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Drip, Drip, Drip ...

Standards Help Avoid Condensation Aggravation

BY RICHARD RINKA

While condensation on windows was once considered to be little more than an unavoidable nuisance, nowadays it is taken much more seriously. The collection of moisture can stain or damage interior surfaces and degrade the indoor environment. In primarily residential venues, this can result in mold growth and lead to costly remediation and even lawsuits over alleged toxic reactions.

How Condensation Occurs

While the particulars vary with climate, altitude and type of room occupancy (e.g., kitchens and bathrooms vs. bedrooms), condensation forms on window glass or framing whose surface temperature falls below the dew point—the temperature at which airborne moisture (water vapor) turns into a liquid. In general, the greater the indoor-outdoor temperature difference, the more likely condensation is to form. If the dew point is below 32 degrees Fahrenheit, the condensation will be in the form of frost or even ice.

The challenge to minimize condensation is to lower the indoor humidity and keep the inside surface temperature of the glass and frame above the dew point temperature, especially when outdoor temperatures are frigid. This calls for the same design features that promote energy conservation.

Condensation Ratings

In order to make valid comparisons of window, door and skylight products, industry standards have evolved to predict how well a given product resists condensation.

Three different condensation rating systems are available. They are the AAMA Condensation Resistance Factor (CRF), the National Fenestration Rating Council (NFRC) Condensation Rating (CR) and the Canadian Standards Association (CSA) Temperature Index (I). All three use a numerical index between 1 and 100 with higher values indicating better performance. While similar (for example, all are based on standardized conditions of 0 degrees Fahrenheit exterior ambient air temperature and 70 degrees Fahrenheit interior room temperature), they are determined by different methods.

AAMA publication CRS-15, *A Comparison of Condensation Rating Systems for Fenestration*, describes the three methods in detail, including calculation formulas and applications.

AAMA Condensation Resistance Factor (CRF)

The CRF is derived from actual interior surface temperature readings obtained from testing per AAMA 1503-09, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections*, or from NFRC 100-14, *Procedure for Determining Fenestration Product U-Factors*.

The window is placed in a test chamber that maintains the standardized conditions. The inside surface temperatures are measured at 24 locations on the specimen. Separate CRF numbers are then calculated for the frame and for the glass. The lower of these numbers is then taken as the CRF for the product as a whole.

AAMA offers an online condensation resistance factor (CRF) tool to provide guidance on defining a target minimum CRF based on a project-specific set of environmental conditions. Visit www.aamanet.org/crf-calculator/1/334/crf-tool for details.

Guidelines to manage indoor humidity levels are also available at www.aamanet.org/general/3/507/understanding-indoor-condensation.

NFRC Condensation Resistance Measurement (CR)

The condensation resistance (CR) measurement is similar to AAMA's CRF, the principal difference being that the CR is derived from simulations using software tools (THERM 5.2 and WINDOW 5.2) to model and calculate a CR rating. It is based on the same standardized conditions as CRF with the addition of three humidity levels of 30, 50, and 70 percent. This differs from the AAMA CRF, which is derived from actual test data. The method is described in NFRC 500, *Procedure for Determining Fenestration Product Condensation Resistance Values*.

CSA Temperature Index (I)

The I rating, like the CRF, is obtained through laboratory testing at standard test conditions, albeit with different thermocouple locations as prescribed in CSA A440.2. In general, a given product's temperature index will be lower than its CRF.

It should be emphasized that CR and CRF and I ratings differ significantly and are not interchangeable. For example, a CR 50 is not equivalent to a CRF 50. It's therefore important to use the same rating system when comparing products (i.e., CRF versus CRF). No method exists to convert between the different indices. CRS-15 can be obtained via the AAMA Publication Store at www.aamanet.org.

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