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# Condensation Resistance Factor (CRF) Calculator User's Guide

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## Overview

The Condensation Resistance Factor (CRF) calculator is intended to provide general guidance on suggesting a minimum condensation resistance factor (CRF) based on a project specific set of environmental conditions.

While not an absolute value, the CRF is a rating number obtained under specified test conditions to allow a relative comparison of the condensation performance of the product. It will provide a comparative rating of similar products of the same configuration and permit the determination of the conditions beyond which an objectionable amount of condensation may occur. Some interpretative allowances may need to be made in comparing products of dissimilar type or configuration (e.g. wall sections versus operating windows or versus fixed glazing).

The calculations used to determine the CRF rating are based on the procedures outlined in **AAMA 1503-09, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.***

## How to Obtain AAMA 1503

[Click here](#) to order AAMA 1503, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.*

Enter the quantity needed, select the desired medium (electronic download, CD, paper) and select "Add to cart." When prompted, add the necessary payment information and proceed to checkout.

## How to Use the CRF Calculator

Simply enter the project specific environmental information in each of the three boxes requiring User Data Input:

- Outdoor air temperature (°F)
- Select the ASHRAE 99.6% Heating DB Temperature from the nearest city to the project's location from the "Major U.S. cities and state capitals" chart.
- Indoor air temperature (°F)
- Indoor relative humidity
- Entered as a whole number

Once all data has been entered, the suggested CRF is calculated and shown:

## ASHRAE 99.6% HDB

These values represent dry-bulb temperatures corresponding to 99.6% annual cumulative frequency of occurrence (cold conditions), °F. These Climatic Design Conditions were extracted from the American Society of Heating, Refrigerating and Air Conditioning Engineers 2005 ASHRAE Handbook of Fundamentals. The values were obtained from various World Meteorological Organization (WMO) observing stations across the country.

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### **Calculations from AAMA 1503**

$$W = [(FT_p - FT_r)/(FT_p - (t_{ii} + 10))]0.40$$

Where:

**W** = A weighting factor for calculation of FT

**FT<sub>p</sub>** = Average temperature of 14 predetermined thermocouple locations on frame and sash members

**FT<sub>r</sub>** = Average temperature of 4 roving thermocouple locations on the 4 coldest locations of frame and sash members

**t<sub>ii</sub>** = Average temperature of cold side air (deg F)

**10** = arbitrary temperature adjustment

**0.40** = arbitrary weighting factor

$$FT = FT_p (1-W) + W FT_r$$

Where:

**FT** = weighted frame temperature

$$CRF = (FT - t_{ii}/t_i - t_{ii})100$$

Where:

**CRF** = condensation resistance factor

**t<sub>i</sub>** = Average temperature of warm side air (deg F)

**100** = A multiplier to make CRF a whole number

### **Heat flow from Exterior Air to Interior Air**

$$q_e = U_i A (T_i - T_o) \text{ BTU/hr}$$

Where:

**U<sub>i</sub>** = Local U-Factor (BTU/hr/sq. ft./deg F)

**A** = Area (sq. ft.)

**T<sub>i</sub>** = Interior ambient air temperature (deg F)

**T<sub>o</sub>** = Exterior ambient air temperature (deg F)

### **Heat flow from Interior Surface to the Interior Air**

$$q_i = [A(T_i - T_s)]/R_s \text{ BTU/hr}$$

Where:

**T<sub>s</sub>** = Interior Surface Temperature (deg F)

**R<sub>s</sub>** = Resistance of the surface to heat transfer (R<sub>s</sub> = 1/h<sub>s</sub>, where h<sub>s</sub> = Local surface heat transfer coefficient)