Metal Roofing – Practical Design
Learning Outcomes

- Minimum Requirements
- Design Resources
- Low Slope Metal Roofing
- Design Details
- Continuously Insulated (Ci) Systems
Minimum Requirements

✓ Requires components to shed water and prevent water due to ice damming from entering the building

✓ Code requires minimum fastener type
  • Corrosion resistant, ½” into sheathing

✓ Slope
  • 3 in 12, unless specifically designed by manufacturer for low slope applications

✓ Flashings at various intersections
Metal Roofing in the Building Codes

✓ 9.23.16.1.(1) Required Roof Sheathing

• <Except where the 1-in-50 hourly wind pressure is less than 0.8kPa and the seismic spectral response acceleration $S_a (0.2)$, is less than or equal to 0.70,> continuous lumber or panel-type roof sheathing shall be installed to support the roofing.
  ◦ All locations in BC fall below the wind pressure requirement.
  ◦ What About Seismic
Minimum Requirements

Metal Roofing in the Building Codes

✓ Most areas along the south coastline fall within the seismic area requiring full sheathing, including Squamish and out to Chilliwack.
Metal Roofing in the Building Codes

✓ 9.26.13 – Sheet Metal Roofing

• Thickness
  ◦ Sheet metal roofing shall be not less than:
    - 0.33 mm thick galvanized steel, (roughly 29 gauge)
    - 0.46 mm thick copper,
    - 0.46 mm thick zinc, or
    - 0.48 mm thick aluminum.

• Support
  ◦ Except as provided in Sentence 9.23.16.1.(1), where sheet metal roofing is not supported by roof decking but spans between spaced supports, the panels shall be designed to support the specified live loads for the roof.
✓ What else is in the building code?
  • Only other assistance in the building code is a reference to the SMACNA Architectural Sheet Metal Manual with respect to flashing design.

✓ So in essence as long as you put a 29 Gauge thick sheet metal onto a fully supported roof it meets code, right?
Metal Roofing in the Building Codes

✓ What about the “designed for specified Live Load” comment in part 9?
  • This is specifically in the event of the roof not having sheathing and the metal needing to act as the sheathing.

✓ However, in the structural portion of the code the roof will still need to be designed to meet the specified live loads that each component will be anticipated to need to accommodate.
  • This is to design the type, size, and frequency of clips and drag load fasteners.
Minimum Requirements

Metal Roofing in the Building Codes

✓ Clip spacing is determined based on the wind uplift requirements of the metal roof.

*RCABC manual require 2’ o/c for clips

  This is a standard guide and not for design purposes.

✓ Similar to flat roofs there are various zones that require potential fastener pattern increases

✓ With pitched roofs there are six (6) zones with the difference being overhangs.
Metal Roofing in the Building Codes

✓ Drag load fastener requirements are based on the snow load for the project.

✓ Longer panels typically require increased fastener frequency.

*RCABC manual require 2 drag load screws per panel

This is a standard guide and not for design purposes.
Thermal Expansion

- To detail the eave drip edge clip thermal expansion must be determined.
- For every 10’ of length the metal will expand roughly 0.08” per 100 degrees Fahrenheit.
- In Burnaby this works out to about 0.12” per 10’ length on dark colour pitched metal roofs
- How much can be expected on previous example?
  - Roof is roughly 180’ long ~ 2.17”
UPLIFT FASTENERS AND CLIPS
- 158-FC-22G CLIPS SPACED AT 4’ O.C. EXCEPT 8’ FROM ANY ROOF RIDGE, RAKE OR EAVE WHERE CLIPS SHALL BE SPACED AT 2’ O.C. (SEE DIAGRAM AT TOP RIGHT OF RP-0.02). A CLIP MUST BE LOCATED A MINIMUM OF 6” FROM THE BOTTOM OF EACH PANEL.
- 3: UPLIFT FASTENERS FROM CLIP TO 2X4 WOOD BLOCKING
  #12-14 2” METAL TO WOOD WAFER HEAD FASTENERS
- 4: UPLIFT FASTENERS FROM 2X4 WOOD BLOCKING TO STEEL DECK
  #12-14 TEK WAFER HEAD FASTENERS c/w WASHER SPACED AT 10” O.C. (APPROPRIATE LENGTH TO SUIT FULL PENETRATION OF STRUCTURAL STEEL DECK*)

DRAG LOAD FASTENERS
- 5: #12-14 2.5” TEK GASKETED DRAG LOAD FASTENER QTY PER PANEL WIDTH*
  ZONE: A B C D E F G H I
  QTY: 4 5 9 6 15 13 11 9 5
  *FASTENERS MUST BE LOCATED A MINIMUM OF 1” FROM EACH OTHER AND FROM THE END OF THE PANEL.
- 6: #14-14 TEK WAFER HEAD FASTENER (APPROPRIATE LENGTH TO FULLY PENETRATE STEEL DECK*, OR PENETRATE INTO T&G DECK BY 2”. QUANTITY BY ZONE AS PER ABOVE.
**FASTENER SPACING ALONG PANEL (WIND UPLIFT)**

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<tbody>
<tr>
<td>&gt; 7:12</td>
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<tr>
<td>CORNERS</td>
<td>5-3/16&quot;</td>
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<tr>
<td>SIDES</td>
<td>10-3/8&quot;</td>
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<tr>
<td>FIELD</td>
<td>25-15/16&quot;</td>
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<td>EDGE DIST. ZONE</td>
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**DRAG LOAD FASTENERS**

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<thead>
<tr>
<th>PANEL LENGTH</th>
<th>ROOF SLOPE</th>
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<tbody>
<tr>
<td></td>
<td>6:12</td>
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<tr>
<td>1' - 10'</td>
<td>3</td>
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<tr>
<td>11' - 20'</td>
<td>6</td>
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<tr>
<td>21' - 30'</td>
<td>9</td>
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<tr>
<td>31' - 40'</td>
<td>11</td>
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<tr>
<td>41' - 50'</td>
<td>10</td>
</tr>
<tr>
<td>51' - 60'</td>
<td>11</td>
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<tr>
<td>61' - 70'</td>
<td>13</td>
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*Specific to Specific Project*
Design Resources

✓ Building Codes
✓ RCI Courses
  • Metal Roofing - 2 day course
✓ Industry Manuals
  • SMACNA Architectural Sheet Metal Manual
  • SMACNA Architectural Sheet Metal Inspection Manual
  • NRCA Metal Panel and SPF Roof Systems—2012
  • RCABC Roofing Practices Manual
✓ Industry Manufacturers
Low Slope Metal
Low Slope Metal
Specialty testing needs to be performed on the panel to determine the performance of the metal panel under low slope and curved conditions.

ASTM E 2140 (09) - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head

FBC - TAS 114 – Test Procedures for Roof System Assemblies in the High-Velocity Hurricane Zone Jurisdiction
Design Details
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Continuously Insulated (Ci) Systems
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Closure

✓ Topics

• Minimum Requirements
• Design Resources
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Closure

✓ Thank You