Interesting Facts About Product-Approved Roofing Materials and the Building Code

By Dale Nelson

In Florida, where Roof Hugger does a significant amount of retrofit roofing, there is a system for product approval. The state of Florida has one system, and Miami-Dade has another. Florida Product Approval and a Notice of Acceptance are the respective systems. Both require certain minimum product test criteria to be used in the state. Upon acceptance, a number—commonly known as an "FL #" or an "NOA #" for the new roofing material—is issued.

Building departments require the product number be on the plans before a permit can be issued—a well-intended practice designed to protect the consumer. There is one simple problem: Just because you have an FL # or an NOA # does not automatically mean that that product meets the Florida Building Code (FBC)!

Florida Product Approvals for roofing products give one the "limits-of-use" defining maximum wind-uplift pressure resistance for each tested product installed in a particular way on a particular roof substrate. Well, fine, but if the product has an FL # and it is also UL-90 rated, then at least it is good for 90-psf wind uplift—right? No, not so. A UL-580 test places a particular roofing product in a vacuum chamber; draws a vacuum incrementally up to a maximum of 105 psf; and, if the product/assembly stays together, it passes the test and can be UL-90 rated. Since the FBC and many other design professionals require a minimum "Factor of Safety" of 2.0, the product will typically have a maximum usable uplift load capacity of 52.5 psf (half of the the 105 psf maximum).

Other roofing products employ tests designed for their specific products in specific assemblies. Each roofing material has its own particular test protocol. For structural metal roof panel systems, the most commonly accepted industry tests are UL-580 and ASTM E1592 (*Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Air Pressure Difference*). E1592 tests use a larger test sample, and they test the product/assembly to failure. Failure can be fastener pullout, seam/joint disengagement, deflection, or roof clip failure. The sustained pressure prior to the point of failure is then divided in half, and that is the maximum working uplift pressure that can be used in design calculations. So if the panel system fails at 125 psf and 120 psf was the highest sustained test load, then a maximum of 60 psf may be used as the design load, assuming deflection limitations are not exceeded.

So what does this all mean for designing and permitting a new roof or a reroofing project? This part is pretty straightforward: If the FBC-required wind uplift loads on a roof exceed the tested capacity of the roofing material—even if the material is Florida Product Approved—it does not meet FBC. These same parameters apply to the International Building Code (IBC).

So how does one know what the loads are? It all starts with the American Society of Civil Engineering's ASCE-7 published design criteria, which is an FBC-approved engineering method that determines design pressures in each of several different roof "zones." The size of these zones and the minimum uplift pressure each zone must resist is established by ASCE-7. On a simple, low-slope gable building, there are three zones: the corners (Zone III) are where the loads are typically highest, the perimeter or edges (Zone II) are where the loads are higher but less than the corners, and the field (Zone I) is where the loads are the lowest.

A simple low-slope roof plan would look like *Figure 1*.

The ASCE-7-2010 loads for an 80-ft.-wide x 150-ft.-long x 20-ft.-high-eaved building in Orlando, Florida, at 136-mph wind speed, under general occupancy, are approximately:

- Zone I: 25 psf
- Zone II: 42 psf
- Zone III: 64 psf

Let's look at this building, comparing two different FBC-approved metal roof panel systems installed on a pre-engineered building with 5-ft. purlin spacing.

Figure 1

Panel System "A" is a new 24-in. trapezoidal standing-seam roof with snap-together seams. When we look up the "limits of use" in the Florida Product Approval, we find the following test values:

- Maximum allowable load: 22.5 psf when attached to purlins 5 ft. o.c.
- Maximum allowable load: 52.5 psf when attached to purlins 1 ft. o.c.
- Values between 1 and 5 ft. can be interpolated per *Table A*.

This roof panel can only meet the lightest loads in Zone I of the roof if additional framing is added to reduce the clip/attachment spacing to 4 ft. This is similar for Zone II, except the panel must now be attached 2 ft. o.c. The bigger problem is that in Zone

Sample PSF Uplift Resistance Values of Florida Product-Approved Panels		
	Panel A	Panel B
Purlin/Clip Spacing	24-in. Trap-Snap-Together System	16-in. Mechanically Seamed System
5 ft.	22.5	47.0
4 ft.	30.0	66.5
3 ft.	37.5	86.0
2 ft.	45.0	105.5
1 ft.	52.5	125.0

Table A

Review of Panels vs. Required Capacity			
Roof Zone	Code-Required Min. PSF Uplift Resistance	Panel A Required Purlin/Clip Spacing	Panel B Required Purlin/Clip Spacing
Zone I	25.0	4 ft. o.c.	5 ft. o.c.
Zone II	42.0	2 ft. o.c.	5 ft. o.c.
Zone III	64.0	Beyond Limits	4 ft. o.c.

Table B

III, the required load of 64 psf is beyond the tested capacity of the panel: 52.5 psf attached 1 ft. o.c. This panel cannot be used on this project, even though it is Florida Product Approved. See *Table B*.

For Panel System "B," with the "limits of use" using a mechanically seamed, standing-seam panel with 16-in. o.c. vertical ribs, we find the following:

- Maximum allowable load: 47.0 psf when attached to purlins 5 ft. o.c.
- Maximum allowable load: 125.0 psf when attached to purlins 1 ft. o.c.

This panel can meet the 25-psf Zone I loads on 5-ft. attachments and the 42-psf Zone II loads on 5-ft. attachments. It can also meet the 64-psf Zone III loads in Zone III, but the attachment/purlin spacing must be reduced from the existing 5-ft. spacing. Adding the needed structure to reduce the purlin spacing to 4 ft. provides 66.5-psf capacity, making the product fully FBC-compliant.

All roofing materials—conventional and metal—have similar limitations on their use, and simply selecting a product that is "approved" does not mean it is appropriate or will meet the code-required loadings.

I have encountered products such as single plies and TPOs that were rated to 130 mph and beyond that were designed to be installed over poured concrete or 20- to 22-ga. structural metal decking and are being specified on composite boards, plywood, or existing 26-ga. metal roof panels. Similarly, metal panels with capacities well below code requirements are being specified for use just because they have "product approval."

When selecting a material for a new or reroofing project, I recommend the following:

1. Find out what the required roof loads are in each zone, as well as the zone size and shape. Differently shaped roofs will have different zone configurations. Many suppliers will assist with an "estimate" of these loads, which is fine for budgeting, but consulting a professional engineer is the only way to ensure compliance.
2. Understand the "limits of use" for the roofing product you want to install. Make sure they exceed the code minimums. Remember, each product, although similar to another, will have its own specific limits.
3. Make sure the building construction is within the parameters of the product approval limits of use. If the building is outside of those parameters, consult an engineer to determine how to proceed.
4. Finally, when installing the product, make sure it is installed exactly as stated in the product approval documents. Failure to follow the installation guidelines may result in a non-code-compliant assembly.

The FBC, the IBC, and the related product approvals have set a high bar to ensure strong, durable, high-quality roofs. Understanding and following the details and limitation of the approvals are keys to achieving the intended results and keeping a building code-compliant.

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