

Determining when insulation is wet

by James R. Kirby, AIA

Q: How does one determine whether existing roof insulation is wet and unsuitable to be re-covered or reused in a low-slope roofing application?



A: Good roofing practice requires removing all wet insulation before a re-cover roof system or replacement membrane is installed. But the roofing industry does not have a consensus evaluation method for determining whether insulation is wet. Currently, there are three methods that can be used to determine this: equilibrium moisture content (EMC), thermal resistance ratio (TRR) and visual examination.

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EMC

During the 1985 International Symposium on Roofing Technology, Carl Cash, a principal and vice president of consulting engineering firm Simpson Gumpertz & Heger Inc., Arlington, Mass., presented a paper titled "Moisture and built-up roofing." One portion of this paper discusses the EMC of roof system materials, including insulation.

From this paper, it can be inferred that materials used in roof systems have maximum acceptable moisture contents. Materials with moisture contents greater than the parameters listed in the technical paper are wet (i.e., unacceptable) and should not be used.

Cash writes, "The [EMC] data on many [roof] system components are listed as aid[s] in determining when materials are 'dry' (contain less water than the 45 percent relative humidity [RH] EMC); 'moist' (contain more water than the 45 percent RH EMC but less water than the 90 percent

RH EMC); and 'wet' (contain more water than the 90 percent RH EMC)."

For example, polyisocyanurate foam insulation (3 pounds per cubic foot [pcf] [48 kg/m³]) without facers has, at 45 percent RH, an EMC of 1.4 percent by weight and, at 90 percent RH, an EMC of 3 percent by weight. Fiberboard insulation (16 pcf [256 kg/m³]) without facers has, at 45 percent RH, an EMC of 5.4 percent by weight and, at 90 percent RH, an EMC of 15 percent by weight.

TRR

During the 1991 International Symposium on Roofing Technology, Wayne Tobiaasson, a former civil engineer with the U.S. Army Corps of Engineers Cold Regions Research and Engineering Laboratory (CRREL); Alan Greatorex, a CRREL civil engineering technician; and Doris Van Pelt, a former CRREL civil engineering technician, presented a paper titled "New wetting curves for common roof insulations." This paper discusses a model for determining when insulating materials, based on moisture content, lose their abilities to resist thermal transfer.

The authors explain their position: "The ratio of a material's wet thermal resistivity to its dry thermal resistivity, expressed as a percentage, is termed its [TRR]. As moisture accumulates in a material, its TRR decreases. Graphs [and equations] of TRR vs. moisture content were developed for fiberboard, perlite, cork, gypsum, insulating concrete, cellular glass, fibrous glass, expanded polystyrene, extruded polystyrene, urethane/[poly]isocyanurate, foamed-in-place urethane and phenolic insulations. Insulation with a TRR of 80 percent or less is, by our definition, 'wet' and unacceptable."

The information presented in the paper is based on moisture content and TRR of the insulating material only (i.e., unfaced insulation). In addition, moisture contents of insulating materials at TRR are presented as functions of weight and volume.

For example, polyisocyanurate

foam insulation without facers having a TRR equal to 80 percent has a moisture content of 262 percent by weight and 8.8 percent by volume. Fiberboard with a TRR of 80 percent has a moisture content of 15 percent by weight and 4.4 percent by volume.

EMC and TRR evaluation methods typically are most useful when performed before a roof re-cover project begins. The amount of wet insulation to be replaced during a re-cover can be reasonably predetermined by the combination of nondestructive moisture surveys, rational core sampling, and EMC or TRR analysis.

Visual observation

Using visual observation to determine whether insulation is wet may be more difficult because no rational parameters exist. Instead, roofing professionals must rely on subjective analysis. However, one factor never can be ignored—if liquid moisture is present in existing insulation, the insulation is too wet to be left in place or re-covered.

When EMC and TRR methods are not used and visual observation is relied on, it is difficult to predetermine the amount of wet insulation to be replaced because the decision to remove and replace wet insulation is made during the reroofing project, not before work begins.

NRCA considers the determination of whether insulation is wet and the method selected to make that determination to be the roof system designer's responsibility. **PR**

Editor's note: Roofing professionals interested in obtaining copies of the referenced papers should call NRCA's Fax-On-Demand at 1-888-455-NRCA and request document 1318.

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