

New, Improved Recessed Lights

by J. D. Ned Nisson

Recessed light fixtures can create a variety of problems in insulated ceilings or attics. These perforated metal cans, operating at close to 200°F, act like tiny chimneys, drawing moist indoor air up into the ceiling cavity (see Figure 1). In cold weather, the moisture condenses against the roof sheathing, causing a buildup of water or frost (which eventually melts into water). The wet sheathing can get blackened from mold. In cathedral ceilings, the water often drips back to the house, staining the ceiling and finishes.

Recessed lights also hurt the

performance of attic insulation. The hot fixtures cause convective loops that seriously degrade the effective R-value of the insulation surrounding the fixture. This problem is not well documented, but research at Oak Ridge National Laboratory suggests that it could be significant.

To avoid these problems, some builders simply avoid recessed lights, opting instead for surface-mounted ceiling or wall fixtures. (I know one "superinsulated" home builder who allows home buyers only two recessed lights. Any additional ones

are penalized with an extra \$200 charge for each!)

But recessed light fixtures remain popular, and fortunately there are now ways to minimize and possibly eliminate air leakage, moisture, and convection problems. There is even an innovative retrofit product that can cure the ceiling moisture problems described above.

Only Use IC-Rated Cans

"IC" (insulated ceiling) is a safety rating applied by Underwriters Laboratory (UL) to recessed fixtures that will not overheat when covered with insulation. UL tests fixtures by operating them while covered with high-density, loose-fill cellulose. To pass the IC rating, the temperature in the insulation must never exceed 190°F.

Non-IC rated fixtures must be left exposed with at least a 3-inch clearance to combustibles or attic insulation. This uninsulated area is an obvious and substantial pathway for conduction and infiltration heat loss.

Use Airtight Fixtures

Although IC-rated fixtures are an improvement over standard recessed cans, they will still leak a significant amount of air and moisture into the attic unless they are also airtight.

Recessed fixtures vary enormously in airtightness. Measured leakage rates under induced pressure (0.3 inch water gauge) vary from less than 2 cfm to over 30 cfm. Before last year, there was no easy way to identify airtight fixtures. That changed when the State of Washington revised its building code to require that all recessed light fixtures have a measured leakage rate no higher than 2 cfm at 0.3 inch (75 pascals) pressure. Fixtures that meet the Washington State specification carry a certification sticker (see Figure 2).

Airtight fixtures generally cost \$10 to \$20 more than comparable nonairtight fixtures. A list of manufacturers appears at the end of the column.

An alternative to airtight fixtures is an airtight cover over a conventional IC-rated fixture (see Figure 3). Most fixture manufacturers sell plastic covers that are made for this purpose, but some builders make their own airtight boxes out of gypsum board or plywood.

Airtight covers can certainly be effective, but some builders find

them a nuisance to install. All wiring penetrations must be caulked, and the joint where the cover meets the ceiling drywall must be well sealed with caulk or gaskets. Also, if you use an airtight cover, you *must* use an IC-rated fixture, even though the insulation is not touching the fixture. Covering a standard fixture this way violates code and is a fire hazard.

One final approach, which I don't recommend, is to seal the fixture on site with tape, gaskets, or caulk. There are several possible problems with this technique. Materials must be durable and withstand high temperatures. Quality control is difficult. Finally, although it may not create an actual fire hazard, sealing the fixtures voids their UL rating and thus creates a technical code violation.

More Moisture Problem Than Heat Loss

The reason that the State of Washington requires airtight fixtures is not to save energy, but rather to prevent moisture condensation problems in attics and cathedral ceilings.

Nobody has measured the air leakage rate through ceiling light fixtures in the field. Like air leakage through electrical outlets, it probably varies enormously, depending on the type of fixture, the type and amount of insulation in the attic, the outdoor temperature, wind conditions, etc. Without knowing how much the ceiling fixtures leak, it's not possible to estimate the savings from sealing them.

Preventing moisture problems is a clearer benefit. Many ceiling moisture problems are linked to leaky recessed lights, according to experienced air-leakage sleuth, Gary Nelson, president of Energy Conservatory, which makes the Minneapolis Blower Door. The problems are serious and well documented, according to Nelson.

Use Cellulose Attic Insulation

There are two reasons to select loose-fill cellulose rather than fiberglass in an attic. Researchers at Princeton University clearly demonstrated that, when installed over a leaky attic floor, cellulose — because of its higher density — reduces air leakage through the floor much more effectively than loose-fill fiberglass or fiberglass batts. Cellulose should provide the same benefit where it is installed over IC-rated ceiling fixtures.

The second reason for selecting cellulose is that it is more resistant to internal convection than fiberglass.

Place a Layer of Batts on Top

One final technique to combat convection in loose-fill fiberglass is

Figure 1. Unless they are airtight, recessed light fixtures act as small chimneys, drawing moist indoor air up into the attic or cathedral ceiling. In cold climates, the condensed moisture may drip down and stain the ceiling or leak into the house.

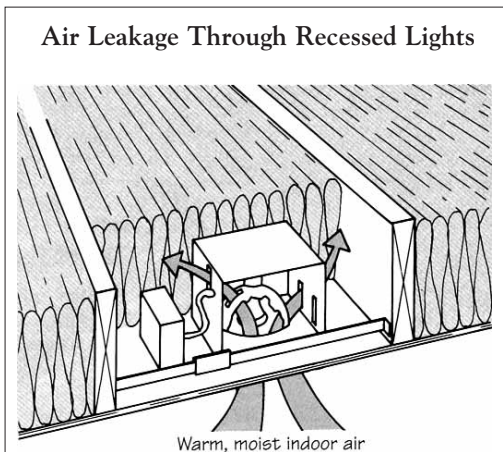


Figure 2. A few new recessed fixtures, such as Halo's Air-Tite model, are designed and certified to meet the stringent airtightness standards of the Washington State energy code.

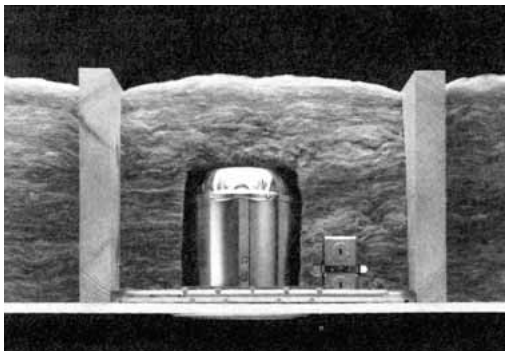
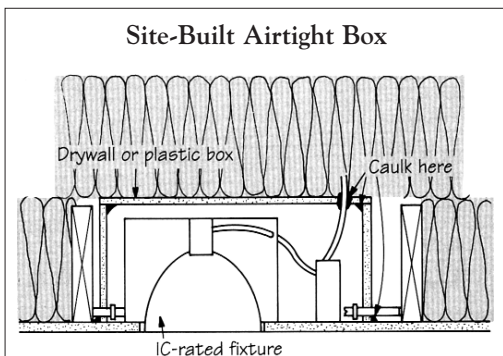


Figure 3. One way to stop air leakage through a recessed fixture is to cover it with an airtight cover that is caulked to the ceiling drywall. The fixture must be IC-rated.





A. The existing lamp and ceiling strip are removed.



B. The X-18 electrical connector is screwed into the existing bulb socket.



C. The fixture is pulled up against the ceiling using the "zip cord."



D. Lamps and diffuser are installed.

Figure 4. Scientific Components Systems' unique retrofit system makes existing downlights airtight.

to place batts over the loose-fill insulation near each light fixture. Oak Ridge scientists demonstrated this technique using both 1-inch-thick high-density batts and conventional 6-inch R-19 batts. This works because batts laid horizontally — even without a facing — effectively suppress convection much better than loose-fill fiberglass.

Innovative Retrofit

Scientific Component Systems of Tustin, Calif., sells an innovative and effective system, called X-18, for retrofitting existing downlights for airtightness (see Figure 4). The system uses a novel "zip cord" attachment, which allows an installer to pull the fixture up tightly against the ceiling surface to form an airtight seal. The kit converts the fixture to energy-saving compact fluorescent bulbs, as well.

Scientific Components also makes airtight fixtures for new construction. ■

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