TECHNICAL BULLETIN NO. D-2

PREMIER SIPS
STRUCTURAL INSULATED PANELS

SUBJECT: HVAC DESIGN AND ENERGY CALCULATIONS

HVAC professionals require substantiated design information to properly select the mechanical systems installed in Premier SIPS residential projects. HVAC professionals rely on ACCA (Air Conditioning Contractors of America) Manual J as the design guide to calculate the requirements for the heating and cooling systems in residential structures. These Manual J calculations are computer software based and have defaults for R-value and air changes per hour (ACH). However, if a proper evaluation of a home built with SIPs is to be accurate, the HVAC professional needs to manually input the following two factors to arrive at a meaningful result: Premier SIPS higher R-value and air tightness.

Premier SIPS energy savings can be attributed to two main factors:

1. Increased stable R-value do to the high performance rigid insulation core
2. Lowered air infiltration due to few and tighter joints on the envelope.

Manual J based calculations require the R-value of the insulation material and the air infiltration rate, or air leakage rate. The R-value of Premier SIPS needs to be manually inputted into Manual J calculations based on their Whole Wall R-value. Additionally, the air infiltration rate for Premier SIPS must be accounted for properly. Design guidelines for Manual J calculations suggest a reasonable air leakage assumption between 0.35 to 0.50 natural air-changes per hour at 50 pascals. This recommendation is for stick-built homes.

Premier Building Systems has blower door test data generated from homes using SIPs for the exterior walls and roof of homes that tested between .04 to .06 ACH. These SIP home ACH values are on the order of 10 times better than what the Manual J design guidelines suggest for natural air changes per hour.

Therefore, based on Premier SIPS achieving verified ACH test values between 0.04 to .06, Premier recommends that a value of .05 natural air changes per hour be used when performing Manual J heat loss calculations on homes using Premier SIPS as the exterior walls and roof. If the software being used does not allow for numerical input, select the tightest option possible.

Applying Manual J calculations provides for the increased R-value and the reduced air infiltration of buildings constructed with SIPs. These two factors will allow for down-sizing/right sizing of the heating and cooling equipment. This will provide initial cost savings at the time of construction. In addition right-sizing of the HVAC system will provide a more comfortable environment for the occupants.

Architects/engineers, builders, building owners and other building professionals have learned from experience that energy savings for a well-built Premier SIPS structure an be 30 to 50%, or more.

FRESH AIR VENTILATION OF SIP STRUCTURES

Reducing air leaks in a structure is central to achieving maximum energy and clean air performance. Many building strategies such as house wraps, vapor retarders, rigid insulation sheathing, tapes and sealants are designed to reduce air leakage. Premier SIPS are one of the best building systems available to provide low air leakage and overall building energy efficiency. Moisture, fumes from adhesives, smoking and other gases and particulates can become trapped within the structure. When these pollutants accumulate to high levels, they could potentially contribute to an unhealthy living environment. Heat Recovery Ventilators (HRVs) and Energy Recovery Ventilators (ERVs) allow a structure to remain efficient while also providing fresh air at a low operating cost. Indoor air pollutants are continuously being taken away and replaced with fresh air. This provides a healthier living environment while retaining energy savings.

A brief synopsis of how HRVs and ERVs work to effectively improve indoor air quality follows:

HRVs and ERVs are mechanical units that can continually exchange stale inside air for fresh outside air, while also using the heat (or cold) from the exhaust air to raise or lower the temperature of the incoming air. A large percentage of the heat in the exhausted air can be recaptured. This efficiency allows a constant flow of fresh air and doesn't require a separate heating unit to heat the incoming fresh air. ERVs work in a similar manner regarding heat recovery, but also allow the building owner to control inside humidity.

WHAT INSTALLATION IS REQUIRED?

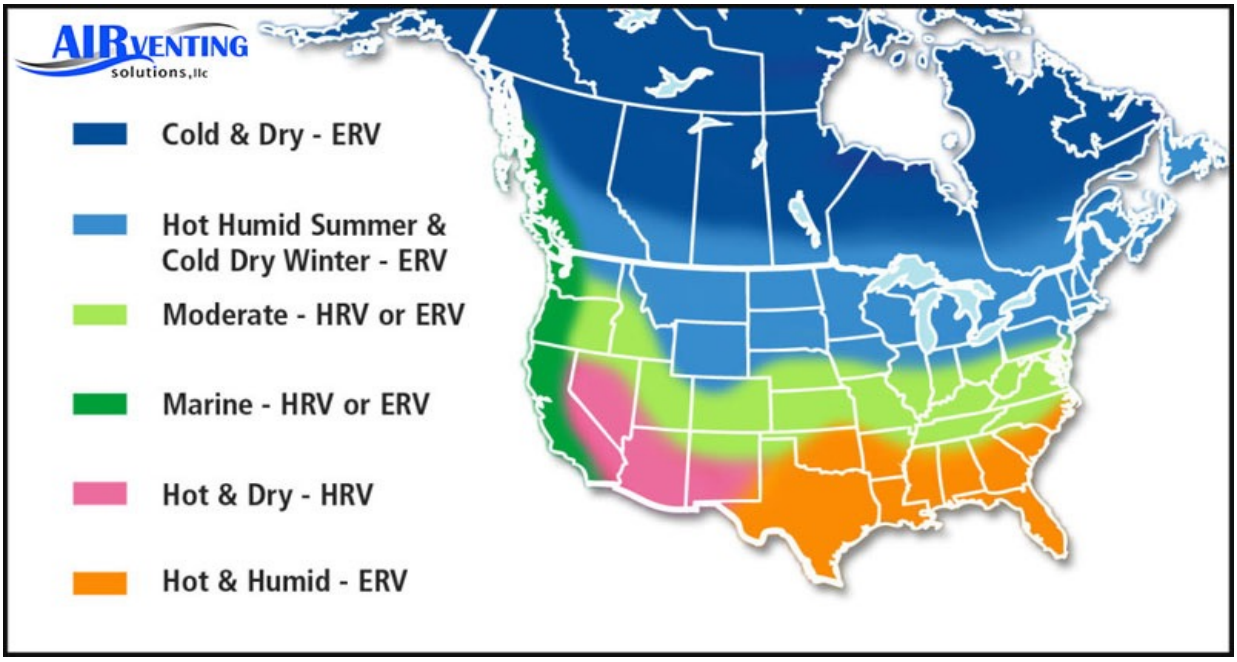
HRVs and ERVs require some planning before construction. The main unit should be placed in a temperature - controlled area, a basement, mechanical room, etc. Ductwork is typically run from rooms such as bathrooms, laundries and kitchens to the HRV or ERV unit. These areas are chosen for their typically high levels of odor and humidity. Insulated ductwork is then run from the HRV or ERV to the exterior of the building. A separate system of fresh air ductwork is run from the exterior of the building to the unit and continued to the fresh air drop, often return air duct of a furnace.

HOW DO HRVS AND ERVS WORK?

Stale air is drawn from the bath, laundry and kitchen to the HRV or ERV, and is ducted through the HRV or ERV to the outdoors. Meanwhile, fresh outside air is drawn into the HRV or ERV, then ducted to the inside fresh air drop point. As the two separate streams of air pass each other within the HRV or ERV, they are separated by a medium that provides a conductor for the heat to be exchanged from the hot air to the cold air. The incoming fresh air is warmed by the transfer of heat from the inside air and is then ducted into the living area or furnace air supply. Excessive summertime moisture can be controlled with an ERV. As the air streams pass the medium, condensation will appear on the exhaust side of the medium.

The condensation forms because the warm moisture-laden exhaust air cannot hold as much moisture after its heat has been drawn through the medium. The condensed moisture is removed and drained away. Conversely, the ERV can be set to retain interior moisture in the winter months of operation.

WHERE SHOULD I USE AN HRV OR AN ERV?



NOTE: Map prepared by Air Venting Solutions, LLC at www.airventingsolutions.com.

It is recommended that the humidity level in a SIP structure should be controlled to <40% in winter and <60% in summer. Higher levels of moisture could lead to condensation problems. Please consult a local HVAC engineer and contractor, or reference ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) standards for the design and installation of HRVs and ERVs as part of a complete HVAC design.

ADDITIONAL RESOURCES:

National Center for Appropriate Technology
P.O. Box 2525
Butte, Montana
Ph: 800-428-2525

Energy Efficiency and Renewable Energy Clearinghouse
P.O. Box 3048
Merrifield, VA
Ph: 800-DOE-EREC