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Aldes ME Flash

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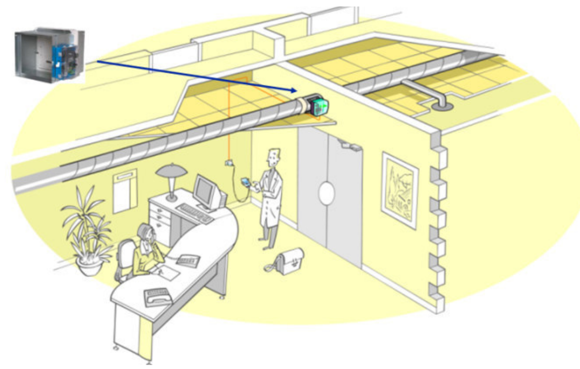
Technical Information

How to ensure a safe compartmentation?

Basics of Compartmentation



Definition:
A **fire compartment** is defined as an area of the building which is totally separated from the rest of the building by continuous construction. This area could be a single room or a series of rooms or even an entire floor area.

Objective:
To **subdivide a building into fire compartment(s)** to isolate the fire at birth in a small volume and to limit spread of **fire, smoke & heat** through HVAC ductwork.

How to do:
Fire dampers shall be installed in fire separating walls and floors **to prevent fire** and **to reduce smoke & heat spreading from one fire compartment to another** through HVAC ductwork.

Fire Damper

A fire damper is a device, installed in an air distribution system with blades open and designed **to close automatically upon detection of heat** or **close through remote signal from fire alarm panel** in order to interrupt the airflow and to restrict the passage of flame, smoke and heat. Fire damper can be manual or motorised.

1. **Manual fire damper*,*** typically also known as curtain fire dampers, close automatically via melting of fusible link when temperature exceeds temperature rating of fusible link.

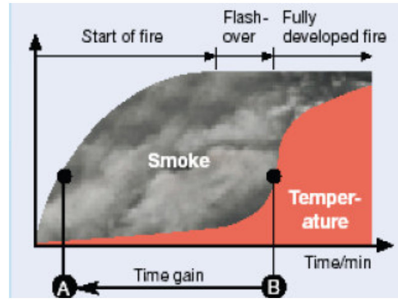
2. **Motorised fire damper** is connected with Fire Alarm Control Panel (FACP) and Building Management system (BMS). It can be closed through remote signal from FACP in early stage of fire upon detection of smoke (to avoid spread of cold smoke to other areas through HVAC ductwork). It is also equipped with fusible link or Thermal Responsive Device (TRD) to close automatically on detection of heat → **dual safety.**

Open
(Normal position)

Close
(Safety position)

1st priority: Limit the spread of smoke through HVAC ductwork

At the start of fire, smoke develops rapidly as compared to the rise in temperature. As this smoke is cold, ***manual fire damper*** will not close automatically and smoke could easily be spread through the HVAC ductwork to other areas of the building.



Few examples of fire incidences in the History:

1st example: MGM Grand Hotel fire in 1980 – Smoke inhalation

According to the "Investigation report on the MGM Grand Hotel fire – Las Vegas, Nevada - November 21, 1980 (Best and Demers 1982)" available on NFPA website, *"the HVAC systems operated during the fire and contributed to smoke spread through the high-rise tower. The equipment was not equipped with smoke detector arranged to shut down the systems upon sensing products of combustion. In addition, some fire dampers were arranged so that they could not close when the fusible links melted and others did not close completely".*

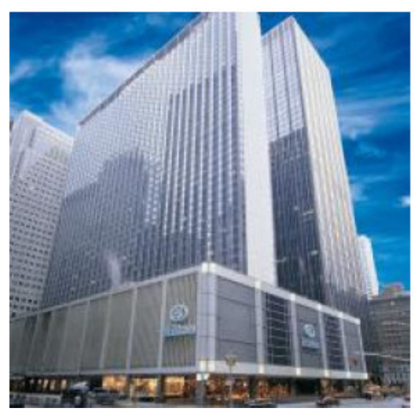
Consequently, *"the fire was limited to the first floor, but smoke spread throughout the building. Some occupants on upper floors were exposed to smoke for hours before rescue. The death toll was 85, and the majority of the deaths were on floors far above the fire."*

Source: Design of smoke management systems, J. Klote J. Milke, ASHRAE Special Publications, 1992

2nd example: Hilton New York hotel fire in 2005 – Smoke inhalation

"A fire in an electrical shaft at the Hilton New York hotel forced the evacuation of the 45-story Midtown building, sent 33 people to the hospital with smoke inhalation [...]. No one was seriously injured. The fire started about 4 p.m.[...]. The smoke spread rapidly throughout the 2,017-room hotel through the ventilation system. Hotel guests from the 8th to the 33rd floors said that the hallways were thick with smoke".

Source: http://www.iklimnet.com/hotelfires/case52.html



Conclusion:

To **stop the smoke propagation** through the HVAC ductwork shall be the **first priority** of any compartmentation system with quick activation through a smoke detection system.

Therefore, **fire dampers** shall be:

1. **Motorised with a quick or instantaneous (1s) operation** via a fire alarm control panel (FACP) connected to smoke detectors.

2. **Airtight at low as well as high temperatures** to stop propagation of smoke, preferably with intumescent seal to seal gaps.

3. **Installed in a HVAC system with fan shut-off** quickly after the start of the fire.

2nd priority: Stop flame heat transfer

Principle causes of ignition and fire spread inside ducts

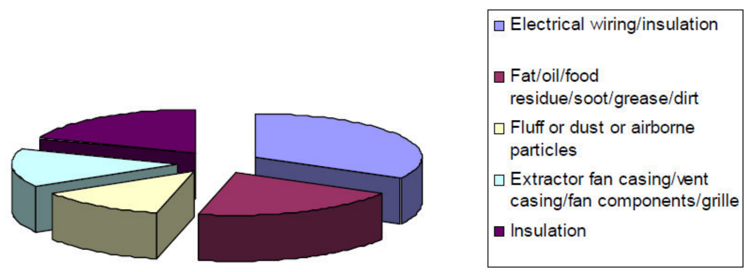
From the report "*Examination of the fire resistance requirements for ducts and dampers*" made in 2005 in UK by *Building Research Establishment* (BRE):

→ Fluff, dust, food residue, grease contents inside ducts can have an impact on both fire ignition and fire spread inside the HVAC ducts.

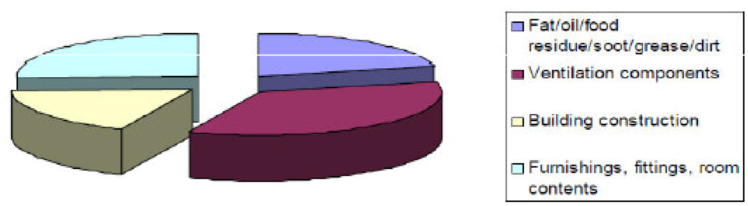
→ **Heat transfer through fire dampers (even with blades in close position)** could ignite any fluff or dust on the opposite side, and then spread the fire throughout the building.

The main danger due to the heat transfer comes from the **pyrolysis of any material and dust.** For example, the pyrolysis of a piece of wood starts at 200℃, and the **pyrolysis of the products (gases...) starts to burn (with flames) between 500℃ and 700℃** leading to the fire propagation**.**

Principle causes of ignition involving HVAC systems
LFB data



Principle contributors to fire
LFB data spread of fire in ducts



Conclusion:

To prevent flames and heat transfer from one compartment to another shall be the **second priority** of any compartmentation system.

Therefore:

1. **Fire damper blades** should be **made of refractory material** to **avoid heat transfer** to the unexposed side of the damper.
2. **No flame** should be allowed to transfer to the unexposed side through the closed damper.

UAE Fire Code:

Below is an extract from the new UAE Fire Code (Chapter 10), which also explains that a fire damper should not only stop flames but should also ensure no smoke leakage and no heat transfer, especially in sensitive buildings.

"10.6: Fire dampers** used in any **sensitive buildings** as healthcare facilities, hotels (i.e. occupancy with sleeping risk), education buildings, and any buildings where habitable height exceeds 23m shall be controlled by an automatic alarm initiated device, and **shall ensure no smoke leakage** and **no heat transfer."