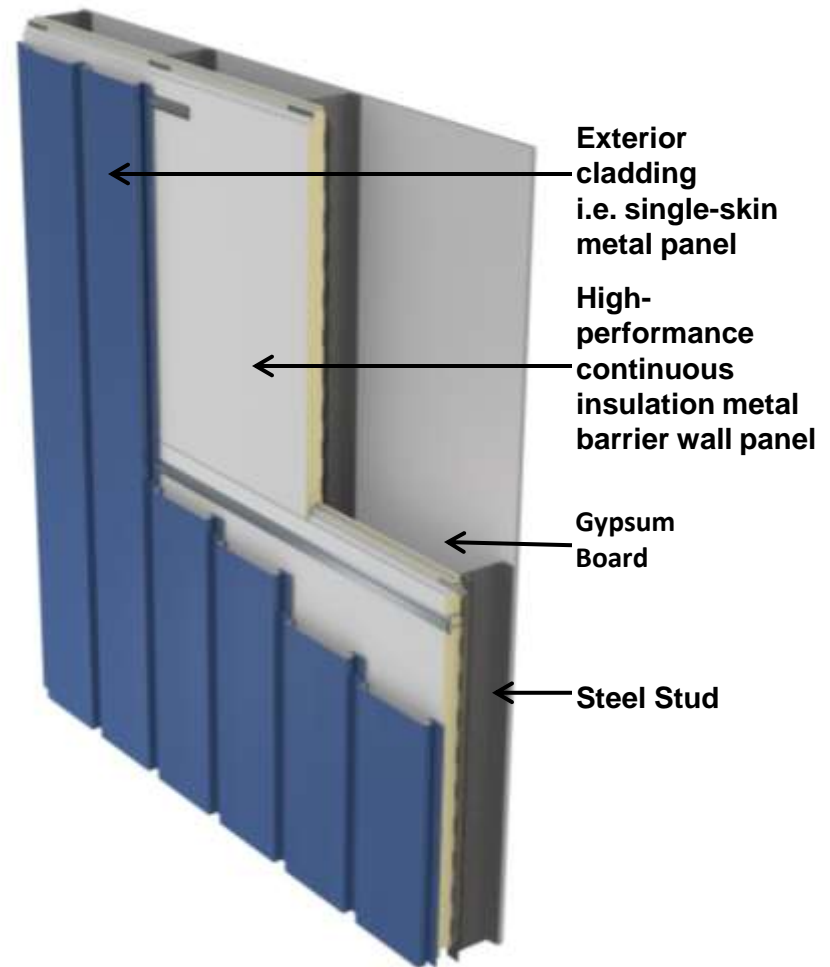
Architectural Wall Panels

- Provide flush, high-profile, clean appearance
- Combine well with window systems
- Formed side joints – hidden application of vapor sealant
- Concealed attachments with clips and fasteners
- Trimless ends



High-Performance Continuous Insulation Panels

- Provides air, water, thermal and vapor protection in a single-panel component
- No thermal bridges
- Quick and easy to install behind any type of façade
- Separated from the interior of the building by an approved thermal barrier



Testing Requirements

IMPs are tested and carry ratings for:

- fire
- structural
- thermal transmittance
- foam core properties
- water penetration
- air pressure differential



Thermal Performance

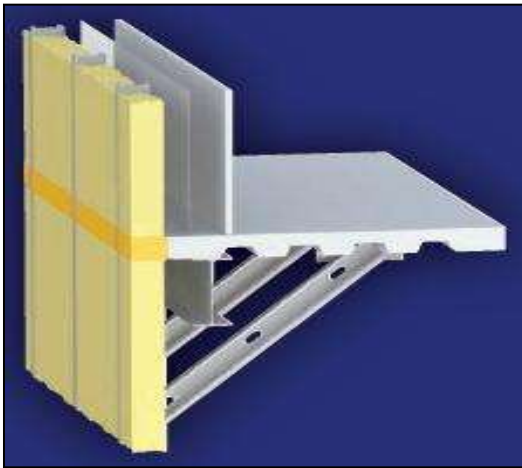
- Panel faces and metal trim completely encapsulate insulation
- Consistent R-values maintained across entire wall and roof areas
- Consistent R value over life of panel
- Insulation is never compressed
- Complete concealed fastener system
- No thermal bridging from exterior to interior skin



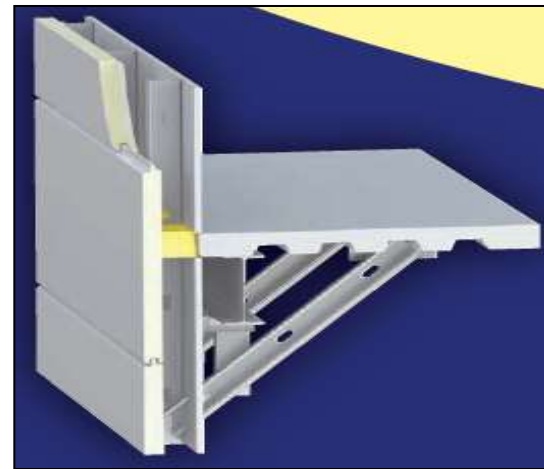
Thermal Efficiency and R-Value Comparison

R-value for 1" of material:

- Polyurethane 7
- Extruded Polystyrene 4.7
- Expanded Polystyrene 4
- Mineral Fiber 3.6
- Cellular Glass 3.4

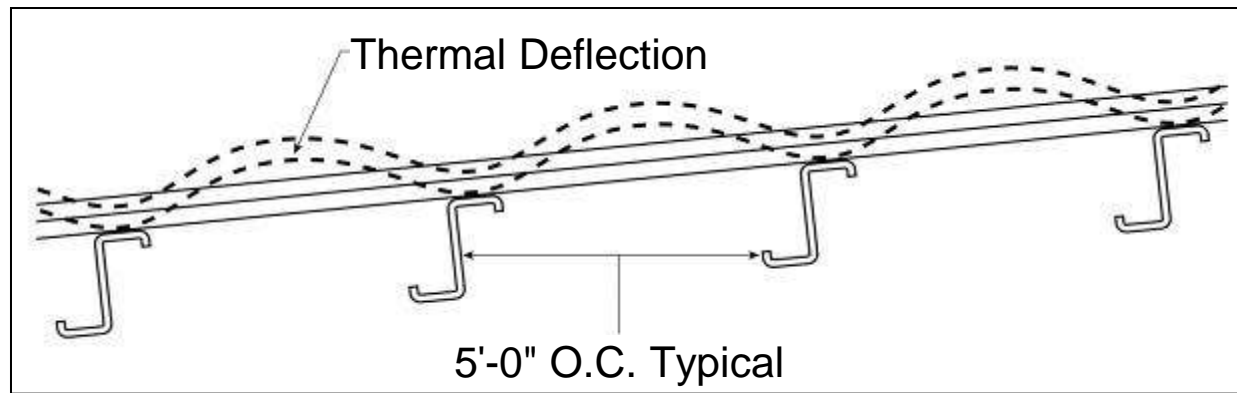


R-7.4 6" Fiberglass Insulated Wall



R-21 3" Insulated Metal Panel

Ratings: Thermal Transmittance



- IMPs have a foam core that provides R-values generally ranging from 15 to 48 as tested with ASTM C 1363 at 75°F, in thicknesses from 2" to 6" for wall systems, and R-values ranging from 10 to 48 for roof systems
- Thermal values should be specified based on local codes, usage, and occupancy

Ratings: Foam Core Properties

Panel production must formulate a foam system with the right balance of the following properties:

- density
- shear strength
- tensile strength
- compressive strength
- humid aging
- heat and cold aging
- flash and ignition properties



Ratings: Water Penetration and Air Infiltration

Complete panel assembly, mounted vertically with panel side joints:

- ASTM E 331 - no uncontrolled water leakage at 6.24 psf air pressure differential for wall panel assemblies
- ASTM E 1646 - no uncontrolled water leakage through the panel joints at a static pressure of 12 psf for roof panel assemblies
- Air infiltration should not exceed 0.06 cfm/sf at 6.24 psf air pressure differential for wall panel assemblies, and in accordance with ASTM E 1680 at a static pressure of 12 psf for roof panel assemblies

Ratings: Structural

- Structural load capacity should be verified by representative structural tests for positive as well as negative wind loads
- IMP manufacturer should provide calculations verifying the testing to ensure the structural capacity of the panels meet the project requirements
- Insulated metal roof panels should be tested to determine load capabilities by an independent testing agency
 - UL Wind Uplift–UL 580 or Factory Mutual Class 1 Rating for roof and ceiling–FM 4471
 - FM 1-60 and 1-90 Windstorm Classifications or UL-60 and UL-90 classifications

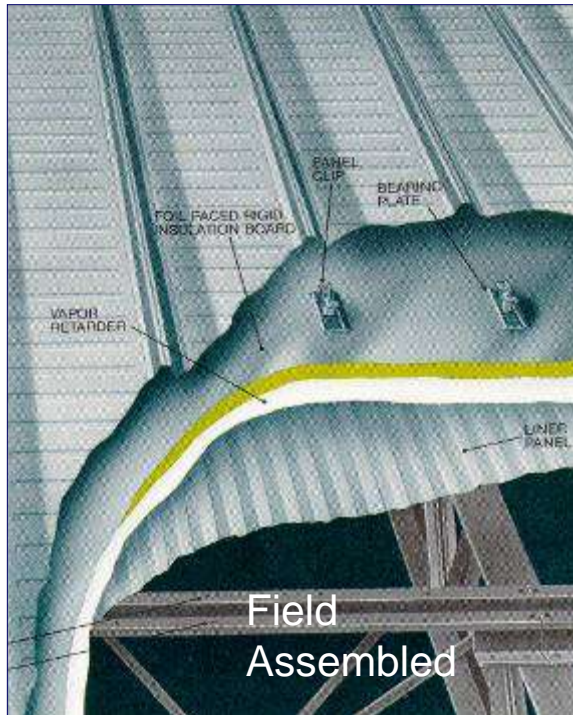
Ratings: Fire

- IMPs should be tested by Underwriters Laboratories, Factory Mutual or similar testing and listing agencies for conformance with the requirements of the model building codes
- FM 4880 and FM 4881 - the foam core should have a maximum Flame Spread of 25 and a maximum Smoke Developed rating of 450

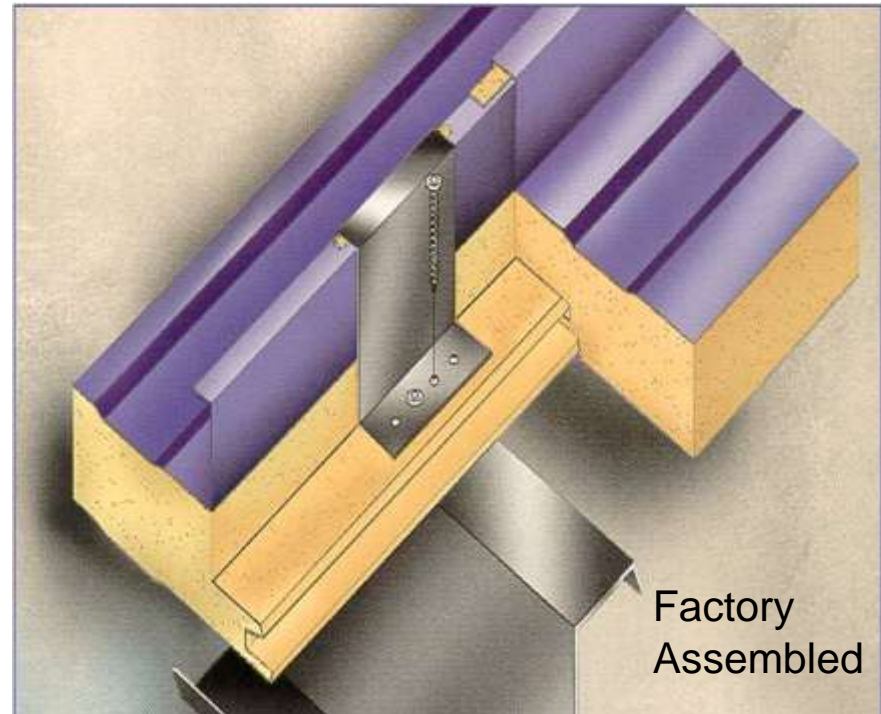
Ratings: Coatings

- Color Change (ASTM D 2244)
- Chalk Resistance (ASTM D 4214)
- Specular Gloss at 60° (ASTM D 523)
- Dew Cycle Weatherometer Test (ASTM D 366)
- Humidity Resistance (ASTM D 2247)
- Salt Spray Resistance (ASTM B 117)
- T-Bend (ASTM D 4145)
- Impact Resistance Test, Reverse Impact (ASTM D 2794)
- Abrasion Resistance Test, Falling Sand (ASTM D 968)
- Pencil Hardness HB to 2H (ASTM D 3363)
- Cross Hatch Adhesion (ASTM D 3359)

Design Benefits: Installation



1. Liner Panel or Deck
2. Vapor Retarder
3. Insulation Board
4. Standing Seam Roof Panel or Membrane/Ballast



Insulated Metal Roof Panel: Single Element

Design Benefits: Building Installation Efficiency

- Panels are lightweight and less affected by weather conditions
- One-piece construction process; factory-fabricated IMPs are attached directly to the supporting structure
- Reduced construction and interim financing costs



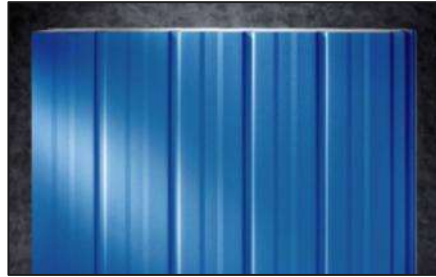
Design Benefits: Flexibility and Aesthetics

- Available in a wide range of colors, finishes, and textures
- Flat, profiled, curved and formed panels may be installed either horizontally or vertically
- Flush appearance when panels are attached with concealed clips and fasteners in the side joint
- Custom widths and specialty features to suit project needs



Design Benefits: Panel Profiles

The bold vertical lines of a fluted wall panel with a ribbed profile enhance the high-tech industrial look.



Vertical application
Modules: 42"
Thickness: 2", 2 ½", 3",
4", 5", 6"
Lengths: 8' to 53'

A lightly corrugated profile on both faces of the panel ensures symmetry from outside the building to inside, and from room to room in interior partition applications.



Vertical application
Modules: 30", 36", 42"
Thickness: 2", 2 ½", 3",
4", 5", 6"
Lengths: 8' to 53'

Flat architectural panels provide a flush appearance, ideal for high-profile architectural applications.



Vertical and horizontal application
Factory-folded panel ends
Preformed corners
Radius corners
Side joint reveals
Modules: 24", 30", 36"
& custom
Thickness: 2", 2 ½", 3"
Lengths: 1' to 32'

Design Benefits: Panel Profiles

The striated wall panel is an attractive alternative to typical flat wall panels. The exterior face exhibits a virtual flat appearance from a short distance away.



Vertical and horizontal application
Factory-folded panel ends
Preformed corners
Modules: 30", 36", 42"
Thickness: 2", 2 ½", 3"
Lengths: 8' to 40' for 30" & 36" modules, and 8' to 32' for 42"

A flat exterior profile with a heavy non-directional embossed stucco texture provides the look of a masonry stucco finish.



Vertical and horizontal application
Factory-folded panel ends
Textured brake form trim
Modules: 36", 42"
Thickness: 2", 2 ½", 3"
Lengths: 8' to 40'

A ribbed wall panel is ideal for interior partition walls, exterior walls and soffit applications where a light vertical accent line is desired.



Vertical application
Module: 42"
Thickness: 2", 2 ½", 3", 4", 5", 6"
Lengths: 8' to 40'

U.S. Green Building Council (USGBC)

- USGBC developed the LEED® (Leadership in Energy and Environmental Design) green building certification program
- Point-based system with the following categories:
 - Sustainable Sites (SS)
 - Water Efficiency (WE)
 - Energy & Atmosphere (EA)
 - Materials & Resources (MR)
 - Indoor Environmental Quality (IEQ)
 - Innovation in Design (ID)
 - Regional Priority
- LEED credit requirements cover the performance of materials in aggregate, not the performance of individual products



LEED Credits

IMPs may help a building project satisfy the requirements of earning LEED credits in the following categories:

- SS Credit 7.2: Heat Island Effect: Roof
- MR Credit 1.1: Building Reuse: Maintain Existing Walls, Floors and Roof
- MR Credit 1.2: Building Reuse: Maintain Interior Non-Structural Elements
- MR Credit 3: Materials Reuse
- MR Credit 4: Recycled Content
- MR Credit 6: Rapidly Renewable Materials

LEED Credits

- EA Prerequisite 2: Minimum Energy Performance (Required)
- EA Credit 1: Optimize Energy Performance
- EA Credit 2: On-Site Renewable Energy

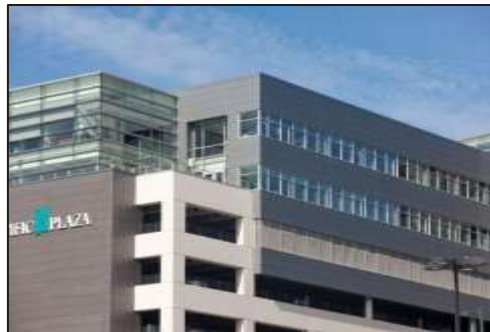
- IEQ Credit 4.1: Low Emitting Materials: Adhesives & Sealants
- IEQ Credit 8.1: Daylight & Views: Daylight

- WE Credit 1: Water Efficient Landscaping
- WE Credit 2: Innovative Wastewater Technologies
- WE Credit 3: Water Use Reduction

- ID Credits 1.1 to 1.4: Innovation in Design

Pacific Plaza, LEED Platinum

- More than 26,000 sq. ft. of IMPs were used to clad the inhabited portion of the office building/parking garage structure
- 3" panels finished in Weathered Zinc and installed horizontally in 24", 30" and 36" widths
- IMPs interface with a cement composite façade system used to clad the exterior walls on parking garage portion of the building



Hope Lake Lodge, LEED Silver

- Approx. 60,000 sq. ft. of IMPs were used to clad the roof and walls of the Varco Pruden building
- Kynar finish on 4" thick roof panels and 3" thick wall panels
- Steel structure enabled use of large clear spans of IMPs to house the water park features
- Temperature inside is maintained at 80-84°F year-round



Ballard Blocks, LEED Silver

- Approx. 51,000 sq. ft. of IMPs were utilized
- 2" panels in a custom color and were installed horizontally
- IMPs provided all of the systems—the metal skin, insulation and vapor barrier—in one product



Aerzen USA, LEED Gold

- Approx. 54,000 sq. ft. of IMPs were used on the walls and roof
- Lightly corrugated panel profile on both faces ensures symmetry from outside the building to inside, and from room to room in partition applications
- IMPs normally used for freezer applications quadrupled the insulation value



Summary and Resources



Project: Takao America



Project: Swiss American

Course Evaluations

In order to maintain high-quality learning experiences, please access the evaluation for this course by logging into [CES Discovery](#) and clicking on the Course Evaluation link on the left side of the page.



The screenshot shows the AIA CES Discovery website. At the top left is the AIA logo (a red stylized eagle) and the text "THE AMERICAN INSTITUTE OF ARCHITECTS". Below this is a red navigation bar with white text links: "Discovery Home", "Notifications", "Scheduled Courses", "Course Directory", "Self-Report Activities", "Transcript", and "Resources". The main content area features a large banner image of a person's hands typing on a keyboard and holding architectural plans. To the left of the banner is the "CESDiscovery" logo. Below the banner, on the left, are three links: "Update My Account", "E-mail AIA/CES Member Care Center", and "Course Evaluation". To the right of these links is a red heading "Welcome, AIA Members". Below this heading are four promotional boxes, each with an icon and text:

- Find Courses**: Search the CES Discovery for available courses.
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Questions?

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