Article

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Meeting 2012 International Energy Conservation Code Requirements with Hybrid Insulation Systems

With the more stringent new thermal resistance and airtightness requirements of the 2012 International Energy Conservation Code (IECC), energy-efficient exterior wall assemblies are now an even higher priority in North American new construction and retrofit projects. The new IECC requires continuous insulation between a home's exterior cladding and sheathing in Canada Climate Zones 6 through 8, with a thermal resistance of R-5 (RSI 0.8) in Climate Zone 6 and R-10 (RSI 1.7) in the latter two zones. In addition, third-party blower door testing confirming the airtightness of a home is now required.

Fortunately, today's high-performance insulation products and innovative installation strategies provide several options for contractors striving to meet these new requirements. Caulking under baseboards and along wall stud seams, as well as using closed-cell spray polyurethane foam (SPF) to insulate around rim joists, can provide more effective air seals in areas traditionally known for air leakage. One of the best overall strategies for meeting thermal resistance and airflow resistance requirements, though, is to install a hybrid insulation system.

Hybrid insulation systems combine the best attributes of two or more insulation products to provide a cost-effective airtight seal around the home, as well as high thermal resistance and superior moisture control. In this article, we'll take a closer look at the components of one high-performance hybrid insulation system strategy and what each component contributes to the ultimate goal of a more thermally efficient building envelope.

Housewrap

The first component of a hybrid insulation system is a weather-resistive barrier, commonly known as housewrap, which is installed directly under the siding, over the exterior sheathing. Properly applied housewrap allows water vapor, which can damage drywall and wood sheathing, to escape from the building's wall cavity, while acting as a full wall flashing to mitigate the infiltration of bulk moisture from the exterior.

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Continuous Insulation

Usually in board form, continuous insulation covers the entire exterior wall, including structural members. Often placed between the sheathing and exterior cladding, it reduces energy loss by providing a thermal break in the wall and impeding air leakage. Though the most common choice for continuous insulation is a foam board—usually expanded polystyrene (EPS), extruded polystyrene (XPS) or polyisocyanurate (PIR)—there are other ways to achieve the objective. One lesser-known, but effective, alternative is high-density rigid fiberglass board.

Rigid fiberglass, proven in countless commercial applications, has the same advantages as polyfoam, such as easy installation and high thermal

FEATURED PRODUCT

Hybrid Insulation Systems

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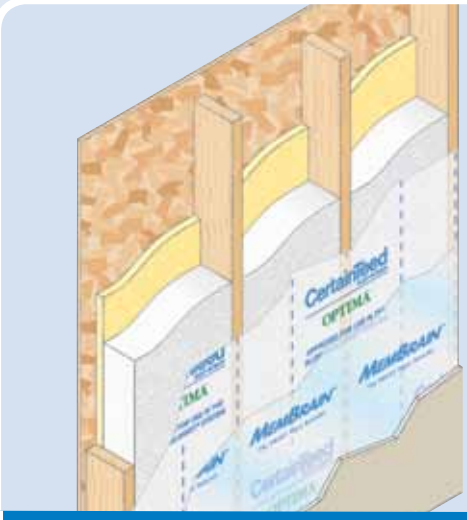

Hybrid Insulation Wall System from CertainTeed

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IECC Insulation Fenestration Requirements

CLIMATE ZONE	FENESTRATION U-FACTOR[b]		SKYLIGHT[b] U-FACTOR		GLAZED FENESTRATION SHGC[b,e]		CEILING R-VALUE		WOOD FRAME WALL R-VALUE		MASS WALL R-VALUE[i]		FLOOR R-VALUE		BASEMENT[c] WALL R-VALUE		SLAB[d] R-VALUE & DEPTH		CRAWL SPACE[c] WALL R-VALUE	
	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012	2009	2012
1	1.2	NR	0.75	0.75	.30	0.25	30	30	13	13	3/4	3/4	13	13	0	0	0	0	0	0
2	.65	0.4	0.75	0.65	.30	0.25	30	38	13	13	4/6	4/6	13	13	0	0	0	0	0	0
3	.50	0.35	.65	0.55	.30	0.25	30	38	13	20 or 13+5[h]	5/8	8/13	19	19	5/13[f]	5/13[f]	0	0	5/13	5/13
4 except Marine	0.35	0.35	.60	0.55	.30	0.40	38	49	13	20 or 13+5[h]	5/10	8/14	19	19	10/13	10/13	10, 2 ft	10, 2 ft	10/13	10/13
5 and Marine 4	0.35	0.32	.60	0.55	NR	NR	38	49	20 or 13+5[h]	20 or 13+5[h]	13/17	13/17	30[g]	30[g]	10/13	15/19	10, 2 ft	10, 2 ft	10/13	15/19
6	0.35	0.32	.60	0.55	NR	NR	49	49	20 or 13+5[h]	20+5 13+10[h]	15/19	15/20	30[g]	30[g]	15/19	15/19	10, 4 ft	10, 4 ft	10/13	15/19
7 and 8	0.35	0.32	.60	0.55	NR	NR	49	49	21	20+5 13+10[h]	19/21	19/21	38[g]	38[g]	15/19	15/19	10, 4 ft	10, 4 ft	10/13	15/19

R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.
b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in Climate Zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.
c. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
d. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.
e. There are no SHGC requirements in the Marine Zone.
f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.
i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

performance. It has better fire resistance and tends to be more solid and slightly less expensive than polyfoam, though. In regards to thermal resistance, the R-value per inch of rigid fiberglass board is comparable to that of standard polyfoam boards—fiberglass rates slightly above R-4 (RSI 0.67) per inch, with EPS at R-4 per inch and polyisocyanurate at about R-6 (RSI 1) per inch. The boards should be installed over the exterior sheathing with the faced side looking toward the interior, with all seams taped.

Advanced Framing

Framing best practices have evolved in recent years to increase thermal efficiency. This strategy, known as Advanced Framing, places 2x6 studs 24 inches (60 cm) apart, instead of 16 inches (40 cm), utilizes single headers instead of double headers, and reduces the number of studs in corners and at door and window frames. This decreases the amount of lumber in walls without compromising structural support and boosts the overall insulative value of the wall assembly. Wood is a poor insulator, so the less lumber in the wall assembly, the more room there is for more effective insulation materials.

Closed-Cell SPF and Blown-in Fiberglass

Made from polyurethane, closed-cell SPF insulation offers a thermal resistance of up to R-6.4 (RSI 1.7) per inch of installed thickness—one of the highest insulating values available on the insulation market today. It is more durable than open-cell SPF, has a higher R-value and a stronger resistance to moisture, and is the preferred choice for high-performance hybrid systems. SPF is sprayed as a liquid into the wall cavity and expands via chemical reaction to up to 30 times its initial volume, filling crevices, gaps and other hard-to-reach spaces. This creates a very effective air barrier. In addition to excellent insulation attributes, applying SPF insulation to exterior walls and attic ceilings also provides additional structural support and racking strength.

Combining SPF with fibrous insulation in the wall cavity provides similar airtightness performance as a full cavity of SPF at a significantly lower installed cost. This hybrid insulation system strategy is composed of a 1- to 2-inch (2.5 to 5 cm) flash coat of closed-cell SPF against the interior surface of the exterior sheathing, with blown-in loose-fill fiberglass insulation filling the remainder of the cavity. Fiberglass batts can also be used, but permit more air leakage around and through the fiberglass than does blown-in insulation.

Hybrid insulation systems are an ideal way for contractors to offer homes that conserve and generate lower utility bills for homeowners.

Smart Vapor Retarders

Completing the system, polyamide-film "smart" vapor retarders are known for their ability to change permeability with ambient humidity conditions. With a high resistance to water vapor permeance at low relative humidity levels, smart vapor retarders, such as CertainTeed's MemBrain™, protect the hybrid insulation system like traditional poly or kraft vapor retarders. But, unlike traditional solutions, they can react to high relative humidity by altering pore size, allowing water vapor to pass through them. Smart vapor retarders can also form an interior air barrier system when combined with recommended tapes and sealants.

The System Works

A hybrid insulation system like the one referenced above provides the thermal, air and moisture resistance needed to meet or exceed the requirements of the 2012 IECC. Installing these components in a 5 1/2-inch (14 cm) wall cavity would produce a clear-wall cavity insulation R-value of about 25 (RSI 4.2). This, combined with the proper amount of continuous insulation, will easily exceed the 2012 IECC R-value requirements for Climate Zones 6 through 8. Hybrid insulation systems are an ideal way for contractors to offer homes that conserve and generate lower utility bills for homeowners.

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