

The Chimney Safety/Heat-Loss Dilemma

If you want an energy-efficient seal around your chimney flue, you're on your own

by Charlie Page

Many new materials and techniques have been designed to cut energy losses in residential construction. They help the builder and architect in almost every aspect of energy-efficient house construction from the foundation on up.

One area that product designers have overlooked, though, is the chimney. At this time, there are few techniques and materials specifically designed to block heat loss where a chimney breaks through the building shell.

From my perspective as a fireplace-product designer, I see no easy solutions short of new-product development and, possibly, code changes. On the one hand, we must remove heat from around the chimney to maintain safe temperatures on adjacent combustible materials. On the other, we want to reduce heat loss from the living space. Each type of residential chimney installs somewhat differently, but the basic dilemma is the same.

Safety First

Safety has been the main concern of building-code agencies in developing standards for chimneys. This is true for site-built masonry chimneys as well as pre-engineered, prefabricated metal chimneys.

For masonry chimneys located on the interior, most codes call for a two-inch air space around the chimney coupled with a noncombustible firestop at each floor and the upper ceiling of the structure.

The intent of the code, as I understand it, is to allow free air movement between the chimney and surrounding framing members in order to prevent heat buildup in this area. It is not the intent of the code to have insulation filling this space.

The firestopping is required to prevent flames and heat from spreading to the upper story in the event of a house fire. Figure 1 shows typical code requirements for clearances and firestopping around masonry chimneys.

Because drywall is considered a combustible material, it must be spaced two inches from the chimney and not be used as a firestop. While there is some debate as to whether drywall should be considered combustible, most codes, as well as the National Fire Protection Association (in guideline NFPA 211), specifically cite it as such. In high-temperature tests, it has been shown that the paper facing burst into flame.

Tests conducted for the National Bureau of Standards by Underwriters' Laboratories (UL) indicate that the two-inch clearance around flues is necessary to maintain safe temperatures on adjacent combustible materials. Although wood framing located too close to the chimney is unlikely to overheat under the normal firing of oil or gas heating systems, it is not unlikely when using a wood-burning stove or fireplace.

The fact is that, under extended high firing, masonry chimneys conduct heat outward as effectively as uninsulated glass. Since codes must provide a margin of safety under worst-case condi-

Figure 1. Typical code-required clearances and firestopping around masonry chimneys.

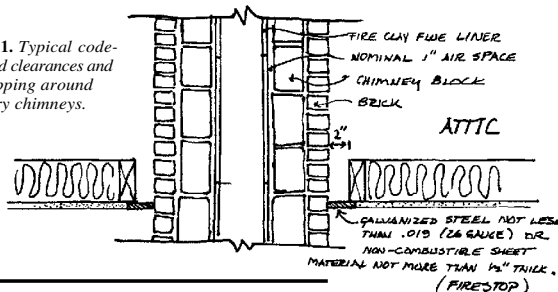


Figure 2. Typical clearances and firestopping for premanufactured metal chimneys.

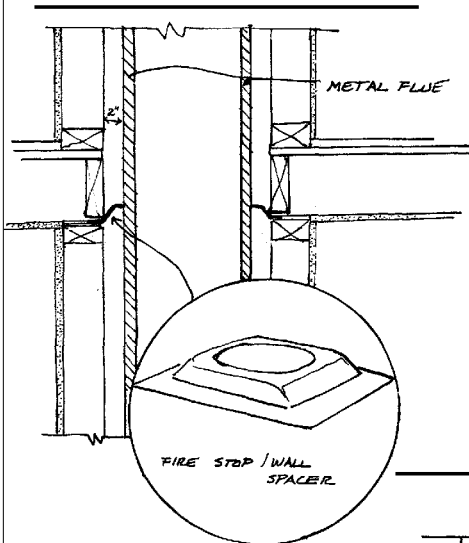


Figure 3. Insulating between the chimney and framing increases fire risks and violates most codes. Butting combustibles—including drywall—up to a chimney also violates many codes.

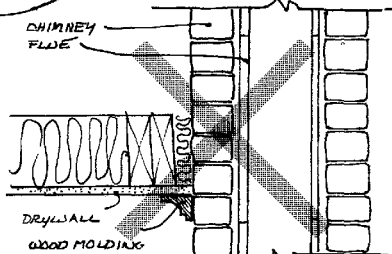


Figure 4. Underwriters' Laboratories recently mandated the use of attic insulation shields to hold insulation away from HT-listed chimneys.

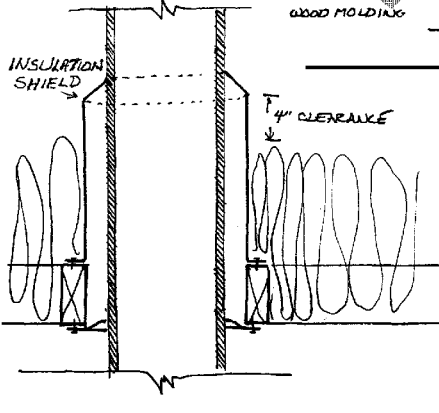
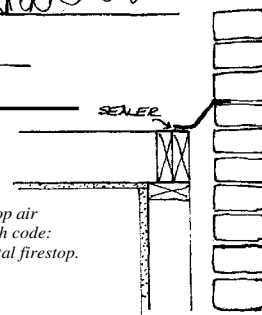


Figure 5. The way to stop air leakage and comply with code: a carefully installed metal firestop.



tions, they cautiously require a two-inch clearance for chimneys positioned within the dwelling and a one-inch clearance for chimneys located outside the house.

Engineered for Economy

Prefab metal chimneys used for venting furnaces, stoves, and zero-clearance fireplaces also are designed with safety—and not necessarily energy savings—in mind.

Underwriters' Laboratories has a standard (UL 103) for evaluating prefabricated metal chimneys. In this standard, various fire tests are conducted to evaluate whether a chimney system will contain heat well enough to protect adjacent wood framing.

The chimney systems are designed and tested with firestops and joist shields, which are engineered to remove as much heat as possible from around the chimney so it can economically meet the temperature limits of the standard.

Like masonry chimneys, most prefabricated chimneys require a two-inch air space all the way around them (Figure 2). A chimney could be designed to work without this space, but it would cost more—and chimney manufacturers operate in a very cost-competitive market.

Common sense might lead you to believe that insulating the area between the flue and the framing would lower the framing temperatures and solve the heat-loss problem at the same time. But field experience has proved otherwise (Figure 3).

Most insulations conduct a greater amount of heat than free air in this case. They also can trap and focus heat against combustible materials around the chimney. There are documented cases where packing the area around a metal chimney with insulation has contributed to house fires.

In response to this field problem, Underwriters' Laboratories, in UL 103, recently mandated the use of attic insulation shields for HT-listed chimneys to be used for wood-burning stoves to keep the attic insulation away from prefabricated chimneys (Figure 4).

Guidelines for masonry chimneys are less clear and sometimes even contradictory on this point. But if you want to be prudent—and to comply with the intent of the code—insulation should be held back two inches from a chimney that will be used for a stove or fireplace. In some cases, this may require fashioning a baffle to hold back the insulation.

Leaky Firestops

Most building codes call for a galvanized-metal (or equivalent noncombustible material) firestop between the chimney and surrounding framing members, but do not specify that the firestop be tightly mortared into the brickwork. A poorly sealed firestop can be a major source of cold-air infiltration—particularly when the living space is under negative pressure.

For instance, when an exhaust fan runs, or winds create pressure differences, cold air can be drawn down

through holes in the flashing or firestopping into the heated space. This problem is less acute for chimneys passing through sidewalls, but air leakage often occurs here, too.

A carefully installed firestop (Figure 5) that is mortared into the chimney and sealed to the framing members will stop this air infiltration. Heat will still be lost by conduction through the single-wall firestop, but this heat loss will be minor because of the small surface area.

Moisture Problems, Too

The lack of insulation and airtight firestopping can contribute to moisture problems as well as energy loss. Masonry chimneys, due to their mass

good solutions at this time.

Most of the commonsense steps you can take—such as caulking with high-temperature RTV silicone around prefabricated chimneys to reduce infiltration and potential condensation—violate the UL listing of the chimney. The caulking may do the job, but who is going to defend you in court if it overheats and causes a house fire?

For masonry chimneys, the best approach is to use the firestop as an air seal by tightly mortaring it to the chimney and caulking it to the wood framing. There are some effective noncombustible insulations, such as ceramic wool, that could be used in products that would both cut heat loss around chimneys and limit heat buildup on

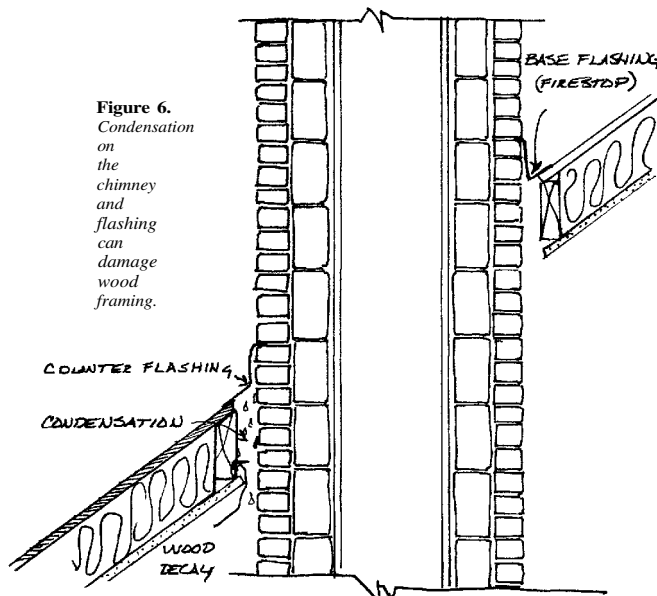
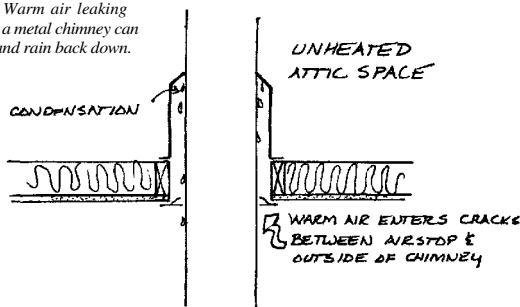


Figure 7. Warm air leaking up around a metal chimney can condense and rain back down.



and high thermal conductivity, act as wicks, transferring heat to the outside. Moisture from within the home can condense on the flashing and the cool upper portion of an unheated chimney (Figure 6) and rot the surrounding framing and roof sheathing.

Condensation can be a problem with prefabricated chimneys as well. Air passing through leaks in the firestopping of the ceiling (Figure 7) can condense on the flashing and outer walls of the chimney in the unheated attic space, and then drop down the outside of the chimney into the house like a leak in a rainstorm.

New Products and Codes Needed

So what can energy-conscious builders and architects do to reduce energy loss and moisture problems around chimneys? Unfortunately, there are few

adjacent combustible materials. But since this option is not yet recognized by building codes, you have little choice but to leave the area open and uninsulated.

I would like to see new methods and materials developed that will reduce heat loss around chimneys. Designing more energy-efficient firestops and flashings is not difficult and need not add significant cost. If I am not mistaken, the problem lies less with technical issues than with code groups and chimney manufacturers who need convincing that change is needed. ■

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