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Below Deck Netting Insulation Method Provides an Effective Means to Achieve High Performance Attics

Over the next two building code cycles (2016 and 2019), the California Energy Commission (Energy Commission) is moving towards Building Energy Efficiency Standards (Energy Standards) that will require Zero Net Energy in all residential newly constructed buildings. For the 2016 Energy Standards update, the number one priority is for the building industry to move to high performance attics by insulating at the roof deck. Insulating at the roof deck dramatically lowers attic temperatures, that otherwise can exceed 150°F in the summer, keeping that heat from getting into the conditioned space below, and creating a much cooler attic environment, which results in reduced HVAC duct losses. The Energy Commission will provide builder flexibility by offering a number of optional methods to achieve high performance attics by installing insulation either above or below the roof deck.

Some builders have chosen below deck insulation in unvented attics (see Figure 1). Features which make unvented attics attractive are:

1. Higher attic temperatures in the winter;
2. Fewer roof penetrations making photovoltaic (PV) system mounting less complicated;
3. Elimination of the need for acceptable attic vent materials in Wildland-Urban Interface Fire Areas;
4. Reducing duct losses by placement of ducts and HVAC in indirectly conditioned space; and

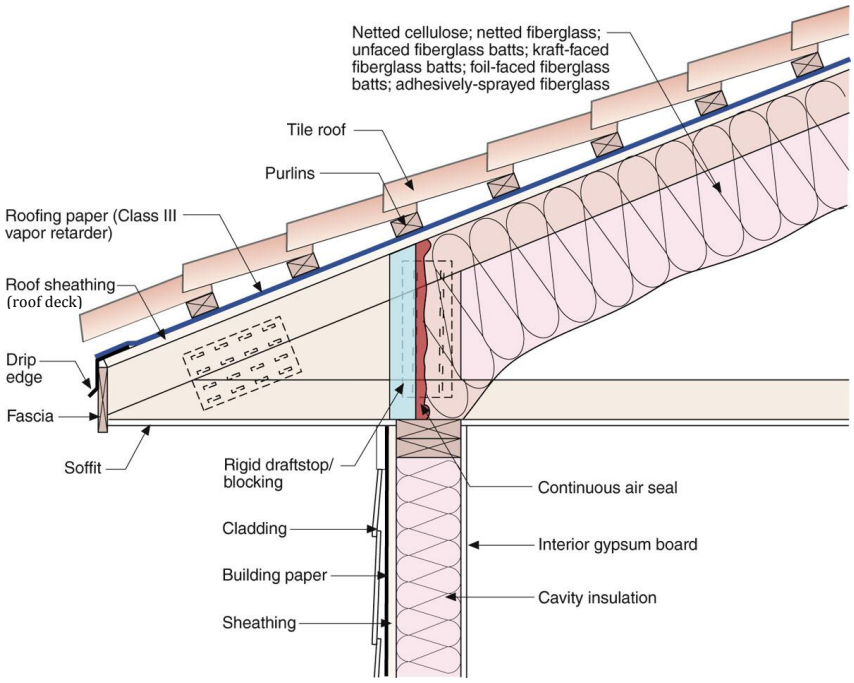

Figure 1 - Placement of attic insulation in an unvented attic[1].

5. Potentially reducing the need for air sealing of the ceiling to achieve low air leakage levels for the entire building envelope.

One challenge in building with unvented attics has been meeting the mandatory R-30 ceiling insulation requirement in the Energy Standards. In an unvented attic, insulation is mounted or applied to the underside of the roof deck instead of at the ceiling. Wood roof trusses constructed with 2x4 materials yield a cavity space of 3.5 inches, which limits the options for builders to meet the R-30 ceiling insulation requirement. Loose-fill materials such as fiberglass and cellulose are popular air-permeable insulation materials that are installed on the ceiling in vented attic construction, largely due to ease of installation and cost effectiveness. To achieve these same advantages for under roof deck installation, netted insulation systems could be used. Typical netted wall insulation systems do not yield the R-30 needed to meet the Energy Standards requirement when applied below the roof deck in 2x4 truss systems.

Alternative installation methods can provide high R-value insulation below the roof deck. One approach is a new netting system that is suspended from the top member of the truss, or top chord, to provide a fill depth that completely encloses the top chord, creating a uniform insulation layer of loose-fill fiberglass across the entire underside of the roof deck (see Figure 2). This method can be done with common loose-fill insulation tools and equipment. Other approaches may also be feasible.

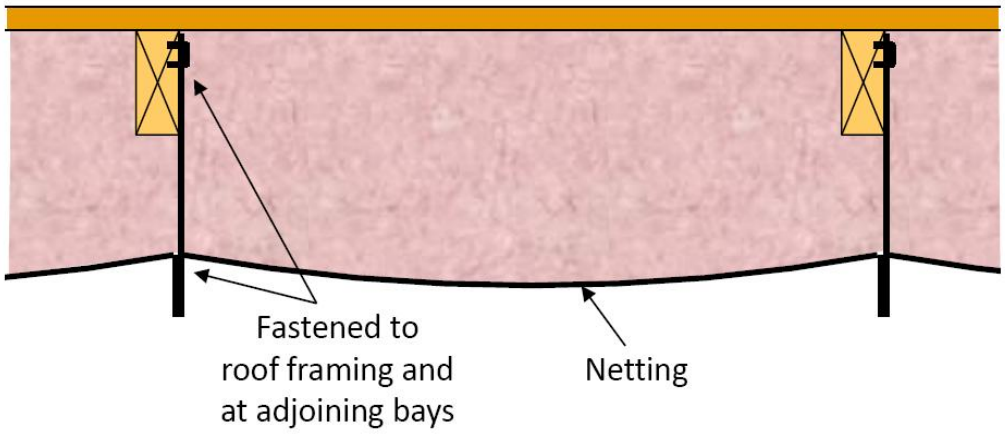

Figure 2 - Netting insulation installed below the roof deck. Image courtesy of Owens Corning[2].

An Energy Commission funded study[1] concluded that moisture is not expected to be an issue, except in Climate Zone 16, when installing air-permeable insulation below and in direct contact with the roof deck in unvented attics, and when installing tile roofing with top side ventilation (tile installed on battens) in combination with a vapor semi-permeable roofing paper (Class III vapor retarder)(see Figure 1). Class II or Class I vapor retarders, typically fully adhered vapor impermeable membranes, should not be installed in place of Class III roofing paper in this attic configuration. Note that in Climate Zones 14 and 16, Section

[1] Lstiburek, Joseph and Schumacher, Christopher. *Hygrothermal Analysis of California Attics*. Somerville, MA: Building Science Corporation, October 2, 2011. http://www.energy.ca.gov/title24/2013standards/prerulemaking/documents/current/Reports/Residential/Envelope/Hygrothermal_Analysis_of_California_Attics-BSC.pdf, Figure 25, pp. 33.

150.0(g)1 also requires a Class II vapor retarder to be installed on the conditioned space side of air-permeable insulation in unvented attics.

To comply with the California Residential Code (CRC) California Code of Regulations Title 24, Part 2.5, Section R806.5, builders may wish to request local building department approval of alternates, pursuant to CRC Section 1.8.7.2.

The California Energy Commission welcomes your feedback on Blueprint. Please contact Andrea Bailey at Title24@energy.ca.gov.

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