Metal Panel Roof Coverings Guidance: Selection and Installation of Metal Panel Roof Coverings

Technical Bulletin

FH 2019-01

First Release:

November 2019

Prepared by:

Warner Chang, Project Engineer,

FORTIFIED Building Programs

Applicable Standards:

FORTIFIED Home™–Hurricane
FORTIFIED Home™–High Wind

Applicable Designation Level:

Abstract

This bulletin is intended to provide selection and installation guidance for residential, non-structural metal roof systems installed over wood roof decks with a roof slope 2:12 (10 degrees) or greater.

Metal roof panel systems are graded by pounds per square foot (psf) design pressure (DP) ratings, not by wind speed. These ratings are based on testing in accordance with approved standards. Metal roofing panels must be attached in compliance with design pressure ratings and the manufacturer's instructions to ensure the system performs as designed.

Introduction

Metal panels installed over solid wood sheathing are a common option for roof coverings. They typically fall into one of the following shape categories:

- **Rib and 5-V crimp panels fastened with exposed fasteners**
  Low-profile rib shape with typical corrugations spaced at less than 12" apart.

Typical low-profile rib panel

Typical 5V crimp panel profile

- **Standing Seam panels fastened with concealed fasteners or fastener/clip system**
  Profile shape with major and deeper corrugations typically spaced at more than 12" apart where attachments are installed to resist wind uplift pressures.

Typical standing seam panel profile

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Required Design Pressures

It is a common misconception that metal panels are rated for a certain wind speed. Metal panel systems (panels and their connections) must be able to resist the design uplift pressures calculated by using ASCE 7 design wind speed, site exposure condition, and mean roof height of the building. A summary of required design wind pressures is provided in Table 1. Use ASCE 7-10 or ASCE 7-05 wind speed based on the locally adopted building code.

Design Pressure (DP) Ratings

Design pressures listed in certified reports from the following organizations can be used to validate compliance with the project site-specific design pressure requirements:

- International Code Council Evaluation Service (ICC-ES) Report
- Florida Building Code Product Approval
- Miami-Dade Notice of Acceptance (NOA)
- Texas Department of Insurance (TDI) Product Evaluation

DP ratings from organizations not listed above must incorporate the 2.0 safety factor by testing in accordance with UL 580 or UL 1897 or TAS 125, be approved by the manufacturer, comply with locally adopted building code requirements, and be accepted by the local building officials. Refer to the Glossary at end of this document for test standard titles and descriptions.

Attachment and Installation Requirements

Prior to the installation of metal roof panels, the roof deck plywood/OSB thickness, attachment to roof framing members, and sealed-roof-deck application per FORTIFIED Standards must be verified and photo documented by the evaluator and/or the installing contractor. The metal panel system must be installed and fastened to the roof deck in compliance with manufacturer specifications. It is vital that the fasteners are verified with photo documentation.

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An essential but often-overlooked fact is that DP ratings dependent on the proper attachment of the metal panels to the roof. Therefore, it is vital to understand the panel attachment requirements, such as type, size, and spacing of fasteners or clips, and comply with those requirements when installing the panels.

If the panels are not installed as specified in the certified report, the system may not perform as tested and the DP rating cannot be met.

The required attachment spacings vary for different areas of the roof. As shown in Figure 1, the 4'-0" zones are areas of the roof within 4 ft from roof ends and ridges (also referred to as *end* or *edge* zones). In these 4 ft zones, the wind pressures are higher, and consequently more attachments are needed (i.e. closer connection spacings). The "interior" zones are areas of the roof that are not within 4 ft of a roof end or ridge (also referred to as "field" zones). In these interior zones, the required attachment spacings are usually farther apart than for edge zones.

Many metal panel manufacturers also provide specific installation details for metal panel attachments at different areas of the roof. For examples: ridges, eves, valleys, gutters, sidewalls, flashings, etc. These details are typically published separately from the certified report, so it is vital to ensure that all information required for proper installation of the panels is obtained and followed. If in doubt, always contact the manufacturer to obtain all installation information.

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Table 1: Required Design Pressures (ASD)•(psf)
By Mean Roof Height and Site Exposure Category
7 < Roof Slope < 27 Degrees

Wind Speed (mph)	ASCE 7-10 (V_{ult})		120	130	140	150	160	170	180	190
	ASCE 7-05 (V_{asd})		93	101	108	116	124	132	139	147
Site Exposure Category	Roof Height[1]	Roof Zone[2]	Design Uplift Pressure (ASD)•(psf)							
Exposure B & C	Up to 30 ft	Interior	−20	−23	−27	−31	−35	−40	−45	−51
		4 ft zone	−51	−61	−69	−80	−91	−103	−116	−129
	40 ft	Interior	−21	−24	−29	−33	−38	−42	−48	−54
		4 ft zone	−54	−65	−73	−85	−97	−109	−123	−138
Exposure D	Up to 30 ft	Interior	−24	−27	−32	−37	−42	−47	−22	−60
		4 ft zone	−60	−72	−82	−95	−108	−122	−137	−153
	40 ft	Interior	−25	−28	−34	−39	−44	−49	−56	−63
		4 ft zone	−63	−75	−86	−100	−114	−128	−144	−161

1. Roof heights are generalized to: 2-story = 30 ft and 3-story = 40 ft.
2. Roof zones are simplified to the interior and 4 ft zones which measure 4 ft from roof edges and ridges, see figure below.

Site Exposure Category:

B Dense residential area.

C Open terrain with scattered obstructions, such as grasslands, intracoastal, lake front and areas landward of Exposure D.

D Ocean front up to a few blocks from ocean.

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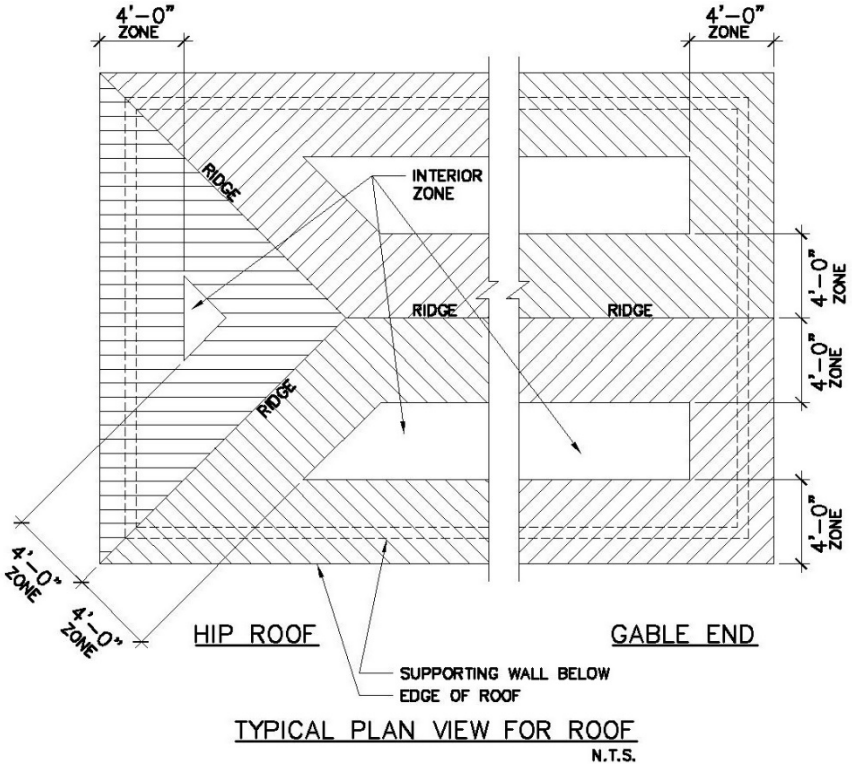

Figure 1: Roof Zone Diagram for Panel Attachment

Example

Determine the required design uplift pressures for a metal panel system on a home with the following site conditions:

- Wind speed = 150 mph per ASCE 7-10
- Exposure C
- Mean Roof Height = 30 ft

Solution

Using Table 1, the required design uplift pressures for the metal panel system are:

- Interior Zones: −31 psf
- 4′-0″ Zones: −80 psf

Therefore, the DP rating for the metal panel system must meet or exceed these pressures.

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Documentation Requirements

The Roofing Compliance Form must indicate the roof assembly's manufacturer and system type.

The product approval indicating the design pressure rating for the installed system meets or exceeds the site-specific roof design pressures must be provided to the Evaluator.

Photos must be provided indicating the attachment and spacing of the panel fasteners and or clips in compliance with the roofing system approval.

Glossary

UL 580	Standard for Tests for Uplift Resistance of Roof Assemblies
UL 1897	Standard for Uplift Tests for Roof Covering Systems
TAS 125-03	Florida Building Code, Testing Application Standard 125: Standard Requirements for Metal Roofing Systems.
Metal Panel Roof Coverings	Metal panels and their connections as a system that are tested in one of the applicable test standards. Shortened to *metal panel* in this document.
ASD	*Allowable Stress Design* (V_{asd}) pressures that are the actual capacities of metal panel. No 0.6 reduction factor is necessary as in V_{ult} design pressures.