

Britt/Makela Group, Inc

P.O. Box 474
Greenleaf, ID 83626

Conditioned Attics / Cocoon Insulation System

The conditioned attic system or “Cocoon system” moves the building envelope for the roof/ceiling assembly to under the roof sheathing instead of placing the insulation on top of the sheetrock as in a standard ventilated attic. The attic space is not vented to the outside per the requirements of the 2003 IRC but instead sealed. Under this system the heating and cooling air handler system is placed in the attic space and ductwork insulated to a minimum of R-4.2 is used to deliver air to the spaces below the sheetrock ceiling. Insulated ductwork is used to eliminate the possibility of condensation on the ducts during the cooling season. Heat and cool transfer from the living space below the sheetrock floor of the attic, in addition to duct leakage from both the duct system and the air handler, is used to keep the temperature of the attic space in a range from 50 degree F to approximately 85 degree F during the heating and cooling season respectively.

At question is whether the ducts located in this unvented attic space are required to be insulated to an R-8 per Table 503.3.3.3 of the 2003 IECC for ducts in unconditioned attics. The primary issue is whether the attic space can be considered conditioned space under the provisions and definitions in the 2003 IECC and also reviewing the requirements for space conditioning from the IRC.

The Section R308.4 of the IRC requires that a heating system be installed to maintain the temperature of 68 degree F during the peak design winter conditions for all habitable rooms. There is no requirement for the installation of a space cooling system within the code. The IECC uses a definition for conditioned space to determine which of the building assemblies must be insulated and which can be exempted. The conditioned space definition implies that to be conditioned the space must be either heated or cooled or both so a space that is heated only is by code considered a conditioned space (see definition below).

CONDITIONED SPACE. A heated or cooled space, or both, within a building and, where required, provided with humidification or dehumidification means so as to be capable of maintaining a space condition falling within the comfort envelope set forth in ASHRAE 55.

The term “heated space” is used as one criteria to defining a conditioned space. The definition of heated space (see below) states that to be considered heated it must have a positive heat supply.

HEATED SPACE. Space within a building which is provided with a positive heat supply (see “Positive heat supply”). Finished living space within a basement with registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space.

In reviewing the definition of positive heat supply two methods of providing heat count toward this criteria. The first method is to provide heat through a supply register or heating element as space conditioning would be provided to a habitable space. The second method would be to provide space heat through an indirect means such as space-heating components which would include the air handler and duct system. While the IECC requires that ducts be sealed with an approved sealant there is no

performance requirement for testing of the ducts to ensure 100 percent air tightness and Chapter 4 of the IECC allows a credit to be taken for ducts that are substantially leak free (5% leakage for the system). The cabinet of the air handler system is not required to be sealed under the 2003 IECC but will be required to be sealed under the 2006 IECC. Typical duct/system leakage can range from 10% - 20% with studies showing a 14% duct leakage at the plenum (Energy Design Update).

Indirect heat transfer from the living space below the attic through the sheetrock ceiling would also contribute significantly to heating this space. The R-value of sheetrock is approximately R-0.45 verses typical insulation at an R-30. With insulation placed at the roof assembly the heat transfer into the attic space would be similar to a closet located on an exterior insulated wall with no register in the space and the door closed. More heat is transferred into the space from inside the house than is allowed to leave through the exterior wall thus maintaining the temperature in a temperature consistent with ASHRAE 55. For the sealed attic, more heat is transferred through the sheetrock into the attic than is allowed to leave through the roof system.

POSITIVE HEAT SUPPLY. Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space-heating components, such as furnaces, boilers and heating and cooling distribution systems which continually maintain air temperature within the space of 50°F (10°C) or higher during normal operation. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this code.

Through heat transfer and duct leakage, maintaining a temperature of 50 F during normal operation in the sealed attic space is very realistic especially in a climate like Las Vegas. This would imply that the space would be considered conditioned per the definitions of the IECC.

Also, the 2004 Supplement to the IRC allows this type of attic installation calling the space a Conditioned Attic Assembly

Research Data

Monitoring was conducted on 4 houses using a conditioned attic in Las Vegas over a one year period of time. The following temperatures were monitored:

- Outside Temperature
- House Temperature
- Attic Temperature
- Roof Temperature

Based on the monitoring data provide the attic temperatures in three of the houses remained well over the 50 F temperature through the winter months. The attic temperature and house temperature for one of the homes was abnormally low (20 – 30F) even when the exterior temperature was in the 50 degree range which would invalidate the data set for that house. Also, the maximum summer attic temperatures were at or near 85 F during the cooling season the homes. The Excel file is included as a separate document.

Opinion

Based on a review of the 2003 IECC and IRC and the monitoring data provided, it is the opinion of Britt/Makela Group, Inc that the sealed attic space with insulation placed under the roof deck be considered a conditioned space. This designation allows the use of uninsulated ductwork under Table 503.3.3.3 of the 2003 IECC.