

Code of practice for oil firing —

Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes

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Committees responsible for this British Standard

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Foreword

This part of BS 5410 has been prepared by Technical Committee RHE/13. It supersedes BS 5410-1:1977, which is withdrawn.

It is desirable that there should be minimum recommendations for the installation of all types of oil burning equipment so that equipment manufacturers, suppliers, installers and users may have a common basis on which to work.

In following the recommendations given in this standard it will become apparent that other authorities may need to be consulted.

The code is published in three parts as follows:

- *Part 1: Installations up to 45 kW output capacity for space heating and hot water supply purposes;*
- *Part 2: Installations of 45 kW and above output capacity for space heating, hot water and steam supply purposes;*
- *Part 3: Installations for furnaces, kilns, ovens and other industrial purposes.*

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

As a code of practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as if it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

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 cannot confer immunity from legal obligations.

In particular, attention is drawn to the following statutory regulations: the Boiler (Efficiency) Regulations 1993 amended by the Boiler (Efficiency) (Amendment) Regulations 1994 [1], the Building Regulations [2], [3], [4], [5], the Environmental Protection Act 1990 [6], the Control of Pollution (Special Waste) Regulations 1980 [7], the Control of Pollution (Oil Storage) (England) Regulations 2001 [8] and the Water Environment Oil Storage (Scotland) Regulations 2006 [9].

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 62, an inside back cover and a back cover.

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Sidelining in this document indicates the most recent changes by amendment.

Section 1. General

1.1 Scope

This part of BS 5410 deals with oil burning installations up to 45 kW output capacity for space heating and hot water supply purposes and associated oil tanks of capacity up to 3 500 l. It also applies, where relevant, to oil fired cookers where these are connected to flues. This code does not apply to oil firing in marine and transportable installations, or in flueless heaters.

1.2 References

1.2.1 Normative references

This part of BS 5410 incorporates, by dated or undated reference, provisions from other publications. These normative references are made at the appropriate places in the text and the cited publications are listed on page 60. For dated references, only the edition cited applies; any subsequent amendments to, or revisions of the cited publication apply to this part of BS 5410 only when incorporated in the reference by amendment or revision. For undated references, the latest edition of the cited publication applies, together with any amendments.

1.2.2 Informative references

This part of BS 5410 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on page 60, but reference should be made to the latest editions.

Section 2. Liquid fuels

2.1 Types of petroleum oil fuels

Kerosene (class C2) or gas oil (class D) conforming to BS 2869:2006, should be used in the oil fired appliances covered by this part of BS 5410.

Kerosene should be used for general domestic heating purposes because of its low sulfur content, clean burning characteristics and excellent cold flow properties. To meet HM Revenue and Customs requirements kerosene is both invisibly marked (with coumarin) and dyed yellow (with C.I. Solvent Yellow 124).

NOTE 1 Kerosene is sometimes referred to as 28 second burning oil. This relates to an old viscosity classification and is a deprecated descriptor.

Gas oil should be used for larger domestic and for commercial heating purposes. Whilst the cold flow properties of gas oil are not as good as those of kerosene, gas oil is produced in summer and winter grades to provide satisfactory cold flow performance throughout the year. To meet HM Revenue and Customs requirements gas oil is both invisibly marked (with quinizarin) and dyed yellow (with C.I. Solvent Yellow 124); it is further coloured by the addition of a red marker dye in order to distinguish it from taxed diesel (to BS EN 590) intended for use in road vehicles.

NOTE 2 Gas oil is sometimes referred to as red diesel or as 35 second oil, the latter relates to an old viscosity classification and both are deprecated descriptors.

2.2 Fuel oil characteristics

Users should obtain information on the typical characteristics of the fuel supplied, and advice on the safe storage and handling of this, from their supplier. A full safety data sheet, giving information required under the Control of Substances Hazardous to Health Regulations [10], should also be obtained from the supplier or from the fuel producer.

Section 3. Appliances and burners

3.1 Types of appliance

3.1.1 General

The oil fired appliances described in this standard comprise heating boilers, of the freestanding, wall mounted and hearth type and combination boilers. They are intended to be used typically in single family dwellings and other buildings of similar scale. The code can also be of guidance in the installation and operation of oil fired cookers or roomheaters, with or without boilers.

These appliances are designed to be connected to a flue pipe, chimney or integral flue discharging flue gas into the open air.

3.1.2 Heating boilers

These are generally constructed of carbon steel plate or of cast iron sections. Condensing boilers will use stainless steel or aluminium for those parts where condensate may be present. Boilers are designed, with the exception of those used with pressurized sealed systems, to operate with a vent to the atmosphere and to be capable of withstanding the static pressure of the heating system. If it is possible that the static head on a system can exceed 6 m the boiler manufacturer should be consulted as to the suitability of its equipment for the duty involved.

Boilers in this category are designed to operate over the range 50 °C to 95 °C and are suitable for the indirect heating of domestic hot water by means of a heat exchanger, such as an indirect cylinder. Some models take the form of combination boilers, which can provide instantaneous domestic hot water.

NOTE 1 Attention is drawn to the Boiler (Efficiency) Regulations 1993 amended by the Boiler (Efficiency) (Amendment) Regulations 1994 [1].

NOTE 2 See BS EN 303-1, BS EN 303-2 and OFS A100 [11] for further information on oil fired boilers.

3.1.3 Cookers

3.1.3.1 Oil fired domestic cookers in use at present comprise three basic types:

- a) heat storage cookers with or without a domestic hot water facility;
- b) a more direct form of heat application for cooking with or without a domestic hot water facility;
- c) similar to b) but with a larger boiler output to give central heating capacity and a domestic hot water facility.

Heat storage cookers, type a), are generally constructed with large iron castings forming a heat reservoir surrounded by a thick insulated casing to retain the heat. The temperature of the heat reservoir is maintained by either thermostatic or manual methods using a comparatively small burner and the ovens and hot plates are heated mainly by conduction from this source.

The cookers of type b) are normally of lighter construction and employ a burner suitable for giving quick temperature response to the hot plates and ovens.

The cookers of type c) are similar to type b) and may employ one or more burners.

3.1.3.2 When a single burner is used, manually operated deflectors are sometimes fitted to direct the hot gases to either the boiler or to the hot plates and ovens depending upon user requirements.

NOTE See OFS A101 [11] for further information on oil fired cookers.

3.1.4 Roomheaters

The oil fired roomheaters to which this code applies are of the freestanding or inset type, flued to the outside and provided with an oil supply from a remotely located storage tank. Some models are fitted with boilers capable of providing domestic hot water or space heating.

3.2 Types of burner

The types of burner most generally used for installations up to 45 kW capacity for space heating and hot water supply purposes are as described in 3.2.1, 3.2.2 and 3.2.3.

NOTE See BS EN 267, BS EN 293, OFS E100 [11], BS 799-2 and BS 799-8 for further information on oil fired burners.

3.2.1 Natural draught vaporizing burners

3.2.1.1 Natural draught vaporizing burners of the following classes are used on some types of cooker:

- a) perforated sleeve burners;
- b) pot burners.

3.2.1.2 The perforated sleeve burner, see Figure 1, is constructed with a level cast iron base in which are formed one or two concentric troughs to distribute oil evenly round the base. Kindlers in the form of heat resistant tapes are placed in the troughs to assist oil distribution and to facilitate lighting. The troughs also accommodate metal sleeves of suitable diameters to fit the inner and outer perimeters of each trough. The sleeves are perforated in a regular pattern of air holes to allow a mixture of air with oil vapour which rises within the pair of sleeves when the base is heated by ignited kindlers. Generally a lighting port, covered by a moveable flap, is provided in the outer sleeve for lighting by match, but burners may have an electric element with low voltage transformer to achieve ignition.

The burner creates sufficient draught to induce the correct quantity of combustion air for efficient operation by virtue of the chimney effect created by the hot sleeves which may extend some 250 mm above the base. In applications of this type of burner a draught break is usually provided to cut down the draught effect on the burner.

3.2.1.3 The pot burner is constructed of steel, see Figure 2, and is generally circular in section although rectangular sections are also used to achieve a different flame distribution. The base of the pot is oiltight, having a small pipe welded in to admit oil to the base. Rows of air holes are provided in the sides of the pot in a systematic way to introduce air to the oil vapour generated within the pot. In many pot burners metal rings are sited in the lower part of the pot to stabilize the small flame obtained under controlled low fire conditions.

3.2.1.4 Both types of vaporizing burner can be controlled manually or thermostatically. The desired temperature of water or air produced by the appliance is achieved by altering the flow to the burner between a preset maximum and a minimum flow rate. This means that the burner once lit is always alight and therefore the minimum firing rate should not exceed the minimum heat requirement. Both types of burner are designed to use class C2 fuel (kerosene).

3.2.2 On/off mechanical draught vaporizing burners

This type of vaporizing burner operates in conjunction with an electrical control system and flame ignition device to give on/off operation so that when the heat demand is satisfied, the oil supply is turned off until further heat is required, see Figure 3. Oil remaining in the burner at shutdown continues to burn until it is exhausted.

When further heat is required the control system will switch on the fan, energize the ignition and admit oil to the burner to supply heat again until the demand is satisfied. This arrangement enables the appliance to meet varying heat demands with greater flexibility than in the case of the burner types previously described.

This type of burner is designed to use class C2 fuel (kerosene).

3.2.3 On/off pressure jet burners

Pressure jet burners, see Figure 4, are the principal type of atomizing burners in use and, at ratings up to 45 kW, can be of the monobloc type, in which all components are fitted in a single burner unit, or utilize separate self-powered components, which can be located separately from each other.

Atomization of the fuel is achieved by passing oil at high pressure through an orifice device to produce a spray pattern. A pump is used to achieve the necessarily high oil pressures and, in monobloc burners, the motor which drives it is also used to drive a fan giving air for combustion. This air is directed along a tube in which the atomizing jet is centrally placed. The atomized oil and air mixture is ignited by a high tension spark from electrodes and the flame is stabilized to burn away from the end of the draught tube.

The burners have electrical controls to give the correct sequence and timings for the various components of the burner which govern start up, shut down and safety precautions.

NOTE See BS EN 230 for further information on burner safety controls.

These burners are designed to use either class C2 (kerosene) or class D fuels (gas oil) in accordance with the manufacturer's instructions.

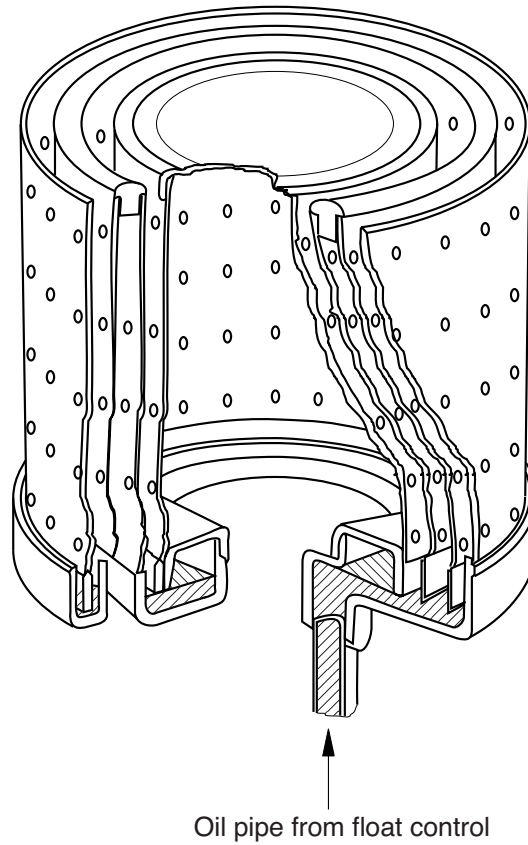


Figure 1 — Schematic diagram of a natural draught perforated sleeve burner

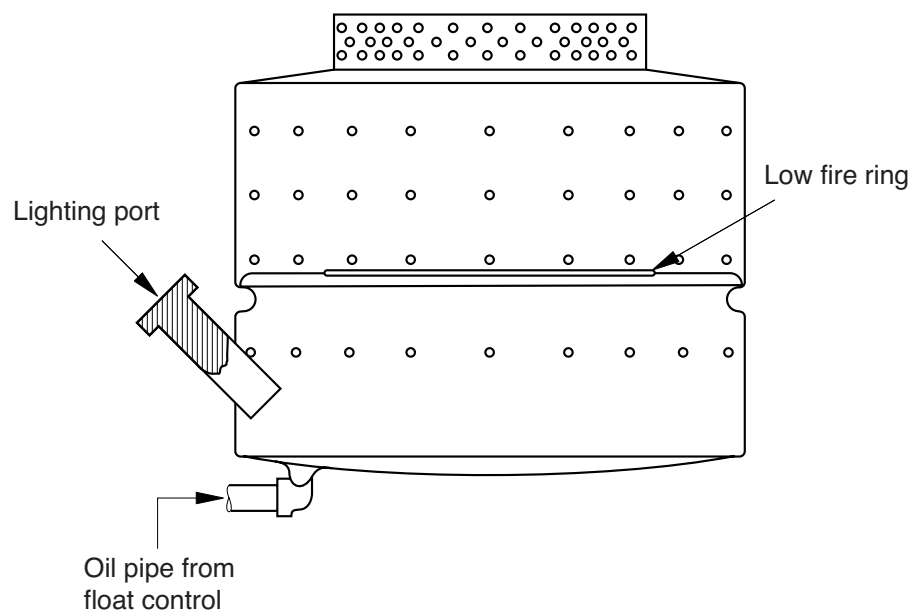


Figure 2 — Schematic diagram of a natural draught pot burner

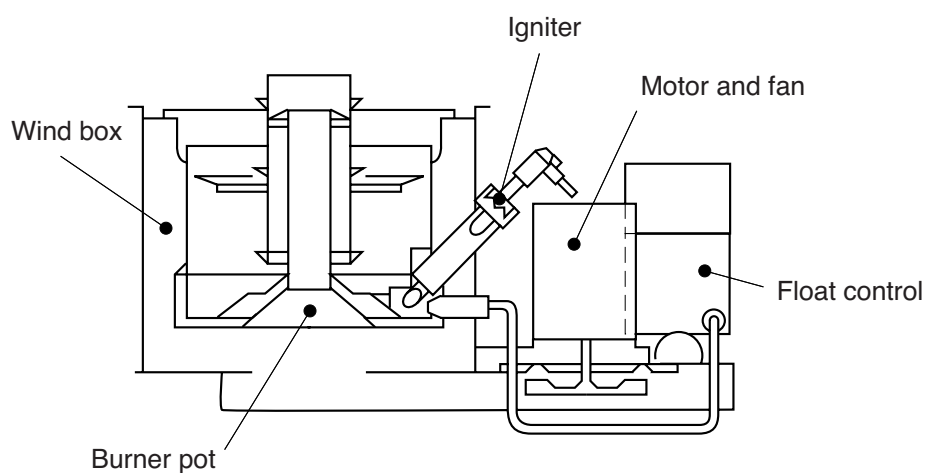


Figure 3 — Schematic diagram of a mechanical draught pot burner with a central air diffuser

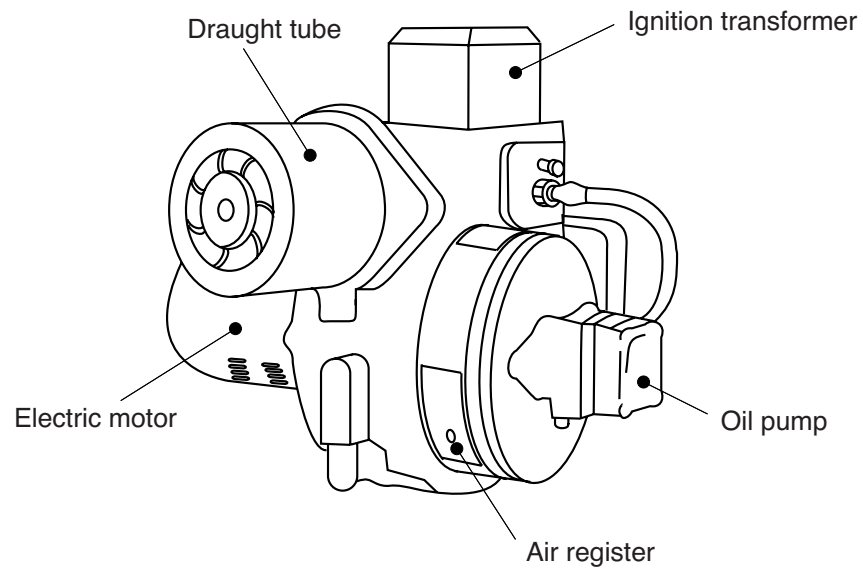


Figure 4 — Schematic diagram of a pressure jet burner

Section 4. Installation of oil fired appliances

4.1 General

The initial installation and replacement of oil fired appliances is work covered by the Building Regulations [2], [3], [4], [5]. This type of work should be undertaken by competent technicians, subject to supervision by a registration body.

In England and Wales, if a person registered with an approved scheme is used for such work then it is not required that application is made to the local authority building control department for approval prior to the work commencing and such firms can self-certify compliance of their work at completion.

NOTE In England and Wales, where documentation is required by the local authority to confirm competent installation work, form CD/10 [13] has been approved for use.

The location of the appliance and its method of installation will depend on the disposition of the outlets from it, a tidy layout of pipes, cables and ductwork, connection to a satisfactory flue and provision of combustion and ventilation air.

NOTE Attention is drawn to the Building Regulations [2], [3], [4], [5] with respect to structural alterations to buildings.

4.2 Selection of appliance

4.2.1 Factors affecting selection

The serviceability and safety of a heating appliance depend upon careful selection to enable it to match its working environment as well as the characteristics of the appliance itself. The manner in which appliances are used varies from building to building and it is because of this, as much as the characteristics of the appliance itself, that consideration should be given before a choice is finally made.

NOTE See OFTEC *Equipment Directory* [12] for a list of oil burning appliances.

The type of information that should be gathered and the order in which it should be handled is listed in 4.2.2.

4.2.2 Operating factors

4.2.2.1 The information needed in order to establish an estimate of gross capacity and response is:

- a) the preferred room temperature;
- b) the design winter temperature;
- c) the structural and ventilation heat losses per °C;
- d) the degree of continuity of heating required by the use;
- e) the extent to which space and water heating are to be coupled;
- f) the preferred form of user control or programming.

4.2.2.2 The rated output of the appliance should be able to meet the calculated space and water heating demand. Correct selection of system controls may avoid the need for a margin of extra capacity.

Consideration should also be given to the low load requirements of the heating system, particularly when space and water heating are combined. If these requirements are likely to be exceeded at the lowest limit of the turn-down range of a continuously burning semi-automatic appliance, an automatic on/off appliance should be used.

NOTE 1 Guidance on the design of space and water heating systems is given in BS 5449.

Heating systems served by fully automatic oil fired appliances should be of the fully pumped circulation type with their electrical controls arranged to prevent the burner short cycling.

NOTE 2 Attention is drawn to the Building Regulations [2], [3], [4], [5] with regard to heating system control.

4.3 Siting of appliance

4.3.1 General

The siting of the appliance should be undertaken with great care to reduce hazards such as fire risk to a minimum. If possible, the appliance should be installed at ground floor or basement level, preferably in a boiler room, utility area or kitchen. The appliance should be installed on a floor or above a surface which is impervious to oil. Any spillages from the burner or connections should be contained within the appliance. On no account should accidental spillage be able to soak into combustible material such as wood or carpeting. Fuel pipework within the building should be kept to a minimum.

NOTE 1 Attention is drawn to the Building Regulations [2], [3], [4], [5].

Consideration should be given to the avoidance of noise and vibration nuisance to occupants and neighbours.

The following should also be taken into account:

- a) any constraint imposed under 4.2.2;
- b) the manufacturer's installation instructions with respect to the provision of space around the appliance to allow:
 - 1) sufficient circulation of air for combustion and cooling and the operation of a draught diverter if required;
 - 2) sufficient access and clearance for maintenance and servicing (see also 4.6.10 and 15.2);
- c) environmental conditions and need for combustion and ventilation air, as specified in 4.4;
- d) heat emission from the appliance casing; provision for the protection of the floor or wall on which the appliance is to be mounted in accordance with the manufacturer's instructions;
- e) the recommendations of Section 9 regarding flues and chimneys;

NOTE 2 Some of these are requirements of the Building Regulations [2], [3], [4], [5].

- f) that open-flued appliances should not be installed in bathrooms, bedrooms or bedsitting rooms because of the possible increased risk of carbon monoxide poisoning.

The physical size alone may dictate whether an appliance may be accommodated within habitable rooms or whether it should be separately housed. If an appliance is intended to be built-in, so that it is adjacent to combustible material, an appliance classified as suitable for this purpose should be selected.

4.3.2 Room sealed appliances

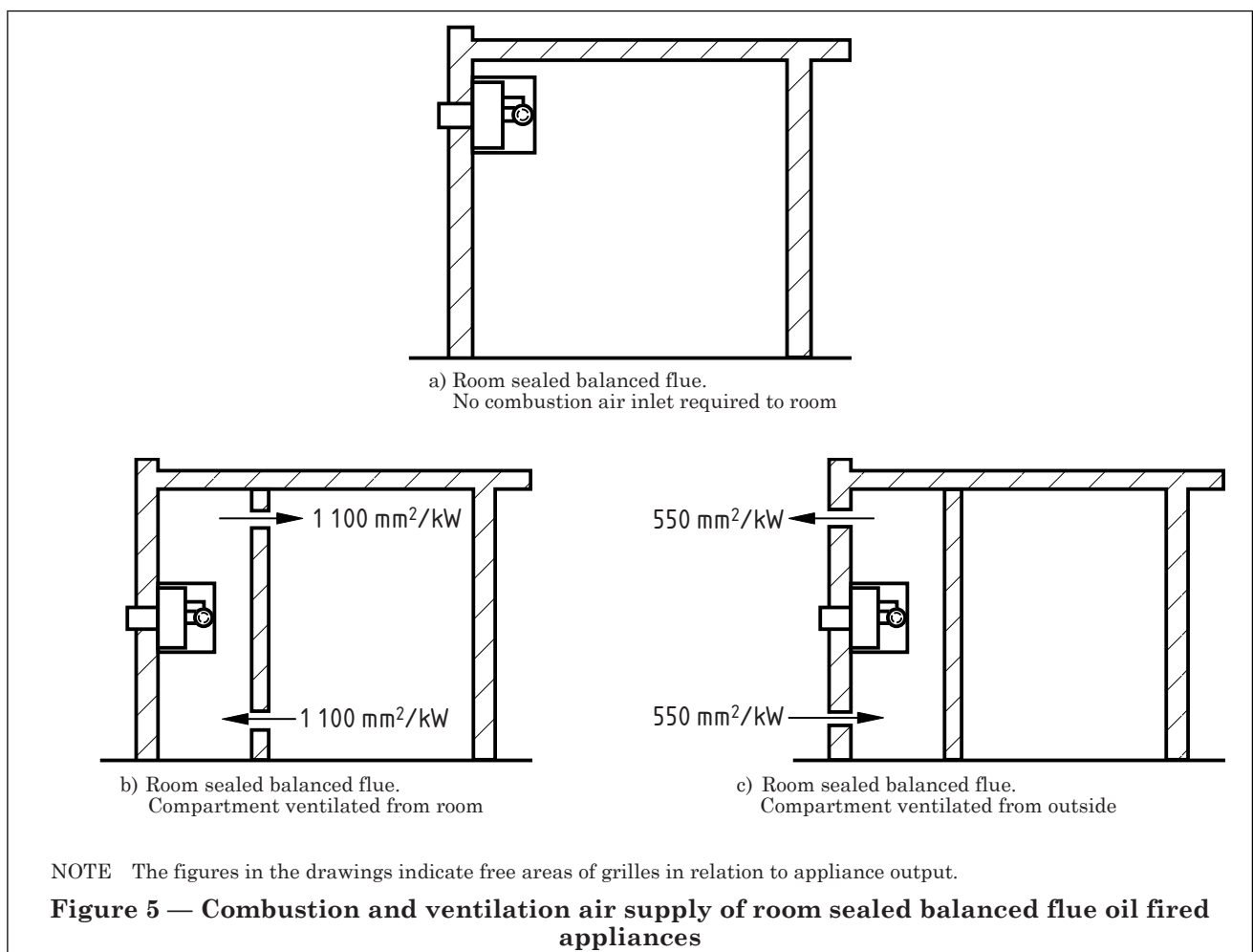
It may be desirable, or indeed preferable in some circumstances, to avoid taking air for combustion or for draught control from within the habitable space. To meet this need, room sealed appliances are available that take their air directly from outside the building.

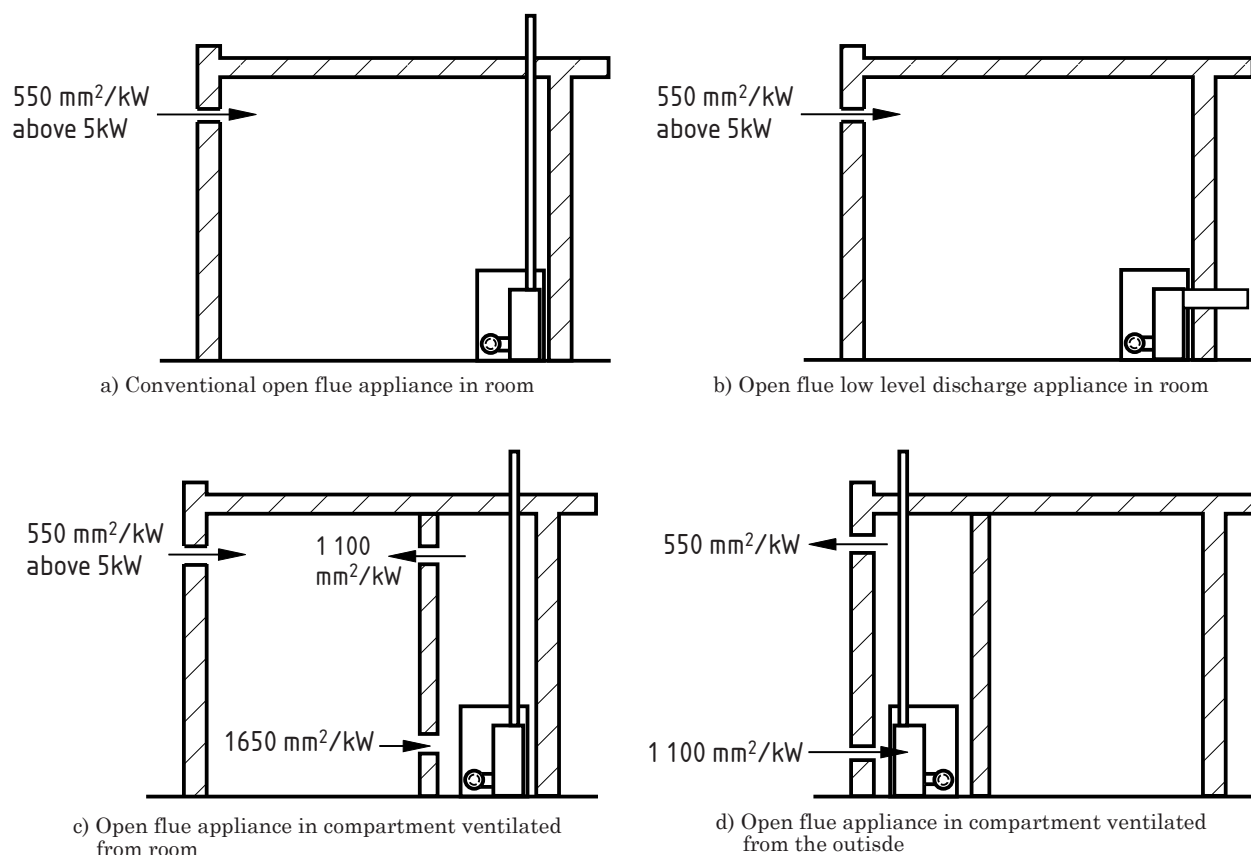
4.3.3 Chimney and flue pipe

The chimney and flue pipe may affect the selection and location of the appliance, see Section 9.

4.4 Provision for air for combustion and ventilation

The recommendations of this section are illustrated in Figure 5 and Figure 6.





NOTE 1 The figures in the drawings indicate the free areas of grilles in relation to appliance output.

NOTE 2 Extract fans, where needed, should be in accordance with 4.4.7.

NOTE 3 If an appliance with a draught break is fitted in a room, an extra 550 mm²/kW of free area should be added to the combustion air inlet. For an appliance fitted in a compartment, which is ventilated as shown, no additional allowance is necessary.

Figure 6 — Combustion and ventilation air supply of open flue oil fired appliances

4.4.1 General

A sufficient permanent air supply to an appliance should be provided:

- a) for proper combustion of fuel and effective discharge of combustion products to the open air;
- b) for the ventilation of any confined space in which an appliance is installed to prevent overheating of the appliance and any equipment in and near the appliance;
- c) for the satisfactory operation of any draught break or stabilizer which may be fitted.

It should be both the designer's and the installer's concern that the air required for these functions be introduced so as to cause as little discomfort as possible to building occupants and thus to offer them the least temptation to obstruct ventilators.

4.4.2 Air for combustion for open flued appliances

The room or space in which the appliance is installed should have a purpose designed non-closeable opening or duct which is designed to allow the passage of air at all times, equivalent in total free area to 550 mm² for each kW of appliance rated output above 5 kW. Notwithstanding the above recommendation, the recommended means of providing the minimum combustion/make up air for a vaporizing appliance is to fit a grille having a free area of at least 100 cm² to pass air directly from the outside into the room or space in which the appliance is fitted.

Such provision is not necessary for a room sealed appliance designed to take air for combustion directly from outside.

Consideration should be given to the degree of air permeability of the building before 5 kW is deducted from the appliance output when calculating the free area of combustion openings. Buildings constructed to air permeability standards better than about 10 m³/(h·m²) at 50 Pa will be unlikely to provide a sufficient adventitious air supply for the deduction to be made. In these cases the full appliance output should be used in the calculation of opening size.

4.4.3 Air for ventilation

For an appliance in a confined space, such as a boiler compartment, care should be taken to provide air for ventilation. The minimum free area of openings to be provided in addition to that for combustion air should be as follows:

- a) where the air is taken from a heated space, 1 100 mm² per kW at high level and 1 100 mm² per kW at low level;
- b) where the air is taken from outside, 550 mm² per kW at high level and 550 mm² per kW at low level.

This provision is needed for both open flued and room sealed appliances.

NOTE Free area is the unobstructed opening allowing air to flow through the grille or air brick.

A compartment is a room or space partitioned for the purpose of containing plant and equipment, or a room or space of insufficient volume to satisfactorily disperse the build-up of heat around the plant and equipment contained therein.

4.4.4 Air supply ducts and grilles

Grilles and other openings should be of the purpose designed non-closeable type.

They should be positioned so that they are not likely to be accidentally blocked, i.e. they should always be positioned in the vertical plane even if they supply air from an underfloor or similar area. Where more than two air vents are fitted in series across an air supply path, the free area of each vent should be increased by at least 50 % over that required for a corresponding single vent. Ductwork should be properly supported and sealed, particularly where it crosses cavities. The cross-sectional area should not be less than the area of the opening required to accommodate the air vent it serves.

4.4.5 Draught breaks and stabilizers

An appliance fitted with a draught break or draught stabilizer should have adequate inlet air supply to allow efficient operation. Where ventilation openings are provided as recommended in 4.4.3 no separate allowance need be made, but where a combustion air supply opening only is provided an additional free area of 550 mm² per kW should be provided.