

ASFP



An Industry Guide to the design for the installation of Fire and Smoke Resisting Dampers

Association House, 99 West Street, Farnham, Surrey, GU9 7EN
Telephone: 01252 739142 Fax: 01252 739140

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FOREWORD

Fire/smoke resisting dampers represent a major method used in the United Kingdom and other countries to prevent fire and smoke from passing from one compartment to another through Heating, Ventilation and Air Conditioning (HVAC) systems.

It is imperative that fire resisting dampers are adequately fire tested and are installed in accordance with the damper manufacturer's instructions. Such instructions must take into account site conditions and the variable order of different trades from contract to contract.

This document attempts to provide practical advice so that damper manufacturers, system designers and installers are able to consider the appropriate issues and at the design stage, to make the necessary decisions to ensure that dampers will function as intended by current regulations.

Association for Specialist Fire Protection (ASFP)

Association House, 235 Ash Road, Aldershot, Hampshire GU12 4DD

t: +44(0) 1252 321322 f: +44(0)1252 333901

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

ASFP seeks to increase awareness and understanding of the nature of fire and the various forms, functions and benefits provided by passive fire protection.

It is willing to make available its specialist knowledge on all aspects of fire protection and can assist specifiers and main contractors in identifying products suitable for specific requirements, both in the UK and overseas.

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1 Scope

This document is intended to make the specification and installation of fire/smoke dampers easier for designers and installers and also acts as a guide for inspectors. It emphasises the importance of installing dampers as recommended by the manufacturer and ensuring that only dampers that have been fire tested are used.

2 Introduction

This publication has been produced to assist those involved in the manufacture, specification, installation, inspection and verification of fire resisting dampers installed in Heating and Ventilation and Air conditioning (HVAC) ductwork systems. For information on fire resisting ductwork, reference should be made to the ASFP publication "Fire rated and smoke outlet ductwork - An industry guide to design and installation (known as blue book)".

Despite many years of use, there are no nationally recognised guidelines as to the basic criteria for installing fire and smoke damper units used for fire resisting compartmentation and separation.

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

There are numerous types of damper and associated installation frames available in the market place. Equally numerous are the varieties of walls and floors that the duct and damper will penetrate. Add to this the variations in the fire-stopping market place and it can be understood why many projects may not manage to install dampers successfully or at least to any recognisable tested method.

These guidelines attempt to clarify some of the basic principles of installation and at the same time highlight the important responsibilities attached to the ductwork system designer, the local authorities, the ductwork contractor/installer and the fire barrier contractor.

Some important information is included as an appendix relating to test methods and limitation of test results.

3 Definitions

3.1 Damper types:

3.1.1 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 normally rated at $72^{\circ}\text{C} \pm 4^{\circ}\text{C}$. The blades fall/are sprung to fill the airway to prevent the passage of the fire. Test results or assessments are required for plane of installation (e.g. horizontal and vertical) and the method of installation.



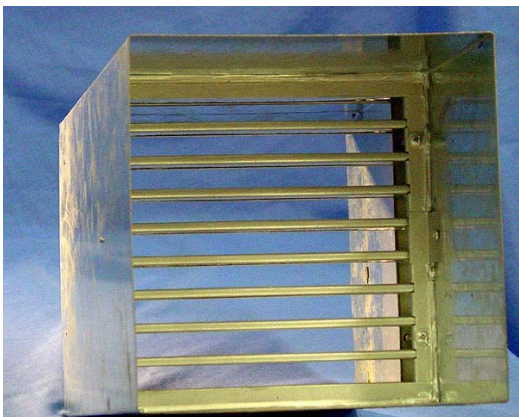
3.1.2 Insulated Fire Dampers

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

3.1.3 Intumescent Fire Resisting Dampers

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

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



3.1.4 Mechanical Fire Resisting dampers

The basic purpose of fire resisting dampers is to maintain the fire compartmentation provided by fire separating/compartment walls and floors when HVAC ducts penetrate walls and floors. Unlike fire resisting ducts, that extend the boundary of the fire compartment, dampers are designed to close the opening at the plane of the wall or floor in the event of a fire. Mechanical fire dampers may be

actuated by an integral thermal release mechanism that is activated by heat and causes the dampers to close. Some mechanical dampers incorporate a motorised system that is interfaced with smoke sensors via a fire alarm panel, thereby providing smoke containment as soon as it is detected.

3.1.5 Multi-blade Fire Dampers

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



3.1.6 Multi-section dampers

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

3.1.7 Single Blade Fire Dampers

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



3.1.8 Smoke Control Damper

Although not covered in this document, Smoke control dampers 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 thermal release mechanism, relying on a control system to ensure that they achieve the correct position.

3.2 Related definitions

3.2.1 Assessments

Documents from test centres 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

3.2.2 Duct/ductwork

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

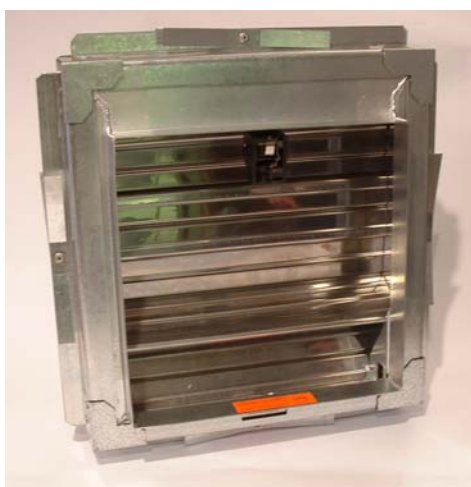
3.2.3 Engineered Judgements (EJ)

Solution to specific technical problem that may lie outside that for which it would be considered reasonable to have test data. They should 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.

An engineered judgement is not a best guess or a “best practice” solution based on the cheapest way round the problem linked to “the way things have been done before. If there is any doubt that a third party (notified body) would be unable to arrive at the same conclusion an EJ should not be made.

3.2.4 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 must be to a design which has been successfully fire tested or assessed. (A HEVAC frame can be regarded as falling within this definition.)



3.2.5 Fire 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’

3.2.6 Fire-stop

A seal provided to close small gaps such as an imperfection of fit or design tolerance between elements or components to restrict the passage of fire and smoke.

3.2.7 Penetration

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

3.2.8 Penetration seal

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

3.2.9 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.

3.2.10 Test Evidence

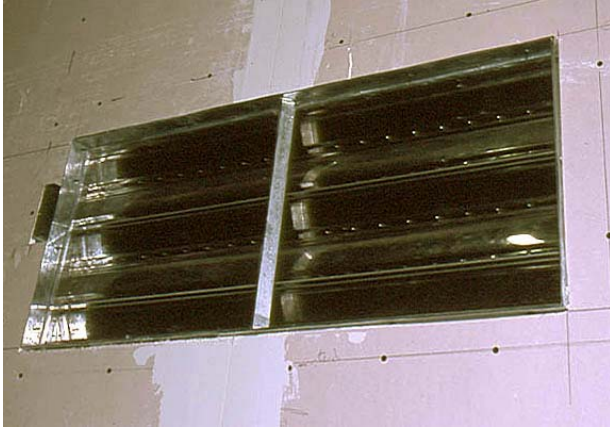
Data obtained from a fire resistance test carried out to determine the suitability of a product, system or combinations to seal service penetrations. In respect to fire dampers, this usually means the use of BS 476 pt 20 historically but will now mean BS EN 1366 2.

4 Main design criteria and responsibilities

4.1 Design Criteria

Regardless of the type of fire barrier in which the damper is to be mounted, there are only two main design criteria to be met and they are:–

- i. that the damper should be fixed either within or directly adjacent to the fire 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.



- ii. that the damper is installed in accordance with the manufacturers recommended tested method
- iii. that the installation meets or exceeds its design specification especially with regard to its fire rating

4.2 Responsibilities

4.2.1 Overview

It cannot be over-emphasised how important it is for each party involved in the satisfactory specification, design and installation of fire and smoke dampers to not only recognise their responsibilities in meeting the design criteria outlined above but also to communicate with the appropriate party in terms of resolving, clarifying and implementing any non-standard occurrences.

The Building Control Body of the local authority is a frequently used resource for many construction sites. In relation to fire protection the comment “its been passed by the building controller” is frequently given when manufacturers check the work on their own products and find elements wanting. It is important to understand the responsibilities of those concerned in the process.

There is a statutory duty to notify the Building Control Body prior to installation of any system. There is a general duty to enforce all the Building Regulations; this is done on a risk basis. Central to their ability to provide this support will be time and availability. Some projects will attract much more attention than others.

It seems that general comments offered by a building inspector in answer to very general questions are taken as “approval” for work done or specified, which may not be to a suitable standard. Building control bodies only check compliance with the building regulations. Even then, the contractor cannot assume carte blanche that all damper installations will be the same and not need additional technical support.

It is incumbent upon the site team to satisfy themselves that they have fulfilled all the criteria necessary to ensure that installations will provide the protection required. For this reason it is recommended that any construction project appoints a designated and clearly identified “Responsible Person” to over-see the process.

Individual responsibilities, which are listed in detail in later sections, can be summarised as follows:–

4.2.2 The Fire Damper Manufacturer

The damper manufacturer shall ensure that he provides detailed recommendations on how the damper is installed and that the method has been fire tested. He must liaise with installers to ensure that the method specified is practical for site conditions.

4.2.3 The System Specifier and Designer

System specifiers and designers should recognise their basic responsibilities outlined in 5, System Design. The system designer should, at an initial design stage submit proposals to the local building control / fire Body for conceptual approval. This process should be repeated with the final designs including full details of proposed damper installations. Consideration must be made to provide sufficient space to enable the installer to make a satisfactory installation.

4.2.4 Building Control Bodies

Building Control Bodies (including approved inspectors) must be content that the damper installation shows compliance with building regulations. The easiest way of showing this is for the installation to have been fire tested.

4.2.5 The Ductwork/Damper Installer

Ductwork/damper installers must not only satisfy the dimensional/specification requirements of both the system designer and the damper manufacturer, but must also ensure that all standard and non-standard applications/methods meet the approval of the system specifier, the designer and the local authorities.

4.2.6 The Fire Barrier Contractor

Fire Barrier contractors must not only ensure that fire barriers and penetrations are formed to accommodate specific damper units but they must also ensure that the penetration seals they apply are as tested or assessed and conform to the specific requirements of the system specifier, the designer and the damper manufacturer. All installations must be supported by relevant fire tests or assessments.

5 System Design

When establishing the ductwork routes, the system designer is responsible for the following actions:-

5.1 Tender stage

At the tender stage the designer should provide the following minimum information:-

- (a) the locations, types and fire resistance period of all fire barriers;
- (b) the locations, sizes, orientation (vertical or horizontal) and types of all dampers – e.g. fire and/or smoke having first ensured that the actual size of the fire barrier penetration / opening can be accommodated within the spatial design;
- (c) the method of control and the extent of the interface between the damper(s) and the control system;
- (d) the method of blade release;
- (e) the requirements for blade position indication;
- (f) basic material requirements of blade and casing;
- (g) any particular local authority or client requirements that is peculiar to the project;
- (h) inspection and handover requirements.

5.2 Freedom from obstructions and spatial requirements

There is very often a lack of space in which to fit services. The system designer should allow sufficient space for the selected method of installation to be used.

Ensuring that an area on the appropriate side of the fire barrier is free of services or other obstructions that would prevent access to the damper/access panel(s) which will be fitted into the connecting ductwork or damper plenum adjacent to the damper unit.

Ductwork takes up a great deal of room which can affect overall costs. This leads to difficulties caused by lack of access in construction and long term routine maintenance.

In new-build projects, have the following factors been taken into consideration when the installation sequence has been determined:

At the time of installation, will there be sufficient space on all four sides of the damper for the appropriate contractor to apply/fit masking clamps, mechanical fixings, batts, penetration seals, mastic beads, etc, etc.? *It must be remembered that as ductwork and barrier installation progresses, inaccessible 'voids' / cavities can be formed where the ductwork is either tight against a wall or tight up to the underside of a structural soffit.*

Would the presence of building services being installed at a lower level than the damper prevent the damper/duct items being safely lifted into their installation position?

Would the presence of primary ceiling grids at a lower level than the damper prevent the damper and/or the ductwork being safely lifted into their installation position?

5.3 Support system

Indicating a support system for the damper that not only suits the type of fire barrier to be penetrated, but also the adjacent conditions with regard to other services and the structure. This information should include material details such as cleats, angle clamps/rods, suspension rods, etc, which must be sized and specified to match the fire resistance of the fire barrier. It should be noted that the support system should take into account the practical considerations that will arise if the programme of installation dictates that the barriers will be installed after the damper and/or ductwork installation.

5.4 Fire barriers

Ensuring that the contractor responsible for the construction of the fire barriers is given instructions by the designer on the requirements to seal the initial open penetrations, including all dimensional information. They should also be instructed on any finishing-off activities and the sequence in which they should be carried out relative to both the installation of the damper assembly and the connecting ductwork.

Holes formed for ductwork often have no consideration for the damper unit and its frame. In solid walls this leaves holes too small to fit the damper or too large to seal in a cost effective way. In drywall this means that holes must be reformed which may render the construction of a hole, required to the fire

tested standard recommended by the manufacturer, impossible without significant additional work and cost.

5.5 Penetration seals

Indicate, where necessary, the type of penetration seal that is to be used to make good any clearance space within the fire barrier and around the damper to ensure that the integrity and insulation of the fire barrier is maintained.

Fire-stopping subcontractors are very often selected on price at tender stage without in-depth analysis of the systems they propose or an accurate specification provided for them. This leads to low cost tenders using cheaper untested solutions. This will increase the final cost if poor work is picked up by approval bodies.

5.6 Non standard methods

Whilst this document only recommends the adoption of tested methods, the need to design/illustrate non-standard methods often arises. When this occurs, the system designer shall assist in resolving, in a practical manner and to the satisfaction of the local authorities, any problems that arise during installation, when it is evident that there is a significant difference between the proposed specified methods and the less than practical conditions that face the contractor carrying out the installation. (see also 6.2.5)

5.7 Compliance with manufacturers instruction

Ensure that all methods of installation not only meet the requirements of the local Building Control Body but also satisfy the manufacturer's tested/assessed criteria relative to the damper and its functionality. Has the installation method been tested and / or assessed and approved by the system designer for inclusion in the type of fire separation element that it protects? i.e. methods for particular types of dry-lining barriers may not be suitable for other types of barriers such as blockwork, flexible curtains, etc, and vice-versa.

All parties involved in both the installation sequence and the installation activities themselves should recognise that the final installation will be checked for validity by an authorised representative of the system designer. Failure by any party to correctly interpret a design may result in extremely expensive corrective action having to take place – especially if the prevailing conditions involve the temporary removal of 'obstacles' / services that interfere with the successful rectification of a problem.

6 Recommendations for installation

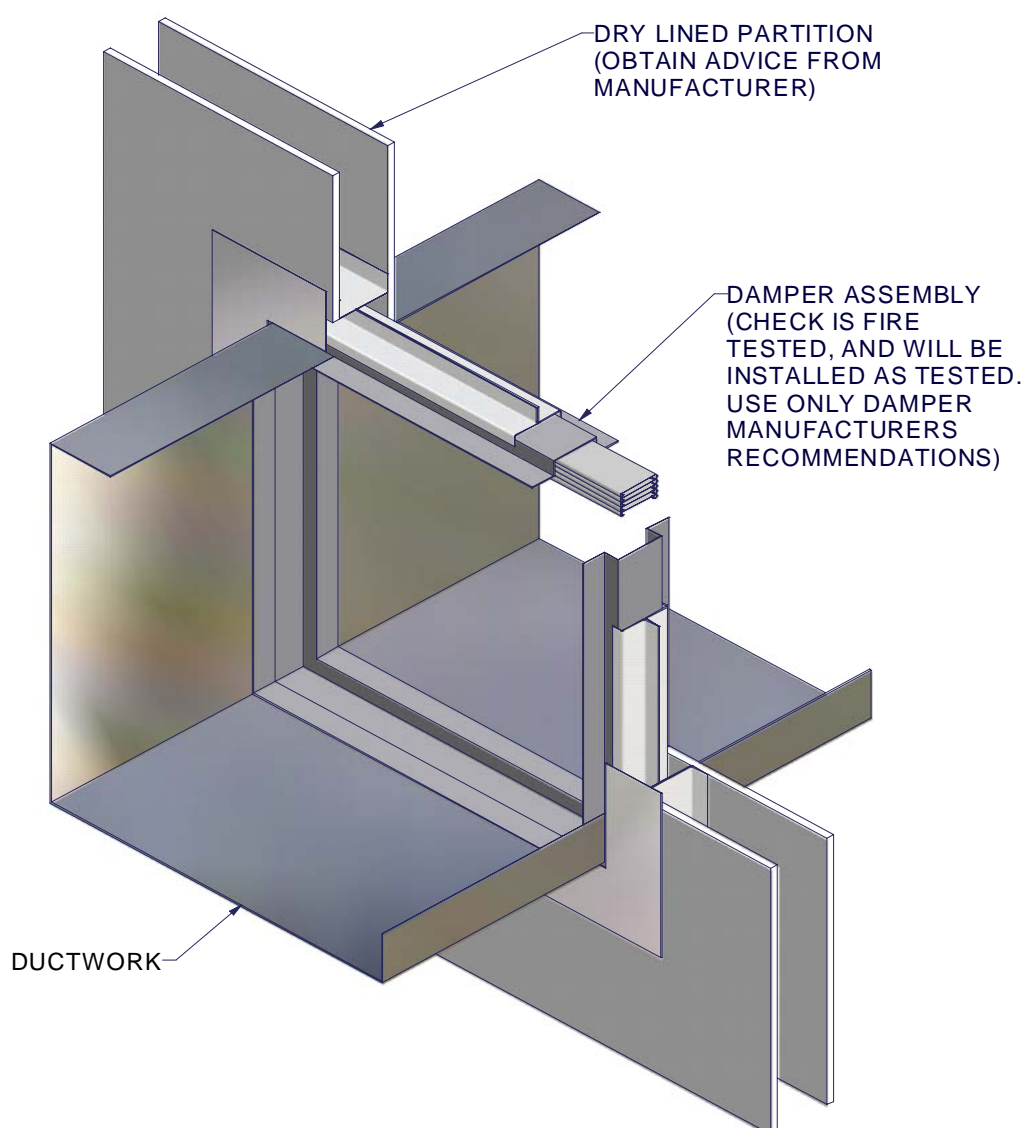
6.1 General

Any method of installation specified or used shall always be furnace tested or assessed by a suitably qualified person from a notified body.

Whilst manufacturers recommended details may work under laboratory conditions, they may not always be suited to the prevailing site conditions with regard to space and access. The responsibility of a successful installation cannot just be passed down to the 'last man in', be it the ductwork contractor, the barrier contractor or the penetration sealing contractor.

Important 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 are applicable to site conditions. Close liaison between damper manufacturers and installers is essential

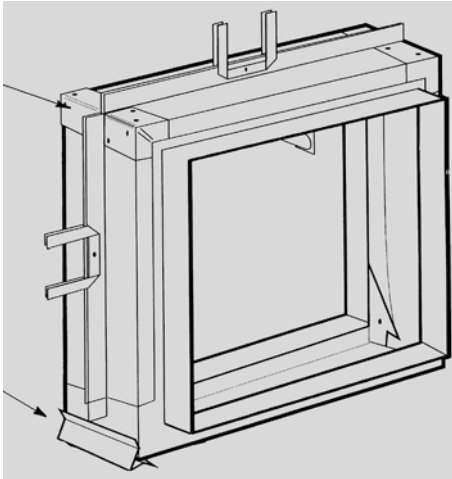


During product development, damper manufacturers shall, in addition to considering fixing methods for masonry and concrete, liaise with dry-lining manufacturers for most appropriate interface detail. The detail shall ensure no reduction of integrity/insulation of the partition and that the damper will operate under fire conditions.

During the drafting of this document, a number of site and design related problems were identified which combine to make the installation of dampers in walls and floors to any recognisable and tested standard very difficult to achieve. These problems can be summarised as follows:-

- i. Problems with different trades and disciplines being involved each with limited responsibility – Architect, Mechanical consultant, ductwork installer, wall builder, main contractor, fire-stopping contractor. Programming the work is very difficult due to the range of people involved. This leaves a number of differing routes to completion, each requiring a method to achieve a tested installation. Further complicating this is the need to begin constructing a building before the services layout has been finalised. (see 6.2.2)
- ii. Lack of defined person who is responsible for complete combined installation. Many individuals are perceived by others to be responsible but usually only take partial responsibility for their own aspect. This typically involves the architect, mechanical consultant, building control, clerk of the works, QS, site managers, damper manufacturer and individual trades e.g. drywall contractor or ductwork installer.
- iii. There is a lack of knowledge amongst most or all those involved in the construction process about how dampers work and how different substrates and sealing systems affect them. This is especially apparent with site based trades and main contractors.
- iv. There is very little accurate coordination between trades enabling precise hole forming to take place. (see 6.2.2) Duct size and location must be accurately set out. Different program sequences are required for drywall and solid wall. In respect to drywall, holes must be provided as the wall is constructed so as to accurately locate studwork positions.
- v. Little consideration is given to the type of fire-stopping system required to complete damper installation. Often the choice is left to a subcontractor who carries out work unchecked. Lack of knowledge and skill is a general problem in the fire-stopping industry sector – for more information on this and advice, contact the ASFP who can provide data on third party approval systems.
- vi. Very few people understand the need to install ductwork and dampers to a fire tested method.
- vii. Current test requirement and standards are in a transient state with damper and general services testing moving from ad hoc BS 476 methods to the far more appropriate and demanding BS EN 1366-2 method.
- viii. There appears to be a lack of appropriate test data to modern standards by the relevant manufacturers. There is also very little willingness on the part of approval bodies to rigorously inspect test data to ensure it is relevant and applicable to the particular case on site. This is a basic requirement of all fire protection systems. This failing results in endemic incorrect application and installation. It should never be over-looked that tested installation methods are carried out under 'laboratory conditions' but should only be selected / indicated by the system designer if detailed consideration is given to the site conditions and installation sequence.
- ix. Incorrect damper frame selection which is critical to installation success.
- x. Very little consideration is given to the fact that dampers sealed in floors may have to conform to load bearing requirements to allow access for inspection and maintenance through the building

6.2 Installation Check list



6.2.1 General

This section focuses on the practical installation aspects that need to be considered to ensure that job specific design criteria can be fulfilled. Such are the permutations involved in both the design solutions and the sequence of installation, it is impossible to define all the detailed installation method statements that may be required. This section therefore attempts to list all the factors that need to be taken into consideration in order to satisfactorily meet the designer's requirements in terms of a successful and correctly installed damper arrangement. A check-list for the design considerations can be found in 4.3 of this guide.

Fire and smoke dampers are installed as part of part of a building's life support strategy and it should be recognised by all parties that these designs, methods and sequencing should not be altered or modified purely on the grounds of either programme expediency or 'opinion engineering'. A timing problem associated with a building services programme, or an individual's opinion that a design should be modified, cannot and should not over-ride or affect any activity or design that is based on certified test and assessment methods. NB! See sections elsewhere in this Guide on the subject of 'Engineered Judgements' which explains valid reasons for addressing and resolving a recognised technical problem that has not been covered by any available technical data or formal design instructions.

6.2.2 Installation sequence

- Has a job specific programme of sequenced installation activities been prepared that covers all the separate trades involved in the activity, i.e. the barrier contractor, the ductwork contractor and the penetration seal contractor? (see 6.1(i))
- Does the sequence recognise the requirements for each party to ensure that the system designer's detailed requirements can be successfully installed?
- Has this necessary sequence, and the importance of it, been transmitted to the either the Main or the Management Contractor who is responsible for the overall programming activity of the project?

Note 1, It is not sufficient to take a design sketch and an installation sequence that has been successful on a previous contract and to assume that pre-planning and programming on a new project can be avoided. The congestion of structure and services around/local to a damper unit will determine the correct sequence of installation. From project to project, the installation sequence may be different for the same design.

Note 2, The installation sequence may differ for the same design depending on whether the project involves the up-grading/re-furbishing of an existing building and its services or if the project is a new-build activity.

6.2.3 On-site changes to the installation sequence

- Have solutions to any necessary on-site changes to the sequence been recorded and transmitted back to the system designer and/or programmer so that future projects will benefit from the knowledge? *e.g. by having to reverse the sequence of one or more contractors in order to achieve the design in a more practical and cost effective manner.*

6.2.4 Design approval of on-site alterations

- Has the system designer approved any alterations to a design that involves material / dimensional changes, bearing in mind that failure to work to the original details could result in the modified details being invalidated if their inclusion has not been either tested and / or assessed? *e.g. material gauges, non-specified products, etc.*
- Has the system designer approved any additions to a design that involves the use of materials that have been requested by a third party bearing in mind that failure to work to the original details could result in the modified methods being invalidated if their inclusion has not been either tested and/or assessed? *e.g. cavities being filled with mineral wool or similar.*

Note! In the USA, the practice of introducing in-fills and / or sealant is 'outlawed' as it could, according to their standards, either "render the damper inoperable" or "compromise the function for which the damper was ultimately installed". The point to be made is that only tested and / or assessed methods and materials should be utilised.

6.2.5 Tabulated checklist

Essential checklist for successful damper installation	
Question	Guidelines
What is the fire rating required?.	Each component must have the same minimum rating.
What is the substrate?	Wall or floor
What is the wall construction type?	Dry wall or solid?
Does the damper frame match the wall type and intended fixing method?.	This is fundamental to success.
Is the damper aligned within the wall correctly?	
How is the damper to be independently supported?	
Are the reveals of the hole in drywall correctly formed? Is the hole correctly trimmed and lined?.	
Can the intended installation be carried out within the boundaries of the construction program?	In drywall the holes must be accurately planned and set out in advance of work commencing. It is very difficult to trim and line a hole to tested standards after the wall has been built.
Is there a plan to retro-fitting fit dampers that have been missed or changed?	Retro fitting of dampers in flexible partitions is difficult
Will there be room to build in the damper or dampers when the entire duct and nearby walls, ceilings and services are in place?.	
Has a fire-stopping manufacturer been consulted prior to design completion to give advice on whether or not there is a tested solution for the circumstances on site?	
Will that manufacturer be on site to provide guidance and training for installation?	
Has fire-stop manufacturer given test evidence or assessment for solution intended?.	
Does the test relate to the actual application with appreciation of the wall type, damper type and frame type?.	
Is the installation of the builders work between damper frame and wall to be carried out by a suitably qualified installer?	
Is the installer Third Party Approved?.	
Has the damper manufacturer been consulted as to the most appropriate type and layout of dampers?	Important that they are
Has a pre site meeting been planed between the designers, site management team, Building Control Body/Fire Authority, duct installer, drywall subcontractor and manufacturers of drywall, damper and fire-stopping system?	This is essential
Has adequate space been provided to allow for access to the damper for maintenance and testing that it is able to operate?	

6.3 Comment on selecting suitable fire protection materials for making good in walls and floors around dampers

6.3.1 General

Specific installation details should only be derived from manufacturer's tested configurations that are appropriate to the intended application.

The System Designer shall ensure that the damper installation will provide meaningful protection in the event of a fire. They shall check the relevant test evidence of the wall/floor, the damper manufacturer and the fire-stop manufacturer. It is not sufficient to accept that combinations of materials will work because they "*have always been installed in that way*". This is no guide to future success.

There are frequent miss matches between the type of damper installation frame used and the substrate in to which it will be installed. This is especially apparent in drywall construction. Evidence available to the passive fire protection industry suggests that standard practice on construction sites is to simply infill the gaps between the frame and the wall as "well as possible". This happens with no regard for appropriate test data to illustrate that the installation will be effective.

The leading guidance on fire protection for most buildings in England and Wales is Approved Document B (AD B). The document stresses the need for proper tested applications:-

*"the .. product .. should be in accordance with a specification or design which has been **shown by test** to be capable of meeting that performance or have been assessed from test evidence against appropriate standards"* **AD B Appendix 'A' 1a**

It is the recommendation of this guidance that whatever the recommendations or claims of any manufacturer for any part of the damper system, it is only reference to tested solutions and applications or proper assessments that should be taken as fulfilling the requirements of AD B and hence the Building Regulations.

In addition, other useful comments from Approved Document B that this document recommends that any project team adhere to, are found in the introduction relating to both workmanship and product or material quality:-

"Third party accredited product conformity certification schemes not only provide a means of identifying products.... which have demonstrated that they have the requisite performance in fire, but additionally provide confidence that the ... products .. actually supplied are provided to the same specification or design as that tested/assessed" **AD B 0.20**

"Third party accreditation and registration of installers of systems, materials, products or structures provide a means of ensuring that installations have been conducted by knowledgeable contractors to appropriate standards, thereby increasing reliability of the anticipated performance in fire." **AD B 0.20**

These comments were added to the 2000 edition of AD B because senior observers from the fire protection industry recognised that the general standard of installation of many fire protection systems is simply below a reasonable standard. Additionally, it is also recognised that the range of material types available, and the test evidence in support of it, more often than not leads to incorrect product selection.

6.3.2 Specific recommendations

Correct selection and installation of systems is probably more important in the area of damper penetrations (especially in drywall) than any other building feature. Below is a ready guide to ensuring as far as possible that duct and damper installation will meet expected requirements in the event of a fire:-

- 6.3.2.1 At design stage a competent person should be designated as responsible for the design of the correct installation of dampers in compartment walls and floors.
- 6.3.2.2 Responsible manufacturers should be contacted to assist with the specification, including the damper manufacturer and the fire-stop manufacturer. Manufacturers with Third party accreditation are recommended as assistance with checking test data can be sought from accreditation bodies. Where drywall construction is to be used the drywall manufacturer should also be consulted.
- 6.3.2.3 With advice from the above a sequence of installation should be derived. In general, solid walls are flexible in that they can have holes formed for services with out breaching their innate fire resistance once making good has taken place. For drywall construction planning

is critical to ensure that services pass through properly created openings that ensure that the integrity of the wall is not compromised.

- 6.3.2.4 A full specification should be written to allow pricing to be accurately calculated.
- 6.3.2.5 An early conference between relevant personnel from the main contractor and the design team, together with approval bodies, should be arranged to ensure that everyone understands the requirements. This could include, but is not limited to: the building control Body, clerk of works, or fire brigade fire prevention officer, the architect, mechanical consultant, main contractors QS, site manager, M & E coordinator, the main M & E contractor, the fire-stop, damper and drywall manufacturer. At a later stage the relevant subcontractors for the duct installation, the drywall installer and the fire-stopping contractor should all be included in such a meeting.
- 6.3.2.6 Topics for discussion at such a meeting should include: the construction program as it relates to wall and floor type, damper frames, inspection regimes, test data, space to work, timing of installation for key components, fire ratings, and load bearing requirements on floor seals.
- 6.3.2.7 Installation contractors should be selected based on suitable credentials. In the case of fire-stopping it is essential that a separate fire-stop package is created, which specifies that a third party accredited company is employed to carry out the works. It is very useful if the manufacturer has an agreement with the contractor to train and supervise the installer with a view to ensuring quality. It is also considered good practice to make use of manufacturers who can visit site to inspect completed works with the approval body. It is difficult to know after installation if fire-stopping systems have been correctly installed. Manufacturers are best placed to assess if the work is completed correctly and allowance should be made for the cost of disruptive inspections in order to pay for making good.
- 6.3.2.8 Regular inspections of work should be carried out to ensure conformity to the method statement of the installers and the requirements of the designers.

The above clauses are not exhaustive. Individual sites all have their own specific problems. It is important that there is traceability of installers, components and design decisions. All too often the installation of critical life safety and building safety functions are left to chance. This becomes much less likely when an individual is charged with the task of designing and signing off the complete works. Included in 5.2. is a checklist to help with scrutiny of specification and installation.

It is incumbent upon the person responsible for selecting the systems to ensure that relevant test data exists for the method, materials and components chosen for the damper installation. It is not acceptable to use one manufacturers test data as a generic or industry standard for seemingly similar materials and components.

7 Bibliography

BS ISO 10294-1	1996	Fire resistance tests- Fire dampers for air distribution systems – Part 1: Test method
BS ISO 10294-2	1999	Fire resistance tests- Fire dampers for air distribution systems – Part 2: Classification, criteria and field of application of test results
BS ISO 10294-3	1999	Fire resistance tests- Fire dampers for air distribution systems – Part 3: Guidance on the test method
ISO 10294-4	2001	Fire resistance tests- Fire dampers for air distribution systems – Part 4: Test of thermal release mechanism
BS ISO 10294-5	Under development	Fire resistance tests- Fire dampers for air distribution systems – Part 5: Method of test for intumescent fire dampers
BS EN 1366-2	1999	Fire resistance tests for service installations – Part2: Fire dampers
prEN 13501-3	Under Development	Fire classification of construction products
BS EN 1751	1999	Ventilation for buildings- Air terminal Devices – Aerodynamic testing of dampers and valves
BS 5588-9	1999	Fire precautions in the design, construction and use of buildings – Part 9: Code of Practice for ventilation and air conditioning ductwork
BS 9999 Series	Under Development	Precautions against fire - Codes of Practice
Approved Document B		DETR – 2000
Technical Standards(Scotland)		
Technical Booklet E(Northern Ireland)		
Technical Guidance Document B		
(Republic of Ireland)		
Sheet Metal and Air Conditioning Contractors National Association, USA		Fire, Smoke and radiation damper installation guide for HVAC systems
BSRIA		Detail drawings, project 15761, Fire damper and fire stopping details
DW/144		Specification for sheet metal ductwork
CIBSE		,Guide B2 Ventilation and air conditioning
The LPC Design Guide for the Fire Protection of Buildings		LPC – 2000 (in conjunction with the Association of British Insurers and published by FPA)

Appendix A

Test methods for fire resisting dampers

Background

Until 1997 no specific tests for fire dampers existed. This meant that manufacturers had to test to BS476 part 20 (formerly part 8) to give an indication of how their products reacted when subjected to fire. BS476 part 20 is titled "Fire tests on building materials and structures – Method for determination of the fire resistance of elements of construction (general principles)", and was the best available standard that could be followed, but rather crude for a damper exposed to a potentially higher flow of hot gases.

The method of test thus adopted followed closely the method of test for uninsulated doors where the only suitable method for evaluating integrity was by using the 6mm-diameter rod (additionally 25 mm gap, cotton pad if applicable and sustained flaming). In addition, the dampers were not installed in a duct system; neither were the pressure conditions representative of normal HVAC practice. In addition, dampers were tested typically in brickwork (later in blockwork) and normal weight concrete (later using lightweight aggregates or aerated concrete slabs). Application of such test results was more difficult to apply to actual situations, particularly when considering the effect of high underpressures more typical of air-distribution applications and the higher gas leakage that would be found. There are also practical limitations in using the gap gauge criterion for dampers where large gaps are rare. However, there is plenty of potential for leakage between damper blades, around the perimeter of the damper and, for multi-blade dampers, around the pivot rods as well. Lack of opening and closing test requirements also mean that even the minimum information on durability was not available.

Because of these significant limitations, a method based on testing a damper in a ducted system with integrity based on measurement of leakage was developed. This included a fifty opening and closing cycle prior to the fire test. This was tabled as a proposal by the UK to ISO TC 92 and received much support from other major European countries.

This work was generally completed in 1997 with the start of the publication of the BS ISO 10294 series. This meant that for the first time manufacturers could test to a British Standard specifically written for their products. Indeed, most of the leading manufacturers had been testing to the drafts of this standard since the early '90's to both aid the development of the standard and to determine whether products would meet the new more stringent requirements.

The general view is that historical test data on dampers, tested as uninsulated doors to the criterion of BS 476:Parts 8 or 22, should be viewed with considerable caution and ideally should not be accepted. The principle difference between the original ad-hoc test methods and the EN/ISO tests are tabulated overleaf.

Comparison between test methods for fire dampers

BS 476:Part 8 BS 476:Part 20	BS EN 1366-2 ISO 10294-1,2 and 3
No guidance available for testing fire dampers so ad-hoc methods used	EN and ISO standards available specific to testing mechanical fire dampers
No leakage measurements taken so limited data for end-use conditions.	Leakage measurements essential part of establishing integrity criterion. A more onerous leakage criterion available when smoke leakage considered an important factor.
Dampers not tested in a duct	Requirement is that damper is tested installed in a representative duct. Several different locations of damper in duct covered to represent end-use conditions.
No application rules	Some guidance on field of application rules. More extensive rules being drafted in CEN TC 127

BS 476:Part 8 BS 476:Part 20 (cont.)	BS EN 1366-2 ISO 10294-1,2 and 3 (cont.)
Little relevance to end use conditions	Tests try as far as possible to be representative of HVAC practices with variations such as higher under-pressure conditions being covered as an option for special applications.
No opening and closing test prior to fire test	An opening and closing test is undertaken prior to the fire test. This represents the minimum amount of opening and closing cycles a damper would be subjected to in its operating life.

The work in ISO TC92 was adopted by CEN TC 127, whose main task was to develop a suitable leakage criterion. BS EN 1366-2 was published in 1999. This is a mandated European Standard and states in its foreword that it should supersede any national standards in September 2001. prEN13501 part 3 gives classification details to be used for dampers tested to BS EN 1366-2. The 'pr' designation means that this document is still under preparation although it is referenced in ADB as an undated standard.

Current situation

Although BS 5588: Part 9: 1999 still makes reference to the BS 476: Part 20 series, it also cross references to BS ISO 10294-1, BS ISO 10294-2 and BS ISO 10294-3. BS EN 1366-2 is technically identical to ISO 10294-1 (although earlier tests did not have the furnace temperature measured by plate thermocouple) and ISO 10294-2. However, CEN does not have a commentary document at all so background information has to be derived from BS ISO 10294-3.

Method of test defined in BS EN 1366-2 and ISO 10294-1



The test method prescribed by BS EN 1366-2 and ISO 10294-1 and is essentially the same and, in summary, consists of the following:

The damper (of the largest size to be manufactured as a single section) is installed in a wall, partition or floor in the manner that would normally be used for installation on site

A section of plenum/duct is attached to the damper unit on the non-furnace side. This is in turn connected via measuring stations to a high temperature fan

Prior to the test the damper is subjected to 50 closures in the manner that it would normally close on receipt of a fire signal

The cold leakage of the damper is tested at various underpressures above and below the test pressure (normally -300Pa)

The test is started with the damper open – i.e. it is required to close within two minutes from the start due to exposure to the fire. There is a nominal air velocity of 0.15m/s passing through the damper controlled by the fan.

The furnace is started and the damper having closed, the leakage is recorded from 5 minutes into the test for the duration of the test. Adjusting the fan controls the pressure drop across the damper and this is normally maintained at -300Pa. Not meeting the leakage criterion after 5 minutes constitutes a failure.

The furnace follows the standard fire test curve of either BS EN 1363-1 or ISO 834-1.

The integrity of the joints between the damper and the wall or partition is regularly assessed for gaps etc.

Full details may be found in the standards concerned. A simplified illustration is shown below in Figure 1.

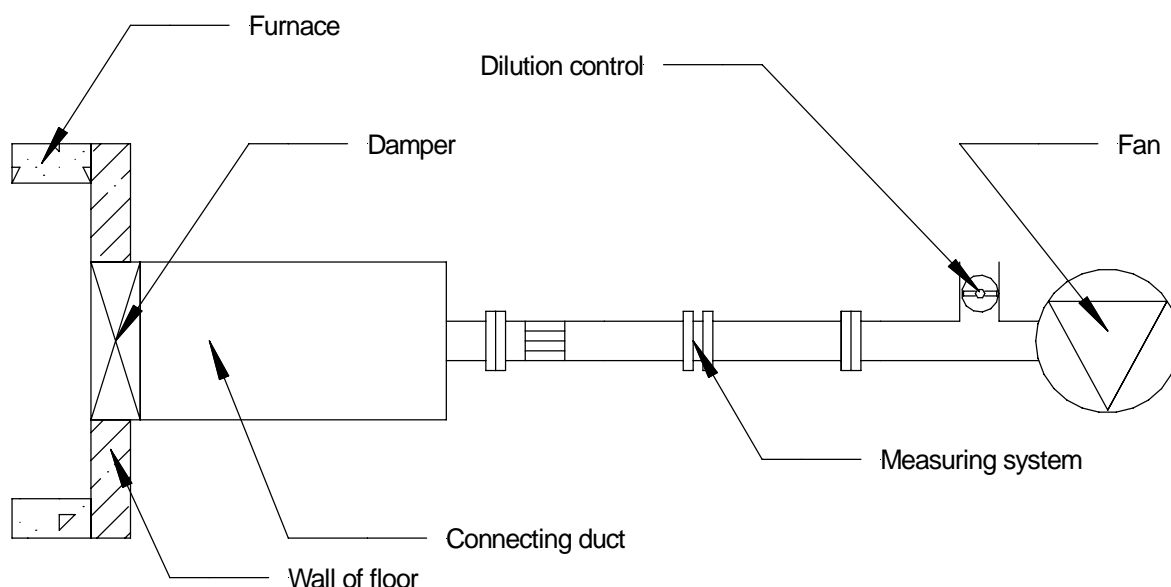


Figure 1 Example of general test arrangement used in ISO 10294-1 and BS EN 1366-2

Classification Criteria

The classification system described in BS ISO 10294-2 and prEN 13501-3 are also essentially the same and, in summary, are as follows: -

Integrity (E) - Leakage during the fire test of less than $360 \text{ m}^3/\text{hr}/\text{m}^2$, 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 $200 \text{ m}^3/\text{hr}/\text{m}^2$ and the same requirement for a 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 might be seen

E240 – Fire damper with integrity of 240 minutes

ES120 – Leakage rated fire damper with integrity of 120 minutes

EIS 180 – Leakage rated fire damper with integrity and insulation characteristics for 180 minutes

The full detail of the classification system may be determined by reading the standards concerned.

Appendix B

Other test methods for dampers

Thermal release mechanisms

Thermal release mechanisms for mechanical dampers can now be evaluated to ISO 10294-4:2001 but currently this standard is not referenced in BS 5588:Part 9:1999.

This test determines if a thermal release mechanism is:

- suitable for a fire damper assembly to be tested according to ISO 10294-1
- suitable for a fire damper already qualified according to ISO 10294-1 with an alternative system of the same class (temperature-load)
- to maintain its performance after the reliability tests

Intumescent fire dampers

A method of test for ducted intumescent fire dampers is currently being developed in ISO TC 92. This is based on the same method of test for mechanical dampers but without the requirement to close at 2 minutes or required to undergo the 50 opening and closing test. This will be published as ISO 10294-5.

The test method includes reliability tests as well as fire tests.

Smoke control dampers

Smoke dampers are available from various manufacturers. There has been an adhoc test set up to prove that the units will operate when subjected to elevated temperature. This is usually 300°C for one hour. The units are heated to 300°C in around five minutes. The time is then started and the damper opened and closed. This operation (open and close) is repeated at 5-minute intervals, with a final cycle started at the sixtieth minute. The test is deemed complete when the unit has successfully completed this final cycle.

Units supplied are generally based on the tested fire damper, but are supplied without a thermal release mechanism due to the fact that the requirement for the damper to close automatically would be in direct conflict with it re-opening to allow smoke to be extracted. Units may be leakage tested before and after the temperature exposure to give details of such performance for system design. For reference, both BSI and CEN are working towards clarification of the requirements and test methods for smoke control dampers. This may involve testing beyond that described above. It will also give guidance on the application of such units. It is envisaged that it will be at least 2 years before this work is complete.

There is no requirement that units that have been subjected to high temperatures and/or smoke conditions should still conform to the specification. It is recommended that any such units be replaced, as their performance cannot be guaranteed for a second time.

Control dampers (aerodynamic testing)

Dampers may be aerodynamically tested to BS EN 1751. This gives details for measuring performance (flow rate/pressure drop), damper blade leakage (with classification), damper casing leakage (with classification), torque and thermal transmittance.

Where classification is defined this is presented graphically within the standard and is too complex to be presented here; reference should be made to the standard.

Before specifying thermal transmittance requirements, reference should be made to individual manufacturers to determine whether products are available that have been subjected to this test.

Please note that fire dampers may be tested using these methods to allow determination of their general performance under standard conditions.

Appendix C

Assessment of test data

General

Both BS EN 1366-2 and BS ISO 10294-2 provide a limited guidance on direct field of application. CEN TC 127 is working on extended field of application, but this will take some time to develop adequately.

It is a condition of both ISO 10294-1 and EN 1366-1 that the largest size damper in terms of width and breadth is tested. Therefore, a request for assessing a larger single damper should not arise.

This extended application standard will identify the parameters that affect the fire resistance of dampers. It also will identify the factors that need to be considered when deciding whether, or by how much, the parameter can be extended when contemplating the fire resistance performance of an untested, or un-testable variation in the construction. It does not cover the effect of the fire damper assembly on the performance of the wall or floor into which it is installed.

The standard will provide the required principles behind how a conclusion on the influence of specific parameters/constructional details, relating to the relevant criteria (E,I,S), can be achieved.

The following have been identified as being applicable to installation rules where further testing will not be required if these conditions are met:

Spacing between dampers

Dampers shall not be installed less than [200mm] apart unless tested closer together.

Influence of fixing damper to supporting construction

- a) Centres between fixings shall not be reduced
- b) Size of fixing shall not be decreased
- c) Alternative fixings may be used if supporting data is available.

Note: The location of fixings also needs to be given consideration

Multiple damper assemblies

- a) Units may be joined as multi-sectional up to a multiple of 4 units using materials of the same thickness as used in their construction. (2X2 or 1X4). Any through gaps should be filled with steel or insulation materials.
- b) Multi-sectional units above 4 individual sections must be installed with supporting rolled steel angle or channel sections of a minimum 6mm thick.
- c) Calculations may be possible to ensure the strength of the supports.

Operating motors

Operating motors can be changed without requiring additional fire tests provided operating time, and thermal response time is the same or less. Output torque shall be the same or greater than that used in the tested damper.

Alternative penetration seals

Alternative penetration seals may be used if supporting fire test data relevant to the application is available. The possibility of some differential movement between the damper, duct and wall, partition or floor should be considered when specifying the most appropriate method of sealing.

Those Seals that are not able to accommodate some movement of the adjacent components should not be specified.

Appendix D

Trade Associations and Research Bodies

The following organisations may provide appropriate advice:

ASFP Association House, 99 West Street, Farnham, Surrey, GU9 7EN

t 01252 739142 f 01252 739140

www.asfp.org.uk

BRE, Bucknalls Lane, Watford, Herts WD25 9XX

t 01923 66 4000, f 01923 66 4910

www.bre.co.uk

BSRIA, Old Bracknell Lane West, Bracknell, Berks, RG12 7AH

t 01344 465600, f 01344 465626

www.bsria.co.uk

HEVAC, 2 Waltham Court, Milley Lane, Hare Hatch, Reading, Berks RG10 9TH

t 0118 940 3416, f 0118 940 6258

www.feta.co.uk

HVCA (Heating and Ventilating Contractors' Association), Esca House 34 Palace Court, London W2 4JG

t 0207 313 4900, f 0207 727 9268

www.hvca.org.uk

IFSA (Intumescent Fire Seals Association), 20 Park Street, Princess Risborough, Bucks, HP27 9AH

t 01844 276928, f 01844 276928

www.ifsa.org.uk

WFRC

Holmesfield Road, Warrington, Cheshire, WA1 2DS

t 01925 655116 f 01925 655419

www.wfrc.co.uk