

## **Sector: Residential**

## **Category/Practice: Energy Efficiency / Insulation Installation**

### **Proposed GB Practice**

#### **Description**

All insulation must be installed to Residential Energy Services Network (RESNET) Grade I standard, except as follows:

RESNET Grade II will be accepted for cavity insulation in two locations:

1. Exterior walls which include continuous rigid insulating sheathing, insulated siding or combination of the two, R-5 minimum; and
2. Rim joists.

#### **Applicability**

New Construction: Applies

Existing Buildings/Additions: Applies only to the addition portion

Existing Buildings/Alterations: Applies to building envelope components for which insulation is being altered

#### **Intent**

Install insulation so it delivers rated energy performance

### **Benefits and Costs**

#### **Triple Bottom Line Benefits**

People: Enhance thermal comfort by improving insulation performance.

Economic: Save energy by improving the effective R-value of insulation. Energy savings are estimated to be in the range of \$30 to \$60 per year.

Environment: Environmental benefits associated with lower energy use.

#### **Costs Passed to Owner**

“Medium” cost (\$200 to \$350). As described in “Context” below, this proposed measure effectively represents a continuation of insulation installation requirements that have been part of the Fort Collins code since 1996. Cost increases represent an elimination of low-bid practices that have slipped by in the past.

#### **Lost Opportunity**

There are many components for which time of construction is the only opportunity to effectively install insulation.

## Implementation

### **Availability of Products and/or Services**

A wide variety of insulation products is available in the Fort Collins market. Local contractors are able to install insulation to meet the proposed requirements.

### **Practicality**

Some types of insulation are easier to effectively install than others.

### **Certification Issues**

None

### **Enforcement Procedures**

Permit application/plan review: Insulation details must be provided.

Field inspection: Visual inspection of all installed insulation will be performed by City building inspectors. At final inspection, access into attic, including ladders, will be required to inspect attic insulation.

Certificate of Occupancy: See above.

### **Support Materials Needs**

A field guide, illustrating required building envelope details (including insulation installation techniques that meet and don't meet the proposed RESNET grade), would be very useful for contractors and enforcement staff.

### **Training Needs - Industry**

Training is needed, for builders, insulation contractors and building inspectors, to set common expectations about installation requirements. This can be handled as part of comprehensive contractor training on building envelope details, ideally supported by a field guide.

### **Training Needs - Staff**

Building inspectors will need training to consistently grade installed insulation. This can be covered in more general training about inspection of building envelope details.

## Background

### **Current Practice**

A 2007 survey of new home construction in Fort Collins yielded the following observations about insulation installation:

- In framed exterior walls, where blown insulation products were used (about 50% of those surveyed), Grade I installation was typical. When fiberglass batts were used, there was a lot of variation; most walls were rated Grade II.
- Flat attics, insulated with blown insulation products, were generally rated Grade I (note: though the installation quality was quite good, the installed R-value in the majority of attics was significantly below the claimed R-value).
- Vaulted sections of attics, typically insulated with fiberglass batts, were generally rated Grade III. Problems were often observed at the edges of vaulted ceilings meeting flat ceilings.

- In a very small sample of cathedral ceilings (i.e. ceilings with no attic), installations ranged from Grade I to Grade III.
- Problems were repeatedly observed at rim joists, cantilever floors and knee walls. These were quite consistently rated Grade III or below.

### **Context**

Insulation is an example of a product that will not deliver its manufacturer-specified R-value if it is not properly installed. Performance will be compromised if there are gaps, voids, compression or opportunities for air to move through, past or around the insulation (thermal bypass). To perform as expected, all these problems must be avoided with careful installation and coordination of insulation and air barrier.

The performance degradation with improper installation has been increasingly recognized since the 1980s. Fort Collins has provided builder training about detailing a quality building envelope since the late 1980s. The City was a leader when it developed the 1996 energy code. Referenced in the code were the *Fort Collins Insulation Guidelines*, a detailed set of requirements for insulation installation for each building envelope component.

The [City of Fort Collins Builder's Guide to Energy Efficient Construction](#), published in 1997, reinforced required and recommended building envelope practices including proper insulation installation.

A [survey of Fort Collins homes built in the mid- to late-1990s](#) showed wide variation in insulation installation practices, with many consistent problem areas. Infrared images showed how insulation installation flaws affected performance.

An [insulation fact sheet](#), developed by the City and E-Star Colorado, has been widely distributed since 2003. It includes an emphasis on proper insulation installation.

In 2006, the Residential Energy Services Network, more commonly known as RESNET, published an insulation installation grading system as part of its [Mortgage Industry National Home Energy Rating Systems Standards](#). The system assigns a Grade I (best), II, or III to insulation in each component. The specifications for even Grade III are fairly stringent.

The practices observed in new Fort Collins homes in 2007 (see "Current Practice," above), compared with the late 1990s, showed significant improvement in certain areas, particularly when blown or spray foam insulation products were used.

National voluntary energy efficiency and green building rating systems have gradually placed increasing emphasis on proper insulation installation and have begun to reference the RESNET grading system. EPA's ENERGY STAR New Homes "Thermal Bypass Checklist," published in 2006, addresses important air sealing and insulation details and provides a systematic inspection approach. ENERGY STAR Version 3 guideline for this climate zone (to be fully effective in January 2012), require RESNET Grade I practices, with only minor exceptions. LEED/Homes has a prerequisite of Grade II, with points awarded for Grade I. NGBS awards points for third-party inspections of Grade I or II.

The 2009 IRC also places increasing emphasis in this area than earlier model codes, providing more detailed requirements for insulation installation in specific locations. However it does not

take a comprehensive approach and could be interpreted as a step backward from the *Fort Collins Insulation Guidelines*. It does not reference the RESNET grading system. It is fuzzy on the need to fully encapsulate insulation to prevent thermal bypasses in common problem areas. This proposed amendment restores the intent of those guidelines by referencing an increasingly well-known standard.

Two exceptions are proposed for which Grade II would be accepted. The first, for frame walls with exterior insulation, mirrors the exception in ENERGY STAR New Homes Version 3. It recognizes that rigid foam board insulation (which must be applied to RESNET Grade I standards) mitigates problems with cavity insulation. The second exception, for rim joists, reflects the reality that an improvement from current practice to Grade II is a large step up from typical current practice.

#### **Related Green Building Practices**

A properly insulated envelope is a key part of a systems approach to high-performance buildings. These requirements go hand-in-hand with tight construction.

#### **Known Objections**

None