GREY BOOK

Volume 1: EN Fire dampers

Volume 1: Fire dampers (European standards)

E (integrity) & ES (integrity and leakage) classified

2nd Edition

As used in ventilation systems to maintain fire compartments and/or to protect the means of escape from buildings

Guidance on EN fire testing, classification, application & installation.

FIRE AND YOUR LEGAL LIABILITY

Fire losses in the UK were £1.1bn in 2011. That's why we must all play our part.

Why is this of relevance to me?

If you are involved in provision of a fire protection package, at any level, then you share liability for its usefulness and its operation when it's needed in 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.

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 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. Otherwise, the user cannot make an effective risk assessment under the Regulatory Reform (Fire Safety) Order 2005.

What is expected of me?

In the event of fire, and deaths, a court will want to know how every fire protection system was selected; 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 2007.

The CDM 2007 regulations, enforced by Health and Safety Executive concentrate on managing the risk, and the health and safety of all those who 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!

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The Association was formed in 1976, and currently represents the majority of UK contractors and manufacturers of specialist fire protection products, with associate members representing regulatory, certification, testing and consulting bodies.

ASFP 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.

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The HVCA represents the interests of firms active in the design, installation, commissioning and maintenance of heating, ventilating, air conditioning and refrigeration (hvac) products and equipment

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1 SCOPE

This document is intended to make the specification and installation of fire dampers, where tested and classified to harmonised European procedures, easier for designers and installers. It will also provide a guide for inspectors. It emphasises the importance of installing fire dampers as recommended by the manufacturer and is intended to ensure the use of fire dampers that have been fire tested for the appropriate application.

It should be noted that this document does not include 'smoke control dampers' which will be discussed in Volume 2 of this Edition.

In simple terms, this Volume 1 is intended to provide guidance for fire and smoke protection for means of escape routes; and for maintaining the fire compartment, whereas Volume 2 will be focussed on the use of smoke control damper systems in combination with ductwork.

2 INTRODUCTION

This publication has been produced to assist those involved in the manufacture, specification, installation, inspection and verification of fire resisting dampers installed in heating, ventilation and air conditioning (HVAC) ductwork systems. For information on fire resisting ductwork, reference should be made to the ASFP publication "Fire resisting ductwork: classified according to BS EN 13501-3 for fire resisting ductwork, and BS EN 13501-4 for smoke control ductwork (known as Blue Book: European version)".

Despite many years of use, there has not previously been a nationally recognised guideline for installing fire and smoke damper units when used for providing fire resisting compartments and separation.

Limited guidance in the correct installation of damper systems has resulted in numerous methods being specified by well intended sources such as design consultants, damper manufacturers, ductwork contractors, local authorities, fire authorities, etc, but to the extent that methods vary quite considerably from one project to another. More often than not, methods are based on opinions rather than accepted principles and, quite often, do not take into account the practical installation conditions that vary from project to project.

This document is intended to provide information on best practice and to progressively include fire damper data sheets provided by Third Party Certification schemes, accredited or recognised by UKAS. For further information see section 19.

Other parallel initiatives are also supported, such as that published by the Heating and Ventilation Contractors Association, HVCA, under the title of 'DW/145: Guide to good practice for the installation of fire and smoke dampers'.

There are numerous types of fire dampers and associated installation frames available in the market place. These are broadly described in this ASFP publication. It is equally important to recognise that there are many varieties of walls and floors that are penetrated by fire resisting ducts and dampers. The combinations will have a direct effect on the fire resistance that is achievable.

IMPORTANT

The ASFP wishes to provide a clear signal to the construction industry and H&V industry as a whole, that the ad hoc installation of fire dampers in duct systems at positions which are out of compliance with manufacturers fire tested systems is completely unacceptable and avoidable. These ineffective installations include positioning of fire dampers away from the fire resisting wall or floor element which is being penetrated by the duct and fire damper system. It is vital that the fire damper is properly positioned in the plane of the wall or floor, unless tested otherwise, fully in accordance with the manufacturer's instructions,

The existing and frequent level of ineffective installation adds delays and unnecessary costs to those projects affected by such bad installations. Too many examples occur. Universal attention is needed to adhere to best practice methods. Construction managers must ensure that fire dampers and walls are mutually installed in line, to meet the fire performance required and the fire risk strategy for the building.

In the case of BS EN European fire tests and classification systems, the system uses formal rules for direct and extended rules for the field of application of test data. Assessments as practiced under previous BS 476 series are not permitted for BS EN Classification systems.

Relevant fire protection & prevention information must be provided to the user of the building to allow effective risk assessments to be made and maintained under the duties arising from the Regulatory Reform (Fire Safety) Order 2005. Those who fail to provide such information will be liable in law under Building Regulation 16B [also see Approved Document B: 2006, Appendix G]. In such cases, the intent of Building Regulations will not have been met, and insurers may be reluctant to provide cover.

Without such duties being fulfilled, ASFP/ HVCA suggest that the requirement to meet the occupation clause, such as that which exists under Section 20 Regulation in London, may not be attained.

This guidance attempts to clarify some of the basic principles of installation and at the same time highlight the important responsibilities attached to the ductwork system designer, the local authorities, the ductwork contractor/installer, the main contractor and the contractor installing fire separating walls.

3 DEFINITIONS

Assessments
For test data based on BS 476 series of tests, documents from competent persons or fire test bodies providing broad ranges of application based on a range of fire test data. Products and systems may only be used in applications covered in the range of the assessment

In the case of BS EN test and classification systems, formal rules for direct and extended application of test data are used. Previous use of 'assessments' are limited to permitted processes within the formal rules. Assessment of arbitrary methods may not be forthcoming! See further comment in section 7.4

Break-away duct joint
A joint connecting a fire damper spigot or sleeve to the attached duct work which will allow collapse of the ductwork during a fire without disturbing the integrity of the fire damper. 'Break-away' and flexible joints incorporate materials, fixings, clamps, etc, that are manufactured from a non - fire resistant material with a low melting point such as aluminium, plastic, etc.

Cavity Barriers
Construction, other than a smoke curtain, provided to close a concealed space against penetration of smoke or flame, or provided to restrict the movement of smoke or flame within such a space.

Compartment wall
A fire resisting wall used to separate one fire compartment from another.

Compartment floor
A floor used to separate one fire compartment from another

Damper, fire
A device for use in heating, ventilation and air-conditioning (HVAC) systems at fire boundaries to maintain compartments and protect means of escape in case of fire – it may have reduced smoke leakage characteristics (E or ES classification).

Damper, fire & smoke

A device for use in heating, ventilation and air-conditioning (HVAC) systems at fire boundaries to maintain compartments, to protect means of escape in case of fire (ES classification).

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.

Duct/ductwork
A system of enclosure of any cross sectional shape for the distribution or extraction of air.

Expansion Frame
A factory fitted installation frame supplied by the damper manufacturer that forms a complete assembly with the appropriate damper fitted therein. This frame allows the damper to expand under fire conditions and must be to a design which has been successfully fire tested. (Figure 1)

Figure 1: Fire damper in a typical expansion frame

A HEVAC / HVCA frame can be regarded as falling within this definition however particular attention must be paid to the individual fire damper manufacturer's data and fixing instructions particularly relating to the positive fixing of the building ties. Failure to do so may result in a non-compliant installation.

Field of application of test data

In the European classification system, formal rules exist for direct and extended rules for the field of application of fire test data. The rules will be provided in BS EN 1366-2 and BS EN 15882-2 respectively

Fire compartment

Enclosed space, which may be sub-divided, separated from adjoining spaces by fire barriers / fire separating elements

Fire containment

Precautions which contain the fire to the smallest possible area, and control the threat to life safety and the extent of property damage

Fire separating element

A compartment wall, compartment floor, cavity barrier and construction enclosing a protected escape route and/or a place of special fire hazard [as defined in Approved Document B]

Fire-stop

A linear joint seal provided to close an imperfection of fit or design tolerance between elements or components to restrict the passage of fire and smoke. The fire- stopping system must be fire tested as part of the fire damper system.

Non combustible material

See Approved Document B Table 6, which includes the following text.

Any material which when tested to BS 476-11:1982 does not flame nor cause any rise in temperature on either the centre [specimen] or furnace thermocouples. Products classified as non-combustible under BS 476-4:1970.

Any material classified as class A1 in accordance with BS EN 13501-1:2002.

Products made from one or more of the materials considered as Class A1 without the need for further testing as defined in European Commission Decision 2003/424/EC of 6 June 2003 amending Decision 96/603/EC , etc.

Penetration seal

The system used to restore/maintain the fire rating of the fire barrier at the position where the damper/ductwork to pass through the barrier.

The penetration seal system must be tested as part of the fire damper system.

Responsible person

The term 'Responsible person' is defined in several ways:-

[a] in relation to a workplace, the employer, if the workplace is to any extent under his control.

[b] in relation to any premises not falling within [a]

- [i] The person who has control of the premises (as occupier or otherwise) in connection with the carrying on by him of a trade, business or other undertaking (for profit or not), or
- [ii] The owner, where the person in control of the premises does not have control in connection with the carrying on by that person of a trade, business or other undertaking

Sleeve and angle installation method

This method applies a sleeve to the outside of the damper casing, to which angles are fitted on either side of the compartment wall to hold the damper in position

Particular attention must be paid to the individual fire damper manufacturer's data and fixing instructions. Failure to do so may result in a non-compliant installation.

Support system

The components used for suspending and/or fixing a damper assembly to either the fire barrier itself or an adjacent floor, wall or soffit.

Test evidence

Data obtained from a fire resistance test carried out to determine the suitability of a product, system or combinations to seal service penetrations. In respect to fire dampers, this means fire testing to BS EN 1366- 2 and classification of performance to BS EN 13501-3:2005. Historical data to BS476-20/22 will only be applicable

in certain instances (e.g. fan shut-down on detection of fire) see Approved Document B: Fire safety. Tests to be undertaken by an UKAS accredited laboratory or equivalent

The following text is provided for clarity:-

The definition of the three elements of the performance criteria of dampers tested to BS EN 1366-2 (1999) are:

Integrity (E)

After the start of the fire test, the leakage through the fire damper shall not exceed 360m³/h/m²) (corrected to 20°C). The integrity around the perimeter of the fire damper shall continue to maintain its separating function during the test without either

a) causing the ignition of a cotton pad

b) permitting a penetration of a gap gauge,

c) resulting in sustained flaming

Insulation (I)

This is the time in completed minutes for which the fire damper continues to maintain its separating function during the test without developing temperatures on its unexposed surface for which either

a) increases the average temperature above the initial average temperature by more than 140°C or

b) increases at any location (including the roving thermocouple) above the initial average temperature by more than 180°C.

Leakage (S)

Leakage through a fire damper shall not exceed 200m³/h/m² (corrected to 20°C). The requirement for leakage during the ambient leakage test need not be met after 5 minutes test duration.

NOTE - The result of the fire test shall be stated in terms of time elapsed to the completed minute from the commencement of the heating to the time when the fire damper failed to satisfy the criteria for integrity, insulation or leakage, or the termination of the heating, whichever is the shortest.

4 TYPES OF FIRE DAMPERS

4.1 Curtain fire dampers

Folding curtain fire dampers are constructed of a series of interlocking blades, which fold to the top of the assembly permitting the maximum free area in the airway. The blades are held open by means of a thermal release mechanism normally rated at 72°C ± 4°C. The blades fall/are sprung to fill the airway to prevent the passage of the fire. Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation.

Figure 2: Curtain fire damper

4.2 Intumescent fire dampers

Intumescent fire dampers incorporate components, which expand by intumescent activity under the action of heat, to close the airway to prevent the passage of fire. The intumescent materials form the main component for fire integrity. In some instances this may be supported with a mechanical device to prevent cold smoke leakage. Activation temperatures will be influenced by the type of intumescent material selected and these temperatures typically range from 120°C to 270°C. Some intumescent dampers, whilst containing fire and hot smoke, also incorporate an electro-mechanical device that provides cold smoke containment by interface with smoke sensors via a fire alarm panel.

Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation.

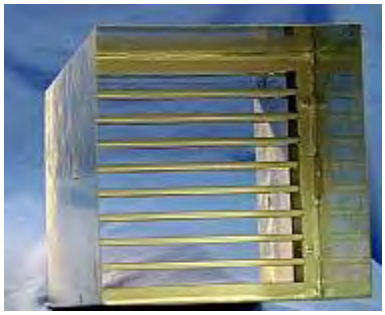

Fig 3: Intumescent Fire Damper

4.3 Multi-blade Fire Dampers

Multi-blade fire dampers are constructed with a number of linked pivoting blades contained within a frame. The blades are released from their open position by means of a thermal release mechanism normally rated at 72°C ± 4°C. When the release mechanism is activated the blades pivot and move to close the airway to prevent the passage of fire. Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation.

Figure 4: Multi-blade Fire Damper

4.4 Single Blade Fire Dampers

Single blade fire dampers are constructed with a single pivoting blade within a frame. The blade is released from its open position by means of a thermal release mechanism normally rated at 72°C ± 4°C. When the release mechanism is activated the blade pivots and moves to close the airway to prevent the passage fire. Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation.

Figure 5: Single Blade Fire Damper

4.5 Multi-section dampers

Where the duct exceeds the maximum tested size of an individual damper (or single section), manufacturers may provide multi-section units. These will generally be supplied with some type of joining strip or mullion to allow the unit to be assembled on site. This joining is not, necessarily, structural. Consideration must be given by installers for additional support, particularly on larger multi-section units.

4.6 Leakage classified fire dampers (S)

Leakage classified fire dampers are fire dampers that satisfy the appropriate integrity and reduced leakage requirements when tested. They are often referred to as fire and smoke dampers.

Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation

4.7 Insulated Fire Dampers (I)

Insulated fire dampers are fire dampers that satisfy the appropriate integrity/leakage requirements and satisfy the insulation performance criterion when tested.

Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation

4.8 Smoke Control Damper

Smoke control dampers will be discussed In Volume 2 of this publication. Smoke control dampers are single or multi-blade dampers that would generally have two positions - 'open' to allow smoke extraction or 'closed' to maintain the fire compartment. They do not have thermal release mechanism, relying on a 'powered' control system to ensure that they achieve the correct position – see also 8.2

5 REGULATIONS & CODES

5.1 Introduction

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

For new buildings, buildings which are changing their use, and for extensions or alterations to existing buildings, one generally should refer to the guidance given in Approved Document B, (England and Wales); Technical Standards - Parts D and E (Scotland); or Technical Booklet E (Northern Ireland).

For commercial and industrial buildings, property and business insurance may also be an important consideration. Useful information can be found in the FPA Design Guide for the Fire Protection of Buildings or go to www.thefpa.co.uk

5.2 Statutory instruments

England and Wales

Building and Buildings - The Building Regulations 2000 (SI 2000 2531 and amendments as SI 2006/652, SI 2004/3210, SI 2004/1465, SI 2003/2692, SI 2002/2871, SI 2002/0440 and SI 2001/3335

NOTE: Building Regulation 38 (formerly 16B) – also see Appendix G Approved Document B – Fire safety

Appendix G of the Approved Document B, 2006 Edition, introduced comments on a new Regulation 38 (formerly16B) of the Building Regulations 2000, which requires that where building work involves the erection or extension of a relevant building, or a relevant change of use of a building, then fire safety information shall be given to the responsible person at the completion of the project, or when the building or extension is first occupied.

- 'Fire safety information' means information relating to the design and construction of the building or extension, and the services, fitting and equipment provided in or in connection with the building or extension, which will assist the responsible person to operate and maintain the building with reasonable safety.
- 'Relevant building' is to which the Regulatory Reform (Fire Safety) Order 2005 applies, or will apply after the work is completed
- 'Responsible person' has the meaning given in Article 3 of the Regulatory Reform (Fire Safety) Order 2005

12.5 Installation check list

An example of an installer's check list is given in DW/145 as published by HVCA.

12.6 Fire-stopping and fire penetration seals

The fire classification of fire resisting ducts or fire damper systems is determined by a harmonised European process of fire test and fire classification. These fire tests include a specified fire stopping system, selected by the damper manufacturer for the duct/fire damper being tested, and should not be replaced by other systems in practice, unless additional test information justifies the change.

13 HANDOVER CHECK LIST

An example of a handover check list is given in DW/145 as published by HVCA.

13.1 Handover information

It is good practice to provide an identifiable list of the location, type and purpose of each fire damper installation in relation to the building records and drawings. Installers may wish to have identification labels at each fire damper.

13.2 Regulation 38 (formerly16B) and provision of fire safety information

Appendix G of the Approved Document B, 2006 Edition, introduced comments on a new Regulation 38 (formerly) 16B of the Building Regulations 2000, which requires that where building work involves the erection or extension of a relevant building, or a relevant change of use of a building, then fire safety information shall be given to the responsible person at the completion of the project, or when the building or extension is first occupied.

- 'Fire safety information' means information relating to the design and construction of the building or extension, and the services, fitting and equipment provided in or in connection with the building or extension, which will assist the responsible person to operate and maintain the building with reasonable safety.
- 'Relevant building' is to which the Regulatory Reform (Fire Safety) Order 2005 applies, or will apply after the work is completed
- 'Responsible person' has the meaning given in Article 3 of the Regulatory Reform (Fire Safety) Order 2005
- Details are provided in Appendix G Approved Document B Volume 2 – Buildings other than dwelling houses.

13.3 Compliant installation & obligations under fire legislation

a) The ASFP wishes to provide a clear signal to the construction industry and H&V industry as a whole, that the ad hoc installation of fire dampers in duct systems at positions which are out of compliance with manufacturers fire tested systems is completely unacceptable and avoidable. These ineffective installations include positioning of fire dampers away from the fire resisting wall or floor element which is being penetrated by the duct and fire damper system. It is vital that the fire damper is properly positioned in the plane of the wall or floor, unless tested otherwise, fully in accordance with the manufacturer's instructions,

b) The existing and frequent level of ineffective installation adds delays and unnecessary costs to those projects affected by such bad installations. Too many examples occur. Universal attention is needed to adhere to best practice methods. Construction managers must ensure that fire dampers and walls are mutually installed in line, to meet the fire performance required and the fire risk strategy for the building.

c) In the case of BS EN European fire tests and classification systems, the system uses formal rules for direct and extended rules for the field of application of test data. Assessments as practiced under previous BS 476 series are not permitted for BS EN Classification systems.

d) Relevant fire protection & prevention information must be provided to the user of the building to allow effective risk assessments to be made and maintained under the duties arising from the Regulatory Reform (Fire Safety) Order 2005. Those who fail to provide such information will be liable in law under Building Regulation 38 (formerly 16B) [also see Approved Document B 2006, Appendix G]. In such cases, the intent of Building Regulations will not have been met, and insurers may be reluctant to provide cover.

e) Without such duties being fulfilled, ASFP/ HVCA suggest that the requirement to meet the occupation clause, such as that which exists under Section 20 Regulation in London, may not be attained,

f) This guidance attempts to clarify some of the basic principles of installation and at the same time highlight the important responsibilities attached to the ductwork system designer, the local authorities, the ductwork contractor/installer, the main contractor and the contractor installing fire separating walls.

14 MAINTENANCE OF FIRE DAMPERS

Adequate access must be provided to fire dampers to enable inspection, maintenance and cleaning. This would normally be in the form of access panels/doors. At least one access point is required for access to the fusible link, but access both sides may be required for cleaning (refer to the relevant ductwork cleaning standards)

Building Regulation 38 (formerly 16B) implies a duty on manufacturers to publish maintenance information for the fire damper. This should include:

- inspection and maintenance procedures;
- recommended frequency of operational checks;
- recommended checks to establish the effects of corrosion.

Regular testing/inspection by suitably qualified personnel shall be undertaken to meet regulatory requirements, such as the Regulatory Reform (Fire Safety) Order 2005, at intervals not exceeding 6 months, or to manufacturers recommendations.

The requirements in BS 9999 (BS 5588-12) should be checked, as these products may form some part of a controlled system that responds to alarms. Some automatic systems may allow more frequent testing (48 hours or less), but physical inspection is still required at the prescribed intervals.

Some systems, where cleanliness is an issue due to site conditions, may require more frequent inspection, testing and cleaning.

All such inspections shall be recorded; a suggested checklist for the above procedure is given below.

15 MAINTENANCE & INSPECTION CHECKLIST FOR FIRE DAMPERS

Operation/task	Result
Damper Reference	
Date of inspection	
Check actuator wiring for damage (where applicable)	
Check end-switch wiring for damage (where applicable)	
Check damper cleanliness and corrosion, clean and repair where necessary	
Check the condition of blades and seals, rectify and report where necessary	
Confirm the safety closure operation of the fire damper according to the manufacturer's instructions	
Confirm operation of damper to OPEN and CLOSE by use of the control system and physical observation of the damper, rectify and report where necessary	
Confirm operation of OPEN and CLOSED end-switches, rectify and report (where necessary)	
Confirm that the damper fulfils its function as part of the control system (where necessary)	
Confirm that the damper is left in its normal working position	

NOTE: A fire damper is usually part of a system. As this is the case the whole system should be checked as governed by the operation and maintenance requirements for the system

16 OTHER INDUSTRY GUIDANCE

A variety of other industry guidance is available in other documents, such as

CIBSE	Guide B2 Ventilation and air conditioning
HVCA	DW/143: 2000 A practical guide to ductwork leakage testing
HVCA	DW/144: 1998 - - Specification for sheet metal ductwork; low medium and high pressure velocity systems (supersedes DW/142)
HVCA	**DW/145: 2009 - Guide to good practice for the installation of fire and smoke dampers**
HVCA	DW/172: 2005 - Standard for kitchen ventilation systems
HVCA	TR/19: 2005 - HVCA Guide to good practice – Internal cleanliness of ventilations systems
SMACNA Sheet Metal and Air Conditioning Contractors National Association, USA	Fire, Smoke and radiation damper installation guide for HVAC systems