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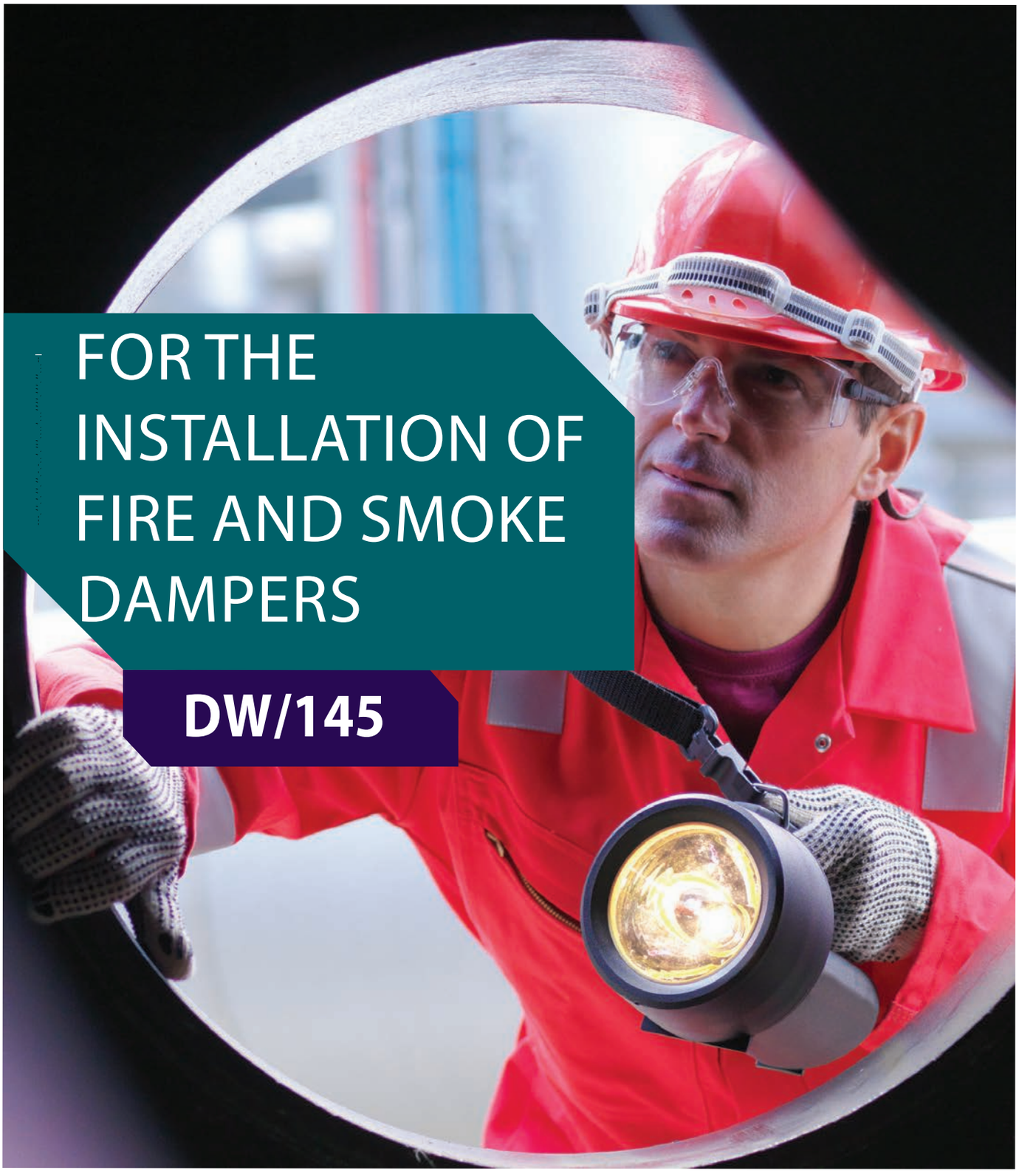
BUILDING ENGINEERING SERVICES ASSOCIATION

Building Engineering Services Association
Guide to good practice:



FOR THE INSTALLATION OF FIRE AND SMOKE DAMPERS

DW/145

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Building Engineering Services Association

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Acknowledgments

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NOTE - This document is based on knowledge available at the time of publication and is meant for general purposes, not for reliance on in relation to specific technical or legal issues, in which case independent advice on such issues should be sought. These guidelines represent current best practice. They are not intended to be used to evaluate the adequacy or otherwise of installation agreements or dampers installed prior to this publication date (13/05/2010) which would have been designed and installed to suit the individual needs of the project. No responsibility of any kind for any injury, death, loss, damage or delay however caused, resulting from the use of the advice and recommendations contained herein, is accepted by the authors or others involved in its publication (including the Building Engineering Services Association).

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Building Engineering Services Association

Guide to good practice: FOR THE INSTALLATION OF FIRE AND SMOKE DAMPERS

DW/145

Foreword

Whilst fire and smoke dampers have been in use for many years, there was until recently a lack of nationally recognised criteria to ensure their integration into the building structure in a practical, efficient and effective manner.

Rather, it was left to ductwork designers, damper manufacturers and Building Control and fire authorities to specify the method of installation in each case. More often than not, the decision on the method to be employed was based in the end upon opinion rather than certified test results.

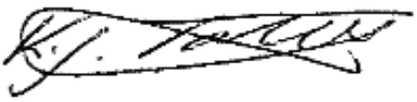
When an industry guide to the design and installation of fire and smoke dampers was finally developed by the ASFP (Association for Specialist Fire Protection) and HEVAC (Heating, Ventilating and Air Conditioning Manufacturers Association), and published in April 2007 as the ASFP's Grey Book, the Ductwork Group of the BESA collaborated in its production and continues fully to support its content.

The Group also believed, however, that a complementary publication was required to address the practicalities of the system design and installation process as a whole – a belief that has led to the introduction of this publication, the Guide to Good Practice: For the Installation of Fire and Smoke Dampers (DW/145).

This guide highlights many of the basic principles contained in the design and installation process, whilst at the same time identifying the responsibilities that attach to the team as a whole – which, of course, comprises designers, builders, manufacturers and local authorities as well as mechanical services, ductwork and other specialist contractors.

It identifies, clearly and concisely, the matters that must be addressed when fire and/or smoke dampers are to be installed within a building's ventilation ductwork system.

Also acknowledged is the universal responsibility we all carry for the protection of individuals throughout the built environment.



Kevin Talbot
Former Chairman BESA Ductwork Group

Industry feedback
This guide to good practice brings together several disciplines involved in the overall process from system specification, damper manufacture through to a compliant installation. The emphasis throughout is on teamwork and, in particular, good communications and in this respect the BESA would welcome any feedback that will allow improvements to the guide to be made in future editions.

CONTENTS

ACKNOWLEDGEMENTS

The BESA records its appreciation and thanks to both the members of the Ductwork Group's Technical Sub-Committee who were given the responsibility of producing the guide and to the various Associations, Professional Bodies and individuals who provided valuable input and verification at the appropriate stages of development.

The members of the Ductwork Group's Technical Sub-Committee involved during the draft stages were:–

M Cain	C Collins	N Edwards-Hughes	S Howard	B James	L Hussey
J E Murray	C Robertson	P Rogers	M Simpson	K Waldron	M Oakes (Secretary)

The Associations and Professional Bodies who support the intent of this guide are:–

ACE (Association for Consultancy and Engineering)
ADCAS (Association of Ductwork Contractors & Allied Services)
AIS (Association of Interior Specialists)
ASFP (Association for Specialist Fire Protection)
BRE Global Ltd (Building Research Establishment incorporating the Loss Prevention Certification Board, LPCB)
BSRIA (Building Services Research and Information Association)
CIBSE (Chartered Institution of Building Services Engineers)
FIA (Fire Industry Association)
FPA (Fire Protection Association)
FPDC (Federation of Plastering and Drywall Contractors)
HEVAC (Heating, Ventilating and Air Conditioning Manufacturers Association)
LABC (Local Authority Building Control)
WCL (Warrington Certification Ltd)

OTHER DUCTWORK-RELATED BESA PUBLICATIONS

DW/144	Specification for Sheet Metal Ductwork	DW/144 AND DW/143 are now both included in the Building Regulations
DW/143	A Practical Guide to Ductwork Leakage Testing	
DW/154	Specification for Plastic Ductwork	
DW/172	Specification for Kitchen Ventilation Systems	
DW/191	Guide to Good Practice – Glass Fibre Ductwork	
DW/TM1	Ductwork – Acceptance Scheme for New Products – Rectangular Cross Joint Classification	
TR/19	Guide to Good Practice – Internal Cleanliness of Ventilation Systems	
BESA	Working Together – Promoting understanding between mechanical services and ductwork contractors.	

SECTION 1

Scope

1.0 This guide is intended to highlight and clarify the important aspects of fire and smoke barrier / damper installation including the responsibilities of all parties involved in the overall sequence from system specification through to a compliant installation. Emphasis is placed on the need for **all parties to work as a team** by recognising not only their individual responsibilities but also those of all other parties in achieving this goal.

The guidance only relates to the installation of fire dampers and leakage rated fire and smoke dampers as used in ventilation systems to maintain fire compartments and/or protect means of escape from buildings and does not cover the installation of powered smoke control dampers. Later editions of the ASFP's Grey Book will be released in two volumes. Volume 1, as with this guide, covers fire dampers and ES leakage classified fire/smoke dampers and Volume 2 covers powered smoke control dampers which are either opened to allow smoke extraction or closed to maintain compartmentation.

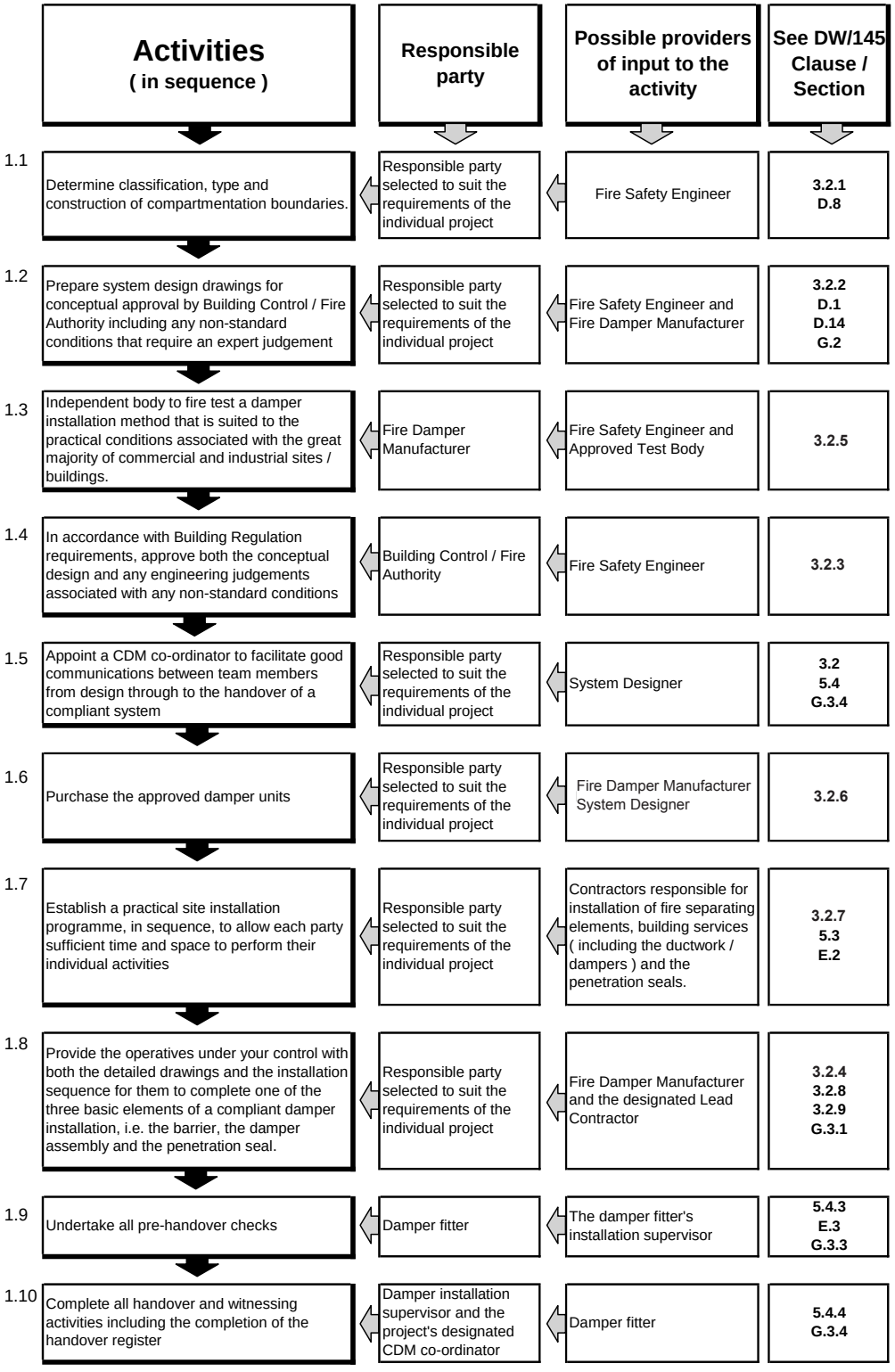
The importance of only installing damper arrangements that have been selected / specified by the system designer and that have been successfully fire tested by an independent body on behalf of the damper manufacturer is emphasised throughout the guide. In using indicative generic illustrations of commonly used damper arrangements, the guide recognises that these must **not** be used or substituted in lieu of the damper manufacturer's tested arrangements.

Industry faces significant changes to test standards over the next few years, particularly with regard to assessments. The current UK test standards will be replaced by the new harmonised European standards. The critical date for change is likely to be July 2012, when the CPR (Construction Products Regulations) becomes a statutory requirement in the UK. The existing adhoc procedures for testing fire and smoke dampers based on BS 476 Part 20 will be withdrawn leaving the European product standard no. BS EN 15650 for fire dampers to take precedence. In the case of the BS EN European product fire resistance test and classification systems, the systems use formal rules for direct and extended field of application of the test data. Therefore assessments on any variations to the tested system as practiced under the previous adhoc BS 476 procedures will not be permitted for BS EN classified systems. **It is likely that up until July 2012 assessments will be allowed in some applications for dampers tested to BS 476 Part 20-22, but after this date, assessments for fire/smoke dampers tested will have to be carried out in accordance with European formal rules by a European notified body. However, in the period preceding this deadline, users of this guide are strongly recommended to fully acquaint themselves with, and adhere to, the specific requirements of individual Project Specifications**. The use of the adhoc BS 476 procedures is already limited in the UK as discussed in Section C.2.1 of this document. If there is a requirement for a damper to be installed in circumstances where an equivalent size and application cannot be tested or assessed to the European standards, an expert judgement (EJ) will be allowed for that particular instance but only by bodies such as a fire test and assessment body which is independently accredited by UKAS (United Kingdom Accreditation Service).

The guide has been compiled and presented in such a way to allow all parties in the design and installation process to appreciate the responsibilities and activities associated with the whole process, a summary of which is illustrated opposite, in flow chart form, as Figure 1 – The Design and Installation Process. **Due to the greater fluidity in the procurement process, the individual contract documentation shall clearly allocate which party is responsible for the listed activities**. In this respect, Figure 1 may be utilised on an individual project as an *aide memoir* or 'check list' in order to contractually identify each responsible party. It is vital, therefore, that all participants in the process are appointed at the outset so that they can – together - agree on who is to take responsibility for each of the listed activities.

NOTE! It is recommended that in allocating such activities on an individual contract basis reference is made to the BSRIA Guide, **A Design Framework for Building Services** (Ref BG 6/2006). This comprehensive publication, in the form of detailed pro-forma guidance, was compiled by the Specialist Engineering Alliance (SEA) and brings together the requirements of CIBSE, ACE, SECG (Specialist Engineering Contractors Group) and FETA (Federation of Environmental Trade Associations) in a collaborative attempt to create a fully integrated design team of consultants, manufacturers and installers and to overcome the ambiguities if companies in a project are not appointed in a coordinated manner including their detailed responsibilities.

Fig 1 The Design and Installation Process



SECTION 2

Definitions

2.0 For the purpose of this practical guide, specifications and communications in general, it is important that there is Industry consistency in the definitions of commonly used terms.

In a joint collaboration with the ASFP, HEVAC, the BESA Ductwork Group and other leading Industry bodies, the publication known as the Grey Book – 'The Installation of Fire and Smoke Resisting Dampers' was published. (**see APPENDIX 'A'** for a summary of the contents of the ASFP Grey Book which includes more detailed information on all aspects of system design criteria)

The ASFP Grey Book includes a section on 'Definitions' and **APPENDIX 'B'** of this BESA Guide contains not only a selected list of commonly used dampers type definitions but also a glossary of terms associated with their installation.

SECTION 3

Main Design Criteria and Responsibilities

3.1 Design criteria

As well as the importance of the type of fire separating element / barrier in which the damper is to be mounted, there are three main design criteria to be met:–

(i) that the installation meets the system design specification with regard to its fire classification.

(ii) that the damper is installed in accordance with the manufacturers tested method.

(iii) that the damper should be fixed either within or directly adjacent to the fire separating element / barrier and be supported independently of the connecting ductwork, i.e. if the ductwork were to be removed from both sides of the damper it would continue to be an integral member of the barrier it protects.

Fire and smoke dampers are installed as part of a building's life safety strategy. Difficulties associated with a building services programme or an individual's opinion that a design should be modified cannot override a design that is based on a damper manufacturer's independently tested method(s).

3.2 Responsibilities

The ASFP Grey Book recommends, under the Construction (Design and Management) Regulations (CDM Regulations 2007), that a client-appointed CDM coordinator oversees the process from design through to installation. The Regulations also require highlight that, along with the CDM coordinator, a principal contractor must be appointed by the client – both appointments being for the duration of a notifiable project.

The CDM coordinator shall "facilitate good communication" between all team members involved in the design, manufacture and installation process chain including the policing and verification of all installations. They also have a duty to "liaise with the principal contractor regarding ongoing design" and to "identify, collect and pass on pre-construction information"

The CDM Regulations also state that the principal contractor must "plan, manage and monitor the construction phase in liaison with the contractors and liaise with the CDM coordinator regarding ongoing design"

A summary of all duties under the CDM Regulations 2007 can be found on the HSE website using the following link:

http://www.hse.gov.uk/construction/cdm/summary.htm

In addition to the CDM coordinator and the principal contractor there are several other parties who may be involved in establishing a compliant damper arrangement:

- **Architect / Client**
- **System Specifier / Designer**
- **Damper Manufacturer**
- **Building Control and Fire Authorities**
- **Project Manager**
- **Mechanical Services Contractor**
- **Damper Installation Contractor**
- **Ductwork Contractor**
- **Fire Barrier Contractor**
- **Penetration Seal Specialist**

It cannot be over-emphasised how important it is for each member of the team involved in the project design, manufacture or installation of fire and smoke dampers to not only discharge their agreed responsibilities in meeting the design criteria outlined above but also to cooperate with other team members to resolve and clarify any issue that may arise during their individual activities.

It is the responsibility of all team members when using this guide to ensure that they recognise and understand all aspects of the process from design to handover and that they do not solely concentrate on their own involvement at the risk of contributing towards a non-compliant installation. Ignorance cannot be used as a defence!

In addition to the responsibilities that follow, further important supplementary information relating to responsibility is provided as part of the typical damper and barrier installation arrangements detailed in Section 6.

As indicated in Figure 1, particular responsibilities are allocated on a project specific basis. The key activities and responsibilities to be considered are as follows:

3.2.1 Fire/smoke compartmentation

The designated responsible party shall, for the benefit of the party responsible for installation, prepare fire strategy drawings, based if necessary on the input from a fire safety engineer, clearly indicating fire and smoke compartmentation, the type and classification of the fire barrier and its construction.

3.2.2 System specification and design

System specification and design (depending on the agreement between team members as to allocation of responsibilities) may be the responsibility of either the building services consultant, the mechanical services contractor or, in the case of smaller 'design and supply' projects, the ductwork contractor.

System specifiers and designers shall, at the initial design stage, submit proposals incorporating a tested damper arrangement to the building control and / or fire authority for their approval. This process shall be repeated with the final designs including full details of proposed damper arrangements. Consideration shall be made in the

design to provide sufficient space and access not only to enable installation of the complete damper arrangement including penetration seals but also to allow both handover and future maintenance inspections to be performed bearing in mind that such on-going activities are now based on current legislation.

A brief list of technical information to be provided by the system designer to the installation contractor can be found in Clause 4.3 along with a more detailed overview in **APPENDIX 'G'** and, in particular, Clauses G.2. and G.3.1.

3.2.3 Compliance with Building Regulations

Building Control Authorities (BCA) must be satisfied that the designed arrangement presented to them shows compliance with Building Regulations including any requirements for either E and/or ES criteria (see **APPENDIX 'C'**, Clause C.2.1). The method of installation must have been successfully fire tested by an independent body on behalf of the damper manufacturer (see **APPENDIX 'H'** for a register of currently approved bodies).

Where site conditions differ from those tested, the building control authorities shall be prepared to consider what other test evidence is available to the system designer and arrive at an acceptable conclusion. This consideration shall be made before the damper is installed. Requesting the damper manufacturers' approval 'after the event' is not always acceptable. In most cases this will not be given as third party assessments may not be readily available (see B.2.1, Assessments and B.2.3, Expert Judgments in **APPENDIX 'B'**).

3.2.4 Damper specification

The designated responsible party for system design must not only specify the fire or smoke damper size, type, installation method and accessories required, but also ensure that the requirements of the building control authority and fire officer are met.

Substituting a damper from a different manufacturer to that specified in the agreed design shall only be undertaken with agreement of the system designer in consultation with other members of the team. The originally specified damper may have been selected with particular characteristics to allow E or ES classifications (see C.2.1) to be satisfied and an apparent equivalent damper from a different manufacturer may not have the necessary test evidence to support such a substitution.

APPENDIX 'G' contains key guidance points for the system design office and the on-site damper fitter so that they are aware of their responsibility not to deviate from the system design details.

3.2.5 Damper assembly selection

Damper manufacturers and suppliers shall ensure when handing over dampers to purchasers that they provide dimensionally detailed guidance on how the damper assembly is to be installed **including any requirements for damper unit expansion**. Damper manufacturers shall cooperate when required with members of the team to ensure that the method specified is practical relative to the differing site conditions that exist from project to project. In order to achieve a compliant installation arrangement that is compatible with the fabric of a building and its penetrations, this may involve seeking input from a Fire Safety Engineer. Damper manufacturers must also provide evidence that the method has been fire tested by an independent body (see **APPENDIX 'H'** for a register of currently approved bodies) and that, where applicable, it meets E or ES classification as required by the Building Regulations (see **APPENDIX 'C'** Clause C.2.1)

3.2.6 Damper procurement

The team member responsible for system design should work closely with other team members involved in damper procurement specification to ensure that the necessary information is provided.

3.2.7 Programmed activity sequence

The designated responsible party should produce a sequenced installation programme of activities that takes into account that the close proximity of other services and the general fabric of the building have a major influence on achieving a successful and compliant damper installation.

The construction programme shall be developed so that it recognises the critical sequencing of all members of the team – not just those contractors involved in the installation of the finalised damper arrangement. Working to a detailed and tabulated check list, such as is provided in **APPENDIX 'E.2'** of this guide, will assist in achieving a practical sequence of installation activities.

3.2.8 Fire separating elements/ barriers

A particular team member will have responsibility for the fire separating elements / barriers, be they floor slabs, structural walls, drylining partitions, etc. They must not only ensure that fire barriers and penetrations are formed to accommodate damper arrangements as specified in the agreed design but they must also ensure that the application on their part of any penetration seals are as tested and conform to the specific requirements of the agreed design and the damper manufacturer. All installations must be supported by relevant fire tests.

3.2.9 Penetration seals

Where a single team member has been allocated responsibility, as a specialist penetration seal contractor, to seal **all** building service penetrations on a project, including those for fire damper assemblies, it is imperative that the penetration seal system is as tested by the damper manufacturer. It must be recognised that the damper manufacturer is the only team member who can give approval to an alternative penetration seal system that is considered to be compatible with the penetration seal that has been tested with their product.

SECTION 4

System Design

4.0 Responsibility for the system design and selection of the damper arrangement shall be allocated to a member of the team.

System design must be project-specific and be based on the fire strategy of the building which will embody current legislative requirements and associated recommendations. It is not an acceptable practice to follow the custom and practice adopted on previous unrelated projects. It is the responsibility of the system designer to take account of current legislation and to consider many important aspects of the system design before ensuring that all involved members of the team are in possession of all the technical information needed to install a compliant damper arrangement.

4.1 Legislation and UK Standards

Important information concerning current legislation relating to Approved Document B, British Standards and Regulatory Reform Order, with a brief explanation of their content, can be found in **APPENDIX 'C'**.

4.2 System design considerations

Installation methods must be the subject of test data as provided by the damper manufacturer. Where either site conditions or issues occur during installation then it is important that the damper manufacturer as part of the team is involved in resolving such occurrences.

4.2.1 Tested methods that reflect site conditions.

The ASFP Grey Book includes the following note:

"Whilst it is very important to ensure that only tested dampers and installation details are used on site, it is imperative that damper manufacturers test installation methods that reflect the installation conditions that can be expected to be found on site. Close liaison, therefore, between damper manufacturers, system designers and installers is essential"

There are many important design considerations that should be taken into account by the team member responsible for system design who shall make such considerations known to other members of the team. It is advisable that all team members familiarise themselves with these design parameters in order that they can highlight and, if necessary, query any aspect of the design that could result in the installation of a non-compliant damper arrangement. **APPENDIX 'D'** of this BESA guide, lists these system design considerations in detail.

4.2.2 Overview of European standards for fire resisting dampers and smoke control dampers.

The ASFP Grey Book states;

"In general terms, all BS EN European standards are referenced in a product standard that lists the agreed fire classification system. The classification document provides details of the fire tests required to satisfy the classification requirements. In addition to this, the field of application of test data and classification shall be determined using agreed BS EN rules for direct and extended application of the fire test data. These BS EN standards are listed below;

Fire resisting dampers

Product standard BS EN 15650 fire dampers.

Test standard BS EN 1366-2 1999 fire resistance test for service installations, fire dampers.

Classification standard BS EN 13501-3 2005 fire classification of construction products and building elements - part 3 classification using data from fire resistance tests on components of normal building service installations.

Extended field of application BS EN 15882-2 extended applications of test results for fire resistance tests for service installations, dampers.

Smoke control dampers

Product standard BS EN 12101-8, smoke and heat control systems, specification for smoke control dampers.

Test standard BS EN 1366-10 fire resistance test for service installations, smoke control dampers.

Classification standard BS EN 13501-4 2007 fire classification of construction products and building elements - part 4 classification using data for fire resistance tests on components of smoke control systems.

Extended field of application pr BS EN 15080-XX smoke control dampers (work not started).

Note! All BS EN standards without a publication date have yet to be formally adopted as of September 2009

European fire classifications, fire tests and direct and extended fields of application

European fire classification systems for fire dampers.

The classification systems described in BS ISO 10294-2 and BS 13501-3 are essentially the same and in summary are as follows;

Integrity (E) – leakage during the fire test of less than 360m^3 per hour per m^2, no failure of the installation.
Insulation (I) – average temperature rise on the unexposed face of 140°C with a maximum value of 180°C
Leakage (S) – leakage during the fire test of less than 200m^3 per hour per m^2 and the same requirement for second unit of the smallest section to be manufactured and measured at ambient conditions.

The above system is then qualified with a time interval, such that as an example the following classifications may be seen;

E240 –- fire damper with integrity of 240 minutes.

ES120 – leakage rated fire damper with integrity of 120 minutes

EIS180 – leakage rated fire damper with integrity and insulation characteristics for 180 minutes

Full details of the classification system may be determined by reading the standards concerned."

4.2.3 Technical issues during installation.

All the installation information from formal testing undertaken on behalf of damper manufacturers shall be freely available. If this manufacturer's test information is not taken into account when a technical issue either occurs or is anticipated, then the manufacturer may not be able to contribute towards any attempt to arrive at a satisfactory solution to the issue - particularly not "after the event" when an installation has been concluded in an unsatisfactory manner. This emphasizes the need for the damper manufacturer to be part of the team. Damper manufacturers will only have their test information to refer to and, therefore, assessments to BS EN1366-2 and BS EN 13501-3 will not be easily forthcoming from laboratories which, in turn, makes expert judgments even more difficult (see **APPENDIX 'B'**, B.2.1, Assessments and B.2.3, Expert Judgments and **APPENDIX 'H'** for a current list of approved test / assessment bodies).

If an issue arises relating to prevailing site conditions with regard to space and access, the situation shall be referred to the CDM coordinator who in turn, and with the entire test evidence available from the damper manufacturer and the system designer, must address the problem with the building control authorities in order that a practical and acceptable solution can be achieved.

4.3 Technical information

Technical information to be provided by the system designer to the damper installation company:

- Damper manufacturers test data sheets and dimensionally detailed technical illustrations.
- Performance characteristics including, if applicable, the controls specification.
- Material specification for the blades, damper casing, expansion sleeves and frames, etc, including any critical dimensional values.
- System designers' project-specific detailed and dimensioned arrangement drawings incorporating the compartment barrier, the damper and the penetration seal.
- System design drawings including dampers marked with identification codes which cross reference back to a schedule of all dampers that include their rating and location.
- Damper support arrangement
- Damper manufacturers instructions for incorporating any expansion allowance and / or expansion frame details that are required for the damper unit.
- Damper to ductwork connection details including any specific requirements for fixings, joints, breakaway joints and fastenings.
- Location of first ductwork support relative to the damper centreline – for both sides of the damper.
- Activity programme clearly detailing the sequence of installation relative to each contractor.
- Any additional or special requirements.
- Inspection and handover requirements

APPENDIX 'G' offers key guidance points for team members responsible for system design and installation and is a useful and quick reference to the overall key points of the guide as a whole.

SECTION 5

Installation

5.0 A successful and compliant damper installation is dependent on three key factors:

- Has the system designer incorporated a damper unit that has been tested by an independent body on behalf of the damper manufacturer as being suitable for the compartment barrier that it is protecting?
- Has the system designer included project specific certified sketches showing the complete installation?
- Has the Principal Contractor, in conjunction with the relevant team members, developed a coordinated installation sequence in the form of a programme?

APPENDIX 'G' offers key guidance points for team members particularly involved in system design and installation and is a useful and quick reference to the overall key points of the guide as a whole.

5.1 Installation arrangements

The system design shall include project-specific certified sketches based on a damper manufacturer's methods which have been successfully tested by an independent body.

Section 6 of this guide provides generic illustrations that cover the majority of installation arrangements in the UK. The illustrations should only be used for guidance and planning purposes. The project-specific sketches in the system design showing the complete installation arrangement shall always over-ride any illustrations shown in this or any other guide or specification.

5.2 Information to be provided to the damper installer

In addition to the information listed in Clause 4.3 and G.3.1, and to ensure that all the relevant information is made available to the damper installer, it is recommended that a check list is compiled which is based on proven information and procedures successfully used on previous projects. A typical check list is provided in **APPENDIX 'E.2'**

5.3 Sequence of installation

On receipt of the project-specific certified sketches (detailing the damper arrangement in the compartmentation barrier that it protects), it will be necessary for the designated principal contractor to establish a coordinated programme for the installation sequence for the barrier, the damper, the ductwork and the penetration seal. **APPENDIX 'F'** indicates typical activity sequences to suit the agreed order of installation.

5.4 Installation considerations

For a cost efficient and successful installation, it needs to be recognised that issues can occur and that they should be overcome with the continued involvement of the CDM Coordinator. The team as a whole have the responsibility of addressing and resolving unexpected issues and ensuring that work-in-progress inspections are conducted to ensure that a final inspection before handover to either the commissioning team or the client will not result in any corrective action having to be instigated.

5.4.1 On-site modifications

During installation, issues can arise that might need either a revised or 'non-standard' solution. They should only be introduced by the system designer who may need to take advice from other members of the team including the damper manufacturer and/or a fire safety engineer. It may also be necessary for Building Control and/ or the local Fire Authority to be involved.

Where site conditions differ from those tested, the building control authorities must consider what test evidence is available and reach a conclusion. Simply requesting a damper manufacturers' approval is unacceptable, as in most cases this may not be given as assessments may not be available (see

4.2.3)

5.4.2 Work-in-progress inspections

The CDM coordinator must monitor compliance with the project-specific design and ensure that the work-in-progress is regularly inspected in accordance with the installers approved method statement and the system design.

5.4.3 Pre-handover activities

It is in the interest of the whole team that pre-handover inspections by the damper installer and the hand-over itself are based on an agreed check list. A typical Inspection and Handover Check List can be found in **APPENDIX 'E.3'**

On completion of the works, the team member carrying out the damper installation must ensure that:–

5.4.3.1 Dampers are internally clean and free from damage.

5.4.3.2 Dampers continue to operate after installation and can be reset from the access provided.

5.4.3.3 All internal and external control devices are in good condition and accessible.

5.4.3.4 Terminals on connections to control systems are accessible.

Following the checks the damper(s) must be offered for inspection by the agreed parties.

5.4.4 Final inspection and certification

At the outset of their involvement, all team members must be made aware of the intended final inspection and certification regime. The final installation must be checked for compliance by the CDM coordinator. The completed installation forms part of the building's life support strategy and nothing must be left to chance with every aspect of the installation being checked against the project-specific certified sketches included in the system design.

All final inspections must be documented in a handover register that must be retained by members of the team responsible for system design and installation.

A typical Inspection and Handover Check List can be found in **APPENDIX 'E.3'**

SECTION 6

Typical Damper/Barrier Installation Arrangements

Ensure that the selected fire damper has the required classification and that it can be incorporated into an installation arrangement that can be supported by the individual fire damper manufacturer's test data. Methods are not interchangeable between manufacturers. Test or assessments are required for different fire damper models, which, in turn, may have different installation methods available with regard to E and/or ES classifications.

The typical damper/barrier installation arrangements listed below cover the vast majority of damper installations common in the UK.

Methods 1 and 2 are the preferred methods for use with pre-formed openings.

- **Method 1**
  Pre-formed vertical or horizontal opening complete with damper sleeve and blades **out** of the airstream
- **Method 2**
  Pre-formed vertical or horizontal opening complete with damper sleeve and blades **in** the airstream
- **Method 3**
  Pre-formed vertical or horizontal structural / builders work opening complete with damper expansion frames
- **Method 4**
  Pre-formed vertical opening in a dry-lining partition complete with damper faceplate
- **Method 5**
  Damper and ductwork installed prior to the forming of a dry-lining partition
- **Method 6**
  Damper installed in a vertical fire curtain
- **Method 7**
  Surface mounted damper on pre-formed vertical or horizontal builders work / structural opening using a sheet metal 'Z'-frame

The methods and illustrations on the following pages are provided for guidance and planning purposes only; the project-specific certified sketches in the system design showing the complete installation will over-ride any illustrations shown in this or any other guide or specification.

The lack of detailed dimensional information on the illustrations in this guide reflects the fact that only the project-specific sketches can contain such detailed information.

Although the illustrations that follow relate to rectangular ductwork applications, the arrangements equally apply to both circular and flat oval damper / ductwork applications. As stated in the illustration headings, some arrangements can be utilised in horizontal structural openings.

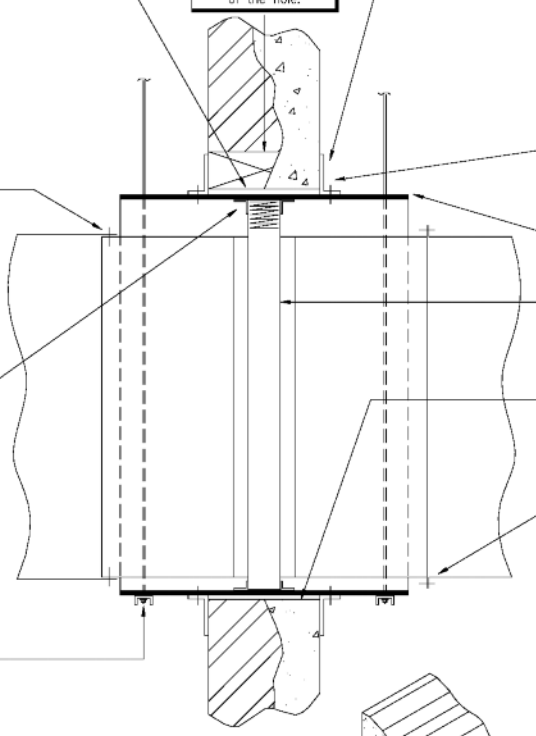
BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 1

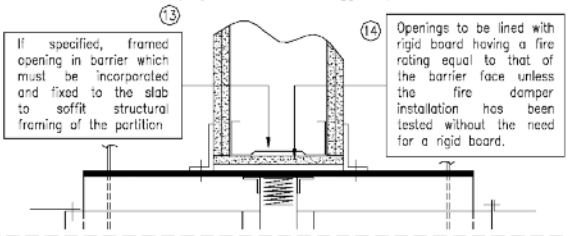
TYPICAL ARRANGEMENT OF A GENERIC DAMPER WITH BLADES OUT OF AIRSTREAM SUITABLE FOR VERTICAL AND HORIZONTAL FIRE BARRIERS WITH PRE-FORMED OPENINGS

TYPICAL ARRANGEMENT FOR DRY STRUCTURAL BARRIERS

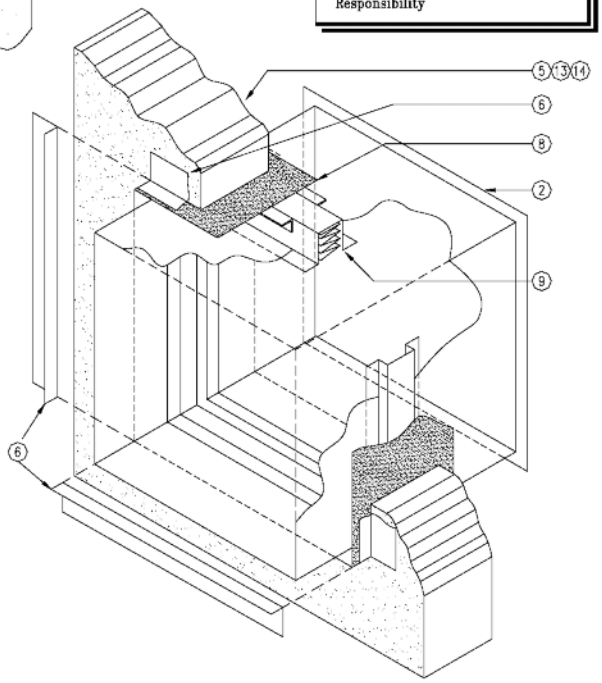


1. Air gap for expansion of sleeve in both planes. Minimum gap dimension to be 1% of the overall size of the damper, maximum gap dimension to be 20mm. It is not necessary that the sleeve is centered in the gap. Note! gaps greater than 20mm to be filled with a suitable fire rated material such as stone mineral wool or similar, that allows expansion
2. Appropriate break-away/flexible joint between sleeve and adjoining ductwork on both sides of assembly. Typical break-away joint would be socket & spigot (as illustrated) or, alternatively, flanged (see Note 11) with appropriate fixings, eg plastic cleats, clips, clamps, bolts, aluminium alloy rivets, etc.
3. Dampers may be secured to sleeve with stitch welds, bolts, screws or steel rivets. Alternatively the damper may be secured by clamping angle frames on both sides of the damper (as illustrated). The clamping angle frames are fixed only to the sleeve with fixings as indicated above. Warning! any type of fixing must not affect damper operation.
4. Supports required if partition is not designed to take the weight of the fire damper assembly. This is a particularly important consideration for the dry lining partition arrangement illustrated below and also for other non-structural constructions. Supports may be fixed to the top face of the sleeve in order to accomodate local obstructions, eg: actuator housings, etc.
5. Vertical partitions may require lintels to maintain the structural integrity of the hole.
6. Sleeve clamping angle frames fixed only to the sleeve on a minimum of two sides on both faces of barrier using steel fixings. Sleeve clamping angles to be full face and may be unequal angles to allow for building tolerances at the face of the hole. Sleeve clamping angles may be split and bolted together to fix around a pre-installed sleeve.
7. In order to accommodate assembly expansion there must be no fixings through the clamping angles into the face of the partition
8. Sleeve – gauge as tested by the damper manufacturer
9. Damper
10. Cautionary note! Sleeve supports should not be overtightened to the extent that they rigidise the assembly and negate the air gap expansion requirements in Note 1
11. Alternative break-away flanged joint – see Note 2
12. **This is a typical arrangement and is not to be used to demonstrate either compliance or as a substitute for project-specific design sketches. See note at foot of page re: System Designers Responsibility**

Typical arrangement for dry lining partitions also applies to timber framed and steel partitions (subject to manufacturers approval)



13. If specified, framed opening in barrier which must be incorporated and fixed to the slab to soffit structural framing of the partition
14. Openings to be lined with rigid board having a fire rating equal to that of the barrier face unless the fire damper installation has been tested without the need for a rigid board.



General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. The assembly shall be installed so that the damper is within the partition thickness and the sleeve extends beyond the clamping frames

C. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breckaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse affect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

D. Both multi-section and single section units may be supplied as single sections with a sleeve and angle kit for site assembly / fitting by others. All site fitting / fixings shall be in accordance with this drawing.

E. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

F. All lintels and frames/linings (in dry lining partitions) to be provided by others

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

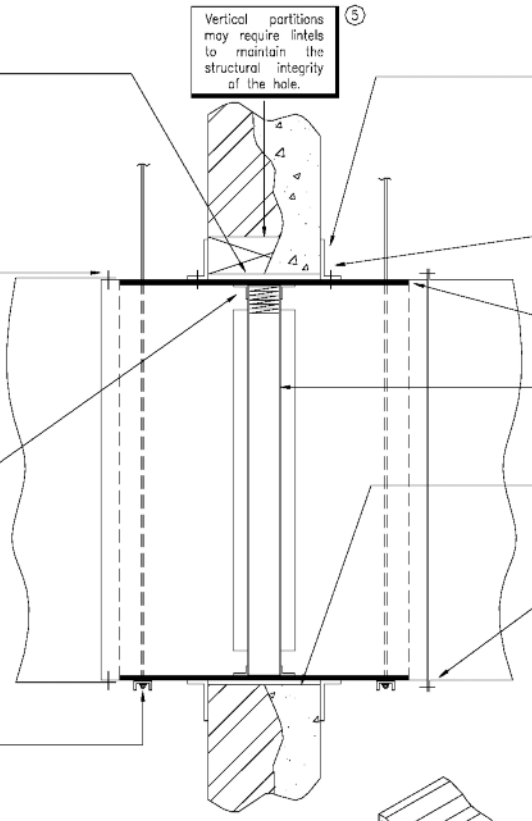
BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 2

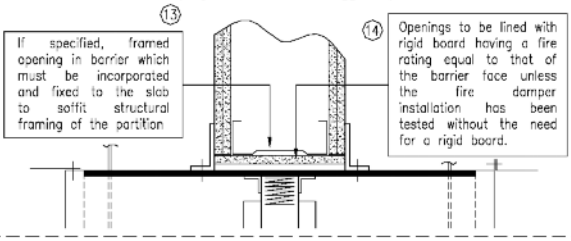
TYPICAL ARRANGEMENT OF A GENERIC DAMPER WITH BLADES IN AIRSTREAM SUITABLE FOR VERTICAL AND HORIZONTAL FIRE BARRIERS WITH PRE-FORMED OPENINGS

TYPICAL ARRANGEMENT FOR DRY STRUCTURAL BARRIERS

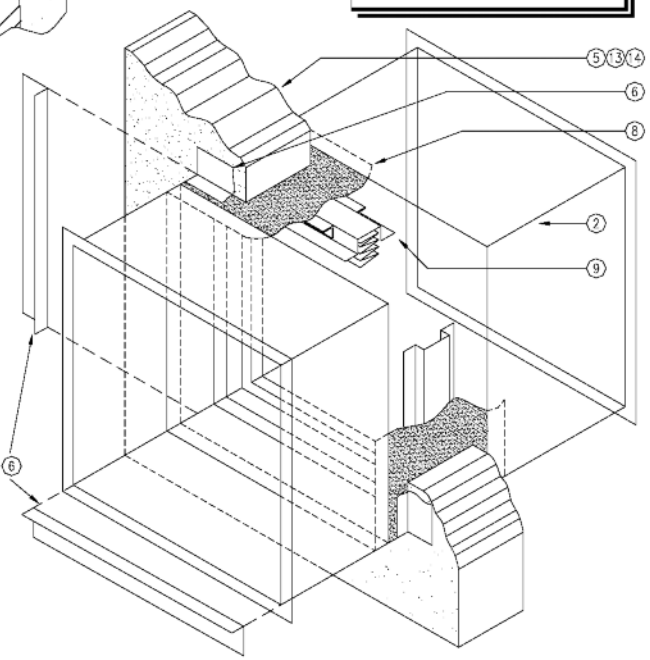


1. Air gap for expansion of sleeve in both planes. Minimum gap dimension to be 1% of the overall size of the damper, maximum gap dimension to be 20mm. It is not necessary that the sleeve is centered in the gap. Note! gaps greater than 20mm to be filled with a suitable fire rated material such as stone mineral wool or similar, that allows expansion
2. Appropriate break-away/flexible joint between sleeve and adjoining ductwork on both sides of assembly. Typical break-away joint would be socket & spigot (as illustrated) or, alternatively, flanged (see Note 11) with appropriate fixings, eg plastic cleats, clips, clamps, bolts, aluminium alloy rivets, etc.
3. Dampers may be secured to sleeve with stitch welds, bolts, screws or steel rivets. Alternatively the damper may be secured by clamping angle frames on both sides of the damper (as illustrated). The clamping angle frames are fixed only to the sleeve with fixings as indicated above. Warning! any type of fixing must not effect damper operation.
4. Supports required if partition is not designed to take the weight of the fire damper assembly. This is a particularly important consideration for the dry lining partition arrangement illustrated below and also for other non-structural constructions. Supports may be fixed to the top face of the sleeve in order to accomodate local obstructions, eg: actuator housings, etc.
5. Vertical partitions may require lintels to maintain the structural integrity of the hole.
6. Sleeve clamping angle frames fixed only to the sleeve on a minimum of two sides on both faces of barrier using steel fixings. Sleeve clamping angles to be full face and may be unequal angles to allow for building tolerances at the face of the hole. Sleeve clamping angles may be split and bolted together to fix around a pre-installed sleeve.
7. In order to accommodate assembly expansion there must be no fixings through the clamping angles into the face of the partition
8. Sleeve - gauge as tested by the damper manufacturer
9. Damper
10. Cautionary note! Sleeve supports should not be overtightened to the extent that they rigidise the assembly and negate the air gap expansion requirements in Note 1
11. Alternative break-away flanged joint - see Note 2
12. **This is a typical arrangement and is not to be used to demonstrate either compliance or as a substitute for project-specific design sketches. See note at foot of page re: System Designers Responsibility**

Typical arrangement for dry lining partitions also applies to timber framed and steel partitions (subject to manufacturers approval)



13. If specified, framed opening in barrier which must be incorporated and fixed to the slab to soffit structural framing of the partition
14. Openings to be lined with rigid board having a fire rating equal to that of the barrier face unless the fire damper installation has been tested without the need for a rigid board.



General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. The assembly shall be installed so that the damper is within the partition thickness and the sleeve extends beyond the clamping frames

C. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse effect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

D. Both multi-section and single section units may be supplied as single sections with a sleeve and angle kit for site assembly / fitting by others. All site fitting / fixings shall be in accordance with this drawing.

E. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

F. All lintels and frames/linings (in dry lining partitions) to be provided by others

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

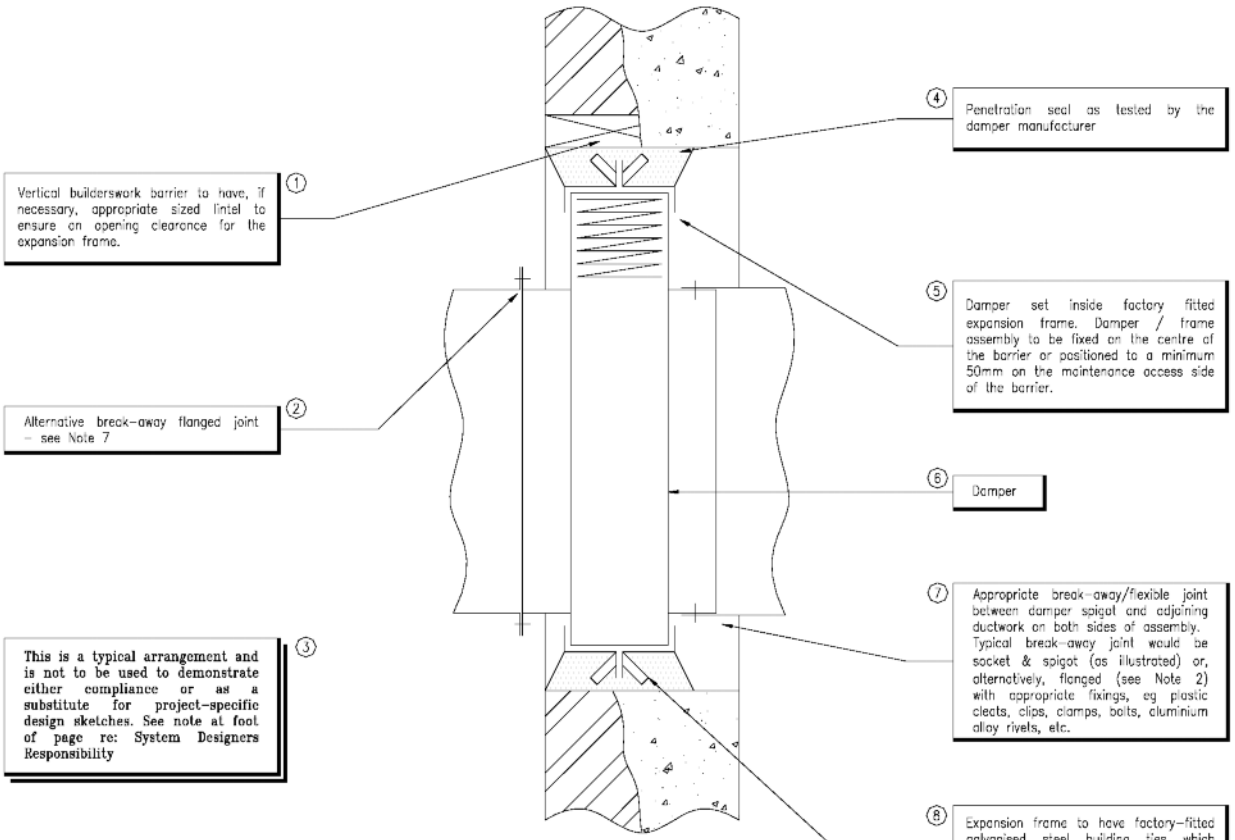
NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire - see Approved Document B.

BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 3

TYPICAL ARRANGEMENT OF A GENERIC DAMPER IN PRE-FORMED VERTICAL OR HORIZONTAL STRUCURAL / BUILDERSWORK OPENING COMPLETE WITH EXPANSION FRAME.



BARRIER SECTION

General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse effect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

C. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

D. All lintels to be provided by others.

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

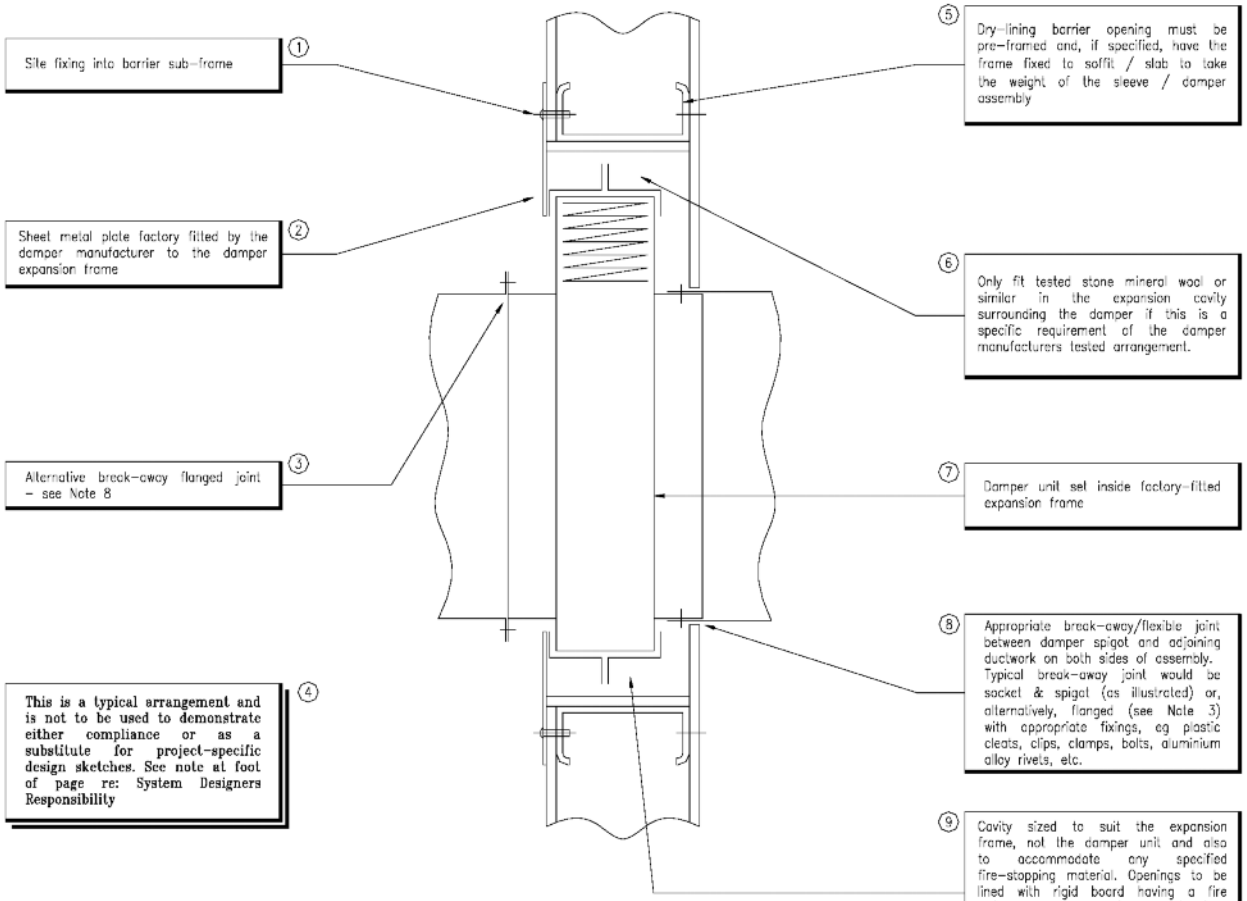
Note!
This method may also be utilised for either concrete or brick / blockwork barriers with pre-formed openings and where site fixings achieve a positive fixing into the barrier

BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 4

TYPICAL ARRANGEMENT OF A GENERIC DAMPER WITH A PRE-FORMED OPENING IN A VERTICAL DRY-LINING BARRIER COMPLETE WITH FACTORY FITTED DAMPER FACE PLATE



BARRIER SECTION

General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse affect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

C. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

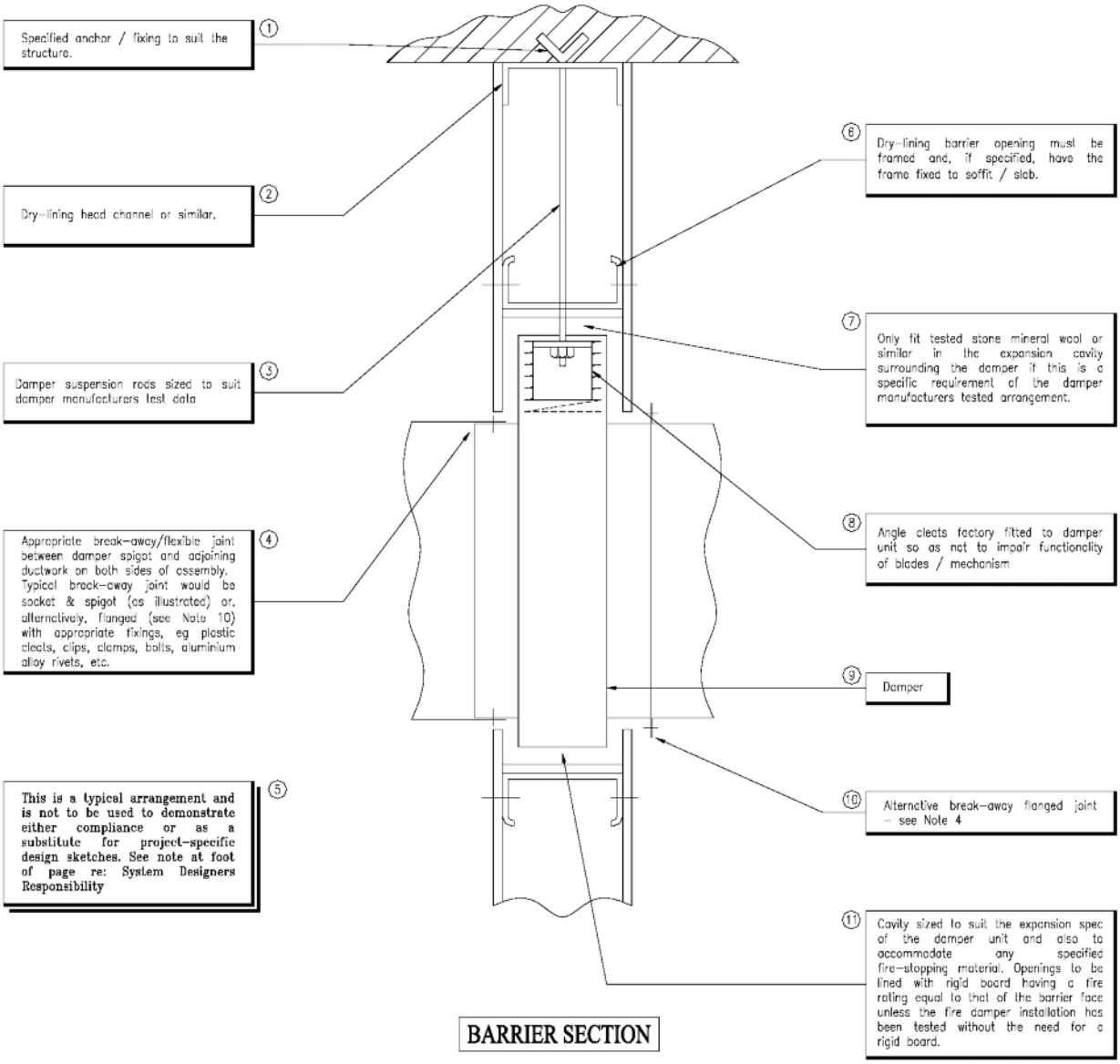
Note!
This method may also be utilised for either concrete or brick / blockwork barriers with pre-formed openings and where site fixings achieve a positive fixing into the barrier

BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 5

TYPICAL ARRANGEMENT OF A GENERIC DAMPER WITH THE DAMPER AND DUCTWORK INSTALLED PRIOR TO THE FORMING OF A DRY-LINING BARRIER.



BARRIER SECTION

General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS E 1366-2 as being appropriate for the application.

B. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse affect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

C. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

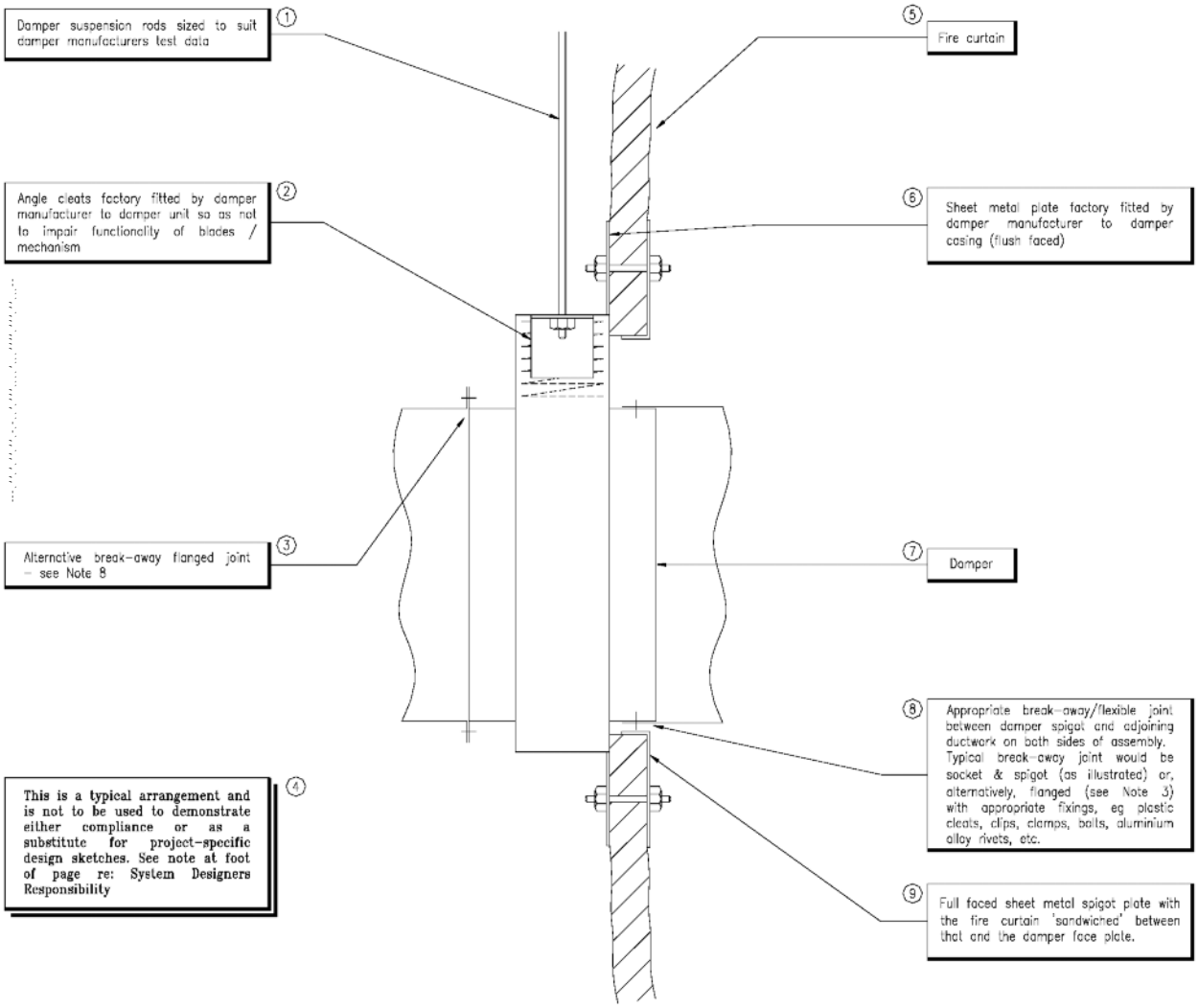
Note!
This method may also be utilised for either concrete or brick / blockwork barriers with pre-formed openings and where site fixings achieve a positive fixing into the barrier

BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 6

TYPICAL ARRANGEMENT OF A GENERIC DAMPER WITH THE DAMPER AND DUCTWORK INSTALLED IN A VERTICAL FIRE CURTAIN.



BARRIER SECTION

General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse affect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

C. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

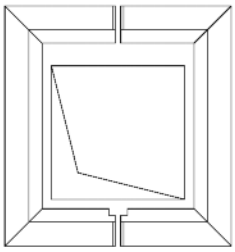
Note!
This method may also be utilised for either concrete or brick / blockwork barriers with pre-formed openings and where site fixings achieve a positive fixing into the barrier

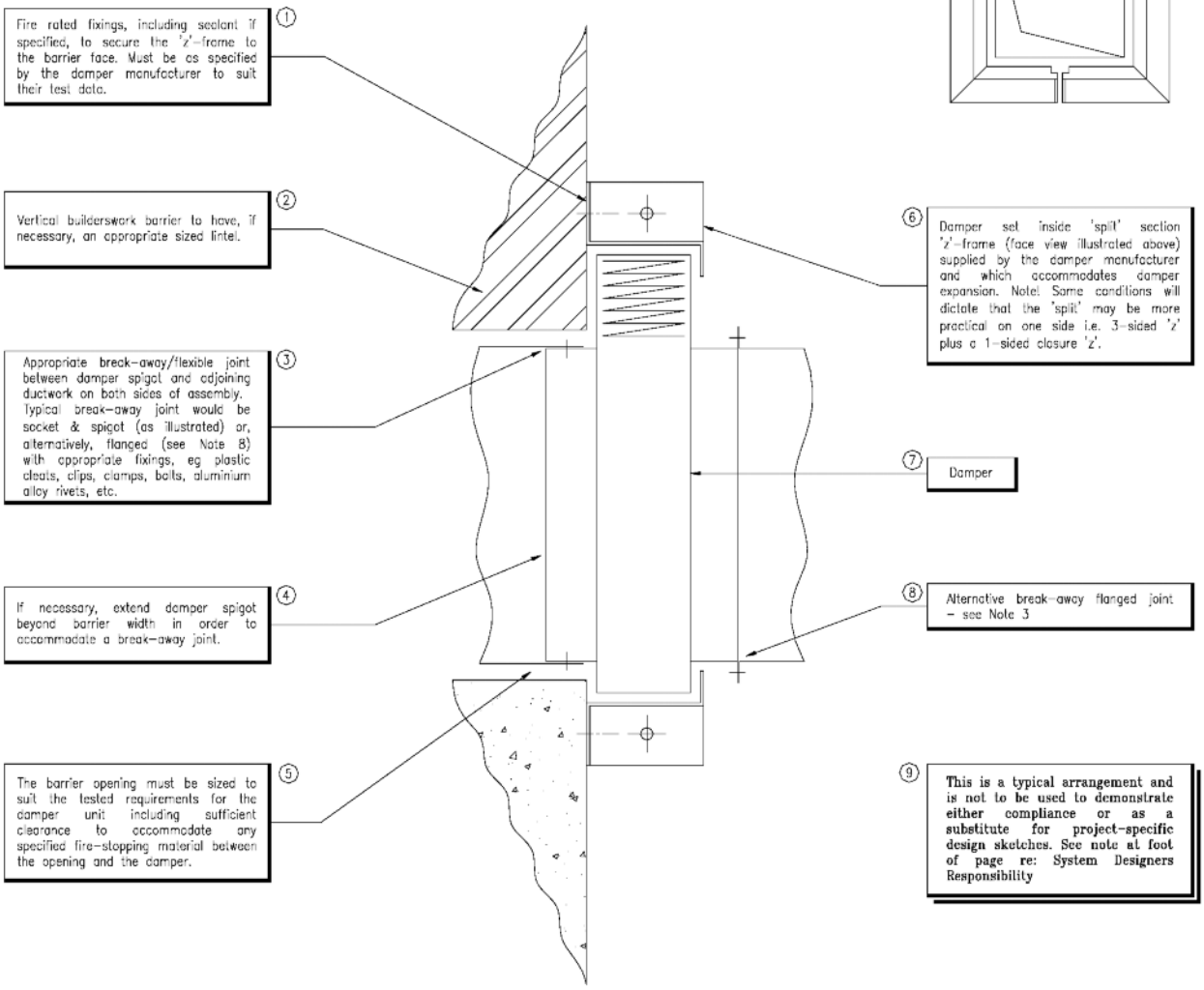
BESA BUILDING ENGINEERING SERVICES ASSOCIATION

DW/145

METHOD 7

TYPICAL ARRANGEMENT OF A GENERIC DAMPER IN PRE-FORMED VERTICAL OR HORIZONTAL STRUCTURAL / BUILDERSWORK OPENING USING SURFACE MOUNTED SHEET-METAL 'Z'-FRAME





BARRIER SECTION

General Notes:

A. Test data from the damper manufacturer must be checked for suitability for BS 476 or BS EN 1366-2 as being appropriate for the application.

B. Supports to the connecting ductwork (not illustrated) shall be provided in accordance with the requirements of HVCA Specification DW/144. If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork must be supported adjacent to this joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse effect on the damper assembly as either the plastic or flex materials will either melt or burn away. This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144.

C. Access / cleaning panel shall be fitted on the linkage access side of the assembly. Cleaning requirements may need additional access.

D. All lintels and frames/linings (in dry lining partitions) to be provided by others

System Designers Responsibility

The illustration above is a commonly used installation method which contains no specific or definitive dimensional detail as such information can only be provided by either the manufacturer of a specifically tested damper unit or a system designer who has incorporated a tested damper unit into a project-specific design sketch.

In accordance with legislative design / test parameters (see Appendix 'C'), before considering this method, it shall be established whether the installation arrangement is to be used in an area requiring dampers to have an E or an ES classification tested in accordance with BS EN 13501-3. It must then be determined whether installing the proposed damper by this method will provide the correct classification.

NB! Dampers tested in accordance with BS476 cannot be E or ES rated and may only be used if the fans are to shut down in the event of fire – see Approved Document B.

Note!
This method may also be utilised for either concrete or brick / blockwork barriers with pre-formed openings and where site fixings achieve a positive fixing into the barrier

Appendix A

The ASFP Industry Guide to the design for the installation of Fire and Smoke Resisting Dampers (the 'Grey Book')

The ASFP Grey Book, which has been widely cross referenced in the earlier sections of this BESA Guide, contains sections that cover a range of important factors that relate to the subject as a whole. The ASFP are currently up-dating this guide to suit the new and latest EN Standards and it will also be re-titled 'Fire dampers and smoke dampers: 2nd Edition'. The Grey Book will be released in two volumes. Volume 1, as with this guide, covers fire dampers and leakage rated fire and smoke dampers as used in ventilation systems to maintain fire compartments and/or protect means of escape from buildings and Volume 2 covers powered smoke control dampers which are either opened to allow smoke extraction or closed to maintain compartmentation.

The main subjects addressed in the Grey Book 2nd Edition are as follows:-

- Scope
- Introduction
- Definitions
- Damper types
- Regulations and Codes
- European product standards
- European fire classifications, fire tests, and fields of application
- Other related non-fire test for dampers
- Third party certification schemes
- CE Marking and attestation of conformity
- Design, selection and specification
- Installation issues
- Handover information
- Maintenance
- Trade Associations and fire research organisations
- Bibliography
- Fire damper products / data pages

Such are the responsibilities involved in the overall process (see Section 3 of this BESA guide), it is recommended that all parties familiarise themselves with the contents of the ASFP Grey Book if only for the need to appreciate all the critical aspects that have to be considered and undertaken if a building's life safety strategy is to be guaranteed.

To emphasise the need for all parties involved in the overall process to be aware of their responsibilities, the guide includes an introductory page that spells out the legal liabilities of everyone in the process and this covers everything from design and specification through to manufacture and installation.

A copy of the Grey Book can be down-loaded from the publications section of the ASFP Website at:

www.asfp.org.uk

Appendix B

Definition of Damper Types and a Glossary of Terms

B.1 Definitions

For Industry consistency, all definitions of commonly used dampers relate to those published in the ASFP Grey Book of which the BESA were co-authors.

B.1.1 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. When the release mechanism is activated the blades fall, or are sprung, to fill the airway to prevent the passage of the fire

B.1.2 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. When the release mechanism is activated the blade pivot moves to close the airway to prevent the passage fire.

B.1.3 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. When the release mechanism is activated the blades pivot and move to close the airway to prevent the passage of fire

B.1.4 Multi-section Fire 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 shall be given by installers for additional support, particularly on larger multi-section units.

B.1.5 Combination Smoke and Fire Damper

These units are fire dampers as generally described in previous sections but would also expect to be actuated in some way to respond to a remote signal in the case of a smoke alarm to prevent the passage of cold smoke.

B.1.6 Smoke Control Damper

Smoke control dampers, which are not covered in this guide, are single or multi-blade dampers that would generally have two safety positions – 'open' to allow smoke extraction or 'closed' to maintain compartmentation. They do not have a thermal release mechanism, relying on a 'powered' control system to ensure that they achieve the correct position. Volume 2 of the 2nd Edition of the ASFP's Grey Book will cover 'powered' smoke control dampers in detail.

B.1.7 Insulated Fire Damper Blades and Closures

Fire dampers where the blades not only satisfy the appropriate integrity/leakage requirements but also show insulation characteristics when tested.

B.1.8 Intumescent Fire Resisting Damper

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. 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.

B.2 Glossary of terms

In order to appreciate the terminology used in the design and specification of dampers, commonly used terms are listed below, in alphabetical order, and again, for consistency, these terms align to those published in the ASFP Grey Book

B.2.1 Assessments

Documents from independent accredited 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. See **APPENDIX 'H'** for a current list of Fire Testing and Assessment Bodies and also Section 1.0, Scope, on the validity of assessments.

B.2.2 Break-away duct joint

A joint connecting a fire damper spigot or sleeve to the attached ductwork 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.

B.2.3 Expert Judgments (EJ)

Solutions to specific technical problems that may lie outside that for which it would be considered reasonable to have test data. They shall only be issued by competent persons and covered by appropriate guidelines. Products and systems may only be used in applications covered within the scope of the EJ which usually means for a single application. If there is any doubt that a third party (notified body) would be unable to arrive at the same conclusion an EJ shall not be made.

B.2.4 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 be to a design which has been successfully fire tested. A HEVAC/BESA frame (DW/144, fig 78) as illustrated in Method 3, 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.

B.2.5 Fire Separating Element/ Barrier

Floors, walls, partitions and other fire separating elements of construction having a period of fire resistance as determined in accordance with BS 476 Parts 20, 21 and 22 or the relevant European Standard. NB! Whilst the term 'Fire Barrier' is the Industry preferred terminology, the technically correct reference is 'Fire Separating Element' which obviously covers floors in addition to walls, partitions and curtains.

B.2.6 Fire damper sleeve

An enclosure surrounding a fire damper, in an air passage penetrating a fire rated barrier mounted in such a manner that disruption of attached ductwork, if any, will not impair operation of the damper.

B.2.7 Fire-stop

A 'gap' seal provided to close an imperfection of fit or design tolerance between elements or components to restrict the passage of fire and smoke.

B.2.8 Penetration

An aperture through a fire barrier, e.g. an aperture for the passage of a ventilation duct or ductwork.

B.2.9 Penetration Seal

The system used to restore and maintain the fire classification of the fire separating element / barrier at the position where the damper / ductwork pass through the barrier.

B.2.10 Performance criteria for Integrity (E), Insulation (I) and Leakage (S)

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 must not exceed 360m³/h/m²) (corrected to 20°C). The integrity around the perimeter of the fire damper must 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) increase the average temperature above the initial average temperature by more than 140°C or
b) increase at any location (including the roving thermocouple) above the initial average temperature by more than 180°C.

Leakage (S)

Leakage through a fire damper must 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 must 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.

B.2.11 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.

B.2.12 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. With respect to fire dampers this will be to BS EN 1366-2 with classification to BS EN 13501-3. 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 **(United Kingdom Accreditation Service)** accredited laboratory or equivalent.

Appendix C

Synopsis of current Legislation and UK Standards

Note! The contents of this appendix have been compiled by HEVAC (Heating, Ventilating and Air Conditioning Manufacturers Association) and relates to information that was current at the date of publication of DW/145. HEVAC's members manufacture the majority of fire and smoke damper assemblies used in the UK and further information on the subject of damper manufacturing and testing can be found on their website at www.feta.co.uk/hevac

C.1 Introduction

Many changes have occurred within both European and British Standards and these are now reflected in the Approved Documents system. Approved Document B: Fire safety, is the UK Governments interpretation of the Building Regulations with regard to fire safety. It contains clear statements on the use of ductwork and dampers, so that when they are used fire compartmentation is maintained. This document must always be carefully considered when designing ductwork systems as The Building Regulations are a legal requirement.

Approved Document B: Fire safety, acts as a signpost to other standards. In this case they are BS EN 1366-2:1999 (fire test for fire dampers) and BS EN 13501-3:2005 (classification standard for fire dampers). The old ad-hoc method of testing to BS476-20/22 is only applicable in the situation where a fan shuts down in the event of a fire being detected. Unlike BS EN 13501-3:2005, BS476-20/22 does not permit dampers to be given a classification. Approved document B: Fire safety, also points in the direction of the BS5588 series which give further insight into ductwork design for fire and smoke design and safety considerations.

C.2 Brief explanation of Approved Document B: Fire safety and relevant British Standards

C.2.1 Approved Document B: Fire safety

Approved document B must be fully consulted prior to any design work being done. It requires that where dampers are to be used to protect penetrations of compartments by ductwork, they must meet certain requirements. This will be that at least that they match the E (integrity) criteria of the partition in to which they are to be installed. In addition, it states that escape routes and areas with sleeping risk must have an additional S (leakage) criteria.

Also in these areas, there is the requirement for the dampers to close under response from a smoke detector or a suitable fire detection system. Such dampers must be actuator operated to close when smoke is detected. E and ES criteria are only available for dampers tested to BS EN1366-2 and classified to BS EN 13501-3. Dampers tested to BS476 are only acceptable in situations where the fan will be switched off during a fire incident, and will not in any case meet the requirements for escape routes and areas with sleeping risk as they cannot be classified E or ES to BS EN 13501-3, as this only allows classification using results from testing to BS EN 1366-2.

C.2.2 BS EN 1366-2 Fire resistance tests for service installations – Part 2: Fire Dampers

This is the test standard for fire dampers. A unit of the largest size to be offered for sale as a single unit is used for the fire test. The damper starts the test open with a small volume of air passing through it. It must close under thermal element control. When it is closed a pressure differential of 300Pa is placed across it using a high temperature fan. This pressure differential is maintained across

it for the duration of the test. The leakage through the damper is measured continuously throughout the test. It is corrected to 20°C for classification purposes.

To meet the E criteria the damper must leak no more than 360m³/hr/m² and have no failures around its penetration as described in the standard (gaps, etc). To further meet the S criteria the damper must leak no more than 200m³/hr/m². This must also be repeatable at ambient on the smallest size of unit to be offered for sale.

Thus it may be seen that for different dampers installed by different methods in different partitions; different time periods may be achieved.

C.2.3 BS EN 13501-3: Fire classification of construction products and building elements – Part 3: Classification using data from fire resistance tests on components of normal building service installations

Using the results from the above tests allows classification of the units for specific installations. The classification times are stated within the standard, but generally follow 30 minute intervals. Thus it may be seen that a specific unit may have E60S, E180 in one partition and E60S, E90 in another or, if it was a different type of unit (such as a curtain fire damper) it may have E120 in both, as it was unable to meet the ambient leakage requirements to achieve an S classification.

C.2.4 BS476 20-22 1987 (Formally Part 8) Fire tests on building materials and structures – Method for the determination of the fire resistance of elements of the construction (General Principles)

Prior to there being a specific test for fire dampers, this was the test used to test the fire damper as if it were a partition. This test made no provision for a pressure differential across the damper nor did it require the integrity of the damper to be checked with anything other than gap gauges.

Despite these shortcomings BS476 20-22 remained the most appropriate test available to fire and smoke damper manufacturers prior to the introduction of the forerunner of the EN & ES standards now being introduced in the UK. Despite the fact that the new standards are more appropriate and demanding than BS 476 20-22 it is not uncommon to see reference to this test on nearly all UK fire/smoke dampers literature.

C.3 Regulatory Reform Order

The Regulatory Reform (Fire Safety) Order 2005 came into effect in October 2006 (see http://www.communities.gov.uk/fire/firesafety/firesafetylaw/) and establishes a general duty to ensure the safety of both employees and non employees in the event of fire. The Main duty holder is the 'responsible person' who may be the employer, owner or other person who has control of the premises. The responsible person has to ensure that a 'suitable and sufficient' fire risk assessment is carried out, that suitable general fire precautions are provided and maintained and, that the fire risk assessment is reviewed periodically.

Appendix D

System Design Considerations

The considerations that follow are not listed in any order of importance but they highlight the issues that must be addressed by the system designer in conjunction with the damper manufacturer and their tested installation arrangements.

D.1 Tender Stage information

The system designer is not only responsible for defining and specifying all aspects of the installation from damper locations through to final inspection but also that the systems are compliant with current Building Regulations.

D.2 Design appreciation

Fire and smoke dampers are installed as part of a building's life safety strategy and all parties must make themselves aware of how and why dampers work, the need to work to tested methods and, the importance of working to a pre-agreed installation sequence for each individual damper regardless of the support and installation method.

D.3 Damper manufacturers' instructions and test data

Failure to comply with manufacturers tested methods of installation can have serious and expensive consequences. Good use shall be made of the experience and expertise of manufacturers in terms of pre-handover inspections.

Manufacturers test data is a critical aspect that cannot be ignored. Both system designers and installers need to ensure that any alterations to a design, either at the system specification stage or during installation, must be approved by the Building Control and / or Fire Authorities who must be able to consider what test evidence is available and reach a conclusion. Simply requesting a damper manufacturers' approval is unacceptable, as in most cases this may not be given as assessments may not be available (see **APPENDIX 'B'**, B2.1, Assessments and B2.3, Expert Judgments). Failure to adhere to this requirement may invalidate the method.

Where prevailing conditions result in a specified method being modified, then it must be approved by the system designer in conjunction with the damper manufacturer and the Building Control Officer and Fire Authorities.

D.4 System designer's specification

In order that individual activities can be accurately priced, a detailed specification needs to be compiled and made available at tender stage which covers all aspects of the system designers requirements and in particular the supports system in relation to the barrier type and the penetration and its seal. Specifications shall take advantage from feedback from previous similar installations and, to ensure that no consideration is overlooked, be compiled by a competent person using check lists (see Clause D.15 of this Appendix.)

The system designer shall bring together the relevant team members in order to consider and give specific guidance on the following subjects:

D.4.1 Methods of Installation

As BS EN 1366-2 and BS EN 13501-3 test results and classifications (see **APPENDIX 'C'**) are based on leakage through the damper (differential pressure 300Pa), the method of installation has an effect on the results, so the terms "practical" and "have to do to pass the test" become important. This factor shall be considered during the design with regard to leaving sufficient space around the units to allow installation. Damper manufacturers would not impose stringent methods, unless this is specifically required when building-in to a specific construction, to gain the fire classification required.

D.4.2 Multi-duct Single openings

Single openings in fire barriers with several ducts passing through them

should be avoided because of the practical difficulties with both the support and penetration seal methods.

If the system designer cannot avoid the situation then specific methods must be agreed with both the damper manufacturer and the appropriate authorities before finalising the design.

D.4.3 Adjacent and Multiple Damper Assemblies

Assemblies must be separated either by builders work of a minimum width as directed by the damper manufacturer or by factory made steel centre mullions formed from channel-formed sections of a material and gauge that has been proven by test i.e. multiple assemblies.

D.4.4 Expansion Frames

Damper manufacturers set a maximum size on expansion frames and damper assemblies. Frames and damper assemblies that exceed that size shall have their expansion and support systems pre-agreed and approved by the System Designer with the local Building Control Officer and Fire Authorities.

D.4.5 Damper / Assemblies outside the line of the Fire Barrier

If, for practical and design reasons, the damper assembly cannot be positioned within the thickness of the fire barrier then any connecting ductwork / casing between the fire barrier and the damper assembly must meet the following criteria:–

(a) Be independently supported/restrained

(b) Have a fire resistance equal to or greater than the fire barrier (demonstrated by certification through test and / or assessment to BS 476 Pt 24 and / or BS EN1366 Pt 1)

(c) Be adequately protected against the possibility of damage by impact.

(c) The complete assembly (damper, duct and fire barrier combined) must have the required fire performance as demonstrated by a successful test undertaken by a UKAS accredited laboratory or equivalent. (The three elements cannot be considered separately as they may have an adverse affect on each other in fire conditions)

Any fire resistant casing material or ductwork cladding must be specified by the system designer and clearly illustrated on the design layout drawings.

NB! Ultimately, all of the aforementioned design considerations must be accepted by the local Building Control and Fire Authority.

D.4.6 Safe Access for future Damper Maintenance, Operation and Inspection

In addition to providing space to access the internal components of a damper through an adjacent ductwork opening, it is important that provisions are made to gain safe and easy access to the opening through, for example, ceilings, voids and adjacent services. In the case of risers, safety chains or wires to be fitted to removable access panels.

D.5 Generic test data

Individual manufacturer's test data must not be used as a generic or industry standard for seemingly similar materials and components

D.6 Damper selection

In selecting the type of damper and support arrangement, it must be ensured that the fire

barrier / penetration opening can accommodate the arrangement.

To avoid a 'miss match' between the type of damper, its installation housing and the substrate in to which it will be installed, it is essential that the damper type is in accordance with a specification or design which has been shown by test to be capable of meeting the required performance.

D.7 Spatial requirements during installation

A specified design method can only be achieved in practice if there is sufficient space for each trade to complete their activities in the defined sequence. Recommended and tested details may work under laboratory conditions but they may not always be suited to the prevailing site conditions with regard to space and access. It is not acceptable to hope that either the barrier, ductwork, damper or penetration seal contractors can overcome some of the problems that the system designers and programmers have failed to recognise or consider. Many problems can be overcome if the designer works to a tabulated check list that highlight these type of considerations (see Clause D.15 of this Appendix). Many of these difficulties can be overcome if the key trades are consulted prior to and during the design and programming process.

D.8 Identification of Fire Separating Elements

It is essential, at the tender stage, that locations, types and fire resistance periods of fire separating elements (walls, partitions, curtains, floors, etc.) are clearly identified to the system designer by the Architects representative who is designated to provide such information.

Dimensional information for barrier openings shall relate to the damper and its support arrangement and many of the problems that occur can be avoided by utilising a design check list (see Clause D.15 of this Appendix) and recognising the importance of the criteria laid down in the Building Regulations

D.9 Penetration Seals

The penetration seal, often referred to as 'fire-stopping', is a critical component of a successful installation and the system designer must ensure that advice is taken from the damper manufacturer in terms of the appropriate seal relative to the manufacturer's test results.

It is not sufficient to assume that any type or form of penetration seal can be utilised and the damper manufacturer must be involved in all aspects of the penetration seal selection including test data compatibility, quality, installation control and final inspection of the completed installation

The penetration seal must be installed in accordance with the successfully tested method for use when penetrated by the damper. More information on penetration seals can be found in the Association for Specialist Fire Protection (ASFP) Red Book entitled Fire Stopping and Penetration Seals for the Construction Industry.

The penetration seal area and space around a damper assembly must not be used for the passage of other building services as their presence will invalidate the tested penetration seal method.

Where a damper arrangement incorporates a proprietary installation and expansion frame, the sealing system shall be capable of accommodating any axial and / or linear movement due to thermal expansion. Where there is a risk of loads being transmitted from the ducts and fire dampers to a non-loadbearing fire barrier during a fire, the construction must be so designed to ensure that the fire barrier will maintain its function for its full fire resistance period.

It shall also be noted that openings in brick or blockwork walls may require lintels and the system designer shall ensure that the appropriate requirements are passed down to the fire barrier contractor responsible for forming such openings.

D.10 Damper Support systems

The fire damper manufacturer, via the system designer, will have defined the material and its size to suit the type of barrier in which the arrangement has been tested.

The successful installation of the damper and its supporting system will be dependent on the programming of the installation with other trades and all the main installation considerations being covered. To ensure that no important installation criteria are overlooked it is recommended that a design check list is adopted (see Clause D.15 of this Appendix)

D.11 Support of adjacent ductwork

Supports to the connecting ductwork shall be provided in accordance with the requirements of BESA Specification DW/144.

If the ductwork connection to a damper's spigot or sleeve is either a flanged breakaway joint, secured with plastic (or similar) fixings, or a flexible joint then the connecting ductwork shall be supported adjacent to the joint. This is a safety consideration as these types of connections are not usually capable of taking the connecting ductwork's weight. During a fire condition, the weight of the adjoining ductwork will have no adverse affect on the damper assembly as either the plastic or flex materials will either melt or burn away.

This adjacent support does not apply to socket and spigot connections made with aluminium alloy mechanically closed fixings and the first ductwork support beyond this joint only needs to conform to the support centres listed in DW/144. During a fire condition, tests have proven that such fixings melt and the adjoining ductwork collapses under its own weight without any adverse affect on the stability of the damper assembly.

D.12 Load bearing on vertical ducts

Consideration shall be given to the loads imposed on penetration seals applied to dampers set horizontally in a vertical duct system and this is a subject that should not be overlooked during design meetings.

As proprietary penetration seals may or may not have loadbearing properties, it is not always possible to determine that the correct size of hole or reinforcing has been provided. It is recommended that openings in floors should be protected against foot traffic or other unauthorised standing loads wherever possible, e.g. by independently supported chequer plate floor, guard rail or similar protection (designed and provided by others).

D.13 Controls

Damper support systems and penetration seals can all be affected by the interface between dampers and controls such as actuators. Provision for their inclusion must be considered and finalised during the design stage.

D.14 Combustible materials

Materials or insulation of a combustible nature must not be incorporated into a ductwork system within 500mm of a fire damper assembly

D.15 Design check lists

The system design process as a whole involves many considerations some of which vary depending on project-specific factors such as barrier type, installation sequence, space (both for installation and future maintenance), other services, etc. Every effort shall be made to ensure no critical factors are overlooked. To assist in this it is advisable to work to a check list which is regularly up dated by drawing on experience gained from previous projects. **An example of a typical design checklist is provided in Appendix 'E.1'**.

Appendix E

Design, Installation, Inspection and Handover Check Lists

Communications between team members and the need for consistency in both design and approach are key factors in achieving a compliant design. It is recommended that check lists are utilised and adapted to suit the specific requirements of an individual project. Typical check lists for design, installation and inspection / handover are included in this appendix.

Note! Copies of the three typical tabulated checklists on the following pages are available from the BESA website and are titled as follows:

E.1 Design check list

As stated previously, the system design process as a whole involves many considerations some of which vary depending on project-specific factors such as barrier type, installation sequence, space (both for installation and future maintenance), other services, etc. Every effort shall be made to ensure no critical factors are overlooked. To assist in this it is advisable to work to a check list which is regularly updated by drawing on experience gained from previous projects.

E.2 Installation check list

This check list covers the practical installation considerations to be addressed to ensure that project-specific design criteria are fulfilled

NOTE! Refer to **APPENDIX 'B'**, Clause B.2.3 on the subject of 'Expert Judgments' (EJ's) which explains valid reasons for addressing and resolving a recognised technical problem that has not been covered by any technical data or formal design instructions.

E.3 Inspection and handover check list

Having established that all parties must be made aware of the intended final inspection and certification regime, the final installation must be checked for compliance by the nominated CDM coordinator or the System Designer. The completed installation forms part of the building's life support strategy and nothing must be left to chance with every aspect of the installation being checked against the system designers project-specific certified sketches. All final inspections must be documented in a register that must be retained by both the system designer and the installation contractor. See 5.4.3 and 5.4.4 for more detailed guidance.

E.1 Design Check List

No.	Question	Guidelines	Responsibility
01	What evidence of compliance with the latest Building Regulations is available for the selected damper installation method?	Damper manufacturer must provide evidence that the installation method meets with Building Regs.	System Designer.
02	What damper fire classification is required? Do the system design drawings have dampers marked with identification codes which cross reference back to a schedule of all dampers that includes their rating and location?	Each damper must meet the same minimum fire classification as all other system components	System Designer.
03	Into what substrate is the damper to be installed?	Wall or Floor?	Architect / Client.
04	From what is the substrate constructed?	Concrete, blockwork, dry-lining, etc	Architect / Client.
05	Is the damper frame / support compatible with the substrate type and intended installation method?	This is fundamental to a successful installation.	System Designer.
06	Has the damper manufacturer been consulted as to the most appropriate type and layout of dampers?		System Designer.
07	Is the method tested and approved for the type of barrier that is being protected?	Assemblies for block work walls may not be suitable for dry-lining barriers	Damper purchaser And manufacturer
08	How is the damper to be independently supported from the connecting ductwork?	Include guidance on the use of break away joints.	System Designer.
09	Can the intended installation be completed within the boundaries of the construction programme?	In dry-lining, openings must be accurately planned and set out in advance. It is difficult and expensive to form openings to tested standards after walls have been built	Lead Contractor.
10	Have methods of retro-fitting dampers which have been missed or modified been agreed?	Retro-fitting dampers in partitions is difficult.	System Designer.
11	Has sufficient room been allowed for building-in dampers when the entire ductwork, nearby walls, ceilings and services are installed?		System Designer.
12	Has a fire-stopping contractor been consulted prior to design completion to advise on whether a tested solution is available for the circumstances on site?		System Designer.
13	Has the fire-stopping manufacturer provided evidence to support the tested solution?		System Designer.
14	Does the fire-stopping test evidence relate to the actual application with appreciation of the wall type, the damper type and the frame type?		System Designer.
15	Will the fire-stopping manufacturer be on site to provide guidance and training during installation?		System Designer.
16	Are load bearing supports needed for vertical ducts		System Designer.
17	Is the installation of the builders work between damper frame and wall to be carried out by a suitably qualified and approved third party installer?		Lead Contractor
18	Have materials or insulation of a combustible nature been excluded from the duct within 500mm of a damper?		System Designer.
19	Has adequate space been provided allow for access to dampers for maintenance and testing purposes?	Consider access on both sides of the damper for both maintenance and future cleaning purposes.	System Designer.
20	Has pre-installation meeting been planned between the system designer, site management team, Building Control Body / Fire Authority, duct/damper installer, barrier subcontractor and manufacturers of drywall, damper and fire-stopping systems?	This is essential	Lead Contractor

E.2 Installation Check List

No.	Question	Guidelines	Responsibility
01	Has all the necessary technical information been made available for the damper installer and all other associated trades?	Refer to Clause 4.3	System Designer
02	Has a project-specific programme of sequenced installation activities been prepared?	An acceptable sequence to achieve the same design criteria can vary from project to project	Lead Contractor.
03	Does the programme sequence of other trades allow for there being sufficient space on all four sides of the damper to fit associated support systems, apply fixings and to complete the penetration seals	Inaccessible voids and cavities caused by adjacent walls, columns and structural soffits shall be considered during programming.	Lead Contractor.
04	Does the programme sequence ensure that there are no other services installed that would prevent the damper arrangement being fitted as per the system design?	Other trades cannot 'share' the openings for dampers and their penetration seals.	Lead Contractor.
05	Does the programme sequence ensure that there are no ceiling grids / tiles installed that would prevent ease of installation for all associated contractors?		Lead Contractor
06	Have solutions to any necessary on-site change to the installation sequence been transmitted back to the programmer so that future projects will benefit?	Altering the sequence of one or more contractors in order to achieve the design in a more practical manner shall be communicated back to the programmer for use on future projects.	Damper installer, Barrier contractor, Penetration seal contractor.
07	Has the system designer approved any ad-hoc instructions issued by a third party? e.g. The 'ad-hoc' insertion of stone mineral wool, or similar, in cavities	The inclusion of non-specified products, material and dimensional modifications may result in the invalidity of the final assembly	Damper installer, Barrier contractor, Penetration seal contractor.
08	Is the method tested and approved for the type of barrier that is being protected?	Assemblies associated with block work may not be suitable for dry-lining	Damper Purchaser Damper Manuf'cter
09	Is the opening in the dry-lined barrier correctly formed, trimmed and lined?	Do trimming members need to be tied back to the soffit and slab?	Barrier Contractor.
10	Prior to installation are method statements, COSHH assessments and risk assessments available to the installers?	The availability of clear instructions to the installers is essential in ensuring correct installation methods are adopted.	Damper installer, Barrier contractor, Penetration seal contractor.
11	Has the damper, duct and penetration seal been installed as per the specification?	Query before installation if any element appears to be non-compliant	All parties.
12	Has adequate space been provided to allow for access to the damper for maintenance and testing purposes?	Consider access on both sides of the damper for both maintenance and future cleaning purposes.	System Designer.

E.3 Inspection and Handover Check List

No.	Question	Guidelines	Responsibility
01	Are the dampers the correct type?	Confirm the damper is the correct type i.e. Fire, Fire/Smoke, Curtain type, Single/Multi Blade type, etc.	System Designer.
02	Are the dampers correctly identified?	Any unique system identification or plant item number must be clearly indicated on the damper or agreed location.	System Designer or Commissioning Engineer
03	Are the dampers located correctly?	The damper position shall be dimensionally checked against the installation drawings / details.	Damper Installer.
04	Have supports for both the damper and adjacent ductwork been installed in accordance with the approved method?		Damper Installer.
05	Are the dampers fitted in the correct orientation?	Is damper installed the correct way up and relative to airflow / access?	Damper Installer.
06	Is access, through the ductwork, to the damper unobstructed?	Unobstructed space shall be provided for safe access to damper. Also consider access through ceiling voids and adjacent services.	Damper Installer to advise System Designer if problems are foreseen.
07	Has the space around the damper, and within the penetration, been left clear and not been used for the passage of other services?	The presence of other services will invalidate the installation method.	Damper Installer to advise Lead Contractor if problems are foreseen.
08	Using the access opening provided, has the damper been left in the open position?		Damper Installer.
09	Has the dampers blade catch been released to simulate failure of thermal release mechanism (damper 'drop test').	Ensure blade operation is free from interference.	Damper Installer.
10	Has the damper been checked for internal cleanliness and freedom from damage? Are vertical casings in particular free from debris?	With the damper in the closed position inspection for damage.	Damper Installer.
11	Have the dampers blades been re-set following the drop test and the access panel replaced?	After re-setting the damper blades, check position shown on blade position indicator is correct.	Damper Installer.
12	At the time of the damper handover, is the fire barrier and penetration seal complete?	Damper installer to record, on the handover register, if any following trades have still to complete their activities.	Damper Installer.
13	Is the damper installation completed and available for handover prior to system commissioning?	Obtain relevant acceptance of the damper installation from the CDM coordinator	Damper Installer.
14	Is the completed handover register cross referenced back to the identification codes listed in the system designer's damper schedule?		Damper Installer.

Appendix F

Typical Installation Sequences

This appendix highlights two different but typical installation sequences associated with a damper system (based on Methods 1 and 5 respectively) with illustrations and notes describing the considerations that need to be taken into account to ensure that all parties involved in the installation are able to meet the damper manufacturers and the system designer's requirements.

Sequence 1 – Damper installed using sleeve and angle clamps in pre-formed opening in vertical partition as outlined in Method 1.

Figure F1

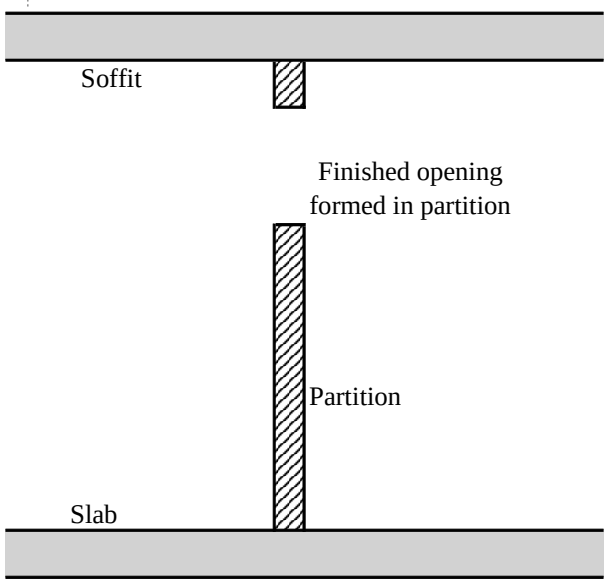


Fig F1 - Elevation with partition and designated clearance opening (including expansion allowance) formed to suit the eventual damper / sleeve assembly.

1A – Designated Contractor to install the partition / barrier including a formed (and where necessary lined) opening to accommodate the damper and sleeve assembly including the specified expansion allowance – all as indicated in the damper design specification (see Fig F1).

Figure F2

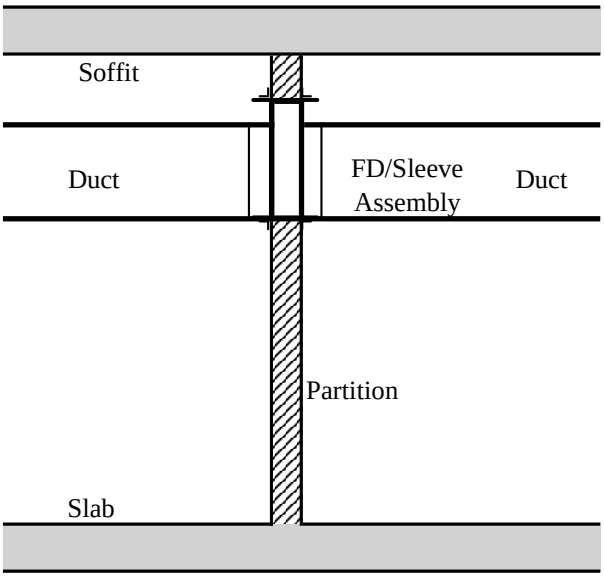


Fig F2 - Elevation with sleeve, angle clamps, damper and duct, including breakaway duct joints, fitted to suit the pre-formed opening in the partition.

1B – Designated Contractor/s to fit damper, sleeve, clamps and ductwork (which may be complete with an access panel for future re-setting of the thermal release mechanism) ensuring that the access panel is on the side of the barrier that is designated to be free of other services and obstructions during future maintenance activities (see Fig F2). Depending on the type of breakaway duct joint, the duct is to be supported accordingly, i.e. either flanged breakaway joints or flexible joints must have an adjacent duct support whereas socket and spigot type breakaway joints only need to have a duct support to suit DW/144 support centres.

Design / practical considerations relating to Sequence 1

Have the following trades been sequenced in order to avoid ductwork installation difficulties such as building services and / or ceiling grids being installed at a lower level than the ductwork system which prevent the damper and / or ductwork being lifted into place and the sleeve and damper being secured in accordance with the damper manufacturers instructions.

Sequence 2 – Damper installed prior to the installation of a vertical dry-lining partition using drop rod supports and damper lugs as outlined in Method 5.

Figure F3

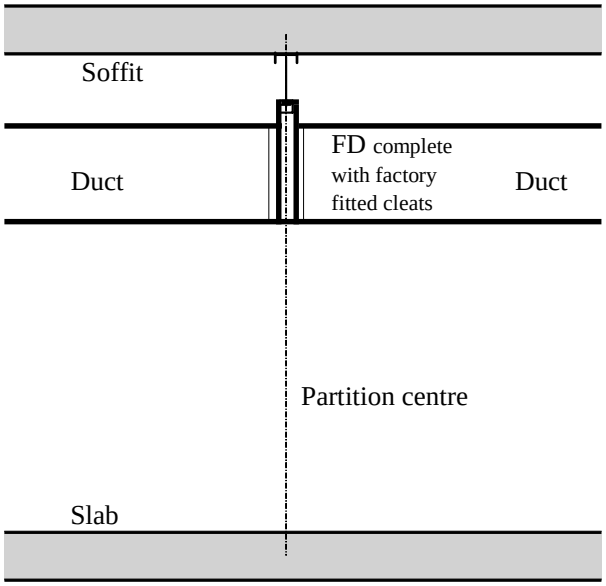


Fig F3 - Elevation with support, damper (incl support cleat) and duct (including breakaway duct joints) fitted to suit the head channel (or its centre line)

2A – Designated Contractor to either fit a dry-lining head channel or mark the centreline of the partition on the soffit. (see Fig F3).

2B – Designated Contractor/s to fit damper (using support hangers secured to factory fitted damper support cleats) and ductwork (which must be complete with an access panel for future re-setting of the thermal release mechanism) so that the damper blade centre-line is within the barrier width and the access panel is on the side of the barrier that is designated to be free of other services and obstructions during future maintenance activities (see Fig F3). Depending on the type of breakaway duct joint, the duct is to be supported accordingly, i.e. either flanged breakaway joints or flexible joints shall have an adjacent duct support whereas socket and spigot type breakaway joints only need to have a duct support to suit DW/144 support centres.

Figure F4

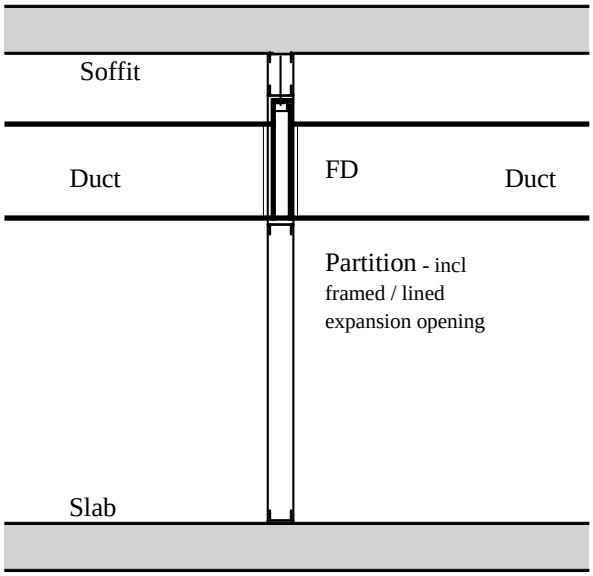


Fig F4 - Elevation with damper / duct installed first, then partition / opening framed, lined and clad around the damper / duct installation

2C – Partition Contractor to install the partition framework (see Fig F4), with the damper opening also framed and lined accordingly, including the necessary damper expansion allowances, as indicated in the damper design specification.

2D – Partition Contractor to clad the framework including its openings and apply, if specified, any stone mineral wool, or similar, to the cavity surrounding the damper.

Appendix G

Key guidance points for the system designer and the damper installation contractor

The purpose of this appendix is to provide a quick reference to the key points of DW/145 which shall be considered by the system designer and the damper installation contractor and their on-site fitter. System designers, depending on individual contractual responsibilities, may be either building services consultants, mechanical services contractors or, in the case of 'design and supply' projects, ductwork contractors.

References in this appendix to the 'design office' relates to the source of the system design be it any one of the three parties referred to in the previous paragraph.

Much of the information in this appendix is ideal for training purposes both off-site for those involved in the design office and on-site for the damper fitter. Section G.4 presents the key points in a simplified format which can be used as a refresher training guide or a simple *'aide memoir'*. A copy of this appendix in a format that that can be easily carried and referenced by the damper fitter is available from the BESA website.

G.1 Responsibilities

Damper installations are a critical element of a building's life safety strategy. The initial responsibility for ensuring a compliant installation lies with the design office and the final responsibility with the on-site fitter. It is essential that lines of communication are formally established between the parties and, when appropriate, that the CDM coordinator monitors and progresses such communications. Failure by either party in not recognising and working to formal design parameters may result in serious consequences especially if, during a fire insurance claim, it can be proven that any party has acted in a negligent manner. Dampers are not just installed to minimise fire and smoke damage to the fabric and contents of a building but, more importantly, they are there to save lives.

G.2 The design office.

Parties responsible for the ductwork and damper design shall familiarise themselves with the full contents of DW/145 and not just this appendix and its recommendations.

G.2.1 Selecting the appropriate damper

By using a damper catalogue or contacting the manufacturers directly, select an appropriate damper. If the information obtained does not clearly reflect the conditions that are expected on site then discuss with the damper manufacturer the best option(s) that they can provide which they are prepared to endorse and satisfy the need to only provide dampers and methods of installation that have been fire tested. Evidence must be made available that the method has been fire tested by a UKAS accredited laboratory or equivalent.

Damper manufacturers will provide dimensionally detailed guidance on how the damper is to be installed **including any requirements for damper assembly expansion**. It must also be ensured that the method specified is practical relative to the site conditions that exist for the project.

Once selected, it is imperative that only the damper manufacturer's model of damper and the agreed method of installation are used. Failure to adhere to the agreed methods will invalidate any responsibility on the part of the damper manufacturer **including using another manufacturer's similar product without approval**. It is not an option to simply purchase a similar unit from a third party stockist; this would be a change in the design and therefore a breach of the CDM Regulations.

G.2.2 Spatial coordination

Using the contract issue drawings, the design office must make provision for sufficient space and access not only to

enable the damper fitter and follow-on trades to install the complete damper arrangement, but also to allow both handover and future maintenance activities to be performed.

G.2.3 Project specific sketches

Having selected an appropriate damper, it is necessary to incorporate this information into a project specific sketch which shall include the detailed information required by the fitter as listed in Clause G.3.1 of this appendix.

G.2.4 Installation sequence

The design office must liaise with the designated principal contractor and any specialist contractors involved in ensuring that a practical sequence is established that allows all parties to complete each element of the installation, i.e. the damper, the barrier, the penetration seal and the ductwork connections.

G.3 The damper fitter

In addition to working to the project-specific information provided by either the design office or their installation supervisor, the damper fitter not only has a responsibility to comply with that information **without deviation** but they also have a responsibility to undertake the pre-handover checks. (See G.3.3)

G.3.1 Information to be provided to the damper fitter

It is not an acceptable practice for the damper fitter to be expected to follow the custom and practice adopted on previous unrelated projects. The following information must always be provided by the design office:

G.3.1.1 Project-specific detailed and dimensioned arrangements incorporating the compartment barrier, the damper and the penetration seal.

G.3.1.2 Manufacturer's details for incorporating any expansion allowance including, where appropriate, damper unit expansion frames.

G.3.1.3 Damper to ductwork connection details including any specific requirements for fixings, joints, breakaway joints, fastenings, etc.

G.3.1.4 In addition to indicating the supporting method for the damper, it is important that the dimensional location of the first ductwork support relative to the damper centreline or face is indicated – for both sides of the damper.

G.3.1.5 If not already incorporated into the connecting ductwork in the factory, the position of (a) an access cover that is free of obstructions and on the appropriate side of the barrier for blade testing, re-setting and maintenance, and (b), if necessary, a second access cover on the opposite side of the barrier that may be called for by the ductwork cleaning specification.

G.3.1.6 A programme clearly detailing the sequence of installation relative to each activity.

G.3.1.7 Inspection and handover requirements to be witnessed and recorded in the handover register.

G.3.1.8 Any other requirements.

G.3.2 Responsibilities of the damper fitter

It is imperative that the damper fitter reports back to the design office any activity that may arise on site that could cause the damper arrangement to be non-compliant.

G.3.2.1 If the damper fitter has been requested to deviate from any of the information provided in G.3.1 without formal instruction being provided by an authorised party involved in the damper arrangement, the installation supervisor must refer such matters to the design office for acceptance before acting on the request.

G.3.2.2 It is recommended that the damper fitter checks the operation of the damper **before** installing so that any malfunction can be corrected. NB! If the damper fitter has been requested by an authorised party to substitute a damper from a different manufacturer to that specified, this request must be approved by the design office as such a substitution should only be undertaken with the system designer's consent.

G.3.2.3 If an issue arises relating to prevailing site conditions with regard to space and access, the situation must be referred to the design office who in turn, with the entire test evidence available, take the problem, via the CDM coordinator, to the damper manufacturer and the building control authorities in order that a practical solution can be agreed.

G.3.2.4 If requested to fit stone mineral wool, or similar, in any expansion gap which is not a specified requirement of the project-specific information that the damper fitter has been provided with, the request must be referred to the design office. Such additions could render a damper inoperable or compromise the function for which the damper was installed.

G.3.2.5 The design office must be informed if a pre-formed dry-lining barrier opening has not been pre-framed and, if necessary, lined and does not appear to be fixed to the soffit / slab. It is not sufficient for a 'raw' opening to be simply cut into the barrier. A clear indication that an opening is not satisfactory is if the barrier itself is unstable before the installation of the damper assembly.

G.3.2.6 If before installing the damper and / or duct connections, it becomes apparent there will be in-sufficient access around all sides of the damper assembly, on both sides of the barrier, to either fit the damper support system or to complete the penetration seal then, via the design office, the affected party needs to be consulted as an installation sequence change may need to be introduced.

G.3.3 Pre-handover checks by the damper fitter

Prior to handing over the damper to the designated party, the damper fitter, in conjunction with the installation supervisor, must carry out the following checks to ensure that the installation is compliant:

G.3.3.1 Dampers are internally clean and free from damage.

G.3.3.2 Dampers continue to operate after installation and can be reset from the access provided.

G.3.3.3 All internal and external control devices are accessible and in good condition.

G.3.3.4 Terminals on connections to control systems are accessible.

G.3.3.5 Dampers are installed the correct way up relative to airflow and access.

G.3.3.6 Confirm the damper has been left in the open position.

G.3.3.7 Release the damper blade catch or mechanism to simulate failure of the thermal release mechanism, i.e. a damper drop test.

G.3.3.8 If the barrier is to be built after the installation of the damper arrangement, ensure that dampers fitted with expansion frames have their building ties bent out prior to the application of the penetration seal.

G.3.4 Inspection and handover by the damper fitter

In conjunction with the design office, either the damper fitter or the installation supervisor needs to formally hand over the installation for final inspection by the CDM coordinator. All final inspections must be documented and recorded in a register that is retained by all interested parties which must include the identification details of the CDM coordinator who has witnessed any tests and taken over the damper arrangement.

G.3.4.1 Undertake a witnessed test that confirms the damper mechanism performed satisfactorily and can be reset from the access provided. NB! The need for 'man access' to re-set a damper is a critical factor especially if it at a later date non-related 'obstructions' have been fitted by other parties after handover which restrict this critical operation.

G.3.4.2 Following the handover event, the register records must include the following information:

- Damper reference number (identified relative to contract drawings)
- Date
- Witness's name in both **printed** and signature form.
- Activities which are incomplete at the time of handover, i.e. ductwork connections, compartment barrier and penetration seals. NB! This is essential especially if it is found that the eventually completed installation is not compliant and remedial actions are required.

G.4 Key considerations – a Summary

System Design office

- Only use damper manufacturers who can provide evidence that the installation method has been fire tested by a UKAS accredited laboratory or equivalent.
- If site conditions do not permit the use of a damper manufacturer's particular installation method, discuss and agree with them alternative methods that they are prepared to endorse.
- Prepare detailed drawings of the complete arrangement (damper, fire barrier / slab and penetration seal) and gain client's approval.
- Agree an installation sequence with all involved parties that takes into consideration spatial availability and which allows them to complete their element of a compliant arrangement.
- Prepare a handover register for use by the damper fitter.

Damper fitter (or their installation supervisor)

- Only use the method illustrated in the project-specific information.
- Never revert to methods used on a previous project unless approved by the design team.
- Expansion allowance will have been incorporated into the contract drawings – it must not be ignored.

- Before installation, check that the damper is free from damage and operates correctly and that it is the unit specified on the contract drawings.
- Do not use substitute dampers.
- If a problem arises that is outside your control and which may result in a non-compliant installation, report the situation back to the design office.
- If the compartment barrier (wall or slab) is not formed or finished-off as per the contract drawings, report the situation back to the design office.
- During installation, ensure that the damper is fitted to suit the airflow direction and that it is not upside down.
- After installation, check that the damper is clean and free from damage.
- Connecting ducts must only be fitted to suit the agreed installation sequence of all involved parties.
- Fixings, cleats, duct supports, etc, must only be fitted in accordance with the contract drawings and a note must be made of the specified type of fixing and, in particular, it's material. Some similar but totally different fixings such as mechanically closed rivets may be, **by design**, manufactured from either steel or an aluminium alloy
- Prior to handover, ensure that the damper blades can be accessed and re-set via the access panels in the adjacent ductwork connections.
- Ensure that the appropriate information is recorded in the handover register.

Appendix H

UKAS fire certification bodies

BRE Global Ltd (incorporating the Loss Prevention Certification Board, LPCB)

BRE, Bucknalls Lane, Watford, Herts, WD25 9XX
Tel: +44 (0)1923 664 100
Email: enquiries@breglobal.com
Web link: http://www.redbooklive.com

Chiltern International Fire

Stocking Lane, Hughenden Valley, High Wycombe, Bucks HP14 4ND
Tel: +44 (0) 1494 569 800
Email: cif@chilternfire.co.uk
Web link: http://www.chilternfire.co.uk

FM Approvals Limited

1 Windsor Dials, Arthur Road, Windsor, Berkshire, SL4 1RS
Tel: +44 (0)1753 750 000
Email: cpd@fmapprovals.com
Web link: http://www.fmapprovals.com

International Fire Consultants Ltd

20 Park Street, Princes Risborough, Buckinghamshire, HP27 9AH.
Tel: + 44 (0)1844 275 500
Email: ifc@intfire.com
Web link: http://www.intfire.com

Warrington Certification Ltd

Holmesfield Road, Warrington, Cheshire WA1 2DS
Tel: +44 (0) 1925 646 777
Email: info@warringtonfire.net
Web link: http://www.warringtonfire.net and http://www.bodycote.com

NOTES

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