

# Fire precautions in the design and construction of buildings —

## Part 9: Code of practice for ventilation and air conditioning ductwork

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# Contents

|                                                                                                                 | Page               |
|-----------------------------------------------------------------------------------------------------------------|--------------------|
| Committees responsible                                                                                          | Inside front cover |
| Foreword                                                                                                        | ii                 |
| <hr/>                                                                                                           |                    |
| Section 1. General                                                                                              |                    |
| 1 Scope                                                                                                         | 1                  |
| 2 Definitions                                                                                                   | 1                  |
| 3 Use of this code                                                                                              | 2                  |
| <hr/>                                                                                                           |                    |
| Section 2. Analysis of the problem                                                                              |                    |
| 4 General                                                                                                       | 5                  |
| 5 Fire problems of ventilation systems                                                                          | 5                  |
| <hr/>                                                                                                           |                    |
| Section 3. Design and construction                                                                              |                    |
| 6 Ductwork systems                                                                                              | 11                 |
| 7 Methods for the protection of ventilation ductwork                                                            | 11                 |
| 8 Fire dampers                                                                                                  | 13                 |
| 9 Installation of ductwork systems                                                                              | 15                 |
| 10 Combustibility of materials and components                                                                   | 20                 |
| 11 Recirculating distribution systems                                                                           | 21                 |
| 12 Domestic heating, ventilating and air conditioning systems                                                   | 22                 |
| 13 Transfer grilles                                                                                             | 22                 |
| 14 Firefighting control                                                                                         | 22                 |
| <hr/>                                                                                                           |                    |
| Appendix A Advice to management                                                                                 | 23                 |
| <hr/>                                                                                                           |                    |
| Figure 1 — Potential smoke spread within ventilation systems                                                    | 7                  |
| Figure 2 — Positioning of fire dampers in systems with unprotected ductwork                                     | 16                 |
| Figure 3 — Positioning of fire dampers in systems where the ductwork is protected by a fire-resisting enclosure | 17                 |
| Figure 4 — Positioning of fire dampers in systems with fire-resisting ductwork                                  | 18                 |
| Figure 5 — Shunt systems                                                                                        | 20                 |
| <hr/>                                                                                                           |                    |
| Publications referred to                                                                                        | Inside back cover  |

## Foreword

This code of practice, prepared under the direction of the Fire Standards Policy Committee, is a revision of appendix A of CP 413. CP 413 will be withdrawn on the publication of its revision (excluding appendix A) as BS 8313, which gives recommendations for the design, construction, installation and maintenance of ducts in buildings used for the accommodation of services.

The fire protection of ventilation systems has, in the past, tended to be considered primarily in the context of the breakdown of fire compartmentation in buildings. Ventilation systems and ductwork however can be responsible for accelerating the initial spread of fire, for example between rooms within a fire compartment, and perhaps of even more importance, by the rapid dispersion of smoke and decomposition products. This code therefore considers the system as a whole and recommends the protection that needs to be provided in order to meet the specific requirements of any given type of building or occupancy.

Some of the more important changes from the text of appendix A of CP 413 are as follows.

- a) Fire problems associated with ventilation ductwork generally are more extensively discussed.
- b) Three main approaches to the fire protection of ventilation ductwork are identified. These three approaches form the basis for subsequent recommendations.
- c) Problems associated with ventilation ductwork in different building occupancies are discussed.
- d) In section three the commentary on the relevant principles is followed by any recommendations that are made. The commentary on the relevant principles is intended to provide an explanatory background to the recommendations.

This code draws attention to the potential fire dangers associated with ventilation and air conditioning ductwork. The systems covered include ducted supply and extract systems, whether through ducts or plenums, mechanically assisted systems and those relying on natural convection. It discusses a range of protective measures, the adoption of which should effectively counterbalance the potential dangers of fire. It offers guidance on the appropriateness of such protective methods in a range of circumstances. However, no single recommendation is made in respect of any specific method of protection for a given type of occupancy. Each project should be examined by the designer to identify the potential dangers before selecting the appropriate protective measures.

The code is mainly concerned with the effective isolation of the ventilation system. It provides advice on the selection of appropriate measures that will confine fire, smoke and decomposition products within a pre-selected area of the building, or within the system itself, in such a way that other areas are subject neither to fire attack nor to the spread of smoke and/or toxic gases.

A fire can generate large quantities of combustion products (usually referred to as “smoke”), namely hot gases carrying smoke particles and containing toxic or noxious and irritant products.

In the event of a fire within a building, ventilation by natural or mechanical means can be used to limit the spread of these products which could otherwise hinder or prevent escape and thus endanger the lives of the occupants, and restrict or prevent effective rescue and firefighting by the fire brigade. The requirements for ventilation in the event of fire may, on occasion, be incompatible with those for normal ventilation. In most cases larger flows of air or gases have to be allowed for, in directions sometimes different from those required for normal ventilation. Experimental evidence of the efficacy of measures to prevent fire spread by way of ductwork is scarce. A considerable international effort is being made, aimed at a better understanding of the problems of fire and smoke spread associated with ventilation ductwork. In particular this concerns the pressure distribution throughout a building and how this is affected, either directly or indirectly, by fire. This code is based on the best available information in respect of both practical experience and scientific investigation.

Throughout the code life safety is the main parameter in setting standards. However, measures taken to inhibit the spread of fire and smoke between compartments for life safety purposes may often have benefits for property protection.

It has been assumed in the drafting of this code that the execution of its provisions will be entrusted to appropriately qualified and experienced people.

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. In particular, attention is drawn to 3.4.**

### 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 code of practice provides guidance for designers and the building construction team in their task of incorporating ventilation and air conditioning ductwork into new and existing buildings other than premises covered by BS 5908. It is essential that the recommendations of the code are applied anew if physical alterations are made to an existing building, even if such alterations are not structural.

The code covers non-combustible building services ducts, and ductwork manufactured from metal and/or rigid mineral based components which exhibit:

- a) high integrity when exposed to fully developed fire conditions;
- b) resistance to penetration by flame;
- c) an ability to exclude or contain fire.

It does not cover ductwork manufactured from materials that rapidly melt, shatter or degrade during fire exposure, for example glass and plastics materials.

The code covers precautions to prevent the spread of fire and smoke and other by-products of combustion within a building through the movement of air for environmental control, i.e. ventilation, heating and cooling. It does not cover the movement of air for purposes other than for environmental control, e.g. boiler flues, pneumatic information transfer systems, nor smoke control systems, pressurization systems and industrial process plant extract systems.

NOTE 1 The design and construction of service ducts is covered in BS 8313<sup>1)</sup> and the design of pressurization systems for smoke control in protected escape routes is covered in BS 5588-4.

NOTE 2 The titles of the publications referred to in this standard are listed on the inside back cover.

## 2 Definitions

For the purposes of this code the following definitions apply.

### 2.1

#### air handling void (plenum)

a duct, usually a ceiling or floor void, which forms part of either the supply or the return air distribution system

### 2.2

#### cavity barrier

construction provided:

- a) to seal a cavity (concealed space) against the penetration of smoke and flame; or
- b) within a cavity (concealed space) to restrict the movement of smoke and flame within the cavity.

### 2.3

#### ceiling void

a cavity between a structural floor or roof and the suspended ceiling below, through which building services may pass

### 2.4

#### class 0 material or surface

either:

- a) composed throughout of materials of limited combustibility; or
- b) composed of a material classified as class 1 when tested in accordance with BS 476-7, which has a fire propagation index  $I$  of not more than 12, and a subindex  $i_1$  of not more than 6, when tested in accordance with BS 476-6.

### 2.5

#### compartment

a part of a building, comprising one or more rooms, spaces or storeys, constructed to prevent the spread of fire to or from another part of the same building

### 2.6

#### duct

a passage through which services such as water pipes, electrical cables or air ductwork can be led through a building

### 2.7

#### ductwork

a system of enclosures of any cross-sectional shape for the distribution or extraction of air

### 2.8

#### fire resistance

the ability of a component or construction of a building to satisfy for a stated period of time the appropriate criteria specified in the relevant Part of BS 476

### 2.9

#### fire damper

a mobile closure within a duct which is operated automatically or manually and is designed to prevent the passage of fire and which, together with its frame, is capable of satisfying for a stated period of time the fire resistance criterion for integrity

### 2.10

#### fire stopping

a seal provided to close an imperfection of fit between elements, components or construction in a building, or any joint, so as to restrict penetration of smoke and flame through that imperfection or joint

<sup>1)</sup> In preparation. Revision of CP 413.

**2.11****floor void**

a cavity between a structural floor and a platform floor above, through which building services may pass

**2.12****material of limited combustibility**

either:

- a) a non-combustible material; or
- b) any material of density  $300 \text{ kg/m}^3$  or more which, when tested in accordance with BS 476-11, does not flame and the rise in temperature on the furnace thermocouple is not more than  $20^\circ\text{C}$ ; or
- c) any material with a non-combustible core of 8 mm thick or more, having combustible facings (on one or both sides) not more than 0.5 mm thick; or
- d) any material of density less than  $300 \text{ kg/m}^3$  which, when tested in accordance with BS 476-11, does not flame for more than 10 seconds and the rise in temperature on the centre (specimen) thermocouple is not more than  $35^\circ\text{C}$  and on the furnace thermocouple is not more than  $25^\circ\text{C}$ .

**2.13****non-combustible**

any material capable of satisfying the performance requirements specified in BS 476-4, or any material which when tested in accordance with BS 476-11 does not flame nor cause any rise in temperature on either the centre (specimen) or furnace thermocouples

**2.14****pressurization**

a method of protecting escape routes against the ingress of smoke by maintaining the air within them at pressures higher than those in adjacent parts of the building

**2.15****protected shaft**

a stairway, lift, escalator, chute, duct or other shaft of fire-resisting construction which enables persons, things or air to pass from one compartment to another

**2.16****protected stairway/lobby/corridor**

a stairway, including any exit passageway leading therefrom to its final exit, or lobby or corridor, separated from any other part of the building by fire-resisting construction

**2.17****return (air) grille**

a grille connected to the ductwork system through which air is extracted from a room or space

**2.18****shunt system**

a system in which branch ductwork, instead of making a direct connection to the main ductwork turns through an angle and runs parallel to the main ductwork for a specified distance before turning into and connecting with the main ductwork

**2.19****supply grille**

a grille or diffuser connected to the ductwork system through which air is discharged into a room or space

NOTE For the purposes of this code the term "supply grille" should be taken to include air diffusers.

**2.20****thermally actuated device**

a device or system which releases a fire damper closing mechanism when the temperature in the vicinity of the fire damper rises to a predetermined value

**2.21****transfer grille**

a fixed grille not connected to the ductwork system providing for the free transfer of air between adjacent rooms and/or spaces

**3 Use of this code****3.1 Means of providing for safety**

The recommendations in this code are intended to provide safety from fire by means of:

- a) design and construction of ductwork systems to prevent their becoming the means by which fire, smoke and other products of combustion can spread from one compartment to another, or prejudice the safe use of escape routes;
- b) construction and finishing with suitable materials to limit the spread of fire over or within the ductwork.

**3.2 Use of the principles and recommendations**

The fire hazard of a particular building and its contents has to be appreciated when designing a ductwork system. However, it is not possible to make comprehensive recommendations capable of covering every possible risk, and intelligent appraisal of the principles and application of the recommendations of this code is therefore essential.

### 3.3 Application of all the recommendations

Individual recommendations of this code should not be applied in isolation. To secure compliance with the code all the relevant recommendations should be applied.

### 3.4 Relationship with statutory provisions

**3.4.1 General.** It is important to appreciate the relationships between this code and the various statutory provisions relevant to the design and construction of new buildings and to the fire precautions to be provided in existing buildings. The relevant legislation indicated in general terms in and **3.4.2** has to be complied with in the event of a conflict with this code. However, there are two main ways in which this code is intended to supplement the legislation. The first is that, since Acts of Parliament and Regulations made under them are necessarily drafted in broad terms and cannot deal in detail with a wide variety of different situations, one of the objects of this code is to provide guidance for the building designer in matters not covered in sufficient detail by the legislation. Secondly, because the objectives of the legislation are mainly concerned with the health and safety of the general public, this code is of wider scope and includes matters relevant to the protection of the building and its contents from fire as well as the safety of the occupants.

*Building regulation.* The design and construction of new buildings, and of alterations of existing buildings, are controlled by the following statutory provisions, collectively referred to as building regulations in this code.

England and Wales: The Building Regulations

Scotland: The Building Standards (Scotland) Regulations

Northern Ireland: The Building Regulations (Northern Ireland)

It should be noted that some county and other authorities in England and Wales have local powers in respect of fire precautions.

**3.4.2 Legislation and other regulations for fire safety in existing premises.** In addition to the controls mentioned in , fire safety and means of escape for a wide variety of buildings is dealt with under the following legislation.

England and Wales:

The Fire Precautions Act, 1971, as amended by the Health and Safety at Work etc. Act, 1974, and the Fire Safety and Safety of Places of Sport Act, 1987

The Building Act, 1984 (except in Inner London where the fire provisions of the London Building Acts, 1939-1982, as amended by the Local Government Act, 1985, apply)

Scotland:

The Fire Precautions Act, 1971, as amended by the Health and Safety at Work etc. Act, 1974, and the Fire Safety and Safety of Places of Sport Act, 1987

The Building (Scotland) Act, 1959 (as amended)

Northern Ireland:

The Fire Services (Northern Ireland) Order, 1984, and the Health and Safety at Work (Northern Ireland) Order, 1978

The Building Regulations (Northern Ireland) Order, 1979

It should be noted that for premises subject to the Fire Certificates (Special Premises) Regulations, 1976, the regulations apply to all buildings within the premises.

There are also a number of local Acts as well as entertainment and other licensing legislation which deal with fire safety and means of escape. The designer should consult the fire authority and building authority at an early stage to make certain the buildings as planned will meet the requirements those authorities may make, particularly if a fire certificate or licence may be necessary.

**NOTE** Under the Fire Precautions Act, 1971, fire authorities in England and Wales cannot, as a condition of the issue of a fire certificate, require structural or other alterations relating to escape from the premises if the plans of the building comply with building regulations, unless the fire authority is satisfied that the means of escape in case of fire are inadequate by reason of matters or circumstances of which particulars were not required to be supplied to the local authority in connection with the deposit of plans for building regulation purposes.

### 3.5 Information to be given to clients

Designers are advised to inform their clients of the nature and function of the fire precautions that have been designed into the ductwork system, and especially those whose nature may be less evident. This will enable a better understanding of the responsibilities for ensuring that a high standard of safety is maintained. Sufficient drawings and written information should also be given to the client on completion of the work to enable him to establish proper maintenance records (see **A.3**).

The advice given in appendix A is intended as a guide to the information concerning the fire precautions that have been designed into the building which designers are advised to pass to their clients.

### 3.6 Diagrams

The figures are intended to clarify concepts, and should not be taken as indicating the only acceptable forms of planning or construction.