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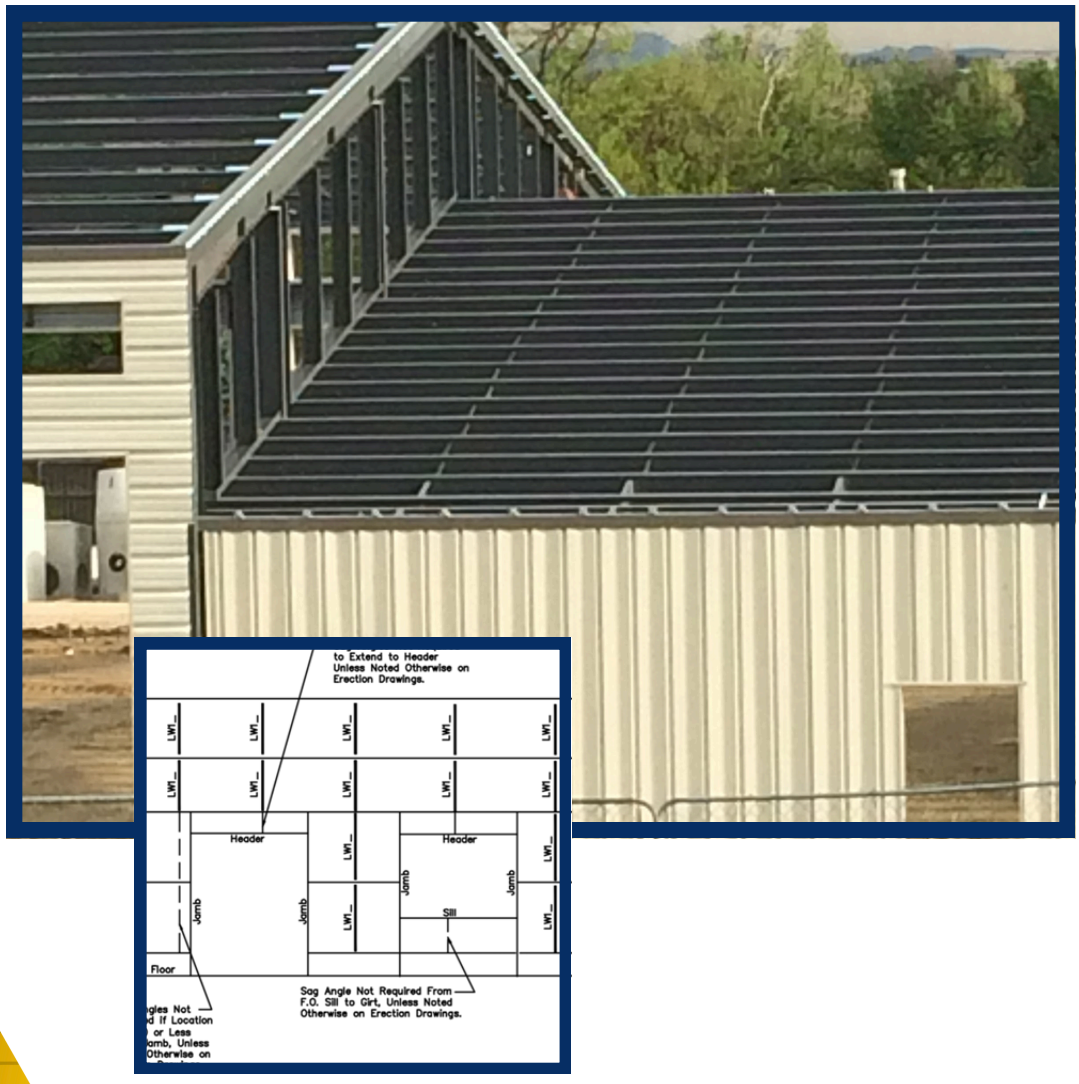
METAL BUILDINGS

2018 INTERNATIOANAL ENERGY CONSERVATION CODE



In this guide you will find:

Code Requirements

Outlined and Itemized Plan Review: Hints, Tips, and Tricks

Field Inspection: Finished Product

SHUMS CODA ASSOCIATES Group 14 BUILDTank Inc.

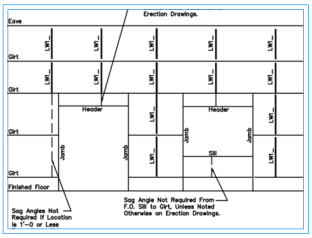
DEFINITIONS

The 2018 International Energy Conservation Code and the 2018 International Building Code do not currently have a definition for "metal building".

ASHRAE 90.1 DEFINITION

METAL BUILDING:

a complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin.



- **Metal buildings use girts and purlins, and not studs and trusses**
- **Metal buildings have a metal skin, not wood sheathing or fiberglass covered gypsum board**

2018 INTERNATIONAL ENERGY CONSERVATION CODE DEFINITION

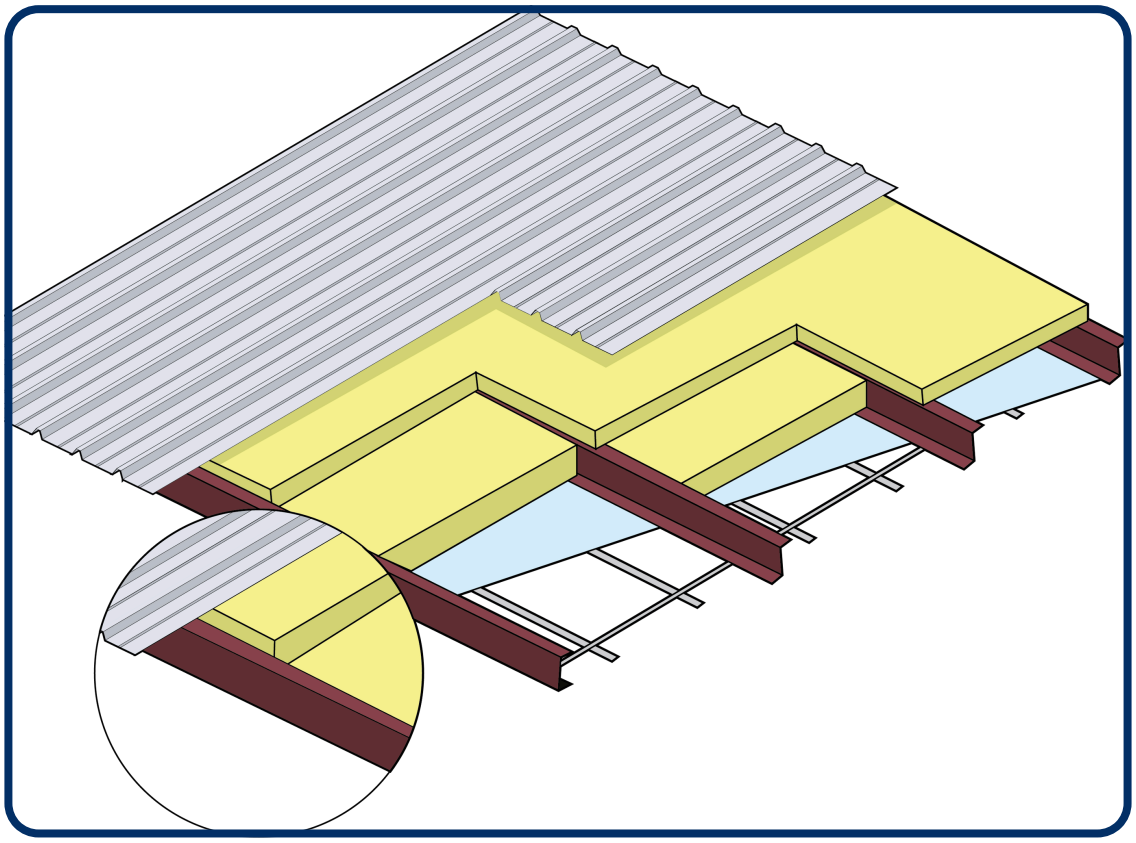
A system that includes the following:

1. *A continuous vapor barrier liner membrane that is installed below the purlins and that is uninterrupted by framing members.*
2. *An uncompressed, unfaced insulation resting on top of the liner membrane and located between the purlins.*

LINER SYSTEM (LS)

For multilayer installations, the last rated R-value of insulation is for unfaced insulation draped over purlins and then compressed when the metal roof panels are attached.

LINER SYSTEM



Liner system design includes the following items:

- Continuous vapor barrier liner
  - Installed below the purlins and uninterrupted by any framing members
- First R-value in tables is the uncompressed and unfaced insulation installed between the purlins and rests on top of the vapor barrier liner
- Second R-value is tables is the unfaced insulation installed over the purlins
- Thermal spacer is provided between the purlins and the metal roof panels, if using the R-value option (Insulation Min. R-value column in tables)

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BUILDING ENVELOPE REQUIREMENTS SPECIFICALLY FOR METAL BUILDINGS USING R-VALUE OPTION

TABLE C402.1.3 OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD

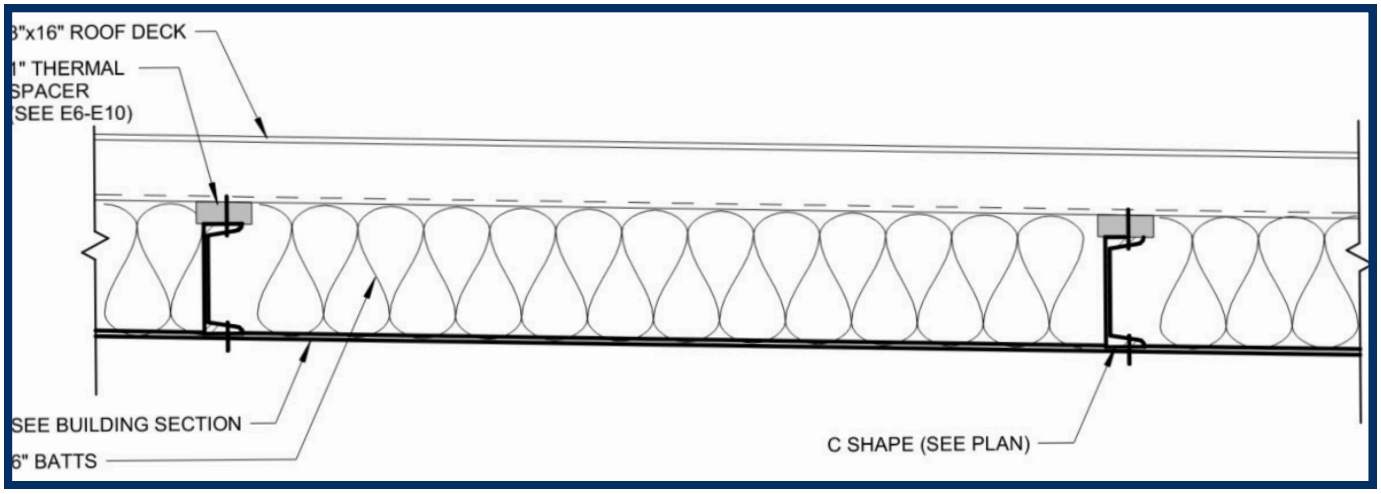
Climate Zones	4		5		6		7	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roof								
Metal Building[b]	R-19 + R-11LS	R-19 + R-11LS	R-19 + R-11LS	R-19 + R-11LS	R-25 + R-11LS	R-25 + R-11LS	R-30 + R-11LS	R-30 + R-11LS
Wall, Above Grade								
Metal Building	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-19.5ci
Slab-on-Grade Floors								
Unheated	R-10 24" below	R-10 24" below	R-10 24" below	R-10 24" below	R-10 24" below	R-15 24" below	R-15 24" below	R-15 24" below
Heated	R-10 24" below + R-5 full slab	R-15 24" below + R-5 full slab	R-15 36" below + R-5 full slab	R-15 36" below + R-5 full slab	R-15 36" below + R-5 full slab	R-20 48" below + R-5 full slab	R-20 48" below + R-5 full slab	R-20 48" below + R-5 full slab

Footnote b:

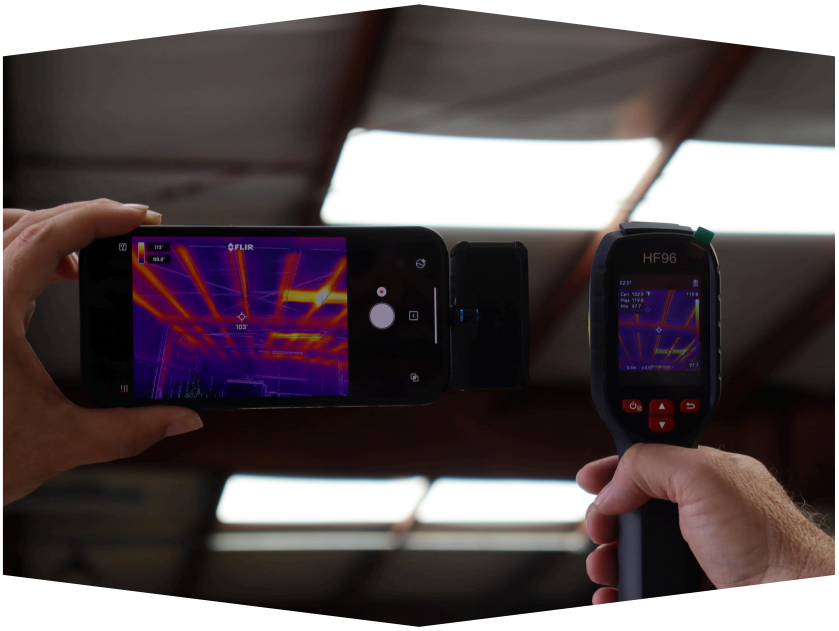
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.

Basically, if you do not use a thermal block then you will need to use the U-factor, C-factor-F-factor option of the prescriptive path (the assembly approach).

THERMAL SPACER (BLOCK) INFORMATION



Thermal spacer is a material that is placed at the purlins to reduce the transfer of heat, also known as thermal bridging, at the connections between the outer shell or skin of the building and the interior framing of the building.



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BUILDING ENVELOPE REQUIREMENTS SPECIFICALLY FOR METAL BUILDINGS USING U-FACTOR, C-FACTOR, & F-FACTOR OPTION

TABLE C402.1.4 OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD

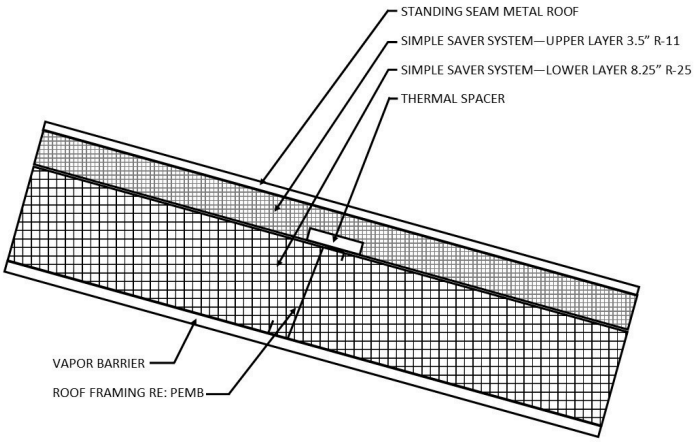
Climate Zones	4		5		6		7	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Roof								
Metal Building	U - 0.035	U - 0.035	U - 0.035	U - 0.035	U - 0.031	U - 0.031	U - 0.029	U - 0.029
Wall, Above Grade								
Metal Building	U - 0.052	U - 0.052	U - 0.052	U - 0.052	U - 0.052	U - 0.052	U - 0.052	U - 0.039
Slab-on-Grade Floors								
Unheated	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.52	F - 0.40	F - 0.40
Heated[f]	F - 0.86 0.64	F - 0.86 0.64	F - 0.79 0.64	F - 0.79 0.64	F - 0.79 0.55	F - 0.69 0.55	F - 0.69 0.55	F - 0.69 0.55

Footnote f:

f. The first value is for perimeter insulation and the second value is for full slab insulation.

METAL BUILDING ROOF INSULATION LINER SYSTEM FOR PLAN REVIEW (PRESCRIPTIVE PATH)

With a Thermal Spacer



This design contains all of the components required for use of the R-value option.

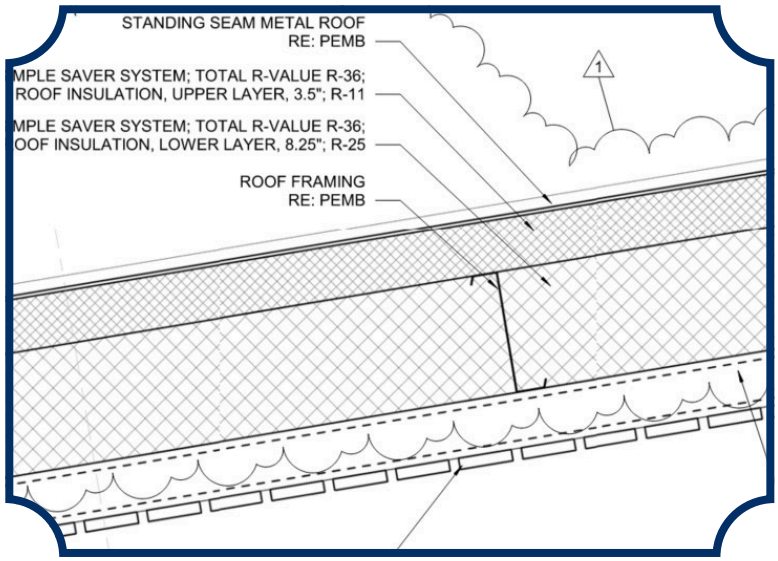
- Vapor barrier membrane below purlins
- Insulation between the purlins
- Insulation over the purlins
- Thermal spacer separating the purlins and the metal roofing

Without a Thermal Spacer

This design does not contain a thermal spacer, so it cannot use the R-value option. This project would have to comply with the assembly U-factor option.

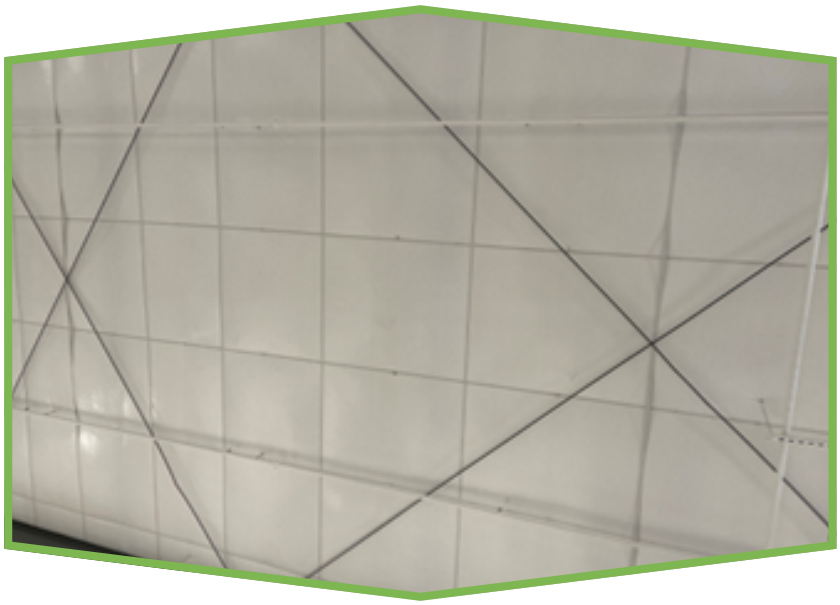
- Vapor barrier membrane below purlins
- Insulation between the purlins
- Insulation over the purlins

This design could work, but it has to use the correct prescriptive option for it, or include a thermal spacer in the design.



METAL BUILDING ROOF INSULATION LINER SYSTEM FOR INSPECTION (PRESCRIPTIVE PATH)

Metal building roofs will require multiple inspections to verify the entire system. These can be combined with other inspections. A good policy is to determine when your team wants to inspect and verify each layer and or component.



VAPOR BARRIER MEMBRANE FOR LINER SYSTEM

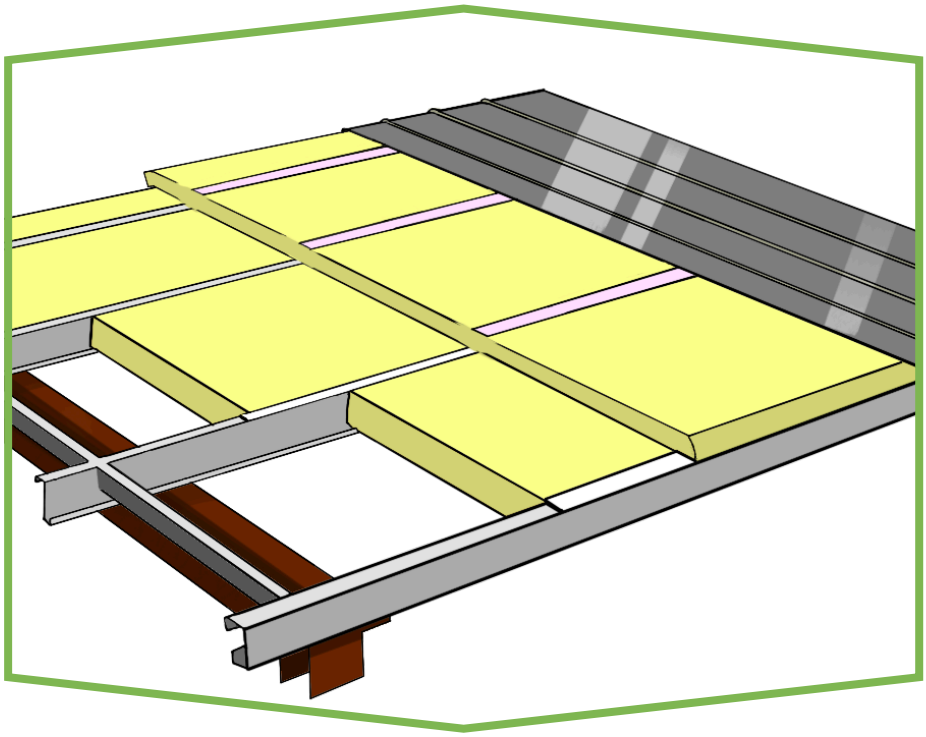
This membrane has been installed properly.

- Installed below the purlins
- Not interrupted by the purlins

THERMAL SPACER (THERMAL BLOCK)

Thermal spacer has been installed properly.

- Installed above the purlins and below the metal roofing



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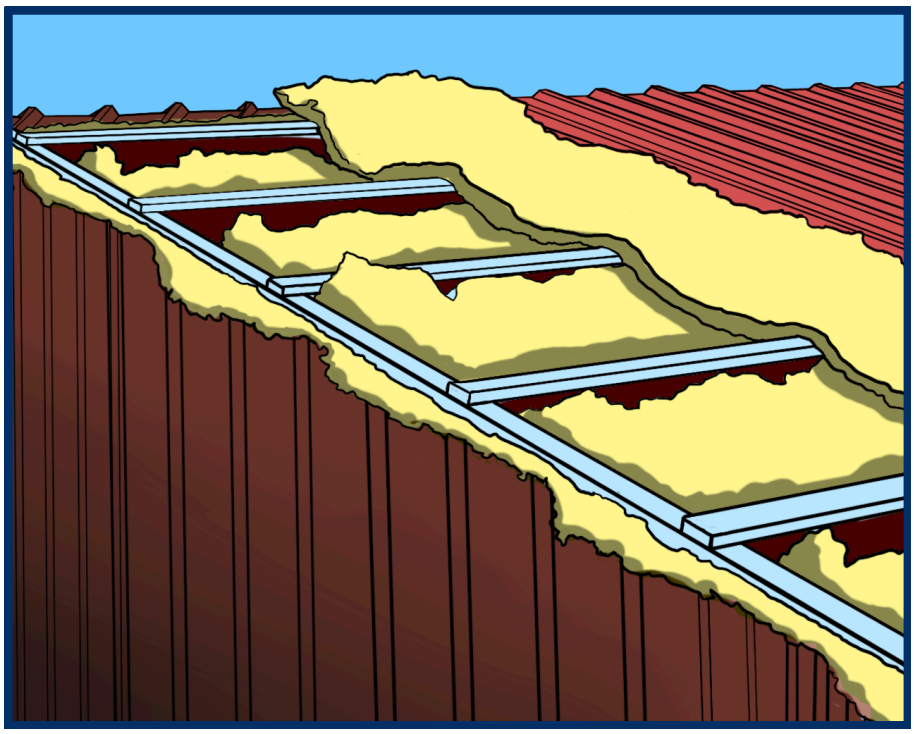
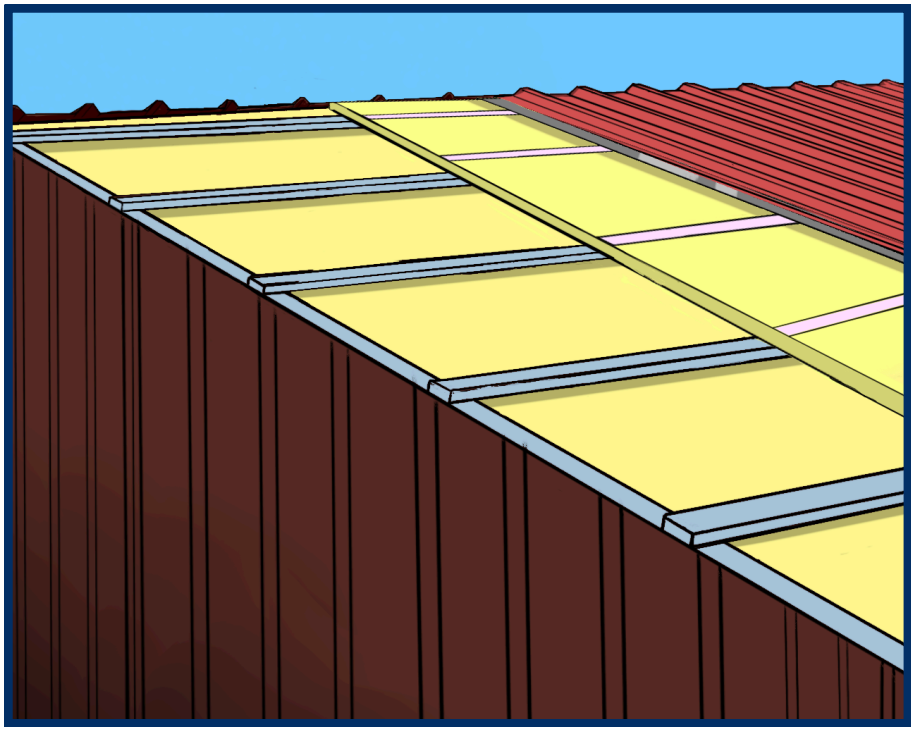
SYSTEM INSTALLATION

INSTALLATION MATTERS

The insulation is installed between the purlins and over the purlins.



- The installation of the insulation between the purlins is not correct.
- It doesn't extend to the edge of the roof at the roof wall junction.
- There is a gap. Building envelope is not continuous at these areas.

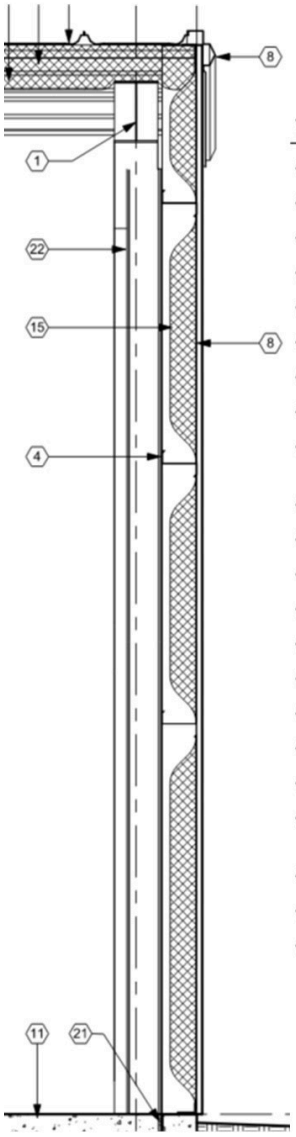


- The installation of the insulation between the purlins is installed correctly.
- The insulation fills the cavity between the purlins and uncompressed.
- The second layer is installed in the perpendicular direction over the purlins.
- Thermal spacer provided over purlins to separate the interior framing and the metal roofing.

METAL BUILDING WALL INSULATION LINER SYSTEM FOR PLAN REVIEW (PRESCRIPTIVE PATH)

Metal building walls that use the R-value option of the table require continuous insulation to be installed and cavity insulation.

- The continuous insulation can be installed on the outside or inside of the girts



WALL SECTION KEYNOTES

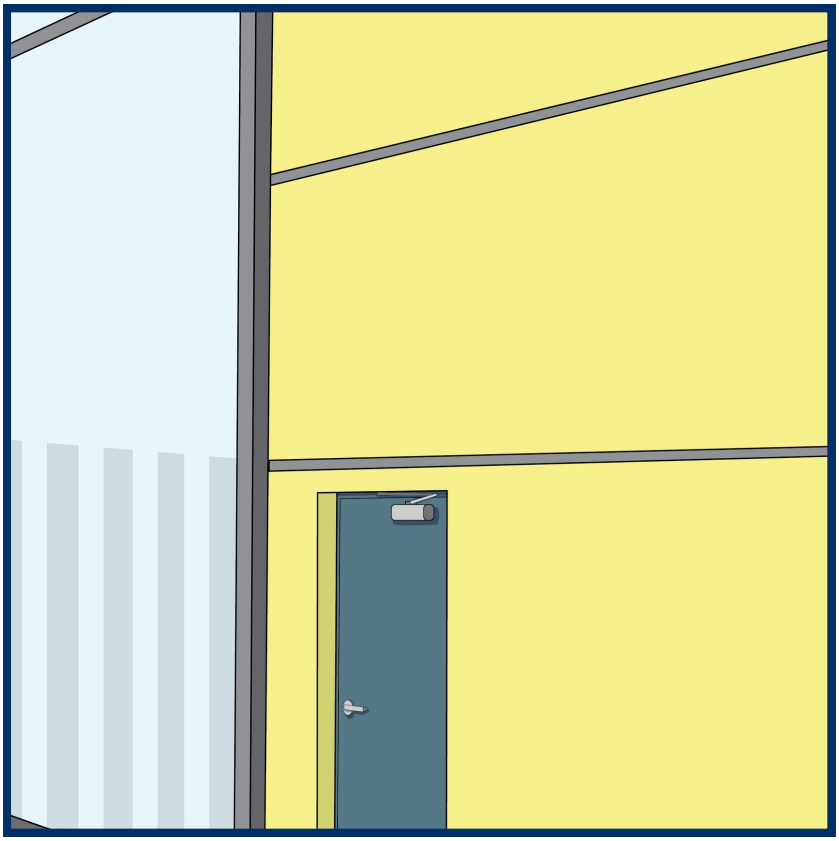
1. PEMB FRAME, RE: PEMB DRAWINGS
2. PEMB METAL SIDING, RE: PEMB DRAWINGS
3. PEMB METAL ROOFING, RE: PEMB DRAWINGS
4. PEMB GIRT, RE: PEMB DRAWINGS
5. PEMB PURLIN, RE: PEMB DRAWINGS
6. PEMB HIGH EAVE TRIM, RE: PEMB DRAWINGS
7. PEMB GUTTER, RE: PEMB DRAWINGS
8. PEMB RAKE TRIM, RE: PEMB DRAWINGS
9. PREFINISHED METAL DOWNSPOUT, RE: PEMB DWGS - CONNECT TO STORM DRAIN, RE: CIVIL
10. CONCRETE WAINSCOT, RE: STRUCT
11. CONCRETE SLAB ON GRADE, RE: STRUCT
12. CONCRETE CURB AT CONTAINMENT AREA
13. INTEGRAL WATERSTOP AT PERIMETER OF CONTAINMENT AREA
14. 2" RIGID INSULATION
15. R-19 BATT INSULATION
16. R-11 BATT INSUL. IN CAVITY + R-19 CONT. BATT INSUL.
17. LIGHT FIXTURE, RE: ELEC.
18. CRANE BEAM & CAP CHANNEL, RE: PEMB DWGS.
19. CRANE RAIL BY CRANE SUPPLIER - SHIM AS REQ'D TO ALIGN W/ (E) CRANE RAIL IN EXISTING BUILDING
20. HAUNCH TO SUPPORT CRANE BEAM, RE: PEMB DWGS.
21. 1/2" ISOLATION JOINT
22. PEMB COLUMN, RE: PEMB DRAWINGS

This design is showing continuous insulation, but it appears that the insulation is being compressed at the girts.

- **Insulation must be continuous**

METAL BUILDING WALL INSULATION LINER SYSTEM FOR INSPECTION (PRESCRIPTIVE PATH)

CONTINUOUS INSULATION SHOWN



- **The girts do not interrupt the continuous insulation**
- **Not compressed**
- **Located on the exterior side of the girts**

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AIR BARRIER/ LEAKAGE

AIR BARRIERS/AIR LEAKAGE:

- Mandatory for all energy compliance paths
- Projects must pick one of the two options for compliance listed in C402.5
  - Prescriptive approach: comply with Sections C402.5.1 - C402.5.8
  - Performance approach: whole-building air leakage testing
    - Air leakage testing rate cannot exceed 0.40 cfm/ft^2
    - Must comply with Sections C402.5.5, C402.5.6, and C402.5.7
- Continuous air barrier must be provided in accordance with C402.5.1

For a material to qualify as an air barrier it must be tested in accordance with the test method listed in Section C402.5.1.2.1 and have an air leakage rate that cannot exceed 0.004 cfm/ft2. The code has 16 materials already deemed to comply.

- For metal buildings they use # 15 in the list to comply, which is sheet steel or aluminum.