Smoke Control Systems
Dampers – Testing - Access

What is Smoke Control?

- Video 5
- https://www.youtube.com/watch?v=UeGDjKS6xHw

(BSEFSD – K1/2/3/5/6/7/8/9/10/11/12/13/15/16/17/18/21/22)

Smoke Control Dampers

- **Smoke Control Dampers** control the flow (extract) of Smoke and Hot Gases through ducted systems (and also provide compartmentation); enabling occupants to escape and give clearer access for emergency services

(BSEFSD – K1/2/3/5/6/7/8/9/10/11/12/13/15/16/17/18/21/22)

What is the difference between a fire damper and a smoke control damper?

- Fire dampers respond to heat, when the temperature reaches a set point the damper slams shut.
- Smoke dampers respond to the detection of smoke, and close automatically.
- They can also be activated remotely. They resist the passage of smoke, toxic gases and air through a fire barrier.
- Whilst fire dampers function to help stop the passage of fire, smoke dampers work in a similar way to preserve the integrity of physical smoke barriers e.g. floors and walls.
- A combination fire/smoke damper is used when a barrier is both rated for fire resistance as well as designed to restrict the transfer of smoke and will meet both the fire damper and smoke damper requirements.

(BSEFSD – K1/2/3/5/6/7/8/9/10/11/12/13/15/16/17/18/21/22)

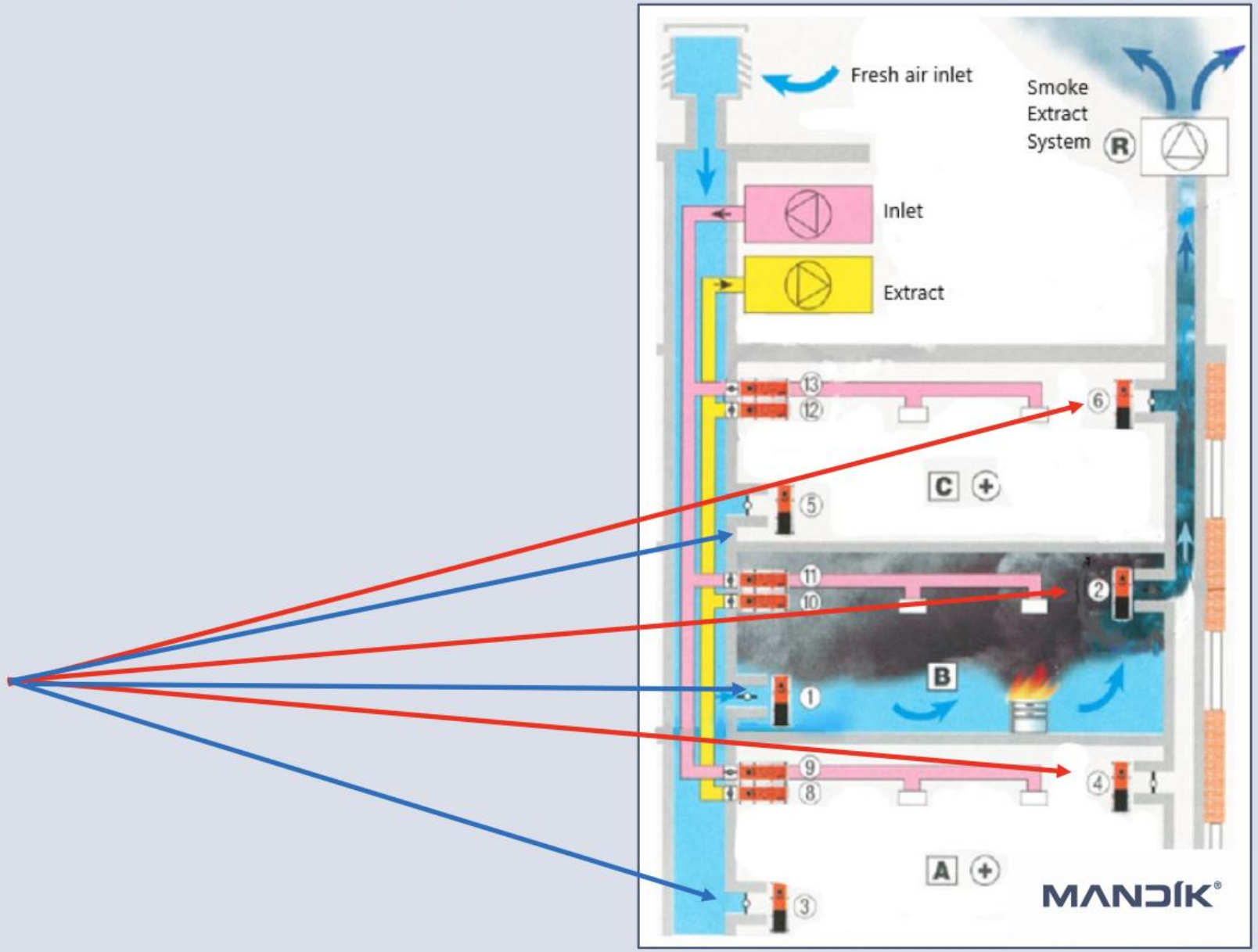
Smoke Control Damper

• 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 a thermal release mechanism, relying on a ‘powered’ control system to ensure that they achieve the correct position.

Smoke Control Damper Operation

- Smoke detectors indicate the area where smoke is detected and send a message to buildings automation or fire alarm systems.
- Fire dampers of the fire compartment will close (if fitted with actuators)
- Smoke control dampers in each fire compartment will move to the cause and effect position
- Fans will ramp up and extraction will begin
- If the make up air fails – extract fails!



How Mechanical Smoke Ventilation Systems Work

- Video 6
- https://www.youtube.com/watch?v=GRnnYJC0zAA&list=PLyst3wvNTOPaHvxafDOJInBuaXymqH_74&index=4

Belimo Safety Solutions (Fire protection scenarios)

- Video 7
- https://www.youtube.com/watch?v=luziw3wyahQ

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THIRD PARTY CERTIFICATION

DUCTWORK SYSTEMS, TYPES & FUNCTIONS

- Mechanical ventilation systems
- Mechanical ventilation systems are used to extract vitiated (Air in which the oxygen content has been reduced) or polluted air from a building and to supply replacement fresh or conditioned air.
- The necessary fans and conditioning equipment are generally located in separate plant rooms, often in a basement or on the roof.
- The distribution of the air involves ductwork which may be very large, extend throughout the building, penetrate compartment walls and/or floors and have openings in every space through which it passes.
- Without suitable fire precautions, therefore, ventilation ductwork can provide a route by which fire, smoke and toxic gases are enabled to spread rapidly through a building.

Smoke extraction systems

- Smoke extraction systems
- Smoke extraction is the evacuation from a building of products of combustion, such as smoke and toxic gases, which could otherwise reduce visibility and impair human functions. This facilitates the escape of the building occupants and assists fire fighters in locating the seat of the fire and extinguishing it.
- In situations where smoke clearance by natural ventilation through windows or other openings may be difficult (e.g. in large or deep basements or in high rise buildings without operable windows) ductwork is required to conduct the smoke to a suitable outlet from the building.
- In cases where the natural buoyancy of the combustion products is not adequate to ensure the required smoke extraction rate through the ductwork, fan assisted systems are used. It may also be necessary to install ducted air inlets as part of the smoke extraction scheme, in order to provide the replacement air.

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Smoke Control Dampers play a vital part in the integrity of Smoke and Heat Control Systems. They are installed into the smoke shaft wall at high level in the corridor or lobby and are controlled automatically to open or closed positions.

On receiving a fire signal, the smoke control system fully opens the Smoke Control Damper on the fire floor to exhaust smoke, while all dampers on all other levels remain closed to resist the passage of fire and smoke.

Smoke Control Dampers used with **Powered Smoke and Heat Exhaust Systems** must, therefore, be able to fully open to allow the extract of smoke and heat and remain closed to maintain compartmentation. Smoke Control Dampers used in this situation must be tested as multi-compartment Smoke Control Dampers and are designated as suitable by the addition of a suffix ‘multi’. In addition the symbols ‘i – o’, ‘ o – I’ or ‘I – o’ indicate whether the damper has been tested from inside or outside or both. To be a multi-compartment damper they must be tested and certified as ‘o-I’.

Smoke extraction systems

Smoke Control Dampers must also demonstrate integrity (E)and insulation (I) in the closed position and be classified in accordance with EN 13501-4 Fire classification of construction products and building elements – Part 4 Classification using data from fire resistance tests on components of smoke control systems.

The insulation and integrity of a Smoke Control Damper should match the fire resistance of the wall into which it is being installed. In the certification, it is declared as ‘EI’ followed by the number of minutes to which it is tested. For example, EI120 declares that the Smoke Control Damper is tested for integrity and insulation for 120 minutes and may be used in a 2-hour fire compartment wall.

If Smoke Control Dampers are to be used in the vertical and/or horizontal installation into a wall they must be tested in this orientation and given the classification of ‘Vew’ and ‘How’ to demonstrate compliance.

Smoke extraction systems

Smoke control dampers must resist the passage of Smoke under pressure and this performance is also described in EN 1366-10 and classified as (S). The addition of ‘500’, ‘1000’ or ‘1500’ indicates the suitability of use under these pressures in Pa.

In addition, the Smoke control damper must also remotely signal both its open and closed position and move to those positions within 60 s of receipt of a signal. The addition of ‘AA’ indicates the automatic activation of the damper by actuators with strength and durability when subject to tests in EN 1344-10.

Smoke Control Damper Classifications

EI 120 (ved vew hod how - i<->o) S 1000 C10000 Cmod AA or MA multi

E = integrity criterion
I = thermal insulation

120 = all criteria fulfilled 120 minutes (E, I & S)
ved vew hod how = installation in vertical/horizontal supporting construction (walls and floors) & duct systems
i↔o = i – fire from inner to outer side, o – fire from outer to inner side

S = tightness against smoke spread – penetration < 200 m3/(hm2)
1000 = test by 1000 Pa pressure
Cmod = 20 000 cycles test open – close before fire test, for modulated actuator

AA OR MA= automatic activation or manual activation
Multi = multi fire compartment usage

Smoke Control Damper Classifications - Recap

When you're looking at a Declaration of Performance for a damper, you should see a 'code' like this:

EI 120 (vew i ↔ o) S 1000 C10000 AA multi

The ***E*** stands for integrity - the ability to withstand fire when subjected to a furnace-mounted fire resistance test.

The ***I*** stands for thermal insulation - ability of a damper to withstand fire exposure without the transmission of fire as a result of significant transfer of heat.

The '***vew***' means that the product is suitable for vertical installation in a wall.
'***Ved***' would mean that the product was suitable for vertical installation in a duct.
'***Vedw***' would mean that the product is suitable for vertical installation in both walls and ducts.

The '***how***' means that the product is suitable for horizontal installation in a wall. '**Hod**' would mean that the product is suitable for horizontal installation in a duct. '***Hodw***' means the product is suitable for horizontal installation in both walls and ducts.

Smoke Control Damper Classifications - Recap

EI 120 (vew i ↔ o) S 1000 C10000 AA multi

The addition of the symbols (***i>o***), (***o>i***) or (***i<->o***) indicate whether the damper has been tested and fulfills the requirements from the inside only, the outside only or from both sides.

The ***S*** means that the damper satisfactorily meets the leakage requirements. The addition of ***500***, ***1000***, or ***1500*** indicates the suitability of use up to these under pressures.

The ***C10000*** means the damper has been tested for 10,000 cycles for comfort ventilation - this means that the damper can be used as part of an environmental cooling system.

'***AA***' stands for Automatic Activation. '***MA***' stands for Manual Activation

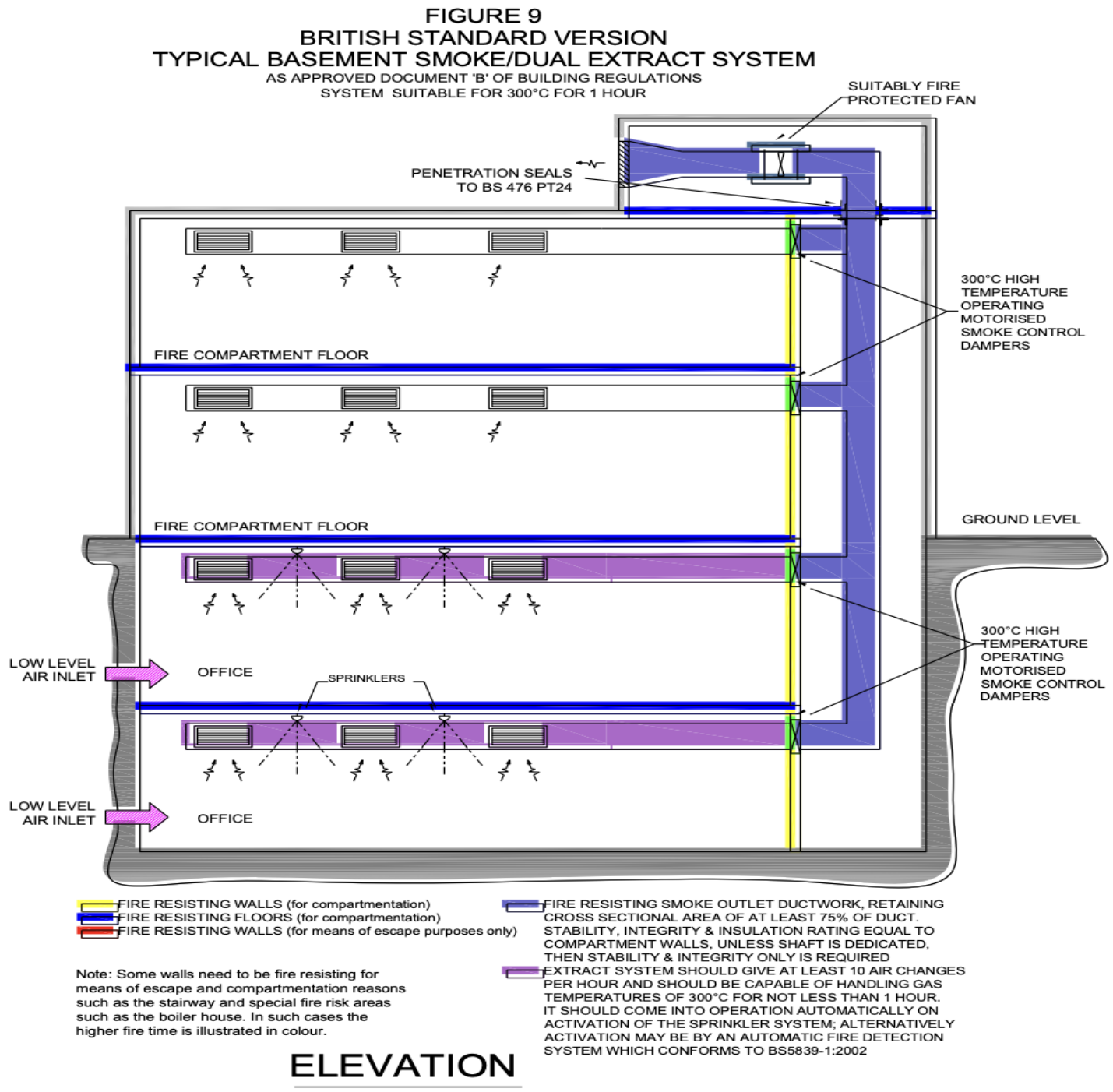
Multi means that the product is suitable for smoke control systems dealing with multiple compartments.

Smoke extraction systems

- If the ductwork incorporated in a smoke extraction system is wholly contained within the fire compartment, it must at least be capable of resisting the anticipated smoke temperatures generated during the development of a fire. These will generally be lower than the temperatures specified in BS 476: Part 24, which are intended to represent a fully developed fire.
- However, if the ductwork penetrates a fire resisting barrier, it must also be capable of providing the relevant fire resistance in a test to Part 24.
- In view of the importance of maintaining the design extraction rates during a fire, BS 476: Part 24 also imposes an additional requirement on smoke outlet/extraction ductwork (i.e. the retention of at least 75% of its original cross-sectional area during the test).

Dual ventilation /smoke extraction systems

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



Pressurisation systems

- Pressurisation is a method of restricting the penetration of smoke into certain critical areas of a building, by maintaining the air within the critical areas at pressures higher or lower than those in adjacent areas.
- It applies particularly to protected stairways, lobbies and corridors, as smoke within these areas would inhibit escape, and also to fire fighting shafts serving deep basements, because of the difficulties in clearing smoke from basements.
- A pressurisation system is a special form of mechanical ventilation system. However, as the air supply creating the pressurisation must be maintained for the duration of a fire, fire dampers cannot be used within the ductwork to prevent the spread of fire. Any duct penetrating fire resisting barriers must be fire resisting.
- BS 9999 Annex B.6 gives guidance on the use of pressurisation in buildings for the purpose of smoke control. An example of a pressurisation system is given in figure 10.

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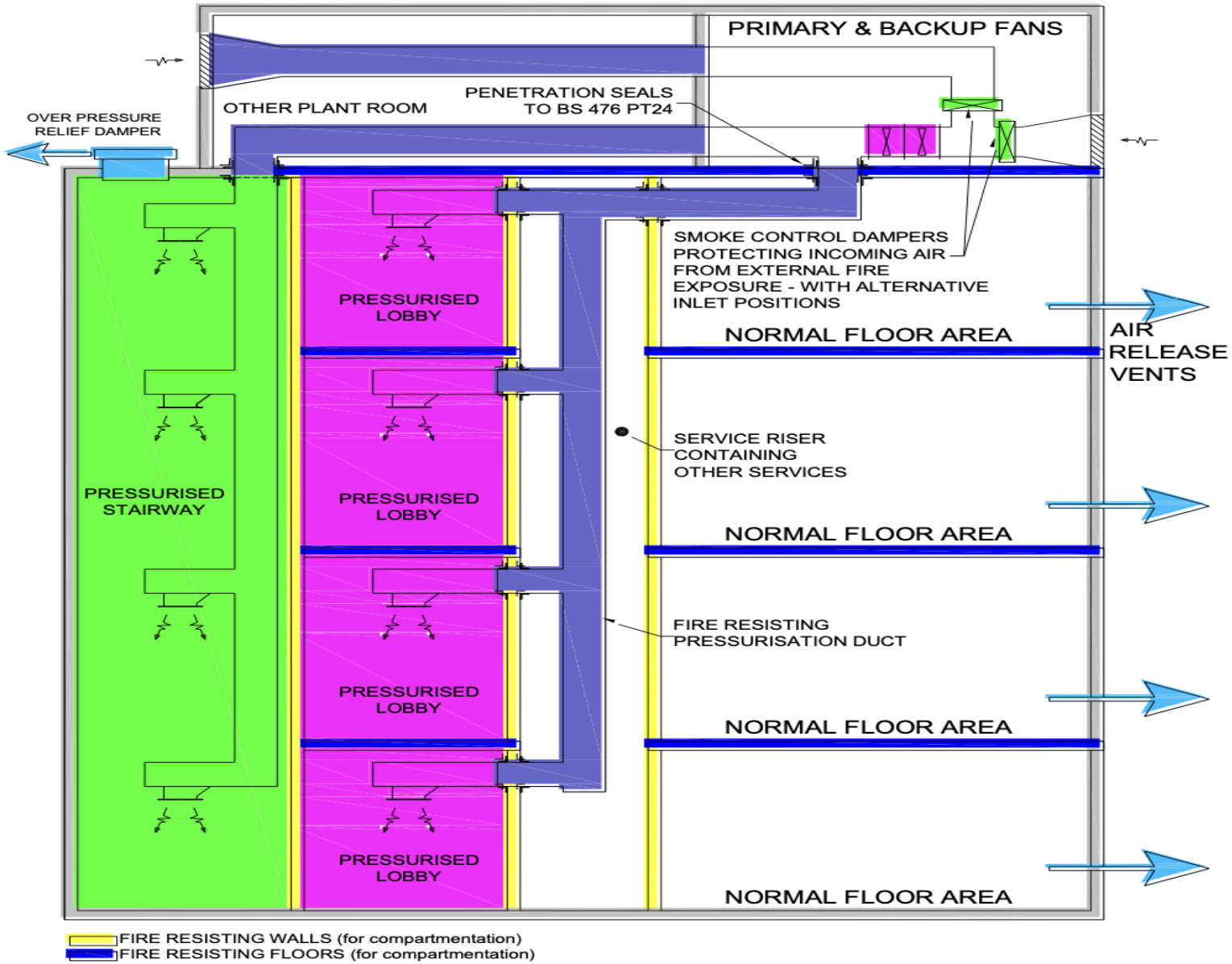
THIRD PARTY CERTIFICATION

FIGURE 10
BRITISH STANDARD VERSION
TYPICAL PRESSURISATION DUCTWORK SYSTEM

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

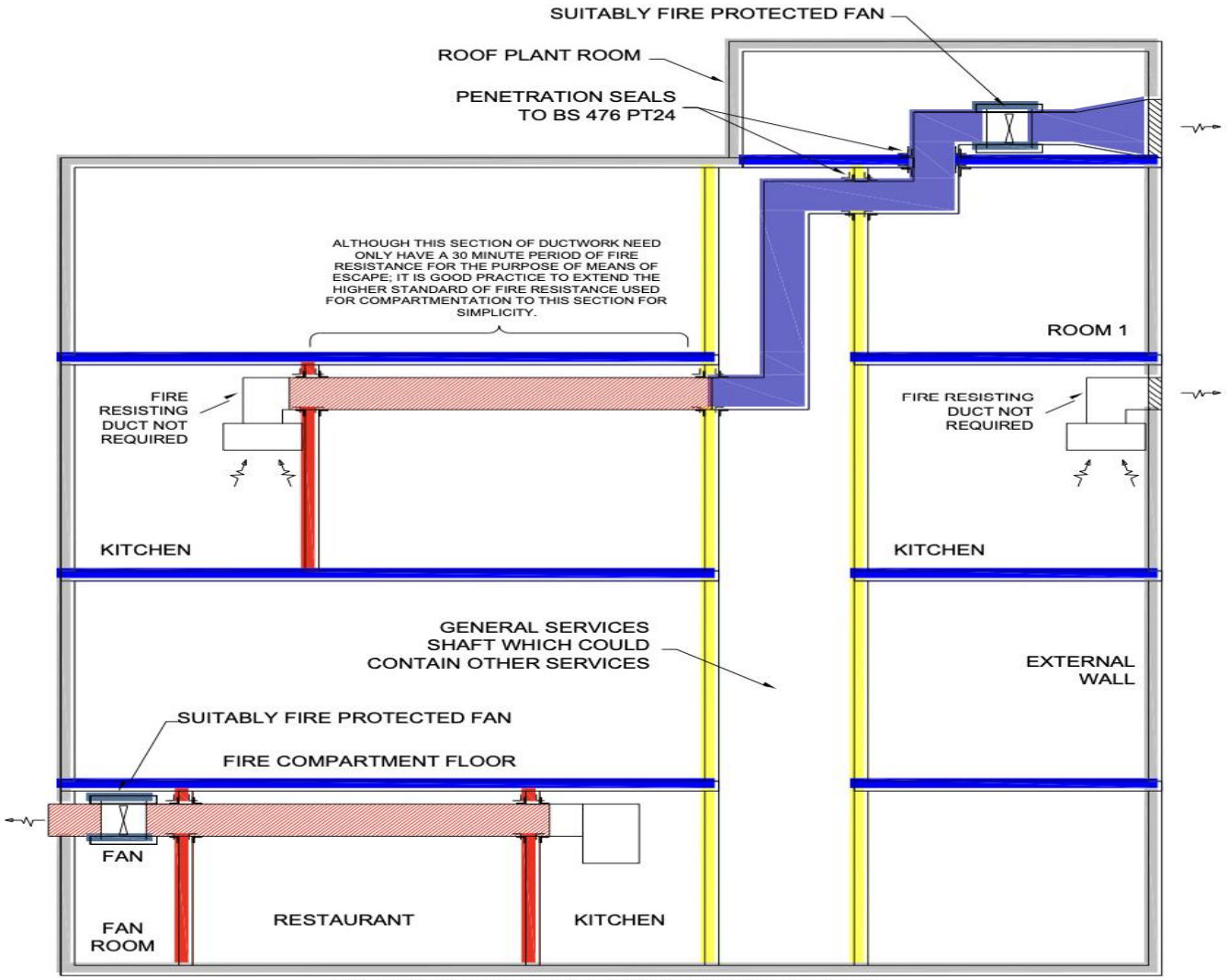


ELEVATION

Kitchen extract systems

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

FIGURE 7
BRITISH STANDARD VERSION
TYPICAL NON-DOMESTIC KITCHEN EXTRACT SYSTEM



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

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

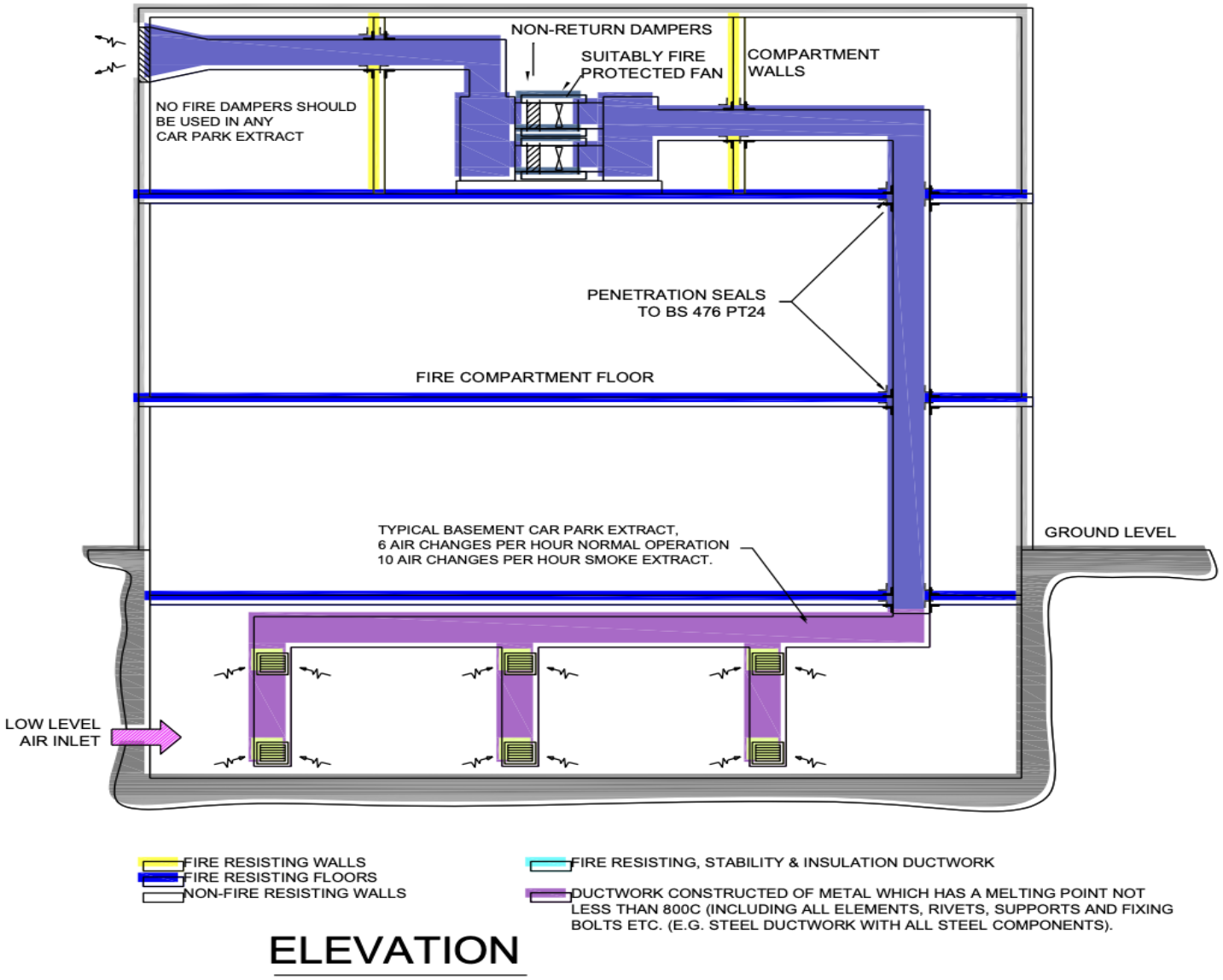
Note: Some walls need to be fire resisting for means of escape and compartmentation reasons such as the stairway and special fire risk areas such as the boiler house. In such cases the higher fire time is illustrated in colour.

ELEVATION

Car park extract systems

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

FIGURE 8
BRITISH STANDARD VERSION
TYPICAL CAR PARK EXTRACT SYSTEM
AS APPROVED DOCUMENT 'B' OF BUILDING REGULATIONS
FANS DESIGNED TO OPERATE AT 400°C FOR 1 HOUR, EACH FAN DESIGNED TO RUN AT 50% OF THE NORMAL AND SMOKE VOLUMES, AND DESIGNED SO THAT EACH FAN CAN OPERATE SINGULARLY AND SIMULTANEOUSLY.



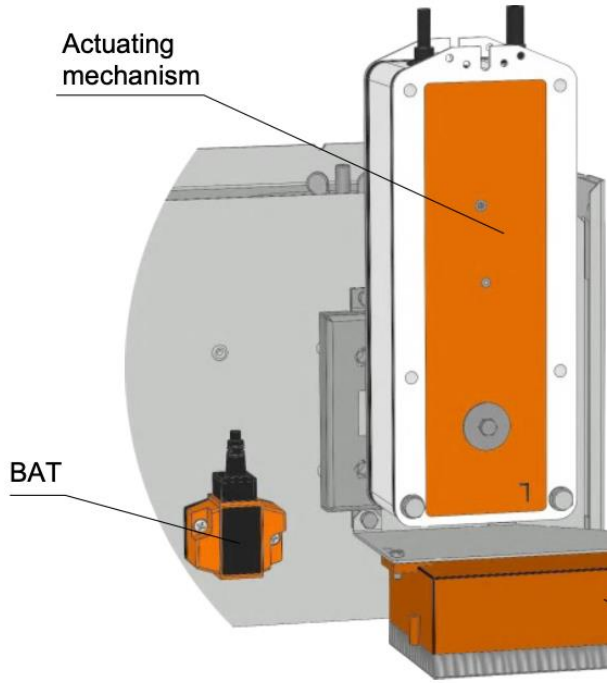
Recommendations for car park extraction ducts

- Figure 8 (previous slide) shows the provisions for car park extraction ductwork as taken from Approved Document B (England and Wales versions). The provision is for ductwork made of metal with a melting point not less than 800OC including other elements such as rivets, supports and fixing bolts.

HVAC Technical | Smoke Test of Basement Ventilation Systems

Wisetech MEP
https://www.youtube.com/watch?v=Lj7j-_9HW_c&list=PLyst3wvNTOPappe4Rrw7UlyY2LfAikpAw&index=3

Video 8



Inspection and Functional Testing

- Before commissioning a damper must be inspected, to determine, and assess its actual condition.

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Access Doors

DW:144 states fire dampers are required to have access either side for cleaning and maintenance as shown in the diagram below:

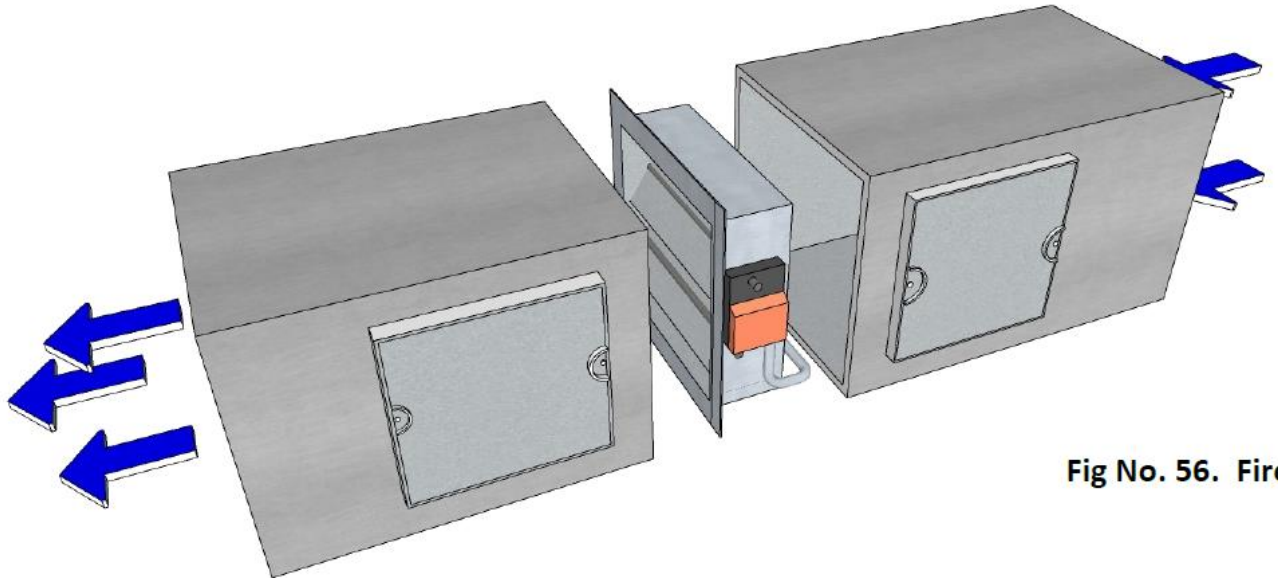

Fig No. 56. Fire Damper

General

Hatches fitted into the duct provide access for cleaning and maintenance.

They are either curved for round duct – although saddles can be fitted – and rectangular doors installed OR square for a square duct.

They must be **airtight** and to the **same integrity or fire rating** as existing ductwork.

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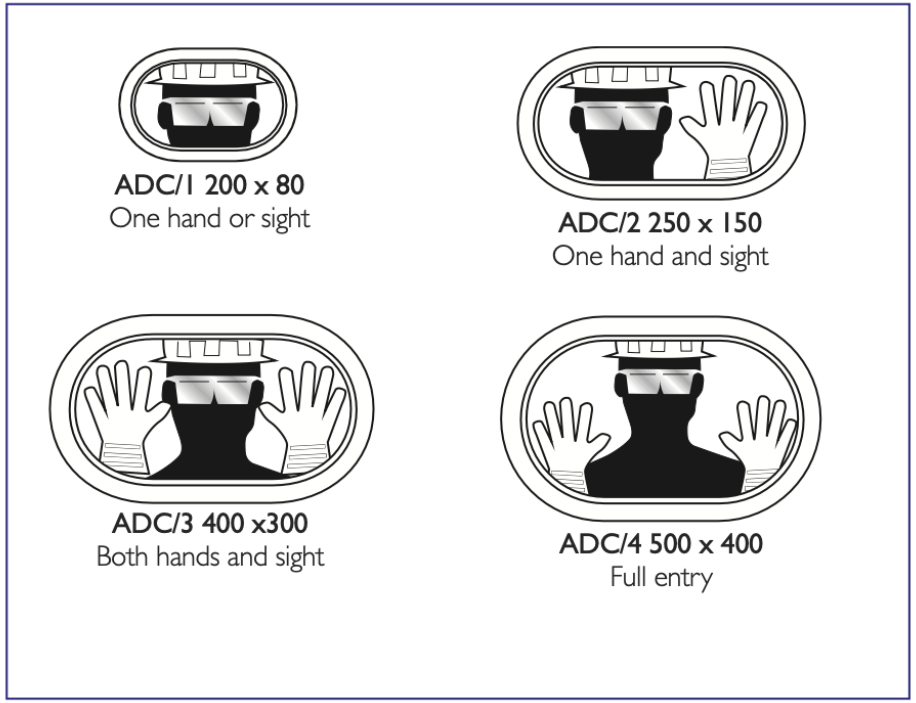
Access Doors

Circular Duct Access Doors

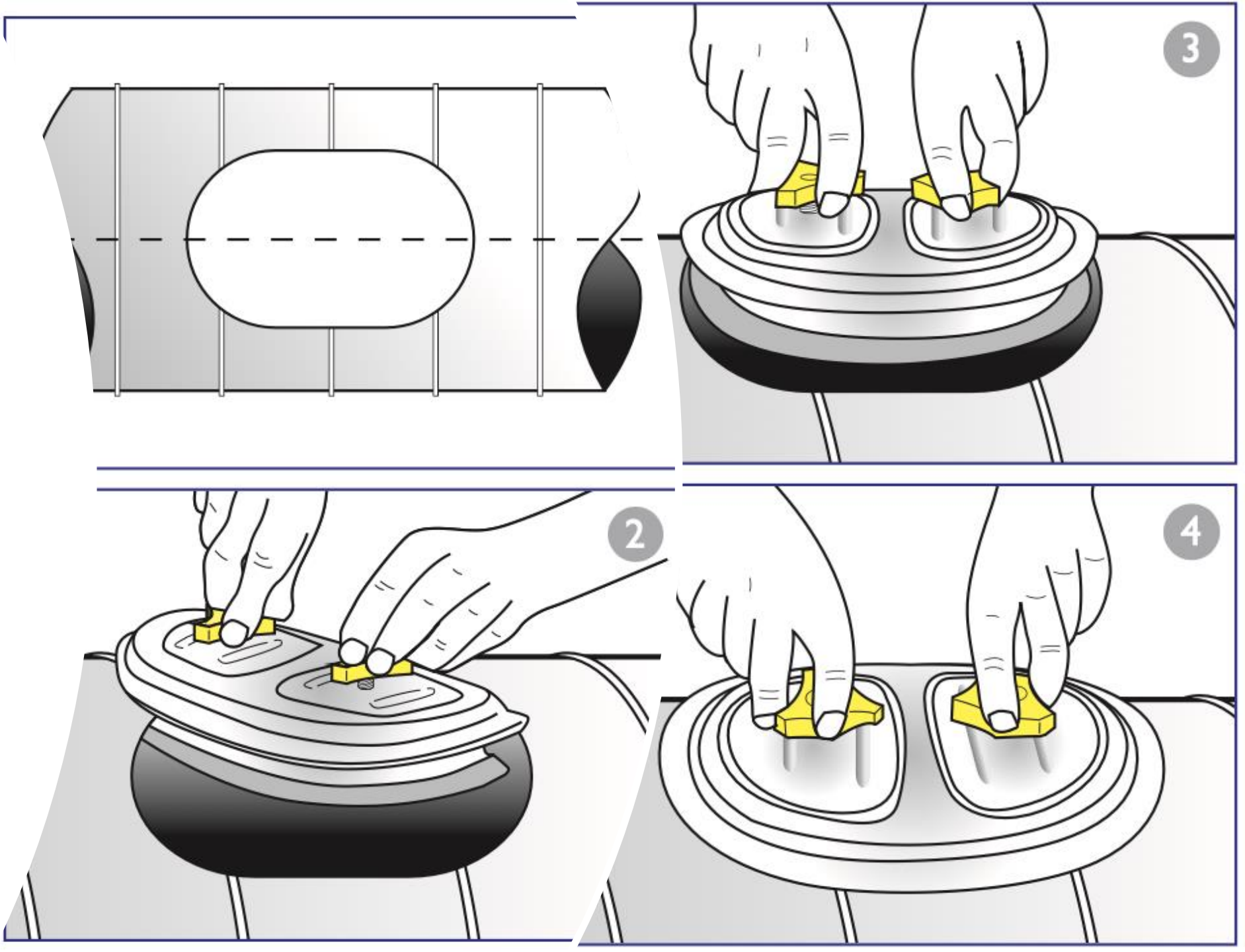
- Fast and simple installation reduces time and costs
- Self-adhesive template allows rapid and simple marking of duct for cutout • Galvanised steel pressing ensures strength and resistance to corrosion
- One joint gasket reduces risk of leakage
- Quick release knobs for rapid removal and replacement
- Captive knobs - no possibility of loss

Size Guide



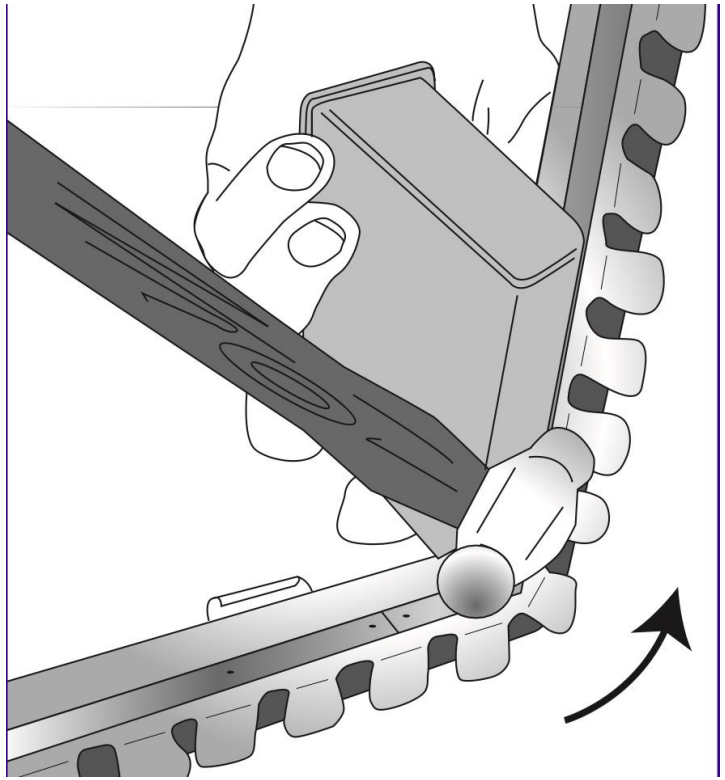
Installation

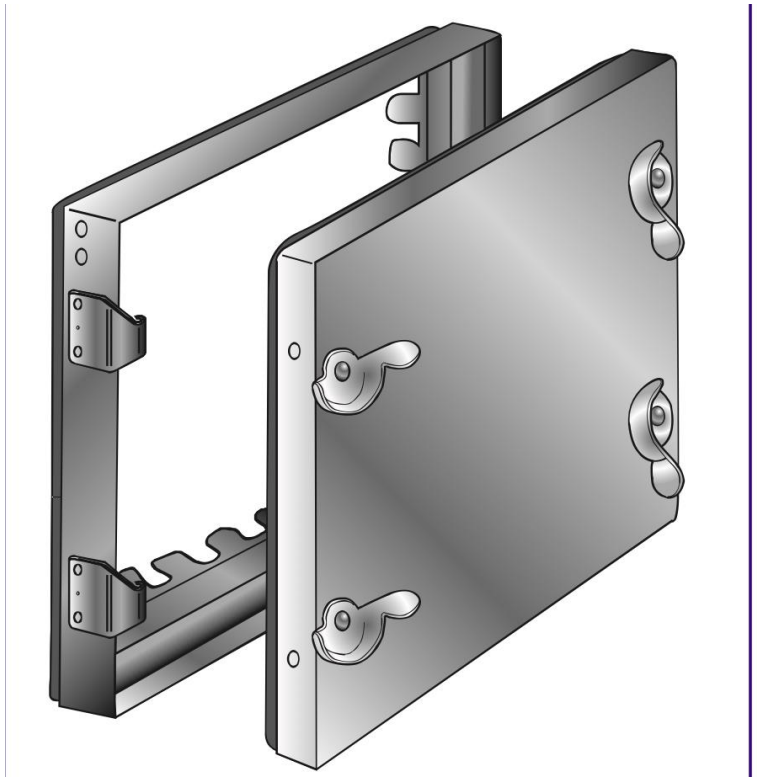
- 1 Mark centre line on duct and attach self- adhesive template to duct ensuring alignment of template with centre line of duct using the blue datum line on template. Cut opening to inside of template.
- Fully slacken captive hand knobs. Feed inner door diagonally through opening at approximately 30° to centre line of duct.
- Centralise door and pull gently to locate inner part into duct.
- Tighten knobs fully.
- (Same for flat oval)



Access Doors

- Door seal meets HVCA DW144 and Eurovent 2/2 Classes A & B • Fire resistance one joint gasket on door as standard
- Double skin insulated construction
- Cam door fasteners for a positive seal (BSB)





As with the Installation instruction, follow the manufacturers inspection directives for inspection. (Here's a brief selection of directives)

- BESA DW145 – (Guide to good practice for the installation of fire and smoke dampers)
- E1 Design Check List
- E2 Installation Check List
- E3 Inspection and Handover Check List
- ASFP – Grey Book, volume 1 (being updated)
- NADD22
- Trox, Mandik, Swegon, BSB, Advanced air, etc. (manufactures)

- The BSEHV06 – NOS for inspection of dampers, BSEFSD Standards now live

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Design Awareness – some considerations

- What damper fire classification is required?
- What damper fire classification is required? – wall, floor.
- From what is the substrate constructed? – Concrete, blockwork, dry-lining
- Has the damper manufacturer been consulted as to the most appropriate type and layout of dampers?
- Is the method tested and approved for the type of barrier that is being protected?
- How is the damper to be independently supported from the connecting ductwork?
- Has sufficient room been allowed for building-in dampers when the entire ductwork, nearby walls, ceilings and services are installed?
- 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?
- Are load bearing supports needed for vertical ducts
- Has adequate space been provided allow for access to dampers for maintenance and testing purposes?

FSD-TD - Inspection and handover check sheet

A brand of MAICO

Project Name:

This check sheet only applies to the BSB Fire and Fire/Smoke dampers.
The installer should complete this handover check sheet to ensure installation is in accordance with BSB installation guides and is compliant before handover.

No.	Question	Guidelines	Confirmed
01	Are the dampers the correct type?	Confirm the damper is the correct type and model.	YES / NO
02	Are the dampers individually correctly identified?	Unique system identification and location reference aids commissioning and must be clearly indicated on the damper or agreed location.	YES / NO
03	Are the dampers located correctly	The damper position shall be checked against the installation drawings/details.	YES / NO
04	Is the installation method tested and approved for the type of barrier that is being protected?	Ensure modifications have not been made to the tested method.	YES / NO
05	Is the damper installed & fixed in accordance with the manufacturers tested and approved method?	Check the damper has been fixed correctly to the fire barrier and is independently supported from the ductwork	YES / NO
06	Have access doors been fitted to the ductwork allowing the damper blades to be inspected?	Access doors are required for commissioning and servicing.	YES / NO
07	Is access through the ductwork, to the damper unhindered?	Unobstructed space shall be provided for safe access to damper. Also consider access through ceiling voids and adjacent services.	YES / NO
08	Is the penetration only used by the damper and not used for the passage of other services?	The presence of other services will invalidate the approved installation method.	YES / NO
09	Using the access opening provided. has the damoer been left in the open position?	Check blade position	YES / NO
10	Is the correct power supply wired to the actuator and power is on? (if motorised)	Check power is on to actuated damper to ensure testing can be carried out	YES / NO
11	Is the Thermal Fuse/link correctly installed?	Confirm fitted correctly to ductwork/damper	YES / NO
12	Have the damper blades been released to simulate failure of thermal release mechanism (damper 'drop test')?	Test button on thermal fuse probe shall be used or fusible link removed to drop test	YES / NO
13	Have the dampers been checked for internal cleanliness and free from damage and debris?	With the damper in the closed position inspect for damaoe and contamination.	YES / NO
14	Have the dampers blades been re-set following the drop test and the access panel replaced?	After re-setting the damper blades, check position of blades to ensure correct.	YES / NO
15	At the time of the damper handover, is the fire damper installation completed in accordance with the above check list?	Damper installer to record, on the register, any incomplete works relevant to the damper installation.	YES / NO
16	Is the damper installation completed and available for handover prior to system commissioning?	Obtain relevant acceptance of the damper installation from the system designer	YES / NO
17	Is the completed handover register cross referenced back to the identification codes listed in the system designer's damper schedule?		YES / NO

Manufacturers Product model(s): .....

Damper Reference I.D: ..... Damper Reference I.D: .....

I the undersigned confirm that the damper referenced above has been checked and is installed to the manufacturers tested installation method.

Company Name: Installers name:

Installers Telephone Number: E-mail:

Installers signature: Print Name:

www.bsb-dampers.co.uk

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.

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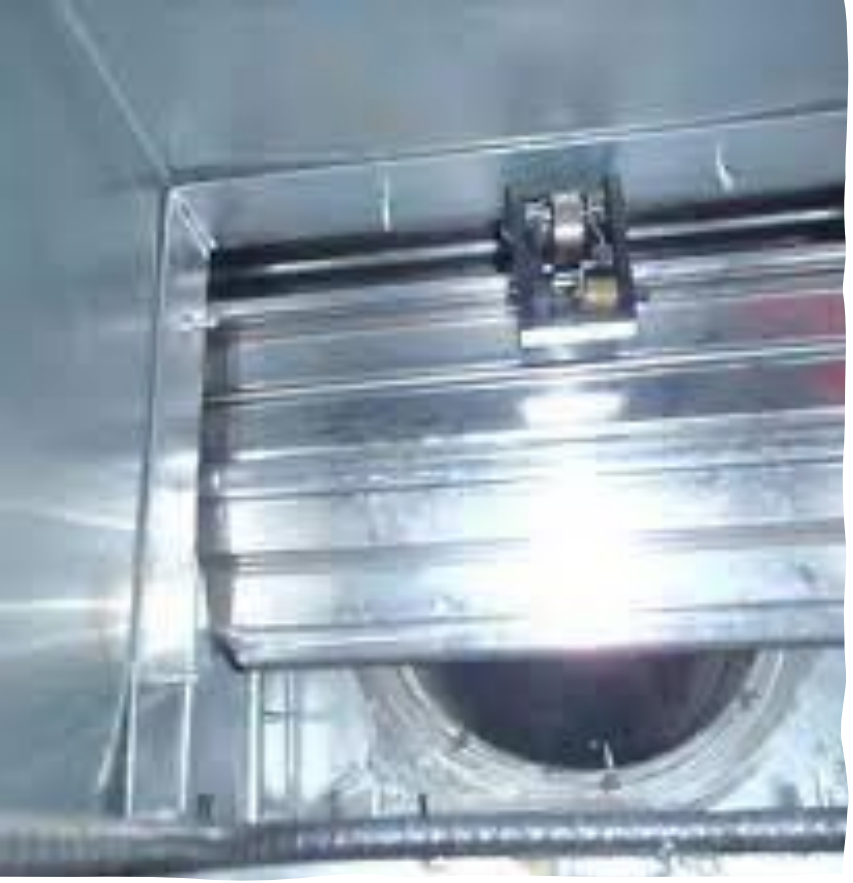


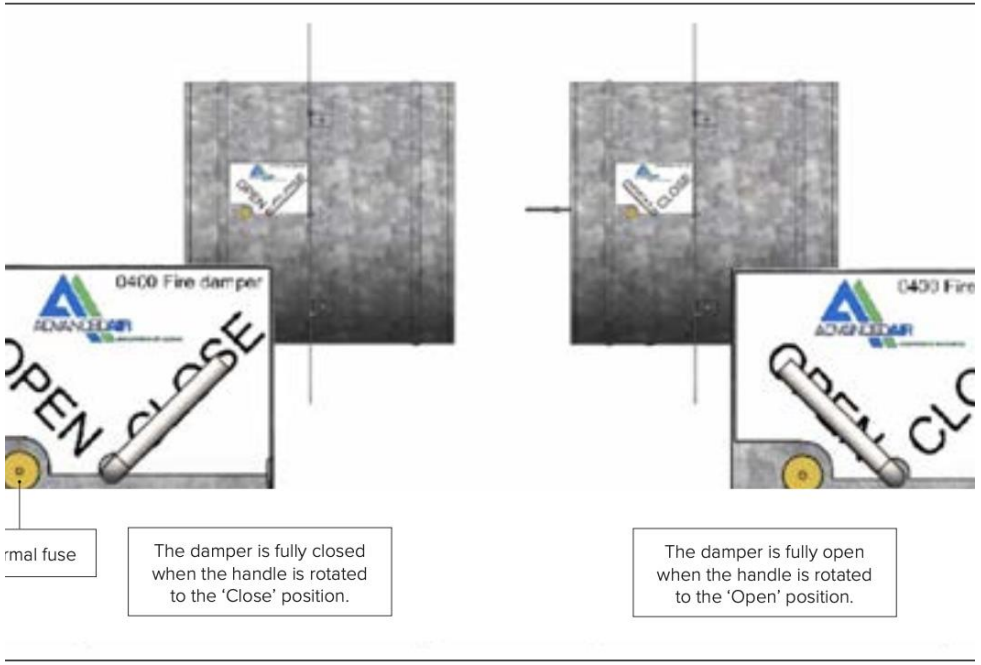
Mechanical fire damper

- **The Drop Test**
  - Clean Galleys of all debris and contaminants
  - Take pre photograph to show pre-test fire damper position
  - Drop the fire damper how it should operate either by removing the fusible link or operating from the MFD control source.
  - Take photograph of the Fire Damper in the closed position
  - Reset Damper and take a photograph in the reset position

THIRD PARTY CERTIFICATION

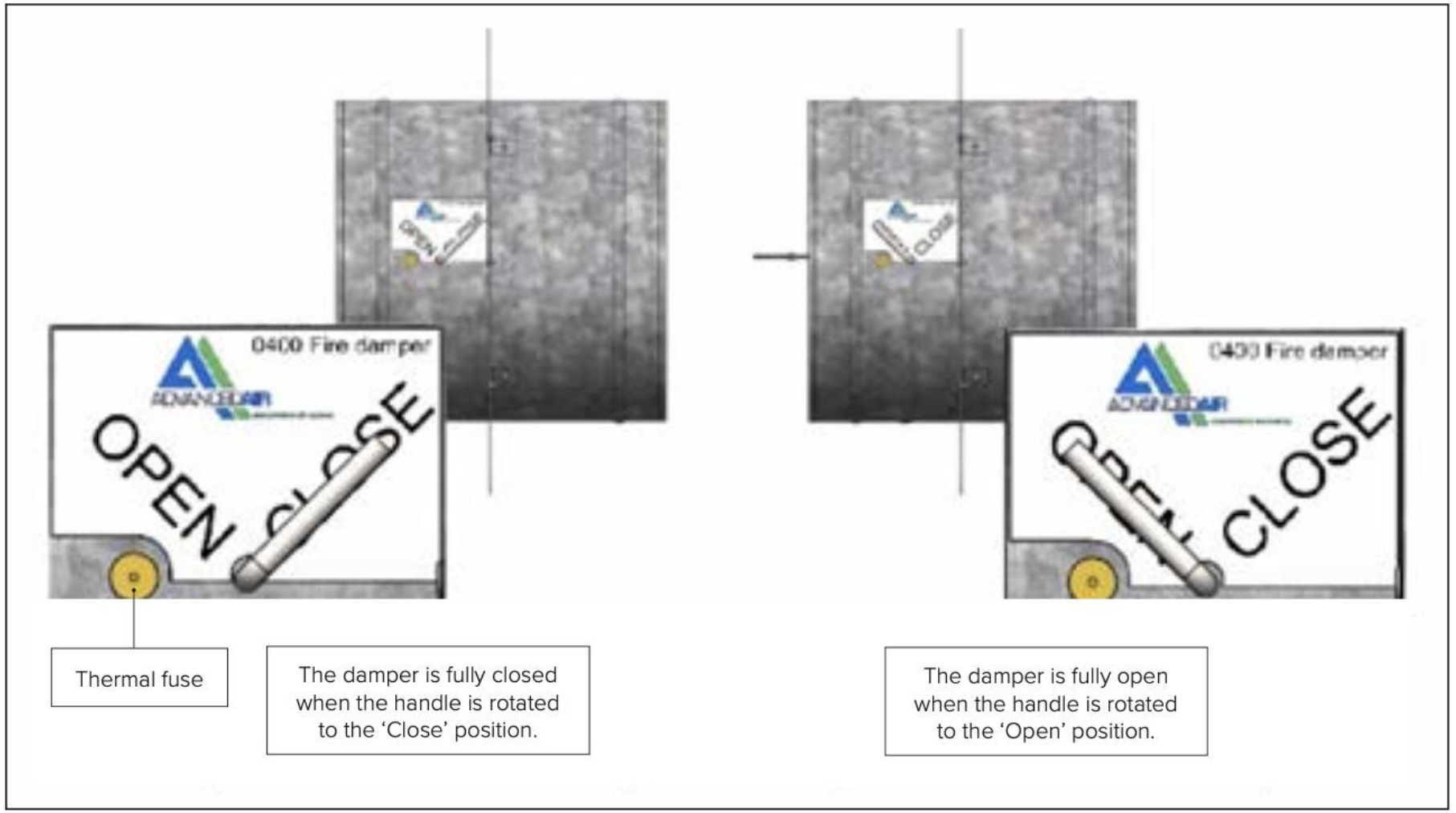
Inspection - 0400MAN – OPERATION AND MAINTENANCE

- **Initial operating check**
- The 0400MAN damper should only be commissioned once the installation has been completed. The damper should be inspected thoroughly to ensure that it is clean and free of any internal debris before the damper actuation is tested as per the following instructions;
- Remove the access door.
- To operate the damper the thermal fuse must be unscrewed, then turn the handle anticlockwise until it is in the open position, as shown on the label.
- The damper blade is under tension from a spring so the handle must be held in position whilst the thermal fuse is re-tightened, the blade will hold in the open position.
- To ensure the damper is operating correctly the damper should be tested by first checking that there are no obstructions to the handle and that it is free to move. Then unscrew the thermal fuse quickly, this will release the blade to its closed position.
- Check that the blade is in the closed position by checking that the handle is in line with the close position on the label.
- If everything is satisfactory then reset the damper to its correct position, either fully open or if it is to balance air then this can be done so long as the damper remains at least 50% open.
- Re-fit the access door.
- If the damper has not closed, the blade may have been incorrectly positioned, or the damper may be faulty. Please contact Advanced Air for advice.



(BSEFSD – K1/5/6/7/9/10/11/13/15/16/19/20/21/22)

Inspection - 0400MAN – OPERATION AND MAINTENANCE



Functional test (Smoke Control Damper)

8.2.1 Manually, on the smoke control damper *The BE, BEE and BEN actuators can be operated without current by means of a crank handle or hex- agon socket spanner.*

- *Fig. 39: Open/Close actuator (smoke control damper is open)*
- 1 CLOSED position
  2 Position indicator
  3 OPEN position
  4 Socket for the crank handle
- Requirement
- The smoke control damper is closed
- 1. Insert the crank handle into the socket (Fig. 39 /4) (the crank handle is clip-fixed to the connecting cable).
- 2. Turn the crank handle anti-clockwise until the position indicator (Fig. 39 /2) shows OPEN (Fig. 39 /3).
- 3. Remove the crank handle.

Manually close the smoke control damper.

- Requirement
- The smoke control damper is open
- Insert the crank handle into the socket (Fig. 39 /4) for the spring-winding mechanism (the crank handle is clip-fixed to the connecting cable).
- Turn the crank handle clockwise until the position indicator (Fig. 39 /2) shows CLOSED (Fig. 39 /1).
- Remove the crank handle.

Manually open the smoke control damper.

(BSEFSD – K1/5/6/7/9/10/11/13/15/16/19/20/21/22)

Cleanliness Levels also play a key role in the functionality of the fire dampers as heavily laden and contaminated ductwork can allow the fire to spread through the compartments before the fire damper has the chance to reach activation temperature. Even then the fire might have the opportunity to pass through the fire damper if it cannot lock into the locking guides correctly. **(BSEHV11)**

- This Ductwork will not allow the damper to function in the correct manner and will not contain the spread of fire between compartments

Recap

Follow the law, follow the standards, follow manufactures guidelines, follow codes of practice.

As the standards demand *“Know the limitations of your OWN competence”*

If you’re unsure ask, keep studying, learning, and developing

Video - 9
Slide – 277 – Fire Dampers, Fire and Smoke Dampers, and Smoke Control Dampers
https://www.youtube.com/watch?v=uBXXcThe3zY&list=PLyst3wvNTOPaHvxafDOJInBuaXymqH_74&index=6

Recap

- The engineering requirements for the installation of fire and smoke control dampers is actually straightforward, jointing methods, cleats, brackets, fixings, nuts and bolts.
- Follow the given specification, information and communication between all stakeholders.
- Follow given practices and procedures.
- There are defined legal industry competence requirements for all individuals to achieve.

- Thanks for your time.

THIRD PARTY CERTIFICATION

Question Paper