

# Fire Safety

in Ventilation Systems



# DS 428.4

## Code for technical measures for fire protection in ventilation systems

Systemair has a complete range of components for fire protection of ventilation systems. This brochure will provide a list of the most commonly used components, including fire- and smoke dampers, smoke dampers, smoke evacuation dampers and a fire control system for monitoring and exercising of the dampers. It also shows various system solutions that provide an overview of the different possible combinations, all of which are in accordance with the fire protection standard DS 428.4.

### DS 428.4

#### Foreword

The standard contains a number of requirements that dictate how to achieve a responsible fire technical safety and operation of ventilation systems.

#### Introduction

The standard contains a number of requirements to ensure a responsible fire technical construction of ventilation systems, so that the risk for start, developing and spreading of a fire due to the ventilation system is minimized.

#### Scope

The purpose of this standard is to ensure that mechanical ventilation systems shall be designed, executed and maintained in such a manner that the potential for start, developing and spreading of a fire due to the system is minimized. The standard contains requirements regarding design, construction, testing, and operation of mechanical ventilation systems.

The standard applies to mechanical and hybrid ventilation systems permanently installed in buildings. Installations for natural ventilation must be performed according to this standard to the extent that they can be assimilated with mechanical ventilation.

Installations for industrial or semi-industrial processes and storage should at least follow the requirements in the standard, but there may be additional requirements from authorities.

#### Definitions

Fire section: Separation with building material class (R) EI60 A2-s1, d0 (formerly BS60)

Fire cell: Separation with building material class (R) EI60 (formerly BD60)

R: Carrying capacity

E: Integrity

I: Isolation

S: Tightness for smoke

A2: Non-combustible material

S1: Very limited smoke development

D0: No burning droplets

RV: Smoke fan intended for a smoke extraction system

Ho: Horizontal

Ve: Vertical

i↔o: Fire from the inside and outside.

#### Fire-, flame-, smoke- and smoke evacuation dampers

BRS: Fire- and smoke damper class EI60 (ve ho i↔o)S, 70 °C fire thermostat, spring-return actuator. Shall prevent fire and smoke being spread between fire sections.

FRS: Flame- and smoke damper class E60 (ve ho i↔o)S, 70 °C fire thermostat, spring-return actuator. Shall prevent smoke being spread between fire sections.

RS: Smoke damper class E30 (ve ho i↔o)S, spring-return actuator. Shall prevent smoke being spread between fire cells.

RES: Smoke evacuation damper class E30 (ve ho i↔o)S, spring-return actuator. Must ensure the discharge of smoke during a fire situation.

Dampers shall be tested according to EN 1366 and classified according to EN 13501-3, appendix classes ho ve i↔o. Monitoring must be installed through the control system, which checks the function of the sensors and damper actuators.

**Flexible connections:** Must comply with class A2-s1,d0, melting point of at least 850 °C, max length of 300 mm for fan connections in unexploitable attic.

**Roof curbs:** Must be insulated with 50 mm insulation A2-s1,d0, through the roof, minimum 100 mm under and 100 mm above the roof.

#### System solutions:

The duct system must be such designed, that the risk of smoke and fire spreading to other fire cells, fire sections or similar building units is not increased.

#### Damper-secured system:

Securing a ventilation system against spreading of smoke must be based on the creation of reasonable security against that smoke and combustion products can enter the duct system.

#### Smoke-ventilated systems:

Securing a ventilation system against spreading of smoke must be based on the creation of reasonable security against that smoke and combustion products, which have entered the duct system, can not be spread through the duct system to other fire cells, fire sections or similar building units.

A smoke-ventilated system must be such designed, that smoke in the system is discharged to the outside with reasonable safety. A smoke-ventilated system cannot be combined with fire-, flame- and/or smoke damper, which prevents the discharge of smoke that has entered the system. With the exception of the outermost fire cell or similar building units, from where spreading of smoke to other fire cells, or similar building units are impossible. In a smoke-ventilated system, the smoke must run via a duct, by-passing parts of the system with large flow resistance, or components in which the risk of clogging of the smoke particles from a fire is great. This includes filters, heat recovery components, heating- and cooling coils, etc.

# Fire Safety in Ventilation Systems



## Fire Safety

Regarding fire safety of ventilation systems, the most important is: To save lives and valuable inventory, and to ensure good working conditions for the rescue team. A fire occurrence must be limited before it develops into a disaster. Foremost to save lives, but also significant values may be lost. The requirements for personal safety and the emergency response capacity are very closely linked to the risk of fire spreading and stability of the building. Strategically, this means that in case of a fire, persons must be able to exit the building by themselves or with help from the rescue team.

Buildings – and especially inventory – contain an amount of combustible material. A correct fire safety of ventilation systems can prevent heat and smoke from spreading through the ventilation system. Should for example a too early destabilization of the building occur, a collapse can cause a disaster risk of a significant size. Fire safety in ventilation plants is thus necessary in modern buildings.

# Fire- and smoke dampers

## PK-I-R EI60/90S



Type PK-I-R EI60S DV9-T

Type PK-I-R EI90S DV9-T

- Approved according to EN 1366-2
- Classified according to EN 13501-3
- Additional class EI60 (ve ho i→o)S,  $\varnothing 100$ - $\varnothing 630$
- Additional class EI90 (ve ho i→o)S,  $\varnothing 710$ - $\varnothing 1000$
- Fire class according to DS 428.4, EI60 (ve ho i→o)S
- For mounting in circular ducts ( $\varnothing 100$ - $\varnothing 1000$ )
- For mounting both horizontal and vertical, independent of position of the damper shaft
- Ready to install in all types of walls and ceilings
- Equipped with 24 V spring-return actuator, currentless closed.

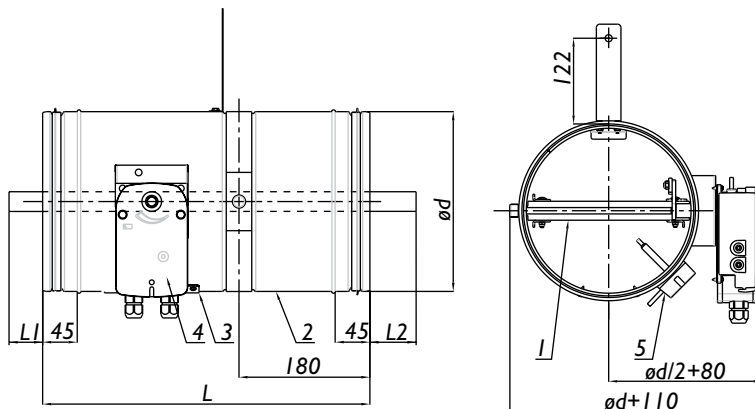
Fire- and smoke dampers shall prevent fire and smoke being spread between fire sections or similar fire performance units through the duct system.

The damper blade consists of calcium-silicate board (asbestos-free), fitted in a protecting frame of galvanized steel. The damper blade has a fire passive sealing (a ring of rubber, which prevents penetration of smoke) and a fire active sealing (an expanding fire paste, which prevents penetration of smoke and heat transfer during a fire). The damper has male connection. The damper will be delivered as type DV9-T with spring-return actuator (24 V), currentless closed. 230 V is available.

The actuator will close the damper blade at thermal or electrical signal. The damper has a fire thermostat which, when having reached or exceeded the ambient temperature

of 72°C (tolerance of  $\pm 1.5^\circ\text{C}$ ) in 30 to 60 seconds, activates the actuator and closes the damper blade within 60 seconds.

Accessories: 2 sets of cover plates made from calcium-silicate boards must be used at installation in lightweight walls (gypsum walls) and heavy structures (bricks/concrete), if no casting is made around the damper. The cover plates must be fastened on both sides of the wall/covered and tightened against smoke with fire sealing. Fire- and smoke dampers must always be installed in the section separation. Installation manual and installation certificate PK-I-R EI60/90S.



1. Damper blade, 2. Frame, 3. Inspection cover, 4. Damper actuator, 5. Fire thermostat

PK-I-R EI60S	ød	L	L1	L2	kg
PK-I-R EI60S 100	100	450	-	-	3,6
PK-I-R EI60S 125	125	450	-	-	4,0
PK-I-R EI60S 160	160	450	-	-	4,8
PK-I-R EI60S 200	200	450	-	-	5,6
PK-I-R EI60S 250	250	450	-	-	7,0
PK-I-R EI60S 315	315	450	-	28	9,4
PK-I-R EI60S 400	400	450	-	53	13
PK-I-R EI60S 500	500	500	-	78	19
PK-I-R EI60S 630	630	500	-	143	25
PK-I-R EI90S	ød	L	L1	L2	kg
PK-I-R EI90S 710	710	500	43	183	29
PK-I-R EI90S 800	800	500	88	228	35
PK-I-R EI90S 900	900	500	138	278	41
PK-I-R EI90S 1000	1000	500	188	328	48

# Smoke dampers and smoke evacuation dampers

## PK-I-R E60S (RS) and EK-I-R E60S (RES)



Type PK-I-R E60S DV9 (RS)

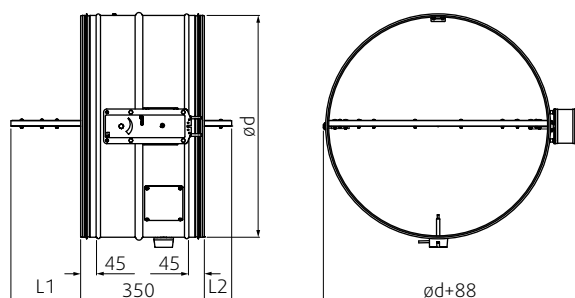
Type EK-I-R E60S DV9 (RES)

- Approved according to EN 1366-2
- Classified according to EN 13501-3
- Additional class E30/E60 (ve ho i⇒o)S
- Fire class according to DS 428.4 E30/E60 (ve ho i⇒o)S
- For mounting in circular ducts (ø100-ø630)
- For mounting both horizontal and vertical, independent of position of the damper shaft
- Equipped with 24 V spring-return actuator, currentless closed/open.

A smoke damper PK-I-R E60S (RS) shall prevent smoke being spread between fire sections or similar fire performance units through the duct system. A smoke evacuation damper EK-I-R E60S (RES) shall ensure the discharge of smoke during a fire. Smoke evacuation dampers are used in ducts with discharge to the outside and in by-pass-ducts that leads the smoke past system parts.

The damper blade consists of galvanized steel and has a rubber sealing, which prevents penetration of smoke.

The damper has male connection. The damper will be delivered as type DV9 with spring-return actuator (24 V), currentless closed at type RS and currentless open at type RES. 230 V is available. An electrical signal to the actuator will activate the damper blade and open/close it within 20 seconds.



PK-I-R E60S (RS) / EK-I-R E60S (RES)	ød	L	L1	L2	Kg
PK-I-R E60S (RS) / EK-I-R E60S 100 (RES)	100	350	-	-	3,2
PK-I-R E60S (RS) / EK-I-R E60S 125 (RES)	125	350	-	-	3,4
PK-I-R E60S (RS) / EK-I-R E60S 160 (RES)	160	350	-	-	3,6
PK-I-R E60S (RS) / EK-I-R E60S 200 (RES)	200	350	-	-	3,9
PK-I-R E60S (RS) / EK-I-R E60S 250 (RES)	250	350	7	-	4,5
PK-I-R E60S (RS) / EK-I-R E60S 315 (RES)	315	350	40	-	5,3
PK-I-R E60S (RS) / EK-I-R E60S 400 (RES)	400	350	82	-	6,8
PK-I-R E60S (RS) / EK-I-R E60S 500 (RES)	500	350	132	12	10,7
PK-I-R E60S (RS) / EK-I-R E60S 630 (RES)	630	350	197	77	16,0

# Fire- and smoke dampers

## PK-I-S EI90S



Type PK-I-S EI90S DV9-T

- Approved according to EN 1366-2
- Classified according to EN 13501-3
- Additional class EI 90 (ve ho i⇒o)S
- Fire class according to DS 428:4, EI 90 (ve ho i⇒o)S
- For mounting in square ducts (100x100 - 1000x1600)
- For mounting both horizontal and vertical
- Ready for installation in all types of walls and ceilings
- Equipped with 24 V spring-return actuator, currentless closed.

A fire- and smoke damper shall prevent fire and smoke being spread between fire sections or similar fire performance units through the duct system. The damper blade consists of calcium-silicate board (asbestos-free), fitted in a protecting frame of galvanized steel. The damper blade has a fire passive sealing (a rubber sealing, which prevents penetration of smoke) and a fire active sealing (an expanding fire paste, which prevents penetration of smoke and heat transfer during a fire).

The damper will be delivered as type DV9-T with spring-return actuator (24 V), currentless closed. 230 V is available.

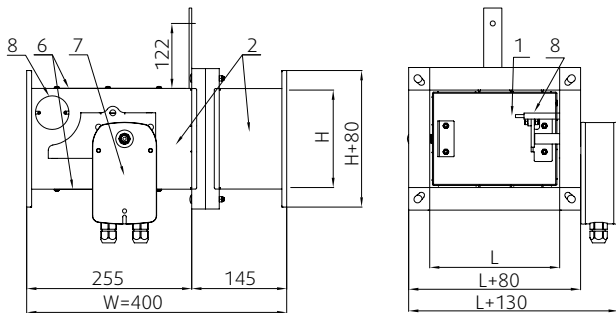
The actuator will close the damper blade at thermal or electrical signal. The damper has a fire thermostat

which, when having reached or exceeded the ambient temperature of 72°C (tolerance of  $\pm 1.5^\circ\text{C}$ ) in 30 to 60 seconds, activates the actuator and closes the damper blade within 60 seconds.

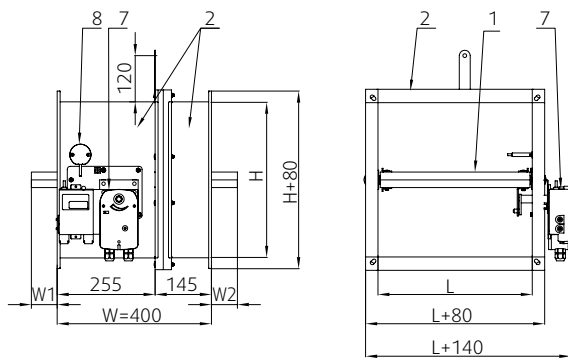
Accessories: 2 sets of cover plates made from calcium-silicate boards must be used at installation in light-weight walls (gypsum walls) and heavy structures (bricks/concrete), if no casting is made around the damper. The cover plates must be fastened on both sides of the wall/covered and tightened against smoke with fire sealing. Fire- and smoke dampers must always be installed in the section separation. Installation manual and installation certificate PK-I-S EI90S.

### B: Dimension and weight, kg

H \ L	200	250	300	350	400	450	500	550	600	700	800	900	1000	1100	1200	1400	1500	1600	W1 mm	W2 mm
200	10,8	11,6	12,4	13,3	14,1	14,9	15,8	16,6	17,4	19,1	20,8	22,4	24,1	25,8	27,4	30,8	32,5	34,1		
250	11,6	12,5	13,4	14,3	15,2	16,1	17,1	18,0	18,9	20,7	22,6	24,4	26,2	28,0	29,9	33,5	37,2	39,1		
300	12,4	13,4	14,4	15,3	16,3	17,3	18,3	19,3	20,3	22,3	24,3	26,2	28,2	30,2	33,1	37,0	39,0	41,0		22
350	13,2	14,3	15,4	16,4	17,5	18,6	19,6	20,7	21,8	23,9	26,1	28,2	30,3	34,4	36,5	40,8	42,9	45,1		22
400	14,0	15,2	16,3	17,5	18,6	19,8	20,9	22,1	23,2	25,5	27,8	32,0	34,3	36,6	38,9	43,5	45,8	48,1		72
450	14,8	16,1	17,3	18,5	19,7	21,0	22,2	23,4	24,6	27,1	31,4	33,9	36,3	38,8	41,2	46,1	48,6	51,0		72
500	15,7	17,0	18,3	19,6	20,9	22,2	23,5	24,8	26,1	28,7	33,2	35,8	38,4	41,0	43,7	48,9	51,5	54,1		122
550	16,5	17,9	19,3	20,7	22,0	23,4	24,8	26,2	27,6	32,2	35,0	37,8	40,5	43,3	46,1	51,6	54,4	57,2		122
600	17,3	18,8	20,2	21,7	23,2	24,6	26,1	27,5	30,9	33,8	36,7	39,6	42,6	45,5	48,4	54,2	57,2	60,1	22	172
700	18,9	20,6	22,2	23,8	25,4	27,0	28,6	32,1	33,7	37,0	40,2	43,4	46,7	49,9	53,1	59,6	62,8	66,0	22	172
800	20,6	22,4	24,1	25,9	27,7	31,3	33,1	34,9	36,6	40,2	43,7	47,3	50,8	54,3	57,9	65,0	68,5	72,0	122	272
900	22,3	24,2	26,1	28,0	31,9	33,8	35,7	37,6	39,6	43,4	47,3	51,2	55,0	58,9	62,7	70,5	74,3	78,2	122	272
1000	23,9	26,0	28,1	30,2	34,1	36,2	38,3	40,4	42,5	46,7	50,8	55,0	59,2	63,3	67,5	75,8	80,0	84,2	222	372



A: Fire- and smoke dampers in small sizes. See table A below.



B: Fire- and smoke dampers in large sizes. See table B on page 6.

1. Damper blade, 2. Frame, 3. Inspection cover,
4. Damper actuator, 5. Fire thermostat

Note: Dampers with dimensions  $\leq 150$  mm have flange dimensions of 30 mm.



### A: Dimension and weight, kg

L \ H	100	150	200	250	300	400	500	600	800	W2 (mm)
100	8,5	9,1	9,8	10,5	11,2	12,5	13,9	15,3	18,0	
150	9,1	9,8	10,6	11,4	12,1	13,6	15,1	16,6	19,6	
200	11,1	11,9								
250	11,7	12,6								
300	12,4	13,4								22
400	13,7	14,9								72

\* Damper blade measurements, when it is fully open.

# Fire Safety in Ventilation Systems

## Fire control system BR-A2

Systemair's fire control system has been prepared in accordance with DS 428.4 for easy and simple installation (bus system); it is configurable and therefore extremely flexible. The fire control system contains all the necessary functions such as monitoring, testing and verifying the operation of fire- and smoke dampers, smoke dampers, smoke evacuation dampers, and communicating with the unit and possibly, the smoke extract fan.

### Key features:

- Disables the dampers and disconnects the fan/unit in case of a fire
- Weekly tests of dampers and possibly, the smoke extract fan, to ensure that they are operational
- Manual testing is possible
- Ensures that the dampers are open during normal operation, and ventilation is functioning as planned
- When smoke-/fire is detected, you can choose to have all dampers closed and shut down the ventilation in the entire building or only in the current fire section
- Detailed error message on each damper
- 24 V supply and control via the bus system for each damper.

The fire control system consists of the following components:

### Control panel BR-A2, BP

- Display for monitoring and setting of the necessary parameters
- Alarm readout for fire- and service alarms and alarm log

- Reset of the alarms above.
- Manual exercise of fire- and smoke dampers, smoke dampers, smoke evacuation dampers, and possibly, smoke extract fan
- Timer-setting for weekly exercise
- A control panel can be connected to max. 16 section controllers
- Event log for the latest 84 exercises and service receipts are saved automatically.

### Section controller BR-A2, SK

- Max. 62 damper units can be controlled and monitored
- When using more than 62 dampers an extra section controller must be connected as a "slave"
- Smoke detector (max. 10 pcs.)
- BTB temperature sensor with reset on the control panel, 40 °C (default)
- Detailed error message on each damper
- Stop of the fan/unit
- External fire detection system or signal device
- Start and control of smoke fan
- Service signal
- DPT Differential pressure transmitter for monitoring and control of fan
- IP 54 box enclosed
- Main power supply 230 V AC
- Power supply 24 V DC for 5 dampers
- The section controller can work without any control panel.

### Damper module BR-A2, SM

- One damper module used by each fire- and smoke damper, smoke damper or smoke evacuation damper

- Mounting bracket included
- Terminals and cable clamp for connection of damper and bus cable.

### Power supply BR-A2, SF

- The section controller can supply the first 5 dampers
- Hereafter use a power supply for every 8 dampers
- Max. 100 m cable to the farthest damper
- Max. total bus length 1200 m.

### Smoke detector for duct type RDK-2 (UG-3-0)

- Smoke detector for measuring/detection of smoke in the duct system
- Air velocity between 0.2 and 20 m/s.

### Temperature sensor type BTB (TT-522)

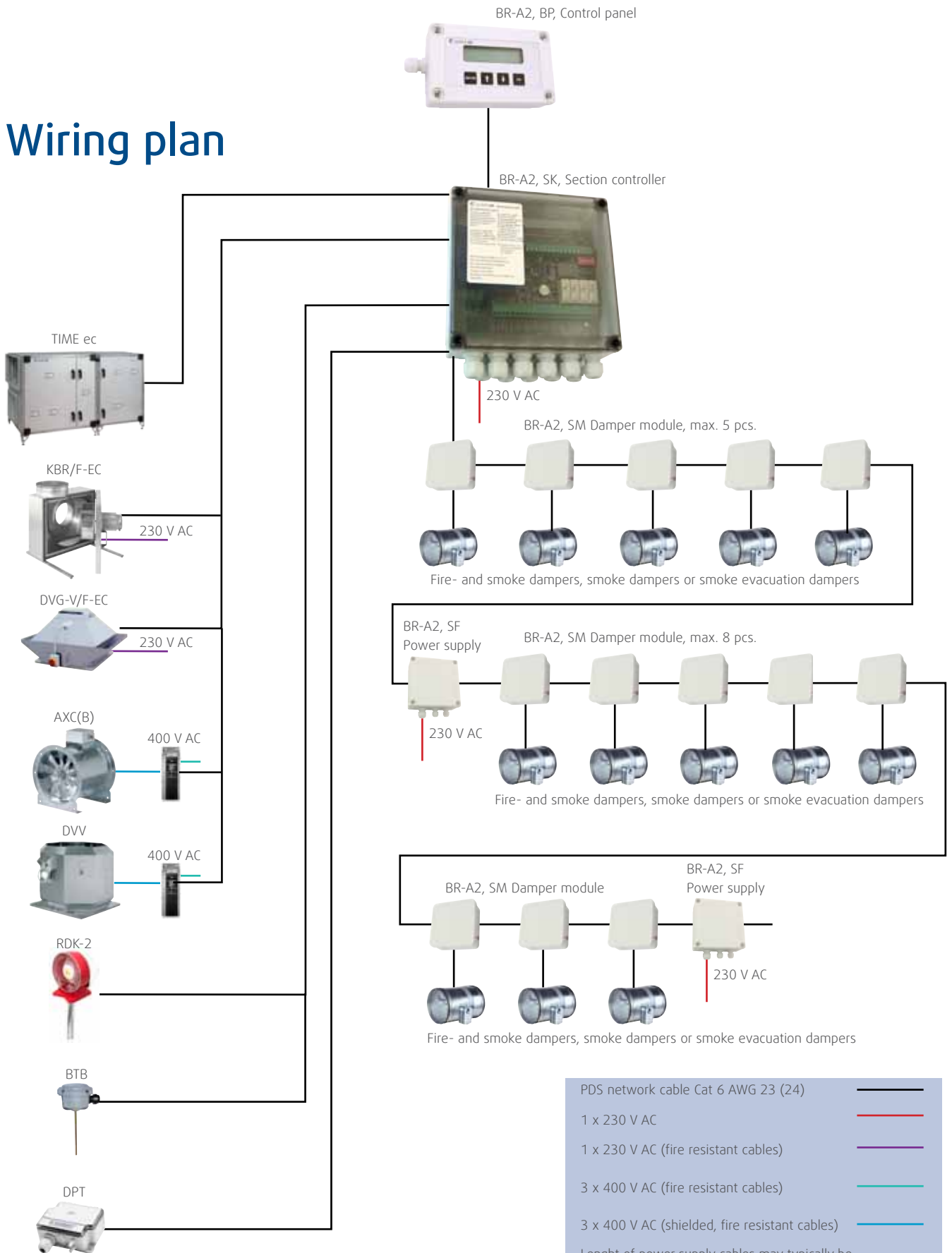
- The temperature sensor detects a set temperature due to fire and transmit the signal to the section controller.

### Differential pressure transmitter type DPT

- Differential pressure transmitter incl. connector and measure hose, detects the pressure in the duct and transmits the signal to the section controller
- Monitors the exhaust fan operation
- Control of smoke fan operation by weekly exercising
- Pressure control of the smoke fan in a fire situation.



# Wiring plan



# Damper-secured system

## Excerpts from DS 428.4

Damper-secured systems can be used in all usage categories, but are most suitable for usage category 1, 2, 3, and 6. These usage categories are all buildings for day time occupancy, where ventilation often will be stopped at night. These categories include for instance:

- 1: Offices, industrial and warehouse buildings, certain garages, outbuildings and carports.
- 2: Teaching rooms, school day-care centers, after-school facilities, day centers.
- 3: Shops, shopping malls, places of public assembly, meeting rooms, canteens, restaurants, cinemas, discotheques, theatres.

6: Elderly housing, treatment rooms and wards on hospitals, nursery-homes, homes and institutions for people with physical or mental difficulties, nurseries and kindergartens.

### Spreading of smoke and fire through the duct system

The duct system must be such designed, that the risk of smoke and fire spreading to other fire cells, fire sections or similar building units is not increased.

Penetration of fire sections must be ensured with fire- and smoke dampers BRS. Penetration of fire cells must be secured with smoke dampers RS.

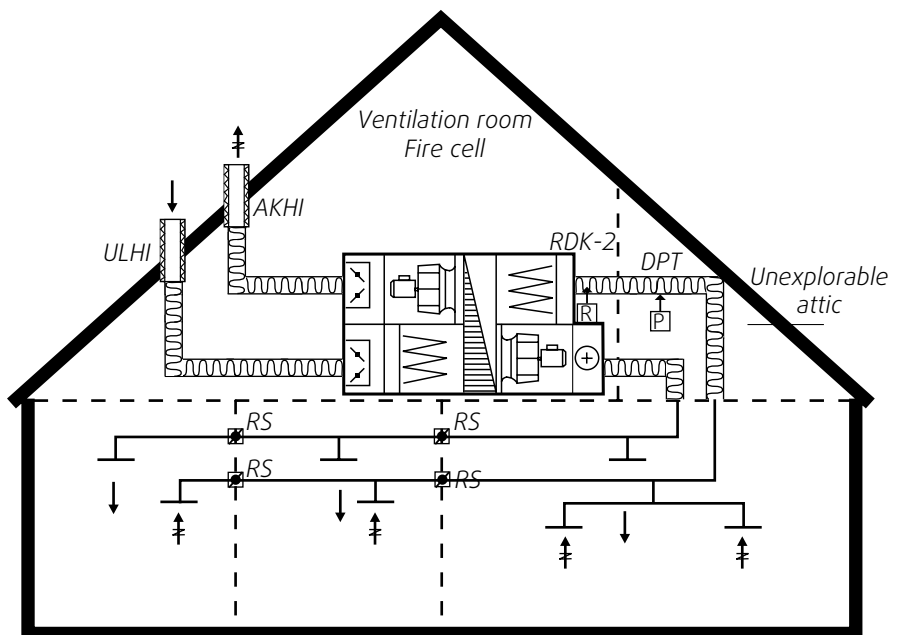
For usage category 1, 2 and 3, there will be some exceptions for penetration of fire cells, for example, if there is already established automatic fire alarm- and warning systems, sprinkler- and warning systems, smaller secondary rooms for short stay or if there is established a direct escape route to the outside from the room.

Systemair fire control system ensures that smoke dampers and fire- and smoke dampers closes by fire and by night stop.

Detection of fire must be made for each fire section in the exhaust duct. Smoke dampers between cells are

### Explanation of symbols

- Fire section separation
- Fire cell separation
- Ventilation duct
- RS Smoke damper
- RES Smoke evacuation damper
- BRS Fire- and smoke damper
- xxPa Smoke resistance indicated in Pa
- B-iso Fire insulation
- Iso Insulation
- RV Smoke fan
- Fire thermostat/temperature sensor BTB
- Pressure transmitter DPT
- Smoke detector, duct mounting RDK-2
- ABA+AVA Auto. fire alarm- and warning system



### Example 1

1 fire section, 3 fire cells: 4 pcs. smoke dampers RS. Fire control system consisting of: 1 pcs. BR-A2, BP control panel, 1 pcs. BR-A2, SK section controller, 4 pcs. BR-A2, SM Damper modules, 1 pcs. RDK-2 Smoke detector for duct, 1 pcs. DPT pressure transmitter. All ventilation ducts in the ventilation room and unexplorable attic must be insulated with thermal insulation class A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.

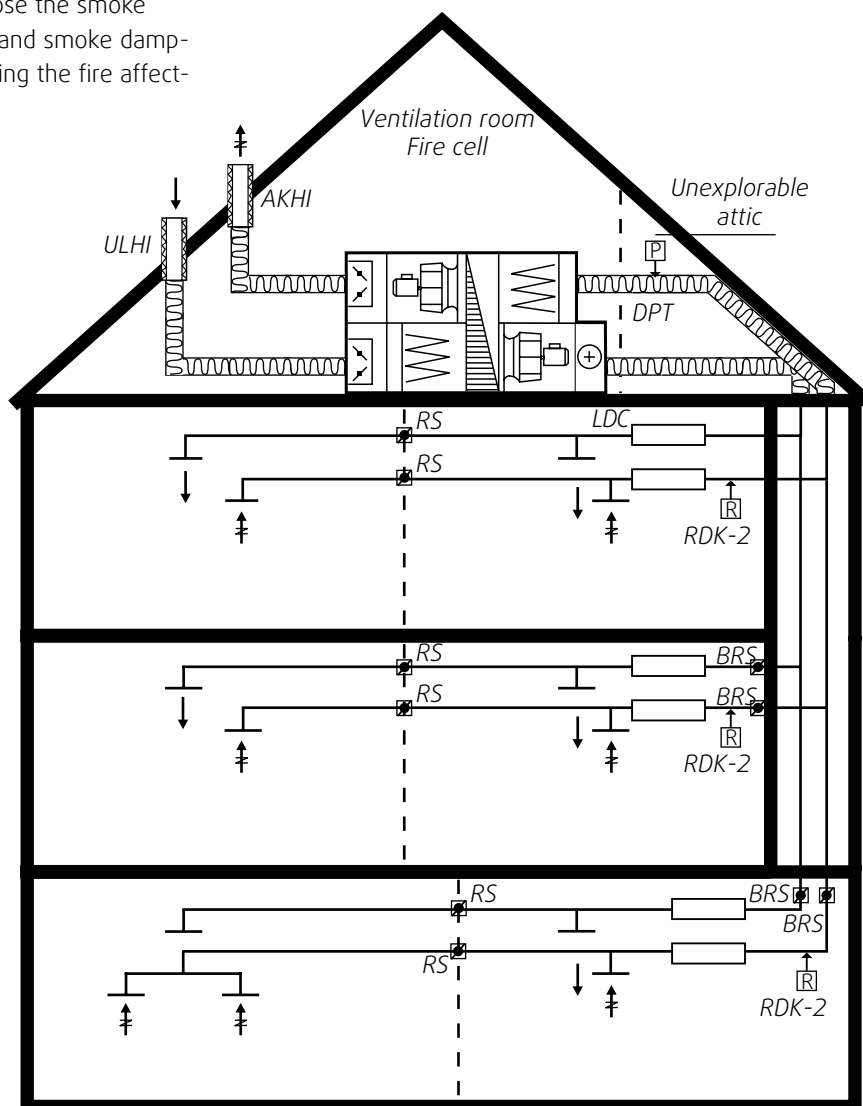


activated by the shared detector of the current fire section.

At fire detection, you can choose to let supply- and exhaust fans continue to run, and only close the smoke dampers and fire- and smoke dampers that are operating the fire affected section.

Air intake- and exhaust dampers must also be closed. You can also choose to stop the supply- and exhaust fans. Then all smoke dampers and fire- and smoke dampers must close.

Weekly exercise of smoke dampers and ensuring that the dampers are open during normal operation. It is possible to do manual testing of dampers.



**Example 2**

3 residential fire sections, 6 residential fire cells: 6 pcs. BRS fire- and smoke dampers, 6 pcs. RS smoke dampers. Fire control system consisting of: 1 pcs. BR-A2, BP control panel, 1 pcs. BR-A2, SK section controller, 1 pcs. BR-A2 SF power supply, 12 pcs. BR-A2, SM Damper modules, 3 pcs. RDK-2 Smoke detector for duct, 1 pcs. DPT pressure transmitter. Alternatively, 3 pcs. BR-A2, SK section controls (no BR-A2 SF power supply, but BRS in all branches of the shaft). All ventilation ducts in the ventilation room and unexplorable attic must be insulated with thermal insulation class A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.

# Smoke-ventilated system

## Excerpts from DS 428.4

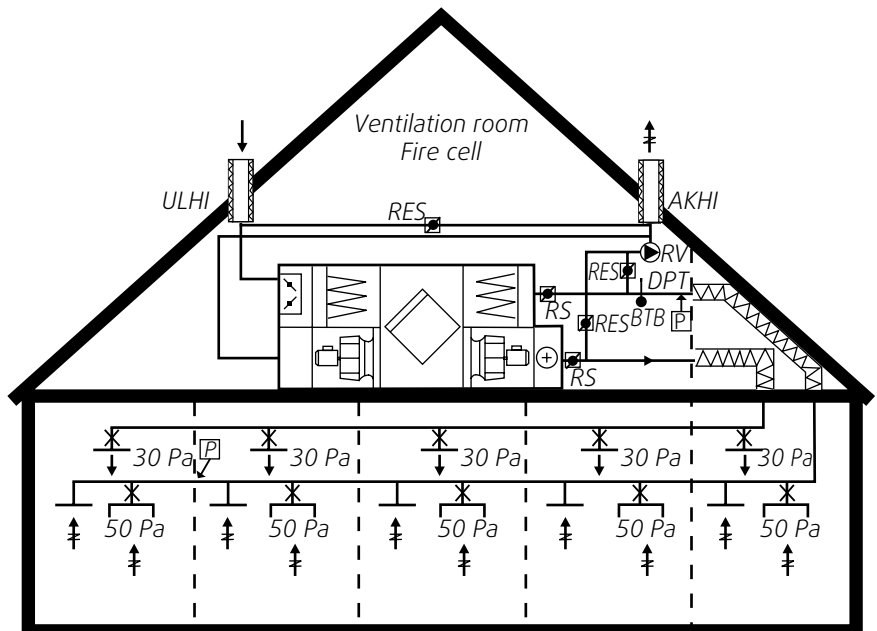
Smoke-ventilated systems can be used in all usage-categories, but are especially suitable for usage category 4, 5, 6, and for buildings whose upper floors are higher than 22 meters above the ground. Usage category 4, are for example residential buildings and youth housing, where there is a requirement for 24 hours of operation of the ventilation system. Usage category 5, are for example hotels, hostels, inns, dorms and guesthouses where there is a requirement for full automatic fire alarm- and warning systems, if there are more than 10 beds. Otherwise, a voluntary automatic fire alarm- and warning system

must be considered. Alternatively there must be established a damper-ensured system, which must be either for 24 hours of operation or with an automatic fire alarm- and warning system, which is required if there are more than 10 beds. Usage category 6 Elderly housing, treatment rooms and wards on hospitals, nurseryhomes, homes and institutions for people with physical or mental difficulties, nurseries and kindergartens. All buildings where a complete automatic fire alarm- and warning system is demanded.

A smoke-ventilated system must be such designed, that smoke in the system is discharged to the outside with reasonable safety. A smoke-ventilated system cannot be combined with fire-, flame- and/or smoke damper, which prevents the discharge of smoke that has entered the system. In a smoke-ventilated system, the smoke must run via a duct, by-passing parts of the system with large flow resistance or components in which the risk of clogging of the smoke particles from a fire is high. This includes filters, heat recovery components, heating- and cooling coils etc. A by-pass duct is equipped with a smoke evacuation

**Explanation of symbols**

- Fire section separation
- Fire cell separation
- Ventilation duct
- RS Smoke damper
- RES Smoke evacuation damper
- BRS Fire- and smoke damper
- xxPa Smoke resistance indicated in Pa
- B-iso Fire insulation
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- RV Smoke fan
- Fire thermostat or temperature sensor BTB
- Pressure transmitter DPT
- Smoke detector, duct mounting RDK-2
- ABA+AVA Auto. fire alarm- and warning system

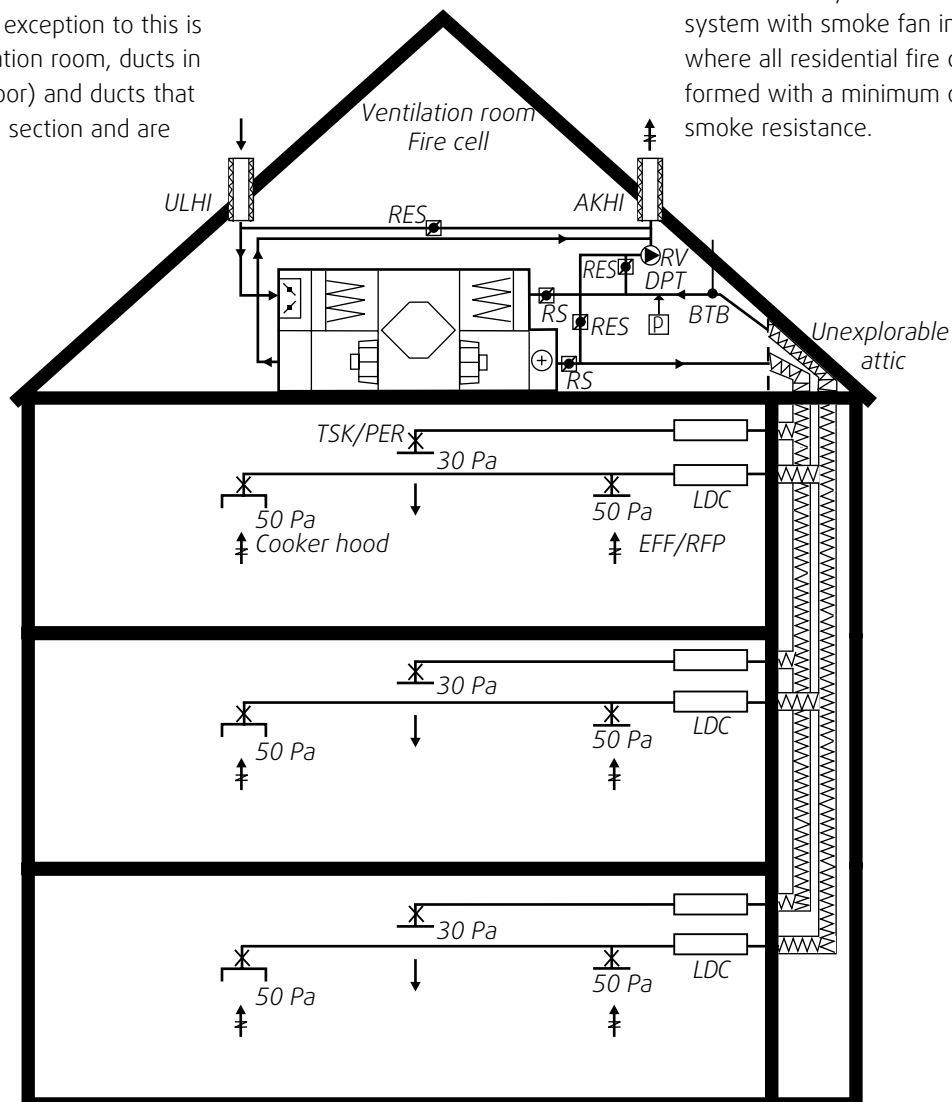


**Example 3, elderly housing, usage category 6**  
 Residential ventilation with heat recovery unit and smoke fan (50/30 Pa). Level 1: 1 pcs. smoke fan RV, 2 pcs. FLXB flexible connections, 2 pcs. smoke damper, 3 pcs. smoke evacuation dampers. Fire control system consisting of: 1 pcs. BR-A2, BP control panel, 1 pcs. BR-A2, SK section controller, 1 pcs. DPT pressure transmitter, 1 pcs. BTB temperature sensor, 5 pcs. cooking hoods H-106-E. All ventilation ducts in the ventilation room must be insulated with thermal insulation class A2-s1, d0. Ducts in unused attic must be insulated with fire insulation class EI 30/E 60 A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.

damper that is closed at normal operation with voltage (currentless open). A smoke-ventilated system is generally performed as a duct class EI 30/E60 A2-s1,d0, which also includes ducts in installation shafts and unexploitable attics. An exception to this is ducts in the ventilation room, ducts in the open air (outdoor) and ducts that only serve one fire section and are

located within this. Ducts in an unexploitable attic, which only serves one fire section and are located within this, must be insulated with minimum 50 mm insulation class A2-s1,d0. Branches from a fire insulated duct

should be fire insulated corresponding to the diameter of the branch, but a minimum of 0.2 m. For an extraction system, reasonable safety for the discharge of smoke to the outside can be achieved by: Smoke-ventilated system with smoke fan in operation, where all residential fire cells is performed with a minimum of 50 Pa smoke resistance.



#### Example 4

Residential ventilation with heat recovery unit and smoke fan: 1 pcs. smoke fan RV, 2 pcs. FLXB flexible connections, 2 pcs. smoke damper, 3 pcs. smoke evacuation damper. Fire control system consisting of: 1 pcs. BR-A2, BP control panel, 1 pcs. BR-A2, SK section controller, 5 pcs. BR-A2, SM damper modules, 1 pcs. DPT pressure transmitter, 1 pcs. BTB temperature sensor, 3 pcs. cooker hoods H-106-E. All ventilation ducts in the ventilation room must be insulated with thermal insulation class A2-s1, d0. All ducts in shaft and unexploitable attic must be insulated with fire insulation class EI30/E60 A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.

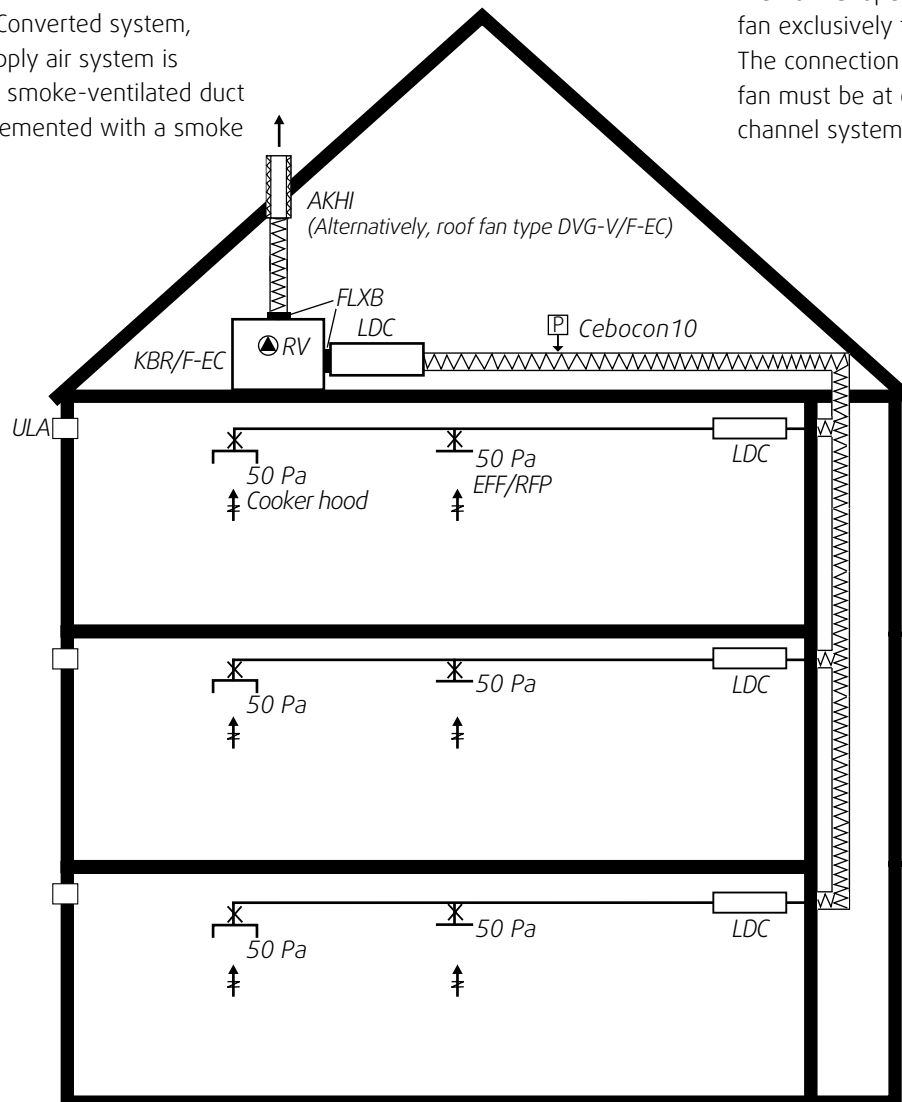
# Smoke-ventilated system

## Excerpts from DS 428.4

For supply air systems, where the extract system in the operated fire sections or similar fire units are designed as smoke-ventilated system, can reasonable safety for the discharge of smoke to the outside be achieved by: Converted system, where the supply air system is designed as a smoke-ventilated duct system, supplemented with a smoke

fan or coupled with the smoke fan in the extract system. All residential fire units are performed with a minimum of 30 Pa smoke resistance. A smoke resistance including connected ducts

and possible flexible connections must everywhere be performed as material class A2-s1, d0 with a melting point of at least 850 °C. The smoke fan can be the extract fan for the normal operation or a separate fan exclusively for smoke extraction. The connection point for the smoke fan must be at or above the upper channel system branching to the



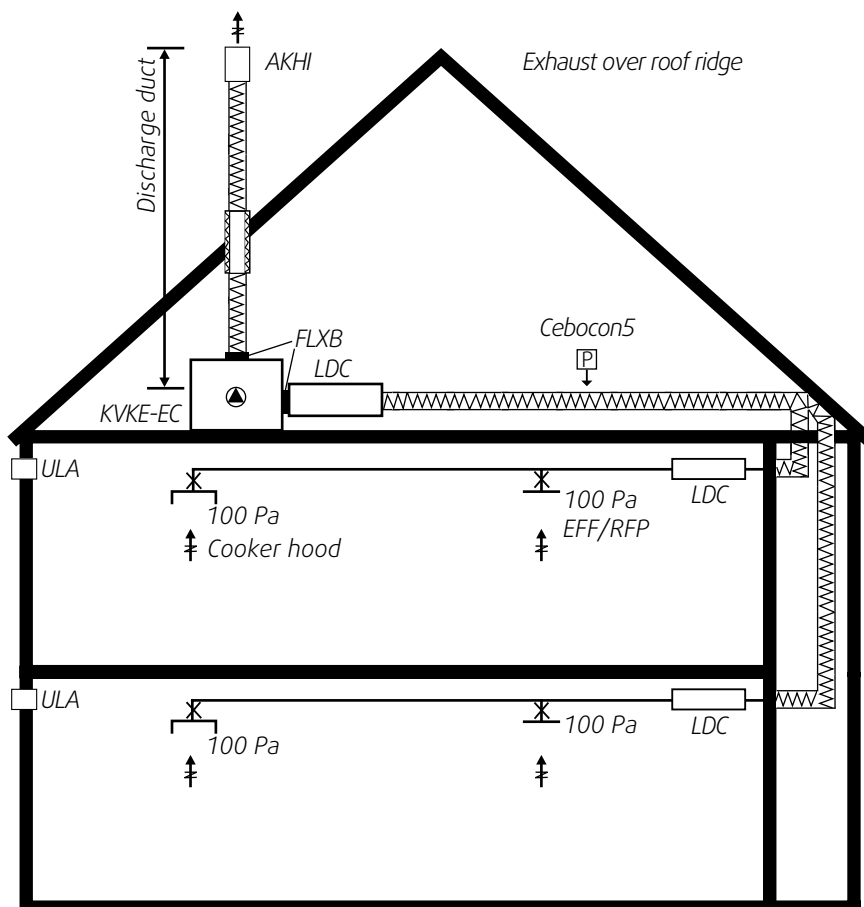
### Example 5

Residential ventilation with the smoke fan as daily, normal fan (50 Pa): 1 pcs. RV smoke fan KBR/F-EC (400 °C), 2 pcs. FLXB flexible connections, 1 pcs. CEBOCON 10 pressure control, 3 pcs. cooker hoods H-106-E (50 Pa), 1 pcs. AKHI roof cowl. Alternatively, roof fan type DVG-V/F-EC can be used. All ducts in shaft and unused attic must be insulated with fire insulation class EI30/E60 A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.

operating area, so that smoke will not be sucked down into a duct system with branches. A smoke fan must be able to withstand the occurring temperature for 60 min. after the fire has started, valid from a normal-temperature operating fan with a minimum of 1 hours operation and at an ambient temperature of 20 °C without cooling from wind or rain. Functional requirement is documented by manufacturer.

The temperature at the smoke fan is set as a mixing temperature, consisting of 945 °C from the fire room, and 20 °C from the remaining rooms (the mixing temperature must be at least 100 °C). The fire room is usually determined as the fire cell with the largest air volume - for systems with variable air volume, uses the maximum air volume rate. For calculation of the maximum flue gas tempera-

ture, the maximum air volume in the fire room is used. For remaining rooms, use diversity factor 0.2 for the difference in air volume between minimum and maximum air volume without incalculation of other diversity factors. The air volume depends on the building's density and is typically smaller than the air volume. The volume must be sufficient to ensure the system's required smoke resistance, however pressure limited to a maximum of 100 Pa negative pressures at the upper branch to the operating area. This negative pressure must be maintained at maximum and minimum opening of diffusers and dampers in systems with variable air volume.



### Explanation of symbols

- Fire section separation
- - - Fire cell separation
- Ventilation duct
- RS Smoke damper
- RES Smoke evacuation damper
- BRS Fire- and smoke damper
- xxPa Smoke resistance indicated in Pa
- ▨ B-iso Fire insulation
- ▨ Iso Insulation
- RV Smoke fan
- Fire thermostat or temperature sensor BTB
- Cebocon5 Pressure transmitter DTP, Cebocon5
- RDK-2 Smoke detector duct mounting RDK-2
- ☒ ABA+AVA Auto. fire alarm- and warning system

#### Example 6

Residential ventilation with the extract fan as daily, normal fan (100 Pa). Separate fire insulated ducts in shaft: 1 pcs. KVKE-EC box fan, 2 pcs. FLXB flexible connections, 1 pcs. CEBOCON 5 pressure control (100 Pa), 2 pcs. cooker hoods H-106-E (100 Pa), 1 pcs. AKHI roof cowl. All ducts in shaft and unused attic must be insulated with fire insulation class E130/E60 A2-s1, d0. The drawing is indicative, and it is the design engineer's responsibility to ensure that the design is in accordance with the law.



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