

Gas Information Sheet 38

Testing for negative pressure and carbon monoxide spillage



Introduction

This gas information sheet provides guidance to gasfitters when testing for negative pressure and carbon monoxide (CO) spillage while carrying out gas service work^[1]. The sealing of buildings to achieve higher energy efficiency coupled with the increased use of extraction fans (like high capacity range hoods, exhaust fans, or any other device that can draw air out of the space) can adversely impact the safe operation of internal open-flue gas appliances, leading to CO spillage.

Australian gas appliance standards state there can be no combustion product leakage or spillage (usually detected from the draught diverter and/or the warm air outlet)^[2]:

- 5 minutes after ignition if the appliance is a gas space heater, indirect gas-fired ducted air-heater, or a Type 2 decorative-effect gas heater^[3]
- 10 minutes after ignition if the appliance is a Type 1 decorative-effect heater^[4] installed in an existing fireplace

CO testing for indoor, open-flued gas heaters

Testing for CO spillage from open-flued gas heaters must be carried out in four stages and in the following order (otherwise you will not know whether the fault lies with negative pressure when extraction fans are operating or with the appliance):

1. **Establish baseline conditions.** This allows you to observe any effects the weather conditions are having on the fluing
2. **Test for a negative pressure environment.** This is a smoke test using smoke matches, incense sticks, or any other suitable smoke producing device. The appliance is off and at room temperature, and all extraction fans are turned on
3. **Test for CO spillage.** The appliance and all extraction fans are left on
4. Assessing CO test outcomes.

When using CO measuring equipment, always:

- Follow the manufacturer's instructions for the correct use of measuring equipment
- Ensure that measuring equipment has been calibrated yearly. The equipment supplier should be able to assist with this requirement. For more information see Gas Information Sheet No.37 Carbon Monoxide Measuring Equipment

While carrying out CO spillage testing, always take personal CO exposure readings at the same time. Measure the CO levels where you are located. This information will allow you to calculate your average CO exposure for an eight-hour period. For more information see Gas Information Sheet 44, Carbon Monoxide Safe Working Level

1) Establish baseline conditions

1. Ensure the gas heater is switched off and the flue is cold.
2. Close all external doors and windows.
3. Ensure all extraction fans are switched off.
4. Position a suitable smoke producing device at the appliance draught diverter relief openings, or next to appliance openings for combustion air.
5. Generate smoke and watch it for any effects from weather conditions (for example, wind gusts or airflow within the flue/chimney due to temperature differences between the indoors and outdoors).
6. Note any observable effects so a comparison can be made when the test for a negative pressure environment is conducted.

2) Test for a negative pressure environment

1. Ensure the gas heater is switched off and the flue is cold.
2. Ensure all external doors and windows are still closed.
3. Ensure all extraction fans are operating.
4. Open or close internal doors to achieve the greatest possible negative pressure.
5. Generate smoke and check it is not drawn away from the appliance draught diverter or from the appliance's combustion air intake.

If the smoke is:

- Different from the baseline condition and is being drawn away from the appliance, negative pressure is present and must be addressed; see Fixing a negative pressure environment (below) for information about how to do this
- The same as the baseline condition, the extraction fans are not having any observable affect.

For more information about the test for a negative pressure environment, see Energy Safe Victoria's guide to negative pressure:



<https://www.youtube.com/watch?v=-BMy9lvJM2s>

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Fixing a negative pressure environment

You can establish the amount of ventilation required to correct a negative pressure environment by slowly opening a window in the room where the appliance is installed until the smoke responds in the same way as the baseline condition test. The size of the window's open area is equivalent to the permanent ventilation needed to overcome the negative pressure.

Record the size of the ventilation area required before proceeding.

For a new installation, this ventilation must be installed prior to commissioning the appliance.

3) Test for CO Spillage

1. Close any windows opened during the test for a negative pressure environment.
2. Turn on your detection equipment and record the background CO reading in the room where the appliance is installed. (Remember that a background CO reading may occur due to other sources, like a cooktop or from the smoke test.)
3. Ensure all extraction fans are still operating.
4. Switch on the appliance and adjust it to the highest settings for the burner and appliance fan (if fitted). During this period, commission the appliance in accordance with the manufacturer's instructions and ensure that the appliance being tested is operating at its nominal test-point pressure.
5. Place the CO detection equipment's sampling probe at all locations where leakage or spillage of combustion products can occur:
 - Draught diverter relief openings (always ensure that the sampling probe is positioned next to the opening and not inside the draught diverter)
 - Heat exchanger joints
 - Warm air outlet
 - Flue connection and joints
 - Base of the flue product collection hoods.
6. Continue monitoring for CO spillage and record the readings taken after the appliance has been operating for:
 - 5 minutes from cold if it is a gas space heater, indirect gas-fired ducted air-heater, or a Type 2 decorative-effect gas heater (allow another five minutes if the appliance is installed in a chimney without a chimney liner)
 - 10 minutes from cold if it is a Type 1 decorative-effect gas heater.
7. Take the background reading again, as the appliance might have been spilling during the warm up period.

The CO reading at Step 6 **must not** exceed the reading at Step 7 (the room's background reading).

4) Assessing CO test outcomes

CO spillage is not detected

If no CO spillage is detected but there is evidence of negative pressure, then advise the customer to **stop using the appliance until one of the following actions have been taken:**

- The negative pressure situation has been fixed
- As a temporary measure, a window is left open in the rooms where the extraction fans are located or all extraction fans are switched off while the heater is operating.

When there is no evidence of negative pressure, testing is complete.

For existing appliance installations where negative pressure is identified but cannot be immediately rectified by installing additional permanent ventilation:

1. Give the client the Energy Safe / Victorian Building Authority (VBA) co-branded advice letter and reiterate the potential dangers of CO and the effect of negative pressure
2. Record the negative pressure on the VBA service record and submit the record with the VBA.

CO spillage is detected

If CO spillage is detected, establish whether the cause is negative pressure or an appliance fault.

To establish the cause of the CO spillage:

1. Switch off all extraction fans and operate the appliance at the highest settings for the burner and appliance fan (if fitted).
2. After 5 minutes, if:
 - there is still CO spillage (and no negative pressure with all extraction fans off), then check for faults with the appliance or flue; if no fault can be found (or rectified), isolate the appliance and contact the appliance manufacturer (or consider replacing the heater if it is beyond its life expectancy).
 - the CO spillage has stopped – then negative pressure is the cause. Additional ventilation must be installed and the tests repeated or the gas appliance must be isolated until additional ventilation is installed.

If the client does not agree to ventilation being installed and refuses to allow you to make the installation safe, then contact Energy Safe on 1800 652 563 (and select option 5).

Testing central and room-sealed space heaters

The procedure to test for negative pressure and CO spillage is different when testing:

- Central heating units
- Room-sealed space heaters.

Central heating units

Spillage from central heating units (ducted air heaters) ^[5] located outside a building, in a roof, or under a floor can go unnoticed, with CO being drawn into a building from a cracked heat exchanger or damaged combustion chamber seals.^[6] Follow this procedure:

1. Check the background CO levels.

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2. Place the sampling probe in the air stream of a duct outlet, floor register, or ceiling register to test the CO level. Monitor for 10 minutes.
3. If the CO level exceeds the background level then the appliance is leaking or spilling CO. If no fault can be found (or rectified), isolate the appliance and contact the appliance manufacturer (or consider replacing the heater if it is beyond its life expectancy).

Room-sealed space heaters

1. Check the background CO levels.
2. Operate the appliance for 10 minutes and then check for CO at the appliance.
3. If the CO level exceeds the background level then the appliance is leaking or spilling CO. If no fault can be found (or rectified), isolate the appliance and contact the appliance manufacturer (or consider replacing the heater if it is beyond its life expectancy).

The CO level should not exceed the background level; the appliance must be made safe if it does.

Always check the lower levels of room-sealed gas space heaters as they may incorporate a condensate drain at the base of the heat exchanger that can drain combustion products into the building.

References

^[1] Gas Information Sheet 38 outlines the sequence of test procedures for negative pressure and CO spillage should be used when carrying out gas appliance servicing in conjunction with AS 4575 Servicing Type A gas appliances.

^[2] While operating at its nominal gas consumption.

^[3] Type 2 Decorative flame effect fires supplied with an enclosure and designed to be freestanding, with a flue that vents the flue gases outside the building.

^[4] Type 1 Decorative flame effect fires without an enclosure and designed to be installed in an existing fireplace with a chimney, which vents the flue gases outside the building.

^[5] If the central heating unit is an open-flue type, then follow the testing procedures for open-flue gas appliances.

^[6] More combustion products can enter the supply air stream and the building as the heat exchanger heats up and cracks and openings expand.

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We regulate the energy industry and sector to ensure generation, supply and usage uphold safety standards, and engage with the community to raise awareness of energy safety risks.

In everything we do, we strive to deliver on our purpose to keep Victoria energy safe. Always.

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