

MINNESOTA DEPARTMENT OF PUBLIC SERVICE

Installing Airtight Recessed Lighting Fixtures

Recessed lights are popular with home buyers because they're attractive, yet unobtrusive. Unfortunately, recessed lights in insulated ceilings also have hidden disadvantages that can result in expensive callbacks. Water dripping from a recessed light, staining the ceiling, is the most frequent complaint.

This edition of *Builders' Update* describes cost-effective installations for preventing these problems.

The root of the problem -- air leakage

Older recessed fixtures were not allowed to come in contact with insulation: a baffle was installed to hold insulation at least three inches from the sides of the fixture. Today we have IC (insulation contact) rated fixtures that can be completely covered with insulation; however, covering the assembly with insulation does little to stop air movement. Heat generated by the light contributes to a "stack effect," drawing air from the living space through any openings into unheated space. The housing unit of many IC fixtures has a variety of holes and seams through which this air can escape. Air also leaks between the housing and the ceiling drywall.

Uncontrolled leakage of conditioned air causes a number of

problems. It increases utility bills in both summer and winter. During the winter, the air leaking out of the house carries water vapor that, as it cools, condenses onto roof framing and sheathing. This moisture can drip back through the fixture, and lead to deterioration of the structure. Air leakage can also be a serious problem in true vaulted ceilings -- where insulation and ventilation are enclosed completely in the space between rafters. Cool surfaces are only inches from the recessed fixture, and true vaulted ceilings usually have only the bare minimum of ventilation to carry away moisture. If there is a callback on vaulted ceilings, there is no simple solution because of inaccessibility.

The problems associated with air leakage in recessed lights are beginning to be addressed by establishing standards and procedures to prevent leakage. The state of Washington changed its energy code in 1991 to require air-sealing of recessed fixtures in insulated ceilings. As of June 1994, the Minnesota Energy Code mandates that all new recessed light fixtures be sealed to prevent air leakage.

The Stack Effect

During the winter, warm air inside the house causes the house to act like a big chimney, drawing air in at the lower parts of the house and exhausting air from the upper parts. This is called the "stack effect." As a result, warm moist air leaks out wherever there is an opening in the ceiling and escapes up into the unheated attic.

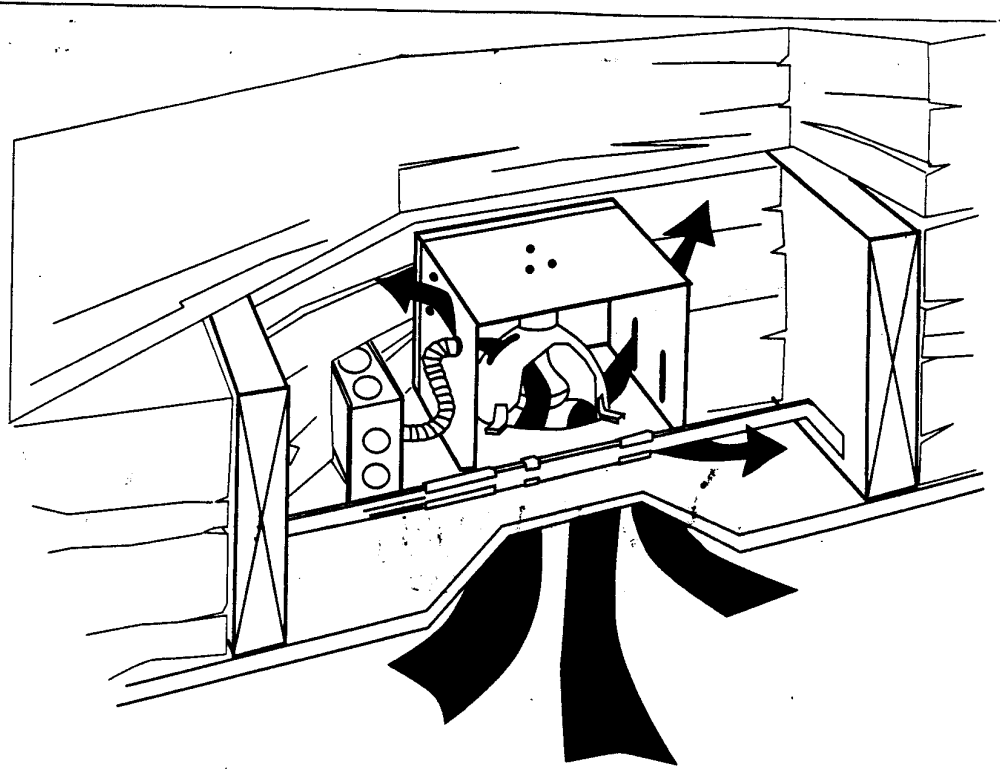


Figure 1. Recessed light fixtures rated IC can be covered with insulation, but that may not stop air-transported heat loss and moisture into the attic.

Two Options

The good news is that installing an airtight recessed light fixture in an insulated ceiling is neither difficult nor expensive. There are two solutions: install fixtures designed and tested for low air leakage, or install tight enclosures around fixtures.

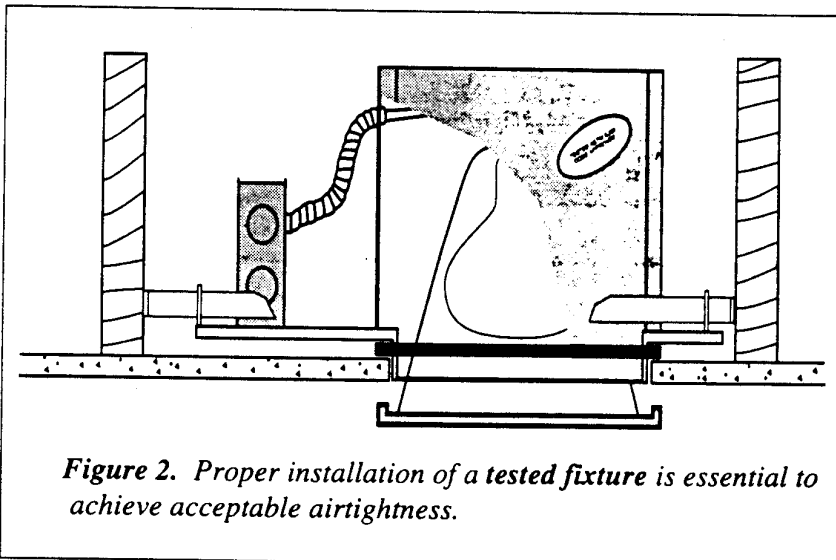


Figure 2. Proper installation of a tested fixture is essential to achieve acceptable airtightness.

Tested fixtures. Probably the easiest way to limit air leakage in recessed lights is to buy a fixture especially designed for that purpose (Figure 2). Fixtures should be tested for air leakage under the ASTM E283 procedure to leak no more than 2.0 cfm at 75 pascals pressure difference (about 0.3-inch water column). Proper installation is essential. A gasket, supplied with the fixture, seals the installation. In some brands, the gasket is located between the housing and the ceiling vapor retarder; in others it is between the trim ring and the ceiling. (See sidebar, "Proper Installation Critical")

Tested fixtures must be IC rated. Some fixtures meet the air leakage standard because the housing itself is airtight, meaning all trims for that model will work. Other fixtures will meet the airtightness standard only with specific trims. Tested fixtures normally carry a label attesting to

compliance with standards.

Manufactured or home-made enclosure. IC rated fixtures can be mounted in a sealed enclosure (Figure 3). Clearances to combustible materials must be maintained. The enclosure can be homemade with one-half inch drywall as long as it provides a completely sealed housing.

Some manufactured "hats" made of high temperature plastic are available. Hats should be specified to fit the particular fixture. High quality caulk seals the hat to the ceiling vapor retarder. Be sure to seal all cuts made in the hat, such as those needed to thread the electric cable and those that allow the hat to slip over the hanger bars.

Can a standard IC fixture be "fixed-up?" Probably not. The holes in a standard IC fixture housing may have been intentionally placed to disburse heat by convection. Plugging these holes could result in dangerous overheating. Furthermore, trying to install a gasket against a textured ceiling (Figure 4) will likely not prevent air leakage. Either a tested fixture or an enclosure (properly installed is a necessity) are the only options to assure a sealed recessed light fixture.

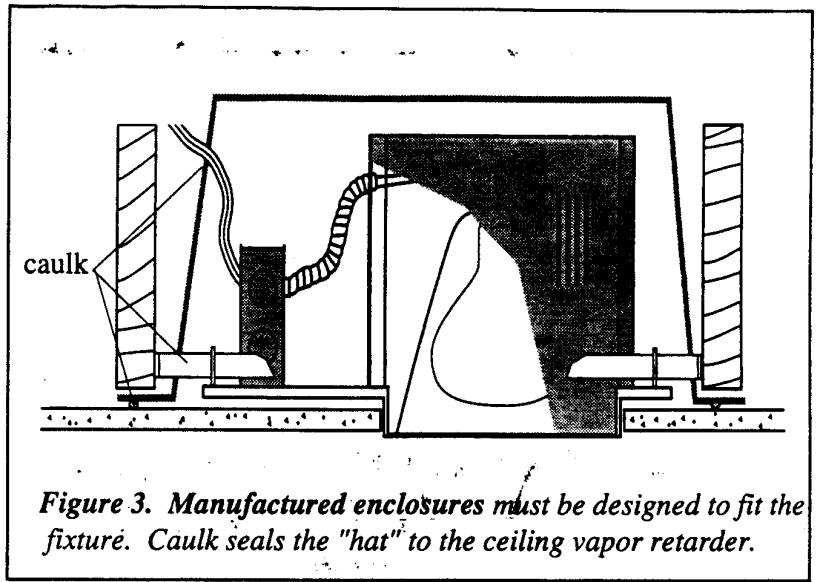


Figure 3. *Manufactured enclosures must be designed to fit the fixture. Caulk seals the "hat" to the ceiling vapor retarder.*

A recessed light fixture installed in a dropped soffit can probably rely on the soffit as its air-tight enclosure. Care must be taken, however, to assure a tight air seal at the wall and insulated ceiling behind the soffit.

A recent study found that air leakage through a single conventional (unsealed) recessed light fixture results in energy loss of \$4-\$15 per year. In addition, calculations with winter conditions estimate moisture transfer to the attic because of air leakage can be as much as nine gallons per month per unsealed fixture! (From Energy Design Update, January 1994 and April 1994.)

Proper Installation Critical

Insulation installation must be followed carefully to ensure a tight frame. One evaluation of tested fixtures in Minnesota showed them to perform only marginally better than standard recessed light fixtures. Closer inspection revealed that the gasketing material had not been installed as instructed.

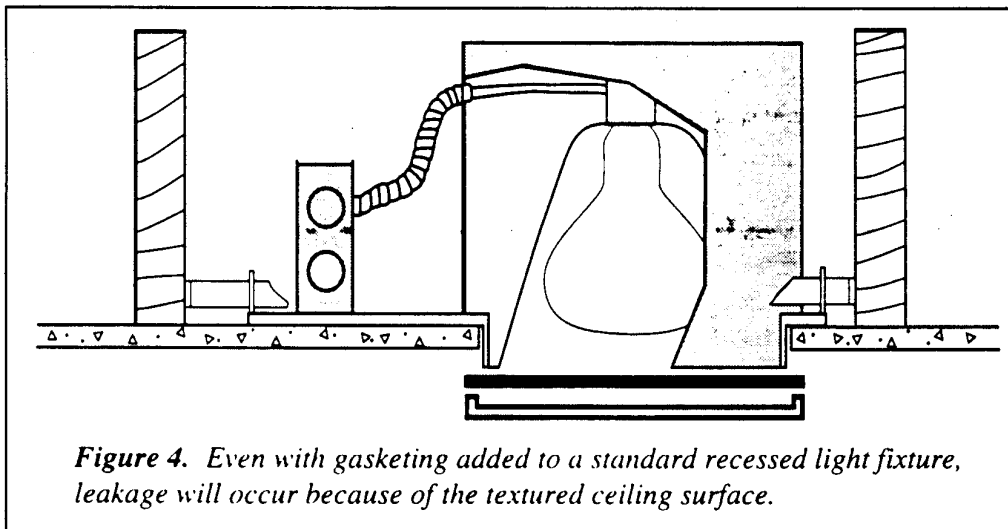


Figure 4. *Even with gasketing added to a standard recessed light fixture, leakage will occur because of the textured ceiling surface.*