

Better Safety, Better Life!

When HVAC fire protection issues inside buildings really matters!

► Fires in the UAE

Fire hazards within buildings are still a global concern, especially in the UAE where more than 2000 fires occur annually. These fires are caused essentially by accidental human factors (60%) and technical failures (40%). Such fires result in deaths, injuries and/or damages which form real threats for all locals, residents and tourists in the UAE. For this reason, **preventive** safety against fire hazards and disasters has become a major strategic objective in the Dubai Civil Defence strategic plan 2009-2015.

► Need for Fire protection: Preventive Safety

Safety is a key subject that needs to be addressed not only by UAE authorities (civil defence), but also by developers, consultants, and contractors in order to ensure a maximum level of safety for all buildings presently under construction or already built.

If **sustainability** can be considered as a positive trend taking shape slowly in the UAE to promote efficient green buildings (via effective water and waste management, energy consumption ratings, indoor environmental quality etc.), **quality and safety** need to be further prioritised by the different construction bodies in the UAE. The quality & safety standards of building construction are still quite low in the UAE. This is due to various factors such as cost reduction, lack of regulations, minimum specification requirements by consultants, poor labour skills, and disregard towards specifications by actual contractors. As a direct result, the UAE has faced structural collapses affecting some buildings or car parks under construction. But if these collapses constitute tangible and visible proof of bad quality of structural construction, a low level of quality and safety is also affecting the thermal insulation, the HVAC systems... and the **fire protection systems** which are really critical in case of fire.

► Critical Nature: People, Building destruction & Environment

The first issue is that fire can pose a real tragedy for a country by **endangering its people** (family, children, people with disabilities, tourists and fire fighters) with deaths and injury often the result. As the value of life is priceless, there should be no cost issues in bringing the best level of safety to a building. The key danger for people caught in a fire comes mainly from smoke inhalation, which can be managed efficiently through ...



Figure 1
A winning triptych ensuring a valuable and efficient building

...proper compartmentation of structural areas plus an efficient smoke management system.

But, what is a fire? Fire is the combination of flame and smoke caused by the combustion of gases occurring at high temperatures. The flame is the visible part of the fire which attacks and burns materials. Smoke is made of combustion gases. The resulting toxic and opaque fumes prevent people from breathing and affect the visibility required to escape a building. This creates panic. At high temperatures, the large volume of smoke generated by the fire creates high pressures with convection movement. As a direct result of this, fire can spread quickly and unpredictably throughout surrounding areas if there is a lack of efficient compartmentation and no smoke management systems in place.

To effectively deal with the possible dangers caused by fire, the European Committee has developed different standards based on the following nomenclature for “the resistance to fire performance of construction products, construction works” (eg: fire dampers, smoke dampers, ventilation ducts in HVAC...):

- E: Integrity (no damage to flame)
- I: Insulation (no heat transfer)
- S: Smoke leakage (no smoke leakage)

The second issue resulting from a fire can be the **destruction of a building** or similarly parts of the building if effective compartmentation has been implemented. This destruction has a tangible cost for insurance companies, developers and even owners/tenants. In this case, it is essential to limit the spread of flame, smoke and heat via

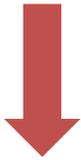
efficient compartmentation, with “EIS” fire dampers, and to fight the fire with water (sprinkler systems) to notably reduce its intensity and spread.

A fire can also cause damage to the **environment** given the large amount of combustion gases emitted into the atmosphere during a blaze.

► Impacts on MEP/HVAC systems

There are **four key priorities** in protecting people, buildings and the environment during a fire:

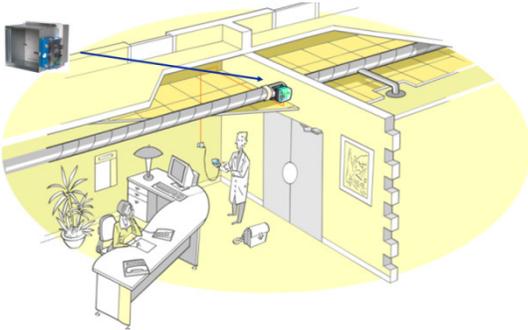
- 1- Limit the spread of the fire (flame, smoke, heat)
- 2- Let people escape the building safely
- 3- Fight safely the fire to avoid damages
- 4- Limit the impact on the environment



1. Compartmentation
2. Smoke management system
3. Fire fighting system

► Compartmentation

An efficient **compartmentation** is fundamental to ensure a minimum level of safety inside a building. The main objective is to subdivide a building into fire compartments to isolate a fire as soon as it starts and to limit the spread of flames, smoke & heat throughout the existing AC ductwork.



It is critical that there be **no smoke leakage** and **no heat transfer** for **2 hours** through any fire dampers. This means an efficient sealing system (for eg. intumescent seal, use of sealant...) and quality refractory blade material (for eg. calcium silicate) must be in place. These fire dampers should be **motorized** to ensure instantaneous operation via a fire alarm panel connected to smoke detectors. The key objective is to avoid any leakage of cold fumes through the blades of the fire damper before the potential activation of a mandatory thermal trip or fusible link at 72°C. In the European EN 13501-3 classification, these fire dampers are classified **EIS 120**.

Moreover, to ensure energy savings and achieve a better sustainability, motorized fire dampers should be operated under an electric signal emission and not by a power cut.

Too many curtain fire dampers (CFD) are still used in the UAE even though their performance is really poor: smoke leakage through openings, heat transfer, and late activation only when the temperature reaches 72°C.... The authorities, developers, consultants and even contractors should be more concerned about these issues, especially on great projects such as the Masdar Institute of Sciences and Technology where so much emphasis is put on sustainability. Safety should come first – after all, a building on fire is not sustainable at all!

Curtain fire dampers should be replaced by the more efficient fire dampers described above in any **new buildings** and especially in any **sensitive buildings** (for eg. high-rise buildings, hotels, schools, hospitals) with occupancy with potential sleeping risks.

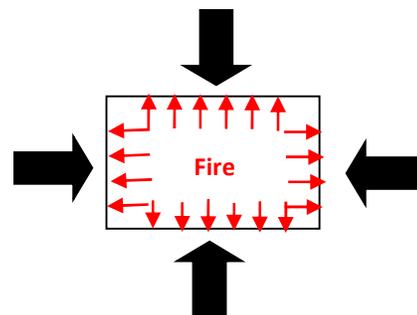
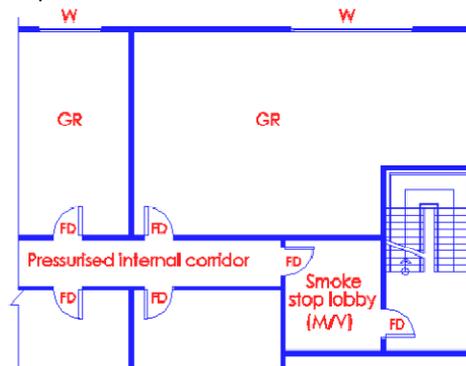
► Smoke management systems

The management of smoke is best done by controlling the high pressure of smoke generated directly by the fire. This allows people to escape safely via fire exits. The way smoke spreads is by moving from areas of high pressure to areas of lower pressure, in an attempt to find a balance.

Consequently, there are two main ways to manage smoke:

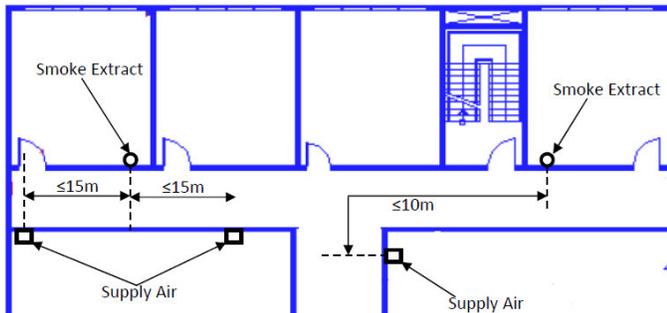
* **Pressurization:**

The objective is to create a higher pressure in opposing areas (for eg. staircases and corridors) of the fire compartment to avoid any smoke passageways, even if a door is opened.



***Natural/Mechanical Smoke Extraction (Corridor Smoke Control):**

The objective is to create a low pressure point in a corridor (opening through a smoke exhaust damper) to create a controlled smoke passageway. The goal is to extract the most smoke and combustion gases in the early stages of a fire in order to keep the escape and access routes free from smoke and gases.



The basic smoke extraction system is made by one vertical riser supplying outdoor air through an air inlet located close to the floor, and one other vertical riser that extracts smoke via a smoke fan through a smoke exhaust damper located close to the ceiling. The goal is to create a **smoke free area** (stratification) in the bottom area of a corridor to allow a safe escape, and to keep smoke in the upper area of the corridor before being discharged outside.

These two systems have two different strategies. Whereas the pressurization system is fighting (with the support of a sprinkler system) against the high pressure of smoke generated by the fire by creating a higher pressure, the advantage of the smoke extraction system is to control the amount of smoke and heat not by fighting against it, but rather by working together with its flow and leading the spread of smoke and heat towards safe exhaust openings.

This is a key advantage for smoke extraction system considering that **fire behaviour is nearly always unpredictable and uncontrollable**. By supplying fresh air and exhausting smoke and heat close to the fire location, a **smoke extraction system reduces the dangers** for fire fighters due to an under-ventilated fire (for eg. flashover, backdraft). In turn this dramatically **eases the fire-fighters' operations** by reducing the temperature and increasing the visibility within the building. Even if the burning rate may increase due to the supply of fresh air, the smoke extraction system creates a "safer" environment by controlling the fire spread and intensity. This benefits both the victims and the fire fighters during the early stages of a fire.

► Conclusion

Dubai Civil Defence with the support of the Government of Dubai is heading in the right direction by implementing a **fire code** in the near future. This fire code will address all the main fire protection issues to give a tangible framework for all consultants and contractors in the UAE. Both compartmentation and smoke extraction issues will be dealt with in accordance to the American and **European standards**. The publication of this code will be a great achievement towards bringing better safety standards to Dubai and as a result, creating a better city for a better life. As the UAE has been participating in the Shanghai World Expo 2010 - whose motto is "**Better City, Better Life**" - the UAE and the Government of Dubai are demonstrating once again with this new fire code that they are fully dedicated to improving the quality, sustainability and safety of buildings to bring to all locals, residents and tourists the safest living conditions.

From this new and positive regulatory framework to the existing construction sites, there is obviously a big gap that needs to be bridged. An efficient training programme, helpful support to consultants and contractors from the authorities, and the intensification of site inspections, should enforce a correct implementation in the UAE market, and considerably upgrade the level of safety in the UAE.

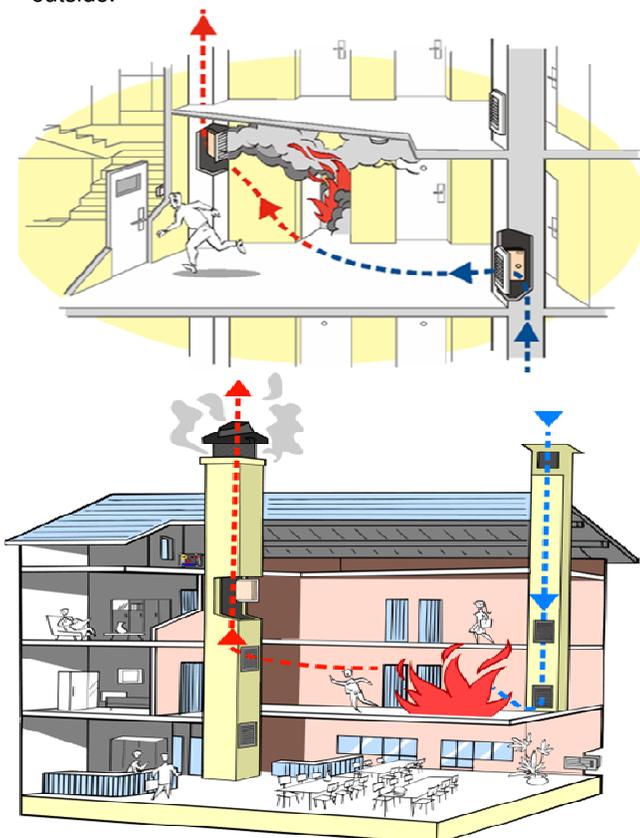


Figure 2 & 3
Example of a European mechanical smoke extraction system