CE

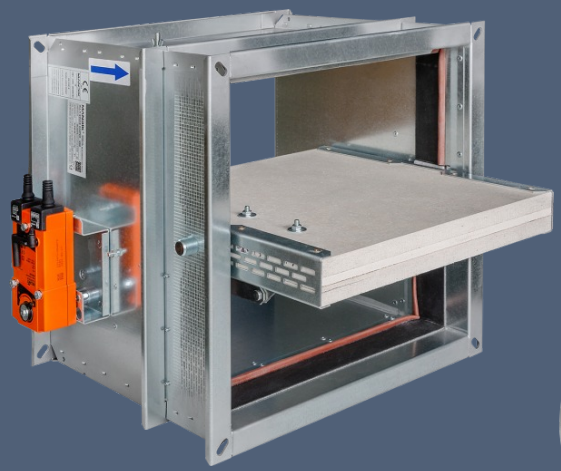
TPM 109/15
Revision 8
Valid from 20/3/23

EN 12101-8

MANDÍK®

MULTI SMOKE DAMPER

MSD





These technical specifications state a row of manufactured sizes and models of multi smoke dampers (further only dampers) MSD. It is valid for production, designing, ordering, delivery, maintenance and operation.

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II. GENERAL INFORMATION

1. Description

Fig. 1 **MSD - square**



Fig. 2 **MSD - round**



1.1. Multi smoke dampers are shutters in the smoke exhaust duct systems. The dampers are designed to remove heat and combustible products (e.g. smoke) from effected fire compartments. In the event of fire the Smoke and Fire ventilation system opens the damper in the affected section and removes combustion products and heat from this section.
The damper blade is controlled by electrical actuating mechanism.
Dampers are fire resistant and are intended for systems with automatic activation.
Dampers can be installed in construction of the fire compartment.

Basic types of dampers square:

- MSD Cycling test with load (possible design .44, .54, .65 and .66)
- MSD-W Cycling test without load (possible design .44, .54, .66, .4M0, .4M1, .5M0 and .5M1)

Basic types of dampers round:

- MSD Cycling test with load (possible design .44, .54 and .66)
- MSD-W Cycling test without load (possible design .4M0, .4M1, .5M0 and .5M1)

Dampers MSD can be open against flow and pressure.
Dampers MSD-W has to be open with the help of flow or without flow present.

1.2. Damper characteristics

- CE certified acc. to EN 12101-8
- Tested in accordance with EN 1366-10
- Classified acc. to EN 13501-4+A1
- Fire resistance according Tab. 1.2.1. and 1.2.2.
- External casing leakage class min. C acc. to EN 1751
- Internal leakage: round dampers - class min. 2, diameters from 560 mm to 630 mm min. class 3 acc. to EN 1751
  square dampers - class min. 2, for max. dimension 1500 x 800 mm min. class 3 acc. to EN 1751
- Cycling test: MSD square dampers - C_{mod} acc. to EN 12101-8
  MSD, MSD-W round dampers - C_{10000} acc. to EN 12101-8
  MSD-W square dampers - C_{10000} acc. to EN 12101-8 (tested without load acc. to EN 1366-10)
- ES Certificate of conformity No. 1391-CPR-2021/0084 for MSD
- ES Certificate of conformity No. 1391-CPR-2021/0012 for MSD-W
- Declaration of Perfomance No. PM/MSD/01/22/3, PM/MSD-W/01/23/1
- Hygienic assessment of smoke control dampers - Report No. 1.6/pos/19/19c

Tab. 1.2.1. **Classification of dampers MSD - square**

Supporting Construction	Classification
Porous concrete ceiling construction	**EI 120 (h_{ow} - i↔o) S1500C_{mod}AAmulti**
Porous concrete wall construction	**EI 120 (v_{ew} - i↔o) S1500C_{mod}AAmulti**
Gypsum wall	**EI 120 (v_{ew} - i↔o) S1500C_{mod}AAmulti**

Tab. 1.2.2. **Classification of dampers MSD - round and MSD-W - round and square**

Supporting Construction	Classification
Porous concrete ceiling construction	**EI 120 (h_{ow} - i↔o) S1500C_{10000}AAmulti**
Porous concrete wall construction	**EI 120 (v_{ew} - i↔o) S1500C_{10000}AAmulti**
Gypsum wall	**EI 120 (v_{ew} - i↔o) S1500C_{10000}AAmulti**

1.3. Working conditions

Exact damper function is provided under the following conditions:
a) maximum air velocity 15 m/s
b) underpressure max. -1500 Pa or overpressure max. 500 Pa.

Dampers can be installed in arbitrary position (horizontal or vertical blade axis).

Dampers are designed for macroclimatic areas with mild climate according to EN 60 721-3-3. Temperature in the place of installation is permitted to range from - 30°C to + 50°C.

2. Design

2.1. Design with actuating mechanism

Design .44 and .54

Belimo actuators are used for dampers, series BEN, BEE, BE for 230V AC resp. 24 V AC/DC, Schischek InMax 50.75-S actuators (universal 24V or 230V supply) are used for large size of dampers.

After connection to the power supply voltage, the actuator moves the damper blade to the "OPEN" position or "CLOSED" (according to the corresponding connection, see wiring diagram). If the power supply is interrupted, the actuator stops at the current position. The signalling of the "OPEN" and "CLOSED" damper blade positions is ensured by two built-in fixed “potential-free” end- limit switches.

The actuator for operating the damper blade can be mounted in an insulated cover/box. It is accessible after removing the cover lid. The electrical connection of the actuator is made with a non-flammable cable (or a cable located in the adjoining cable duct), which passes through an opening made in the wall of the insulated cover/box when installing the damper or when connecting the actuator power cable. The cable entry must meet a minimum fire resistance of 30 minutes.

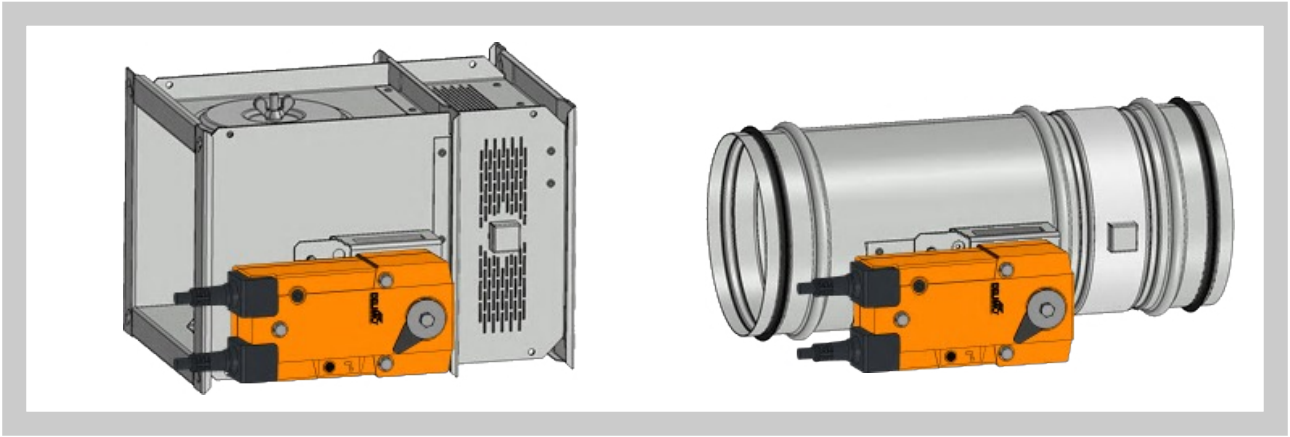
Design .65 - only for square dampers MSD

Belimo modulating actuators, BEN (BEE)-SR series for 24V AC/DC are specially designed for remote control of smoke control dampers. The position of the damper blade is adjustable by means of control voltage 0 (2)...10V DC.

The signalling of the "OPEN" and "CLOSED" damper blade positions is ensured by two built-in fixed “potential-free” limit switches.

The actuator for operating the damper blade is mounted in an insulated cover/box. It is accessible after removing the cover lid. The electrical connection of the actuator is made with non-flammable cables (or cables located in the adjoining cable duct), which pass through an opening made in the wall of the insulated cover when installing the damper or when connecting the power cables of the actuator. The cable entry must meet a minimum fire resistance of 30 minutes.

Fig. 3 Design .44, .54 and .65



Tab. 2.1.1. Actuator BELIMO BEN 24(-ST), BEN 24-SR, BEN 230

Actuator BELIMO - 15 Nm	BEN 24(-ST)	BEN 24-SR only for square MSD	BEN 230
Power voltage	AC/DC 24 V 50/60Hz	AC/DC 24 V 50/60Hz	AC 230 V 50/60Hz
Power consumption - in operation - in the end position	3 W 0,1 W	3 W 0,3 W	4 W 0,4 W
Dimensioning	6 VA (Imax 8,2 A @ 5 ms)	6,5 VA (Imax 8.2 A @ 5 ms)	7 VA (Imax 4 A @ 5 ms)
Protection class	III	III	II
Degree of protection	IP 54		
Adjustment time for 95°	< 30 s		
Ambient temperature Storage temperature	-30°C … +55°C -40°C … +80°C		
Connection - drive - auxiliary switch	Cable 1 m, 3 x 0,75 mm² Cable 1 m, 6 x 0,75 mm² (BEN 24-ST) with plug connectors	Cable 1 m, 4 x 0,75 mm² Cable 1 m, 6 x 0,75 mm²	Cable 1 m, 3 x 0,75 mm² Cable 1 m, 6 x 0,75 mm²

Fig. 4 Actuator BELIMO BEN 24(-ST)

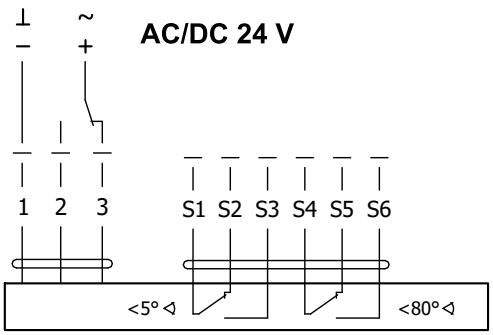




Fig. 5 Actuator BELIMO BEN 24-SR - only for square dampers MSD

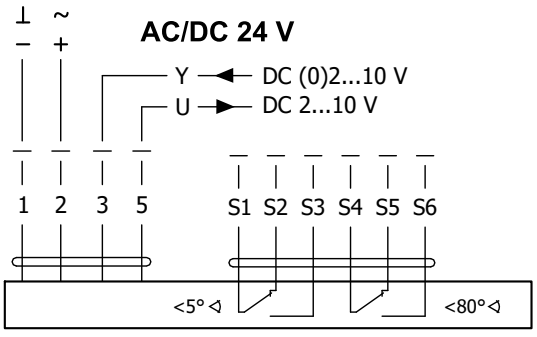
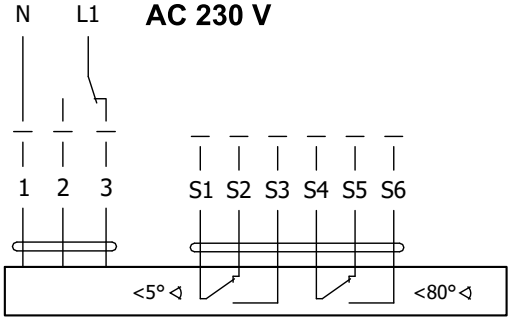




Fig. 6 Actuator BELIMO BEN 230





Tab. 2.1.2. Actuator BELIMO BEE 24(-ST), BEE 24-SR, BEE 230

Actuator BELIMO - 25 Nm	BEE 24(-ST)	BEE 24-SR only for square MSD	BEE 230
Power voltage	AC/DC 24 V 50/60Hz	AC/DC 24 V 50/60Hz	AC 230 V 50/60Hz
Power consumption - in operation - in the end position	2,5 W 0,1 W	3 W 0,3 W	3,5 W 0,4 W
Dimensioning	5 VA (Imax 8,2 A @ 5 ms)	5,5 VA (Imax 8.2 A @ 5 ms)	6 VA (Imax 4 A @ 5 ms)
Protection class	III	III	II
Degree of protection	IP 54		
Adjustment time for 95°	< 60 s		
Ambient temperature Storage temperature	-30°C … +55°C -40°C … +80°C		
Connection - drive - auxiliary switch	Cable 1 m, 3 x 0,75 mm² Cable 1 m, 6 x 0,75 mm² (BEE 24-ST) with plug connectors	Cable 1 m, 4 x 0,75 mm² Cable 1 m, 6 x 0,75 mm²	Cable 1 m, 3 x 0,75 mm² Cable 1 m, 6 x 0,75 mm²

Fig. 7 Actuator BELIMO BEE 24(-ST)

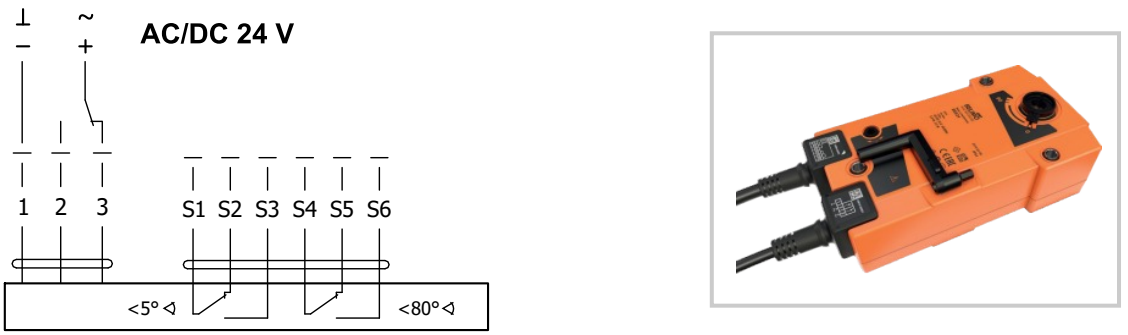


Fig. 8 Actuator BELIMO BEE 24-SR - only for square dampers MSD

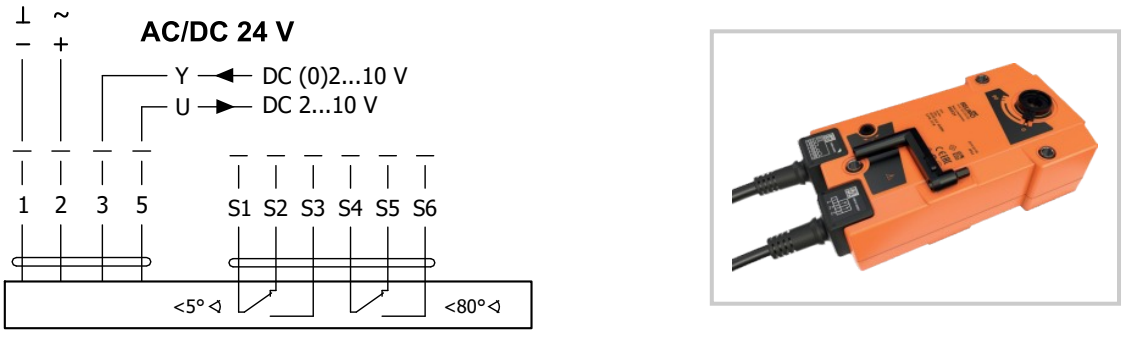
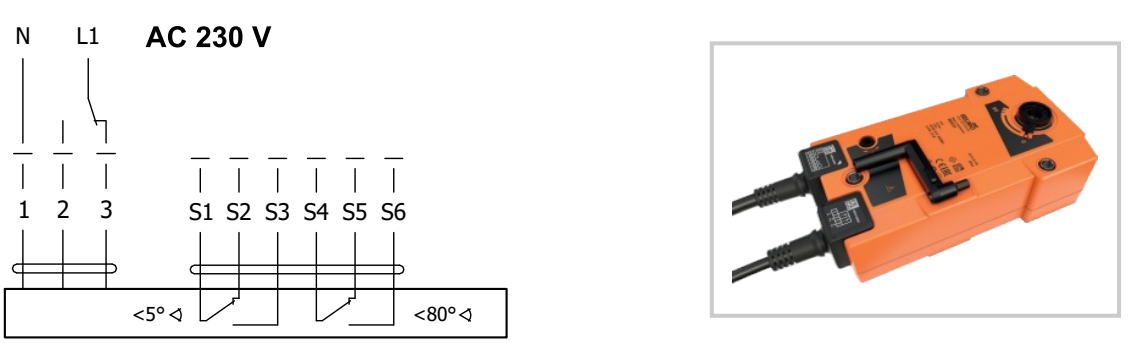


Fig. 9 Actuator BELIMO BEE 230



Tab. 2.1.3. Actuator BELIMO BE 24-12(-ST), BE 230-12

Actuator BELIMO - 40 Nm	**BE 24-12(-ST)**	**BE 230-12**
Power voltage	AC/DC 24 V 50/60Hz	AC 230 V 50/60Hz
Power consumption - in operation - in the end position	12 W 0,5 W	8 W 0,5 W
Dimensioning	18 VA (Imax 8,2 A @ 5 ms)	15 VA (Imax 7,9 A @ 5 ms)
Protection class	III	II
Degree of protection	IP 54	
Adjustment time for 95°	< 60 s	
Ambient temperature Storage temperature	-30°C … +50°C -40°C … +80°C	
Connection - drive - auxiliary switch	Cable 1 m, 3 x 0,75 mm² Cable 1 m, 6 x 0,75 mm² (BE 24-ST) with plug connectors	

Fig. 10 Actuator BELIMO BE 24-12(-ST)

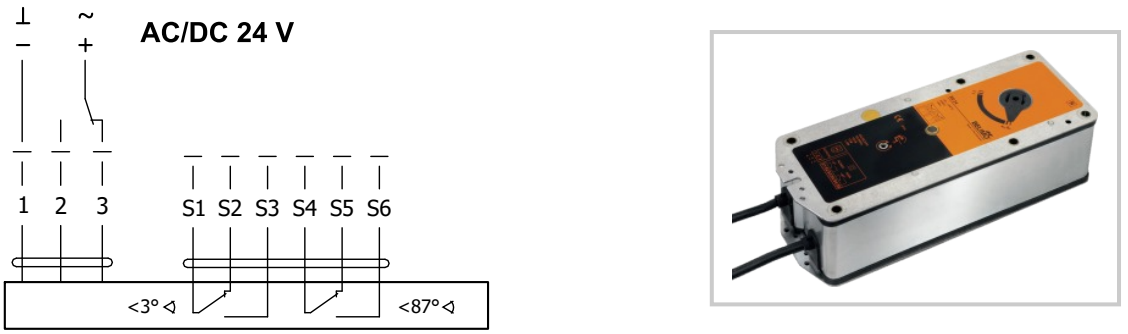
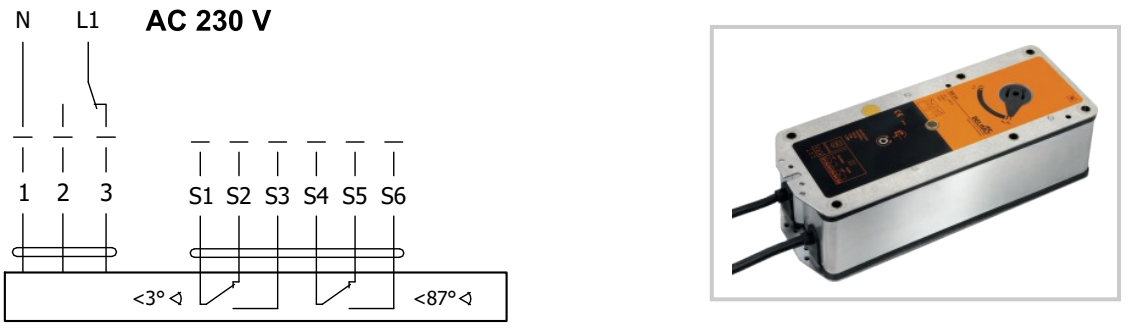


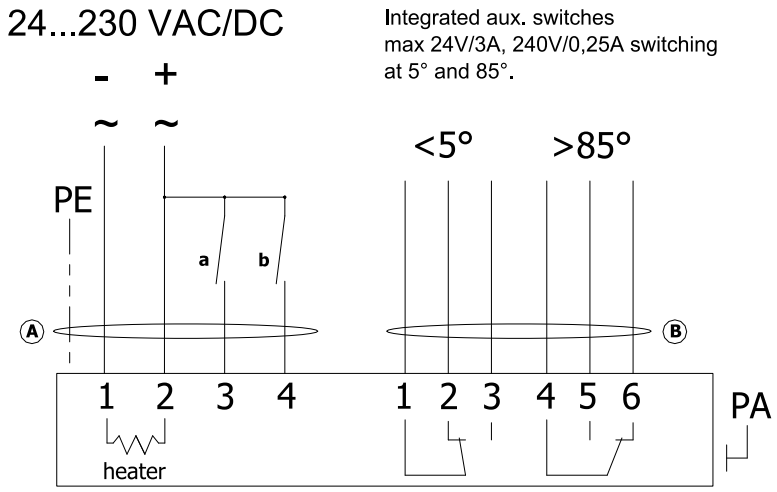
Fig. 11 Actuator BELIMO BE 230-12



Tab. 2.1.4. Actuating mechanism SCHISCHEK InMax 50.75-S

Actuator SCHISCHEK	InMax 50.75-S
Nominal voltage	24-240 VAC/DC 50/60Hz
Power consumption - motoring - heating	10 W 16 W (start at -20°C)
Protection class	I
Degree of protection	IP 66
Running time for 95°	< 60 s
Ambient temperature range Non-operating temperature	-40°C … +50°C -40°C … +70°C
Connecting	Cable 1 m, 0,5 mm^2

Fig. 12 Actuating mechanism SCHISCHEK InMax 50.75-S



2.2. Design with the communication and supply device BKNE 230-24

Design. 66

Design with communication and power supply device BKNE 230-24 and with actuator BEN (BEE, BE)-ST for 24V.

The BKNE 230-24 serves on the one hand as a decentralized network device for powering the actuator and on the other hand transmits the signal of the communication and control device BKSE 24-6.

It simplifies electrical installation and connection of dampers. In the meantime, it facilitates “on-site inspection” and allows central control and inspection of dampers using a simple 2-wire line.
The BKNE 230-24 transmits the "OPEN" / "CLOSED" damper position (switches in the actuator) and fault messages to the BKSE 24-6. It also receives commands from the control device and controls the adjustment of the actuator to the desired position. The last control command will be retained even after a temporary network failure..

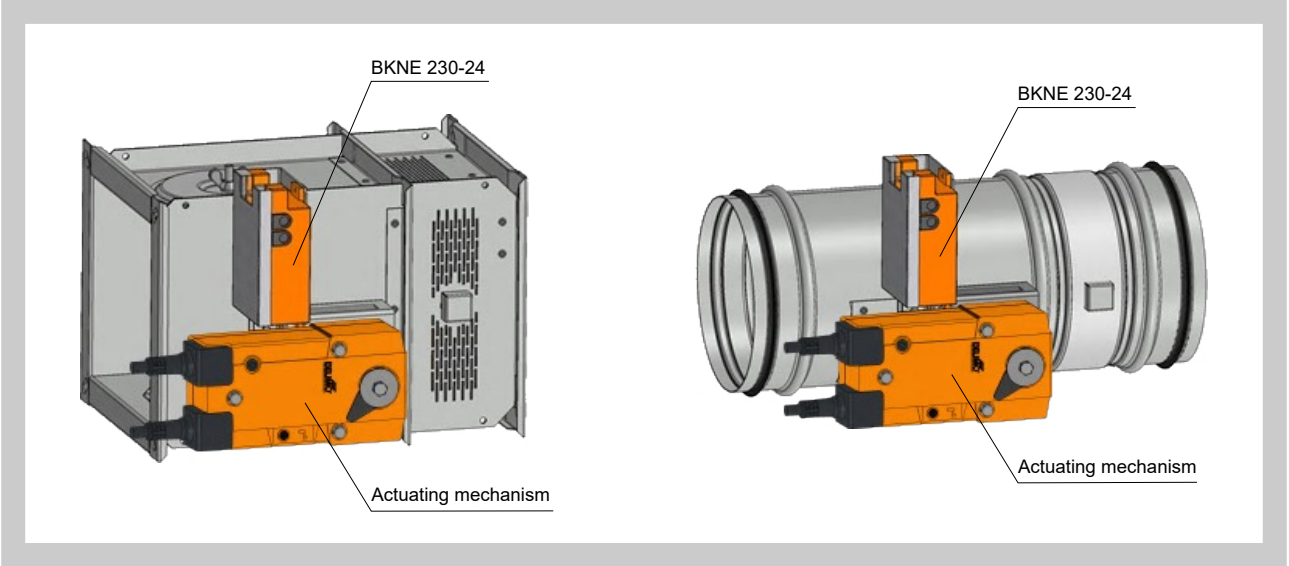
The BKNE 230-24 controls the switching position of the actuator, its adjustment time and the data exchange with the BKSE 24-6. In addition, it controls the actuator current (actuator connection) and the power supply.
To simplify the connection, the actuator is equipped with plug connectors that plug directly into the BKNE 230-24.

The actuator, communication and power supply device BKNE 230-24 can be mounted in an insulated cover, they are accessible after removing the cover. The electrical connection of the actuator and the BKNE 230-24 communication and power supply device is made with a non-flammable cable (or a cable located in an adjoining cable duct), the two-wire BKNE 230-24 cable should be connected to terminals 6 and 7. It is also recommended to use cable, which is used for fire signalling network. The cables pass through an opening made in the wall of the insulated cover when installing the damper or when connecting the actuator power cable. The cable entry must meet a minimum fire resistance of 30 minutes.

For more information on actuators and devices, see the Belimo catalogue.

This variant is not available for dampers with Schischek InMax 50.75-S actuator.

Fig. 13 Design .66

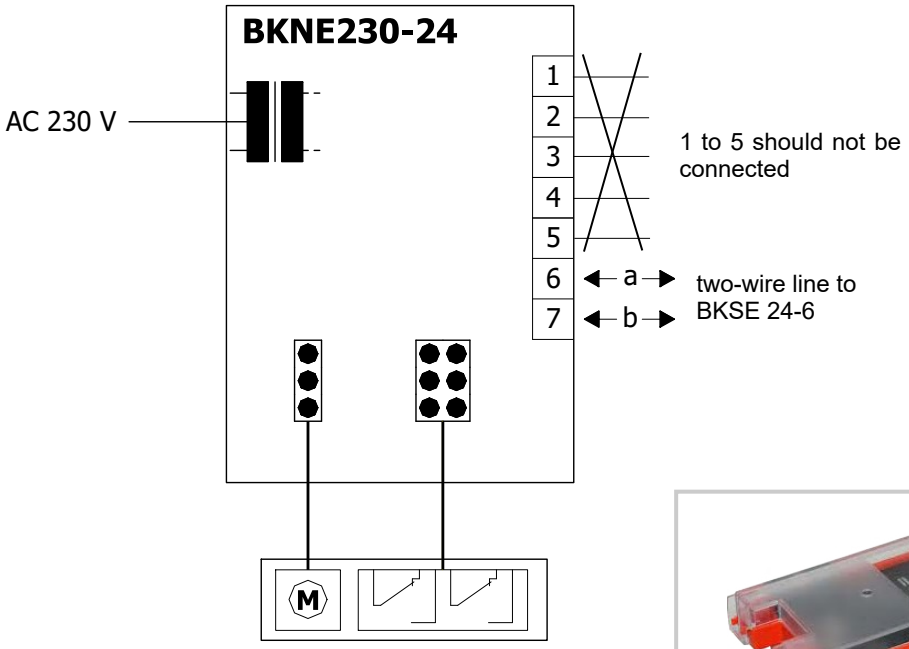


2.3. Communication and supply device

Tab. 2.3.1. Communication and power supply device BKNE 230-24

Communication and power supply device	BKNE 230-24
Power voltage	AC 230V 50/60Hz
Power consumption	10 W (including actuator)
Dimensioning	19 VA (including actuator)
Protection class	II
Ambient operation temperature Storage temperature	-30°C … +50°C -40°C … +80°C
Connection - network - drive - terminal blocks	cable 1 m without plug 6-pin plug, 3-pin plug screw terminals for 2x1.5 mm^2 conductor

Fig. 14 Communication and power supply device BKNE 230-24





Signalling

LED	State	Function
yellow	flashing	damper rotates to the open position
yellow	lit-up	damper is open
green	flashing	damper rotates to the closed position
green	lit-up	damper is closed
yellow or green	flashes twice as often	fault
yellow + green	dark	network outage

2.4. Communication and control devices

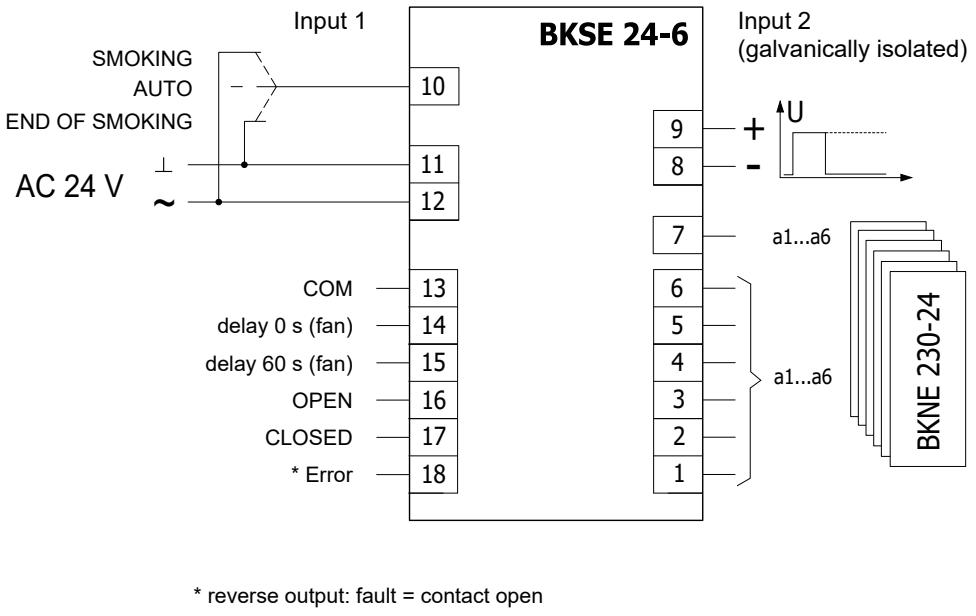
BKSE 24-6 indicates operating condition and faults of flue dampers. These conditions can be signalled or transmitted to the higher-level control system via the auxiliary built-in contacts. Signals from individual BKNE 230-24 are evaluated separately. All BKNE 230-24 are controlled simultaneously. A maximum of 6 BKNE 230-24 can be connected to the BKSE 24-6.

Damper control is ensured with a simple 2-wire line. The damper's correct function is indicated by two LEDs. The operating status of the entire control system and any errors are indicated by these LEDs and the corresponding error LED.
Mounting and connection of BKSE 24-6 can be done on a 35mm DIN rail. It's connected using two 9-pin terminal blocks (plug connectors).

Tab. 2.4.1. Communication and control devices BKSE 24-6

Communication and control devices	BKSE 24-6
Power voltage	AC 24 V 50/60Hz
Power consumption	3,5 W (operating position)
Dimensioning	5,5 VA 18 VA (Imax 6.4 A @ 2.5 ms)
Protection class	III (low voltage)
Degree of protection	IP 20
Ambient operation temperature	0 … +50°C
Connection	screw terminals for 2x1.5 mm^2 conductor

Fig. 15 Communication and control devices BKSE 24-6



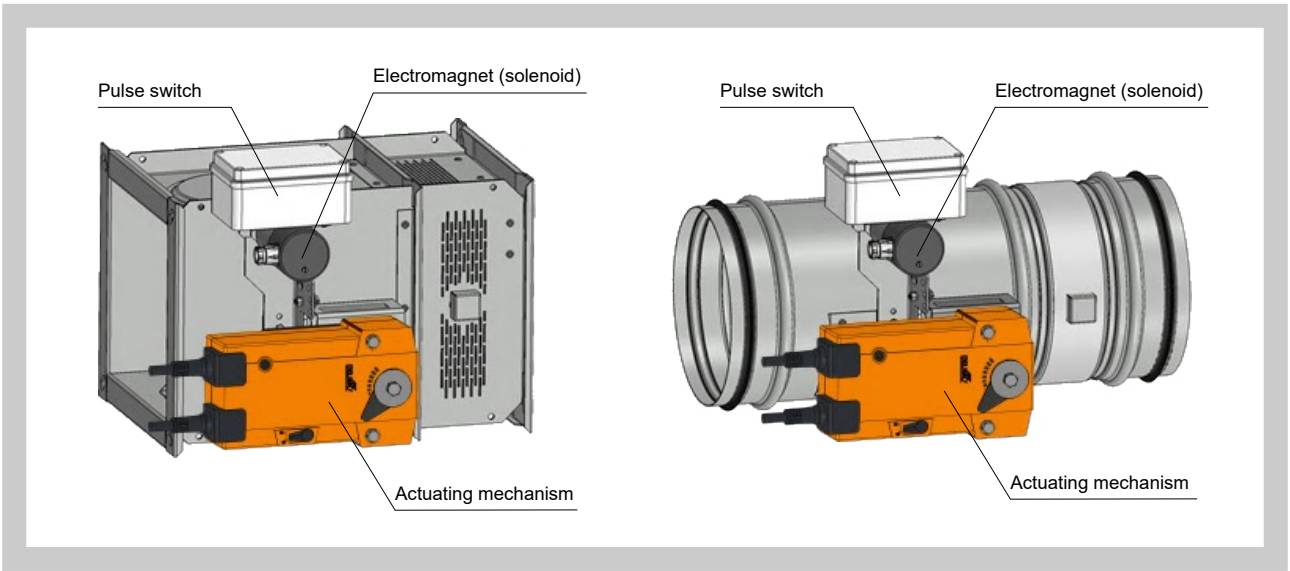
* reverse output: fault = contact open

2.5. Design with electric actuating mechanism with emergency function and electromagnet

Design .4M0, .4M1, .5M0 a .5M1

MSD-W is always equipped by electric actuating mechanism BFN 230-T, BFN 24-T, DAF2.20S or DAF1.20S (further only "actuating mechanism") and is complemented with initiation by means of an electromagnet (solenoid). After being connected to power supply AC/DC 24V or 230V, the actuating mechanism displaces the damper blade into operation position "CLOSED" and at the same time it pre-stretches its back spring. When the actuating mechanism is under voltage, the damper blade is in the position "CLOSED" and the back spring is pre-stretched. Time needed for full closing of the flap blade from the position "OPEN" to the position "CLOSED" is maximum 60 sec. This possition is secured by initional lever. If the actuating power supply is cut off damper is still in the position "CLOSED". After activation of electromagnet is released initiation lever and the back spring displaces the damper blade into the breakdown position "OPEN". The time of displacing the blade from the position "OPEN" to the position "CLOSED" takes maximum 16 sec. In case that the power supply is restored again (the blade can be in any position), the actuating mechanism starts to re-displace the damper blade into the position "CLOSED".
By voltage AC 230 V is damper equipped by electromagnet EM230. By voltage AC/DC 24 V is damper equipped by electromagnet EM230 with pre-pulse switch SIEM24. SEIM24 activates the electromagnet after capacitor charge witch is placed inside of SIEM24. It takes about 10 sec. Charging time depends on the current supply. For reliable operation is necessary connect to electromagnet or pre-pulse switch appropriate supply for 2 sec (230 V) or 20 to 30 sec (24 V).

Fig. 16 Design .4M0, .4M1, .5M0 a .5M1



Tab. 2.5.1. **Actuating mechanism BELIMO BFN 24, BFN 230**

Actuating mechanism BELIMO	BFN 24	BFN 230
Nominal voltage	AC 24V 50/60Hz DC 24 V	AC 230 V 50/60Hz
Power consumption - motoring - holding	5 W 2,5 W	5W 3W
Dimensioning	7 VA (Imax 5,8 A @ 5 ms)	7 VA (Imax 150 mA @ 10 ms)
Protection class	III	II
Degree of protection	IP 54	
Running time - motor - spring return	< 120 s ~ 16 s	
Ambient temperature - normal duty - safety duty - non-operating temperature	-30°C … +50°C The safe position will be attained up to max. 75°C -40°C … +50°C	
Connecting - motor - auxiliary switch	cable 1 m, 2 x 0,75 mm² cable 1 m, 6 x 0,75 mm²	

Fig. 17 **Actuating mechanism BELIMO BFN 24**

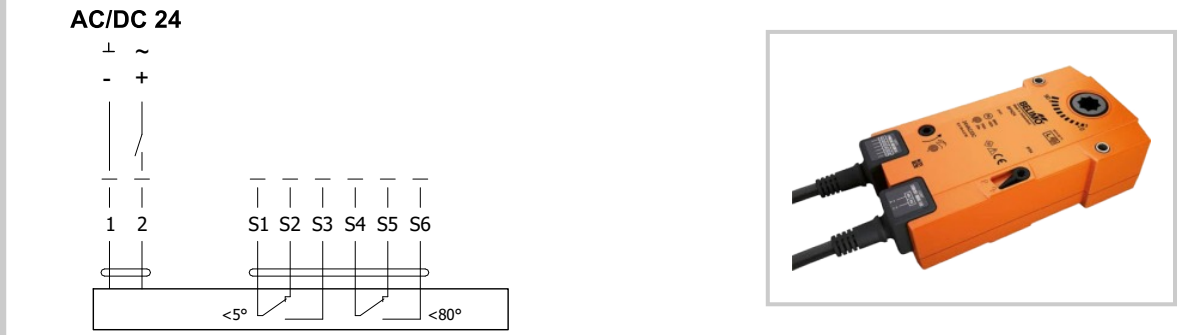
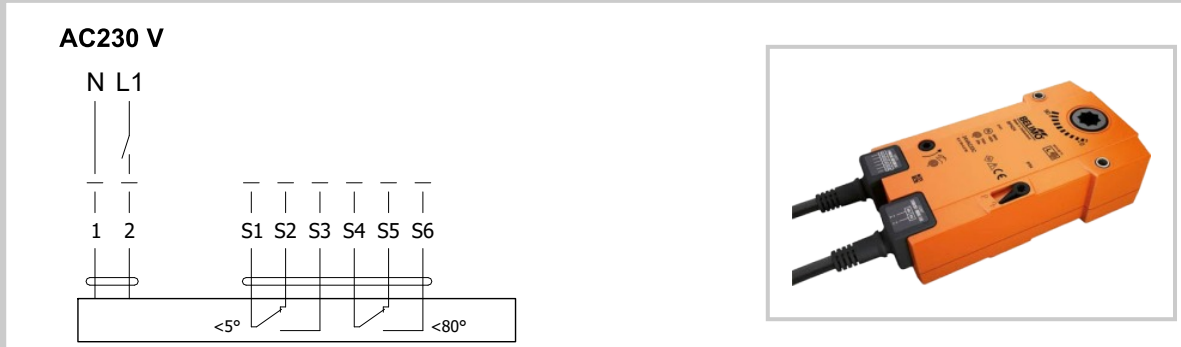


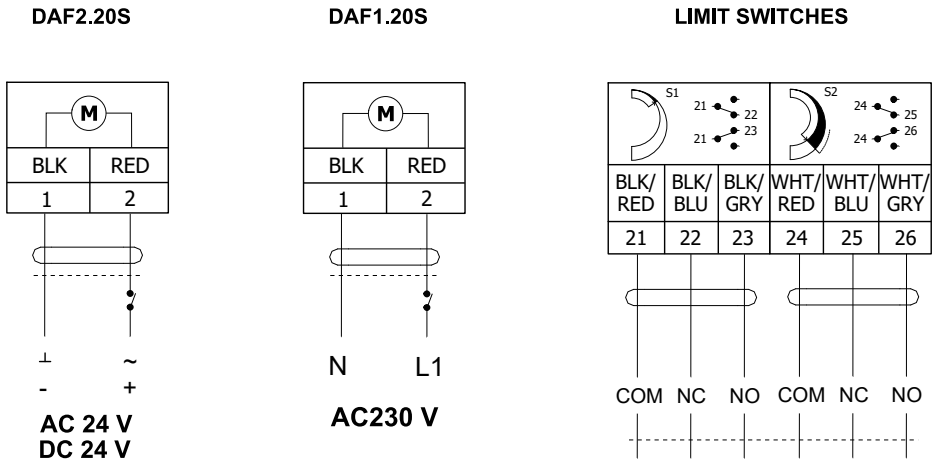
Fig. 18 **Actuating mechanism BELIMO BFN 230**



Tab. 2.5.2. Actuating mechanism Joventa DAF2.20S and DAF1.20S

Actuating mechanism Joventa	DAF2.20S	DAF1.20S
Nominal voltage	AC 24V 50/60Hz DC 24 V	AC 230 V 50/60Hz
Power consumption - motoring - holding	26 VA (AC); 15,6 W (DC) 9,3 VA (AC); 2,6 W (DC)	0,15 A 0,09 A
Dimensioning	14 VA	14 VA
Protection class	II	II
Degree of protection	IP 54	
Running time - motor - spring return	24…57 s 11…15 s	
Ambient temperature - normal duty - non-operating temperature	 -40°C … +55°C -65°C … +85°C	
Connecting - motor - auxiliary switch	cable 1,2 m halogen-free; 2-wires cable 1,2 m halogen-free; 6-wires	

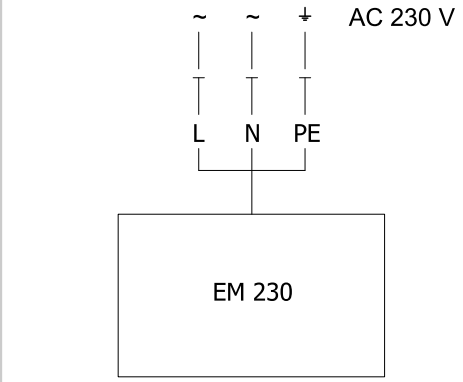
Fig. 19 Actuating mechanism Joventa DAF2.20S a DAF1.20S



Tab. 2.5.3. Electromagnet EM230

Electromagnet EM230	
Nominal voltage	AC 230 V / 50 Hz
Dimensioning	1,2 A
Degree of protection	IP 40
Ambient temperature range	-10°C … +40°C
Connecting	cable 1m, 3x0,75mm^2

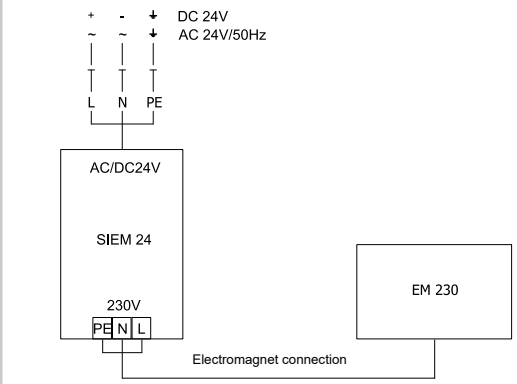
Fig. 20 Electromagnet EM230



Tab. 2.5.4. Electromagnet EM230 with impulse switchSIEM24

Electromagnet EM230 with impulse switch SIEM24	
Nominal voltage	AC 24 V / 50 Hz DC 24 V
Dimensioning	1 A
Degree of protection	IP 40
Ambient temperature range	-10°C … +40°C
Switching frequency	max. 1x per minute
Connecting	cable 1m, 3x0,75mm^2

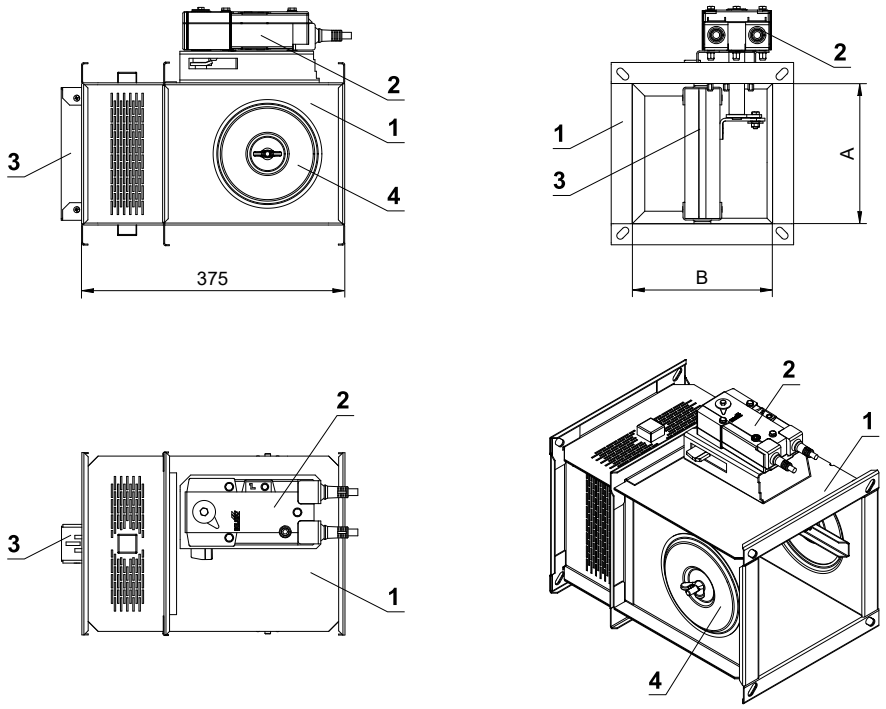
Fig. 21 Electromagnet EM230 with impulse switch SIEM24



3. Dimensions, weights

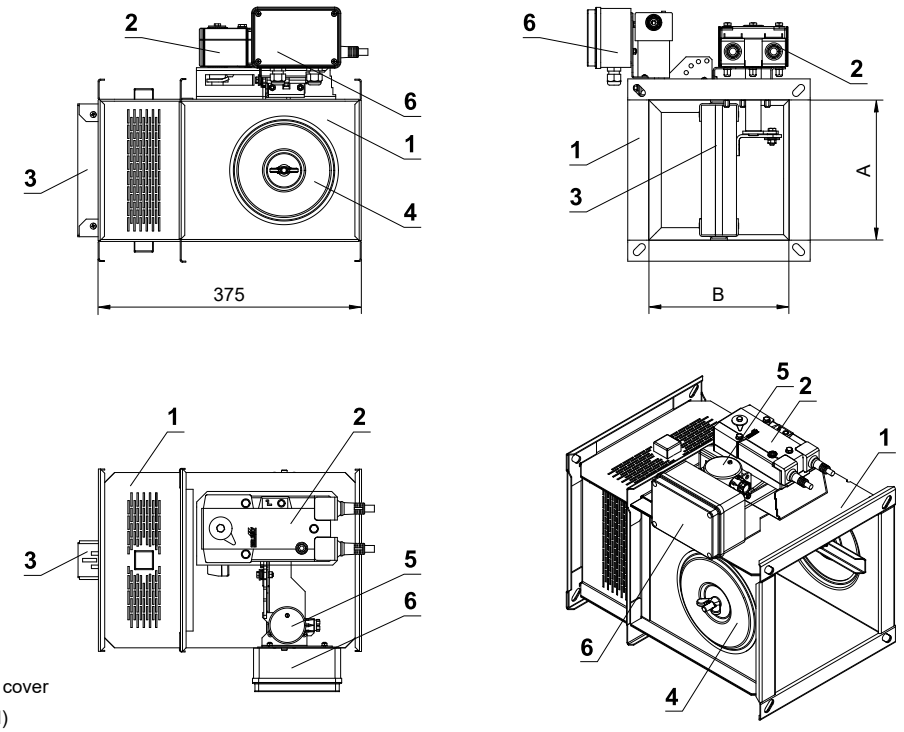
3.1. Dimensions

Fig. 22 Square MSD (MSD-W) - design with actuating mechanism



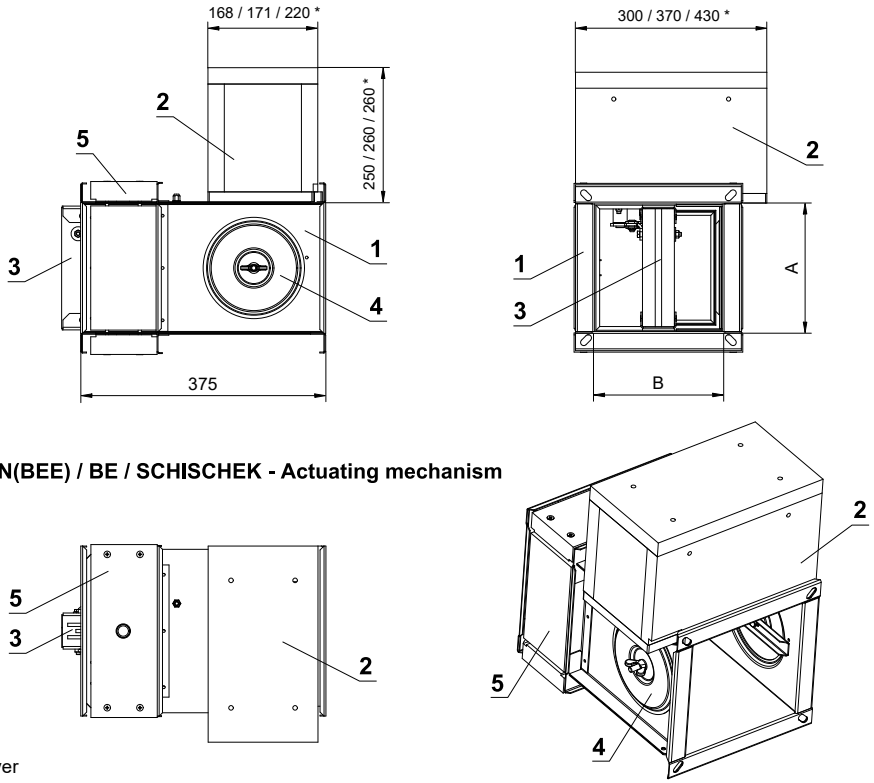
Position:
1 MSD
2 Actuating mechanism
3 Damper blade
4 Access door/ inspection cover

Fig. 23 Square MSD-W - design with electric actuating mechanism with emergency function and electromagnet



Position:
1 MSD
2 Actuating mechanism
3 Damper blade
4 Access door/ inspection cover
5 Electromagnet (solenoid)
6 Pulse switch SIEM24

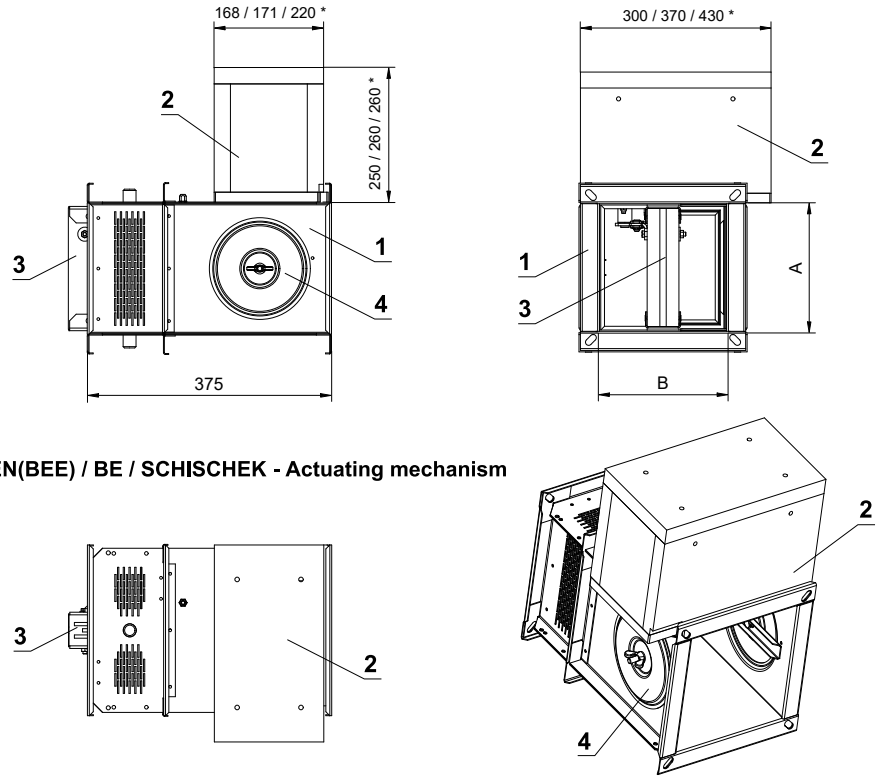
Fig. 24 Square MSD - design with actuating mechanism and insulation box



*** BEN(BEE) / BE / SCHISCHEK - Actuating mechanism**

Position:
1 MSD
2 Insulation box
3 Damper blade
4 Access door/ inspection cover
5 Protective cladding boards

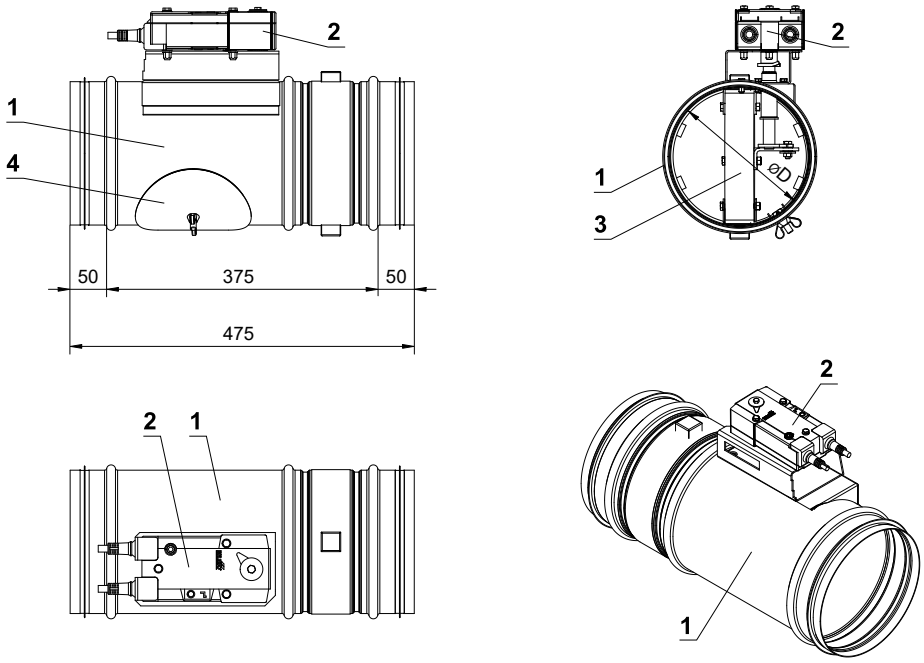
Fig. 25 Square MSD - design with actuating mechanism and insulation box



*** BEN(BEE) / BE / SCHISCHEK - Actuating mechanism**

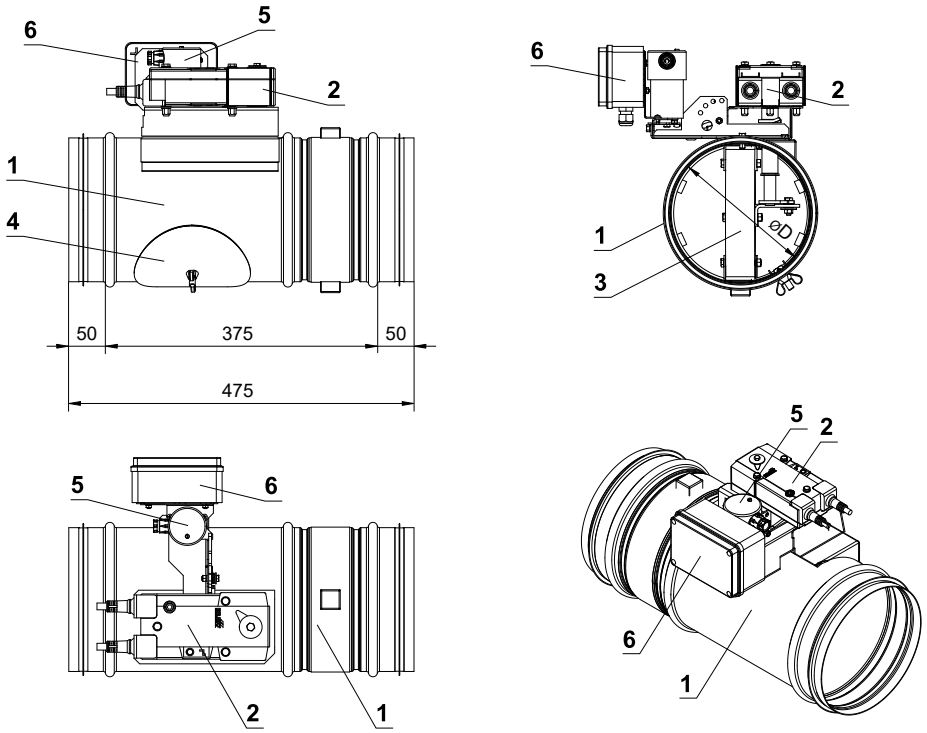
Position:
1 MSD
2 Insulation box
3 Damper blade
4 Access door/ inspection cover

Fig. 26 Round MSD (MSD-W) - design with actuating mechanism



Position:
1 MSD
2 Actuating mechanism
3 Damper blade
4 Access door/ inspection cover

Fig. 27 Round MSD-W - design with electric actuating mechanism with emergency function and electromagnet



Position:
1 MSD
2 Actuating mechanism
3 Damper blade
4 Access door/ inspection cover
5 Electromagnet (solenoid)
6 Pulse switch SIEM24

3.2. Weight and effective area - square dampers

Tab. 3.2.1. Weight and effective area - square dampers

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
160 x 180	-	19	0,0162	11,2	BELIMO BEN	11,7	BELIMO BFN	12,2	BELIMO BEN
x 200	-	29	0,0191	11,6	BELIMO BEN	12,1	BELIMO BFN	12,6	BELIMO BEN
x 225	-	41,5	0,0228	12,1	BELIMO BEN	12,6	BELIMO BFN	13,1	BELIMO BEN
x 250	-	54	0,0264	12,6	BELIMO BEN	13,1	BELIMO BFN	13,6	BELIMO BEN
x 280	-	69	0,0307	13,3	BELIMO BEN	13,8	BELIMO BFN	14,3	BELIMO BEN
x 300	-	79	0,0336	13,7	BELIMO BEN	14,2	BELIMO BFN	14,7	BELIMO BEN
x 315	-	86,5	0,0358	14	BELIMO BEN	14,5	BELIMO BFN	15	BELIMO BEN
x 355	-	106,5	0,0416	14,8	BELIMO BEN	15,3	BELIMO BFN	15,8	BELIMO BEN
x 400	-	129	0,0481	15,8	BELIMO BEN	16,3	BELIMO BFN	16,8	BELIMO BEN
x 450	-	154	0,0554	16,8	BELIMO BEN	17,3	BELIMO BFN	17,8	BELIMO BEN
x 500	-	179	0,0626	17,8	BELIMO BEN	18,3	BELIMO BFN	18,8	BELIMO BEN
x 550	-	204	0,0699	18,9	BELIMO BEN	19,4	BELIMO BFN	19,9	BELIMO BEN
x 560	-	209	0,0713	19,1	BELIMO BEN	19,6	BELIMO BFN	20,1	BELIMO BEN
x 600	-	229	0,0771	19,9	BELIMO BEN	20,4	BELIMO BFN	20,9	BELIMO BEN
x 630	-	244	0,0815	20,5	BELIMO BEN	21	BELIMO BFN	21,5	BELIMO BEN
x 650	9	254	0,0844	20,9	BELIMO BEN	21,4	BELIMO BFN	21,9	BELIMO BEN
x 700	34	279	0,0916	22	BELIMO BEN	24,3	JOVENTA DAFx.20S	23	BELIMO BEN
x 710	39	284	0,0931	22,2	BELIMO BEN	24,5	JOVENTA DAFx.20S	23,2	BELIMO BEN
x 750	59	304	0,0989	23	BELIMO BEN	25,3	JOVENTA DAFx.20S	24	BELIMO BEN
x 800	84	329	0,1061	24	BELIMO BEN	26,4	JOVENTA DAFx.20S	25	BELIMO BEN
180 x 180	-	19	0,0185	11,6	BELIMO BEN	12,1	BELIMO BFN	12,6	BELIMO BEN
x 200	-	29	0,0218	12	BELIMO BEN	12,5	BELIMO BFN	13	BELIMO BEN
x 225	-	41,5	0,0259	12,5	BELIMO BEN	13	BELIMO BFN	13,5	BELIMO BEN
x 250	-	54	0,0300	13,1	BELIMO BEN	13,6	BELIMO BFN	14,1	BELIMO BEN
x 280	-	69	0,0350	13,7	BELIMO BEN	14,2	BELIMO BFN	14,7	BELIMO BEN
x 300	-	79	0,0383	14,2	BELIMO BEN	14,7	BELIMO BFN	15,2	BELIMO BEN
x 315	-	86,5	0,0408	14,5	BELIMO BEN	15	BELIMO BFN	15,5	BELIMO BEN
x 355	-	106,5	0,0474	15,3	BELIMO BEN	15,8	BELIMO BFN	16,3	BELIMO BEN
x 400	-	129	0,0548	16,3	BELIMO BEN	16,8	BELIMO BFN	17,3	BELIMO BEN
x 450	-	154	0,0630	17,4	BELIMO BEN	17,9	BELIMO BFN	18,4	BELIMO BEN
x 500	-	179	0,0713	18,5	BELIMO BEN	19	BELIMO BFN	19,5	BELIMO BEN
x 550	-	204	0,0795	19,6	BELIMO BEN	20,1	BELIMO BFN	20,6	BELIMO BEN
x 560	-	209	0,0812	19,8	BELIMO BEN	20,3	BELIMO BFN	20,8	BELIMO BEN
x 600	-	229	0,0878	20,6	BELIMO BEN	21,1	BELIMO BFN	21,6	BELIMO BEN
x 630	-	244	0,0927	21,3	BELIMO BEN	21,8	BELIMO BFN	22,3	BELIMO BEN
x 650	9	254	0,0960	21,7	BELIMO BEN	22,2	BELIMO BFN	22,7	BELIMO BEN
x 700	34	279	0,1043	22,8	BELIMO BEN	25,1	JOVENTA DAFx.20S	23,8	BELIMO BEN
x 710	39	284	0,1059	23	BELIMO BEN	25,3	JOVENTA DAFx.20S	24	BELIMO BEN
x 750	59	304	0,1125	23,9	BELIMO BEN	26,2	JOVENTA DAFx.20S	24,9	BELIMO BEN
x 800	84	329	0,1208	25	BELIMO BEN	27,3	JOVENTA DAFx.20S	26	BELIMO BEN
200 x 180	-	19	0,0207	11,9	BELIMO BEN	12,4	BELIMO BFN	12,9	BELIMO BEN
x 200	-	29	0,0244	12,4	BELIMO BEN	12,9	BELIMO BFN	13,4	BELIMO BEN
x 225	-	41,5	0,0290	12,9	BELIMO BEN	13,4	BELIMO BFN	13,9	BELIMO BEN
x 250	-	54	0,0337	13,5	BELIMO BEN	14	BELIMO BFN	14,5	BELIMO BEN
x 280	-	69	0,0392	14,2	BELIMO BEN	14,7	BELIMO BFN	15,2	BELIMO BEN
x 300	-	79	0,0429	14,6	BELIMO BEN	15,1	BELIMO BFN	15,6	BELIMO BEN
x 315	-	86,5	0,0457	15	BELIMO BEN	15,5	BELIMO BFN	16	BELIMO BEN
x 355	-	106,5	0,0531	15,9	BELIMO BEN	16,4	BELIMO BFN	16,9	BELIMO BEN
x 400	-	129	0,0614	16,9	BELIMO BEN	17,4	BELIMO BFN	17,9	BELIMO BEN
x 450	-	154	0,0707	18	BELIMO BEN	18,5	BELIMO BFN	19	BELIMO BEN
x 500	-	179	0,0799	19,1	BELIMO BEN	19,6	BELIMO BFN	20,1	BELIMO BEN
x 550	-	204	0,0892	20,3	BELIMO BEN	20,8	BELIMO BFN	21,3	BELIMO BEN
x 560	-	209	0,0910	20,5	BELIMO BEN	21	BELIMO BFN	21,5	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
200 x 600	-	229	0,0984	21,4	BELIMO BEN	21,9	BELIMO BFN	22,4	BELIMO BEN
x 630	-	244	0,1040	22,1	BELIMO BEN	22,6	BELIMO BFN	23,1	BELIMO BEN
x 650	9	254	0,1077	22,5	BELIMO BEN	23	BELIMO BFN	23,5	BELIMO BEN
x 700	34	279	0,1169	23,6	BELIMO BEN	26	JOVENTA DAFx.20S	24,6	BELIMO BEN
x 710	39	284	0,1188	23,9	BELIMO BEN	26,2	JOVENTA DAFx.20S	24,9	BELIMO BEN
x 750	59	304	0,1262	24,8	BELIMO BEN	27,1	JOVENTA DAFx.20S	25,8	BELIMO BEN
x 800	84	329	0,1354	25,9	BELIMO BEN	28,2	JOVENTA DAFx.20S	26,9	BELIMO BEN
225 x 180	-	19	0,0235	12,4	BELIMO BEN	12,9	BELIMO BFN	13,4	BELIMO BEN
x 200	-	29	0,0277	12,8	BELIMO BEN	13,3	BELIMO BFN	13,8	BELIMO BEN
x 225	-	41,5	0,0330	13,4	BELIMO BEN	13,9	BELIMO BFN	14,4	BELIMO BEN
x 250	-	54	0,0382	14	BELIMO BEN	14,5	BELIMO BFN	15	BELIMO BEN
x 280	-	69	0,0445	14,7	BELIMO BEN	15,2	BELIMO BFN	15,7	BELIMO BEN
x 300	-	79	0,0487	15,2	BELIMO BEN	15,7	BELIMO BFN	16,2	BELIMO BEN
x 315	-	86,5	0,0519	15,6	BELIMO BEN	16,1	BELIMO BFN	16,6	BELIMO BEN
x 355	-	106,5	0,0603	16,5	BELIMO BEN	17	BELIMO BFN	17,5	BELIMO BEN
x 400	-	129	0,0697	17,6	BELIMO BEN	18,1	BELIMO BFN	18,6	BELIMO BEN
x 450	-	154	0,0802	18,7	BELIMO BEN	19,2	BELIMO BFN	19,7	BELIMO BEN
x 500	-	179	0,0907	19,9	BELIMO BEN	20,4	BELIMO BFN	20,9	BELIMO BEN
x 550	-	204	0,1012	21,1	BELIMO BEN	21,6	BELIMO BFN	22,1	BELIMO BEN
x 560	-	209	0,1033	21,3	BELIMO BEN	21,8	BELIMO BFN	22,3	BELIMO BEN
x 600	-	229	0,1117	22,3	BELIMO BEN	22,8	BELIMO BFN	23,3	BELIMO BEN
x 630	-	244	0,1180	23	BELIMO BEN	25,3	JOVENTA DAFx.20S	24	BELIMO BEN
x 650	9	254	0,1222	23,4	BELIMO BEN	25,8	JOVENTA DAFx.20S	24,4	BELIMO BEN
x 700	34	279	0,1327	24,6	BELIMO BEN	26,9	JOVENTA DAFx.20S	25,6	BELIMO BEN
x 710	39	284	0,1348	24,9	BELIMO BEN	27,2	JOVENTA DAFx.20S	25,9	BELIMO BEN
x 750	59	304	0,1432	25,8	BELIMO BEN	28,1	JOVENTA DAFx.20S	26,8	BELIMO BEN
x 800	84	329	0,1537	27	BELIMO BEN	29,3	JOVENTA DAFx.20S	28	BELIMO BEN
250 x 180	-	19	0,0263	12,8	BELIMO BEN	13,3	BELIMO BFN	13,8	BELIMO BEN
x 200	-	29	0,0310	13,3	BELIMO BEN	13,8	BELIMO BFN	14,3	BELIMO BEN
x 225	-	41,5	0,0369	13,9	BELIMO BEN	14,4	BELIMO BFN	14,9	BELIMO BEN
x 250	-	54	0,0428	14,6	BELIMO BEN	15,1	BELIMO BFN	15,6	BELIMO BEN
x 280	-	69	0,0498	15,3	BELIMO BEN	15,8	BELIMO BFN	16,3	BELIMO BEN
x 300	-	79	0,0545	15,8	BELIMO BEN	16,3	BELIMO BFN	16,8	BELIMO BEN
x 315	-	86,5	0,0580	16,1	BELIMO BEN	16,6	BELIMO BFN	17,1	BELIMO BEN
x 355	-	106,5	0,0674	17,1	BELIMO BEN	17,6	BELIMO BFN	18,1	BELIMO BEN
x 400	-	129	0,0780	18,2	BELIMO BEN	18,7	BELIMO BFN	19,2	BELIMO BEN
x 450	-	154	0,0898	19,4	BELIMO BEN	19,9	BELIMO BFN	20,4	BELIMO BEN
x 500	-	179	0,1015	20,7	BELIMO BEN	21,2	BELIMO BFN	21,7	BELIMO BEN
x 550	-	204	0,1133	21,9	BELIMO BEN	22,4	BELIMO BFN	22,9	BELIMO BEN
x 560	-	209	0,1156	22,1	BELIMO BEN	22,6	BELIMO BFN	23,1	BELIMO BEN
x 600	-	229	0,1250	23,1	BELIMO BEN	25,4	JOVENTA DAFx.20S	24,1	BELIMO BEN
x 630	-	244	0,1321	23,8	BELIMO BEN	26,2	JOVENTA DAFx.20S	24,8	BELIMO BEN
x 650	9	254	0,1368	24,3	BELIMO BEN	26,7	JOVENTA DAFx.20S	25,3	BELIMO BEN
x 700	34	279	0,1485	25,6	BELIMO BEN	27,9	JOVENTA DAFx.20S	26,6	BELIMO BEN
x 710	39	284	0,1509	25,8	BELIMO BEN	28,1	JOVENTA DAFx.20S	26,8	BELIMO BEN
x 750	59	304	0,1603	26,8	BELIMO BEN	29,1	JOVENTA DAFx.20S	27,8	BELIMO BEN
x 800	84	329	0,1720	28	BELIMO BEN	30,3	JOVENTA DAFx.20S	29	BELIMO BEN
280 x 180	-	19	0,0297	13,4	BELIMO BEN	13,9	BELIMO BFN	14,4	BELIMO BEN
x 200	-	29	0,0350	13,9	BELIMO BEN	14,4	BELIMO BFN	14,9	BELIMO BEN
x 225	-	41,5	0,0416	14,5	BELIMO BEN	15	BELIMO BFN	15,5	BELIMO BEN
x 250	-	54	0,0482	15,2	BELIMO BEN	15,7	BELIMO BFN	16,2	BELIMO BEN
x 280	-	69	0,0562	15,9	BELIMO BEN	16,4	BELIMO BFN	16,9	BELIMO BEN
x 300	-	79	0,0615	16,5	BELIMO BEN	17	BELIMO BFN	17,5	BELIMO BEN
x 315	-	86,5	0,0655	16,8	BELIMO BEN	17,3	BELIMO BFN	17,8	BELIMO BEN
x 355	-	106,5	0,0761	17,9	BELIMO BEN	18,4	BELIMO BFN	18,9	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
280 x 400	-	129	0,0880	19	BELIMO BEN	19,5	BELIMO BFN	20	BELIMO BEN
x 450	-	154	0,1012	20,3	BELIMO BEN	20,8	BELIMO BFN	21,3	BELIMO BEN
x 500	-	179	0,1145	21,6	BELIMO BEN	22,1	BELIMO BFN	22,6	BELIMO BEN
x 550	-	204	0,1277	22,8	BELIMO BEN	23,3	BELIMO BFN	23,8	BELIMO BEN
x 560	-	209	0,1304	23,1	BELIMO BEN	25,4	JOVENTA DAFx.20S	24,1	BELIMO BEN
x 600	-	229	0,1410	24,1	BELIMO BEN	26,4	JOVENTA DAFx.20S	25,1	BELIMO BEN
x 630	-	244	0,1489	24,9	BELIMO BEN	27,2	JOVENTA DAFx.20S	25,9	BELIMO BEN
x 650	9	254	0,1542	25,4	BELIMO BEN	27,7	JOVENTA DAFx.20S	26,4	BELIMO BEN
x 700	34	279	0,1675	26,7	BELIMO BEN	29	JOVENTA DAFx.20S	27,7	BELIMO BEN
x 710	39	284	0,1701	26,9	BELIMO BEN	29,2	JOVENTA DAFx.20S	27,9	BELIMO BEN
x 750	59	304	0,1807	27,9	BELIMO BEN	30,3	JOVENTA DAFx.20S	28,9	BELIMO BEN
x 800	84	329	0,1940	29,2	BELIMO BEN	31,5	JOVENTA DAFx.20S	30,2	BELIMO BEN
300 x 180	-	19	0,0319	13,7	BELIMO BEN	14,2	BELIMO BFN	14,7	BELIMO BEN
x 200	-	29	0,0376	14,3	BELIMO BEN	14,8	BELIMO BFN	15,3	BELIMO BEN
x 225	-	41,5	0,0447	14,9	BELIMO BEN	15,4	BELIMO BFN	15,9	BELIMO BEN
x 250	-	54	0,0519	15,6	BELIMO BEN	16,1	BELIMO BFN	16,6	BELIMO BEN
x 280	-	69	0,0604	16,4	BELIMO BEN	16,9	BELIMO BFN	17,4	BELIMO BEN
x 300	-	79	0,0661	16,9	BELIMO BEN	17,4	BELIMO BFN	17,9	BELIMO BEN
x 315	-	86,5	0,0704	17,3	BELIMO BEN	17,8	BELIMO BFN	18,3	BELIMO BEN
x 355	-	106,5	0,0818	18,4	BELIMO BEN	18,9	BELIMO BFN	19,4	BELIMO BEN
x 400	-	129	0,0946	19,5	BELIMO BEN	20	BELIMO BFN	20,5	BELIMO BEN
x 450	-	154	0,1089	20,8	BELIMO BEN	21,3	BELIMO BFN	21,8	BELIMO BEN
x 500	-	179	0,1231	22,2	BELIMO BEN	22,7	BELIMO BFN	23,2	BELIMO BEN
x 550	-	204	0,1374	23,5	BELIMO BEN	25,8	JOVENTA DAFx.20S	24,5	BELIMO BEN
x 560	-	209	0,1402	23,7	BELIMO BEN	26,1	JOVENTA DAFx.20S	24,7	BELIMO BEN
x 600	-	229	0,1516	24,8	BELIMO BEN	27,1	JOVENTA DAFx.20S	25,8	BELIMO BEN
x 630	-	244	0,1602	25,6	BELIMO BEN	27,9	JOVENTA DAFx.20S	26,6	BELIMO BEN
x 650	9	254	0,1659	26,1	BELIMO BEN	28,4	JOVENTA DAFx.20S	27,1	BELIMO BEN
x 700	34	279	0,1801	27,4	BELIMO BEN	29,7	JOVENTA DAFx.20S	28,4	BELIMO BEN
x 710	39	284	0,1830	27,7	BELIMO BEN	30	JOVENTA DAFx.20S	28,7	BELIMO BEN
x 750	59	304	0,1944	28,7	BELIMO BEN	31	JOVENTA DAFx.20S	29,7	BELIMO BEN
x 800	84	329	0,2086	30	BELIMO BEN	32,4	JOVENTA DAFx.20S	31	BELIMO BEN
315 x 180	-	19	0,0336	14	BELIMO BEN	14,5	BELIMO BFN	15	BELIMO BEN
x 200	-	29	0,0396	14,6	BELIMO BEN	15,1	BELIMO BFN	15,6	BELIMO BEN
x 225	-	41,5	0,0471	15,2	BELIMO BEN	15,7	BELIMO BFN	16,2	BELIMO BEN
x 250	-	54	0,0546	15,9	BELIMO BEN	16,4	BELIMO BFN	16,9	BELIMO BEN
x 280	-	69	0,0636	16,7	BELIMO BEN	17,2	BELIMO BFN	17,7	BELIMO BEN
x 300	-	79	0,0696	17,3	BELIMO BEN	17,8	BELIMO BFN	18,3	BELIMO BEN
x 315	-	86,5	0,0741	17,7	BELIMO BEN	18,2	BELIMO BFN	18,7	BELIMO BEN
x 355	-	106,5	0,0861	18,7	BELIMO BEN	19,2	BELIMO BFN	19,7	BELIMO BEN
x 400	-	129	0,0996	19,9	BELIMO BEN	20,4	BELIMO BFN	20,9	BELIMO BEN
x 450	-	154	0,1146	21,3	BELIMO BEN	21,8	BELIMO BFN	22,3	BELIMO BEN
x 500	-	179	0,1296	22,6	BELIMO BEN	23,1	BELIMO BFN	23,6	BELIMO BEN
x 550	-	204	0,1446	23,9	BELIMO BEN	26,3	JOVENTA DAFx.20S	24,9	BELIMO BEN
x 560	-	209	0,1476	24,2	BELIMO BEN	26,5	JOVENTA DAFx.20S	25,2	BELIMO BEN
x 600	-	229	0,1596	25,3	BELIMO BEN	27,6	JOVENTA DAFx.20S	26,3	BELIMO BEN
x 630	-	244	0,1686	26,1	BELIMO BEN	28,4	JOVENTA DAFx.20S	27,1	BELIMO BEN
x 650	9	254	0,1746	26,6	BELIMO BEN	28,9	JOVENTA DAFx.20S	27,6	BELIMO BEN
x 700	34	279	0,1896	28	BELIMO BEN	30,3	JOVENTA DAFx.20S	29	BELIMO BEN
x 710	39	284	0,1926	28,2	BELIMO BEN	30,6	JOVENTA DAFx.20S	29,2	BELIMO BEN
x 750	59	304	0,2046	29,3	BELIMO BEN	31,6	JOVENTA DAFx.20S	30,3	BELIMO BEN
x 800	84	329	0,2196	30,6	BELIMO BEN	33	JOVENTA DAFx.20S	31,6	BELIMO BEN
355 x 180	-	19	0,0381	14,7	BELIMO BEN	15,2	BELIMO BFN	15,7	BELIMO BEN
x 200	-	29	0,0449	15,3	BELIMO BEN	15,8	BELIMO BFN	16,3	BELIMO BEN
x 225	-	41,5	0,0534	16	BELIMO BEN	16,5	BELIMO BFN	17	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
355 x 250	-	54	0,0619	16,7	BELIMO BEN	17,2	BELIMO BFN	17,7	BELIMO BEN
x 280	-	69	0,0721	17,6	BELIMO BEN	18,1	BELIMO BFN	18,6	BELIMO BEN
x 300	-	79	0,0789	18,2	BELIMO BEN	18,7	BELIMO BFN	19,2	BELIMO BEN
x 315	-	86,5	0,0840	18,6	BELIMO BEN	19,1	BELIMO BFN	19,6	BELIMO BEN
x 355	-	106,5	0,0976	19,7	BELIMO BEN	20,2	BELIMO BFN	20,7	BELIMO BEN
x 400	-	129	0,1129	21	BELIMO BEN	21,5	BELIMO BFN	22	BELIMO BEN
x 450	-	154	0,1299	22,4	BELIMO BEN	22,9	BELIMO BFN	23,4	BELIMO BEN
x 500	-	179	0,1469	23,8	BELIMO BEN	26,1	JOVENTA DAFx.20S	24,8	BELIMO BEN
x 550	-	204	0,1639	25,2	BELIMO BEN	27,5	JOVENTA DAFx.20S	26,2	BELIMO BEN
x 560	-	209	0,1673	25,5	BELIMO BEN	27,8	JOVENTA DAFx.20S	26,5	BELIMO BEN
x 600	-	229	0,1809	26,6	BELIMO BEN	28,9	JOVENTA DAFx.20S	27,6	BELIMO BEN
x 630	-	244	0,1911	27,5	BELIMO BEN	29,8	JOVENTA DAFx.20S	28,5	BELIMO BEN
x 650	9	254	0,1979	28	BELIMO BEN	30,4	JOVENTA DAFx.20S	29	BELIMO BEN
x 700	34	279	0,2149	29,5	BELIMO BEN	31,8	JOVENTA DAFx.20S	30,5	BELIMO BEN
x 710	39	284	0,2183	29,7	BELIMO BEN	32,1	JOVENTA DAFx.20S	30,7	BELIMO BEN
x 750	59	304	0,2319	30,9	BELIMO BEN	33,2	JOVENTA DAFx.20S	31,9	BELIMO BEN
x 800	84	329	0,2489	33,3	BELIMO BEN	34,6	JOVENTA DAFx.20S	34,3	BELIMO BEE
400 x 180	-	19	0,0431	15,5	BELIMO BEN	16	BELIMO BFN	16,5	BELIMO BEN
x 200	-	29	0,0508	16,2	BELIMO BEN	16,7	BELIMO BFN	17,2	BELIMO BEN
x 225	-	41,5	0,0604	16,9	BELIMO BEN	17,4	BELIMO BFN	17,9	BELIMO BEN
x 250	-	54	0,0701	17,7	BELIMO BEN	18,2	BELIMO BFN	18,7	BELIMO BEN
x 280	-	69	0,0816	18,6	BELIMO BEN	19,1	BELIMO BFN	19,6	BELIMO BEN
x 300	-	79	0,0893	19,2	BELIMO BEN	19,7	BELIMO BFN	20,2	BELIMO BEN
x 315	-	86,5	0,0951	19,6	BELIMO BEN	20,1	BELIMO BFN	20,6	BELIMO BEN
x 355	-	106,5	0,1105	20,8	BELIMO BEN	21,3	BELIMO BFN	21,8	BELIMO BEN
x 400	-	129	0,1278	22,2	BELIMO BEN	22,7	BELIMO BFN	23,2	BELIMO BEN
x 450	-	154	0,1471	23,7	BELIMO BEN	24,2	BELIMO BFN	24,7	BELIMO BEN
x 500	-	179	0,1663	25,2	BELIMO BEN	27,5	JOVENTA DAFx.20S	26,2	BELIMO BEN
x 550	-	204	0,1856	26,6	BELIMO BEN	29	JOVENTA DAFx.20S	27,6	BELIMO BEN
x 560	-	209	0,1894	26,9	BELIMO BEN	29,3	JOVENTA DAFx.20S	27,9	BELIMO BEN
x 600	-	229	0,2048	28,1	BELIMO BEN	30,5	JOVENTA DAFx.20S	29,1	BELIMO BEN
x 630	-	244	0,2164	29	BELIMO BEN	31,4	JOVENTA DAFx.20S	30	BELIMO BEN
x 650	9	254	0,2241	29,6	BELIMO BEN	31,9	JOVENTA DAFx.20S	30,6	BELIMO BEN
x 700	34	279	0,2433	31,1	BELIMO BEN	33,4	JOVENTA DAFx.20S	32,1	BELIMO BEN
x 710	39	284	0,2472	31,4	BELIMO BEN	33,7	JOVENTA DAFx.20S	32,4	BELIMO BEN
x 750	59	304	0,2626	32,6	BELIMO BEN	34,9	JOVENTA DAFx.20S	33,6	BELIMO BEN
x 800	84	329	0,2818	35,1	BELIMO BEN	36,4	JOVENTA DAFx.20S	36,1	BELIMO BEE
450 x 180	-	19	0,0487	16,5	BELIMO BEN	17	BELIMO BFN	17,5	BELIMO BEN
x 200	-	29	0,0574	17,1	BELIMO BEN	17,6	BELIMO BFN	18,1	BELIMO BEN
x 225	-	41,5	0,0683	17,9	BELIMO BEN	18,4	BELIMO BFN	18,9	BELIMO BEN
x 250	-	54	0,0792	18,7	BELIMO BEN	19,2	BELIMO BFN	19,7	BELIMO BEN
x 280	-	69	0,0922	19,7	BELIMO BEN	20,2	BELIMO BFN	20,7	BELIMO BEN
x 300	-	79	0,1009	20,3	BELIMO BEN	20,8	BELIMO BFN	21,3	BELIMO BEN
x 315	-	86,5	0,1074	20,8	BELIMO BEN	21,3	BELIMO BFN	21,8	BELIMO BEN
x 355	-	106,5	0,1248	22,1	BELIMO BEN	22,6	BELIMO BFN	23,1	BELIMO BEN
x 400	-	129	0,1444	23,5	BELIMO BEN	24	BELIMO BFN	24,5	BELIMO BEN
x 450	-	154	0,1662	25,1	BELIMO BEN	27,4	JOVENTA DAFx.20S	26,1	BELIMO BEN
x 500	-	179	0,1879	26,6	BELIMO BEN	29	JOVENTA DAFx.20S	27,6	BELIMO BEN
x 550	-	204	0,2097	28,2	BELIMO BEN	30,6	JOVENTA DAFx.20S	29,2	BELIMO BEN
x 560	-	209	0,2140	28,5	BELIMO BEN	30,9	JOVENTA DAFx.20S	29,5	BELIMO BEN
x 600	-	229	0,2314	29,8	BELIMO BEN	32,1	JOVENTA DAFx.20S	30,8	BELIMO BEN
x 630	-	244	0,2445	30,8	BELIMO BEN	33,1	JOVENTA DAFx.20S	31,8	BELIMO BEN
x 650	9	254	0,2532	31,4	BELIMO BEN	33,7	JOVENTA DAFx.20S	32,4	BELIMO BEN
x 700	34	279	0,2749	33	BELIMO BEN	35,3	JOVENTA DAFx.20S	34	BELIMO BEN
x 710	39	284	0,2793	33,3	BELIMO BEN	35,6	JOVENTA DAFx.20S	34,3	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
450 x 750	59	304	0,2967	34,6	BELIMO BEN	36,9	JOVENTA DAFx.20S	35,6	BELIMO BEN
x 800	84	329	0,3184	37,2	BELIMO BEN	38,5	JOVENTA DAFx.20S	38,2	BELIMO BEE
500 x 180	-	19	0,0543	17,4	BELIMO BEN	17,9	BELIMO BFN	18,4	BELIMO BEN
x 200	-	29	0,0640	18,1	BELIMO BEN	18,6	BELIMO BFN	19,1	BELIMO BEN
x 225	-	41,5	0,0761	18,9	BELIMO BEN	19,4	BELIMO BFN	19,9	BELIMO BEN
x 250	-	54	0,0883	19,8	BELIMO BEN	20,3	BELIMO BFN	20,8	BELIMO BEN
x 280	-	69	0,1028	20,8	BELIMO BEN	21,3	BELIMO BFN	21,8	BELIMO BEN
x 300	-	79	0,1125	21,5	BELIMO BEN	22	BELIMO BFN	22,5	BELIMO BEN
x 315	-	86,5	0,1198	22	BELIMO BEN	22,5	BELIMO BFN	23	BELIMO BEN
x 355	-	106,5	0,1392	23,3	BELIMO BEN	23,8	BELIMO BFN	24,3	BELIMO BEN
x 400	-	129	0,1610	24,8	BELIMO BEN	25,3	BELIMO BFN	25,8	BELIMO BEN
x 450	-	154	0,1853	26,5	BELIMO BEN	28,8	JOVENTA DAFx.20S	27,5	BELIMO BEN
x 500	-	179	0,2095	28,1	BELIMO BEN	30,5	JOVENTA DAFx.20S	29,1	BELIMO BEN
x 550	-	204	0,2338	29,8	BELIMO BEN	32,1	JOVENTA DAFx.20S	30,8	BELIMO BEN
x 560	-	209	0,2386	30,2	BELIMO BEN	32,5	JOVENTA DAFx.20S	31,2	BELIMO BEN
x 600	-	229	0,2580	31,5	BELIMO BEN	33,8	JOVENTA DAFx.20S	32,5	BELIMO BEN
x 630	-	244	0,2726	32,5	BELIMO BEN	34,8	JOVENTA DAFx.20S	33,5	BELIMO BEN
x 650	9	254	0,2823	33,2	BELIMO BEN	35,5	JOVENTA DAFx.20S	34,2	BELIMO BEN
x 700	34	279	0,3065	34,8	BELIMO BEN	37,2	JOVENTA DAFx.20S	35,8	BELIMO BEN
x 710	39	284	0,3114	35,2	BELIMO BEN	37,5	JOVENTA DAFx.20S	36,2	BELIMO BEN
x 750	59	304	0,3308	37,5	BELIMO BEN	38,8	JOVENTA DAFx.20S	37,5	BELIMO BEN
x 800	84	329	0,3550	39,2	BELIMO BEN	40,5	JOVENTA DAFx.20S	40,2	BELIMO BEE
550 x 180	-	19	0,0599	18,3	BELIMO BEN	18,8	BELIMO BFN	19,3	BELIMO BEN
x 200	-	29	0,0706	19	BELIMO BEN	19,5	BELIMO BFN	20	BELIMO BEN
x 225	-	41,5	0,0840	19,9	BELIMO BEN	20,4	BELIMO BFN	20,9	BELIMO BEN
x 250	-	54	0,0974	20,8	BELIMO BEN	21,3	BELIMO BFN	21,8	BELIMO BEN
x 280	-	69	0,1134	21,9	BELIMO BEN	22,4	BELIMO BFN	22,9	BELIMO BEN
x 300	-	79	0,1241	22,6	BELIMO BEN	23,1	BELIMO BFN	23,6	BELIMO BEN
x 315	-	86,5	0,1321	23,1	BELIMO BEN	23,6	BELIMO BFN	24,1	BELIMO BEN
x 355	-	106,5	0,1535	24,5	BELIMO BEN	25	BELIMO BFN	25,5	BELIMO BEN
x 400	-	129	0,1776	26,1	BELIMO BEN	28,4	JOVENTA DAFx.20S	27,1	BELIMO BEN
x 450	-	154	0,2044	27,9	BELIMO BEN	30,2	JOVENTA DAFx.20S	28,9	BELIMO BEN
x 500	-	179	0,2311	29,6	BELIMO BEN	32	JOVENTA DAFx.20S	30,6	BELIMO BEN
x 550	-	204	0,2579	31,4	BELIMO BEN	33,7	JOVENTA DAFx.20S	32,4	BELIMO BEN
x 560	-	209	0,2632	31,8	BELIMO BEN	34,1	JOVENTA DAFx.20S	32,8	BELIMO BEN
x 600	-	229	0,2846	33,2	BELIMO BEN	35,5	JOVENTA DAFx.20S	34,2	BELIMO BEN
x 630	-	244	0,3007	34,2	BELIMO BEN	36,5	JOVENTA DAFx.20S	35,2	BELIMO BEN
x 650	9	254	0,3114	34,9	BELIMO BEN	37,2	JOVENTA DAFx.20S	35,9	BELIMO BEN
x 700	34	279	0,3381	36,7	BELIMO BEN	39	JOVENTA DAFx.20S	37,7	BELIMO BEN
x 710	39	284	0,3435	37	BELIMO BEN	39,4	JOVENTA DAFx.20S	38	BELIMO BEN
x 750	59	304	0,3649	39,5	BELIMO BEN	40,8	JOVENTA DAFx.20S	40,5	BELIMO BEE
x 800	84	329	0,3916	41,2	BELIMO BEN	42,5	JOVENTA DAFx.20S	42,2	BELIMO BEE
560 x 180	-	19	0,0610	18,4	BELIMO BEN	18,9	BELIMO BFN	19,4	BELIMO BEN
x 200	-	29	0,0719	19,2	BELIMO BEN	19,7	BELIMO BFN	20,2	BELIMO BEN
x 225	-	41,5	0,0856	20,1	BELIMO BEN	20,6	BELIMO BFN	21,1	BELIMO BEN
x 250	-	54	0,0992	21	BELIMO BEN	21,5	BELIMO BFN	22	BELIMO BEN
x 280	-	69	0,1155	22,1	BELIMO BEN	22,6	BELIMO BFN	23,1	BELIMO BEN
x 300	-	79	0,1264	22,8	BELIMO BEN	23,3	BELIMO BFN	23,8	BELIMO BEN
x 315	-	87	0,1346	23,4	BELIMO BEN	23,9	BELIMO BFN	24,4	BELIMO BEN
x 355	-	106,5	0,1564	24,8	BELIMO BEN	25,3	BELIMO BFN	25,8	BELIMO BEN
x 400	-	129	0,1809	26,4	BELIMO BEN	28,7	JOVENTA DAFx.20S	27,4	BELIMO BEN
x 450	-	154	0,2082	28,2	BELIMO BEN	30,5	JOVENTA DAFx.20S	29,2	BELIMO BEN
x 500	-	179	0,2354	29,9	BELIMO BEN	32,3	JOVENTA DAFx.20S	30,9	BELIMO BEN
x 550	-	204	0,2627	31,7	BELIMO BEN	34	JOVENTA DAFx.20S	32,7	BELIMO BEN
x 560	-	209	0,2681	32,1	BELIMO BEN	34,4	JOVENTA DAFx.20S	33,1	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
560 x 600	-	229	0,2899	33,5	BELIMO BEN	35,8	JOVENTA DAFx.20S	34,5	BELIMO BEN
x 630	-	244	0,3063	34,6	BELIMO BEN	36,9	JOVENTA DAFx.20S	35,6	BELIMO BEN
x 650	9	254	0,3172	35,3	BELIMO BEN	37,6	JOVENTA DAFx.20S	36,3	BELIMO BEN
x 700	34	279	0,3444	37,1	BELIMO BEN	39,4	JOVENTA DAFx.20S	38,1	BELIMO BEN
x 710	39	284	0,3499	38,4	BELIMO BEN	39,7	JOVENTA DAFx.20S	38,4	BELIMO BEN
x 750	59	304	0,3717	39,9	BELIMO BEN	41,2	JOVENTA DAFx.20S	40,9	BELIMO BEE
x 800	84	329	0,3989	41,6	BELIMO BEN	42,9	JOVENTA DAFx.20S	42,6	BELIMO BEE
600 x 180	-	19	0,0655	19,2	BELIMO BEN	19,7	BELIMO BFN	20,2	BELIMO BEN
x 200	-	29	0,0772	20	BELIMO BEN	20,5	BELIMO BFN	21	BELIMO BEN
x 225	-	41,5	0,0918	20,9	BELIMO BEN	21,4	BELIMO BFN	21,9	BELIMO BEN
x 250	-	54	0,1065	21,9	BELIMO BEN	22,4	BELIMO BFN	22,9	BELIMO BEN
x 280	-	69	0,1240	23	BELIMO BEN	23,5	BELIMO BFN	24	BELIMO BEN
x 300	-	79	0,1357	23,7	BELIMO BEN	24,2	BELIMO BFN	24,7	BELIMO BEN
x 315	-	86,5	0,1445	24,3	BELIMO BEN	24,8	BELIMO BFN	25,3	BELIMO BEN
x 355	-	106,5	0,1679	25,8	BELIMO BEN	26,3	BELIMO BFN	26,8	BELIMO BEN
x 400	-	129	0,1942	27,4	BELIMO BEN	29,8	JOVENTA DAFx.20S	28,4	BELIMO BEN
x 450	-	154	0,2235	29,3	BELIMO BEN	31,6	JOVENTA DAFx.20S	30,3	BELIMO BEN
x 500	-	179	0,2527	31,1	BELIMO BEN	33,5	JOVENTA DAFx.20S	32,1	BELIMO BEN
x 550	-	204	0,2820	33	BELIMO BEN	35,3	JOVENTA DAFx.20S	34	BELIMO BEN
x 560	-	209	0,2878	33,4	BELIMO BEN	35,7	JOVENTA DAFx.20S	34,4	BELIMO BEN
x 600	-	229	0,3112	34,8	BELIMO BEN	37,2	JOVENTA DAFx.20S	35,8	BELIMO BEN
x 630	-	244	0,3288	36	BELIMO BEN	38,3	JOVENTA DAFx.20S	37	BELIMO BEN
x 650	9	254	0,3405	36,7	BELIMO BEN	39	JOVENTA DAFx.20S	37,7	BELIMO BEN
x 700	34	279	0,3697	39,6	BELIMO BEN	40,9	JOVENTA DAFx.20S	39,5	BELIMO BEN
x 710	39	284	0,3756	39,9	BELIMO BEN	41,2	JOVENTA DAFx.20S	40,9	BELIMO BEE
x 750	59	304	0,3990	41,4	BELIMO BEN	42,7	JOVENTA DAFx.20S	42,4	BELIMO BEE
x 800	84	329	0,4282	43,3	BELIMO BEN	44,6	JOVENTA DAFx.20S	44,3	BELIMO BEE
630 x 180	-	19	0,0689	19,7	BELIMO BEN	20,2	BELIMO BFN	20,7	BELIMO BEN
x 200	-	29	0,0812	20,6	BELIMO BEN	21,1	BELIMO BFN	21,6	BELIMO BEN
x 225	-	41,5	0,0966	21,5	BELIMO BEN	22	BELIMO BFN	22,5	BELIMO BEN
x 250	-	54	0,1119	22,5	BELIMO BEN	23	BELIMO BFN	23,5	BELIMO BEN
x 280	-	69	0,1304	23,6	BELIMO BEN	24,1	BELIMO BFN	24,6	BELIMO BEN
x 300	-	79	0,1427	24,4	BELIMO BEN	24,9	BELIMO BFN	25,4	BELIMO BEN
x 315	-	86,5	0,1519	25	BELIMO BEN	25,5	BELIMO BFN	26	BELIMO BEN
x 355	-	106,5	0,1765	26,5	BELIMO BEN	27	BELIMO BFN	27,5	BELIMO BEN
x 400	-	129	0,2042	28,2	BELIMO BEN	30,5	JOVENTA DAFx.20S	29,2	BELIMO BEN
x 450	-	154	0,2349	30,1	BELIMO BEN	32,4	JOVENTA DAFx.20S	31,1	BELIMO BEN
x 500	-	179	0,2657	32	BELIMO BEN	34,4	JOVENTA DAFx.20S	33	BELIMO BEN
x 550	-	204	0,2964	33,9	BELIMO BEN	36,3	JOVENTA DAFx.20S	34,9	BELIMO BEN
x 560	-	209	0,3026	34,3	BELIMO BEN	36,6	JOVENTA DAFx.20S	35,3	BELIMO BEN
x 600	-	229	0,3272	35,8	BELIMO BEN	38,2	JOVENTA DAFx.20S	36,8	BELIMO BEN
x 630	-	244	0,3456	37	BELIMO BEN	39,3	JOVENTA DAFx.20S	38	BELIMO BEN
x 650	9	254	0,3579	37,8	BELIMO BEN	40,1	JOVENTA DAFx.20S	38,8	BELIMO BEN
x 700	34	279	0,3887	40,7	BELIMO BEN	42	JOVENTA DAFx.20S	40,7	BELIMO BEN
x 710	39	284	0,3948	41,1	BELIMO BEN	42,4	JOVENTA DAFx.20S	42,1	BELIMO BEE
x 750	59	304	0,4194	42,6	BELIMO BEN	43,9	JOVENTA DAFx.20S	43,6	BELIMO BEE
x 800	84	329	0,4502	44,5	BELIMO BEN	45,8	JOVENTA DAFx.20S	45,5	BELIMO BE
650 x 180	-	19	0,0711	20,1	BELIMO BEN	20,6	BELIMO BFN	21,1	BELIMO BEN
x 200	-	29	0,0838	20,9	BELIMO BEN	21,4	BELIMO BFN	21,9	BELIMO BEN
x 225	-	41,5	0,0997	22	BELIMO BEN	22,5	BELIMO BFN	23	BELIMO BEN
x 250	-	54	0,1156	22,9	BELIMO BEN	23,4	BELIMO BFN	23,9	BELIMO BEN
x 280	-	69	0,1346	24,1	BELIMO BEN	24,6	BELIMO BFN	25,1	BELIMO BEN
x 300	-	79	0,1473	24,9	BELIMO BEN	25,4	BELIMO BFN	25,9	BELIMO BEN
x 315	-	86,5	0,1568	25,4	BELIMO BEN	25,9	BELIMO BFN	26,4	BELIMO BEN
x 355	-	106,5	0,1822	27	BELIMO BEN	27,5	BELIMO BFN	28	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
650 x 400	-	129	0,2108	28,7	BELIMO BEN	31,1	JOVENTA DAFx.20S	29,7	BELIMO BEN
x 450	-	154	0,2426	30,7	BELIMO BEN	33	JOVENTA DAFx.20S	31,7	BELIMO BEN
x 500	-	179	0,2743	32,6	BELIMO BEN	35	JOVENTA DAFx.20S	33,6	BELIMO BEN
x 550	-	204	0,3061	34,6	BELIMO BEN	36,9	JOVENTA DAFx.20S	35,6	BELIMO BEN
x 560	-	209	0,3124	35	BELIMO BEN	37,3	JOVENTA DAFx.20S	36	BELIMO BEN
x 600	-	229	0,3378	36,5	BELIMO BEN	38,8	JOVENTA DAFx.20S	37,5	BELIMO BEN
x 630	-	244	0,3569	37,7	BELIMO BEN	40	JOVENTA DAFx.20S	38,7	BELIMO BEN
x 650	9	254	0,3696	38,5	BELIMO BEN	40,8	JOVENTA DAFx.20S	39,5	BELIMO BEN
x 700	34	279	0,4013	41,4	BELIMO BEN	42,7	JOVENTA DAFx.20S	42,4	BELIMO BEE
x 710	39	284	0,4077	41,8	BELIMO BEN	43,1	JOVENTA DAFx.20S	42,8	BELIMO BEE
x 750	59	304	0,4331	43,4	BELIMO BEN	44,7	JOVENTA DAFx.20S	44,4	BELIMO BEE
x 800	84	329	0,4648	45,3	BELIMO BEN	46,6	JOVENTA DAFx.20S	46,3	BELIMO BE
700 x 180	-	19	0,0767	21	BELIMO BEN	21,5	BELIMO BFN	22	BELIMO BEN
x 200	-	29	0,0904	21,9	BELIMO BEN	22,4	BELIMO BFN	22,9	BELIMO BEN
x 225	-	41,5	0,1075	23	BELIMO BEN	23,5	BELIMO BFN	24	BELIMO BEN
x 250	-	54	0,1247	24	BELIMO BEN	24,5	BELIMO BFN	25	BELIMO BEN
x 280	-	69	0,1452	25,2	BELIMO BEN	25,7	BELIMO BFN	26,2	BELIMO BEN
x 300	-	79	0,1589	26	BELIMO BEN	26,5	BELIMO BFN	27	BELIMO BEN
x 315	-	86,5	0,1692	26,6	BELIMO BEN	27,1	BELIMO BFN	27,6	BELIMO BEN
x 355	-	106,5	0,1966	28,2	BELIMO BEN	30,6	JOVENTA DAFx.20S	29,2	BELIMO BEN
x 400	-	129	0,2274	30,1	BELIMO BEN	32,4	JOVENTA DAFx.20S	31,1	BELIMO BEN
x 450	-	154	0,2617	32,1	BELIMO BEN	34,4	JOVENTA DAFx.20S	33,1	BELIMO BEN
x 500	-	179	0,2959	34,1	BELIMO BEN	36,4	JOVENTA DAFx.20S	35,1	BELIMO BEN
x 550	-	204	0,3302	36,2	BELIMO BEN	38,5	JOVENTA DAFx.20S	37,2	BELIMO BEN
x 560	-	209	0,3370	36,6	BELIMO BEN	38,9	JOVENTA DAFx.20S	37,6	BELIMO BEN
x 600	-	229	0,3644	38,2	BELIMO BEN	40,5	JOVENTA DAFx.20S	39,2	BELIMO BEN
x 630	-	244	0,3850	39,4	BELIMO BEN	41,7	JOVENTA DAFx.20S	40,4	BELIMO BEN
x 650	9	254	0,3987	41,2	BELIMO BEN	42,5	JOVENTA DAFx.20S	42,2	BELIMO BEE
x 700	34	279	0,4329	43,3	BELIMO BEN	44,6	JOVENTA DAFx.20S	44,3	BELIMO BEE
x 710	39	284	0,4398	43,7	BELIMO BEN	45	JOVENTA DAFx.20S	44,7	BELIMO BEE
x 750	59	304	0,4672	45,3	BELIMO BEN	46,6	JOVENTA DAFx.20S	46,3	BELIMO BEE
x 800	84	329	0,5014	47,3	BELIMO BEN	48,6	JOVENTA DAFx.20S	48,3	BELIMO BE
710 x 180	-	19	0,0778	21,2	BELIMO BEN	21,7	BELIMO BFN	22,2	BELIMO BEN
x 200	-	29	0,0917	22,1	BELIMO BEN	22,6	BELIMO BFN	23,1	BELIMO BEN
x 225	-	41,5	0,1091	23,2	BELIMO BEN	23,7	BELIMO BFN	24,2	BELIMO BEN
x 250	-	54	0,1265	24,2	BELIMO BEN	24,7	BELIMO BFN	25,2	BELIMO BEN
x 280	-	69	0,1473	25,4	BELIMO BEN	25,9	BELIMO BFN	26,4	BELIMO BEN
x 300	-	79	0,1612	26,2	BELIMO BEN	26,7	BELIMO BFN	27,2	BELIMO BEN
x 315	-	86,5	0,1717	26,8	BELIMO BEN	27,3	BELIMO BFN	27,8	BELIMO BEN
x 355	-	106,5	0,1995	28,5	BELIMO BEN	30,8	JOVENTA DAFx.20S	29,5	BELIMO BEN
x 400	-	129	0,2307	30,3	BELIMO BEN	32,6	JOVENTA DAFx.20S	31,3	BELIMO BEN
x 450	-	154	0,2655	32,4	BELIMO BEN	34,7	JOVENTA DAFx.20S	33,4	BELIMO BEN
x 500	-	179	0,3002	34,4	BELIMO BEN	36,7	JOVENTA DAFx.20S	35,4	BELIMO BEN
x 550	-	204	0,3350	36,5	BELIMO BEN	38,8	JOVENTA DAFx.20S	37,5	BELIMO BEN
x 560	-	209	0,3419	36,9	BELIMO BEN	39,2	JOVENTA DAFx.20S	37,9	BELIMO BEN
x 600	-	229	0,3697	38,5	BELIMO BEN	40,8	JOVENTA DAFx.20S	39,5	BELIMO BEN
x 630	-	244	0,3906	40,8	BELIMO BEN	42,1	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 650	9	254	0,4045	41,6	BELIMO BEN	42,9	JOVENTA DAFx.20S	42,6	BELIMO BEE
x 700	34	279	0,4392	43,7	BELIMO BEN	45	JOVENTA DAFx.20S	44,7	BELIMO BEE
x 710	39	284	0,4462	44,1	BELIMO BEN	45,4	JOVENTA DAFx.20S	45,1	BELIMO BEE
x 750	59	304	0,4740	45,7	BELIMO BEN	47	JOVENTA DAFx.20S	46,7	BELIMO BE
x 800	84	329	0,5087	47,8	BELIMO BEN	49,1	JOVENTA DAFx.20S	48,8	BELIMO BE
750 x 180	-	19	0,0823	21,9	BELIMO BEN	22,4	BELIMO BFN	22,9	BELIMO BEN
x 200	-	29	0,0970	22,8	BELIMO BEN	23,3	BELIMO BFN	23,8	BELIMO BEN
x 225	-	41,5	0,1154	24	BELIMO BEN	24,5	BELIMO BFN	25	BELIMO BEN

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
750 x 250	-	54	0,1338	25	BELIMO BEN	25,5	BELIMO BFN	26	BELIMO BEN
x 280	-	69	0,1558	26,3	BELIMO BEN	26,8	BELIMO BFN	27,3	BELIMO BEN
x 300	-	79	0,1705	27,1	BELIMO BEN	27,6	BELIMO BFN	28,1	BELIMO BEN
x 315	-	86,5	0,1815	27,8	BELIMO BEN	28,3	BELIMO BFN	28,8	BELIMO BEN
x 355	-	106,5	0,2109	29,5	BELIMO BEN	31,8	JOVENTA DAFx.20S	30,5	BELIMO BEN
x 400	-	129	0,2440	31,4	BELIMO BEN	33,7	JOVENTA DAFx.20S	32,4	BELIMO BEN
x 450	-	154	0,2808	33,5	BELIMO BEN	35,8	JOVENTA DAFx.20S	34,5	BELIMO BEN
x 500	-	179	0,3175	35,6	BELIMO BEN	37,9	JOVENTA DAFx.20S	36,6	BELIMO BEN
x 550	-	204	0,3543	37,7	BELIMO BEN	40,1	JOVENTA DAFx.20S	38,7	BELIMO BEN
x 560	-	209	0,3616	38,2	BELIMO BEN	40,5	JOVENTA DAFx.20S	39,2	BELIMO BEN
x 600	-	229	0,3910	39,9	BELIMO BEN	42,2	JOVENTA DAFx.20S	40,9	BELIMO BEN
x 630	-	244	0,4131	42,2	BELIMO BEN	43,5	JOVENTA DAFx.20S	42,1	BELIMO BEN
x 650	9	254	0,4278	43	BELIMO BEN	44,3	JOVENTA DAFx.20S	44	BELIMO BEE
x 700	34	279	0,4645	45,1	BELIMO BEN	46,4	JOVENTA DAFx.20S	46,1	BELIMO BEE
x 710	39	284	0,4719	45,6	BELIMO BEN	46,9	JOVENTA DAFx.20S	46,6	BELIMO BEE
x 750	59	304	0,5013	47,3	BELIMO BEN	48,6	JOVENTA DAFx.20S	48,3	BELIMO BE
x 800	84	329	0,5380	49,4	BELIMO BEN	50,7	JOVENTA DAFx.20S	50,4	BELIMO BE
800 x 180	-	19	0,0879	22,8	BELIMO BEN	23,3	BELIMO BFN	23,8	BELIMO BEN
x 200	-	29	0,1036	23,8	BELIMO BEN	24,3	BELIMO BFN	24,8	BELIMO BEN
x 225	-	41,5	0,1232	25	BELIMO BEN	25,5	BELIMO BFN	26	BELIMO BEN
x 250	-	54	0,1429	26,1	BELIMO BEN	26,6	BELIMO BFN	27,1	BELIMO BEN
x 280	-	69	0,1664	27,4	BELIMO BEN	27,9	BELIMO BFN	28,4	BELIMO BEN
x 300	-	79	0,1821	28,3	BELIMO BEN	28,8	BELIMO BFN	29,3	BELIMO BEN
x 315	-	86,5	0,1939	28,9	BELIMO BEN	29,4	BELIMO BFN	29,9	BELIMO BEN
x 355	-	106,5	0,2253	30,7	BELIMO BEN	33	JOVENTA DAFx.20S	31,7	BELIMO BEN
x 400	-	129	0,2606	32,7	BELIMO BEN	35	JOVENTA DAFx.20S	33,7	BELIMO BEN
x 450	-	154	0,2999	34,9	BELIMO BEN	37,2	JOVENTA DAFx.20S	35,9	BELIMO BEN
x 500	-	179	0,3391	37,1	BELIMO BEN	39,4	JOVENTA DAFx.20S	38,1	BELIMO BEN
x 550	-	204	0,3784	39,3	BELIMO BEN	41,7	JOVENTA DAFx.20S	40,3	BELIMO BEN
x 560	-	209	0,3862	39,8	BELIMO BEN	42,1	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 600	-	229	0,4176	42,6	BELIMO BEN	43,9	JOVENTA DAFx.20S	42,5	BELIMO BEN
x 630	-	244	0,4412	43,9	BELIMO BEN	45,2	JOVENTA DAFx.20S	44,9	BELIMO BEE
x 650	9	254	0,4569	44,8	BELIMO BEN	46,1	JOVENTA DAFx.20S	45,8	BELIMO BEE
x 700	34	279	0,4961	47	BELIMO BEN	48,3	JOVENTA DAFx.20S	48	BELIMO BEE
x 710	39	284	0,5040	47,4	BELIMO BEN	48,7	JOVENTA DAFx.20S	48,4	BELIMO BE
x 750	59	304	0,5354	49,2	BELIMO BEN	50,5	JOVENTA DAFx.20S	50,2	BELIMO BE
x 800	84	329	0,5746	51,4	BELIMO BEN	52,7	JOVENTA DAFx.20S	52,4	BELIMO BE
900 x 180	-	19	0,0991	24,6	BELIMO BEN	25,1	BELIMO BFN	25,6	BELIMO BEN
x 200	-	29	0,1168	25,7	BELIMO BEN	26,2	BELIMO BFN	26,7	BELIMO BEN
x 225	-	41,5	0,1389	27	BELIMO BEN	27,5	BELIMO BFN	28	BELIMO BEN
x 250	-	54	0,1611	28,2	BELIMO BEN	28,7	BELIMO BFN	29,2	BELIMO BEN
x 280	-	69	0,1876	29,6	BELIMO BEN	30,1	BELIMO BFN	30,6	BELIMO BEN
x 300	-	79	0,2053	30,5	BELIMO BEN	31	BELIMO BFN	31,5	BELIMO BEN
x 315	-	86,5	0,2186	31,3	BELIMO BEN	33,6	JOVENTA DAFx.20S	32,3	BELIMO BEN
x 355	-	106,5	0,2540	33,2	BELIMO BEN	35,5	JOVENTA DAFx.20S	34,2	BELIMO BEN
x 400	-	129	0,2938	35,3	BELIMO BEN	37,7	JOVENTA DAFx.20S	36,3	BELIMO BEN
x 450	-	154	0,3381	37,7	BELIMO BEN	40	JOVENTA DAFx.20S	38,7	BELIMO BEN
x 500	-	179	0,3823	40,1	BELIMO BEN	42,4	JOVENTA DAFx.20S	41,1	BELIMO BEN
x 550	-	204	0,4266	42,5	BELIMO BEN	44,8	JOVENTA DAFx.20S	43,5	BELIMO BEN
x 560	-	209	0,4354	44	BELIMO BEN	45,3	JOVENTA DAFx.20S	45	BELIMO BEE
x 600	-	229	0,4708	45,9	BELIMO BEN	47,2	JOVENTA DAFx.20S	46,9	BELIMO BEE
x 630	-	244	0,4974	47,4	BELIMO BEN	48,7	JOVENTA DAFx.20S	48,4	BELIMO BEE
x 650	9	254	0,5151	48,3	BELIMO BEN	49,6	JOVENTA DAFx.20S	49,3	BELIMO BEE
x 700	34	279	0,5593	50,7	BELIMO BEN	52	JOVENTA DAFx.20S	51,7	BELIMO BE
x 710	39	284	0,5682	51,2	BELIMO BEN	52,5	JOVENTA DAFx.20S	52,2	BELIMO BE

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
900 x 750	59	304	0,6036	53,1	BELIMO BEN	54,4	JOVENTA DAFx.20S	54,1	BELIMO BE
x 800	84	329	0,6478	55,5	BELIMO BEN	56,8	JOVENTA DAFx.20S	56,5	BELIMO BE
1000 x 180	-	19	0,1103	26,4	BELIMO BEN	26,9	BELIMO BFN	27,4	BELIMO BEN
x 200	-	29	0,1300	27,6	BELIMO BEN	28,1	BELIMO BFN	28,6	BELIMO BEN
x 225	-	41,5	0,1546	29	BELIMO BEN	29,5	BELIMO BFN	30	BELIMO BEN
x 250	-	54	0,1793	30,3	BELIMO BEN	30,8	BELIMO BFN	31,3	BELIMO BEN
x 280	-	69	0,2088	31,9	BELIMO BEN	32,4	BELIMO BFN	32,9	BELIMO BEN
x 300	-	79	0,2285	32,9	BELIMO BEN	35,2	JOVENTA DAFx.20S	33,9	BELIMO BEN
x 315	-	86,5	0,2433	33,7	BELIMO BEN	36	JOVENTA DAFx.20S	34,7	BELIMO BEN
x 355	-	106,5	0,2827	35,8	BELIMO BEN	38,1	JOVENTA DAFx.20S	36,8	BELIMO BEN
x 400	-	129	0,3270	38,1	BELIMO BEN	40,5	JOVENTA DAFx.20S	39,1	BELIMO BEN
x 450	-	154	0,3763	40,7	BELIMO BEN	43,1	JOVENTA DAFx.20S	41,7	BELIMO BEN
x 500	-	179	0,4255	43,4	BELIMO BEN	45,7	JOVENTA DAFx.20S	44,4	BELIMO BEN
x 550	-	204	0,4748	47	BELIMO BEN	48,3	JOVENTA DAFx.20S	47	BELIMO BEE
x 560	-	209	0,4846	47,5	BELIMO BEN	48,8	JOVENTA DAFx.20S	48,5	BELIMO BEE
x 600	-	229	0,5240	49,6	BELIMO BEN	50,9	JOVENTA DAFx.20S	50,6	BELIMO BEE
x 630	-	244	0,5536	51,2	BELIMO BEN	52,5	JOVENTA DAFx.20S	52,2	BELIMO BEE
x 650	9	254	0,5733	52,2	BELIMO BEN	53,5	JOVENTA DAFx.20S	53,2	BELIMO BE
x 700	34	279	0,6225	54,9	BELIMO BEN	56,2	JOVENTA DAFx.20S	55,9	BELIMO BE
x 710	39	284	0,6324	55,4	BELIMO BEN	56,7	JOVENTA DAFx.20S	56,4	BELIMO BE
x 750	59	304	0,6718	57,5	BELIMO BEN	58,8	JOVENTA DAFx.20S	58,5	BELIMO BE
x 800	84	329	0,7210	60,1	BELIMO BEN	61,4	JOVENTA DAFx.20S	61,1	BELIMO BE
1100 x 180	-	19	0,1215	28,2	BELIMO BEN	28,7	BELIMO BFN	29,2	BELIMO BEN
x 200	-	29	0,1432	29,5	BELIMO BEN	30	BELIMO BFN	30,5	BELIMO BEN
x 225	-	41,5	0,1703	31	BELIMO BEN	31,5	BELIMO BFN	32	BELIMO BEN
x 250	-	54	0,1975	32,4	BELIMO BEN	32,9	BELIMO BFN	33,4	BELIMO BEN
x 280	-	69	0,2300	34,1	BELIMO BEN	34,6	BELIMO BFN	35,1	BELIMO BEN
x 300	-	79	0,2517	35,2	BELIMO BEN	37,5	JOVENTA DAFx.20S	36,2	BELIMO BEN
x 315	-	86,5	0,2680	36	BELIMO BEN	38,3	JOVENTA DAFx.20S	37	BELIMO BEN
x 355	-	106,5	0,3114	38,2	BELIMO BEN	40,6	JOVENTA DAFx.20S	39,2	BELIMO BEN
x 400	-	129	0,3602	40,8	BELIMO BEN	43,1	JOVENTA DAFx.20S	41,8	BELIMO BEN
x 450	-	154	0,4145	43,6	BELIMO BEN	45,9	JOVENTA DAFx.20S	44,6	BELIMO BEN
x 500	-	179	0,4687	46,4	BELIMO BEN	48,7	JOVENTA DAFx.20S	48,4	BELIMO BEE
x 550	-	204	0,5230	50,2	BELIMO BEN	51,5	JOVENTA DAFx.20S	51,2	BELIMO BEE
x 560	-	209	0,5338	50,7	BELIMO BEN	52	JOVENTA DAFx.20S	51,7	BELIMO BEE
x 600	-	229	0,5772	53	BELIMO BEN	54,3	JOVENTA DAFx.20S	54	BELIMO BEE
x 630	-	244	0,6098	54,7	BELIMO BEN	56	JOVENTA DAFx.20S	55,7	BELIMO BE
x 650	9	254	0,6315	55,8	BELIMO BEN	57,1	JOVENTA DAFx.20S	56,8	BELIMO BE
x 700	34	279	0,6857	58,6	BELIMO BEN	59,9	JOVENTA DAFx.20S	59,6	BELIMO BE
x 710	39	284	0,6966	59,1	BELIMO BEN	60,4	JOVENTA DAFx.20S	60,1	BELIMO BE
x 750	59	304	0,7400	61,4	BELIMO BEN	62,7	JOVENTA DAFx.20S	62,4	BELIMO BE
x 800	84	329	0,7942	64,2	BELIMO BEN	65,5	JOVENTA DAFx.20S	65,2	BELIMO BE
1250 x 180	-	19	0,1383	30,9	BELIMO BEN	31,4	BELIMO BFN	31,9	BELIMO BEN
x 200	-	29	0,1630	32,3	BELIMO BEN	32,8	BELIMO BFN	33,3	BELIMO BEN
x 225	-	41,5	0,1939	34	BELIMO BEN	34,5	BELIMO BFN	35	BELIMO BEN
x 250	-	54	0,2248	35,5	BELIMO BEN	36	BELIMO BFN	36,5	BELIMO BEN
x 280	-	69	0,2618	37,4	BELIMO BEN	39,7	JOVENTA DAFx.20S	38,4	BELIMO BEN
x 300	-	79	0,2865	38,6	BELIMO BEN	40,9	JOVENTA DAFx.20S	39,6	BELIMO BEN
x 315	-	87	0,3050	39,5	BELIMO BEN	41,8	JOVENTA DAFx.20S	40,5	BELIMO BEN
x 355	-	106,5	0,3544	42	BELIMO BEN	44,3	JOVENTA DAFx.20S	43	BELIMO BEN
x 400	-	129	0,4100	44,7	BELIMO BEN	47	JOVENTA DAFx.20S	45,7	BELIMO BEN
x 450	-	154	0,4718	47,8	BELIMO BEN	50,1	JOVENTA DAFx.20S	48,8	BELIMO BEN
x 500	-	179	0,5335	51,9	BELIMO BEN	53,2	JOVENTA DAFx.20S	52,9	BELIMO BEE
x 550	-	204	0,5953	54,9	BELIMO BEN	56,2	JOVENTA DAFx.20S	55,9	BELIMO BEE
x 560	-	209	0,6076	55,5	BELIMO BEN	56,8	JOVENTA DAFx.20S	56,5	BELIMO BEE

A x B [mm]	Overlaps		Efective area	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]	S_{ef} [m²]	weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
1250 x 600	-	229	0,6570	58	BELIMO BEN	59,3	JOVENTA DAFx.20S	59	BELIMO BE
x 630	-	244	0,6941	59,8	BELIMO BEN	61,1	JOVENTA DAFx.20S	60,8	BELIMO BE
x 650	9	254	0,7188	61,1	BELIMO BEN	62,4	JOVENTA DAFx.20S	62,1	BELIMO BE
x 700	34	279	0,7805	64,1	BELIMO BEN	65,4	JOVENTA DAFx.20S	65,1	BELIMO BE
x 710	39	284	0,7929	64,8	BELIMO BEN	66,1	JOVENTA DAFx.20S	65,8	BELIMO BE
x 750	59	304	0,8423	67,2	BELIMO BEN	68,5	JOVENTA DAFx.20S	68,2	BELIMO BE
x 800	84	329	0,9040	70,3	BELIMO BEN	71,6	JOVENTA DAFx.20S	71,3	BELIMO BE
1400 x 180	-	19	0,1551	33,7	BELIMO BEN	34,2	BELIMO BFN	34,7	BELIMO BEN
x 200	-	29	0,1828	35,2	BELIMO BEN	35,7	BELIMO BFN	36,2	BELIMO BEN
x 225	-	41,5	0,2174	37	BELIMO BEN	37,5	BELIMO BFN	38	BELIMO BEN
x 250	-	54	0,2521	38,7	BELIMO BEN	41	JOVENTA DAF2.20S	39,7	BELIMO BEN
x 280	-	69	0,2936	40,7	BELIMO BEN	43	JOVENTA DAF2.20S	41,7	BELIMO BEN
x 300	-	79	0,3213	42	BELIMO BEN	44,3	JOVENTA DAF2.20S	43	BELIMO BEN
x 315	-	86,5	0,3421	43	BELIMO BEN	45,3	JOVENTA DAF2.20S	44	BELIMO BEN
x 355	-	106,5	0,3975	45,7	BELIMO BEN	48	JOVENTA DAF2.20S	46,7	BELIMO BEN
x 400	-	129	0,4598	48,7	BELIMO BEN	51	JOVENTA DAF2.20S	49,7	BELIMO BEN
x 450	-	154	0,5291	53	BELIMO BEN	54,3	JOVENTA DAF2.20S	54	BELIMO BEE
x 500	-	179	0,5983	56,4	BELIMO BEN	57,7	JOVENTA DAF2.20S	57,4	BELIMO BEE
x 550	-	204	0,6676	59,7	BELIMO BEN	61	JOVENTA DAF2.20S	60,7	BELIMO BE
x 560	-	209	0,6814	60,4	BELIMO BEN	61,7	JOVENTA DAF2.20S	61,4	BELIMO BE
x 600	-	229	0,7368	63	BELIMO BEN	64,3	JOVENTA DAF2.20S	64	BELIMO BE
x 630	-	244	0,7784	65	BELIMO BEN	66,3	JOVENTA DAF2.20S	66	BELIMO BE
x 650	9	254	0,8061	66,4	BELIMO BEN	67,7	JOVENTA DAF2.20S	67,4	BELIMO BE
x 700	34	279	0,8753	69,7	BELIMO BEN	71	JOVENTA DAF2.20S	70,7	BELIMO BE
x 710	39	284	0,8892	70,4	BELIMO BEN	71,7	JOVENTA DAF2.20S	71,4	BELIMO BE
x 750	59	304	0,9446	73	BELIMO BEN	74,3	JOVENTA DAF2.20S	74	BELIMO BE
x 800	84	329	1,0138	76,4	BELIMO BEN	77,7	JOVENTA DAF2.20S	84,2	SCHISCHEK InMax 50.75
1500 x 180	-	19	0,1663	35,5	BELIMO BEN	36	BELIMO BFN	36,5	BELIMO BEN
x 200	-	29	0,1960	37,1	BELIMO BEN	37,6	BELIMO BFN	38,1	BELIMO BEN
x 225	-	41,5	0,2331	39	BELIMO BEN	39,5	BELIMO BFN	40	BELIMO BEN
x 250	-	54	0,2703	40,7	BELIMO BEN	43,1	JOVENTA DAFx.20S	41,7	BELIMO BEN
x 280	-	69	0,3148	42,9	BELIMO BEN	45,2	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 300	-	79	0,3445	44,3	BELIMO BEN	46,6	JOVENTA DAFx.20S	45,3	BELIMO BEN
x 315	-	86,5	0,3668	45,3	BELIMO BEN	47,6	JOVENTA DAFx.20S	46,3	BELIMO BEN
x 355	-	106,5	0,4262	48,1	BELIMO BEN	50,4	JOVENTA DAFx.20S	49,1	BELIMO BEN
x 400	-	129	0,4930	51,3	BELIMO BEN	53,6	JOVENTA DAFx.20S	52,3	BELIMO BEN
x 450	-	154	0,5673	55,8	BELIMO BEN	57,1	JOVENTA DAFx.20S	56,8	BELIMO BEE
x 500	-	179	0,6415	59,3	BELIMO BEN	60,6	JOVENTA DAFx.20S	60,3	BELIMO BEE
x 550	-	204	0,7158	62,9	BELIMO BEN	64,2	JOVENTA DAFx.20S	63,9	BELIMO BE
x 560	-	209	0,7306	63,6	BELIMO BEN	64,9	JOVENTA DAFx.20S	64,6	BELIMO BE
x 600	-	229	0,7900	66,4	BELIMO BEN	67,7	JOVENTA DAFx.20S	67,4	BELIMO BE
x 630	-	244	0,8346	68,5	BELIMO BEN	69,8	JOVENTA DAFx.20S	69,5	BELIMO BE
x 650	9	254	0,8643	69,9	BELIMO BEN	71,2	JOVENTA DAFx.20S	70,9	BELIMO BE
x 700	34	279	0,9385	73,4	BELIMO BEN	74,7	JOVENTA DAFx.20S	74,4	BELIMO BE
x 710	39	284	0,9534	74,1	BELIMO BEN	75,4	JOVENTA DAFx.20S	75,1	BELIMO BE
x 750	59	304	1,0128	76,9	BELIMO BEN	78,2	JOVENTA DAFx.20S	77,9	BELIMO BE
x 800	84	329	1,0870	80,5	BELIMO BEN	81,6	JOVENTA DAF2.20S	88,3	SCHISCHEK InMax 50.75

3.3. Weight and effective area - round dampers

Tab. 3.3.1. Weight and effective area - round dampers

Size øD [mm]	Overlaps f [mm]	Efective area S_{ef} [m^2]	MSD-W with electromagnet		MSD	
			weight [kg]	actuating	weight [kg]	actuating
180	-	0,0160	11,3	BELIMO BFN	9,1	BELIMO BEN
200	-	0,0208	11,7	BELIMO BFN	9,5	BELIMO BEN
225	-	0,0277	12,2	BELIMO BFN	10,1	BELIMO BEN
250	2,5	0,0356	12,9	BELIMO BFN	10,7	BELIMO BEN
280	17,5	0,0463	13,6	BELIMO BFN	11,4	BELIMO BEN
315	35	0,0607	14,6	BELIMO BFN	12,5	BELIMO BEN
355	55	0,0794	15,8	BELIMO BFN	13,6	BELIMO BEN
400	77,5	0,1035	15,6	JOVENTA DAFx.20S	15,1	BELIMO BEN
450	102,5	0,1339	17,3	JOVENTA DAFx.20S	16,8	BELIMO BEN
500	127,5	0,1683	19,2	JOVENTA DAFx.20S	18,7	BELIMO BEN
560	157,5	0,2148	21,7	JOVENTA DAFx.20S	21,2	BELIMO BEN
630	192,5	0,2762	24,8	JOVENTA DAFx.20S	24,3	BELIMO BEN

3.4. For square damper the open damper blade overlaps the damper body by the value “c” or “a” and “c”. These values are specified in the Tab. 3.2.1.

For round damperthe open damper blade overlaps the damper body by the value “f” These values are specified in the Tab. 3.3.1.

Values "a","c" and "f", has to be respected when projecting related smoke exhaust ducts.

Fig. 28 Value “a” a “c” (square dampers)

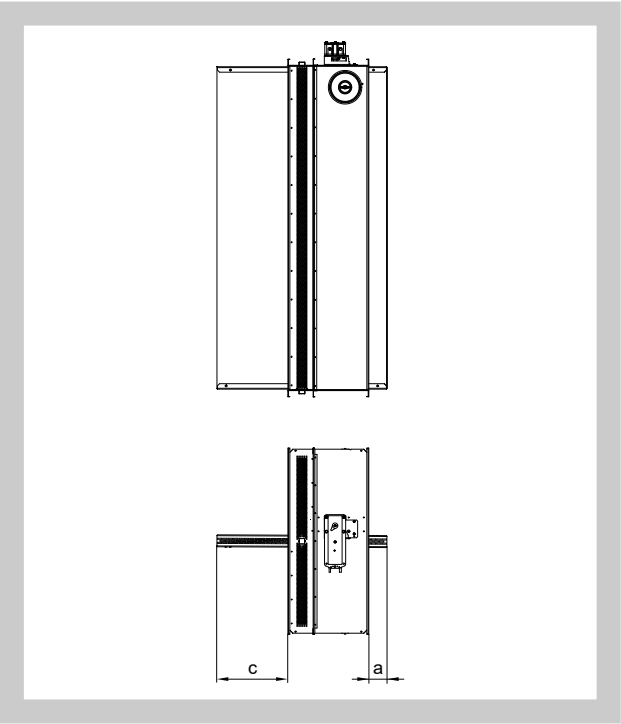
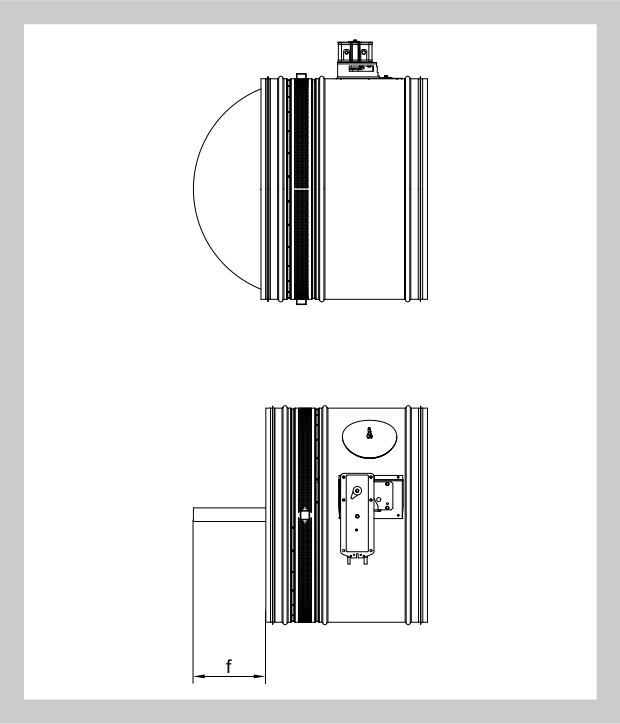


Fig. 29 Value “f” (round dampers)



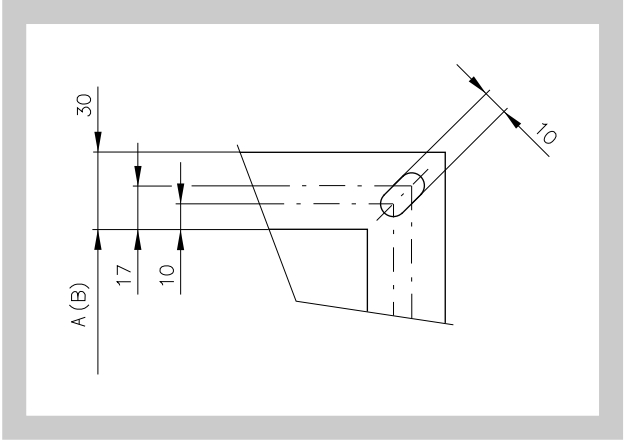
3.5. For the design .66 (with BKNE supply and communication device) add to weight of the damper with an actuating mechanism (from the Tab. 3.2.1. and 3.3.1.) the weight of BKNE (0.7 kg).

For the design .4M0, .4M1, .5M0 and .5M1 (with electric actuating mechanism with emergency function and electromagnet add to weight of the damper with an actuating mechanism (from the Tab. 3.2.1. and 3.3.1.) the weight of electromagnet (1 kg).

3.6. Square dampers can be supplied on the customer´s demands in all subdimension of the above mentioned range.

3.7. Flanges of square smoke control dampers are 30 mm wide with oval hole.
In case of damper installation into SPIRO duct, round dampers are supplied without the flanges so as it is possible to connect them with external joints.

Fig. 30 Flange of square damper



4. Placement and Assembly

4.1. Multi smoke extraction dampers are designed to remove heat and combustion products (e.g. smoke) from fire compartments according EN1366-8.
Multi smoke extraction dampers are designed to horizontal or vertical installation with arbitrary blade axis position.
To provide needed access space to the control device, all other objects must be situated at least 350 mm from the control parts of the damper.

4.2. The distance between damper:
- distance 200 mm between dampers installed in the duct;
- distance 75 mm between damper and construction (wall/ceiling).

Fig. 31 The distance between the smoke damper and the construction

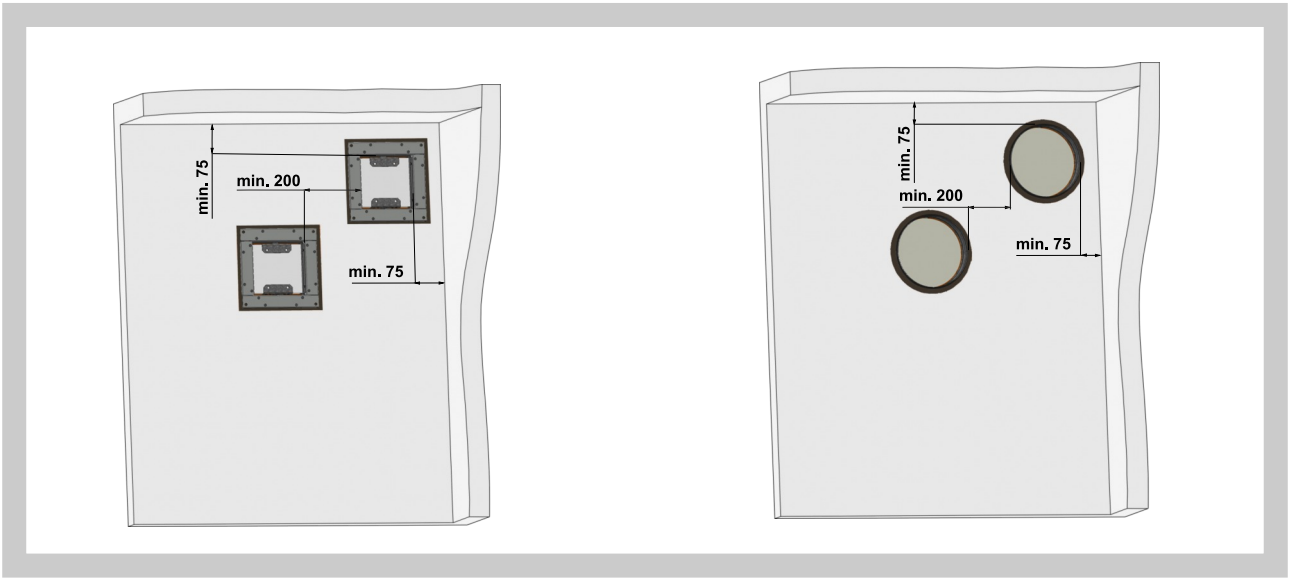
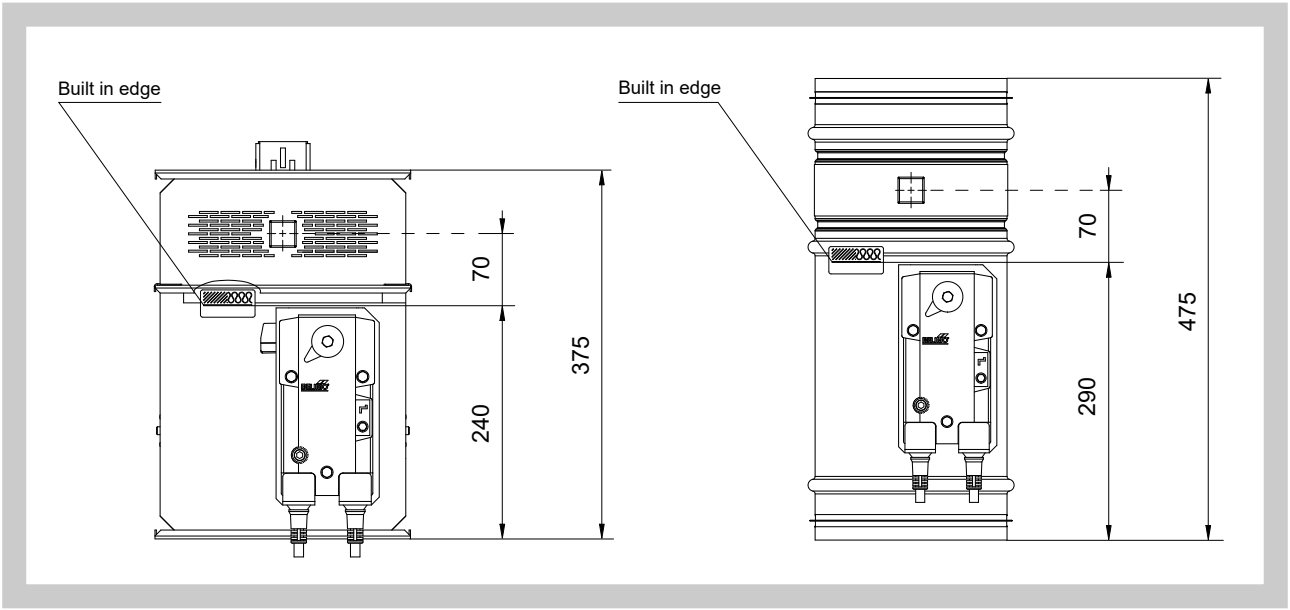


Fig. 32 Built in edge



"Wall edge sticker" indicates the recommended edge of installation of fire damper into the fire partition structure (wall).
The damper must be installed so that the entire damper blade - in the closed position - is located inside the fire separating structure (wall) and at the same time the control mechanism and inspection openings are freely accessible.

4.3. The control mechanism has to be protected (covered) against damage and pollution during installation process.

During installation the damper blade must be in position “CLOSED”. The damper body should not be deformed in the course of installation. Once the damper built in, its blade should not grind on the damper casing during opening or closing.

4.4. Installation opening dimensions

Fig. 33 Installation opening - square damper

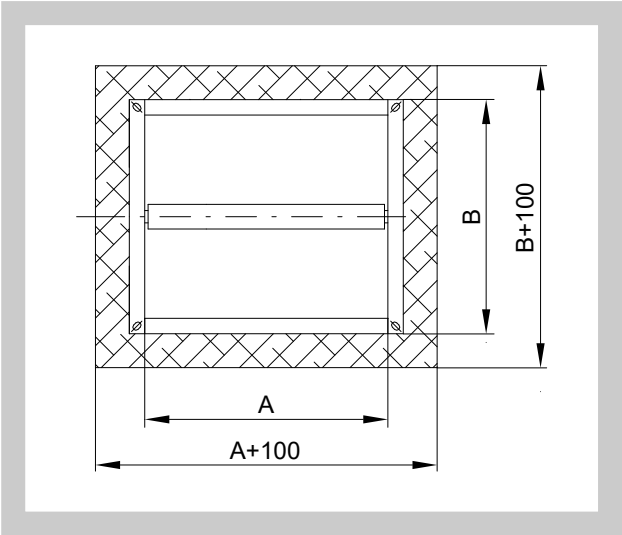


Fig. 34 Installation opening - round damper

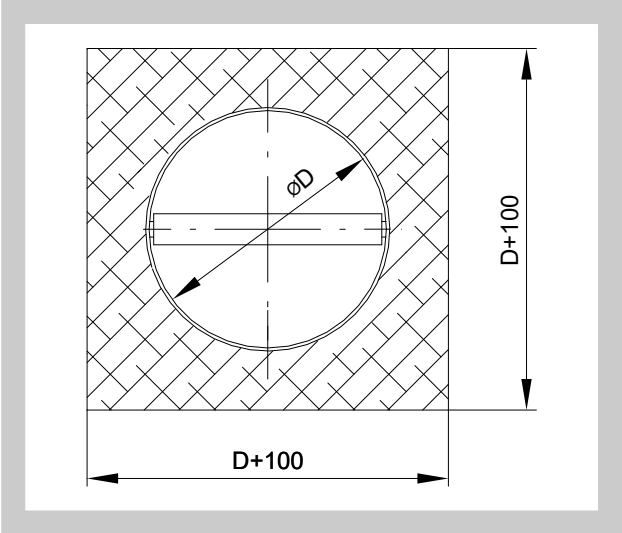
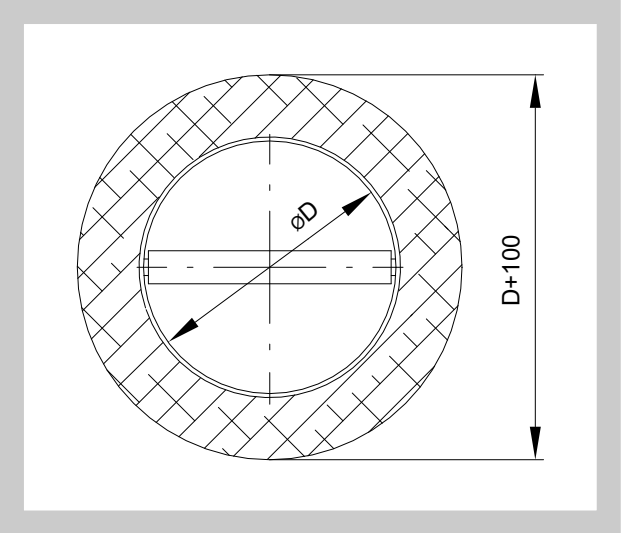


Fig. 35 Installation opening - round damper



5. Statement of installations

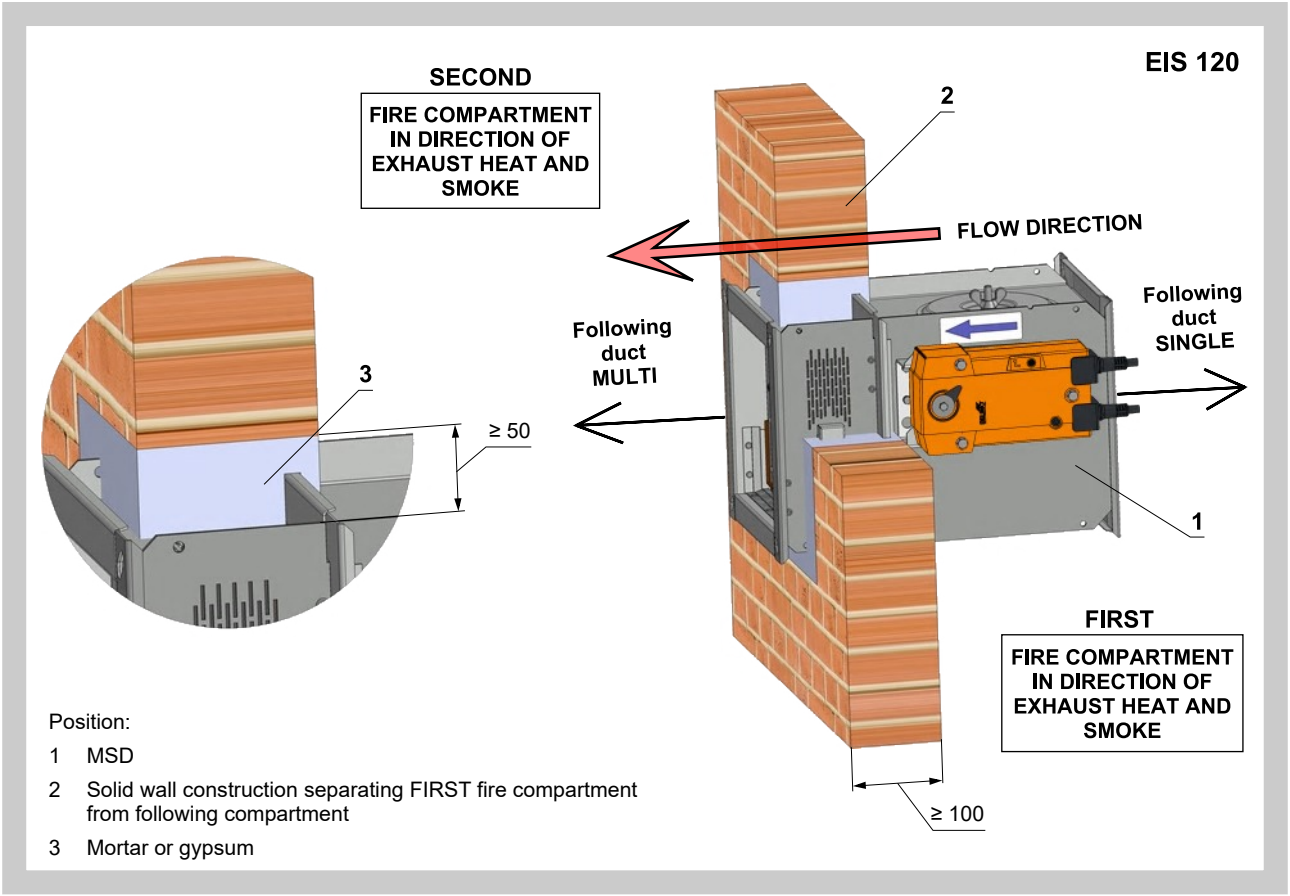
5.1. Installation method list

Tab. 5.1.1. Installation method list

Fire separating constru.	Wall/Ceiling Min. thickness [mm]	Installation	Fire resist.	Page
Solid wall construction SINGLE / MULTI	100	Mortar or gypsum	EIS 120	34
		Weichschott / Ablative Coated Batt	EIS 90	35
Solid wall construction MULTI / MULTI		Insulation with stone wool - mortar or gypsum	EIS 120	36
		Insulation with cement-lime plates - mortar or gypsum		
		Insulation with stone wool - Weichschott / Ablative Coated Batt	EIS 90	37
		Insulation with cement-lime plates - Weichschott / Ablative Coated Batt		
Gypsum wall construction SINGLE / MULTI	125	Mortar or gypsum	EIS 120	38
	100	Weichschott / Ablative Coated Batt	EIS 90	39
Gypsum wall construction MULTI / MULTI	125	Insulation with stone wool - mortar or gypsum	EIS 120	40
		Insulation with cement-lime plates - mortar or gypsum		
	100	Insulation with stone wool - Weichschott / Ablative Coated Batt	EIS 90	41
		Insulation with cement-lime plates - Weichschott / Ablative Coated Batt		
Solid ceiling construction SINGLE / MULTI	150 - concrete 125 - aerated concrete	Mortar or gypsum	EIS 120	42
	110 - concrete 125 - aerated concrete	Mortar or gypsum	EIS 90	
		Weichschott / Ablative Coated Batt		43
Solid ceiling construction MULTI / MULTI	150 - concrete 125 - aerated concrete	Insulation with stone wool - mortar or gypsum	EIS 120	44
		Insulation with cement-lime plates - mortar or gypsum		
	110 - concrete 125 - aerated concrete	Insulation with stone wool - mortar or gypsum	EIS 90	
		Insulation with cement-lime plates - mortar or gypsum		
		Insulation with stone wool - Weichschott / Ablative Coated Batt		45
		Insulation with cement-lime plates - Weichschott / Ablative Coated Batt		
Installation in vertical duct MULTI / MULTI	–	Insulation with stone wool	EIS 120	46
	–	Duct from calcium-silicate plates		47
Installation in horizontal duct MULTI / MULTI	–	Insulation with stone wool		48
	–	Duct from calcium-silicate plates		49

5.2. Installation in solid wall construction SINGLE / MULTI

Fig. 36 Dividing construction between SINGLE / MULTI duct - mortar or gypsum



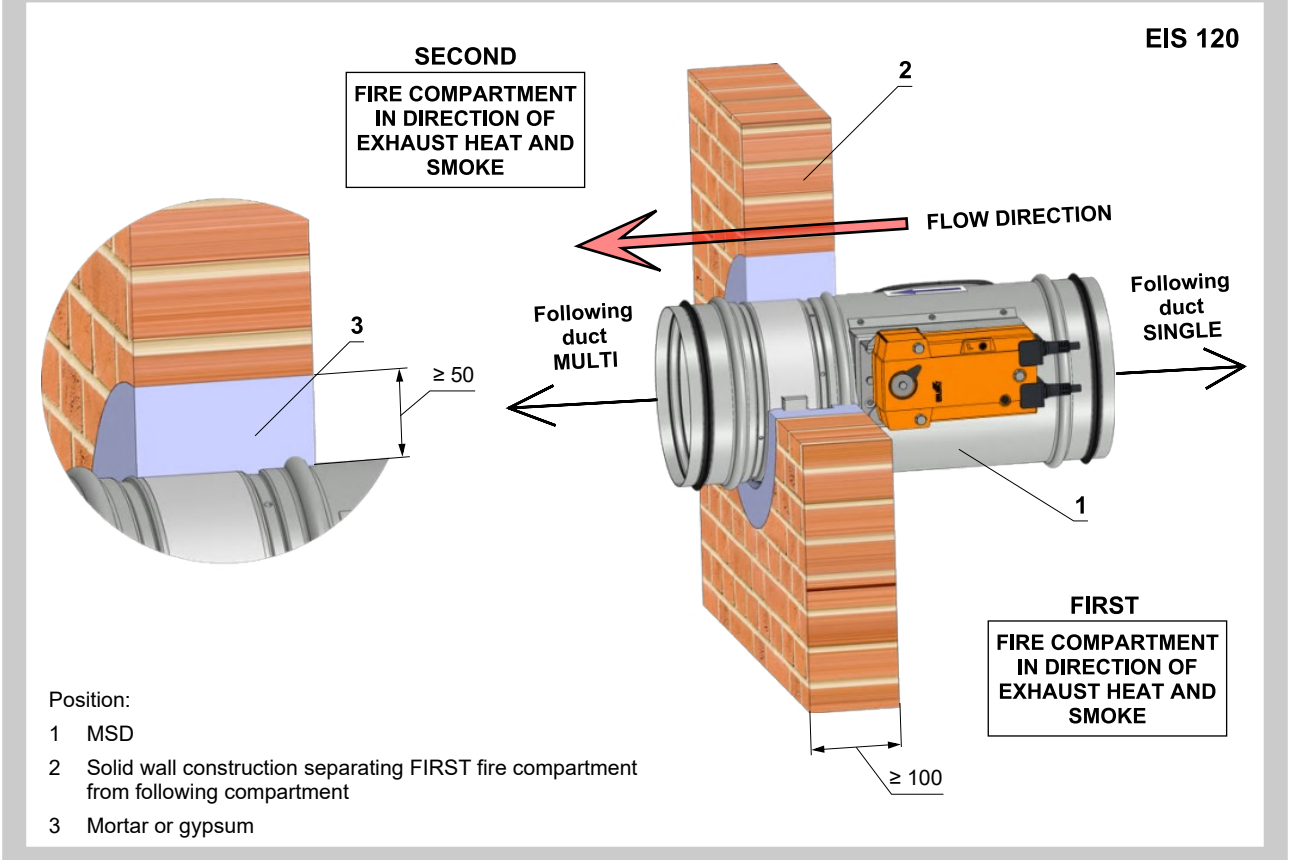
Position:

1 MSD

2 Solid wall construction separating FIRST fire compartment from following compartment

3 Mortar or gypsum

Fig. 37 Dividing construction between SINGLE / MULTI duct - mortar or gypsum



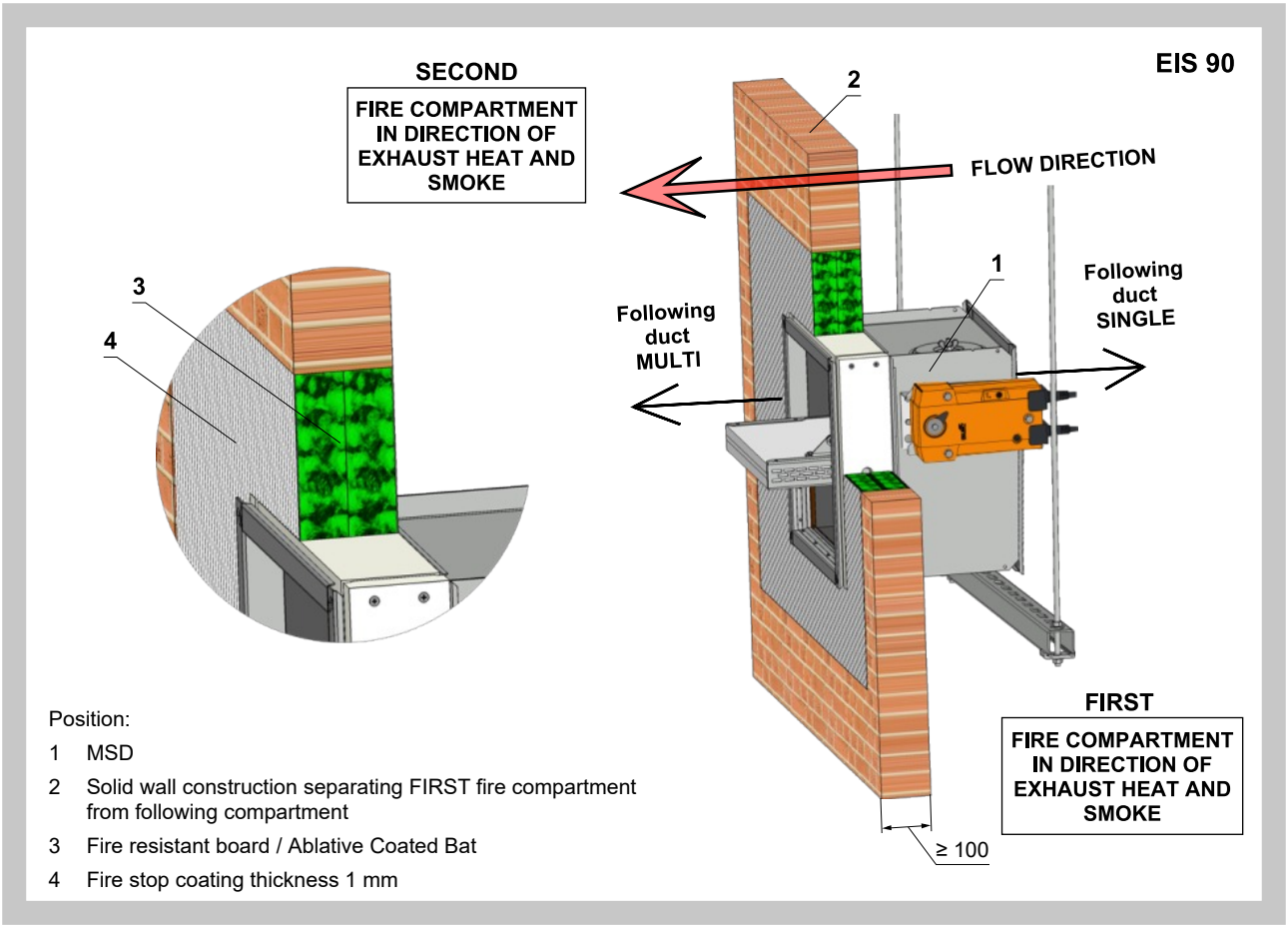
Position:

1 MSD

2 Solid wall construction separating FIRST fire compartment from following compartment

3 Mortar or gypsum

Fig. 38 Dividing construction between SINGLE / MULTI duct - Weichschott / Ablative Coated Batt



Position:

1 MSD

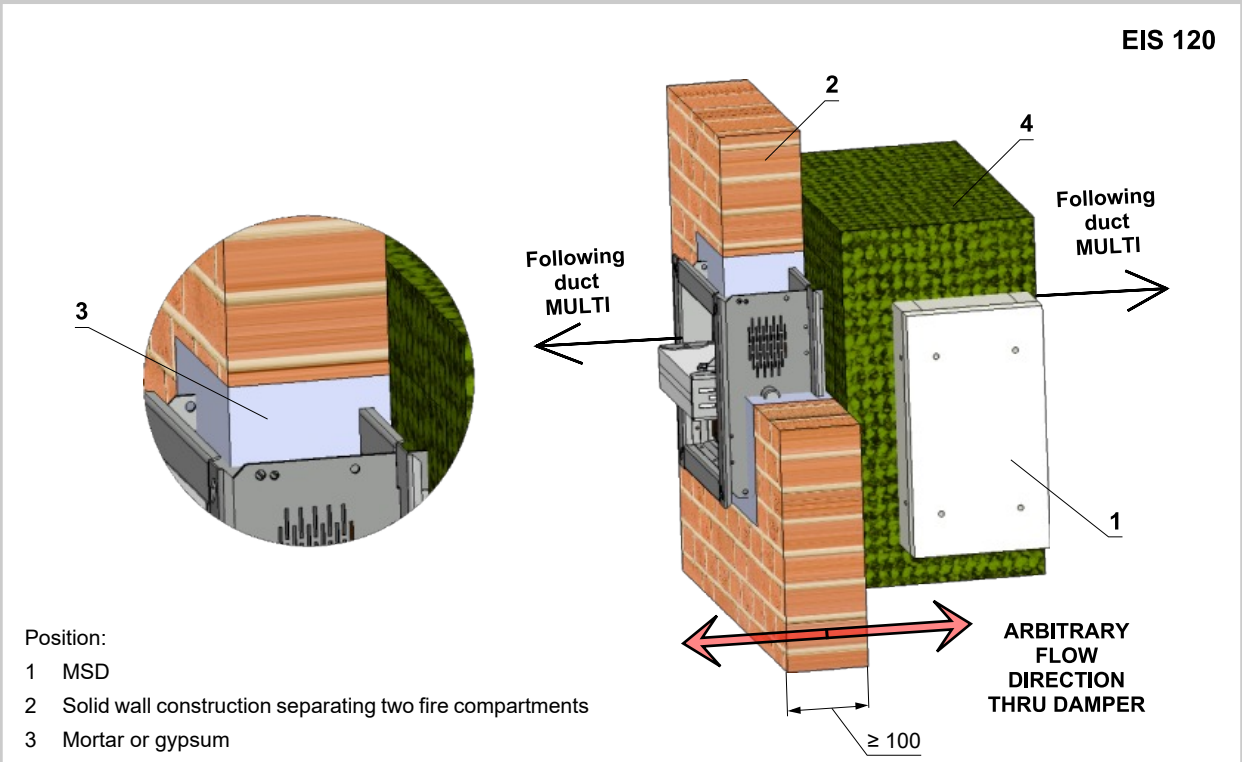
2 Solid wall construction separating FIRST fire compartment from following compartment

3 Fire resistant board / Ablative Coated Bat

4 Fire stop coating thickness 1 mm

5.3. Installation in solid wall construction MULTI / MULTI

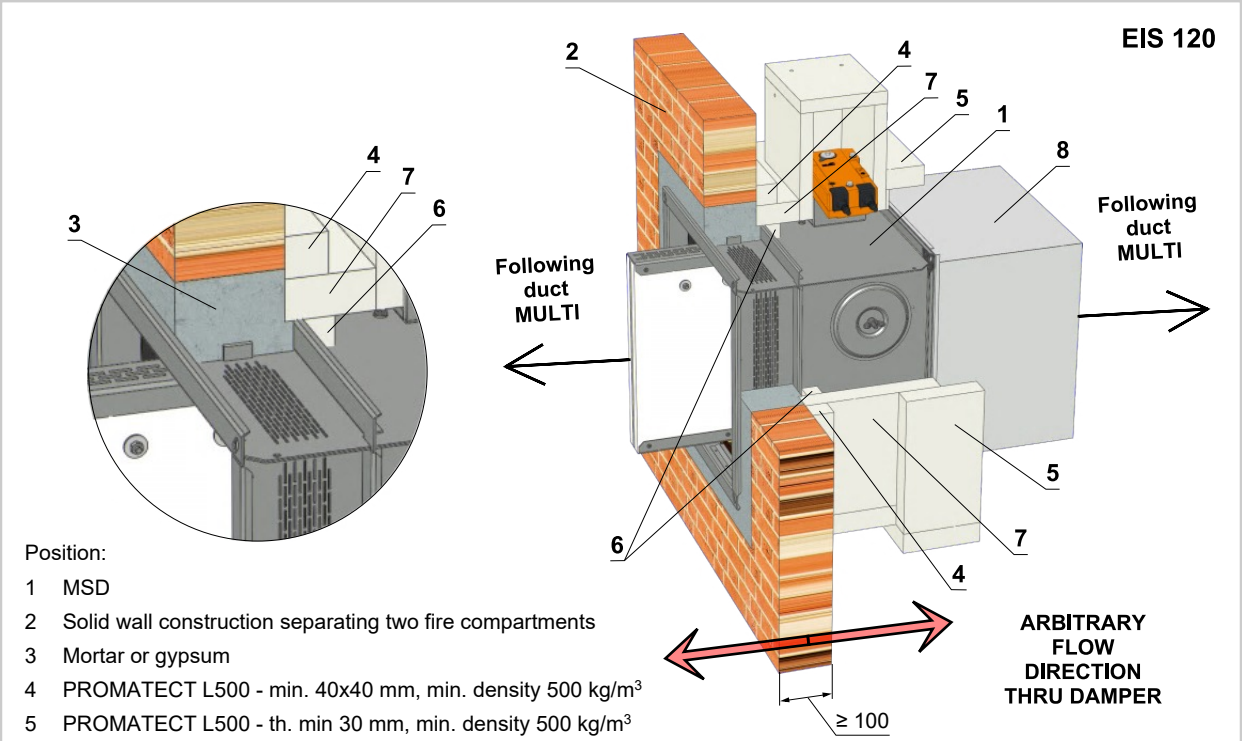
Fig. 39 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum



Position:

1 MSD
2 Solid wall construction separating two fire compartments
3 Mortar or gypsum
4 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

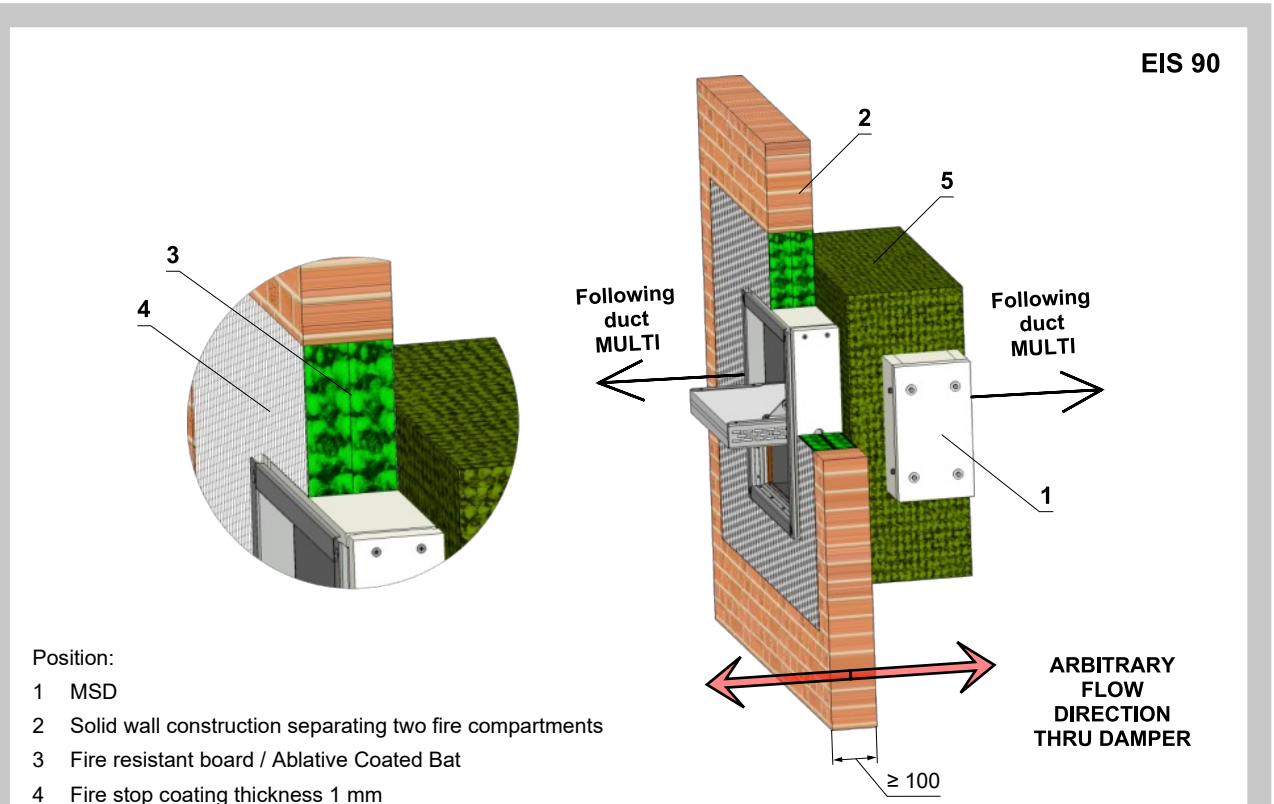
Fig. 40 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum



Position:

1 MSD
2 Solid wall construction separating two fire compartments
3 Mortar or gypsum
4 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
5 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
6 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
7 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
8 Duct

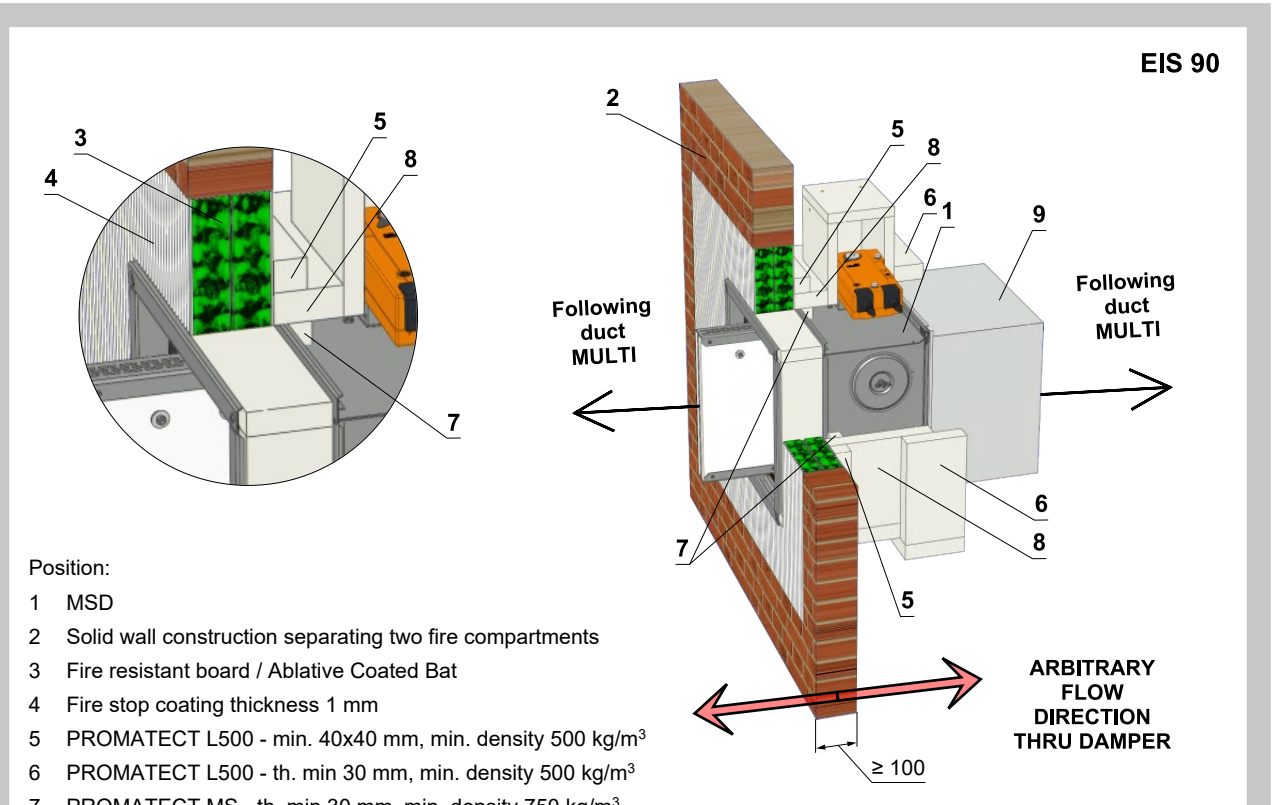
Fig. 41 **Dividing construction between MULTI / MULTI duct - insulation with stone wool - Weichschott / Ablative Coated Batt**



Position:

1 MSD
2 Solid wall construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

Fig. 42 **Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Weichschott / Ablative Coated Batt**

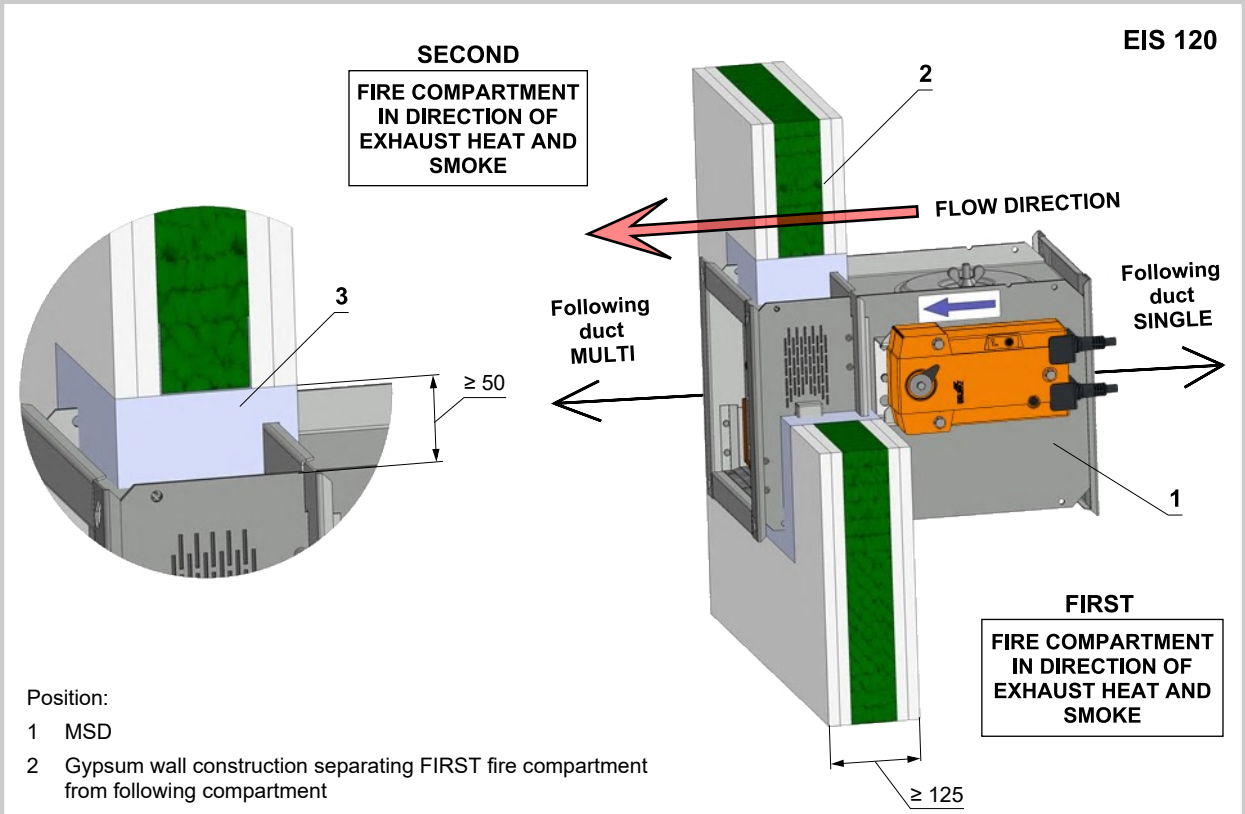


Position:

1 MSD
2 Solid wall construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
6 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
7 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
8 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
9 Duct

5.4. Installation in gypsum wall SINGLE / MULTI

Fig. 43 Dividing construction between SINGLE / MULTI duct - mortar or gypsum



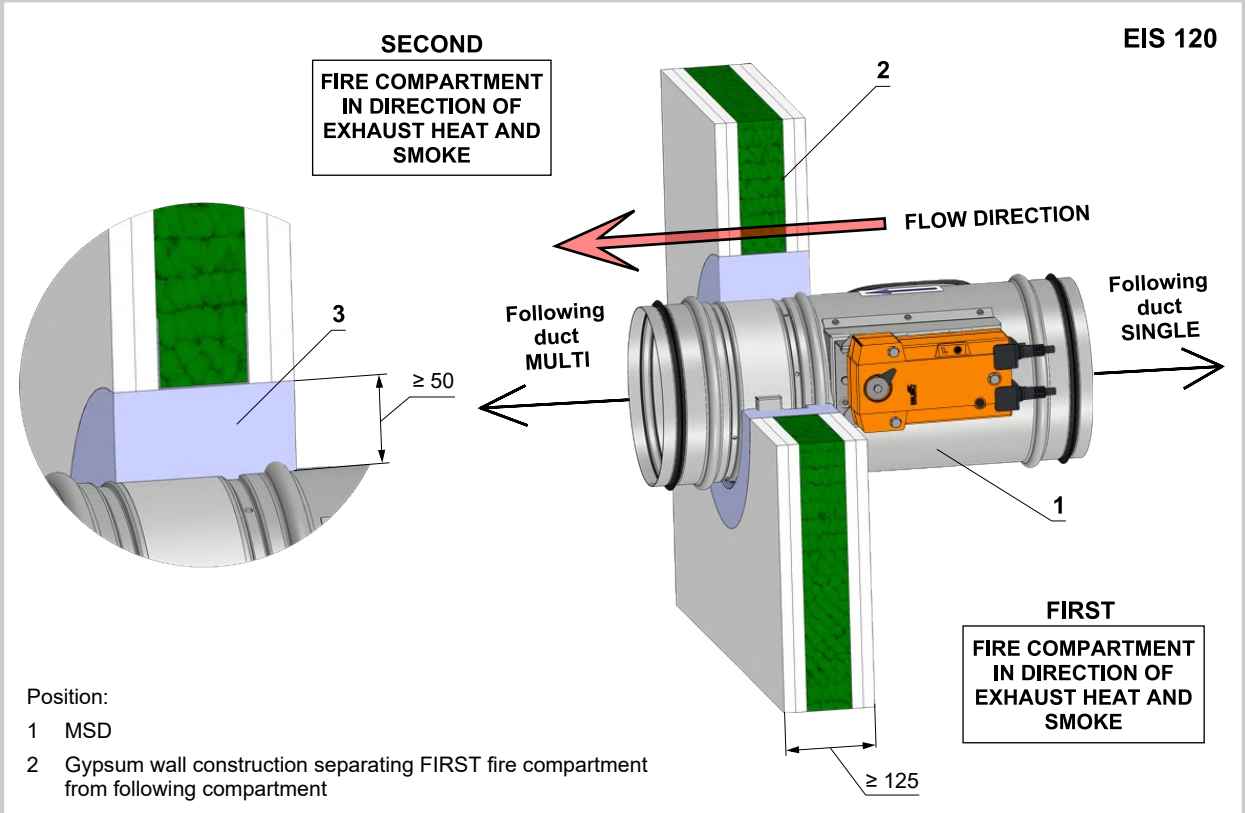
Position:

1 MSD

2 Gypsum wall construction separating FIRST fire compartment from following compartment

3 Mortar or gypsum

Fig. 44 Dividing construction between SINGLE / MULTI duct - mortar or gypsum



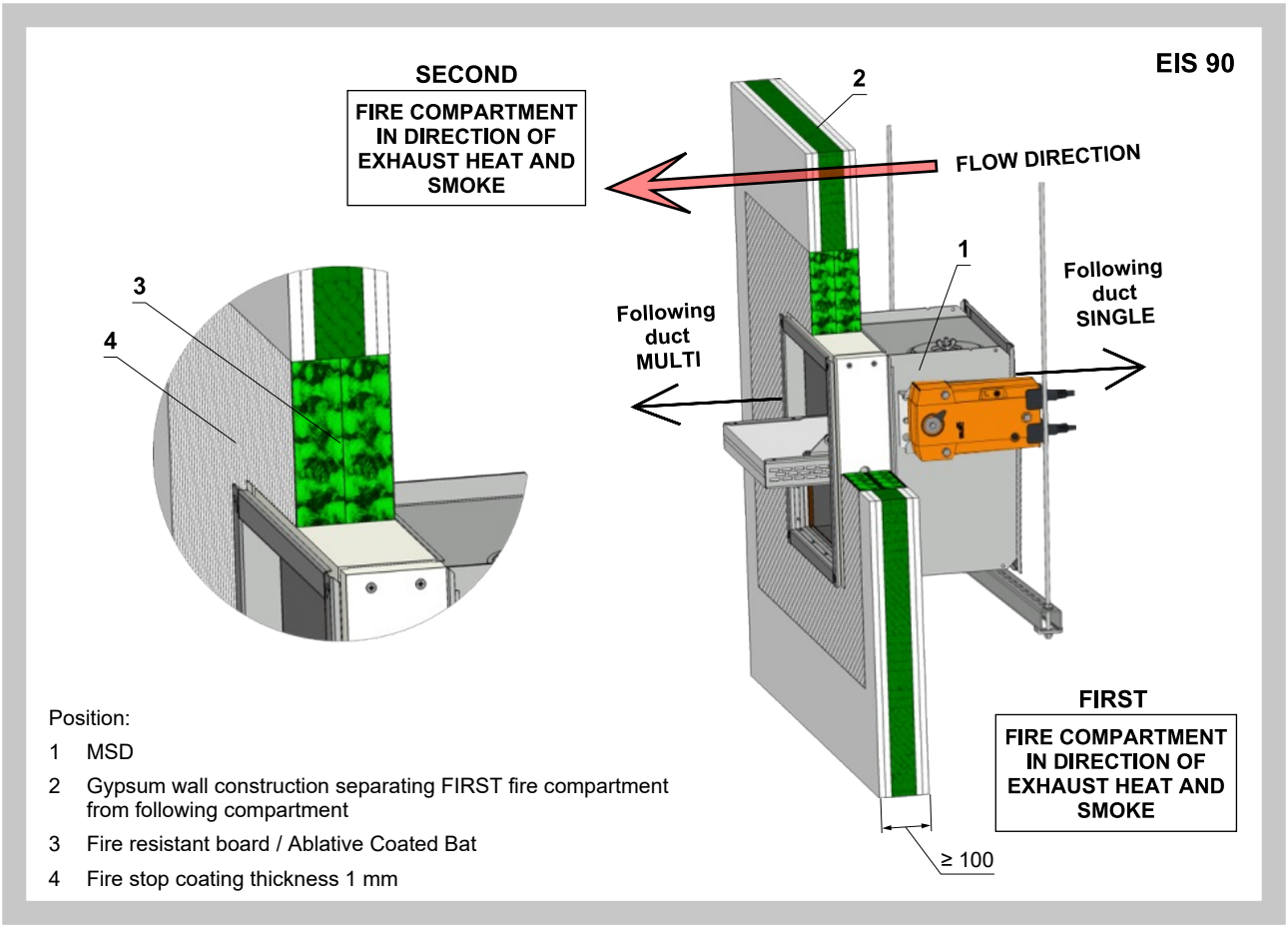
Position:

1 MSD

2 Gypsum wall construction separating FIRST fire compartment from following compartment

3 Mortar or gypsum

Fig. 45 Dividing construction between SINGLE / MULTI duct - Weichschott / Ablative Coated Batt



Position:

1 MSD

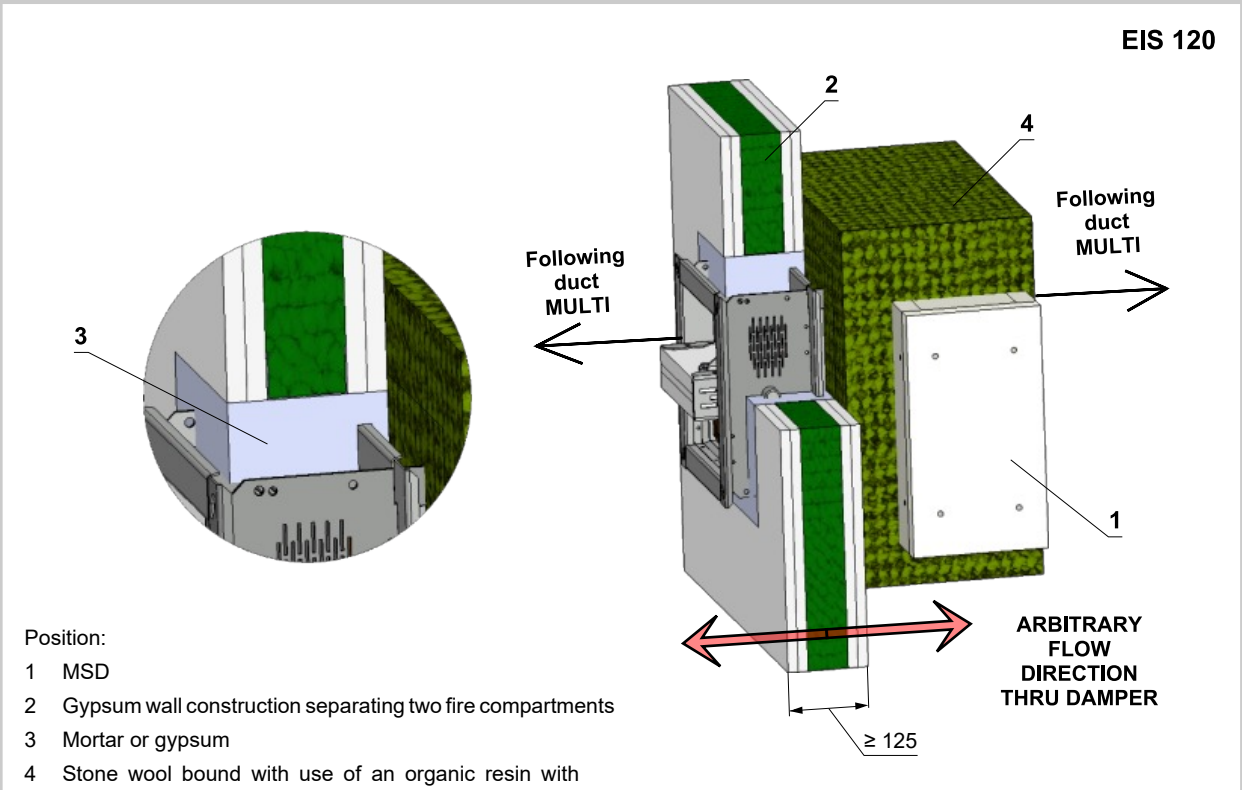
2 Gypsum wall construction separating FIRST fire compartment from following compartment

3 Fire resistant board / Ablative Coated Bat

4 Fire stop coating thickness 1 mm

5.5. Installation in gypsum wall MULTI / MULTI

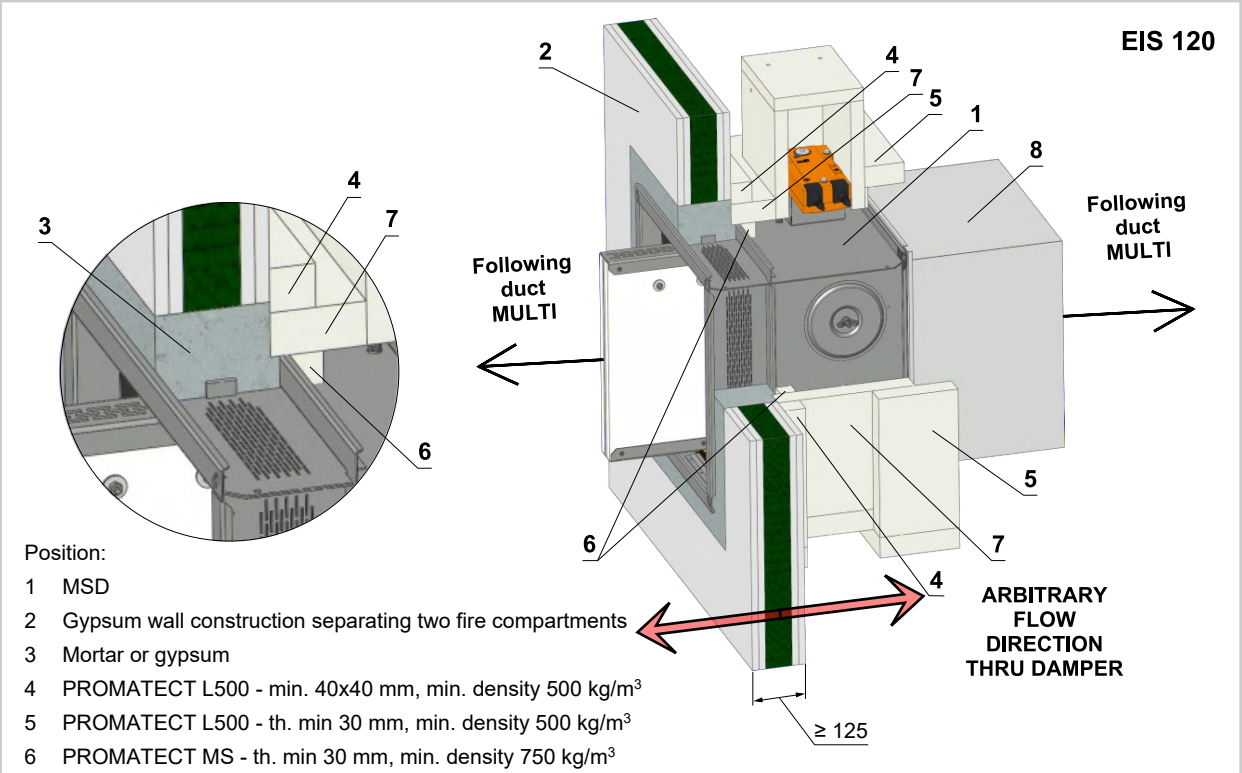
Fig. 46 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum



Position:

1 MSD
2 Gypsum wall construction separating two fire compartments
3 Mortar or gypsum
4 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

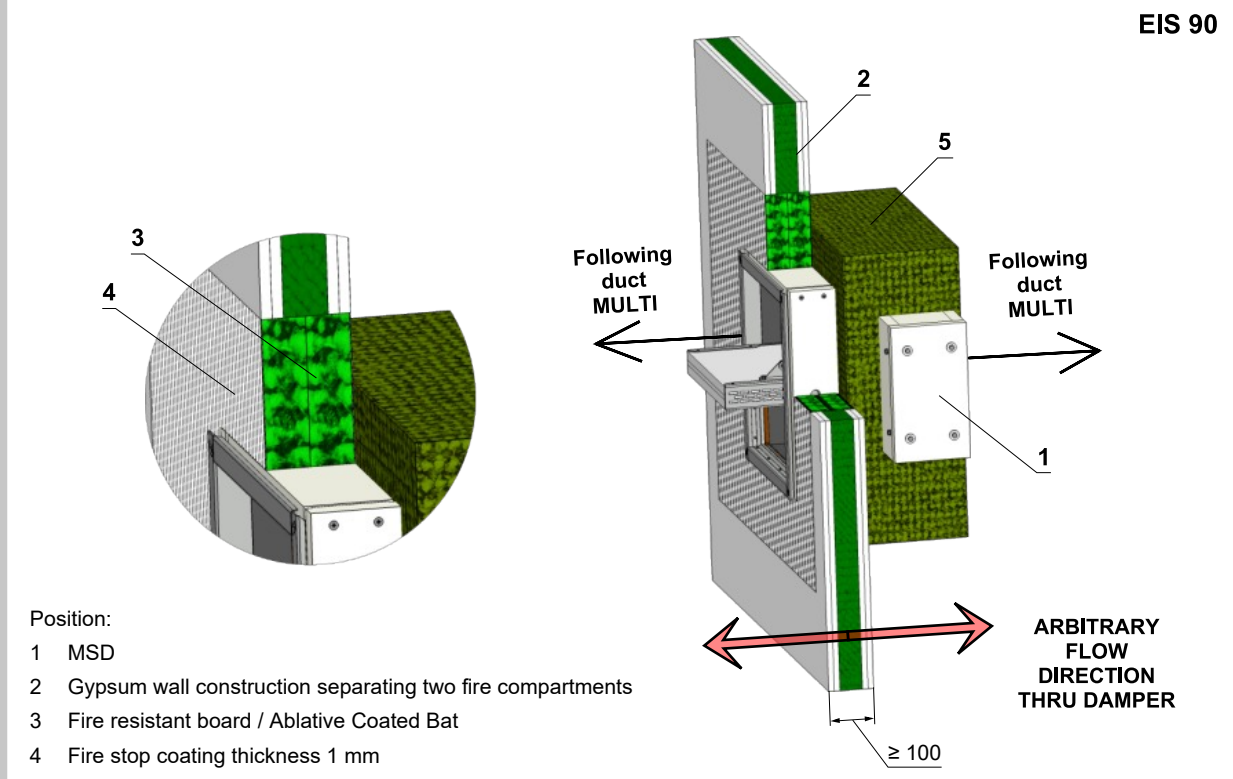
Fig. 47 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum



Position:

1 MSD
2 Gypsum wall construction separating two fire compartments
3 Mortar or gypsum
4 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
5 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
6 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
7 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
8 Duct

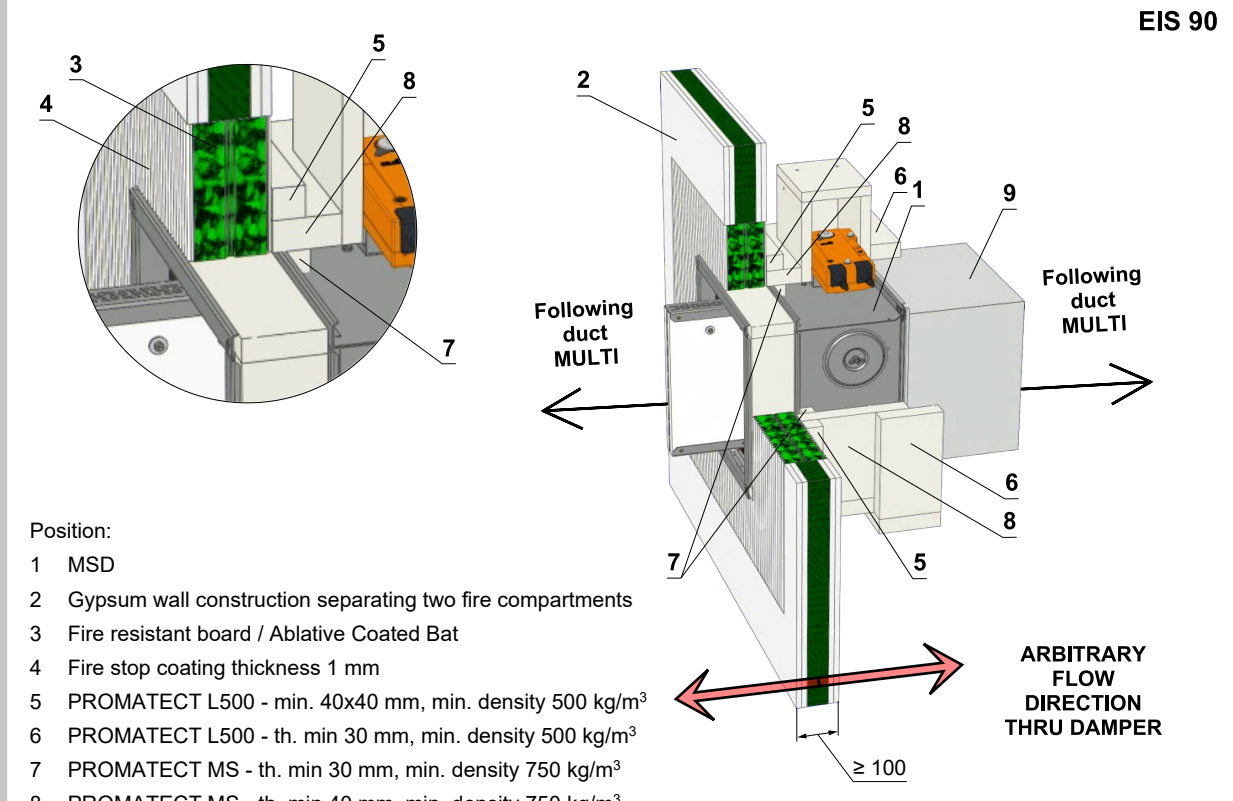
Fig. 48 Dividing construction between MULTI / MULTI duct - insulation with stone wool - Weichschott / Ablative Coated Batt



Position:

1 MSD
2 Gypsum wall construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

Fig. 49 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Weichschott / ACB

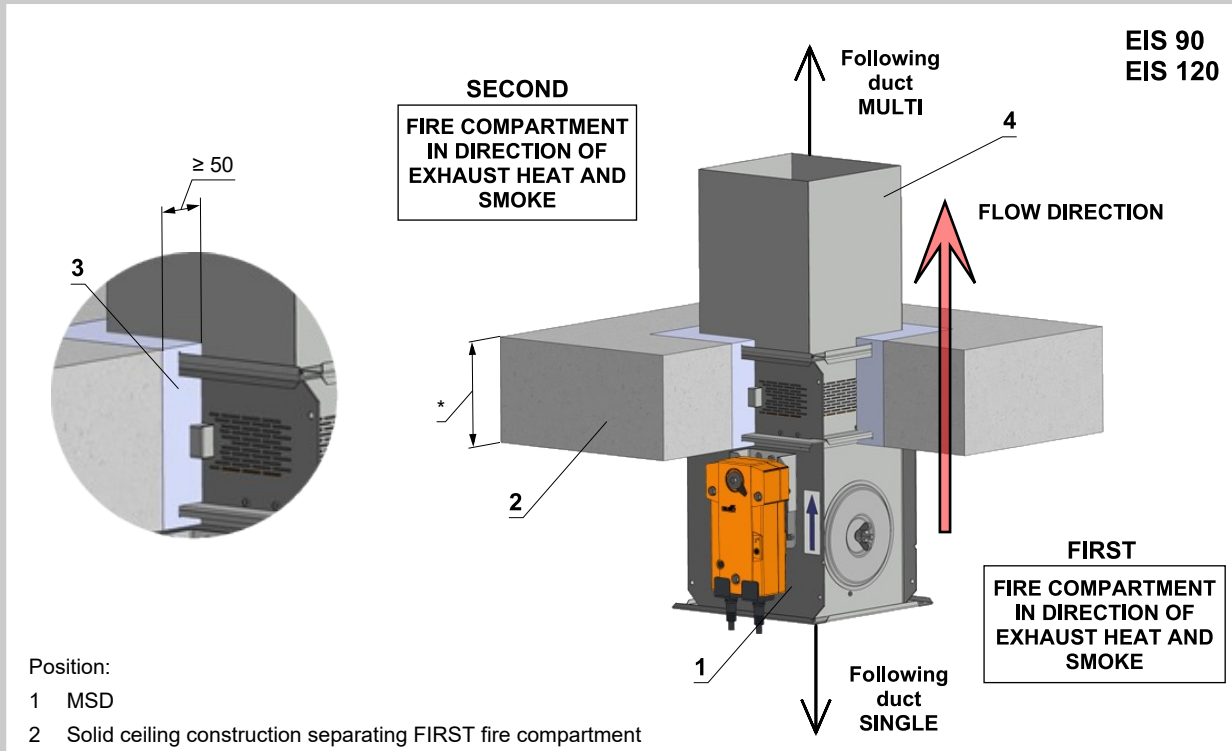


Position:

1 MSD
2 Gypsum wall construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
6 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
7 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
8 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
9 Duct

5.6. Installation in solid ceiling construction SINGLE / MULTI

Fig. 50 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

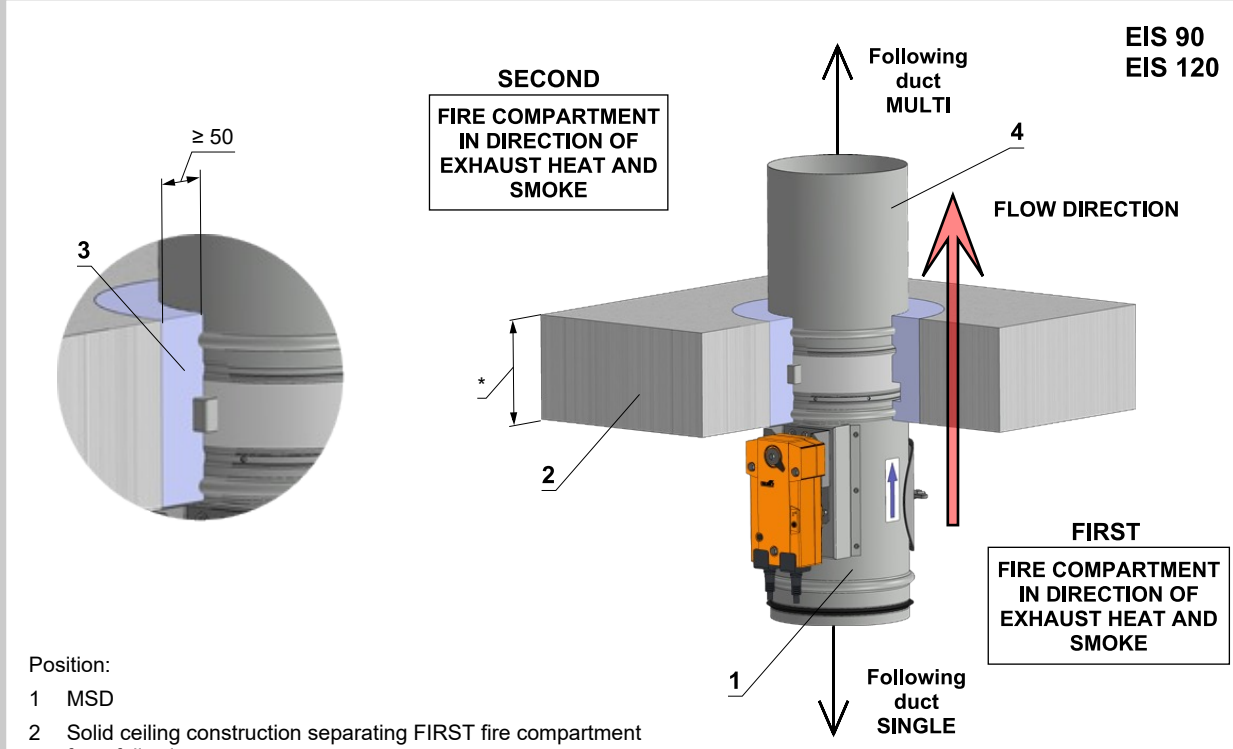


Position:

1 MSD
2 Solid ceiling construction separating FIRST fire compartment from following compartment
3 Mortar or gypsum
4 Duct

* min. 110 mm - Concrete - for EIS 90
min. 125 mm - Aerated concrete - for EIS 90 and EIS 120
min. 150 mm - Concrete - for EIS 120

Fig. 51 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

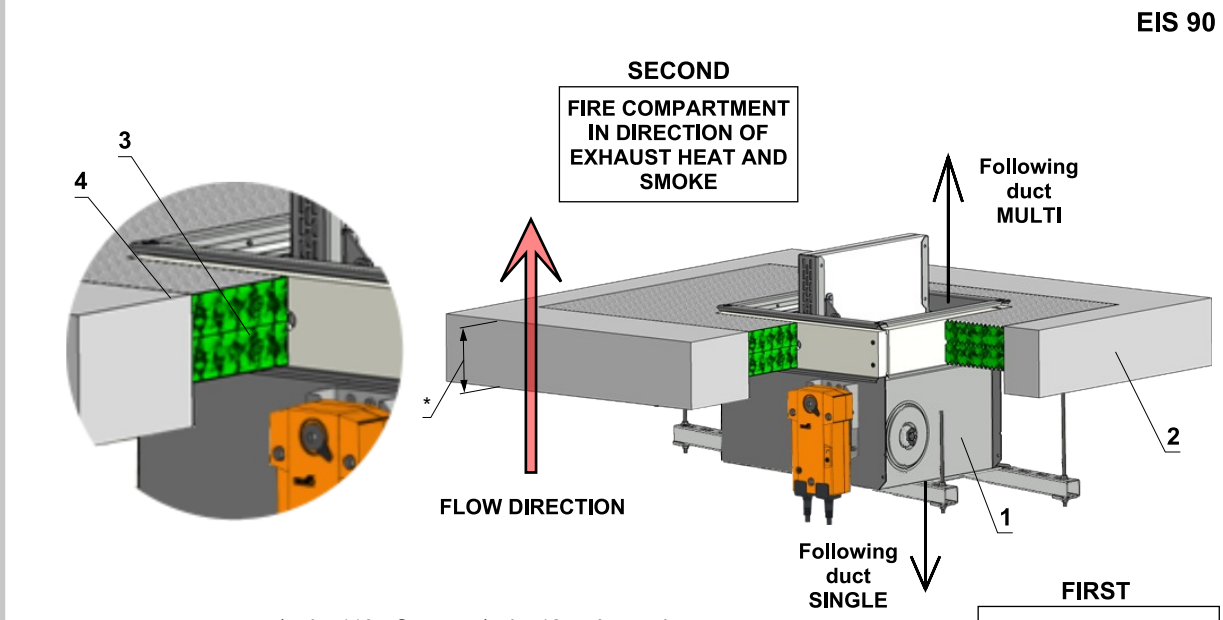


Position:

1 MSD
2 Solid ceiling construction separating FIRST fire compartment from following compartment
3 Mortar or gypsum
4 Duct

* min. 110 mm - Concrete - for EIS 90
min. 125 mm - Aerated concrete - for EIS 90 and EIS 120
min. 150 mm - Concrete - for EIS 120

Fig. 52 Dividing construction between SINGLE / MULTI duct - Weichschott / Ablative Coated Batt



* min. 110 - Concrete/ min. 125 - Aerated concrete

Position:

1 MSD

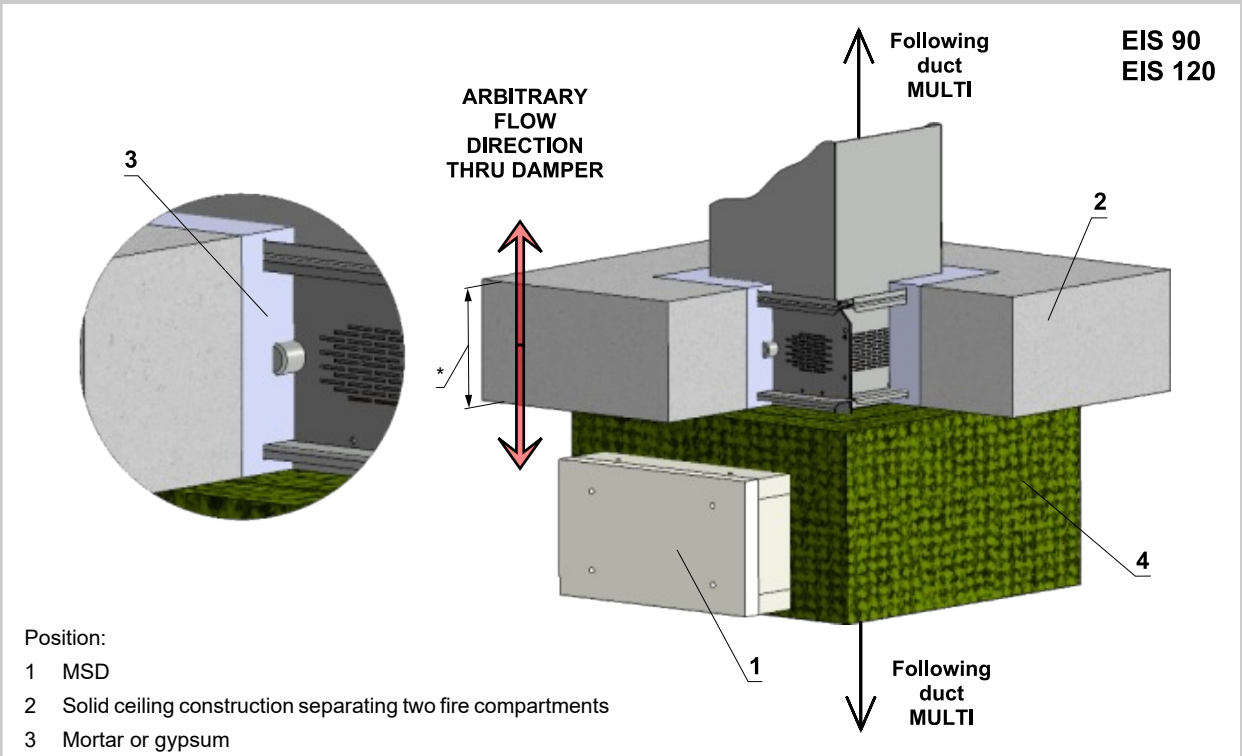
2 Solid ceiling construction separating FIRST fire compartment from following compartment

3 Fire resistant board / Ablative Coated Bat

4 Fire stop coating thickness 1 mm

5.7. Installation in solid ceiling construction MULTI / MULTI

Fig. 53 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum

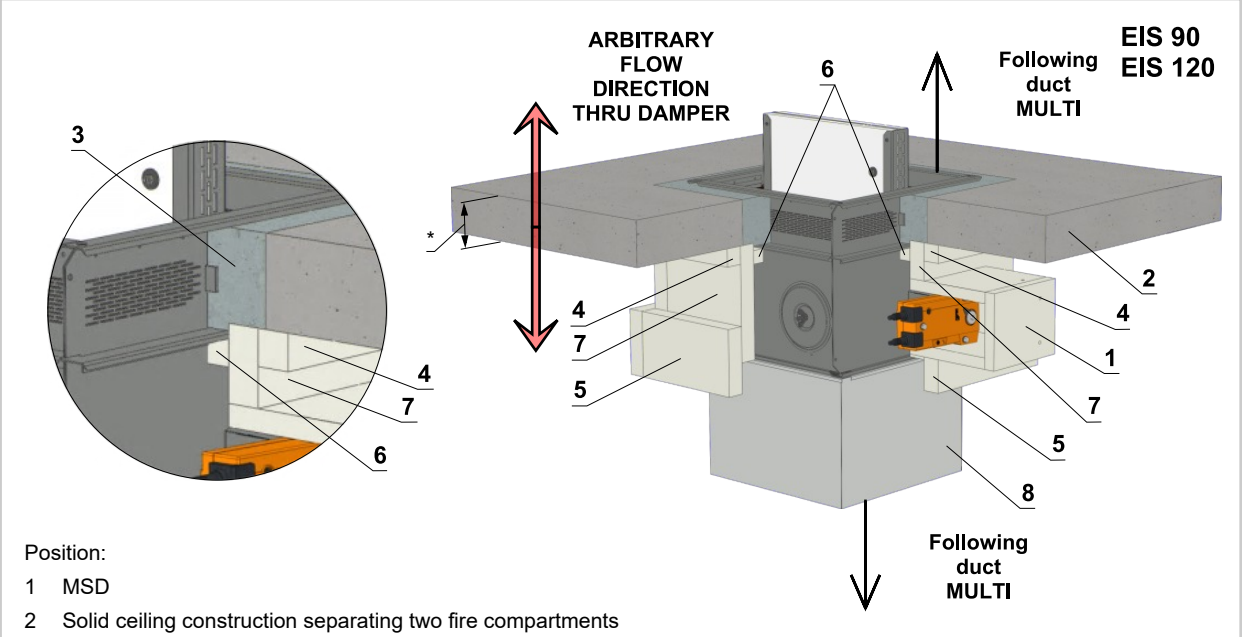


Position:

1 MSD
2 Solid ceiling construction separating two fire compartments
3 Mortar or gypsum
4 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

* min. 110 mm - Concrete - for EIS 90
min. 125 mm - Aerated concrete - for EIS 90 and EIS 120
min. 150 mm - Concrete - for EIS 120

Fig. 54 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum

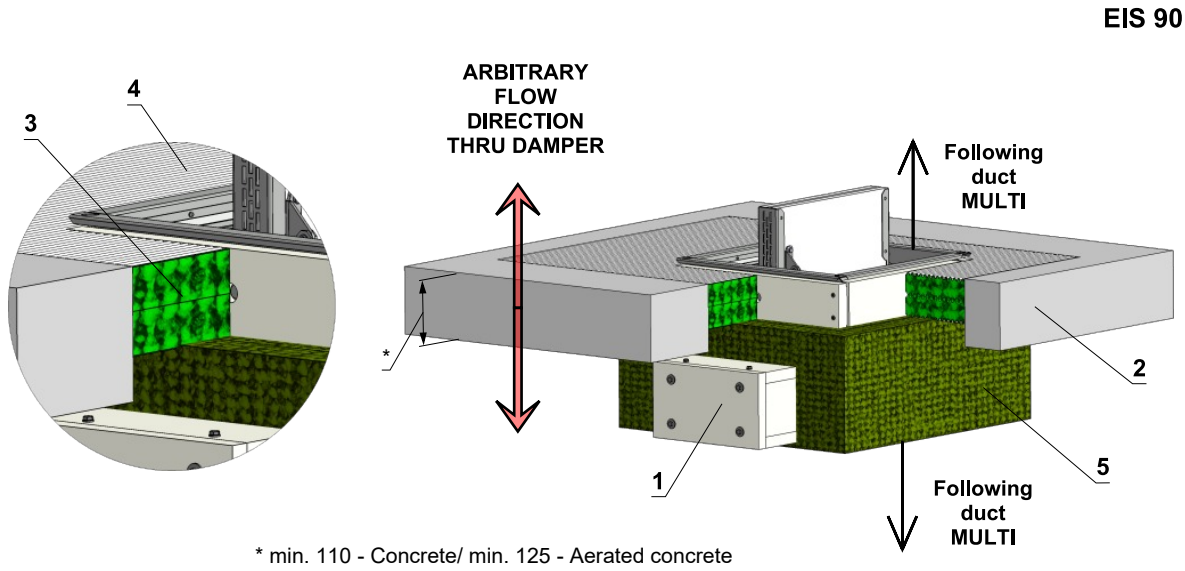


Position:

1 MSD
2 Solid ceiling construction separating two fire compartments
3 Mortar or gypsum
4 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
5 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
6 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
7 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
8 Duct

* min. 110 mm - Concrete - for EIS 90
min. 125 mm - Aerated concrete - for EIS 90 and EIS 120
min. 150 mm - Concrete - for EIS 120

Fig. 55 **Dividing construction between MULTI / MULTI duct - insulation with stone wool - Weichschott / Ablative Coated Batt**

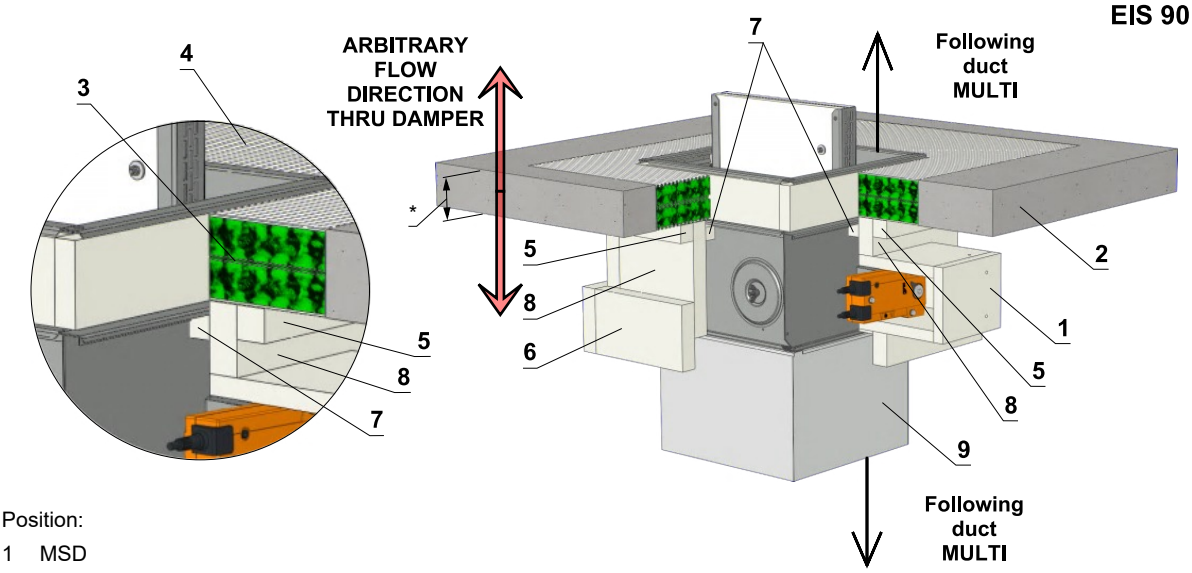


* min. 110 - Concrete/ min. 125 - Aerated concrete

Position:

1 MSD
2 Solid ceiling construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ composed of two layers 2x60 mm

Fig. 56 **Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Weichschott / Ablative Coated Batt**



Position:

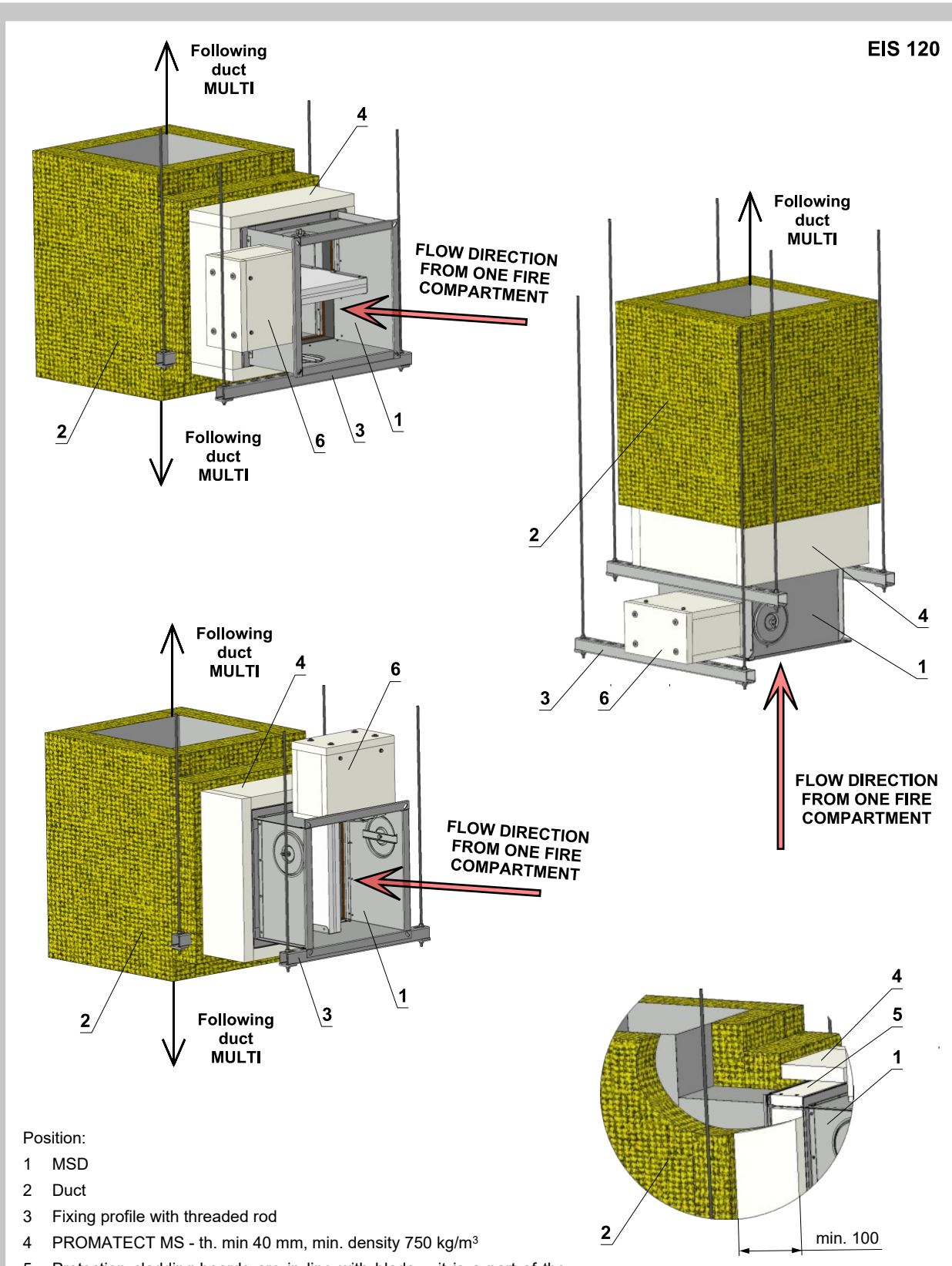
1 MSD
2 Solid ceiling construction separating two fire compartments
3 Fire resistant board / Ablative Coated Bat
4 Fire stop coating thickness 1 mm
5 PROMATECT L500 - min. 40x40 mm, min. density 500 kg/m³
6 PROMATECT L500 - th. min 30 mm, min. density 500 kg/m³
7 PROMATECT MS - th. min 30 mm, min. density 750 kg/m³
8 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
9 Duct

* min. 110 - Concrete/ min. 125 - Aerated concrete

6. Suspension systems

6.1. Suspension MSD installed in vertical duct MULTI

Fig. 57 Installation in vertical duct MULTI / MULTI - insulation with stone wool

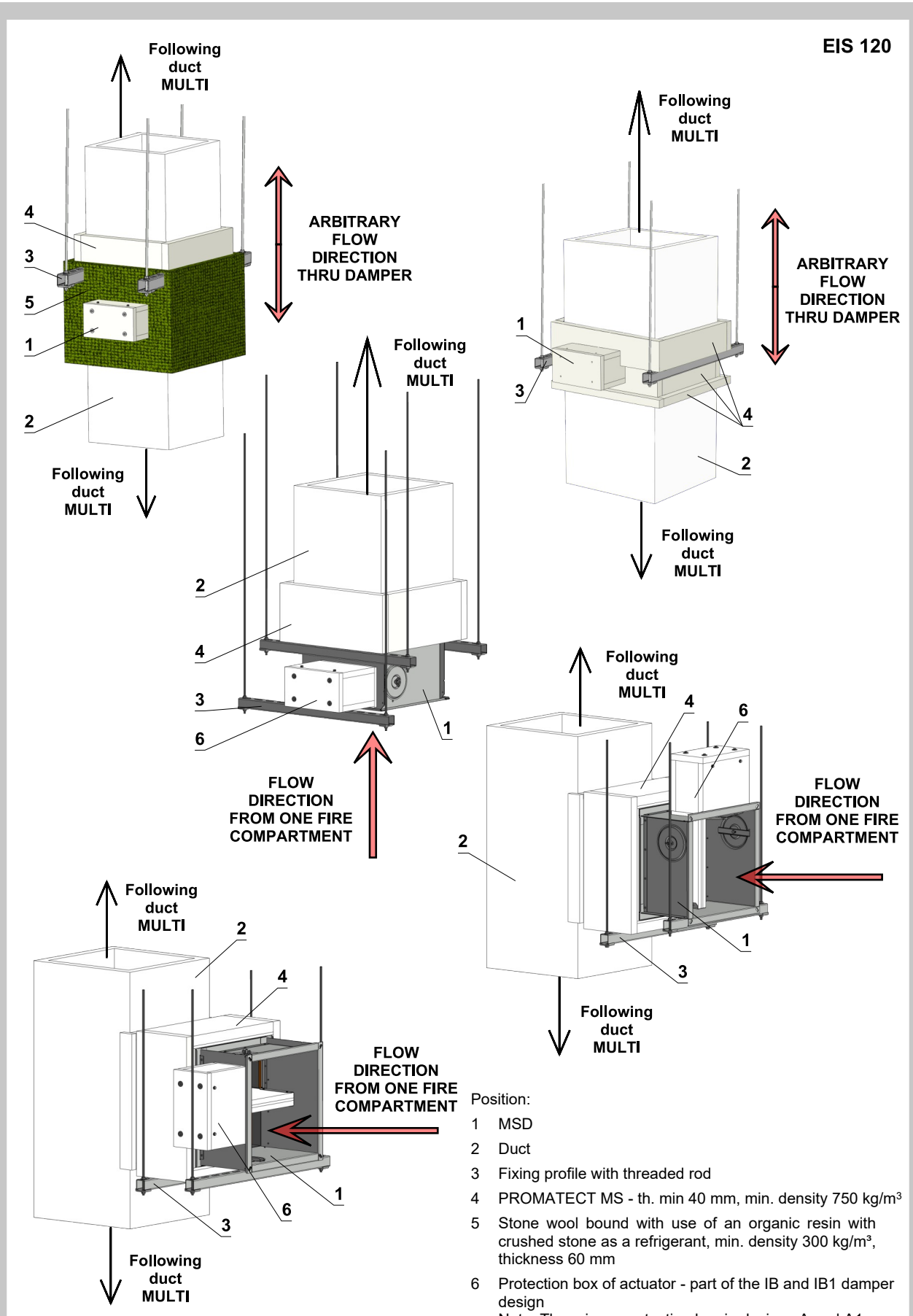


Position:

1 MSD
2 Duct
3 Fixing profile with threaded rod
4 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³
5 Protection cladding-boards are in line with blade – it is a part of the damper in designs A1 and IB1
6 Protection box of actuator - part of the IB and IB1 damper design
Note: There is no protection box in designs A and A1.

6.2. Suspension MSD installed in vertical duct from calcium-silicate plates MULTI

Fig. 58 Installation in vertical duct MULTI / MULTI - duct from calcium-silicate plates



Position:

1 MSD

2 Duct

3 Fixing profile with threaded rod

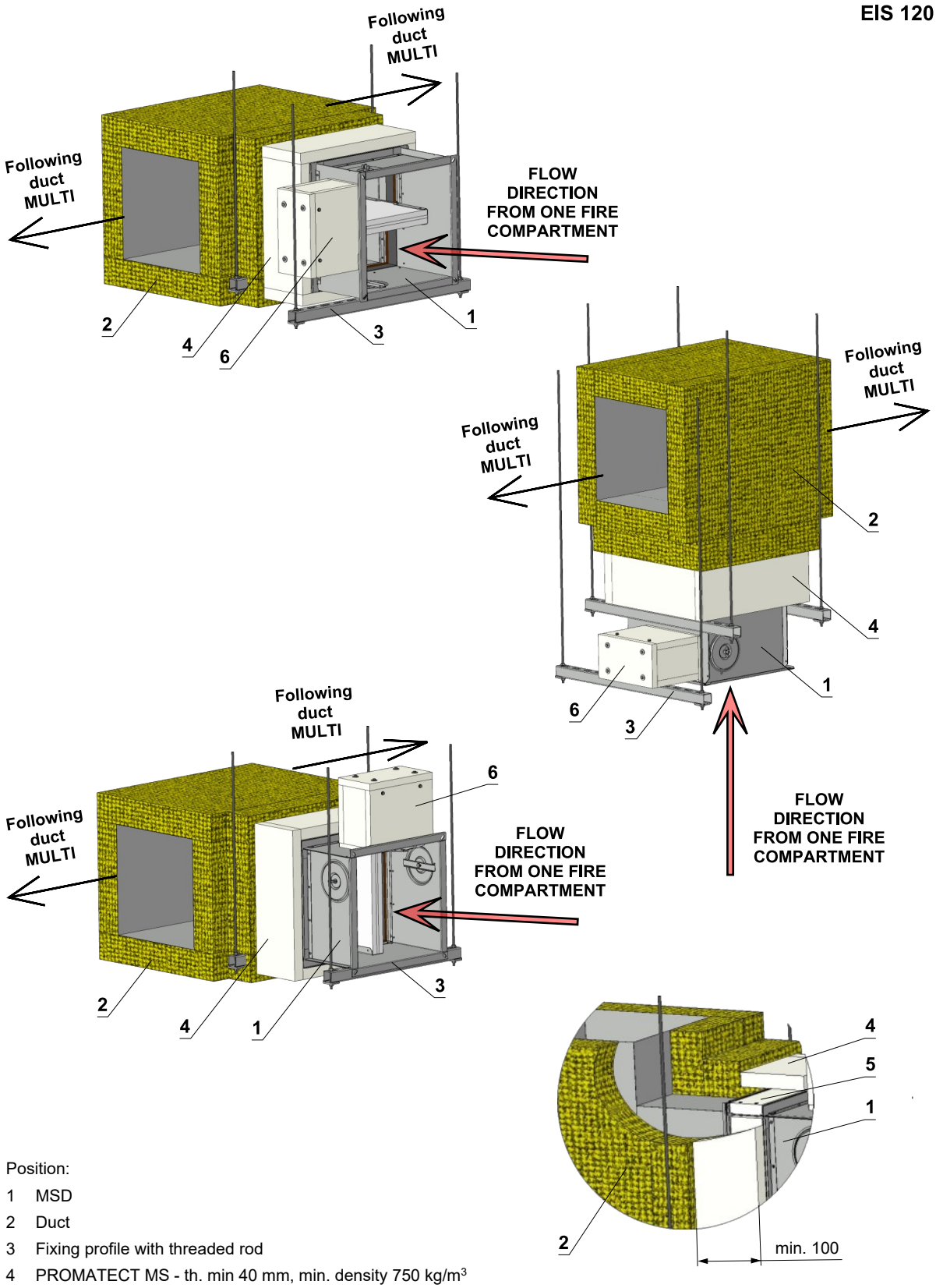
4 PROMATECT MS - th. min 40 mm, min. density 750 kg/m³

5 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³, thickness 60 mm

6 Protection box of actuator - part of the IB and IB1 damper design
Note: There is no protection box in designs A and A1.

6.3. Suspension MSD installed in horizontal duct MULTI

Fig. 59 Installation in horizontal duct MULTI / MULTI - insulation with stone wool

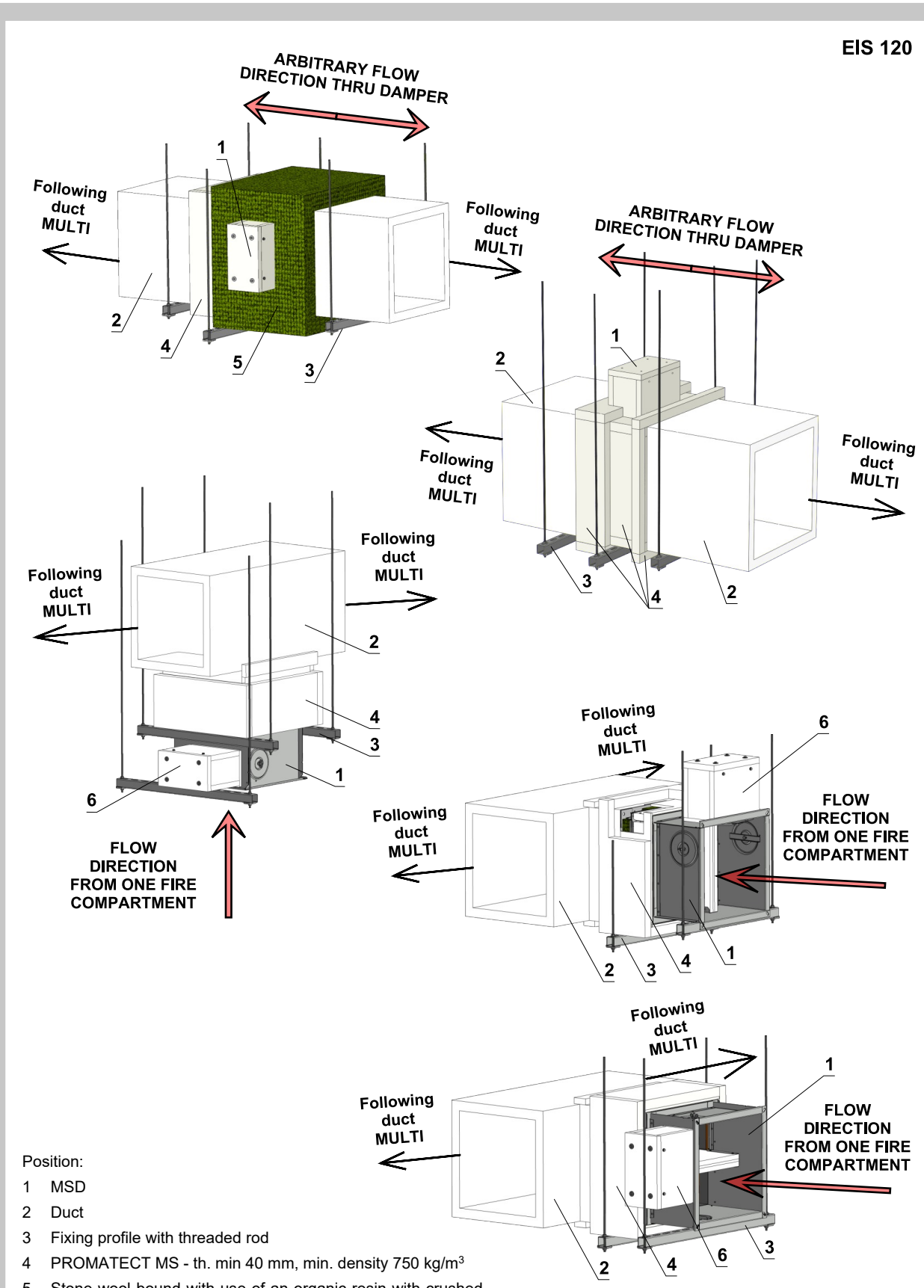


Position:

1 MSD
2 Duct
3 Fixing profile with threaded rod
4 PROMATECT MS - th. min 40 mm, min. density 750 kg/m^3
5 Protection cladding-boards are in line with blade – it is a part of the damper in designs A1 and IB1
6 Protection box of actuator - part of the IB and IB1 damper design
Note: There is no protection box in designs A and A1.

6.4. Suspension MSD installed in horizontal duct from calcium-silicate plates MULTI

Fig. 60 Installation in horizontal duct MULTI / MULTI - duct from calcium-silicate plates



Position:

1 MSD

2 Duct

3 Fixing profile with threaded rod

4 PROMATECT MS - th. min 40 mm, min. density 750 kg/m^3

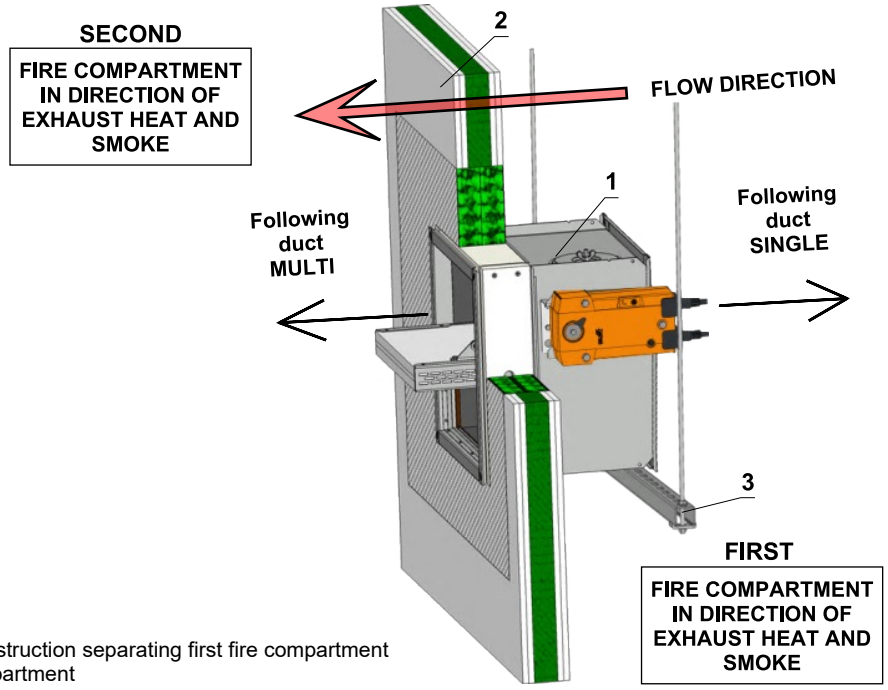
5 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m^3, thickness 60 mm

6 Protection box of actuator - part of the IB and IB1 damper design
Note: There is no protection box in designs A and A1.

6.5. Suspension MSD installed in fire separating construction in soft seal

In case of installation in **soft seal,** dampers must be suspended using threaded rods and fixing profiles. Their dimensioning depends on the damper's weight (see. 6.6.) The dampers and duct must be suspended separately.

Fig. 61 Installation in fire separating construction in soft seal - fire compartment between duct SINGLE/MULTI



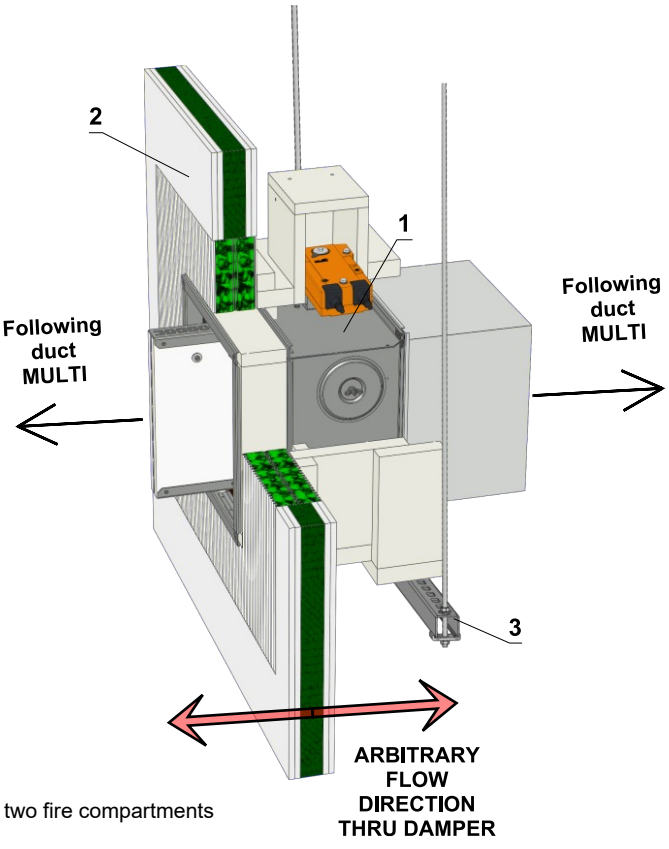
Position:

1 MSD

2 Fire separating construction separating first fire compartment from following compartment

3 Fixing profile with threaded rod

Fig. 62 Installation in fire separating construction in soft seal (cement lime plates) - fire compartment between duct MULTI/MULTI



Position:

1 MSD

2 Fire separating construction separating two fire compartments

3 Fixing profile with threaded rod

6.6. Mounting to the ceiling wall

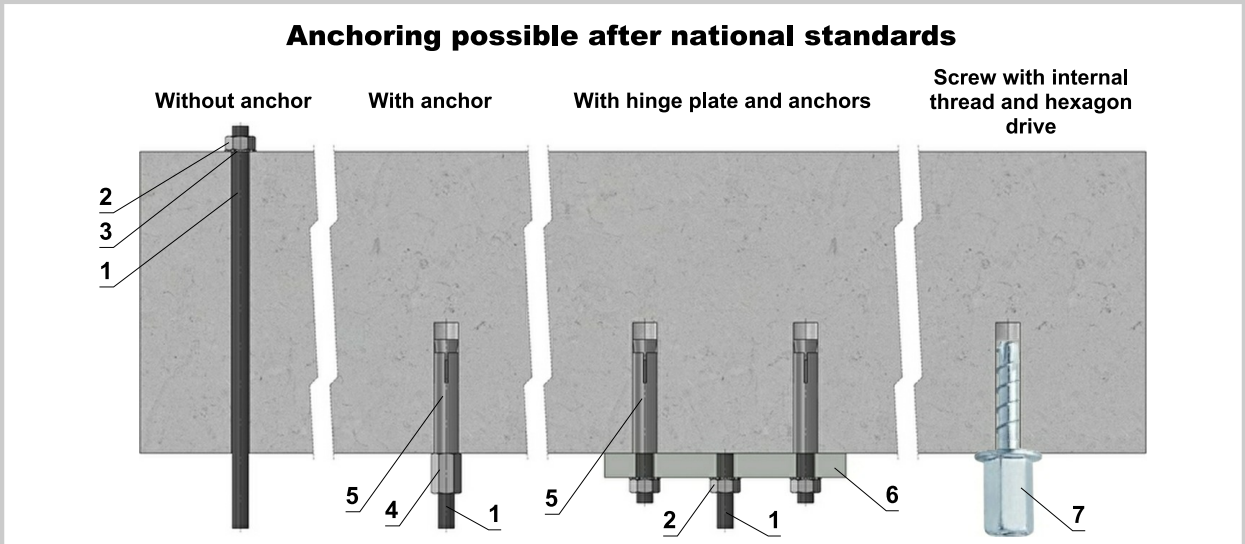
The dampers must be suspended using threaded rods and mounting profiles. Their dimensioning depends on the damper's weight.

The dampers and duct must be suspended separately. The connected duct must be suspended in such a way that the transfer of all loads from the adjoining ventilation duct to the damper body is completely excluded. Adjacent duct must be suspended or supported, as required by the duct suppliers.

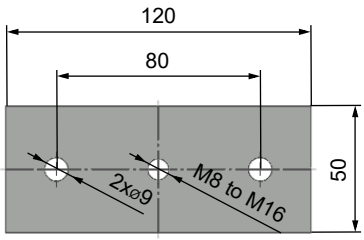
Threaded rods longer than 1.5 m must be protected by fire insulation.

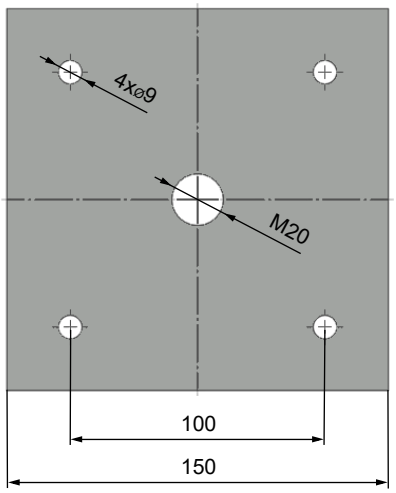
Fastening threaded rods to the ceiling structure – see Fig. 63

Fig. 63 Mounting to the ceiling wall

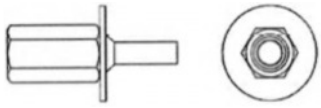


Hinge plates





Screw with internal thread and hexagon drive



Position:

1 Threaded rod M8 – M20
2 Nut
3 Washer
4 Coupling Nut
5 Anchor
6 Hinge plate - min. thickness 10 mm
7 Concrete screw tested for fire resistance R30-R90, max. Tension up to 0.75 KN (length 35 mm)

Load capacities of threaded hanger rods F [N] at the required fire resistance 90 minutes

Size	A_s [mm²]	Weight G [kg]	
		for 1 piece	for 1 pair
M8	36,6	22	44
M10	58	35	70
M12	843	52	104
M14	115	70	140
M16	157	96	192
M18	192	117	234
M20	245	150	300

III. TECHNICAL DATA

7. Pressure loss

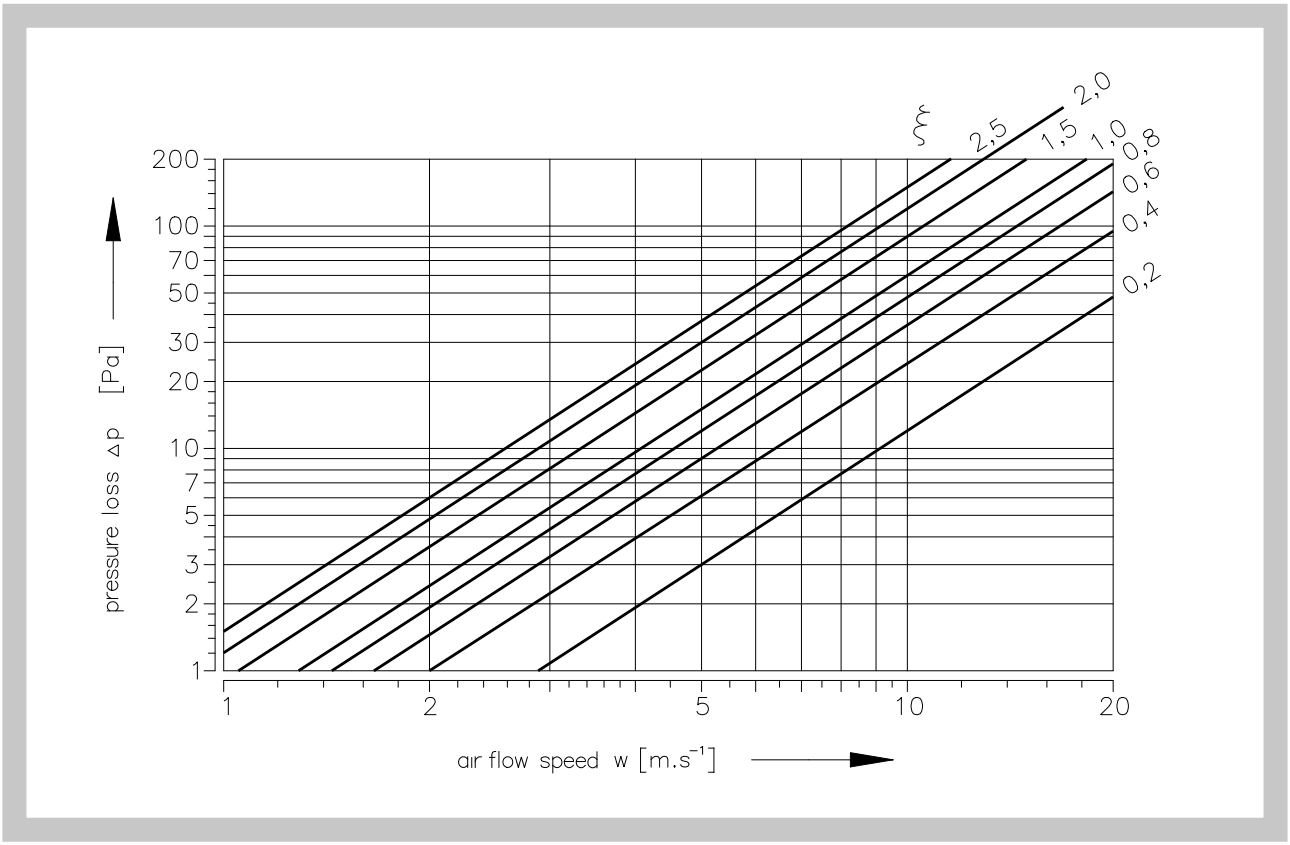
7.1. Pressure loss calculation

$$\Delta p = \xi \cdot \rho \cdot \frac{w^2}{2}$$

Δp	[Pa]	pressure loss
w	[m.s^{-1}]	air flow speed in nominal damper section
ρ	[kg.m^{-3}]	air density
ξ	[-]	coefficient of local pressure loss for the nominal damper section (see Tab. 8.1.1. and 8.2.1.)

7.2. Determination of pressure loss by using diagram ρ = 1,2 kg.m^{-3}

Diagram 7.2.1. Pressure losses for air density



8. Coefficient of local pressure loss

8.1. Coefficient of local pressure loss - square dampers

Tab. 8.1.1. Coefficient of local pressure loss - square dampers

	B									
A	**180**	**200**	**225**	**250**	**280**	**300**	**315**	**355**	**400**	**450**
180	2,1314	1,6906	1,3782	1,1149	1,0037	0,9288	0,7918	0,6827	0,6003	0,5350
200	1,9945	1,5804	1,2423	1,0368	0,9748	0,8785	0,7383	0,6367	0,5585	0,4976
225	1,9207	1,5162	1,1256	0,9994	0,9341	0,8442	0,7137	0,6078	0,5329	0,4772
250	1,8415	1,4584	1,1032	0,9651	0,9009	0,8068	0,6837	0,5832	0,5125	0,4590
280	1,7505	1,3782	1,0732	0,9116	0,8571	0,7597	0,6484	0,5543	0,4847	0,4366
300	1,6853	1,3311	1,0400	0,8635	0,8046	0,7148	0,6099	0,5264	0,4665	0,4109
315	1,6071	1,2690	1,0037	0,8303	0,7597	0,6645	0,5864	0,5050	0,4419	0,3927
355	1,5408	1,2155	0,9544	0,7929	0,7083	0,6356	0,5607	0,4815	0,4227	0,3756
400	1,4841	1,1706	0,9063	0,7651	0,6859	0,6227	0,5382	0,4633	0,4045	0,3606
450	1,4359	1,1331	0,8913	0,7394	0,6666	0,5896	0,5200	0,4473	0,3916	0,3478
500	1,3996	1,1021	0,8624	0,7201	0,6548	0,5810	0,5061	0,4344	0,3799	0,3371
550	1,3803	1,0882	0,8378	0,7073	0,6474	0,5757	0,4965	0,4269	0,3734	0,3349
560	1,3643	1,0754	0,8282	0,7009	0,6324	0,5725	0,4922	0,4227	0,3692	0,3285
600	1,3493	1,0582	0,8218	0,6944	0,6270	0,5585	0,4858	0,4184	0,3659	0,3242
630	1,3332	1,0497	0,8100	0,6837	0,6238	0,5436	0,4804	0,4130	0,3606	0,3199
650	1,3204	1,0379	0,7907	0,6752	0,6003	0,5393	0,4740	0,4066	0,3542	0,3157
700	1,3108	1,0304	0,7832	0,6741	0,5949	0,5382	0,4719	0,4045	0,3531	0,3146
710	1,3043	1,0272	0,7747	0,6688	0,5896	0,5371	0,4697	0,4034	0,3520	0,3135
750	1,2926	1,0176	0,7683	0,6634	0,5842	0,5307	0,4633	0,3980	0,3478	0,3103
800	1,2808	1,0079	0,7618	0,6559	0,5767	0,5222	0,4601	0,3959	0,3456	0,3060
900	1,2594	0,9908	0,7479	0,6441	0,5692	0,5136	0,4526	0,3884	0,3381	0,3007
1000	1,2433	0,9780	0,7383	0,6367	0,5607	0,4976	0,4462	0,3831	0,3338	0,2975
1100	1,2284	0,9662	0,7287	0,6281	0,5478	0,4869	0,4408	0,3777	0,3296	0,2932
1250	1,2155	0,9544	0,7126	0,6206	0,5339	0,4804	0,4355	0,3734	0,3264	0,2900
1400	1,2027	0,9459	0,6998	0,6142	0,5254	0,4783	0,4301	0,3692	0,3231	0,2857
1500	1,1952	0,9395	0,6955	0,6110	0,5157	0,4708	0,4280	0,3670	0,3199	0,2846

	B									
A	**500**	**550**	**560**	**600**	**630**	**650**	**700**	**710**	**750**	**800**
180	0,4879	0,4665	0,4462	0,4216	0,4109	0,3916	0,3884	0,3820	0,3681	0,3585
200	0,4526	0,4323	0,4152	0,3959	0,3820	0,3681	0,3606	0,3552	0,3424	0,3328
225	0,4355	0,4152	0,4002	0,3788	0,3681	0,3531	0,3456	0,3413	0,3338	0,3221
250	0,4216	0,4002	0,3809	0,3659	0,3542	0,3403	0,3328	0,3274	0,3210	0,3092
280	0,3948	0,3766	0,3585	0,3435	0,3328	0,3199	0,3167	0,3114	0,2975	0,2932
300	0,3766	0,3531	0,3435	0,3253	0,3157	0,3071	0,2996	0,2953	0,2814	0,2750
315	0,3574	0,3349	0,3264	0,3103	0,3007	0,2932	0,2846	0,2782	0,2696	0,2611
355	0,3413	0,3253	0,3114	0,2975	0,2868	0,2750	0,2718	0,2664	0,2557	0,2493
400	0,3274	0,3082	0,2985	0,2900	0,2761	0,2654	0,2589	0,2557	0,2472	0,2386
450	0,3167	0,2964	0,2889	0,2782	0,2654	0,2589	0,2525	0,2461	0,2386	0,2301
500	0,3071	0,2943	0,2803	0,2664	0,2579	0,2482	0,2429	0,2386	0,2311	0,2236
550	0,3039	0,2857	0,2771	0,2611	0,2450	0,2365	0,2301	0,2268	0,2279	0,2194
560	0,2996	0,2825	0,2729	0,2515	0,2504	0,2408	0,2290	0,2268	0,2236	0,2172
600	0,2943	0,2793	0,2707	0,2493	0,2482	0,2375	0,2268	0,2247	0,2194	0,2140
630	0,2910	0,2761	0,2664	0,2482	0,2450	0,2343	0,2268	0,2247	0,2161	0,2119
650	0,2900	0,2707	0,2632	0,2461	0,2418	0,2322	0,2258	0,2236	0,2140	0,2097
700	0,2868	0,2654	0,2622	0,2450	0,2408	0,2301	0,2247	0,2226	0,2129	0,2087
710	0,2846	0,2632	0,2600	0,2440	0,2397	0,2290	0,2226	0,2215	0,2119	0,2076
750	0,2814	0,2611	0,2568	0,2397	0,2365	0,2268	0,2204	0,2194	0,2108	0,2054
800	0,2793	0,2600	0,2547	0,2354	0,2333	0,2236	0,2183	0,2172	0,2087	0,2022
900	0,2739	0,2547	0,2504	0,2333	0,2301	0,2172	0,2151	0,2129	0,2044	0,1990
1000	0,2696	0,2515	0,2461	0,2290	0,2268	0,2151	0,2119	0,2087	0,2001	0,1958
1100	0,2664	0,2482	0,2429	0,2258	0,2236	0,2129	0,2097	0,2065	0,1969	0,1937
1250	0,2632	0,2429	0,2397	0,2226	0,2204	0,2076	0,2065	0,2044	0,1947	0,1905
1400	0,2611	0,2397	0,2375	0,2204	0,2183	0,2044	0,2033	0,2022	0,1926	0,1894
1500	0,2589	0,2386	0,2365	0,2183	0,2161	0,2022	0,2012	0,2001	0,1905	0,1883

8.2. Coefficient of local pressure loss - round dampers

Tab. 8.2.1. Coefficient of local pressure loss - round dampers

øD	180	200	225	250	280	315	355	400	450	500	560	630
ξ	3,546	2,124	1,291	0,877	0,609	0,438	0,328	0,255	0,205	0,173	0,147	0,127

9. Noise data

9.1. Level of acoustic output corrected with filter A.

$$L_{WA} = L_{W1} + 10 \log(S) + K_A$$

L_{WA}	[dB(A)]	level of acoustic output corrected with filter A
L_{W1}	[dB]	level of acoustic output L_{W1} related to the 1 m^2 section (see Tab. 9.3.1. a 9.3.2)
S	[m²]	duct cross section
K_A	[dB]	correction to the weight filter A (see Tab. 9.3.3.)

9.2. Level of acoustic output in octave ranges.

$$L_{Woct} = L_{W1} + 10 \log(S) + L_{rel}$$

L_{Woct}	[dB]	spectrum of acoustic output in octave range
L_{W1}	[dB]	level of acoustic output L_{W1} related to the 1 m^2 section (see Tab. 9.3.1. a 9.3.2)
S	[m²]	duct cross section
L_{rel}	[dB]	relative level expressing the shape of the spectrum (see Tab. 9.3.4.)

9.3. Table of acoustics values

Tab. 9.3.1. Level of acoustic output L_{W1}[dB] related to the 1 m² section - square dampers

	ξ [-]											
w [m/s]	**0,2**	**0,3**	**0,4**	**0,5**	**0,6**	**0,7**	**0,8**	**0,9**	**1**	**1,5**	**2**	**2,5**
2	15,5	18,7	20,9	22,6	24,0	25,2	26,3	27,2	28,0	31,2	33,4	35,1
3	26,1	29,2	31,5	33,2	34,6	35,8	36,9	37,8	38,6	41,7	44,0	45,7
4	33,6	36,7	39,0	40,7	42,1	43,3	44,3	45,3	46,1	49,2	51,5	53,2
5	39,4	42,5	44,8	46,5	47,9	49,1	50,2	51,1	51,9	55,0	57,3	59,0
6	44,1	47,3	49,5	51,3	52,7	53,9	54,9	55,8	56,6	59,8	62,0	63,8
7	48,2	51,3	53,5	55,3	56,7	57,9	58,9	59,8	60,7	63,8	66,1	67,8
8	51,6	54,8	57,0	58,8	60,2	61,4	62,4	63,3	64,1	67,3	69,5	71,3
9	54,7	57,9	60,1	61,8	63,2	64,4	65,5	66,4	67,2	70,4	72,6	74,3
10	57,4	60,6	62,8	64,6	66,0	67,2	68,2	69,1	70,0	73,1	75,3	77,1
11	59,9	63,1	65,3	67,1	68,5	69,7	70,7	71,6	72,4	75,6	77,8	79,6
12	62,2	65,4	67,6	69,3	70,7	71,9	73,0	73,9	74,7	77,9	80,1	81,8

Tab. 9.3.2. Level of acoustic output L_{W1}[dB] related to the 1 m² section - round dampers

	ξ [-]											
w [m/s]	**0,1**	**0,2**	**0,3**	**0,4**	**0,6**	**0,8**	**1,0**	**1,5**	**2,0**	**2,5**	**3,0**	**3,5**
2	9,0	11,5	14,7	16,9	20,1	22,3	24,1	27,2	29,4	31,2	32,6	33,8
3	16,7	22,1	25,3	27,5	30,7	32,9	34,6	37,8	40,0	41,7	43,2	44,4
4	24,2	29,6	32,8	35,0	38,1	40,4	42,1	45,3	47,5	49,2	50,7	51,9
5	30,0	35,4	38,6	40,8	44,0	46,2	47,9	51,1	53,3	55,1	56,5	57,7
6	34,8	40,2	43,3	45,6	48,7	51,0	52,7	55,8	58,1	59,8	61,2	62,4
7	38,8	44,2	47,3	49,6	52,7	55,0	56,7	59,9	62,1	63,8	65,2	66,4
8	42,3	47,7	50,8	53,1	56,2	58,4	60,2	63,3	65,6	67,3	68,7	69,9
9	45,4	50,7	53,9	56,1	59,3	61,5	63,3	66,4	68,6	70,4	71,8	73,0
10	48,1	53,5	56,6	58,9	62,0	64,3	66,0	69,1	71,4	73,1	74,5	75,7
11	50,6	56,0	59,1	61,4	64,5	66,7	68,5	71,6	73,9	75,6	77,0	78,2
12	52,8	58,2	61,4	63,6	66,8	69,0	70,7	73,9	76,1	77,9	79,3	80,5

Tab. 9.3.3. Correction to the weight filter A - square and round dampers

w [m/s]	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
K_A [dB]	-15,0	-11,8	-9,8	-8,4	-7,3	-6,4	-5,7	-5,0	-4,5	-4,0	-3,6

Tab. 9.3.4. Relative level expressing the shape of the spectrum L_{rel} - square and round dampers

	f [Hz]							
w [m/s]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
2	-4,5	-6,9	-10,9	-16,7	-24,1	-33,2	-43,9	-56,4
3	-3,9	-5,3	-8,4	-13,1	-19,5	-27,6	-37,4	-48,9
4	-3,9	-4,5	-6,9	-10,9	-16,7	-24,1	-33,2	-43,9
5	-4,0	-4,1	-5,9	-9,4	-14,6	-21,5	-30,0	-40,3
6	-4,2	-3,9	-5,3	-8,4	-13,1	-19,5	-27,6	-37,4
7	-4,5	-3,9	-4,9	-7,5	-11,9	-17,9	-25,7	-35,1
8	-4,9	-3,9	-4,5	-6,9	-10,9	-16,7	-24,1	-33,2
9	-5,2	-3,9	-4,3	-6,4	-10,1	-15,6	-22,7	-31,5
10	-5,5	-4,0	-4,1	-5,9	-9,4	-14,6	-21,5	-30,0
11	-5,9	-4,1	-4,0	-5,6	-8,9	-13,8	-20,4	-28,8
12	-6,2	-4,3	-3,9	-5,3	-8,4	-13,1	-19,5	-27,6

IV. MATERIAL, FINISHING

10. Material

10.1. Damper bodies are supplied in the standard design made of galvanized plate without any other surface finish.

Damper blades are made of fire resistant asbestos free boards made of mineral fibres.

Fasteners is galvanized.

10.2. According to the customer's requirements, damper can be made of stainless material.

Specifications for stainless-steel models – classification of stainless steel:

- Class A2 – Food-grade stainless steel (AISI 304 – EN 17240)
- Class A4 – Chemistry-grade stainless steel (AISI 316, 316L – EN 17346, 17349)

The respective stainless steel is the material for all components present or accessing the damper interior; components outside the damper body are typically from galvanised sheet metal (fasteners for mounting the servo drive or mechanics, mechanics components except Item 4), frame components.

The following components, including the fasteners, are made from stainless steel at all times:

1) Damper body and all components permanently attached
2) Leaf holders, including pins, metal parts of leaf
3) Control components inside the damper (leaf angle selector, pin with lever)
4) Mechanical components entering the interior of damper body (lower sheet of mechanics, lock holder “1”, lock lever “2”, lock spring, 8 dia. stopper pin, mechanics pin)
5) Inspection hole cover including the clip and fasteners (if they are parts of the cover)
6) Bearing for torque transfer from the lever with pin on the angle selector at the leaf (made from AISI 440C)

The leaf of the angular damper is made from Promatect-H sheets, 2x 20mm and 1x 10mm, connected with galvanised nailed “U” connectors which are sealed with Promat K84 from the outside; Promaseal tape is attached to the leaves with stainless-steel nailed “U” connectors.

The leaf of the circular damper is made from a single piece of homogeneous material Promatect--MST, thickness 40 mm.

Plastic, rubber and silicon components, sealants, foaming bands, glass-ceramic seals, housings, brass bearings of the leaf, servo drives, and end switches are identical for all material variants of the dampers.

Some fasteners and components are available in one class of stainless steel; the type will be used in all stainless-steel variants.

The leaf in the variants for chemical environments (Class A4) is always treated with a coating of chemically resistant Promat SR.

Any other requirements for the design shall be considered atypical and shall be addressed on an individual basis.

V. INSPECTION, TESTING

11. Inspection, testing

11.1. The appliance is constructed and and preset by the manufacturer, its operation is dependent on proper installation and adjustment.

VI. TRANSPORTATION AND STORAGE

12. Logistic terms

12.1. Dampers are transported by box freight vehicles without direct weather impact, there must not occur any sharp shocks and ambient temperature must not exceed +50°C. Dampers must be protected against mechanic damages when transported and manipulated. During transportation, the damper blade must be in the "CLOSED" position.

12.2. Dampers are stored indoor in environment without any aggressive vapours, gases or dust. Indoor temperature must be in the range from -30°C to +50°C and maximum relative humidity 95% (avoid condensation on the damper body). Dampers must be protected against mechanic damages when transported and manipulated.

VII. ASSEMBLY, ATTENDANCE, MAINTENANCE AND REVISIONS

13. Assembly

13.1. Assembly, maintenance and damper function check can be done only by qualified and trained person, i.e. “AUTHORIZED PERSON” according to the manufacturer documentation. All works done on the smoke control dampers must be done according international and local norms and laws.

13.2. All effective safety standards and directives must be observed during fire damper assembly.

13.3. Flange and screw joints must be conductively connected to protect against dangerous contact. 2 galvanized fan shape pads that are placed under the head of one screw and a fastened nut are used for conductive connection.

13.4. To ensure reliable fire damper function it is necessary to avoid blocking the closing mechanism and contact surfaces with collected dust, fibre and sticky materials and solvents.

13.5. **Manual operation**

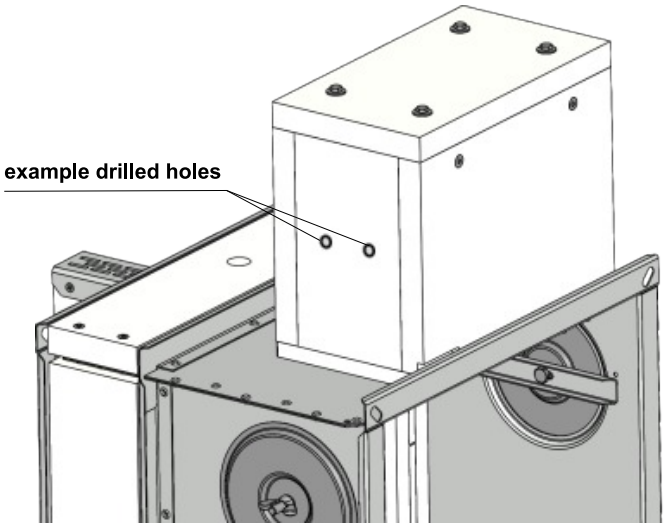
Without power supply, the damper can be operated manually and fixed in any required position.

13.6. Electrical connection of the actuator in protection box

Protection box without slot or predrilled holes

Drill two holes into the protection box (from outside to inside) and pull through field wiring cables (fire resistant cables) to connect actuator trailing lead. Protection box is made of calcium silicate plates.

Fig. 64 Example of position of holes in the wall of the box, without pre-manufactured slot



Procedure:

- Use drill (drill size acc. To suit connecting cable Ø + 2 mm for seal up by mastic) and make two holes (see fig. 64). **It is possible to drill holes in any side of the housing.**
- Pull the heat resistant cable through the calcium silicate plate (wall) and connect with cables from actuator acc. to above mentioned electrical diagram.
- Seal up the space around cable with fire resistant mastic (HILTI CFS-S ACR, PROMASTOP) or equivalent.
- Let the mastic harden.

14. Entry into service and revisions

14.1. Before entering the dampers into operation after assembly and after sequential revisions, checks and functionality tests of all designs including operation of the electrical components must be done. After entering into operation, these revisions must be done according to requirement set by national regulations.

In case that dampers are found unable to serve for their function for any cause, it must be clearly marked. The operator is obliged to ensure so that the damper is put into condition in which it is able to function and meanwhile he is obliged to provide the fire protection another appropriate way.

Results of regular checks, imperfections found and all-important facts connected with the damper function must be recorded in the "FIRE BOOK" and immediately reported to the operator.

14.2. Before entering the dampers into operation after their assembly and by sequential checks, the following checks must be carried out for all designs.

Visual inspection of proper damper integration, inside damper area, damper blade, contact surfaces and silicon sealing.

Inspection hole disassembly: release the covering lid by turning the wing nut and while turning the lid right or left release it from the security belt. Then tilt the lid and remove it from its original position.

14.3. For designs .44, .54, .65 and .66 check of damper blade displacement can be realize after actuating mechanism supply connection or signal connection from higher level control systems. Blade displacement from position “OPEN” to position “CLOSED” and return displacement is

14.4. For designs 4Mx or 5Mx check of blade displacement into the position "CLOSED" can be done after connecting the electromagnet impuls. Check of blade displacement back into the "OPEN" position can be done after connection of actuating mechanism power supply. After check actuating mechanism power supply has to be cutting off.

15. Spare parts

15.1. Spare parts are supplied only on basis of an order.

VIII. PRODUCT DATA

16. Data label

16.1. Data label is placed on the damper body.

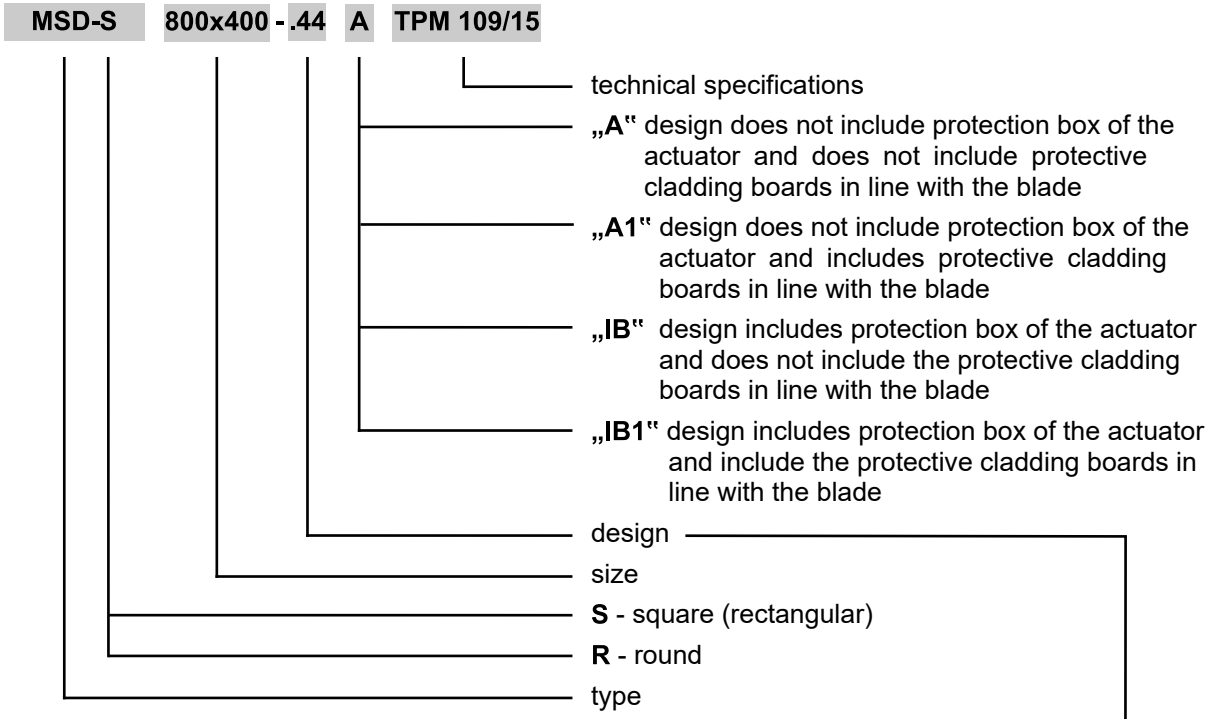
Fig. 65 Data label



IX. ORDERING INFORMATION

17. Ordering key

17.1. Smoke damper MSD



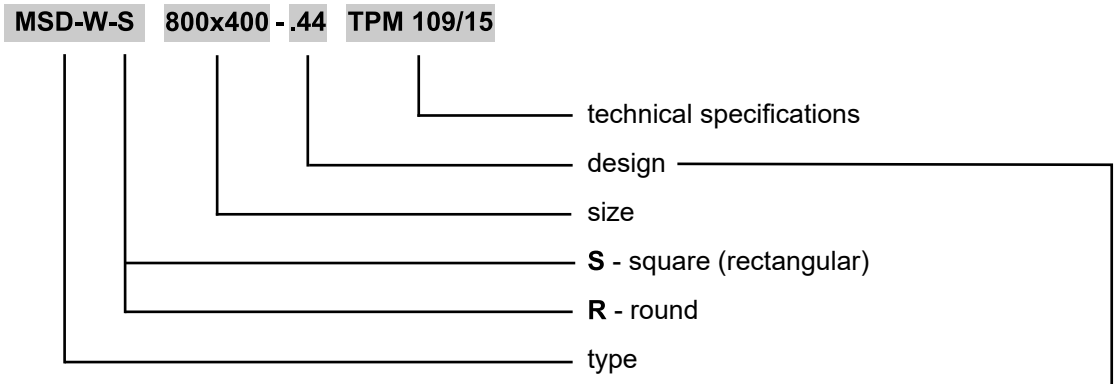
Tab. 17.1.1. Dampers design

Dampers design	Additional digit
with actuating mechanism BEN, BEE, BE, InMax 50.75-S for 230V	.44
with actuating mechanism BEN, BEE, BE, InMax 50.75-S for 24V	.54
with actuating mechanism BEN (BEE)-SR for 24V - **can be used only with MSD-S damper**	.65*
with the communication and supply device BKNE 230-24 and actuating mechanism BEN (BEE, BE)-ST for 24V	.66**

* **Design .65 is not available by using actuating mechanism BE, InMax 50.75-S**

** **Design .66 is not available by using actuating mechanism InMax 50.75-S**

17.2. Smoke damper MSD-W



Tab. 17.2.1. Dampers design SQUARE

Dampers design SQUARE	Additional digit
with actuating mechanism BEN, BEE, BE, InMax 50.75-S for 230V	.44
with actuating mechanism BEN, BEE, BE, InMax 50.75-S for 24V	.54
with the communication and supply device BKNE 230-24 and actuating mechanism BEN (BEE, BE)-ST for 24V	.66*
with actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 230V	.4M0
with actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 24V	.4M1
with actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 230V	.5M0
with actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 24V	.5M1

*** Design .66 is not available by using actuating mechanism InMax 50.75-S**

Tab. 17.2.2. Dampers design ROUND

Dampers design ROUND	Additional digit
with actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 230V	.4M0
with actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 24V	.4M1
with actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 230V	.5M0
with actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 24V	.5M1

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