Insulation For Life

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HVAC Requirements for Icynene Thermal Envelope

Description
The Icynene Thermal Envelope is a design technique that uses Icynene spray-in-place, expanding foam insulation. Icynene insulation will be applied to all exterior walls and directly to the underside of the roof deck, creating a completely sealed, unvented, conditioned attic space. This is an extremely effective and energy efficient design that has successfully been used in thousands of residential and commercial projects all over the United States. Using Icynene in this fashion brings all ductwork and air handling units into the conditioned space of the envelope of the building. With this approach there are several considerations when designing an HVAC system for these buildings.

Load Calculations
Insulation For Life recommends that all systems be sized and engineered to all current ASHRAE specifications including Manual J and Manual D. When performing a load calculation, the following parameters should be used:

- Treat all ceilings as cathedral ceilings with an R value of R18
- Exterior wall R value: R11
- Floors exposed to outside air: R18
- Floors over unconditioned crawlspaces: R11
- All ductwork, except that located in a crawlspace, will be in conditioned space
- We do not recommend placing ductwork in crawlspaces
- As long as there is no ductwork located within a crawlspace, there will be no losses in the system due to duct leakage
- Use an envelope leakage rate (air infiltration rate) of .1 ACH at natural pressure
- Adding the square footage of the attic to the total volume of air in the house is optional and if done will result in sufficient extra capacity to provide any “safety margin” that might be desired

Assuming the home will also have reasonably efficient windows, using these parameters typically results in a 30-50% reduction over what a similar calculation would determine if using standard construction practices with fiberglass insulation applied to walls and tops of ceilings. Generally we see systems that are sized to about 1 ton per 750-1,000ft^2 depending on the other factors that contribute to a heating and cooling load calculation.

Other Design Considerations
- Since the air handling units will be located inside the thermal envelope of the building, they must be either electric or 90% sealed combustion gas with their own combustion air supply
- All bath and kitchen exhaust fans should vent directly to the outside, not the attic
- We strongly recommend the use of a controlled mechanical fresh air ventilation system that results in a net positive pressure on the house. A simple and effective system is a supply only intake using an AirCycler fan control unit. Design specifications can be found at www.aircycler.com. ASHRAE determines ventilation standards for residential construction.
- We strongly recommend some type of upgraded filtration such as a 5” media filter.
- Use of transfer grills or passive returns in rooms without hard ducted returns results in improved air flow and minimal room to room temperature variations. Room to room pressure differences should be kept below 3 Pascals.