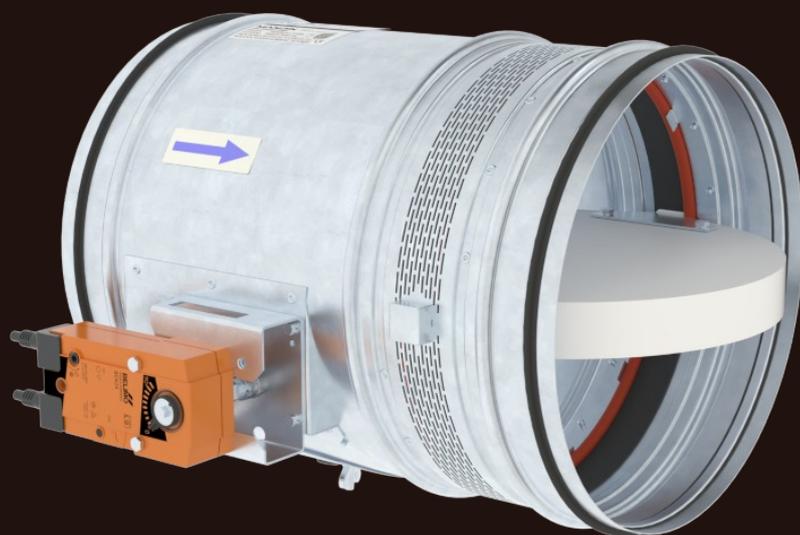


MSD (MSD-W)

Multi compartment smoke control damper

Technical Documentation

Installation, Commissioning, Operation, Maintenance and Service Manual



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

I. CONTENT

II. GENERAL INFORMATION	3
1. Description.....	3
2. Design.....	4
3. Dimensions, weights.....	13
4. Placement and Assembly.....	28
5. Statement of installations.....	30
6. Suspension systems.....	43
III. TECHNICAL DATA	49
7. Pressure loss.....	49
8. Coefficient of local pressure loss.....	50
9. Noise data.....	51
IV. MATERIAL, FINISHING	53
10. Material.....	53
V. INSPECTION, TESTING	53
11. Inspection, testing.....	53
VI. TRANSPORTATION AND STORAGE	53
12. Logistic terms.....	53
VII. ASSEMBLY, ATTENDANCE, MAINTENANCE AND REVISIONS	53
13. Assembly.....	53
14. Entry into service and revisions.....	55
15. Spare parts.....	55
VIII. PRODUCT DATA	56
16. Data label.....	56
IX. ORDERING INFORMATION	57
17. Ordering key MSD.....	57
18. Ordering key MSD-W.....	58

II. GENERAL INFORMATION

1. Description

Fig. 1 MSD - square



Fig. 2 MSD - round



1.1. Multi compartment smoke control damper 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)
- MSD-W Cycling test without load (possible design .44, .54, .4M0, .4M1, .5M0, .5M1)

Basic types of dampers round:

- MSD Cycling test with load (possible design .44, .54)
- MSD-W Cycling test without load (possible design .4M0, .4M1, .5M0, .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
- Fire resistance according Tab. 1.2.1. and 1.2.2.
- External casing leakage class min. ATC 3 (old marking "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 - C₁₀₀₀₀ acc. to EN 12101-8
MSD-W square dampers - C₁₀₀₀₀ acc. to EN 12101-8 (tested without load acc. to EN 1366-10)
- ES Certificate of conformity No. 1391-CPR-XXXX/XXXX for MSD
- ES Certificate of conformity No. 1391-CPR-XXXX/XXXX for MSD-W
- Declaration of Performance No. PM/MSD/01/XX/X, PM/MSD-W/01/XX/X
- 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) S1500C₁₀₀₀₀AAmulti
Porous concrete wall construction	EI 120 (v_{ew} - i↔o) S1500C₁₀₀₀₀AAmulti
Gypsum wall	EI 120 (v_{ew} - i↔o) S1500C₁₀₀₀₀AAmulti

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 mm ² Cable 1 m, 6 x 0,75 mm ² (BEN 24-ST) with plug connectors	Cable 1 m, 4 x 0,75 mm ² Cable 1 m, 6 x 0,75 mm ²	Cable 1 m, 3 x 0,75 mm ² Cable 1 m, 6 x 0,75 mm ²

Fig. 4 Actuator BELIMO BEN 24(-ST)

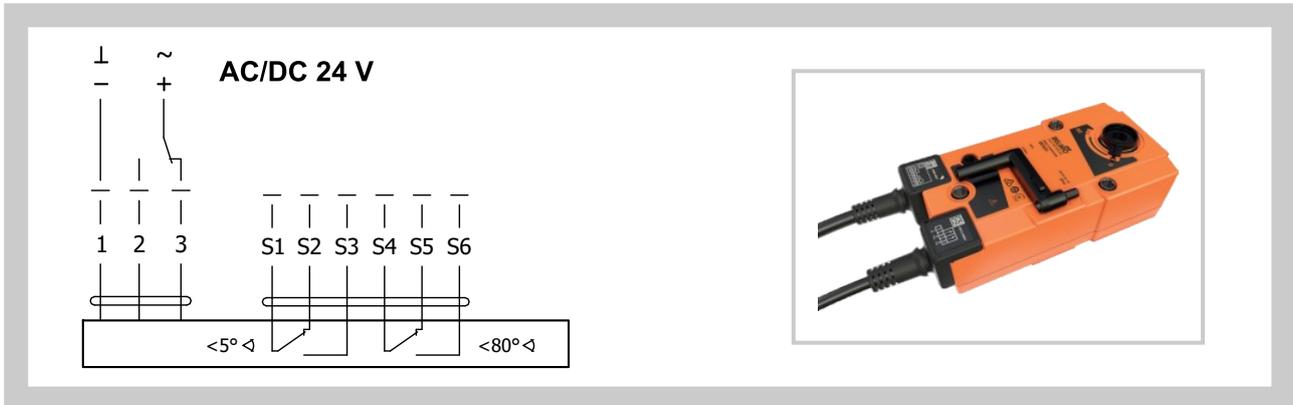


Fig. 5 Actuator BELIMO BEN 24-SR - only for square dampers MSD

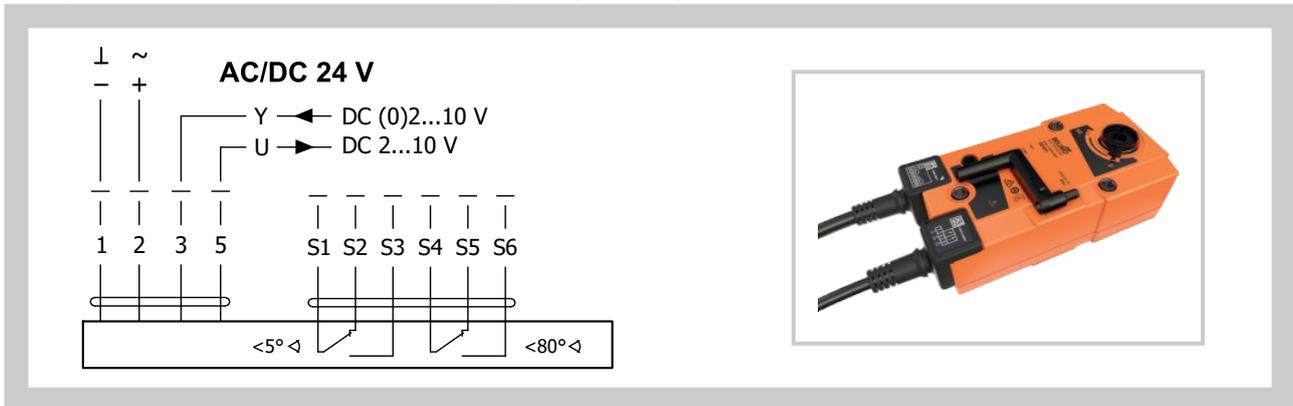
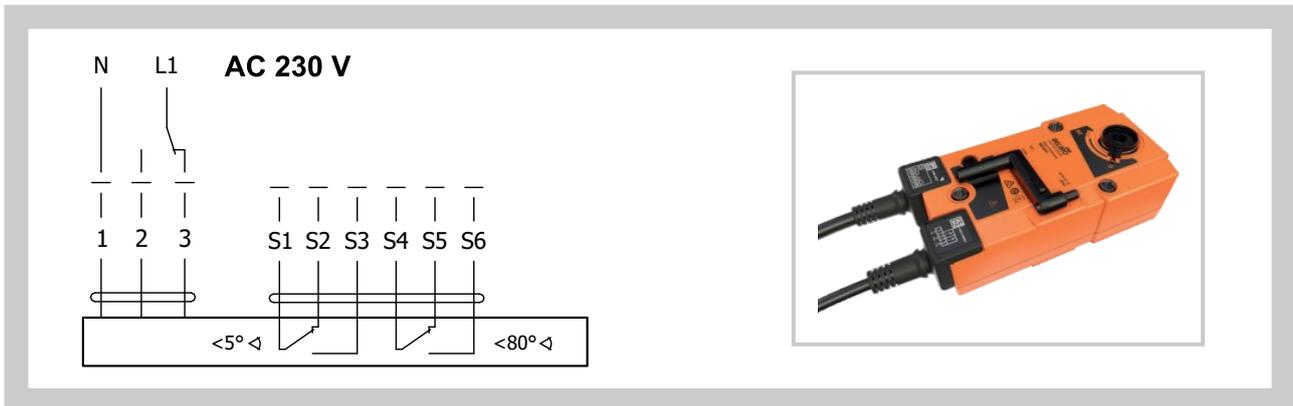


Fig. 6 Actuator BELIMO BEN 230



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 (I _{max} 8,2 A @ 5 ms)	5,5 VA (I _{max} 8,2 A @ 5 ms)	6 VA (I _{max} 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 mm ² Cable 1 m, 6 x 0,75 mm ² (BEE 24-ST) with plug connectors	Cable 1 m, 4 x 0,75 mm ² Cable 1 m, 6 x 0,75 mm ²	Cable 1 m, 3 x 0,75 mm ² Cable 1 m, 6 x 0,75 mm ²

Fig. 7 Actuator BELIMO BEE 24(-ST)

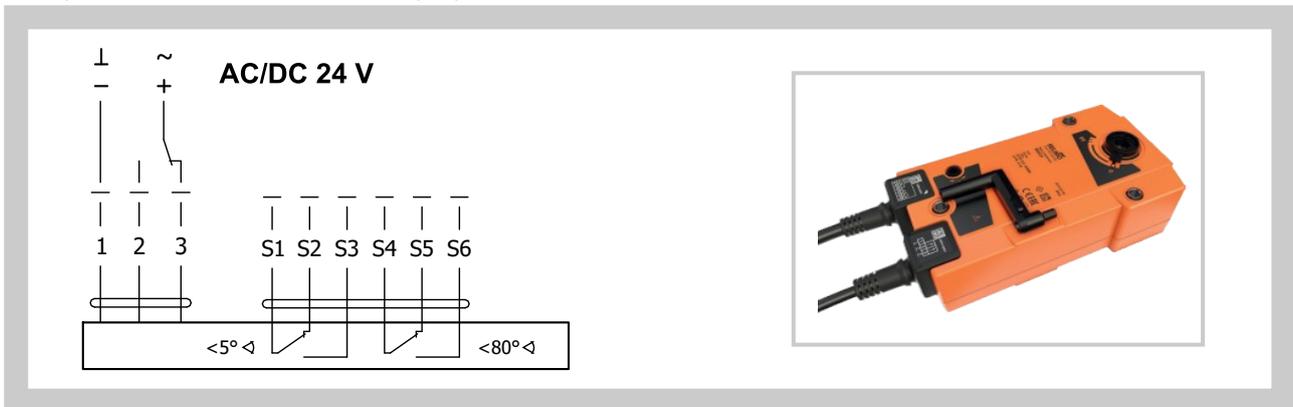


Fig. 8 Actuator BELIMO BEE 24-SR - only for square dampers MSD

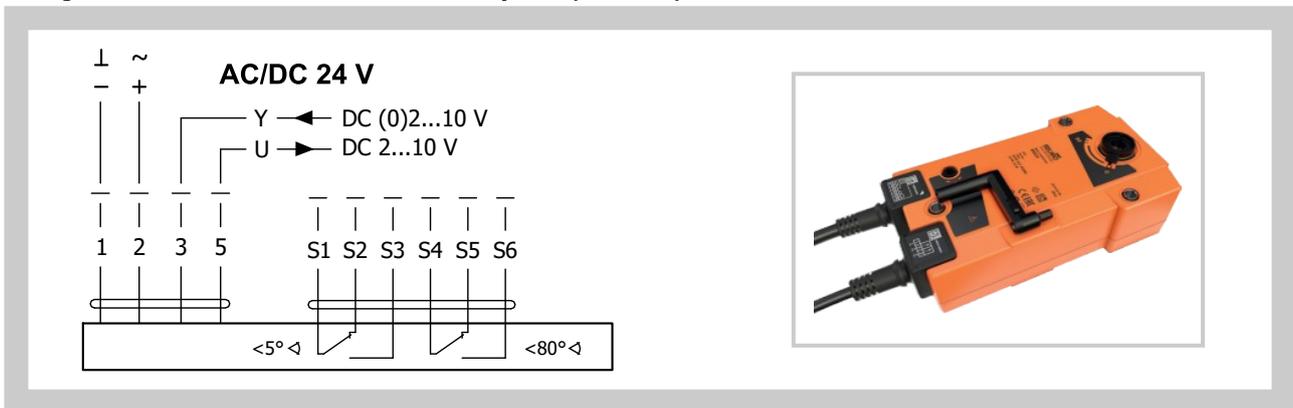
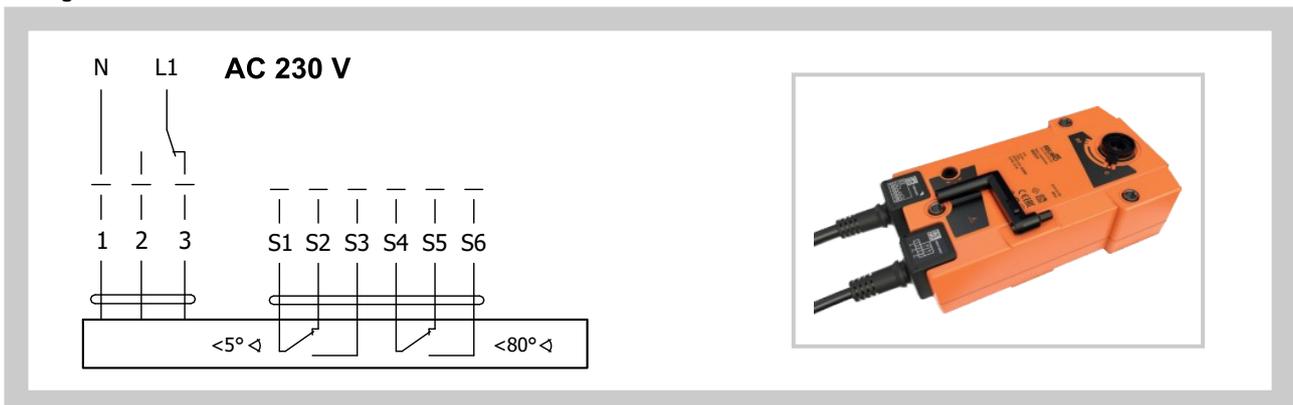


Fig. 9 Actuator BELIMO BEE 230



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 mm ² Cable 1 m, 6 x 0,75 mm ² (BE 24-ST) with plug connectors	

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

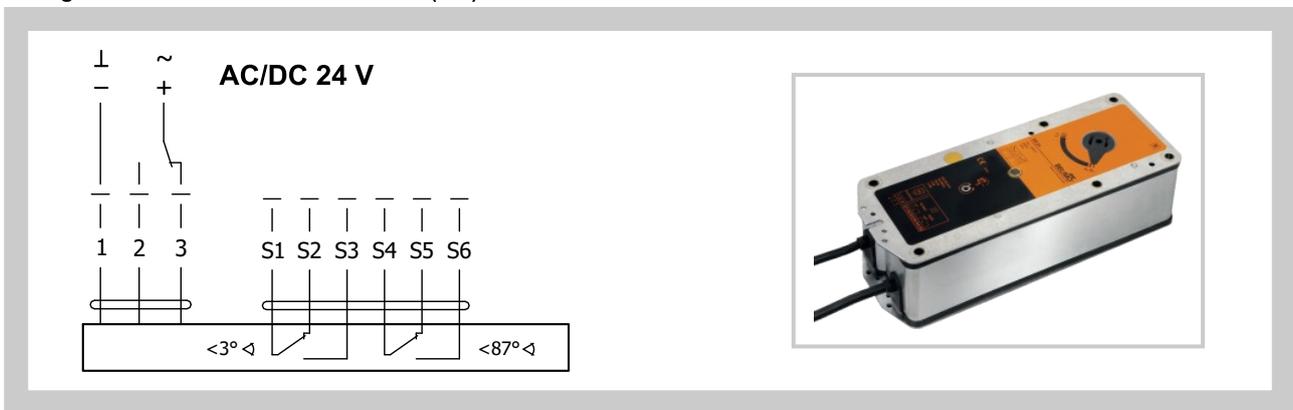
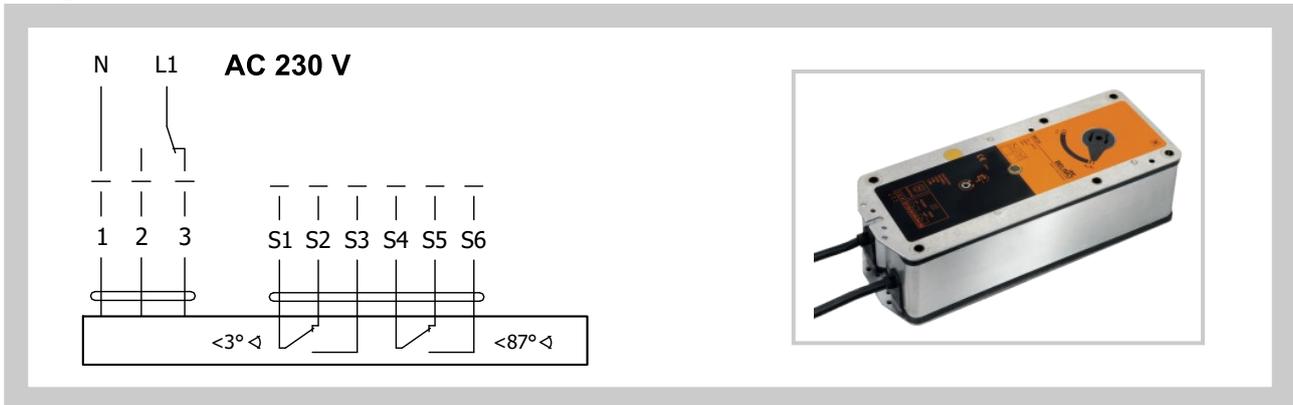


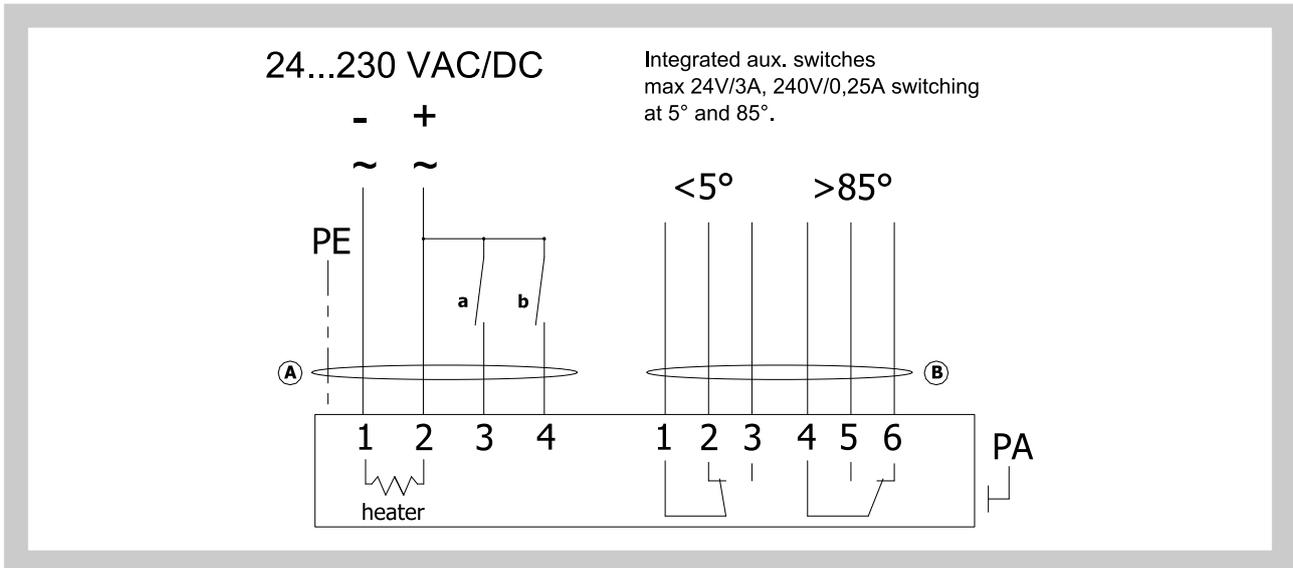
Fig. 11 Actuator BELIMO BE 230-12



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	-40°C ... +50°C
Non-operating temperature	-40°C ... +70°C
Connecting	Cable 1 m, 0,5 mm ²

Fig. 12 Actuating mechanism SCHISCHEK InMax 50.75-S



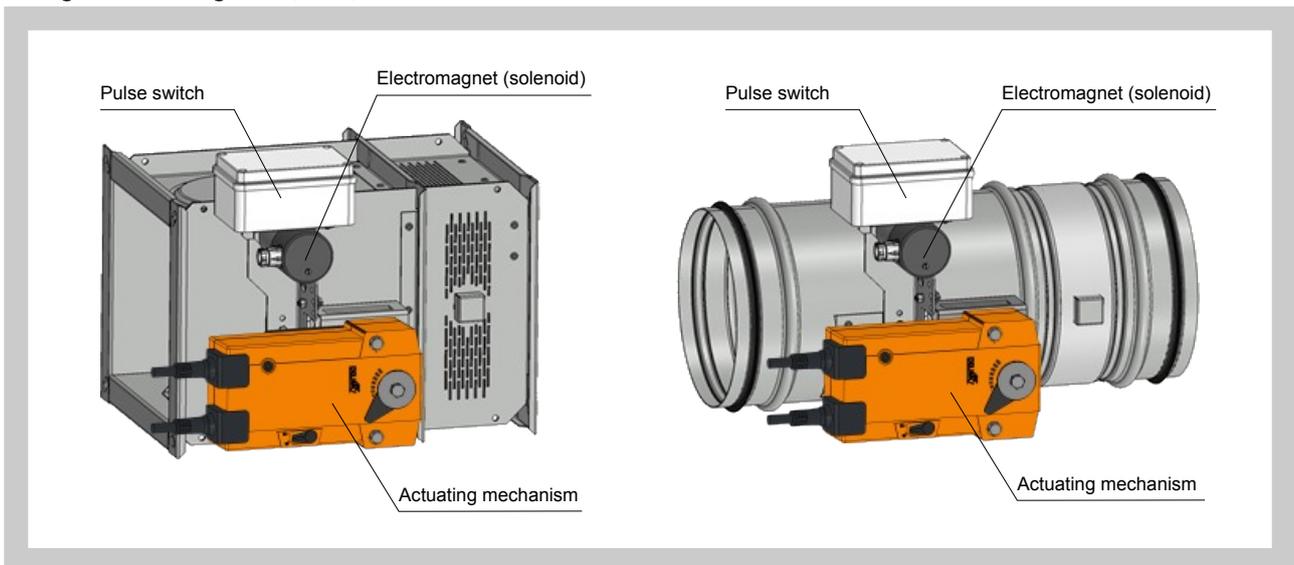
2.2. Design with electric actuating mechanism with emergency function and electromagnet

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 position is secured by initial 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. 13 Design .4M0, .4M1, .5M0 a .5M1



Tab. 2.2.1. 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 mm ² cable 1 m, 6 x 0,75 mm ²	

Fig. 14 Actuating mechanism BELIMO BFN 24

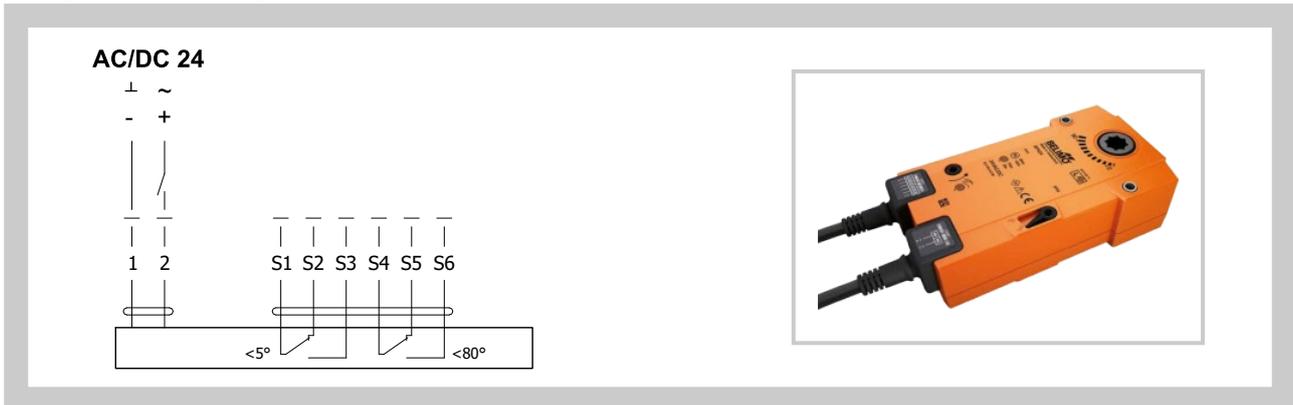
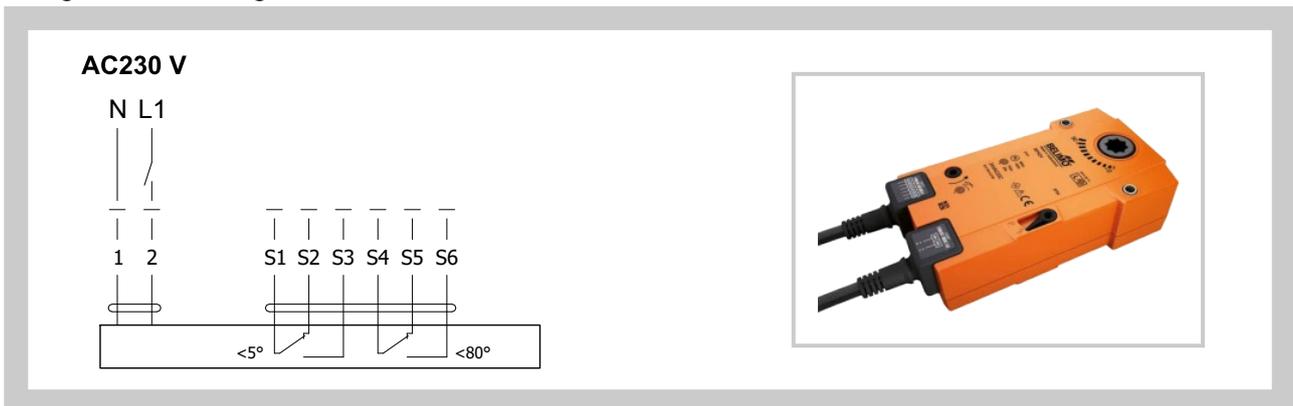


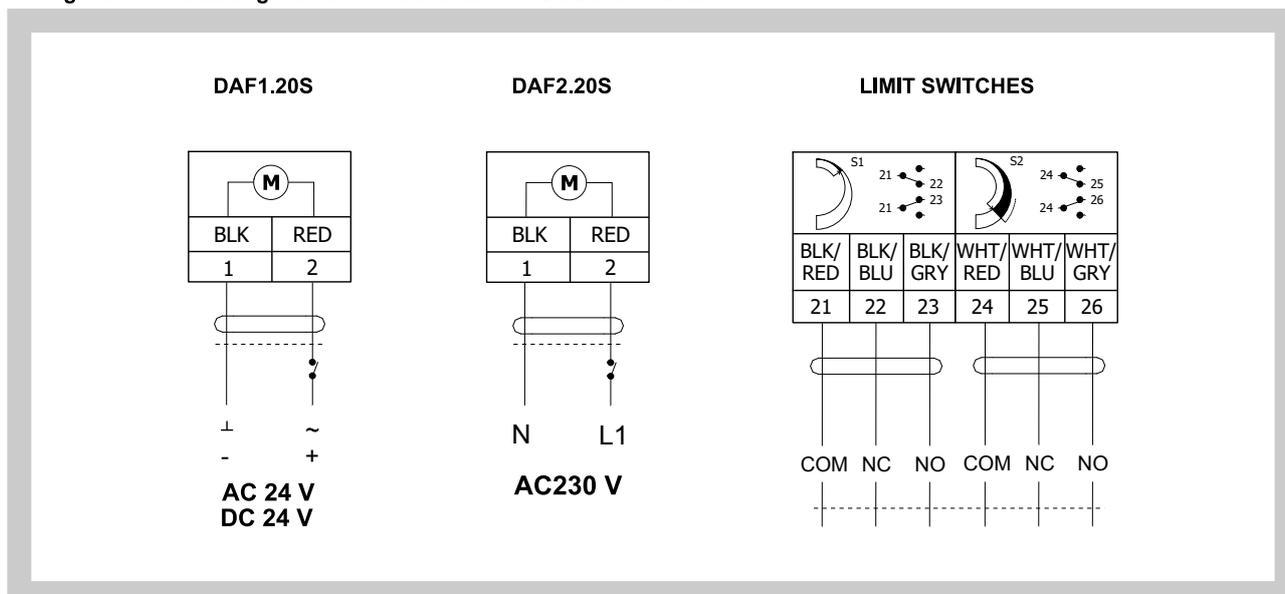
Fig. 15 Actuating mechanism BELIMO BFN 230



Tab. 2.2.2. Actuating mechanism Joventa DAF1.20S and DAF2.20S

Actuating mechanism Joventa	DAF1.20S	DAF2.20S
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	

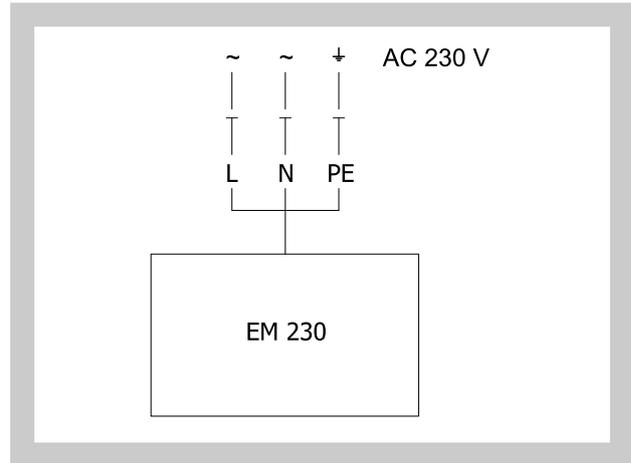
Fig. 16 Actuating mechanism Joventa DAF1.20S a DAF2.20S



Tab. 2.2.3. 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

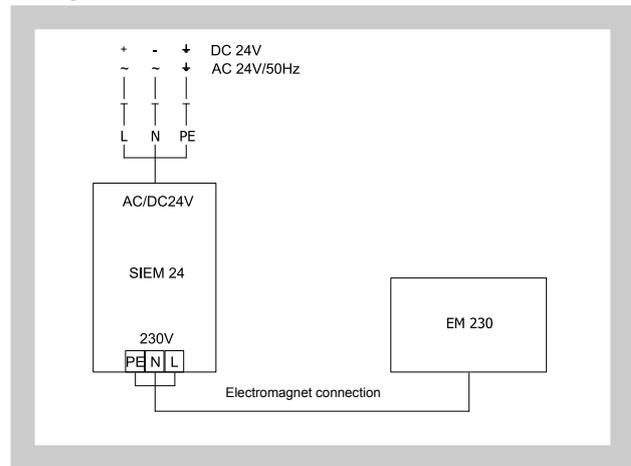
Fig. 17 Electromagnet EM230



Tab. 2.2.4. Electromagnet EM230 with impulse switch SIEM24

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. 18 Electromagnet EM230 with impulse switch SIEM24



3. Dimensions, weights

3.1. Dimensions

Fig. 19 Square MSD (MSD-W) - design with actuating mechanism

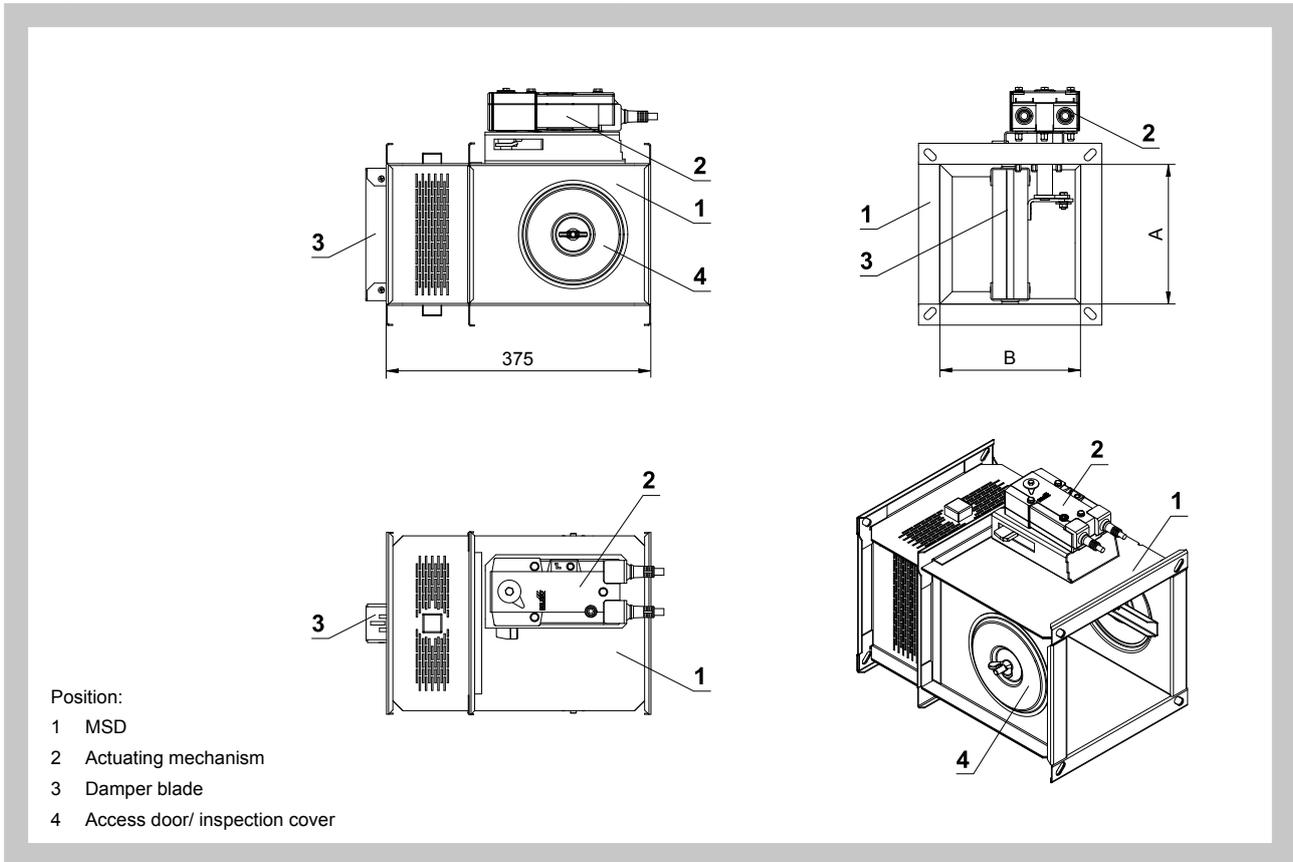


Fig. 20 Square MSD-W - design with electric actuating mechanism with emergency function and electromagnet

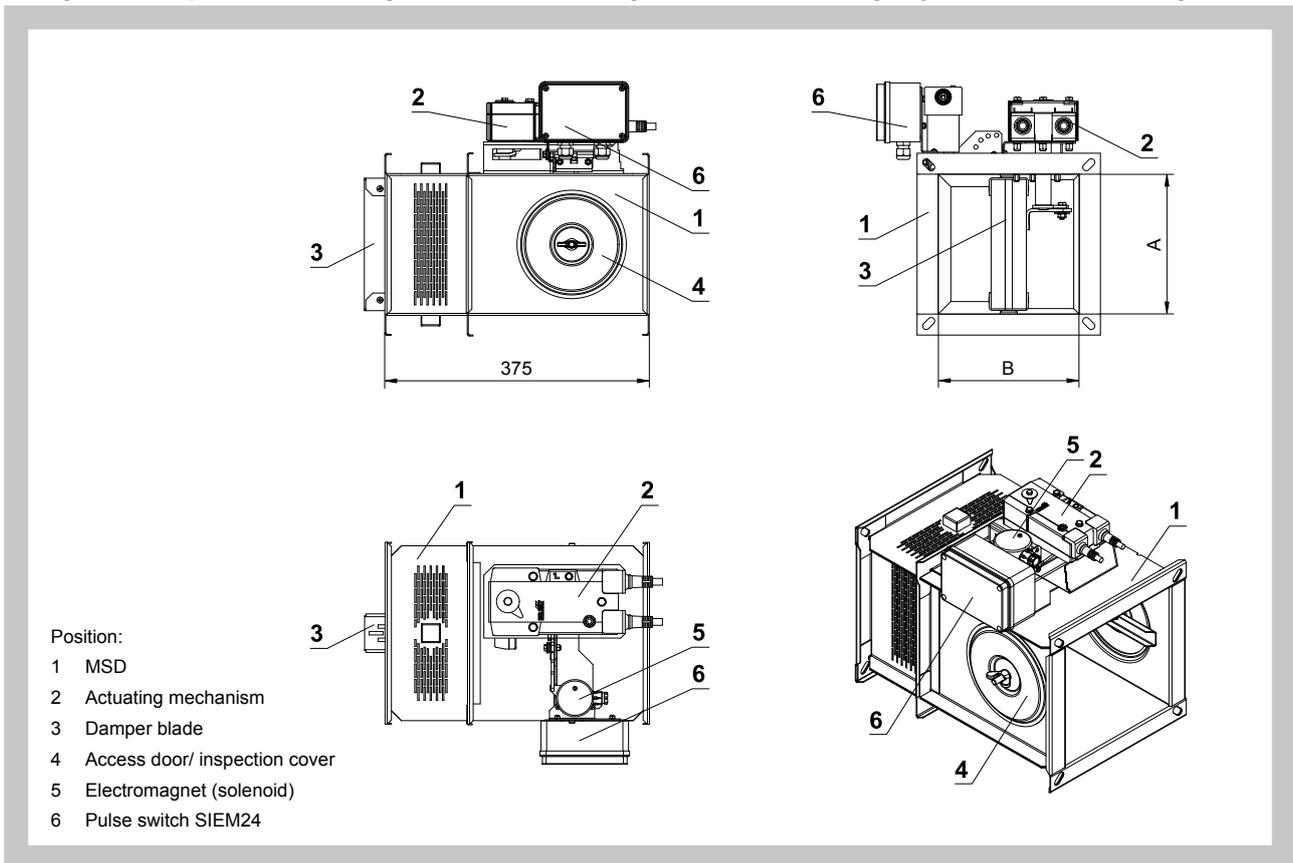


Fig. 21 Square MSD - design with actuating mechanism and insulation box

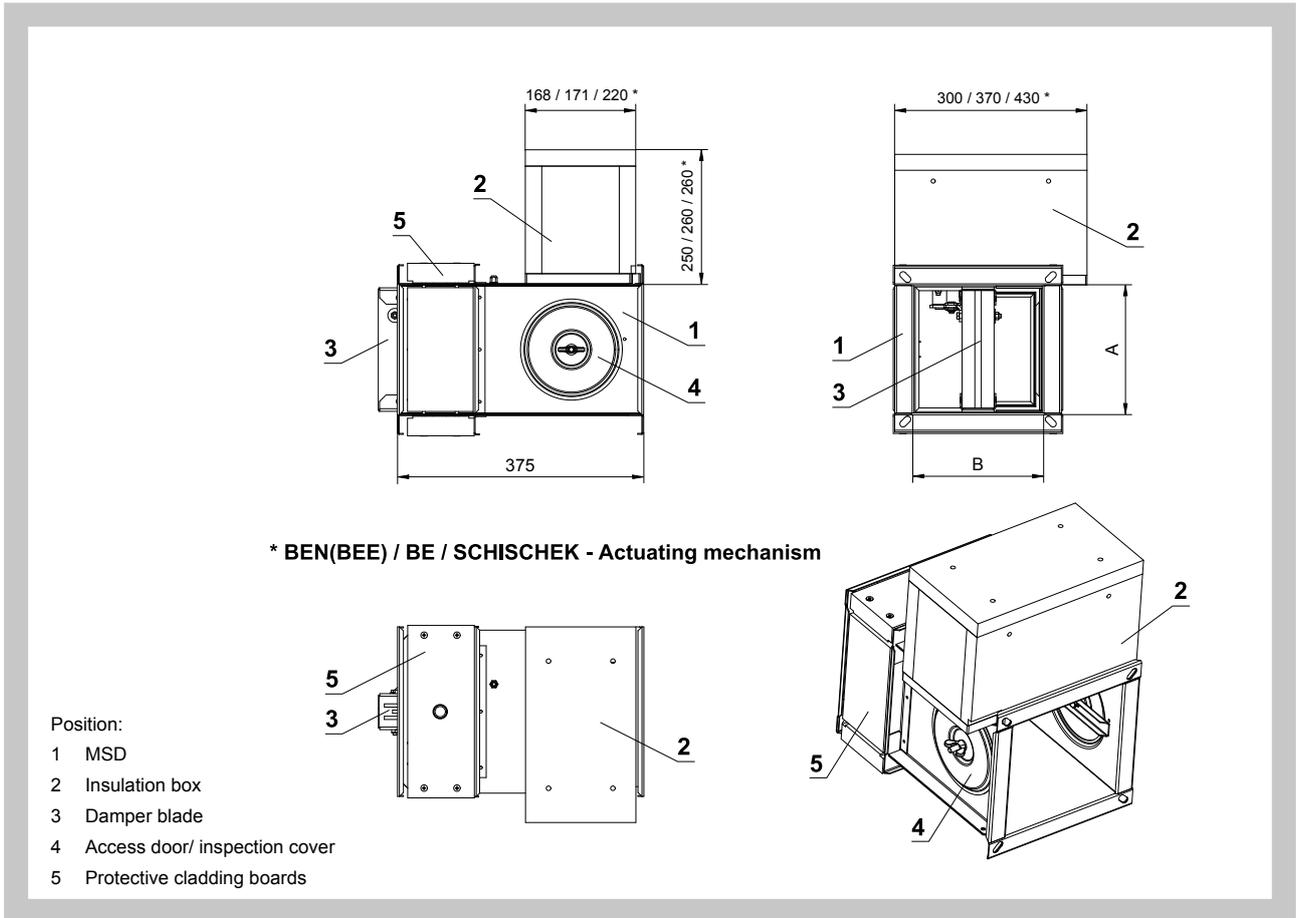


Fig. 22 Square MSD - design with actuating mechanism and insulation box

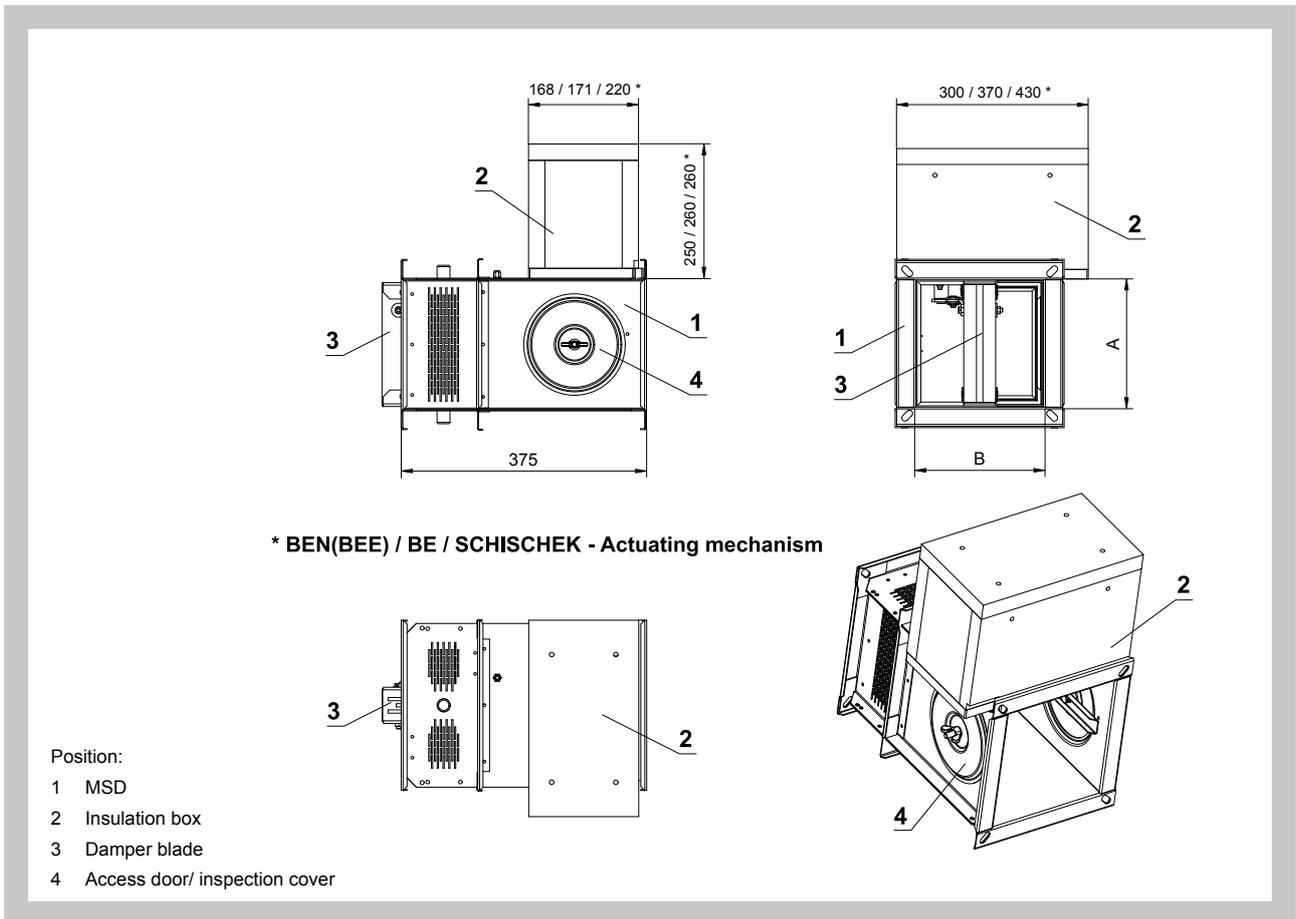


Fig. 23 Round MSD (MSD-W) - design with actuating mechanism

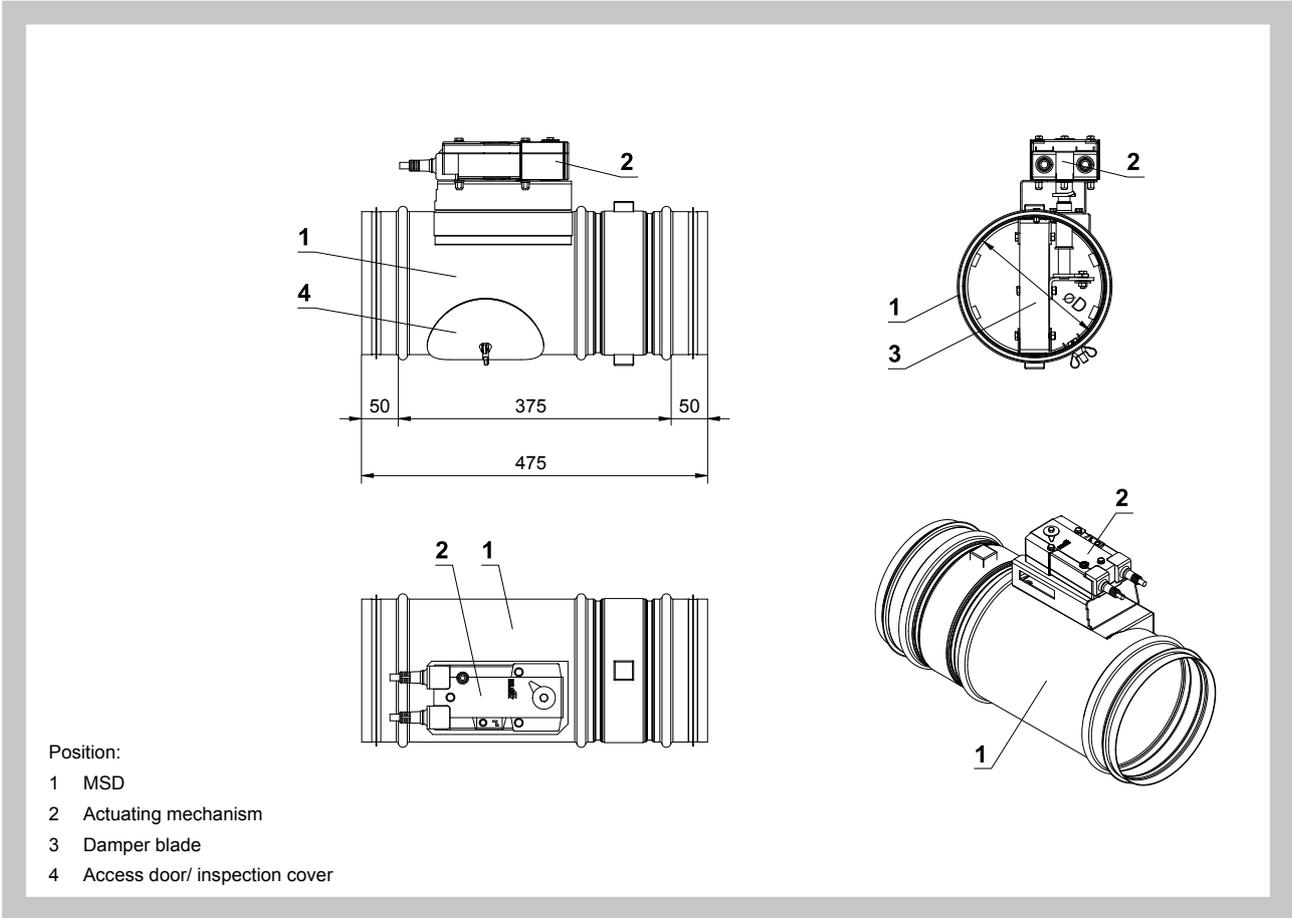
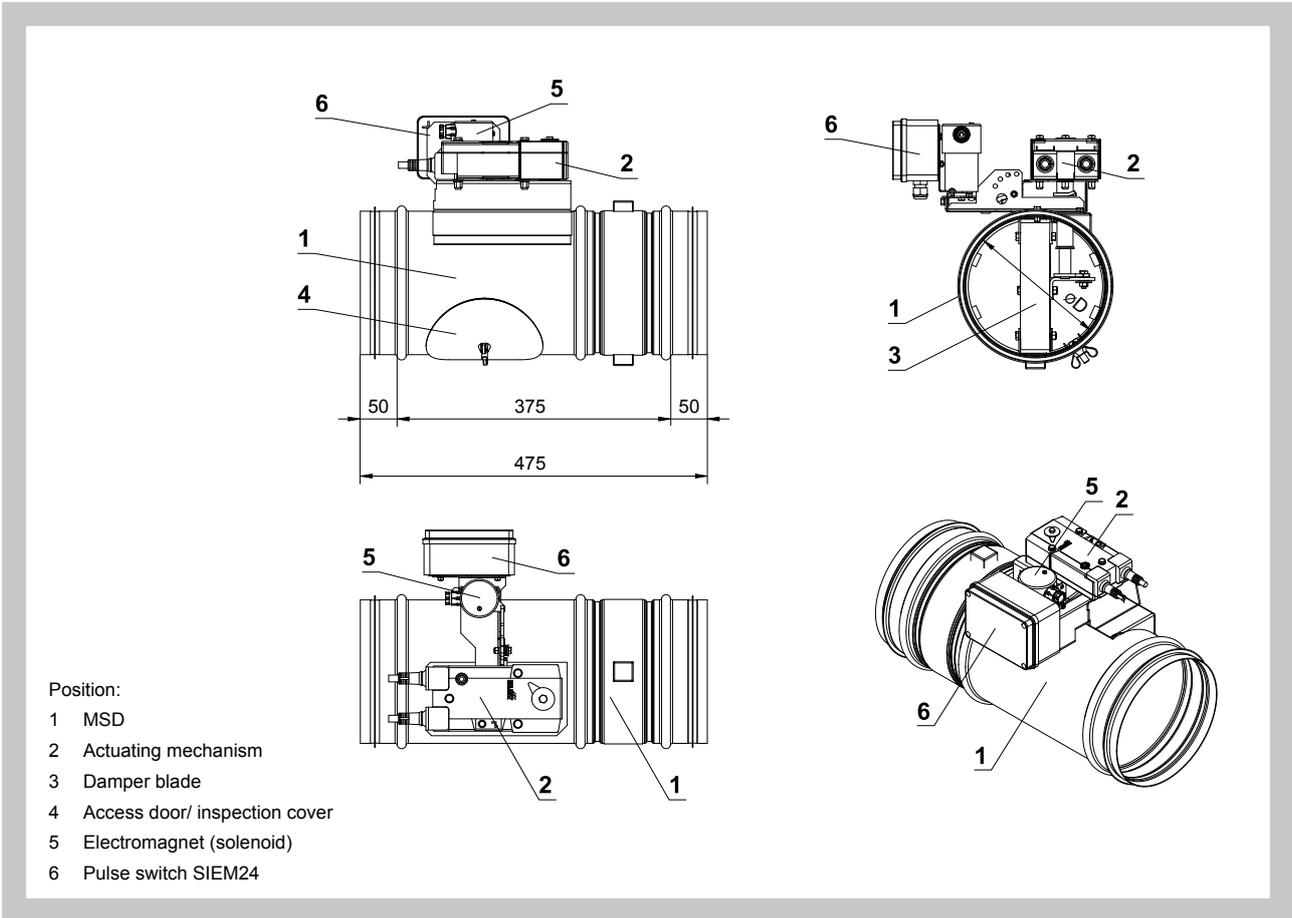


Fig. 24 Round MSD-W - design with electric actuating mechanism with emergency function and electromagnet



3.2. Weight and Free area - square dampers

Tab. 3.2.1. Weight and Free area - square dampers

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
160 x 180	-	19	0,0162	9,3	BELIMO BEN	11,7	BELIMO BFN	17,4	BELIMO BEN
x 200	-	29	0,0191	9,6	BELIMO BEN	12,1	BELIMO BFN	17,7	BELIMO BEN
x 225	-	41,5	0,0228	9,9	BELIMO BEN	12,6	BELIMO BFN	18,1	BELIMO BEN
x 250	-	54	0,0264	10,3	BELIMO BEN	13,1	BELIMO BFN	18,5	BELIMO BEN
x 280	-	69	0,0307	10,7	BELIMO BEN	13,8	BELIMO BFN	19	BELIMO BEN
x 300	-	79	0,0336	10,9	BELIMO BEN	14,2	BELIMO BFN	19,3	BELIMO BEN
x 315	-	86,5	0,0358	11,1	BELIMO BEN	14,5	BELIMO BFN	19,5	BELIMO BEN
x 355	-	106,5	0,0416	11,6	BELIMO BEN	15,3	BELIMO BFN	20,1	BELIMO BEN
x 400	-	129	0,0481	12,2	BELIMO BEN	16,3	BELIMO BFN	20,8	BELIMO BEN
x 450	-	154	0,0554	12,9	BELIMO BEN	17,3	BELIMO BFN	21,6	BELIMO BEN
x 500	-	179	0,0626	13,5	BELIMO BEN	18,3	BELIMO BFN	22,3	BELIMO BEN
x 550	-	204	0,0699	14,2	BELIMO BEN	19,4	BELIMO BFN	23,1	BELIMO BEN
x 560	-	209	0,0713	14,3	BELIMO BEN	19,6	BELIMO BFN	23,3	BELIMO BEN
x 600	-	229	0,0771	14,8	BELIMO BEN	20,4	BELIMO BFN	23,9	BELIMO BEN
x 630	-	244	0,0815	15,2	BELIMO BEN	21	BELIMO BFN	24,3	BELIMO BEN
x 650	9	254	0,0844	15,5	BELIMO BEN	21,4	BELIMO BFN	24,6	BELIMO BEN
x 700	34	279	0,0916	16,1	BELIMO BEN	24,3	JOVENTA DAFx.20S	25,4	BELIMO BEN
x 710	39	284	0,0931	16,2	BELIMO BEN	24,5	JOVENTA DAFx.20S	25,5	BELIMO BEN
x 750	59	304	0,0989	16,8	BELIMO BEN	25,3	JOVENTA DAFx.20S	26,1	BELIMO BEN
x 800	84	329	0,1061	17,4	BELIMO BEN	26,4	JOVENTA DAFx.20S	26,9	BELIMO BEN
180 x 180	-	19	0,0185	9,6	BELIMO BEN	12,1	BELIMO BFN	17,8	BELIMO BEN
x 200	-	29	0,0218	9,9	BELIMO BEN	12,5	BELIMO BFN	18,1	BELIMO BEN
x 225	-	41,5	0,0259	10,3	BELIMO BEN	13	BELIMO BFN	18,5	BELIMO BEN
x 250	-	54	0,0300	10,7	BELIMO BEN	13,6	BELIMO BFN	19	BELIMO BEN
x 280	-	69	0,0350	11,1	BELIMO BEN	14,2	BELIMO BFN	19,5	BELIMO BEN
x 300	-	79	0,0383	11,4	BELIMO BEN	14,7	BELIMO BFN	19,8	BELIMO BEN
x 315	-	86,5	0,0408	11,6	BELIMO BEN	15	BELIMO BFN	20,1	BELIMO BEN
x 355	-	106,5	0,0474	12,2	BELIMO BEN	15,8	BELIMO BFN	20,8	BELIMO BEN
x 400	-	129	0,0548	12,9	BELIMO BEN	16,8	BELIMO BFN	21,6	BELIMO BEN
x 450	-	154	0,0630	13,6	BELIMO BEN	17,9	BELIMO BFN	22,4	BELIMO BEN
x 500	-	179	0,0713	14,3	BELIMO BEN	19	BELIMO BFN	23,3	BELIMO BEN
x 550	-	204	0,0795	15,1	BELIMO BEN	20,1	BELIMO BFN	24,1	BELIMO BEN
x 560	-	209	0,0812	15,2	BELIMO BEN	20,3	BELIMO BFN	24,3	BELIMO BEN
x 600	-	229	0,0878	15,8	BELIMO BEN	21,1	BELIMO BFN	25	BELIMO BEN
x 630	-	244	0,0927	16,2	BELIMO BEN	21,8	BELIMO BFN	25,5	BELIMO BEN
x 650	9	254	0,0960	16,5	BELIMO BEN	22,2	BELIMO BFN	25,9	BELIMO BEN
x 700	34	279	0,1043	17,2	BELIMO BEN	25,1	JOVENTA DAFx.20S	26,7	BELIMO BEN
x 710	39	284	0,1059	17,4	BELIMO BEN	25,3	JOVENTA DAFx.20S	26,9	BELIMO BEN
x 750	59	304	0,1125	18	BELIMO BEN	26,2	JOVENTA DAFx.20S	27,5	BELIMO BEN
x 800	84	329	0,1208	18,7	BELIMO BEN	27,3	JOVENTA DAFx.20S	28,4	BELIMO BEN
200 x 180	-	19	0,0207	9,9	BELIMO BEN	12,4	BELIMO BFN	18,1	BELIMO BEN
x 200	-	29	0,0244	10,3	BELIMO BEN	12,9	BELIMO BFN	18,5	BELIMO BEN
x 225	-	41,5	0,0290	10,7	BELIMO BEN	13,4	BELIMO BFN	19	BELIMO BEN
x 250	-	54	0,0337	11,1	BELIMO BEN	14	BELIMO BFN	19,5	BELIMO BEN
x 280	-	69	0,0392	11,6	BELIMO BEN	14,7	BELIMO BFN	20	BELIMO BEN
x 300	-	79	0,0429	11,9	BELIMO BEN	15,1	BELIMO BFN	20,4	BELIMO BEN
x 315	-	86,5	0,0457	12,1	BELIMO BEN	15,5	BELIMO BFN	20,7	BELIMO BEN
x 355	-	106,5	0,0531	12,8	BELIMO BEN	16,4	BELIMO BFN	21,5	BELIMO BEN
x 400	-	129	0,0614	13,5	BELIMO BEN	17,4	BELIMO BFN	22,3	BELIMO BEN
x 450	-	154	0,0707	14,3	BELIMO BEN	18,5	BELIMO BFN	23,3	BELIMO BEN
x 500	-	179	0,0799	15,1	BELIMO BEN	19,6	BELIMO BFN	24,2	BELIMO BEN
x 550	-	204	0,0892	16	BELIMO BEN	20,8	BELIMO BFN	25,2	BELIMO BEN
x 560	-	209	0,0910	16,1	BELIMO BEN	21	BELIMO BFN	25,4	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
200 x 600	-	229	0,0984	16,8	BELIMO BEN	21,9	BELIMO BFN	26,1	BELIMO BEN
x 630	-	244	0,1040	17,2	BELIMO BEN	22,6	BELIMO BFN	26,7	BELIMO BEN
x 650	9	254	0,1077	17,6	BELIMO BEN	23	BELIMO BFN	27,1	BELIMO BEN
x 700	34	279	0,1169	18,4	BELIMO BEN	26	JOVENTA DAFx.20S	28	BELIMO BEN
x 710	39	284	0,1188	18,5	BELIMO BEN	26,2	JOVENTA DAFx.20S	28,2	BELIMO BEN
x 750	59	304	0,1262	19,2	BELIMO BEN	27,1	JOVENTA DAFx.20S	29	BELIMO BEN
x 800	84	329	0,1354	20	BELIMO BEN	28,2	JOVENTA DAFx.20S	29,9	BELIMO BEN
225 x 180	-	19	0,0235	10,3	BELIMO BEN	12,9	BELIMO BFN	18,5	BELIMO BEN
x 200	-	29	0,0277	10,7	BELIMO BEN	13,3	BELIMO BFN	19	BELIMO BEN
x 225	-	41,5	0,0330	11,1	BELIMO BEN	13,9	BELIMO BFN	19,5	BELIMO BEN
x 250	-	54	0,0382	11,6	BELIMO BEN	14,5	BELIMO BFN	20,1	BELIMO BEN
x 280	-	69	0,0445	12,1	BELIMO BEN	15,2	BELIMO BFN	20,7	BELIMO BEN
x 300	-	79	0,0487	12,5	BELIMO BEN	15,7	BELIMO BFN	21,1	BELIMO BEN
x 315	-	86,5	0,0519	12,8	BELIMO BEN	16,1	BELIMO BFN	21,5	BELIMO BEN
x 355	-	106,5	0,0603	13,5	BELIMO BEN	17	BELIMO BFN	22,3	BELIMO BEN
x 400	-	129	0,0697	14,3	BELIMO BEN	18,1	BELIMO BFN	23,3	BELIMO BEN
x 450	-	154	0,0802	15,2	BELIMO BEN	19,2	BELIMO BFN	24,4	BELIMO BEN
x 500	-	179	0,0907	16,2	BELIMO BEN	20,4	BELIMO BFN	25,4	BELIMO BEN
x 550	-	204	0,1012	17,1	BELIMO BEN	21,6	BELIMO BFN	26,5	BELIMO BEN
x 560	-	209	0,1033	17,2	BELIMO BEN	21,8	BELIMO BFN	26,7	BELIMO BEN
x 600	-	229	0,1117	18	BELIMO BEN	22,8	BELIMO BFN	27,5	BELIMO BEN
x 630	-	244	0,1180	18,5	BELIMO BEN	25,3	JOVENTA DAFx.20S	28,2	BELIMO BEN
x 650	9	254	0,1222	18,9	BELIMO BEN	25,8	JOVENTA DAFx.20S	28,6	BELIMO BEN
x 700	34	279	0,1327	19,8	BELIMO BEN	26,9	JOVENTA DAFx.20S	29,6	BELIMO BEN
x 710	39	284	0,1348	19,9	BELIMO BEN	27,2	JOVENTA DAFx.20S	29,9	BELIMO BEN
x 750	59	304	0,1432	20,6	BELIMO BEN	28,1	JOVENTA DAFx.20S	30,7	BELIMO BEN
x 800	84	329	0,1537	21,5	BELIMO BEN	29,3	JOVENTA DAFx.20S	31,7	BELIMO BEN
250 x 180	-	19	0,0263	10,7	BELIMO BEN	13,3	BELIMO BFN	19	BELIMO BEN
x 200	-	29	0,0310	11,1	BELIMO BEN	13,8	BELIMO BFN	19,5	BELIMO BEN
x 225	-	41,5	0,0369	11,6	BELIMO BEN	14,4	BELIMO BFN	20,1	BELIMO BEN
x 250	-	54	0,0428	12,1	BELIMO BEN	15,1	BELIMO BFN	20,7	BELIMO BEN
x 280	-	69	0,0498	12,7	BELIMO BEN	15,8	BELIMO BFN	21,4	BELIMO BEN
x 300	-	79	0,0545	13,1	BELIMO BEN	16,3	BELIMO BFN	21,9	BELIMO BEN
x 315	-	86,5	0,0580	13,4	BELIMO BEN	16,6	BELIMO BFN	22,2	BELIMO BEN
x 355	-	106,5	0,0674	14,2	BELIMO BEN	17,6	BELIMO BFN	23,2	BELIMO BEN
x 400	-	129	0,0780	15,1	BELIMO BEN	18,7	BELIMO BFN	24,2	BELIMO BEN
x 450	-	154	0,0898	16,2	BELIMO BEN	19,9	BELIMO BFN	25,4	BELIMO BEN
x 500	-	179	0,1015	17,2	BELIMO BEN	21,2	BELIMO BFN	26,6	BELIMO BEN
x 550	-	204	0,1133	18,2	BELIMO BEN	22,4	BELIMO BFN	27,8	BELIMO BEN
x 560	-	209	0,1156	18,4	BELIMO BEN	22,6	BELIMO BFN	28	BELIMO BEN
x 600	-	229	0,1250	19,2	BELIMO BEN	25,4	JOVENTA DAFx.20S	29	BELIMO BEN
x 630	-	244	0,1321	19,8	BELIMO BEN	26,2	JOVENTA DAFx.20S	29,6	BELIMO BEN
x 650	9	254	0,1368	20,2	BELIMO BEN	26,7	JOVENTA DAFx.20S	30,1	BELIMO BEN
x 700	34	279	0,1485	21,1	BELIMO BEN	27,9	JOVENTA DAFx.20S	31,3	BELIMO BEN
x 710	39	284	0,1509	21,3	BELIMO BEN	28,1	JOVENTA DAFx.20S	31,5	BELIMO BEN
x 750	59	304	0,1603	22,1	BELIMO BEN	29,1	JOVENTA DAFx.20S	32,4	BELIMO BEN
x 800	84	329	0,1720	23,1	BELIMO BEN	30,3	JOVENTA DAFx.20S	33,6	BELIMO BEN
280 x 180	-	19	0,0297	11,1	BELIMO BEN	13,9	BELIMO BFN	19,5	BELIMO BEN
x 200	-	29	0,0350	11,6	BELIMO BEN	14,4	BELIMO BFN	20	BELIMO BEN
x 225	-	41,5	0,0416	12,1	BELIMO BEN	15	BELIMO BFN	20,7	BELIMO BEN
x 250	-	54	0,0482	12,7	BELIMO BEN	15,7	BELIMO BFN	21,4	BELIMO BEN
x 280	-	69	0,0562	13,4	BELIMO BEN	16,4	BELIMO BFN	22,2	BELIMO BEN
x 300	-	79	0,0615	13,8	BELIMO BEN	17	BELIMO BFN	22,7	BELIMO BEN
x 315	-	86,5	0,0655	14,2	BELIMO BEN	17,3	BELIMO BFN	23,1	BELIMO BEN
x 355	-	106,5	0,0761	15,1	BELIMO BEN	18,4	BELIMO BFN	24,2	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
280 x 400	-	129	0,0880	16,1	BELIMO BEN	19,5	BELIMO BFN	25,4	BELIMO BEN
x 450	-	154	0,1012	17,2	BELIMO BEN	20,8	BELIMO BFN	26,7	BELIMO BEN
x 500	-	179	0,1145	18,4	BELIMO BEN	22,1	BELIMO BFN	28	BELIMO BEN
x 550	-	204	0,1277	19,5	BELIMO BEN	23,3	BELIMO BFN	29,3	BELIMO BEN
x 560	-	209	0,1304	19,7	BELIMO BEN	25,4	JOVENTA DAFx.20S	29,6	BELIMO BEN
x 600	-	229	0,1410	20,6	BELIMO BEN	26,4	JOVENTA DAFx.20S	30,6	BELIMO BEN
x 630	-	244	0,1489	21,3	BELIMO BEN	27,2	JOVENTA DAFx.20S	31,4	BELIMO BEN
x 650	9	254	0,1542	21,7	BELIMO BEN	27,7	JOVENTA DAFx.20S	31,9	BELIMO BEN
x 700	34	279	0,1675	22,8	BELIMO BEN	29	JOVENTA DAFx.20S	33,2	BELIMO BEN
x 710	39	284	0,1701	23	BELIMO BEN	29,2	JOVENTA DAFx.20S	33,5	BELIMO BEN
x 750	59	304	0,1807	23,9	BELIMO BEN	30,3	JOVENTA DAFx.20S	34,5	BELIMO BEN
x 800	84	329	0,1940	25	BELIMO BEN	31,5	JOVENTA DAFx.20S	35,8	BELIMO BEN
300 x 180	-	19	0,0319	11,4	BELIMO BEN	14,2	BELIMO BFN	19,8	BELIMO BEN
x 200	-	29	0,0376	11,9	BELIMO BEN	14,8	BELIMO BFN	20,4	BELIMO BEN
x 225	-	41,5	0,0447	12,5	BELIMO BEN	15,4	BELIMO BFN	21,1	BELIMO BEN
x 250	-	54	0,0519	13,1	BELIMO BEN	16,1	BELIMO BFN	21,9	BELIMO BEN
x 280	-	69	0,0604	13,8	BELIMO BEN	16,9	BELIMO BFN	22,7	BELIMO BEN
x 300	-	79	0,0661	14,3	BELIMO BEN	17,4	BELIMO BFN	23,3	BELIMO BEN
x 315	-	86,5	0,0704	14,7	BELIMO BEN	17,8	BELIMO BFN	23,7	BELIMO BEN
x 355	-	106,5	0,0818	15,7	BELIMO BEN	18,9	BELIMO BFN	24,9	BELIMO BEN
x 400	-	129	0,0946	16,8	BELIMO BEN	20	BELIMO BFN	26,1	BELIMO BEN
x 450	-	154	0,1089	18	BELIMO BEN	21,3	BELIMO BFN	27,5	BELIMO BEN
x 500	-	179	0,1231	19,2	BELIMO BEN	22,7	BELIMO BFN	29	BELIMO BEN
x 550	-	204	0,1374	20,4	BELIMO BEN	25,8	JOVENTA DAFx.20S	30,3	BELIMO BEN
x 560	-	209	0,1402	20,6	BELIMO BEN	26,1	JOVENTA DAFx.20S	30,6	BELIMO BEN
x 600	-	229	0,1516	21,5	BELIMO BEN	27,1	JOVENTA DAFx.20S	31,7	BELIMO BEN
x 630	-	244	0,1602	22,3	BELIMO BEN	27,9	JOVENTA DAFx.20S	32,6	BELIMO BEN
x 650	9	254	0,1659	22,7	BELIMO BEN	28,4	JOVENTA DAFx.20S	33,1	BELIMO BEN
x 700	34	279	0,1801	23,9	BELIMO BEN	29,7	JOVENTA DAFx.20S	34,5	BELIMO BEN
x 710	39	284	0,1830	24,1	BELIMO BEN	30	JOVENTA DAFx.20S	34,8	BELIMO BEN
x 750	59	304	0,1944	25,1	BELIMO BEN	31	JOVENTA DAFx.20S	35,9	BELIMO BEN
x 800	84	329	0,2086	26,2	BELIMO BEN	32,4	JOVENTA DAFx.20S	37,2	BELIMO BEN
315 x 180	-	19	0,0336	11,6	BELIMO BEN	14,5	BELIMO BFN	20,1	BELIMO BEN
x 200	-	29	0,0396	12,1	BELIMO BEN	15,1	BELIMO BFN	20,7	BELIMO BEN
x 225	-	41,5	0,0471	12,8	BELIMO BEN	15,7	BELIMO BFN	21,5	BELIMO BEN
x 250	-	54	0,0546	13,4	BELIMO BEN	16,4	BELIMO BFN	22,2	BELIMO BEN
x 280	-	69	0,0636	14,2	BELIMO BEN	17,2	BELIMO BFN	23,1	BELIMO BEN
x 300	-	79	0,0696	14,7	BELIMO BEN	17,8	BELIMO BFN	23,7	BELIMO BEN
x 315	-	86,5	0,0741	15,1	BELIMO BEN	18,2	BELIMO BFN	24,2	BELIMO BEN
x 355	-	106,5	0,0861	16,1	BELIMO BEN	19,2	BELIMO BFN	25,4	BELIMO BEN
x 400	-	129	0,0996	17,2	BELIMO BEN	20,4	BELIMO BFN	26,7	BELIMO BEN
x 450	-	154	0,1146	18,5	BELIMO BEN	21,8	BELIMO BFN	28,2	BELIMO BEN
x 500	-	179	0,1296	19,8	BELIMO BEN	23,1	BELIMO BFN	29,6	BELIMO BEN
x 550	-	204	0,1446	21	BELIMO BEN	26,3	JOVENTA DAFx.20S	31,1	BELIMO BEN
x 560	-	209	0,1476	21,3	BELIMO BEN	26,5	JOVENTA DAFx.20S	31,4	BELIMO BEN
x 600	-	229	0,1596	22,3	BELIMO BEN	27,6	JOVENTA DAFx.20S	32,6	BELIMO BEN
x 630	-	244	0,1686	23	BELIMO BEN	28,4	JOVENTA DAFx.20S	33,4	BELIMO BEN
x 650	9	254	0,1746	23,5	BELIMO BEN	28,9	JOVENTA DAFx.20S	34	BELIMO BEN
x 700	34	279	0,1896	24,7	BELIMO BEN	30,3	JOVENTA DAFx.20S	35,5	BELIMO BEN
x 710	39	284	0,1926	25	BELIMO BEN	30,6	JOVENTA DAFx.20S	35,7	BELIMO BEN
x 750	59	304	0,2046	26	BELIMO BEN	31,6	JOVENTA DAFx.20S	36,9	BELIMO BEN
x 800	84	329	0,2196	27,2	BELIMO BEN	33	JOVENTA DAFx.20S	38,3	BELIMO BEN
355 x 180	-	19	0,0381	12,2	BELIMO BEN	15,2	BELIMO BFN	20,8	BELIMO BEN
x 200	-	29	0,0449	12,8	BELIMO BEN	15,8	BELIMO BFN	21,5	BELIMO BEN
x 225	-	41,5	0,0534	13,5	BELIMO BEN	16,5	BELIMO BFN	22,3	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
355 x 250	-	54	0,0619	14,2	BELIMO BEN	17,2	BELIMO BFN	23,2	BELIMO BEN
x 280	-	69	0,0721	15,1	BELIMO BEN	18,1	BELIMO BFN	24,2	BELIMO BEN
x 300	-	79	0,0789	15,7	BELIMO BEN	18,7	BELIMO BFN	24,9	BELIMO BEN
x 315	-	86,5	0,0840	16,1	BELIMO BEN	19,1	BELIMO BFN	25,4	BELIMO BEN
x 355	-	106,5	0,0976	17,2	BELIMO BEN	20,2	BELIMO BFN	26,7	BELIMO BEN
x 400	-	129	0,1129	18,5	BELIMO BEN	21,5	BELIMO BFN	28,2	BELIMO BEN
x 450	-	154	0,1299	19,9	BELIMO BEN	22,9	BELIMO BFN	29,9	BELIMO BEN
x 500	-	179	0,1469	21,3	BELIMO BEN	26,1	JOVENTA DAFx.20S	31,5	BELIMO BEN
x 550	-	204	0,1639	22,7	BELIMO BEN	27,5	JOVENTA DAFx.20S	33,1	BELIMO BEN
x 560	-	209	0,1673	23	BELIMO BEN	27,8	JOVENTA DAFx.20S	33,5	BELIMO BEN
x 600	-	229	0,1809	24,1	BELIMO BEN	28,9	JOVENTA DAFx.20S	34,8	BELIMO BEN
x 630	-	244	0,1911	25	BELIMO BEN	29,8	JOVENTA DAFx.20S	35,7	BELIMO BEN
x 650	9	254	0,1979	25,5	BELIMO BEN	30,4	JOVENTA DAFx.20S	36,4	BELIMO BEN
x 700	34	279	0,2149	26,9	BELIMO BEN	31,8	JOVENTA DAFx.20S	38	BELIMO BEN
x 710	39	284	0,2183	27,2	BELIMO BEN	32,1	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 750	59	304	0,2319	28,3	BELIMO BEN	33,2	JOVENTA DAFx.20S	39,6	BELIMO BEN
x 800	84	329	0,2489	29,7	BELIMO BEN	34,6	JOVENTA DAFx.20S	41,2	BELIMO BEE
400 x 180	-	19	0,0431	12,9	BELIMO BEN	16	BELIMO BFN	21,6	BELIMO BEN
x 200	-	29	0,0508	13,5	BELIMO BEN	16,7	BELIMO BFN	22,3	BELIMO BEN
x 225	-	41,5	0,0604	14,3	BELIMO BEN	17,4	BELIMO BFN	23,3	BELIMO BEN
x 250	-	54	0,0701	15,1	BELIMO BEN	18,2	BELIMO BFN	24,2	BELIMO BEN
x 280	-	69	0,0816	16,1	BELIMO BEN	19,1	BELIMO BFN	25,4	BELIMO BEN
x 300	-	79	0,0893	16,8	BELIMO BEN	19,7	BELIMO BFN	26,1	BELIMO BEN
x 315	-	86,5	0,0951	17,2	BELIMO BEN	20,1	BELIMO BFN	26,7	BELIMO BEN
x 355	-	106,5	0,1105	18,5	BELIMO BEN	21,3	BELIMO BFN	28,2	BELIMO BEN
x 400	-	129	0,1278	20	BELIMO BEN	22,7	BELIMO BFN	29,9	BELIMO BEN
x 450	-	154	0,1471	21,5	BELIMO BEN	24,2	BELIMO BFN	31,7	BELIMO BEN
x 500	-	179	0,1663	23,1	BELIMO BEN	27,5	JOVENTA DAFx.20S	33,6	BELIMO BEN
x 550	-	204	0,1856	24,7	BELIMO BEN	29	JOVENTA DAFx.20S	35,4	BELIMO BEN
x 560	-	209	0,1894	25	BELIMO BEN	29,3	JOVENTA DAFx.20S	35,8	BELIMO BEN
x 600	-	229	0,2048	26,2	BELIMO BEN	30,5	JOVENTA DAFx.20S	37,2	BELIMO BEN
x 630	-	244	0,2164	27,2	BELIMO BEN	31,4	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 650	9	254	0,2241	27,8	BELIMO BEN	31,9	JOVENTA DAFx.20S	39	BELIMO BEN
x 700	34	279	0,2433	29,3	BELIMO BEN	33,4	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 710	39	284	0,2472	29,7	BELIMO BEN	33,7	JOVENTA DAFx.20S	41,2	BELIMO BEN
x 750	59	304	0,2626	30,9	BELIMO BEN	34,9	JOVENTA DAFx.20S	42,6	BELIMO BEN
x 800	84	329	0,2818	32,4	BELIMO BEN	36,4	JOVENTA DAFx.20S	44,4	BELIMO BEE
450 x 180	-	19	0,0487	13,6	BELIMO BEN	17	BELIMO BFN	22,4	BELIMO BEN
x 200	-	29	0,0574	14,3	BELIMO BEN	17,6	BELIMO BFN	23,3	BELIMO BEN
x 225	-	41,5	0,0683	15,2	BELIMO BEN	18,4	BELIMO BFN	24,4	BELIMO BEN
x 250	-	54	0,0792	16,2	BELIMO BEN	19,2	BELIMO BFN	25,4	BELIMO BEN
x 280	-	69	0,0922	17,2	BELIMO BEN	20,2	BELIMO BFN	26,7	BELIMO BEN
x 300	-	79	0,1009	18	BELIMO BEN	20,8	BELIMO BFN	27,5	BELIMO BEN
x 315	-	86,5	0,1074	18,5	BELIMO BEN	21,3	BELIMO BFN	28,2	BELIMO BEN
x 355	-	106,5	0,1248	19,9	BELIMO BEN	22,6	BELIMO BFN	29,9	BELIMO BEN
x 400	-	129	0,1444	21,5	BELIMO BEN	24	BELIMO BFN	31,7	BELIMO BEN
x 450	-	154	0,1662	23,3	BELIMO BEN	27,4	JOVENTA DAFx.20S	33,8	BELIMO BEN
x 500	-	179	0,1879	25,1	BELIMO BEN	29	JOVENTA DAFx.20S	35,9	BELIMO BEN
x 550	-	204	0,2097	26,8	BELIMO BEN	30,6	JOVENTA DAFx.20S	37,9	BELIMO BEN
x 560	-	209	0,2140	27,2	BELIMO BEN	30,9	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 600	-	229	0,2314	28,6	BELIMO BEN	32,1	JOVENTA DAFx.20S	39,9	BELIMO BEN
x 630	-	244	0,2445	29,6	BELIMO BEN	33,1	JOVENTA DAFx.20S	41,1	BELIMO BEN
x 650	9	254	0,2532	30,3	BELIMO BEN	33,7	JOVENTA DAFx.20S	41,9	BELIMO BEN
x 700	34	279	0,2749	32	BELIMO BEN	35,3	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 710	39	284	0,2793	32,4	BELIMO BEN	35,6	JOVENTA DAFx.20S	44,3	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
450 x 750	59	304	0,2967	33,7	BELIMO BEN	36,9	JOVENTA DAFx.20S	45,9	BELIMO BEN
x 800	84	329	0,3184	35,4	BELIMO BEN	38,5	JOVENTA DAFx.20S	47,9	BELIMO BEE
500 x 180	-	19	0,0543	14,3	BELIMO BEN	17,9	BELIMO BFN	23,3	BELIMO BEN
x 200	-	29	0,0640	15,1	BELIMO BEN	18,6	BELIMO BFN	24,2	BELIMO BEN
x 225	-	41,5	0,0761	16,2	BELIMO BEN	19,4	BELIMO BFN	25,4	BELIMO BEN
x 250	-	54	0,0883	17,2	BELIMO BEN	20,3	BELIMO BFN	26,6	BELIMO BEN
x 280	-	69	0,1028	18,4	BELIMO BEN	21,3	BELIMO BFN	28	BELIMO BEN
x 300	-	79	0,1125	19,2	BELIMO BEN	22	BELIMO BFN	29	BELIMO BEN
x 315	-	86,5	0,1198	19,8	BELIMO BEN	22,5	BELIMO BFN	29,6	BELIMO BEN
x 355	-	106,5	0,1392	21,3	BELIMO BEN	23,8	BELIMO BFN	31,5	BELIMO BEN
x 400	-	129	0,1610	23,1	BELIMO BEN	25,3	BELIMO BFN	33,6	BELIMO BEN
x 450	-	154	0,1853	25,1	BELIMO BEN	28,8	JOVENTA DAFx.20S	35,9	BELIMO BEN
x 500	-	179	0,2095	27	BELIMO BEN	30,5	JOVENTA DAFx.20S	38,1	BELIMO BEN
x 550	-	204	0,2338	29	BELIMO BEN	32,1	JOVENTA DAFx.20S	40,4	BELIMO BEN
x 560	-	209	0,2386	29,3	BELIMO BEN	32,5	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 600	-	229	0,2580	30,9	BELIMO BEN	33,8	JOVENTA DAFx.20S	42,6	BELIMO BEN
x 630	-	244	0,2726	32	BELIMO BEN	34,8	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 650	9	254	0,2823	32,8	BELIMO BEN	35,5	JOVENTA DAFx.20S	44,8	BELIMO BEN
x 700	34	279	0,3065	34,7	BELIMO BEN	37,2	JOVENTA DAFx.20S	47	BELIMO BEN
x 710	39	284	0,3114	35,1	BELIMO BEN	37,5	JOVENTA DAFx.20S	47,4	BELIMO BEN
x 750	59	304	0,3308	36,6	BELIMO BEN	38,8	JOVENTA DAFx.20S	49,2	BELIMO BEN
x 800	84	329	0,3550	38,4	BELIMO BEN	40,5	JOVENTA DAFx.20S	51,3	BELIMO BEE
550 x 180	-	19	0,0599	15,1	BELIMO BEN	18,8	BELIMO BFN	24,1	BELIMO BEN
x 200	-	29	0,0706	16	BELIMO BEN	19,5	BELIMO BFN	25,2	BELIMO BEN
x 225	-	41,5	0,0840	17,1	BELIMO BEN	20,4	BELIMO BFN	26,5	BELIMO BEN
x 250	-	54	0,0974	18,2	BELIMO BEN	21,3	BELIMO BFN	27,8	BELIMO BEN
x 280	-	69	0,1134	19,5	BELIMO BEN	22,4	BELIMO BFN	29,3	BELIMO BEN
x 300	-	79	0,1241	20,4	BELIMO BEN	23,1	BELIMO BFN	30,3	BELIMO BEN
x 315	-	86,5	0,1321	21	BELIMO BEN	23,6	BELIMO BFN	31,1	BELIMO BEN
x 355	-	106,5	0,1535	22,7	BELIMO BEN	25	BELIMO BFN	33,1	BELIMO BEN
x 400	-	129	0,1776	24,7	BELIMO BEN	28,4	JOVENTA DAFx.20S	35,4	BELIMO BEN
x 450	-	154	0,2044	26,8	BELIMO BEN	30,2	JOVENTA DAFx.20S	37,9	BELIMO BEN
x 500	-	179	0,2311	29	BELIMO BEN	32	JOVENTA DAFx.20S	40,4	BELIMO BEN
x 550	-	204	0,2579	31,1	BELIMO BEN	33,7	JOVENTA DAFx.20S	42,8	BELIMO BEN
x 560	-	209	0,2632	31,5	BELIMO BEN	34,1	JOVENTA DAFx.20S	43,3	BELIMO BEN
x 600	-	229	0,2846	33,2	BELIMO BEN	35,5	JOVENTA DAFx.20S	45,3	BELIMO BEN
x 630	-	244	0,3007	34,4	BELIMO BEN	36,5	JOVENTA DAFx.20S	46,7	BELIMO BEN
x 650	9	254	0,3114	35,2	BELIMO BEN	37,2	JOVENTA DAFx.20S	47,7	BELIMO BEN
x 700	34	279	0,3381	37,3	BELIMO BEN	39	JOVENTA DAFx.20S	50	BELIMO BEN
x 710	39	284	0,3435	37,7	BELIMO BEN	39,4	JOVENTA DAFx.20S	50,5	BELIMO BEN
x 750	59	304	0,3649	39,4	BELIMO BEN	40,8	JOVENTA DAFx.20S	52,4	BELIMO BEE
x 800	84	329	0,3916	41,4	BELIMO BEN	42,5	JOVENTA DAFx.20S	54,7	BELIMO BEE
560 x 180	-	19	0,0610	15,2	BELIMO BEN	18,9	BELIMO BFN	24,3	BELIMO BEN
x 200	-	29	0,0719	16,1	BELIMO BEN	19,7	BELIMO BFN	25,4	BELIMO BEN
x 225	-	41,5	0,0856	17,2	BELIMO BEN	20,6	BELIMO BFN	26,7	BELIMO BEN
x 250	-	54	0,0992	18,4	BELIMO BEN	21,5	BELIMO BFN	28	BELIMO BEN
x 280	-	69	0,1155	19,7	BELIMO BEN	22,6	BELIMO BFN	29,6	BELIMO BEN
x 300	-	79	0,1264	20,6	BELIMO BEN	23,3	BELIMO BFN	30,6	BELIMO BEN
x 315	-	87	0,1346	21,3	BELIMO BEN	23,9	BELIMO BFN	31,4	BELIMO BEN
x 355	-	106,5	0,1564	23	BELIMO BEN	25,3	BELIMO BFN	33,5	BELIMO BEN
x 400	-	129	0,1809	25	BELIMO BEN	28,7	JOVENTA DAFx.20S	35,8	BELIMO BEN
x 450	-	154	0,2082	27,2	BELIMO BEN	30,5	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 500	-	179	0,2354	29,3	BELIMO BEN	32,3	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 550	-	204	0,2627	31,5	BELIMO BEN	34	JOVENTA DAFx.20S	43,3	BELIMO BEN
x 560	-	209	0,2681	31,9	BELIMO BEN	34,4	JOVENTA DAFx.20S	43,8	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
560 x 600	-	229	0,2899	33,6	BELIMO BEN	35,8	JOVENTA DAFx.20S	45,8	BELIMO BEN
x 630	-	244	0,3063	34,9	BELIMO BEN	36,9	JOVENTA DAFx.20S	47,2	BELIMO BEN
x 650	9	254	0,3172	35,7	BELIMO BEN	37,6	JOVENTA DAFx.20S	48,2	BELIMO BEN
x 700	34	279	0,3444	37,8	BELIMO BEN	39,4	JOVENTA DAFx.20S	50,6	BELIMO BEN
x 710	39	284	0,3499	38,3	BELIMO BEN	39,7	JOVENTA DAFx.20S	51,1	BELIMO BEN
x 750	59	304	0,3717	39,9	BELIMO BEN	41,2	JOVENTA DAFx.20S	53	BELIMO BEE
x 800	84	329	0,3989	42	BELIMO BEN	42,9	JOVENTA DAFx.20S	55,4	BELIMO BEE
600 x 180	-	19	0,0655	15,8	BELIMO BEN	19,7	BELIMO BFN	25	BELIMO BEN
x 200	-	29	0,0772	16,8	BELIMO BEN	20,5	BELIMO BFN	26,1	BELIMO BEN
x 225	-	41,5	0,0918	18	BELIMO BEN	21,4	BELIMO BFN	27,5	BELIMO BEN
x 250	-	54	0,1065	19,2	BELIMO BEN	22,4	BELIMO BFN	29	BELIMO BEN
x 280	-	69	0,1240	20,6	BELIMO BEN	23,5	BELIMO BFN	30,6	BELIMO BEN
x 300	-	79	0,1357	21,5	BELIMO BEN	24,2	BELIMO BFN	31,7	BELIMO BEN
x 315	-	86,5	0,1445	22,3	BELIMO BEN	24,8	BELIMO BFN	32,6	BELIMO BEN
x 355	-	106,5	0,1679	24,1	BELIMO BEN	26,3	BELIMO BFN	34,8	BELIMO BEN
x 400	-	129	0,1942	26,2	BELIMO BEN	29,8	JOVENTA DAFx.20S	37,2	BELIMO BEN
x 450	-	154	0,2235	28,6	BELIMO BEN	31,6	JOVENTA DAFx.20S	39,9	BELIMO BEN
x 500	-	179	0,2527	30,9	BELIMO BEN	33,5	JOVENTA DAFx.20S	42,6	BELIMO BEN
x 550	-	204	0,2820	33,2	BELIMO BEN	35,3	JOVENTA DAFx.20S	45,3	BELIMO BEN
x 560	-	209	0,2878	33,6	BELIMO BEN	35,7	JOVENTA DAFx.20S	45,8	BELIMO BEN
x 600	-	229	0,3112	35,4	BELIMO BEN	37,2	JOVENTA DAFx.20S	47,9	BELIMO BEN
x 630	-	244	0,3288	36,8	BELIMO BEN	38,3	JOVENTA DAFx.20S	49,4	BELIMO BEN
x 650	9	254	0,3405	37,7	BELIMO BEN	39	JOVENTA DAFx.20S	50,5	BELIMO BEN
x 700	34	279	0,3697	39,9	BELIMO BEN	40,9	JOVENTA DAFx.20S	53	BELIMO BEN
x 710	39	284	0,3756	40,4	BELIMO BEN	41,2	JOVENTA DAFx.20S	53,5	BELIMO BEE
x 750	59	304	0,3990	42,1	BELIMO BEN	42,7	JOVENTA DAFx.20S	55,6	BELIMO BEE
x 800	84	329	0,4282	44,3	BELIMO BEN	44,6	JOVENTA DAFx.20S	58,1	BELIMO BEE
630 x 180	-	19	0,0689	16,2	BELIMO BEN	20,2	BELIMO BFN	25,5	BELIMO BEN
x 200	-	29	0,0812	17,2	BELIMO BEN	21,1	BELIMO BFN	26,7	BELIMO BEN
x 225	-	41,5	0,0966	18,5	BELIMO BEN	22	BELIMO BFN	28,2	BELIMO BEN
x 250	-	54	0,1119	19,8	BELIMO BEN	23	BELIMO BFN	29,6	BELIMO BEN
x 280	-	69	0,1304	21,3	BELIMO BEN	24,1	BELIMO BFN	31,4	BELIMO BEN
x 300	-	79	0,1427	22,3	BELIMO BEN	24,9	BELIMO BFN	32,6	BELIMO BEN
x 315	-	86,5	0,1519	23	BELIMO BEN	25,5	BELIMO BFN	33,4	BELIMO BEN
x 355	-	106,5	0,1765	25	BELIMO BEN	27	BELIMO BFN	35,7	BELIMO BEN
x 400	-	129	0,2042	27,2	BELIMO BEN	30,5	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 450	-	154	0,2349	29,6	BELIMO BEN	32,4	JOVENTA DAFx.20S	41,1	BELIMO BEN
x 500	-	179	0,2657	32	BELIMO BEN	34,4	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 550	-	204	0,2964	34,4	BELIMO BEN	36,3	JOVENTA DAFx.20S	46,7	BELIMO BEN
x 560	-	209	0,3026	34,9	BELIMO BEN	36,6	JOVENTA DAFx.20S	47,2	BELIMO BEN
x 600	-	229	0,3272	36,8	BELIMO BEN	38,2	JOVENTA DAFx.20S	49,4	BELIMO BEN
x 630	-	244	0,3456	38,2	BELIMO BEN	39,3	JOVENTA DAFx.20S	51,1	BELIMO BEN
x 650	9	254	0,3579	39,1	BELIMO BEN	40,1	JOVENTA DAFx.20S	52,1	BELIMO BEN
x 700	34	279	0,3887	41,5	BELIMO BEN	42	JOVENTA DAFx.20S	54,8	BELIMO BEN
x 710	39	284	0,3948	41,9	BELIMO BEN	42,4	JOVENTA DAFx.20S	55,3	BELIMO BEE
x 750	59	304	0,4194	43,8	BELIMO BEN	43,9	JOVENTA DAFx.20S	57,4	BELIMO BEE
x 800	84	329	0,4502	46,1	BELIMO BEN	45,8	JOVENTA DAFx.20S	60,1	BELIMO BE
650 x 180	-	19	0,0711	16,5	BELIMO BEN	20,6	BELIMO BFN	25,9	BELIMO BEN
x 200	-	29	0,0838	17,6	BELIMO BEN	21,4	BELIMO BFN	27,1	BELIMO BEN
x 225	-	41,5	0,0997	18,9	BELIMO BEN	22,5	BELIMO BFN	28,6	BELIMO BEN
x 250	-	54	0,1156	20,2	BELIMO BEN	23,4	BELIMO BFN	30,1	BELIMO BEN
x 280	-	69	0,1346	21,7	BELIMO BEN	24,6	BELIMO BFN	31,9	BELIMO BEN
x 300	-	79	0,1473	22,7	BELIMO BEN	25,4	BELIMO BFN	33,1	BELIMO BEN
x 315	-	86,5	0,1568	23,5	BELIMO BEN	25,9	BELIMO BFN	34	BELIMO BEN
x 355	-	106,5	0,1822	25,5	BELIMO BEN	27,5	BELIMO BFN	36,4	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
650 x 400	-	129	0,2108	27,8	BELIMO BEN	31,1	JOVENTA DAFx.20S	39	BELIMO BEN
x 450	-	154	0,2426	30,3	BELIMO BEN	33	JOVENTA DAFx.20S	41,9	BELIMO BEN
x 500	-	179	0,2743	32,8	BELIMO BEN	35	JOVENTA DAFx.20S	44,8	BELIMO BEN
x 550	-	204	0,3061	35,2	BELIMO BEN	36,9	JOVENTA DAFx.20S	47,7	BELIMO BEN
x 560	-	209	0,3124	35,7	BELIMO BEN	37,3	JOVENTA DAFx.20S	48,2	BELIMO BEN
x 600	-	229	0,3378	37,7	BELIMO BEN	38,8	JOVENTA DAFx.20S	50,5	BELIMO BEN
x 630	-	244	0,3569	39,1	BELIMO BEN	40	JOVENTA DAFx.20S	52,1	BELIMO BEN
x 650	9	254	0,3696	40,1	BELIMO BEN	40,8	JOVENTA DAFx.20S	53,2	BELIMO BEN
x 700	34	279	0,4013	42,5	BELIMO BEN	42,7	JOVENTA DAFx.20S	56	BELIMO BEE
x 710	39	284	0,4077	43	BELIMO BEN	43,1	JOVENTA DAFx.20S	56,5	BELIMO BEE
x 750	59	304	0,4331	44,9	BELIMO BEN	44,7	JOVENTA DAFx.20S	58,7	BELIMO BEE
x 800	84	329	0,4648	47,2	BELIMO BEN	46,6	JOVENTA DAFx.20S	61,4	BELIMO BE
700 x 180	-	19	0,0767	17,2	BELIMO BEN	21,5	BELIMO BFN	26,7	BELIMO BEN
x 200	-	29	0,0904	18,4	BELIMO BEN	22,4	BELIMO BFN	28	BELIMO BEN
x 225	-	41,5	0,1075	19,8	BELIMO BEN	23,5	BELIMO BFN	29,6	BELIMO BEN
x 250	-	54	0,1247	21,1	BELIMO BEN	24,5	BELIMO BFN	31,3	BELIMO BEN
x 280	-	69	0,1452	22,8	BELIMO BEN	25,7	BELIMO BFN	33,2	BELIMO BEN
x 300	-	79	0,1589	23,9	BELIMO BEN	26,5	BELIMO BFN	34,5	BELIMO BEN
x 315	-	86,5	0,1692	24,7	BELIMO BEN	27,1	BELIMO BFN	35,5	BELIMO BEN
x 355	-	106,5	0,1966	26,9	BELIMO BEN	30,6	JOVENTA DAFx.20S	38	BELIMO BEN
x 400	-	129	0,2274	29,3	BELIMO BEN	32,4	JOVENTA DAFx.20S	40,8	BELIMO BEN
x 450	-	154	0,2617	32	BELIMO BEN	34,4	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 500	-	179	0,2959	34,7	BELIMO BEN	36,4	JOVENTA DAFx.20S	47	BELIMO BEN
x 550	-	204	0,3302	37,3	BELIMO BEN	38,5	JOVENTA DAFx.20S	50	BELIMO BEN
x 560	-	209	0,3370	37,8	BELIMO BEN	38,9	JOVENTA DAFx.20S	50,6	BELIMO BEN
x 600	-	229	0,3644	39,9	BELIMO BEN	40,5	JOVENTA DAFx.20S	53	BELIMO BEN
x 630	-	244	0,3850	41,5	BELIMO BEN	41,7	JOVENTA DAFx.20S	54,8	BELIMO BEN
x 650	9	254	0,3987	42,5	BELIMO BEN	42,5	JOVENTA DAFx.20S	56	BELIMO BEE
x 700	34	279	0,4329	45,1	BELIMO BEN	44,6	JOVENTA DAFx.20S	58,9	BELIMO BEE
x 710	39	284	0,4398	45,6	BELIMO BEN	45	JOVENTA DAFx.20S	59,5	BELIMO BEE
x 750	59	304	0,4672	47,6	BELIMO BEN	46,6	JOVENTA DAFx.20S	61,8	BELIMO BEE
x 800	84	329	0,5014	50,1	BELIMO BEN	48,6	JOVENTA DAFx.20S	64,6	BELIMO BE
710 x 180	-	19	0,0778	17,4	BELIMO BEN	21,7	BELIMO BFN	26,9	BELIMO BEN
x 200	-	29	0,0917	18,5	BELIMO BEN	22,6	BELIMO BFN	28,2	BELIMO BEN
x 225	-	41,5	0,1091	19,9	BELIMO BEN	23,7	BELIMO BFN	29,9	BELIMO BEN
x 250	-	54	0,1265	21,3	BELIMO BEN	24,7	BELIMO BFN	31,5	BELIMO BEN
x 280	-	69	0,1473	23	BELIMO BEN	25,9	BELIMO BFN	33,5	BELIMO BEN
x 300	-	79	0,1612	24,1	BELIMO BEN	26,7	BELIMO BFN	34,8	BELIMO BEN
x 315	-	86,5	0,1717	25	BELIMO BEN	27,3	BELIMO BFN	35,7	BELIMO BEN
x 355	-	106,5	0,1995	27,2	BELIMO BEN	30,8	JOVENTA DAFx.20S	38,3	BELIMO BEN
x 400	-	129	0,2307	29,7	BELIMO BEN	32,6	JOVENTA DAFx.20S	41,2	BELIMO BEN
x 450	-	154	0,2655	32,4	BELIMO BEN	34,7	JOVENTA DAFx.20S	44,3	BELIMO BEN
x 500	-	179	0,3002	35,1	BELIMO BEN	36,7	JOVENTA DAFx.20S	47,4	BELIMO BEN
x 550	-	204	0,3350	37,7	BELIMO BEN	38,8	JOVENTA DAFx.20S	50,5	BELIMO BEN
x 560	-	209	0,3419	38,3	BELIMO BEN	39,2	JOVENTA DAFx.20S	51,1	BELIMO BEN
x 600	-	229	0,3697	40,4	BELIMO BEN	40,8	JOVENTA DAFx.20S	53,5	BELIMO BEN
x 630	-	244	0,3906	41,9	BELIMO BEN	42,1	JOVENTA DAFx.20S	55,3	BELIMO BEN
x 650	9	254	0,4045	43	BELIMO BEN	42,9	JOVENTA DAFx.20S	56,5	BELIMO BEE
x 700	34	279	0,4392	45,6	BELIMO BEN	45	JOVENTA DAFx.20S	59,5	BELIMO BEE
x 710	39	284	0,4462	46,1	BELIMO BEN	45,4	JOVENTA DAFx.20S	60,1	BELIMO BEE
x 750	59	304	0,4740	48,1	BELIMO BEN	47	JOVENTA DAFx.20S	62,4	BELIMO BE
x 800	84	329	0,5087	50,6	BELIMO BEN	49,1	JOVENTA DAFx.20S	65,3	BELIMO BE
750 x 180	-	19	0,0823	18	BELIMO BEN	22,4	BELIMO BFN	27,5	BELIMO BEN
x 200	-	29	0,0970	19,2	BELIMO BEN	23,3	BELIMO BFN	29	BELIMO BEN
x 225	-	41,5	0,1154	20,6	BELIMO BEN	24,5	BELIMO BFN	30,7	BELIMO BEN

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
750 x 250	-	54	0,1338	22,1	BELIMO BEN	25,5	BELIMO BFN	32,4	BELIMO BEN
x 280	-	69	0,1558	23,9	BELIMO BEN	26,8	BELIMO BFN	34,5	BELIMO BEN
x 300	-	79	0,1705	25,1	BELIMO BEN	27,6	BELIMO BFN	35,9	BELIMO BEN
x 315	-	86,5	0,1815	26	BELIMO BEN	28,3	BELIMO BFN	36,9	BELIMO BEN
x 355	-	106,5	0,2109	28,3	BELIMO BEN	31,8	JOVENTA DAFx.20S	39,6	BELIMO BEN
x 400	-	129	0,2440	30,9	BELIMO BEN	33,7	JOVENTA DAFx.20S	42,6	BELIMO BEN
x 450	-	154	0,2808	33,7	BELIMO BEN	35,8	JOVENTA DAFx.20S	45,9	BELIMO BEN
x 500	-	179	0,3175	36,6	BELIMO BEN	37,9	JOVENTA DAFx.20S	49,2	BELIMO BEN
x 550	-	204	0,3543	39,4	BELIMO BEN	40,1	JOVENTA DAFx.20S	52,4	BELIMO BEN
x 560	-	209	0,3616	39,9	BELIMO BEN	40,5	JOVENTA DAFx.20S	53	BELIMO BEN
x 600	-	229	0,3910	42,1	BELIMO BEN	42,2	JOVENTA DAFx.20S	55,6	BELIMO BEN
x 630	-	244	0,4131	43,8	BELIMO BEN	43,5	JOVENTA DAFx.20S	57,4	BELIMO BEN
x 650	9	254	0,4278	44,9	BELIMO BEN	44,3	JOVENTA DAFx.20S	58,7	BELIMO BEE
x 700	34	279	0,4645	47,6	BELIMO BEN	46,4	JOVENTA DAFx.20S	61,8	BELIMO BEE
x 710	39	284	0,4719	48,1	BELIMO BEN	46,9	JOVENTA DAFx.20S	62,4	BELIMO BEE
x 750	59	304	0,5013	50,3	BELIMO BEN	48,6	JOVENTA DAFx.20S	64,8	BELIMO BE
x 800	84	329	0,5380	52,9	BELIMO BEN	50,7	JOVENTA DAFx.20S	67,8	BELIMO BE
800 x 180	-	19	0,0879	18,7	BELIMO BEN	23,3	BELIMO BFN	28,4	BELIMO BEN
x 200	-	29	0,1036	20	BELIMO BEN	24,3	BELIMO BFN	29,9	BELIMO BEN
x 225	-	41,5	0,1232	21,5	BELIMO BEN	25,5	BELIMO BFN	31,7	BELIMO BEN
x 250	-	54	0,1429	23,1	BELIMO BEN	26,6	BELIMO BFN	33,6	BELIMO BEN
x 280	-	69	0,1664	25	BELIMO BEN	27,9	BELIMO BFN	35,8	BELIMO BEN
x 300	-	79	0,1821	26,2	BELIMO BEN	28,8	BELIMO BFN	37,2	BELIMO BEN
x 315	-	86,5	0,1939	27,2	BELIMO BEN	29,4	BELIMO BFN	38,3	BELIMO BEN
x 355	-	106,5	0,2253	29,7	BELIMO BEN	33	JOVENTA DAFx.20S	41,2	BELIMO BEN
x 400	-	129	0,2606	32,4	BELIMO BEN	35	JOVENTA DAFx.20S	44,4	BELIMO BEN
x 450	-	154	0,2999	35,4	BELIMO BEN	37,2	JOVENTA DAFx.20S	47,9	BELIMO BEN
x 500	-	179	0,3391	38,4	BELIMO BEN	39,4	JOVENTA DAFx.20S	51,3	BELIMO BEN
x 550	-	204	0,3784	41,4	BELIMO BEN	41,7	JOVENTA DAFx.20S	54,7	BELIMO BEN
x 560	-	209	0,3862	42	BELIMO BEN	42,1	JOVENTA DAFx.20S	55,4	BELIMO BEN
x 600	-	229	0,4176	44,3	BELIMO BEN	43,9	JOVENTA DAFx.20S	58,1	BELIMO BEN
x 630	-	244	0,4412	46,1	BELIMO BEN	45,2	JOVENTA DAFx.20S	60,1	BELIMO BEE
x 650	9	254	0,4569	47,2	BELIMO BEN	46,1	JOVENTA DAFx.20S	61,4	BELIMO BEE
x 700	34	279	0,4961	50,1	BELIMO BEN	48,3	JOVENTA DAFx.20S	64,6	BELIMO BEE
x 710	39	284	0,5040	50,6	BELIMO BEN	48,7	JOVENTA DAFx.20S	65,3	BELIMO BE
x 750	59	304	0,5354	52,9	BELIMO BEN	50,5	JOVENTA DAFx.20S	67,8	BELIMO BE
x 800	84	329	0,5746	55,7	BELIMO BEN	52,7	JOVENTA DAFx.20S	71	BELIMO BE
900 x 180	-	19	0,0991	20,1	BELIMO BEN	25,1	BELIMO BFN	30,1	BELIMO BEN
x 200	-	29	0,1168	21,5	BELIMO BEN	26,2	BELIMO BFN	31,7	BELIMO BEN
x 225	-	41,5	0,1389	23,3	BELIMO BEN	27,5	BELIMO BFN	33,8	BELIMO BEN
x 250	-	54	0,1611	25,1	BELIMO BEN	28,7	BELIMO BFN	35,9	BELIMO BEN
x 280	-	69	0,1876	27,2	BELIMO BEN	30,1	BELIMO BFN	38,3	BELIMO BEN
x 300	-	79	0,2053	28,6	BELIMO BEN	31	BELIMO BFN	39,9	BELIMO BEN
x 315	-	86,5	0,2186	29,6	BELIMO BEN	33,6	JOVENTA DAFx.20S	41,1	BELIMO BEN
x 355	-	106,5	0,2540	32,4	BELIMO BEN	35,5	JOVENTA DAFx.20S	44,3	BELIMO BEN
x 400	-	129	0,2938	35,4	BELIMO BEN	37,7	JOVENTA DAFx.20S	47,9	BELIMO BEN
x 450	-	154	0,3381	38,8	BELIMO BEN	40	JOVENTA DAFx.20S	51,7	BELIMO BEN
x 500	-	179	0,3823	42,1	BELIMO BEN	42,4	JOVENTA DAFx.20S	55,6	BELIMO BEN
x 550	-	204	0,4266	45,4	BELIMO BEN	44,8	JOVENTA DAFx.20S	59,3	BELIMO BEN
x 560	-	209	0,4354	46,1	BELIMO BEN	45,3	JOVENTA DAFx.20S	60,1	BELIMO BEE
x 600	-	229	0,4708	48,7	BELIMO BEN	47,2	JOVENTA DAFx.20S	63	BELIMO BEE
x 630	-	244	0,4974	50,6	BELIMO BEN	48,7	JOVENTA DAFx.20S	65,2	BELIMO BEE
x 650	9	254	0,5151	51,9	BELIMO BEN	49,6	JOVENTA DAFx.20S	66,6	BELIMO BEE
x 700	34	279	0,5593	55	BELIMO BEN	52	JOVENTA DAFx.20S	70,2	BELIMO BE
x 710	39	284	0,5682	55,6	BELIMO BEN	52,5	JOVENTA DAFx.20S	70,9	BELIMO BE

A x B [mm]	Overlaps		Free area S _f [m²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
900 x 750	59	304	0,6036	58,1	BELIMO BEN	54,4	JOVENTA DAFx.20S	73,7	BELIMO BE
x 800	84	329	0,6478	61,2	BELIMO BEN	56,8	JOVENTA DAFx.20S	77,1	BELIMO BE
1000 x 180	-	19	0,1103	21,5	BELIMO BEN	26,9	BELIMO BFN	31,7	BELIMO BEN
x 200	-	29	0,1300	23,1	BELIMO BEN	28,1	BELIMO BFN	33,6	BELIMO BEN
x 225	-	41,5	0,1546	25,1	BELIMO BEN	29,5	BELIMO BFN	35,9	BELIMO BEN
x 250	-	54	0,1793	27	BELIMO BEN	30,8	BELIMO BFN	38,1	BELIMO BEN
x 280	-	69	0,2088	29,3	BELIMO BEN	32,4	BELIMO BFN	40,8	BELIMO BEN
x 300	-	79	0,2285	30,9	BELIMO BEN	35,2	JOVENTA DAFx.20S	42,6	BELIMO BEN
x 315	-	86,5	0,2433	32	BELIMO BEN	36	JOVENTA DAFx.20S	43,9	BELIMO BEN
x 355	-	106,5	0,2827	35,1	BELIMO BEN	38,1	JOVENTA DAFx.20S	47,4	BELIMO BEN
x 400	-	129	0,3270	38,4	BELIMO BEN	40,5	JOVENTA DAFx.20S	51,3	BELIMO BEN
x 450	-	154	0,3763	42,1	BELIMO BEN	43,1	JOVENTA DAFx.20S	55,6	BELIMO BEN
x 500	-	179	0,4255	45,8	BELIMO BEN	45,7	JOVENTA DAFx.20S	59,7	BELIMO BEN
x 550	-	204	0,4748	49,4	BELIMO BEN	48,3	JOVENTA DAFx.20S	63,8	BELIMO BEE
x 560	-	209	0,4846	50,1	BELIMO BEN	48,8	JOVENTA DAFx.20S	64,6	BELIMO BEE
x 600	-	229	0,5240	52,9	BELIMO BEN	50,9	JOVENTA DAFx.20S	67,8	BELIMO BEE
x 630	-	244	0,5536	55	BELIMO BEN	52,5	JOVENTA DAFx.20S	70,2	BELIMO BEE
x 650	9	254	0,5733	56,4	BELIMO BEN	53,5	JOVENTA DAFx.20S	71,7	BELIMO BE
x 700	34	279	0,6225	59,8	BELIMO BEN	56,2	JOVENTA DAFx.20S	75,6	BELIMO BE
x 710	39	284	0,6324	60,5	BELIMO BEN	56,7	JOVENTA DAFx.20S	76,4	BELIMO BE
x 750	59	304	0,6718	63,2	BELIMO BEN	58,8	JOVENTA DAFx.20S	79,4	BELIMO BE
x 800	84	329	0,7210	66,5	BELIMO BEN	61,4	JOVENTA DAFx.20S	83,1	BELIMO BE
1100 x 180	-	19	0,1215	23	BELIMO BEN	28,7	BELIMO BFN	33,4	BELIMO BEN
x 200	-	29	0,1432	24,7	BELIMO BEN	30	BELIMO BFN	35,4	BELIMO BEN
x 225	-	41,5	0,1703	26,8	BELIMO BEN	31,5	BELIMO BFN	37,9	BELIMO BEN
x 250	-	54	0,1975	29	BELIMO BEN	32,9	BELIMO BFN	40,4	BELIMO BEN
x 280	-	69	0,2300	31,5	BELIMO BEN	34,6	BELIMO BFN	43,3	BELIMO BEN
x 300	-	79	0,2517	33,2	BELIMO BEN	37,5	JOVENTA DAFx.20S	45,3	BELIMO BEN
x 315	-	86,5	0,2680	34,4	BELIMO BEN	38,3	JOVENTA DAFx.20S	46,7	BELIMO BEN
x 355	-	106,5	0,3114	37,7	BELIMO BEN	40,6	JOVENTA DAFx.20S	50,5	BELIMO BEN
x 400	-	129	0,3602	41,4	BELIMO BEN	43,1	JOVENTA DAFx.20S	54,7	BELIMO BEN
x 450	-	154	0,4145	45,4	BELIMO BEN	45,9	JOVENTA DAFx.20S	59,3	BELIMO BEN
x 500	-	179	0,4687	49,4	BELIMO BEN	48,7	JOVENTA DAFx.20S	63,8	BELIMO BEE
x 550	-	204	0,5230	53,3	BELIMO BEN	51,5	JOVENTA DAFx.20S	68,2	BELIMO BEE
x 560	-	209	0,5338	54	BELIMO BEN	52	JOVENTA DAFx.20S	69,1	BELIMO BEE
x 600	-	229	0,5772	57,1	BELIMO BEN	54,3	JOVENTA DAFx.20S	72,5	BELIMO BEE
x 630	-	244	0,6098	59,4	BELIMO BEN	56	JOVENTA DAFx.20S	75,1	BELIMO BE
x 650	9	254	0,6315	60,9	BELIMO BEN	57,1	JOVENTA DAFx.20S	76,7	BELIMO BE
x 700	34	279	0,6857	64,6	BELIMO BEN	59,9	JOVENTA DAFx.20S	80,9	BELIMO BE
x 710	39	284	0,6966	65,3	BELIMO BEN	60,4	JOVENTA DAFx.20S	81,7	BELIMO BE
x 750	59	304	0,7400	68,2	BELIMO BEN	62,7	JOVENTA DAFx.20S	84,9	BELIMO BE
x 800	84	329	0,7942	71,8	BELIMO BEN	65,5	JOVENTA DAFx.20S	88,8	BELIMO BE
1250 x 180	-	19	0,1383	25,1	BELIMO BEN	31,4	BELIMO BFN	35,9	BELIMO BEN
x 200	-	29	0,1630	27	BELIMO BEN	32,8	BELIMO BFN	38,1	BELIMO BEN
x 225	-	41,5	0,1939	29,4	BELIMO BEN	34,5	BELIMO BFN	40,9	BELIMO BEN
x 250	-	54	0,2248	31,8	BELIMO BEN	36	BELIMO BFN	43,7	BELIMO BEN
x 280	-	69	0,2618	34,7	BELIMO BEN	39,7	JOVENTA DAFx.20S	47	BELIMO BEN
x 300	-	79	0,2865	36,6	BELIMO BEN	40,9	JOVENTA DAFx.20S	49,2	BELIMO BEN
x 315	-	87	0,3050	38	BELIMO BEN	41,8	JOVENTA DAFx.20S	50,8	BELIMO BEN
x 355	-	106,5	0,3544	41,7	BELIMO BEN	44,3	JOVENTA DAFx.20S	55	BELIMO BEN
x 400	-	129	0,4100	45,8	BELIMO BEN	47	JOVENTA DAFx.20S	59,7	BELIMO BEN
x 450	-	154	0,4718	50,3	BELIMO BEN	50,1	JOVENTA DAFx.20S	64,8	BELIMO BEN
x 500	-	179	0,5335	54,7	BELIMO BEN	53,2	JOVENTA DAFx.20S	69,8	BELIMO BEE
x 550	-	204	0,5953	59	BELIMO BEN	56,2	JOVENTA DAFx.20S	74,6	BELIMO BEE
x 560	-	209	0,6076	59,8	BELIMO BEN	56,8	JOVENTA DAFx.20S	75,6	BELIMO BEE

A x B [mm]	Overlaps		Free area S _f [m ²]	MSD-W		MSD-W with electromagnet		MSD	
	a [mm]	c [mm]		weight [kg]	actuating	weight [kg]	actuating	weight [kg]	actuating
1250 x 600	-	229	0,6570	63,2	BELIMO BEN	59,3	JOVENTA DAFx.20S	79,4	BELIMO BE
x 630	-	244	0,6941	65,7	BELIMO BEN	61,1	JOVENTA DAFx.20S	82,1	BELIMO BE
x 650	9	254	0,7188	67,4	BELIMO BEN	62,4	JOVENTA DAFx.20S	84	BELIMO BE
x 700	34	279	0,7805	71,4	BELIMO BEN	65,4	JOVENTA DAFx.20S	88,5	BELIMO BE
x 710	39	284	0,7929	72,2	BELIMO BEN	66,1	JOVENTA DAFx.20S	89,3	BELIMO BE
x 750	59	304	0,8423	75,4	BELIMO BEN	68,5	JOVENTA DAFx.20S	92,8	BELIMO BE
x 800	84	329	0,9040	79,3	BELIMO BEN	71,6	JOVENTA DAFx.20S	97,1	BELIMO BE
1400 x 180	-	19	0,1551	27,2	BELIMO BEN	34,2	BELIMO BFN	38,3	BELIMO BEN
x 200	-	29	0,1828	29,3	BELIMO BEN	35,7	BELIMO BFN	40,8	BELIMO BEN
x 225	-	41,5	0,2174	32	BELIMO BEN	37,5	BELIMO BFN	43,9	BELIMO BEN
x 250	-	54	0,2521	34,7	BELIMO BEN	41	JOVENTA DAF2.20S	47	BELIMO BEN
x 280	-	69	0,2936	37,8	BELIMO BEN	43	JOVENTA DAF2.20S	50,6	BELIMO BEN
x 300	-	79	0,3213	39,9	BELIMO BEN	44,3	JOVENTA DAF2.20S	53	BELIMO BEN
x 315	-	86,5	0,3421	41,5	BELIMO BEN	45,3	JOVENTA DAF2.20S	54,8	BELIMO BEN
x 355	-	106,5	0,3975	45,6	BELIMO BEN	48	JOVENTA DAF2.20S	59,5	BELIMO BEN
x 400	-	129	0,4598	50,1	BELIMO BEN	51	JOVENTA DAF2.20S	64,6	BELIMO BEN
x 450	-	154	0,5291	55	BELIMO BEN	54,3	JOVENTA DAF2.20S	70,2	BELIMO BEE
x 500	-	179	0,5983	59,8	BELIMO BEN	57,7	JOVENTA DAF2.20S	75,6	BELIMO BEE
x 550	-	204	0,6676	64,6	BELIMO BEN	61	JOVENTA DAF2.20S	80,9	BELIMO BE
x 560	-	209	0,6814	65,5	BELIMO BEN	61,7	JOVENTA DAF2.20S	81,9	BELIMO BE
x 600	-	229	0,7368	69,2	BELIMO BEN	64,3	JOVENTA DAF2.20S	86	BELIMO BE
x 630	-	244	0,7784	71,9	BELIMO BEN	66,3	JOVENTA DAF2.20S	88,9	BELIMO BE
x 650	9	254	0,8061	73,7	BELIMO BEN	67,7	JOVENTA DAF2.20S	90,9	BELIMO BE
x 700	34	279	0,8753	78,1	BELIMO BEN	71	JOVENTA DAF2.20S	95,7	BELIMO BE
x 710	39	284	0,8892	79	BELIMO BEN	71,7	JOVENTA DAF2.20S	96,7	BELIMO BE
x 750	59	304	0,9446	82,4	BELIMO BEN	74,3	JOVENTA DAF2.20S	100,4	BELIMO BE
x 800	84	329	1,0138	86,6	BELIMO BEN	77,7	JOVENTA DAF2.20S	104,9	SCHISCHEK InMax 50.75
1500 x 180	-	19	0,1663	28,6	BELIMO BEN	36	BELIMO BFN	39,9	BELIMO BEN
x 200	-	29	0,1960	30,9	BELIMO BEN	37,6	BELIMO BFN	42,6	BELIMO BEN
x 225	-	41,5	0,2331	33,7	BELIMO BEN	39,5	BELIMO BFN	45,9	BELIMO BEN
x 250	-	54	0,2703	36,6	BELIMO BEN	43,1	JOVENTA DAFx.20S	49,2	BELIMO BEN
x 280	-	69	0,3148	39,9	BELIMO BEN	45,2	JOVENTA DAFx.20S	53	BELIMO BEN
x 300	-	79	0,3445	42,1	BELIMO BEN	46,6	JOVENTA DAFx.20S	55,6	BELIMO BEN
x 315	-	86,5	0,3668	43,8	BELIMO BEN	47,6	JOVENTA DAFx.20S	57,4	BELIMO BEN
x 355	-	106,5	0,4262	48,1	BELIMO BEN	50,4	JOVENTA DAFx.20S	62,4	BELIMO BEN
x 400	-	129	0,4930	52,9	BELIMO BEN	53,6	JOVENTA DAFx.20S	67,8	BELIMO BEN
x 450	-	154	0,5673	58,1	BELIMO BEN	57,1	JOVENTA DAFx.20S	73,7	BELIMO BEE
x 500	-	179	0,6415	63,2	BELIMO BEN	60,6	JOVENTA DAFx.20S	79,4	BELIMO BEE
x 550	-	204	0,7158	68,2	BELIMO BEN	64,2	JOVENTA DAFx.20S	84,9	BELIMO BE
x 560	-	209	0,7306	69,2	BELIMO BEN	64,9	JOVENTA DAFx.20S	86	BELIMO BE
x 600	-	229	0,7900	73,1	BELIMO BEN	67,7	JOVENTA DAFx.20S	90,2	BELIMO BE
x 630	-	244	0,8346	75,9	BELIMO BEN	69,8	JOVENTA DAFx.20S	93,3	BELIMO BE
x 650	9	254	0,8643	77,8	BELIMO BEN	71,2	JOVENTA DAFx.20S	95,4	BELIMO BE
x 700	34	279	0,9385	82,4	BELIMO BEN	74,7	JOVENTA DAFx.20S	100,4	BELIMO BE
x 710	39	284	0,9534	83,3	BELIMO BEN	75,4	JOVENTA DAFx.20S	101,3	BELIMO BE
x 750	59	304	1,0128	86,9	BELIMO BEN	78,2	JOVENTA DAFx.20S	105,2	BELIMO BE
x 800	84	329	1,0870	91,3	BELIMO BEN	81,6	JOVENTA DAF2.20S	109,8	SCHISCHEK InMax 50.75

3.3. Weight and Free area - round dampers

Tab. 3.3.1. Weight and Free area - round dampers

Size øD [mm]	Overlaps	Free area S _f [m ²]	MSD-W with electromagnet		MSD	
	f [mm]		weight [kg]	actuating	weight [kg]	actuating
180	-	0,0160	11,3	BELIMO BFN	5,9	BELIMO BEN
200	-	0,0208	11,7	BELIMO BFN	6,4	BELIMO BEN
225	-	0,0277	12,2	BELIMO BFN	7	BELIMO BEN
250	2,5	0,0356	12,9	BELIMO BFN	7,7	BELIMO BEN
280	17,5	0,0463	13,6	BELIMO BFN	8,6	BELIMO BEN
315	35	0,0607	14,6	BELIMO BFN	9,7	BELIMO BEN
355	55	0,0794	15,8	BELIMO BFN	10,9	BELIMO BEN
400	77,5	0,1035	15,6	JOVENTA DAFx.20S	12,4	BELIMO BEN
450	102,5	0,1339	17,3	JOVENTA DAFx.20S	14,2	BELIMO BEN
500	127,5	0,1683	19,2	JOVENTA DAFx.20S	16	BELIMO BEN
560	157,5	0,2148	21,7	JOVENTA DAFx.20S	18,3	BELIMO BEN
630	192,5	0,2762	24,8	JOVENTA DAFx.20S	21,2	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 damper the 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. 25 Value “a” a “c” (square dampers)

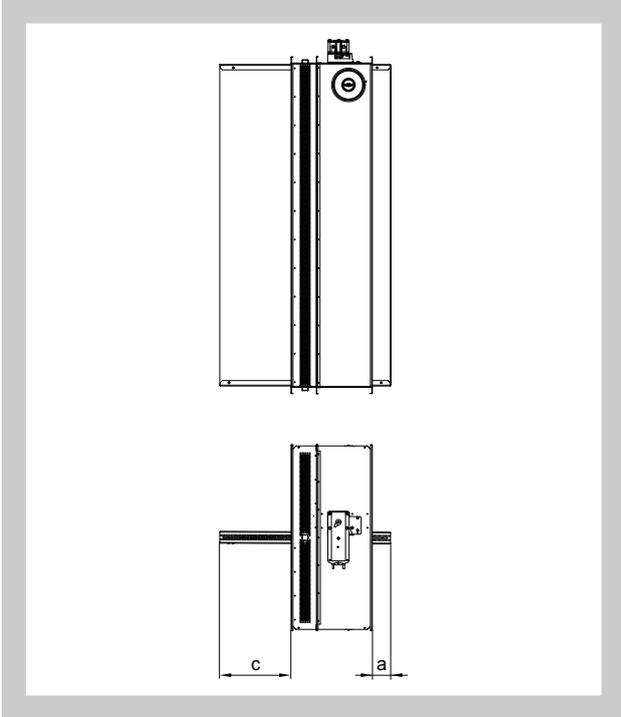
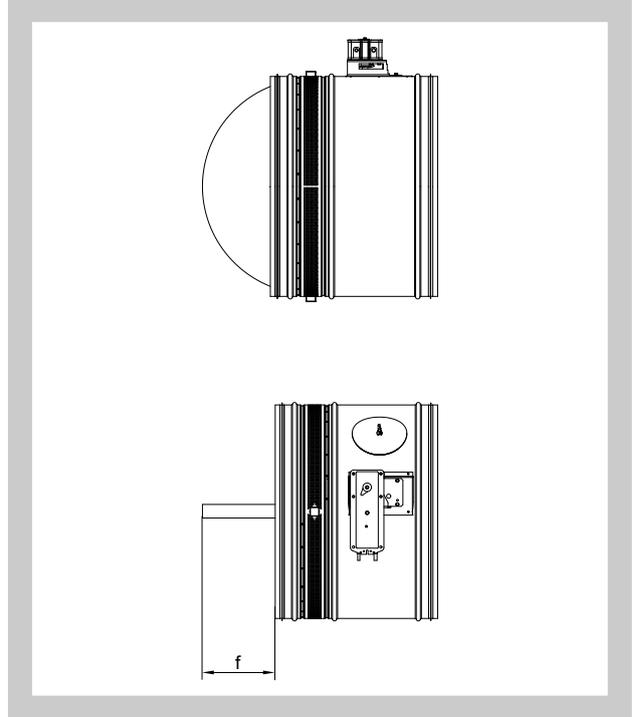


Fig. 26 Value “f” (round dampers)

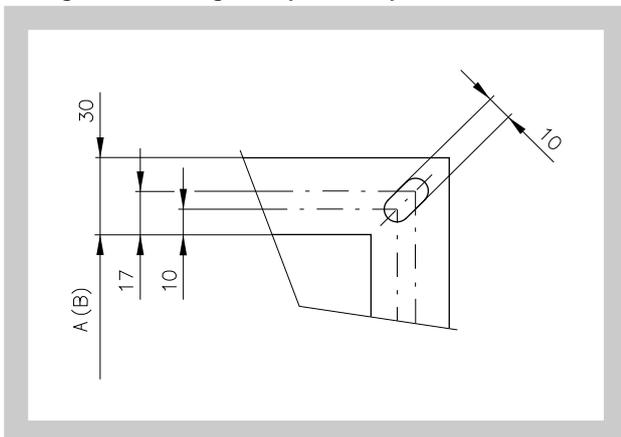


3.5. For the design .4M0, .4M1, .5M0 and .5M1 (with electric actuating mechanism with emergency function and electromagnet add to weight of the damper with an actuating mechanism (from the Tab. 3.2.1. and 3.3.1.) the weight of electromagnet (1 kg).

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. 27 Flange of square damper



4. Placement and Assembly

- 4.1. Multi compartment smoke control dampers are designed to remove heat and combustion products (e.g. smoke) from fire compartments according EN1366-8. Multi compartment smoke control 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. 28 The distance between the smoke damper and the construction

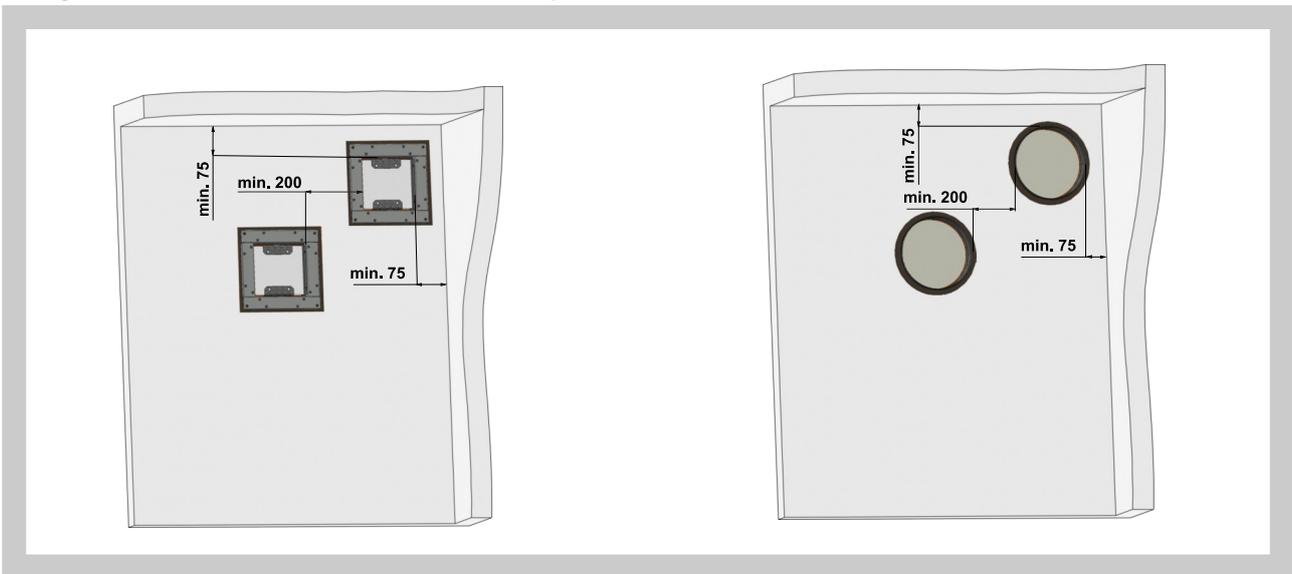
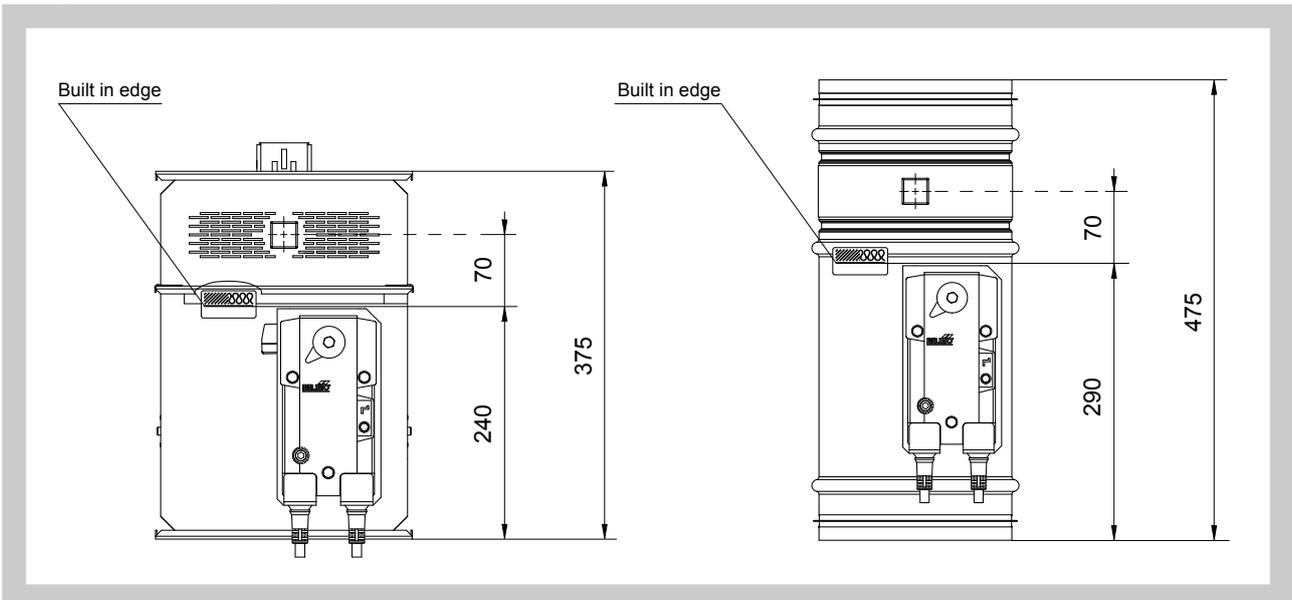


Fig. 29 Built in edge



- 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. 30 Installation opening - square damper

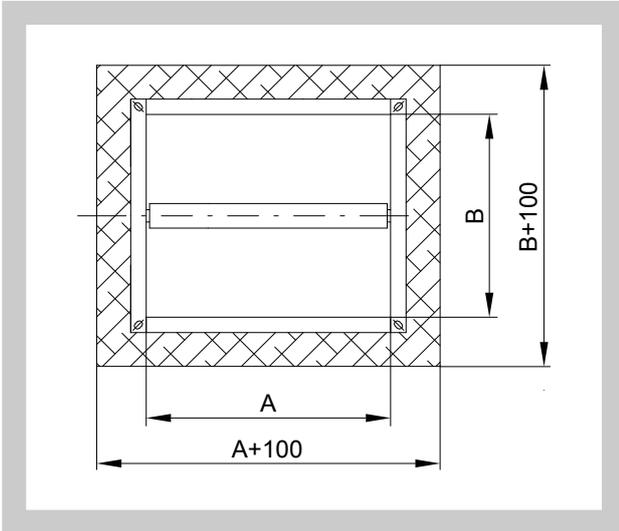


Fig. 31 Installation opening - round damper

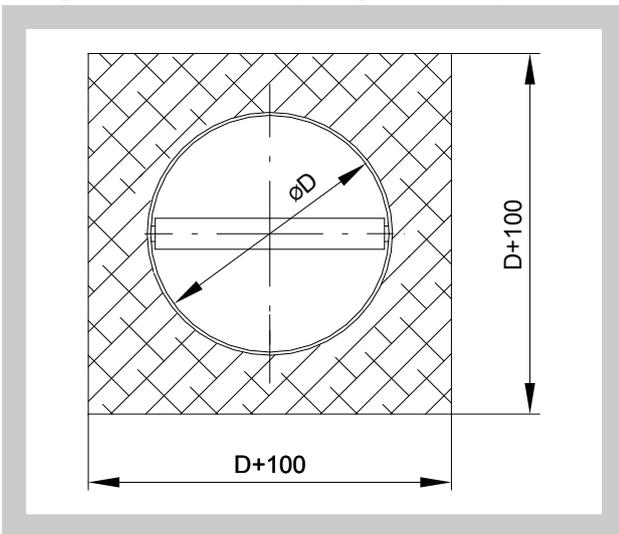
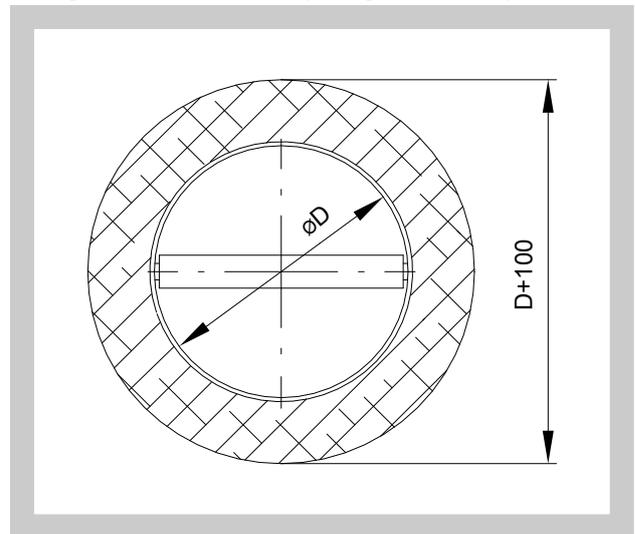


Fig. 32 Installation opening - round damper



5. Statement of installations

5.1. Installation method list

Tab. 5.1.1. Installation method list

Fire separating constru.	Wall/Ceiling	Installation	Fire resist.	Page
	Min. thickness [mm]			
Solid wall construction SINGLE / MULTI	125	Mortar or gypsum	EIS 120	31
	100	Ablative Coated Batt	EIS 90	32
Solid wall construction MULTI / MULTI	125	Insulation with stone wool - mortar or gypsum	EIS 120	33
		Insulation with cement-lime plates - mortar or gypsum		
	100	Insulation with stone wool - Ablative Coated Batt	EIS 90	34
		Insulation with cement-lime plates - Ablative Coated Batt		
Gypsum wall construction SINGLE / MULTI	125	Mortar or gypsum	EIS 120	35
	100	Ablative Coated Batt	EIS 90	36
Gypsum wall construction MULTI / MULTI	125	Insulation with stone wool - mortar or gypsum	EIS 120	37
		Insulation with cement-lime plates - mortar or gypsum		
	100	Insulation with stone wool - Ablative Coated Batt	EIS 90	38
		Insulation with cement-lime plates - Ablative Coated Batt		
Solid ceiling construction SINGLE / MULTI	150	Mortar or gypsum	EIS 120	39
		Ablative Coated Batt	EIS 90	40
Solid ceiling construction MULTI / MULTI	150	Insulation with stone wool - mortar or gypsum	EIS 120	41
		Insulation with cement-lime plates - mortar or gypsum		
	150	Insulation with stone wool - Ablative Coated Batt	EIS 90	42
		Insulation with cement-lime plates - Ablative Coated Batt		
Installation in vertical duct MULTI / MULTI	–	Insulation with stone wool	EIS 120	43
	–	Duct from calcium-silicate plates		44
Installation in horizontal duct MULTI / MULTI	–	Insulation with stone wool	EIS 120	45
	–	Duct from calcium-silicate plates		46

5.2. Installation in solid wall construction SINGLE / MULTI

Fig. 33 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

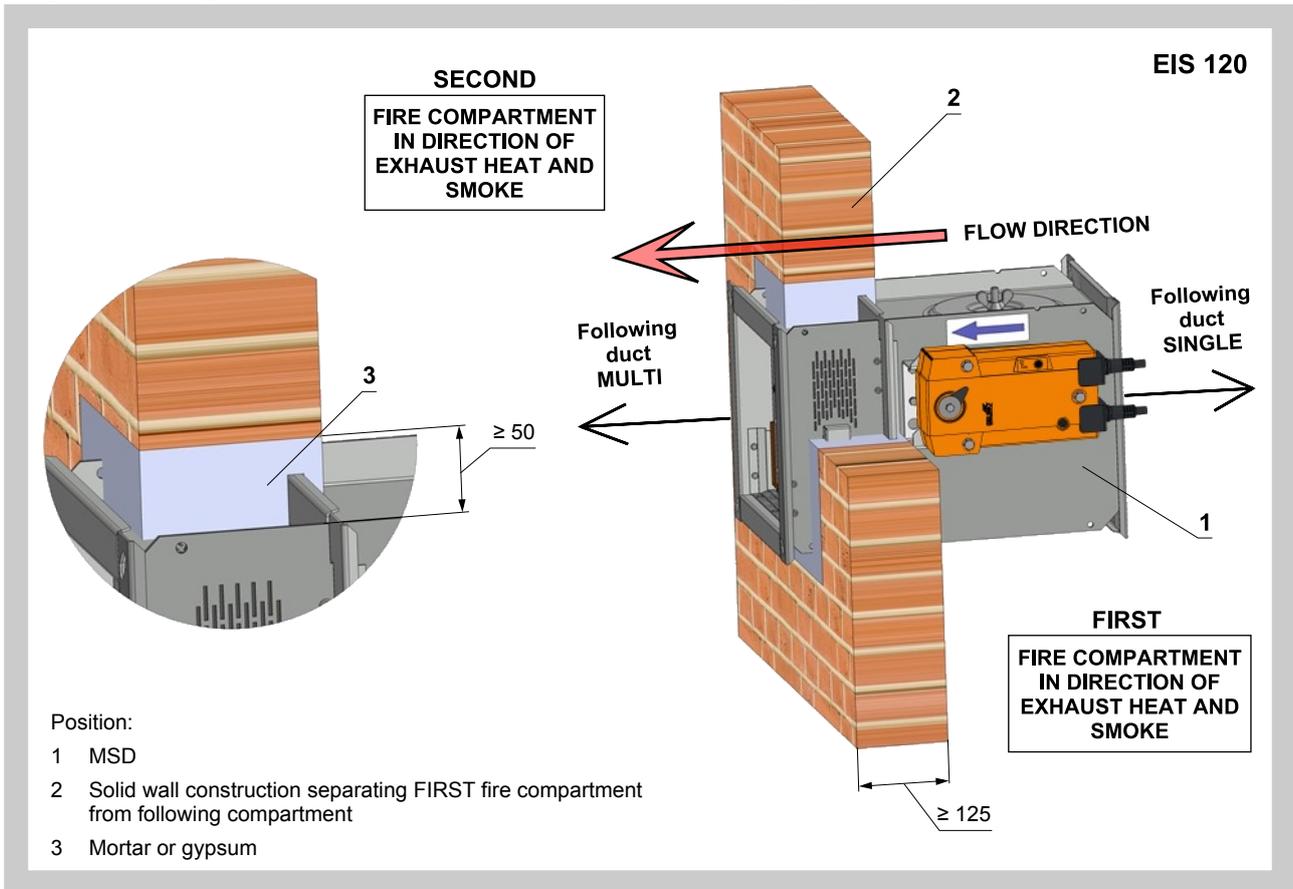


Fig. 34 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

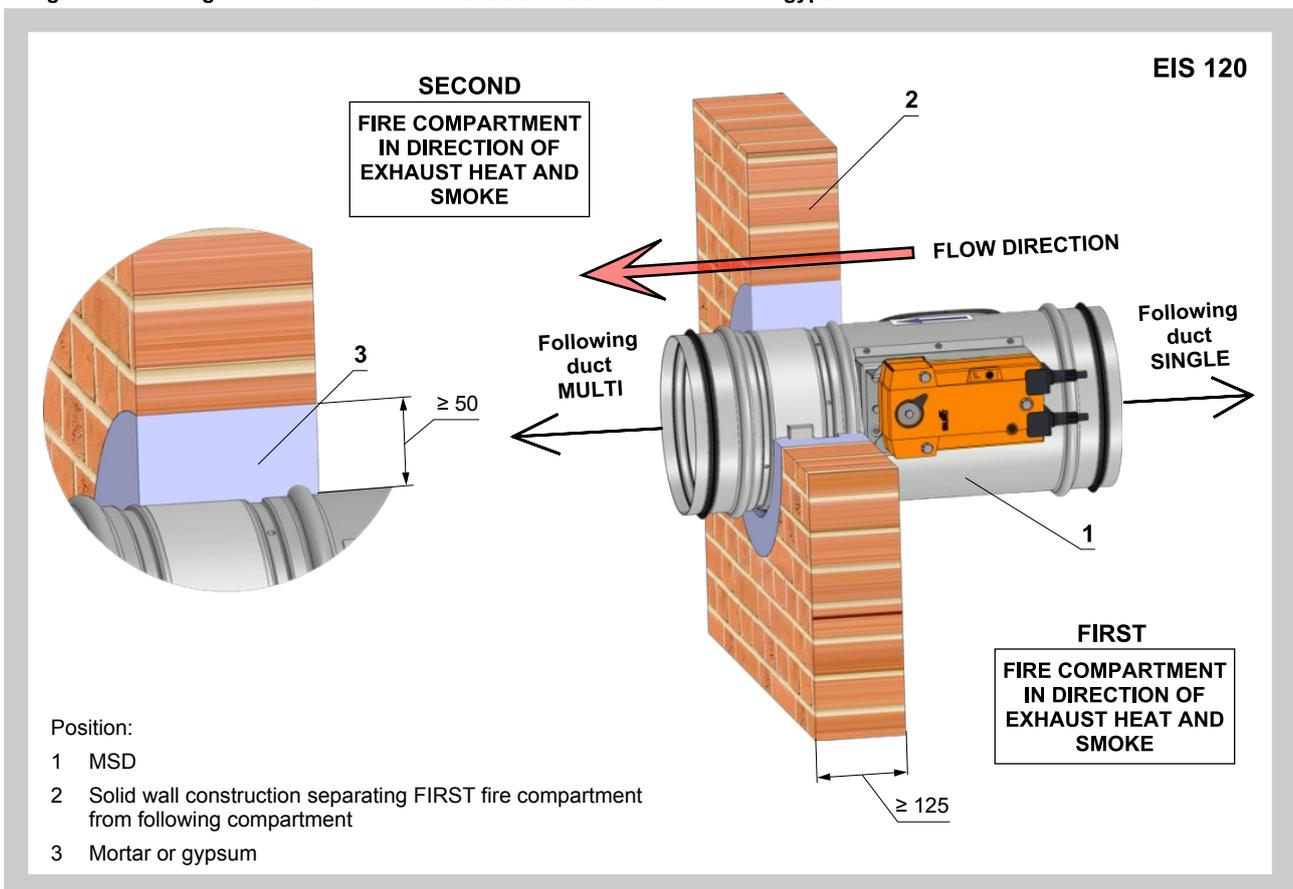
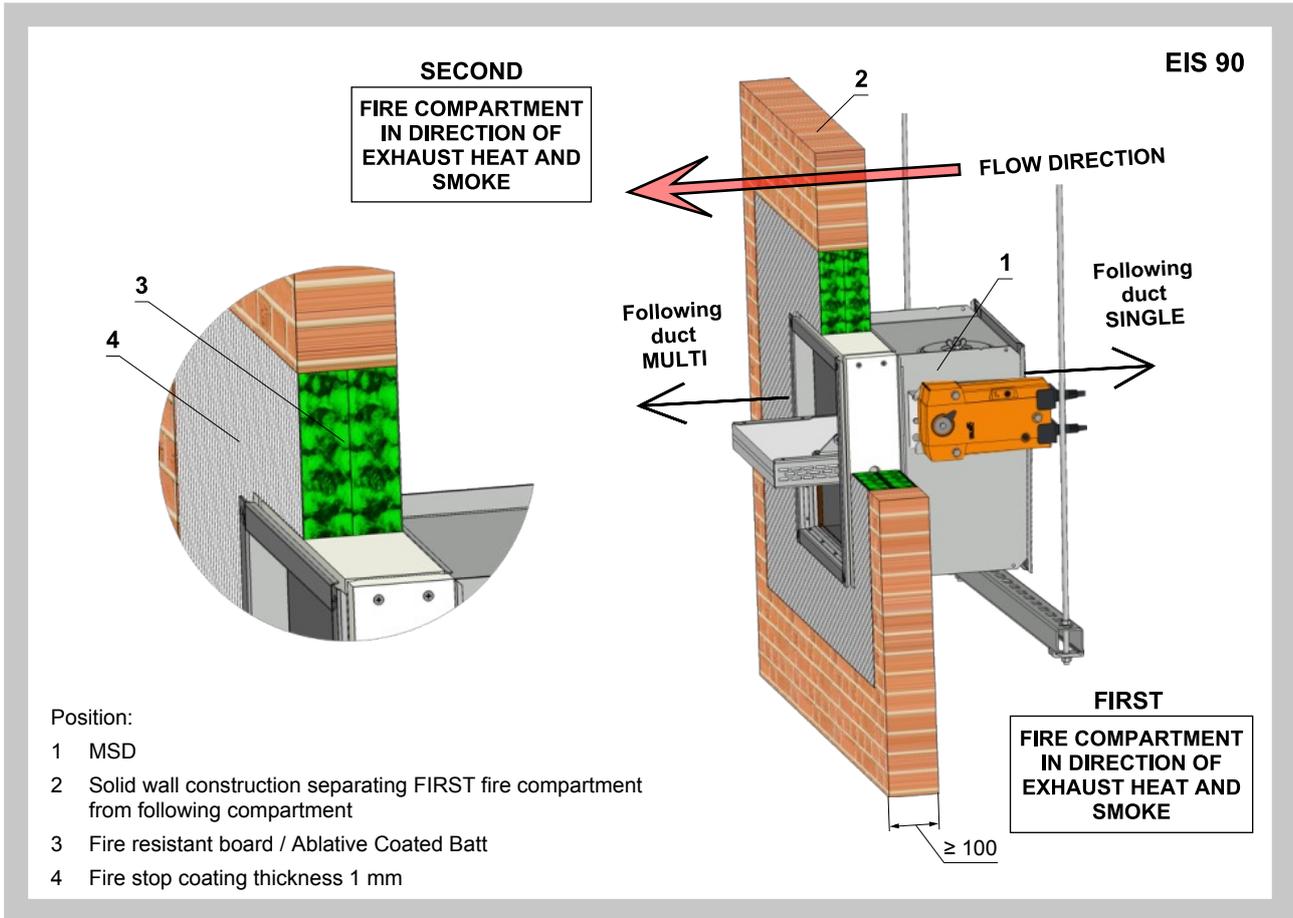


Fig. 35 Dividing construction between SINGLE / MULTI duct - Ablative Coated Batt



5.3. Installation in solid wall construction MULTI / MULTI

Fig. 36 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum

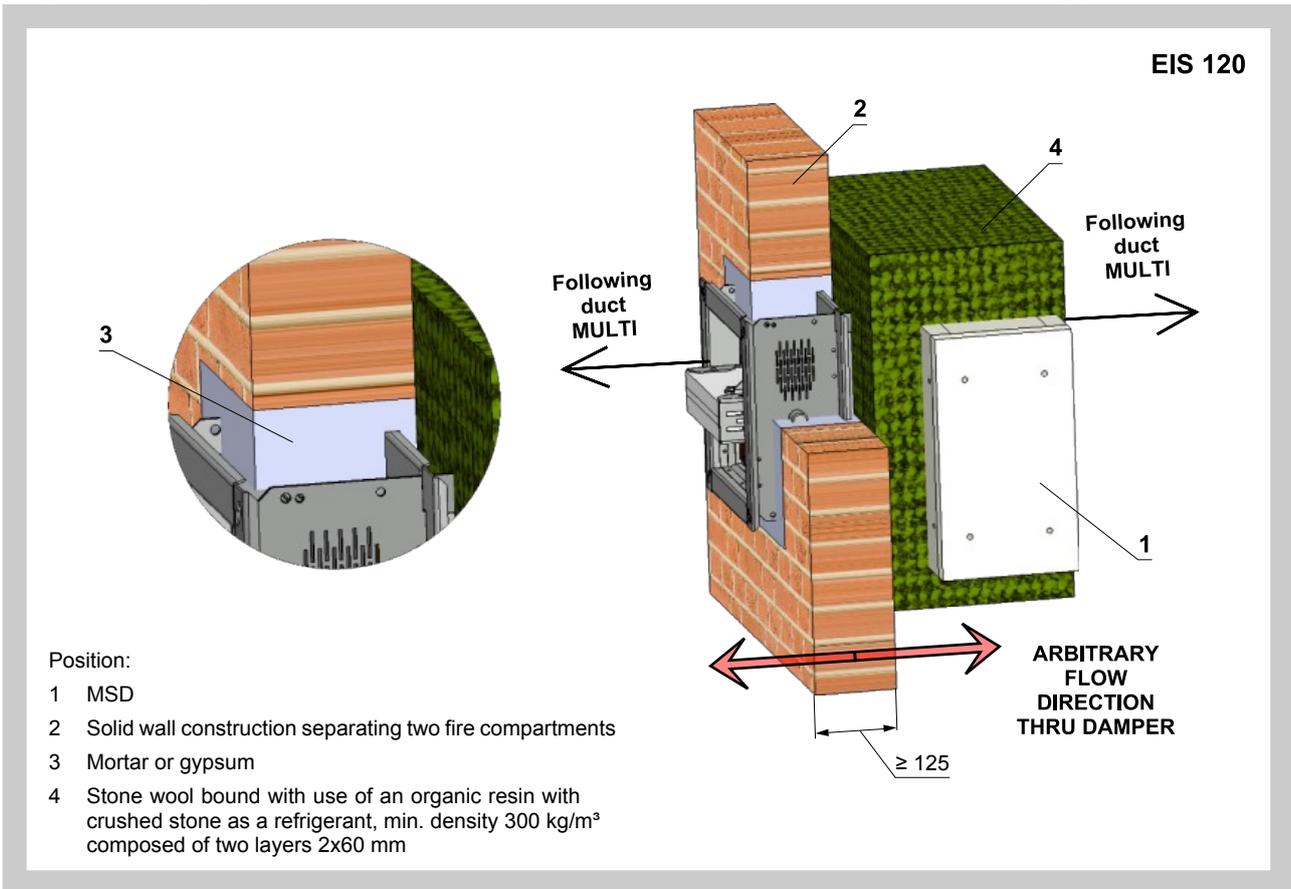


Fig. 37 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum

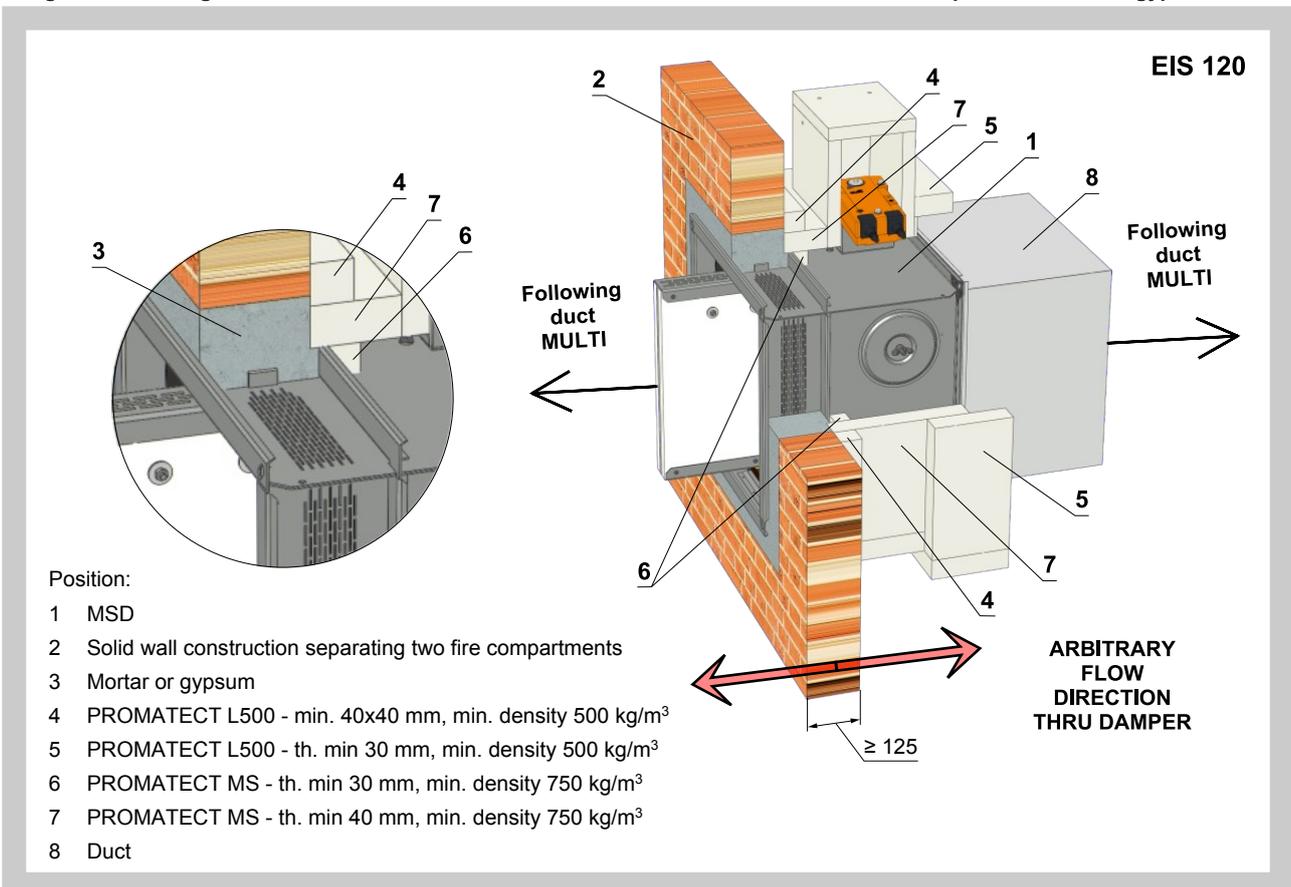


Fig. 38 Dividing construction between MULTI / MULTI duct - insulation with stone wool - Ablative Coated Batt

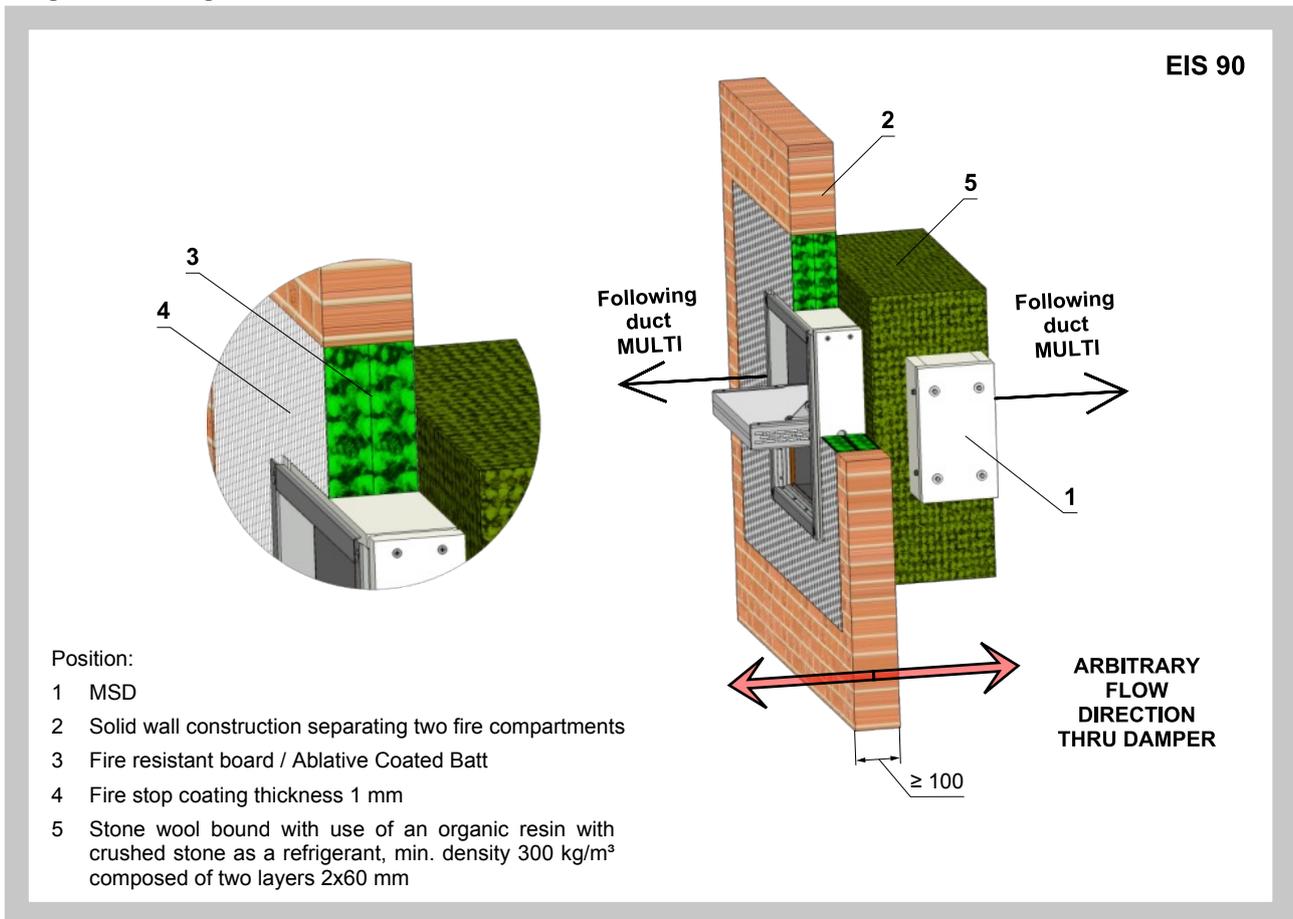
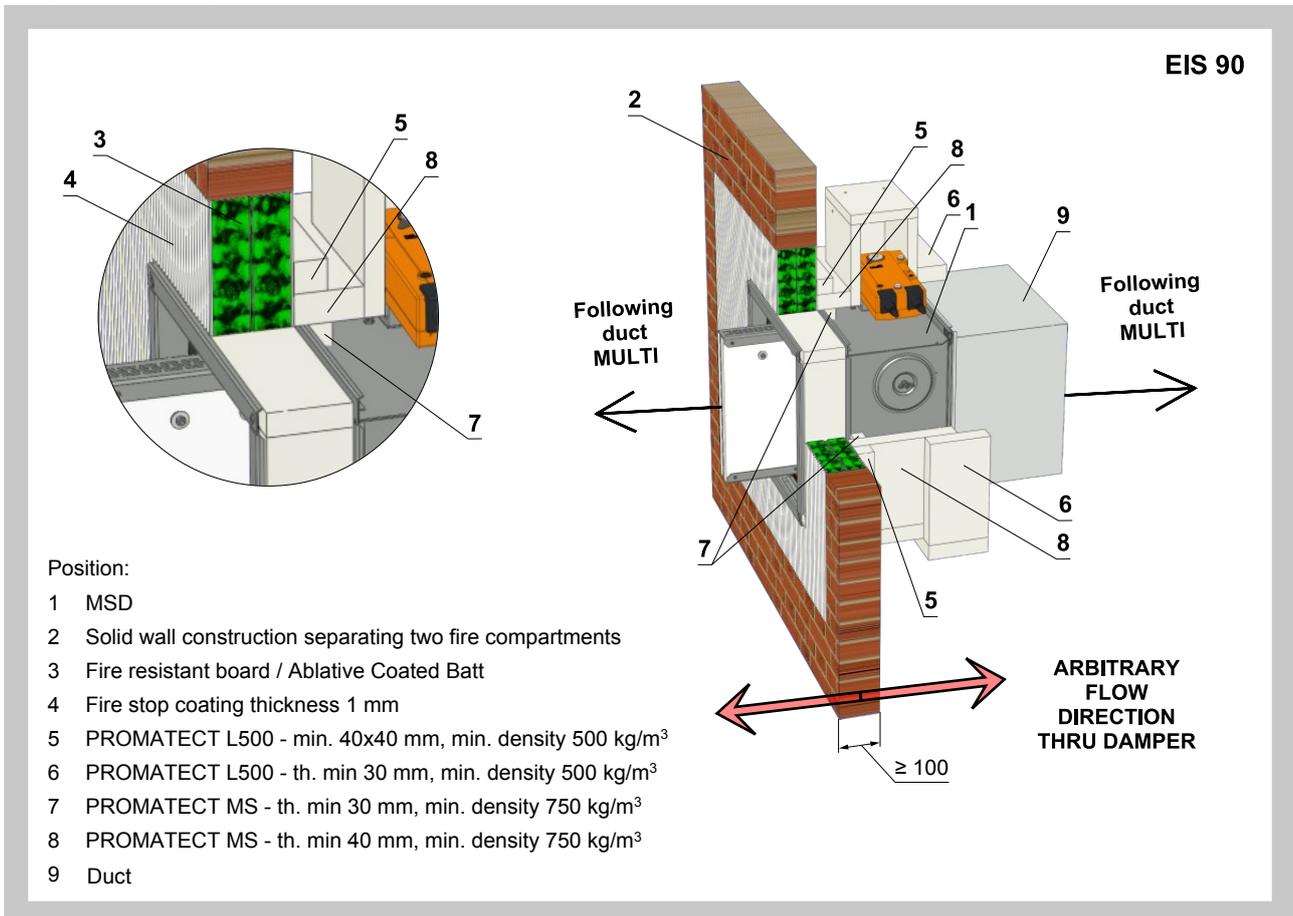


Fig. 39 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Ablative Coated Batt



5.4. Installation in gypsum wall SINGLE / MULTI

Fig. 40 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

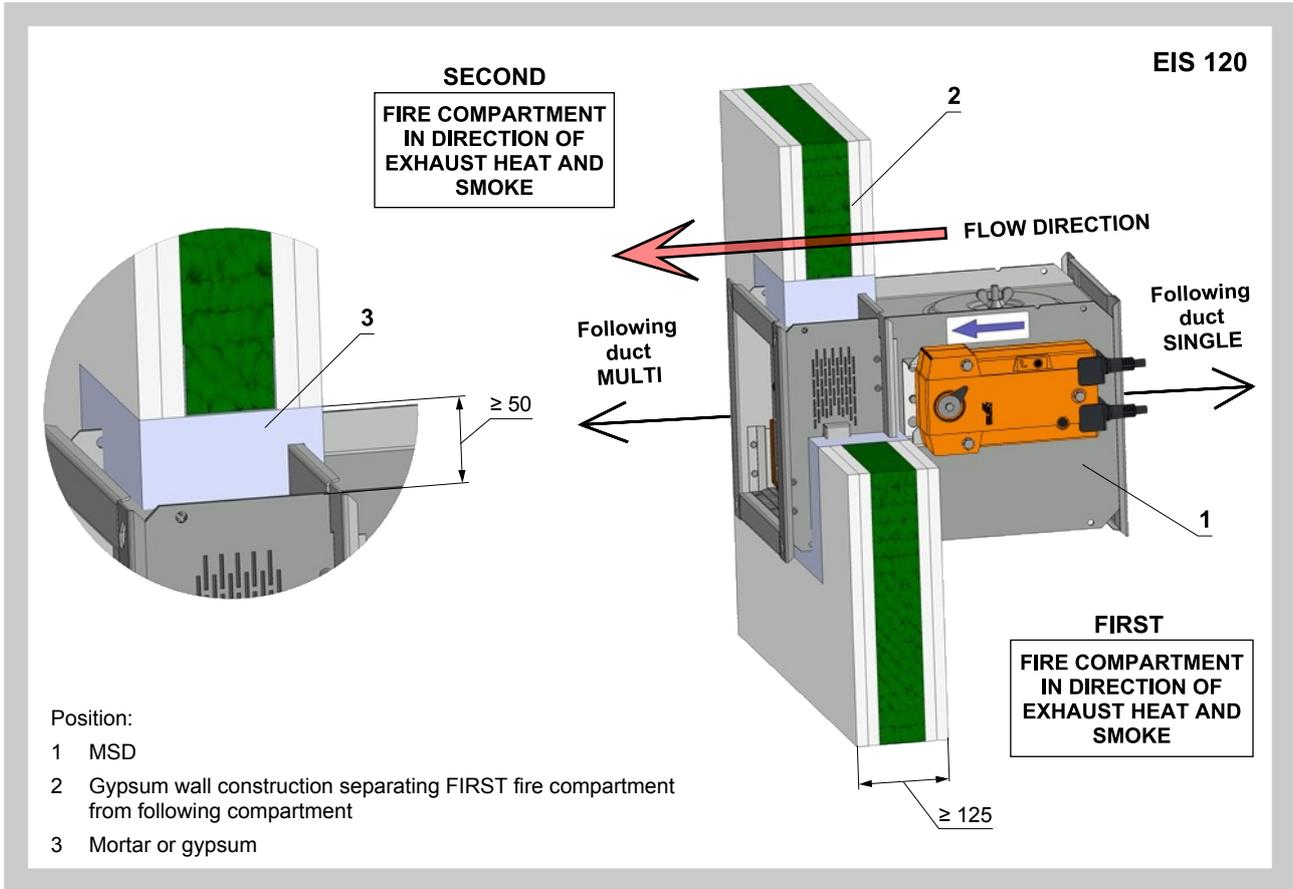


Fig. 41 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

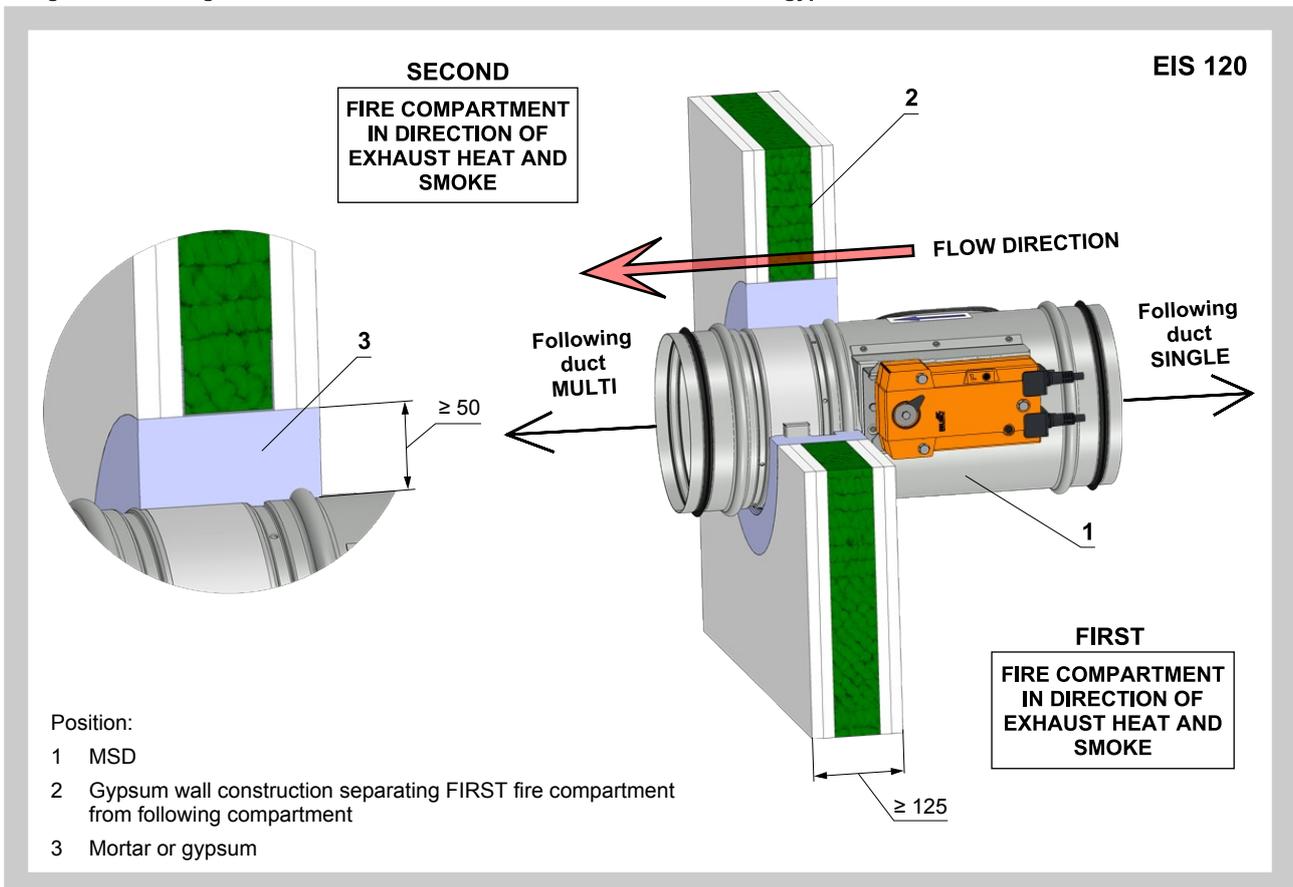
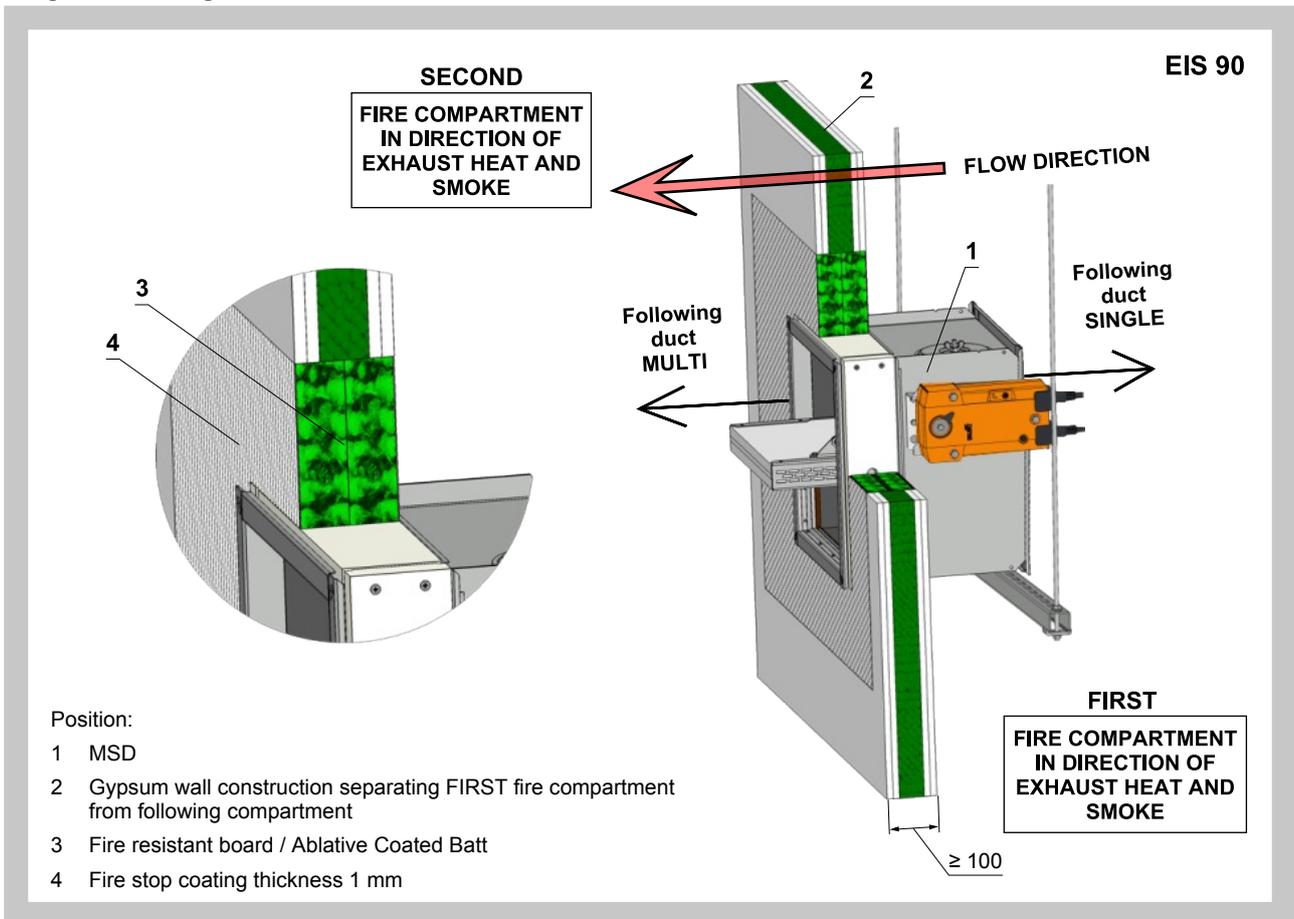


Fig. 42 Dividing construction between SINGLE / MULTI duct - Ablative Coated Batt



5.5. Installation in gypsum wall MULTI / MULTI

Fig. 43 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum

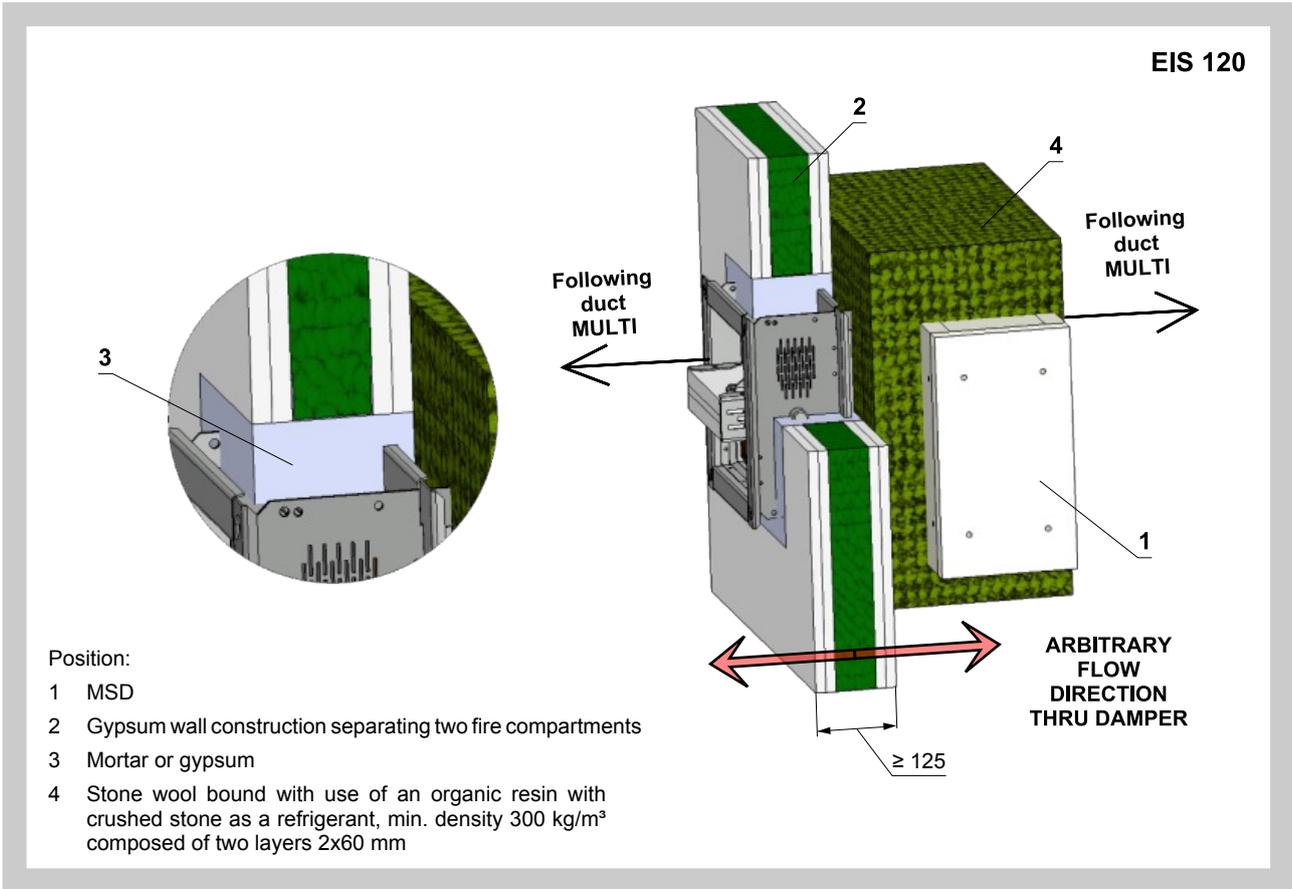


Fig. 44 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum

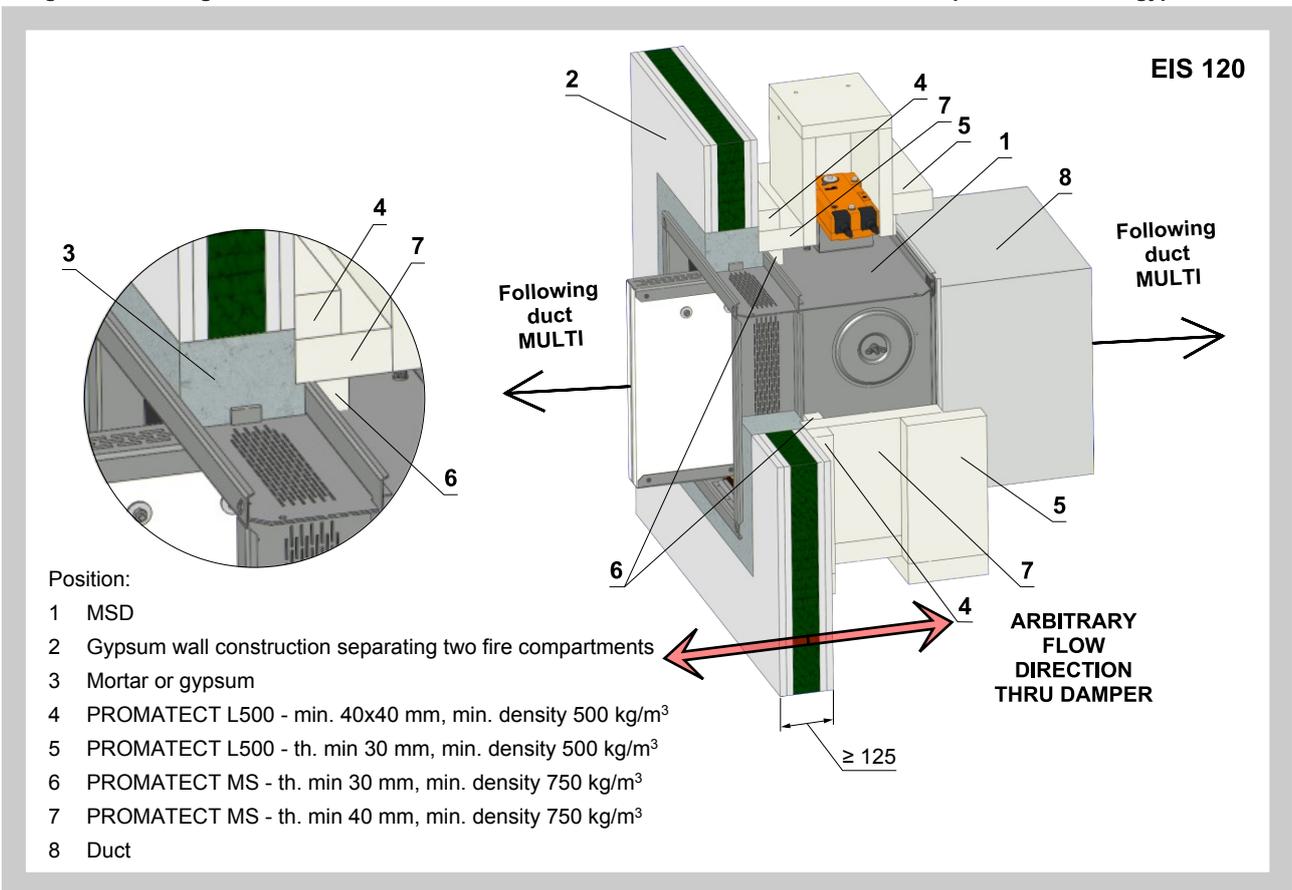


Fig. 45 Dividing construction between MULTI / MULTI duct - insulation with stone wool - Ablative Coated Batt

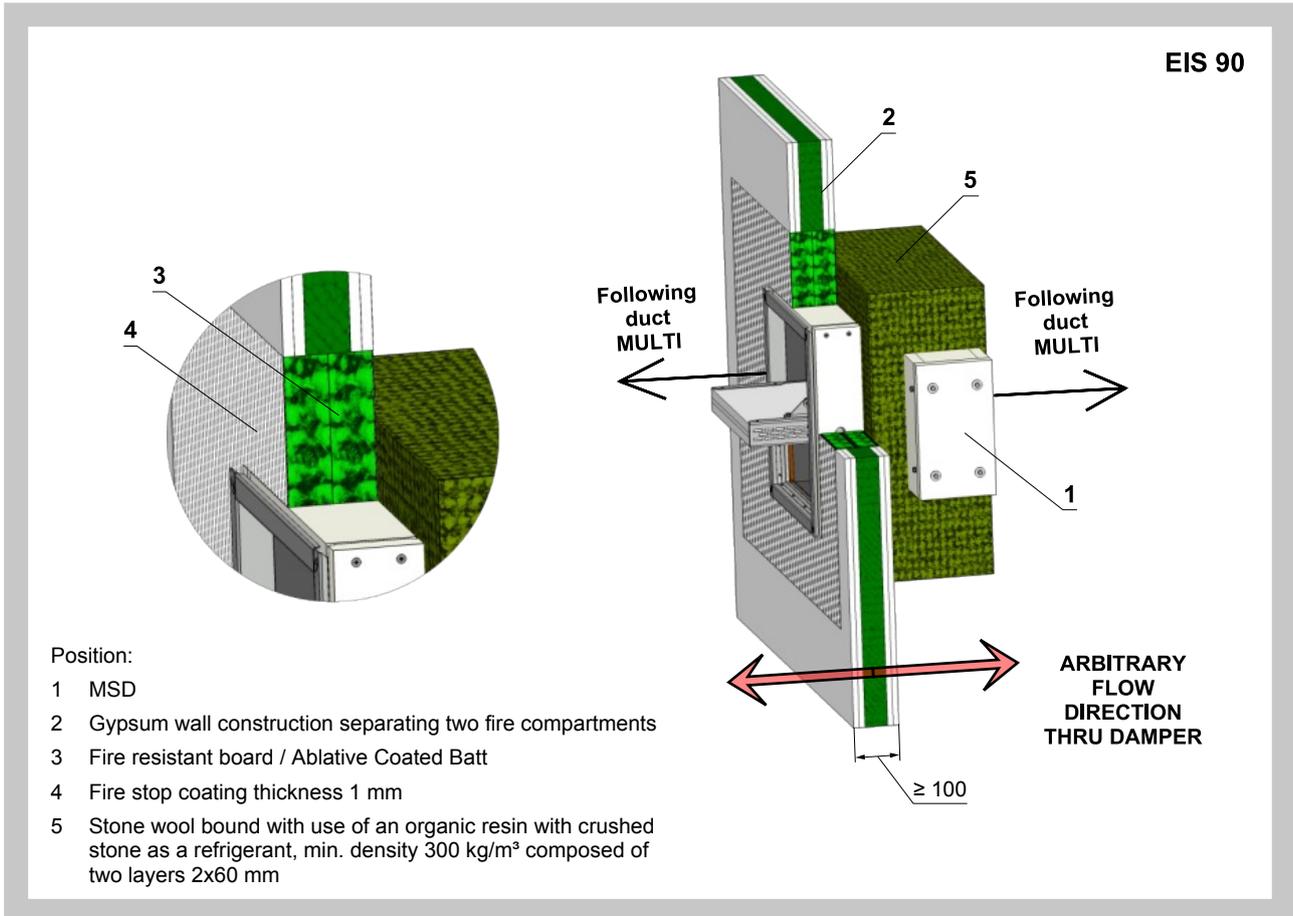
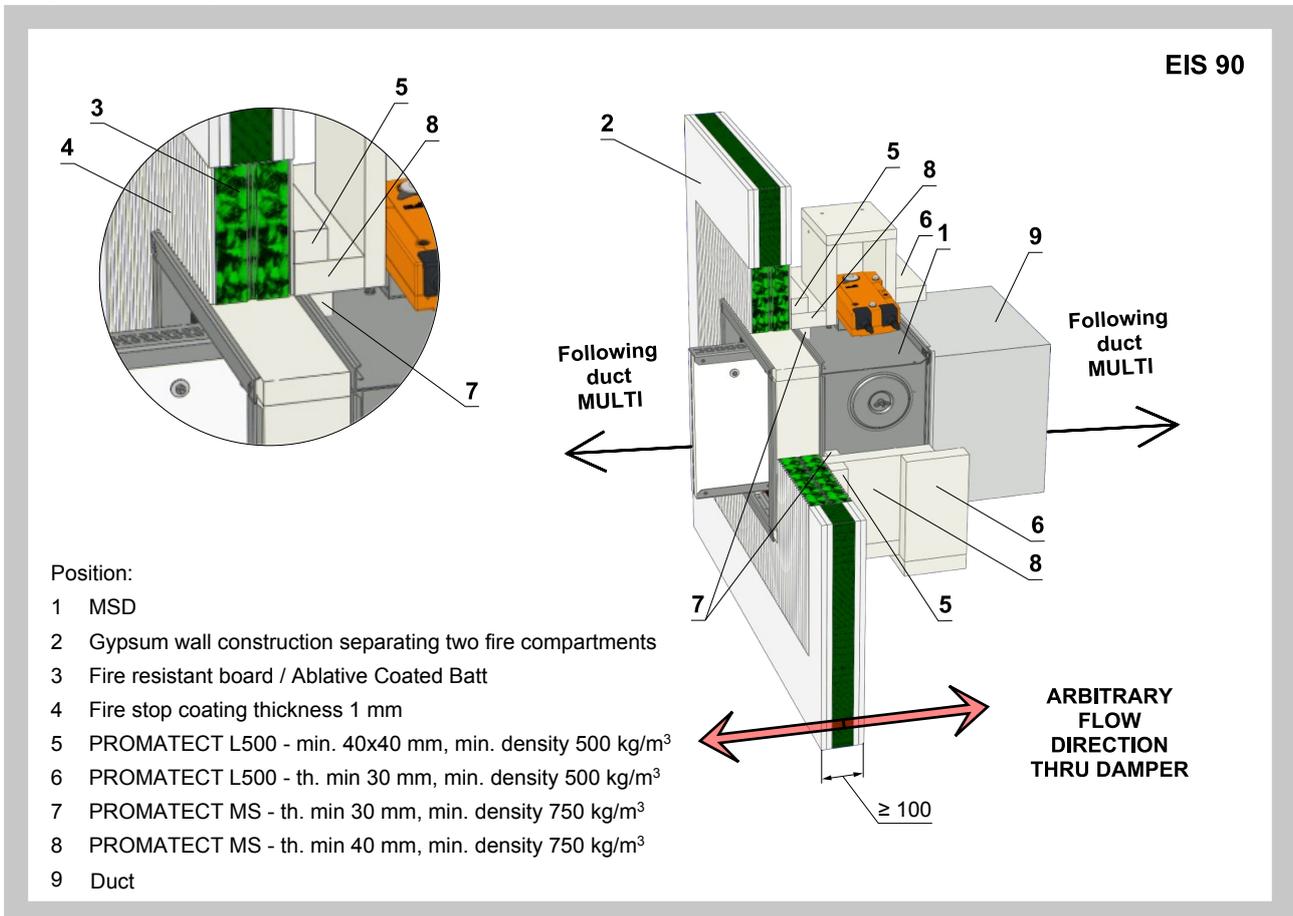


Fig. 46 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Ablative Coated Batt



5.6. Installation in solid ceiling construction SINGLE / MULTI

Fig. 47 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

- The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.

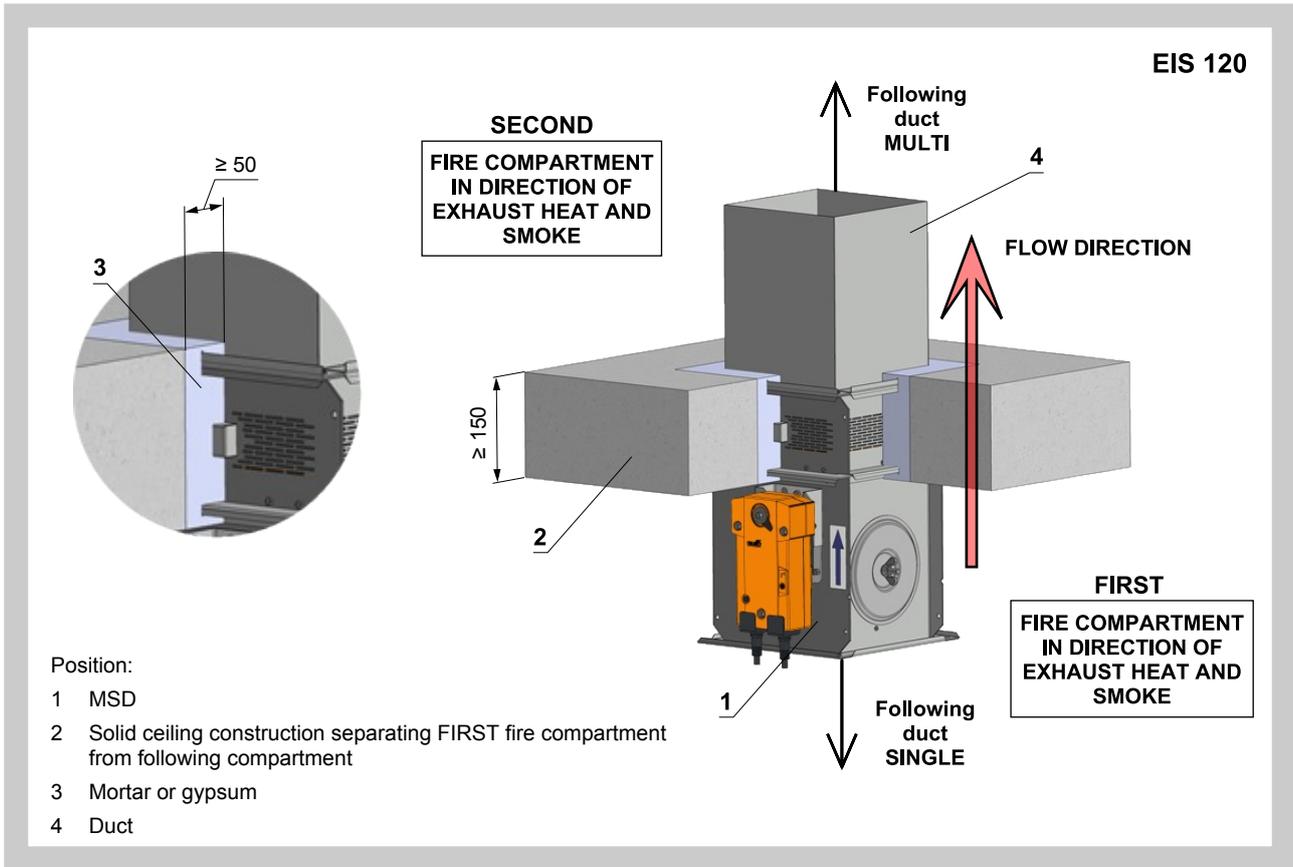


Fig. 48 Dividing construction between SINGLE / MULTI duct - mortar or gypsum

- The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.

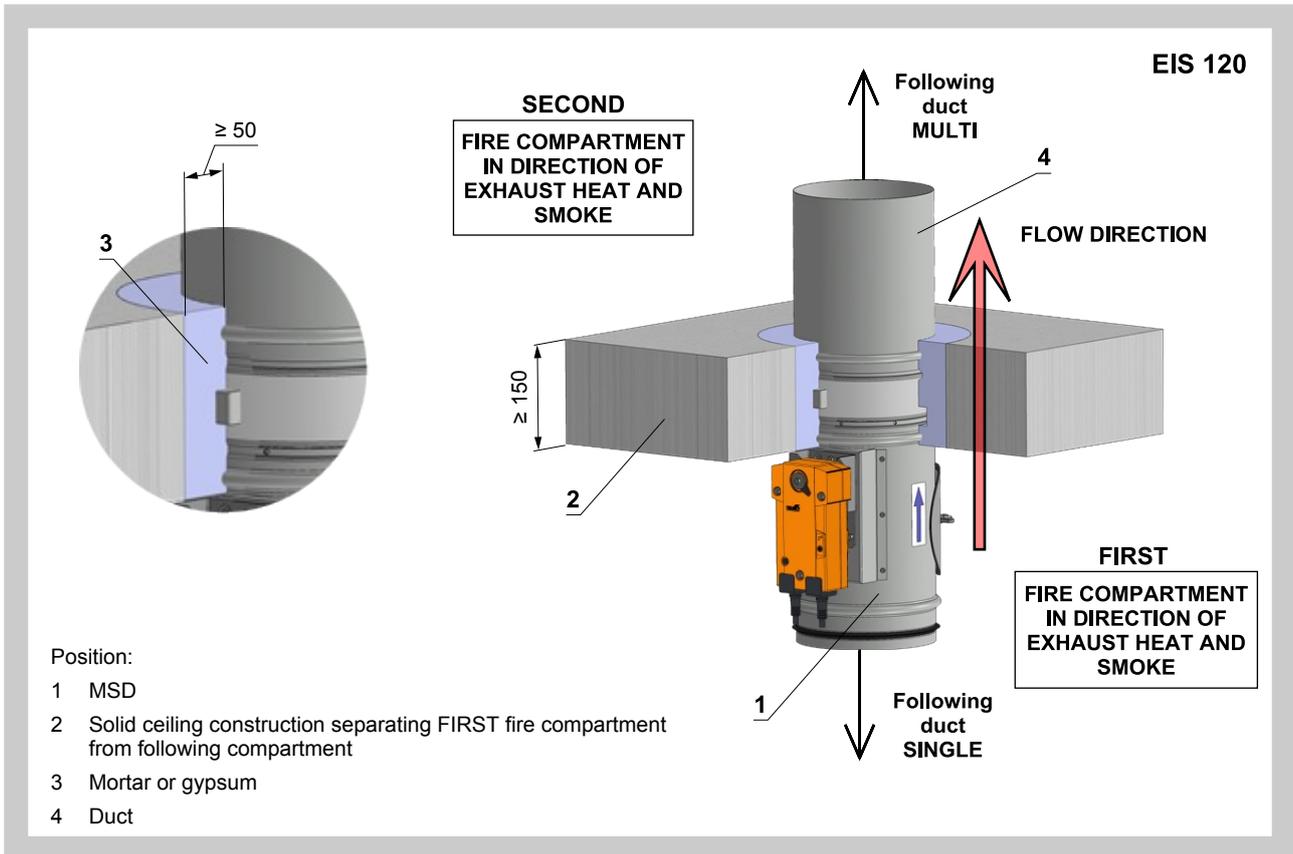
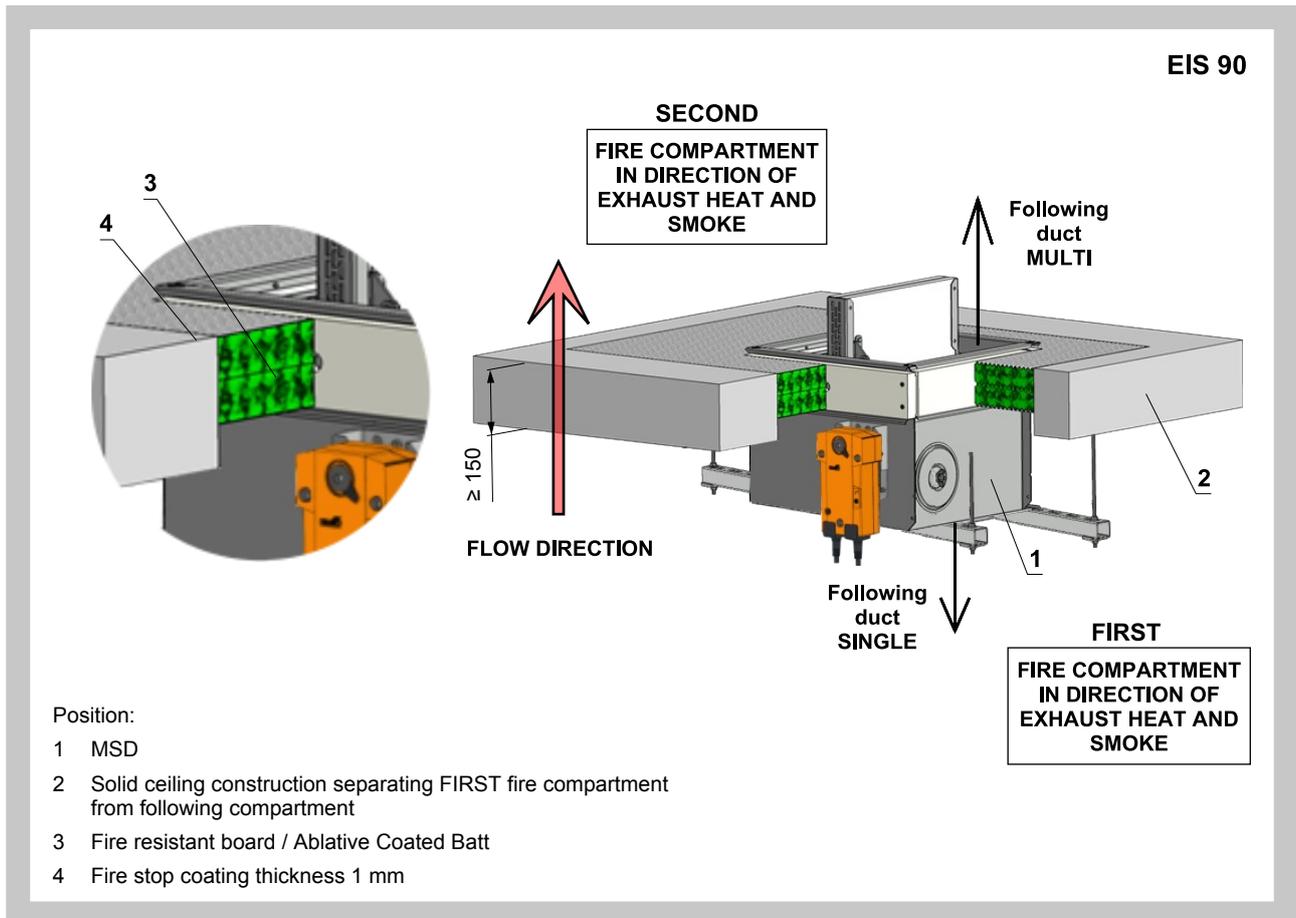


Fig. 49 Dividing construction between SINGLE / MULTI duct - Ablative Coated Batt

- The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.



5.7. Installation in solid ceiling construction MULTI / MULTI

Fig. 50 Dividing construction between MULTI / MULTI duct - insulation with stone wool - mortar or gypsum
 - The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.

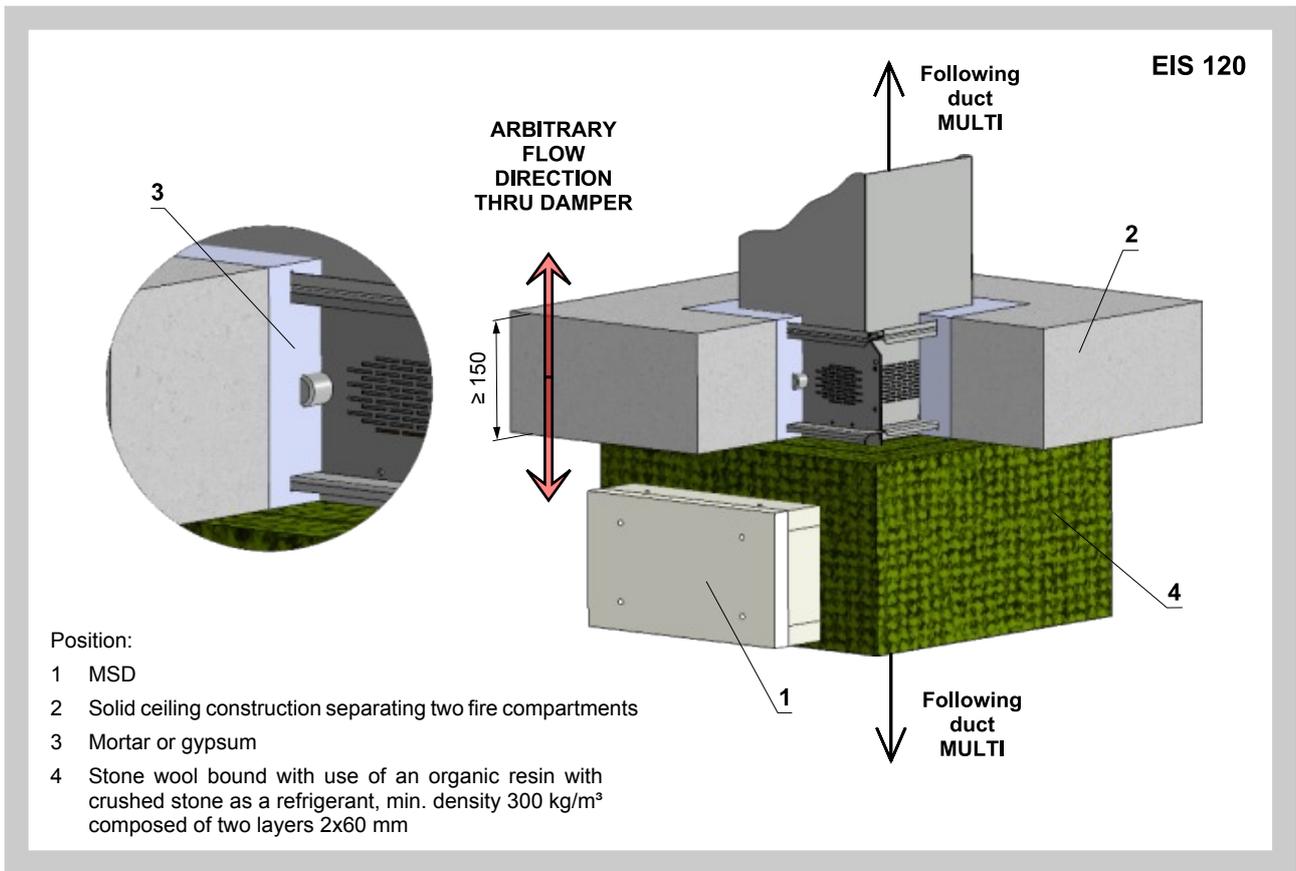


Fig. 51 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - mortar or gypsum
 - The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.

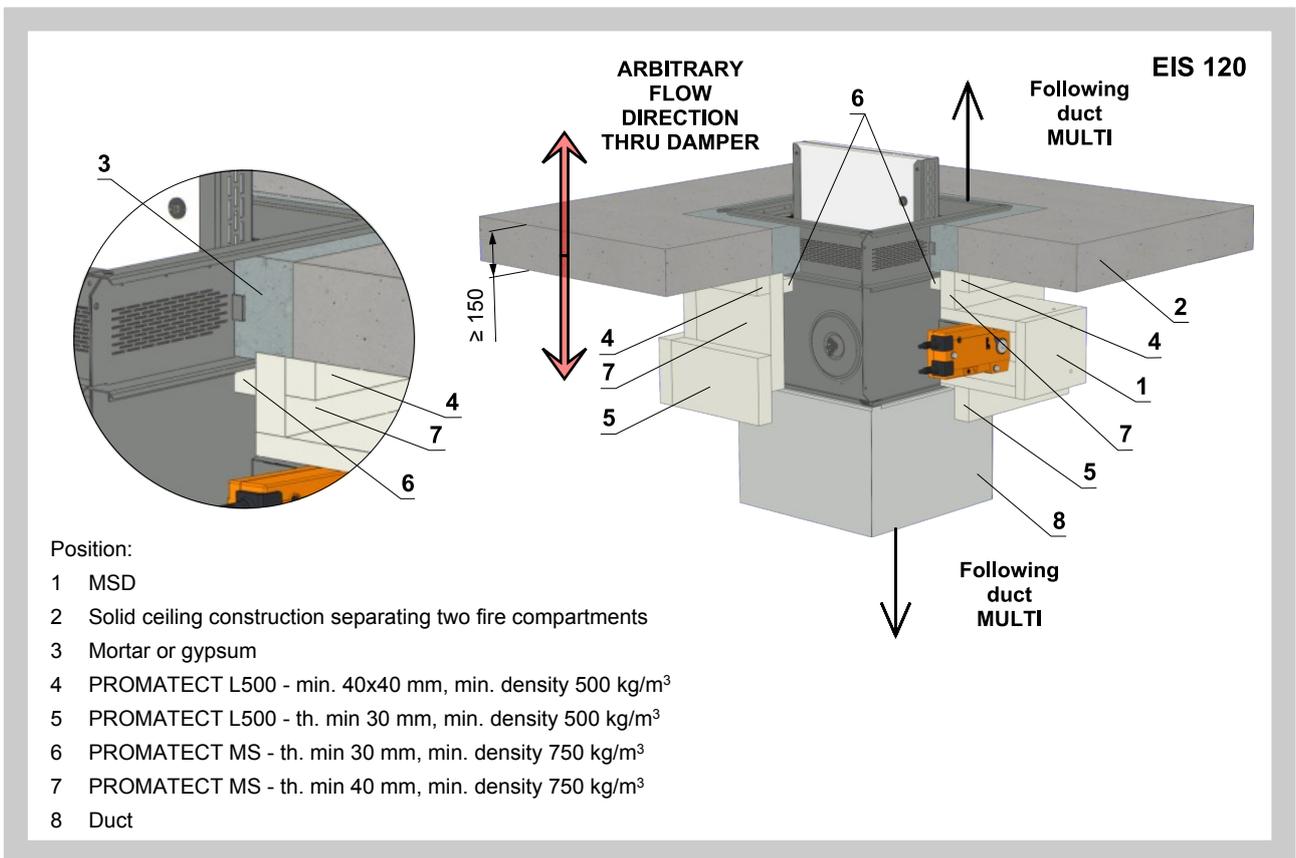


Fig. 52 Dividing construction between MULTI / MULTI duct - insulation with stone wool - Ablative Coated Batt
 - The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.

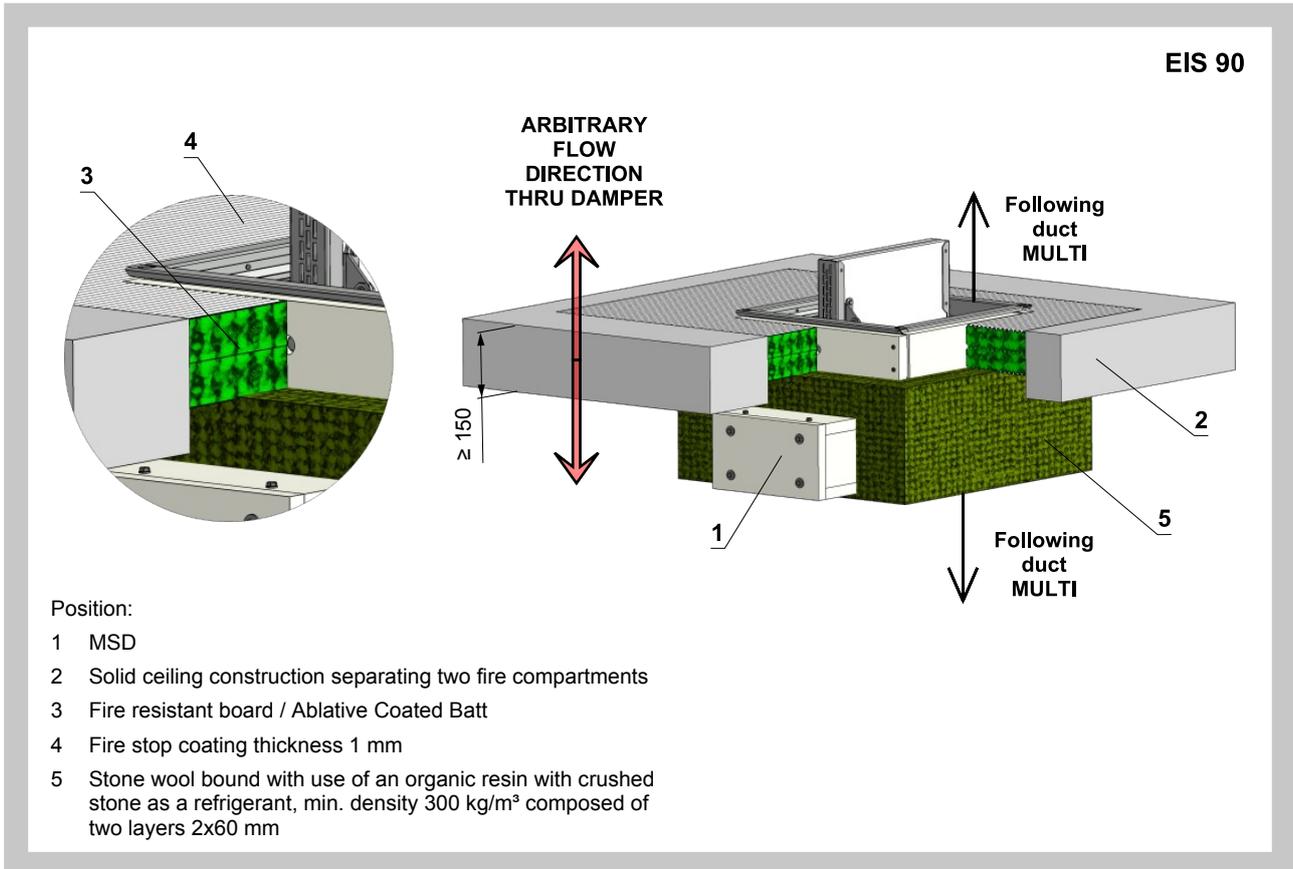
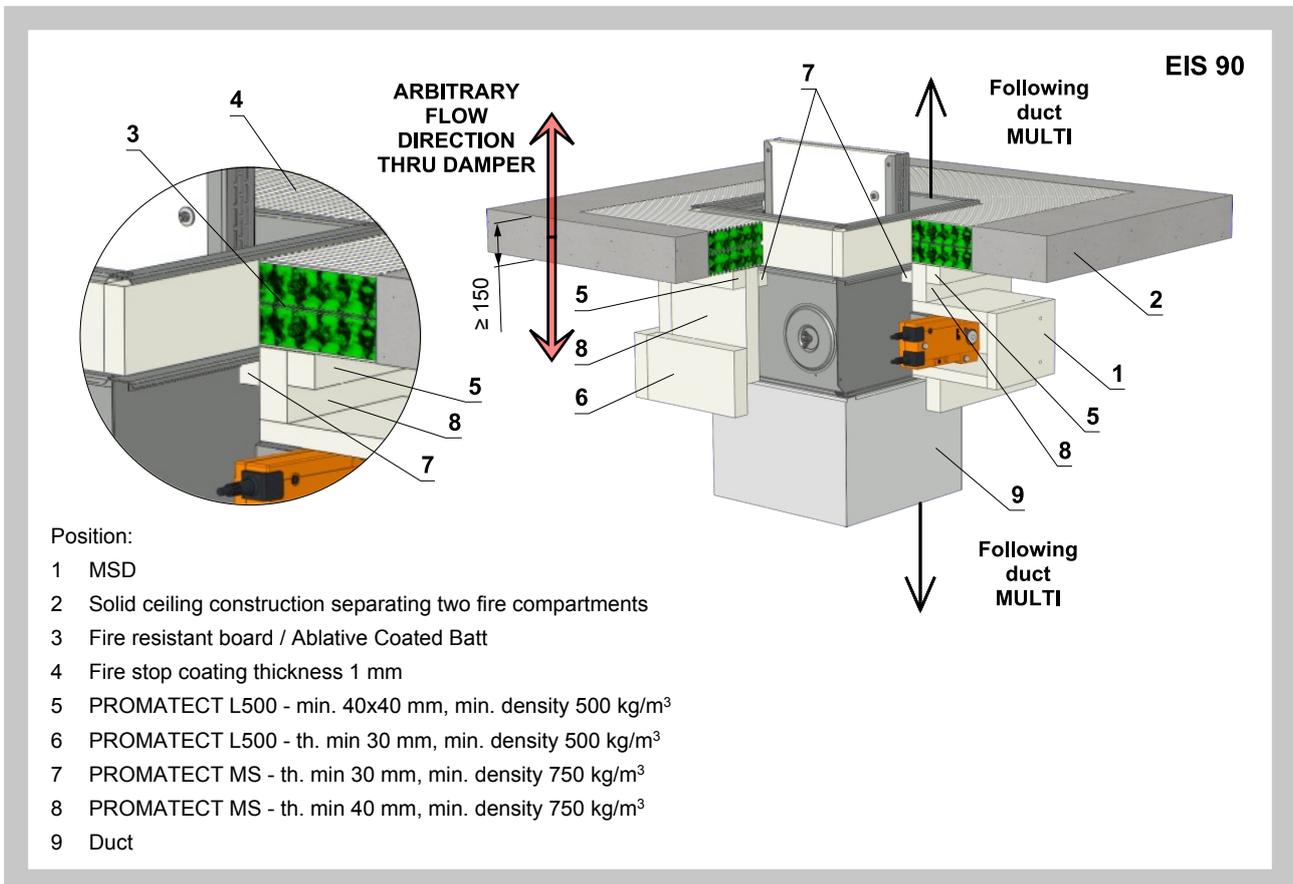


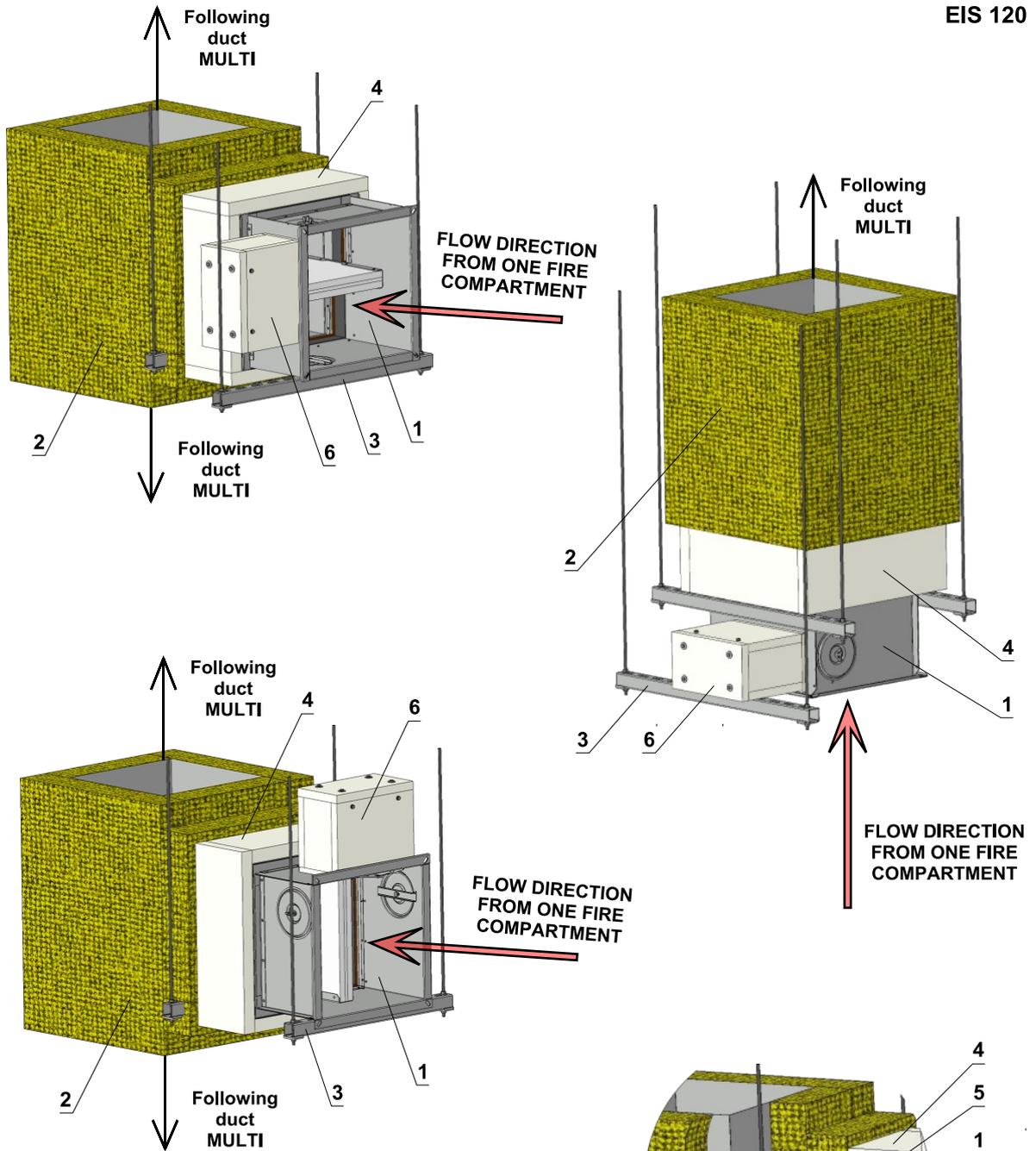
Fig. 53 Dividing construction between MULTI / MULTI duct - insulation with cement-lime plates - Ablative Coated Batt
 - The damper can be installed from both sides of the construction, i.e. From the top or the bottom side of the ceiling.



6. Suspension systems

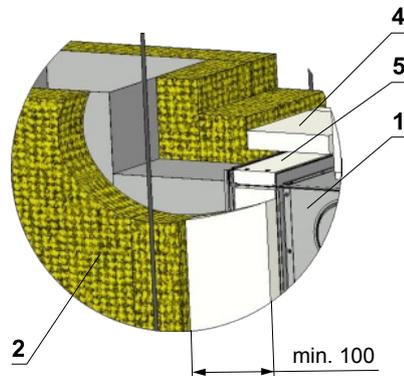
6.1. Suspension MSD installed in vertical duct MULTI

Fig. 54 Installation in vertical duct MULTI / MULTI - insulation with stone wool



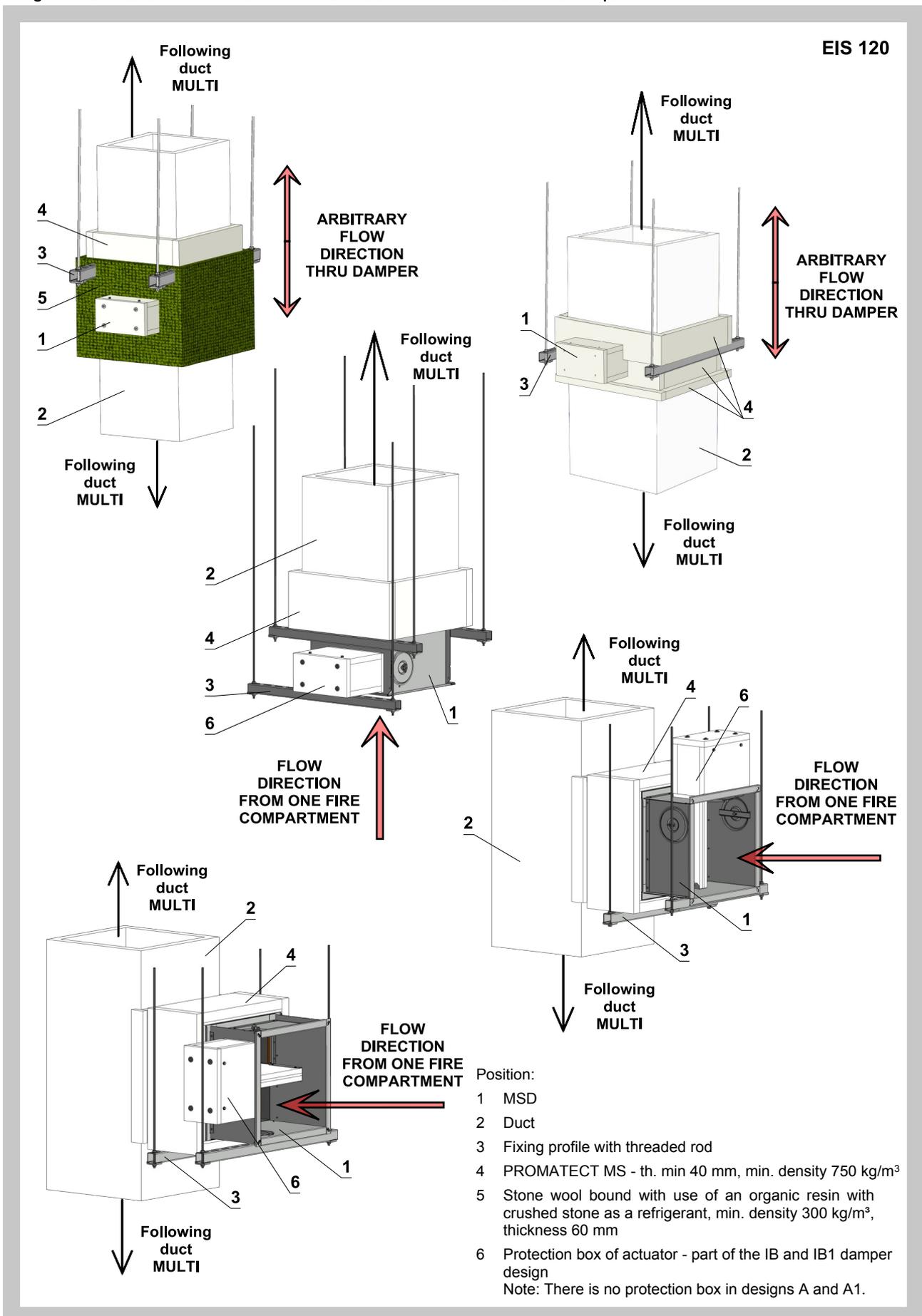
Position:

- 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.



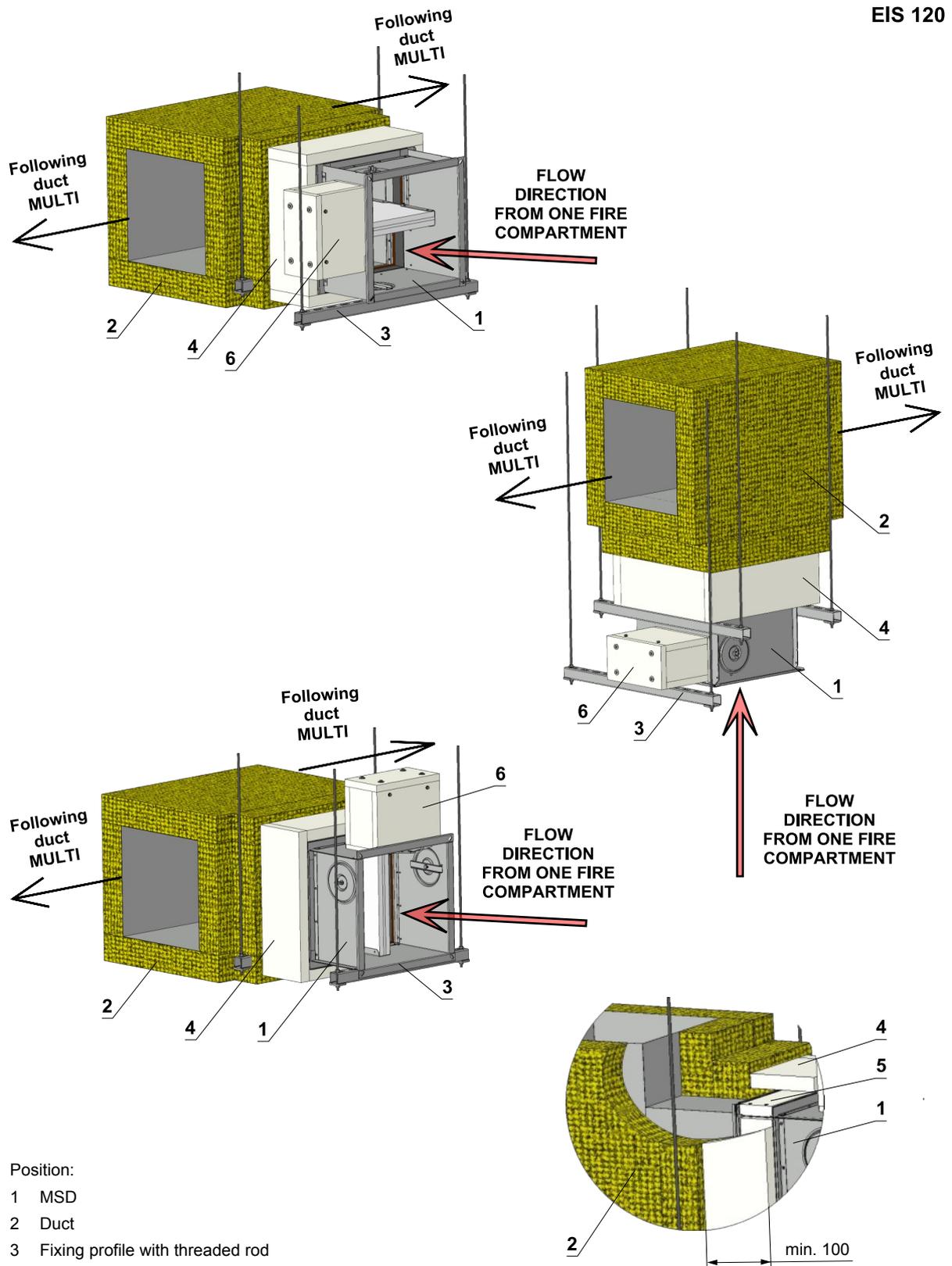
6.2. Suspension MSD installed in vertical duct from calcium-silicate plates MULTI

Fig. 55 Installation in vertical duct MULTI / MULTI - duct from calcium-silicate plates



6.3. Suspension MSD installed in horizontal duct MULTI

Fig. 56 Installation in horizontal duct MULTI / MULTI - insulation with stone wool



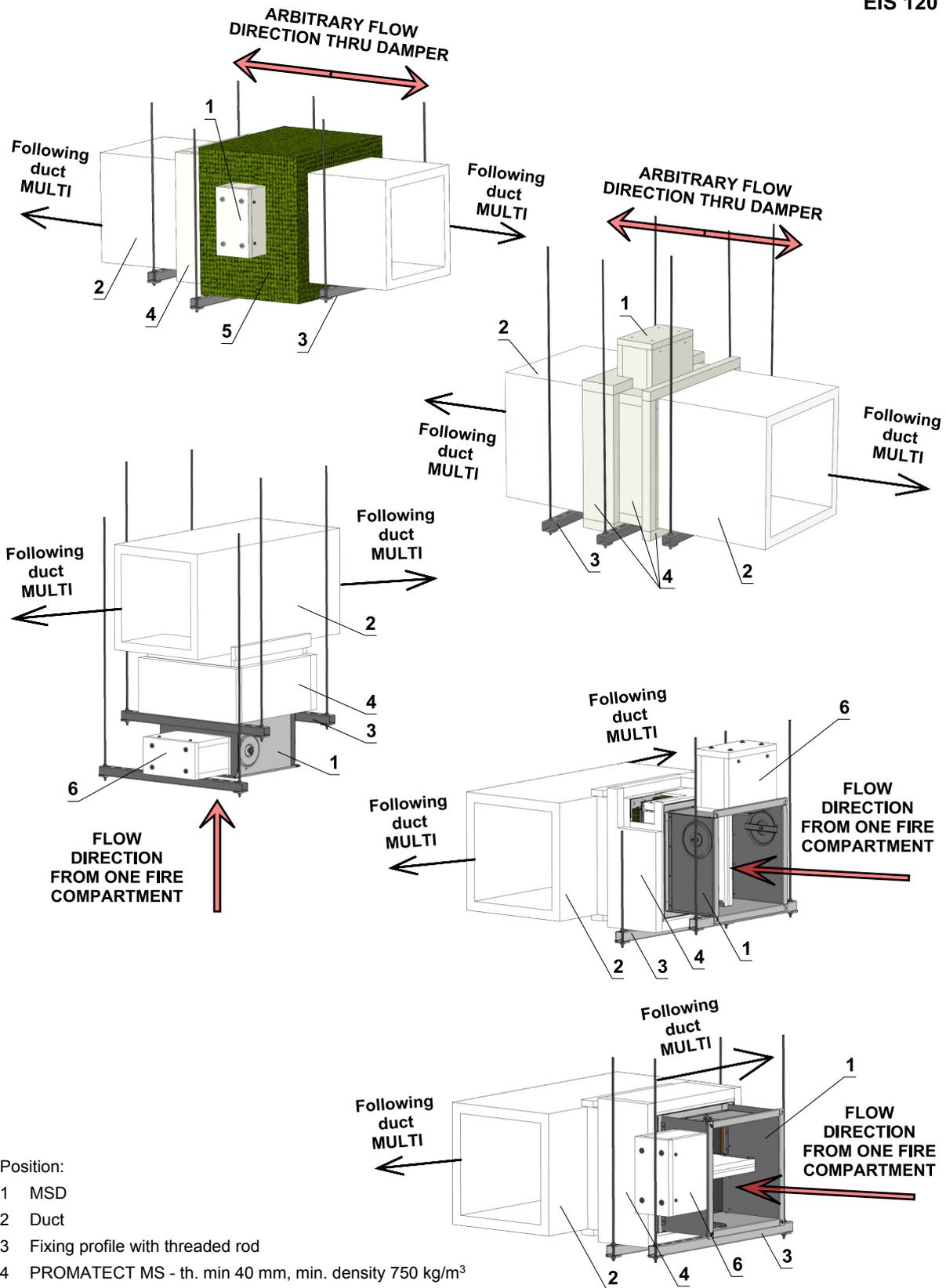
Position:

- 1 MSD
 - 2 Duct
 - 3 Fixing profile with threaded rod
 - 4 PROMATECT MS - th. min 40 mm, min. density 750 kg/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.

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

Fig. 57 Installation in horizontal duct MULTI / MULTI - duct from calcium-silicate plates

EIS 120



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.

6.5. 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. 58 Installation in fire separating construction in soft seal - fire compartment between duct SINGLE/MULTI

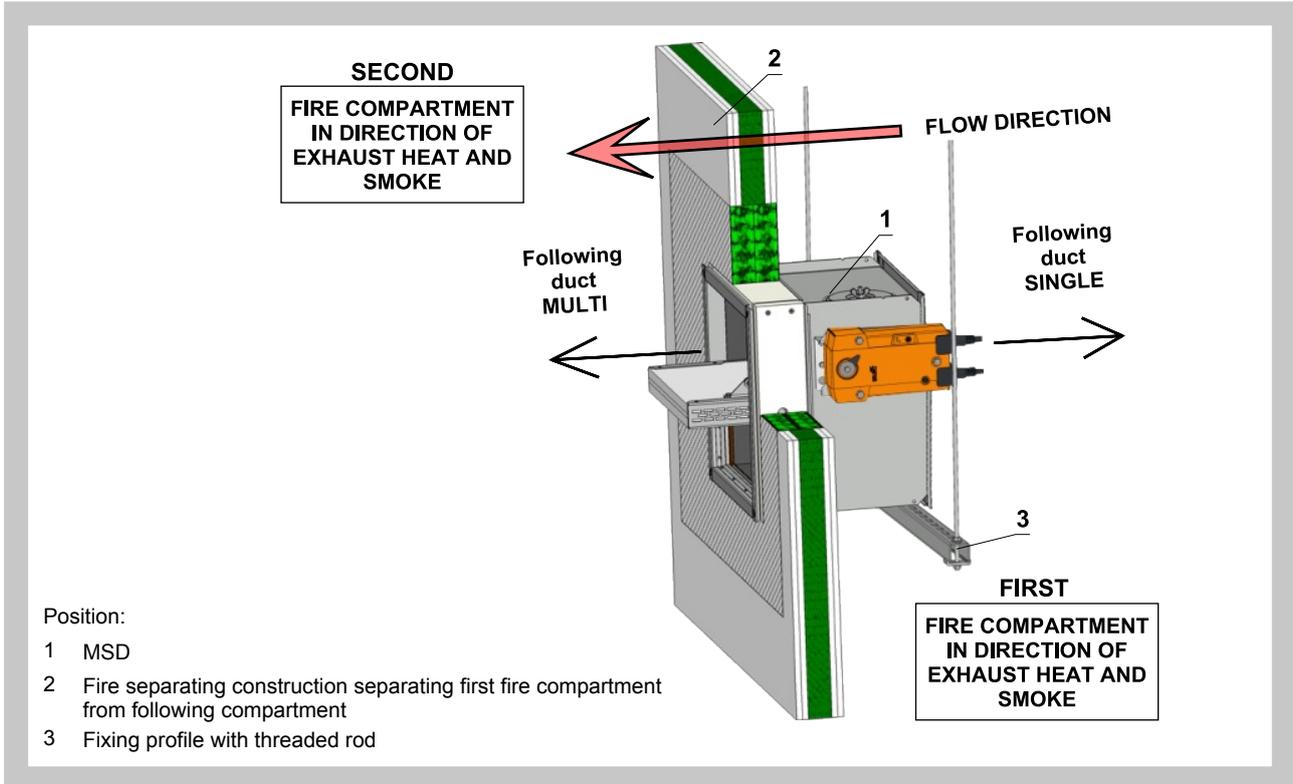
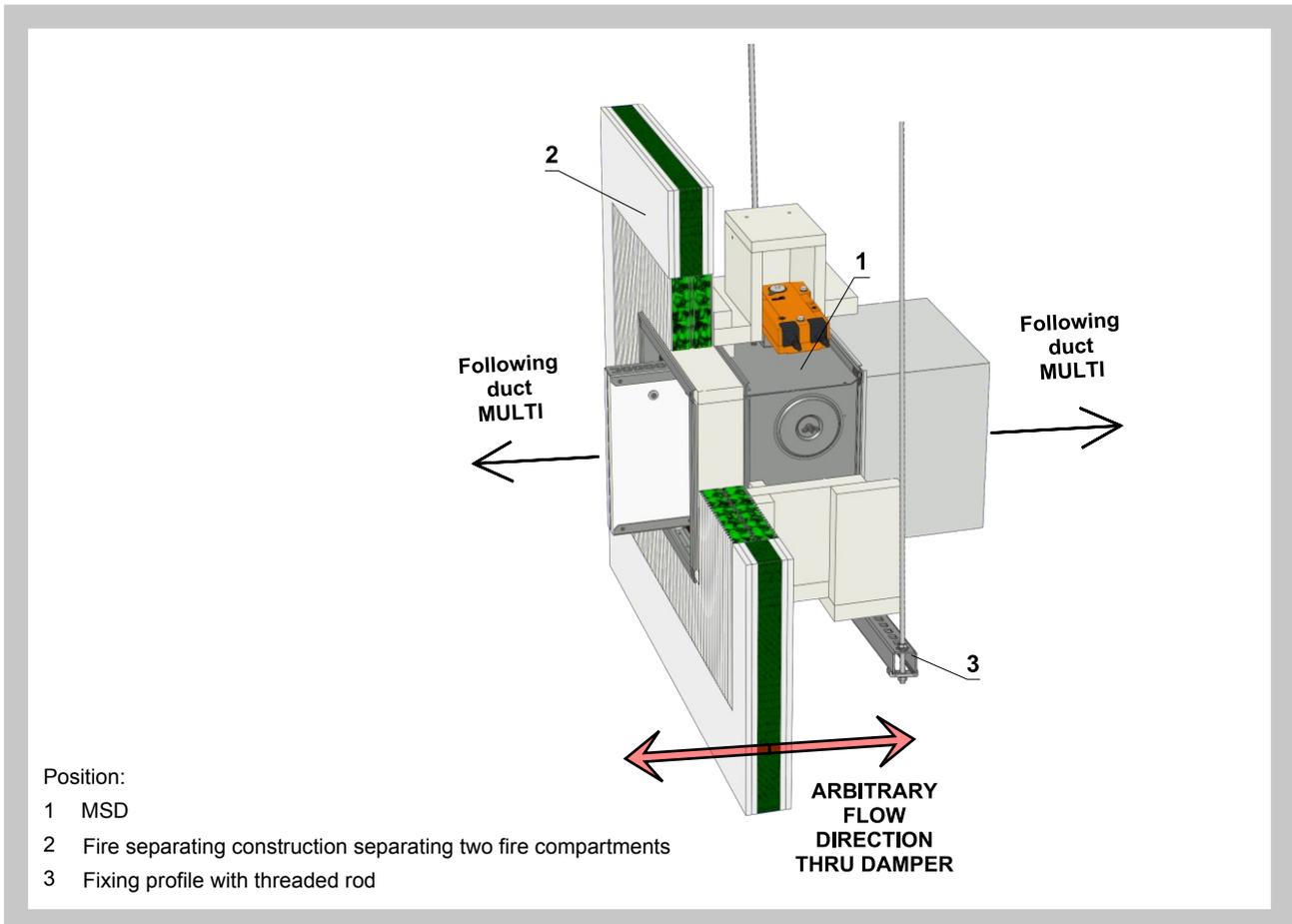


Fig. 59 Installation in fire separating construction in soft seal (cement lime plates) - fire compartment between duct MULTI/MULTI



6.6. Mounting to the ceiling wall

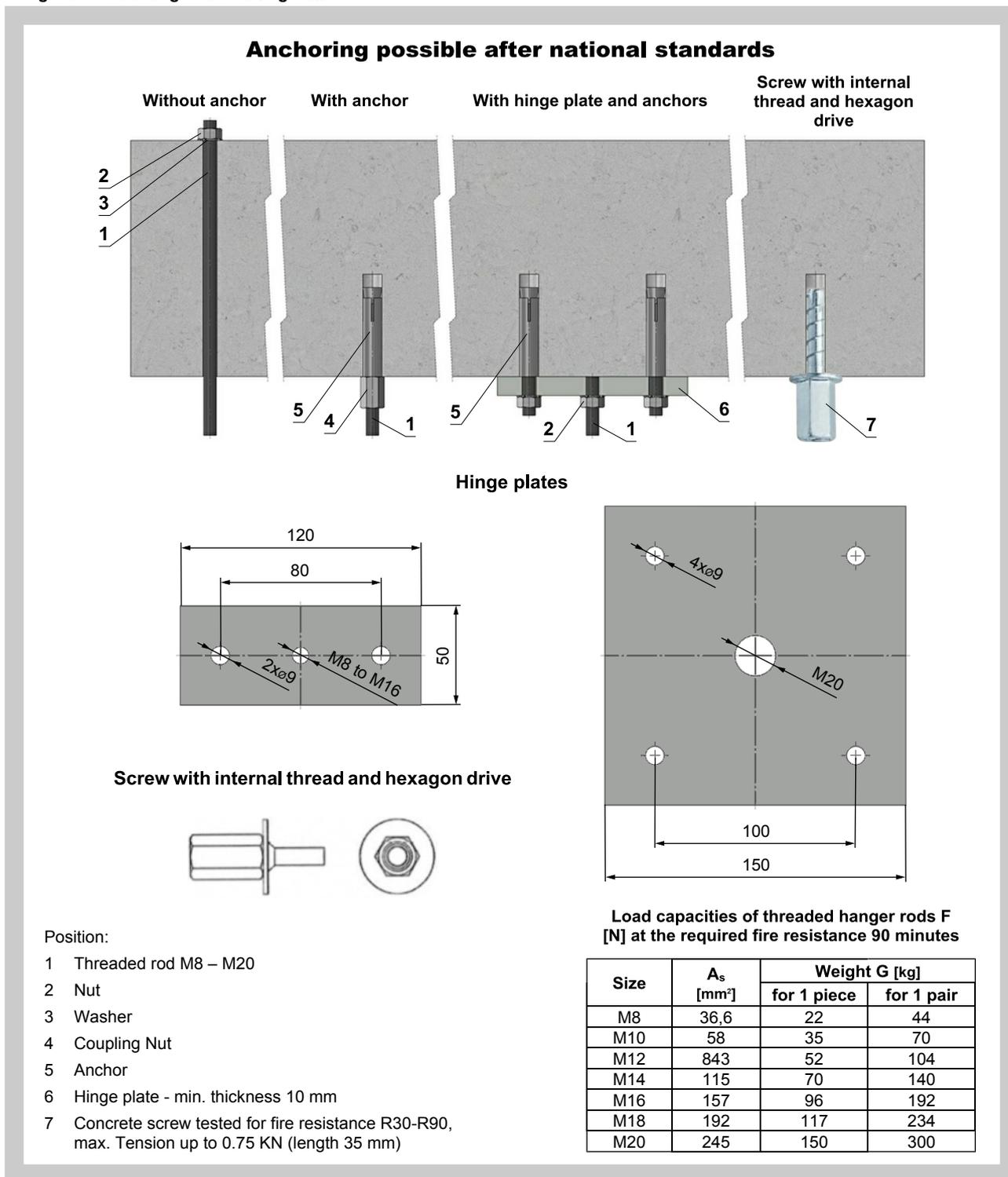
The dampers must be suspended using threaded rods and mounting profiles. Their dimensioning depends on the damper's weight.

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. 60

Fig. 60 Mounting to the ceiling wall



III. TECHNICAL DATA

7. Pressure loss

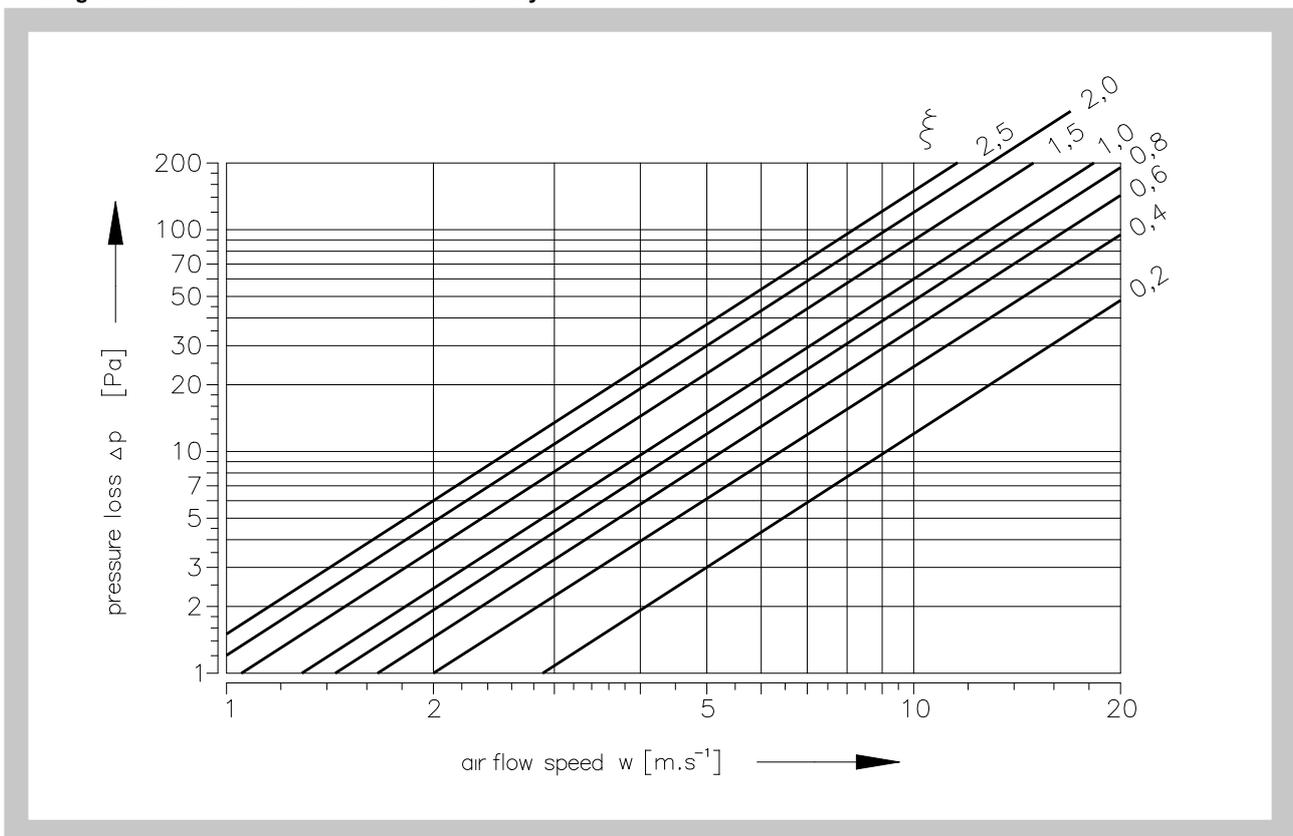
7.1. Pressure loss calculation

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

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 $\rho = 1,2 \text{ kg.m}^{-3}$

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

A	B									
	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

A	B									
	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 m² 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 m² 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

w [m/s]	ξ [-]											
	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,5	2,0	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

w [m/s]	ξ [-]											
	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

w [m/s]	f [Hz]							
	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.

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

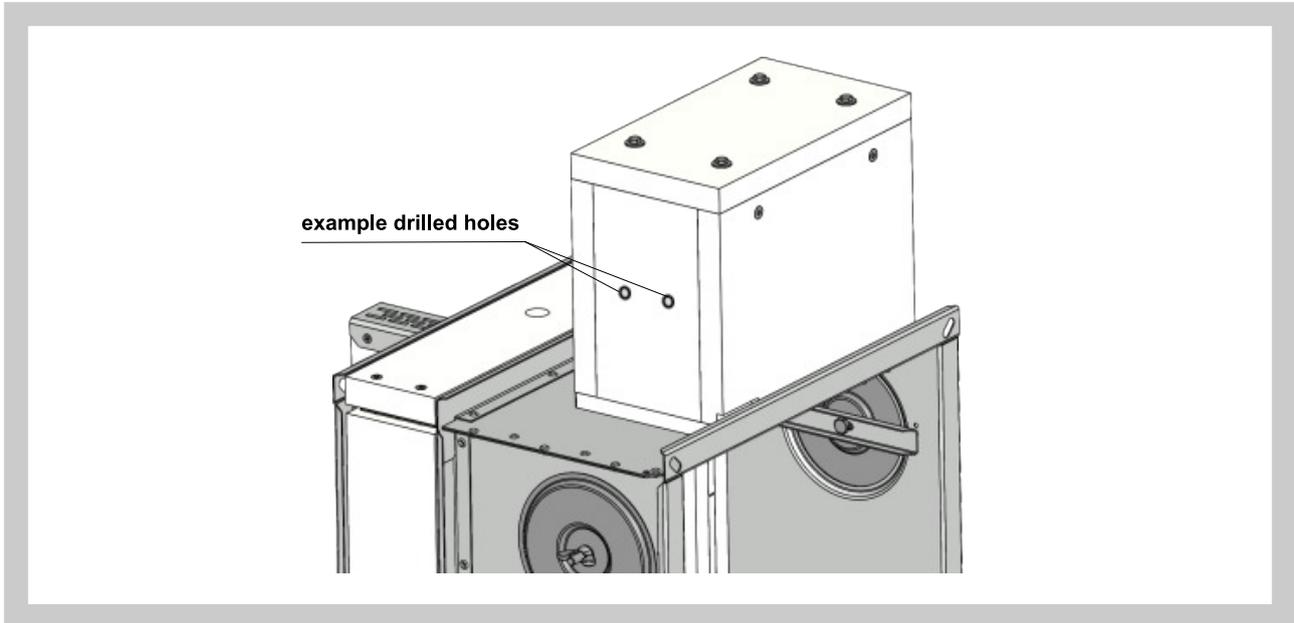
- 13.1. Assembly, maintenance and damper function check can be done only by qualified and trained person, i.e. "AUTHORIZED PERSON" according to the manufacturer documentation. All works done on the smoke control dampers must be done according international and local norms and laws.
- 13.2. All effective 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. 61 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 $\varnothing + 2$ mm for seal up by mastic) and make two holes (see fig. 61). **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 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 checked.

- 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.

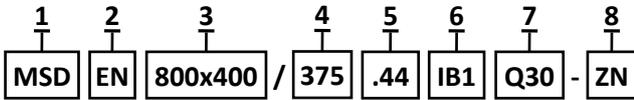
Fig. 62 Data label



IX. ORDERING INFORMATION

17. Ordering key MSD

Square damper MSD



EXAMPLE:

MSD EN 800x400/375 .44 IB1 Q30-ZN

Square smoke control damper MSD, dimension 800x400 mm, built length 375 mm, control design with spring return actuator 230 V, design includes protection box of the actuator and include the protective cladding boards in line with the blade, flange dimension 30 mm, galvanized material variant.

1| Type of smoke control damper - MSD

2| Country of destination

3| Damper dimensions A x B → see pages 16 to 25

"A" is the width of the damper

"B" is the height of the damper

4| Built length - 375 mm

5| Damper design

.44	With actuating mechanism BEN, BEE, BE, InMax 50.75-S for 230V
.54	With actuating mechanism BEN, BEE, BE, InMax 50.75-S for 24V
.65*	With actuating mechanism BEN (BEE)-SR for 24V

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

6| Accessories

	Without accessories
A	Design does not include protection box of the actuator and does not include protective cladding boards in line with the blade
A1	Design does not include protection box of the actuator and includes protective cladding boards in line with the blade
IB	Design includes protection box of the actuator and does not include the protective cladding boards in line with the blade
IB1	Design includes protection box of the actuator and include the protective cladding boards in line with the blade

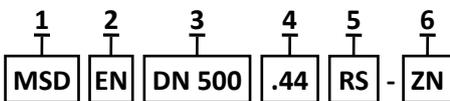
7| Flange dimension

Q30	Flange width 30 mm
-----	--------------------

8| Material

ZN	Galvanized
----	------------

Round damper MSD



EXAMPLE:

MSD EN DN 500 .44 RS-ZN

Round smoke control damper MSD, dimension DN 500 mm, control design with spring return actuator 230 V, straight connection to circular duct, galvanized material variant.

1| Type of smoke control damper - MSD

2| Country of destination

3| Damper dimensions øD → see page 26

4| Damper design

.44	With actuating mechanism BEN 230V
.54	With actuating mechanism BEN 24V

5| Duct connection

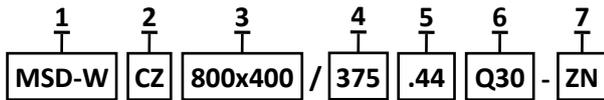
RS	Straight connection to circular duct
----	--------------------------------------

6| Material

ZN	Galvanized
----	------------

18. Ordering key MSD-W

Square damper MSD-W



EXAMPLE:

MSD-W EN 800x400/375 .44 Q30-ZN

Square smoke control damper MSD-W, dimension 800x400 mm, built length 375 mm, control design with spring return actuator 230 V, flange dimension 30 mm, galvanized material variant.

1| Type of smoke control damper - MSD-W **2| Country of destination**

3| Damper dimensions A x B → see pages 16 to 25

"A" is the width of the damper
"B" is the height of the damper

4| Built length - 375 mm

5| Damper design

.44	With actuating mechanism BEN 230V
.54	With actuating mechanism BEN 24V
.4M0	With actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 230V
.4M1	With actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 24V
.5M0	With actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 230V
.5M1	With actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 24V

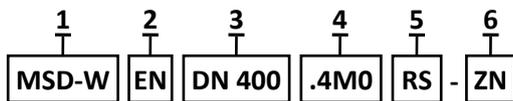
6| Flange dimension

Q30	Flange width 30 mm
-----	--------------------

7| Material

ZN	Galvanized
----	------------

Round damper MSD-W



EXAMPLE:

MSD-W EN DN 400 .4M0 RS-ZN

Round smoke control damper MSD-W, dimension DN 400 mm, control design with spring return actuator 230 V, straight connection to circular duct, galvanized material variant.

1| Type of smoke control damper - MSD-W **2| Country of destination**

3| Damper dimensions øD → see page 26

4| Damper design

.4M0	With actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 230V
.4M1	With actuating mechanism BFN 230, JOVENTA DAF2.20S with an electromagnet for 24V
.5M0	With actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 230V
.5M1	With actuating mechanism BFN 24, JOVENTA DAF1.20S with an electromagnet for 24V

5| Duct connection

RS	Straight connection to circular duct
----	--------------------------------------

6| Material

ZN	Galvanized
----	------------

The producer reserves the right for innovations of the product.
For actual product information see www.mandik.com

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