

## DESIGN BASIC

### GENERAL

BASIC is a self-acting backflow prevention damper that prevents the spread of fire gas between fire cells via supply air ducts. It is designed specifically for type FT(X) ventilation systems in apartments, hotels and sheltered accommodation, etc. BASIC requires that fans are operating in the event of a fire.

- Type approved by RISE, TG 0016/05
- Fire tested by FOI
- Unique patented design

BASIC contains no moving parts such as damper blades, bearings, springs, and does not need to be connected electrically or electronically. This provides a high degree of automatic operating reliability. BASIC has successfully undergone a long-term test consisting of more than 10,000 closing cycles while still maintaining its function.

### CONDITIONS

#### USE:

To prevent the spread of fire gases via the supply air system

#### SYSTEM TYPE:

Intended for FT AND FTX systems. Operation: Fans must be in operation throughout the course of the fire.

**Construction:** The supply air duct to each fire cell is equipped with a BASIC backflow prevention damper. The exhaust air system is dimensioned to allow the evacuation of fire gas.

#### SYSTEM FUNCTION:

**Supply air systems** – The system requires that supply air fans are in operation throughout the course of the fire. In the initial stage of the fire, BASIC closes the supply air duct due to the fire pressure in the burning fire cell. This prevents the fire gas from spreading to other fire cells via the supply air system. Backflow prevention dampers in the other fire cells are not affected.

**Exhaust air systems** – The system requires that exhaust air fans are in operation throughout the course of the fire. Fire gases from the burning fire cell are evacuated via the exhaust air system.

#### INSTALLATION OPTIONS:

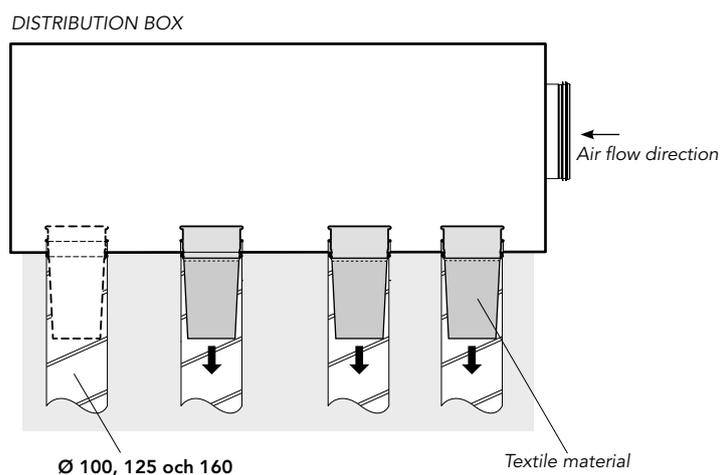
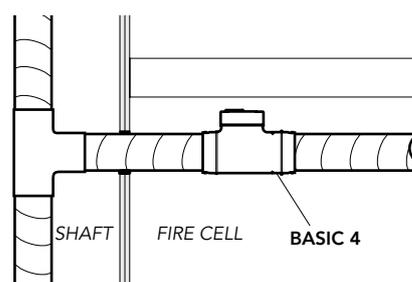
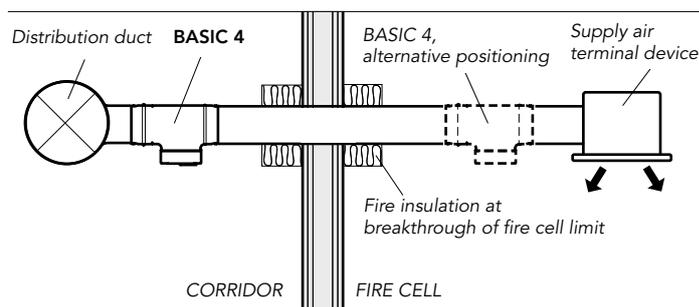
Exhaust air system with a distribution duct in the shaft between several floors. BASIC 4 can be installed in the shaft or in a served fire cell. Any branches are installed between the backflow prevention damper and the supply air terminal device.

See system solutions **Figure 4, page 2**.

Exhaust air system with a distribution duct in a corridor on the same floor. BASIC 4 is installed in the corridor or in a served fire cell. Any branches are installed between the backflow prevention damper and the supply air terminal device. Measures should be taken to prevent the spread of fire at the breakthrough in fire cell limit.

Exhaust air system with separate ducts to each fire cell in combination with a distribution box in the attic. BASIC 2 is installed.

See system solutions **Figure 6, page 4**.





### FT(X) – SYSTEMS WITH COMMON DISTRIBUTION DUCTS TO MULTIPLE FIRE CELLS

BASIC is installed in connection ducts (supply air) in shafts or in rooms. Fans can be positioned above, below or level with the served fire cells.

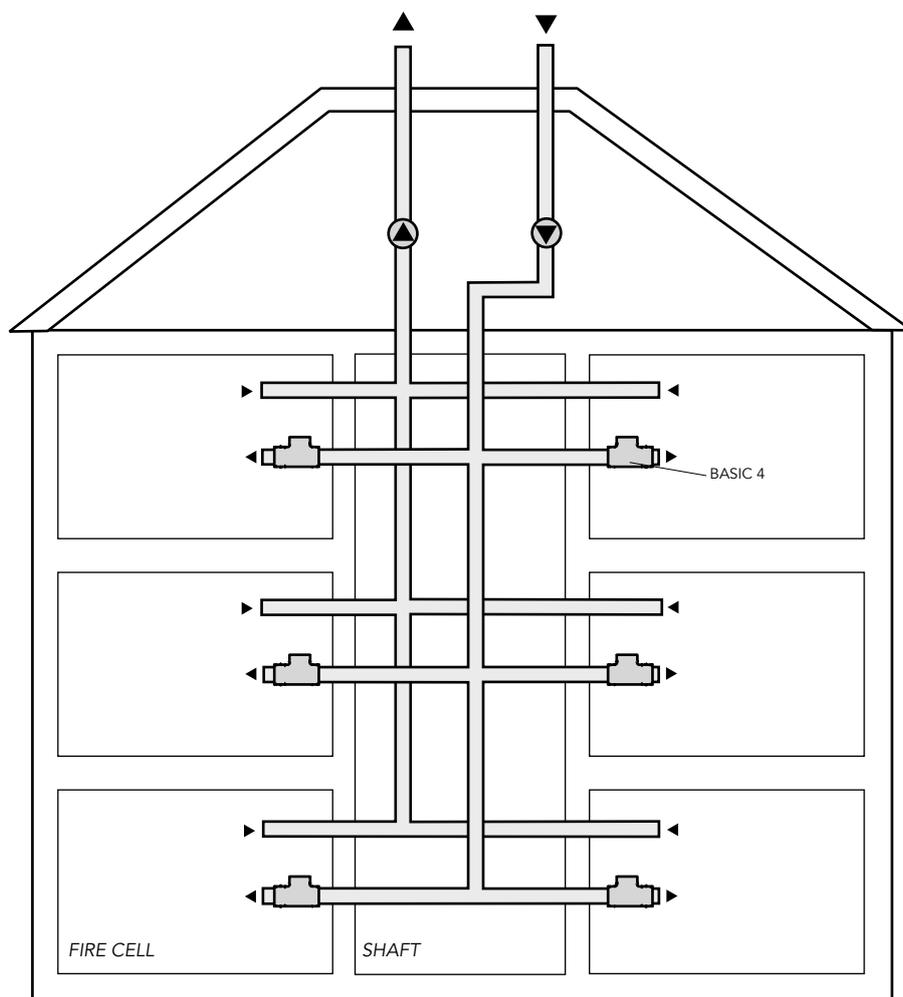


Figure 4

#### SECTION

*BASIC 4 is recommended in this installation, i.e. in a sealed casing with an opening inspection cover. BASIC 4 is positioned in shafts or in served fire cells adjoining the shafts.*



### FT(X) – SYSTEMS WITH COMMON DISTRIBUTION DUCTS TO MULTIPLE FIRE CELLS ON THE SAME FLOOR

BASIC is installed in connection ducts (supply air) in corridors or in rooms. Fans can be positioned above, below or level with the served fire cells.

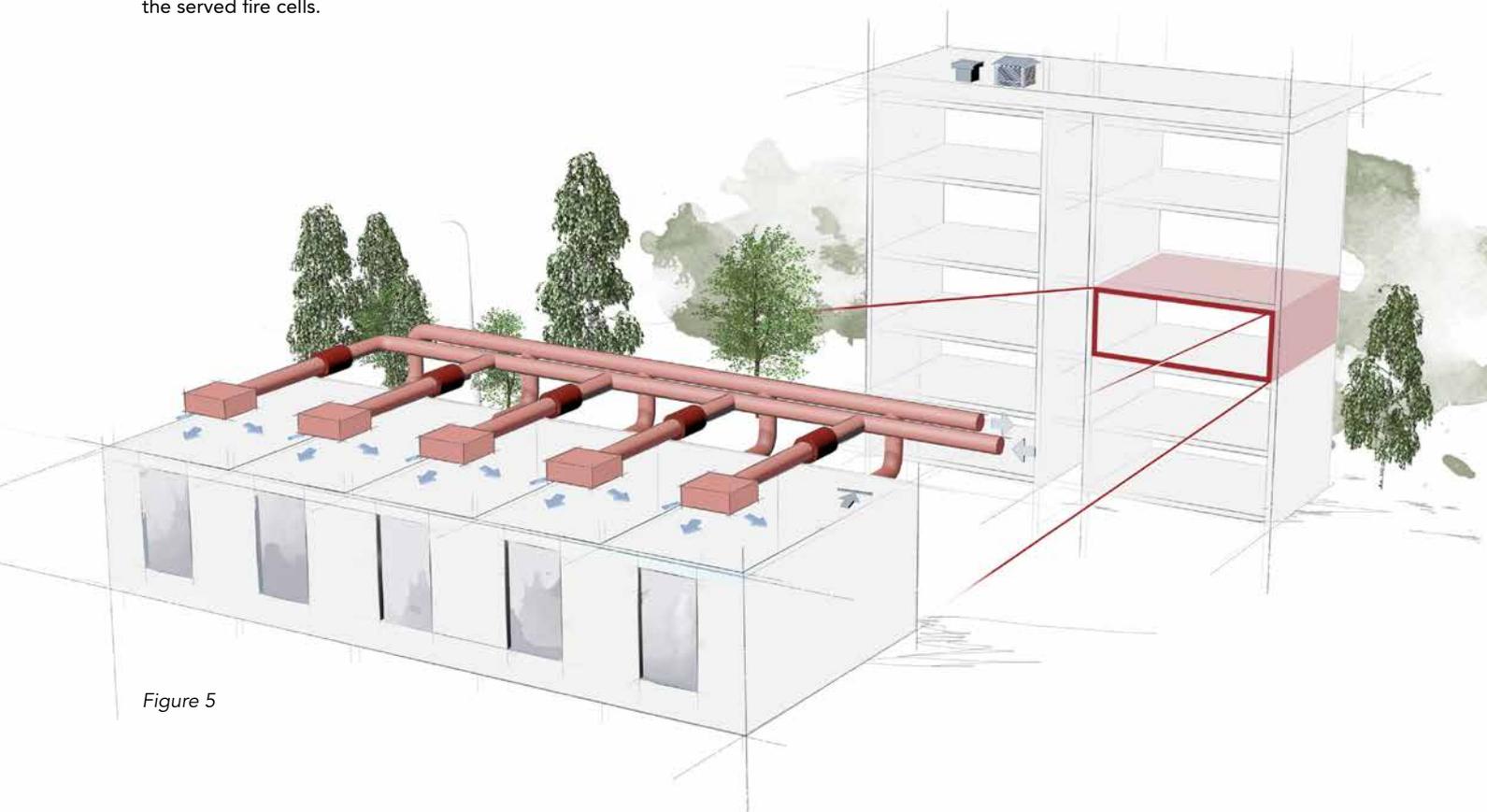


Figure 5

BASIC 4 can be positioned in corridors (separated escape route in hotels, sheltered accommodation, etc.) or in served fire cells.



**FT(X) – SYSTEMS WITH SEPARATE DUCTS TO EACH FIRE CELL**

BASIC 2 is installed in distribution boxes (supply air) in the attic. It is also possible to install the distribution box in the cellar with an upward air flow direction.

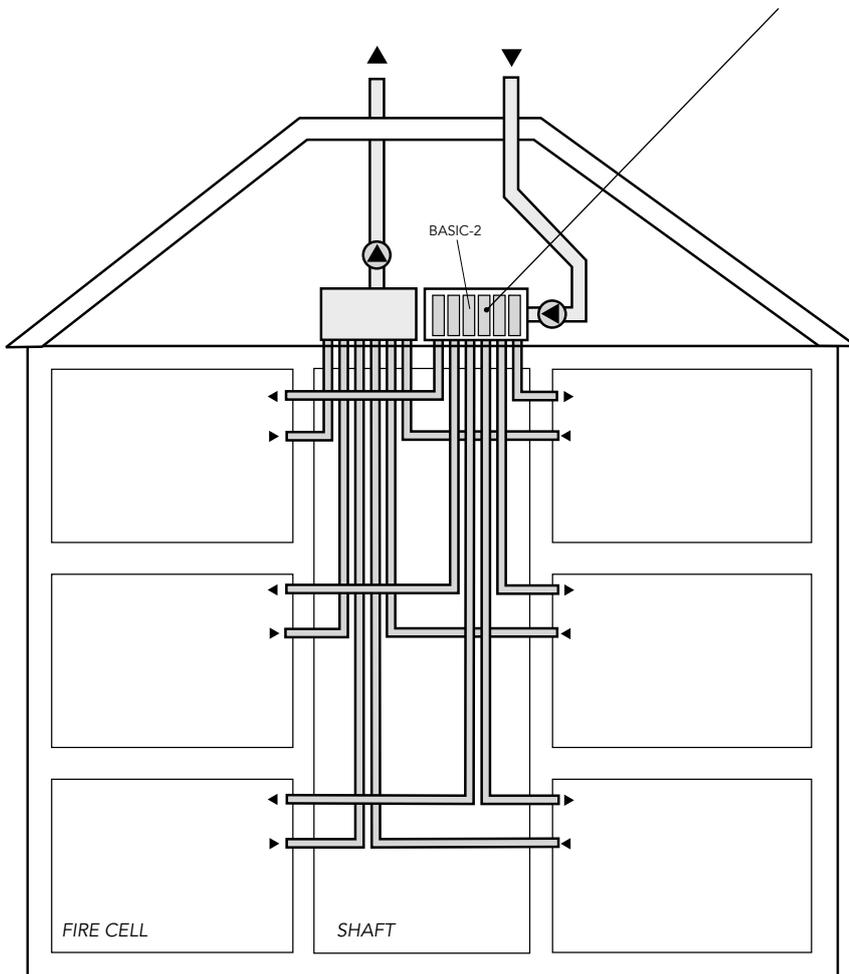
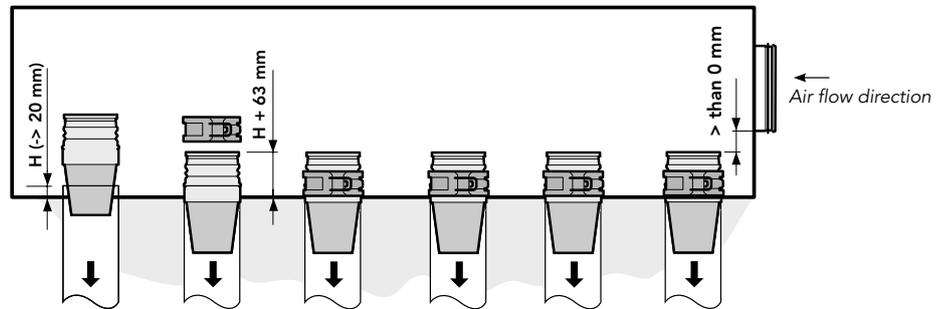


Figure 6

BASIC always requires that the system is designed for fans in operation in the event of fire. BASIC is installed according to any of the previously listed options. Other installation options must always be approved by a fire expert.

The following procedure always applies for fans in operation regardless of whether BASIC is used or not. The major difference is that any detailed analysis and upgrade/change regarding protection against the spread of fire gas in the supply air system does not need to be carried out when installing BASIC, such as fire gas dampers, conversion, etc. The following points are included in a normal design procedure that the designers involved resolve together with the fire protection consultant.

## PROCEDURE

- 1) Fans can be positioned above, below or level with the served fire cells.
- 2) The exhaust air fan and any control equipment must be able to withstand the resulting mixture temperature for at least the same amount of time as the building elements' fire resistance time.
- 3) During the fire's flashover phase, e.g. when windows collapse, the fire pressure drops in the fire room. In rooms with a normal room height, there is an overpressure of approx. 20 Pa at the ceiling. If the room is very high and the supply air terminal device is positioned at ceiling level, the minimum total pressure in the supply air duct to the individual fire must be:  
**Room height 2.5 m, min. 30 Pa**  
**Room height 5 m, min. 40 Pa**
- 4) Perform a calculation to check that fire gas is not spreading via the exhaust air system. Low risk.
- 5) Any filters in the exhaust air unit are equipped with bypass dampers. If bypass dampers also include energy recovery, anti-freeze must be blocked. Bypass dampers can be avoided if calculations show that this is possible. The aim is to prevent the filter causing an excessive flow reduction due to soot particles getting caught in the filter. Bypass dampers can for example be controlled to open via a pressure switch.
- 6) Do not position outdoor air openings in relation to extract air openings or windows in facades, so that exiting fire gas can continuously be sucked into the outdoor air duct.
- 7) Stop the fans if smoke detectors are only triggered in the supply air duct directly after the supply air fan. The control sequence must not be activated if the fire was previously detected in fire cells served by the ventilation system. This interlocking can justify detection even in the exhaust air system. The aim is to prevent a short circuit with indirect fire gas spread via the outdoor air intake from stopping the fans.
- 8) When building in areas where it is possible to predict a risk of e.g. chemical emissions, the installation of an emergency stop device for the ventilation system may be required as a condition for planning permission. – If an emergency stop device using a push button is installed, this must be labelled with the following text "Emergency stop device for the ventilation system must not be used in the event of fire in the building". The push button must be positioned in an appropriate space adjoining the stairwell.
- 9) The fans must be powered in such that a fire in fire cells served by the ventilation system cannot cause a power failure. Cables with no special classification can be laid in fan rooms provided that no ventilators are located within these fan rooms. Electrical rooms served by the ventilation system are separated by fire gas dampers or fire/fire gas dampers. Alternatively, electrical rooms can be equipped with a reduced ventilation system.
- 10) Ventilation ducts are insulated against fire and/or designed with safety distances to flammable material at the breakthrough in fire cell separating elements. Insulation to prevent the spread of fire is installed according to "A manual of fire protection technology for ventilation systems" ISBN-91-630-4419-6 and "Ventilation fire protection, technical solutions, etc." ISBN-91-630-7381-1. Note that if the building or part of the building is fitted with sprinklers, the insulating capacity may be reduced or removed completely.
- 11) Ventilation ducts and components are suspended with suspension devices with the required bearing capacity R.
- 12) Shafts are designed and built according to the required fire class.
- 13) Breakthroughs in fire separating elements are sealed using approved methods/materials according to the element's fire class.
- 14) Air handling units are positioned in fire classified fan rooms built using enclosing building elements according to the required fire class. Note that ducts within fan rooms, exhaust air, may need to be insulated depending on the resulting mixture temperature.

### BBR22 (BFS 2015:3) 5:112 ANALYTICAL DIMENSIONING

The product is verified according to Boverket's General Advice (2011:27) on the analytical dimensioning of fire protection in buildings, (BBRAD 3) (BFS2013:12). (Fire protection in ventilation).

### SPREAD THEORY

The risk of fire gas spread occurs in both F systems and FT(X) systems, provided that the system serves different fire cells. Spread via ventilation systems can occur between fire cells and between different rooms within a fire cell. However, the performance requirement according to BBR however only applies to fire gas spread between fire cells. In a fire room, the fire produces a "fire created flow", a thermal expansion per time unit, commonly known as fire flow.

This fire flow is dependent on the rate of fire development and is roughly proportional to the root of the room volume. This expansion creates a pressure rise in the fire room. The fire pressure forces fire gases into the duct system, affecting the pressure and flow conditions so that fire gases can spread between fire cells via the ventilation system. This can be illustrated with a simple F system as shown in **Figure 7**.

As fire pressure rises, the **pressure at point A** also rises (negative pressure in normal operation). In a borderline case, the pressure will be 0 – a "balance" between the fan and the fire pressure – but if the pressure at A continues to rise, fire gases will spread to outside fire cells. Fans in operation in F systems can be an effective protection method, not least because the outdoor air device provides considerable pressure relief.

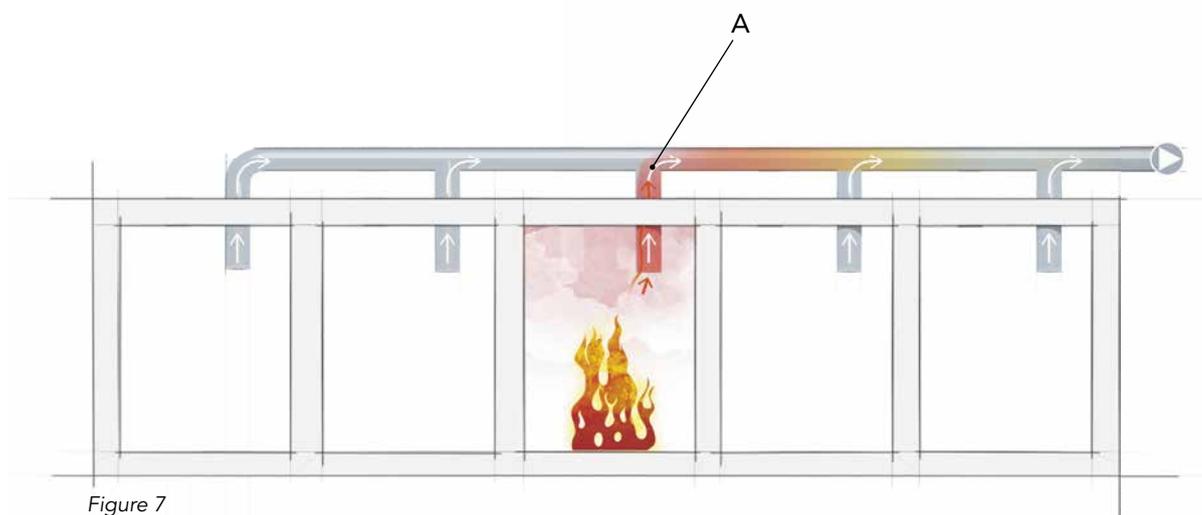


Figure 7

## EXHAUST AND SUPPLY AIR SYSTEMS

**Figure 8** shows a fire room with an FT system. The fire pressure mainly affects the supply air duct. When the fire pressure is only a fraction of that which produces a borderline case in the F system, fire gases penetrate back into the supply air duct and spread to another fire cell. At the same time, note that in FT systems there is no outdoor air device which may limit the pressure rise. Supply air systems are normally sensitive to fire gas spread.

The critical stage for fire gas spread is in the initial stage of the fire when the climate shell is intact. There then follows a natural pressure relief when the windows break. In the later stages, overpressure at the ceiling is limited to approx. 20 Pa, while the floor has a negative pressure of approx. -10 Pa. The time before the natural pressure relief occurs varies with the growth

rate of the fire. In the case of "normal" growth, natural pressure relief occurs within approx. 5–7 minutes, but at a slower growth rate, pressure relief may occur much later.

A smouldering fire can produce a lot of smoke, but in return develops little heat and thermal expansion (fire pressure) is limited. The level of pressure rise depends on the density of the room and the construction of the ventilation system inside and outside the fire room.

With large pressure rises in the fire room, there is an increased risk of fire gas spreading to adjacent spaces via the ventilation ducts. The effect of the fire can also be limited by a lack of oxygen in the room. This causes the temperature to drop and the fire flow decreases.

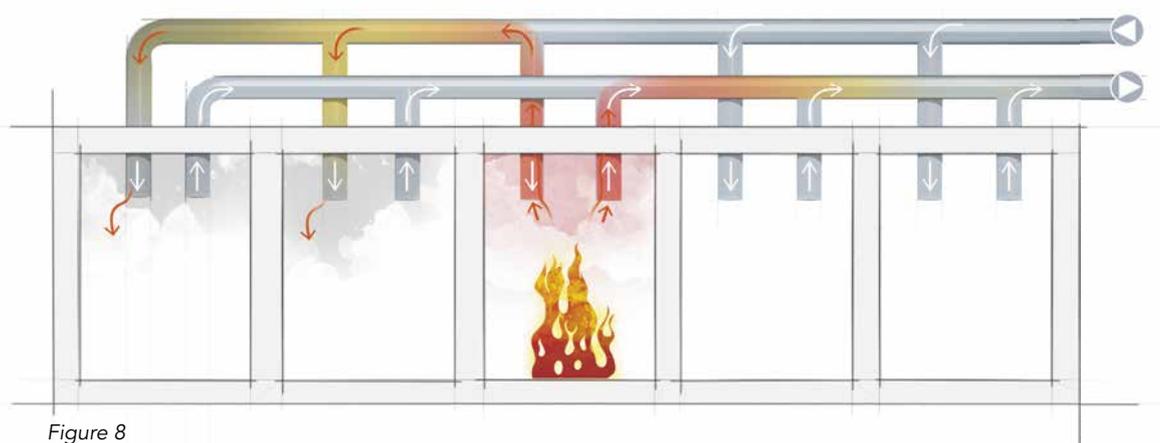


Figure 8



### BASIC, FUNCTION IN FT SYSTEMS WITH FANS IN OPERATION

In the initial stage of the fire, when the pressure in the fire room is greater than the back pressure in the supply air duct to the fire room, BASIC automatically "closes" and prevents the spread of fire gas via the supply air system to another fire cell, see **Figure 9**.

During the fire's flashover phase, e.g. when windows collapse, the fire pressure drops in the fire room. In rooms with a normal room height, overpressure at the ceiling is approx. 20 Pa, while the floor has a negative pressure of approx. -10 Pa. Thus the pressure in the supply air duct to the fire room will be greater than the pressure in the fire room, which is why BASIC opens and the supply air is fed back into the fire room, see **Figure 10**.

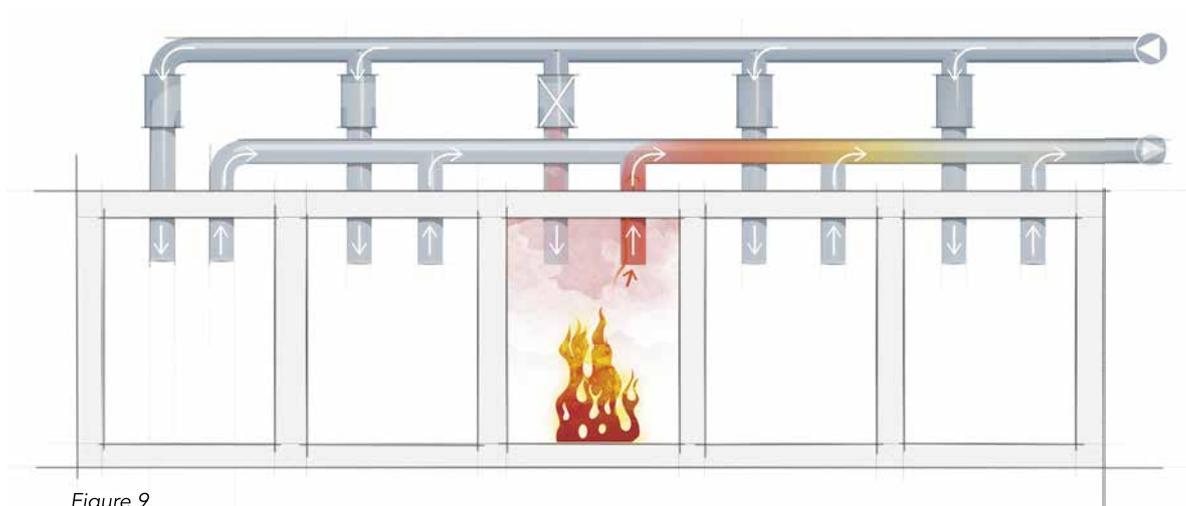


Figure 9

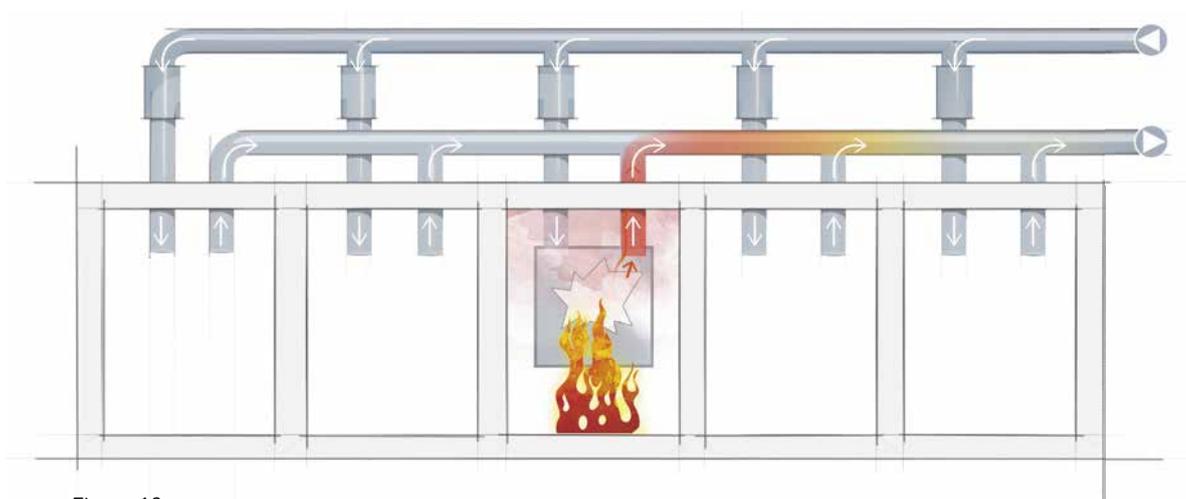


Figure 10

