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THE IMPORTANCE OF AIR INFILTRATION TO WINDOW PERFORMANCE

It is a known fact that even moderate air leakage can increase BTU loss in an average home. There is even a formula to quantify it: Air leakage (cu.ft./hr) times the temperature difference between outside and inside (ΔT) x .018 = BTU/hr. A small difference of 1 cu.ft./hr on a day where the temperature is 30° F outside and 70° F inside can impact home heating loads by over 60 BTU/hr. Multiply that by a full day and multiple window and door products and there is a significant impact when windows and doors leak.

While AWDI, LLC applauds the recommendation by EPA for the Energy Star addition of air leakage consideration in testing and labeling; we are also recommending the consideration of air leakage considerations in installation recommendations.

Presumed airtight windows have been installed for years (especially in retrofit applications) using methods that are unable to restrict air infiltration around the window to levels attained by the windows themselves. AWDI has found that this is the root of the complaints consumers often raise about feeling “drafts” when new windows have been installed. Blower door testing of homes also confirm the air leakage around windows.

Recently, AWDI, in conjunction with NCTL in York, PA and HANNO Werk, Laatzen, Germany, parent company of HANNO-VITO Corp, tested two methods of installation for thermal properties and air leakage.

Following recognized ASTM testing procedures, windows were installed fully exposing gap between the window and the frame to which they were fastened and subjected to air leakage testing. The results clearly show, that even when using ASTM 2112 installation recommendations, and approved sealant methods, and subtracting out any leakage attributable to the window itself, significant air leakage occurs from the gap that can reduce the effective thermal performance of the installed window up to 50%.

What this shows, is that a consumer can purchase an R-5 window, but using industry accepted installation methods could render the installed R-Value to below 3, or worse.

RECENT LAB TESTS PROVE INDUSTRY INSTALLATION GUIDELINES ERODE IN-SERVICE PERFORMANCE OF HIGH PERFORMANCE WINDOWS

NCTL Test series 13402-01 was conducted, in conjunction with AWDI using R-5 rated pvc windows and a ½” gap tested according to ASTM 283. The gaps were modeled according to NFRC standards for material R-Values, as installed. The air leakage tests were incorporated in the final results to produce and quantified R-Value of the installed window to compare to the R-Value rating achieved by the window alone. The purpose was to show the effect installation could have on the in-service performance of energy efficient windows

There were two tests:

1. Window Installed using spray foam according to Installation Masters and ASTM 2112 for retrofit application. Thermal performance modeled at R-5.124. Combined thermal modeling and measure air infiltration, achieved a cumulative R-Value of 1.28. *

2. Window installed using multifunction, slow expansion, foam tape according to AWDI protocol (foam tape, caulked tape corners, cork pads and self-shimming anchors). Thermal performance modeled at R-5.119. Combined thermal modeling and measure air infiltration, achieved a cumulative R-Value of 5.094. *

The results show a marked difference. When present industry accepted installation procedures are used, the advantages of using high performance windows can be lost. The net effect might be no better than installing a single pane window. As tested, inclusion of air leakage in the calculations is shown to reduce the effective, in service R-Value of the window installed by industry accepted standards, by nearly 75%.

Extrapolation of these results, substituting a window with a U-Value of .30, presently accepted replacement installation methods would yield an effective, in service R-Value of 1.06 (U-value of .95), while the use of the multi function foam sealing tape would produce an effective in-service R-Value of 3.5 (U-Value 2.8).

These results were for the overall, installed product, and show how the performance of the small percentage of installation gap can degrade the overall performance significantly where there is air leakage, and can maintain or improve the overall performance when a multi-function foam sealing tape is used.

What has been quantified is why homes where replacement windows have been installed still leak air and why consumers report in large numbers "...still feeling drafts" from recently replaced windows.

This lab verified performance demonstrates the effect air infiltration from the installation has a bigger impact on energy consumption than air leakage from the windows, themselves. It also demonstrates the need for air leakage evaluation of present installation methods, and should be included in the proposed additions to the Energy Star Program.

The use of the foam tape and use of self-shimming anchors along with support blocks under the window eliminates the need for shims and weep. AWDI has developed these protocols based on well accepted European procedures and materials, and would like to form a committee designing the various tests and protocols to describe proper installation methods, which control air infiltration. These performance-quantified methods would be made available to manufacturers as recommendations for the proper, performance maintenance of their products when installed – and dealers and contractors to better deliver in-home performance that matches lab test labels. Such results would further the goals of EPA, DOE and the Energy Star Program.

*Test results available from AWDI, LLC.

Who is AWDI?

AWDI and Window Fitters Guild have provided training and resource materials for installing contractors to acquire meaningful certification credentials (since 1989), and we have been recognized for those efforts in Trade Publications and Consumer Reports Magazine — as a recommended source of qualified installers.

AWDI offers the only government registered Certification Mark for installation enjoying the same status as Energy Star does for performance, and we have longest running Internet presence (<http://www.awdi.com>) delivering window and door installation information on the world-wide-web since 1996.

Since our inception 20 years ago, our mantra has been “It won’t work right if it’s not installed right”. Our mission, along with that of the Window Fitters Guild Training Program, has been to help all installing contractors and workers have the tools and resources to create quality installations and operate successful businesses.

AWDI pioneered installation standards, and these initial efforts were used to create ASTM 2112. They have also been incorporated in comprehensive illustrated retro fit and new construction installation standards, practices, supported by fully detailed and illustrate manuals.