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High Performance Building Products
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ICF Better and Best Options for Vapor Barrier and R-10 EPS Foam

An ICF building functions as a multi-sided thermal box. The ICF walls represent only part of the overall thermal envelope. While near-airtight ICF walls perform at approximately three times the energy efficiency of a conventional 2×6 wall system, the remaining two sides—floor and ceiling—must also be addressed to maximize performance. This paper explains how low-cost, "static" product options can deliver significant energy savings. These materials are paid for once and continue to perform for the entire life of the building.

Thermal Performance Benefits and Options for an ICF Building

Good: ICF walls only, approximately **2× more energy efficient** than a conventional 2×6 building

Better: ICF walls, floor slab with vapor barrier and R-10 EPS slab insulation, vapor barrier installed below trusses - Up to **3× more energy efficient**

Best: ICF walls, floor slab with vapor barrier and R-10 EPS slab insulation, vapor barrier and R-10 EPS insulation under trusses - Up to **4× more energy efficient**

The **Better** and **Best** options improve air tightness and thermal performance of the floor and ceiling assemblies. By adding continuous insulation and air-sealing strategies, these assemblies more closely match the performance characteristics of the ICF walls. When all six sides of the building perform in thermal harmony, overall energy efficiency can improve by up to four times. Without these additional measures, the building is typically limited to about two times the energy savings.

Floor System Performance:

An insulated slab that includes a vapor barrier and R-10 EPS insulation is approximately 20% more energy efficient than a conventional wood floor system over a crawl space. When installed correctly, these materials create a near-airtight floor assembly, making it both more energy efficient and less costly than a wood floor crawl space. If a conditioned crawl space is still in your ICF plans, a concrete slab complete with a vapor barrier and R-10 EPS foam under the slab is the best solution.

Wood Floor and Wood Roof System Challenges:

Wood floor and roof systems contain structural wood connections that account for nearly 20% of the total surface area of each. These connections are "thermal weak points" that significantly reduce overall performance. Even when cavities are well insulated with cellulose, these assemblies are not airtight. Approximately 20% of the assembly consists of solid wood connections with an insulation value of only R-1 per inch, which reduces overall thermal performance. For the roof system, the Better option addresses this issue by installing a high-quality vapor barrier beneath the trusses, creating a near-airtight ceiling assembly. Proper installation is critical, especially around electrical penetrations and vents. While this improves air tightness and energy efficiency, it does not provide continuous insulation or a thermal break at the solid wood truss connections. Maximum roof system energy efficiency is achieved with the Best Option, which includes both a vapor barrier and continuous R-10 insulation installed under the trusses. This combination creates excellent air tightness and a true thermal break at the wood truss connections. Ceiling drywall is installed using 4-inch screws that pass through the R-10 insulation and vapor barrier into the trusses. The roof assembly is then insulated with R-50 cellulose insulation within the truss cavities. This approach has demonstrated an increase in overall thermal performance of up to 25% and represents one of the most cost-effective solutions for addressing roof system energy losses.