

# Fire Prevention

Part V – 4/2007

## Differential pressure systems

Smoke and heat control of escape routes  
in accordance with DIN EN 12101-6



# DIN EN 12101-6:2005

## Smoke and heat control

### Part 6: Provisions for differential pressure systems – kits

DIN EN 12101-6 is a mandated harmonized standard.

Announcement in the Official Journal of the EC: 2005-12-14	/	<b>2006-06-08</b>
Publication in the Federal Official Gazette	/ Gazette of	<b>2006-03-16</b>
Coexistence phase	until	<b>2007-04-01</b>

Thus as from 1<sup>st</sup> April 2007 DIN EN 12101-6 will be established law and applicable to differential pressure systems.

**This means:**

Differential pressure systems shall meet the following requirements on principle:

**Door opening force:**

Differential pressure systems shall be designed such that the door opening force applied at the door handle will not exceed 100 N.

**Control-system acting time of 3 seconds:**

Within 3 seconds at least 90 % of the volumetric requirements can be determined,  
hence:  $c = 0,9 \cdot c_0$

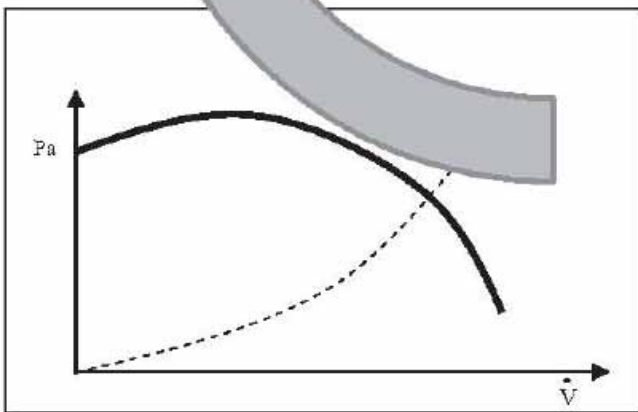
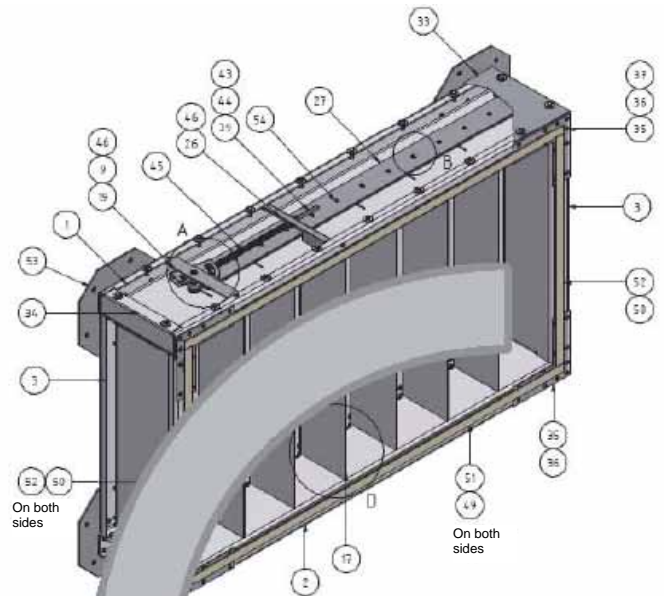
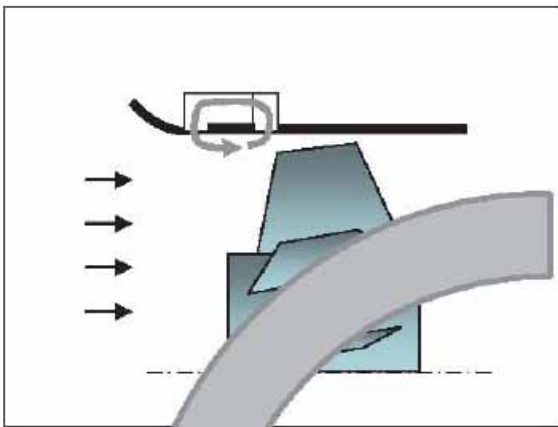
**Air velocity through the open door:**

A defined air velocity in accordance with the respective class of system shall be determined for the open door situation between the pressurized zone and the fire storey.

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**Strulik differential pressure systems with regard to these system classes have already been designed and carried out since 2004.**

# The term "kit": stabilized axial-flow fan and control valve



## Quality assurance

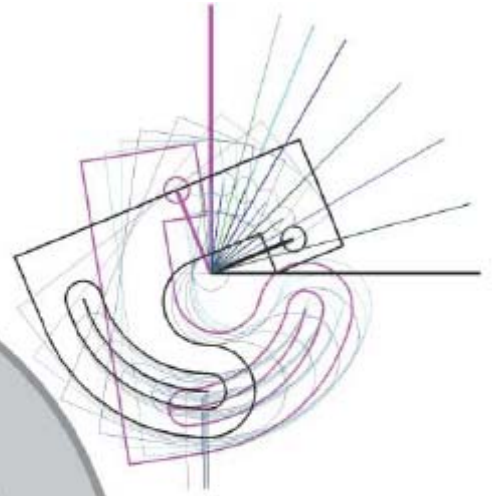
### Testing chamber



## Quality assurance

## Control valve systems

10.000 cycles loading  
of all mechanical parts,  
afterwards functional testing

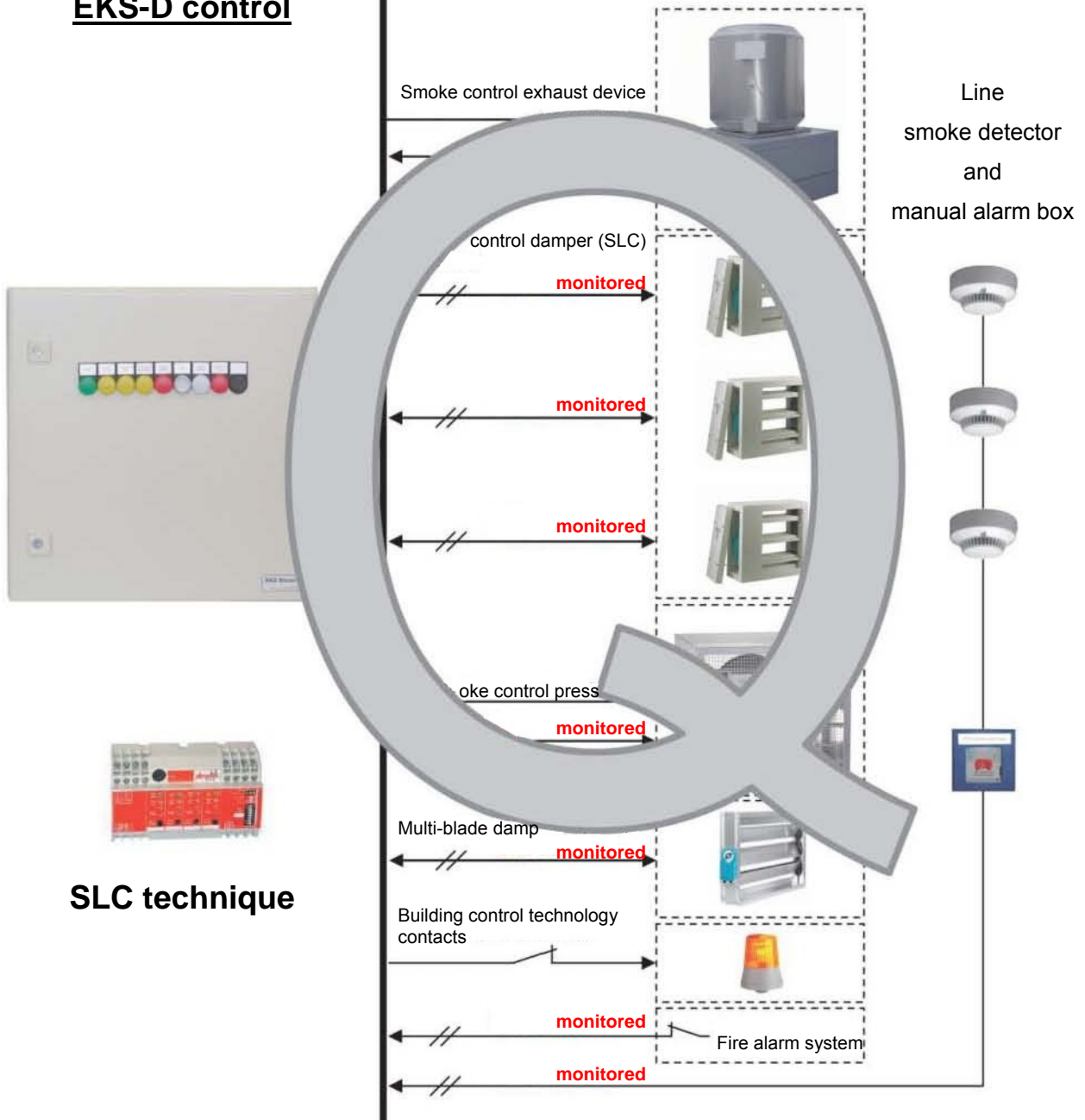


Twelve-month weather testing  
of all mechanical parts

# Quality assurance

## System safety

### EKS-D control



# Differential pressure systems

## Overview

Smoke control pressure device with an integral automatic control valve  
Type: DV-RK1



Smoke control pressure device  
Type: DV1



Discharge fan with an integral automatic control valve  
Type: DV-RK2-EV



Automatic control valve  
Type: RK2



Automatic discharge unit  
Type: RK2-JZI-DS-AH





**The maximum permissible door opening force is 100 N.**

The permissible pressure difference  $\Delta p$  in Pa (diagram 1) is determined by the appropriate door surface.

The pressure difference supplies the energy for the flow through the open door:  
 door:  $\sqrt{\Delta p} \sim c$  in m/s

The achieved velocity does not allow smoke to flow into the staircase at certain temperatures (diagram 2).

Diagram 1:

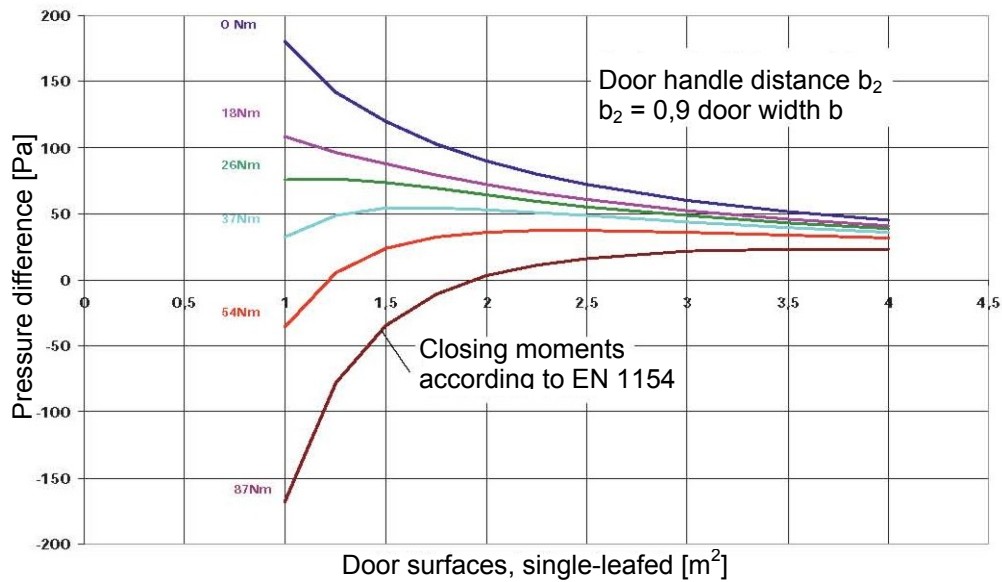
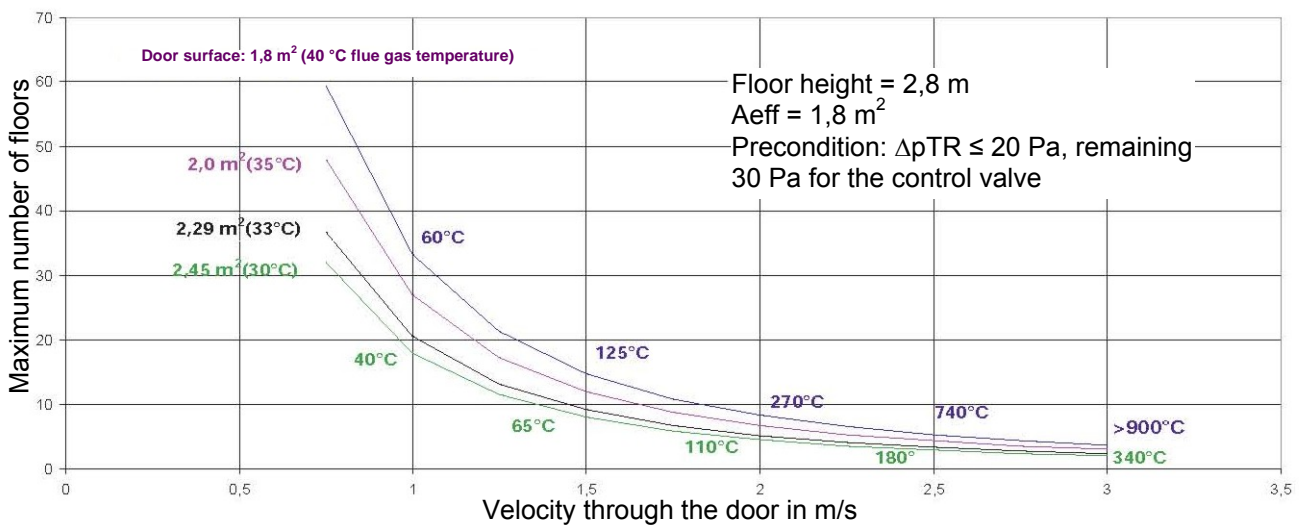


Diagram 2:

Rough selection pressure differential systems, corridor width 1,25 m, eye distance 0,15 m





## Differential pressure systems

### System example:

Mechanical air supply with DV-RK1

Mechanical air exhaust with DS-RK2-EV

RK1 pressure control valves **open**, staircase door **closed**  
RK2 pressure control valves **open**, exhaust fan DV in the **by-pass mode**

### Components:

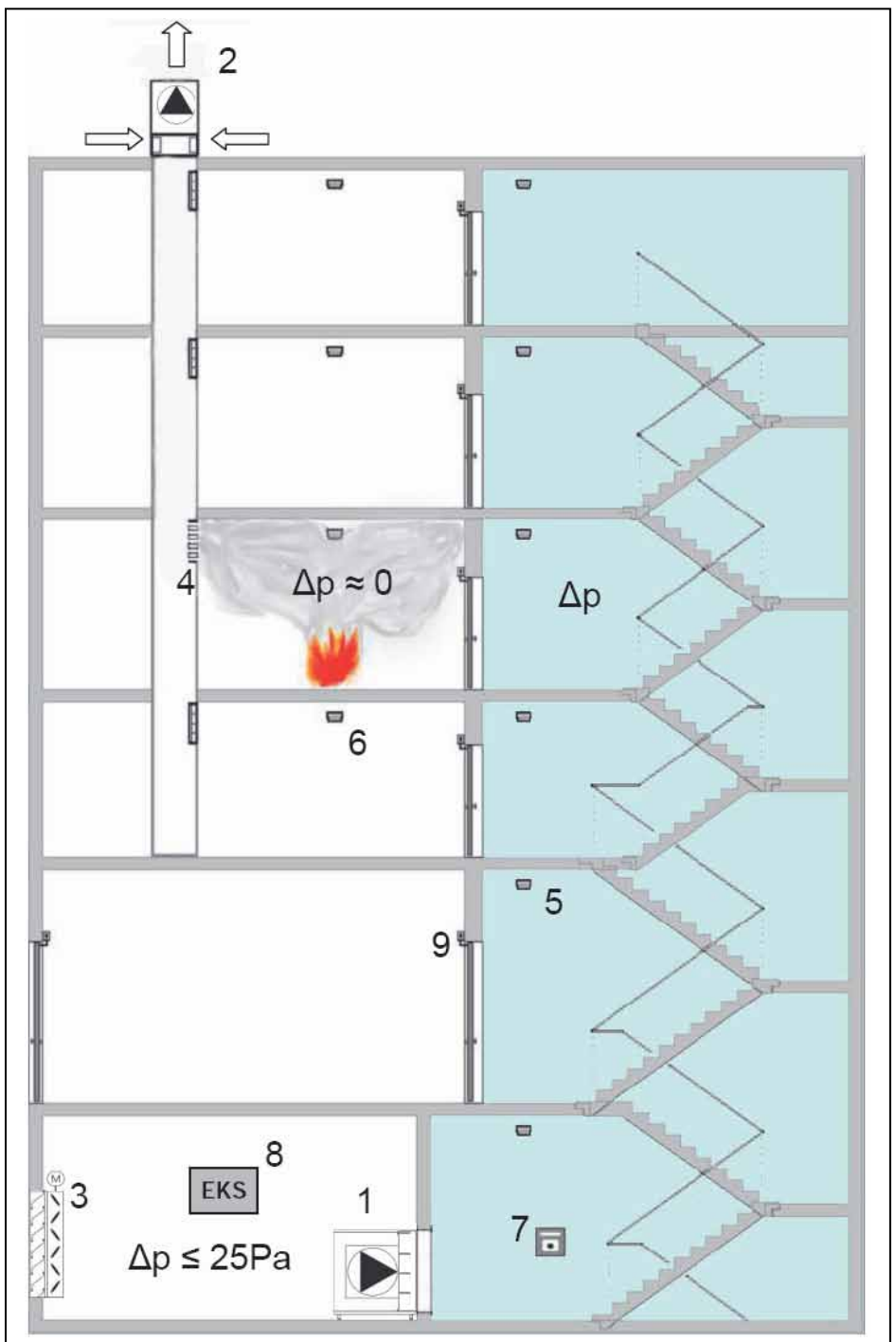
1. DV-RK1 supply air device with an integral control valve
2. DS-RK2-EV exhaust ventilator with a roof base and control valve. For a secure discharge independent from the weather factors.
3. Multi-blade damper with SLC drive and weather protection grille for the wake
4. RKI-90 SLC smoke control damper
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
First detection row
6. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Second detection row, apartments optional
7. DKM manual alarm box
8. EKS control, tested by VdS
9. Door closer

### Advantages of this system:

- Absolutely safe from smoke entering the staircase
- No wind influences, slight convection influences

### Features of the system:

- Pressure losses on the suction side of the DV-RK1 shall be limited to 25 Pa
- EKS monitored for cable break and short circuit



## Differential pressure systems

### System example:

Mechanical air supply with DV-RK1

Mechanical air exhaust with DS-RK2-EV

RK1 pressure control valves **closed**, staircase door **open**

RK2 pressure control valves **closed**, exhaust fan DV during nominal operation

### Components:

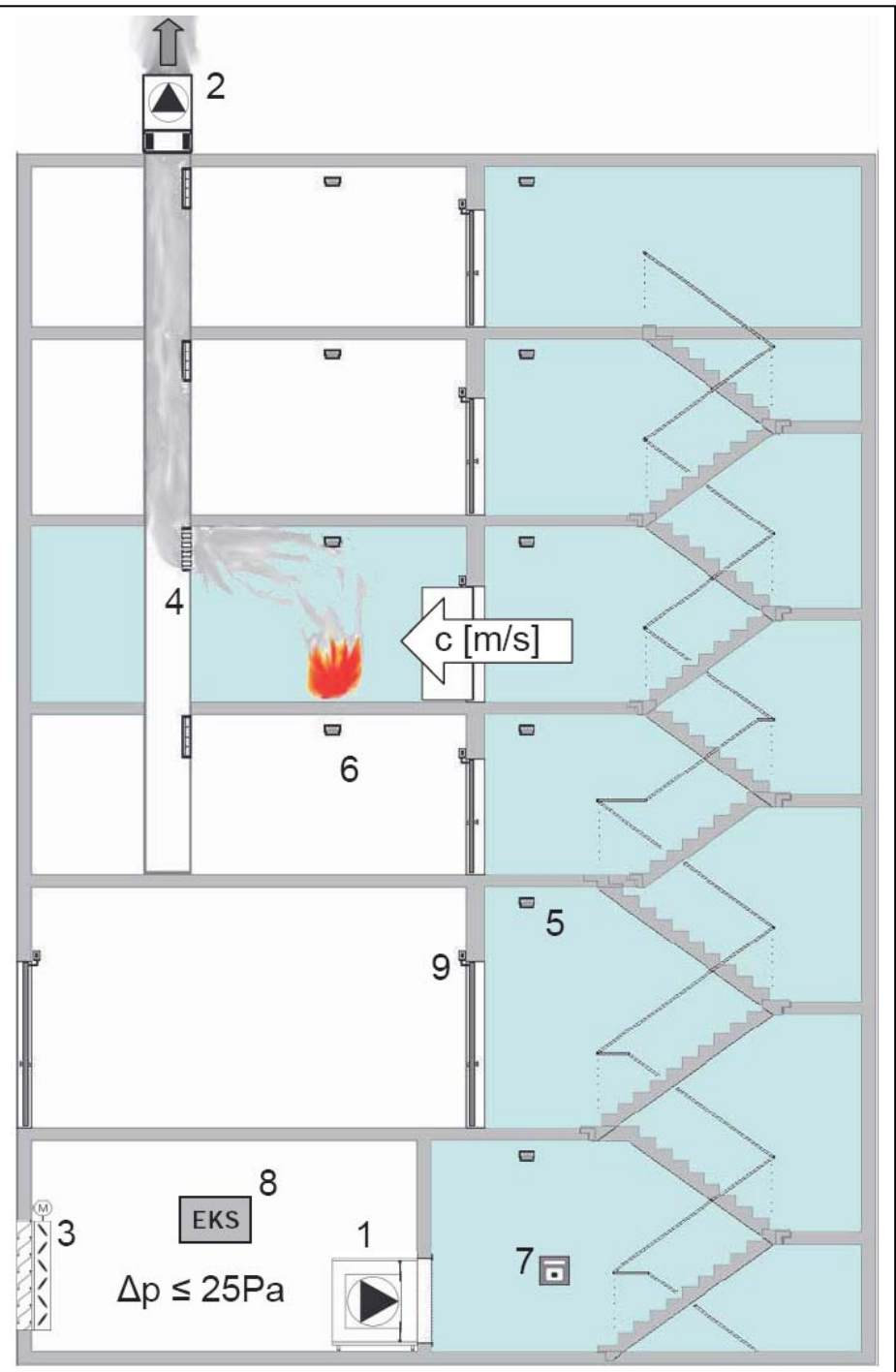
1. DV-RK1 box device with an integral control valve
2. DS-RK2-EV exhaust ventilator with a roof base and control valve. For a secure discharge independent from the weather factors.
3. Multi-blade damper with SLC drive and weather protection grille for the wake
4. RKI-90 SLC smoke control damper
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors First detection row
6. Appropriate number of ST-P-DA-STB ceiling smoke detectors Second detection row, apartments optional
7. DKM manual alarm box
8. EKS control, tested by VdS
9. Door closer

### Advantages of this system:

- Absolutely safe from smoke entering the staircase
- No wind influences, slight convection influences

### Features of the system:

- Pressure losses on the suction side of the DV-RK1 shall be limited to 25 Pa
- EKS monitored for cable break and short circuit



## Differential pressure systems

### System example:

Mechanical air supply with DV1

RK2-JZI-DS-AH discharge unit with pressure control valve

Natural discharge in the fire level

**RK2 pressure control valves open, staircase door closed**  
**Facade discharge area open**

### Components:

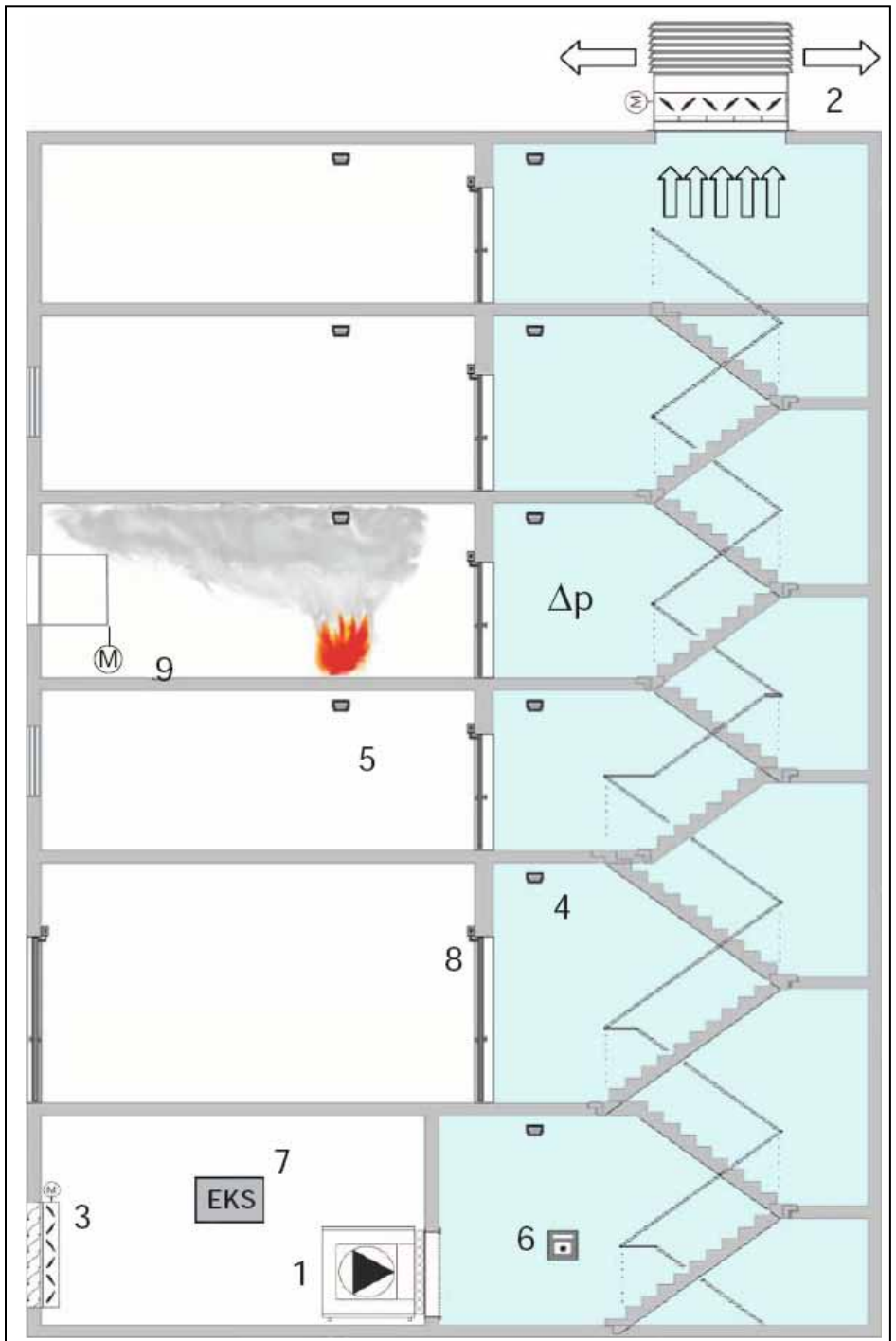
1. DV1 supply air fan as a box device
2. Pressure relief unit with integral RK2 control valve and powered JZI (SLC) multi-blade damper
3. Multi-blade damper (SLC drive) with a weather protection grille for the wake
4. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
First detection row
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Second detection row, apartments optional
6. DKM manual alarm box
7. EKS control, tested by VdS
8. Door closer
9. Discharge opening fire level

### Advantages of this system:

- Pressure losses on the suction side of the DV1 have no influence on the staircase overpressure

### Features of the system:

- The RK2 pressure control valve opens immediately when the staircase door is closed. Afterwards immediate flow-through inside the staircase (attention shall be paid to the flow-through pressure loss)
- Dimension convection influences for the operation in the summer and winter



## Differential pressure systems

### System example:

Mechanical air supply with DV1  
 RK2-JZI-DS-AH discharge unit with pressure control valve  
 Natural discharge in the fire level

RK2 pressure control valves **closed**, staircase door and facade discharge area **open**

### Components:

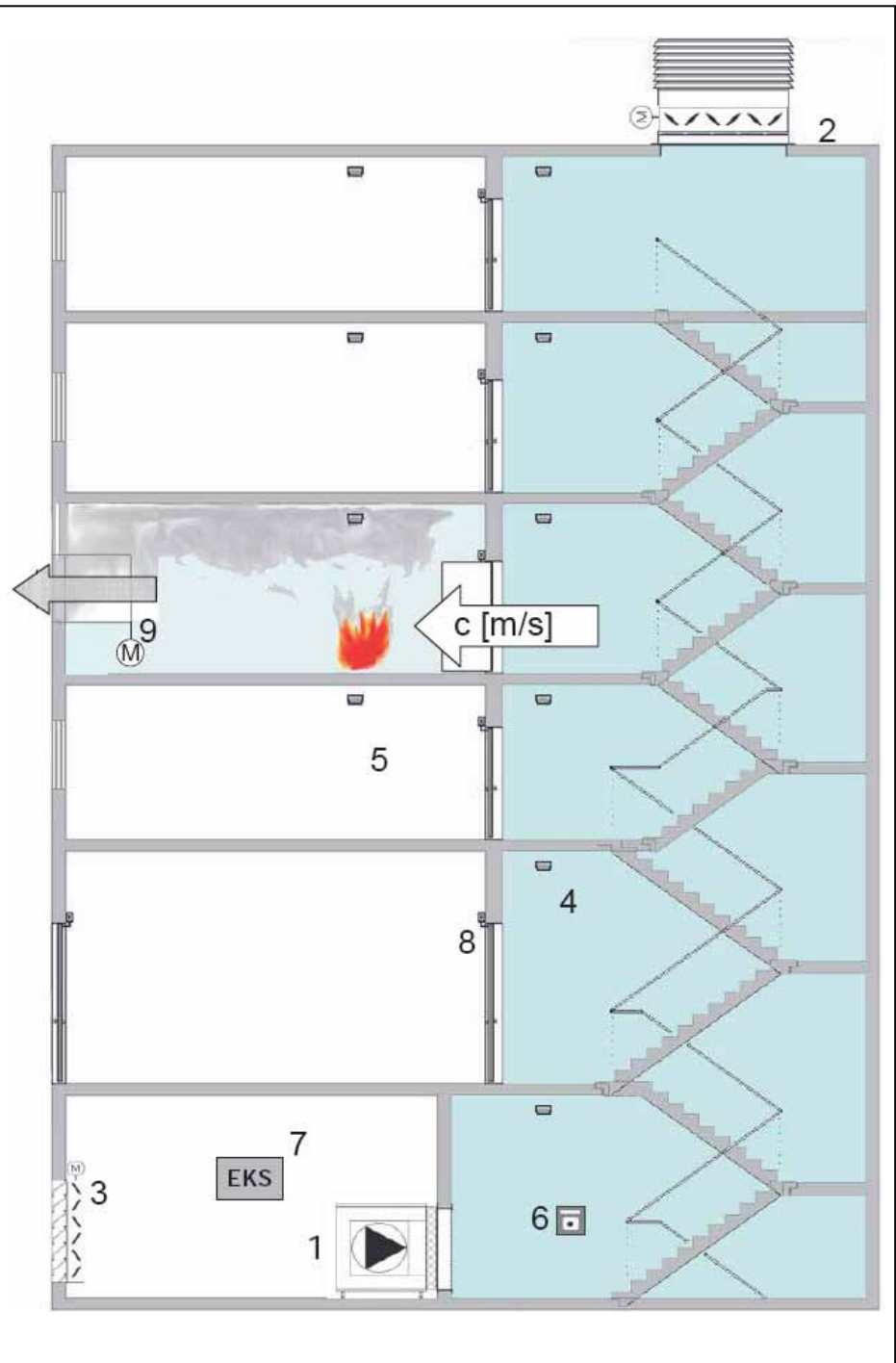
1. DV1 box device
2. Pressure relief unit with integral RK2 control valve and powered JZI (SLC) multi-blade damper
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4. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
First detection row
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Second detection row, apartments optional
6. DKM manual alarm box
7. EKS control, tested by VdS
8. Door closer
9. Discharge opening fire level

### Advantages of this system:

- Pressure losses on the suction side of the DV1 have no influence on the staircase overpressure

### Features of the system:

- The RK2 pressure control valve opens immediately when the staircase door is closed. Afterwards immediate flow-through inside the staircase (attention shall be paid to the flow-through pressure loss)
- Dimension convection influences for the operation in the summer and winter



## Differential pressure systems

### System example:

Mechanical air supply with DV1  
 RK2-JZI-DS-AH discharge unit with pressure control valve  
 Overflow between floodgate and elevator lobby,  
 all floors with the same preference regarding  
 the flow-through

**RK2 pressure control valve open, staircase doors closed and facade discharge area open**

### Components:

1. DV1 box device
2. Pressure relief unit with integral RK2 control valve and powered JZI (SLC) multi-blade damper
3. Multi-blade damper (SLC drive) with a weather protection grille for the wake
4. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
First detection row
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Second detection row
6. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Third detection row, apartments optional
7. DKM manual alarm box
8. EKS control, tested by VdS
9. Door closer
10. Overflow element with fire protection
11. Discharge opening fire level

### Advantages of this system:

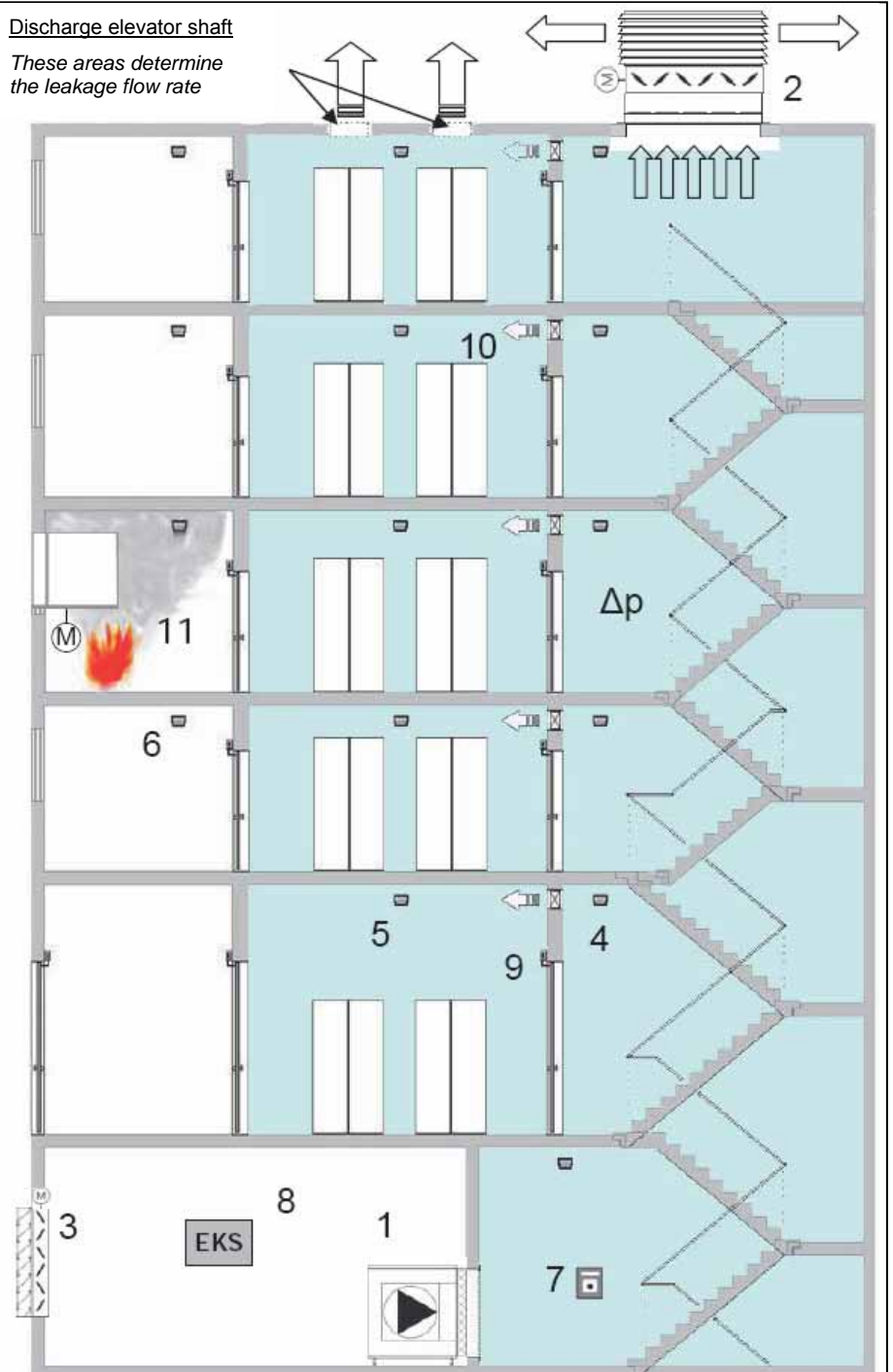
- Prevention of smoke spread by means of a permanent discharge via closed lift landing doors

### Features of the system:

- The RK2 pressure control valve opens immediately when the staircase door is closed. Afterwards immediate flow-through inside the staircase (attention shall be paid to the flow-through pressure loss)
- Dimension convection influences for the operation in the summer and winter

### Discharge elevator shaft

*These areas determine the leakage flow rate*



## Differential pressure systems

### System example:

Mechanical air supply with DV1  
 RK2-JZI-DS-AH discharge unit with pressure control valve  
 Overflow between floodgate and elevator lobby,  
 all floor with the same preference regarding  
 the flow-through

**RK2 pressure control valve closed, staircase doors closed and fire room door as well as facade discharge area open**

### Components:

1. DV1 box device
2. Pressure relief unit with integral RK2 control valve and powered JZI (SLC) multi-blade damper
3. Multi-blade damper (SLC drive) with a weather protection grille for the wake
4. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
First detection row
5. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Second detection row
6. Appropriate number of ST-P-DA-STB ceiling smoke detectors  
Third detection row, apartments optional
7. DKM manual alarm box
8. EKS control, tested by VdS
9. Door closer
10. Overflow element with fire protection
11. Discharge opening fire level

### Advantages of this system:

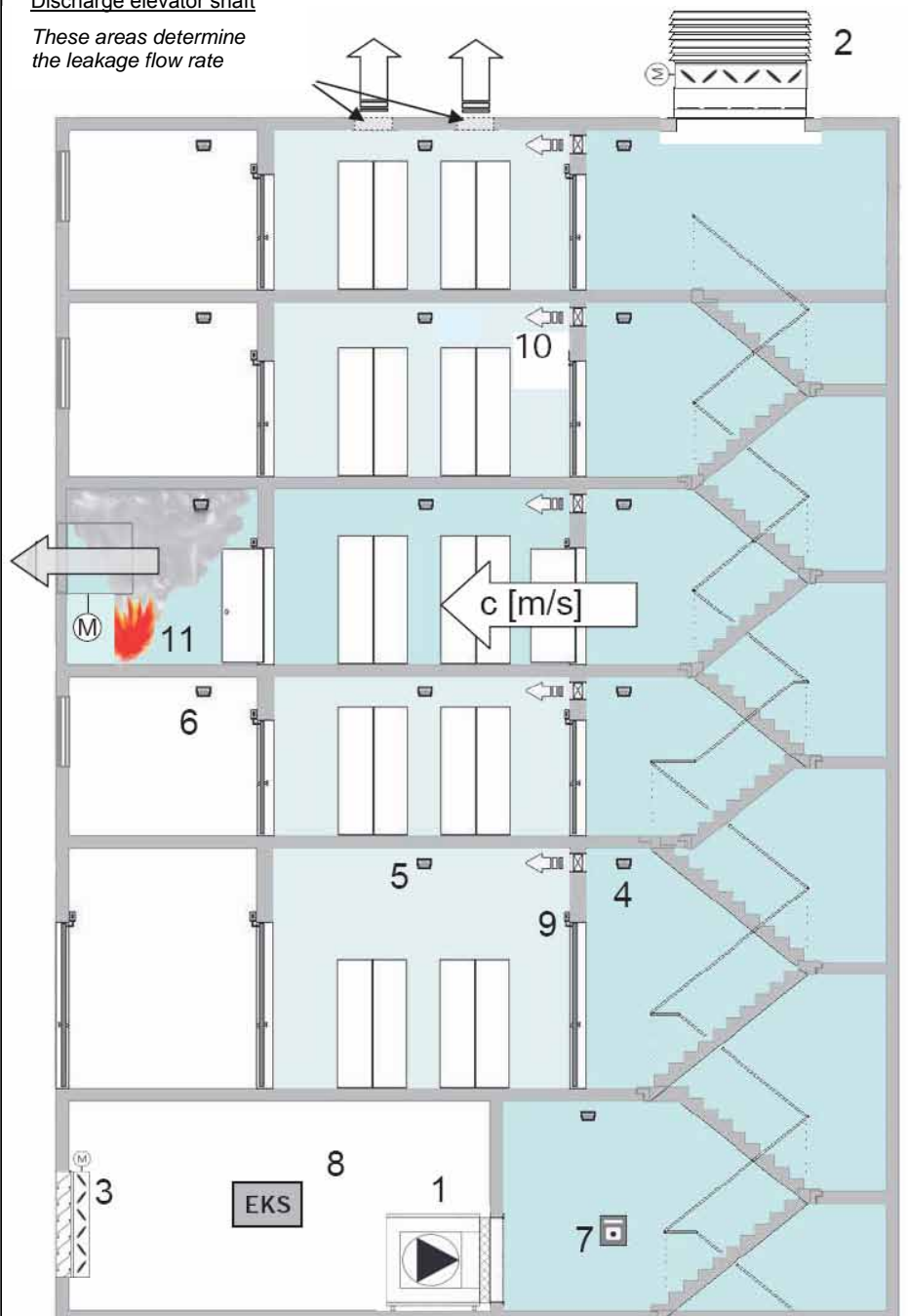
- Prevention of smoke spread by means of a permanent discharge via closed lift landing doors

### Features of the system:

- The RK2 pressure control valve opens immediately when the staircase door is closed. Afterwards immediate flow-through inside the staircase (attention shall be paid to the flow-through pressure loss)
- Dimension convection influences for the operation in the summer and winter

### Discharge elevator shaft

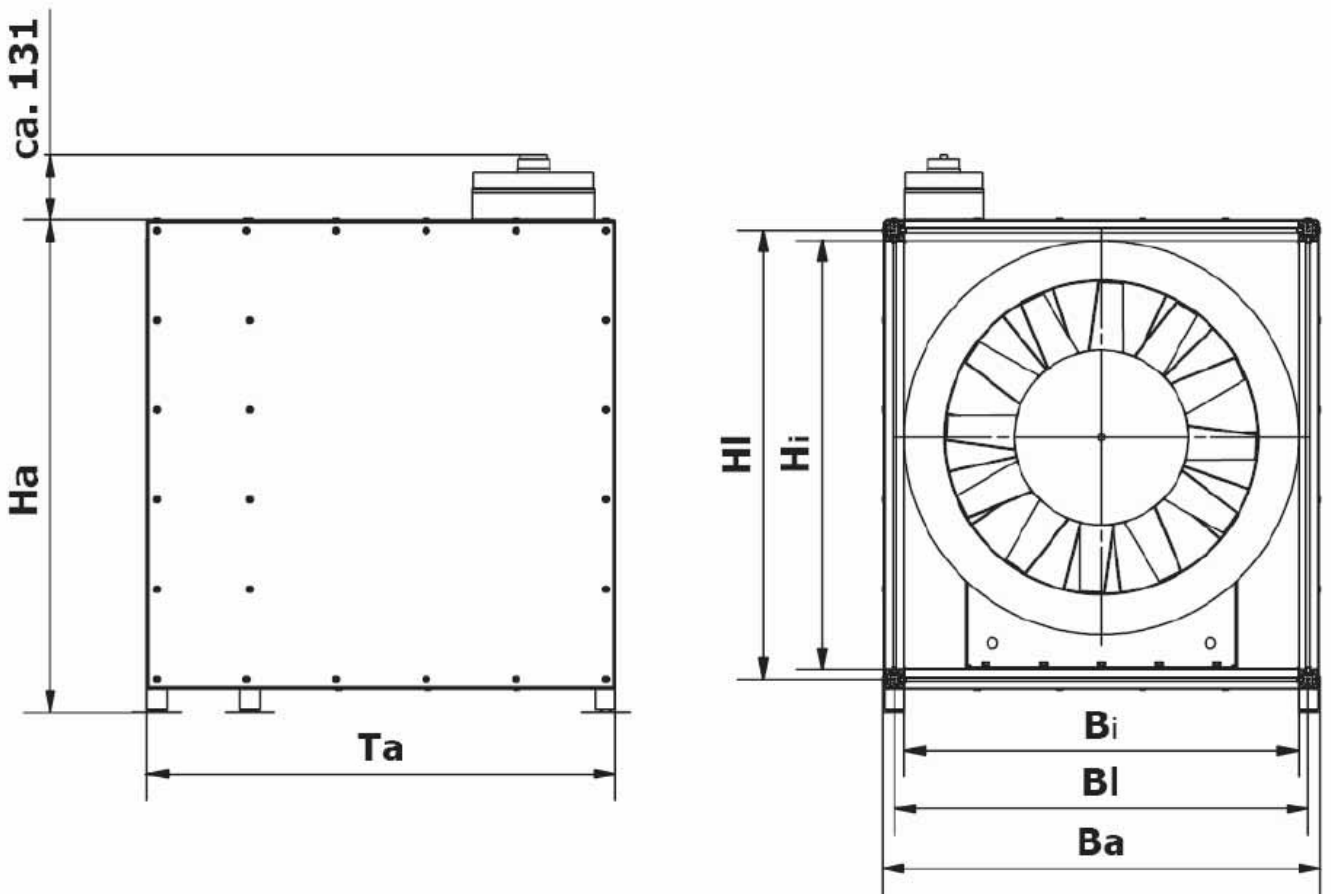
*These areas determine the leakage flow rate*



## DV1 – supply air fan as a box device

### Accessories:

1. Protection grille: at the suction side or at the pressure side
2. Elastic spigot: at the suction side or at the pressure side
3. Multi-blade damper with a SFR 1.90SLC drive – affixed at the pressure side
4. Repair switch in the direction of flow – affixed at the top, at the side (on the left/right side)



\* Rubber vibration damper included in the scope of delivery

Main dimensions (mm)								
Type	Ta	Ba	Bl	Bi	Ha	HI	Hi	Maximum weight
DV1 400	710	588	540	500	681	590	550	110 kg
DV1 450	740	648	600	560	746	655	615	120 kg
DV1 500	810	718	670	630	821	730	690	190 kg
DV1 630	950	888	840	800	1001	910	870	250 kg
DV1 710	1025	988	940	900	1106	1015	975	350 kg
DV1 800	1180	1088	1040	1000	1216	1125	1085	445 kg



## DV1 summary table

### Summary table for the DV1 supply air fan

Volume flow [m <sup>3</sup> /h]	Total pressure increase [Pa]	Static pressure [Pa]	Motor output [kW]	Starting current [A]	Rated current [A]	Revolutions (1/min)	Blade angle [°]	Type
5000	600	440	1,5	20,8	3,3	2895	11	DV1-400/1,5 kW
7500	700	345	3,0	40,3	6,2	2895	20	DV1-400/3 kW
5000	240	140	0,75	9,6	2,0	1400	26	DV1-450/0,75 kW
10000	900	500	4,0	66,4	7,9	2860	18	DV1-450/4 kW
7500	240	100	1,5	19,6	3,5	1400	22	DV1-500/1,5 kW
12500	900	500	5,5	69,3	11,0	2880	13	DV1-500/5,5 kW
15000	1200	640	7,5	94,9	14,6	2880	21	DV1-500/7,5 kW
12500	370	210	2,2	25,4	4,8	1400	14	DV1-630/2,2 kW
15000	420	195	3,0	40,9	6,6	1400	21	DV1-630/3 kW
17500	450	135	4,0	55,4	8,8	1400	27	DV1-630/4 kW
20000	450	50	4,0	55,4	8,8	1400	30	DV1-630/4 kW
17500	570	380	4,0	55,4	8,8	1430	15	DV1-710/4 kW
20000	600	350	5,5	75,9	11,5	1430	19	DV1-710/5,5 kW
25000	660	260	7,5	105,4	15,5	1430	28	DV1-710/7,5 kW
25000	850	600	11,0	151,8	22,0	1450	18	DV1-800/11 kW
30000	950	590	15,0	200,6	29,5	1450	25	DV1-800/15 kW

Arrangement: Fan blowing out freely

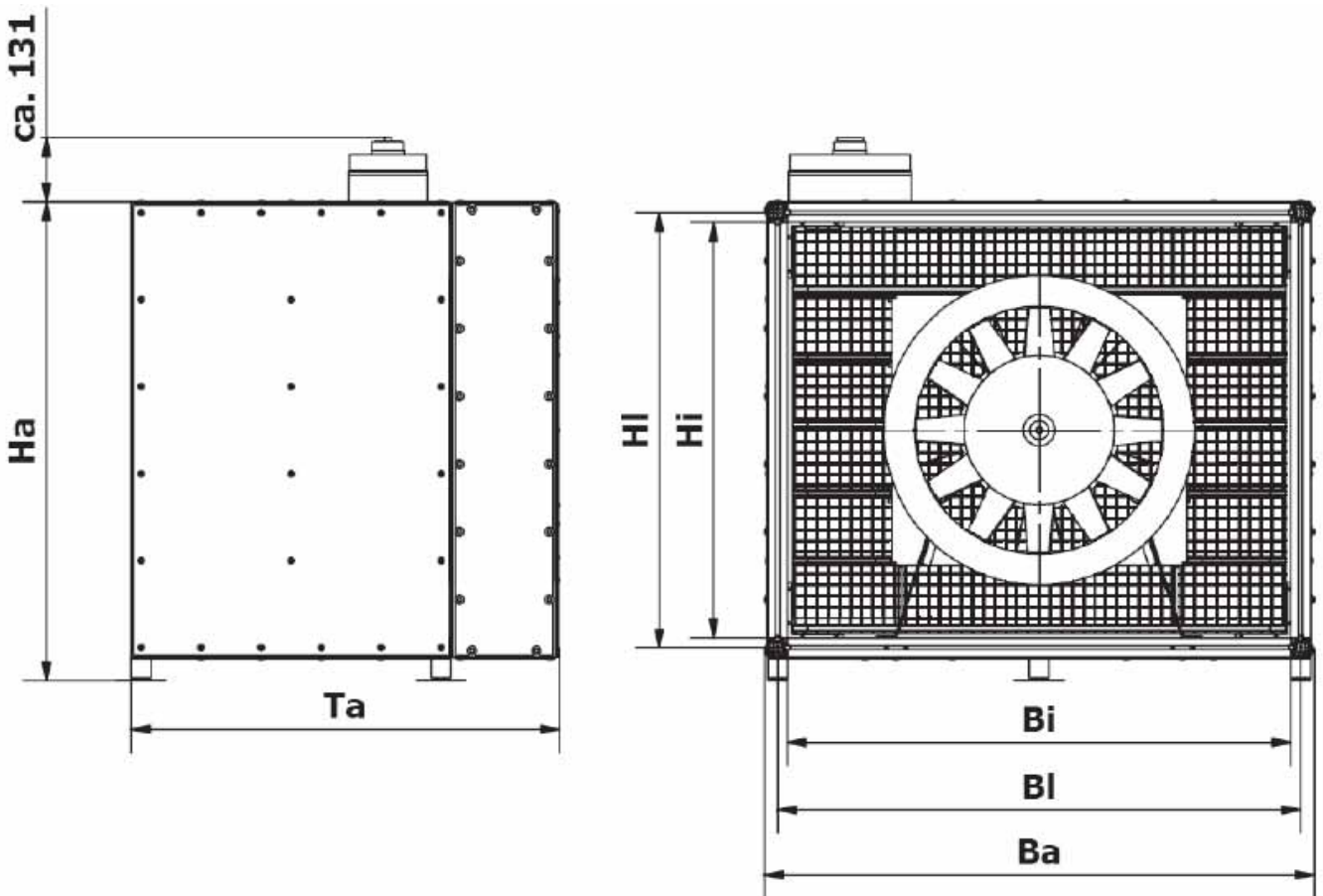
The above table lists a selection of operating points. Further operating points are achievable on request.



## DV-RK1 – smoke control pressure device with integral control valve

### Accessories:

1. Protection grille: at the suction side or at the pressure side
2. Elastic spigot: at the suction side or at the pressure side
3. Multi-blade damper with a SFR 1.90SLC drive – affixed at the pressure side
4. Repair switch in the direction of flow – affixed at the top, at the side (on the left/right side)



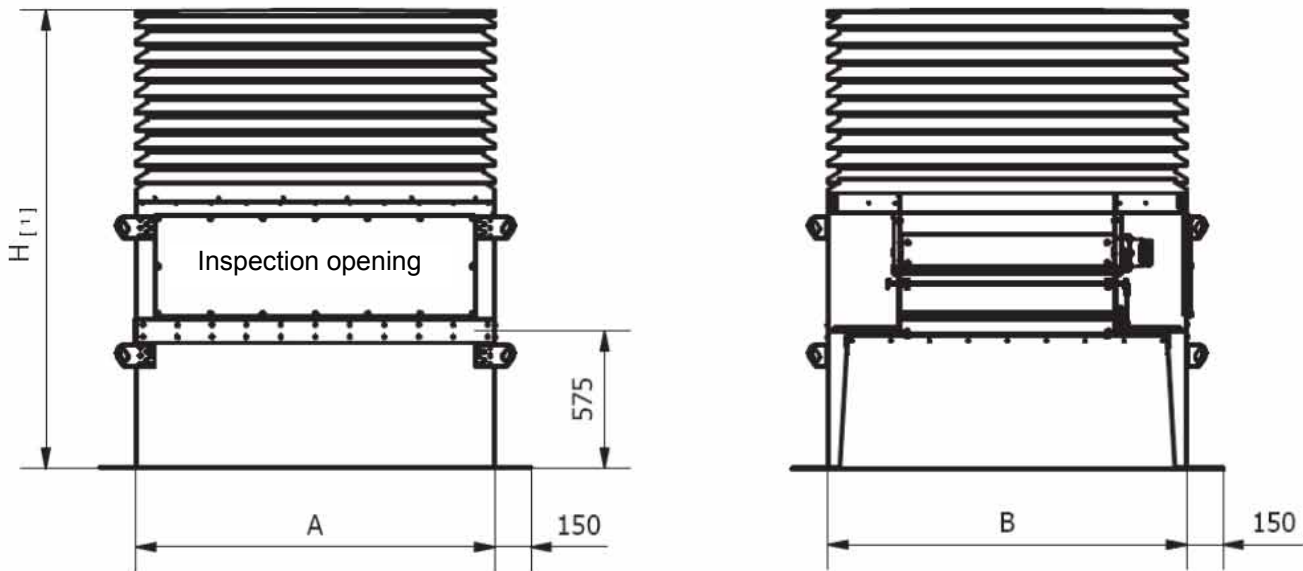
\* Rubber vibration damper included in the scope of delivery

Type	Ta	Ba	BI	Bi	Ha	HI	Hi	Maximum weight	Volume flow rate
DV-RK1 400	768	1014	960	920	782	690	650	150 kg	5000 m <sup>3</sup> /h
DV-RK1 500	869	1114	1060	1020	978	886	846	230 kg	10000 m <sup>3</sup> /h
DV-RK1 630	1027	1239	1185	1145	1254	1162	1122	300 kg	15000 m <sup>3</sup> /h
DV-RK1 630	1027	1239	1185	1145	1392	1300	1260	315 kg	20000 m <sup>3</sup> /h
DV-RK1 710	1096	1304	1250	1210	1668	1576	1536	420 kg	25000 m <sup>3</sup> /h

## RK2-JZI-DS-AH

Automatically adjusting pressure relief unit for the installation on top of flat roofs

### Volume flow rates and dimensions



	A [mm]	B [mm]	H [mm]	Total weight [kg]	RK2 size [b x h]	Recommended roof penetration size [mm]	Volume flow rate at a pressure difference of 50 Pa [m <sup>3</sup> /h]
RK2 400/550 JZI-DS-AH 900/900	900	900	1815	260	400/550	800 x 800	5000
RK2 630/688 JZI-DS-AH 1200/1200	1200	1200	1935	350	630/688	1000 x 1000	10000
RK2 800/826 JZI-DS-AH 1500/1500	1500	1500	2115	470	800/826	1300 x 1300	15000
RK2 900/964 JZI-DS-AH 1500/1500	1500	1500	2115	480	900/964	1300 x 1300	20000
RK2 900/1240 JZI-DS-AH 1500/1500	1500	1500	2115	500	900/1240	1300 x 1300	25000

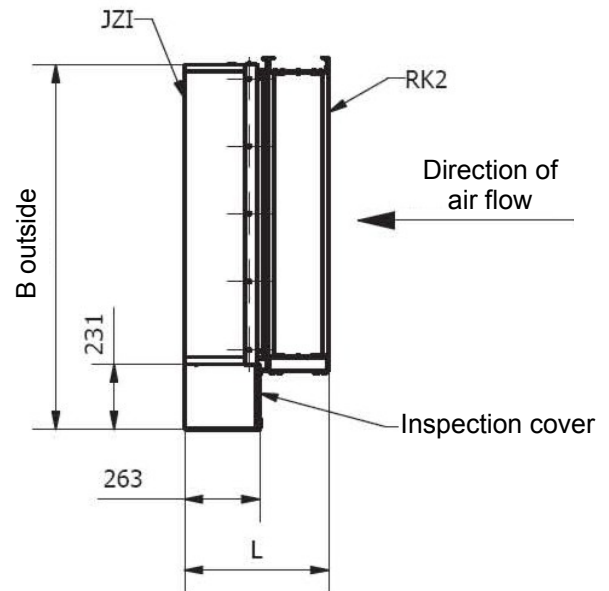
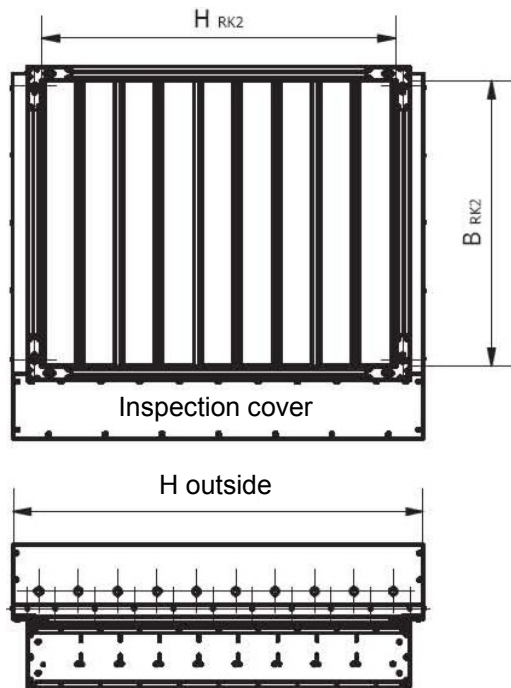
\* Basis and lamella hood in galvanized steel, powder coated to RAL 7001; further RAL colors on request.  
[ 1 ] different height on request.

### RK2-H-JZI

Automatically adjusting pressure relief unit for the installation into walls and floors

**Optional accessory:**  
Baffle plate projecting structure

### Volume flow rates and dimensions



**Attention:**

$B_{\text{wall opening}} = H_{\text{outside}} + \text{min. } 40 \text{ mm}$

$H_{\text{wall opening}} = B_{\text{outside}} + \text{min. } 40 \text{ mm}$

	B outside [mm]	H outside [mm]	L [mm]	Total weight [kg]	Size $B_{RK2} \times H_{RK2}$ [b x h]	Recommended wall penetration size [mm]	Volume flow rate at a pressure difference of 50 Pa [m <sup>3</sup> /h]
RK2-H 400/500 JZI	681	753	506	60	400/550	793 x 721	5000
RK2-H 630/688 JZI	911	891	506	80	630/688	931 x 951	10000
RK2-H 800/826 JZI	1081	1029	506	100	800/826	1069 x 1121	15000
RK2-H 900/946 JZI	1181	1167	506	120	900/964	1207 x 1221	20000
RK2-H 900/1240 JZI	1181	1443	506	140	900/1240	1483 x 1221	25000

**RKU-90/Z-78.2-12**  
**RKU-90-KL/Z-78.3-78**



EK-90 fire resistance class  
 90 min fire resistance time

**RKE/Z-78.2-47**  
**RKE-KL/Z-78.3-109**



Functional endurance of 60 min at 600 °C or 120 min at 400 °C  
 within smoke extraction ducts of sheet steel

**RKI-90/Z-78.2-11**  
**RKI-90-KL (test certificate in preparation)**



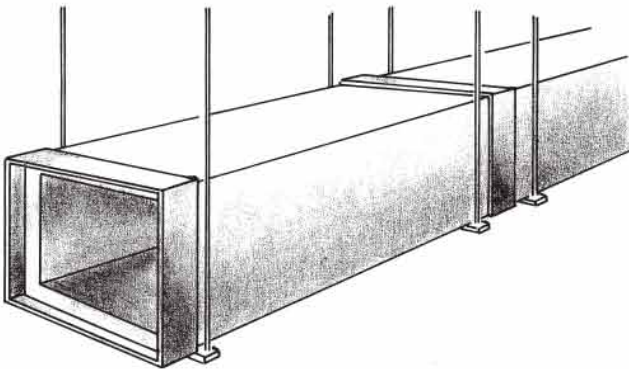
EK-90 fire resistance class within smoke extraction ducts with a fire  
 resistance time of 90 min

**WSK-600/P-TUM-411 or P-3464/5595-MPA BS**  
**and P-3469/5645-MPA BS**



Functional endurance of 120 min at 600 °C within smoke extraction  
 ducts of sheet steel

**L90 smoke extraction duct/P-TUM-405/P-TUM-406**



Self-supporting, fire-resistant smoke extraction duct

**Smoke extraction ducts of sheet steel/P-TUM-411**  
**or P-3464/5595-MPA BS and P-3469/5645-MPA BS**

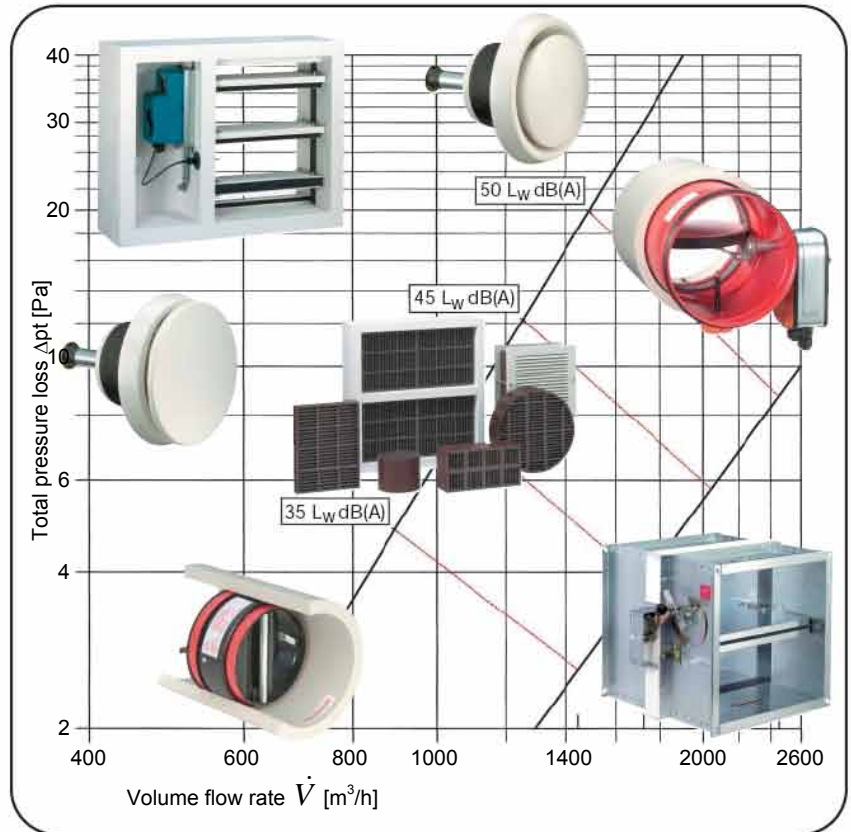


Functional endurance of 120 min at 600 °C inside the smoke  
 exhaust zone (without a fire resistance class)

## Fire prevention

K90 or K30 dampers in accordance with DIN 4102-6

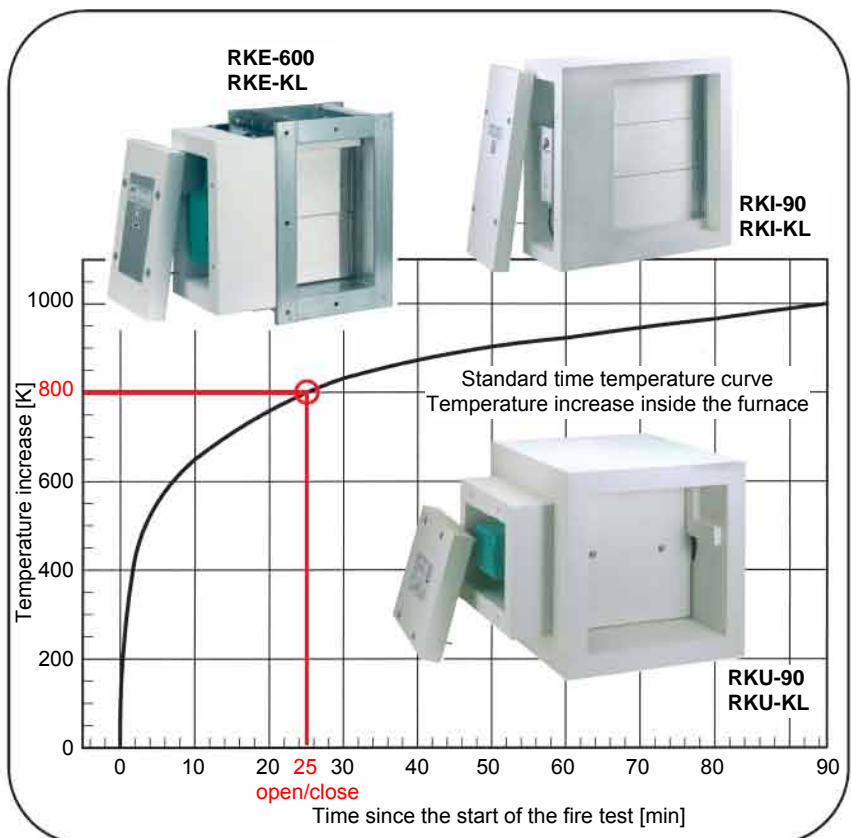
Part I – 09/2006



## Fire prevention

Smoke exhaust systems

Part III – 03/2007





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