# VENTILATION OF DOMESTIC NATURAL GAS APPLIANCES

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Definitions of terms specific to ventilation (printed in **bold type** on their first main appearance) are given on page 20.

## Contents

## Why ventilation is important

When natural gas undergoes **complete combustion** the only **products of combustion** (**POC**) are **carbon dioxide** and water vapour. The volume of **combustion air** needed to achieve complete combustion is approximately ten times the volume of gas being burned. In other words, the minimum **air : gas ratio** needed to achieve complete combustion is 10 : 1.

Lack of clean air causes **incomplete combustion**, where the poisonous gas **carbon monoxide** is produced together with **soot**.

In addition to providing combustion air, ventilation is also needed for appliance cooling, human comfort, dilution of flueless appliance emissions and to provide motive force for chimneys including the operation of **downdraught diverters**.

## References

*BS 5440-2:2009 Flueing and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases). Specification for the installation and maintenance of ventilation provision for gas appliances*

*BS 5871-3:2005 Specification for the installation and maintenance of gas fires, convector heaters, fire / back boilers and decorative fuel effect gas appliances*

*The Building Regulations Part J (Heat Producing Appliances) 2010 and Approved Document J (reprinted 2015)*

*IGEM/G/11 The Gas Industry Unsafe Situations Procedure*

*BS 5250:2011+A1:2016 Code of practice for control of condensation in buildings*

## Unsafe Situations categories

According to IGEM/G/11 a gas appliance is deemed **At Risk** (**AR**) if:

- the air vent supplying it is less than 90 % of the required size, or:
- the air vent supplying it is unsuitable (closable, fitted with a fly-screen etc.), or:
- no air vent is fitted where one is required, or:
- the room volume is smaller than manufacturer's instructions or standards permit

More than one related AR fault can be upgraded to **Immediately Dangerous** (**ID**).

Spillage of products of combustion into a room or internal space from a flued appliance is ID.

## Gas appliance categories

There are three 'flue categories' or 'flue types' of gas appliance, known as A, B and C. Their differences arise from their source of combustion air and where they release products of combustion (POC).

### Category A – Flueless appliances

- Take combustion air from the room
- Release POC into the room
- Need a source of ventilation in the room

Flueless cooker

Flueless fire

### Category B – Open flue appliances

- Take combustion air from the room
- Release POC outside via flue or chimney
- Need a source of ventilation in the room

Open flue fire

Open flue boiler

### Category C – Room sealed appliances

- Take combustion air from outside via air intake
- Release POC outside via flue
- Do not need a source of ventilation in the room
- May need cooling ventilation in compartments

Room sealed boiler

Flue terminal and air intake

## Heat input

Heat input is effectively a measure of how much gas an appliance burns in a given time. For certain appliances it can be used to calculate the size of air vent needed. All ventilation calculations in these notes are based on **net** (sometimes spelled 'nett') heat input measured in **kilowatts** (**kW**).

*Note: do not use **heat output** for ventilation calculations. Heat output is a measure of the useful heat produced by an appliance, not of the amount of gas it consumes.*

Heat input is usually given on the appliance data badge and in manufacturer's instructions (MI).

Older appliance MI may specify **gross** heat input in kW or British Thermal Units per hour (BTU / h). In some cases, appliance **gas rate** may be known instead of heat input. The table below can be used to convert these to kW (net):

| Unit of measurement | Conversion to kW (net) |
|---|---|
| kW (gross heat input) | ÷ 1.1 |
| BTU / h (gross heat input) | ÷ 3787 |
| $m^3$ / h (gas rate) | × 9.5 |
| $ft^3$ / h (gas rate) | × 0.27 |

**Conversion to net heat input (kW)**

### Converting to net heat input (kW) – examples

*1. The data badge of a 1980s open flue boiler states its heat input as 24 kW*

The appliance is old and the data badge does not specify 'net' so we may assume that the given heat input is gross.

Net heat input = 24 ÷ 1.1 = 21.8 kW

*2. The MI for an open flue water heater specifies its heat input as 33,000 BTU / h*

Net heat input = 33000 ÷ 3787 = 8.7 kW

*3. The gas rate of an appliance is measured at 2.61 cubic metres per hour ($m^3$ / h)*

Net heat input = 2.61 × 9.5 = 24.8 kW

## Air vents for gas appliances

Where purpose-provided ventilation is required, it shall be provided by air vents which:

- are rigid
- are not closable
- do not have a fly-screen
- do not have openings narrower than 5 mm

To prevent the entry of pests, vents to outside should have openings no wider than 10 mm.

### Measuring an air vent

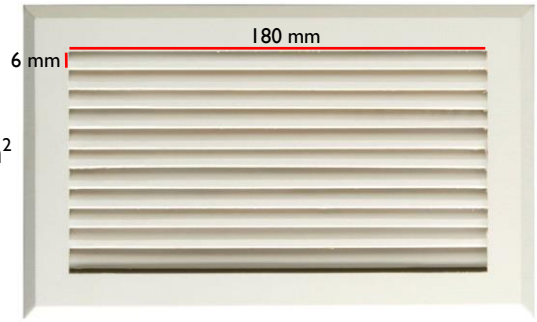
The **free area** (or 'free air') of an air vent is the total area of the holes open to the air source. Modern vents are usually marked with their free area in square centimetres ($cm^2$).

Free area can be measured as follows:

Each hole = 180 mm × 6 mm = 1080 $mm^2$

Total free area = 1080 $mm^2$ × 11 holes = 11880 $mm^2$

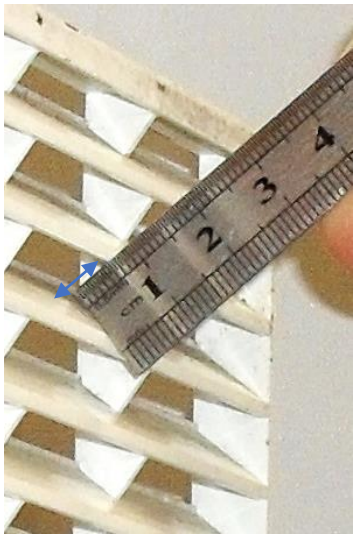
Convert to $cm^2$ = 11880 $mm^2$ ÷ 100 = 118.8 $cm^2$



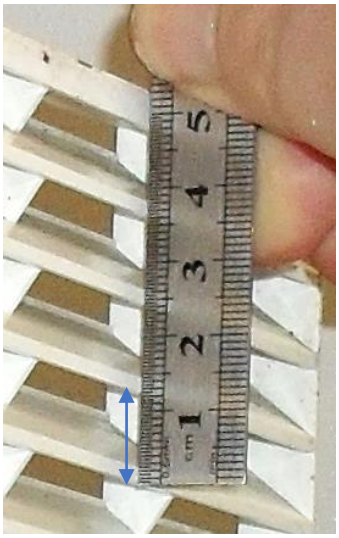

### Vents with angled louvres

If a vent has angled or sloping louvres it is important to use the correct method to measure hole width. Use a steel rule with the base of the rule resting flat on a louvre. Measure the air gap only; do not include the thickness of the vent material.

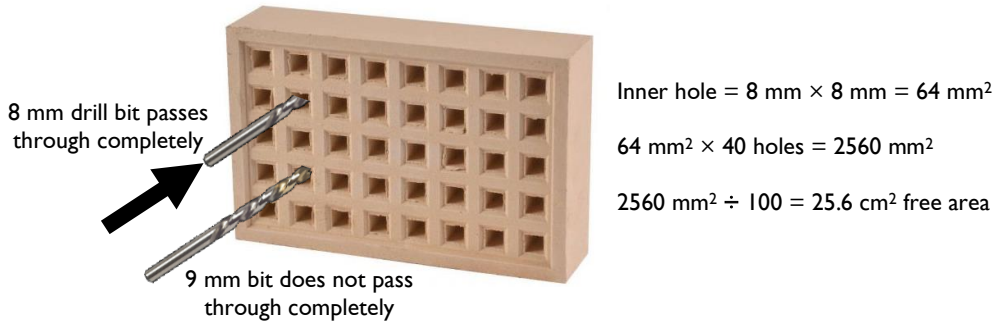
Correct measurement 6 mm



<u>Incorrect</u> measurement 12 mm overestimates vent free area by 100 %



## Terracotta air bricks




Air bricks are an acceptable form of air vent for gas appliances although their free area is small. They are often used in a supplementary role with other types of vent, or when ventilation requirements are just above adventitious allowance (page 8).

Many air bricks have holes which taper down in size from front to back. Free area must be calculated from the smaller side. Unfortunately, the back of the air brick will be inside the wall cavity, making it impossible to access. This problem can be solved by using a tapered measuring device or by inserting drill bits of increasing diameter as shown above.

## Intumescent air vents

Intumescent vents are needed when ventilation must pass through a fire-resistant wall. They close when overheated in the event of a fire. A special material inside the vent expands greatly to completely block air flow. This limits the spread of smoke and poisonous gases and stops the vent from acting as a source of oxygen for the fire.

Intumescent vent closure is permanent. After activation, the vent must be replaced before gas appliances can be re-commissioned.

## Ventilation of open flue appliances

Manufacturer's instructions (MI) will specify appliance ventilation requirements. If MI are unobtainable, room ventilation for an open flue appliance can be calculated as:

$$\text{Ventilation required (cm}^2\text{)} = \text{Net heat input (kW)} \times 5$$

*Note: this formula does not apply to* ***decorative fuel effect (DFE)*** *fires (see below).*

### Adventitious air

In older, unrenovated properties a significant amount of 'adventitious' air comes into rooms through gaps around window frames, door frames and floorboards. Where adventitious air is available, the ventilation requirement of one open flue appliance in the room can be reduced by **35 cm²**.

*Note: reducing vent size by 35 cm² is equivalent to subtracting 7 kW from appliance heat input in the ventilation formula. A non-DFE open flue gas fire of heat input 7 kW or lower therefore does not need an air vent in a room where adventitious air is available.*

Properties built after 2002 and older, fully-renovated properties may have double glazing and improved draughtproofing which reduces or eliminates adventitious air. A gas engineer must make an informed on-site decision whether adventitious air is available or not.

### Decorative fuel effect (DFE) appliances

A DFE is a type of gas fire in the form of a basket of ceramic radiants made to look like coal, wood or stone placed inside or underneath an open chimney. *Note: unlike DFEs, inset live fuel effect (ILFE) fires have a convector canopy or heat exchanger above the radiant bed. ILFE fires should not be confused with DFEs.*

Most DFEs need an air vent of **100 cm²** regardless of heat input. This value has already had adventitious allowance taken off and should not be reduced further. Air vents for DFEs should not be situated inside the chimney area.

DFE

Requires 100 cm² ventilation

ILFE (<u>not</u> a DFE)

Ventilation according to above formula

## Open flue ventilation – worked examples

*1. A living room in a new house contains an open flue ILFE fire of heat input 6.5 kW net*

6.5 × 5 = 32.5 $cm^2$ ventilation required.

There is no allowance for adventitious air in a new-build property.

*2. A kitchen in an unrenovated house built in 1989 contains an open flue boiler of 26 kW net*

26 × 5 = 130 $cm^2$

Assuming adventitious air is available, 130 – 35 = 95 $cm^2$ ventilation required.

*3. A room in an unrenovated house built in 1983 contains a DFE*

100 $cm^2$ ventilation required as standard for DFEs.

*4. A bedroom of a unrenovated 1970s house contains an open flue gas fire of 6.6 kW gross*

Using the conversion chart (page 5), 6.6 kW gross ÷ 1.1 = 6.0 kW net

6.0 × 5 = 30 $cm^2$ ventilation required.

Adventitious ventilation provides 35 $cm^2$, so no vent is required.

*5. A room in an unrenovated pre-war house contains an open flue boiler of 72,000 BTU / h*

Using the conversion chart (page 5), 72000 ÷ 3787 = 19 kW net

19 × 5 = 95 $cm^2$

Assuming adventitious air is available, 95 – 35 = 60 $cm^2$ ventilation required.

## Ventilation of flueless appliances

Manufacturer's instructions (MI) will specify appliance ventilation requirements. If MI are unobtainable, use the flueless ventilation chart from BS 5440-2 (adapted below):

| Appliance type | Maximum heat input NOTE 1 | Room volume NOTE 2 | Vent size required NOTES 3 & 4 | Openable window needed? NOTE 5 |
|---|---|---|---|---|
| Cooker, grill or hotplate | No specified maximum | < 5 $m^3$ | 100 $cm^2$ | YES |
| | | 5 to 10 $m^3$ | 50 $cm^2$ if there is no door to outside<br>No vent needed if there is a door to outside | |
| | | > 10 $m^3$ | No vent required | |
| Instantaneous water heater | 11 kW (net) | < 5 $m^3$ | Not permitted (At Risk) | YES |
| | | 5 to 10 $m^3$ | 100 $cm^2$ | |
| | | > 10 to 20 $m^3$ | 50 $cm^2$ | |
| | | > 20 $m^3$ | No vent required | |
| Fire in habitable room | 0.045 kW (net) / $m^3$ | Minimum 22.22 $m^3$ / kW | If heat input ≤ 2.7 kW = 100 $cm^2$<br>Otherwise = (Heat input – 2.7) × 55 + 100 $cm^2$ | YES |
| Fire in hallway, landing etc. | 0.090 kW (net) / $m^3$ | Minimum 11.11 $m^3$ / kW | If heat input ≤ 5.4 kW = 100 $cm^2$<br>Otherwise = (Heat input – 5.4) × 27.5 + 100 $cm^2$ | YES |

**Ventilation chart for flueless appliances**

*Note 1: heat input limits apply to certain types of flueless appliance. For example, flueless fires are limited to a heat input of 0.045 kW per cubic metre of available room volume.*

*Note 2: unlike open flue appliances, which draw new air into a room, flueless appliances simply use up oxygen and replace it with products of combustion (POC). Room size is therefore an important factor in the safe dilution of POC and in determining flueless appliance ventilation.*

*Note 3: adventitious allowance should not be deducted for flueless appliances.*

*Note 4: flueless appliance ventilation should come directly from outside, either through an air vent on an outside wall or via a continuous duct to outside.*

*Note 5: because they emit heat and water vapour into the room, flueless appliances need additional* ***purge ventilation*** *in the form of an openable window to outside or equivalent (e.g. an extractor fan or cooker hood extractor). The householder can open the window or turn on the extractor if the room becomes hot, stuffy or humid because of appliance emissions.*

## Flueless ventilation – worked examples

*1. A kitchen of 12 $m^3$ contains a flueless water heater of 8 kW net heat input*

From the chart, 50 $cm^2$ ventilation and an openable window are required.

*2. A room of 9 $m^3$ with no door to outside contains a flueless cooker*

From the chart, 50 $cm^2$ ventilation and an openable window are required.

*3. A flueless fire of heat input 3.1 kW (net) is to be installed in a living room of 70 $m^3$*

First determine whether the room is big enough. From the chart, room size must be at least 3.1 × 22.22 = 68.9 $m^3$. The room size is acceptable.

The required ventilation is:

(Heat input – 2.7) × 55 + 100
= (3.1 – 2.7) × 55 + 100
= 0.4 × 55 + 100
= 122 $cm^2$ and an openable window

*4. While performing a landlord's safety check you encounter a flueless fire of net heat input 3.0 kW installed in a living room of 36 $m^3$. You measure the room air vent as 100 $cm^2$.*

From the chart, room size must be at least 3.0 × 22.22 = 66.7 $m^3$. This room is too small. This is an At Risk situation.

Ventilation required is (3.0 – 2.7) × 55 + 100 = 116.5 $cm^2$. The room vent is less than 90 % of the required size. This is a second At Risk situation.

Two related At Risk situations may be upgraded to Immediately Dangerous.

*5. A flueless water heater of net heat input 13 kW is installed in a kitchen of 40 $m^3$*

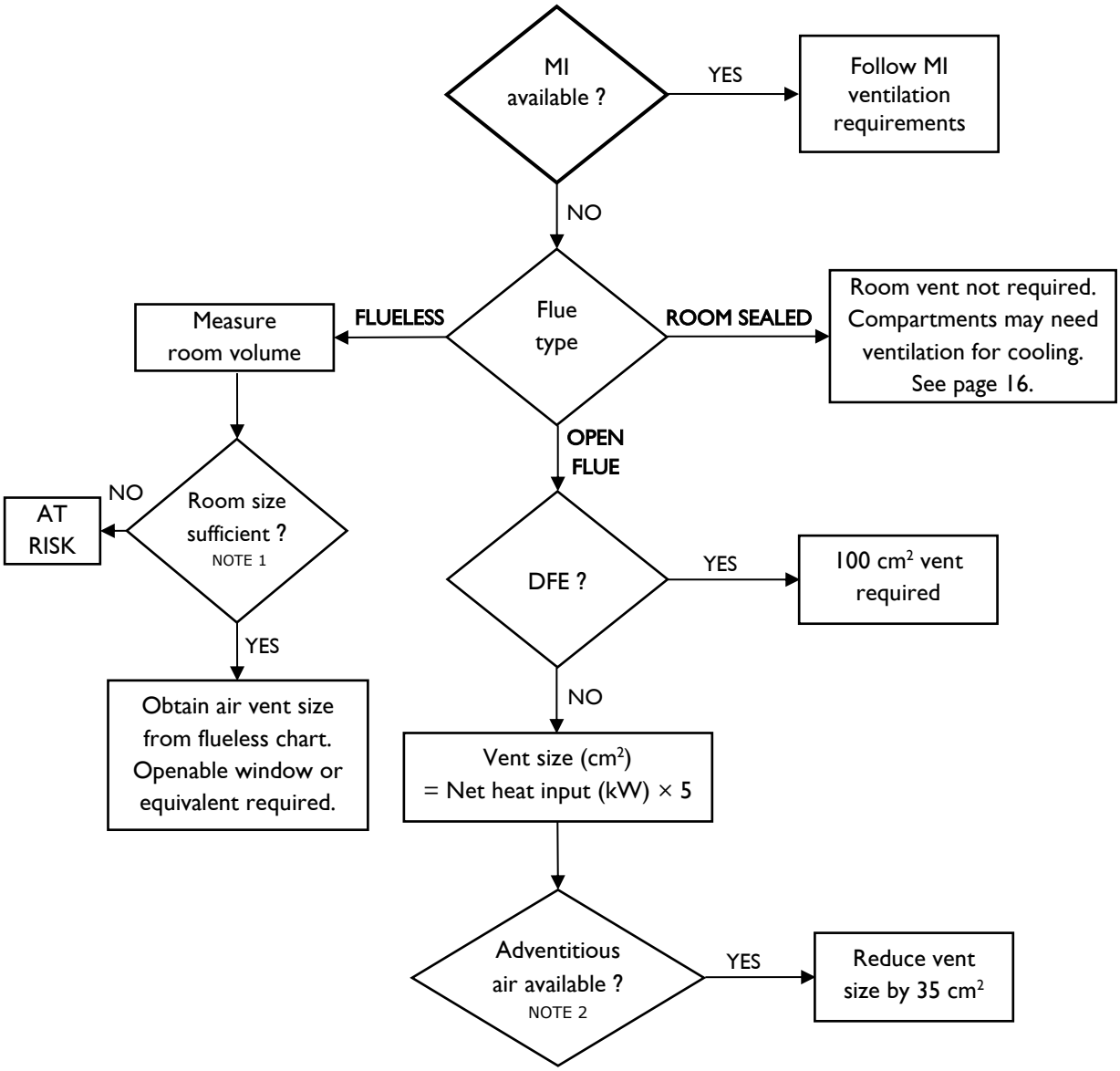
From the chart we see that the water heater's heat input is above the 11 kW limit. This is an At Risk situation.

## Open flue and flueless ventilation – summary of differences

| Flueless appliance ventilation | Open flue appliance ventilation |
|---|---|
| If MI unobtainable, use chart (page 10) | If MI unobtainable, use formula (page 8)<br>100 $cm^2$ for DFEs |
| Must be direct, i.e. air must come directly from outside or be ducted from outside | Can be indirect, i.e. air can be taken through a series of internal vents. See page 19. |
| No adventitious allowance | 35 $cm^2$ adventitious allowance in older, unrenovated properties (not for DFEs) |
| Vent size dependent on room volume for cookers and water heaters | Vent size not dependent on room volume |
| Minimum room sizes apply for water heaters and fires | No minimum room size |
| Additional purge ventilation (e.g. openable window) required | No purge ventilation required |

*Note: the term 'purge ventilation' is not related to the purging of air from gas installations.*

## Ventilation flowchart for a room containing a single appliance




*Note 1: flueless instantaneous water heaters require a room volume of at least 5 $m^3$. Flueless gas fires require the room volume to be at least 22.22 $m^3$ per kW net heat input for habitable rooms and 11.11 $m^3$ per kW net heat input for non-habitable rooms.*

*Note 2: properties built after 2002 or older properties that have been renovated to modern standards may not have any source of adventitious air.*

## Ventilation of rooms containing more than one appliance

Where a room contains more than one gas appliance, we use the **multi-appliance rule**:

A room's overall ventilation requirement is the largest of either:

- the total requirement of all **open flue space heaters**, or:
- the total requirement of all **flueless space heaters**, or:
- any other individual requirement

*Note 1: **space heaters** are appliances designed to heat living spaces, e.g. fires, warm air heaters and central heating boilers. Cookers and water heaters are not space heaters and are always considered individually. Although they heat the room via wastage, this is not their purpose and they should never be used as space heaters (their carbon monoxide emissions are too high for continuous use).*

*Note 2: for open flue space heaters, take off any adventitious allowance only once from the total requirement, not for each individual appliance.*

*Note 3: for exactly two appliances, the rule simplifies to: 'if both appliances are space heaters of the same flue type, add their requirements; otherwise, fit the larger vent requirement only.'*

## Multi-appliance ventilation – worked examples

*1. A kitchen of 18 $m^3$ in an unrenovated 1990s house contains the following gas appliances:*

*a) a flueless water heater of net heat input 8.5 kW*
*b) an open flue central heating boiler of net heat input 28 kW*
*c) an open flue gas fire of net heat input 5 kW*

From the flueless chart, appliance a) requires 50 $cm^2$ and an openable window.

Appliances b) and c) are both **open flue space heaters**. According to the multi-appliance rule, we must find their total ventilation requirement. We can treat them as a single appliance of combined heat input 28 + 5 = 33 kW. Taking adventitious air into account, their ventilation requirement is 33 × 5 – 35 $cm^2$ = 130 $cm^2$

The open flue space heaters' requirement is larger than that of the water heater, so the room must be fitted with a vent of 130 $cm^2$. An openable window is also needed because there is a flueless appliance in the room.

*2. What ventilation is needed in an unrenovated 1950s house for a 20 $m^3$ kitchen containing:*

*a) a flueless cooker*
*b) an open flue boiler of net heat input 26 kW*
*c) a flueless water heater of net heat input 10 kW*
*d) an open flue gas fire of net heat input 6 kW*

From the flueless chart, appliance a) does not require purpose-provided ventilation but does require an openable window.

From the flueless chart, appliance c) requires 50 $cm^2$ and an openable window. *Note: a single window is sufficient for both flueless appliances.*

Appliances b) and d) are both **open flue space heaters**. According to the multi-appliance rule, we must find their <u>total</u> ventilation requirement. We can treat them as a single appliance of 26 + 6 = 32 kW. Taking adventitious air into account, their ventilation requirement is $32 \times 5 - 35 = 125$ $cm^2$

The largest requirement is for the open flue space heaters, so the room needs 125 $cm^2$ ventilation. An openable window is needed because there are flueless appliances in the room.

*3. What is the ventilation requirement of a 70 $m^3$ living room containing:*

*a) a DFE of net heat input 5.6 kW*
*b) a flueless gas fire of net heat input 2.9 kW*

Both a) and b) are space heaters but are not of the same flue type, so their ventilation requirements are <u>not</u> added. Instead, the room should be ventilated to the larger requirement.

Appliance a) needs 100 $cm^2$

According to the flueless ventilation chart, the room size for appliance b) should be at least $2.9 \times 22.22 = 64.4$ $m^3$. The room is big enough.

Appliance b) needs $(2.9 - 2.7) \times 55 + 100 = 111$ $cm^2$

The larger requirement is for appliance b), so the room needs 111 $cm^2$ ventilation. An openable window is needed because there is a flueless appliance in the room.

## Compartment ventilation

*Note: for **balanced** **compartments** see page 18.*

Open flue and room sealed appliances may be installed in compartments for decorative reasons. There should be a warning label fitted inside the compartment informing the householder not to block vents and not to use the compartment for storage or airing linen unless there is a purpose-designed partition.

A compartment for an open flue appliance shall be ventilated for combustion air and cooling.

A compartment for a room sealed appliance does not need ventilation for combustion air but *may* need cooling ventilation. The only way to be certain is to consult manufacturer's instructions (MI). If MI are unobtainable, assume cooling ventilation is required.

Compartment vents shall be provided at both high and low level. The low-level vent allows the entry of cool air. The high-level vent allows the removal of warm air by convection. For open flue appliances, high-level and low-level vents should communicate with the same internal space or outside wall. Otherwise, there is the possibility of **cross-ventilation**, where unequal air pressures create draughts potentially harmful to the operation of the flue.

If MI are unobtainable, the table below can be used to size compartment vents:

| **Vent sizes** ($cm^2$ per kW) | Open flue | | Room sealed | |
|---|---|---|---|---|
| | Vents to outside | Vents to room | Vents to outside | Vents to room |
| High-level | 5 | 10 | 5 | 10 |
| Low-level | 10 | 20 | 5 | 10 |

**Compartment vent size table**

*Note: there is no allowance for adventitious air in compartment vent sizing.*

In the case of an open flue appliance in a compartment vented to a room, the room must be ventilated according to the usual requirements of the appliance.

Compartments shall not be used to house open flue appliances in a bathroom or shower room. Compartment air vents shall not communicate with a bathroom or shower room.

Ventilation may be ducted into a compartment from a ventilated roof space. Separate ducts shall be provided to high and low level. The cross-sectional area of ducts shall be at least equal to the area of the vents they serve. A ventilated roof space may be considered as outside air if sufficiently ventilated to BS 5250 but otherwise should be treated as an internal space.

## Compartment ventilation – worked examples

*1. A room sealed boiler of 28 kW net heat input is to be installed in a compartment with air vents communicating directly to outside air*

From the table, the compartment requires:

$28 \times 5 = 140$ cm$^2$ at high level

$28 \times 5 = 140$ cm$^2$ at low level

*2. An open flue water heater of 18 kW net heat input is installed in a compartment with air vents communicating with a kitchen*

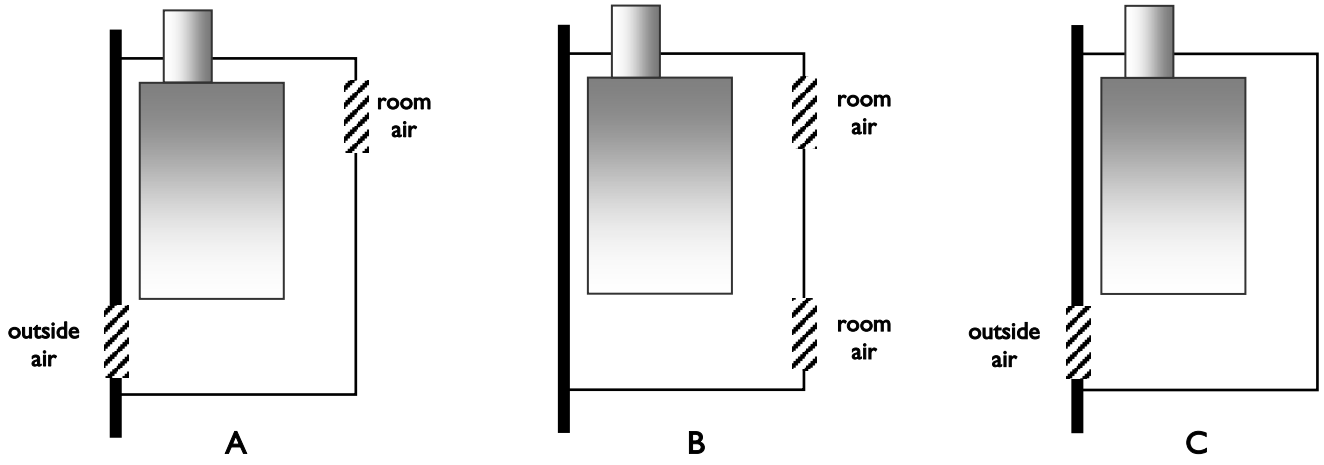
From the table, the compartment requires:

$18 \times 10 = 180$ cm$^2$ at high level

$18 \times 20 = 360$ cm$^2$ at low level

The kitchen requires a vent of $18 \times 5 = 90$ cm$^2$ (55 cm$^2$ if adventitious air is available).

*3. Are the following open flue compartment installations acceptable or not?*




A – Unacceptable: vents are communicating with different spaces (cross ventilation).

B – Acceptable

C – Unacceptable: no high-level ventilation is provided.

## Balanced compartments

A balanced compartment is a purpose-designed housing for an open flue appliance. It brings some of the advantages of a room sealed balanced flue; for example, low-level flue termination.

To achieve 'room sealed' status the compartment door is draughtproofed, self-closing and interlocked with the appliance so that the appliance cannot function when the door is open. A notice is attached stating that the door must be kept closed at all times.

To achieve the balanced flue effect, the sole air inlet to the compartment is situated no more than 150 mm below the flue outlet (so that they are in the same atmospheric pressure zone).

Two types of balanced compartment exist (Diagrams A and B below). These have different ventilation requirements.

If the air intake is ducted to low level (Diagram A), the duct and vent shall have minimum cross-sectional area of 7.5 $cm^2$ per kW net of the appliance's maximum rated input.

*Note: if the ceiling of the compartment is more than 300 mm above the bottom of the downdraught diverter, an additional high level opening should be provided in the air duct of the same size as the duct.*

If the air intake is at high level (Diagram B) it shall have minimum free area of 12.5 $cm^2$ per kW net of the appliance's maximum rated input.

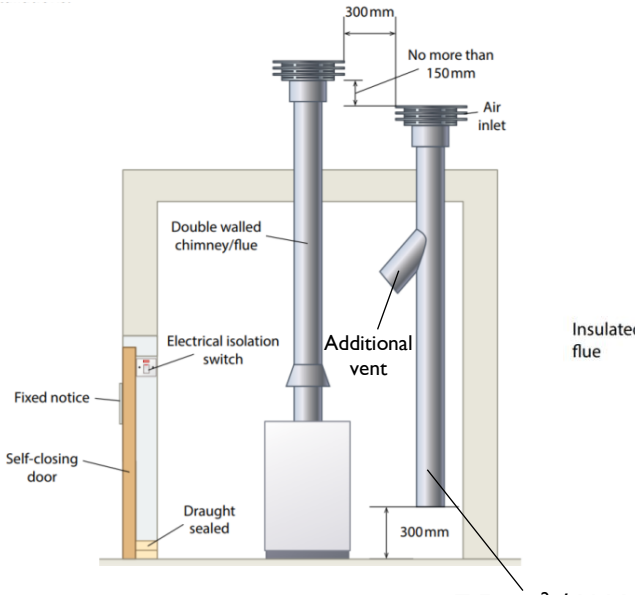



Diagram A
Balanced compartment with air intake ducted to low level

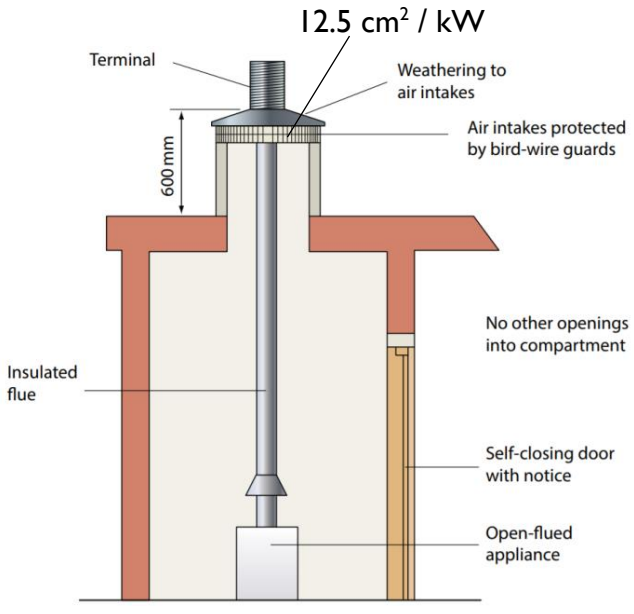



Diagram B
Balanced compartment with air intake at high level

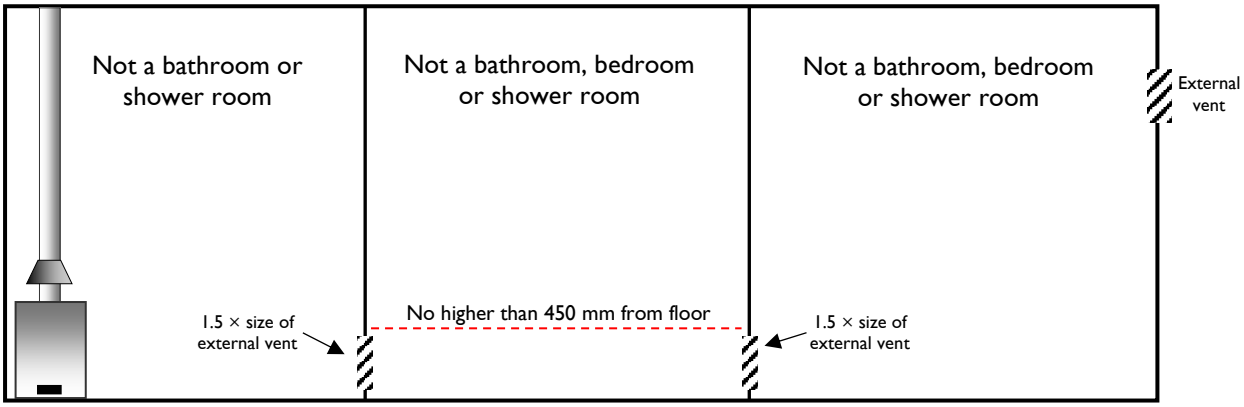
## Indirect ventilation

If there is no suitable external wall, combustion air for open flue appliances may be brought in indirectly through an adjoining room or series of rooms via internal air vents.

*Note: combustion air for flueless appliances shall be taken directly from outside or be ducted directly from outside.*

If the air path passes through more than one internal wall, all internal vents should be 1.5 times larger than the external vent (which is sized in the usual way; see page 8). The air path cannot pass through a bathroom, shower room or bedroom.

Internal air vents should be no higher than 450 mm from the floor in order to slow down the passage of smoke and poisonous gases in the event of a fire.




**Indirect ventilation**

## Indirect ventilation – worked example

*An open flue water heater of net heat input 15 kW is installed in the kitchen of a renovated house. Ventilation is to be taken through two adjoining rooms. Calculate the size of the external vent and the two internal vents, stating any positional requirements.*

External vent: $15 \times 5 = 75$ cm$^2$

The house is renovated so we ignore adventitious air.

Both internal vents will be $75 \times 1.5 = 112.5$ cm$^2$, no higher than 450 mm off the floor.

## Glossary

| | |
|---|---|
| Adventitious air | Air entering a room through gaps in window frames etc. |
| Air : gas ratio | The respective volumes of air and gas going into combustion |
| Air vent | An open grille designed to allow air into a room or **compartment** |
| Balanced compartment | A **room sealed**, **balanced flue** housing for an **open flue** appliance |
| Balanced flue | A flue with terminal in the same pressure zone as its air intake |
| Carbon | Chemical element produced by **incomplete combustion** as **soot** |
| Carbon monoxide | A poisonous, odourless gas produced by **incomplete combustion** |
| Carbon dioxide | One of the **products of combustion** of **gas** |
| CO | Chemical formula of **carbon monoxide** |
| $CO_2$ | Chemical formula of **carbon dioxide** |
| Combustion air | Air used for the combustion of **gas** |
| Compartment | A cupboard or housing for an appliance |
| Complete combustion | **Gas** burned with enough **oxygen** to produce negligible **CO** |
| Cross-ventilation | **Ventilation** from different pressure zones causing draughts |
| Downdraught diverter | Part of an **open flue** that reduces the impact of wind |
| Flue | The chimney of an appliance |
| Flueless | Type of gas appliance with no chimney or **flue** |
| Free area | The total area of the openings in an **air vent** |
| Gas | Commonly-used abbreviation for **natural gas** |
| Heat input | A measure of the **gas** usage of an appliance in units of power |
| Hydrocarbon | A compound made up of only hydrogen and **carbon** |
| Incomplete combustion | **Gas** burned with too little **oxygen**, producing **carbon monoxide** |
| Indirect ventilation | **Ventilation** taken through a series of internal vents |
| Intumescent air vent | A special type of **vent** which permanently closes if there is a fire |
| Methane | A **hydrocarbon** fuel gas with the chemical formula $CH_4$ |
| MI | Manufacturer's instructions |
| Natural gas | A fuel gas composed mostly of **methane** |
| Open flue | Type of gas appliance with a chimney or **flue** |
| Oxygen | The active part of air that supports combustion |
| POC | **Products of combustion** |
| Products of combustion | Exhaust/waste gases produced by a fuel-burning appliance |
| Purge ventilation | A controllable source of cool fresh air, e.g. an openable window |
| Room sealed | Type of gas appliance completely sealed from the room it is in |
| Space heater | An appliance designed to heat living spaces |
| Soot | Black powdery deposits of **carbon** from **incomplete combustion** |
| Vent | Another name for an **air vent** |
| Ventilation | Provision of **combustion air** or cooling air to an appliance |
| Ventilator | Another name for an **air vent** |
| Vitiation | Contamination of **combustion air** by **products of combustion** |