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Enhancing Metal Roofing Systems with Stone Wool Insulation

Metal roofing panels are broadly categorized into two types: structural and architectural. Each type serves a different function and offers unique benefits, making them suitable for specific applications in building design and construction. Choosing the right type of metal roofing panels is crucial for both the structural integrity and aesthetic appeal of a building.

Structural panels are designed to be load-bearing and are fabricated from roll-formed sheet metal. They can support the weight of the roof as well as other loads without the need for an extensive support structure such as a solid decking. This capability makes them ideal for spanning across open spaces. Typically, these panels are attached directly to the building's structural supports, such as rafters, joists, or purlins. They do not bear on the insulation, allowing for the use of an insulation product with lower compressive resistance, such as ROCKWOOL Cavityrock®.

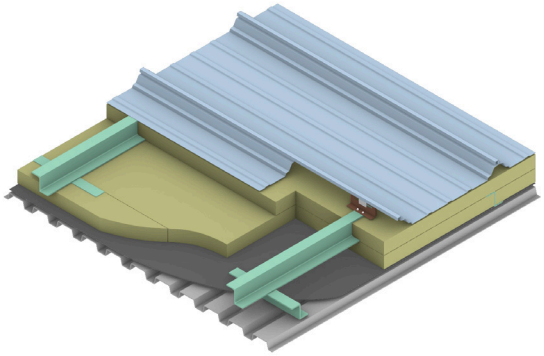

Figure 1: Illustration of a structural metal roof panel system over insulation and decking

Although available in various finishes and colors, the primary focus of structural panels is on strength and durability rather than aesthetics.

Underlayment membranes are typically not necessary over the insulation in these systems. Rather, a sealant is integrated into the seams of the metal panels, making the systems effectively monolithic and watertight. Sealant is also applied to all overlapping panel joints. These systems can be installed on slopes with a minimum of a 2% grade.

Architectural standing seam panels, which often feature a more intricate joining system that may include hidden fasteners and interlocking seams, on the other hand, are primarily used for their visual appeal. They are available in a wide array of colors, styles, and finishes, though they are also fabricated from roll-formed sheet metal. These panels are often chosen for projects where the aesthetic impact of the roof is significant.

Architectural panels differ from structural panels in that they require a solid substrate for installation, such as large bearing plates or a cover board over insulation. This necessity arises because architectural panels do not possess the inherent strength to span between supports and therefore cannot be installed directly over purlins. The insulation used in these systems must have sufficient compressive resistance and exhibit limited creep over time. Products such as ROCKWOOL Toprock® DD and ROCKWOOL Multifix™ are specifically designed to fulfill these requirements, while ROCKWOOL Comfortboard® 80 and ROCKWOOL Comfortboard® 110 may also be suitable options under specific conditions.

While structural panels are designed and assembled to be watertight, architectural panels are designed simply to shed water and rely on an underlayment membrane* to handle any water that may penetrate the metal panels above.

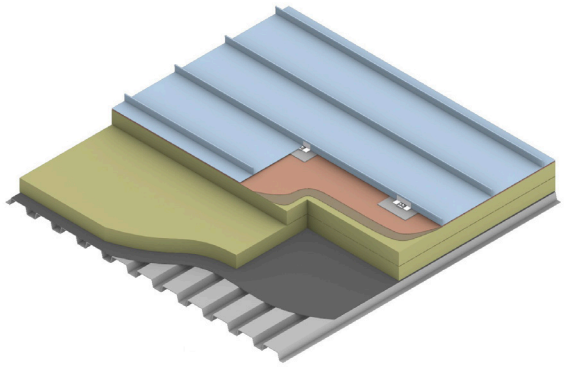

Figure 2: Illustration of an architectural metal roof panel system

In summary, the choice between structural and architectural panels often comes down to the specific needs of the project, including structural requirements, aesthetic goals, and budget considerations.

It is also worth noting that the orientation of the underlying deck may vary depending on the structural framework in place. Based on experience with metal decking in roof assemblies, it appears that the deck seams are typically oriented perpendicular to the slope.

* Roofing underlayment options may include self-adhered waterproof underlayment, felt paper, or synthetic underlayment. However, for designs likely to experience higher temperatures, a high-temperature (HT) underlayment is advisable to ensure durability.

Benefits of Stone Wool

ROCKWOOL stone wool insulation delivers a multitude of advantages to insulated metal roof systems, encompassing long-term performance characterized by consistent thermal properties throughout the roof's lifespan, superior fire resistance, reduced sound transmission, and inherent moisture resistance. Durable by nature, ROCKWOOL stone wool insulation is an excellent choice for metal roof systems, which are known for their longevity, often exceeding 40 years. Stone wool insulation insulates by trapping air and limiting its movement between the fibers of the insulation, resulting in consistent thermal performance throughout the roof's lifespan without any known thermal drift. Its dimensional stability helps reduce the effects of insulation movement, enhancing the roof system's overall durability and effectiveness.

The Superior Fire Resistance of Stone Wool Systems

ROCKWOOL stone wool insulation products such as Cavityrock®, Comfortboard® 80, Comfortboard® 110 and Toprock® DD are noncombustible, as per ASTM E136[1], and CAN/ULC-S114[2], and have a flame spread and smoke developed index, rating and classification of 0, respectively, as per ASTM E84 (UL 723)[3] and CAN/ULC-S102[4] thereby contributing to the fire resistance of the assembly.

Indeed, for both structural and architectural roof panels, there are a multitude of fire rated assemblies available, as per ASTM E119 (UL 263)[5], and CAN/ULC-S101[6] using ROCKWOOL stone wool insulation.

Combining stone wool insulation with Class A metal roofs creates a highly effective fire safety solution that enhances building resilience especially in Wildland-Urban Interface (WUI) zones.

Roof coverings that satisfy Class A exposure in accordance with ASTM E108 (UL 790)[7] are expected to provide superior protection against severe fire exposure. Class A metal roof coverings maintain their position without slipping and do not pose a risk of producing flying embers. Furthermore, the interlocking panels of metal roofs contribute added fire resistance, safeguarding the structure from sparks and embers.

Optimizing Acoustic Comfort

Finally, beyond their aesthetic and structural benefits, metal roof systems, which are commonly perceived as loud, can play a crucial role in enhancing acoustic performance in building environments, thereby improving the comfort and usability of spaces beneath them. When used alongside an absorbent, porous insulation material such as ROCKWOOL stone wool, these systems can be effective in minimizing noise disruptions from rainfall and reducing sound transmission from external sources like air traffic. This performance significantly surpasses that of traditional roofing insulation materials.

Several systems incorporating Toprock® DD have undergone rigorous testing as per ASTM E90[8] to evaluate their performance in terms of Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC).

Additional testing was conducted in accordance with ISO 140-18[9] to determine their resistance to heavy rainfall. These tests ensure that the systems meet the required standards for acoustic insulation and weather resilience, providing reliable solutions for building projects.

Tested assemblies are available in ROCKWOOL's **Rated Acoustic Assembly Catalog**

Referenced Test Standards

[1] ASTM E136: Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C
[2] CAN/ULC-S114: Standard Method of Test for Determination of Non-Combustibility in Building Materials
[3] ASTM E84 (UL 723): Standard Test Method for Surface Burning Characteristics of Building Materials
[4] CAN/ULC-S102: Surface Burning Characteristics of Building Materials and Assemblies
[5] ASTM E119 (UL 263): Standard Test Methods for Fire Tests of Building Construction and Materials
[6] CAN/ULC-S101: Standard Methods of Fire Endurance Tests of Building Construction Materials
[7] ASTM E108 (UL 790): Standard Test Method for Fire Tests of Roof Coverings
[8] ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
[9] ISO 140-18: Acoustics — Measurement of sound insulation in buildings and of building elements — Part 18: Laboratory measurement of sound generated by rainfall on building elements

Features of Structural Panel Systems

Structural roof panels are designed to span between Z-framing (typically 4'-0"), and do not rely on insulation for support. As a result, this system utilizes semi-rigid ROCKWOOL insulation as referenced in the insulation selection table on page 6. Since metal Z-framing can create a thermal bridge, it is advisable to use fiberglass or thermally broken metal Z-framing to minimize thermal conductivity. Furthermore, structural roof panels require significantly fewer anchor clips, using only 1/3 to 1/4 the number needed for architectural panels.

To improve thermal performance, the structure can incorporate two perpendicular layers of insulation along with crossed Z-framing, which offers superior efficacy compared to full-height Z-framing alone. As a recommended upgrade, integrating fiberglass or thermally broken metal girts or brackets should be considered to further reduce thermal bridging, thereby significantly increasing the system's overall efficiency.

Assembly Components

1. Deck system, as structural support for vertical and lateral loads. Options include corrugated steel, concrete, metal liner panels, gypsum, plywood or OSB sheathing, and tongue and groove decking, spanning between trusses, wood joists, etc.
2. Air and vapor control layer, if the deck does not provide sufficient control, installed atop the deck to control moisture migration. Optional substrate board is recommended to support the membrane with corrugated decks.
3. Semi-rigid stone wool insulation installed in one or several layers, with joints staggered, fitted between (a) **Z-framing** or (b) **thermally broken framing**, anchored through the air and vapor control layer to the deck below.
4. Anchor Clips, attached with screws to Z-framing, positioned at required intervals at roof panel seams, and available as fixed or floating, to handle panel movement.
5. Structural Roof Panels, spanning across Z-framing, secured with anchor clips.

Z-framing

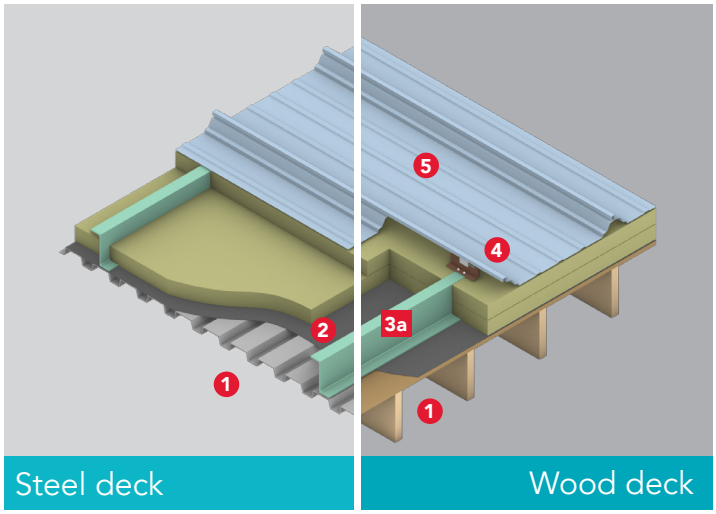

Figure 3: Structural metal roof panel system over insulation fitted between metal Z-framing, over steel or wood decking

Thermally Broken Framing

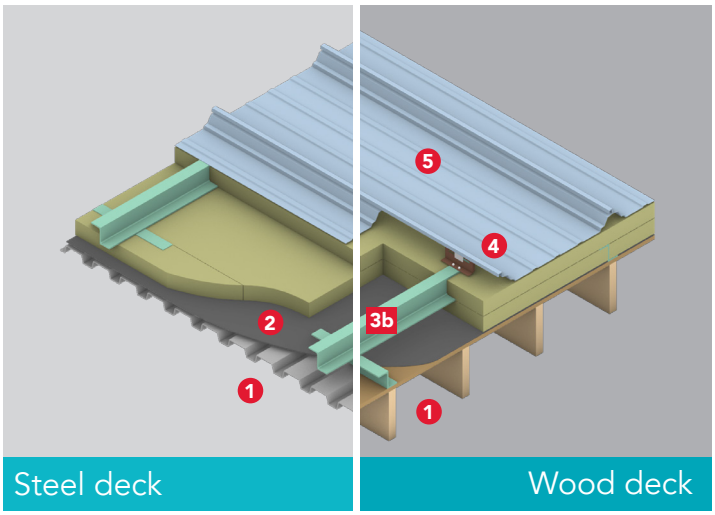

Figure 4: Structural metal roof panel system over insulation fitted between thermally broken framing, over steel or wood decking

Features of Architectural Panel

Architectural roof panels depend on insulation for support, requiring the use of higher-density insulation for its superior compressive resistance, compared to the insulation used in structural panel options as referenced in the insulation selection table on page 6. These systems can significantly enhance thermal performance with a multi-layered, staggered insulation arrangement and minimal penetrations, effectively minimizing thermal bridging and thereby optimizing the efficiency of the roof system.

Bearing Plates (Figure 5)

In these systems, effective load distribution is vital for maintaining structural integrity. This can be achieved through the use of bearing plates, which act as attachment points for the anchor clips that are securely fastened to the structure.

Cover Board (Figure 6, on next page)

As an alternative solution, architectural roof panels can be supported and anchored using a cover board that rests directly on the insulation. The anchoring system penetrates through the entire thickness of the insulation, securing into the deck system beneath. This method necessitates the use of medium to high-density mineral wool insulation to adequately support both the coverboard and the architectural roof panels as referenced in the insulation selection table on page 6.

The inclusion of a cover board offers multiple benefits, such as enhanced durability by protecting the air and vapor control layer and the insulation against physical damage during construction. It also provides a uniform surface for the underlayment membrane application.

Anchoring Substrate (Figure 7, on next page)

As a third alternative solution, architectural roof panels can be supported and attached using an anchoring substrate such as plywood or OSB, that bears directly on the insulation, eliminating the need for a coverboard or bearing plates. This anchoring substrate serves as the primary bearing surface for the metal panel clips, allowing for anchoring directly to the substrate rather than using long screws that penetrate through the entire system. This setup not only simplifies the installation process but also enhances the structural integrity of the roof.

An anchoring substrate offers enhanced durability by protecting the air and vapor control layer and insulation against physical damage during construction, while also providing a uniform surface for underlayment membrane application, similar to the benefits of a cover board.

Bearing Plates

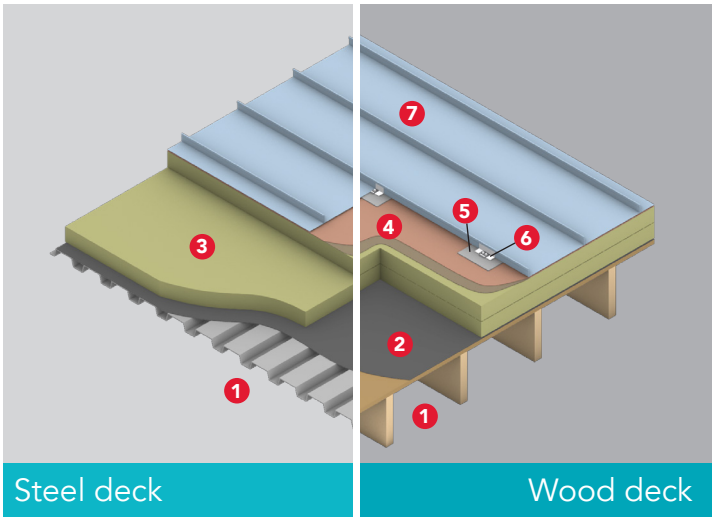

Figure 5: Architectural metal roof panel system using bearing plates as an attachment point for the anchor clips, over steel or wood decking

Assembly Components

1. Deck system, as structural support for vertical and lateral loads. Options include corrugated steel, concrete, metal liner panels, gypsum, plywood or OSB sheathing, and tongue and groove decking, spanning between trusses, wood joists, etc.
2. Air and vapor control layer, if the deck does not provide sufficient control, installed atop the deck to control moisture migration. Optional substrate board is recommended to support the membrane with corrugated decks.
3. Rigid stone wool insulation, installed in one or several layers.
4. Underlayment membrane, with rosin paper installed between the metal panel and underlayment as a slip sheet, laid over the insulation in a shingle-lapped manner, continuously, and integrated with the flashing at the perimeter for adequate drainage.
5. Large **bearing plates** distributing pressure from anchor clips across a large area of insulation, with their size, shape, and thickness determined by the type of insulation, anchor clip spacing, and load requirements. Shear blocking may be necessary to prevent screw rotation under certain loading conditions.
6. Anchor Clips, attached with long screws that extend through the bearing plates, the underlayment membrane, the insulation and the air and vapor control layer to the deck substrate, positioned at required intervals at roof panel seams, and available as fixed or floating, to handle panel movement.
7. Architectural roof panels, supported on the insulation and secured to the anchor clips

Cover Board

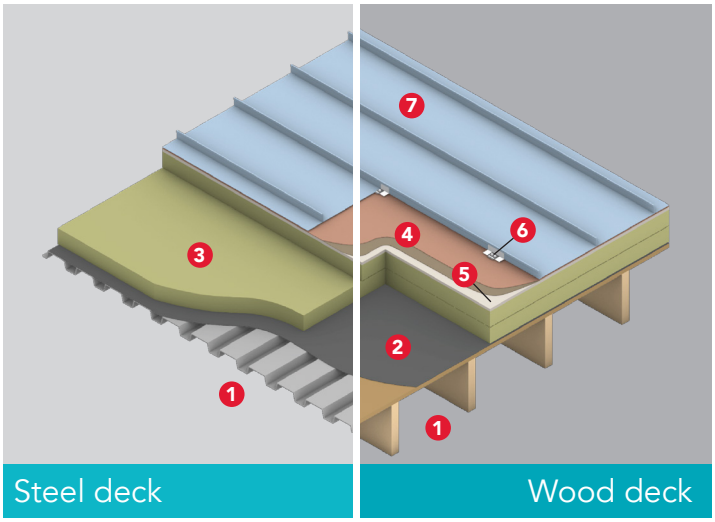

Figure 6: Architectural metal roof panel system anchored using a cover board resting directly on the insulation, over steel or wood decking

Assembly Components

1. Deck system, as structural support for vertical and lateral loads. Options include corrugated steel, concrete, metal liner panels, gypsum, plywood or OSB sheathing, and tongue and groove decking, spanning between trusses, wood joists, etc.
2. Air and vapor control layer, if the deck does not provide sufficient control, installed atop the deck to control moisture migration. Optional substrate board is recommended to support the membrane with corrugated decks.
3. Rigid stone wool insulation, installed in one or several layers.
4. Underlayment membrane, with rosin paper installed between the metal panel and underlayment as a slip sheet, laid over the insulation in a shingle-lapped manner, continuously, and integrated with the flashing at the perimeter for adequate drainage.
5. **Cover board**, positioned over the top of the insulation and fastened with long screws and plates into the deck below, distributing the loads from the metal roof system to the underlying insulation.
6. Anchor Clips, attached with long screws that extend through the cover board, the underlayment membrane, the insulation and the air and vapor control layer to the deck substrate, positioned at required intervals at roof panel seams, and available as fixed or floating, to handle panel movement.
7. Architectural roof panels, supported on the insulation and secured to the anchor clips

Anchoring Substrate

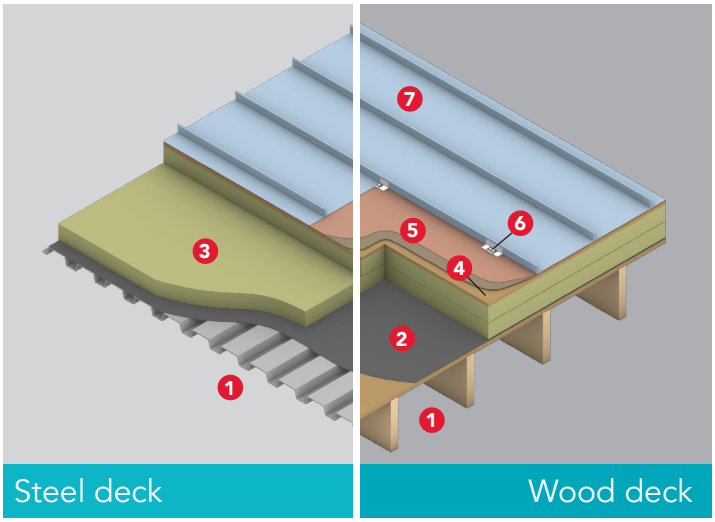

Figure 7: Architectural metal roof panel system supported and attached using an anchoring substrate bearing directly on the insulation, over steel or wood decking

Assembly Components

1. Deck system, as structural support for vertical and lateral loads. Options include corrugated steel, concrete, metal liner panels, gypsum, plywood or OSB sheathing, and tongue and groove decking, spanning between trusses, wood joists, etc.
2. Air and vapor control layer, if the deck does not provide sufficient control, installed atop the deck to control moisture migration. Optional substrate board is recommended to support the membrane with corrugated decks.
3. Rigid stone wool insulation, installed in one or several layers.
4. **Anchoring substrate**, such as plywood or OSB, installed over the insulation and fastened through the insulation and the air and vapor control layer to the deck substrate.
5. Underlayment membrane, with rosin paper installed between the metal panel and underlayment as a slip sheet, laid over the insulation in a shingle-lapped manner, continuously, and integrated with the flashing at the perimeter for adequate drainage.
6. Anchor Clips, attached with screws through the underlayment membrane to the anchoring substrate, positioned at required intervals at roof panel seams, and available as fixed or floating, to handle panel movement.
7. Architectural roof panels, supported on the insulation and secured to the anchor clips

Summary

Selecting the appropriate metal roofing panel systems—whether structural or architectural—depends on the specific needs and priorities of each project. Structural panels offer strength and durability, ideal for industrial and commercial applications where load-bearing capacity is crucial. In contrast, architectural panels are typically chosen for their aesthetic appeal and design versatility, most suitable for residential and commercial buildings where visual impact is prioritized.

Integrating ROCKWOOL stone wool insulation products enhances the performance of both system types, including fire resilience, acoustic comfort, and long-term thermal efficiency. By carefully considering these factors, architects and builders can optimize the functionality, fire safety, and aesthetic value of their metal roofing systems.

Insulation Selection

The following table provides a summary of recommended ROCKWOOL insulation products for various metal roof panel systems. However, the selection of the insulation product and the design of the system are the responsibilities of the designer or structural engineer, who must ensure the suitability of the insulation for the specific construction requirements.

Further Considerations Regarding Moisture Performance

The systems described in this bulletin should perform effectively across all climate zones; however, exceptions may arise, particularly in regions prone to high snow loads and potential ice damming.

In areas where the ground snow load exceeds 50 lbs/ft², it is advisable to install the metal roof over the unvented roof layers in a manner that allows for adequate ventilation to effectively mitigate this issue.

For inquiries regarding UL rated or FM approved systems, please contact ROCKWOOL Technical Services. Our team is available to provide you with detailed information and support to ensure you make the best choices for your projects.

Table 1: Insulation Selection Table for Metal Roof Panel Systems

ROCKWOOL Board Product	Metal Roof Panel Systems			
	Structural	Architectural		
		Anchor clips over bearing plates	Anchor clips over cover board	Anchor clips over anchoring substrate
Cavityrock®	✓	✗	✗	✗
Comfortboard® 80	✓	▲	▲	▲
Comfortboard® 110	✓	▲	▲	▲
Toprock® DD	✓	✓	✓	✓
Multifix™	✓	✓	✓	✓

✓ Recommended ✓ Suitable ✗ Not Recommended ▲ Further analysis may be required based on project-specific loads

For more information about the use of ROCKWOOL insulation in WUI zones, access **ROCKWOOL's Technical Bulletin** available at rockwool.com.

To get in touch with the ROCKWOOL Technical Services team, visit **rockwool.com/north-america/contact/** or call at 1-877-823-9790

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