

Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases) —

**Part 2: Specification for installation and
maintenance of ventilation for gas
appliances**

ICS 91.060.40

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee GSE/30, Gas installations (1st, 2nd and 3rd family gases), upon which the following bodies were represented:

BCEMA – British Combustion Equipment Manufacturers Association
Boiler and Radiator Manufacturers' Association Ltd
British Flue and Chimney Manufacturers' Association
Centrica
Consumer Policy Committee of BSI
CORGI – Council for Registered Gas Installers
DTI – Consumer Safety Unit
HSE – Health and Safety Executive
Heating and Ventilating Contractors' Association
Institute of Domestic Heating and Environmental Engineers
Institution of Gas Engineers
Liquified Petroleum Gas Industry Technical Association
Society of British Gas Industries
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Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
1 Scope	1
2 Normative references	2
3 Definitions	2
4 Design and materials for air vents and ducts	3
5 Size and position of air vents	5
6 Other aspects of ventilation	12
7 Maintenance	13
Bibliography	21
Figure 1 — Typical air vent arrangements	14
Figure 2 — Free-areas	15
Figure 3 — Air vents in series	16
Figure 4 — Air vent positions for an open-flued appliance in a room or internal space	17
Figure 5 — Air vent positions for an open-flued appliance in an appliance compartment	18
Figure 6 — Air vent positions for a room-sealed appliance in an appliance compartment, room and internal space	19
Table 1 — Minimum separation distances between air vents and appliance flue terminals (mm)	6
Table 2 — Minimum air vent free-area for appliance compartments: open-flued appliances	8
Table 3 — Minimum air vent free-area for appliance compartments: room-sealed appliances	9
Table 4 — Minimum permanent opening free-area for flueless appliances	11

Foreword

This part of BS 5440 has been prepared by Technical Committee GSE/30. It is a revision of the specification BS 5440-2:1989, which is withdrawn.

The title has been modified to incorporate actions required when maintaining appliances and the provisions for ventilation. A new Clause 7 has been introduced to cover this aspect.

This standard recognizes investigative work carried out by British Gas plc and other bodies into the magnitude of adventitious openings, which are always present in rooms to some degree. The lower limit of 35 cm² remains valid and this figure is used in this revision for open-flued appliances.

This standard allows manufacturers' instructions to specify a method of installation, testing, commissioning or maintenance which differs in points of detail from this standard. This reference to manufacturers' instructions is allowed only where it will result in at least an equivalent level of safety. In such circumstances, it is important that the manufacturer's instructions are followed.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Attention is drawn to the following statutory regulations. The regulations may be amended from time to time and whichever regulations are currently in force at the time an installation is carried out are to be complied with. The advice in this British Standard reflects the state of the regulations in 1999.

- a) The Gas Safety (Installation and Use) Regulations [1]. These control all aspects of the ways in which gas-fired systems are installed, maintained and used, in premises where they apply, and the classes of persons who may undertake gas work.
- b) The building regulations for the appropriate legislative region. These control works carried out in the construction of new or extension of existing buildings. Detailed advice for England and Wales [2] is given in approved documents and for Northern Ireland [3] in technical booklets. The Building Standards (Scotland) [4] are accompanied by methods that are deemed to satisfy these standards.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 21 and a back cover.

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1 Scope

1.1 Equipment

This part of BS 5440 specifies the ventilation requirements for new or replacement gas appliances for domestic or non-domestic purposes utilizing 1st, 2nd or 3rd family gases which carry the CE mark and with a rated heat input not exceeding 70 kW based on net CV (net calorific value). It may also be used for installations of appliances which are not required under the Gas Appliances (Safety) Regulations:1995 [5] to carry the CE mark, e.g. used appliances. This standard does not cover:

- a) LPG installations covered by the requirements of BS 5482-2 and installations with all gases covered by BS 5482-3;
- b) any gas installations in caravans, holiday homes or residential park homes constructed to conform to BS EN 721 or BS 3632 as appropriate, which were installed at the time of construction;
- c) decorative fuel effect gas appliances of the type covered by BS 5871-3.

NOTE 1 Standards that should be consulted are listed in normative references Clause 2 and the bibliography at the end of the standard.

NOTE 2 Maintenance requirements relating to existing vents are given in Clause 7.

NOTE 3 The installer should check the data given with an appliance to establish the basis on which the heat input is given. The data in this standard refers to heat input expressed in terms of net calorific values (CV) with conversion given for natural gas gross CV quoted in brackets where appropriate.

The ratio of gross:net heat input is approximately 1.11:1 for natural gas, 1.09:1 for propane and 1.08:1 for butane. For example, convert 9 kW input based on gross CV for natural gas to the equivalent net CV input as follows.

$$\text{Net input} = 9.0/1.11 = 8.1 \text{ kW.}$$

The change to the method of quoting input rating is not intended to have any significant effect on the sizes of vents required for gas appliances as compared with the previous version of this standard (BS 5440-2:1989).

The differences in gross:net input ratio between natural gas, propane and butane are marginal and this factor has been taken into account when specifying the method of calculating vent requirements in 5.2.1.

1.2 Competence

It is essential that persons carrying out the installation of any gas appliance be competent to do so, and, in the case of any work that is subject to the current Gas Safety (Installation and Use) Regulations, it is essential to comply with these regulations.

It is essential that persons who design the ventilation system or installation have a knowledge and understanding of the standards and regulations that apply to ensure that the completed plans will produce a safe and satisfactory installation.

COMMENTARY AND RECOMMENDATIONS ON 1.2

At the time of publication, the body with HSE approval to operate and maintain a register of businesses who are "members of a class of persons" is the Council for Registered Gas Installers (CORGI). Thus it is essential that all business or self employed gas fitters should be registered with CORGI.

Guidance on the individual competency required for gas work is given in the Health and Safety Commission's Approved Code Of Practice (ACOP) — Standards of training in safe gas installation. [6]

Persons deemed competent to carry out gas work are those who hold a current certificate of competence in the type of activity to be conducted issued under the ACOP arrangements, or by a certification body accredited by the United Kingdom Accreditation Service (UKAS).

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 1179-6, *Glossary of terms used in the gas industry — Combustion and utilization including installation at consumer's premises*.

BS 7624, *Specification for the installation of domestic direct gas-fired tumble dryers up to 3 kW heat input (2nd and 3rd family gases)*.

BS EN 449:1997, *Specification for dedicated LPG appliances. Domestic flueless space heaters (including catalytic combustion heaters)*.

3 Definitions

For the purpose of this part of BS 5440 the definitions given in BS 1179-6 apply, together with the following.

3.1 adapter

a device to facilitate smooth and unrestricted air flow through transitional changes in section, where the cross-sectional shape of an air duct differs to that of the associated air vent

3.2 air vent

a non-adjustable purpose provided unit/assembly designed to allow permanent ventilation (see Figure 1)

3.3 appliance compartment

an enclosure (not being a habitable space) specifically designed or adapted to house one or more gas appliances. (See 5.2.2 and 5.3.2 for further details.)

3.4 equivalent area

the air vent free-area which is aerodynamically equivalent to a single sharp edged circular hole. For a simple air vent (e.g. a grille on both ends of a smooth uninterrupted duct), the equivalent area can be regarded as the "free-area"

3.5 free-area

the unobstructed cross-sectional area of a grille, louvre or duct calculated as the sum of the cross-sectional areas of all unobstructed apertures measured through the plane of minimum area and at right angles to the air flow within the apertures (see Figure 2)

3.6 grille

a simple fixed mesh or lattice arrangement designed and constructed to preclude vermin but to allow the passage of air at all times. It may be employed independently as an air vent, set in a dedicated housing, or used with an adapter or duct. (See commentary and recommendations to 4.1.2 for further details.)

3.7 internal space

an interior space such as a hall, passageway, stairway or landing, which is not a room

3.8 intumescent air vent

an assembly specified for preventing the spread of fire, consisting of a metal louvre/grille with an intumescent block secured behind it which incorporates a latticework of holes to provide continuous ventilation but will expand and close in the event of extreme heat build up such as in a fire. When fitted to doors, the assembly usually has a louvre/grille on both sides

3.9

louvre

an assembly of fixed sloping blades or vanes contained within a framework designed and constructed to resist light and rain penetration but allow the unrestricted passage of air at all times. It may be employed independently as an air vent, set in a dedicated housing or used with an adapter or duct

3.10

protected area

an area (e.g. hall, landing, lobby, corridor, stairway, shaft) other than an appliance compartment, which is enclosed with fire resisting materials

3.11

ventilation

the process of supplying air to, and removing air from a room, internal space, appliance compartment or garage. The air may be used or intended to be used for purposes of combustion, cooling and/or the operation of a flue

4 Design and materials for air vents and ducts

4.1 Design

4.1.1 Free-area

A proprietary unit/assembly which is marked with the free-area shall be used wherever possible.

COMMENTARY AND RECOMMENDATIONS ON 4.1.1

The development of materials, technology and manufacturing techniques has led to a wide diversity of ventilation products, including complex multiple assemblies dedicated to specific applications such as minimizing draughts or sound transmission, or providing air warming. The free-area of such products, by virtue of their internal aerodynamic characteristics, may not be calculated reliably from physical measurement. There is currently no formally agreed standard for the design or production of air vents for use with gas appliances and thus manufacturers are not obliged to mark their products with an area calculated in a uniform manner. However, in order to encourage consistency between claims of vent characteristics, a procedure has been developed which is contained in the BG Technology publication. "A dynamic test procedure for characterizing ventilator free-area" [7]. The equivalent area measured by this procedure and stated in the vent manufacturer's literature and/or marked on the air vent, should be used where it is available, as this may differ considerably from the free-area measured at one end of the air vent. In the absence of any such marking on a grille, louvre or duct, the sum of the free cross-sectional areas of the apertures should be used (see Figure 2). For a louvre, the areas should be measured at right angles to the blades or vanes. For an air vent assembly, the free cross-sectional area of the most restrictive component in an assembly should be used to calculate the free-area.

Where two or more components are employed to construct a non-proprietary assembly, changes in section and cross-sectional area should be avoided where possible. Where such changes do occur, adapters should be used to facilitate a smooth and efficient transition which minimizes any restriction at any of the components. The free-area should be determined from the free-area of the component with minimum free-area.

In Figure 1a), for example, if the air brick has 60 holes of 9 mm × 9 mm, i.e. area = 48 cm², the duct is 150 mm in diameter, i.e. area = 176 cm², the louvre has 6 slots each of which is 156 mm long and 9 mm wide, i.e. area = 84 cm², the free-area for the whole vent should be taken as that of the component with the minimum area i.e. 48 cm². If the areas are similar then caution should be used since components with similar aerodynamic resistances placed in series will be more restrictive than the individuals. If the free-area cannot be established, an alternative vent should be used.

Although a non-preferred practice, where grilles/louvres and ducts of dissimilar shape or proportion are used together, [see Figure 2b)], e.g. 225 mm × 150 mm rectangular louvre and a 125 mm diameter duct, sufficient space should be allowed between the rear face of the louvre and the end of the duct to prevent an obstruction to the free-area. (20 mm is typically a satisfactory clearance.)

All grilles, louvres or louvered doors required by this standard to be used internally, should be marked or labelled "IMPORTANT — Do not block this vent".

4.1.2 Air vents communicating directly with outside air

A ventilation opening across an external wall directly to outside air, shall be continuous, unobstructed and fitted with a terminal device such as a grille or louvre at each end. Where a ventilation opening passes through a cavity wall, it shall include a continuous duct across the cavity, conforming to 4.1.4 and shall be fitted so that it does not impair the water resistance of the cavity.

COMMENTARY AND RECOMMENDATIONS ON 4.1.2

Where an air vent incorporates a draught reducing device or other restriction, experience has shown that this imposes a 25 % to 50 % reduction in equivalent area over that of an unrestricted air duct. The manufacturer should state the equivalent area.

The apertures of an air vent should prevent the entry of a 10 mm diameter ball but allow entry of a 5 mm diameter ball. Experience has shown that vermin can thrive in ducts fitted with vents of little over 10 mm and conversely that domestic debris can block vents of little less than 5mm. No gauze or fly screen (i.e. mesh having apertures of less than 5 mm) should be incorporated or subsequently fitted to an air vent. Such practices may compromise the free-area and in certain circumstances provide habitat for vermin.

4.1.3 Air vents not communicating directly with outside air

Where an opening is made through any internal wall, door, partition or panel for the purpose of providing ventilation, the opening so formed shall be completely cleared of debris prior to fitting of the air vent. Where the wall, door, partition or panel contains any material, e.g., insulation, that may slip and cause an obstruction, a duct shall be used between each end of the air vent.

COMMENTARY AND RECOMMENDATIONS ON 4.1.3

Where air is taken from a roof space or underfloor space, refer to the commentary and recommendations on 5.1.2.2.

4.1.4 Ducts

Any duct used for the purpose of providing ventilation shall be of such a size to allow the full ventilation requirement of this standard to be met. The cross-sectional free-area of a duct shall be not less than that of any grilles or louvres fitted at either end of the duct. The design and construction of a duct shall be such that there are no gaps which permit the ingress of water, vermin, cavity insulation material etc. It shall facilitate inspection of the entire air passage for integrity and blockage at any time, e.g. on initial installation or after cavity foam insulation has been installed.

COMMENTARY AND RECOMMENDATIONS ON 4.1.4

Where the cross-sectional shape of a duct differs from that of the associated grille/louvre, the cross-section of the duct should be modified, or adapters employed to facilitate smooth transition and ensure that neither the air duct nor the grilles/louvres are restricted. Where an adapter is employed, the air vent free-area may be reduced, or even determined by the adapter. Every effort should be made to keep the ducts proportional and of similar cross-sectional shape to that of the associated grilles/louvres.

It may be necessary to inspect a duct on installation of the air vent and/or the gas appliance, or after the cavity has been filled with insulation, e.g. foam or granules.

Long horizontal ducts and ducts intended to convey air downwards should be avoided. Where horizontal ducts are necessary, e.g. for internal rooms or basements, they should be as short as practicable, not more than 3 m long and incorporate not more than 2 right angled bends, unless a special allowance is made for the restriction that they impose. This may be achieved by increasing the cross-sectional area by 50 % for each successive 3 m or part thereof in excess of the initial 3 m run and/or incorporating an upwards slope.

Ducts intended to convey air downwards are unlikely to be effective as buoyancy forces of indoor air tend to counteract the flow of incoming air. Attention is drawn to BS 5440-1 for advice on balanced compartments.

The use of flexible ducting should be avoided wherever possible. Where there is no practicable alternative, flexible ducting should be firmly fixed in a taut manner.

4.2 Materials

4.2.1 Air vents and ducts shall be such that they are dimensionally stable (except in the case of an intumescent air vent, see 4.3) and corrosion resistant and suitable for their intended use. When selecting an air vent or duct, due consideration shall be given to its free-area, siting and environment.

4.2.2 Components containing asbestos shall not be used. Further advice is given in BS 5440-1.