

Builder Insight

Sidewall Venting of Gas Appliances

OVERVIEW

Newer modern gas appliances used for space and water heating are increasingly being installed with sidewall venting as it is easier for builders and equipment installers to implement. Proper care and attention are required in the design and installation of the vents in order to ensure that the exhaust is dissipated away from the building and its occupants.

Combustion gases in traditional gas appliances were vented through the roof. The buoyancy effect of warm gases was relied on to move the exhaust gases up through a chimney flue and out of the building. Gases were quickly dispersed upwards into the atmosphere with few consequences on the building or its occupants.

Today's high efficiency gas appliances have lower temperature flue gases and must use forced venting systems to ensure proper exhaust gas flow. High efficiency power vented equipment no longer require a chimney and can be vented through the wall of a building.

Current Gas and Building Codes allow venting through the sidewall. Sidewall venting is easier for builders and equipment installers to implement saving them time, materials, labour and interior living space (by avoiding flue chases) in both new construction and renovations. These inherent advantages have made sidewall venting increasingly popular in British Columbia and elsewhere in Canada.

This Builder Insight examines issues surrounding sidewall venting along with current installation requirements and recommendations.

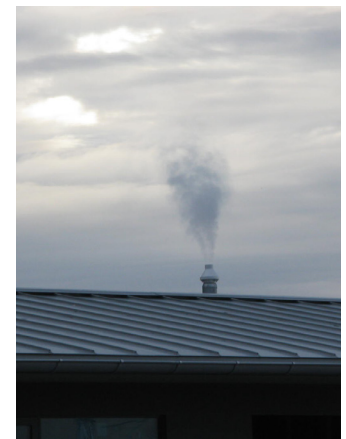
Furnace flue gases from a high efficiency furnace vented through the roof – mostly moisture.



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Builder Insight is a series of bulletins designed to provide practical information on new technologies, research results, good building practices and emerging technical issues in residential construction to Licensed Residential Builders and others in the industry.

This bulletin is produced by the Homeowner Protection Office (HPO), a branch of BC Housing, and was prepared by Richard Kadulski Architect in cooperation with industry and research experts.



The Canadian Standards Association (CSA) addresses aspects of natural gas and propane appliance installation (CSA B149.1). However, it does not address the impact of vent gases on the building envelope or those of neighbouring buildings. As for the BC Building Code, it is currently silent with respect to the placement of sidewall vents other than requiring compliance to the Gas Code. Some jurisdictions in Canada are beginning to look at the issue, and are considering placing restrictions on the location of the vents.

Other design elements with similarities are covered in the BC Building Code, including:

- Restrictions on the number of unprotected openings in walls close to a property line and spatial separation provisions.
- Location and height of chimneys relative to portions of the building and neighbouring buildings.

HOW DOES SIDEWALL VENTING DIFFER FROM CHIMNEY VENTING?

In a traditional rooftop flue, the combustion gases dissipate into the atmosphere. In the case of sidewall vented appliances, the gases are discharged close to the ground, adjacent to the house. The warm, moist gases move up the wall of the house and against any overhangs above. The moisture plume is very visible on a cool day, as the exhaust gases form vapour clouds when they leave the flue.

Since the heating appliance is firing for long periods during cold weather, which generally is associated with high outdoor humidity levels, the vapour cloud can overload the capacity for the adjacent building surfaces to manage all this moisture. Frost and ice buildup can be noticeable in the winter as the plume condenses water on the colder surfaces – such as the siding. Moisture absorption within the building materials will not be as noticeable, but can have a big impact on their durability.



Appliances of concern

- High efficiency furnaces, boilers and water heaters that are vented through a sidewall vent pipe.
- Direct vent gas fireplaces.

In cold climate conditions, vent gas condensation is visible as frost buildup against wall and roof overhang.



Moisture from flue gases accumulating on the wall of a heritage building will affect the durability of that building.



Sidewall vented appliance retrofitted into an older home blows flue gases against the neighbouring house where it has led to ice buildup.

In infill situations and narrow lot subdivisions, the side yards between houses are narrow, limiting air movement. This offers less opportunity for the dissipation of the flue gases or for the drying of moisture accumulating on adjacent surfaces of not only the house with the appliance, but also the neighbouring house, as can be seen in the photo above. Such a buildup is not just an aesthetic concern; it can also compromise the long-term durability and performance of the building.

The main by-products of natural gas combustion are carbon dioxide and moisture; other by-products include carbon monoxide, nitrous oxides, sulphur dioxide and particulates. For every 10,000 BTU/hr of gas burned, 452 g/hr of moisture is generated. As such, a 50,000 BTU furnace or boiler can put out the equivalent of about 2.5 or more litres of moisture per hour. On a cold day, depending on the heat load and firing time, a furnace and water heater could be generating flue gases that would be equivalent to throwing 30 to 120 litres of water into the air close to the surface of the house adjacent to the vent. A high efficiency condensing appliance should vent less moisture, but there will nevertheless be significant quantities of moisture in the vented gases.

While dryer and bath fan vents also release a vapour plume adjacent to a house, it has been observed that the extent of their related damage is not as significant. This is likely because the duration of operation of the dryer or bath fan is intermittent, and of short duration compared to the gas furnace or boiler.

WHAT ISSUES CAN ARISE FROM SIDEWALL VENTING?

Improper sidewall venting can have serious unintended consequences that must be recognized and addressed. A number of different elements can be impacted:

- Building envelope
- Attic moisture and mould
- Air quality and health
- Noise

BUILDING ENVELOPE DAMAGE

As discussed, the moisture generated by the gas combustion in winter can both condense on and be absorbed by building envelope materials, which can lead to damage. In winter, the exterior building envelope materials are already at or nearly at saturation moisture content. With very little drying potential, the additional moisture can impact building envelope durability.

Icing problems on building envelopes due to sidewall venting have been observed on the Prairies and have prompted some authorities in Saskatchewan and Alberta to introduce local requirements for larger spacing requirements between houses with sidewall vents. Minimum distances as great as 8 feet (2.4 m) between a house and property line are being proposed.

ATTIC MOISTURE AND MOULD

The flue gases moving up the house can enter the attic through the soffit vents where they can condense on the framing and underside of the roof sheathing. There have been reports of moisture and mould on the underside of roof sheathing in houses with sidewall vented appliances and also on adjoining houses. Some builders have even reported condensation and mould growth in new houses that are still under construction – where the water vapour from an adjacent home's gas appliance is blown into the attic. Similar problems have been observed in older homes that have been retrofitted with new high efficiency gas furnaces where the venting has been put through the wall rather than keeping it through the roof.

AIR QUALITY AND HEALTH

There are also potential health impacts associated with sidewall venting. Indoor air quality can be negatively affected if there are operable windows near a sidewall vent that are left open when the gas appliance is operating. Similarly, if there is a ventilation

air intake in the area, the indoor air quality could be compromised as the combustion gases can be drawn in.

Because the gas-fired appliance is often located in the basement or crawlspace, the vent is taken directly out the sidewall of the building. The vent gases are often dispersed near the ground in narrow confined spaces between buildings – a less than ideal situation.

Malfunctioning equipment could produce higher levels of carbon monoxide and other harmful combustion gases that could affect occupant health.

NOISE

Another issue that has been raised by some building officials is that of equipment noise. The fan motors of some power vented equipment can be loud, even when installed according to manufacturer specifications. These noise levels can exceed allowable noise limits set out in municipal noise by-laws.

NATURAL GAS AND PROPANE INSTALLATION CODE (CSA B149.1)

The Natural Gas and Propane Installation Code (CSA B149.1) focuses on installation requirements for:

- The safe operation of the gas appliance.
- Dispersal of combustion gases, including the separation of vent gases from windows and mechanical air supply for the building.
- Placement of vents to prevent re-entrainment of combustion gases into the building.
- The extent frost or ice can buildup on adjacent property surfaces.

The Gas Code requires that there must be a side yard equal or greater than 4 feet (1.2 m) to the property line and a means of redirecting the vent plume with a certified fitting such as a "T", a 90-degree elbow, or termination acceptable to the authority having jurisdiction. The vent termination must be installed in accordance to the manufacturer's installation instructions. There are no restrictions on the placement of a sidewall vent relative to an adjoining building if they are separated by 8 feet (2.4 m) or more.

The Gas Code permits the placement of a vent underneath a veranda, porch, or deck if it is fully open on at least two sides underneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is at least 1 foot (0.3 m). However, this is never advisable because it is a location where ice and condensation can build up and lead to structural deterioration. An example of this ice accumulation is evident in the photo on page 4.



Venting should never be placed underneath the building or cold floor areas.

CSA B149.1 Article 8.14.8 states that a vent shall not terminate:

- Where it may cause hazardous frost or ice accumulations on adjacent property surfaces.
- Less than 7 feet (2.1 m) above a paved sidewalk or a paved driveway that is located on public property.
- Within 6 feet (1.8 m) of a mechanical air-supply inlet to any building.
- Within 3 feet (900 mm) horizontally of the vertical centerline above the gas service regulator vent outlet to a maximum vertical distance of 15 feet (4.5 m).
- Less than 1 foot (300 mm) above grade level.
- Within 12 inches (300 mm) of a window or door that can be opened in any building, of any non-mechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance for gas units up to and including 100,000 BTU/hr (30 kW).
- Within 3 feet (900 mm) of a window or door that can be opened in any building, of any non-mechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance for gas units exceeding 100,000 BTU/hr (30 kW).

WHAT CAN BE DONE TO AVOID PROBLEMS?

- Venting combustion gases through the roof is recommended to avoid a number of potential problems associated with sidewall venting. Most sidewall vented equipment can be vented through the roof. Manufacturer's product literature and installation instructions provide the installer with information, including the maximum allowable length of vent pipe, and options for increasing the vent length – usually achieved by increasing the diameter of the vent pipe. In most cases, even a larger vent pipe will still fit within standard wall framing, so special flue chases should not be required.
- When venting through the roof, determine the location of mechanical equipment and placement of venting needs early in the design stage, to minimize problems during construction. Large chases for traditional chimneys and B-vents are not

required, but the vent pipes, typically 2 inch (50 mm) to 4 inch (100 mm) in diameter, have to be accommodated within interior walls. Contemporary open concept floor plans may provide challenges for finding a place to install vents because there are fewer interior walls.

- When sidewall venting must be used, vent terminations should be placed so the vent gases can be dispersed quickly into open areas, away from operable windows and other openings.
- Always ensure that the installation is done in accordance with CSA B149.1 and the manufacturer's installation instructions.
- Never place a vent underneath a cold floor, deck or adjacent to a roof overhang.
- If there are vented soffits above a sidewall vent, the soffit vents should be sealed for 6 feet on either side of the vent. Draw a vertical line above the vent and measure 6 feet on either side of that line. If the roof space is to be vented, ensure that there is adequate venting overall in other portions of the attic.

KEY POINTS TO REMEMBER WHEN INSTALLING SIDEWALL VENTING

- ❑ Don't place sidewall vent terminations near openings or underneath any structure that can obstruct the dissipation of the exhaust gases.
- ❑ Place vent termination in an exposed location where flue gases can dissipate widely – preferably through the roof.
- ❑ Ensure penetrations through the building enclosure maintain the continuity of the air barrier.
- ❑ When sidewall venting cannot be avoided, seal all soffit vents immediately above the vent – even if the soffit is two floors above.

FOR MORE INFORMATION

- ❑ CSA B149.1, *Natural Gas and Propane Installation Code*. Available at <http://shop.csa.ca>.
- ❑ *Clearance Distance for Gas Appliance Sidewall Venting Research Project*. The Fire Protection Research Foundation, 2007. Available at www.nfpa.org.
- ❑ Reuther, J. J.; Hemphill JR., *Vent – Terminal Locations as Related to Air Infiltration and Indoor Air Quality*, ASHRAE Journal, v 108, n 1, p 563-571, 2002. Available at www.ashrae.org.



Homeowner
Protection Office
Branch of BC Housing

For HPO Technical Research & Education inquiries contact:

HPO Technical Research & Education
1701 – 4555 Kingsway
Burnaby, BC V5H 4V8

Tel: 778 452 6454
Toll-free: 1 866 465 6873

www.hpo.bc.ca
www.bchousing.org
Email: hpo@hpo.bc.ca

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