Can you spot the difference?

Sometimes all it takes is a closer look. See, words like stone wool, mineral wool & rock & slag wool are all great terms used to describe insulation made from stone. But ROCKWOOL on its own is a trademark. In fact, it’s been our name for over 80 years with trademark registrations in over 60 countries globally. And, when it comes to sound absorption, fire resilience, and energy efficiency, people that use our products know how different we really are. So, the next time you’re working with the world’s bestselling brand of stone wool, go ahead and call us by our name.

ROCKWOOL our trademark for stone wool insulation.

https://www.rockwool.com/trademark/
Stuff it or
Wrap it

Understanding Advancing Wall
System Design around
Continuous Insulation
The world is changing. And so are we.

You’ve always known us as ROXUL, the company behind high-quality Stone Wool insulation. But in a time when the potential energy savings of buildings has yet to be reached, how can we simply sit back? We can’t.

United under one global name, we can innovate, explore and develop new ways to do more for our customers and our planet.

We are the leader in Stone Wool insulation.

We are ROCKWOOL.
At ROCKWOOL, we are committed to enriching the lives of everyone who comes into contact with our products. Our portfolio is perfectly suited to tackle many of today’s biggest sustainability and development challenges.

From energy consumption to noise pollution, water scarcity to flooding, our solutions help our customers address many of the big issues of modern living.

Our range of products address the diversity of the world’s needs, supporting our stakeholders in reducing their own carbon footprint along the way.
More stone wool secrets unveiled

- **Lapinus**
  - Special fibres for e.g. automotive brakes
  - Securing your vehicle can come to a stop
  - Fully sustainable products throughout their life

- **Grodan**
  - Precision growing for the horticultural industry
  - Support sustainable production of fresh and healthy vegetables
  - Multiplies yields and saves water

- **Rockpanel**
  - Exterior cladding for buildings
  - Durable and resilient
  - Easy to fit and retrofit

- **Rockfon**
  - Acoustic ceiling and wall solutions
  - Reduces noise and echoes
  - Creates a comfortable indoor climate

© ROCKWOOL International A/S
Technical insulation solutions for process industry, marine and offshore:
- Reduces heat loss and CO₂ emissions for industrial insulation
- It has a positive carbon footprint

Firesafe insulation for all types of buildings including ROCKWOOL wall systems:
- 97% of stone wool can be recycled after use
- It does not burn or emit high levels of toxic smoke in a fire
- Provides firefighters critical extra time to save lives by slowing the spread of fire
- Durable and resilient
- Easy to fit and retrofit
- It has a positive carbon footprint

Core solutions Customised stone wool solutions to industrial partners:
- It does not burn or emit high levels of toxic smoke in a fire
- Makes air-conditioning less noisy
World leader with local presence
We create sustainable solutions to protect life, assets, and the environment today and tomorrow.

North America
3 Stone Wool Factories
2 ceiling grid plants
1,000 Employees

Russia
4 Stone Wool factories
1 ceiling tile plant
1,300 employees

Europe
16 Stone Wool factories
7 additional production plants
7,100 employees

Asia
5 Stone Wool factories
1 ceiling grid plant
1,100 employees
Fire Resistant

Made from naturally fire resilient stone, ROCKWOOL insulation can withstand temperatures of up to 2150°F (1177°C) and does not burn.

Stone Wool is non-combustible, and does not contribute to the spread of fire.

Flame Spread Index = 0
Smoke Development Index = 0
Why Stone Wool?

Water Repellent
ROCKWOOL insulation repels water and will not promote mold growth making it more durable during unexpected exposure to water.

Sound Absorbent
The unique non-directional structure of ROCKWOOL insulation is denser than traditional insulations, reducing airflow and sound transmission.

Vapor Permeable
ROCKWOOL insulation allows vapor to pass through without restriction. This allows for an increased potential for drying without trapping moisture in the wall assembly.
Best Practice

ROCKWOOL is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members are available on request.

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Course Outline

Stuff it or Wrap it – Understanding Advancing Wall System Design around Continuous Insulation (1 AIA/CES HSW CREDIT)

This one hour educational session will cover the latest in building enclosure technology for energy efficient buildings. Presented by one of North America’s leading manufacturer of insulation, A ROCKWOOL Representative will provide an in-depth discussion of emerging wall systems that provide durable, cost effective and thermally efficient performance.

Recent building and energy code changes will be reviewed including an opportunity to discuss solutions to meet these more stringent requirements. Current building science research and field monitoring information will be presented, demonstrating how insulation materials perform under different climatic conditions and how R-values change with time and season. Strategies to construct highly insulated wall assemblies and avoid thermal bridging will be presented,

The seminar will cover all building types and construction materials, with a few highlights and lessons learned from building science researchers.
Learning Objectives

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

1. Review and understand recent changes to local building and energy codes that impact building enclosure design strategies and whole building energy efficiency

2. Understand the building enclosure design requirements for wall assemblies and how the selection of the right materials are critical to reliable long-term performance

3. Learn about several emerging design strategies including various cladding attachment systems being used for the construction of highly insulated wall assemblies and how to apply these technologies to projects

4. Understand how these new systems are installed in the field with minimal changes to current construction practices
Contents

1
Building Science & the Building Enclosure

2
Choosing a Cladding Attachment System
1

Building Science & the Building Enclosure
History of Enclosure Control Functions

Older Buildings
One layer does everything

Newer Building
Separate layers, . . . separate functions
State of the Art: the “Perfect Wall”

- **Support**
  - structure is anything that works

- **Control ** *Continuity*
  - Rain control layer
    - Perfect barrier
    - Drained with gap
    - Storage
  - Air control layer
    - Air barrier
  - Thermal control layer
    - Aka insulation, radiant barriers
  - Vapor control layer
    - Retarders, barriers, etc

- **Finish**
  - interior and exterior

Fire Control may be needed
Sound Control optional
Why Thermal Control?

Ensures Comfort
Avoid hot/cold interior surfaces
Warm surfaces = durability
Avoids condensation in hot and cold weather
Keeps structure warm, dry and stable
Keeps inhabitants healthy (mold issues)
Saves Energy
Reduces heat flow
How to do Thermal Control

• Insulation (conduction)
  - Slows heat flow in and out

• Windows (conduction, radiation)
  - Slow heat flow in and out
  - Control solar gain: allow or reject?

• Airtightness (convection)
  - Can bypass insulation

• Other important considerations:
  - “cool” roofs (reduce solar gain)
  - Radiant barriers
  - Shading (radiation)
  - Thermal bridging of structure and mechanical penetrations
Thermal Resistance Terminology

• **Rated R-value:** The theoretical R-value of the insulation. Sometimes called the Nominal or Advertised R-value. E.g., R-13 batt; R-6/inch

• **Effective R-value:** The functional R-value of the insulation as installed in the wall assembly, de-rated if necessary due to thermal bridging at framing members.

• **Total R-value:** The actual R-value of the wall assembly including not only the Effective R-value of the insulation but also the R-values for other wall system components such as materials, air spaces, air films, etc.
Insulation

How much? Use much *more than normal practice*?

- Comfort & condensation resistance:
  
  **True** R5 - R10 is usually enough, but ..... 

- For energy / environment:
  
  “As much as practical”, e.g. R10 - R20 

- “True” R-value is what matters 
  
  Control thermal bridging!

Increased insulation should reduce HVAC capital as well as operating!
# Thermal Resistance Recommendations

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Wall</th>
<th>Vented Attic</th>
<th>Compact Roof</th>
<th>Foundation Wall</th>
<th>Exposed floor</th>
<th>Slab edge</th>
<th>Windows (U/SHGC)</th>
<th>Sub-slab</th>
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<td>5</td>
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<td>5</td>
<td>1.2 / &lt; 0.25</td>
<td>7.5</td>
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<td>0.6 / &lt; 0.25</td>
<td>10</td>
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<tr>
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<td>20</td>
<td>40</td>
<td>20</td>
<td>5</td>
<td>30</td>
<td>7.5</td>
<td>0.40 / &lt; 0.4</td>
<td>15</td>
</tr>
<tr>
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<td>30</td>
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<td>0.35 / &lt; 0.4</td>
<td>15</td>
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<td>40</td>
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<td>10</td>
<td>30</td>
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<td>0.35 / &lt; .40</td>
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<td>15</td>
<td>0.35 / --</td>
<td>20</td>
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<td>20</td>
<td>10</td>
<td>40</td>
<td>20</td>
<td>0.35 / --</td>
<td>20</td>
</tr>
</tbody>
</table>

*Table 3: Effective R-value Recommendations by Climate Zone for Steel-Framed, Commercial Construction, adapted from ASHRAE 90.1*
Where to Add More Insulation in Walls?

Stuff it?

Wrap it?
What do you see?
What do you see?
Understanding Thermal Bridging

**Thermal Bridging**

occurs when a conductive material (e.g. aluminum, steel, concrete, wood etc.) provides a path for heat to bypass, or short-circuit, the installed insulation – reducing overall effectiveness of the entire system

**Effective R-values**

account for the additional heat loss/heat gain due to thermal bridges and represent actual heat flow through enclosure assemblies and details
Find the thermal bridge
Thickness of material required to reach a thermal resistance of R20 (RSI 3.5)

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extruded polystyrene</td>
<td>0.5</td>
</tr>
<tr>
<td>Batt insulation</td>
<td>0.75</td>
</tr>
<tr>
<td>Sawdust</td>
<td>1.5</td>
</tr>
<tr>
<td>Softwood</td>
<td>1.75</td>
</tr>
<tr>
<td>Adobe / straw (1000 kg/m³)</td>
<td>2.25</td>
</tr>
<tr>
<td>Loose, dry sand</td>
<td>2.5</td>
</tr>
<tr>
<td>Common brick</td>
<td>3.75</td>
</tr>
<tr>
<td>Concrete (2200 kg/m³)</td>
<td>15</td>
</tr>
</tbody>
</table>
Impact of Steel Studs
Adding studspace insulation is not helpful!

Wall Construction (Stud Size and Spacing and Cavity Insulation R-value)

From: Bombino and Burnett, Pennsylvania Housing Research Center
Impact of Insulating Sheathing

From: Bombino and Burnett, Pennsylvania Housing Research Center

- Exterior Insulating Sheathing R-value (ft²°F/hr/BTU)
- R∞ (steel framing)
- Ravg (steel framing)

Buy R5 Get R6
R-value (ft²°F/hr/BTU)
12.1
14.6
17.1
19.6
22.1
24.6
27.1

Buy R10 Get R11.2
R-value (ft²°F/hr/BTU)
6.6
9.9
12.6
15.3
17.8
20.4
22.9

68%
74%
78%
81%
83%
85%

* effective R-value is the performance of the assembly, not the material.
Are studs usually 16” o.c.?
Industry Trends in Building Enclosure Designs

Trend towards more efficiently insulated building enclosures due to higher energy code targets and uptake of passive design strategies

• At a point where traditional wall/roof designs are being replaced with new ones
• Seeing many new building materials, enclosure assemblies and construction techniques
• Greater attention paid to reducing thermal bridging & use of effective R-values instead of nominal insulation R-values
• Optimization of cladding attachments for both structural and thermal performance
• More & more insulation is being used
Getting to Higher Insulation Levels in Exterior Walls

**Base 2x6 Framed Wall**

*<R-16 (wood)>

**Exterior Insulation**  
*R-20 to R-60+*  
Issues: cladding attachment, thickness

**Interior Insulation**  
*R-20 to R-30+*  
Issues: thickness, durability, interior details

**Deep Stud, Double Stud, SIPS**  
*R-20 – R-80+*  
Issues: thermal bridging, thickness, durability

**Split Insulation**  
*R-20 to R-60+*  
Issues: cladding attachment, material selection
Design Considerations for Highly Insulated Walls

- Durability
- Material & Labor Cost
- Ease of Construction
- Wood vs Steel vs Concrete Backup
- Pre-fabrication vs Site-Built
- Thickness & Floor Area
- Air Barrier System & Detailing
- Insulation type(s)
- Water & Vapour control
- Environmental aspects/materials
- Cladding Attachment
- Combustibility
- and Others…
Highly Insulated Building Enclosure Considerations

Highly insulated building enclosures require more careful design and detailing to ensure durability

- **More insulation = less heat flow** to dry out incidental moisture
- Amount, type & placement of insulation materials matter for air, vapour and moisture control
- Art of balancing material, cost, and detailing considerations

Well insulated buildings require balancing thermal performance of all components & airtightness

- No point super-insulating walls or roofs if you have large thermal bridges - address the weakest links first
Other Things to Consider with Insulation

R-value is not constant (and often not as published)
  • Aged R-value (long term thermal resistance)
  • Temperature Dependant R-value

Fire Resistance
Stable vs Unstable R-values

- Stone Wool achieves its R-value from trapped air held within the multi-directional fiber structure and uses no blowing agents.

- Foam Insulation products such as ISO and XPS use blowing agents to achieve R-Values.

- Over time blowing agents escape into the environment and R-value decreases.

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2-20</th>
<th>Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stone Wool (SW)</td>
<td>R4.2-4.3</td>
<td>R4.2-4.3</td>
<td>0%</td>
</tr>
<tr>
<td>Polyisocyanurate (ISO)</td>
<td>R5.6</td>
<td>R4.5</td>
<td>20%*</td>
</tr>
<tr>
<td>Extruded Polystyrene (XPS)</td>
<td>R5</td>
<td>R4.5</td>
<td>10%*</td>
</tr>
</tbody>
</table>

*As per manufacturer’s warranties

Foam Insulation warranties for polyisocyanurate (ISO) and Extruded Polystyrene (XPS) recognize the loss of R-value over time.
Limited Warranty:
“Company XXXX warrants that the thermal insulation R-Value of its family of polyisocyanurate foam insulation products will not at any time after the first (1st) year after purchase, but prior to the start of the twentieth (20th) year after purchase, diminish to less than eighty percent (80%) of the published R-Value at the time of purchase.”

“Company XXX hereby warrants that for a period of fifteen years, commencing with the date of manufacture printed on the product, that the Insulation’s actual thermal resistance for all the products listed below will not vary by more than ten percent from its published R-value. If the Insulation is determined by sampling and tests (conducted as…”

“Company XXXX does hereby warrant that XXXX Extruded Polystyrene Insulation:
1. Is free from defects in material and/or workmanship.
3. Will retain those physical properties advertised at the time of purchase for 20 years from the date of manufacture.
4. Will retain 90 percent (%) of its advertised R-value for 20 years from the date of manufacture.”

<table>
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</tr>
</tbody>
</table>

*As per manufacturer’s warranties
Varying Insulation R-value with Temperature

Long-Term R-value per Inch for Various Insulation Samples vs. Mean Temperature

Typical R-value as would be Published @ 75°F

Published data adapted from BSL - Thermal Metric Project & Other Recent Research by BSL & RDH - data may not be representative of all insulation types
It Gets Even More Complicated with Polyiso

Temperature Dependence of Polyiso Thermal Performance

Temperature [°F]

Temperature [°C]

R-Value per Inch [(hr·ft²·°F/Btu)/in]

Conductivity, k [W/(m·K)]

-4 14 32 50 68 86 104 122

-20 -10 0 10 20 30 40 50

0.048 0.041 0.036 0.032 0.029 0.026 0.024 0.022 0.021

0.019 0.017 0.015 0.013 0.011 0.009 0.007 0.005 0.003 0.001

0.02 0.023 0.026 0.029 0.032 0.035 0.038 0.041 0.044 0.047

12b (2012)
Fire Resistance and Safety

Grenfell Tower tragedy, June 14, 2017

1000 home housing complex

Highly combustible building façade system likely contributed to the speed at which the fire spread throughout the building

Passive and active fire protection should be included in a building design

• NO trade offs for unsuitable materials
Industry Triggers & Response

Foam Plastic Insulation

Combustible cladding
- High Pressure Laminates
- Fiber Reinforced Polymers
- Metal Composite Materials
- EIFS

Combustible WRB – 2012 IBC

NFPA 285
Industry Test for Exterior Combustible Assemblies
NFPA 285


Provides a test method for determining the flammability of wall assemblies containing combustible foam plastics such as Expanded Polystyrene (EPS), Extruded Polystyrene (XPS), and Polyisocyanurate (ISO)
Code Shift to Effective R-values

US Codes now require consideration of Effective R-values

Energy code compliance has historically focused on assembly R-values (nominal R-value) – however more importance is now being placed on details and interfaces & included thermal bridges

Comfort implications
From Code Minimum to Next Generation

Energy codes outline minimum thermal performance criteria based on general climate zone classifications

Energy Standards & International Codes: ASHRAE 90.1, IECC
  • Municipal & State Adoptions w/ Modifications

Green Building Codes (ASHRAE 189.1, IGCC) and Voluntary Programs (Passive House, LEED) raise the bar

Wall Effective R-value/U-values are an integral part of energy code compliance
Energy Code Compliance Options

General Energy Code compliance options

Prescriptive
• Install minimum insulation R-values within standard assemblies (i.e. stud walls) and meet code
• Continuous Insulation (ci) required for some assemblies when following minimum R-value tables

Building Enclosure Trade-off
• Evaluate effective R-values of assemblies & areas
• UxA calculation & trade-off insulation levels

Whole Building Modeling & Trade-off
• Building enclosure inputs
• HVAC and other equipment considered
Energy Codes Targets for Commercial Buildings – IECC 2012/2015

<table>
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<td>7.0, 13.0, 15.6</td>
<td>6.6, 13.0, 15.6</td>
</tr>
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</table>

Based on Maximum Effective Assembly U-value Tables.

Residential Building R-values similar or in some cases slightly higher.

Some state by state & municipal differences depending on year of energy code adoption.
R-15.6 Steel Stud Wall?

As bad (here), or as good as you can practically build – you just can’t get an effective R-15.6 (or even lower R-13) out of stuffing insulation between steel studs – no matter what depth the studs may be.
Choosing a Cladding Attachment System
Heavy Weight Cladding Attachment: Masonry Ties & Shelf Angles

Brick ties – 10-30% loss for galvanized ties, 5-10% loss for stainless steel

Continuous shelf angles ~50% R-value loss

Shelf angle on stand-offs only ~15% R-value loss
Efficient Masonry Attachments
Light and Medium Weight Cladding Attachment Considerations

Cladding weight & gravity loads

Wind & seismic loads

Back-up wall construction (wood, concrete, steel)

• Attachment from clip/girt back into structure (studs, sheathing, or slab edge)

Cladding orientation (panel, vertical, horizontal)

Ease of attachment of cladding – returns, corners etc.

Combustibility requirements
Light & Medium Weight Claddings: Insulation Performance Considerations

Thickness of exterior insulation

Use of rigid, semi-rigid or spray-applied insulation

- Ability to fasten cladding supports through face
- Ability to fit insulation tightly around cladding supports

R-value target, tolerable thermal loss from supports
Cladding Attachment & Exterior Insulation

Exterior insulation is only as good as the cladding attachment strategy

What attachment systems work best?

What is and how to achieve true continuous insulation (ci) performance?

What type of insulation?
Many Cladding Attachment Options & Counting

Vertical Z-girts  
Horizontal Z-girts  
Crossing Z-girts  
Galvanized/Stainless Clip & Rail

Aluminum Clip & Rail  
Thermally Improved Clip & Rail  
Non-Conductive Clip & Rail  
Long Screws through Insulation
Types of Insulation & Cladding Attachment

**Continuous Girts** – Rigid or Semi-rigid boards or spray-foam (i.e. almost anything works)

**Intermittent Clip & Rail Systems** – Semi-rigid boards or spray-foam (i.e. flexibility & ease of installation is key)

**Screws through Insulation** – rigid insulation boards (i.e. stiff enough to support compression load)
Also not R-15.6 Steel Framed Walls

No matter the insulation type, you also cannot practically get to >R-15.6 with continuous steel girts through exterior insulation.
Cladding Attachment: Vertical Steel Z-Girts

20-40% Thermal Efficiency of Vertical Z-girts

RELATIVE COST

$ $$$ CONSTRUCTABILITY

hammer icon
Cladding Attachment: Horizontal Steel Z-Girts

30-50% Thermal Efficiency of Horizontal Z-girts
Cladding Attachment: Crossing Steel Z-Girts

RELATIVE COST
$$\$$
CONSTRUCTABILITY

40-60%
Thermal Efficiency of Crossing Z-girts
Cladding Attachment: Clip & Rail, Steel

50-75% Thermal Efficiency of Galvanized Steel Clips

$ $$$ Relative Cost

Constructability

[Image of a building entrance]
Cladding Attachment: Clips w/ Diagonal Z-Girts

65-85%
Thermal Efficiency of Stainless Steel Clips

RELATIVE COST
$$$
CONSTRUCTABILITY

65
Cladding Attachment: Aluminum Clip & Dual Girt

40-70% Thermal Efficiency of Aluminum T-Clips
Cladding Attachment: Clip & Rail, Isolated Galvanized

60-90% Thermal Efficiency of Thermally Isolated Clips

RELATIVE COST

$ $$$ CONSTRUCTABILITY
Cladding Attachment: Clip & Rail, Fiberglass

Remove the metal – maximize the performance

70-95%

Thermal Efficiency of Fiberglass Clips

Cladding Attachment: Improved Metal Panel
**Cladding Attachment: Screws through Insulation**

- Longer cladding Fasteners directly through rigid insulation (up to 2” for light claddings)

- Long screws through vertical strapping and rigid insulation creates truss – short cladding fasteners into vertical strapping

- Rigid shear block type connection through insulation, short cladding fasteners into vertical strapping
Cladding Attachment: Screws Through Insulation

75-95%
Thermal Efficiency of Screws Through Insulation

RELATIVE COST

$$ $$
CONSTRUCTABILITY
Cladding Attachment: Screws Through Insulation

75-95%
Thermal Efficiency of Screws Through Insulation

RELATIVE COST

$$$$
CONSTRUCTABILITY
Cladding Attachment: Screws Through Insulation
Really Thick Insulation = Really Long Screws

10” Exterior Insulation
COMFORTBOARD™ 110

Project Name: Hudson Exchange West, Jersey City, NJ

Project Architects: Beyer Blinder Belle and Perkins Eastman

GC: Suffolk Construction

Installer: Bamco Inc.

Framing System: Knight Wall
Percent Effectiveness of Exterior Insulation with Various Cladding Support Systems

- Continuous Vertical Z-Girt
- Continuous Horizontal Z-Girt
- Aluminum T-Clip
- Intermittent Galvanized Clip
- Isolated Galvanized Clip
- Stainless Steel Clip
- Fiberglass Clip
- Galvanized Screws
- Stainless Steel Screws

Percent Effectiveness of Exterior Insulation (Typical Range)
Insulation Retainment /Attachment Fasteners
Prefabrication & Cladding Attachment

R-40 Passive House Walls Pre-fabricated Remote 6-plex
Prefabrication & Cladding Attachment

R-20 High-rise Wood Frame Walls
## Cladding Attachment Recommendations

<table>
<thead>
<tr>
<th>Substrate</th>
<th>Wood Backup (OSB/Plywood)</th>
<th>Steel Stud Backup</th>
<th>Concrete or Concrete Block Backup</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cladding Type</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Light weight</strong> (up to fiber cement panels, &lt;10psf)</td>
<td>Clip &amp; Rail good</td>
<td>Clip &amp; Rail good</td>
<td>Clip &amp; Rail good</td>
</tr>
<tr>
<td></td>
<td>Screws good</td>
<td>Screws okay, but difficult to hit stud</td>
<td>Screws can be difficult to install</td>
</tr>
<tr>
<td><strong>Medium weight</strong> (stucco, cultured stone, 10-30 psf)</td>
<td>Clip &amp; Rail good</td>
<td>Clip &amp; Rail good</td>
<td>Clip &amp; Rail good</td>
</tr>
<tr>
<td></td>
<td>Screws with shear block or engineered</td>
<td>Screws with shear block or engineered</td>
<td>Screws can be difficult to install</td>
</tr>
<tr>
<td><strong>Heavy weight</strong> (Masonry, Stone Panels, &gt;30 psf)</td>
<td>Gravity supports, anchors &amp; engineered connections only</td>
<td>Gravity supports, anchors &amp; engineered connections only</td>
<td>Gravity supports, anchors &amp; engineered connections only</td>
</tr>
</tbody>
</table>
Questions?

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The ROCKWOOL Building Science team (RBS) provides services and resources for architects, designers and specifiers to assist in optimizing the thermal efficiency and durability of your building design, reaching far beyond insulation.

Building Science Support
- Building science expertise & resources
- Educational seminars & architectural/site visits
- Envelope detailing & material specifications

R-Value Calculations
- Codes & standards compliance evaluations
- Effective thermal performance calculations
- Heat transfer modeling

Thermal Bridging Modeling
- 2D & 3D thermal modeling (THERM/HEAT3)
- Overall U-value analysis
- Insulation detailing review

Heat, Air & Moisture Transfer Modeling
- 1D transient hygrothermal analysis (WUFI)
- Dew point calculations

Full Building Modeling
- Building energy modeling (Design Builder)
- Building envelope sensitivity analysis

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