



BLUE BOOK

European version

Fire resisting ductwork

Tested to BS EN1366 Parts 1, 8 & 9

(Classification to BS EN13501 Parts 3 & 4)

2nd Edition

(Volume 1)

FIRE AND YOUR LEGAL LIABILITY

Fire kills around 300 people and damage claims exceed £1 billion every year in the UK. That's why we must all play our part.

Why is this of relevance to me?

If you are involved in the provision of fire protection, at any level, then you share liability for its usefulness and its operation when it's needed in a fire, and that liability will still be there in the event of a court case.

I place the order; it is not my responsibility to install the works

If it is your responsibility to specify the materials and/or appoint the installation contractor it is also your responsibility to ensure that they can prove competency for the fire protection materials used, or the works to be carried out. It's no longer simply a duty of care or voluntary – it's a legal obligation under sections 5.3 and 5.4 of the Regulatory Reform (Fire Safety) Order 2005. Similar provisions also exist in equivalent legislation in Scotland and Ireland.

If you knowingly ignore advice that leads to a failure in the fire performance of any element of installed fire protection within a building, then you are likely to be found to be just as culpable as the deficient installer.

You also share liability for the provision of information required under Building Regulation 38 (formerly 16B) that tells the user of the building about the fire prevention measures provided in the building. The user needs this to make an effective risk assessment under the Regulatory Reform (Fire Safety) Order 2005 and national equivalents in Scotland and Ireland.

I'm only installing what I'm contracted to do

If you are installing fire protection, then as with those specifying the materials and/or the contractor, you also have a legal obligation to ensure that the materials you install are adequate under sections 5.3 and 5.4 of the Regulatory Reform (Fire Safety) Order 2005 and national equivalents in Scotland and Ireland.

What is expected of me?

In the event of fire, and deaths, a court will want to know how every fire protection system was designed and specified; the basis for selection of the installer; whether adequate time was provided for its installation; and whether there was adequate liaison between the different parties to ensure it was installed correctly. No ifs, no buts – it's all contained in the Construction, Design and Management Regulations 2015.

The CDM 2015 Regulations, enforced by Health and Safety Executive, concentrate on managing the risk, and the health and safety of all those who design, specify and build, those that use the building, those who maintain it and those that demolish it – cradle to grave.

Be aware – the time to consider the above is before the event, not after it!



Association for Specialist Fire Protection (ASFP)



The Association was formed in 1976, and currently represents UK manufacturers and contractors of specialist passive fire protection products, with associate members representing regulatory, certification, testing and consulting bodies. It seeks to increase awareness and understanding of the nature of fire and the various forms, functions and benefits provided by passive fire protection. It is willing to make available its specialist knowledge on all aspects of fire protection and can assist specifiers and main contractors in identifying products suitable for specific requirements, both in the UK and related overseas markets. The Association encourages experimental work related to passive fire protection and promotes consideration and discussion of all issues affecting the fire protection of buildings

Spectra House, Westwood Way, Westwood Business Park, Coventry CV4 8HS

Tel: 02476 935412 www.asfp.org.uk

The Fire Test Study Group (UK) Ltd (FTSG)



FTSG is a forum for technical discussions and liaisons between consulting fire test laboratories involved in producing test and assessment information for the purposes of building control.

The member laboratories are all UKAS Accredited for testing and the primary objective of the group is to ensure common technical interpretations of the fire test standards and a common approach to technical appraisals or assessments of products which may be made by the members within the terms of Approved Document B and national equivalents in Scotland and Ireland.

FTSG members support the publication of this edition of the “Blue Book” as it provides specifiers and regulatory bodies with an independently validated comprehensive and concise guide to the performance of fire resisting ducts when tested against British Standards.

Fire Test Study Group (UK) Ltd, Holmesfield Road, Warrington, Cheshire, WA1 2DS

Tel: 01925 655116 www.ftsg.co.uk

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Darren Webster	Firesafe Fire Rated Ductwork Ltd (TG6 Chair)
Paul Hanson	Royal Borough of Kensington & Chelsea
Brian James	Firespray International Ltd and BESA delegate
Alan Kinnear	Fire Protection Ltd
Tony Baker	BRE
Norman Macdonald	Firemac
Shayne Wehrle	Actionair / Swegon Air Management
Andrew Taylor	ASFP Technical Officer
Niall Rowan	ASFP Chief Executive Officer

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Foreword

As Convenor of ASFP Task Group 6 (Ducts and Dampers), I am pleased to introduce this 2nd Edition of 'Fire Resisting Ductwork': tested to EN 1366 1, 8 & 9 (classified as applicable according to BS EN 13501 Parts 3 and 4). It provides complementary information to the UK version entitled 'Fire resisting ductwork: tested to BS 476 Part 24: 3rd Edition' which is limited to fire test data from BS 476 Part 24 tests. Both documents provide guidance to best practice for the use of fire resisting ducts in buildings.

The European version is used for tests and classifications from BS EN13501 Parts 3 and 4 and for products which may have to be CE marked under the European Construction Products Regulation. Until CE marking becomes mandatory, both BS and EN versions remain valid in the UK. Once CE marking becomes mandatory, the BS version will become redundant for EU markets but can still be used in applications elsewhere. See ASFP advisory Note 16 for the latest position regarding the status of the standards and CPR.

Both the British Standard version and this European version contain sections on the different types of system and their function. This document also includes information on all the relevant legislation, standards and codes of practice as well as notes on penetration seals and support systems.

The ASFP believes that third party certification of passive fire protection products and installers is the best way to instil confidence in the use of passive fire protection.

This document is cited in Approved Document B – the statutory guidance to the England and Wales Building Regulations.



Darren Webster

Chairman

ASFP TG6 Ducts and Dampers

Firesafe Fire Rated Ductwork Ltd

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SCOPE

This publication aims to assist the reader in understanding the essential factors relating to the design and installation of fire resisting ductwork (which includes smoke control ductwork) in accordance with UK and EU legislation. It references the relevant Building Regulations and European (BS EN) Standards which apply.

Detailed information on current European (BS EN) Standard fire resistance and reaction to fire tests is provided, together with recommended methods for appraisal systems for both direct and extended fields of application. Guidance is also given in respect of the fire resisting requirements for duct systems incorporating penetration seals, support systems and ancillary items, with a section relating to limitations.

Drawings of typical BS EN 1366 fire test constructions are reproduced and diagrams of types and functions of various fire resisting ductwork systems are included. These are for guidance purposes only.

The guidance given in this publication specifically refers to fire resisting ductwork tested to BS EN 1366 and does not, therefore, include advice on conventional non-fire resisting ductwork systems, or ducts containing services such as water pipes and cables.

Cautionary note to all ductwork designers, manufacturers and installers

General purpose DW/144 air conditioning ductwork cannot be utilised as, or converted into, a fire resisting ductwork system unless the construction/materials of the whole system are proven by test or assessment in accordance with the requirements of BS EN 1366 or BS476: Part 24 (see Blue Book BS).

Under the Construction Products Regulation, where there is a harmonised European Product Standard (hEN) for a particular product it is necessary for a manufacturer to comply with it and CE mark the product. At the time of writing, the only published standard relevant to fire resisting ductwork is BS EN 12101-7, Smoke and heat control systems, Part 7: Smoke duct sections. Note, currently size restrictions also apply to CE marked ducts.

For further details regarding the status of BS EN standards and CE marking, please see ASFP advisory note 16. The latest version of this document can be downloaded from the ASFP website.

1. INTRODUCTION

This publication aims to assist those involved in the specification, installation, inspection and verification of fire resisting ductwork tested to BS EN 1366 Parts 1, 8 or 9 and to ensure that minimum performance standards are maintained which will contribute to ensuring that fire compartmentation systems are not breached prematurely.

1.1 What is fire resisting ductwork?



Fire resisting ductwork being installed

Fire resisting ductwork is ductwork that has been successfully tested or assessed to BS EN 1366 Parts 1, 8 or 9. It may be provided either by specialist companies producing proprietary systems or by insulating satisfactorily constructed and supported steel ductwork. Care must be taken when choosing a fire resisting ductwork system and checks should be made to ensure that the ductwork fire performance meets with the requirements of the relevant application.

1.2 What is fire resisting ductwork required to do?

Fire resisting ductwork usually needs to pass through compartment walls or floors that will have a prescribed fire resistance period in terms of the integrity and insulation criteria, for durations of 30 to 240 minutes. It is a requirement that where these compartment walls/floors are penetrated by ducts or other building services, the fire performance criteria for the penetrated wall or floor are maintained, such that fire in one compartment may not spread to other areas. So the fire resisting duct needs to maintain i.e. not compromise the fire resistance of the wall or floor through which it penetrates. The performance of a fire resisting duct which penetrates a fire resisting/separating element requires careful consideration by specifiers and controlling authorities. **The standard periods of fire resistance should in all cases be at least equal to those required for the penetrated element of construction.**

In certain circumstances, fire engineers may argue for and/or controlling authorities may allow waiver of the insulation requirement or allow a reduced period of insulation, for example, in some car parks, where enforcers have considered that there was not a possibility of combustible materials being in close proximity of the ductwork.

The requirement for insulation needs to be considered by the system designer taking into account as a number of scenarios including (but not limited to) the following:

- Risk of fire inside the duct igniting combustible materials in close proximity to the duct due to radiant heat. Note “close proximity” would be within 500mm of the duct.
 - Risk of a fire outside the duct igniting a fire inside the duct through heat transfer (for this to happen the duct would need to have combustible linings).
 - Fire resisting ducts passing through fire resistant compartments, or those that pass above or across protected corridors and escape routes.
- Further clarification on these scenarios is contained in this document.

National Statutory Guidance documents such as Approved Document B (and its equivalents in Scotland, Northern Ireland and Ireland) refer to BS 5588: Part 9/BS 9999 for alternative ways in which the integrity of compartments may be maintained where ductwork penetrates fire separating elements.

1.3 Maintaining the fire resistance of walls & floors penetrated by ducts

Most ductwork systems offer little or no protection against fire spread. When ductwork penetrates building compartmentation, regulatory requirements and the guidance of BS 9999 should be followed:

Method 1	Protection using thermally activated fire dampers;
Method 2	Protection using fire resisting enclosures;
Method 3	Protection using fire resisting ductwork.
Method 4	Protection using automatically actuated fire and smoke dampers triggered by smoke detectors

Statutory regulations and design codes provide the designer with prescribed periods of fire resistance to elements of construction and fire separating elements, which give a safe period for evacuation of people, a safe period for firefighting and can also provide for property protection. It is vitally important for life safety that the fire resistance of the element of construction is not reduced when ductwork is routed through it.

Good practice dictates that fire dampers should not be installed within certain ductwork systems in buildings (e.g. kitchen extraction, staircase and lobby pressurisation, lift shaft ventilation, fresh air make up provision, etc.) and therefore either Method 2 or Method 3 of BS 9999 should be used.

Steel ductwork systems for air movements around buildings are generally constructed to the BESA guide DW/144 which covers a wide range of construction standards in the manufacture of sheet metal ductwork for use in low, medium or high pressure applications and includes various methods of jointing, stiffening and support for the ductwork.

BS 5588: Part 9 paragraph 7.5.1 acknowledges that steel ductwork ‘if satisfactorily constructed and supported will be able to provide a high degree of resistance to the passage of smoke and decomposition products. However, rapid transfer of heat through the steel regardless of its thickness prevents the ductwork achieving any degree of fire resistance without supplementary insulation’. **A satisfactorily constructed and supported fire resisting steel duct is only one proven by test and/or assessment to BS EN 1366 parts 1, 8 or 9 or BS476: Part 24 (see Blue Book BS).**

An alternative to steel ductwork systems is self-supporting ductwork such as that constructed from rigid boards. Supplementary insulation may also have to be considered for these systems.

The European fire tests for evaluating the fire resistance of ducts, BS EN 1366 part 1, 8 & 9 were introduced in 1999, 2004 and 2009 respectively. *This document includes an explanatory Annex giving guidance on the fire performance criteria required for kitchen extract and smoke control applications, which differ from the requirements for ducts. It is important that the evaluation and suitability of any proposed system of fire resisting ductwork matches the requirements for the application; (e.g. a smoke control duct to the performance criteria of BS EN 1366 part 8 & 9).*

1.4 Other characteristics

It is essential to give due consideration to other factors that may be required when evaluating the suitability of a proposed system of fire resisting ductwork including (but not limited to):

- Seismic qualification of ductwork, support system and penetration sealing method
- Pressure / air carrying capacity
- Materials sensitive to thermal shock
- Materials susceptible to physical damage
- Acoustic performance requirement of the system
- Thermal performance requirement of the system
- Resistance to air flow.
- The suitability for cleaning, if a kitchen duct system
- Any need for a smooth internal surface, for high pressure ducts.
- The structure from which the system will be supported (i.e. adequate load bearing fire resisting structure is required to provide the stability of the system).

2. DEFINITIONS

For the purpose of this document the following definitions apply.

2.1 Duct/ductwork terms

Access doors

A closure of an inspection opening within the duct.

Compensator

A device that is used to prevent damage from the forces generated by expansion.

Duct/Ductwork

A system of enclosures of any cross sectional shape for the distribution or extraction of air.

Duct/Ductwork - Fire resisting

Note: the term 'fire rated' is sometimes incorrectly used instead of the correct term fire resisting. The term 'fire rated' is deprecated because it can refer to a reaction to fire requirement rather than any for fire resistance or smoke control.

Duct/Ductwork - Fire Resisting ventilation duct

A duct or ductwork used for the distribution or extraction of air, designed and tested to satisfy the criteria defined in BS EN 1366 -1.

Duct/Ductwork - Fire resisting smoke extraction for multi-compartments

A duct used for the extraction of smoke in case of fire and designed to provide a degree of fire resistance, when tested to BS EN 1366 - 8.

Duct/Ductwork - Fire resisting smoke extraction for single compartments

A duct used for the extraction of smoke in case of fire and designed to provide a degree of fire resistance, when tested to BS EN 1366 - 9.

Duct/Ductwork - Fire Resisting Kitchen Extract (equivalent to ducts with combustible linings)

A duct or ductwork designed and tested to satisfy the criteria defined in BS EN 1366 – 1 (fire resistance test for ventilation ducts) that is installed entirely independent of any other duct or ductwork within the building and which serves as an extract for non-domestic kitchens (see clause 32.5.4 of BS 9999: 2017 and clause 9.5 of BS 5588: Part 9). Fire dampers (*methods 1 and 4 of BS9999:2017*) should not be used for kitchen extraction.

Duct/Ductwork - Self supporting

Self-supporting fire resisting ducts are those that are formed with fire protection boards, and possibly framework, without a steel duct.

Duct A, B and C

Duct A terminology is associated with ducts where fire is outside the duct.

Duct B terminology is associated with ducts where fire is inside the duct.

Duct C terminology is associated with multi compartment smoke extract ducts with fire inside the duct.

Specific conditions are provided in the relevant fire test standards EN 1366 Parts 1, 8 and 9

Support System

The components used for supporting a duct or ductwork from, and fixing to, a fire resisting element of construction.

2.2 Dampers

Damper, fire

A device for use in heating, ventilation and air-conditioning (HVAC) systems at fire separating elements to maintain compartments (E classification). Note: not all fire separating elements are compartment walls.

Damper, fire and smoke

A device for use in heating, ventilation and air-conditioning (HVAC) systems at fire separating elements to maintain compartments and reduce smoke leakage to protect escape routes (ES classification). Note: not all fire separating elements are compartment walls.

Damper, smoke control

A device, automatically or manually activated, which may be open or closed in its operational position, to control the flow of smoke and hot gases into, from or within a duct, and may assist fire fighting procedures. (ES classification).

2.3 General terms

Compartment

A building or 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, or an adjoining building. A roof space above the top storey of a compartment is included in that compartment.

Depressurisation

Smoke control using pressure differentials where the air pressure in the fire zone or adjacent spaces is reduced below that in the protected zone

Fire Resistance

The ability of a component or construction to satisfy, for a stated period of time, the appropriate criteria specified in the relevant part of EN 1366. The following criteria are applied to fire resisting, multi-compartment ductwork.

Integrity (E)

The ability of a duct or ductwork and support system to remain stable and free of cracks, holes or openings outside the compartment in which the fire is present for a specified period of time, when tested to EN 1366-1 Section 11, which also references EN 1363-1.

The volume flow rate measured in duct type A (fire outside the duct) must not exceed $15\text{m}^3/\text{m}^2\text{h}$ related to 20°C and related to the internal surface area of the duct inside the furnace as specified in EN 1366-1.

Insulation (I)

The ability of a duct or ductwork to maintain its integrity without developing temperatures on its external surface, outside the compartment in which the fire is present, which exceed:

- i. 140°C as an average value above ambient and/or
- ii. 180°C as a maximum value above ambient at any one point

When tested for a specified period of time to the requirements of EN 1366-1 Section 11, which also references EN 1363-1. For ventilation ductwork with combustible linings these limitations also apply to

the internal surface of the duct type A (fire outside the duct) within the compartment in which the fire is present (Referenced as the T3 Thermocouples). It is generally accepted that this performance criterion may also apply to a kitchen extract duct as it may have a build up of grease or oil on its inner surface.

Smoke leakage (S)

See EN 1366-1 Section 11, which also references EN 1363-1

Failure of this criterion shall have occurred if the flow rate in Duct A during the test exceeds $10\text{m}^3/\text{m}^2\text{h}$ at normal temperature and pressure, related to the internal surface area of the duct inside the furnace.

Additional performance criteria for smoke control ducts

For smoke control duct systems refer to 'Smoke control'.

Fire Separating Elements

Floors, walls, fire protected shafts (multi-service or dedicated) and other separating elements of construction having a period of fire resistance as determined in accordance with the relevant parts of relevant BS EN fire resistance test. Note: not all fire separating elements are compartment walls.

Penetration

An aperture through a fire separating element for the passage of a duct or ductwork, or building services, that can compromise the fire performance of the fire separating element unless sealed with an appropriate penetration sealing system.

Penetration sealing system

The system used to maintain the fire resistance of the ductwork where it passes through a fire separating element as evaluated by test to BS EN 1366 Part 1 or 8.

Note: penetration sealing systems tested with e.g. cables and pipes to BS EN 1366-3 cannot be used with fire resisting ducts, unless the system has been tested according to the relevant standard detailed within this document. The seal used must be the same as that when the duct was tested to BS EN 1366 Part 1 or 8. No other seal type can be used.

Supporting Construction

A wall, partition, or floor which the duct passes through in a fire resistance test according to BS EN1366 part 1,8 or 9.

Pressurisation

Smoke control using pressure differentials, where the air pressure in the spaces being protected is raised above that in the fire zone

Protected shaft

A shaft which enables persons, air or objects to pass from one compartment to another, and which is enclosed with or comprises fire-resisting construction.

Protected stairway

A stair discharging through a final exit to a place of safety (including any exit passageway between the foot of the stair and the final exit) that is adequately enclosed with fire resisting construction.

Smoke control

These are ventilation systems that are designed to function in the event of a fire to 'control' the spread of fire and smoke. They may be a combination of extraction, pressurisation, de-pressurisation or make-up air systems.

Multi-compartment smoke control duct systems must first have been tested to EN 1366-1 and shown to satisfy all of the criteria listed under 'Fire resistance'.

Multi-compartment and single compartment smoke control duct systems are tested to EN 1366-8 and EN 1366-9 respectively, and are subject to the following performance criteria.

1. Integrity - Volume flow rate - Ensure that the flow rate in the tested duct system does not exceed $10\text{m}^3/\text{m}^2\text{h}$ both at ambient temperatures and under fire conditions, as described in the test standard.
2. Smoke Leakage - Failure of this criterion shall have occurred if the flow rate in Duct C during the test exceeds $5\text{m}^3/\text{m}^2\text{h}$ at normal temperature and pressure, related to the internal surface area of the duct between the perforated plate and the end of the duct.
3. Mechanical stability – If the duct inside the furnace collapses, so that it can be judged as not being able to maintain its smoke extraction or fire resistance function, this shall be regarded as failure under the criterion of mechanical stability.
4. Reduction in cross section – the internal dimensions of the smoke extracting ductwork at ambient temperatures and under fire conditions, shall not decrease by more than 10% during the test.

BS EN 1366-8 - Thermocouples are applied to the non-fire face of the duct, and to the supporting structure and penetration seal outside the furnace, as required by the standard, although these are not required to demonstrate insulation performance and are for information only. (Insulation performance is taken from the EN 1366-1 test data).

BS EN 1366-9 – There is no insulation performance criteria.

3. DUCTWORK TYPES & FUNCTIONS

This document does not apply to ducts containing services such as water pipes or electrical cables. It covers only ductwork that is part of the following systems for handling air, fumes or products of combustion. Typical examples are illustrated in figures 2-10.

If a product is subject to a harmonised product standard it is a legal requirement under the Construction Products Regulation that it is supplied in accordance with this and CE marked accordingly. This applies to smoke control ducts to BS EN 12101-7, Smoke and heat control systems, Part 7: Smoke duct sections. Note currently size restrictions also apply to CE marked ducts. Other product areas are being brought into harmonisation. See ASFP advisory note 16 for an up to date picture, regarding the publication of BS EN 15871 (ventilation duct sections), which is in progress.

3.1 Mechanical ventilation systems

Mechanical ventilation systems are used to extract vitiated or polluted air from a building and to supply replacement fresh or conditioned air. The necessary fans and conditioning equipment are generally located in separate plant rooms, often in a basement or on the roof. The distribution of the air involves ductwork which may be very large, extend throughout the building, penetrate compartment walls and/or floors and have openings in every space through which it passes.

Without suitable fire precautions, therefore, ductwork can provide a route by which fire, smoke and toxic gases are enabled to spread rapidly through a building.

Fire resisting ductwork elements can be used in these systems as shown in relevant figures below.

3.2 Smoke extraction systems

Smoke extraction is the evacuation from a building of products of combustion, such as smoke and toxic gases, which could otherwise reduce visibility and impair human functions. This facilitates the escape of the building occupants and assists fire fighters in extinguishing fires.

In situations where smoke clearance by natural ventilation through windows or other openings may be difficult (e.g. in large or deep basements or in high rise buildings without operable windows) ductwork is required to conduct the smoke to a suitable outlet from the building. In cases where the natural buoyancy of the combustion products is not adequate to ensure the required smoke extraction rate through the ductwork,

fan assisted systems are used. It may also be necessary to install ducted air inlets as part of the smoke extraction scheme, in order to provide the replacement air.

If the ductwork incorporated in a smoke extraction system is wholly contained within the fire compartment, it can be tested to BS EN1366-9 to show that it is capable of resisting the anticipated smoke temperatures generated during the development of a fire. These will generally be lower (i.e. 600°C to mimic temperatures pre flash over) than the temperatures specified in BS EN1366 parts 1 & 8, which are intended to represent a fully developed fire (around 1000°C). However, if the ductwork penetrates a fire resisting barrier, it must be capable of providing the relevant fire resistance in a test to the relevant part of BS EN 1366 part 8. Further clarification of the fire testing requirements for these two different situations is provided in Section 6 of this document 'Standard Fire Tests'. This approach needs to be verified against the requirements of BS9999 and local fire engineering requirements.

In view of the importance of maintaining the design extraction rates during a fire, BS EN1366-8 and 9 also impose an additional requirement on smoke outlet/extraction ductwork (i.e. the retention of at least 90% of its original cross sectional area during the test). Figures 6, 8 and 9 show examples of smoke extraction systems.

Approved Document B (England and Wales versions) in the clarified version states in clause 18.12 the air extraction system should be capable of handling gas temperatures of 300°C for not less than one hour, which implies the ductwork need not have a standard of fire resistance. The ASFP recommends that to ensure proven reliability of such ductwork in the event of a fire, that it has been successfully tested in accordance with BS EN 1366-8. The ASFP believes that only a fully tested system can guarantee the performance required. Further it must be clear that any ductwork that passes through a fire compartment barrier must also be capable of providing the same level of fire resistance as the barrier (wall or floor) which can only be done in accordance with BS EN 1366-8. In addition, as with all passive fire protection products, the ASFP recommends that the ducting is third party certificated and is installed by contractors holding third party certification for the installation of fire resisting ductwork.

3.3 Dual ventilation /smoke extraction systems

These systems serve as a conventional ventilation system under normal conditions, but are converted to a smoke extraction system in the event of fire, thus providing an economical dual system. See figures 6, 8 & 9.

3.4 Pressurisation systems

Pressurisation is a method of restricting the penetration of smoke into certain critical areas of a building, by maintaining the air within the critical areas at pressures higher or lower than those in adjacent areas. It applies particularly to protected stairways, lobbies and corridors, as smoke within these areas would inhibit escape, and also to firefighting shafts serving deep basements, because of the difficulties in clearing smoke from basements.

A pressurisation system is a special form of mechanical ventilation system. However, as the air supply creating the pressurisation must be maintained for the duration of a fire, fire dampers cannot be used within the ductwork to prevent the spread of fire. Any duct penetrating fire resisting barriers must be fire resisting.

BS 9999 provides guidance on the use of pressurisation in buildings for the purpose of smoke control for specific examples e.g. atria, firefighting stairs etc.).

An example of a pressurisation system is given in figure 10.

3.5 Means of escape

There are three options for safeguarding protected means of escape routes commonly in use:-

Method 2 - Fire resisting enclosure of ductwork systems (known as Method 2 in BS 5588-9 and BS 9999)

Method 3 - The use of fire resisting ductwork (known as Method 3 in BS 5588-9 and BS 9999)

Method 4 - ES fire and smoke dampers as described in BS 9999: 2017.

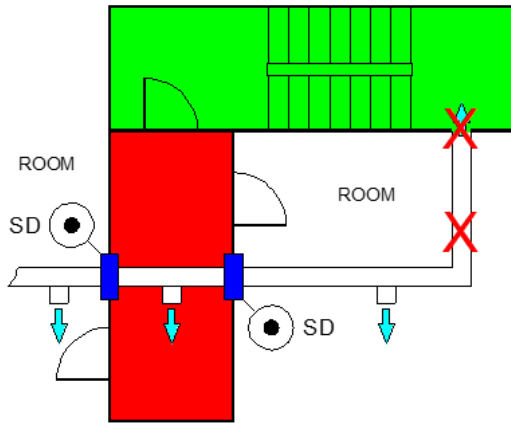
Note Method 1 (thermally activated fire dampers) is not suitable for use in escape routes as indicated in BS 9999 (clause 35.5.2.3) and Building Regulations Guidance – (see documents referred to in section 5) , because large volumes of smoke can pass through without activation of the thermal devices and E-rated fire dampers have no performance rating in terms of smoke resistance.

These are shown in figure 1 below.

FIGURE 1

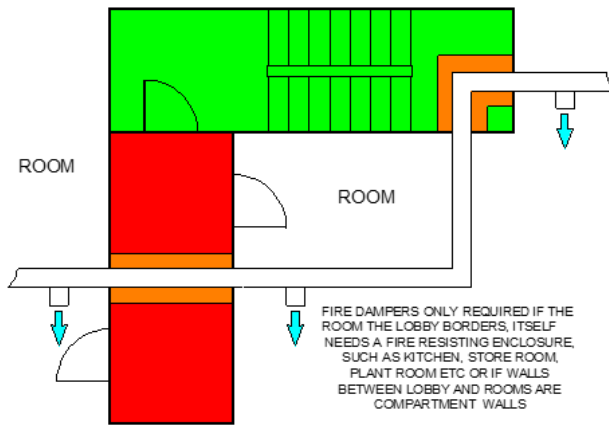
VENTILATION OUTLETS SHOULD NOT SERVE A PROTECTED STAIRWAY.

IF DUCTWORK NEEDS TO PASS THROUGH STAIRWAYS METHOD 2 OR 3 PROTECTION IS REQUIRED

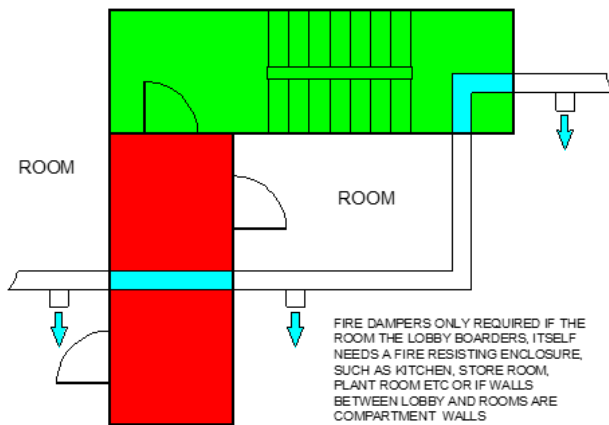


STAIRWAY REQUIRING LOBBIES

ES CLASSIFIED FIRE/SMOKE DAMPER SOLUTION; METHOD 4
DUCTWORK PASSING THROUGH PROTECTED ROUTES IS ABLE TO SERVE THE PROTECTED ROUTES



PROTECTED DUCTWORK SOLUTION; METHOD 2
DUCTWORK PASSING THROUGH PROTECTED ROUTES WITHOUT SERVING THE ROUTE
(METHOD 2 IN BS5588-9; 6.4.3 AND BS9999; 33.4.2)



PROTECTED DUCTWORK SOLUTION; METHOD 3
DUCTWORK PASSING THROUGH PROTECTED ROUTES WITHOUT SERVING THE ROUTE

KEY

- PROTECTED STAIRWAY
- PROTECTED LOBBY
- DUCTWORK ENCLOSED WITH FIRE RESISTING CONSTRUCTION TESTED TO BS EN 1366-1 OR BS EN 1366-8 FURTHER CLASSIFIED EI X IN ACCORDANCE WITH BS EN 13501-3 OR BS EN 13501-4 (FIRE EXPOSURE FROM THE DUCT SIDE),
- FIRE-RESISTING DUCTWORK TESTED TO BS EN 1366-1 OR BS EN 1366-8 FURTHER CLASSIFIED EIS X IN ACCORDANCE WITH BS EN 13501-3 OR BS EN 13501-4
- WHERE X IS THE FIRE RESISTANCE RATING (IN MINUTES) OF THE WALLS OF THE PROTECTED ROUTE.
- ES CLASSIFIED FIRE/SMOKE DAMPER FIRE RESISTANCE TESTED TO BS EN 1366-2 CLASSIFIED TO EN 13501-3
- SD SMOKE DETECTION SYSTEM IN ACCORDANCE WITH BS 5839-1:2013 TO ACTIVATE ES FIRE/SMOKE DAMPER
- DUCTWORK SERVING AREA

3.6 Kitchen extract systems

Kitchen extraction ductwork presents a particular hazard, in that combustible deposits such as grease are likely to accumulate on its internal surfaces, and may spread fire if ignited. A fire in a kitchen may spread to other areas of the building by way of the kitchen extract ductwork and may also prejudice escape routes See figure 7.

Figure 7 references a room 1. It is important when assessing the risk for fire to consider the potential of a fire breaking out in room 1 and igniting the grease within the kitchen extract duct passing through the room. Therefore, insulation is essential and the testing shall have included for the thermocouples on a duct A within the furnace (T3 thermocouples). There are various considerations to be taken into account for kitchen extraction systems and we recommend that reference is made to BESA DW 172 to ensure full compliance with these requirements (see 3.6.2).

Guidance for the installations for kitchen extract ducts is provided in various documents. Whilst 3.6.1 and 3.6.2 below may not be exhaustive, they attempt to list the common requirements with reference to the regulatory guidance in Approved Document B 2006 where applicable. Similar requirements are given in the statutory guidance documents in Wales, Scotland and Ireland.

3.6.1 Provisions for means of escape in relation to kitchen extraction systems (AD-B)

a) *Approved Document B Volume 2: 2019, Paragraph 10.10*
Non-domestic kitchens are required to have separate and independent extraction systems, because of the polluted nature of the extracted air. The extracted air should not be re-circulated.

b) Any kitchen extract duct or ductwork penetrating fire resisting barriers must be fire resisting between the kitchen and the external weathering cowl.

The fire resistance requirement is normally 30 minutes, unless the duct also penetrates a compartment separation wall/floor where the fire resistance period and criteria should meet any higher requirement of the compartment wall/floor.

c) British Standards

Although Approved Document B, 2019 does not provide guidance on kitchens other than in small premises and residential care homes, BS 9999:2017, section 32.5.4, *Segregation of ventilation ductwork serving areas of special risk or carrying polluted air*, states

Certain areas of a building, e.g. non-domestic kitchens, car parks and plant rooms, should have separate and independent extraction systems, and the extracted air should not be recirculated. Separate ventilation should be provided in residential accommodation in mixed-use buildings because of the sleeping risk involved.

d) *Guidance for Hospitals is given in HTM 05-02.*

In most cases, unless a suitable automatic extinguishing arrangement is provided, kitchens are required to be enclosed with fire resisting construction. Consequently the extract ductwork also needs to be enclosed with fire resisting construction where passing outside the kitchen enclosure up to its discharge to external air. The required fire resistance is to be achieved from inside the duct, to prevent a fire from inside the duct breaking out and spreading to other areas in the building.

NOTE: *ASFP emphasises that regular internal cleaning of kitchen extract ducts is an essential part of all fire risk assessments and planned maintenance programmes in accordance with BESA publication DW/172, TR 19 and BS 9999 Annex W1. See also 9.5.*

3.6.2 Provisions for compartmentation in relation to kitchen extract systems (AD-B)

- a) *Approved Document B Volume 2: 2019, Paragraph 10.12 and 10.14*
Where a kitchen extract duct passes through fire separating elements the integrity of those elements should be maintained. Fire dampers (known as Method 1 is not suitable for extract ductwork serving kitchens.[see BS9999] This is due to the likely build-up of grease within the duct, which can adversely affect the effectiveness of any dampers. Therefore a fire resisting enclosure (known as Method 2) or fire resisting duct (known as Method 3) should be used.
- b) *BS ISO 6944-2: 2009*
The specifier may select a system which has been tested to BS ISO 6944-2: 2009 which has been developed specifically for kitchen extract ducts.

NOTE: Regardless of the publication of BS ISO 6944-2: 2009 the UK regulators may choose not to adopt all published standards in regulatory documents. Specific regulatory information is available in Approved Document B as guidance to building regulations.

- c) *BESA DW 172 Specification for kitchen ventilations systems*

This specification contains useful information for designers, consultants and contractors as follows:

- I. "18.14 All interior surfaces of the ductwork shall be accessible for cleaning and inspection purposes. In the absence of a detailed specification/method, access doors shall be installed at 2m centres."
- II. "D6 No fire dampers are to be installed in the extract ductwork"
- III. "D 6 It is essential that the installed system complies with BSEN 1366-1 fire inside (Type B) is rated for integrity and insulation for the same period as the compartment through which the duct passes."
- IV. "D6 In addition, the duct shall also be tested for fire outside (Type A) with the additional requirement that the internal surface of the ductwork within the adjacent compartment shall also meet the insulation criteria (T3 thermocouples). This is when a fire risk exists in the adjacent compartment and could ignite the grease within the extract duct."

3.7 Car park extract systems

Car parks are required to have separate and independent extraction systems because of the polluted nature of the extracted air. It is recommended that fire dampers should not be installed in extraction ductwork serving car parks. Any duct or ductwork penetrating fire resisting barriers must be fire resisting. See Figure 8. See also section 4.5 for recommendations regarding car park extract systems.

3.8 Sound and thermal insulation used on and in ductwork systems

This item relates not to 'insulation' in relation to fire resistance but to where 'insulation materials' commonly known as 'ductwrap', although sometimes in the form of slab based materials, are to be applied to the outer or inner surface of ductwork systems to improve the sound and thermal insulation properties of ductwork systems. It is important that supports are adequately sized to take account of the additional weight'

These standards are described in BS 5588-9:1999; 10.2, and 7.5 and BS 9999: 2017 32.5.10.1, 32.5.10.2, and are reproduced below. There are two occasions where this may arise:-

3.8.1 Internal linings to ductwork

All insulation either forming part of the construction of the duct itself or applied as an internal lining to ductwork should have a Class 0 surface (national) or B-s3, d2 (European) and be either:

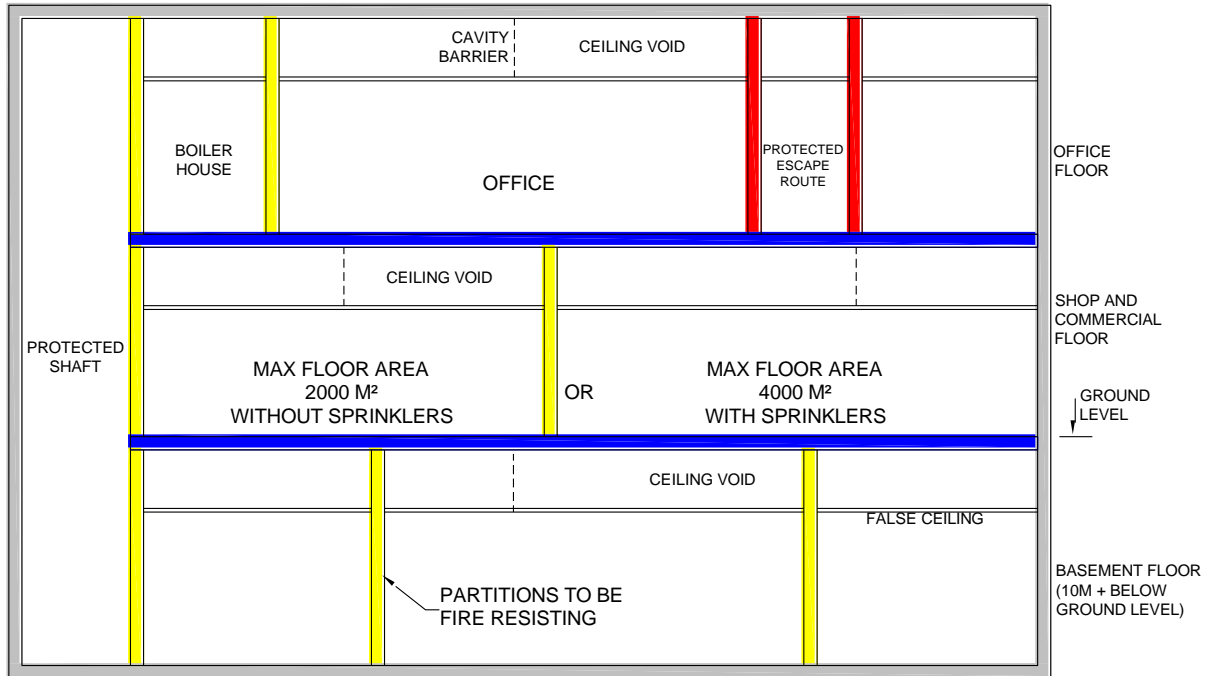
- a) a non-combustible material or
- b) a material of limited combustibility.

3.8.2 External insulation ductwork

All external insulation should be in accordance with one of the following applicable.

- a) External insulation within a fire-resisting ductwork enclosure should have a Class 0 surface (national) or B-s3, d2 (European) unless the space between the ductwork and the fire-resisting enclosure is subdivided at each floor level, and wherever the fire-resisting ductwork enclosure penetrates a compartment boundary, by fire-resisting construction with a fire resistance of not less than that of the ductwork enclosure.
- b) External insulation not situated within a fire-resisting ductwork enclosure should have a rating for surface spread of flame of not less than that the surface of the wall or ceiling which the ductwork traverses.
- c) External insulation should not be within 500 mm of a fire damper unless:
 - 1) the external insulation is a non-combustible material; or
 - 2) the external insulation is a material of limited combustibility.

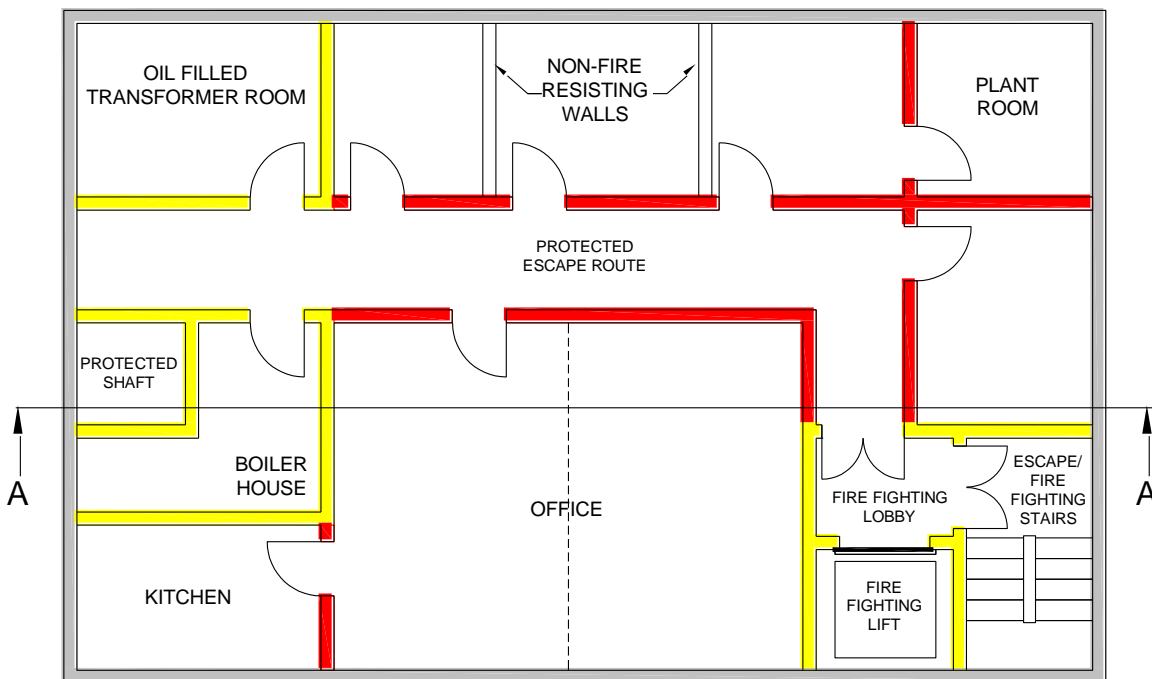
FIGURE 2
EN STANDARD VERSION
FIRE RESISTING SEPARATION
FOR COMPARTMENTATION AND MEANS OF ESCAPE PURPOSES
 IN LINE WITH APPROVED DOCUMENT 'B' OF THE BUILDING REGULATIONS



- FIRE RESISTING WALLS (for compartmentation)
- FIRE RESISTING FLOORS (for compartmentation)
- FIRE RESISTING WALLS (for means of escape purposes only)

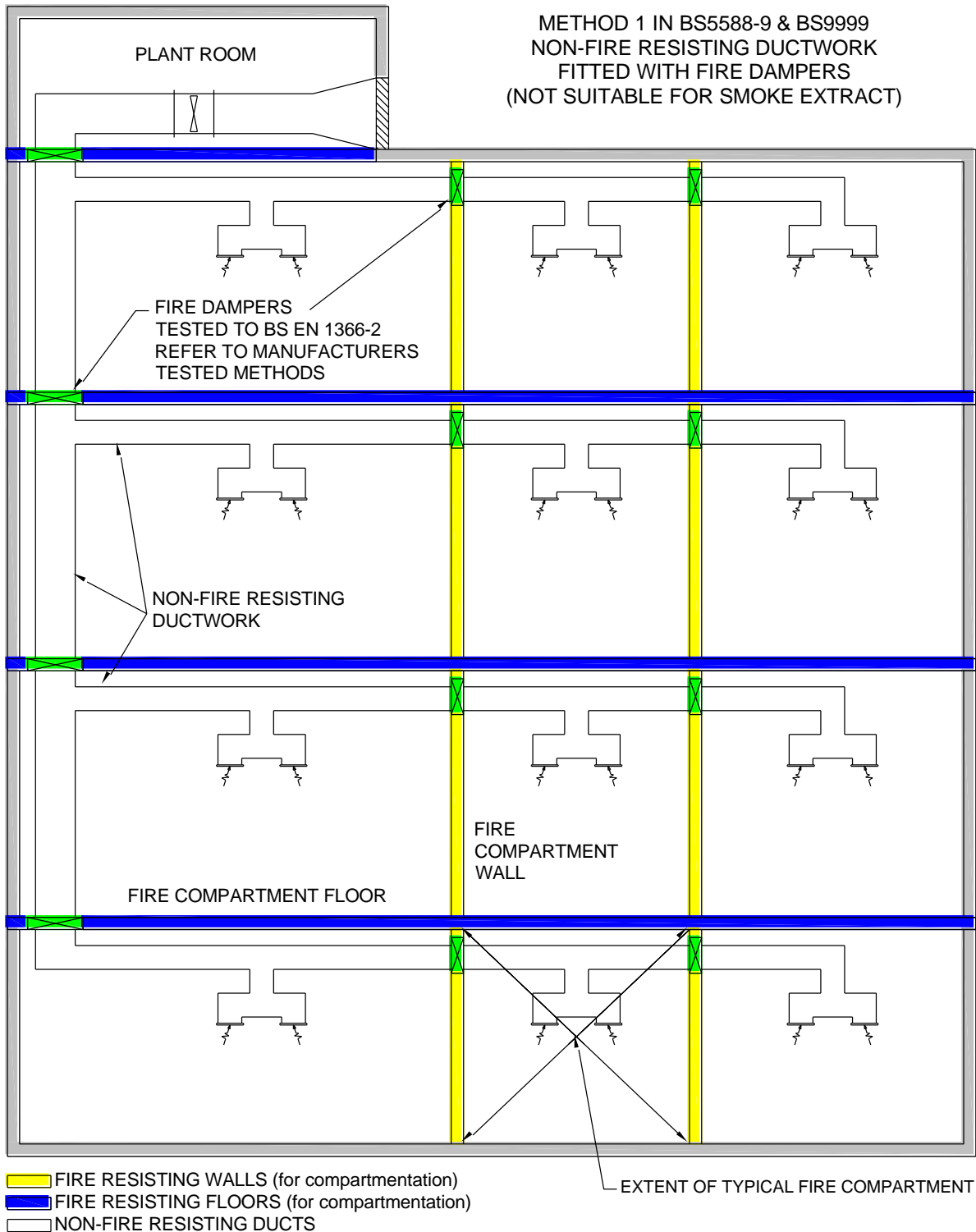
SECTION A-A

Note: Some walls need to be fire resisting for means of escape and compartmentation reasons such as the stairway and special fire risk areas such as the boiler house. In such cases the higher fire time is illustrated in colour.



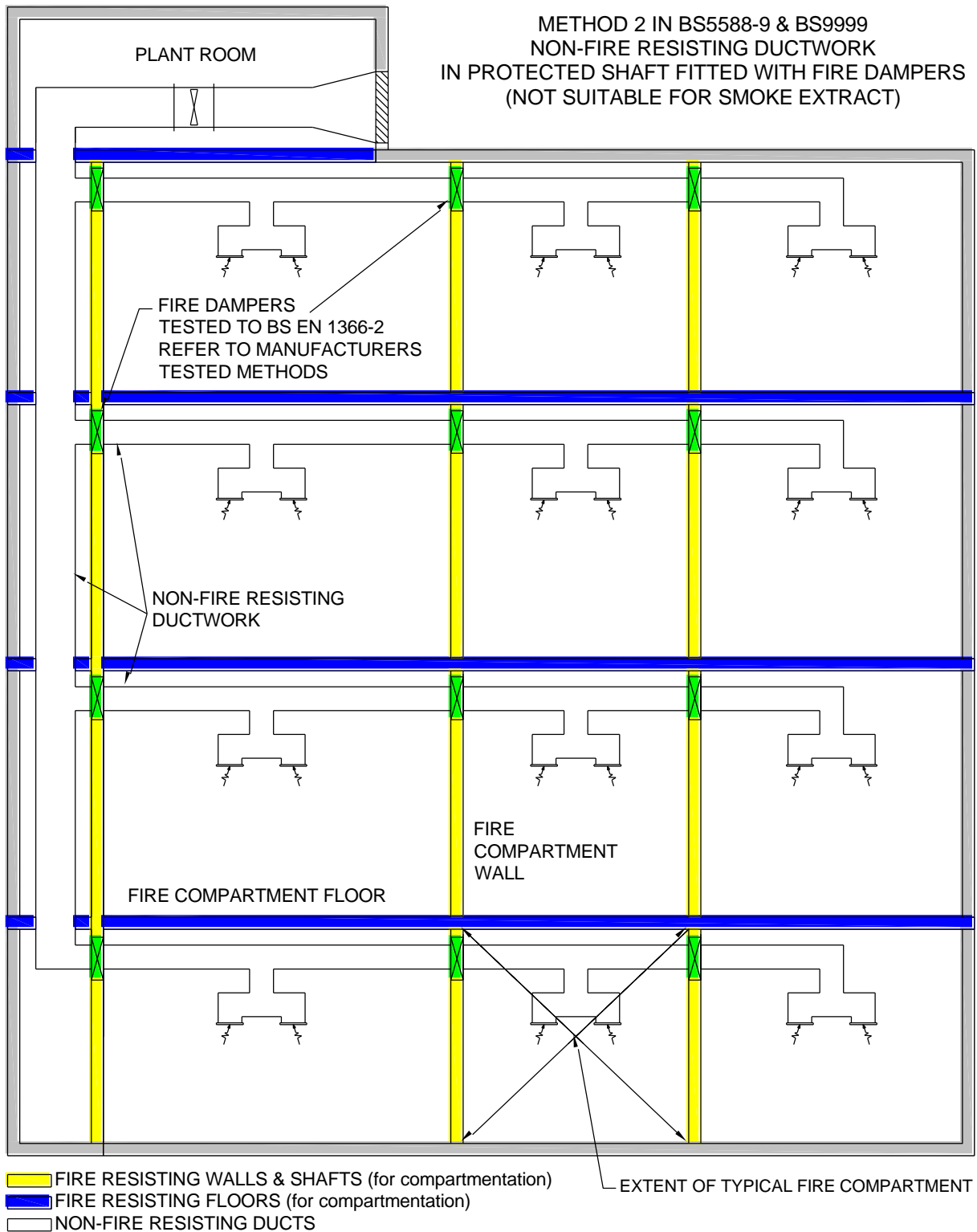
PLAN

FIGURE 3
EN STANDARD VERSION
MECHANICAL VENTILATION SYSTEMS FOR
COMPARTMENTATION ONLY



ELEVATION

FIGURE 4
EN STANDARD VERSION
MECHANICAL VENTILATION SYSTEMS FOR
COMPARTMENTATION ONLY

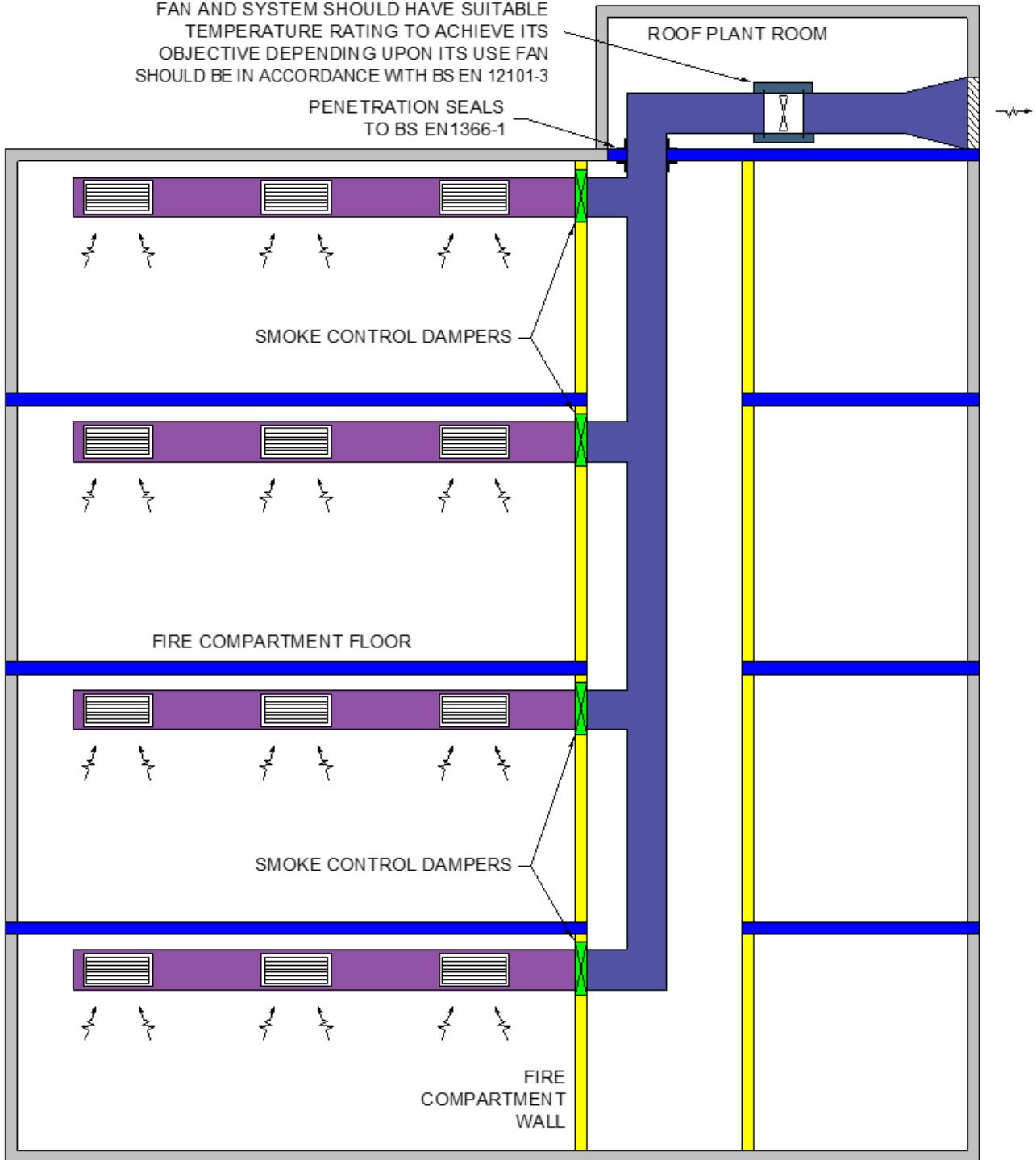


ELEVATION

FIGURE 6 EN STANDARD VERSION TYPICAL SMOKE OUTLET DUCTWORK SYSTEM

FAN AND SYSTEM SHOULD HAVE SUITABLE TEMPERATURE RATING TO ACHIEVE ITS OBJECTIVE DEPENDING UPON ITS USE FAN SHOULD BE IN ACCORDANCE WITH BS EN 12101-3

PENETRATION SEALS TO BS EN1366-1

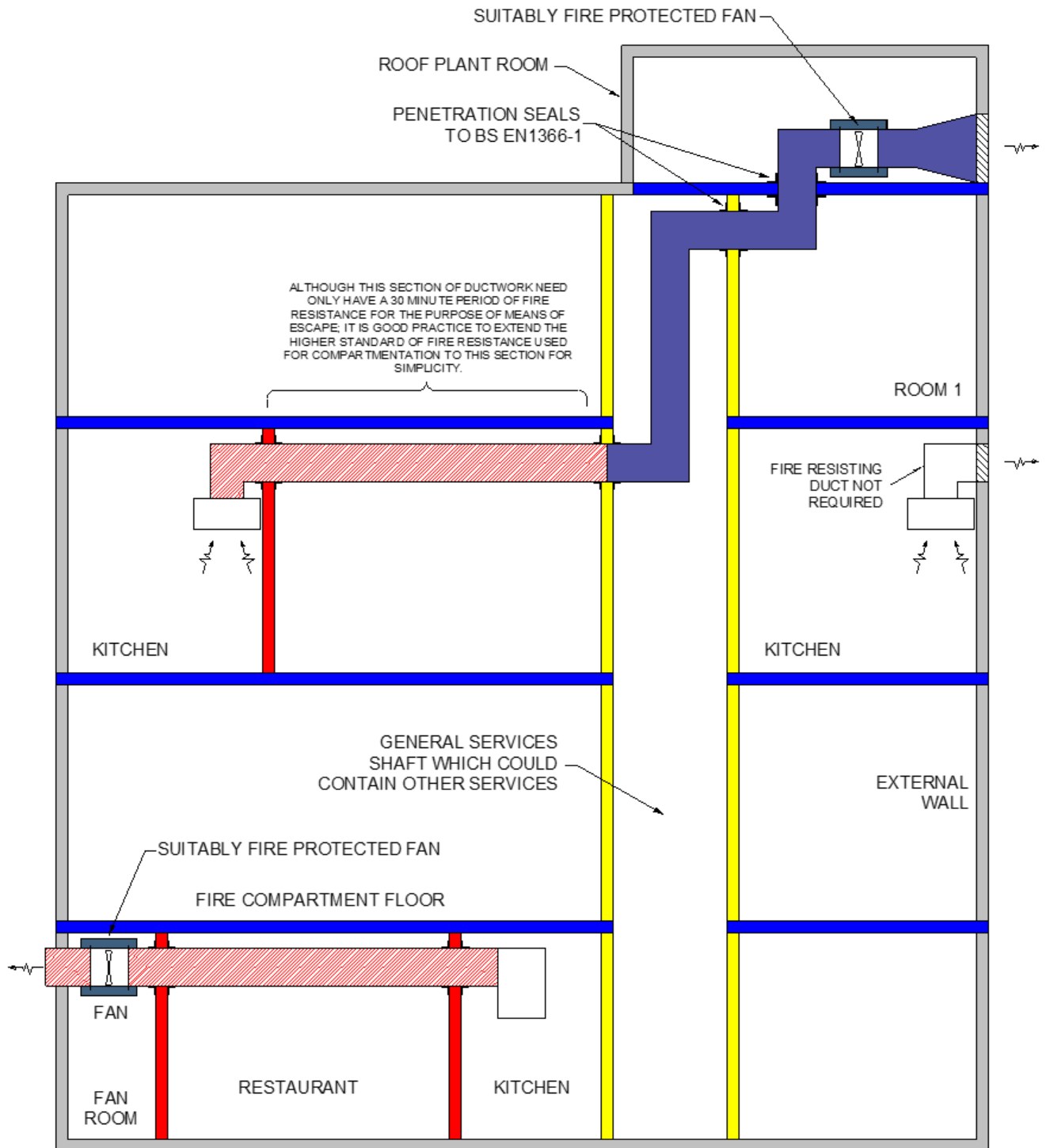


Yellow FIRE RESISTING WALLS (for compartmentation)
Blue FIRE RESISTING FLOORS (for compartmentation)

Dark Blue FIRE RESISTING SMOKE OUTLET DUCTWORK, RETAINING CROSS SECTIONAL AREA OF MORE THAN 90% OF DUCT. INTEGRITY & INSULATION RATING EQUAL TO COMPARTMENT WALLS, UNLESS SHAFT IS DEDICATED, THEN INTEGRITY ONLY IS REQUIRED
Purple DUCTWORK SUITABLE FOR CLEARING SMOKE. TESTED TO BS EN1366-8 RETAINING A CROSS SECTIONAL AREA OF MORE THAN 90%.

ELEVATION

**FIGURE 7
EN STANDARD VERSION
TYPICAL NON-DOMESTIC KITCHEN EXTRACT SYSTEM**



**NOTE: THERE SHOULD BE NO FIRE DAMPERS WITHIN
NON DOMESTIC KITCHEN EXTRACT SYSTEMS**

- | | |
|--|---|
|  FIRE RESISTING WALLS (for compartmentation) |  FIRE RESISTING KITCHEN EXTRACT DUCT, INTEGRITY AND INSULATION RATING EQUAL TO COMPARTMENT WALL |
|  FIRE RESISTING WALLS (for means of escape purposes only) |  30 MINUTE FIRE RESISTING KITCHEN EXTRACT DUCT, INTEGRITY AND INSULATION RATING FOR MEANS OF ESCAPE PURPOSES |
|  NON-FIRE RESISTING DUCTWORK | |

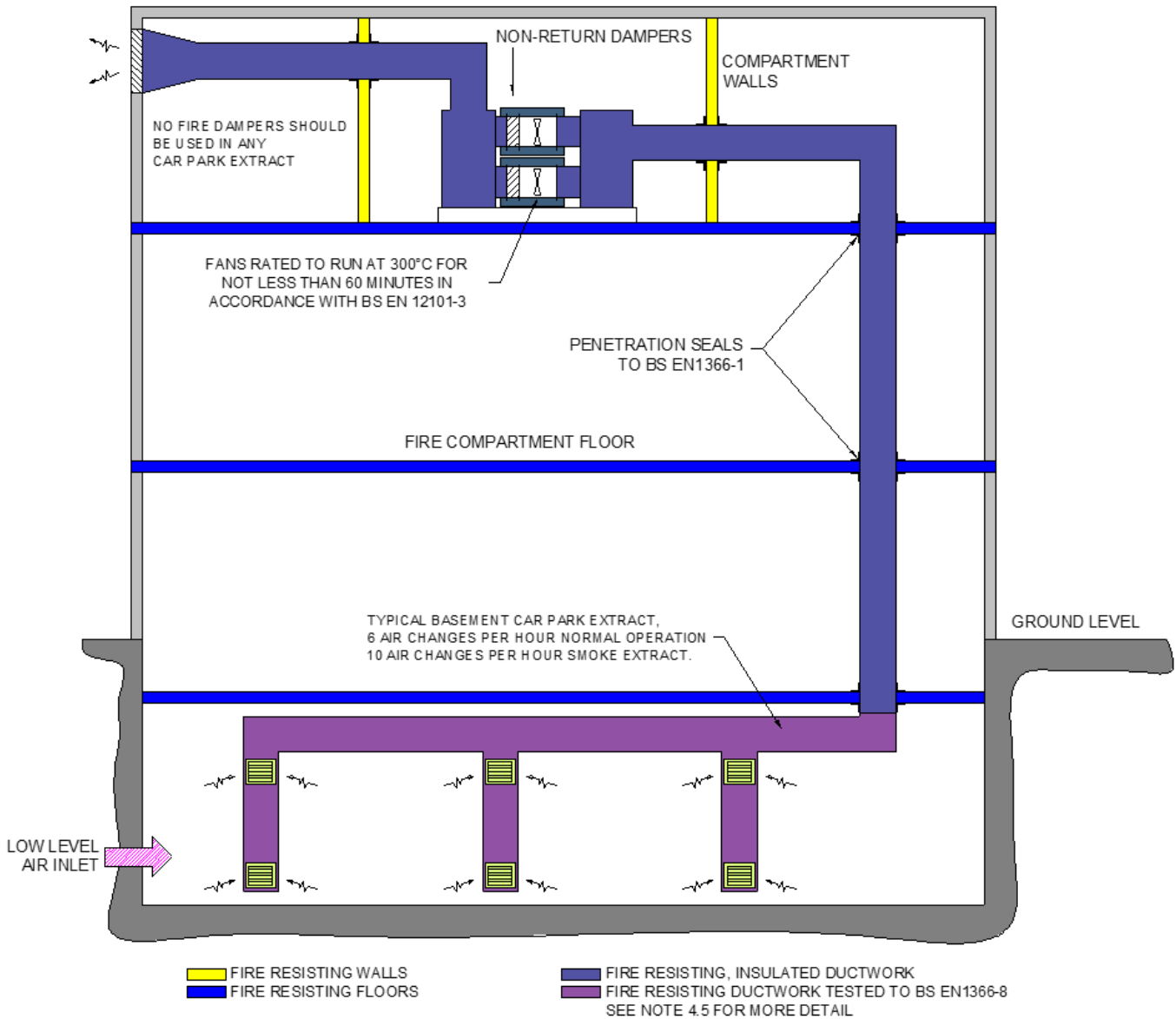
Note: Some walls need to be fire resisting for means of escape and compartmentation reasons such as the stairway and special fire risk areas such as the boiler house. In such cases the higher fire time is illustrated in colour.

ELEVATION

**FIGURE 8
EN STANDARD VERSION
TYPICAL CAR PARK EXTRACT SYSTEM**

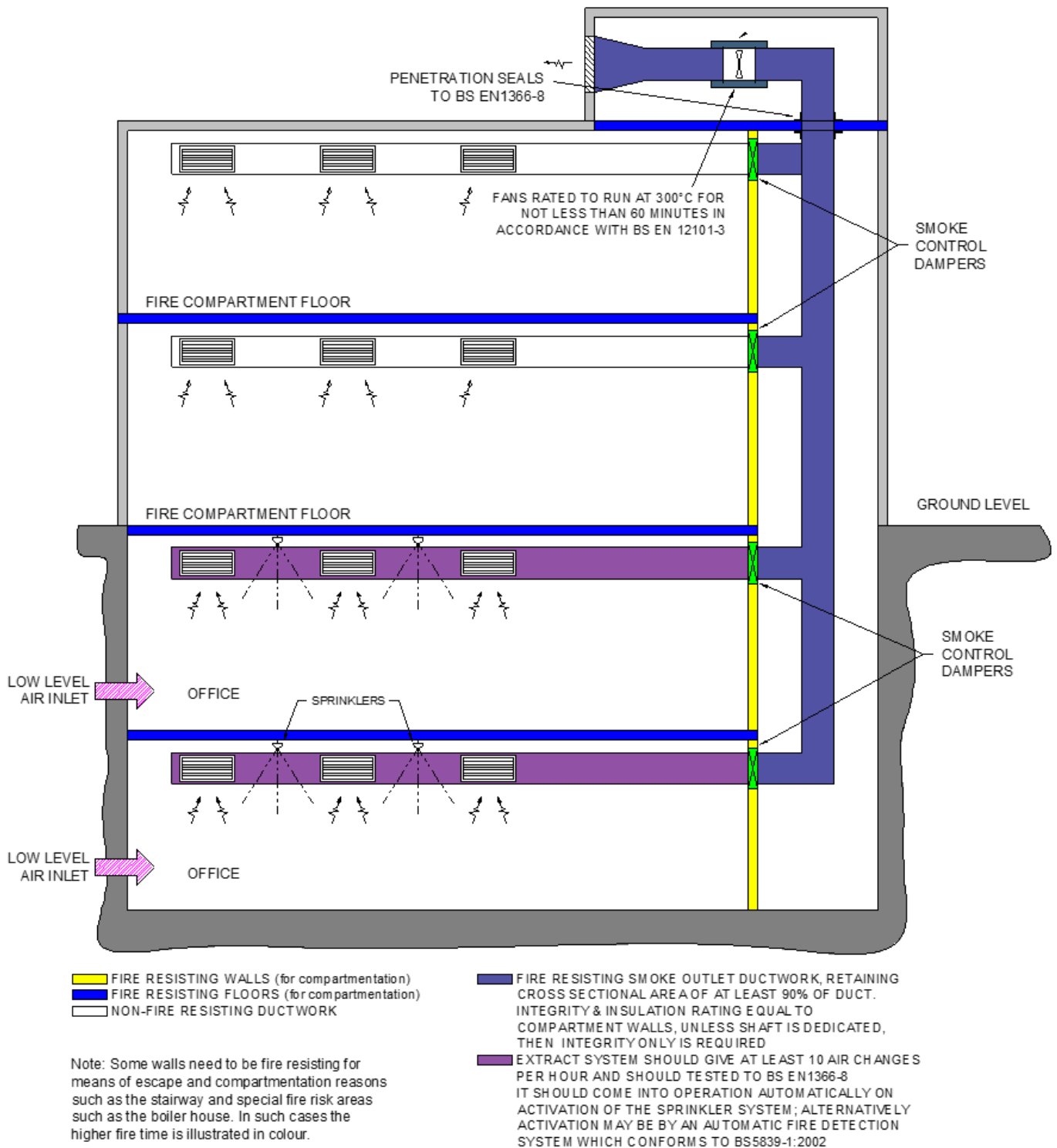
AS APPROVED DOCUMENT 'B' OF BUILDING REGULATIONS
FANS DESIGNED TO OPERATE AT 300°C FOR 1 HOUR, EACH FAN DESIGNED TO RUN AT 50% OF THE NORMAL AND SMOKE VOLUMES, AND DESIGNED SO THAT EACH FAN CAN OPERATE SINGULARLY AND SIMULTANEOUSLY.

SYSTEM SHOULD BE INDEPENDENT OF ANY OTHER SYSTEM (SUCH AS A SYSTEM FOR NORMAL CAR PARK VENTILATION).



ELEVATION

FIGURE 9
EN STANDARD VERSION
TYPICAL BASEMENT SMOKE/DUAL EXTRACT SYSTEM
 AS APPROVED DOCUMENT 'B' OF BUILDING REGULATIONS
 SYSTEM SUITABLE FOR 300°C FOR 1 HOUR

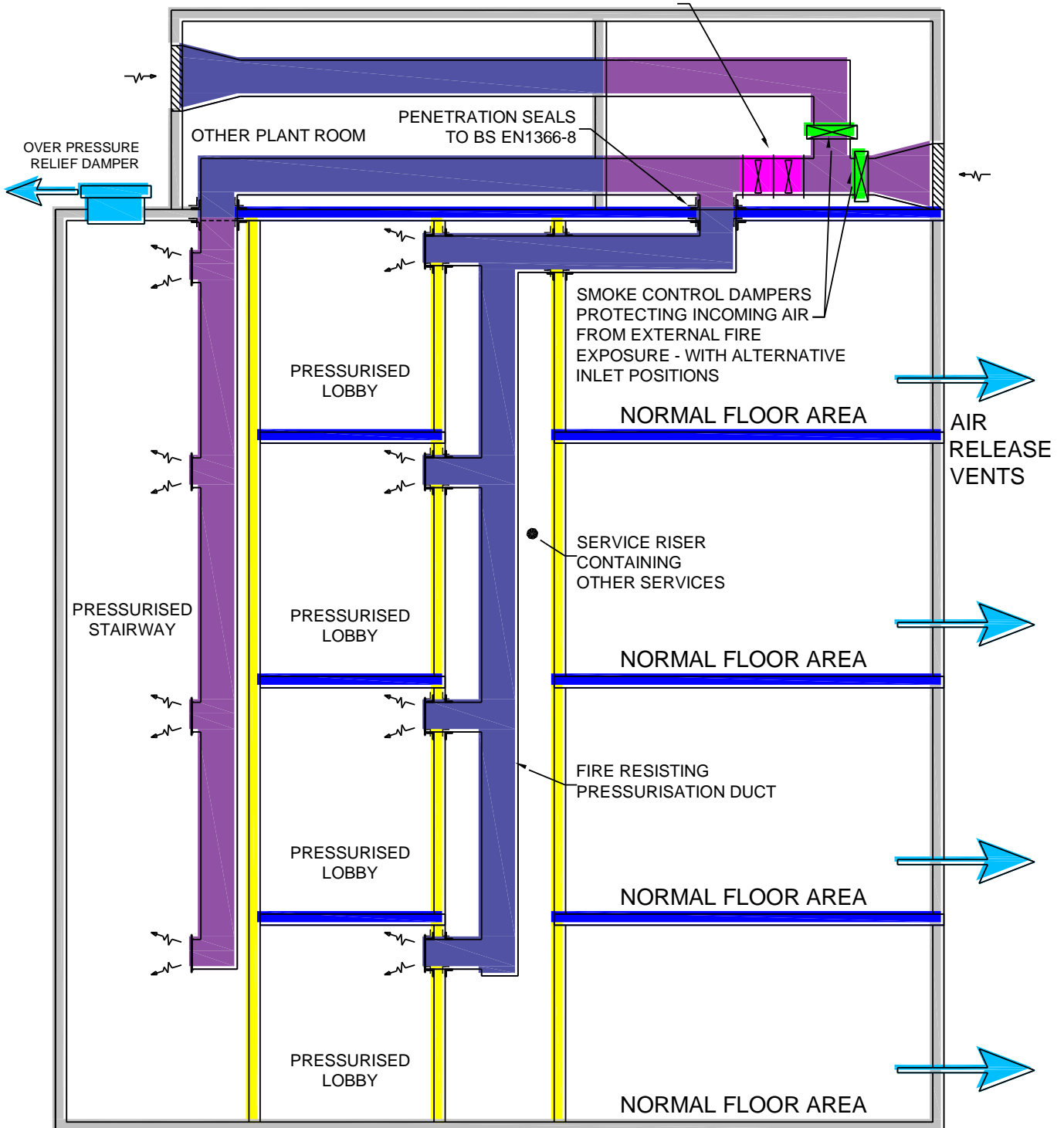


ELEVATION

**FIGURE 10
EUROPEAN VERSION
TYPICAL PRESSURISATION DUCTWORK SYSTEM**

DIAGRAM BASED ON THE PRINCIPLE OF EN12101-6 (FIGURE 8B)

PRIMARY & BACKUP FANS TO BS EN 12101-3



■ FIRE RESISTING WALLS (for compartmentation)
■ FIRE RESISTING FLOORS (for compartmentation)

■ DUCTWORK SUITABLE FOR PRESSURIZATION. OFTEN 1 HOUR INTEGRITY & INSULATION TO BS EN 1366-8 RETAINING A CROSS SECTIONAL AREA OF AT LEAST 90%.

ELEVATION

■ DUCTWORK SUITABLE FOR PRESSURIZATION. OFTEN 1 HOUR INTEGRITY TO BS EN 1366-8 RETAINING A CROSS SECTIONAL AREA OF AT LEAST 90%.

4 BEST PRACTICE

This section gives some general guidance on the best practice to be employed when designing, specifying, installing and maintaining fire resisting ducts in buildings.

The ASFP publication *Ensuring Best Practice for Passive Fire Protection in Buildings*, Edition 2 describes in detail best practice to be followed from a project's inception through design, build and commissioning to providing information for maintenance and for facilities managers. It was written specifically to encourage a 'cradle to grave' approach in the provision of passive fire protection in buildings. The guide includes essential recommendations to be followed and has dedicated sections on fire resisting ducts.



It can be downloaded from www.asfp.org.uk/publications

4.1 Recommendation on design of fire resisting ductwork installations

4.1.1 General

The design of HVAC systems requires special attention from the designer because it is frequently hidden once installed and is therefore difficult to inspect after installation, handover and subsequently through the life of the building. However, it is sometimes not considered early enough, often as a result of a 'design and build' type approach; with the result that layout of the compartmentation with respect to services is not considered properly until it is too late. This results in services and their associated firestopping and supports being installed in the wrong place, too close to each other, too close to adjacent walls/floors and in locations where correct firestopping is almost impossible e.g. because of limited access. If adequate provision was given to the design of the division earlier on in the construction process, these problems would be avoided.

The ASFP publication *Ensuring Best Practice for Passive Fire Protection in Buildings*, Edition 2 gives guidance on when the design of all passive fire protection products should be considered in the construction process and on who is responsible for it.

4.1.2 Penetrations through walls, partitions, and floors

One reason why design is so important to consider at an early stage is to avoid situations where designers put all the services e.g. HVAC equipment, cables and pipes through one opening (penetration) in a wall, partition or floor. Such 'combined penetrations' should be avoided because the heat from a duct penetration and movement due to expansion will adversely affect the fire resistance of other penetration seals and vice versa. The method of fire testing ductwork is different to that for other service penetrations. BS EN 1366 Parts 1 or 8 test the duct with its fire stopping system. BS EN 1366 Part 3 tests fire stopping systems used with cable and/or pipe penetrations only. Therefore, at the time of writing, combined penetrations cannot be validated by any fire resistance test standard. In this case, advice and design of a suitable seal should be sought from a fire engineer with experience of service penetrations, after consultation with the duct and fire stopping manufacturers.

Further guidance on penetrations through walls, partitions and floors is given in Chapter 9.

4.2 Recommendations on who can install fire resisting ducts

Recommendations on the provisions for fire resisting ducts and on the competence of those installing it are given in Approved document B. The ASFP recommends that such installations should only be undertaken by contractors holding the relevant third party certification. See also section 8 of this publication.

Further information on the installation and inspection of fire resisting ducts can be found in ASFP TGD 18 Code of practice for the installation and inspection of fire resisting duct systems in buildings www.asfp.org.uk/publications

4.3 Recommendations for the building owner



Modern commercial and public buildings are dynamic environments in which change is frequent and this can affect the installed fire protection systems. In particular building services are the principal cause of breaches in fire barriers. These breaches in fire resisting elements in the event of a fire may give rise to uncontrolled spread of fire.

Building owners (and their agents) and/or the Responsible Person under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents in Scotland, Wales and Ireland) are responsible for the maintenance of fire resisting ductwork systems within the building and this should form part of the risk assessment carried out under these regulations. Similar provisions apply in Scotland and Ireland. The ASFP publication: *Guide to inspecting passive fire protection for fire risk assessors* gives detailed information on how to inspect passive fire protection to be able to adequately undertake a risk assessment under those regulations. www.asfp.org.uk/publications

4.4 Recommendations on Inspection,

Product manufacturers are required to provide information for inspection, maintenance and repair of their products in accordance with the requirements of Building Regulation 38 – see Appendix G Approved Document B – Fire Safety.



In particular, it is good practice to inspect frequently to ensure that inappropriate unauthorised modifications have not been made e.g. the addition of access doors for cleaning kitchen extract ducts which may not be fire resisting; or their fire resistance performance with the particular duct in which they are installed cannot be verified. In such cases, appropriate measures will need to be undertaken e.g. remedial work to maintain the fire resistance performance of the duct system.

ASFP Advice in this situation is: -

In the first instance, the existing fire resisting ductwork manufacturer must be identified and requested to supply, install and certify the new doors as part of their products. If the manufacturer cannot be identified then a manufacturer of fire resisting ductwork products should be engaged to ensure the doors are suitably tested, installed and certified. The ASFP would advise that the owner should seek to engage a third-party installer certification body of fire resisting ductwork to inspect and advise on the installation to satisfy themselves that the system is correctly installed. These would include FIRAS / LPCB etc.

Further information on the installation and inspection of fire resisting ducts can be found in ASFP TGD 18 *Code of practice for the installation and inspection of fire resisting duct systems in buildings* www.asfp.org.uk/publications

4.5 Recommendations for car park extraction ducts

Figure 8 shows the provisions for car park extraction ductwork.

Approved Document B (England and Wales versions) in the clarified version states in clause 11.5 d. the system should use E, I and S ductwork in accordance with **BS EN 1366-8**.

Similarly, clause 27.3 of BS 9999: 2017 recommends the use of ductwork fully tested in accordance with BS EN 1366 – 8, by virtue of reference to BS7346-7 clause 13, which in turn references BS EN12101-7.

In addition, as with all passive fire protection products, the ASFP recommends that the ducting is third party certificated and is installed by contractors holding third party certification for the installation of fire resisting ductwork.

5. REGULATIONS, CODES AND STANDARDS

5.1 Introduction

The documents listed in this section are most of the publications relevant to the performance requirements of ductwork in the event of a fire.

5.2 Building regulations

Building regulations in the UK and the Republic of Ireland are applicable to most building work that is undertaken. The Regulations for England and Wales are functional and deal with life safety standards for design and building work in the construction of domestic, commercial and industrial buildings. The regulatory systems in Scotland Northern Ireland and the Republic of Ireland differ from those in England and Wales.

A summary of the applicable legislation and appropriate statutory guidance documents for fire safety is given in table 1 below.



Country	England	Wales	Scotland	N Ireland	Ireland
Building Regulations	Building Regulations 2010	Building Regulations 2010	Building (Scotland) Regulations 2006	Building Regulations (N Ireland) 2000	Building Control Regulations 1991, 1997 – 2011. Building Control (Amendment) Regulations 2014
Statutory or Supporting Guidance docs	Approved Document – B 2019 http://is.gd/BVG4MS	Approved Document – B 2007 (including 2010 & 2016 amendments) http://is.gd/DixxNx	Technical Handbook 2019 http://is.gd/k9dVVq	Technical Booklet E 2012 http://is.gd/8RCBtB	Technical Guidance Document B 2017 https://is.gd/0B4hte
Building Regulation 38 equivalent	Yes	Yes	No*	No	Fire Services Acts 1981 and 2003
CDM regulations or equivalent	2015	2015	2015	2007	No

*although Scottish Building Standards Officers can apply 'continuing requirements' and fire safety design documents are part of those. In addition the Scottish Executive is considering an equivalent to Regulation 38.

Table 1: Summary of the applicable Building Regulations in the UK and Ireland.

5.3 Building Regulation 38 - England & Wales only

If a building was constructed after April 2007, Regulation 38 of the Building Regulations applies in England and Wales. This requires that sufficient fire safety information be provided for persons to operate and maintain the building in reasonable safety. An overview of what information is required in terms of PFP measures is provided in the Annex G of Approved Document B Volume 2: Fire Safety (English and Welsh versions). The information, which should have been passed on by the main contractor in compliance with Regulation 38 is vital to ensure that an appropriate and effective Fire Risk Assessment under the Regulatory Reform (Fire Safety) Order can be undertaken (see 5.4.2).

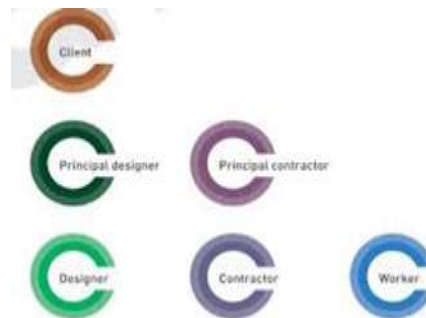
Such information, whether arising from the CDM Regulations or Regulation 38 will include details of fire-resisting construction on escape routes, fire compartmentation and other PFP information specified to satisfy AD-B and should include the fire test and assessment reports or third party certification for the products and installation.

5.4 Other regulations

5.4.1 Construction (Design and Management) Regulations 2015

The Construction (Design and Management) Regulations 2007 were revised in 2015. Whilst mainly aimed at clients, designers and contractors, manufacturers of construction products also have obligations under these Regulations:

Manufacturers supplying standardised products for use in any construction project are not designers; however, the person who selects the product is a designer and must take account of health and safety issues arising from the installation and use of those products. In a situation where a product is required to be purpose built (bespoke), then the person who prepares the specification or drawings is a designer and so is the manufacturer if he develops the specification into a detailed design. The connection is that the designer's decisions can affect the health and safety of workers and others who will construct, maintain, repair, clean, refurbish and eventually demolish the building or structure, as well as those who will use it as a completed workplace.



Further information can be obtained from *CDM2015 Principles in Practice, Industry Guidance for Designers* published by CITB which can be downloaded [here](#). Note that this is still draft guidance which is subject to change. Further Industry Guidance publications include guidance for Contractors (download [here](#)), Principal Contractors (download [here](#)), Workers (download [here](#)) and the new role of Principal Designers (download [here](#)). The existing role of CDM Co-ordinator is not taken forward with the new Regulations. In addition to the above guidance the HSE has published *Draft Guidance on The Construction (Design and Management) Regulations 2015* which provides draft Legal (L) Series guidance on the legal requirements of the Regulation. A copy of this publication can be downloaded [here](#).

For the first time, all the above will now apply to domestic client projects, although the client duties will normally be transferred to the contractor or principal contractor, or if the client wishes to make a specific appointment, the designer.

The ASFP will be producing a short guide to the 2015 CDM regulations.

5.4.2 Risk based fire safety legislation

The move within regulatory guidance from prescriptive rules to performance-based designs and risk assessment during occupation puts greater responsibility for safety onto building owners or occupiers. The establishment of the 'Responsible Person' under the RR(FS)O (and national equivalents in Scotland and Ireland) means that those who are responsible for the operation of a business within a building need to be aware of their responsibilities which include the installation and maintenance of passive fire protection systems.

The Responsible Person is the employer, where there is one, and where there is not it will be the person responsible for the activity undertaken on the premises which might give rise to a risk to those present. It includes;

- a) *the employer in relation to any workplace which is to any extent under his control;*
- b) *in relation to any premises where there is no employer:*
 - i *the person (whether the occupier or owner of the premises or not) who has the overall management of the premises; or*

- ii where there is no one with overall management responsibility, the occupier of the premises; or
 iii where neither (i) or (ii) apply, the owner of the premises

Country	England & Wales	Scotland	N Ireland	Ireland
Relevant Act	Regulatory Reform (Fire Safety) Order (FSO)	Fire Safety (Scotland) Regulations & Fire Scotland Act	Fire and Rescue Services (Northern Ireland) Order 2006	General Application Regulations 2007 under the Safety, Health and Welfare at Work Act 2005. Fire Services Acts 1981 & 2003
Person responsible	Responsible Person	Duty holder	Appropriate Person	Responsible Person (Employer/landlord)
Person to do risk assessment	Responsible or Competent person	Responsible or Competent person	Responsible or Competent Person	Responsible or Competent person
People affected in building	Relevant persons	Relevant Persons	Relevant Persons	Employees and persons connected with the workplace

Table 2: Summary of the applicable legislation pertaining to fire risk assessments in the UK and Ireland.

5.5 Supporting Documents for risk based fire safety legislation

The following supporting documents may be useful, but is not an exhaustive list:

The Ministry for Communities, Housing and Local Government (MHCLG) has published a series of guides which introduce employers, managers, occupiers and owners to the new fire safety regime as it affects a variety of types of premises, under the generic title 'Fire safety risk assessment'. Documents can be downloaded from: <http://is.gd/hB1U1h>.



5.6 Insurers' requirements



Insurers' requirements for the protection of property may be higher than those required for life safety. Business continuity is also a consideration which can lead to higher specification of passive fire protection.

Useful information can be found at www.riscauthority.co.uk including free downloads of relevant documentation including:

- Insurers' version of England Approved Document B <http://is.gd/wm9XjE>
- BDM2 - Fire protection of buildings - Core Document – Compartmentation <http://is.gd/dxDsaj>
- BDM6 - Fire protection of buildings - Core Document - Protection of openings and service penetrations from fire <http://is.gd/HutrbG>

- a) 'Essential principles'
- b) 'Design Guide for the protection of buildings - Protection of openings and service penetrations from fire'

5.7 ASFP documents



Building owners (and their agents) and/or the Responsible Person under the Regulatory Reform (Fire Safety) Order 2005 (and national equivalents in Scotland, Wales and Ireland) are responsible for the maintenance of fire resisting ductwork systems within the building and this should form part of the risk assessment carried out under these regulations. Similar provisions apply in Scotland and Ireland. The ASFP publication: *Guide to inspecting passive fire protection for fire risk assessors* gives detailed information on how to inspect passive fire protection to be able to adequately undertake a risk assessment under those regulations. www.asfp.org.uk/publications

5.8 Codes of practice

The Department for Children, Schools and Families have published Building Bulletin 100 – *Designing & managing against the risk of fire in schools*. <http://is.gd/EHwYC9>



Department of Health
 Firecode – fire safety in the NHS
 Health Technical Memorandum
 05-01: Managing healthcare fire safety



- Department of Health HTM 05 Series, available from <http://is.gd/nQ2PAe>:
 - HTM_05-01 Managing healthcare fire safety
 - HTM_05-02_2015 Guidance in support of (Fire safety in the design of healthcare premises)
 - HTM_05-03_Part_A_Final General fire safety
 - HTM_05-03_Part_J Guidance on fire engineering of healthcare
 - HTM_05-03_Part_M_Final Guidance on the fire safety of atria

- BS 9999: 2017 Code of practice for fire safety in the design, management and use of buildings
- BS 9991: 2015 Fire safety in the design, management and use of residential buildings. Code of practice
- Fire Protection Association Design Guide for the Fire Protection of Buildings – Essential principles, <http://is.gd/C75CwC>
- Fire Protection Association Design Guide for the Fire Protection of Buildings – Essential principles, <http://is.gd/C75CwC>
- University Health and Safety Association Guidance on the Preparation of a Generic Fire Design Guide. <http://is.gd/QL7Fr>



bsi.

5.9 British standards

BS 476: Fire Tests on Building Materials and Structures

Part 20	Method for determination of the fire resistance of elements of construction (general principles)
Part 24	Method for determination of the fire resistance of ventilation ducts

Other British Standards

BS 5588	Fire Precautions in the Design, Construction and Use of Buildings, Code of practice for ventilation and air conditioning ductwork.
BS 8313	Code of practice for accommodation of building services in ducts.
BS 9991	Fire safety in the design, management and use of residential buildings. Code of practice
BS ISO 10294	Fire Resistance tests - Fire dampers for air distribution systems Part 1 - Test method. Part 2 - Classification, criteria & field of application of test results Part 3 - Guidance on the test method Part 4 - Test of thermal release mechanism Part 5 - Intumescent fire dampers
BS EN 12101-3	Specification for powered smoke and heat control ventilators (Fans)
BS EN 12101-7	Smoke and heat control systems. Smoke duct sections

5.10 International standards (ISO)

ISO 834:	Fire resistance tests – Elements of building construction
ISO 834-1	Fire resistance tests – Elements of building construction: Part 1 General requirements
ISO 6944-1	Fire Resistance Tests – Elements of building construction: Part 1 Ventilation ducts
ISO 6944-2	Fire resistance tests – Elements of building construction: Part 2 Kitchen extract ducts
ISO 9000	Quality management systems – Fundamentals and vocabulary
ISO 9001	Quality management systems – Requirements

5.11 European standards

BS EN 1366	Fire resistance tests for service installation -
BS EN 1366-1	Part 1 - Ducts
BS EN 1366-2	Fire dampers
BS EN 1366-3	Penetration seals
BS EN 1366-4	Linear joint seals
BS EN 1366-5	Service ducts and shafts
BS EN 1366-8	Multi compartment smoke extraction ducts
BS EN 1366-9	Single compartment smoke extraction ducts

BS EN 1366-10	Smoke control dampers
BS EN 1366-11	Cables systems
BS EN1366-12	Non Mechanical Fire Barrier for ventilation ducts
BS EN 1366-13	Chimneys
prEN 1366-15	Mixed Penetration
BS EN 13501	Fire classification of construction products and building elements: Part 1: Classification using data from reaction to fire tests Part 2: Classification using data from fire resistance tests, excluding ventilation services Part 3: Classification using data from fire resistance tests on products and elements used in building service installations: fire resisting ducts and fire dampers Part 4: Classification using data from fire resistance test on components of smoke control systems
BS EN 12101-7	Smoke and heat control systems Part 7: Smoke control ducts
BS EN 15882-1	EXAP rules for fire resisting ducts tested to EN 1366-1
EN 15882-xx	EXAP rules for fire resisting ducts tested to EN 1366-8 or EN 1366-9

5.12 BESA Documents

DW/143: 2013	Good practice guide to ductwork leakage testing
DW/144: 2013	Specification for Sheet Metal Ductwork Low, medium and high pressure/velocity air systems
DW/145: 2010	Guide to good practice for the installation of fire and smoke dampers
DW/172: 2020	Specification for kitchen ventilation systems
TR/19: 2019	Guide to good practice – Internal cleanliness of ventilation systems

5.13 Standard method of measurement of building works

RICS NRM2	Detailed Measurement for Building Works The measurement of fire resisting ductwork should follow the guidelines of Table 38 of NRM2
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6. STANDARD FIRE TESTS

The fire performance of passive fire protection products is evaluated primarily by fire tests undertaken to British and European standards. Manufacturers undertake tests at specialist fire test laboratories to satisfy the requirements of building regulations, but also for a variety of other reasons including obtaining market advantage, developing new products, in support of CE marking and for third party certification. This section explains the various processes from fire testing, through assessment (expert judgement), classification, CE marking through to third party certification.

6.1 The stages of a fire

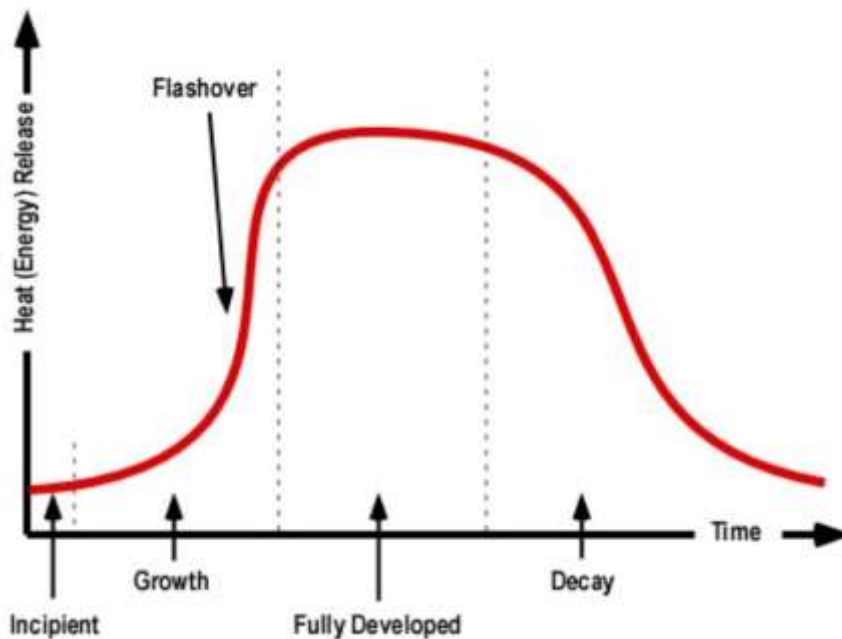


Figure 11: Stages of development of fire in a compartment

Fire occurs when a combustible material is ignited in the presence of oxygen/air which supports the combustion and allows the fire to grow. The stages of a fire in a compartment are shown in figure 11 above.

The rate of fire growth will depend on the combustibility of the item first ignited and the other materials in contact with, or in the vicinity of, the ignited material, such that fire spread could occur through conductivity of heat, convection of heat, or radiation of heat. This is the growth phase.

When the temperature of the enclosure containing the ignited contents in a small room reaches around 600°C, the condition known as flashover will occur, sometimes suddenly, such that all other combustibles in the enclosure will also ignite and release energy through combustion along with smoke and the toxic products of combustion. This is accompanied by a rapid increase in temperature.

The fire temperature will grow further if further combustible material is available in a ventilated space. Otherwise the fire will peak in the fully developed phase and then die back, usually due to lack of fuel. If the oxygen required for combustion is inadequate then combustion will reduce to smouldering level and finally cease.

The duration of any fire is dependent of the amount of combustible organic material available to burn.

6.2 Reaction to fire

Reaction to fire is the term used to describe the behaviour of materials and products during the incipient and growth stages of a fire. The reaction to fire characteristics of a material can be measured using a variety of fire tests. These include:

- Ignitability
- Spread of flame over its surface,
- Amount and rate of heat released,
- Amount of smoke produced
- Amount and toxicity of effluent gasses emitted.

Because such fire exposures (tests) are intended to model the ignition and growth stages of a fire they are described as ‘pre-flashover’ condition. There are British and European standard tests for Reaction to fire; both are given visible recognition in the statutory guidance documents to UK Building Regulations such as Approved Document B.



Figure 12: EN 13823 SBI test

However, if the material under consideration is CE marked, then only the European test can be used to create the resulting ‘Euroclass’

6.3 Fire resistance tests & classification of fire resisting ducts



Figure 13: fire resisting duct under test

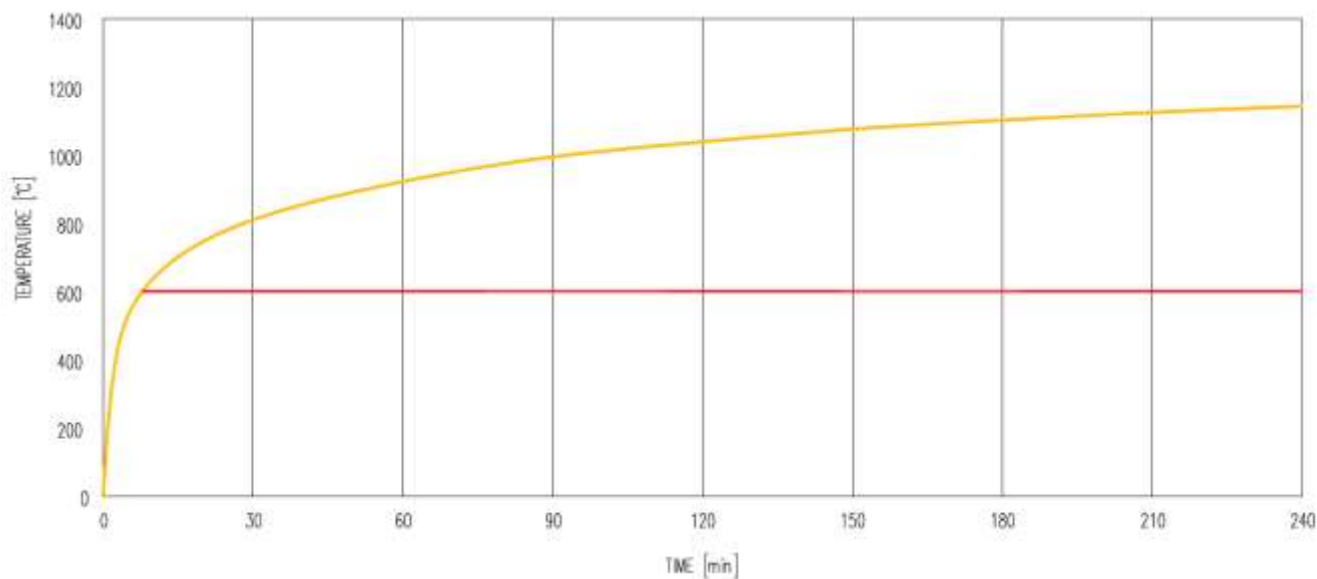


Figure 14 Graph showing BS EN1363 time-temperature curve (yellow) vs EN1366-9 temperature regime (red)

6.3.1 General Information on EN fire resistance tests

The European fire resistance tests and classification system for ducting have their foundations in the ISO 6944 method - which is synonymous with the UK fire resistance test method BS 476: Part 24 method of test. The International Standard has been used to specify a method of test and criteria for the determination of vertical and horizontal ventilation with the general purpose to measure the ability of a representative duct or duct assembly to resist the spread of fire from one compartment to another. It has also been applied to smoke outlet ducts and to kitchen extract ducts - but it contains limited guidance for the use of ducting in extended fields of application.

In contrast, the BS EN 1366 test series includes separate fire test methods for ventilation ducts, as BS EN 1366-1, and for smoke control ducts, as BS EN 1366-8 for multi-compartment use and as BS EN 1366-9 for single compartment use. It is important to differentiate between single and multi-compartment smoke extract systems.

The European fire test documents include rules for the direct field of application of test data, and a separate series of documents (BS EN 15882-x) is in preparation to prescribe methods for agreed rules for extended fields of application of test data from the fire tests.

For further details regarding the status of BS EN standards and CE marking, please see ASFP advisory note 16. The latest version of this document can be downloaded from the ASFP website.

6.3.1.1 BS EN 1366-1 Fire resistance tests for service installations: ducts

The test is conducted without the involvement of fire dampers. It is applicable to vertical and horizontal ducts, taking into account joints, air supply and exhaust openings, as well as suspension devices and penetration seals.

The performance of the duct assembly is measured in terms of its ability to withstand exposure to high temperatures, by setting criteria by which the resistance to fire containment (integrity), the thermal transmittance (insulation) functions, together with the leakage rate of the duct can be judged. The standard temperature/time fire exposure specified in BS EN1363-1 is representative of one possible fire exposure condition at the fully developed fire stage.

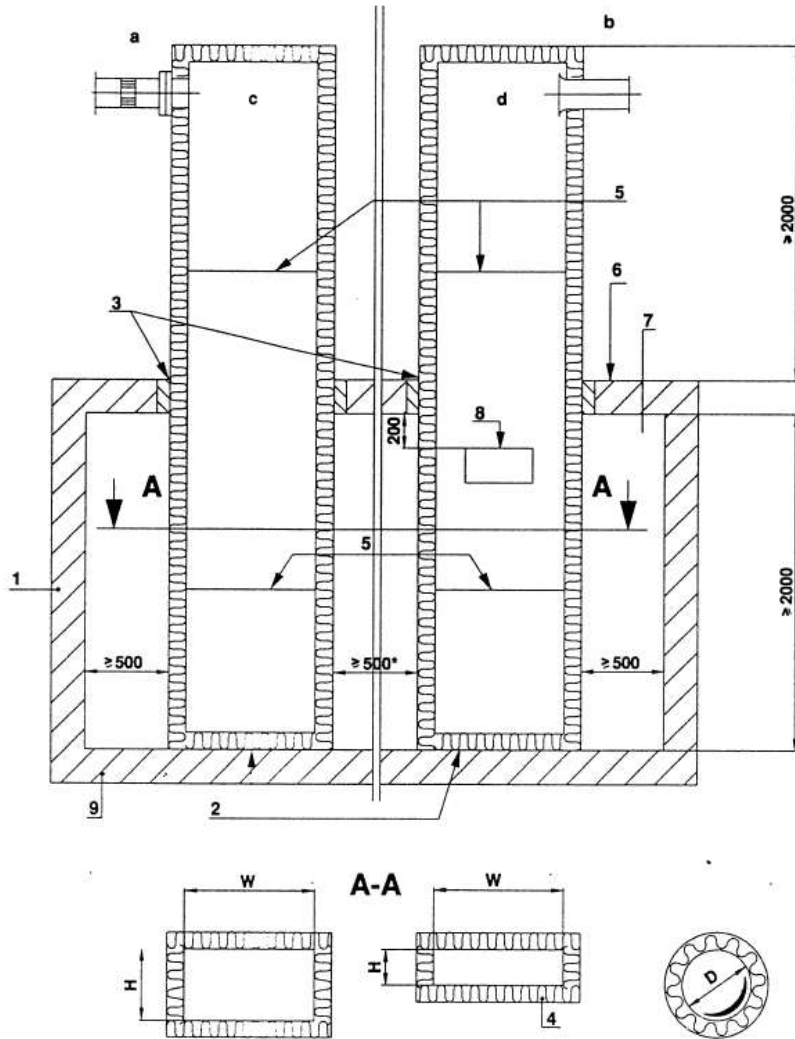
The method of test does not quantify the behaviour of a duct for a precise period of time in a real fire situation, but can be classified for direct field of application to show compliance with fire resistance requirements in regulations or other safety specifications, and enables comparisons to be made between constructions.

The specimen that is subject to the fire test must be designed and constructed to be representative of how it would be constructed on site. Two ducts are tested, one where the fire is outside (Duct A), and one where the fire is inside (Duct B). Both ducts may be tested in either a horizontal or vertical orientation (General views are provided in Figures 14 to 17).

It is applicable only to four sided and circular ducts. One, two and three sided ducts are not covered.

Note: Where steel ducts are used, these shall have a minimum of class A leakage in accordance with EN1507.

Figure 14: General arrangement for vertical ducts as tested to BS EN 1366-1



- | | |
|--|--|
| a) details in figure 3 | 8 openings: total cross section 50% of duct cross section duct B (see 6.3.4) |
| b) details in figure 4 | 9 furnace floor |
| c) duct A | |
| d) duct B | |
| 1 furnace wall | <i>W</i> width |
| 2 sealed end | <i>H</i> height |
| 3 fire-stopping as in practice | <i>D</i> diameter |
| 4 insulation | * when duct A and duct B tested together |
| 5 joints | |
| 6 furnace roof/supporting construction | |
| 7 furnace chamber | |

A connection from the end of the Duct A outside the furnace is taken via a condensing unit and leakage measurement equipment, to a fan that maintains an under-pressure of $-300 \pm 15\text{Pa}$ inside the duct. (The condenser traps and removes water from any leakage gases, by reducing the temperature of any gas flow to below 40°C so eliminating erroneous leakage measurements due to moisture).

(Note: for ducts that are intended for use as smoke extract ducts, and will be tested to EN 1366-8, the Duct A will require to be tested at the higher under-pressure of -500 Pa)

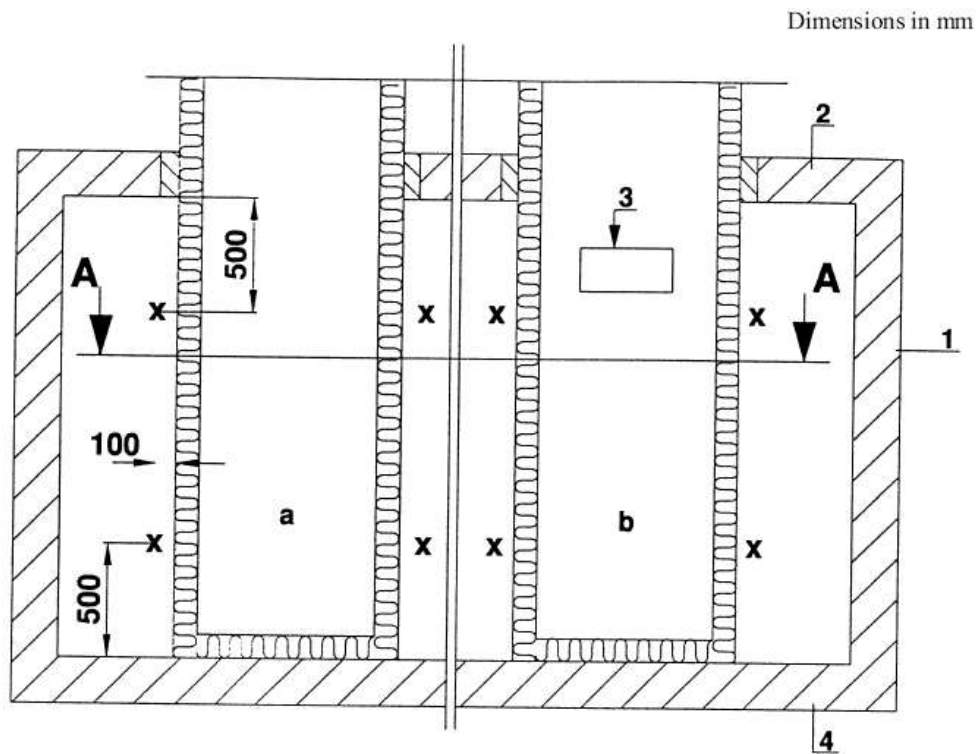
The cross section of Duct B for test is $1000\text{mm} \times 250\text{mm}$. (For circular ducts, the duct diameter is 630mm). A fan is also connected to the end Duct B outside the furnace that induces a furnace gas velocity of 3m/s within the duct, drawn through openings in the sidewall of the duct within the furnace. The velocity is maintained at 3m/s during the 'fan on' periods during the test. Every 30 minutes of the test the fans are switched off for five minutes to evaluate the integrity of the duct in the 'fan off' situation.

The test specimen is subjected to fire on all four sides. The standard time/temperature exposure is followed. The furnace pressure is controlled to $15 \pm 3\text{Pa}$ at the mid height on horizontal ducts, or to $20 \pm 3\text{Pa}$ 100mm below the ceiling for vertical ducts, compared to that of the laboratory.

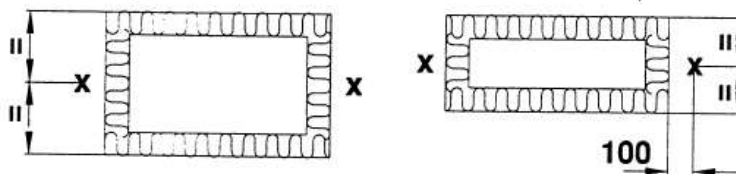
Thermocouples are applied to the non-fire face of the duct, to the supporting structure and penetration seal outside the furnace, as required by the standard. Additional thermocouples may be included within the duct where a duct has a combustible lining, in order to gain additional data on the fire performance (These are referred to as the T3 thermocouples).

The tested duct assembly is judged against Integrity, Insulation and Smoke leakage performance criteria. See 'Fire resistance' in section 2.3 of General Terms.

Figure 16: General arrangement for location of thermocouples on vertical ducts, inside the test furnace, as tested to BS EN 1366-1



A-A



- a) duct A
- b) duct B
- X furnace thermocouple
- 1 furnace wall
- 2 furnace roof
- 3 openings: total cross section 50% of duct cross section duct B (see 6.3.4)
- 4 furnace floor

6.3.1.2 A comparison of BS 476 Part 24 with BS EN1366-1 fire test methods

The test data arising from the previous BS 476 Part 24 tests and harmonised BS EN tests are not directly comparable or interchangeable. The harmonised EN test methods are acceptable for use across Europe and mitigate the costs of testing for manufacturers. The following table illustrates the differences, for ventilation ducts [see 6.4]

Note that there are additional fire tests for smoke extraction ducts: i.e. BS EN 1366-8 for multi-compartment smoke extraction ducts [see 6.5] and BS EN 1366-9 for single compartment smoke extraction ducts [see 6.6]

ITEM	BS 476 Part 24 / ISO 6944 (1985)	BS EN 1366-1 / ISO 6944-1 (2008)
Apparatus	<p>Furnace controlled to ISO 834</p> <p>Device for measuring restraint forces Thermocouples for measuring internal temperature of furnace and internal and external temperature of test specimen(s) Equipment for measuring gas pressures in furnace and in duct</p> <p>Extract fan required for Duct A to produce and maintain an under-pressure of 300Pa.</p> <p>Extract fan with capacity to produce gas velocity at 3m/sec at ambient at start of test. Allows use of flow rate controller to achieve this. (Duct B).</p>	<p>Furnace controlled to EN 1363-1</p> <p>Thermal movement measuring device (Duct A) Force measuring device (Duct B)</p> <p>Equipment for measuring gas pressures in furnace and in Duct A</p> <p>Extract fan required for duct A to produce and maintain an under-pressure of 300Pa connected to measuring station between duct and fan.</p> <p>Extract fan with capacity to produce gas velocity at 3m/sec at ambient at start of test. Allows use of flow rate controller to achieve this. (by-pass valve and damper) (Duct B). Volume flow measuring station Condensing unit Velocity measuring station (Duct B)</p>
Fire exposure	ISO 834 time temperature curve	EN 1363-1
Measurement of temperature of flue gases in duct	At centre of cross-section, at penetration point and 2m from this outside furnace	No specific requirement to measure
Pressure condition in duct A	Neutral pressure below horizontal duct and set to -300 ± 10 Pa at start of test relative to ambient conditions. No subsequent adjustment of fan required for duct A	<u>-300 Pa at start of test and maintained at this value though out test</u>
Velocity in duct B	Set to 3m/sec measured at ambient at start of test but no further adjustments made. Fan shut off prior to integrity evaluations then switched back on after. Integrity determined.	3m/sec at start of test and maintained at this during test except when fan shut off to make integrity measurements
Minimum dimension of ducts	In furnace 3m length horizontal duct	In furnace <u>4m</u> length horizontal duct

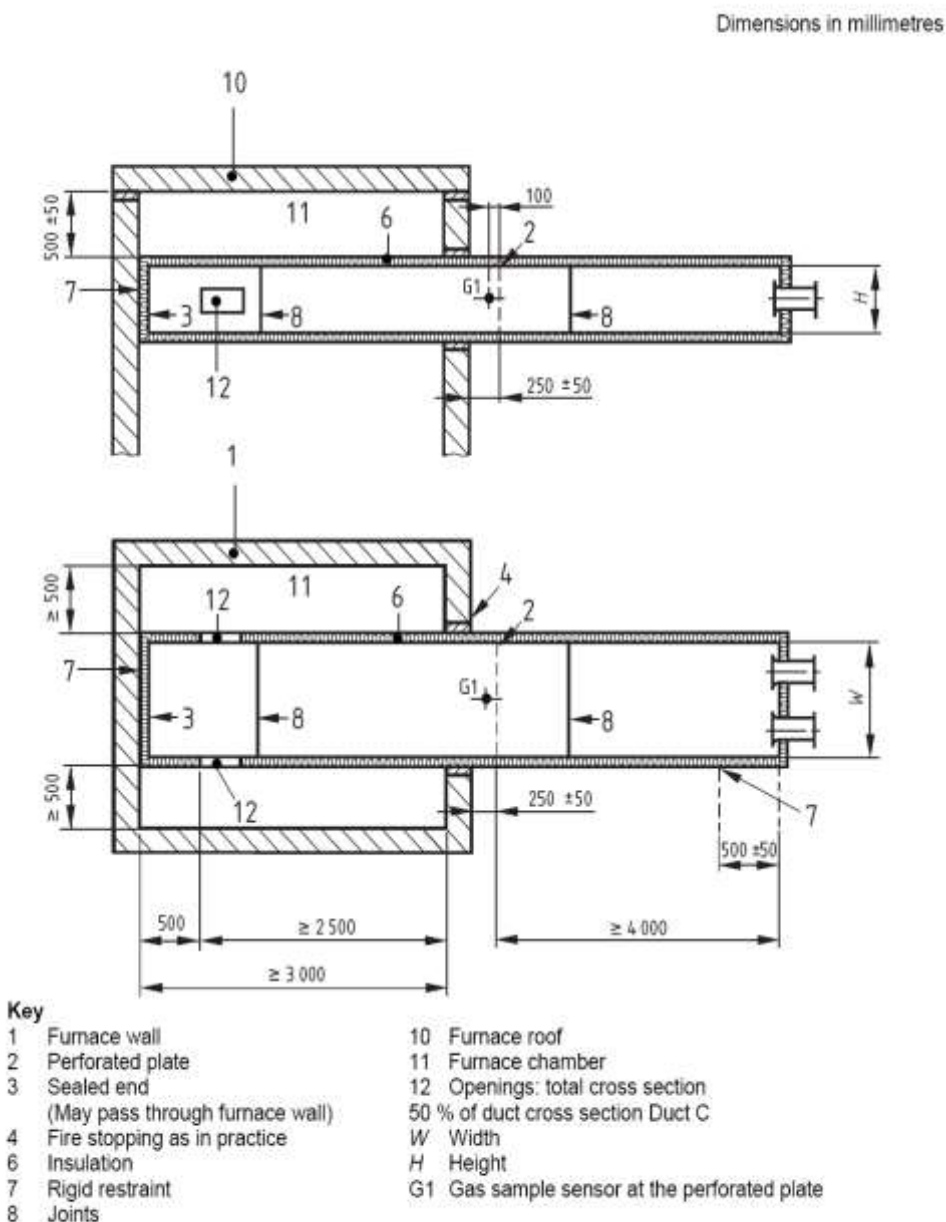
ITEM	BS 476 Part 24 / ISO 6944 (1985)	BS EN 1366-1 / ISO 6944-1 (2008)
	2m length vertical ducts Outside furnace 2.5 m length horizontal duct 2 m length vertical ducts	2m length vertical ducts Outside furnace 2.5m length horizontal duct 2m length vertical ducts
Cross section of ducts	Duct A & Duct B: 1000mm by 250 mm <i>NOTE: No provision in Part 24 to cover circular ducts specifically</i>	Duct A: 1000 mm ± 10 wide <u>500 mm ± 10 high</u> <u>800mm ± 10 diameter</u> Duct B: 1000 mm ± 10 wide 250 mm ± 10 high <u>630 mm ± 10 diameter</u>
Minimum separation	At least 500 mm	500 mm ± 50
Elbow – duct A	Same-cross section area as duct. End of elbow sealed	Cross section of 250 mm by 250 mm
Duct restraint	Both ducts abut to furnace wall with end sealed where it abuts. Full restraint provided 2000 mm ± 50 outside furnace from penetration point	Both ducts abut to furnace wall with end sealed where it abuts. Full restraint provided 2000 mm ± 50 outside furnace from penetration point (duct B only)
Joint arrangement in duct protection	At least two joints inside furnace and one outside (vertical ducts one joint inside furnace and one outside)	one joint inside furnace and one outside [no greater than 700 mm from penetration point] (vertical ducts one joint inside furnace and one outside)
Openings in duct B	At least half the cross-section of the duct cross section	At least half the cross-section of the duct cross section but clear this is the total and each opening is half of that
Supporting construction	Not specifically specified	Various supporting constructions specified in some detail
Assessment of fire resistance	Stability Integrity (cotton pad, gaps, flaming) Insulation	Stability no requirement other than observing general behaviour in furnace Integrity (volume flow rate-15m ³ /m ² h), cotton pad, gaps, flaming) Insulation: additional requirements for ducts with combustible linings Smoke leakage (10m ³ /m ² h)

6.3.1.3 BS EN 1366-8: 2004: Fire resistance tests for service installations: smoke extraction ducts (multi compartment)

This test method is applicable to fire resisting ducts that have already passed the appropriate period to BS EN 1366-1 (Ducts A and B), - where the Duct A has been tested a differential pressure 500Pa. (A greater under pressure than the standard pressure indicated in BS EN 1366-1).

Smoke extraction ductwork shall be made of non-combustible materials (Euro class A1 or A2). The specimen that is subject to the fire test must be designed and constructed to be representative of how it would be constructed on site.

Figure 18 General arrangement for horizontal smoke extract ducts, as tested to BS EN 1366-8 for multi-compartment use



NOTE The sealed end is independent of the furnace wall.

The minimum length of the specimen duct required by the test standard is 3.0m inside the furnace and 4.2m outside the furnace for horizontal ducts, and 2.0m inside the furnace and 4.25m outside the furnace for vertical ducts.

The cross section of Duct C for test is 1000mm x 250mm. (For circular ducts, the duct diameter is 560mm). A fan is connected to the end of the duct outside the furnace that induces a furnace gas velocity of 2m/s \pm 15% within the duct, drawn through openings in the sidewall of the duct within the furnace.

A perforated plate, appropriate to one of three prescribed differential pressures of -150Pa , -300Pa or -500Pa is incorporated within the duct, 250mm outside the furnace. The test specimen is subjected to fire on all four sides. The heating conditions conform to those specified in EN 1363-1 (standard heating curve) and the selected differential pressure maintained to \pm 3%.

The furnace pressure is controlled to $15\pm 3\text{Pa}$ at the mid height on horizontal ducts, or to $20\pm 3\text{Pa}$ 100mm below the ceiling for vertical ducts, compared to that of the laboratory.

(Note: it is the differential duct pressure that is controlled during the test, not the air velocity.)

Thermocouples are applied to the non-fire face of the duct, and to the supporting structure and penetration seal outside the furnace, as required by the standard, although these are not required to demonstrate insulation performance and are for information only. (Insulation performance is taken from the EN 1366-1 test data).

To facilitate observations of reduction of cross-section, an observation window is located at the end the duct.

The tested duct assembly is judged against Integrity, Insulation and Smoke leakage performance criteria. See 'Smoke Control' in section 2.3 of General Terms

6.3.1.4 BS EN 1366-9: Fire resistance tests for service installations: single compartment smoke control ducts

This part of EN 1366 specifies a test method for determining the fire resistance of *horizontal* smoke extraction ducts that are used for *single* compartment applications only. In such applications, the smoke extraction system is only intended to function up to flashover (typically 600°C but other temperatures may be used). It is applicable to smoke extraction ducts *that do not pass through into other fire compartments*.

Note: unlike the test in BS EN 1366-8, it is not a prerequisite that the duct is tested to BS EN 1366-1.

For smoke extraction ducts that pass through into other compartments, the method of test described in BS EN 1366-8 should be used.

It is applicable only to four sided and circular ducts. One, two and three sided ducts are not covered.

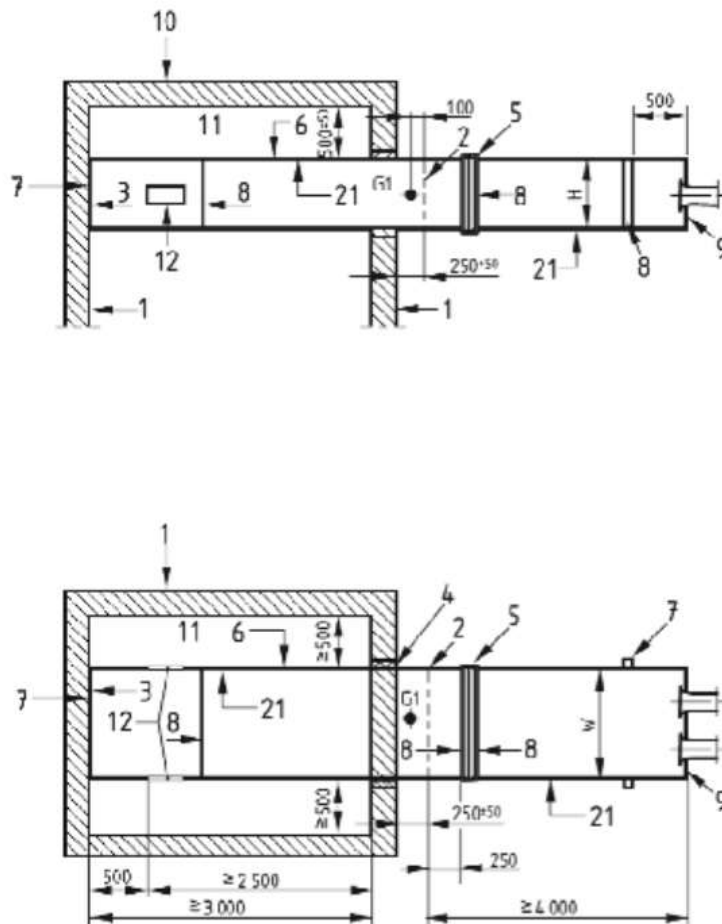
This method of test is only suitable for ducts constructed from non-combustible materials (Euro class A1 and A2-s1, d0).

The method described in this test standard is complex and requires sophisticated instrumentation. Whilst it is permitted, it is not recommended that multiple assemblies are tested together.

The specimen that is subject to the fire test must be designed and constructed to be representative of how it would be constructed on site. A single duct is tested, with fire on the inside of the horizontal duct. See Figure 20.

Figure 20 General arrangement for horizontal smoke extract ducts, as tested to BS EN 1366-9 for single compartment use

Dimensions in millimetres



NOTE The sealed end should be independent of the furnace wall.

Key

- | | |
|--|--|
| 1 furnace wall | 9 duct end plate |
| 2 perforated plate | 10 furnace roof |
| 3 fixed end of the duct
(May pass through furnace wall) | 11 furnace chamber |
| 4 fire stopping as in practice | 12 openings: total cross section
50 % of duct cross section |
| 5 compensator | 21 test duct |
| 6 duct surface | W width |
| 7 rigid restraint see Figure 7 | H height |
| 8 joints | G1 gas sample sensor at the perforated plate |

The minimum length of the specimen duct required by the test standard is 3.0m inside the furnace and 4.2m outside the furnace.

The cross section of duct for test is 1000mm x 250mm. (For circular ducts, the duct diameter is 560mm). A fan is connected to the end of the duct outside the furnace that induces a furnace gas velocity of 2m/s ±15% within the duct, drawn through openings in the sidewall of the duct within the furnace.

A perforated plate appropriate to one of three prescribed differential pressures of -150Pa, -300Pa or -500Pa is incorporated within the duct, 250mm outside the furnace. The test specimen is subjected to fire on all four sides.

The heating conditions and the furnace atmosphere conform to those specified in EN 1363-1 (or, if applicable, EN 1363-2) until 600 °C is reached. The mean temperature of the 6 furnace thermocouples shall be reached between 5 to 10 minutes from igniting the first furnace burner. After 10 minutes this temperature shall be

maintained between +70, -0 °C for the rest of the test. The furnace pressure shall be controlled to (15 ± 3) Pa throughout the test at the mid-height position of the ducts in the furnace.

To facilitate observations of reduction of cross-section, an observation window is to be located at the end of the duct or other suitable place.

Smoke extraction ductwork, for use in combination with smoke exhaust fans and which is intended to extract smoke from the compartment to outside, without passing through other fire compartments. Thermocouples to measure insulation are *not* required to the duct, nor to the supporting structure or penetration seal outside the furnace.

The tested duct assembly is judged against Integrity and Smoke leakage performance criteria. See 'Smoke Control' in section 2.3 of General Terms

6.3.2 Direct field of application (DIAP) for ventilation & multi-compartment smoke control ducts

Rules for direct field of application are included in the fire test standards BS EN 1366-1, BS EN 1366-8 according to the application concerned.

The rules are derived from information obtained from tests carried out in accordance with BS EN 1366 at UKAS accredited or equally recognised accredited laboratories. The test results achieved by a particular design may be directly applied to a limited number of variations (e.g. a reduction in duct size) without recourse to expert advice, providing the design remains substantially as tested.

ASFP has not reproduced the DIAP rules in this document since they are subject to review every 5 years through CENs normal process. The ASFP therefore recommends that the latest copy of EN 1366 Parts 1, and 8 are used for any reference purposes.

6.3.3 Direct field of application (DIAP) for single compartment smoke control ducts

Rules for direct field of application are included in the fire test standard BS EN 1366-9.

The rules are derived from information obtained from tests carried out in accordance with BS EN 1366 at UKAS accredited or equally recognised accredited laboratories. The test results achieved by a particular design may be directly applied to a limited number of variations (e.g. a reduction in duct size) without recourse to expert advice, providing the design remains substantially as tested.

ASFP has not reproduced the DIAP rules in this document since they are subject to review every 5 years through CENs normal process. The ASFP therefore recommends that the latest copy of EN 1366 Part 9 is used for any reference purposes.

6.3.4 Extended application (EXAP) for ventilation & multi-compartment smoke control ducts

The rules for extended field of application of test data are formulated from experience of accumulative test data for various ductwork installations, based on test data from BS EN 1366 Parts 1, and 8 which may be supplemented by appropriate and relevant historical test evidence generated from other sources. The assessment considers changes in the tested design beyond the scope of direct application and may also consider variations to the tested design. For example, an increase in duct size which necessitates the inclusion of a joint in the duct walls.

The EXAP rules are contained in standalone documents BS EN 15882-1 in the case of tests made to BS EN 1366-1 and in BS EN 15882-XX for smoke control ducts tested to BS EN 1366 Parts 8. At the time of writing, the EXAP standard for smoke outlet ducts, BS EN 15882-XX, has not been published.

ASFP has not reproduced the EXAP rules in this document since they are subject to review every 5 years through CEN's normal process. The ASFP recommends that the latest copy of EN 15882 Parts 1 and 8 are used for any reference purposes.

6.3.5 Extended application (EXAP) for single compartment smoke control ducts

The rules for extended field of application of test data are formulated from experience of accumulative test data for various ductwork installations, based on test data from BS EN 1366 Part 9 which may be supplemented by appropriate and relevant historical test evidence generated from other sources. The assessment considers changes in the tested design beyond the scope of direct application and may also

consider variations to the tested design. For example, an increase in duct size which necessitates the inclusion of a joint in the duct walls.

The EXAP rules are contained in standalone documents BS EN 1366-1 and in BS EN 15882-XX for smoke control ducts tested to BS EN 1366 Parts 9. At the time of writing, the EXAP standard for smoke outlet ducts, BS EN 15882-XX, has not been published.

ASFP has not reproduced the EXAP rules in this document since they are subject to review every 5 years through CEN's normal process. The ASFP recommends that the latest copy of EN 15882 Part 9 is used for any reference purposes.

6.3.6 General information on the field of application of test data for EN classification

Classification standards BS EN 13501 parts 3 and 4 inform readers which tests must be undertaken to obtain suitable classification for fire performance. BS EN 13501-3 applies to fire resisting ventilation ducts, and BS EN 13501-4 applies to smoke control ducts.

The field of application from tests to BS EN 1366 may be split into two distinct categories viz. direct and extended fields of application. See 6.3.3 & 6.3.4 for further details

The principle differences between the BS 476 Part 24 test method [derived from ISO 6944] and the European tests are outlined in Section 6.5 of this document.

6.3.6.1 Classification of fire resisting ventilation ducts BS EN 13501 Part 3

Some readers may not be familiar with the CEN European system of tests and classification, etc.

The system can be briefly summarised as follows:-

The product standard will state which European classification system applies to the product being considered.

The Classification system BS EN 13501-3 will tell readers which fire tests have to be undertaken to allow a classification for fire performance to be made

The fire test standard will normally include the direct rules for the field of application of the test data obtained.

A separate document will provide the rules for extended field of application, beyond the limits of the test data obtained

The classification shall indicate if the performance criteria are satisfied by fire from inside or fire from outside or both, and whether it applies to vertical or horizontal orientations or both. The additions "i → o", "o → i" or "i ↔ o" shall be used respectively together with "ve" and/or "ho" to indicate orientation (vertical and horizontal).

For example, a classification **EI 30 (ve ho o → i)** indicates a ventilation duct capable of satisfying 30 min integrity (E) and insulation (I), from outside to inside in both vertical and horizontal applications. The classification (S) shall be included, based on satisfaction of the ambient smoke leakage criterion. This shall be based on a pass/fail test for the leakage. For example, a classification **EI 30 (ve ho o → i) S** indicates a duct with the same performance as above but additionally satisfying the leakage criterion (10 m³/(m²·h). Failure of the suspension devices does not constitute failure of the test specimen unless it leads to failure of either E or EI.

For fire resisting ducts, a number of different classes are defined. See EN13501-3 for details.

6.3.6.2 Classification of fire resisting smoke control ducts (multi compartment) BS EN 13501-4

The classification shall indicate if the performance criteria are satisfied by fire tests for Integrity (E), Insulation (I), and smoke leakage (S) and whether it applies to vertical or horizontal orientations. The additions "ve" and/or "ho" shall be used to indicate orientation (vertical and horizontal). "S" indicates a leakage rate of less than 5m³/(h·m²). '500', '1000' or '1500' indicates that when tested at these negative pressures the duct is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa. The term "multi" indicates a multi compartment test (i.e. to BS EN 1366-8).

For example, a classification **EI 60 (ve ho) 1000 multi** indicates a smoke control duct capable of satisfying 60 min integrity (E) and insulation (I), in both vertical and horizontal applications, for a system of negative

pressure 1000Pa. The classification (S) shall be included, based on satisfaction of the ambient smoke leakage criterion. This shall be based on a pass/fail test for the leakage. For example, a classification **EI 60 (ve ho) S 1000 multi** indicates a duct with the same performance as above but additionally satisfying the leakage criterion ($5 \text{ m}^3/(\text{m}^2\cdot\text{h})$).

For smoke control ducts, a number of different classes are defined. See EN13501-4 for details.

6.3.6.3 Classification of fire resisting smoke control ducts (single compartment) BS EN 13501-4

The classification is completed by the suffix 'single' to indicate suitability for single compartment use only. In addition, the symbols, 'ho' indicate the suitability for horizontal use. At the time of writing, the test standard EN 1366-9 is being reviewed. It is proposed that the test on a horizontal duct test specimen will cover the same system orientated vertically, proving account is taken of the duct support design.

'S' indicates a leakage rate of less than $5 \text{ m}^3/(\text{h}\cdot\text{m}^2)$.

'500', '1 000' or '1 500' indicates that when tested at these negative pressures the duct is suitable for use over the range from the tested negative pressure up to a positive pressure of 500 Pa, at ambient temperature.

The classification E600 covers the classification E300 for the same time period.

For example, a classification **E₆₀₀ 60 (ho) 1000 single** indicates a smoke control duct capable of satisfying 60 min integrity (E), in a horizontal application, for a system of negative pressure 1000Pa. The classification (S) shall be included, based on satisfaction of the ambient smoke leakage criterion. This shall be based on a pass/fail test for the leakage. For example, a classification **E₆₀₀ 60 (ho) S 1000 single** indicates a duct with the same performance as above but additionally satisfying the leakage criterion - $5 \text{ m}^3/(\text{m}^2\cdot\text{h})$.

For smoke control ducts, a number of different classes are defined. See EN13501-4 for details.

7. ASSESSMENTS OR 'TECHNICAL EVALUATIONS'

7.1 General to increase scope of a product's range

The sheer range of products and sizes and configurations of passive fire protection products means that it is almost impossible to test every single variant. It would also be uneconomic to do so and fire resisting ducts are no exception. Consequently, assessments or 'technical evaluations' are used following the generation of fire test evidence to expand the scope of the applicability of the tested product/system. Assessments must be the view of a recognised expert in a particular fire test, and the performance of products in that test, that may be used for the purpose of interpreting or applying results in connection with National Regulations.

Assessments have been used in this way, in the UK, for many years and have been accepted as having a similar status to a test report. It is normal for UKAS, or equivalent accredited test laboratories to conduct the assessments, although this is by no means mandatory. Some fire consultants and suitably qualified/experienced fire engineers would also be expected to have the appropriate knowledge. For more information see ASFP Advisory Note 17. This note can be downloaded from here: [Advisory note 17](#)

ASFP recommends that such assessments are conducted in accordance with the *PFPF's Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence – 2019*. Assessments, which follow the guidance within the PFPF Guide, will provide the end user with confidence that the evaluation has been carried out with the necessary care and expertise and is appropriate to the intended use. The guide can be downloaded from here: [PFPF Guide to undertaking assessments 2019](#)

Previous versions of the Blue Book contained rules for assessments or engineering judgements to increase the scope of products for which manufacturers could claim a fire performance. These rules are also used in in part or completely by some of the certification bodies for the third party certification of fire resisting ducts.

It has agreed to remove these rules partly because they might encourage lay persons without an experienced background in the testing and approval of fire resisting ducts to attempt to assess products. This should be left to UKAS, or equivalent, accredited test laboratories, suitably qualified fire consultants and the certification bodies. The rules will be kept and maintained by ASFP for use by appropriate parties.

7.2 Site-specific assessments

Just as all the combinations of permutations of fire resisting ducts cannot all be tested, so the total range of end-use (on-site) applications cannot be tested either. Special conditions will arise from site to site which may mean that the manufacturer's instructions and tested installation method cannot be followed. In such circumstances, an evaluation of likely performance needs to be undertaken. This is normally conducted via a site specific 'assessment' or 'technical evaluation' report as per 7.1 above. The report should address the on-site condition and the required amendments to the construction and provide justification that the proposed changes are acceptable. Typical areas where site specific assessments may be required are:

- a) 'one-off' projects or applications, where the cost of testing would otherwise make the application uneconomic
- c) Where, for various reasons (e.g. size or configuration) it is not possible to subject a construction or a product to a fire test.

Where a site specific assessment is used, the report should be produced in accordance with the guidelines of the PFPF Document and ASFP Advisory Note 17 mentioned above.

8 THIRD PARTY CERTIFICATION

8.1 Product certification

Voluntary third party product certification schemes vary according to the terms of individual schemes, but essentially include verification of the test evidence and scope of application or use of the product, and a regular audit of the factory quality assurance (QA) system to ensure that the product as supplied to the contractor is to the same design or formulation as the original test samples. Third party certification specifically involves:

- **Independent selection of samples for test**
- **Evaluation of manufacturer's factory production control system**
- **Initial inspection of the factory**
- **Undertaking, or organising, the testing of the product at an independent laboratory**
In addition to fire testing, these will include other characteristics that are relevant to the performance of the product as considered under the individual scheme. Unlike CE marking, which stipulates which characteristics are required to be evaluated in the European Technical Specification, Third Party Schemes are free to be tailored to a specific product type. Usually, such schemes evaluate fitness for purpose, but concentrate on those product characteristics important to the fire performance of the product.
- **An appraisal of all the test and assessment evidence to be able to define a scope of certification**
Again this is another area where third party certification schemes differ from CE marking. CE marking is quite rigid over the extent to which products variations are catered for. The limits being contained within EXAP standards (see 6.3.4). Voluntary third party certification schemes are not so constrained and can use expert judgment to significantly extend the scope of certificated products. Again, the schemes will differ and manufacturers should compare the 'technical schedules' of the schemes to find the most suitable scheme. These are publicly available on the certification body websites.
- **Undertaking audit testing/procedures** including regular retesting or other regular quality checks
- **Issuing a certificate**
- **Traceable labelling of product**

It should be noted that CE Marking is not a 'quality mark' but uses harmonised European classification and fire testing procedures. Voluntary third party product certification schemes are 'product quality' schemes and invariably include more checking procedures than are required for CE Marking.



Figure 18: Certification bodies offering third party product certification

The ASFP strongly supports either CE marking or third party certification of all passive fire protection products including fire resisting ducts. It is a condition that manufacturers who wish to have products listed in this publication must have third party certification for the product. In this way, end-users can use this book as a source of products whose fire performance has been comprehensively evaluated by an independent third party certification body.

8.2 Installer certification

Third party certification for installers is a process whereby the contracting company employs appropriately trained, competent staff to install the required passive fire protection system. Their work is independently audited by site inspections from the third party organisation and a full record system is required as part of the scheme. Installer certification specifically involves:

- **Auditing of offices to check**
 - that written procedures are in place to account for the correct use of staff
 - records for the correct purchase of appropriate materials/products are present
- **Use of staff whose competency has been evaluated**
- **Use of proven e.g. CE marked or third party certificated fire resisting duct products or systems**
- **Certificate of completion of works lodged with certification body**
- **Independent inspection of works by certification body**

As with third party product certification schemes, installer schemes vary slightly and it is useful to compare the requirements of each scheme.

The ASFP recommends that all passive fire protection is installed by third party certificated installers. In the case of fire resisting ducts this is particularly important as they are often covered up and inaccessible after installation, so it is important to get it right.

It is a condition of membership of the ASFP that contractors must have third party certification for installation. End-users can be confident that an ASFP contractor will have had their installation capability comprehensively evaluated by an independent third party certification body.



Figure 19: Certification bodies/schemes offering third party installer certification

8.3 Reference to third party certification in Statutory Guidance documents

The use of third party certification schemes is recognised in the Building Regulations, Approved Document B (Use of Guidance; Independent certification schemes).

In the section dealing 'Use of Guidance; Materials and Workmanship – Independent certification schemes: Approved Document B 2013 includes the following text:-

There are many independent product certification schemes in the UK and elsewhere that may provide information on the performance of a product. Such schemes certify that a material complies with the requirements of a recognized document and indicates is suitable for its intended purpose and use. These may be in addition to, but not in conflict with, CE marking

NOTE: *Materials which are not certified by an independent scheme might still conform to a relevant standard.*

Accreditation of a certification body by a national accreditation body belonging to the European co-operation for Accreditation (EA) provides the means of demonstrating that their certification scheme can be relied upon. In the UK, most independent certification bodies are accredited by the United Kingdom Accreditation Service (UKAS), which belongs to EA.

It is important to check the scope of the accreditation of a certification body, as accreditation might only cover part of the certification body's testing or certification business.

9. NOTES ON PENETRATION SEALS, SUPPORTS & ANCILLARY ITEMS

9.1 Combined Service Penetrations

A combined service penetration contains Fire Resistant Ductwork/Dampers with Cables and Pipes passing through the same penetration within a fire separating element.

There is currently no specific fire test standard that allows for the determination of fire resistance performance for a single penetration containing combinations of Fire resisting ductwork and dampers with other service types (cables and pipes). Therefore, until such a standard is published, ductwork and dampers should not be mixed in the penetration with other services types.

Where it is not possible to separate the services, local site-specific testing in a laboratory may be the only option to provide evidence to satisfy Building Control and Insurance Companies. The project design team should satisfy themselves that independent advice has been sought from a competent person in accordance with the PFPF guide and this information is recorded in the project file for submission under Regulation 38.

9.2 Penetration Sealing Systems

Where ductwork passes through a penetration in a fire separating element, it must be ensured that the fire resistance performance of that separating element is maintained. This is usually achieved in one of two ways:

- i. For fire resisting ductwork, a penetration sealing system is fitted between the duct and the fire separating element. The penetration sealing system and the ductwork are considered as one integral system. For the field of direct application, the ductwork and penetration sealing system must be the identical to that tested in accordance with BS EN1366-1 or 8 and in the same orientation.
- ii. For non-fire resisting ductwork, a fire damper must be fitted in the plane of the wall or floor. The damper and associated penetration sealing system must be installed to a procedure substantiated by test to BS EN1366-2 or 10. Note that the damper must be mounted in the wall or floor and must be supported/ restrained independently of the ductwork.

The penetration sealing system as tested may be one or more of the following:

- General Cement based mortar
- Batt System
- Fire Compound
- Sealant (Silicone and/or acrylic)
- A reactive material (intumescent based)

Where fire resisting ductwork adjoins a damper passing through a penetration of a fire resisting wall or floor, the penetration sealing system to the wall or floor must be installed as (ii) above.

9.2.1 Specific requirements of Penetration Sealing Systems

The primary reason for providing fire-resisting ductwork systems is to maintain the fire resistance of a compartment wall or floor of a building. Some systems can also be used to extract smoke or to pressurise escape routes. It is therefore critical that the correct method of sealing any gaps around the ductwork is used as it passes through any penetration in a fire resisting compartment wall or floor. This detail is one of the most common reasons for the failure of a ductwork system in a fire resistance test.

The fire resistance test for ducts (BS EN1366-1 or 8) is designed to evaluate the fire resistance performance of the duct penetration sealing system through a wall or floor construction (the fire separating element), as well as the fire performance of the duct system itself. The purpose of the penetration seal system is to seal the gap between the duct walls and the perimeter of the penetration to the fire resisting construction.

In a fire situation, an integrity failure of the penetration seal system is often caused by the movement or distortion of the duct. Therefore, it is not possible to separate the fire performance of the penetration seal from the construction of the duct.

A successful test on a duct construction with one penetration seal system type fitted around does not mean that the duct construction and/or penetration seal system is suitable for use with a different type of duct construction and/or penetration seal systems. Similar comments apply for duct sizes other than that tested.

The BS EN 1366-1 or 8 fire tests on ducts are carried out on specimens in the horizontal orientation and in the vertical orientation. The fire performance of both the duct construction and penetration seal system must be demonstrated for the orientation in which the duct is being used. -

The following is a checklist to help with the design and specification of a Penetration Sealing System for a fire resisting duct or damper:

- Check the duct and penetration seal system have been tested together
- Check the maximum allowable duct size according to the test evidence, including any EXAP and/or DiAP rules in the supporting documentation such as a classification.
- Check that the supporting construction is capable of forming the size and location of duct and penetration seal system required
- Check that the thickness (width) of the fire separating element is equal to or greater than that tested – see 9.2.5
- Check that the fire separating element is classified according to EN 13501-2 for the required fire resistance
- Check the maximum size of the penetration allowable according to the test evidence of the duct system in flexible walls (it is recommended that the flexible wall system provider is consulted to establish the maximum size of the penetration permitted within the drylining system)
- Check the maximum size of the penetration allowable according to the test evidence of the duct system in rigid walls
- Check the maximum size of the penetration allowable according to the test evidence of the duct system in rigid floors
- Check how close is the duct penetration can be to other penetrations in the same supporting construction
- Check the minimum and maximum side edge distance permitted between the duct and fire separating element
- Check the minimum and maximum top and bottom edge distance permitted between the duct and fire separating element
- **Check the duct manufacturer has suitable evidence to cover this application**

The performance of a fire resisting duct system will depend on several factors as follows:

9.2.2 Thermal expansion or shrinkage of ductwork system

Systems based on steel ductwork will expand in fire, and self-supporting systems may shrink. This movement may dislodge the seal, unless it has been demonstrated to be suitable by fire testing to BS EN 1366-1 or 8.

9.2.3 Deformation of ductwork

The sides of any ductwork system are likely to deform in fire conditions. In particular, the top horizontal face of horizontal ducts will tend to sag, causing gaps to form at the penetration seal. The extent of any deformation will depend on a) the size of the duct, b) the materials used to form the ductwork, c) the location of any joints or stiffeners in the system within, or close to, the wall or floor, d) the location of

any internal stiffeners within, or close to, the wall or floor, e) the size of any stiffeners and f) the position and size of the hangers on both sides of the wall.

9.2.4 Collars

Several ductwork systems employ collars fitted around the ductwork on each side of the wall or floor as part of the penetration sealing system. The collars used in the fire test may have been fixed to the ductwork, or to the wall or floor, or to both. The collars should be fixed as tested. The size of the collar should be adequate to overlap the wall, partition, or floor to at least the same extent as tested. Generally, it is not advisable to fix the collar to both the ductwork and a non-load bearing partition as the thermal movement of the ductwork may have an adverse effect on the performance of the partition.

9.2.5 Supporting construction

The wall, partition or floor that the duct penetrates is known as the 'Supporting Construction' in the fire test standard. A supporting construction with a fire resistance equal to or greater than that of the test result obtained for the fire resisting duct system is applicable to a supporting construction in practice that may be thicker, denser or more layers of board. Test results obtained with flexible vertical supporting constructions may be applied to rigid supporting constructions of a thickness equal to or greater than that of the element used in the tests, provided that the classified fire resistance of the rigid supporting construction is greater than or equal to the one used for the test.

9.3 Support systems

The support systems used for fire resisting ductwork must be capable of bearing the load of the ductwork under fire conditions. The support system consists of the hangers and bearers, the fixings and brackets. Attention must be given to the spacing of the supports and the size of the support components in accordance with the manufacturer's test data and recommendations. For the required fire resistance, do not exceed –

- The maximum allowable span of the duct between supports
- the maximum distance of the hangers from the side of the duct
- the maximum allowable stress within the components of the supports

The fixings should be carefully selected for the substrate and loading. They should be non-combustible and/or shown by test to be suitable for the fire conditions

Stresses within the support components can be reduced by increasing the size of the components, or reducing the spacing of the supports, or applying fire protection to the support systems.

- If supports were positioned at all duct joints within the furnace in the fire test, then the supports must be located at all duct joints in practice.
- The element of building construction to which the support systems are attached must have a fire resistance of at least that specified for the duct and be able to support the weight of the duct under fire conditions.

9.4 Ancillary items / in-line equipment

A fire resisting duct will often adjoin a component or structure which does not form part of the tested ductwork system, and could have in-line equipment and control devices such as balancing dampers, filters, attenuators, fans, etc. The performance characteristics of the fire resisting duct must be continued through these ancillary items of equipment to ensure the fire resistance of the system is maintained.

Fire Dampers

It is not recommended for fire resisting ductwork to be *randomly* used to rectify **incorrect** installation or positioning of dampers (e.g. in situations where a damper tested only for installation in the plane of a wall or floor has been installed remote from a wall or floor). It may be possible to protect the duct on both sides of

the wall – up to the damper – to ensure that fire compartment is maintained, and that the fire damper can operate as intended, provided that a positive independent site- specific assessment has been carried out.

9.5 Interface between fire resisting ductwork & elements of construction

Responsibility for the satisfactory performance of each element of building construction (e.g. walls, floors, cavity barriers, etc.) lies with the installer of each particular element. The ‘change over’ of responsibility occurs at the interface between the fire resisting ductwork and the elements. It is imperative that the interface detail does not compromise the fire performance of either the element of building construction or the fire resisting duct.

The building designer, mechanical services designer and the installer all have a responsibility to pay due care to this detail and ensure it is in accordance with test evidence of a ductwork penetration.

9.6 Duct cleaning

Insurers are increasingly requiring cleaning of fire resisting kitchen extract ducts; there is also an implicit legal requirement for cleaning arising from food preparation related legislation. Duct cleaning companies can sometimes use highly caustic aggressive chemicals that are needed to shift dirt and especially grease. ASFP, BESA and National Association of Air Duct cleaners UK (NAADUK) are addressing concerns that these might be damaging some of the materials e.g. intumescent used in some fire resisting ducts. Manufacturers are recommended to include information on cleaning requirements for their products so that these can be included with the information they submit as part of the building O & M file. Duct cleaners should consult this information or the manufacturer if the information is not available.

9.7 Access doors

It is sometimes the case that kitchen extract ductwork systems are installed with insufficient numbers of access doors to facilitate cleaning. Due to more rigorous insurers’ requirements for cleaning fire resisting kitchen extract ducts ASFP and BESA members are increasingly being asked to fit access doors to pre-existing fire kitchen extract ducts. Access is also necessary to service ancillary items, including dampers. Generally, the access door system must have been fire tested with the duct system. In some cases, there is fire test evidence for the access door, but not in conjunction with the duct it is to be fitted to. In light of the fact that such modifications to the fire resisting duct will require building regulations approval, installers and building owners should ensure that they have test or assessment evidence to ensure that the access doors are fire resisting and that fitting them to the existing fire resisting duct will not compromise the fire resistance performance.

9.8 Labelling of fire resisting ducts

Some manufacturers of fire resisting ducts do not label their ducts so that they can clearly be distinguished from non-fire resisting types. Consequently, duct cleaning companies and other follow on trades are unaware that they must not compromise the fire resistance e.g. by fitting access doors (see 9.7). It is recommended that all installed fire resisting duct systems are clearly labelled so that the risk of their fire resistance being compromised by modification by other parties is lessened. ASFP is working with the relevant trade associations to develop a joint labelling scheme.

APPENDIX A: Limitations of fire resisting ductwork systems

The list below sets out the principal limitations in the scope of the guidance given in this publication and is not intended to be exhaustive.

- a) The term 'fire resisting ductwork' is deemed to refer to a system as tested or assessed in accordance with BS EN 1366-1. As the vast majority of tests on steel ducts are conducted with rigid ducts it is not appropriate to extrapolate this data for flexible steel ducts. Therefore, unless the flexible steel duct system has been tested in accordance with BS EN 1366-1, this guidance cannot be assumed to apply.
- b) Service ducts are not included within this guidance.
- c) Fire resisting ductwork systems shall be deemed to include all the components as tested or assessed, including supporting systems and penetration seals.
- d) The element of building construction to which the support systems are attached must have a fire rating of at least that specified for the duct and be able to support the weight of the duct under fire conditions
- e) Fire resistance of a fire resisting ductwork system shall be expressed as the three time period components - integrity, insulation and smoke leakage. Where only a single time period is expressed it shall be deemed to apply to all three components, unless clearly defined otherwise. (e.g. 60 minutes, integrity only).
- f) It is essential when choosing a fire resisting duct system that it is fit for the purpose to which it is being applied. Considerations other than the successful completion of a BS EN 1366 - 1, 8 or 9 fire test on a sample section of ductwork may need to be given when assessing the suitability of a fire resisting duct for a particular application.
- g) During any defined non-fire operating conditions, fire resisting ductwork must be capable of both performing and being tested to the ductwork classification and the air leakage limits of the designated ductwork specification, e.g. DW /144.
- h) In general, the air flow characteristics of ductwork and its associated components such as bends, branches and changes of section must all be in accordance with DW /144.
- i) In the case of an **existing metal or a newly constructed duct**, where application of a fire insulation cladding material to provide fire resistance is considered, it is imperative that the construction standard of the metal duct is checked for conformity with the appropriate fire test report. Metal gauge, spacing & size of flanges and stiffeners, bolting centres, use of steel / aluminium rivets, sealants, spacing of hanger supports and fixing method to the soffit should all be checked for compliance with the fire tested construction. It is not sufficient to rely on a DW/144 construction classification for fitness for purpose in this regard.
- j) Light gauge specifications such as DW/144 recognise many machine forming techniques for ancillary items, such as air turning vanes and the increased gauges, associated with fire resisting ductwork systems may not only preclude the use of such techniques but may also, out of necessity, introduce a geometric change that may require the approval of the HVAC designer in terms of a component's air flow characteristics.
- k) A fire resisting duct tested to BS EN 1366-1 (ventilation ducts) which meets criteria of integrity, insulation and smoke leakage may not be suitable for application for smoke extract ducts unless also tested to BS EN 1366-8 (Multi compartment smoke extract) or BS EN 1366-9 (Single compartment smoke extract).
- l) For the field of direct application, any penetration seal must be the same as that used in the original BS EN 1366-1, see section 9.1.
- m) Where fire dampers are connected to a fire resisting duct it is assumed by this guidance note that the combined installation is adequate for the required fire resistance. However it is incumbent upon the designers and providers of such damper installations to verify that they have been appropriately tested adopting the procedures and criteria of BS EN 1366-2 (fire resistance test for fire dampers).

- n) This guidance does not address the complex and detailed issue of fire dampers, fire and smoke dampers and smoke control dampers or any other fire resisting components or elements of structure with which the fire resisting ductwork system interfaces, save for their assumed levels of adequacy. Responsibility is therefore deemed to end with the interface.
- o) Special care must be taken with in-line items of equipment such as fans, volume control dampers, attenuators etc. Where such items are within a fire resisting ductwork run, the item of equipment must maintain the full fire performance of the duct into which it is fitted or it must be installed within its own fire resisting enclosure (same performance as the duct). Access provisions to the ductwork for cleaning and maintenance should also maintain the fire performance of the duct to which they are fitted.
- p) The expansion of the ductwork could cause excessive forces on an associated wall or floor construction and penetration seals, which, could result in their failure under fire conditions. The ductwork route should either be reconsidered, to lessen the effect of expansion on the penetration seals, or fire resisting expansion devices/compensators should be included within the ductwork.

APPENDIX B: Standard Specification

In order to ensure fire resisting ductwork is correctly specified prior to the commencement of work, several factors should be carefully considered and defined.

The Specification should therefore:

- 1) Define the type of ductwork, as - Smoke / Ventilation / Kitchen / Pressurisation
- 2) State the required fire classification to EN 13501- 3 or 4 in minutes for:
 - i. Integrity E
 - ii. Insulation I
 - iii. Leakage S
- 3) Define if the system is Duct Type A (fire outside) or Duct B (fire inside) or requirement for both 'fire inside' and 'fire outside'.
- 4) Define Static Pressure Limits –

Pressure / velocity	Class	Pressure level range	
		Positive pressure	Negative pressure
Low	Class A	Up to + 500 Pa	Down to - 500 Pa
Medium	Class B	Up to + 1000 Pa	Down to - 750 Pa
High	Class C	Up to + 2000 Pa	Down to - 750 Pa
High	Class D	Up to + 2500 Pa	Down to - 750 Pa

NOTE that these classifications are to HVCA DW /143 and 144 requirements

- 5) The Fire Duct manufacturer should define the friction resistant coefficients of all bends and tapers, etc. which are to be used if they differ from those for galvanised sheet steel.
- 6) It is recommended that the manufacturer/installer is working to a Quality Assurance System based upon the ISO 9000 series.

With reference to the above factors, the standard Specification should read:

'The (1) Ductwork should be constructed in accordance with the ASFP Guide to Fire Resisting Ductwork to provide an EN13501-3/4 Classification of (2) when tested to the requirements of EN 1366 by a UKAS approved or recognised laboratory. The ductwork should be capable of providing Type (3) fire containment and, under normal non-fire operating conditions, should conform to the (4) pressure classification of the current HVCA DW/144 Specification for Sheet Metal Ductwork.'