

Understanding Condensation

WHAT IS CONDENSATION?

Whenever there is excess humidity in the air, it shows itself in the form of tiny water droplets on the coolest surfaces available. The warmer the air, the more moisture it will retain. When warm air is cooled, the excess moisture is released in the form of tiny water droplets that we refer to as condensation.

WHAT IS WINDOW CONDENSATION?

Window condensation is the result of excess humidity inside your home or commercial building. Beyond being a nuisance, this condition can lead to mold, rot and a musty odor. Making matters worse, for those in especially cold climates, the condensation forming on windows and glass can freeze and turn into ice.

New construction and remodeling will increase the probability of condensation because wood, drywall, cement and other building materials take time to cure and dry out, thus increasing humidity in the air. Sharp drop in outside temperature can also create a temporary condensation problems during the heating season when inside humidity is higher than normal.

MANAGING CONDENSATION

We recommend new and renovation construction incorporate humidity control within their designs; especially in the northern climates where the average winter temperature is 35° (F) or less.

Window coverings restrict air movement around the window which can increase the formation of condensation. Keep them open as much as possible to allow for more air-flow and increase the material temperature. If the window is recessed in a wall cavity, natural air-flow may not be adequate to minimize condensation; therefore a fan may be necessary to assist air circulation. Ceiling fans can be installed to assist air flow and dehumidifiers can be operated to reduce humidity levels.

UNDERSTANDING DIFFERENT CONDENSATION RATINGS

While **Condensation Resistance Factor (CRF)**, **Condensation Resistance (CR)**, and **Condensation Index (CI)** all measure an opening's ability to resist water droplets, they utilize different test methods and scales that make them non-interchangeable. **CRF** is a physical lab test result on a scale of 30 to 80 that focuses on the weighted average of frame and glass temperatures. In contrast, **CR** is a computer-simulated rating on a 1-100 scale that normalizes performance across three different humidity levels. The newest standard, **CI**, is an advanced simulation designed to replace CR by identifying the single coldest spot on the window, providing a more precise predictor of where condensation will actually begin in specific climates.

Condensation Resistance Factor - (AAMA 1503), Condensation Resistance - (NFRC 500-2017) and Condensation Index (ANSI/NFRC 500-2023)

HOW IS CONDENSATION CONTROLLED?

High Performance Energy Efficient Windows have been designed to keep the temperature of the glass as warm as possible and thus reduce condensation. While well insulated, tight fitting windows provide a draft-free comfort and can help lower your energy bills, air-tight windows can trap moisture inside your home or building. Prior to air-tight windows, moisture in the air may have leaked to the outside through openings in old loose fitting, air-leaking windows, thus preventing condensation.

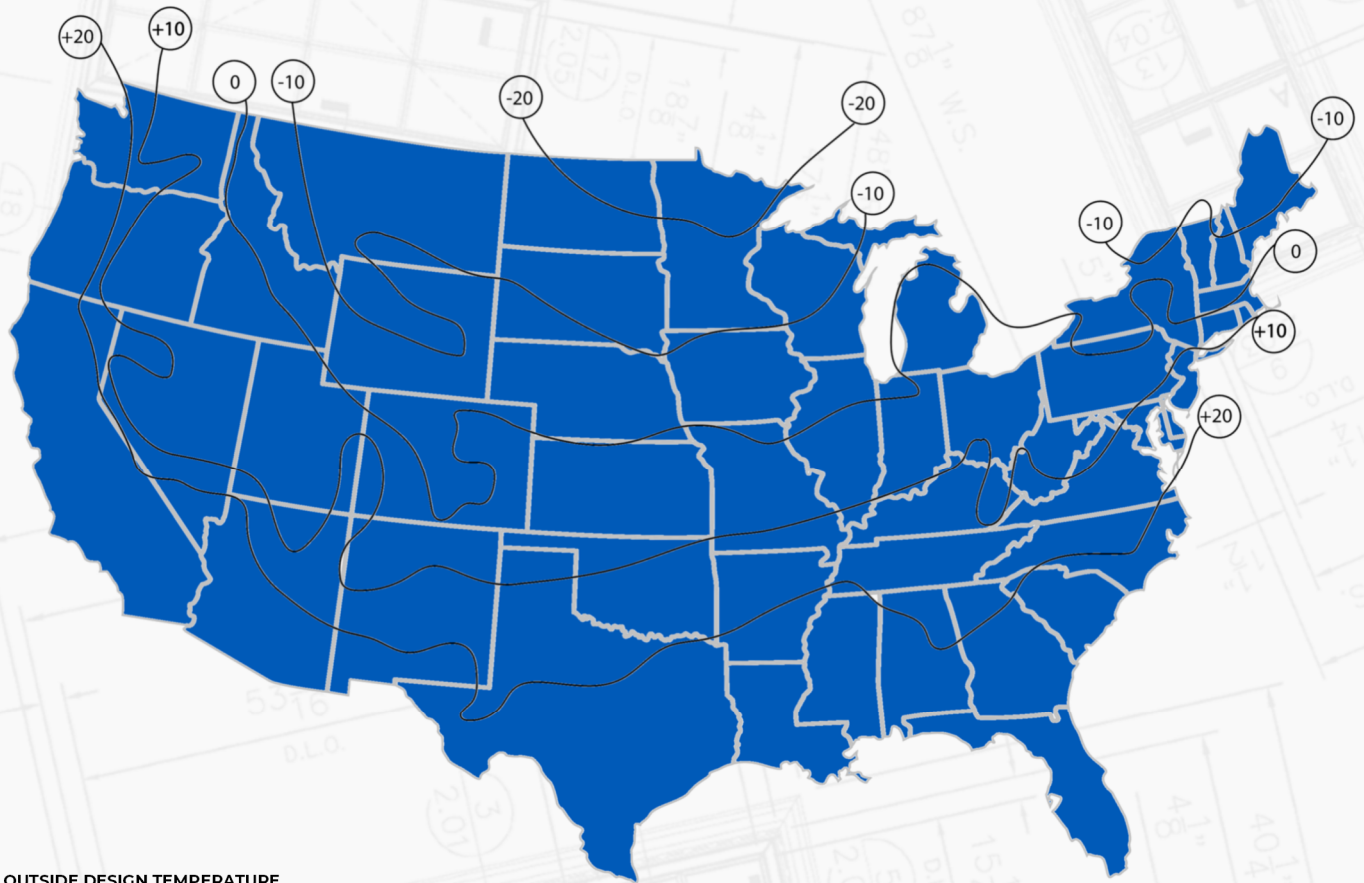
There are four primary variables that need to be considered when trying to control condensation.

- Exterior Air Temperature
- Interior Air Temperature
- Interior Relative Humidity
- Interior Air-Flow

The interior air temperature, interior humidity and interior air-flow are the items we have control over.

Interior humidity and air-flow are the best ways to reduce condensation.

Identify Your Outside Design Temperature



**WINTER OUTSIDE DESIGN TEMPERATURE
ASHRAE 97 1/2 % BASE ***

Temperature data for specific locations are given in Weather Data and Design Conditions, ASHRAE HANDBOOK OF FUNDAMENTALS published by American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

CHART A

*97 1/2 % of the time during the months of December, January, and February, the temperature will not be at or Below the indicated designs temperature.

Maximum Recommended Humidity Levels

Based on engineering studies at 70-degrees (F) conducted at the University of Minnesota Laboratories

Outside Air Temperatures	Inside Relative Humidity
-20 degrees F. or below	< 15%
-20 degrees F. to -10	< 20%
-10 degrees F. to 0	< 25%
0 degrees F. to 10	< 30%
10 degrees F. to 20	< 35%
20 degrees F. to 40	< 40%

This is a brief review of condensation and how it can be managed. Selecting the proper fenestration product from Manko Window Systems, Inc. and designing the building with proper climate control will help manage condensation.

The following sources were used: "The Condensation Problem—Here are the Causes and Cures Canadian Builder, Vol XIII, No. 7." * Condensation Problems in your House: Prevention and Solution. US Dept. of Agriculture Forest Service, Agriculture Information Bulletin No. 373, *technical Bulletin #1. Ethyl Corporation; *The Condensation Answer Book. Andersen