

Mechanically Vented Appliances

PURPOSE

This interpretation has been developed to provide clarity to safety codes officers and industry stakeholders as to what types of appliances are considered to meet the definitions of *mechanically vented* and *direct-vented* in the *National Building Code - 2019 Alberta Edition* (NBC(AE)) and, subsequently, when make-up air would need to be provided within a dwelling unit to protect against the effects of depressurization.

DISCUSSION

The NBC(AE) contains two defined terms for situations where make-up air would not be required to be supplied to a dwelling unit to offset the potential hazard from depressurization of the dwelling unit and the subsequent spillage of products of combustion from fuel-fired appliances. Under Sentence 9.32.3.8.(1) dwelling units that have fuel-fired space-heating or water-heating appliances do not require make-up air if they are *mechanically vented* or *direct-vented* appliances as defined in the NBC(AE).

Safety codes officers and industry have asked for additional clarification regarding the types of fuel-fired appliances that would meet the definition of *mechanically vented*. Some safety codes officers have interpreted the requirements such that if there is any mixing of the air from the space where the appliance is located and products of combustion (regardless of the design of the appliance and any safety features which may be present), then the appliance is considered to be at risk for the spillage of products of combustion, in which case make-up air must be provided.

The CSA B149.1 *Natural gas and propane installation code* makes reference to specific categories of fuel-fired appliances in the definition of “appliance”. All fuel-burning appliances in Canada are required to be classified to receive certification, including any modifications or accessories to the appliance that might change the classification category.

Category I and II appliances often have flue gas dilution air requirements and may result in pathways for exhaust gases that are not totally enclosed. The absence of forced draft or induced draft fans in category I and II appliances result in a non-positive vent static pressure and an appliance that is sensitive to the effects of depressurization. These appliances are susceptible to downdraft, which could result in the discharge of combustion products into the occupied space.

Unless stated otherwise, all Code references in this STANDATA are to Division B of the National Building Code-2019 Alberta Edition

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The logo for the province of Alberta, featuring the word "Alberta" in a stylized, cursive font with a small blue square at the end of the word.

Category III and IV appliances may be configured as forced draft, induced draft or direct vent categorization. The presence of a fan creates a positive vent pressure that requires that the vent is sealed and has no pathways for exhaust gases to escape other than at the terminal on the exterior of the building. These appliances do not have the same level of sensitivity to depressurization as category I and II appliances.

CODE REFERENCES

Clause 3 of CSA B149.1 *Natural gas and propane installation code*, contains the following definitions:

Air supply (with respect to the installation of an appliance) – combustion air, excess air, flue gas dilution air, primary air, secondary air, and ventilation air.

Combustion air – the air required for satisfactory combustion of gas, including excess air.

Excess air – that portion of the combustion air that is supplied to the combustion zone in excess of that which is theoretically required for complete combustion.

Flue gas dilution air – the ambient air that is admitted to a venting system at the draft hood, draft diverter, or draft regulator.

Secondary air – that portion of the combustion air that is supplied for the intermediate and final stages of the combustion process and is supplied downstream from the point of ignition.

Ventilation air – air that is admitted to a space containing an appliance to replace air exhausted through a ventilation opening or by means of exfiltration.

Appliance – a device to convert gas into energy or compressed gas for the purpose of fueling; the term includes any component, control, wiring, piping, or tubing required to be part of the device.

Category I appliance – an appliance that operates with a nonpositive vent static pressure and with the flue loss not less than 17%.

Note: This category consists of draft-hood-equipped appliances, appliances labelled as Category I and fan assisted appliances for venting into Type B vents.

Category II appliance – an appliance that operates with a nonpositive vent static pressure and with the flue loss less than 17%.

Category III appliance - an appliance that operates with a positive vent static pressure and with the flue loss not less than 17%.

Category IV appliance - an appliance that operates with a positive vent static pressure and with the flue loss less than 17%.

Draft - the flow of air or combustion products, or both, through an appliance and its venting system.

Chimney draft - the available natural draft of the chimney measured at or near the base of the chimney.

Mechanical draft – a draft produced by a mechanical device such as a fan blower or aspirator that can supplement natural draft.

Forced draft – a mechanical draft produced by a device upstream of the combustion zone of an appliance.

Induced draft – a mechanical draft produced by a device downstream from the combustion zone of appliance.

Natural draft - a draft other than a mechanical draft.

NBC(AE) Division A, Sentence 1.4.1.2.(1) contains the following definitions:

Direct-vented (as applying to a fuel-fired space- or water-heating *appliance*) means an *appliance* and its venting system in which all the combustion air is supplied directly from the outdoors and the products of combustion are vented directly to the outdoors via independent, totally enclosed passageways connected directly to the *appliance*.

Mechanically vented (as applying to a fuel-fired space- or water-heating *appliance*) means an *appliance* and its combustion venting system in which the products of combustion are entirely exhausted to the outdoors by a mechanical device, such as a fan, blower or aspirator, upstream or downstream from the combustion zone of the *appliance*, and the portion of the combustion venting system that is downstream of the fan, blower or aspirator is sealed and does not include draft hoods or draft control devices. (See Note A-1.4.1.2.(1).)

Division A, Note A-1.4.1.2.(1) states:

A-1.4.1.2.(1) Defined Terms.

Mechanically Vented

The definition of this term is intended to include all types of appliances and venting systems that rely entirely on fans to evacuate the products of combustion. Systems variously referred to as “forced draft,” “power vented” and “induced draft” in standards and industry terminology may be covered by this definition. The key characteristic of such systems is that they are more resistant to depressurization-induced spillage of combustion products into the building in which they are housed because the combustion venting system downstream of the fan is “sealed,” i.e. includes no draft hood or draft control device.

NBC(AE) Sentence 9.32.3.8.(1) and Note A-9.32.3.8. states:

9.32.3.8. Protection Against Depressurization

(See Note A-9.32.3.8.)

1) This Article applies to

- a) *dwelling units* that contain a fuel-fired *space-heating appliance* or fuel-fired water-heating *appliance* of other than *direct-vented* or *mechanically vented* types, and
- b) ancillary spaces that contain an exhaust device, where the space is not within a *dwelling unit* in a house with a *secondary suite* and where the house with a *secondary suite* contains a fuel-fired *space-heating appliance* or fuel-fired water-heating *appliance* of other than *direct-vented* or *mechanically vented* types.

A-9.32.3.8. Protection against Depressurization. When an exhaust device extracts air from a house and there are no provisions for the introduction of outdoor air, such as by means of an outdoor air duct as required by Articles 9.32.3.4. and 9.32.3.5., and no supply fans are operating simultaneously, the exhausted air will automatically be replaced by outdoor air that has infiltrated through the house’s building envelope. The rate of inward leakage will automatically equal the rate of outward extraction: otherwise the house would eventually implode. The instant the exhaust device is turned on, the house pressure is lowered and the inside/outside pressure difference drives outdoor air in through any leaks it can find.

Even if the house is made more airtight, the inward leakage will equal the outward fan flow. However, because there are fewer and/or smaller leakage sites in an airtight house, it will take a larger inside/outside pressure difference to drive the same amount of air through the remaining leakage sites

It is possible that the exhaust device will no longer be able to achieve its rated flow when operating against a very high inside/outside pressure difference. However, in this case, the inward flow will also decrease and will still be in equilibrium with the outward flow, but now at a higher inside/outside pressure difference than in a leakier house.

An exhaust device not operated in conjunction with a supply fan will always depressurize a house to some extent—even a leaky house. But it will depressurize a tight house more than it will depressurize a leaky house. And, of course, an exhaust device with a higher capacity will depressurize a house more than a device with a smaller capacity.

Spillage of Combustion Products

Depressurization of the house by the ventilation system or other exhaust devices can cause the spillage of combustion products from certain types of combustion appliances. The types of appliances that are susceptible to pressure-induced spillage can generally be identified by the fact that they are vented through a natural draft chimney rather than through an arrangement that uses a fan to draw the products of combustion out of the house. Naturally aspirated gas furnaces with draft hoods and oil furnaces with barometric dampers are examples of spillage-susceptible appliances.

On the other hand, some gas furnaces with induced draft venting systems and the “sealed combustion” oil furnaces commonly used in mobile homes, are more resistant to spillage. Terms used in gas appliance standards to describe categories of spillage-resistant appliances include “direct-vented” and “side-wall-vented.”

Almost all fireplaces are spillage-susceptible, even those with so called “airtight” glass doors and outside combustion air intakes, since most “airtight” doors are not really airtight. Certain types of gas combustion appliances, such as cooking appliances and “decorative appliances,” are not required to be vented. Their operation will not be significantly affected by depressurization of the house.

The **NBC(AE)** addresses the potential for spillage from combustion appliances with requirements for:

- makeup air, and
- carbon monoxide alarms.

Makeup Air Requirements

Depressurization caused by the principal ventilation system itself is not an issue in houses with balanced systems (that is, non-exhaust-only systems). However, the operation of other exhaust devices, such as stove-top barbecues, can cause depressurization. Therefore, in a house with spillage-susceptible appliances, any such exhaust devices, including the required supplemental exhaust fans, must be provided with makeup air [see Sentence 9.32.3.8.(2)].

In the past, the NBC(AE) and other codes and standards have tended to rely on the passive supply of makeup air through makeup air openings. This is no longer considered to be a reliable approach in the context of a simple, prescriptively described system without sophisticated controls on depressurization. Therefore, the makeup air must be provided by a supply fan that is automatically activated whenever the exhaust device that requires the makeup air is activated [see Sentences 9.32.3.8.(2) and (3)].

The need for makeup air can be avoided by not using spillage-susceptible combustion equipment.

Carbon Monoxide Alarm Requirements for Solid-Fuel-Burning Appliances

Even at a relatively low level of depressurization, certain open-type solid-fuel-burning appliances, such as fireplaces, or even closed-type solid-fuel-burning appliances whose stoking doors are left open, can spill products of combustion into the house when operating in their “die down” or smouldering stages. In the absence of more sophisticated design and installation controls to prevent such levels of depressurization (such as those mentioned in CAN/CSA-F326-M, “Residential Mechanical Ventilation Systems,” the only available safeguard is to require the installation of a carbon monoxide (CO) alarm in any room incorporating a solid-fuel-burning device [see Sentence 9.32.3.9.(3)]. Where this is not acceptable, the prescriptively described alternatives must be abandoned and a system fully complying with CAN/CSA-F326-M must be designed.

One advantage of solid-fuel-burning devices is that their spillage is readily detected by a carbon monoxide alarm (which is not true of gas- or oil-burning devices). Therefore, where this is the only type of spillage-susceptible combustion device present, one has the choice of not providing makeup air for exhaust devices [see Sentence 9.32.3.8.(6)]: the carbon monoxide alarm required by Sentence 9.32.3.9.(3) will warn occupants when depressurization is causing spillage.

Battery-operated carbon monoxide alarms are permitted, but they must be mechanically fixed to a surface.

INTERPRETATION

1. Category I and II appliances do not meet the definition of either *mechanically vented* or *direct-vented*. As such, any dwelling unit with a category I or II appliance installed within it shall be protected from the effects of depressurization in accordance with the requirements of Article 9.32.3.8.
2. All category III and IV appliances are considered to meet the definition of *mechanically vented*. Any dwelling unit with category III or IV fuel-fired space-heating appliance or fuel-fired water-heating appliance does not need to be protected from the effects of depressurization in accordance with the requirements of NBC(AE) Article 9.32.3.8.
3. Appliances that are installed such that combustion air and products of combustion are directly supplied from and discharged to the exterior via independent, totally enclosed passageways that are connected directly to the appliance are considered to meet the definition of direct-vented and not subject to depressurization.

This INTERPRETATION is applicable throughout the province of Alberta.