Questions about Windows and Condensation?

NFRC Has the Answers

In today's market, architects, builders, and consumers have the opportunity to choose among many different windows. In colder climates that have a heating season, many home and building owners may have concerns regarding the formation of condensation on the inside of their windows.

What is Condensation?

Condensation is a formation of liquid water or ice on a cold surface. This is caused when the surface temperature is lower than its dew point temperature.

The dew point temperature of any surface is directly related to the amount of moisture that is in the air, known as relative humidity. It is also related to the temperature of the air in the room. As the relative humidity in a room increases, the dew point temperature also increases, which means that a surface is more likely to show condensation at warmer temperatures. For example, bathroom and kitchen areas typically have higher relative humidity conditions.

How is Condensation on Windows Reduced?

In order to reduce the formation of condensation on windows, it is important to decrease relative humidity, and increase the surface temperature above the dew point temperature.

Relative humidity can be decreased through the use of exhaust fans, ceiling fans, dehumidifiers, or opening of windows and doors.

Window surface temperatures can be increased by reducing the amount of heat transfer through the window. The measurement of heat transfer through the window is known as U-factor. The lower the U-factor, the lower the potential that condensation will form on a surface of the window.

NFRC categorizes a window into three parts: the center of-glazing; the edge-of-glazing; and the frame. Heat from inside the house will conduct its way through the parts of the window that are the least energy efficient, causing those parts to have lower indoor surface temperatures. To reduce the potential for condensation, each component of the window should be thermally efficient.

You can reduce the potential for condensation on each window component by looking for the following improvements:

Center-of-Glazing – Going from single-glazed (one lite of glass) windows to multiple-glazed windows or insulating glass units reduces the potential for condensation. Choosing energy-efficient, low-e coatings in multiple-glazed or insulating glass units further reduces the potential for condensation.

Edge-of-Glazing – Similar to the center-of-glazing, going from single-glazed to dual-glazed or insulating glass units reduces the potential for condensation on the edge-of-glazing surface, and using high performance glass further reduces the chance for condensation. A third step for reducing the potential for condensation is the use of warm edge spacer systems that reduce conductivity through the edge.

Frame – Going from highly conductive metal framing systems to thermally broken metal frames or thermally improved framing materials (like wood or vinyl) reduces the chance for condensation formation.

What is Condensation Resistance rating?

NFRC has developed a standardized methodology for determining the potential formation of condensation on a window – called Condensation Resistance. Condensation Resistance is reported on a scale of 1 to 100. The higher the number, the better a product is at resisting condensation. The results are based on a set of standardized conditions (0°F outside temperature, 70°F inside temperature) and three levels of relative humidity – 30%, 50%, and 70%. Surface temperatures locations for the window are normalized and recorded for the three window areas (center-of-glass, edge-of-glass, and frame). The Condensation Resistance of the window is then determined by the lowest rating obtained from the three component areas of the window.

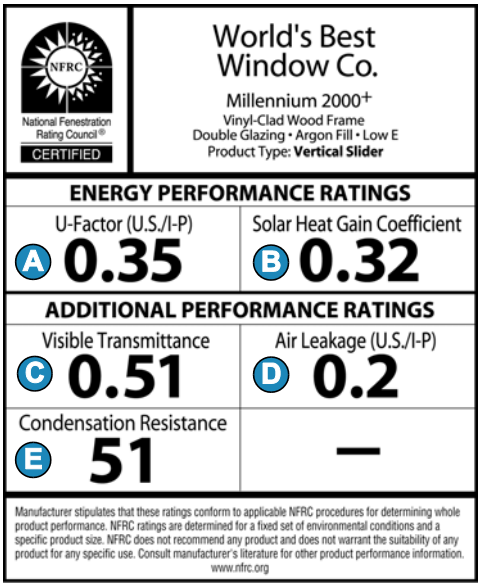
It should be noted that NFRC only reports condensation formation on the inside surfaces of windows. In the real world, environmental conditions vary from the standardized environmental conditions used to determine Condensation Resistance. **This standard (NFRC 500) is not meant to predict condensation; rather it is meant to be a tool for rating and comparing window products and their potential for condensation formation.**

Glass Type	Condensation Resistance Ranges
Clear	10 to 47
Low-E	10 to 61

Condensation Resistance (CR) data from products listed in the NFRC Certified Products Directory (CPD). CR values are based on vertical sliding products and these ranges listed do not guarantee products of similar configuration shall fall within the stated ranges; these values are for comparison only.

NFRC has additional information for selecting energy efficient windows on its Web site www.nfrc.org. Of special interest, see the NFRC *Certified Products Directory*, which lists hundreds of manufacturers and thousands of products authorized for certification by NFRC. If you need further information, contact our offices in Maryland (301-589-1776) or Kansas (785-862-1890).

Both U-factor and Condensation Resistance may be found on the NFRC label, or supplied by the window manufacturer.



A **U-Factor** measures how well a product prevents heat from escaping a home or building. U-Factor ratings generally fall between 0.20 and 1.20. The lower the U-Factor, the better a product is at keeping heat in. U-Factor is particularly important during the winter heating season. This label displays U-Factor in U.S. units. Labels on products sold in markets outside the United States may display U-Factor in metric units.

B **Solar Heat Gain Coefficient** (SHGC) measures how well a product blocks heat from the sun. SHGC is expressed as a number between 0 and 1. The lower the SHGC, the better a product is at blocking unwanted heat gain. Blocking solar heat gain is particularly important during the summer cooling season.

C **Visible Transmittance** (VT) measures how much light comes through a product. VT is expressed as a number between 0 and 1. The higher the VT, the higher the potential for daylighting.

D **Air Leakage** (AL) measures how much outside air comes into a home or building through a product. AL rates typically fall in a range between 0.1 and 0.3. The lower the AL, the better a product is at keeping air out. AL is an optional rating, and manufacturers can choose not to include it on their labels. This label displays AL in U.S. units. Labels on products sold in markets outside the United States may display AL in metric units.

E **Condensation Resistance** (CR) measures how well a product resists the formation of condensation. CR is expressed as a number between 1 and 100. The higher the number, the better a product is able to resist condensation. CR is an optional rating, and manufacturers can choose not to include it on their NFRC labels.

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