Department of
Licenses and Inspections
CITY OF PHILADELPHIA

Reference Code(s):

International Building Code
International Residential Code

FAQ:

My project utilizes a low-slope (≤ 2:12) roof configuration. What considerations should I make to address moisture and condensation control at the roof assembly from the interior environment?

Background:

Typically, roof ventilation is utilized at roof assemblies to address the issue of moisture and condensation that may accumulate from the interior side of a structure. Prescriptive design provisions around roof ventilation may be found under the **IBC, Section B1202**, and **IRC, Section R806**, which include provisions for minimum ventilation area, ventilation sizing, and clearance. The prescriptive method for roof ventilation relies on the use of air exchange between dry exterior air to pick up moisture of an interior airspace through a roof vent, allowing for that mixed air to exit to the exterior.

However, with low-sloped roof assemblies, additional challenges with ventilating these assemblies are posed by air movement issues within the assembly caused by the lack of buoyancy-induced pressures (aka stack effect/chimney effect) that rely on temperature differentials of the air in the assembly, air movement interference by blocking or bridging within an assembly, as well as the negligible effect of lateral air movement.

Answer:

There are documented limitations with roof ventilation installations at low-sloped roofs or flat roofs, where insufficient air exchange between the exterior air and interior airspaces may lead to the accumulation of moisture and condensation within a roof assembly that could potentially rot and deteriorate roof structures and assemblies. Such insufficient air exchange conditions associated with ventilating a low-sloped roof may in fact worsen moisture problems by inducing more moisture-laden interior air to pass through a leaky ceiling assembly, ultimately leading to more condensation.

Not only does venting low-slope roofs depend on an airtight ceiling assembly for condensation control, but dependency on an airtight ceiling assembly is also required for fire control. Exhaust of air through a low-slope roof with a leaky ceiling will draw air from a house, with the increased risk of fire spread as air gets pulled throughout interior spaces of the structure.

With such considerations, the use of an unvented enclosed roof assembly may provide for a better controlled environment in low-sloped roof structures in comparison with vented roof assemblies. However, with the use of an unvented enclosed roof/attic assembly, condensation would still need to be controlled through the provisions of **IRC, Section R806.5** and **IBC, Section B1202.3** with the proper use of vapor barriers and air-impermeable insulation. The proper use of vapor barriers and an air-impermeable insulation helps to prevent any interior moisture from reaching a cold surface that could be subject to rot.

A number of provisions under **IRC, Section R806.5** and **IBC, Section B1202.3** for unvented enclosed roof assemblies need to be considered to ensure proper control of moisture and condensation:

1. Any unvented attic space must be located completely within the building thermal envelope.
2. No interior Class I vapor retarder is permitted to be installed on the ceiling side (attic floor) of the unvented attic assembly, or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, not less than a 1/4-inch vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.

4. Insulation of the assembly shall comply with the following requirements:
    a. Insulation shall be met by one of the following options, dependent on the air permeability of the insulation directly under the structural roof sheathing:
        - Where only air impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing. **(See Exhibit 2)**
        - Where an air permeable insulation is installed directly below the structural sheathing, a rigid board or sheet insulation layer of a *R-15 insulation rating* is required to be installed directly above the structural roof sheathing for condensation control. **(See Exhibit 1)**
        - Where both air permeable and air impermeable insulation are provided, the air impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing **(See Exhibit 2)**, with a *minimum R-15 insulation value rating* for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.
        - Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45-degrees F. For calculations purposes, an interior air temperature of 68-degrees F is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three (3) coldest months.
    b. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

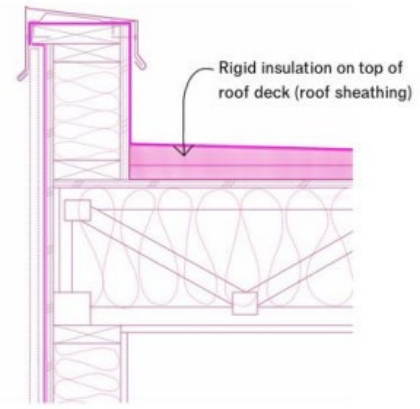

Exhibit 1

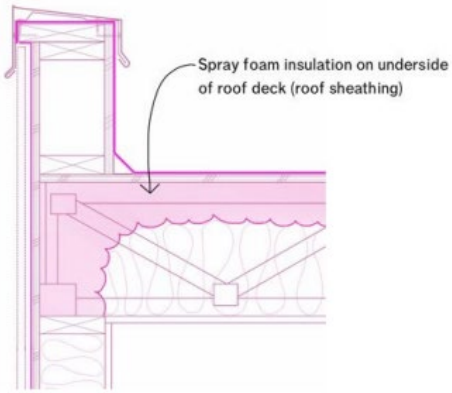

Exhibit 2

The control of moisture and condensation at a Roof Assembly is critical to ensure that the integrity of the structural roof sheathing is not compromised. Where adequate ventilation of an enclosed roof assembly is not possible, design details outlined by prescriptive code provisions should be undertaken to ensure that the installation of air impermeable insulation, or an alternative insulation design is implemented. The proper use of insulation at unvented enclosed roof assemblies provides greater management of indoor moisture and its potential to interact with cold, condensing surfaces, reducing the potential that condensation will lead to the deterioration of structural roof elements.

Questions? Call 311 or (215) 686-8686 (if outside Philadelphia) or submit an online form via http://www.phila.gov/li/get-help.