

## Purpose

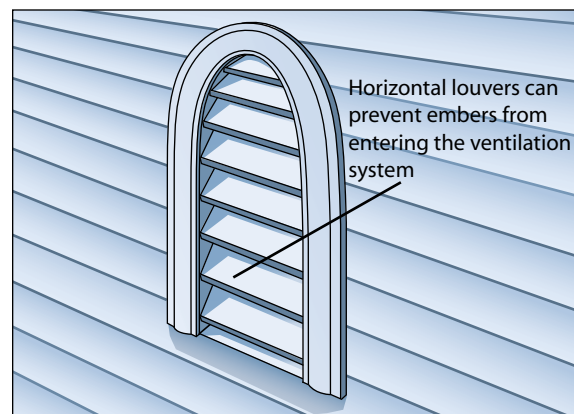
To provide information about ways to avoid windborne embers, convective heat, and radiant heat entering exterior vent openings, which can lead to the ignition of interior building components and contents. Guidance pertains to both new and existing buildings.

## Vent Systems and Vent Openings

Vents can be divided into those for attics; ventilated cathedral ceilings; crawlspaces; and heating, ventilation, and air conditioning (HVAC) systems.

### Attic and Cathedral Ceiling Vents

- **Ridge vent** — a continuous vent installed along the full length of the roof ridge. Ridge vents allow exfiltration of attic air, or in ventilated cathedral ceilings or ventilated nailbase boards, the exfiltration of air from the ventilation cavity of the cathedral ceiling or nailbase boards. Ridge vents are metal or plastic. Some ridge vents have internal baffle media to avoid the entrance of wind-driven rain and snow.
- **Soffit vent** — a continuous or intermittent vent installed along a soffit. Soffit vents provide air intake into the attic or into the ventilation cavity of cathedral ceilings and ventilated nailbase boards. Soffit vents are metal or plastic and often have a screen to prevent insect entry. Vinyl and metal soffits are commonly vented by intermittently spaced, perforated soffit panels.
- **Gable-end vent** — a vent located in the gable-end wall, just below the roof ridge. Gable-end vents allow air to flow into and out of attics. Gable-end vents normally have louver blades to avoid the entrance of wind-driven rain and snow (see Figure 1). This type of vent is commonly metal and normally has an insect screen.
- **Through-roof vent** — a vent that penetrates the roof to allow exfiltration of attic air; also known as an eyebrow or dormer vent. Through-roof vents, including sheet metal “goose-necks,” are also available for kitchen or bathroom exhaust ducts. Through-roof vents are metal, plastic, or rigid fiberglass.



**Figure 1.** A louvered vent opening can be used for gable-end venting or for connection to ductwork.

### Crawlspace Vents

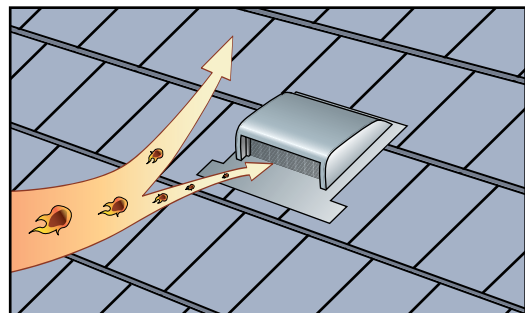
- **Crawlspace vent** — a vent installed intermittently through the foundation wall several inches above-grade. Crawlspace vents allow air to flow into and out of the crawlspace.

### HVAC System Vents

- **Through-roof vent** (see above).
- **Wall louvers** — a vent opening on an exterior wall (see Figure 1). Wall louvers are connected to the HVAC ductwork where air enters or is exhausted from the building. Louvers are commonly metal. The louver blades are normally in a fixed position (i.e., cannot be rotated), but some have moveable blades that can be rotated to close the vent opening.

### Key Issues

- Embers and hot gases can be blown or pulled into vent openings and enter attic spaces, crawlspaces, and ductwork, leading to ignition of the interior of the building (see Figure 2).
- Debris can accumulate at vent openings and ignite during a wildfire.



**Figure 2.** Embers or hot gases can be blown or pulled into vents.

### Guidance for New Buildings

#### All Vents

- Specify and install noncombustible material for all vents. Metal products are recommended for vents and vent flashing.
- Specify and install corrosive-resistant, metal mesh screens with a maximum opening of 1/4 inch at all vent openings.
- Specify and install vent openings with a maximum net free area of 144 square inches.
- Place all vent openings at least 10 feet from other buildings or property lines to avoid ignition from embers and hot gases from an adjacent building that has ignited.

#### Attics (including Cathedral Ceiling and Ventilated Nailbase Boards)

Protecting attic spaces from wildfires is a challenge because air is naturally drawn into attics through vent openings. Although insect screens can prevent the entry of many embers, vent screens and louvers do not prevent the entry of hot gases. Vents that allow air to flow into and out under normal conditions and also avoid the entry of embers and hot gases in a wildfire can be provided in the following ways:

- **Gable-end vent.** Instead of using ridge vents, specify and install gable-end vents with specially designed metal shutters. When a wildfire threatens, the shutters can be placed over the gable-end vent. A hinged shutter that can be latched in an open or closed position is recommended (see Figure 3). A detachable shutter design can be used, but when the shutters are needed,

the homeowner must remember quickly where they are stored. Shutters should have a gasket that provides a tight seal between the shutter and gable-end vent. For a more conservative shutter, a shutter with an insulated core encapsulated by metal (similar to a refrigerator door) can be used.

When gable-end vents are combined with soffit vents, effective attic ventilation can be achieved when the attic space is simple and relatively small, such as a small, gable-roofed house. If the house has a complex roof area or the attic is too large to be effectively ventilated by gable-end vents, ridge vents or through-roof vents should be used.

- **Ridge vent.** Continuous ridge vents can provide effective ventilation, but typical ridge vents are not highly fire-resistant. Although air is normally exhausted through ridge vents, hot gases can enter the ridge vent and flow into the attic. Embers can also enter through the ridge vent if the vent does not have internal baffle media. Typical ridge vents are therefore not recommended unless the attic configuration or size requires ridge vents to ventilate the attic effectively. If ridge vents are used, metal vents with internal baffle media are recommended, but during a wildfire, the internal baffle material may melt and become ineffective at preventing embers from entering.
- **Soffit vent.** As with ridge vents, typical soffit vents are not highly fire-resistant, but because they are a necessary element of a vented attic, they cannot be eliminated. To avoid embers and hot gases from entering the vents, specially designed metal shutters over the soffit vent openings should be specified and installed. See the shutter recommendations for gable-end vents above.
- **Through-roof vent.** Through-roof vents are not recommended for attic ventilation because there is no known effective strategy for avoiding embers and hot gases from entering, other than blocking the vent. A 1/4-inch screen is effective at keeping out firebrands and embers that are larger than 1/4-inch but will not keep out smaller embers or hot air.

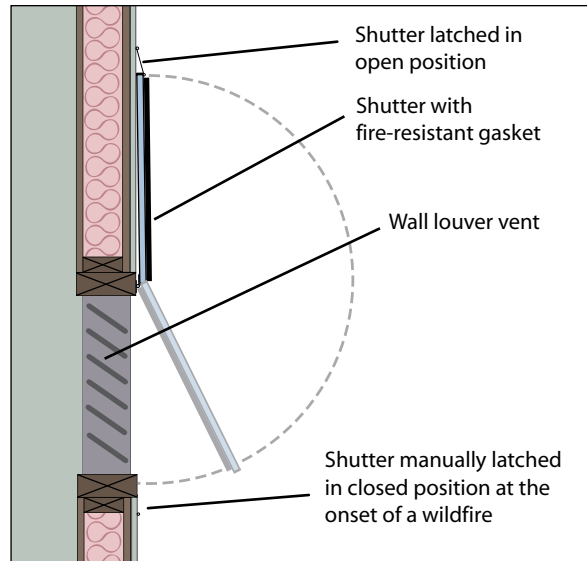


Figure 3. A hinged shutter.

### The Unventilated Attic

The most conservative approach to preventing embers and hot gases from entering the attic is to eliminate attic ventilation, but unventilated attics are controversial. Although allowed by the International Residential Code, provided the Code's criteria are met, unventilated attics may not comply with local building codes.

However, when unventilated attics are allowed by the building code or code compliance is not an issue, and when climatic and interior humidity conditions (e.g., no indoor swimming pools) are conducive to an unventilated design, an unventilated attic is a reliable way to prevent embers and hot gases from entering the attic.

Because of variable reliability of blocking techniques and the potential danger of homeowners falling from roofs while attempting to block vents, blocking is not recommended.

### *Crawlspace Vents*

Specify and install specially designed metal shutters over crawlspace vent openings. A 1/4-inch mesh screen should also be installed over the vent opening. See the shutter recommendations for gable-end vents above.

### *HVAC System Vents*

- **Wall louvers.** Specify and install specially designed metal shutters over wall louvers (see the shutter recommendations for gable-end vents above) or specify and install wall louvers that have adjustable tight-fitting blades that can be closed when a wildfire threatens.  
As an additional conservative measure with either shutters or adjustable blades, specify and install fire dampers within the ducts immediately behind the wall louvers. If sufficiently high heat penetrates beyond the louver, the fire damper will automatically close and prevent high heat from penetrating farther.
- **Through-roof vents.** As discussed in attic ventilation, through-roof vents are not recommended. Rather than running ductwork through the roof, extend the ductwork to an exterior wall where it can be fitted with a wall louver and shutter. If it is necessary to penetrate the roof, however, install a fire damper in the duct at the plane of the roof assembly.

## **Guidance for Existing Buildings**

- If the home has ridge vents or wall louvers and they are not metal, replace them with metal vents according to the guidance provided above.
- If existing vent openings do not have screens or if the screen openings are larger than 1/4-inch, install metal screens according to the guidance provided above.
- Install shutters over gable-end vents, soffit vents, crawlspace vents, and wall louvers. If the existing wall or soffit is combustible, shutters may not be effective. In this case, installing shutters is probably cost-effective only if done in conjunction with upgrades to the wall or soffit.

## **Considerations**

- Low-profile, through-roof vents have been used in place of soffit/eave vents with great success, but none of these products have been tested at the time of this publication.
- The homeowner should periodically have a professional remove debris that has accumulated near or on vent openings, vent screens, and louver blades.
- The amount of vegetation near vent openings should be limited (see Fact Sheet #4, Defensible Space).
- To minimize the possibility that embers and hot gas will be pulled into the home, the HVAC system, including exhaust fans, should be turned off when a wildfire threatens. Attic exhaust

fans should also be shut down. Attic exhaust fans that are controlled by a thermostat may need to be deactivated by tripping the circuit breaker.

- For soffit construction, see Fact Sheet #6, Eaves, Overhangs, and Soffits.

## Effectiveness

All mitigation measures listed in this Fact Sheet are effective in all Fire Severity Zones except as noted below.

- If a ridge vent is installed, the vent opening may be breached during extreme fire exposure by embers or hot gases, which could result in ignition of the attic.
- The effectiveness of shutter-protected vent openings is dependent on the deployment of the shutters by the homeowner prior to fire exposure.

## Resources

Slack, P. 2000. *Firewise Construction Design and Materials*. Colorado State Forest Service.

Under Eave SFM Standard 12-7A-3, 2001 California Referenced Standard Codes (Part 12, Title 24, C.C.R.). Available at [www.fire.ca.gov/fire\\_prevention/downloads/Part\\_12\\_CA\\_SFM\\_12-7A-3\\_Test\\_Standards.pdf](http://www.fire.ca.gov/fire_prevention/downloads/Part_12_CA_SFM_12-7A-3_Test_Standards.pdf).

