APA

Technical Topics

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Wood Moisture Content and The Importance of Drying in Wood Building Systems

The use of impermeable materials such as some types of insulation and moisture barriers must be carefully considered when designing and constructing wood building systems. This Technical Topic provides guidance on how to avoid potential moisture problems which could lead to costly and potentially hazardous structural deterioration as well as possible health risks.

WOOD MOISTURE CONTENT

APA trademarked engineered wood products are bonded with moisture-resistant adhesives and are suitable for limited moisture exposure during construction delays. However, construction should proceed with limited interruption and wood products should be protected by roofing and/or weather-resistive barriers as soon as practicable.

Wood naturally contains some moisture within its cellular structure. The moisture content of wood products during construction and in-service depends on exposure to direct wetting, accumulated moisture, temperature, relative humidity, and the drying potential of the system in which the wood is contained.

When a structure is completed, wood normally stabilizes to an in-service moisture content between 6 and 14 percent. At these low levels, moisture content has negligible impact on the strength, stiffness, or durability of wood products. However, absent sufficient drying potential, accumulated moisture can lead to decay and mold growth if moisture content remains high (approximately 20 to 25 percent or higher) for a prolonged period.

Protecting against moisture damage depends on proper system design, installation and maintenance. Good design and construction practices protect against water leaks, control moisture laden air infiltration and condensation potential, influence the rate at which air moves around and through building systems, and mitigate the effects of humidity and temperature differentials between the inside and outside of the structure. Improper design, construction or maintenance can result in moisture build-up in the structure and lead to problems with mold, mildew, decay or other moisture-related problems such as dimensional stability issues. Even with proper design and construction of the exterior building envelope, it is possible for bulk water or moisture-laden air to penetrate into the wood structural systems over the life of the building. This can occur by natural deterioration of materials, such as siding, windows, roofing or sealants (e.g., caulks and tapes). Wetting events can also be the result of wind-driven rain, ice dams, degradation of flashing, or temporary damage of wall and roof coverings due to natural events such as wind storms.

To mitigate moisture exposure, APA recommends covering wood structural panel sheathing as soon as possible after installation. After the building exterior envelope is complete but before enclosing the wall cavity, roof cavity, or installing interior finish, the roof and wall sheathing and lumber framing should be allowed to dry (to less than 18 percent) so that moisture absorbed during construction or induced from other sources is minimized. This is especially important if anything that might inhibit drying is applied to the sheathing or assembly.

UNVENTED ATTICS

Notwithstanding the acceptance of unvented attics by the International Building Code (IBC) and International Residential Code (IRC) in IBC 1203.3.2 and IRC R806.4[a], there has been a general concern about possible detrimental effects resulting from recently popularized practice of applying insulation directly to the underside of roof sheathing. Should the roof (or other) system become wet due, for example, to misinstalled or failed weather barriers, flashing, or systems that have not been properly maintained, the direct application of some insulation materials may limit the ability of wood structural panel sheathing to dry. **The use of insulation materials that inhibit the drying of wood structural panel roof sheathing, such as some direct applied insulation on the underside of the sheathing, could lead to structural panel performance issues such as buckling and other moisture-induced problems. When such insulation materials are used in combination with an impermeable layer on top of the roof sheathing, such as some adhered shingle underlayment materials, the risk of moisture problems due to reduced drying potential of the system will increase substantially.** This could lead to potential long-term accumulation of moisture in the roof system resulting in costly and potentially hazardous structural deterioration as well as possible health risks.

For unvented attics to be successful, all of the following conditions must be met:

1. The design, detailing, and installation of roof and flashing systems must be complete, correct, and properly maintained.
2. Building and mechanical systems must be maintained in good condition such that the long-term moisture content of wood materials continues in a dry state for the service life of the structure.
3. In the event that moisture accumulation does occur, the roof system must have a means to dry.

The designer and builder should assure that these conditions can be met if using unvented attic assemblies.

WALL ASSEMBLIES

Moisture vapor moving through walls occurs naturally. Therefore it is important to design wall systems that can properly manage moisture vapor. The ideal wall assembly will restrict moisture gain when the wall is dry but will allow for drying of the wall when moisture is elevated. Use of wood structural panel wall sheathing facilitates wall cavity drying to the exterior of the building (see APA Form J450, *Water Vapor Permeance of Wood Structural Panels and Wall Construction).* The use of impermeable exterior wall sheathing, such as some insulating sheathing products, may slow the wall drying process or even trap moisture in the wall cavity. If excessive moisture gets into the wall it is possible that wetting will exceed the ability of the wall assembly to dry. Therefore, it is vital to minimize leaks that allow bulk water or water vapor into the wall cavity and use materials that allow drying when elevated moisture conditions exist. As with roof assemblies, many sources of moisture intrusion can be prevented through proper design, construction and maintenance. However, in the likelihood that higher moisture levels may be present in a wall system at some time over the life of a building, the building designer should select materials that allow for drying to the exterior as well as the interior of the building whenever possible.

ADDITIONAL INFORMATION

For additional information and detailed recommendations on moisture control in engineered wood construction systems, refer to the following APA publications (www.apawood.org/publications):

Condensation Causes and Control	Form X485
Controlling Decay in Wood Construction	Form R495
Water Vapor Permeance of Wood Structural Panels and Wall Construction	Form J450
Build Energy Efficient Walls	Form J440
Build A Better Home – Foundations	Form A520
Build A Better Home – Mold	Form A525
Build A Better Home – Walls	Form A530
Build A Better Home – Roofs	Form A535
Moisture Control in Low Slope Roofs	Form R525

[a]2009 IRC **R806.4 Unvented attic assemblies.** Unvented *attic* assemblies (spaces between the ceiling joists of the top story and the roof rafters) shall be permitted if all the following conditions are met:

1. The unvented *attic* space is completely contained within the *building thermal envelope.*

2. No interior vapor retarders are installed on the ceiling side (*attic* floor) of the unvented *attic* assembly.

3. Where wood shingles or shakes are used, a minimum 1/4 inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.

4. In climate zones 5, 6, 7 and 8, any *air-impermeable insulation* shall be a vapor retarder, or shall have a vapor retarder coating or covering in direct contact with the underside of the insulation.

5. Either Items 5.1, 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.

5.1. *Air-impermeable insulation* only. Insulation shall be applied in direct contact with the underside of the structural roof sheathing.

5.2. Air-permeable insulation only. In addition to the air-permeable installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in Table R806.4 for condensation control.

5.3. Air-impermeable and air-permeable insulation. The *air-impermeable insulation* shall be applied in direct contact with the underside of the structural roof sheathing as specified in Table R806.4 for condensation control. The air-permeable insulation shall be installed directly under the *air-impermeable insulation.*

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying engineered wood products, contact us:

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