



Damper Guide – Rev 6 Aug 2017 (Ireland & UK)

1. Why are dampers required?

Large public and commercial buildings generally use Air Handling Units (AHU's) to circulate fresh conditioned air throughout the building via various ductwork sections. It is vitally important that where compartmentation boundaries are penetrated by building services, the fire separation and the performance criteria for the penetrated wall or floor are maintained and, in particular, that all forms of ducting in a building do not become a conduit along which a fire or smoke may spread to other areas.

Wherever the ductwork penetrates a fire barrier, a fire, smoke/fire or smoke damper must be installed. Depending on the size and layout of the building several AHU's may be required. For very large buildings you could have up to 20 off AHU's and 1000's off fire and/or smoke/fire dampers.

2. Types

Fire dampers – rated E (E - integrity {Fire barrier})

Known as curtain type fire dampers. Constructed as a series of interlocking blades, which fold to the top of the assembly against coiled springs on either side of the blade pack, permitting the maximum free area in the airway. The blades are held in the open position by means of a thermal release mechanism rated at 72°C +/- 4°.

The fire damper rated E must be able to close against dynamic air conditions in either the vertical or horizontal planes.

As and from 1st July 2013, fire dampers must be CE marked and fall under the remit of European law, product standard – EN15650:2010 ventilation for buildings – fire dampers. In the UK, the British Standard simply prefixes the EN. Fire dampers must meet a series of tests, see EN15650:2010 tests and the fire resistance test EN1366-2:2015:2015 later in this guide. Classified to EN13501-3:2005.

Fire dampers – rated ES (Integrity and S – smoke leakage {Fire & Smoke barrier})

Known as smoke/fire dampers. Multi-bladed construction, blades rotate to the open position via mechanical linkages and seal against the damper case and blade to blade. The blades are mechanically connected to an electric actuator to provide opening and fail safe spring loaded closing. The blades are held in the open position by means of a thermal release mechanism rated at 72°C +/- 4°. These types of dampers use fail-safe actuators and are normally triggered by heat /smoke detector or a Safeguard Control & Monitoring System.

The fire damper rated ES (smoke/fire damper) must be able to close against dynamic air conditions in either the vertical or horizontal planes.

As and from 1st July 2013, smoke/fire dampers must be CE marked and fall under the remit of European law, product standard – EN15650:2010 ventilation for buildings – fire dampers. In the UK, the British Standard simply prefixes the EN. Fire dampers rated ES must meet a series of tests, see EN15650:2010 tests and the fire resistance test EN1366-2:2015 later in this guide. Classified to EN13501-3.

Fire dampers – rated EIS (Integrity, I - Insulation and smoke leakage)

Multi-bladed construction or single bladed, blade(s) rotate to the open or closed position via mechanical linkages and seal against the damper case and/or blade to blade. The blade(s) are mechanically connected to an electric actuator to provide opening and fail safe spring loaded closing or can be manually closed. The blade(s) are held in the open position by means of a thermal release mechanism rated at 72°C +/- 4°. These types of dampers use fail-safe actuators and are normally triggered by heat /smoke detector or a Safeguard Control & Monitoring System.

The fire damper rated EIS must be able to close against dynamic air conditions in either the vertical or horizontal planes.

As and from 1st July 2013, fire dampers must be CE marked and fall under the remit of European law, product standard – EN15650:2010 ventilation for buildings – fire dampers. In the UK, the British Standard simply prefixes the EN. Fire dampers must meet a series of tests, see EN15650:2010 tests and the fire resistance test EN1366-2:2015 later in this guide. Classified to EN13501-3. Currently, not an Irish or UK building standards requirement and as a result no UK manufacturer offers a product that meets this standard.

High operating temperature smoke/fire dampers

Multi-bladed construction, blades rotate to the open position via mechanical linkages and seal against the damper case and blade to blade. The blades are mechanically connected to a damper actuator with electric opening and fail safe spring loaded closing or electric closing and spring loaded opening. The actuator is encased in a thermal enclosure normally rated to 300°C for up to 2 hours. These types of dampers typically used fail-safe actuators with no fusible links and are triggered by interfacing with a heat/smoke detector or a Safeguard Control & Monitoring System for use in smoke and heat exhaust ventilation.

The high operating smoke/fire damper must be able to close against dynamic air conditions in either the vertical or horizontal planes.

Smoke dampers

Multi-bladed construction or single bladed, blade(s) rotate to the open or closed position via mechanical linkages and seal against the damper case and blade to blade. The blade(s) are mechanically connected to an electric actuator and are triggered by interfacing with a smoke detector or a Safeguard System. These types of dampers use drive open/closed actuators as power is assumed to be available throughout the incident. They can be rated for single or multi compartment use in smoke and heat exhaust ventilation.

The smoke damper must be able to close against dynamic air conditions in either the vertical or horizontal planes.

As and from 1st July 2013, smoke dampers must be CE marked and fall under the remit of European law, product standard EN12101-8:2011.

In the UK, the British Standard simply prefixes the EN. Smoke dampers must meet a series of tests, the fire resistance test is to EN 1366-10:2011 and classification EN 13501-4:2007. Currently, not an Irish or UK building standards requirement and as a result no UK manufacturer offers a product that meets this standard.

3. Standards

Ireland

The Irish Building regulations (TGD-B 2006) are the law. Part B deals with Fire Safety and makes statements like “A building shall be so designed and constructed that the unseen spread of fire and smoke within concealed spaces in its structure or fabric is inhibited where necessary”

Also, the TGD assumes effective management of fire safety and refers to the Irish Fire Services Act, 2003 and the Health and Welfare Act 2005.

Irish Building Regulations and Technical Guidance Documents do little to advise when and where fire, smoke/fire and smoke dampers should be used. Generally, we have to look to the UK Approved Documents, British Standards, HVCA specifications and the Loss Prevention Council (LPC) for some guidance.

Since the introduction of CE marking on smoke/fire dampers (2013) and the Building Control Amendment Regulation (2014) (BCAR) to the Irish market compliant installation of dampers has become a contentious and difficult issue on all sites due to the black & white nature of manufacturers fire tested methods. See 4. Installation.

UK

- Approved Document B - April 2007
- BS9999:2017 - Code of Practice for Fire Safety
- Scottish Health Technical Memorandum 03-01 - Feb 2013
- England & Wales Health Technical Memorandum 05-02 - Apr 2014
- HVCA DW145 - Industry guide for the installation of fire and smoke/fire dampers (not smoke dampers)
- LPC design guide for the fire protection of buildings

Unfortunately, all of these published documents offer guidance, however, fire engineering input is generally required.

Until the latest revision of Approved Doc B was released, the only legislation that was in force to cover how fire and smoke/fire dampers were tested was BS476 Part 20 1987, but since 1st July 2013 this standard can no longer be used and EN fire test standards are mandatory.

The EN standards are joined by the International standard ISO10294-1, which is basically the same as EN except it follows a slightly different time/temperature curve. BS have now adopted both these standards.

EN1366-2:2015 Tests

These latest fire test standards embody much more rigorous test conditions including: reliability, leakage and symmetry, as follows:-

Fire test = Largest single module damper (can be > 1000 x 1000mm) c/w hevac frame mounted vertically in a furnace wall. Test repeated with largest single module damper c/w hevac frame mounted horizontally in the furnace floor.

Integrity E, (rated E) = Largest single module damper fire tested for 120 or 240 minutes with a maximum permissible leakage of 100 l/s m² @ 300Pa corrected back to 20°C. **N.B.** Fire dampers rated E (known as curtain type fire dampers) must meet this test.

Smoke Leakage S, (rated ES) = Largest & smallest single module damper to be leakage tested at ambient with a maximum permissible leakage of 55 l/s m². Also, largest single module damper fire tested for 120 or 240 minutes with a maximum permissible leakage of 55 l/s m² @ 300Pa corrected back to 20°C. **N.B.** Fire dampers rated ES (known as Smoke/fire dampers) must meet this test.

Insulation I (EIS) = must meet ES rating and Insulation requirements, as follows:-

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

The initial average temperature shall be the average unexposed face temperature at the commencement of the test. To pass the test, the average temperature rise on the unexposed face of 140°C with a maximum value of 180°C.

The argument for the insulated blade is that it stops the heat transfer from one side of the damper to the other and hence the possibility of dust/debris on the far side igniting. There are two arguments against this heat transfer.

- If the duct is kept clean then this argument is negated.
- Typically, dust needs to be above 300°C to ignite and to be present in a reasonable volume. To date, Irish/UK high temp damper applications and smoke fans are typically rated to 300°C, so if the temperature rises above 300°C control has been lost. Typically, at this stage the fire is well developed and the building should have already been evacuated.

EN15650:2010 Tests

- Fire resistance testing to BS EN 1366-2
- Aerodynamic testing:
 - Casing leakage to EN1751 (DW144)
 - Blade leakage - BS EN 1366-2 (smallest dampers)
- Corrosion testing to EN60068-2-52
- Thermal fuse testing to ISO 10294-4
- Sound power levels to EN ISO 5135

In 2005, the Building Research Establishment (BRE) took five fire dampers rated E from five separate UK manufacturers and tested them in a normal ducted environment with various Kw rated fires and fans running and then fans off.

One of the most startling results was that with a 500Kw fire burning under the nearest vent to where the fire damper rated E was mounted and with no fan running none of the fire dampers rated E had closed after 20 minutes!

N.B. As a result of the BRE tests and to promote good practice, Safeguard Systems recommendation is to use fire dampers rated ES (smoke/fire dampers) actuated by smoke and controlled by a Safeguard Control & Monitoring System or other appropriately designed system.

This recommendation is also endorsed by the LPC design guide and is one of the changes in the Approved Document B - April 2007

“10.13 – Where the use of the building involves a sleeping risk, such as an hotel or residential care home, fire dampers rated ES should be actuated by smoke detector-controlled automatic release mechanisms, in addition to being actuated by thermally actuated devices”.

BS9999:2017 states that thermally operated fire dampers rated E should not be used to protect escape routes nor in smoke control systems. Also, smoke detector operated fire dampers rated ES (smoke/fire dampers) should be in all occupancy characteristic Cii and Ciii buildings, unless all occupants of the building can be expected to make an unaided escape.

Another pertinent point that designers must consider is the occupants familiarity with their surroundings. In airports, hospitals, hotels etc it is extremely easy to become disorientated especially in an emergency situation. For this reason, hospitals in the UK are also covered by specific “Health Technical Memorandum” (HTM) and it should be noted that since 2010 (Scottish HTM) and 2014 (England & Wales HTM) stipulated that only fire dampers rated ES (smoke/fire dampers) would be allowed in all future hospital projects, except in a few minor applications.

While installers have to be aware of regulations on testing, building owners and managers need to ensure they comply with the UK (England & Wales) Regulatory Reform Fire Safety Order (RRO) 2005.

Even if fire safety itself were not enough of an incentive to comply with RRO, there is also a fine of up to £10,000 for non-compliance; and the responsible person can face two years in prison. The local fire officer can also close down a premises if they are not assured that the rules have been followed.

4. Installation

Wherever the ductwork penetrates a fire barrier, generally walls & floors, a fire damper rated E or ES must be installed. Damper installation must be as per the manufacturers fire tested approved methods to meet CE requirements.

The generally accepted guide is DW145, produced by the heating & ventilating contractors' association.

The effective formed barrier of the damper assembly shall be located within the structural opening. Where this is not possible the section of the casing outside a fire barrier must have a fire resistance not less than that of the fire barrier and be adequately supported/protected against the possibility of displacement/damage by impact.

Damper assemblies must include built-in installation frames to meet the requirements that the integrity of the fire barrier is maintained either by metal to metal contact or by fire resistant packing.

DW145 states:-

- Seven fire tested installation methods
- After 1st July 2012 assessments will not be accepted
- Only damper manufacturer's tested arrangements must be used
- Life safety 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).
- Safe access for future damper maintenance, operation and inspection shall be provided
- Checklists are available from the HVCA website as follows: Design, Installation and Inspection and handover.
- Witnessed handover register to be kept

Approved Doc B states that "Fire dampers should be situated within the thickness of the fire-separating elements and be securely fixed. It also necessary to ensure that, in a fire, expansion of the ductwork would not push the fire damper through the structure".

To meet CE requirements a life safety damper must only be installed to the manufacturers fire tested method. Where the actual on-site installation of a life safety damper due to project specific restrictions or difficulties varies from the manufacturers fire tested methods, a compromise solution must be proposed by the design team and approval sought from the local building control authority, fire engineer or if in Ireland, the assigned certifier as per the Building Control Amendment Regulation 2014.

Safeguard Systems offers an Irish service for non-CE tested installation methods by providing a Safeguard approved installation drawing / detail. Site visits can be arranged to verify installation is to the Safeguard detail and Safeguard can then issue a certificate of compliance. This service provides the construction industry with a solution to these issues.

5. Maintenance & Testing

BS9999:2017 states:-

- Weekly - Smoke Control Systems used for means of escape. Actuation of the system should be simulated once a week.
- Three-monthly - The actuation of all smoke control systems should be simulated once every three months.
- Yearly – Smoke ventilators/smoke control systems and fire dampers
- Maintenance of air conditioning and ventilating equipment, smoke/fire dampers and their controls, is of paramount importance both in preventing fire and in ensuring that measures taken to mitigate its consequences are effective when needed.

- Adequate means of access must be provided to allow inspection, testing and maintenance of both the fire damper and its actuating mechanism.
- Spring-operated fire dampers should be tested annually and fire dampers in dust-laden and similar atmospheres should be tested much more frequently, at periods suited to the degree of pollution.

Misc:- Please note that curtain type fire dampers are practically impossible to test and reset in situ and therefore are rarely if ever tested.

EN standards are being discussed that will make the testing of installed dampers mandatory and therefore this will prevent the use of curtain type fire dampers in most applications.

6. Summary

Although life safety dampers often remain out of sight, they are some of the most important safety elements in a building. Regulations and guidance on these products is complex and adherence is a challenge. However, Safegard believes that by working together, manufacturers, installers and end-users can share information to ensure that buildings and the people in them continue to be safe from the hazards of fire and smoke.