

Code of practice for

Oil firing —

**Part 1: Installations up to 44 kW output
capacity for space heating and hot
water supply purposes**

**(formerly part of CP 3002-1, CP 3002-2
and CP 3002-3)**

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Cooperating organizations

The Refrigeration, Heating and Air Conditioning Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

- Association of Consulting Engineers
- Association of Manufacturers of Domestic Electrical Appliances
- Boiler and Radiator Manufacturers' Association Ltd
- British Combustion Equipment Manufacturers' Association*
- British Gas Corporation
- British Mechanical Engineering Confederation
- British Refrigeration and Air Conditioning Association
- Building Services Research and Information Association
- Department of the Environment*
- Department of Health and Social Security
- Electricity Supply Industry in England and Wales*
- Engineering Equipment Users' Association
- Heating and Ventilating Contractors' Association
- HEVAC Association*
- Institute of Fuel*
- Institute of Refrigeration
- Institution of Gas Engineers
- Institution of Heating and Ventilating Engineers*
- Lloyd's Register of Shipping
- Manufacturers' Association of Radiators and Convectors
- Ministry of Defence
- National Coal Board
- Society of British Gas Industries
- Water-tube Boilermakers' Association*

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- Associated Offices Technical Committee
- Association of Shell Boiler Makers
- British Tar Industry Association
- Chief and Assistant Chief Fire Officers' Association
- Domestic Oil Burning Equipment Testing Association
- Engineering Industries Association
- Fire Offices Committee
- Fire Protection Association
- Greater London Council
- Health and Safety Executive
- Home Office
- Industrial Warm Air Heater Manufacturers' Association
- Institute of Fire Engineers
- Oil Companies Materials Association
- Process Plant Association

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Contents

	Page
Cooperating organizations	Inside front cover
Foreword	iii
Section 1. General	
1 Scope	1
2 References	1
Section 2. Liquid fuels	
3 Types of petroleum oil fuels	1
4 Typical petroleum oil fuel characteristics	1
Section 3. Appliances and burners	
5 Types of appliance	1
6 Types of burner	2
7 Selection of appliance	2
Section 4. Oil storage tanks and equipment	
8 Types	7
9 Capacity	7
10 Design and test conditions	7
11 Oil level indicators and gauges	7
12 Overfilling alarm and signalling system	7
13 Pressure unloading device	7
14 Filling pipes and connections	7
15 Vent pipes	8
16 Installation of tanks	8
17 Tank supports	8
18 Painting and cleaning	8
Section 5. Oil system from storage tank to burner	
19 Fuel supply systems	8
20 Fuel feed pipework	10
Section 6. Accommodation for boilers and air heaters	
21 General	11
22 Location of appliances	11
23 Provision for air for combustion and ventilation	12
24 Appliance temperature and its relation to surrounding building materials	13
Section 7. Accommodation for oil storage tanks for single family dwellings	
25 General	13
26 Siting of oil storage tanks	13
27 Methods of tank protection	13
28 Requirements for tank accommodation	13
29 Catchpits	14
Section 8. Flues and chimneys	
30 Choice of materials	14
31 Design and construction of chimneys	15
32 Size and height of chimneys	15
33 Height and position of chimneys above roofs	15
34 Shared chimneys	15
35 Structural chimneys	16
36 Factory made insulated chimneys	16
37 Insulated flue pipes used as chimneys	16

	Page
38 Single skin flue pipes used as chimneys	17
39 Liners for chimneys	17
40 Chimney terminals	18
41 External cladding	18
42 Flue pipes for connecting appliances to chimneys	18
43 Dampers	18
44 Inspection and cleaning	18
45 Appliances designed to operate with integral flue systems	19
46 Inspection and testing on site	19
Section 9. Electrical and control requirements	
47 Electrical requirements	19
48 Purpose of controls	20
Section 10. Commissioning	
49 General	20
50 Responsibilities of the commissioning engineer	20
Section 11. Maintenance	
51 General	20
52 Access for maintenance	20
53 Manuals	20
54 Safety controls	20
Section 12. Conversions of existing appliances	
55 General	20
56 Technical recommendations	21
Section 13. Legal requirements	
57 General	21
58 Summary of regulations	21
Appendix A Gravity oil pipe sizing	22
Figure 1 — Typical perforated sleeve burner	3
Figure 2 — Typical natural draught pot burner	3
Figure 3 — Typical mechanical draught pot burner	4
Figure 4 — Typical mechanical draught pot burner with a central air diffuser	4
Figure 5 — Typical rotary vaporizing burner	4
Figure 6 — Typical pressure jet burner	5
Figure 7 — Typical oil supply system: gravity feed	9
Figure 8 — Typical oil supply system: sub-gravity feed with oil lifter	9
Figure 9 — Typical oil supply system: sub gravity feed flow and return system (two pipe system)	10
Figure 10 — Nomogram for gravity oil pipe sizing: class C2 fuel (kerosene)	23
Figure 11 — Nomogram for gravity oil pipe sizing: class D fuel (gas oil)	24
Table 1 — Specification data for class C2 and class D petroleum oil fuels as given in BS 2869:1970	1
Table 2 — Typical characteristics of class C2 and class D petroleum oil fuels	1
Table 3 — Minimum hot water storage capacity for typical households in temperate climates	6
Table 4 — External tank site distance requirements	14
Table 5 — Materials for flue pipes connecting appliances to chimneys	17
Publications referred to	Inside back cover

Foreword

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

While this code is intended to give guidance on current practice, the statutory requirements of the building regulations and the interests of insurance companies should be ascertained. In applying the recommendations in this code it will become apparent that other authorities may need to be consulted.

The code was originally published as CP 3002 “Oil firing”, in three Parts according to the types of fuel burnt as follows:

- *Part 1:1961 Installations burning Class D fuel oil and C.T.F. 50;*
- *Part 2:1964 Installations burning Class C and Class D fuel oils for vaporizing burners;*
- *Part 3:1965 Installations burning pre-heated fuels. Class E, F and G fuel oils and C.T.F. 100 to 250.*

For this revision as BS 5410 the committee considered it preferable to divide the code into Parts according to the type and purpose of the oil firing installation as follows:

- *Part 1: Installations up to 44 kW output capacity for space heating and hot water supply purposes;*
- *Part 2: Installations of 44 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.*

Because of this rearrangement, it is intended to defer the withdrawal of CP 3002-1, CP 3002-2 and CP 3002-3 until all three Parts of the revision have been published.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 24, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This Part of BS 5410 deals with oil burning installations up to 44 kW output capacity for space heating and hot water supply purposes and associated oil tanks of capacity up to 3 400 litres. It also applies, where relevant, to oil fired cookers where these are connected to flues. The code does not apply to oil firing in marine and transportable installations, or in flueless heaters.

2 References

The titles of the standards publications referred to in this standard are listed on the inside back cover.

Section 2. Liquid fuels

3 Types of petroleum oil fuels

Liquid fuels are commercially available in the United Kingdom in various grades, comprising distillate fuels and residual grades, and blends thereof manufactured to comply with the specifications contained in BS 2869. The specifications which are relevant to this code of practice can be found in Table 2 of BS 2869:1970 of which extracts are given in Table 1.

Table 1 — Specification data for class C2 and class D petroleum oil fuels as given in BS 2869:1970

(as amended by AMD 972, June 1972 and AMD 1532, August 1974 AMD 2253, March 1977, AMD 2478, February 1978, AMD 3230, April 1980 and AMD 3549, November 1980)

	C2	D
Kinematic viscosity min.	1.0	1.6
(cSt at 37.8 °C) max.	2.0	6.0
Carbon residue, Ramsbottom on 10 % residue (% by mass) max.	—	0.2
Flash point (Abel) min.	38 °C	—
Flash point (Pensky-Martens) min.	—	55 °C
Water content (% volume) max.	Free from visible water	0.05
Sediment (% by mass) max.	Free from visible sediment	0.01
Ash (% by mass) max.	—	0.01
Sulphur (% by mass) max.	0.2	0.5

4 Typical petroleum oil fuel characteristics

Approximate data for class C2 and class D petroleum oil fuels available in the UK are given in Table 2.

For other characteristics users are advised to obtain from their fuel suppliers typical values for the grades of fuel currently available.

Table 2 — Typical characteristics of class C2 and class D petroleum oil fuels

	C2	D
Specific gravity (15°/15° C)	0.79	0.83
Gross calorific value (MJ/kg)	46.6	45.5
Mean specific heat [kJ/(kg K)]	2.09	2.05

Section 3. Appliances and burners

5 Types of appliance

The oil fired appliances described in this code comprise heating boilers, domestic hot water boilers and air heaters (with or without a domestic hot water facility). They are used typically in single family dwellings. The code can also be of guidance in the installation and operation of oil fired cookers (with or without a domestic hot water facility).

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

5.1 Heating boilers. These are generally constructed of carbon steel plate or of cast iron sections. They are designed, with the exception of those used with pressurized sealed systems, to operate with a vent to the atmosphere and be capable of withstanding the static pressure of the heating system. In the event of a static head on a system exceeding 6 m the boiler manufacturer should be consulted as to the suitability of his equipment for the duty involved.

Boilers in this category are designed to operate over the range 50 °C to 100 °C and are suitable for the indirect heating of domestic hot water by means of a heat exchanger, such as an indirect cylinder.

5.2 Domestic hot water boilers. These boilers are for direct hot water supply and are therefore designed with cleaning access to the waterways to enable the removal of scale or sludge formation incurred when raw water is constantly used in the boiler. If such a system is proposed, it will be necessary to ensure that the water is of suitable quality or is treated as necessary.

5.3 Air heaters. Air heaters may be of the following types:

- a) core heater (brick central),

- b) flued convector,
- c) direct air heater with ducted air distribution,
- d) indirect air heater

5.3.1 Core heater (brick central). A chamber is incorporated in the construction of a dwelling and so sited that its walls, usually of room height, abut on to two or more rooms. A direct air heater, fired by a vaporizing burner, usually with a facility for heating domestic hot water, is situated in the chamber and connected to a flue pipe. The chamber is provided with a number of high level hot air outlets and low level return air inlets so arranged to heat adjoining rooms by natural convection. The hot air outlets are usually provided with adjustable grilles. Some units have a separately fired water heating facility. The water heating system is suitable only for indirect systems.

5.3.2 Flued convector. These appliances are operated by an oil burner of the vaporizing type which heats a direct air heater and in some cases a small boiler section, incorporated in a casing suitably sized to be incorporated into the fireplace opening or placed on a hearth. The flue outlet from the air heater is sealed into the chimney, the heating effect being obtained by air passing over the air heater body. In some designs the proportion of the radiant heat output of the appliance is increased by means of radiant elements behind a glass panel.

The appliance may be designed to incorporate a boiler for providing domestic hot water and also, if the boiler output is sufficient, to provide water for central heating radiators.

5.3.3 Direct air heater with ducted air distribution. An oil fired direct air heater is incorporated within a housing where the heated, and usually filtered, air is propelled along ductwork to outlet grilles in various rooms in the house. Provision is made for returning air from the rooms to the air heater, any deficiency in the amount of circulation air being supplied from a fresh air inlet to the heater. Separate provision for domestic hot water is usual with this heater.

5.3.4 Indirect air heaters. A purpose built oil fired unit where the air is heated indirectly from a hot water heat exchanger, which can also provide domestic hot water.

5.4 Cookers

5.4.1 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.

5.4.2 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.

Burners employed in cookers are generally of the vaporizing perforated sleeve or pot types.

Either manual control or thermostatic control may be used on vaporizing burners for cookers.

6 Types of burner

The types of burner most generally used for installations up to 44 kW capacity for space heating and hot water supply purposes are as described in 6.1 to 6.5 (see also BS 799).

6.1 Natural draught vaporizing burners

6.1.1 All the types of appliances described in clause 5 may employ natural draught vaporizing burners where an emphasis is required on simplicity of operation and cheapness of installation.

Natural draught vaporizing burners are of two types:

- a) perforated sleeve burners
- b) pot burners

6.1.2 The perforated sleeve burner, see Figure 1, is constructed with a level cast iron base in which is 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 burner. The troughs also accommodate metal sleeves of suitable diameters to fit the inner and outer perimeters of each trough. The sleeves form a reasonably gastight joint with the base. 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.

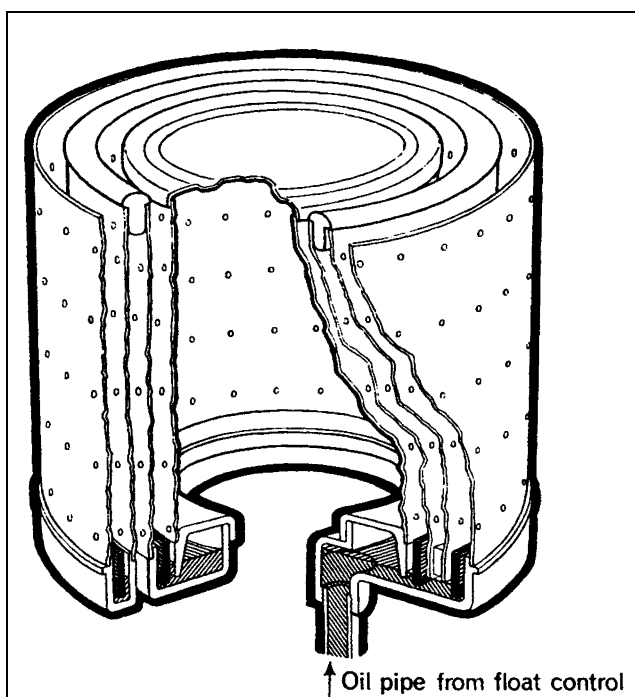
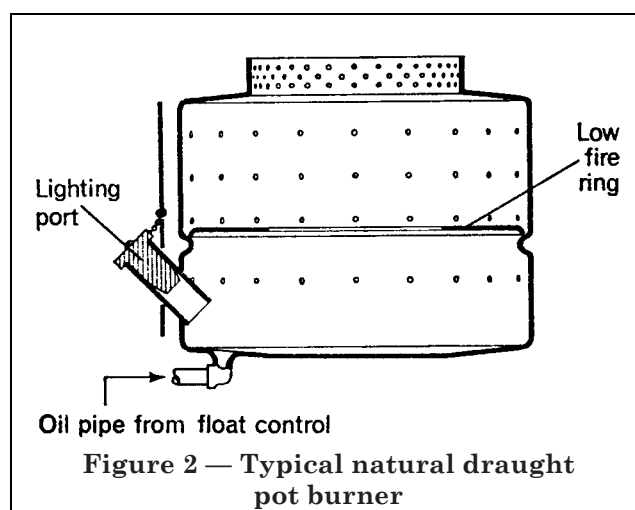


Figure 1 — Typical perforated sleeve burner

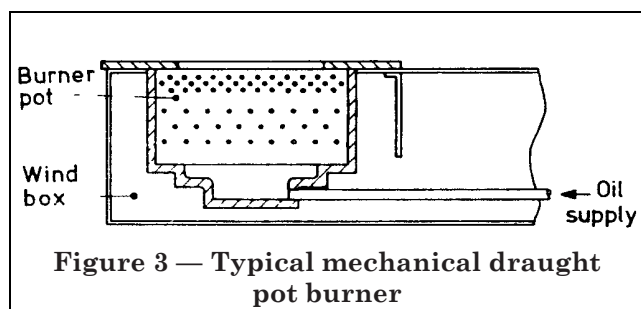
The burner creates sufficient draught to induce the correct quantity of combustion air for efficient operation by virtue of the chimney effect created by the hot sleeves which may extend some 250 mm above the base and in applications of this type of burner a draught break is usually provided to cut down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

6.1.3 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.



6.1.4 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.

6.2 High/low mechanical draught vaporizing burners. The heat output of appliances with burners described in 6.1 is limited by the amount of energy provided by the draught effect of the chimney. A useful extension of output is obtained in the mechanical draught vaporizing burner by augmenting chimney draught with an electrically driven fan to supplement air for combustion (see Figure 3).

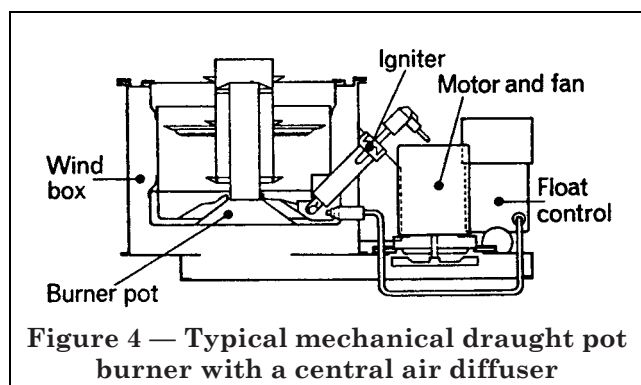


The heat output of the appliance is varied by thermostatic control of the oil flow to the burner, the thermostat sensing the temperature of the air or water flow from the appliance.

Oil flow to the burner is modulated between a fixed low flow and a fixed high fire setting. This is a function of the oil control valve and thermostat, the fan running at all rates of firing in most designs. The control system returns the oil flow to the low rate in the event of electric supply failure and at this setting the burner will operate safely with the available draught, without fan assistance.

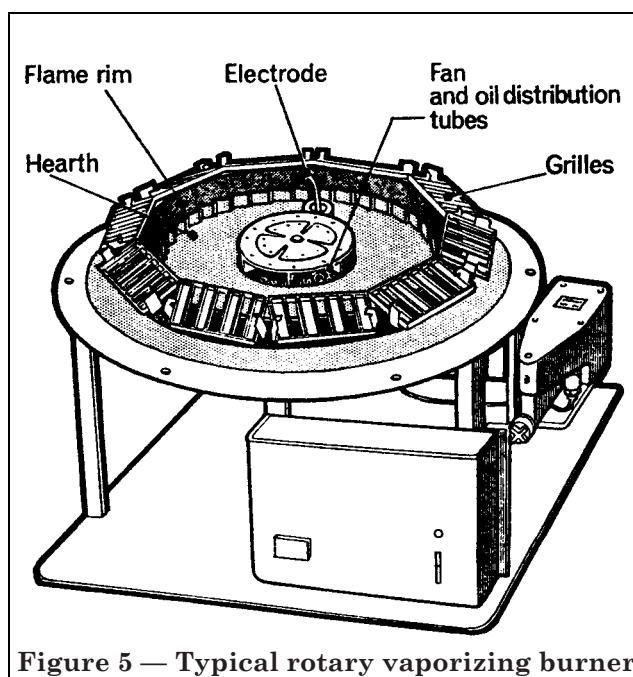
These burners are designed to use class C2 fuels.

6.3 On/off mechanical draught vaporizing burners. The burner described in 6.2 has been developed to operate 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 4). 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, energise 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.

6.4 Rotary vaporizing burners. The rotary vaporizing burner (see Figure 5) is designed so that oil and air are delivered at the centre of the burner hearth in the correct proportions. The spinning action of the oil delivery system produces an oil spray. After ignition, which may be either by a high tension spark or low tension glow plug, the spray burns from a pattern of grilles, or fins, arranged around the circumference of the burner hearth. The burner has automatic on/off controls which give a correct sequence for the ignitor, any preheater device to aid vaporization on flame initiation, the motor delivering oil and air, and the flame sensor. The oil flow rate may be controlled either by an oil control valve or by a metering device incorporated in the burner.



This type of burner is equipped with a combustion air fan, which works in conjunction with a draught break or stabilizer which should be set to the manufacturer's recommendations.

An adjustable shutter is usually fitted on the air inlet to the burner.

These burners are usually designed to use class C2 fuel, but some can be set, in accordance with the manufacturer's instructions, to use class D fuel.

6.5 On/off pressure jet burners. Pressure jet burners (see Figure 6) are the principal type of atomizing burners in use and, at ratings up to 44 kW, are generally of the self-contained package or monobloc type.