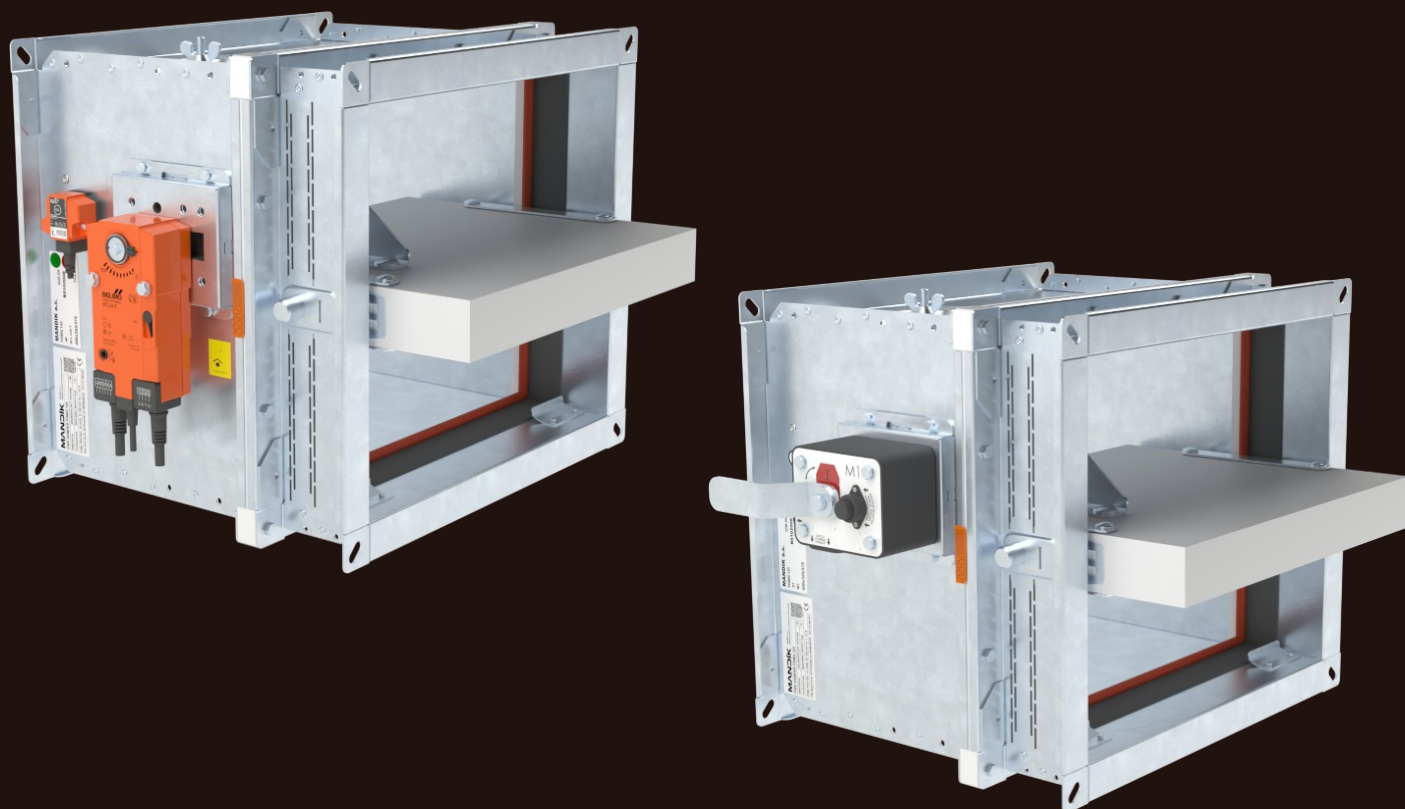


## FDMQ 120

### Fire damper

Technical Documentation

Installation, Commissioning, Operation, Maintenance and Service Manual



These technical specifications state a row of manufactured sizes and models of fire dampers FDMQ 120  
It is valid for production, designing, ordering, delivery, maintenance and operation.

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# I. GENERAL

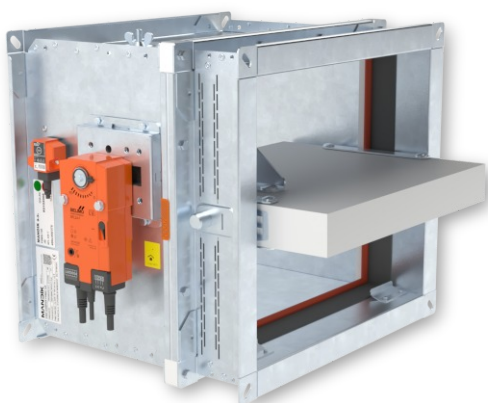
## Description

Fire dampers are shutters in ducts of air-conditioning devices that prevent the spread of fire and combustion products from one fire segment to the other one by means of closing the duct in the points of fire separating constructions.

Damper blade automatically closes air duct using a closing spring or a spring return actuator. The closing spring is actuated by pressing a button on the manual control or by melting a thermal fuse.

The return spring of the actuator is actuated when a thermoelectric activation device BAT is activated, when a test button on BAT is pressed or when power supply of the actuator is interrupted.

After closing the blade, the damper is sealed with silicon against smoke penetration. On request by customer, the damper can be supplied silicon-free. In the closed position, the damper is also sealed with material which increases its volume due to increasing temperature and air proofs the air duct.



*FDMQ 120 with spring return actuator*



*FDMQ 120 with manual control*

### Damper characteristics

- CE certified acc. to EN 15650
- Tested in accordance with EN 1366-2
- Classified acc. to EN 13501-3+A1
- External Casing leakage class min. ATC 3 (old marking "C") acc. to EN 1751, Internal leakage min. class 2 acc. to EN 1751
- Cycling test in class C<sub>10000</sub> acc. to EN 15650
- Corrosion resistant acc. to EN 15650
- Certificate of constancy of performance No. 1391-CPR-XXXX/XXXX
- Declaration of Performance No. PM/FDMQ 120/01/XX/X
- Hygienic assessment of fire dampers - Report No. 1.6/pos/19/19b

### Working conditions

- Exact damper function is provided under the following conditions:
  - maximum air velocity 12 m/s
  - maximum pressure difference 1200 Pa
  - the air circulation in the whole damper section must be secured steady over the entire surface.
- Dampers can be installed with horizontal blade axis.
- Dampers are suitable for systems without abrasive, chemical and adhesive particles.
- Dampers are designed for macroclimatic areas with mild climate according to EN IEC 60 721-3-3 ed.2., class 3K22. (Environment 3K22 is typically protected place with regulated temperature)
- Temperature in the place of installation is permitted to range from -30°C to +50°C.

## II. DESIGN

### Design with manual control

#### Design .01

- Design with manual control with a thermal fuse which actuates the shutting device, after the nominal activation temperature 72°C has been reached.
- Automatic initiation of the manual control is not activated if the temperature does not exceed 70°C.
- In case that other activation temperatures are required, thermal fuses with nominal activation temperature +104°C or +147°C can be supplied (this requirement must be specified in the order).



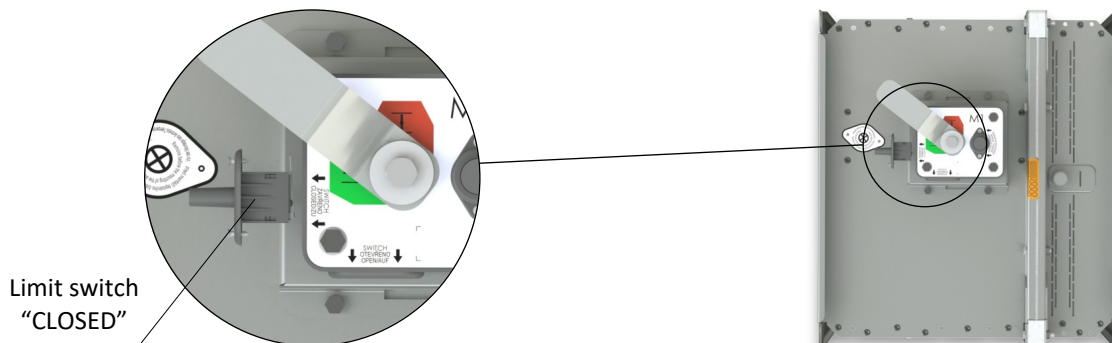
Design .01

#### ATTENTION:

- Manual controls are produced in four sizes M2 to M5, difference is only in size of a closing spring, which closes the fire damper.
- For the size of fire dampers is always assigned the size of the manual control → see pages 16 to 21
- It is not recommended to use different size of the manual control than given by the manufacturer, otherwise there is a risk of damaging the fire damper.

#### Design .11

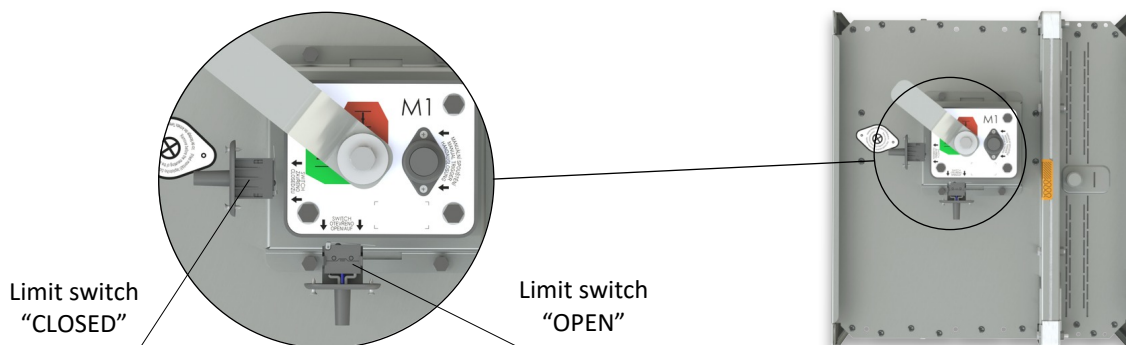
- Design .01 with manual control can be complemented with a limit switch signaling of the damper blade position "CLOSED".
- Cable is connected directly to limit switch.
- Limit switch detail → see page 5



Design .11

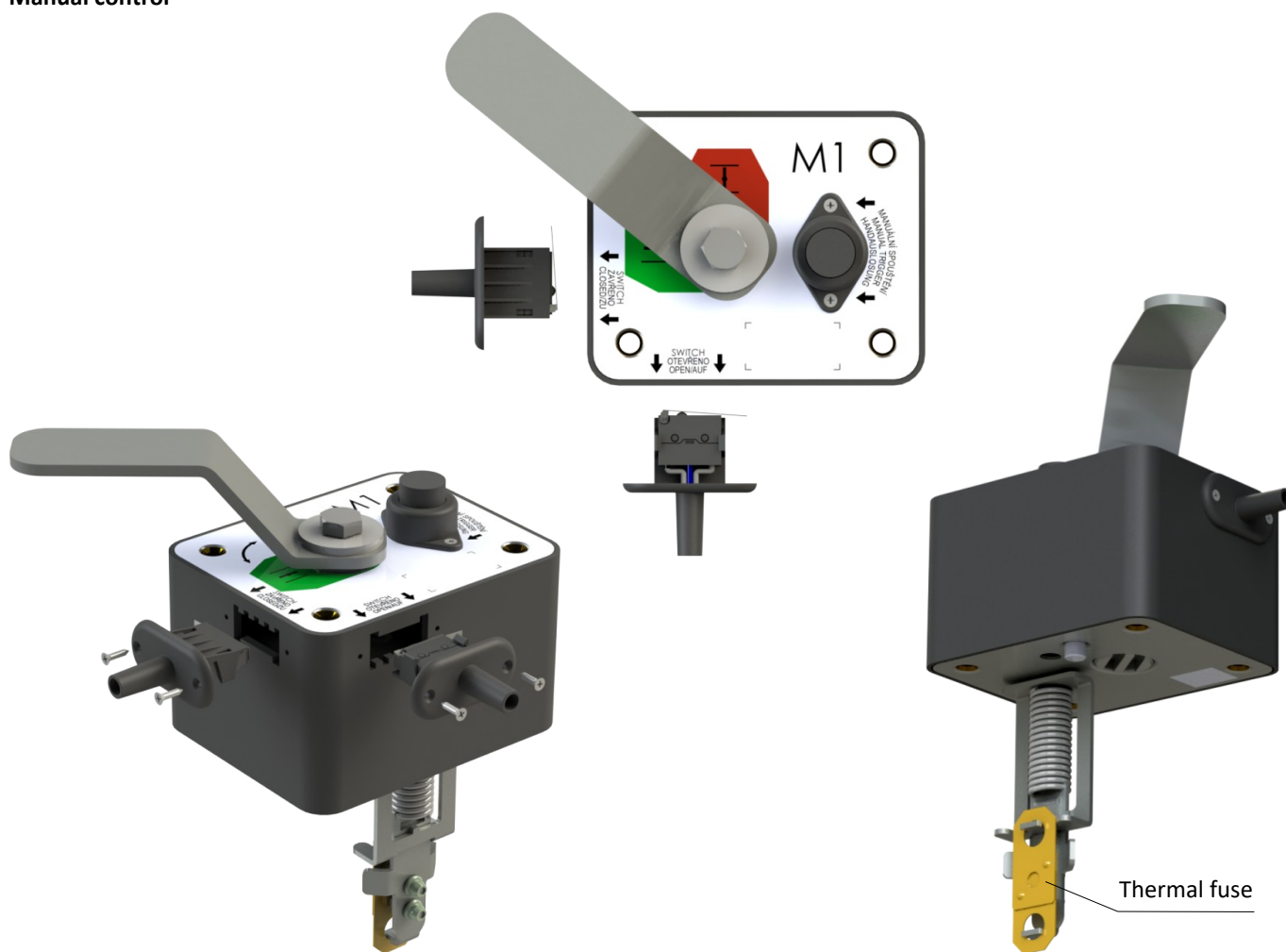
#### Design .80

- Design .01 with manual control can be complemented with two limit switches signaling of the damper blade position "CLOSED" and "OPEN".
- Cables are connected directly to limit switches.
- Limit switch detail → see page 5

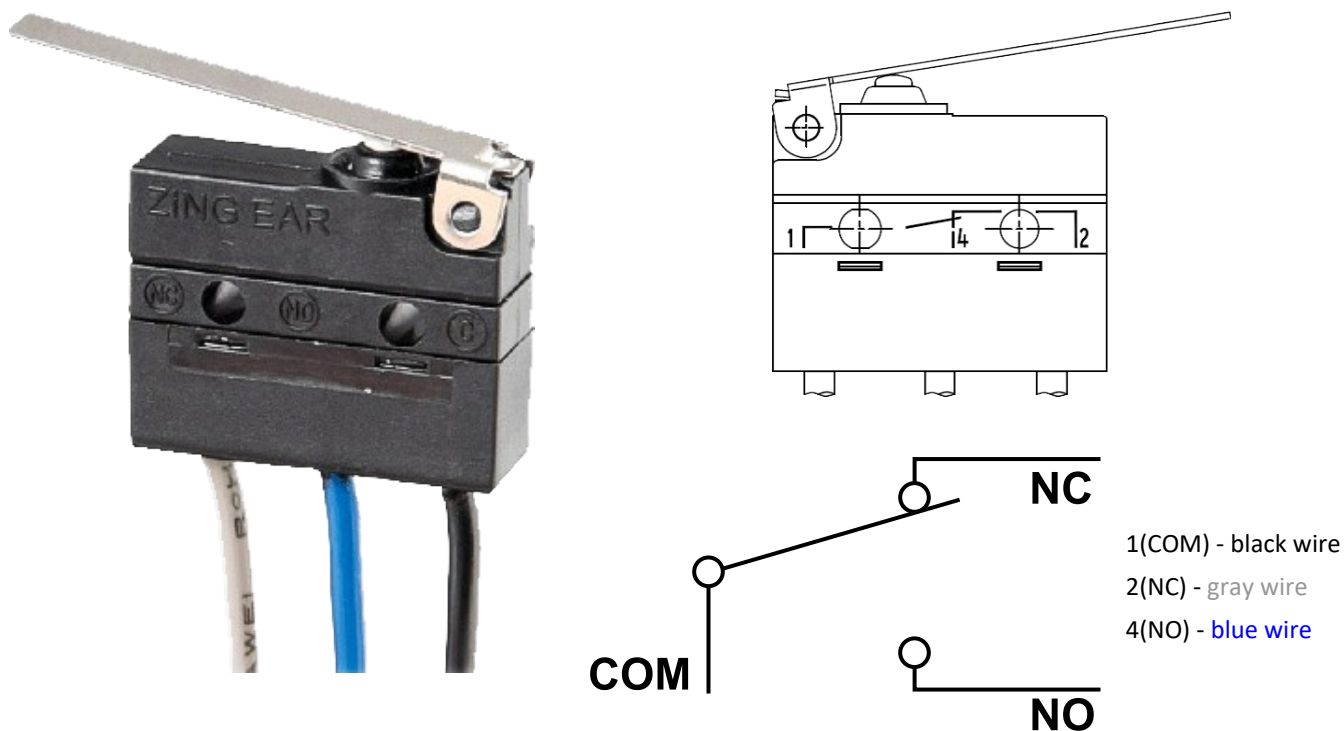


Design .80

Manual control



Limit switch G905-300E03W1



Nominal voltage and maximal current	AC 230V / 5A
Class of protection	IP 67
Working temperature	-25°C ... +120°C

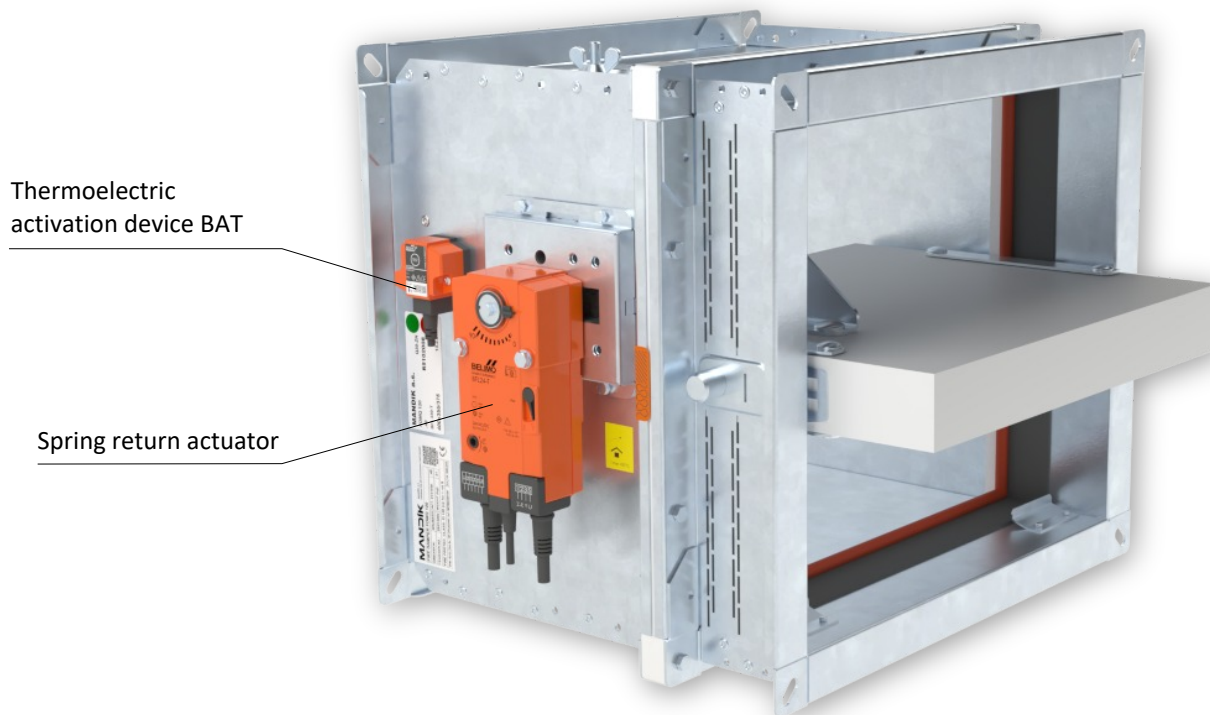
This limit switch is possible to connect in two following ways

- CUT-OFF if the arm is moving ... connect wire 1+2
- SWITCH-ON if the arm is moving ... connect wire 1+4

## Design with spring return actuator

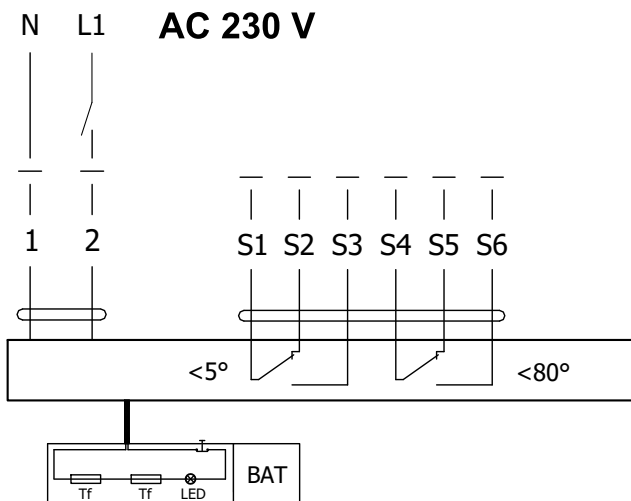
### Design .40 and .50

- The fire dampers are equipped with Belimo spring return actuators with thermoelectric activation device BAT. The spring return actuator types are BFL, BFN or BF depending on the damper size. (Further mentioned as „actuator“).
- After being connected to power supply 230V or AC/DC 24V, the actuator rotates the damper blade to the operating position "OPEN" and at the same time pre-stretches its return spring.
- When the actuator is power supplied, the damper blade is in the position "OPEN" and the return spring is pre-stretched.
- Time needed for full opening of the damper blade from the position "CLOSED" to the position "OPEN" is maximum 120 sec. If the actuator power supply is interrupted (due to loss of supply voltage, or pressing a test button on the thermoelectric activation device BAT), the actuator rotates the damper blade to the breakdown position "CLOSED".
- The time of closing the damper blade from the position "OPEN" to the position "CLOSED" takes maximum 20 sec.
- In case that the power supply is restored again (the blade can be in any position), the actuator starts to rotate the damper blade back to the position "OPEN".
- A thermoelectric activation device BAT, which contains two thermal fuses Tf1 and Tf2, is an integral part of the actuator.
- These fuses are activated when temperature +72°C has been reached (the fuse Tf1 due to temperature outside the duct and the fuse Tf2 due to temperature inside the duct). The thermoelectric activation device can also be equipped with a Tf2 thermal fuse type ZBAT 95/120/140 (must be specified in the order). In this case, the activation temperature inside the duct is +95°C, +120°C or +140°C (depending on the type).
- After the thermal fuse Tf1 or Tf2 has been activated, the power supply is permanently and irreversibly interrupted and the actuator, by means of the pre-stretched spring, rotates the damper blade into the breakdown position "CLOSED".
- Signalisation of damper blade position "OPEN" and "CLOSE" is provided by two microswitches.

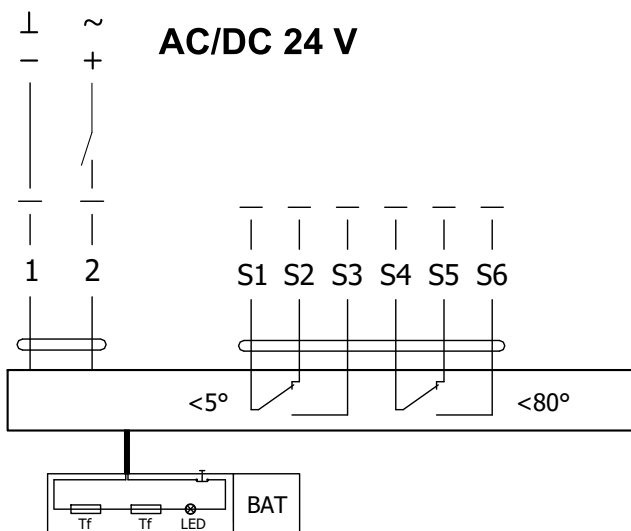


*Design .40 and .50*

**Actuator BELIMO BFL 230-T**



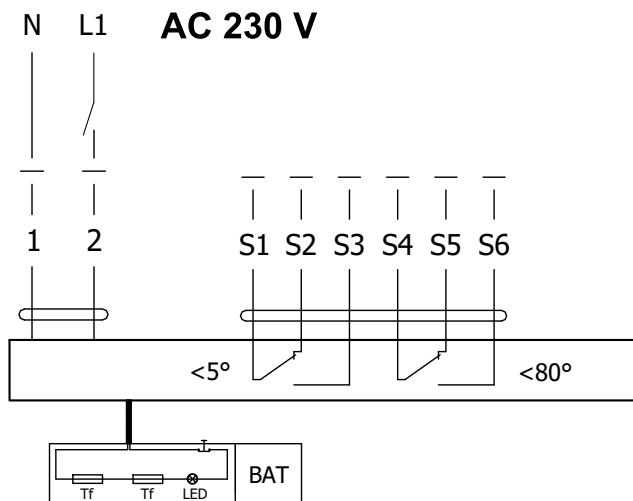
**Actuator BELIMO BFL 24-T(-ST)**



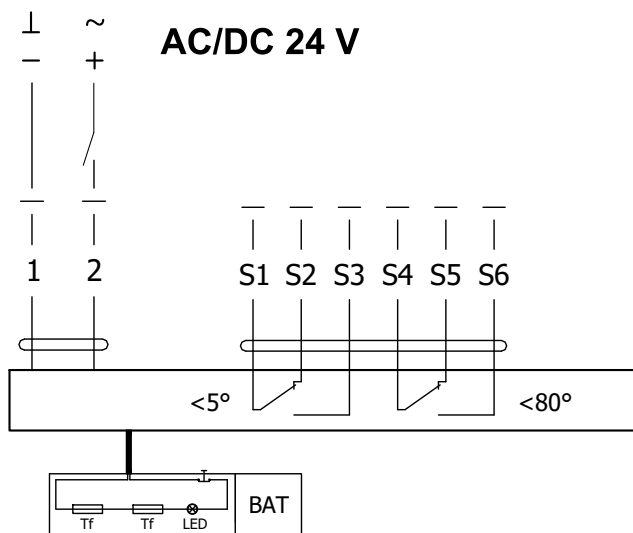
**Actuator BELIMO BFL 230-T(-ST), BFL 24-T(-ST)**

Actuator BELIMO - 4 Nm/ 3 Nm Spring	BFL 230-T(-ST)	BFL 24-T(-ST)
Power voltage	AC 230 V 50/60Hz	AC/DC 24 V 50/60Hz
Power consumption - in operation - in rest position	2,6 W 0,7 W	2,0 W 0,7 W
Dimensioning	4 VA (I <sub>max</sub> 4 A @ 5 ms)	2,8 VA (I <sub>max</sub> 2,9 A @ 5 ms)
Protection class	II	III
Degree of protection	IP 54	
Running time - motor - spring return	< 60 s ~ 20 s	
Ambient temperature - normal duty - safety duty - non-operating temperature	-30°C ... +55°C The safe position will be attained up to max. +75°C -40°C ... +55°C	
Connection - supply/control - auxiliary switch	cable 1 m, 2 x 0,75 mm <sup>2</sup> (BFL 2xx-T-ST) with 3-pin plug-in connectors cable 1 m, 6 x 0,75 mm <sup>2</sup> (BFL 2xx-T-ST) with 6-pin plug-in connectors	
Response temperature thermal fuse	duct outside temperature +72°C duct inside temperature +72°C	

**Actuator BELIMO BFN 230-T**



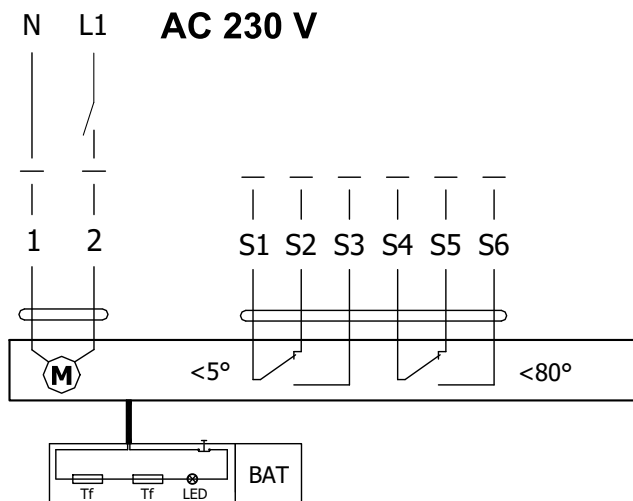
**Actuator BELIMO BFN 24-T(-ST)**



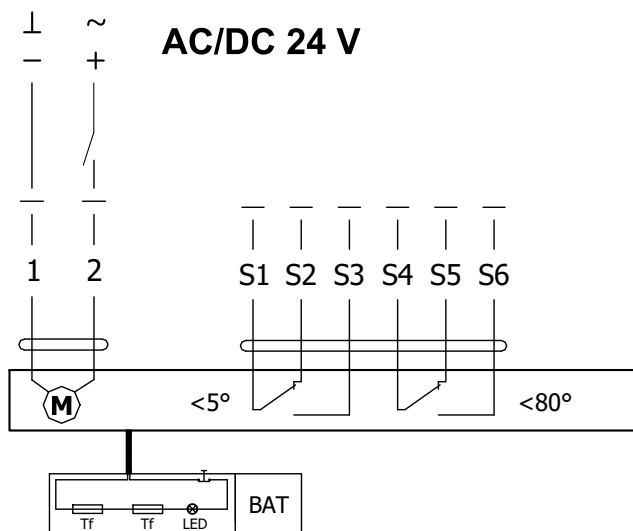
**Actuator BELIMO BFN 230-T(-ST), BFN 24-T(-ST)**

Actuator BELIMO - 9 Nm/ 7 Nm Spring	BFN 230-T(-ST)	BFN 24-T(-ST)
Power voltage	AC 230 V 50/60Hz	AC/DC 24 V 50/60Hz
Power consumption - in operation - in rest position	3,5 W 1,3 W	3,2 W 1,2 W
Dimensioning	6,5 VA (Imax 4 A @ 5 ms)	4,3 VA (Imax 2,9 A @ 5 ms)
Protection class	II	III
Degree of protection	IP 54	
Running time - motor - spring return	< 60 s ~ 20 s	
Ambient temperature - normal duty - safety duty - non-operating temperature	-30°C ... +55°C The safe position will be attained up to max. +75°C -40°C ... +55°C	
Connection - supply/control - auxiliary switch	cable 1 m, 2 x 0,75 mm <sup>2</sup> (BFN 2xx-T-ST) with 3-pin plug-in connectors cable 1 m, 6 x 0,75 mm <sup>2</sup> (BFN 2xx-T-ST) with 6-pin plug-in connectors	
Response temperature thermal fuse	duct outside temperature +72°C duct inside temperature +72°C	

**Actuator BELIMO BF 230-TN**



**Actuator BELIMO BF 24-TN (-ST)**



**Actuator BELIMO BF 230-TN(-ST), BF 24-TN(-ST)**

Actuator BELIMO - 18 Nm/ 12 Nm Spring	BF 230-TN(-ST)	BF 24-TN(-ST)
Power voltage	AC 230 V 50/60Hz	AC/DC 24 V 50/60Hz
Power consumption - in operation - in rest position	8,5 W 3 W	7 W 2 W
Dimensioning	11 VA (I <sub>max</sub> 8,3 A @ 5 ms)	10 VA (I <sub>max</sub> 8,3 A @ 5 ms)
Protection class	II	III
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	
Connection - supply/control - auxiliary switch	cable 1 m, 2 x 0,75 mm <sup>2</sup> (BF 2xx-TN-ST) with 3-pin plug-in connectors cable 1 m, 6 x 0,75 mm <sup>2</sup> (BF 2xx-TN-ST) with 6-pin plug-in connectors	
Response temperature thermal fuse	duct outside temperature +72°C duct inside temperature +72°C	

**Thermoelectric activation device BAT**

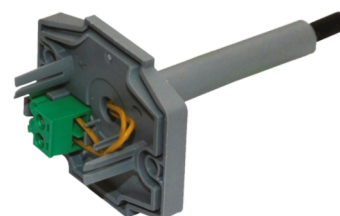
- If the thermal fuse Tf1 is interrupted (due to temperature outside the duct), it is necessary to replace the spring return actuator. Thermoelectric activation device BAT is integral part of the actuator.
- If the thermal fuse Tf2 is interrupted (due to temperature inside the duct), only the spare part ZBAT 72 (95/120/140) needs to be replaced (acc.to the activation temperature).
- When one of the thermal fuses responds, the supply voltage is interrupted permanently and irreversibly.
- The function (interruption of the supply voltage) can be checked by pressing the test button.
- Installation is carried out with the pre-assembled, self-tapping screws.



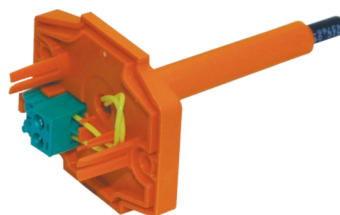
**BELIMO ZBAT 72**  
Black (BK) = 72°C (standard)



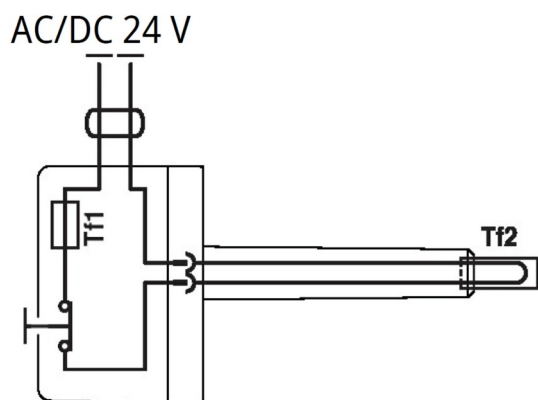
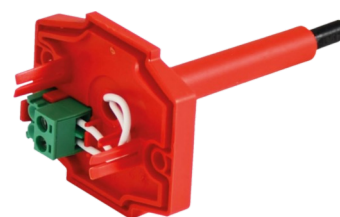
**BELIMO ZBAT 95**  
Grey (GY) = 95°C



**BELIMO ZBAT 120**  
Orange (OG) = 120°C



**BELIMO ZBAT 140**  
Red (RD) = 140°C



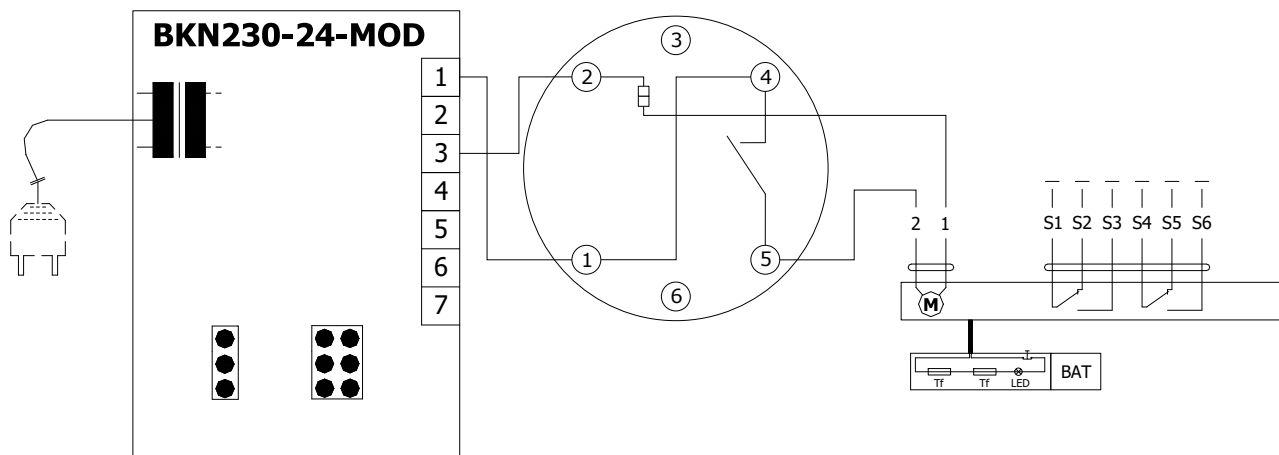
**Thermoelectric activation device BAT 72 (95/120/140)**

Power voltage	AC/DC 24 V 50/60Hz
Rated current	1 A
AC/DC throughput resistance	<1 Ω
Protection class	III
Degree of protection	IP 54
Probe length	65 mm
Ambient temperature	-30°C ... +50°C
Storage temperature	-40°C ... +50°C
Ambient humidity	Max. 95% RH, non-condensing
Connection supply	Cable 1 m, 2 x 0.5 mm <sup>2</sup> , Betaflam cable heatresistant up to 145°C
Response temperature thermal fuse	Duct inside temperature +72 (95/120/140)°C Duct outside temperature +72 (95/120/140)°C

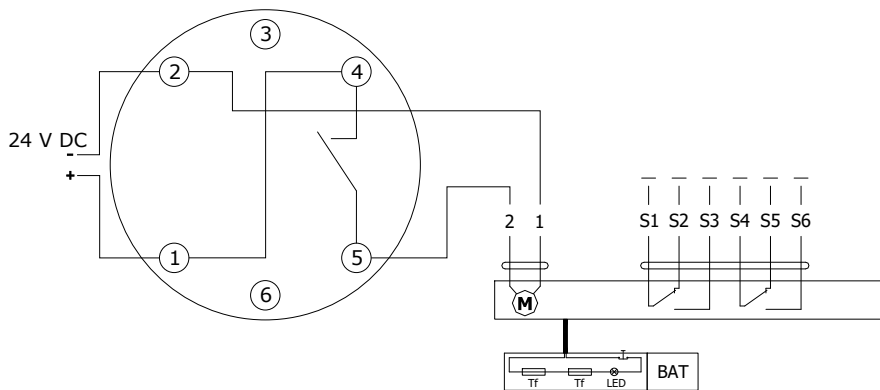
**Design .41 and .51**

- Design .41 or .51 with actuator and smoke detector ORS 142 K. The voltage can be AC 230 V or 24 V DC. Design .41 with voltage AC 230 V is equipped with communication and supply device BKN 230-24-MOD and with actuator BF 24-TN (BFL 24-T, BFN 24-T).
- The smoke detector is activated when smoke spreads in air duct system. Deactivation of the smoke detector alarm status is provided by interruption of supply voltage for min. 2s.
- Signalisation of damper blade position "OPEN" and "CLOSE" is provided by two microswitches.

**Design .41 with actuator BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K and with supply device BKN 230-24-MOD (voltage AC 230 V)**



**Design .51 with actuator BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K (voltage 24 V DC)**



**Communication and supply device BKN 230-24-MOD**

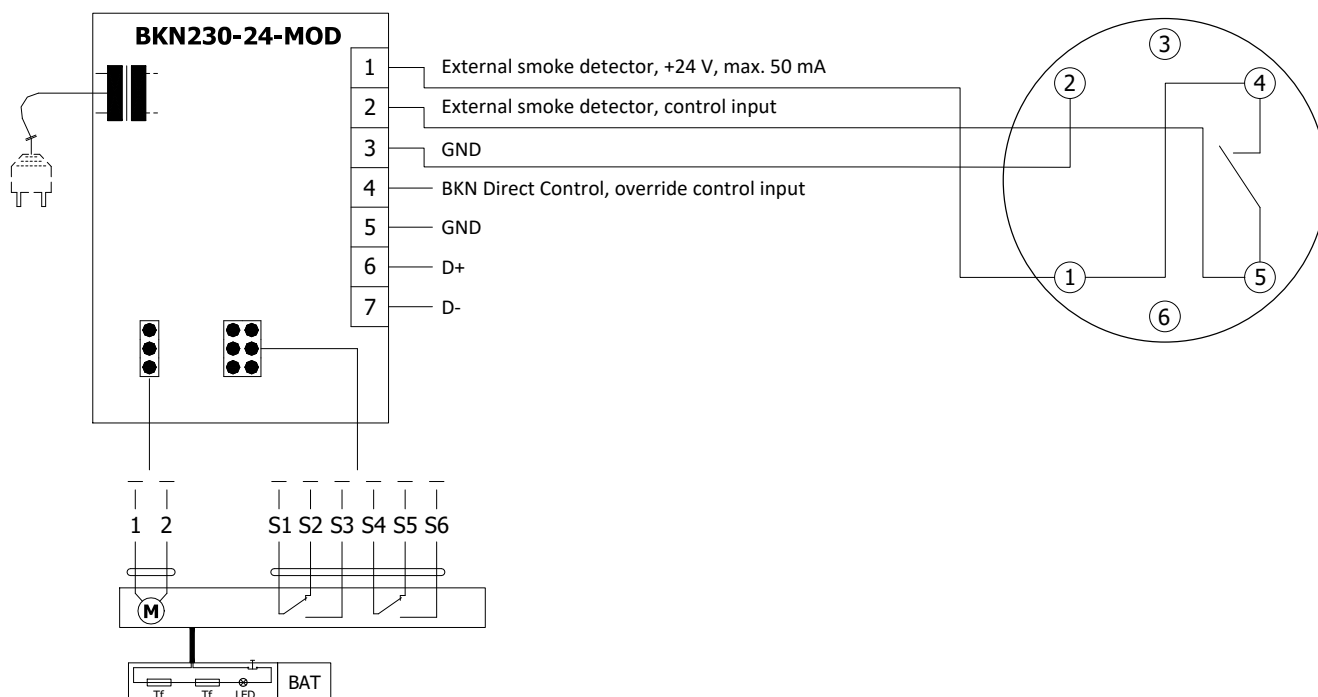
Nominal voltage	AC 230 V 50/60Hz
Power consumption	3 W (operating position)
Dimensioning	14 VA (including actuator)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-20°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net	cable 0,9 m with EURO plug type 26
- motor	6-pole connector, 3-pole connector
- terminal board	screw terminals for cable 2x1,5 mm <sup>2</sup>

## Design with the communication and supply device

### Design .63, 63S

- Design with the communication and supply device BKN 230-24-MOD and actuator BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) for communication with control systems using the Modbus RTU or BACnet MS / TP. Design 63. can be extended with an optical smoke detector ORS 142 K (design .63S).
- The wiring of the line is to be carried out in accordance with applicable RS485 regulations.
- Parameterization of the communication is done using DIL switches.
- BKN 230-24-MOD can be installed separately, without a connection to a master control system, in which case the connection bridge between the terminals 1 and 4 must be installed.
- If the test button on BAT is pressed or if the power supply (e.g. by a signal from ELECTRICAL FIRE SIGNALISATION) is disconnected, the damper blade position will be "FAILURE".
- For design .63S the smoke detector is activated when smoke spreads in air duct system. Deactivation of the smoke detector alarm status is provided by interruption of supply voltage for min. 2s.

### Design with communication and supply device BKN 230-24-MOD, with actuator BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) and smoke detector ORS 142 K



#### Communication and supply device BKN 230-24-MOD

Nominal voltage	AC 230 V 50/60Hz
Power consumption	3 W (operating position)
Dimensioning	14 VA (including actuator)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-20°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net	cable 0,9 m with EURO plug type 26
- motor	6-pole connector, 3-pole connector
- terminal board	screw terminals for cable 2x1,5 mm <sup>2</sup>

### Optical smoke detector ORS 142 K with the socket 143A

- The smoke detector ORS 142 K is used for early smoke detection in rooms or inside the ventilation system.
- The sensor operates on the light scatter principle. Inside the scanning chamber is a light source and a light sensor, in the normal state the light from the source does not fall on the sensor. Only when smoke enters the scanning chamber the light is scattered and falls on the sensor.
- The smoke detector can be connected directly to the actuator (design .41 and .51) which, in case of smoke detection, passes to the safety position, or to the BKN communication and supply device (design .63).
- By early detection of smoke, it can be effectively prevented from spreading of smoke through the ventilation system. In addition to smoke detection, the sensor can distinguish and signal slight and heavy contamination, e.g. the presence of large amounts of dust.
- The ORS 142 K smoke detector has an alarm memory, i.e. if the alarm is triggered, the safety relay opens and stays in this state even if the smoke disappears from the scanning chamber. The sensor remains in the alarm state until the power supply is briefly reset.
- On the pin 3, an external device can be connected via RS-Bus communication to report the status of the sensor.
- Pin 6 has no connection to the detector and is designed as a load-bearing structure in the base.

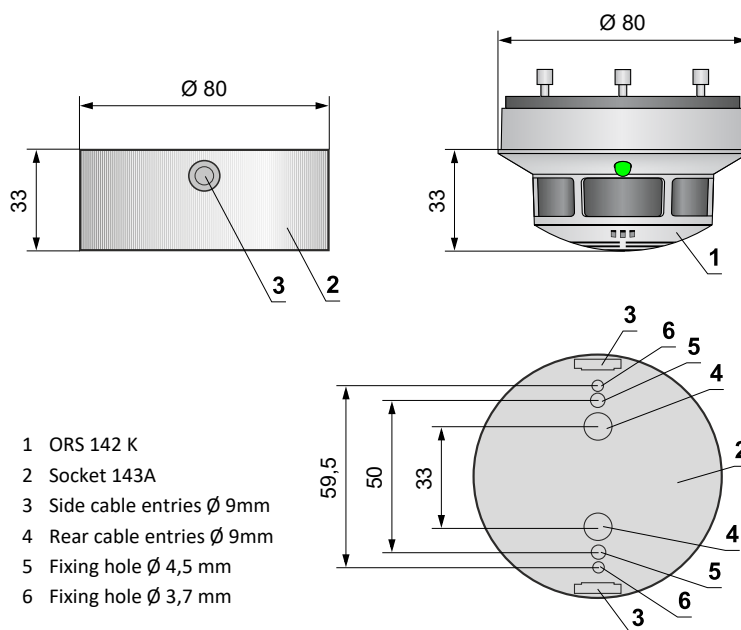
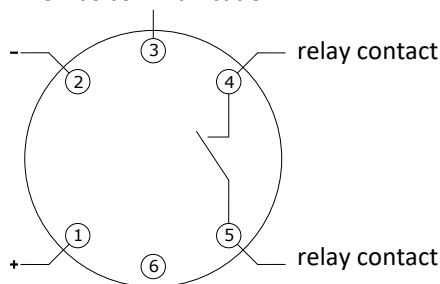
ORS 142 K



Socket 143A



RS-Bus communication



Relay contact		LED	
In operation		Green	Shines
Slight contamination		Green / Yellow	Flashes
Heavy contamination		Green / Yellow	Flashes
Fault		Yellow	Shines
Alarm		Red	Shines
Power Off		Off	-

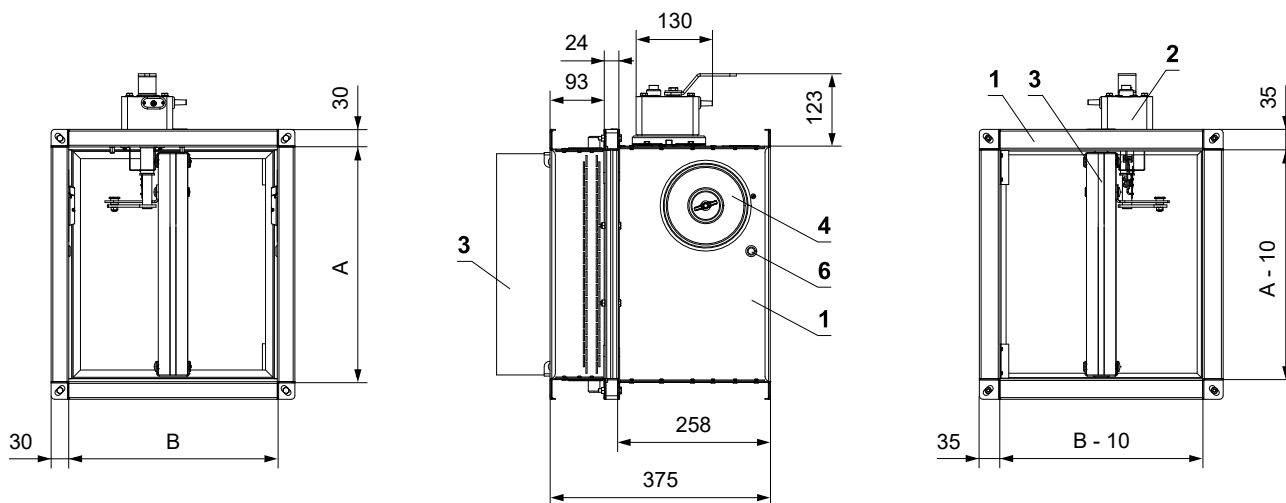
- 1 ORS 142 K
- 2 Socket 143A
- 3 Side cable entries Ø 9mm
- 4 Rear cable entries Ø 9mm
- 5 Fixing hole Ø 4,5 mm
- 6 Fixing hole Ø 3,7 mm

### Optical smoke detector ORS 142 K with the socket 143A

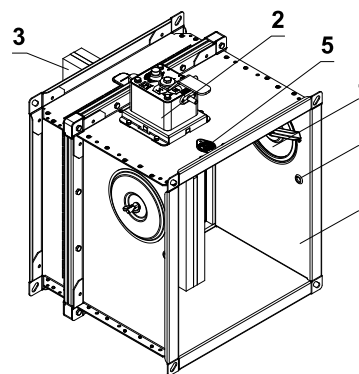
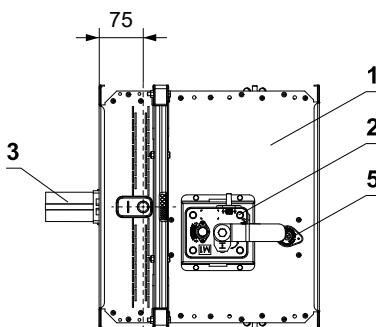
Operating voltage	18 ... 28 V DC
Residual ripple	≤ 200 mV
Power Consumption Socket (without actuator)	max. 22 mA
Degree of protection	IP 42
Ambient temperature	-20°C ... +75°C
Additional temperature sensor	+70°C
Connection - net	Cabel 1m, connected to terminals 1, 2 and 4
- motor	Actuator connected on the terminals 2 and 5
- communication and supply device BKN	Cabel 1m, connected to terminals 1, 2, 4 and 5

### III. DIMENSIONS

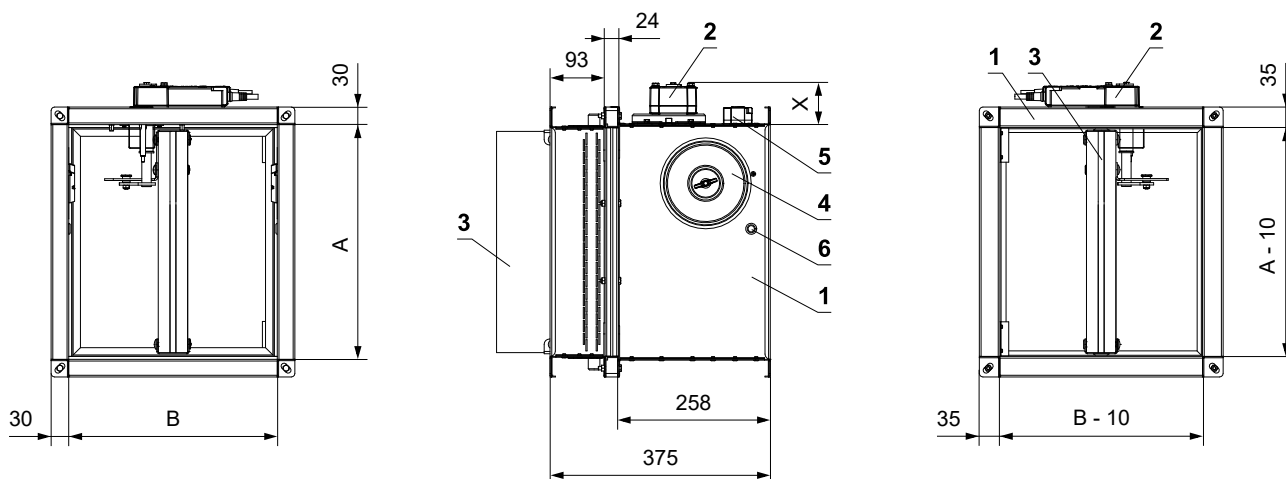
FDMQ 120 with manual control



- 1 Damper casing
- 2 Manual control
- 3 Damper blade
- 4 Inspection opening cover
- 5 Sensor sticker
- 6 Hole for camera

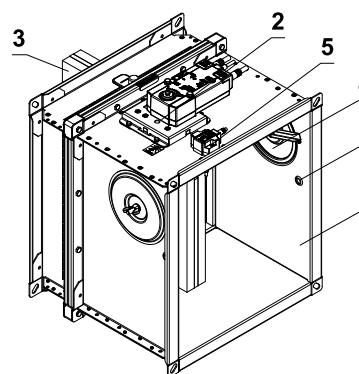
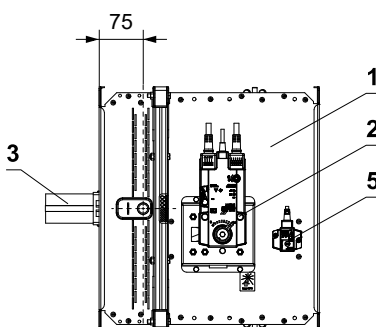


FDMQ 120 with spring return actuator



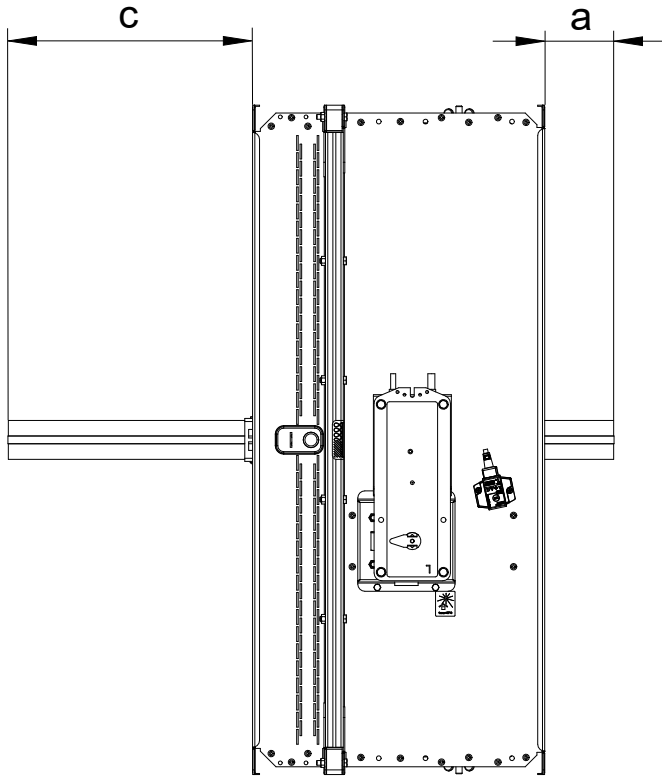
X=72 mm (BFL)  
 X=76 mm (BFN)  
 X=83 mm (BF)

- 1 Damper casing
- 2 Spring return actuator
- 3 Damper blade
- 4 Inspection opening cover
- 5 Thermoelectric activation device BAT
- 6 Hole for camera



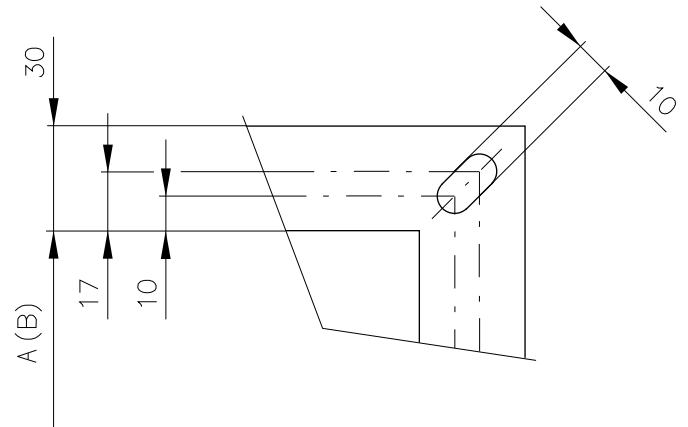
**Damper blade overlaps**

- Open damper blade overlaps the damper casing by the value "a" or "c". These values are specified in chapter Technical parameters → see pages 16 to 21

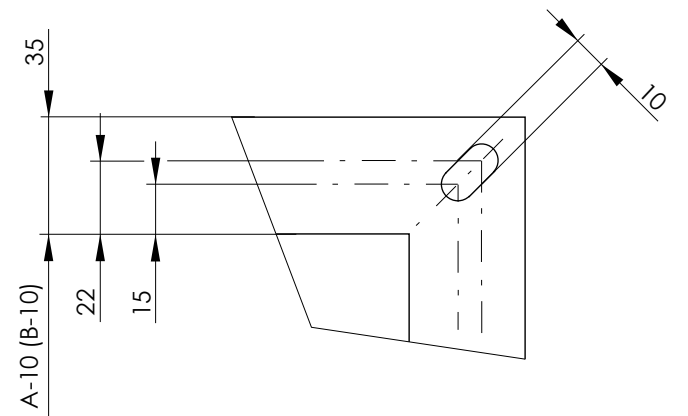


Values "a" and "c" has to be respected when projecting following air-conditioning duct.

**Flange of a damper - CONTROL SIDE**



**Flange of a damper - INSTALLATION SIDE**



*Flanges of dampers are 30 mm wide with oval hole.*

Technical parameters

A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>r</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>r</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control						
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*									
150 x	-	-	8,4	8,5	0,0094	BFL	M2	200 x	650	3	248	17,7	18	0,1006	BFL	M2					
	-	13	8,8	8,9	0,0131				700	28	273	18,6	18,8	0,1094							
	-	23	9	9,2	0,0156				710	33	278	18,7	19	0,1111							
	-	35,5	9,4	9,5	0,0188				750	53	298	19,4	19,7	0,1181							
	-	48	9,7	9,8	0,0219				800	78	323	20,2	20,5	0,1269							
	-	63	10,1	10,2	0,0256				150 x	BFL	225 x	150	-	-			9,4	9,5	0,0150	BFL	M2
	-	73	10,4	10,5	0,0281							180	-	13			10	10,1	0,0210		
	-	80,5	10,6	10,7	0,0300							200	-	23			10,4	10,5	0,0250		
	-	100,5	11,1	11,2	0,0350							225	-	36			10,9	11	0,0300		
	-	123	11,7	11,8	0,0406							250	-	48			11,3	11,5	0,0350		
	-	148	12,3	12,5	0,0469							280	-	63			11,9	12,1	0,0410		
	-	173	13	13,2	0,0531							300	-	73			12,3	12,5	0,0450		
	-	198	13,6	13,8	0,0594							315	-	80,5			12,6	12,8	0,0480		
	-	203	13,8	14	0,0606							355	-	100,5			13,4	13,6	0,0560		
-	223	14,3	14,5	0,0656	400	-	123	14,3				14,5	0,0650								
-	238	14,7	14,9	0,0694	450	-	148	15,3				15,5	0,0750								
180 x	-	-	8,8	8,9	0,0116	BFL	M2	250 x				500	-	173	16,2	16,5	0,0850	BFL	M2		
	-	13	9,2	9,4	0,0163							550	-	198	17,2	17,4	0,0950				
	-	23	9,6	9,7	0,0194							560	-	203	17,4	17,6	0,0970				
	-	36	10	10,1	0,0233				600	-	223	18,1	18,4	0,1050							
	-	48	10,4	10,5	0,0271				630	-	238	18,7	19	0,1110							
	-	63	10,8	11	0,0318				650	3	248	19,1	19,4	0,1150							
	-	73	11,1	11,3	0,0349				700	28	273	20	20,3	0,1250							
	-	80,5	11,4	11,6	0,0372				710	33	278	20,2	20,5	0,1270							
	-	100,5	12	12,2	0,0434				750	53	298	21	21,3	0,1350							
	-	123	12,7	12,9	0,0504				800	78	323	21,9	22,2	0,1450							
	-	148	13,5	13,7	0,0581				150 x	BFL	250 x	150	-	-	9,7	9,8	0,0169			BFL	M2
	-	173	14,3	14,5	0,0659							180	-	13	10,4	10,5	0,0236				
	-	198	15,1	15,3	0,0736							200	-	23	10,8	11	0,0281				
	-	203	15,2	15,5	0,0752							225	-	36	11,3	11,5	0,0338				
-	223	15,8	16,1	0,0814	250	-	48	11,9				12,1	0,0394								
-	238	16,3	16,5	0,0860	280	-	63	12,6				12,7	0,0461								
3	248	16,6	16,9	0,0891	300	-	73	13				13,2	0,0506								
28	273	17,4	17,6	0,0969	315	-	80,5	13,3				13,5	0,0540								
33	278	17,5	17,8	0,0984	355	-	100,5	14,2				14,4	0,0630								
53	298	18,1	18,4	0,1046	400	-	123	15,2				15,4	0,0731								
78	323	18,9	19,2	0,1124	450	-	148	16,2				16,5	0,0844								
200 x	-	-	9	9,2	0,0131	BFL	M2	250 x				500	-	173	17,3	17,6	0,0956	BFL	M3		
	-	13	9,6	9,7	0,0184							550	-	198	18,3	18,6	0,1069				
	-	23	9,9	10,1	0,0219							560	-	203	18,6	18,8	0,1091				
	-	36	10,4	10,5	0,0263				600	-	223	19,4	19,7	0,1181							
	-	48	10,8	11	0,0306				630	-	238	20	20,3	0,1249							
	-	63	11,3	11,5	0,0359				650	3	248	20,4	20,8	0,1294							
	-	73	11,7	11,8	0,0394				700	28	273	21,5	21,8	0,1406							
	-	80,5	11,9	12,1	0,0420				710	33	278	21,7	22	0,1429							
	-	100,5	12,6	12,8	0,0490				750	53	298	22,5	22,9	0,1519							
	-	123	13,4	13,6	0,0569				800	78	323	23,5	23,9	0,1631							
	-	148	14,3	14,5	0,0656				150 x	BFL	280 x	150	-	-	10,1	10,2	0,0191			BFL	M2
	-	173	15,2	15,4	0,0744							180	-	13	10,8	11	0,0268				
	-	198	16	16,3	0,0831							200	-	23	11,3	11,5	0,0319				
	-	203	16,2	16,4	0,0849							225	-	36	11,9	12,1	0,0383				
-	223	16,9	17,1	0,0919	250	-	48	12,6				12,7	0,0446								
-	238	17,4	17,6	0,0971	280	-	63	13,3				13,5	0,0523								

Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

A x B [mm]	Damper blades overlaps		Weight		Free area Sf [m²]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area Sf [m²]	Spring return actuator	Manual control	
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*				
280 x	300	-	73	13,8	14	0,0574	BFL	315 x	710	33	278	25,4	25,8	0,1842	BFL	M2
	315	-	80,5	14,1	14,3	0,0612			750	53	298	26,4	26,9	0,1958		
	355	-	100,5	15,1	15,3	0,0714			800	78	323	27,7	28,1	0,2103		
	400	-	123	16,2	16,4	0,0829			150	-	-	11,1	11,2	0,0248		
	450	-	148	17,4	17,6	0,0956			180	-	13	12	12,2	0,0347		
	500	-	173	18,6	18,8	0,1084			200	-	23	12,6	12,8	0,0413		
	550	-	198	19,7	20	0,1211			225	-	36	13,4	13,6	0,0495		
	600	-	223	20,9	21,2	0,1339			250	-	48	14,2	14,4	0,0578		
	630	-	238	21,6	21,9	0,1415			280	-	63	15,1	15,3	0,0677		
	650	3	248	22	22,4	0,1466			300	-	73	15,7	15,9	0,0743		
	700	28	273	23,2	23,6	0,1594			315	-	80,5	16,2	16,4	0,0792		
	710	33	278	23,4	23,8	0,1619			355	-	100,5	17,4	17,6	0,0924		
	750	53	298	24,3	24,7	0,1721			400	-	123	18,7	19	0,1073		
	800	78	323	25,5	25,9	0,1849			450	-	148	20,2	20,5	0,1238		
300 x	150	-	-	10,4	10,5	0,0206	BFL	355 x	500	-	173	21,7	22	0,1403	BFL	M2
	180	-	13	11,1	11,3	0,0289			550	-	198	23,1	23,5	0,1568		
	200	-	23	11,7	11,8	0,0344			560	-	203	23,4	23,8	0,1601		
	225	-	36	12,3	12,5	0,0413			600	-	223	24,6	25	0,1733		
	250	-	48	13	13,2	0,0481			630	-	238	25,4	25,8	0,1832		
	280	-	63	13,8	14	0,0564			650	3	248	26	26,4	0,1898		
	300	-	73	14,3	14,5	0,0619			700	28	273	27,4	27,9	0,2063		
	315	-	80,5	14,7	14,9	0,0660			710	33	278	27,7	28,1	0,2096		
	355	-	100,5	15,7	15,9	0,0770			750	53	298	28,8	29,3	0,2228		
	400	-	123	16,9	17,1	0,0894			800	78	323	30,2	30,7	0,2393		
	450	-	148	18,1	18,4	0,1031			150	-	-	11,7	11,8	0,0281		
	500	-	173	19,4	19,7	0,1169			180	-	13	12,7	12,9	0,0394		
	550	-	198	20,6	21	0,1306			200	-	23	13,4	13,6	0,0469		
	560	-	203	20,9	21,2	0,1334			225	-	36	14,3	14,5	0,0563		
600	-	223	21,9	22,2	0,1444	250	-	48	15,2	15,4	0,0656					
630	-	238	22,6	23	0,1526	280	-	63	16,2	16,4	0,0769					
650	3	248	23,1	23,5	0,1581	300	-	73	16,9	17,1	0,0844					
700	28	273	24,3	24,7	0,1719	315	-	80,5	17,4	17,6	0,0900					
710	33	278	24,6	25	0,1746	355	-	100,5	18,7	19	0,1050					
750	53	298	25,5	26	0,1856	400	-	123	20,2	20,5	0,1219					
800	78	323	26,7	27,2	0,1994	450	-	148	21,9	22,2	0,1406					
315 x	150	-	-	10,6	10,7	0,0218	BFL	400 x	500	-	173	23,5	23,9	0,1594	BFL	M2
	180	-	13	11,4	11,6	0,0305			550	-	198	25,1	25,5	0,1781		
	200	-	23	11,9	12,1	0,0363			560	-	203	25,5	25,9	0,1819		
	225	-	36	12,6	12,8	0,0435			600	-	223	26,7	27,2	0,1969		
	250	-	48	13,3	13,5	0,0508			630	-	238	27,7	28,1	0,2081		
	280	-	63	14,1	14,3	0,0595			650	3	248	28,3	28,8	0,2156		
	300	-	73	14,7	14,9	0,0653			700	28	273	29,9	30,4	0,2344		
	315	-	80,5	15,1	15,3	0,0696			710	33	278	30,2	30,7	0,2381		
	355	-	100,5	16,2	16,4	0,0812			750	53	298	31,4	32	0,2531		
	400	-	123	17,4	17,6	0,0943			800	78	323	32,9	33,5	0,2719		
	450	-	148	18,7	19	0,1088			150	-	-	12,3	12,5	0,0319		
	500	-	173	20	20,3	0,1233			180	-	13	13,5	13,7	0,0446		
	550	-	198	21,3	21,7	0,1378			200	-	23	14,3	14,5	0,0531		
	560	-	203	21,6	21,9	0,1407			225	-	36	15,3	15,5	0,0638		
600	-	223	24,1	24,5	0,1680	250	-	48	16,2	16,5	0,0744					
630	-	238	23,4	23,8	0,1610	280	-	63	17,4	17,6	0,0871					
650	3	248	23,9	24,3	0,1668	300	-	73	18,1	18,4	0,0956					
700	28	273	25,2	25,6	0,1813	315	-	80,5	18,7	19	0,1020					
								355	-	100,5	20,2	20,5	0,1190			

Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control		
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					
450 x	-	123	21,9	22,2	0,1381	BFL	M2	150	-	-	13,8	14	0,0401				
	-	148	23,7	24,1	0,1594				180	-	13	15,2	15,5	0,0562			
	-	173	25,5	26	0,1806				200	-	23	16,2	16,4	0,0669			
	-	198	27,3	27,8	0,2019				225	-	36	17,4	17,6	0,0803			
	-	203	27,7	28,1	0,2061	BFN			250	-	48	18,6	18,8	0,0936	BFL		
	-	223	29,1	29,6	0,2231				280	-	63	20	20,3	0,1097			
	-	238	30,1	30,7	0,2359				300	-	73	20,9	21,2	0,1204			
	3	248	30,8	31,4	0,2444				315	-	80,5	21,6	21,9	0,1284			
	28	273	32,6	33,1	0,2656				355	-	100,5	23,4	23,8	0,1498			
	33	278	32,9	33,5	0,2699				400	-	123	25,5	25,9	0,1739			
	53	298	34,3	34,9	0,2869	BF		M3	560 x	450	-	148	27,7	28,1	0,2006		
	78	323	35,9	36,6	0,3081					500	-	173	29,9	30,4	0,2274	BFN	
	150	-	-	13	13,2	0,0356				550	-	198	32	32,6	0,2541		
	180	-	13	14,3	14,5	0,0499				560	-	203	32,5	33	0,2595		
200	-	23	15,2	15,4	0,0594			600	-	223	34,1	34,7	0,2809				
225	-	36	16,2	16,5	0,0713			630	-	238	35,4	36	0,2969				
250	-	48	17,3	17,6	0,0831	BFL		650	3	248	36,2	36,9	0,3076				
280	-	63	18,6	18,8	0,0974			700	28	273	38,3	39	0,3344				
300	-	73	19,4	19,7	0,1069			710	33	278	38,7	39,4	0,3397	BF			
315	-	80,5	20	20,3	0,1140			750	53	298	40,3	41	0,3611				
355	-	100,5	21,7	22	0,1330			800	78	323	42,3	43	0,3879		M3		
400	-	123	23,5	23,9	0,1544		M2	150	-	-	14,3	14,5	0,0431				
450	-	148	25,5	26	0,1781	BFN		180	-	13	15,8	16,1	0,0604				
500	-	173	27,5	28	0,2019			200	-	23	16,9	17,1	0,0719				
550	-	198	29,5	30	0,2256			225	-	36	18,1	18,4	0,0863				
560	-	203	29,9	30,4	0,2304	BFN		250	-	48	19,4	19,7	0,1006	BFL			
600	-	223	31,4	32	0,2494			280	-	63	20,9	21,2	0,1179				
630	-	238	32,6	33,1	0,2636			300	-	73	21,9	22,2	0,1294				
650	3	248	33,3	33,9	0,2731			315	-	80,5	22,6	23	0,1380				
700	28	273	35,2	35,8	0,2969			355	-	100,5	24,6	25	0,1610				
710	33	278	35,6	36,2	0,3016	BF	M3	400	-	123	26,7	27,2	0,1869		M2		
750	53	298	37	37,7	0,3206				560 x	450	-	148	29,1	29,6	0,2156	BFN	
800	78	323	38,9	39,6	0,3444			500	-	173	31,4	32	0,2444				
150	-	-	13,6	13,8	0,0394			550	-	198	33,7	34,3	0,2731				
180	-	13	15,1	15,3	0,0551			560	-	203	34,1	34,7	0,2789				
200	-	23	16	16,3	0,0656			600	-	223	35,9	36,6	0,3019				
225	-	36	17,2	17,4	0,0788			630	-	238	37,3	37,9	0,3191				
250	-	48	18,3	18,6	0,0919	BFL		650	3	248	38,1	38,8	0,3306				
280	-	63	19,7	20	0,1076			700	28	273	40,3	41	0,3594	BF			
300	-	73	20,6	21	0,1181			710	33	278	40,7	41,5	0,3651				
315	-	80,5	21,3	21,7	0,1260			750	53	298	42,4	43,2	0,3881				
355	-	100,5	23,1	23,5	0,1470			800	78	323	44,5	45,3	0,4169		M3		
400	-	123	25,1	25,5	0,1706		M2	150	-	-	14,7	14,9	0,0454				
450	-	148	27,3	27,8	0,1969	BFN		180	-	13	16,3	16,5	0,0635				
500	-	173	29,5	30	0,2231			200	-	23	17,4	17,6	0,0756				
550	-	198	31,6	32,2	0,2494			225	-	36	18,7	19	0,0908				
560	-	203	32	32,6	0,2546			250	-	48	20	20,3	0,1059	BFL			
600	-	223	33,7	34,3	0,2756			280	-	63	21,6	21,9	0,1240				
630	-	238	34,9	35,5	0,2914			300	-	73	22,6	23	0,1361		M2		
650	3	248	35,7	36,4	0,3019			315	-	80,5	23,4	23,8	0,1452				
700	28	273	37,8	38,4	0,3281			355	-	100,5	25,4	25,8	0,1694				
710	33	278	38,2	38,9	0,3334	BF	M3	400	-	123	27,7	28,1	0,1966				
750	53	298	39,8	40,5	0,3544				450	-	148	30,1	30,7	0,2269	BFN		
800	78	323	41,7	42,5	0,3806			500	-	173	32,6	33,1	0,2571				

Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	a	c	Man.	Actu.					a	c	Man.	Actu.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	[mm]	[mm]	[kg]	[kg]*					[mm]	[mm]	[kg]	[kg]*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
630 x	550	-	198	34,9	35,5	0,2874	BFN	710 x	225	-	36	20,2	20,5	0,1028	M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	560	-	203	35,4	36	0,2934			600	-	223	37,3	37,9	0,3176		630	-	238	38,6	39,3	0,3358	650	3	248	39,5	40,3	0,3479	700	28	273	41,8	42,5	0,3781	BF	710	33	278	42,2	43	0,3842	750	53	298	44	44,8	0,4084	M3	800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2	0,0469	710 x	550	-	198	38,2	38,9	0,3254	M2	180	-	13	16,6	16,9	0,0656	200	-	23	17,7	18	0,0781	225	-	36	19,1	19,4	0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148	30,8	31,4	0,2344	710 x	560	-	203	38,7	39,4	0,3322	M2	500	-	173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800	78	323	50,3	51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x	450	-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3	248	42,7	43,5	0,3881	700	28	273	45,2	46	0,4219	710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556	710 x	800	78	323	52,3	53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13	17,5	17,8	0,0719	BFL	200	-	23	18,7	19	0,0856	M4	180	-	13	17,5	17,8	0,0719	200	-	23	18,7	19	0,0856	225	-	36	21,9	22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																																																								
	600	-	223	37,3	37,9	0,3176			630	-	238	38,6	39,3	0,3358		650	3	248	39,5	40,3	0,3479	700	28	273	41,8	42,5	0,3781	BF	710	33	278	42,2	43	0,3842	750	53	298	44	44,8	0,4084	M3	800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2		0,0469	710 x	550	-	198	38,2		38,9	0,3254	M2	180	-	13		16,6	16,9	0,0656	200	-	23	17,7	18	0,0781	225	-	36	19,1	19,4	0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-		148	30,8	31,4	0,2344	710 x	560		-	203	38,7	39,4	0,3322	M2		500	-	173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3		650 x	800	78	323	47,2	48,1		0,4531	710 x	800	78	323	50,3		51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4		27,9	0,1890	M3	700 x	400	-		123	29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3	248	42,7	43,5	0,3881	700	28	273	45,2	46	0,4219	710		33	278	45,6	46,5	0,4286	M3		700 x	750	53	298	47,5	48,4		0,4556	710 x	800	78	323	52,3		53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13	17,5	17,8	0,0719	BFL	200	-	23	18,7	19	0,0856	M4	180	-	13	17,5	17,8	0,0719	200	-	23	18,7	19	0,0856	225	-	36	21,9	22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63		25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315		-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																																											
	630	-	238	38,6	39,3	0,3358	650		3	248	39,5	40,3	0,3479	700		28	273	41,8	42,5	0,3781	BF	710	33	278	42,2	43	0,3842	750	53	298	44	44,8	0,4084	M3	800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2	0,0469		710 x	550	-	198	38,2		38,9		0,3254	M2	180	-		13	16,6		16,9	0,0656	200		-	23	17,7	18	0,0781	225	-	36	19,1	19,4	0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148		30,8	31,4		0,2344	710 x	560	-		203		38,7	39,4	0,3322	M2	500			-	173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x			800	78	323	47,2	48,1		0,4531		710 x	800	78	323		50,3	51,3		0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-		100,5	27,4	27,9		0,1890	M3		700 x	400	-	123		29,9		30,4	0,2194	710 x	450	-		148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3	248	42,7	43,5	0,3881	700	28		273	45,2	46	0,4219	710	33			278	45,6	46,5	0,4286	M3		700 x		750	53	298	47,5		48,4	0,4556		710 x	800	78	323	52,3	53,4		0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13	17,5	17,8	0,0719	BFL	200	-	23	18,7	19	0,0856	M4	180	-	13	17,5	17,8	0,0719	200	-	23	18,7	19	0,0856	225	-	36	21,9	22,2	0,1163		250	-	48	23,5	23,9	0,1356		280	-	63	25,5		25,9		0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																															
	650	3	248	39,5	40,3	0,3479	700		28	273	41,8	42,5	0,3781	BF		710	33	278	42,2	43	0,3842	750	53	298	44	44,8	0,4084	M3	800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2		0,0469	710 x	550	-	198	38,2			38,9	0,3254	M2	180		-		13		16,6	16,9		0,0656	200		-	23	17,7		18	0,0781	225	-	36	19,1	19,4	0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-		148	30,8	31,4		0,2344	710 x		560		-	203		38,7		39,4	0,3322	M2		500			-	173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3				650 x	800	78	323	47,2		48,1			0,4531	710 x	800		78	323		50,3		51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6		0,1620	355	-		100,5	27,4			27,9	0,1890	M3		700 x		400	-		123	29,9		30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3		248	42,7	43,5	0,3881	700	28			273	45,2	46	0,4219	710				33	278	45,6	46,5		0,4286	M3			700 x	750	53	298	47,5		48,4		0,4556	710 x	800	78	323	52,3		53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13	17,5	17,8	0,0719	BFL	200	-	23	18,7	19	0,0856	M4	180	-	13	17,5	17,8	0,0719	200	-		23	18,7	19	0,0856	225	-		36	21,9	22,2	0,1163		250		-	48	23,5	23,9	0,1356		280	-	63		25,5	25,9		0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315		-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																		
	700	28	273	41,8	42,5	0,3781	BF		710	33	278	42,2	43	0,3842		750	53	298	44	44,8	0,4084	M3	800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2		0,0469	710 x	550	-	198		38,2		38,9	0,3254	M2	180			-	13		16,6		16,9		0,0656		200	-		23	17,7		18	0,0781	225		-	36	19,1	19,4	0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-		148	30,8		31,4	0,2344	710 x		560			-		203	38,7		39,4		0,3322	M2			500			-	173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3					650 x	800	78	323		47,2			48,1		0,4531		710 x	800		78		323	50,3		51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-		80,5	25,2	25,6		0,1620	355			-	100,5	27,4				27,9	0,1890		M3	700 x		400	-		123		29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-		238	41,8	42,5	0,3746	650	3			248	42,7	43,5	0,3881	700				28	273	45,2	46		0,4219	710				33	278	45,6	46,5		0,4286		M3		700 x	750	53	298		47,5	48,4		0,4556	710 x	800	78	323	52,3		53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13	17,5	17,8	0,0719	BFL	200	-	23	18,7	19		0,0856	M4	180	-	13	17,5		17,8	0,0719	200	-		23		18,7	19	0,0856	225	-		36	21,9	22,2		0,1163	250		-	48	23,5	23,9		0,1356	280	-	63		25,5		25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315		-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																					
	710	33	278	42,2	43	0,3842	750		53	298	44	44,8	0,4084	M3		800	78	323	46,1	47	0,4386	M4	650 x	150	-	-	14,9	15,2	0,0469		710 x	550	-	198	38,2		38,9		0,3254	M2	180		-		13	16,6		16,9			0,0656	200		-		23		17,7		18	0,0781		225	-		36	19,1	19,4		0,0938	250	-	48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148		30,8	31,4		0,2344	710 x		560	-			203			38,7		39,4	0,3322		M2		500				-			173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x						800	78	323		47,2			48,1		0,4531			710 x		800		78	323		50,3	51,3		0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519		315	-	80,5		25,2	25,6			0,1620	355	-				100,5	27,4		27,9			0,1890	M3		700 x		400	-	123		29,9		30,4	0,2194	710 x	450	-		148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-	223		40,3	41	0,3544	630	-	238			41,8	42,5	0,3746	650	3				248	42,7	43,5	0,3881		700	28				273	45,2	46	0,4219		710		33			278	45,6	46,5		0,4286	M3		700 x		750	53	298	47,5		48,4	0,4556		710 x	800	78	323	52,3	53,4		0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1	0,0581	150	-	-	15,7	15,9	0,0514	180	-	13		17,5	17,8	0,0719	BFL	200	-		23	18,7	19	0,0856		M4		180	-	13	17,5	17,8		0,0719	200	-		23	18,7		19	0,0856	225	-		36	21,9	22,2	0,1163		250		-	48	23,5	23,9	0,1356		280	-	63	25,5		25,9		0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																									
	750	53	298	44	44,8	0,4084	M3		800	78	323	46,1	47	0,4386		M4	650 x	150	-	-	14,9	15,2		0,0469	710 x	550	-	198	38,2			38,9	0,3254	M2	180		-		13		16,6		16,9		0,0656	200		-			23	17,7		18		0,0781		225		-	36		19,1	19,4		0,0938	250	-		48	20,4	20,8	0,1094	BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-		148	30,8	31,4		0,2344	710 x		560			-	203			38,7			39,4		0,3322	M2				500				-			173	33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3							650 x	800	78		323			47,2		48,1					0,4531		710 x	800		78	323		50,3		51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73		24,3	24,7	0,1519		315	-			80,5	25,2	25,6				0,1620	355		-			100,5	27,4				27,9	0,1890	M3		700 x		400	-		123	29,9		30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3		39	0,3274	BFL	600	-	223			40,3	41	0,3544	630	-				238	41,8	42,5	0,3746		650	3				248	42,7	43,5	0,3881		700		28			273	45,2	46		0,4219	710				33	278	45,6	46,5		0,4286	M3			700 x	750	53	298	47,5		48,4		0,4556	710 x	800	78	323	52,3		53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x	150	-	-	16,9	17,1		0,0581	150	-	-	15,7	15,9		0,0514	180	-	13		17,5		17,8	0,0719	BFL	200	-		23	18,7	19		0,0856	M4		180	-	13	17,5		17,8	0,0719	200	-		23		18,7	19	0,0856	225	-		36	21,9	22,2	0,1163		250		-	48	23,5	23,9	0,1356		280	-	63		25,5	25,9		0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315		-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069												
	800	78	323	46,1	47	0,4386	M4		650 x	150	-	-	14,9	15,2		0,0469		710 x	550	-	198	38,2		38,9		0,3254	M2	180	-			13	16,6		16,9		0,0656		200		-		23		17,7	18		0,0781			225	-		36		19,1		19,4		0,0938	250		-	48		20,4	20,8	0,1094		BFL	280	-	63	22	22,4	0,1281	300	-	73	23,1	23,5	0,1406	315	-	80,5	23,9	24,3	0,1500	355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148		30,8	31,4		0,2344	710 x	560		-			203			38,7	39,4			0,3322			M2		500					-				173			33,3	33,9	0,2656	550	-	198	35,7	36,4	0,2969	560	-	203	36,2	36,9	0,3031	600	-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x								800	78		323			47,2		48,1					0,4531			710 x		800	78		323		50,3	51,3		0,4966	M2	150	-	-	15,6	15,8	0,0506	180	-	13	17,4	17,6	0,0709	200	-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300		-	73	24,3		24,7	0,1519			315	-	80,5				25,2	25,6		0,1620			355	-				100,5	27,4	27,9				0,1890	M3		700 x	400		-	123		29,9		30,4	0,2194	710 x	450	-		148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500	-	173	35,2	35,8	0,2869	550	-	198	37,8	38,4		0,3206	560	-	203	38,3	39			0,3274	BFL	600	-	223				40,3	41	0,3544	630		-	238				41,8	42,5	0,3746	650		3		248			42,7	43,5	0,3881		700	28				273	45,2	46	0,4219		710	33				278	45,6	46,5	0,4286		M3		700 x		750	53	298	47,5		48,4	0,4556		710 x	800	78	323	52,3	53,4		0,5256	M2	800	78	323		49,8	50,8	0,4894	800 x	150	-		-	16,9	17,1	0,0581		150		-	-	15,7	15,9	0,0514		180	-	13		17,5	17,8		0,0719	BFL	200	-		23	18,7	19	0,0856		M4		180	-	13	17,5	17,8		0,0719	200	-	23		18,7		19	0,0856	225	-	36		21,9	22,2	0,1163		250	-		48	23,5	23,9	0,1356		280	-	63	25,5		25,9		0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069
	650 x	150	-	-	14,9	15,2	0,0469			710 x	550	-	198	38,2		38,9			0,3254	M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
180		-	13	16,6	16,9	0,0656	200	-			23	17,7	18	0,0781	225	-			36		19,1	19,4		0,0938		250		-	48			20,4	20,8		0,1094		BFL		280		-		63		22	22,4		0,1281			300	-		73		23,1		23,5		0,1406	315		-	80,5		23,9	24,3	0,1500		355	-	100,5	26	26,4	0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148	30,8	31,4	0,2344	710 x	560	-	203	38,7	39,4	0,3322	M2	500	-	173	33,3		33,9	0,2656	550		-	198		35,7		36,4		0,2969			560			-	203			36,2					36,9					0,3031				600			-	223	38,1	38,8	0,3281	BFL	630	-	238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800	78	323	50,3	51,3	0,4966	M2	150									-	-		15,6			15,8		0,0506					180					-	13		17,4		17,6	0,0709		200		-	23	18,6	18,8	0,0844	225	-	36	20	20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-		100,5	27,4	27,9		0,1890	M3			700 x	400	-				123	29,9		30,4			0,2194	710 x				450	-	148				34,3	34,9			0,2719		M2	450		-		148	32,6		33,1	0,2531		500	-	173	35,2		35,8	0,2869	550	-	198	37,8	38,4	0,3206	560	-	203	38,3	39	0,3274	BFL	600	-		223	40,3	41	0,3544	630	-			238	41,8	42,5	0,3746	650				3	248	42,7	43,5		0,3881	700				28	273	45,2	46		0,4219		710			33	278	45,6		46,5	0,4286				M3	700 x	750	53		298	47,5				48,4	0,4556	710 x	800		78				323	52,3	53,4	0,5256		M2	800			78	323	49,8	50,8	0,4894		800 x		150	-	-		16,9	17,1	0,0581		150	-		-	15,7	15,9	0,0514		180		-	13	17,5	17,8	0,0719		BFL	200	-		23	18,7		19	0,0856	M4	180		-	13	17,5	17,8		0,0719		200	-	23	18,7	19		0,0856	225	-	36		21,9		22,2	0,1163	250	-	48		23,5	23,9	0,1356		280	-		63	25,5	25,9	0,1589		300	-	73	26,7		27,2		0,1744	M3	710 x	315	-		80,5	27,7	28,1		0,1860	800 x		315	-	80,5	27,7		28,1	0,1860	M2	355	-	100,5		30,2	30,7	0,2170	400	-	123	32,9	33,5	0,2519	BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069			
200		-	23	17,7	18	0,0781	225	-			36	19,1	19,4	0,0938	250	-			48		20,4	20,8		0,1094		BFL		280	-			63	22		22,4		0,1281		300		-		73		23,1	23,5		0,1406			315	-		80,5	23,9	24,3		0,1500		355	-	100,5	26	26,4		0,1750	M3	400	-	123	28,3	28,8	0,2031	M4	650 x	450	-	148	30,8	31,4	0,2344	710 x	560		-	203	38,7	39,4	0,3322	M2		500	-	173	33,3	33,9	0,2656		550	-	198	35,7		36,4	0,2969	560		-	203		36,2		36,9		0,3031			600			-	223			38,1		38,8			0,3281				BFL	630				-		238	39,5	40,3	0,3469	650	3	248	40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2		150	-	-	15,6	15,8	0,0506		180				-					13	17,4	17,6	0,0709			200		-	23				18,6					18,8	0,0844		225		-	36		20		20,3	0,1013	BFL	250	-	48	21,5	21,8	0,1181	280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x		450	-	148			34,3	34,9			0,2719	M2	450		-			148					32,6	33,1	0,2531				500	-			173			35,2		35,8		0,2869	550		-	198		37,8	38,4	0,3206	560		-	203	38,3	39	0,3274	BFL	600	-	223	40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3	248	42,7	43,5	0,3881	700		28	273	45,2	46	0,4219	710			33	278	45,6	46,5	0,4286	M3	700 x				750	53	298	47,5		48,4		0,4556			710 x	800	78		323	52,3				53,4		0,5256	M2		800	78				323	49,8		50,8		0,4894				800 x	150	-	-			16,9			17,1	0,0581	150	-	-				15,7	15,9	0,0514	180	-	13	17,5		17,8	0,0719	BFL	200	-	23	18,7		19	0,0856	M4	180	-	13	17,5		17,8	0,0719	200		-	23		18,7	19	0,0856	225		-	36	21,9	22,2		0,1163		250	-	48	23,5	23,9		0,1356	280	-	63		25,5		25,9	0,1589	300	-	73		26,7	27,2	0,1744		M3	710 x		315	-	80,5	27,7		28,1	0,1860	800 x	315		-		80,5	27,7		28,1	0,1860		M2	355	-		100,5			30,2	30,7	0,2170	400		-	123		32,9	33,5	0,2519		BFL	450	-	148	35,9	36,6	0,2906	500	-	173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069												
225		-	36	19,1	19,4	0,0938	250	-			48	20,4	20,8	0,1094	BFL	280			-		63	22		22,4		0,1281		300	-			73	23,1		23,5		0,1406		315		-		80,5		23,9	24,3		0,1500	355		-	100,5		26	26,4	0,1750	M3	400		-	123	28,3	28,8	0,2031	M4	650 x	450	-	148	30,8	31,4	0,2344	710 x	560		-	203	38,7	39,4	0,3322	M2		500		-	173	33,3	33,9	0,2656			550	-	198	35,7	36,4	0,2969		560	-	203	36,2		36,9	0,3031	600		-	223		38,1		38,8		0,3281			BFL			630	-		238	39,5		40,3			0,3469		650		3	248				40,5	41,2	0,3594	700	28	273	42,7	43,5	0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2		150		-	-	15,6	15,8	0,0506			180	-	13	17,4	17,6	0,0709		200				-	23				18,6	18,8	0,0844	225	-		36		20	20,3			0,1013	BFL					250	-		48		21,5	21,8		0,1181		280	-	63	23,2	23,6	0,1384	300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2		450	-	148	32,6			33,1	0,2531	500		-		173		35,2		35,8	0,2869					550	-	198				37,8	38,4			0,3206			560		-		203	38,3		39	0,3274		BFL	600	-	223		40,3	41	0,3544	630	-	238	41,8	42,5	0,3746	650	3	248	42,7	43,5	0,3881	700	28	273	45,2	46	0,4219	710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298		47,5	48,4	0,4556	710 x	800	78	323		52,3			53,4	0,5256	M2	800	78	323		49,8				50,8	0,4894		800 x	150				-		-			16,9	17,1				0,0581	150		-		-					15,7	15,9	0,0514			180			-	13	17,5	17,8	0,0719				BFL	200	-	23	18,7	19	0,0856		M4	180	-	13	17,5	17,8	0,0719	200	-	23	18,7	19	0,0856	225	-	36	21,9	22,2	0,1163		250	-	48	23,5	23,9	0,1356	280		-	63	25,5	25,9		0,1589		300	-	73	26,7	27,2		0,1744	M3	710 x	315		-		80,5	27,7	28,1	0,1860	800 x		315	-	80,5		27,7			28,1	0,1860	M2	355		-	100,5		30,2		30,7		0,2170	400		-	123			32,9	33,5		0,2519			BFL	450	-	148		35,9	36,6		0,2906	500	-		173	38,9	39,6	0,3294	550	-	198	41,7	42,5	0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																					
250		-	48	20,4	20,8	0,1094	BFL	280			-	63	22	22,4	0,1281	300			-		73	23,1		23,5		0,1406		315	-			80,5	23,9		24,3		0,1500		355		-	100,5	26		26,4	0,1750		M3	400	-	123	28,3		28,8	0,2031	M4	650 x	450	-	148	30,8	31,4	0,2344	710 x	560		-	203	38,7	39,4	0,3322	M2		500		-	173	33,3	33,9	0,2656			550		-	198	35,7	36,4	0,2969			560	-	203	36,2	36,9	0,3031		600	-	223	38,1		38,8	0,3281	BFL		630	-		238		39,5		40,3			0,3469		650	3	248		40,5	41,2		0,3594		700	28		273		42,7	43,5			0,3906	710	33	278	43,2	44	0,3969	750	53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2		150		-	-	15,6	15,8	0,0506			180		-	13	17,4	17,6	0,0709			200	-	23	18,6	18,8	0,0844		225			-	36	20				20,3	0,1013	BFL	250	-	48	21,5		21,8	0,1181			280	-	63				23,2	23,6		0,1384		300	-		73		24,3	24,7	0,1519	315	-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2		450		-	148	32,6	33,1	0,2531			500	-	173	35,2	35,8		0,2869	550	-		198		37,8	38,4	0,3206		560	-				203	38,3	39	0,3274				BFL	600			-			223		40,3		41	0,3544		630	-		238	41,8	42,5	0,3746		650	3	248	42,7	43,5	0,3881	700	28	273	45,2	46	0,4219	710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556	710 x	800		78	323	52,3	53,4	0,5256	M2	800		78	323	49,8		50,8	0,4894		800 x	150		-	-	16,9	17,1	0,0581				150	-	-		15,7				15,9		0,0514			180	-				13	17,5		17,8		0,0719					BFL	200	-			23			18,7	19	0,0856	M4	180				-	13	17,5	17,8	0,0719	200	-		23	18,7	19	0,0856	225	-	36	21,9	22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7		28,1		0,1860		M2	355	-	100,5			30,2	30,7	0,2170		400			-	123		32,9		33,5	0,2519		BFL		450		-	148		35,9	36,6			0,2906	500		-			173	38,9	39,6	0,3294		550	-		198	41,7	42,5		0,3681	560	-	203	42,3	43	0,3759	M3	600	-	223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																														
280		-	63	22	22,4	0,1281	300	-			73	23,1	23,5	0,1406	315	-			80,5		23,9	24,3		0,1500		355		-	100,5			26	26,4		0,1750	M3	400		-		123	28,3	28,8	0,2031	M4	650 x		450	-	148	30,8	31,4	0,2344	710 x	560	-		203	38,7	39,4	0,3322	M2	500		-		173	33,3	33,9	0,2656	550			-		198	35,7	36,4	0,2969	560			-		203	36,2	36,9	0,3031	600			-	223	38,1	38,8	0,3281	BFL		630	-	238	39,5		40,3	0,3469	650		3	248		40,5		41,2		0,3594		700	28		273	42,7	43,5		0,3906	710	33	278		43,2	44		0,3969		750	53		298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800	78		323	50,3	51,3	0,4966	M2	150		-		-	15,6	15,8	0,0506	180			-		13	17,4	17,6	0,0709	200			-		23	18,6	18,8	0,0844	225			-	36	20	20,3	0,1013	BFL		250			-	48	21,5	21,8			0,1181	280	-	63	23,2	23,6	0,1384	300	-	73			24,3	24,7	0,1519			315	-	80,5		25,2		25,6	0,1620		355		-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x	450	-		148	34,3	34,9	0,2719	M2	450		-		148	32,6	33,1	0,2531	500			-		173	35,2	35,8	0,2869	550			-	198	37,8	38,4	0,3206		560	-	203	38,3	39		0,3274	BFL	600		-	223		40,3		41	0,3544	630	-			238	41,8	42,5			0,3746			650		3		248	42,7		43,5	0,3881		700	28	273	45,2		46	0,4219	710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556	710 x	800	78		323	52,3	53,4	0,5256	M2	800		78		323	49,8	50,8	0,4894	800 x		150		-	-	16,9		17,1	0,0581	150		-		-	15,7	15,9	0,0514	180	-			13	17,5	17,8		0,0719	BFL			200		-		23	18,7	19				0,0856	M4		180		-					13	17,5	17,8			0,0719			200	-	23	18,7	19				0,0856	225	-	36	21,9	22,2	0,1163		250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355	-		100,5	30,2	30,7	0,2170	400		-		123	32,9		33,5	0,2519	BFL			450	-	148		35,9			36,6	0,2906		500		-	173		38,9		39,6		0,3294	550		-	198			41,7	42,5		0,3681			560	-	203	42,3		43	0,3759		M3	600	-		223	44,5	45,3	0,4069	M4	600	-	223	44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																								
300		-	73	23,1	23,5	0,1406	315	-			80,5	23,9	24,3	0,1500	355	-			100,5		26	26,4		0,1750		M3		400	-	123		28,3	28,8		0,2031	M4	650 x	450	-		148	30,8	31,4	0,2344	710 x		560	-	203	38,7	39,4	0,3322	M2		500	-		173	33,3	33,9	0,2656		550		-		198	35,7	36,4	0,2969	560			-		203	36,2	36,9	0,3031	600			-		223	38,1	38,8	0,3281	BFL			630	-	238	39,5	40,3	0,3469		650	3	248	40,5		41,2	0,3594	700		28	273		42,7		43,5	0,3906	710		33	278		43,2	44	0,3969	750	53	298	45	45,8		0,4219	M3		650 x		800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2		150	-		-	15,6	15,8	0,0506		180		-		13	17,4	17,6	0,0709	200			-		23	18,6	18,8	0,0844	225			-		36	20	20,3	0,1013	BFL			250	-	48	21,5	21,8	0,1181		280			-	63	23,2	23,6	0,1384		300	-	73	24,3	24,7	0,1519	315	-	80,5	25,2	25,6		0,1620	355	-			100,5	27,4	27,9	0,1890	M3		700 x	400		-		123	29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2		450	-		148	32,6	33,1	0,2531		500		-		173	35,2	35,8	0,2869	550			-		198	37,8	38,4	0,3206	560			-	203	38,3	39	0,3274		BFL	600	-	223	40,3		41	0,3544	630	-	238	41,8		42,5		0,3746	650	3	248	42,7		43,5	0,3881	700			28	273		45,2		46		0,4219	710		33	278		45,6	46,5	0,4286	M3		700 x	750	53	298	47,5	48,4	0,4556	710 x	800		78	323	52,3	53,4	0,5256	M2		800	78		323	49,8	50,8	0,4894		800 x		150		-	-	16,9	17,1			0,0581		150	-	-		15,7	15,9	0,0514		180		-	13	17,5	17,8	0,0719	BFL	200		-	23	18,7		19	0,0856		M4	180		-		13	17,5	17,8	0,0719			200	-		23	18,7	19					0,0856	225	-			36			21,9	22,2	0,1163	250	-				48	23,5	23,9	0,1356	280	-	63		25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170		400	-		123	32,9	33,5	0,2519	BFL		450	-	148	35,9		36,6	0,2906	500		-	173	38,9	39,6		0,3294		550	-	198		41,7		42,5	0,3681		560		-		203	42,3		43	0,3759			M3	600		-			223	44,5	45,3	0,4069		M4	600		-	223	44,5		45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																	
315		-	80,5	23,9	24,3	0,1500	355	-			100,5	26	26,4	0,1750	M3	400			-		123	28,3	28,8	0,2031		M4		650 x	450	-	148	30,8	31,4		0,2344	710 x		560	-	203	38,7	39,4	0,3322	M2			500	-	173	33,3	33,9	0,2656			550	-		198	35,7	36,4	0,2969		560		-		203	36,2	36,9	0,3031	600			-		223	38,1	38,8	0,3281	BFL			630		-	238	39,5	40,3	0,3469			650	3	248	40,5	41,2	0,3594		700	28	273	42,7		43,5	0,3906	710		33	278	43,2	44		0,3969	750	53		298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1		0,4531	710 x			800	78	323	50,3	51,3	0,4966	M2		150		-	-	15,6	15,8	0,0506			180	-		13	17,4	17,6	0,0709		200		-		23	18,6	18,8	0,0844	225			-		36	20	20,3	0,1013	BFL			250		-	48	21,5	21,8	0,1181			280	-	63	23,2	23,6	0,1384		300		-	73	24,3	24,7	0,1519	315		-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-			123	29,9	30,4	0,2194	710 x	450		-		148		34,3	34,9	0,2719	M2		450		-	148	32,6	33,1	0,2531			500	-		173	35,2	35,8	0,2869		550		-		198	37,8	38,4	0,3206	560			-		203	38,3	39	0,3274	BFL			600	-	223	40,3	41		0,3544	630	-	238	41,8		42,5	0,3746	650	3	248	42,7		43,5	0,3881	700	28	273	45,2	46		0,4219	710	33	278		45,6	46,5		0,4286		M3	700 x	750	53		298	47,5		48,4	0,4556	710 x	800			78	323	52,3	53,4	0,5256	M2		800		78	323	49,8	50,8	0,4894			800 x	150		-	-	16,9	17,1				0,0581		150	-	-	15,7			15,9		0,0514	180	-		13	17,5	17,8		0,0719		BFL	200	-	23	18,7	19	0,0856		M4	180	-		13	17,5	17,8	0,0719	200		-		23	18,7	19	0,0856	225		-	36		21,9	22,2	0,1163	250				-	48	23,5	23,9		0,1356			280	-	63	25,5	25,9				0,1589	300	-	73	26,7	27,2	0,1744		M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400	-		123	32,9	33,5	0,2519		BFL	450		-	148	35,9	36,6	0,2906		500	-	173	38,9		39,6	0,3294	550		-	198	41,7	42,5	0,3681	560		-	203	42,3		43	0,3759	M3	600		-		223	44,5	45,3	0,4069		M4	600			-	223		44,5			45,3	0,4069	600	-		223	44,5		45,3	0,4069																																																											
355		-	100,5	26	26,4	0,1750	M3	400			-	123	28,3	28,8	0,2031	M4	650 x		450		-	148	30,8	31,4	0,2344	710 x			560	-	203	38,7	39,4	0,3322	M2			500	-	173	33,3	33,9	0,2656				550	-	198	35,7	36,4	0,2969			560	-		203	36,2	36,9	0,3031		600		-		223	38,1	38,8	0,3281	BFL			630		-	238	39,5	40,3	0,3469			650		3	248	40,5	41,2	0,3594			700	28	273	42,7	43,5	0,3906		710	33	278	43,2		44	0,3969	750	53	298	45	45,8	0,4219		M3	650 x	800	78	323	47,2	48,1	0,4531	710 x		800	78	323	50,3	51,3		0,4966		M2		150	-	-	15,6	15,8	0,0506			180		-	13	17,4	17,6	0,0709			200	-		23	18,6	18,8	0,0844		225		-		36	20	20,3	0,1013	BFL			250		-	48	21,5	21,8	0,1181			280		-	63	23,2	23,6	0,1384			300	-	73	24,3	24,7	0,1519		315		-	80,5	25,2	25,6	0,1620	355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194		710 x	450	-		148	34,3	34,9	0,2719		M2		450	-	148		32,6	33,1	0,2531			500		-	173	35,2	35,8	0,2869			550	-		198	37,8	38,4	0,3206		560		-		203	38,3	39	0,3274	BFL			600		-	223	40,3	41	0,3544			630	-	238	41,8	42,5		0,3746	650	3	248	42,7		43,5	0,3881	700	28	273	45,2		46	0,4219	710	33	278	45,6	46,5	0,4286	M3	700 x	750	53		298	47,5		48,4	0,4556	710 x		800	78		323	52,3	53,4	0,5256	M2		800			78	323	49,8	50,8	0,4894			800 x		150	-	-	16,9	17,1				0,0581		150	-	-	15,7				15,9		0,0514	180	-	13			17,5		17,8	0,0719	BFL		200	-	23		18,7		19	0,0856	M4	180	-	13	17,5		17,8	0,0719	200		-	23	18,7	19	0,0856		225		-	36	21,9	22,2	0,1163	250	-	48		23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589		300	-		73	26,7	27,2	0,1744	M3	710 x			315	-	80,5	27,7	28,1	0,1860	800 x		315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450		-	148	35,9	36,6		0,2906	500		-	173	38,9	39,6	0,3294		550	-	198	41,7		42,5	0,3681	560		-	203	42,3	43	0,3759	M3		600	-	223		44,5	45,3	0,4069	M4		600	-	223	44,5	45,3	0,4069		600	-	223		44,5	45,3		0,4069																																																																							
400		-	123	28,3	28,8	0,2031	M4	650 x	450		-	148	30,8	31,4	0,2344	710 x		560	-		203	38,7	39,4	0,3322	M2		500		-	173	33,3	33,9	0,2656	550				-	198	35,7	36,4	0,2969	560				-	203	36,2	36,9	0,3031	600			-	223		38,1	38,8	0,3281	BFL		630		-		238	39,5	40,3	0,3469	650			3		248	40,5	41,2	0,3594	700			28		273	42,7	43,5	0,3906	710			33	278	43,2	44	0,3969	750		53	298	45	45,8	0,4219	M3	650 x	800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2			150	-	-	15,6	15,8	0,0506	180				-	13	17,4	17,6	0,0709	200			-		23	18,6	18,8	0,0844	225			-	36		20	20,3	0,1013	BFL		250		-		48	21,5	21,8	0,1181	280			-		63	23,2	23,6	0,1384	300			-		73	24,3	24,7	0,1519	315			-	80,5	25,2	25,6	0,1620	355		-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x		450	-	148	34,3	34,9	0,2719			M2	450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869	550			-		198	37,8	38,4	0,3206	560			-	203		38,3	39	0,3274	BFL		600		-		223	40,3	41	0,3544	630			-		238	41,8	42,5	0,3746	650			3	248	42,7	43,5	0,3881		700	28	273	45,2	46		0,4219	710	33	278	45,6	46,5		0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556		710 x	800	78	323	52,3		53,4	0,5256			M2	800	78	323	49,8	50,8	0,4894			800 x	150		-	-	16,9	17,1	0,0581					150	-	-	15,7	15,9				0,0514		180	-	13	17,5				17,8		0,0719	BFL	200	-			23		18,7	19	0,0856		M4	180	-		13		17,5	17,8	0,0719	200	-	23	18,7		19	0,0856	225		-	36	21,9	22,2	0,1163		250		-	48	23,5	23,9	0,1356	280	-	63		25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3		710 x	315	-	80,5	27,7	28,1	0,1860	800 x			315	-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170	400			-		123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906			500	-		173	38,9	39,6	0,3294		550	-		198	41,7	42,5	0,3681	560		-	203	42,3	43		0,3759	M3	600		-	223	44,5	45,3	0,4069	M4		600	-	223		44,5	45,3	0,4069	600		-	223	44,5	45,3	0,4069																																																																																	
650 x	450	-	148	30,8	31,4	0,2344	710 x		560	-	203	38,7	39,4	0,3322	M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	500	-	173	33,3	33,9	0,2656			550	-	198	35,7	36,4	0,2969				560	-	203	36,2	36,9	0,3031	600			-		223	38,1	38,8	0,3281	BFL	630				-	238	39,5	40,3	0,3469	650				3	248	40,5	41,2	0,3594	700			28	273		42,7	43,5	0,3906	710		33		278		43,2	44	0,3969	750	53			298		45	45,8	0,4219	M3	650 x			800	78	323	47,2	48,1	0,4531	710 x		800	78	323	50,3	51,3	0,4966	M2	150	-	-	15,6	15,8	0,0506	180		-	13	17,4	17,6	0,0709	200		-		23	18,6	18,8	0,0844	225				-	36	20	20,3	0,1013	BFL	250				-	48	21,5	21,8	0,1181	280			-		63	23,2	23,6	0,1384	300			-	73		24,3	24,7	0,1519	315		-		80,5		25,2	25,6	0,1620	355	-			100,5		27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194	710 x		450	-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500		-	173	35,2	35,8	0,2869	550			-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544	630			-		238	41,8	42,5	0,3746	650			3	248		42,7	43,5	0,3881	700		28		273		45,2	46	0,4219	710	33			278		45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x	800	78	323	52,3		53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894		800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7	15,9	0,0514				180	-	13	17,5	17,8	0,0719				BFL		200	-	23	18,7	19					0,0856	M4	180	-	13				17,5		17,8	0,0719	200	-				23		18,7	19	0,0856	225			-		36	21,9	22,2		0,1163	250	-		48		23,5	23,9	0,1356	280	-	63	25,5		25,9	0,1589	300		-	73	26,7	27,2	0,1744	M3	710 x		315	-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355		-	100,5	30,2	30,7	0,2170		400	-	123	32,9	33,5	0,2519			BFL	450	-	148	35,9	36,6	0,2906			500	-		173	38,9	39,6	0,3294	550			-		198	41,7	42,5	0,3681	560			-		203	42,3	43	0,3759	M3			600	-		223	44,5	45,3	0,4069		M4	600		-	223	44,5	45,3	0,4069		600	-	223	44,5		45,3	0,4069																																																																																																								
	550	-	198	35,7	36,4	0,2969			560	-	203	36,2	36,9	0,3031				600	-	223	38,1	38,8	0,3281	BFL			630		-	238	39,5	40,3	0,3469	650				3	248	40,5	41,2	0,3594	700				28	273	42,7	43,5	0,3906	710			33	278		43,2	44	0,3969	750		53		298		45	45,8	0,4219	M3	650 x			800	78	323	47,2	48,1	0,4531			710 x	800	78	323	50,3	51,3	0,4966		M2	150	-	-	15,6	15,8	0,0506		180	-	13	17,4	17,6	0,0709	200		-	23	18,6	18,8	0,0844	225		-		36	20	20,3	0,1013	BFL				250	-	48	21,5	21,8	0,1181	280				-	63	23,2	23,6	0,1384	300			-		73	24,3	24,7	0,1519	315			-	80,5		25,2	25,6	0,1620	355		-		100,5		27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2	450	-	148	32,6	33,1	0,2531		500	-	173	35,2	35,8	0,2869	550		-	198	37,8	38,4	0,3206	560			-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746	650			3		248	42,7	43,5	0,3881	700			28	273		45,2	46	0,4219	710		33		278		45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800	78	323	49,8	50,8	0,4894		800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7			15,9	0,0514	180	-	13	17,5	17,8				0,0719	BFL	200	-	23	18,7				19		0,0856	M4	180	-	13					17,5	17,8	0,0719	200	-				23		18,7	19	0,0856	225				-		36	21,9	22,2	0,1163			250		-	48	23,5	23,9	0,1356	280	-		63		25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x		315	-	80,5	27,7	28,1	0,1860		800 x	315	-	80,5	27,7	28,1	0,1860		M2	355	-	100,5	30,2	30,7		0,2170	400	-	123	32,9	33,5	0,2519		BFL	450	-	148	35,9	36,6			0,2906	500	-	173	38,9	39,6	0,3294			550	-		198	41,7	42,5	0,3681	560			-		203	42,3	43	0,3759	M3			600		-	223	44,5	45,3	0,4069			M4	600		-	223	44,5	45,3		0,4069	600		-	223	44,5	45,3	0,4069																																																																																																																
	560	-	203	36,2	36,9	0,3031			600	-	223	38,1	38,8	0,3281				BFL	630	-	238	39,5	40,3	0,3469			650		3	248	40,5	41,2	0,3594	700				28	273	42,7	43,5	0,3906	710				33	278	43,2	44	0,3969	750			53	298		45	45,8	0,4219	M3		650 x		800	78	323	47,2	48,1	0,4531			710 x	800	78	323	50,3	51,3	0,4966		M2		150	-	-	15,6	15,8	0,0506			180	-	13	17,4	17,6	0,0709		200	-	23	18,6	18,8	0,0844	225		-	36	20	20,3	0,1013	BFL		250		-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384	300				-	73	24,3	24,7	0,1519	315			-		80,5	25,2	25,6	0,1620	355			-	100,5		27,4	27,9	0,1890	M3		700 x		400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531			500	-	173	35,2	35,8	0,2869		550	-	198	37,8	38,4	0,3206	560		-	203	38,3	39	0,3274	BFL			600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881	700			28		273	45,2	46	0,4219	710			33	278		45,6	46,5	0,4286	M3		700 x		750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894			800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7			15,9	0,0514	180	-	13			17,5	17,8	0,0719	BFL	200	-	23				18,7	19	0,0856	M4	180	-				13		17,5	17,8	0,0719	200	-					23	18,7	19	0,0856	225				-		36	21,9	22,2	0,1163				250	-	48	23,5	23,9	0,1356			280	-	63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x		315	-	80,5	27,7	28,1	0,1860	M2			355	-	100,5	30,2	30,7	0,2170			400	-	123	32,9	33,5		0,2519	BFL	450	-	148	35,9	36,6		0,2906	500	-	173	38,9	39,6			0,3294	550	-	198	41,7	42,5	0,3681			560	-		203	42,3	43	0,3759	M3			600		-	223	44,5	45,3	0,4069			M4		600	-	223	44,5	45,3			0,4069	600		-	223	44,5	45,3		0,4069																																																																																																																							
	600	-	223	38,1	38,8	0,3281			BFL	630	-	238	39,5	40,3				0,3469	650	3	248	40,5	41,2	0,3594			700		28	273	42,7	43,5	0,3906	710				33	278	43,2	44	0,3969	750				53	298	45	45,8	0,4219	M3			650 x	800	78	323	47,2	48,1	0,4531			710 x	800	78	323	50,3	51,3	0,4966		M2		150	-	-	15,6	15,8	0,0506				180	-	13	17,4	17,6	0,0709			200	-	23	18,6	18,8	0,0844		225	-	36	20	20,3	0,1013	BFL		250	-	48	21,5	21,8	0,1181		280		-	63	23,2	23,6	0,1384				300	-	73	24,3	24,7	0,1519	315				-	80,5	25,2	25,6	0,1620	355			-		100,5	27,4	27,9	0,1890	M3			700 x	400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869			550	-	198	37,8	38,4	0,3206		560	-	203	38,3	39	0,3274	BFL		600	-	223	40,3	41	0,3544			630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881				700	28	273	45,2	46	0,4219	710			33		278	45,6	46,5	0,4286	M3			700 x	750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1				0,0581	150	-	-	15,7			15,9	0,0514	180	-	13			17,5	17,8	0,0719	BFL	200			-	23	18,7	19	0,0856	M4	180				-	13	17,5	17,8	0,0719	200				-		23	18,7	19	0,0856	225					-	36	21,9	22,2	0,1163				250	-	48	23,5	23,9	0,1356			280	-	63	25,5	25,9	0,1589	300		-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2			355	-	100,5	30,2	30,7	0,2170				400	-	123	32,9	33,5	0,2519			BFL	450	-	148	35,9		36,6	0,2906	500	-	173	38,9	39,6		0,3294	550	-	198	41,7	42,5			0,3681	560	-	203	42,3	43	0,3759			M3	600		-	223	44,5	45,3	0,4069			M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																															
	630	-	238	39,5	40,3	0,3469			650	3	248	40,5	41,2	0,3594				700	28	273	42,7	43,5	0,3906	710			33		278	43,2	44	0,3969	750	53				298	45	45,8	0,4219	M3	650 x			800	78	323	47,2	48,1	0,4531	710 x		800		78	323	50,3	51,3	0,4966	M2	150			-	-	15,6	15,8	0,0506	180				-	13	17,4	17,6	0,0709	200				-	23	18,6	18,8	0,0844	225			-	36	20	20,3	0,1013	BFL		250	-	48	21,5	21,8	0,1181	280		-	63	23,2	23,6	0,1384	300		-		73	24,3	24,7	0,1519	315				-	80,5	25,2	25,6	0,1620	355	-				100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194	710 x		450		-	148	34,3	34,9	0,2719	M2	450			-	148	32,6	33,1	0,2531	500				-	173	35,2	35,8	0,2869	550				-	198	37,8	38,4	0,3206	560			-	203	38,3	39	0,3274	BFL		600	-	223	40,3	41	0,3544	630		-	238	41,8	42,5	0,3746	650			3	248	42,7	43,5	0,3881	700				28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x		800		78	323	52,3	53,4	0,5256	M2	800			78	323	49,8	50,8	0,4894	800 x				150	-	-	16,9	17,1	0,0581					150	-	-	15,7	15,9				0,0514	180	-	13	17,5			17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4			180	-	13	17,5	17,8	0,0719	200				-	23	18,7	19	0,0856	225				-		36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355		-		100,5	30,2	30,7	0,2170	400				-	123	32,9	33,5	0,2519	BFL				450	-	148	35,9	36,6	0,2906			500	-	173	38,9	39,6		0,3294	550	-	198	41,7	42,5	0,3681		560	-	203	42,3	43	0,3759			M3	600	-	223	44,5	45,3	0,4069			M4	600		-	223	44,5	45,3	0,4069			600		-	223	44,5	45,3	0,4069																																																																																																																																											
	650	3	248	40,5	41,2	0,3594			700	28	273	42,7	43,5	0,3906				710	33	278	43,2	44	0,3969	750			53		298	45	45,8	0,4219	M3	650 x			800	78	323	47,2	48,1	0,4531			710 x	800	78	323	50,3	51,3	0,4966		M2	150		-	-	15,6	15,8	0,0506		180			-	13	17,4	17,6	0,0709	200				-	23	18,6	18,8	0,0844	225				-	36	20	20,3	0,1013	BFL			250	-	48	21,5	21,8	0,1181		280	-	63	23,2	23,6	0,1384	300		-	73	24,3	24,7	0,1519	315		-		80,5	25,2	25,6	0,1620	355				-	100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2	450		-	148	32,6	33,1	0,2531		500			-	173	35,2	35,8	0,2869	550				-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL			600	-	223	40,3	41	0,3544		630	-	238	41,8	42,5	0,3746	650		3	248	42,7	43,5	0,3881	700			28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3			700 x	750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800		78	323	49,8	50,8	0,4894		800 x			150	-	-	16,9	17,1					0,0581	150	-	-	15,7	15,9					0,0514	180	-	13	17,5				17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4			180	-	13	17,5	17,8			0,0719	200	-	23	18,7	19	0,0856				225	-	36	21,9	22,2	0,1163				250	-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170		400		-		123	32,9	33,5	0,2519	BFL				450	-	148	35,9	36,6	0,2906				500	-	173	38,9	39,6	0,3294			550	-	198	41,7	42,5		0,3681	560	-	203	42,3	43	0,3759		M3	600	-	223	44,5	45,3			0,4069	M4	600	-	223	44,5	45,3			0,4069	600		-	223	44,5	45,3	0,4069																																																																																																																																																				
	700	28	273	42,7	43,5	0,3906			710	33	278	43,2	44	0,3969				750	53	298	45	45,8	0,4219	M3			650 x	800	78	323	47,2	48,1	0,4531			710 x	800	78	323	50,3	51,3	0,4966		M2		150	-	-	15,6	15,8	0,0506			180		-	13	17,4	17,6	0,0709		200			-	23	18,6	18,8	0,0844	225				-	36	20	20,3	0,1013	BFL				250	-	48	21,5	21,8	0,1181			280	-	63	23,2	23,6	0,1384		300	-	73	24,3	24,7	0,1519	315		-	80,5	25,2	25,6	0,1620	355		-		100,5	27,4	27,9	0,1890	M3			700 x	400	-	123	29,9	30,4	0,2194		710 x		450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531			500		-	173	35,2	35,8	0,2869		550			-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544			630	-	238	41,8	42,5	0,3746		650	3	248	42,7	43,5	0,3881	700		28	273	45,2	46	0,4219	710			33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x			800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894			800 x		150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13	17,5					17,8	0,0719	BFL	200	-				23	18,7	19	0,0856	M4			180	-	13	17,5	17,8			0,0719	200	-	23	18,7			19	0,0856	225	-	36	21,9	22,2		0,1163		250	-	48	23,5	23,9	0,1356		280		-	63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400	-		123	32,9	33,5	0,2519		BFL		450		-	148	35,9	36,6	0,2906				500	-	173	38,9	39,6	0,3294				550	-	198	41,7	42,5	0,3681			560	-	203	42,3	43		0,3759	M3	600	-	223	44,5	45,3		0,4069	M4	600	-	223	44,5			45,3	0,4069	600	-	223	44,5	45,3			0,4069																																																																																																																																																											
	710	33	278	43,2	44	0,3969			750	53	298	45	45,8	0,4219			M3	650 x	800	78	323	47,2	48,1	0,4531		710 x		800	78	323	50,3	51,3	0,4966		M2		150	-	-	15,6	15,8	0,0506				180	-	13	17,4	17,6	0,0709			200		-	23	18,6	18,8	0,0844		225			-	36	20	20,3	0,1013	BFL				250	-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384			300	-	73	24,3	24,7	0,1519		315	-	80,5	25,2	25,6	0,1620	355		-	100,5	27,4	27,9	0,1890	M3		700 x	400	-	123	29,9	30,4	0,2194		710 x		450	-	148	34,3	34,9	0,2719			M2	450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869			550		-	198	37,8	38,4	0,3206		560			-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746			650	3	248	42,7	43,5	0,3881		700	28	273	45,2	46	0,4219	710		33	278	45,6	46,5	0,4286	M3		700 x	750	53	298	47,5	48,4	0,4556		710 x		800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200	-					23	18,7	19	0,0856	M4				180	-	13	17,5	17,8			0,0719	200	-	23	18,7			19	0,0856	225	-	36	21,9		22,2	0,1163	250	-	48	23,5	23,9	0,1356	280		-	63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450		-	148	35,9	36,6		0,2906		500		-	173	38,9	39,6	0,3294				550	-	198	41,7	42,5	0,3681				560	-	203	42,3	43	0,3759			M3	600	-	223	44,5		45,3	0,4069	M4	600	-	223	44,5		45,3	0,4069	600	-	223	44,5		45,3	0,4069																																																																																																																																																																				
	750	53	298	45	45,8	0,4219		M3	650 x	800	78	323	47,2	48,1		0,4531	710 x		800	78	323	50,3	51,3	0,4966	M2			150	-	-	15,6	15,8	0,0506				180	-	13	17,4	17,6	0,0709				200	-	23	18,6	18,8	0,0844			225		-	36	20	20,3	0,1013		BFL			250	-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384				300	-	73	24,3	24,7	0,1519			315	-	80,5	25,2	25,6	0,1620		355	-	100,5	27,4	27,9	0,1890	M3	700 x	400	-	123	29,9	30,4	0,2194	710 x		450	-	148	34,3	34,9	0,2719	M2			450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869				550	-	198	37,8	38,4	0,3206			560		-	203	38,3	39	0,3274		BFL			600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881			700	28	273	45,2	46	0,4219		710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556	710 x		800	78	323	52,3	53,4	0,5256			M2	800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200					-	23	18,7	19	0,0856	M4					180	-	13	17,5	17,8				0,0719	200	-	23	18,7			19	0,0856	225	-	36	21,9		22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL		450	-	148	35,9	36,6			0,2906	500		-	173	38,9	39,6		0,3294		550		-	198	41,7	42,5	0,3681				560	-	203	42,3	43	0,3759				M3	600	-	223	44,5	45,3			0,4069	M4	600	-	223		44,5	45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																																																																																																																																												
650 x	800	78	323	47,2	48,1	0,4531	710 x	800		78	323	50,3	51,3	0,4966	M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	150	-	-	15,6	15,8	0,0506		180		-	13	17,4	17,6	0,0709		200			-	23	18,6	18,8	0,0844	225				-	36	20	20,3	0,1013	BFL				250	-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384			300		-	73	24,3	24,7	0,1519		315			-	80,5	25,2	25,6	0,1620	355				-	100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194	710 x		450	-	148	34,3	34,9	0,2719	M2	450	-	148	32,6	33,1	0,2531	500		-	173	35,2	35,8	0,2869	550			-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746			650		3	248	42,7	43,5	0,3881		700			28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x		800	78	323	52,3	53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x		150	-	-	16,9	17,1	0,0581			150	-	-	15,7	15,9	0,0514				180	-	13	17,5	17,8	0,0719					BFL	200	-	23	18,7					19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280			-	63	25,5	25,9	0,1589	300		-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400		-	123	32,9	33,5	0,2519	BFL		450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3	600		-	223	44,5	45,3		0,4069		M4		600	-	223	44,5	45,3				0,4069	600	-	223	44,5	45,3		0,4069																																																																																																																																																																																																				
	180	-	13	17,4	17,6	0,0709		200		-	23	18,6	18,8	0,0844		225			-	36	20	20,3	0,1013	BFL				250	-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384				300	-	73	24,3	24,7	0,1519			315		-	80,5	25,2	25,6	0,1620		355			-	100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2	450	-	148	32,6	33,1	0,2531		500	-	173	35,2	35,8	0,2869	550		-	198	37,8	38,4	0,3206	560			-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881			700		28	273	45,2	46	0,4219		710			33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800	78	323	49,8	50,8	0,4894		800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7	15,9			0,0514	180	-	13	17,5	17,8				0,0719	BFL	200	-	23	18,7					19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2		0,1163			250	-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-	100,5	30,2	30,7	0,2170		400	-	123	32,9	33,5	0,2519	BFL		450	-	148	35,9	36,6	0,2906		500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069	M4		600	-	223	44,5		45,3		0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																												
	200	-	23	18,6	18,8	0,0844		225		-	36	20	20,3	0,1013		BFL			250	-	48	21,5	21,8	0,1181				280	-	63	23,2	23,6	0,1384				300	-	73	24,3	24,7	0,1519				315	-	80,5	25,2	25,6	0,1620			355		-	100,5	27,4	27,9	0,1890		M3	700 x		400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531			500	-	173	35,2	35,8	0,2869		550	-	198	37,8	38,4	0,3206	560		-	203	38,3	39	0,3274	BFL			600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881				700	28	273	45,2	46	0,4219			710		33	278	45,6	46,5	0,4286		M3	700 x		750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894			800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7			15,9	0,0514	180	-	13	17,5			17,8	0,0719	BFL	200	-	23				18,7	19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2			0,1163		250	-	48	23,5	23,9		0,1356		280	-	63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400	-	123	32,9	33,5	0,2519		BFL	450	-	148	35,9	36,6	0,2906		500	-	173	38,9	39,6	0,3294		550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069		M4	600	-	223	44,5			45,3	0,4069		600	-	223	44,5		45,3		0,4069																																																																																																																																																																																																																					
	225	-	36	20	20,3	0,1013		BFL		250	-	48	21,5	21,8		0,1181			280	-	63	23,2	23,6	0,1384				300	-	73	24,3	24,7	0,1519				315	-	80,5	25,2	25,6	0,1620				355	-	100,5	27,4	27,9	0,1890			M3	700 x	400	-	123	29,9	30,4		0,2194		710 x	450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869			550	-	198	37,8	38,4	0,3206		560	-	203	38,3	39	0,3274	BFL		600	-	223	40,3	41	0,3544			630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881				700	28	273	45,2	46	0,4219				710	33	278	45,6	46,5	0,4286			M3	700 x	750	53	298	47,5	48,4		0,4556		710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1				0,0581	150	-	-	15,7			15,9	0,0514	180	-	13			17,5	17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4	180				-	13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2				0,1163	250	-	48	23,5	23,9			0,1356	280	-	63	25,5	25,9	0,1589		300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450	-	148	35,9	36,6		0,2906	500	-	173	38,9	39,6	0,3294		550	-	198	41,7	42,5	0,3681		560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069		M4	600	-	223	44,5			45,3		0,4069	600	-	223	44,5			45,3	0,4069																																																																																																																																																																																																																														
	250	-	48	21,5	21,8	0,1181		280		-	63	23,2	23,6	0,1384		300			-	73	24,3	24,7	0,1519	315				-	80,5	25,2	25,6	0,1620	355				-	100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194	710 x		450		-	148	34,3	34,9	0,2719	M2	450			-	148	32,6	33,1	0,2531	500				-	173	35,2	35,8	0,2869	550				-	198	37,8	38,4	0,3206	560			-	203	38,3	39	0,3274	BFL		600	-	223	40,3	41	0,3544	630		-	238	41,8	42,5	0,3746	650			3	248	42,7	43,5	0,3881	700				28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x		800		78	323	52,3	53,4	0,5256	M2	800			78	323	49,8	50,8	0,4894	800 x				150	-	-	16,9	17,1	0,0581					150	-	-	15,7	15,9				0,0514	180	-	13	17,5			17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4	180			-	13	17,5	17,8	0,0719	200				-	23	18,7	19	0,0856	225					-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280			-	63	25,5	25,9	0,1589	300	-		73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355		-		100,5	30,2	30,7	0,2170	400			-		123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906			500	-	173	38,9	39,6	0,3294		550	-	198	41,7	42,5	0,3681	560		-	203	42,3	43	0,3759	M3		600		-	223	44,5	45,3	0,4069			M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																								
	280	-	63	23,2	23,6	0,1384		300		-	73	24,3	24,7	0,1519		315			-	80,5	25,2	25,6	0,1620	355				-	100,5	27,4	27,9	0,1890	M3	700 x			400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2	450		-	148	32,6	33,1	0,2531		500			-	173	35,2	35,8	0,2869	550				-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL			600	-	223	40,3	41	0,3544		630	-	238	41,8	42,5	0,3746	650		3	248	42,7	43,5	0,3881	700			28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800		78	323	49,8	50,8	0,4894		800 x			150	-	-	16,9	17,1					0,0581	150	-	-	15,7	15,9					0,0514	180	-	13	17,5				17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4			180	-	13	17,5	17,8	0,0719			200	-	23	18,7	19	0,0856				225	-	36	21,9	22,2	0,1163			250		-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170		400		-		123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550	-	198	41,7	42,5	0,3681		560	-	203	42,3	43	0,3759	M3		600	-	223	44,5	45,3	0,4069		M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																	
	300	-	73	24,3	24,7	0,1519		315		-	80,5	25,2	25,6	0,1620		355			-	100,5	27,4	27,9	0,1890	M3			700 x	400	-	123	29,9	30,4	0,2194			710 x	450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531			500		-	173	35,2	35,8	0,2869		550			-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544			630	-	238	41,8	42,5	0,3746		650	3	248	42,7	43,5	0,3881	700		28	273	45,2	46	0,4219	710			33	278	45,6	46,5	0,4286	M3			700 x	750	53	298	47,5	48,4	0,4556		710 x		800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894			800 x		150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13	17,5					17,8	0,0719	BFL	200	-				23	18,7	19	0,0856	M4			180	-	13	17,5	17,8			0,0719	200	-	23	18,7	19			0,0856	225	-	36	21,9	22,2	0,1163			250	-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400	-		123	32,9	33,5	0,2519		BFL		450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560	-	203	42,3	43	0,3759		M3	600	-	223	44,5	45,3	0,4069		M4	600	-	223	44,5	45,3		0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																										
	315	-	80,5	25,2	25,6	0,1620		355		-	100,5	27,4	27,9	0,1890		M3		700 x	400	-	123	29,9	30,4	0,2194		710 x		450	-	148	34,3	34,9	0,2719		M2		450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869			550		-	198	37,8	38,4	0,3206		560			-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746			650	3	248	42,7	43,5	0,3881		700	28	273	45,2	46	0,4219	710		33	278	45,6	46,5	0,4286	M3		700 x	750	53	298	47,5	48,4	0,4556		710 x		800	78	323	52,3	53,4	0,5256			M2	800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200	-					23	18,7	19	0,0856	M4				180	-	13	17,5	17,8			0,0719	200	-	23	18,7			19	0,0856	225	-	36	21,9		22,2	0,1163	250	-	48	23,5	23,9	0,1356	280		-	63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450		-	148	35,9	36,6		0,2906		500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3	600	-	223	44,5	45,3		0,4069	M4	600	-	223	44,5	45,3		0,4069	600	-	223	44,5	45,3		0,4069																																																																																																																																																																																																																																																																			
	355	-	100,5	27,4	27,9	0,1890		M3	700 x	400	-	123	29,9	30,4		0,2194	710 x		450	-	148	34,3	34,9	0,2719	M2			450	-	148	32,6	33,1	0,2531				500	-	173	35,2	35,8	0,2869				550	-	198	37,8	38,4	0,3206			560		-	203	38,3	39	0,3274		BFL			600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881			700	28	273	45,2	46	0,4219		710	33	278	45,6	46,5	0,4286	M3	700 x	750	53	298	47,5	48,4	0,4556	710 x		800	78	323	52,3	53,4	0,5256	M2			800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200					-	23	18,7	19	0,0856	M4					180	-	13	17,5	17,8				0,0719	200	-	23	18,7			19	0,0856	225	-	36		21,9	22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL		450	-	148	35,9	36,6			0,2906	500		-	173	38,9	39,6		0,3294		550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069	M4	600	-	223	44,5		45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																											
700 x	400	-	123	29,9	30,4	0,2194	710 x	450		-	148	34,3	34,9	0,2719	M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
	450	-	148	32,6	33,1	0,2531		500		-	173	35,2	35,8	0,2869		550			-	198	37,8	38,4	0,3206	560				-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746			650		3	248	42,7	43,5	0,3881		700			28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x		800	78	323	52,3	53,4	0,5256	M2	800	78	323	49,8	50,8	0,4894	800 x		150	-	-	16,9	17,1	0,0581			150	-	-	15,7	15,9	0,0514				180	-	13	17,5	17,8	0,0719					BFL	200	-	23	18,7					19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280			-	63	25,5	25,9	0,1589	300		-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400		-	123	32,9	33,5	0,2519	BFL		450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3	600		-	223	44,5	45,3		0,4069		M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																		
	500	-	173	35,2	35,8	0,2869		550		-	198	37,8	38,4	0,3206		560			-	203	38,3	39	0,3274	BFL				600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881			700		28	273	45,2	46	0,4219		710			33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800	78	323	49,8	50,8	0,4894		800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7	15,9			0,0514	180	-	13	17,5	17,8				0,0719	BFL	200	-	23	18,7					19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2		0,1163			250	-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-	100,5	30,2	30,7	0,2170		400	-	123	32,9	33,5	0,2519	BFL		450	-	148	35,9	36,6	0,2906		500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069	M4		600	-	223	44,5		45,3		0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																											
	550	-	198	37,8	38,4	0,3206		560		-	203	38,3	39	0,3274		BFL			600	-	223	40,3	41	0,3544				630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881				700	28	273	45,2	46	0,4219			710		33	278	45,6	46,5	0,4286		M3	700 x		750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894			800 x	150	-	-	16,9	17,1			0,0581	150	-	-	15,7			15,9	0,0514	180	-	13	17,5			17,8	0,0719	BFL	200	-	23				18,7	19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2			0,1163		250	-	48	23,5	23,9		0,1356		280	-	63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400	-	123	32,9	33,5	0,2519		BFL	450	-	148	35,9	36,6	0,2906		500	-	173	38,9	39,6	0,3294		550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069		M4	600	-	223	44,5			45,3	0,4069		600	-	223	44,5		45,3		0,4069																																																																																																																																																																																																																																																																																																																				
	560	-	203	38,3	39	0,3274		BFL		600	-	223	40,3	41		0,3544			630	-	238	41,8	42,5	0,3746				650	3	248	42,7	43,5	0,3881				700	28	273	45,2	46	0,4219				710	33	278	45,6	46,5	0,4286			M3	700 x	750	53	298	47,5	48,4		0,4556		710 x	800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1				0,0581	150	-	-	15,7			15,9	0,0514	180	-	13			17,5	17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4	180				-	13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2				0,1163	250	-	48	23,5	23,9			0,1356	280	-	63	25,5	25,9	0,1589		300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450	-	148	35,9	36,6		0,2906	500	-	173	38,9	39,6	0,3294		550	-	198	41,7	42,5	0,3681		560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069		M4	600	-	223	44,5			45,3		0,4069	600	-	223	44,5			45,3	0,4069																																																																																																																																																																																																																																																																																																																													
	600	-	223	40,3	41	0,3544		630		-	238	41,8	42,5	0,3746		650			3	248	42,7	43,5	0,3881	700				28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556	710 x		800		78	323	52,3	53,4	0,5256	M2	800			78	323	49,8	50,8	0,4894	800 x				150	-	-	16,9	17,1	0,0581					150	-	-	15,7	15,9				0,0514	180	-	13	17,5			17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4	180			-	13	17,5	17,8	0,0719	200				-	23	18,7	19	0,0856	225					-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280			-	63	25,5	25,9	0,1589	300	-		73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355		-		100,5	30,2	30,7	0,2170	400			-		123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906			500	-	173	38,9	39,6	0,3294		550	-	198	41,7	42,5	0,3681	560		-	203	42,3	43	0,3759	M3		600		-	223	44,5	45,3	0,4069			M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																																																							
	630	-	238	41,8	42,5	0,3746		650		3	248	42,7	43,5	0,3881		700			28	273	45,2	46	0,4219	710				33	278	45,6	46,5	0,4286	M3	700 x			750	53	298	47,5	48,4	0,4556			710 x	800	78	323	52,3	53,4	0,5256		M2	800		78	323	49,8	50,8	0,4894		800 x			150	-	-	16,9	17,1					0,0581	150	-	-	15,7	15,9					0,0514	180	-	13	17,5				17,8	0,0719	BFL	200	-			23	18,7	19	0,0856	M4			180	-	13	17,5	17,8	0,0719			200	-	23	18,7	19	0,0856				225	-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280		-		63	25,5	25,9	0,1589	300	-	73		26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170		400		-		123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550	-	198	41,7	42,5	0,3681		560	-	203	42,3	43	0,3759	M3		600	-	223	44,5	45,3	0,4069		M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																																																																
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	700	28	273	45,2	46	0,4219		710		33	278	45,6	46,5	0,4286		M3		700 x	750	53	298	47,5	48,4	0,4556		710 x		800	78	323	52,3	53,4	0,5256		M2		800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200	-					23	18,7	19	0,0856	M4				180	-	13	17,5	17,8			0,0719	200	-	23	18,7			19	0,0856	225	-	36	21,9		22,2	0,1163	250	-	48	23,5	23,9		0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7		27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL	450		-	148	35,9	36,6		0,2906		500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3	600	-	223	44,5	45,3		0,4069	M4	600	-	223	44,5	45,3		0,4069	600	-	223	44,5	45,3		0,4069																																																																																																																																																																																																																																																																																																																																																																		
	710	33	278	45,6	46,5	0,4286		M3	700 x	750	53	298	47,5	48,4		0,4556	710 x		800	78	323	52,3	53,4	0,5256	M2			800	78	323	49,8	50,8	0,4894				800 x	150	-	-	16,9	17,1					0,0581	150	-	-	15,7					15,9	0,0514	180	-	13					17,5	17,8	0,0719	BFL	200					-	23	18,7	19	0,0856	M4					180	-	13	17,5	17,8				0,0719	200	-	23	18,7			19	0,0856	225	-	36		21,9	22,2	0,1163	250	-	48	23,5	23,9	0,1356	280	-	63	25,5	25,9	0,1589	300	-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170			400		-	123	32,9	33,5	0,2519			BFL		450	-	148	35,9	36,6			0,2906	500		-	173	38,9	39,6		0,3294		550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3		600	-	223	44,5	45,3			0,4069	M4	600	-	223	44,5		45,3	0,4069	600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																										
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	800	78	323	49,8	50,8	0,4894		800 x		150	-	-	16,9	17,1		0,0581			150	-	-	15,7	15,9	0,0514				180	-	13	17,5	17,8	0,0719					BFL	200	-	23	18,7					19	0,0856	M4	180	-					13	17,5	17,8	0,0719	200					-	23	18,7	19	0,0856					225	-	36	21,9	22,2	0,1163	250				-	48	23,5	23,9	0,1356	280			-	63	25,5	25,9	0,1589	300		-	73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355	-	100,5	30,2	30,7	0,2170	400		-	123	32,9	33,5	0,2519	BFL		450		-	148	35,9	36,6	0,2906			500		-	173	38,9	39,6	0,3294			550		-	198	41,7	42,5	0,3681			560		-	203	42,3	43	0,3759			M3	600		-	223	44,5	45,3		0,4069		M4		600	-	223	44,5	45,3			0,4069		600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																																																																																																																	
	150	-	-	15,7	15,9	0,0514				180	-	13	17,5	17,8		0,0719			BFL	200	-	23	18,7	19				0,0856	M4	180	-	13	17,5					17,8	0,0719	200	-	23					18,7	19	0,0856	225	-					36	21,9	22,2	0,1163	250					-	48	23,5	23,9	0,1356		280			-	63	25,5	25,9	0,1589	300	-		73		26,7	27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-	80,5	27,7	28,1	0,1860	M2	355		-	100,5	30,2	30,7	0,2170	400		-	123	32,9	33,5	0,2519	BFL		450	-	148	35,9	36,6	0,2906	500		-	173	38,9	39,6	0,3294	550		-		198	41,7	42,5	0,3681	560			-		203	42,3	43	0,3759	M3			600		-	223	44,5	45,3	0,4069			M4		600	-	223	44,5	45,3			0,4069	600		-	223	44,5	45,3		0,4069																																																																																																																																																																																																																																																																																																																																																																																																																					
	180	-	13	17,5	17,8	0,0719				BFL	200	-	23	18,7		19			0,0856	M4	180	-	13	17,5				17,8	0,0719	200	-	23	18,7					19	0,0856	225	-	36					21,9	22,2	0,1163	250	-					48	23,5	23,9	0,1356	280			-		63	25,5	25,9	0,1589	300		-		73	26,7	27,2	0,1744	M3	710 x	315	-	80,5	27,7		28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2	355		-	100,5	30,2	30,7	0,2170	400		-		123	32,9	33,5	0,2519	BFL	450		-	148	35,9	36,6	0,2906	500		-	173	38,9	39,6	0,3294	550	-		198	41,7	42,5	0,3681	560	-		203		42,3	43	0,3759	M3	600			-		223	44,5	45,3	0,4069	M4			600		-	223	44,5	45,3	0,4069			600		-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																
	200	-	23	18,7	19	0,0856				M4	180	-	13	17,5		17,8			0,0719	200	-	23	18,7	19				0,0856	225	-	36	21,9	22,2					0,1163	250	-	48	23,5					23,9	0,1356	280	-	63				25,5	25,9	0,1589	300	-	73			26,7	27,2	0,1744	M3	710 x	315	-		80,5	27,7	28,1	0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355	-		100,5		30,2	30,7	0,2170	400	-		123		32,9	33,5	0,2519	BFL	450	-		148		35,9	36,6	0,2906	500	-	173		38,9	39,6	0,3294	550	-	198		41,7	42,5	0,3681	560	-	203	42,3		43	0,3759	M3	600	-	223		44,5		45,3	0,4069	M4	600	-			223		44,5	45,3	0,4069	600	-			223		44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																											
	180	-	13	17,5	17,8	0,0719				200	-	23	18,7	19		0,0856			225	-	36	21,9	22,2	0,1163				250	-	48	23,5	23,9	0,1356					280	-	63	25,5	25,9	0,1589				300	-	73	26,7	27,2	0,1744			M3	710 x	315	-	80,5	27,7	28,1		0,1860	800 x	315	-		80,5	27,7	28,1	0,1860	M2	355	-		100,5	30,2		30,7	0,2170	400	-		123	32,9		33,5		0,2519	BFL	450	-	148		35,9		36,6	0,2906	500	-	173	38,9		39,6		0,3294	550	-	198	41,7	42,5		0,3681	560	-	203	42,3	43		0,3759	M3	600	-	223	44,5	45,3		0,4069	M4	600	-	223	44,5		45,3		0,4069	600	-	223	44,5			45,3		0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	200	-	23	18,7	19	0,0856				225	-	36	21,9	22,2		0,1163			250	-	48	23,5	23,9	0,1356				280	-	63	25,5	25,9	0,1589	300				-	73	26,7	27,2	0,1744	M3		710 x		315	-	80,5	27,7	28,1	0,1860	800 x		315		-	80,5	27,7	28,1	0,1860	M2	355		-	100,5		30,2	30,7	0,2170	400		-	123		32,9	33,5		0,2519	BFL	450	-		148	35,9		36,6		0,2906	500	-	173	38,9		39,6		0,3294	550	-	198	41,7	42,5		0,3681		560	-	203	42,3	43	0,3759		M3	600	-	223	44,5	45,3		0,4069	M4	600	-	223	44,5	45,3		0,4069	600	-	223	44,5	45,3		0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	225	-	36	21,9	22,2	0,1163				250	-	48	23,5	23,9		0,1356			280	-	63	25,5	25,9	0,1589			300	-	73	26,7	27,2	0,1744	M3	710 x		315		-	80,5	27,7	28,1	0,1860	800 x	315			-	80,5	27,7	28,1	0,1860	M2		355	-		100,5	30,2	30,7	0,2170	400		-		123	32,9		33,5	0,2519	BFL	450		-	148		35,9	36,6		0,2906	500	-	173		38,9	39,6		0,3294		550	-	198	41,7	42,5		0,3681		560	-	203	42,3	43	0,3759		M3		600	-	223	44,5	45,3	0,4069		M4	600	-	223	44,5	45,3		0,4069	600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
	250	-	48	23,5	23,9	0,1356				280	-	63	25,5	25,9		0,1589		300	-	73	26,7	27,2	0,1744	M3		710 x	315	-	80,5	27,7	28,1	0,1860	800 x		315	-		80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170	400			-	123		32,9	33,5	0,2519	BFL	450		-		148	35,9		36,6	0,2906	500	-		173	38,9		39,6	0,3294		550	-	198	41,7		42,5	0,3681		560		-	203	42,3	43	0,3759		M3		600	-	223	44,5	45,3	0,4069		M4		600	-	223	44,5	45,3	0,4069		600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	280	-	63	25,5	25,9	0,1589			300	-	73	26,7	27,2	0,1744		M3	710 x	315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2			355	-	100,5	30,2	30,7	0,2170	400			-		123	32,9	33,5	0,2519	BFL	450			-	148		35,9	36,6	0,2906	500	-		173		38,9	39,6		0,3294	550	-	198		41,7	42,5		0,3681	560		-	203	42,3	43		0,3759	M3		600		-	223	44,5	45,3	0,4069		M4		600	-	223	44,5	45,3	0,4069		600		-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
300	-	73	26,7	27,2	0,1744	M3	710 x		315	-	80,5	27,7	28,1	0,1860	800 x	315		-	80,5	27,7	28,1	0,1860	M2		355		-	100,5	30,2	30,7	0,2170				400	-	123	32,9	33,5	0,2519	BFL			450		-	148	35,9	36,6	0,2906	500			-	173		38,9	39,6	0,3294	550	-		198		41,7	42,5		0,3681	560	-	203		42,3	43		0,3759	M3		600	-	223	44,5		45,3	0,4069		M4		600	-	223	44,5	45,3		0,4069		600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
710 x	315	-	80,5	27,7	28,1	0,1860		800 x	315	-	80,5	27,7	28,1	0,1860		M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
	355	-	100,5	30,2	30,7	0,2170			400	-	123	32,9	33,5	0,2519				BFL	450	-	148	35,9			36,6		0,2906	500	-	173	38,9				39,6	0,3294	550	-	198	41,7	42,5			0,3681		560	-	203	42,3	43	0,3759			M3	600		-	223	44,5	45,3	0,4069		M4		600	-		223	44,5	45,3	0,4069		600	-		223	44,5		45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
	400	-	123	32,9	33,5	0,2519			BFL	450	-	148	35,9	36,6				0,2906	500	-	173	38,9			39,6		0,3294	550	-	198	41,7				42,5	0,3681	560	-	203	42,3	43			0,3759		M3	600	-	223	44,5	45,3			0,4069	M4		600	-	223	44,5	45,3		0,4069		600	-		223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	450	-	148	35,9	36,6	0,2906			500	-	173	38,9	39,6	0,3294				550	-	198	41,7	42,5			0,3681		560	-	203	42,3	43				0,3759	M3	600	-	223	44,5	45,3			0,4069		M4	600	-	223	44,5	45,3			0,4069	600		-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	500	-	173	38,9	39,6	0,3294			550	-	198	41,7	42,5	0,3681				560	-	203	42,3	43			0,3759		M3	600	-	223	44,5				45,3	0,4069	M4	600	-	223	44,5			45,3		0,4069	600	-	223	44,5	45,3			0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	550	-	198	41,7	42,5	0,3681			560	-	203	42,3	43	0,3759				M3	600	-	223	44,5			45,3		0,4069	M4	600	-	223				44,5	45,3	0,4069	600	-	223	44,5			45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	560	-	203	42,3	43	0,3759			M3	600	-	223	44,5	45,3				0,4069	M4	600	-	223			44,5		45,3	0,4069	600	-	223			44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	600	-	223	44,5	45,3	0,4069			M4	600	-	223	44,5	45,3				0,4069	600	-	223	44,5			45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	600	-	223	44,5	45,3	0,4069			600	-	223	44,5	45,3	0,4069																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control				
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*							
800 x	630	-	238	46,1	47	0,4301	BF	M3	315	-	80,5	34,9	35,5	0,2580	BFN	M2			
	650	3	248	47,2	48,1	0,4456			355	-	100,5	38,2	38,9	0,3010					
	700	28	273	49,8	50,8	0,4844			400	-	123	41,7	42,5	0,3494					
	710	33	278	50,3	51,3	0,4921			450	-	148	45,5	46,4	0,4031					
	750	53	298	52,3	53,4	0,5231			500	-	173	49,1	50,1	0,4569					
	800	78	323	54,8	56	0,5619			550	-	198	52,7	53,7	0,5106					
900 x	150	-	-	18,1	18,4	0,0656	BFL	M2	1100 x	560	-	203	53,3	54,4	0,5214	BF	M3		
	180	-	13	20,4	20,7	0,0919			600	-	223	56	57,2	0,5644					
	200	-	23	21,9	22,2	0,1094			630	-	238	58	59,2	0,5966					
	225	-	36	23,7	24,1	0,1313			650	3	248	59,3	60,5	0,6181					
	250	-	48	25,5	26	0,1531			700	28	273	62,4	63,8	0,6719					
	280	-	63	27,7	28,1	0,1794			710	33	278	63	64,4	0,6826					
	300	-	73	29,1	29,6	0,1969			750	53	298	65,3	66,8	0,7256					
	315	-	80,5	30,1	30,7	0,2100			800	78	323	68,1	69,7	0,7794					
	355	-	100,5	32,9	33,5	0,2450			1250 x	180	-	13	25,5	26	0,1286			BFL	M2
	400	-	123	35,9	36,6	0,2844				200	-	23	27,5	28	0,1531				
	450	-	148	39,2	39,9	0,3281				225	-	36	30	30,5	0,1838				
	500	-	173	42,4	43,2	0,3719				250	-	48	32,4	32,9	0,2144				
	550	-	198	45,5	46,4	0,4156				280	-	63	35,2	35,8	0,2511				
	560	-	203	46,1	47	0,4244				300	-	73	37	37,7	0,2756				
600	-	223	48,5	49,4	0,4594	315	-	80,5		38,4	39,1	0,2940							
630	-	238	50,2	51,2	0,4856	355	-	100,5		42	42,7	0,3430							
650	3	248	51,4	52,4	0,5031	400	-	123		45,8	46,7	0,3981							
700	28	273	54,2	55,3	0,5469	450	-	148		50	51	0,4594							
710	33	278	54,8	55,9	0,5556	500	-	173		53,9	55	0,5206							
750	53	298	56,9	58,1	0,5906	550	-	198		57,7	58,9	0,5819							
800	78	323	59,6	60,8	0,6344	560	-	203		58,4	59,7	0,5941							
1000 x	150	-	-	19,4	19,7	0,0731	BFL	M2		600	-	223	61,2	62,6	0,6431	BF	M3		
	180	-	13	21,9	22,2	0,1024			630	-	238	63,3	64,7	0,6799					
	200	-	23	23,5	23,9	0,1219			650	3	248	64,7	66,1	0,7044					
	225	-	36	25,5	26	0,1463			700	28	273	67,9	69,5	0,7656					
	250	-	48	27,5	28	0,1706			710	33	278	68,5	70,1	0,7779					
	280	-	63	29,9	30,4	0,1999			750	53	298	70,9	72,7	0,8269					
	300	-	73	31,4	32	0,2194			800	78	323	73,8	75,7	0,8881					
	315	-	80,5	32,6	33,1	0,2340			1400 x	180	-	13	27,7	28,1	0,1444			BFL	M2
	355	-	100,5	35,6	36,2	0,2730				200	-	23	29,9	30,4	0,1719				
	400	-	123	38,9	39,6	0,3169				225	-	36	32,6	33,1	0,2063				
	450	-	148	42,4	43,2	0,3656				250	-	48	35,2	35,8	0,2406				
	500	-	173	45,8	46,7	0,4144				280	-	63	38,3	39	0,2819				
	550	-	198	49,1	50,1	0,4631				300	-	73	40,3	41	0,3094				
	560	-	203	49,8	50,8	0,4729				315	-	80,5	41,8	42,5	0,3300				
600	-	223	52,3	53,4	0,5119	355	-	100,5		45,6	46,5	0,3850							
630	-	238	54,2	55,3	0,5411	400	-	123		49,8	50,8	0,4469							
650	3	248	55,4	56,6	0,5606	450	-	148		54,2	55,3	0,5156							
700	28	273	58,4	59,7	0,6094	500	-	173		58,4	59,7	0,5844							
710	33	278	59	60,3	0,6191	550	-	198		62,4	63,8	0,6531							
750	53	298	61,2	62,6	0,6581	560	-	203		63,1	64,5	0,6669							
800	78	323	64	65,4	0,7069	600	-	223		66,1	67,6	0,7219							
1100 x	180	-	13	23,4	23,7	0,1129	BFL	M2	630	-	238	68,2	69,8	0,7631	BF	M4			
	200	-	23	25,1	25,5	0,1344			650	3	248	69,6	71,3	0,7906					
	225	-	36	27,3	27,8	0,1613			700	28	273	72,9	74,7	0,8594					
	250	-	48	29,5	30	0,1881			710	33	278	73,5	75,4	0,8731					
	280	-	63	32	32,6	0,2204			750	53	298	75,9	77,9	0,9281					
	300	-	73	33,7	34,3	0,2419			800	78	323	78,8	80,9	0,9969					

Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blades overlaps		Weight		Free area S <sub>f</sub> [m <sup>2</sup> ]	Spring return actuator	Manual control
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*			
1500 x	180	-	13	29,1	29,6	0,1549		1500 x	500	-	173	61,2	62,6	0,6269	
	200	-	23	31,4	32	0,1844	BFL		550	-	198	65,3	66,8	0,7006	M3
	225	-	36	34,3	34,9	0,2213			560	-	203	66,1	67,6	0,7154	
	250	-	48	37	37,7	0,2581	M2		600	-	223	69,1	70,8	0,7744	M4
	280	-	63	40,3	41	0,3024			630	-	238	71,3	73	0,8186	
	300	-	73	42,4	43,2	0,3319	BFN		650	3	248	72,7	74,5	0,8481	BF
	315	-	80,5	44	44,8	0,3540			700	28	273	75,9	77,9	0,9219	
	355	-	100,5	48	48,9	0,4130			710	33	278	76,6	78,6	0,9366	M5
	400	-	123	52,3	53,4	0,4794			750	53	298	79	81,1	0,9956	
	450	-	148	56,9	58,1	0,5531	BF		800	78	323	81,7	84,1	1,0694	

Sizes in increments of 5 mm can be manufactured on request.

\* For designs with BKN a weight of 0.5 kg must be added.

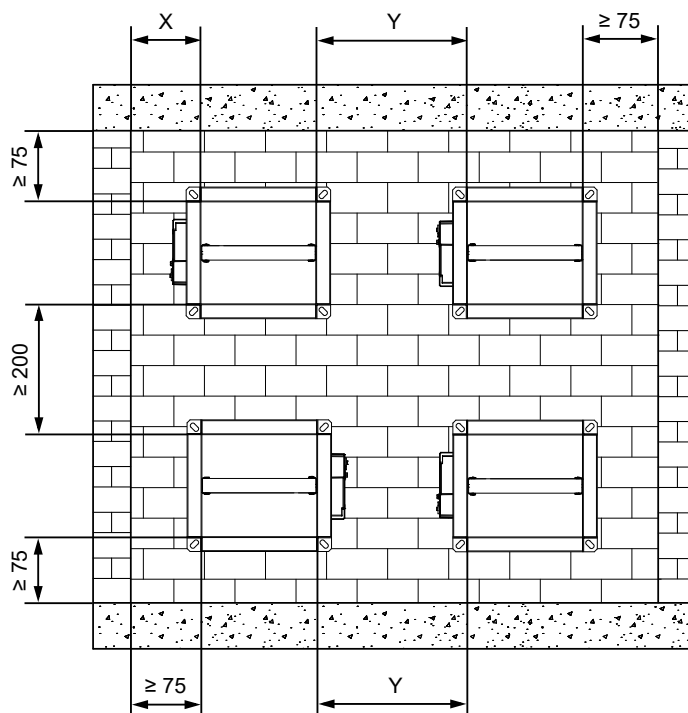
## IV. INSTALLATION

### Placement and installation

- The fire dampers are suitable for installation in arbitrary position in vertical and horizontal passages of fire separating constructions. The damper installation procedures must be done so that all load transfer from the fire separating constructions to the damper is absolutely excluded. Following air-conditioning duct must be suspended or supported so that all load transfer from the following duct to the fire damper is absolutely excluded. The gap between the installed damper and the fire separating construction must be perfectly filled with approved material.
- The damper must be installed so that the damper blade (in closed position) is situated in the fire separating construction - marked by the label BUILT-IN EDGE on the damper casing. If such solution is not possible, the duct between the fire separating construction and the damper blade must be protected according to the certified installation method → see pages 25 to 47
- During the installation and plastering process, the actuating mechanism must be protected (covered) against damage and pollution. The damper casing should not be deformed during bricking in. Once the damper is built in, the damper blade should not grind against the damper casing during opening or closing.
- The distance between the fire damper and the construction (wall, ceiling) must be 75 mm at the minimum, according to EN 1366-2. If two or more dampers are to be installed in one fire separating construction, the distance between adjacent dampers must be 200 mm at the minimum, according to EN 1366-2.

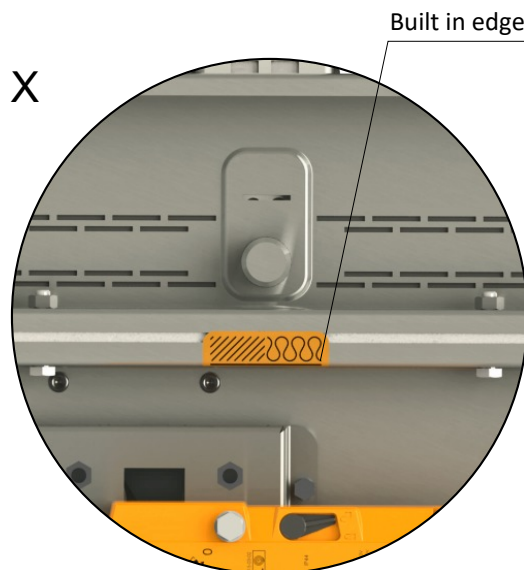
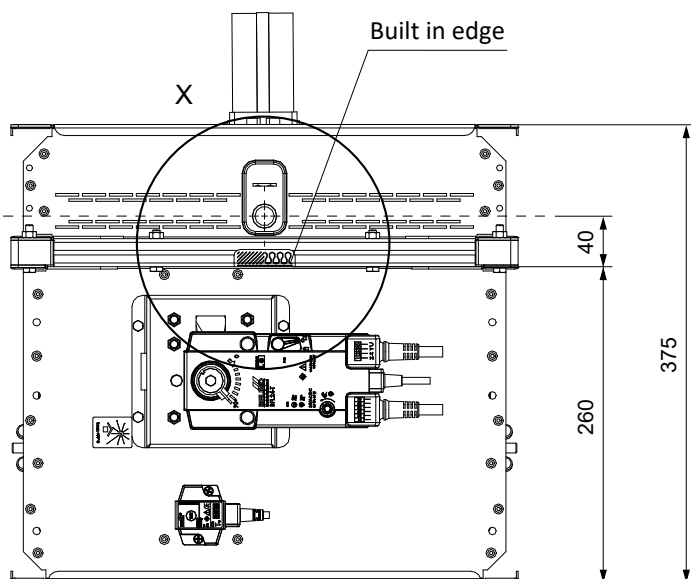
#### Minimum distance between the fire dampers and the construction

- minimum distance 200 mm between dampers, according to EN 1366-2
- minimum distance 75 mm between damper and construction (wall/ceiling), according to EN 1366-2
- recommended minimum distance 150 mm necessary for access to the actuator
- recommended minimum distance 250 mm necessary for access to the manual control

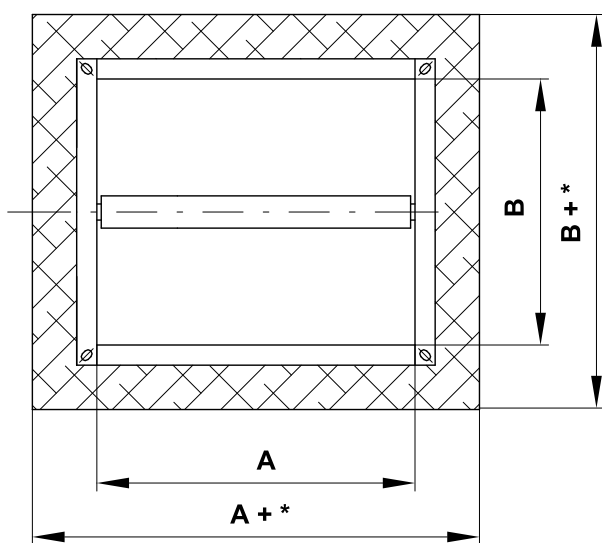


- X = recommended min. distance for actuator  $\geq 150$  mm
- X = recommended min. distance for manual control  $\geq 250$  mm
- Y = min. distance for actuator  $\geq 200$  mm acc. to EN 1366-2
- Y = recommended min. distance for manual control  $\geq 250$  mm

**Built in edge**



**Dimensions of an installation opening**



**\* Mortar or gypsum**

- min. A(B)+100
- max. A(B)+300

**\* Ablative Coated Batt, damper in solid/gypsum wall construction**

- min. A(B)+100
- max. A(B)+360

**\* Ablative Coated Batt, damper outside solid/gypsum wall construction**

- A(B)+200

**\* Ablative Coated Batt, damper in sandwich wall construction EUROCLAD**

- min. A(B)+100
- max. A(B)+400

**\* Ablative Coated Batt, 2 dampers in one opening in shaft wall construction**

- min. A(B)+100
- max. A(B)+180

## Statement of installations

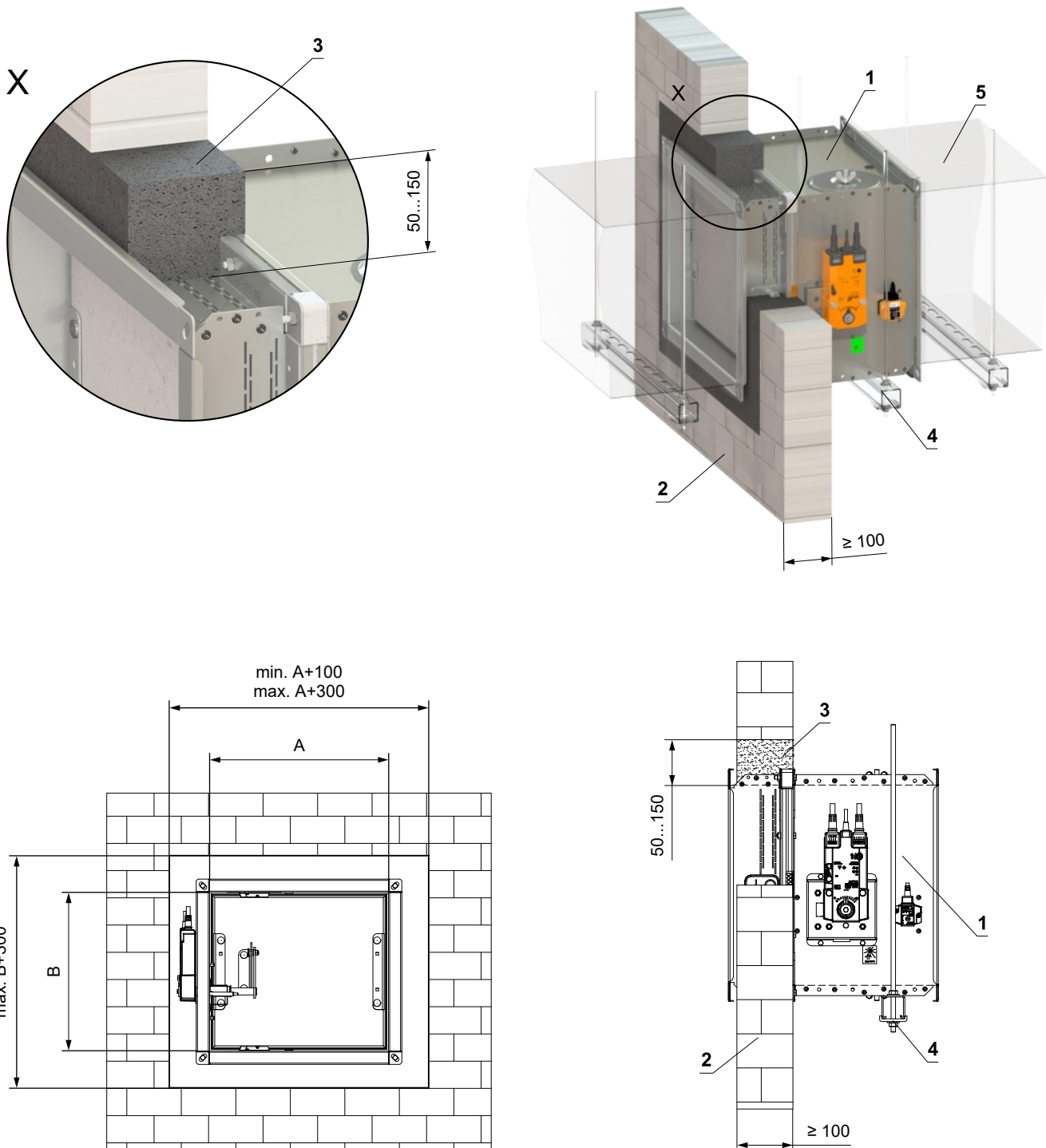
Placement	wall/ceiling min. thickness [mm]	Method of installation	Fire resistance	Page
In solid wall construction	100	Mortar or gypsum	EI 120 (v <sub>e</sub> ) S [H] - 500 Pa	25
		2 dampers in battery - mortar or gypsum		26
		4 dampers in battery - mortar or gypsum	EI 120 (v <sub>e</sub> ) S [H]	27
		Ablative Coated Batt		28
Outside solid wall construction	100	ISOVER Ultimate Protect - Ablative Coated Batt	EI 120 (v <sub>e</sub> ) S [H]	29-30
		Flamebar EN Fire Duct - FPL 110 insulation		31-32
In gypsum wall construction	100	Mortar or gypsum	EI 120 (v <sub>e</sub> ) S [H] - 500 Pa	33
		2 dampers in battery - mortar or gypsum		34
		4 dampers in battery - mortar or gypsum	EI 120 (v <sub>e</sub> ) S [H]	35
		Ablative Coated Batt		36
Outside gypsum wall construction	100	ISOVER Ultimate Protect - Ablative Coated Batt	EI 120 (v <sub>e</sub> ) S [H]	37-38
		Flamebar EN Fire Duct - FPL 110 insulation		39-40
In sandwich wall construction	150	Ablative Coated Batt with fire-resistant boards	EI 120 (v <sub>e</sub> ) S [H]	41
	105	Mortar or gypsum	EI 120 (v <sub>e</sub> ) S [H]	42
In shaft wall construction	107	2 dampers in one opening - mortar or gypsum		43
		2 dampers in one opening - Ablative Coated Batt	EI 120 (v <sub>e</sub> ) S [H]	44
In solid ceiling construction	150	Mortar or gypsum	EI 120 (h <sub>o</sub> ) S [H] - 500 Pa	45
		2 dampers in battery - mortar or gypsum		46
		4 dampers in battery - mortar or gypsum	EI 120 (h <sub>o</sub> ) S [H]	47

### Installation in solid wall construction

In solid wall construction - mortar or gypsum

EI 120 (v<sub>e</sub>) S [H] - 500 Pa

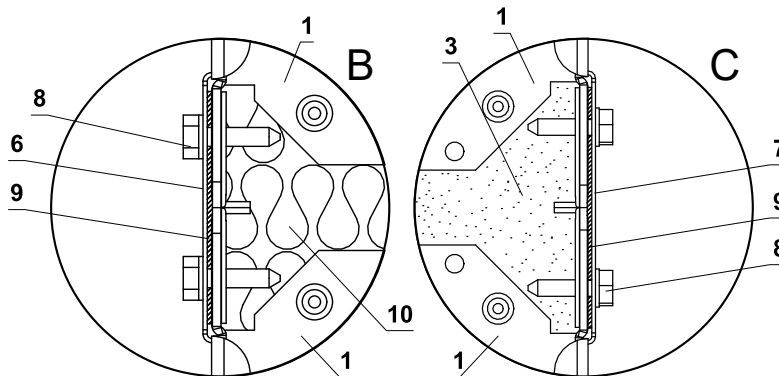
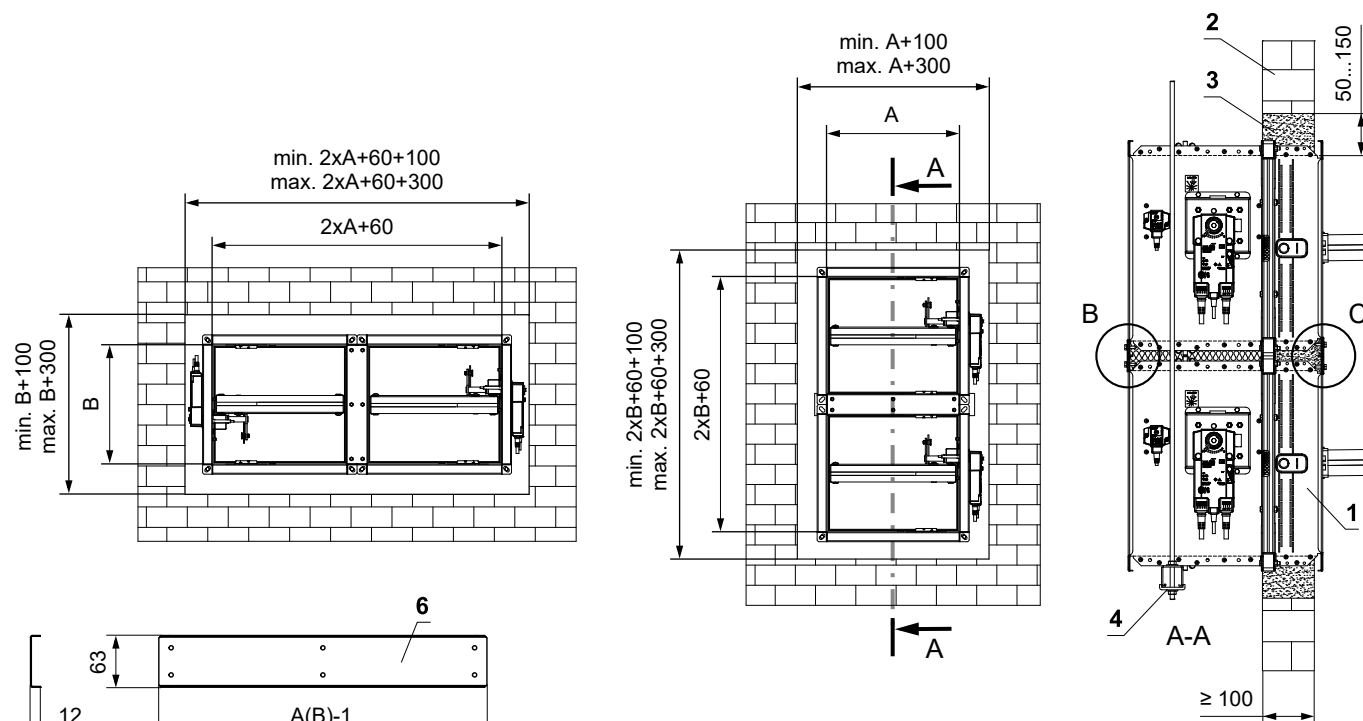
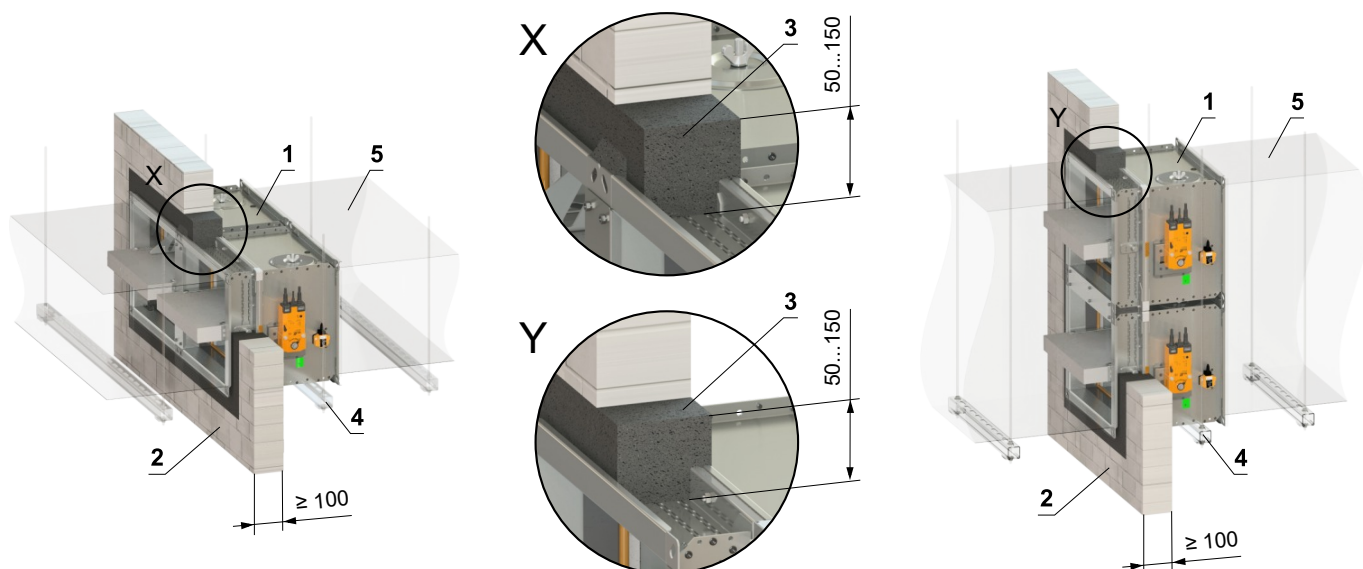
- For connection following duct → see page 52



- 1 FDMQ 120
- 2 Solid wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct

In solid wall construction - 2 dampers in battery - mortar or gypsum

EI 120 (v<sub>e</sub>) S [H]

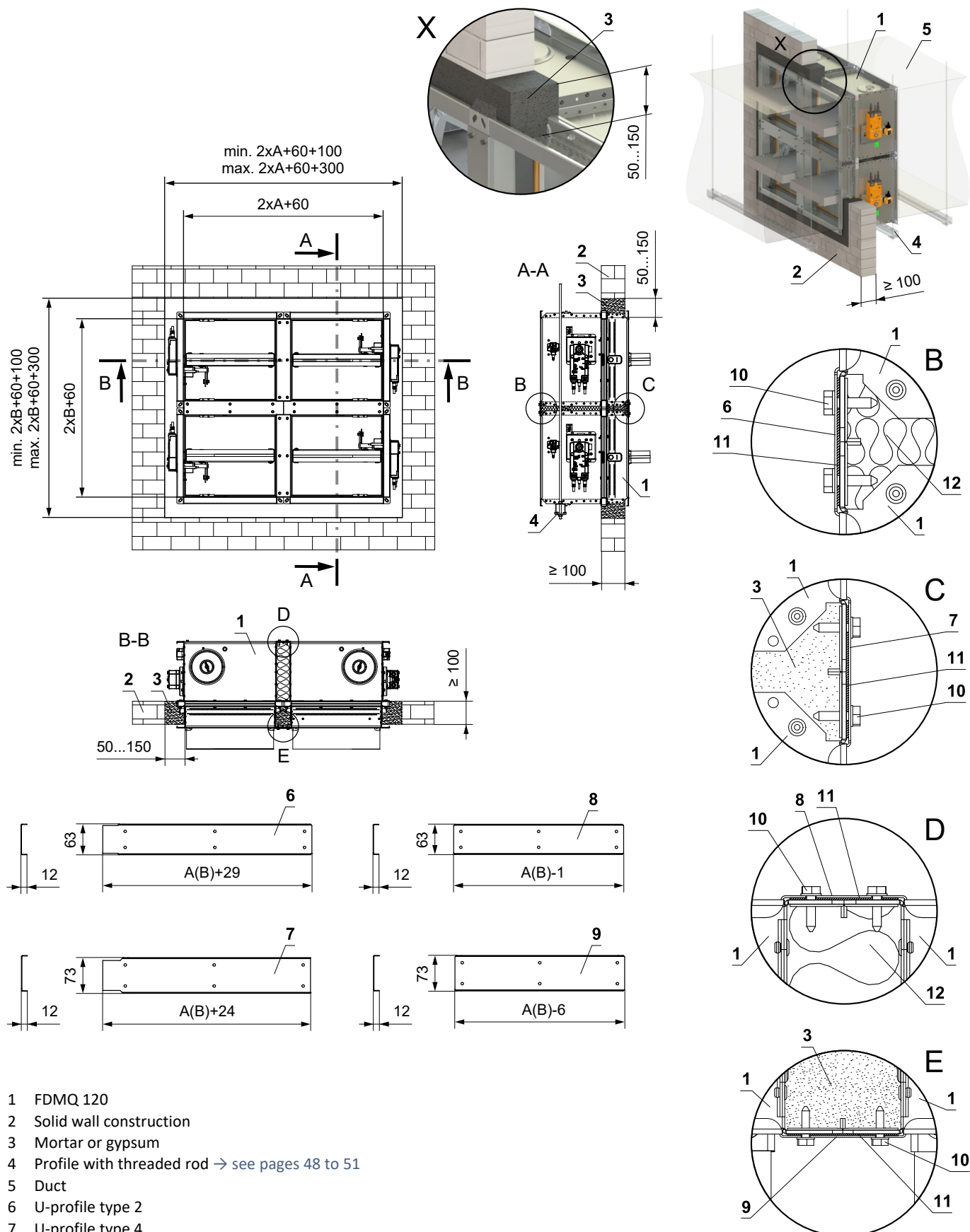


- 1 FDMQ 120
- 2 Solid wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEK 4,8x18 mm (span ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

- For connection following duct → see page 52
- Gap between damper and construction is filled by mortar or gypsum

In solid wall construction - 4 dampers in battery - mortar or gypsum

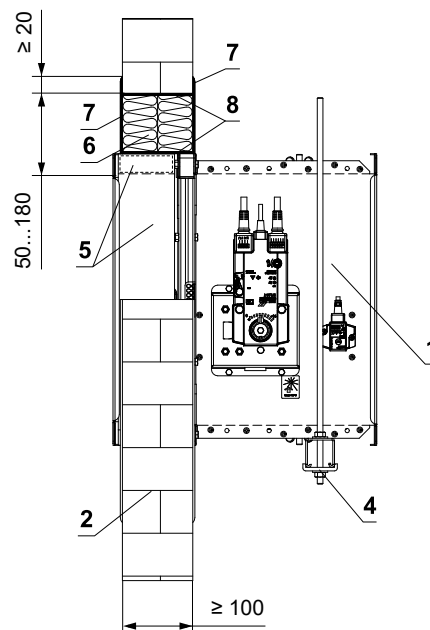
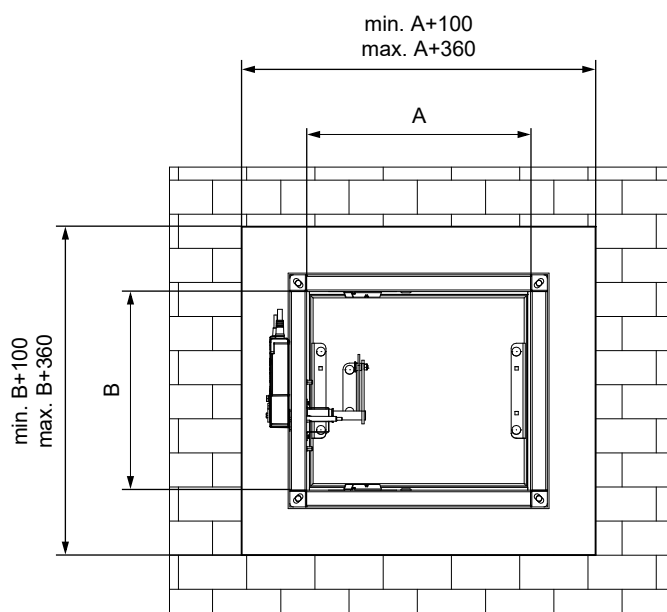
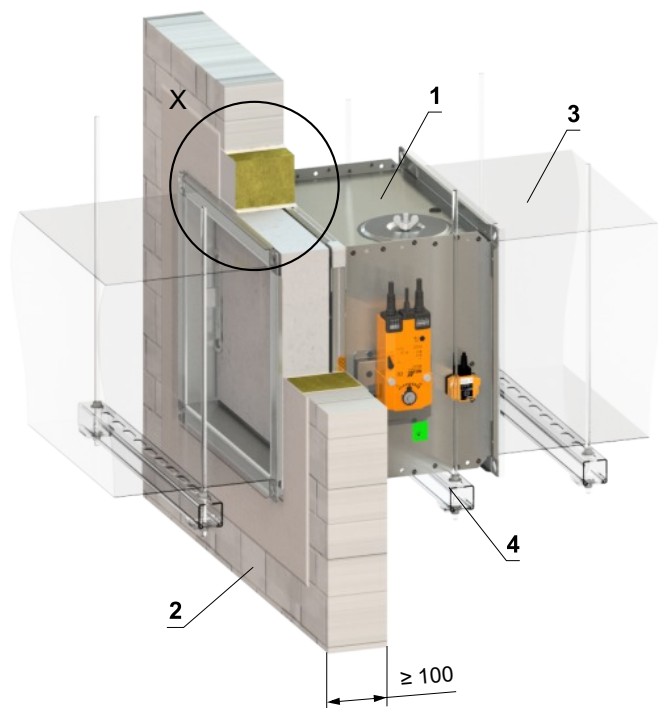
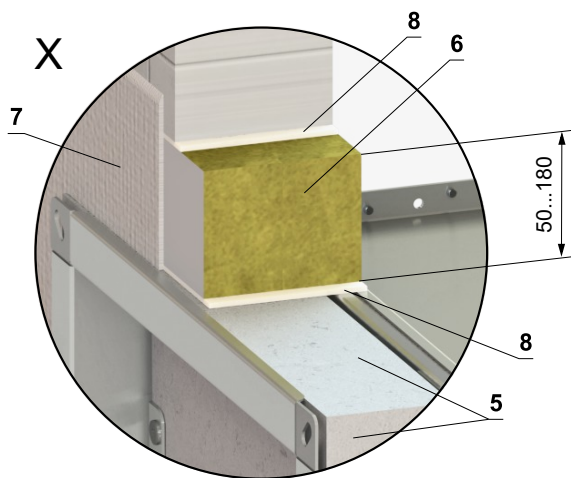
EI 120 (ve) S [H]



In solid wall construction - Ablative Coated Batt

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52



- 1 FDMQ 120
  - 2 Solid wall construction
  - 3 Duct
  - 4 Profile with threaded rod → see pages 48 to 51
  - 5 Protective cladding board - min. th. 30 mm, min. density 750 kg/m<sup>3</sup> (e.g. PROMATECT-MST) → see page 61
- Ablative Coated Batt System HILTI\*
- 6 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
  - 7 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
  - 8 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing

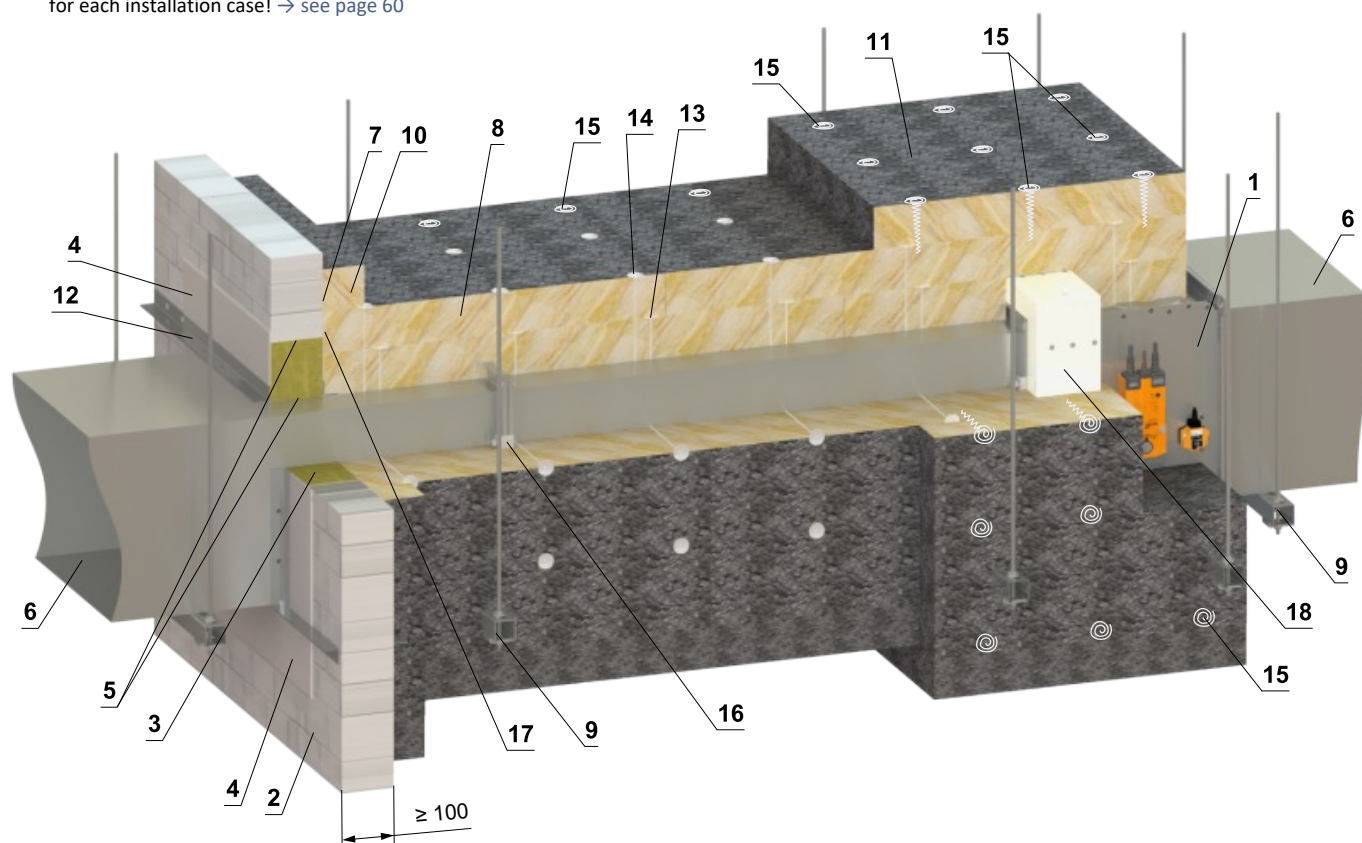
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

## Installation outside solid wall construction

### Outside solid wall construction - ISOVER Ultimate Protect - Ablative Coated Batt

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52
- Minimum and maximum distance between the wall and fire damper is unlimited.
- When installing the insulation, follow the ISOVER manufacturer's instructions.
- The damper and the duct must be suspended separately.
- The duct must be suspended on both sides of damper acc. to national rules.
- Duct between fire damper and fire separating construction must be suspended by using threaded rods and mounting profiles, or another anchoring system acc. to national standards.
- The damper inspection openings are covered by insulation and therefore it's necessary to make inspection openings on the connecting duct.
- Load of the suspension system depends on weight of the fire damper and duct system → see page 48
- Max. distance between two suspension systems is 1500 mm
- Duct at the point of penetration must be fixed to the fire separation structure
- Following air-conditioning duct must be suspended or supported so that all load transfer from the following duct to the fire damper is absolutely excluded. Adjacent duct must be suspended or supported, as required by the duct suppliers
- If the threaded rod is located inside the duct insulation, distance between threaded rod and duct is max 30 mm.
- If the threaded rod is located outside the duct isolation, distance between threaded rod and isolation is max. 40 mm.
- Reinforcing frame VRM-Q 120 must always be used for this type of installation. VRM-Q 120 is not a part of the fire damper and must be ordered separately for each installation case! → see page 60



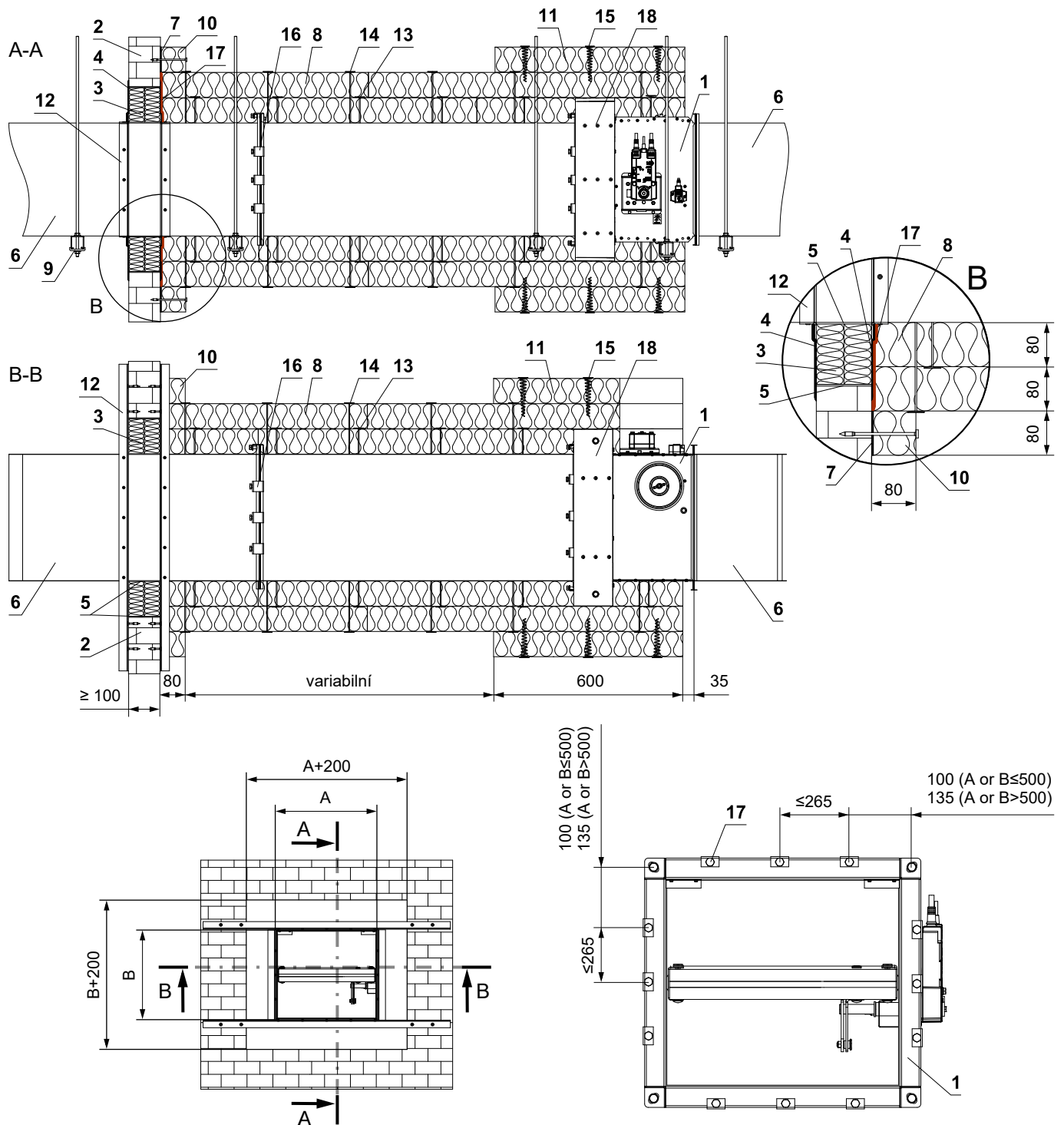
- 1 FDMQ 120
- 2 Solid wall construction  
Ablative Coated Batt System HILTI\*
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 5 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing
- 6 Standard air duct, made of galvanized sheet metal min. thickness 0,8 mm, flanges 30 mm, acc. to EN 1507 and DIN 24190
- 7 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 8 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect SLAB 4.0 Alu1)

\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

- 9 Profile with threaded rod → see pages 48 to 51
- 10 Duct penetration insulation collar - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm - glued (pos. 7) and fixed with screws to the wall construction
- 11 Insulating collar of the damper and duct connection - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm
- 12 L-profile 30x30x3 mm - dimensions and installation acc. to ISOVER manuf.
- 13 Stud-welded pins 80 mm - quantity and placing acc. to ISOVER manufa.
- 14 Stud-welded pins 160 mm - quantity and placing acc. to ISOVER manufa.
- 15 Fire spiral shaped screws - quantity and placing acc. to ISOVER manufa.
- 16 Steel clamp min. screw M8
- 17 ISOVER Protect BSF
- 18 VRM-Q 120 → see page 60

(continued on next page)

(continuation of installation Outside solid wall construction - ISOVER Ultimate Protect - Ablative Coated Batt)



- 1 FDMQ 120
- 2 Solid wall construction  
Ablative Coated Batt System HILTI\*
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 5 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing
- 6 Standard air duct, made of galvanized sheet metal min. thickness 0,8 mm, flanges 30 mm, acc. to EN 1507 and DIN 24190
- 7 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 8 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect SLAB 4.0 Alu1)

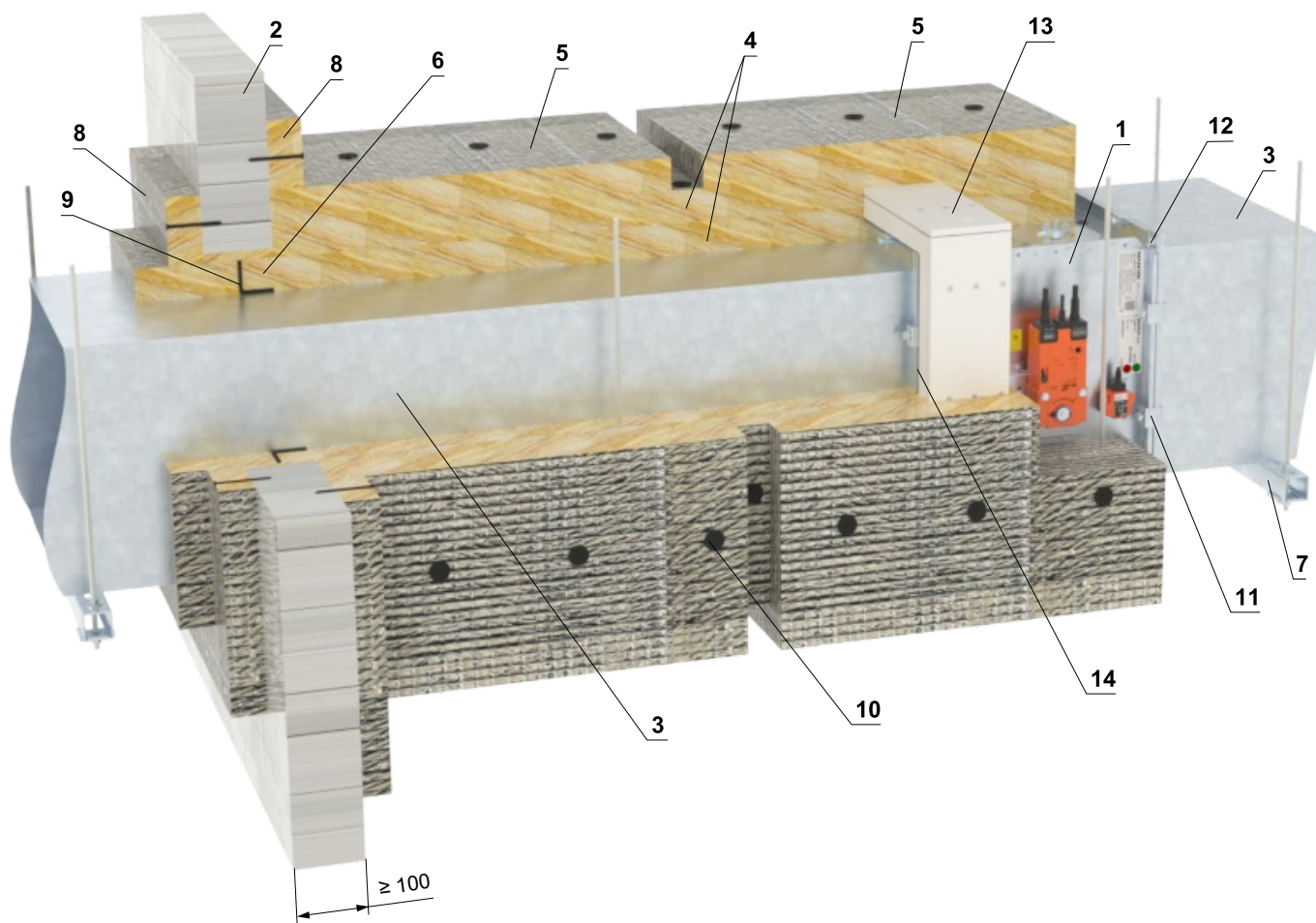
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

- 9 Profile with threaded rod → see pages 48 to 51
- 10 Duct penetration insulation collar - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm - glued (pos. 7) and fixed with screws to the wall construction
- 11 Insulating collar of the damper and duct connection - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm
- 12 L-profile 30x30x3 mm - dimensions and installation acc. to ISOVER manuf.
- 13 Stud-welded pins 80 mm - quantity and placing acc. to ISOVER manufa.
- 14 Stud-welded pins 160 mm - quantity and placing acc. to ISOVER manufa.
- 15 Fire spiral shaped screws - quantity and placing acc. to ISOVER manufa.
- 16 Steel clamp min. screw M8
- 17 ISOVER Protect BSF
- 18 VRM-Q 120 → see page 60

### Outside solid wall construction - Flamebar EN Fire Duct - FPL 110 insulation

EI 120 (v<sub>e</sub>) S [H]

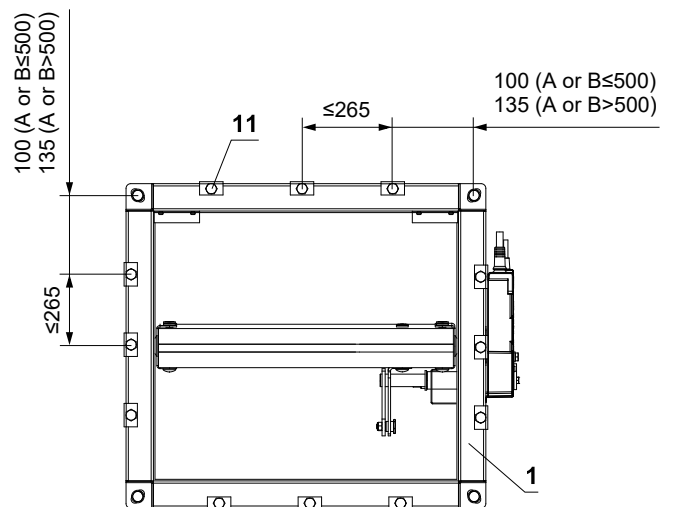
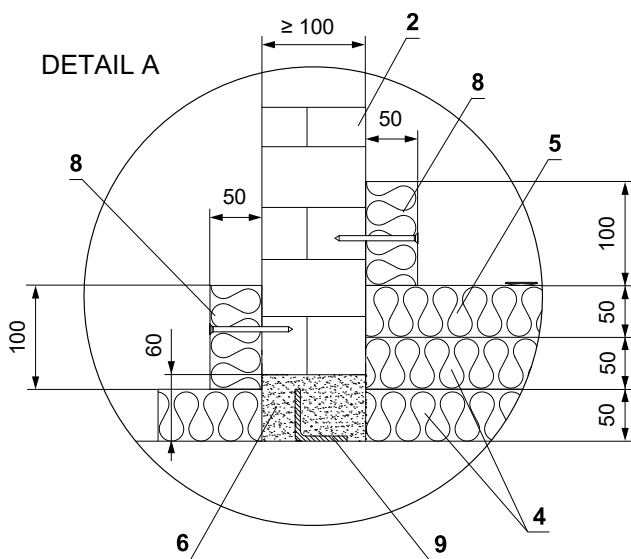
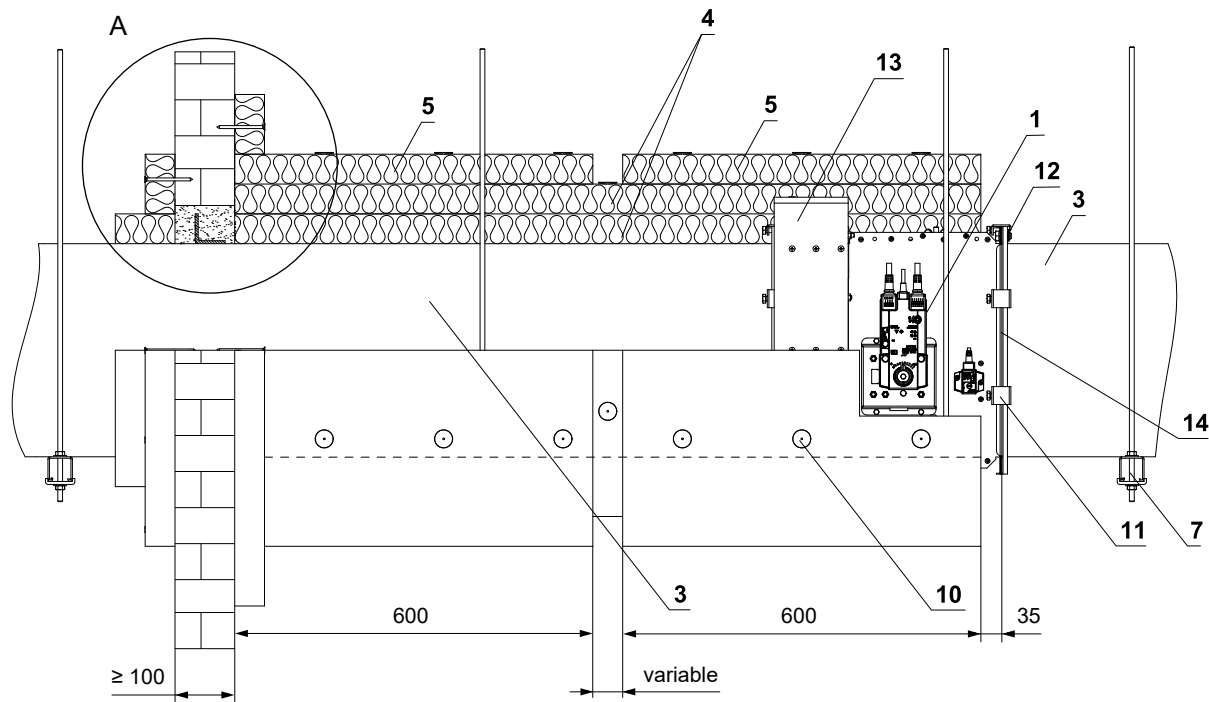
- Minimum and maximum distance between the wall and the fire damper is unlimited.
- The fire damper and duct must be suspended separately.
- The duct must be suspended on both sides of the fire damper in accordance with national standards.
- The duct between the fire damper and the fire separating construction must be suspended using threaded rods and mounting profiles or another suspension system in accordance with national standards.
- Fire damper inspection holes are covered with insulation, therefore it's necessary to install an access door in the connecting duct. (This must be a Flamebar access door if installed in the fire duct.)
- Load on suspension system depends on weight of the fire damper and duct system → see page 48
- Max. length between two suspension systems is 1500 mm.
- Installation must be done in such a way that all load transfer from the fire separating construction to the damper is completely eliminated.
- Reinforcing frame VRM-Q 120 must always be used for this type of installation. VRM-Q 120 is not part of the fire damper and must be ordered separately for each installation! → see page 60



- |   |  |
|---|--|
| <p>1 FDMQ 120</p> <p>2 Solid wall construction</p> <p>3 Flamebar EN fire Duct - made of galvanised sheet metal, thickness is dependant on duct size, type BW18 fire sprayed with Flamebar BW18 (insulated duct), type BW11 fire sprayed with Flamebar BW11 (not insulated duct)</p> <p>4 Insulation - two layers of stone wool FPL 110 SLAB, thickness 2x 50 mm, density 105 kg/m<sup>3</sup>, the second layer of insulation is provided with aluminium foil on the outside (FPL 110 FOIL FACED SLAB) - visible edges of mineral wool are covered with self-adhesive aluminium tape</p> <p>5 Insulation collar - additional insulation of the fire damper and gypsum wall construction - third layer of insulation FPL 110 FOIL FACED SLAB, thickness 50 mm and width 600 mm</p> <p>6 Filling - FPL 110 mineral wool - fill the gap between the duct and the wall</p> <p>7 Fixing profile with threaded rod → see pages 48 to 51</p> | <p>8 Penetration insulation pattress - FPL 110 FOIL FACED SLAB, thickness 50 mm - glued with Idenden 10-450 and fixed with screws to the wall construction</p> <p>9 Reinforcement of the duct - steel L-profile 50x50x5 mm or flange to Flamebar spec. on all sides of the duct within 100 mm of the wall</p> <p>10 Insulation pins - riveted to the duct - after the insulation boards are pushed over the insulation pins, secure the ends with disc plates in each insulation layer</p> <p>11 Steel clamp - flange connection with Flamebar G-Clamps with M8 bolts, max. spacing 200 mm</p> <p>12 Bolt assembly - flange connection at corners - M10 bolt and nut</p> <p>13 VRM-Q 120 → see page 60</p> <p>14 Sealing - all joints between duct segments are insulated with Flamebar Fibre Gasket self-adhesive tape and Flamebar Intumescent Sealant</p> |
|---|--|

(continued on next page)

(continuation of installation Outside solid wall construction - FPL duct - Rockwool insulation)



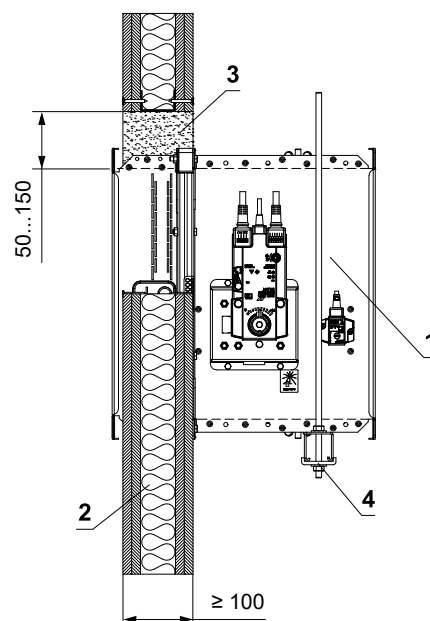
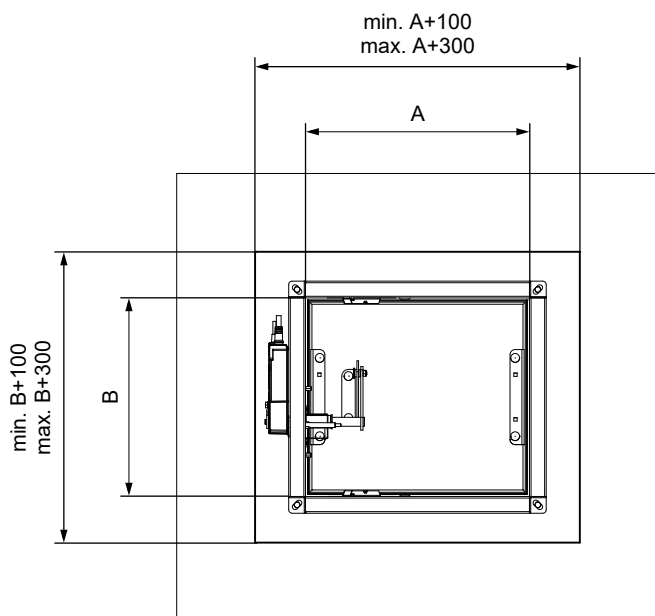
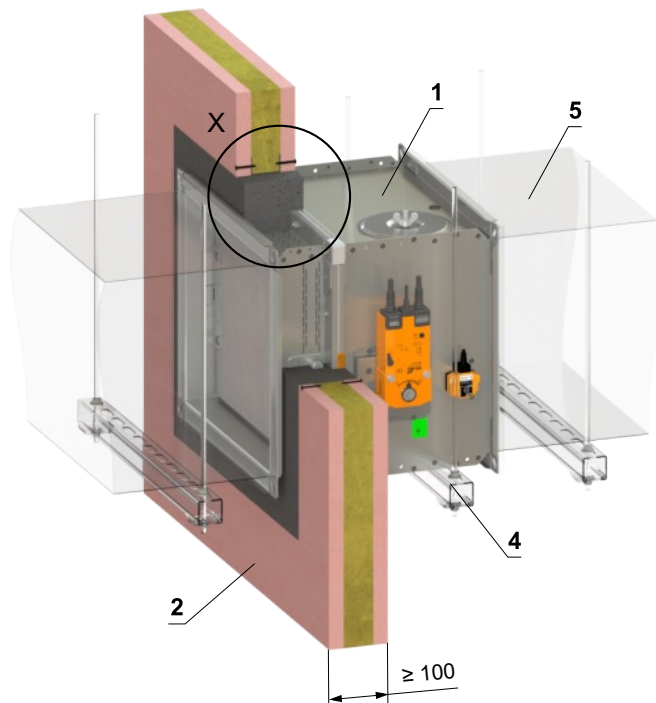
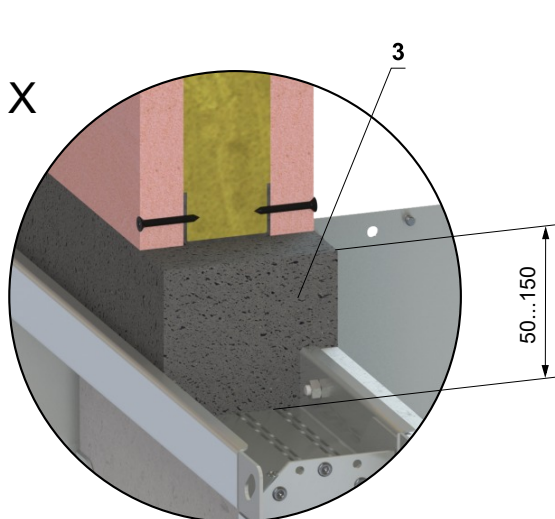
- 1 FDMQ 120
- 2 Solid wall construction
- 3 Flamebar EN fire Duct - made of galvanised sheet metal, thickness is dependant on duct size, type BW18 fire sprayed with Flamebar BW18 (insulated duct), type BW11 fire sprayed with Flamebar BW11 (not insulated duct)
- 4 Insulation - two layers of stone wool FPL 110 SLAB, thickness 2x 50 mm, density 105 kg/m<sup>3</sup>, the second layer of insulation is provided with aluminium foil on the outside (FPL 110 FOIL FACED SLAB) - visible edges of mineral wool are covered with self-adhesive aluminium tape
- 5 Insulation collar - additional insulation of the fire damper and gypsum wall construction - third layer of insulation FPL 110 FOIL FACED SLAB, thickness 50 mm and width 600 mm
- 6 Filling - FPL 110 mineral wool - fill the gap between the duct and the wall
- 7 Fixing profile with threaded rod → see pages 48 to 51
- 8 Penetration insulation pattern - FPL 110 FOIL FACED SLAB, thickness 50 mm - glued with Idenden 10-450 and fixed with screws to the wall construction
- 9 Reinforcement of the duct - steel L-profile 50x50x5 mm or flange to Flamebar spec. on all sides of the duct within 100 mm of the wall
- 10 Insulation pins - riveted to the duct - after the insulation boards are pushed over the insulation pins, secure the ends with disc plates in each insulation layer
- 11 Steel clamp - flange connection with Flamebar G-Clamps with M8 bolts, max. spacing 200 mm
- 12 Bolt assembly - flange connection at corners - M10 bolt and nut
- 13 VRM-Q 120 → see page 60
- 14 Sealing - all joints between duct segments are insulated with Flamebar Fibre Gasket self-adhesive tape and Flamebar Intumescent Sealant

### Installation in gypsum wall construction

In gypsum wall construction - mortar or gypsum

EI 120 (v<sub>e</sub>) S [H] - 500 Pa

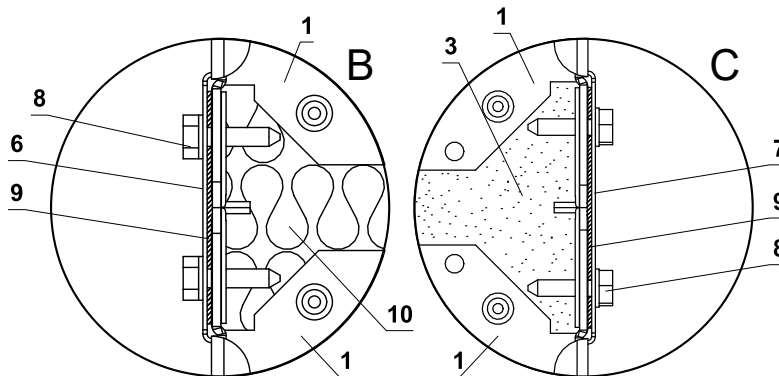
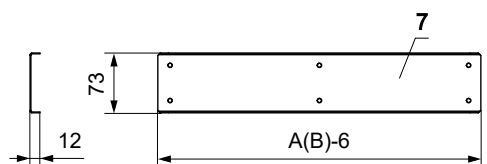
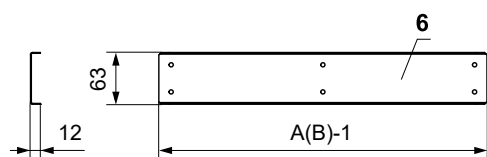
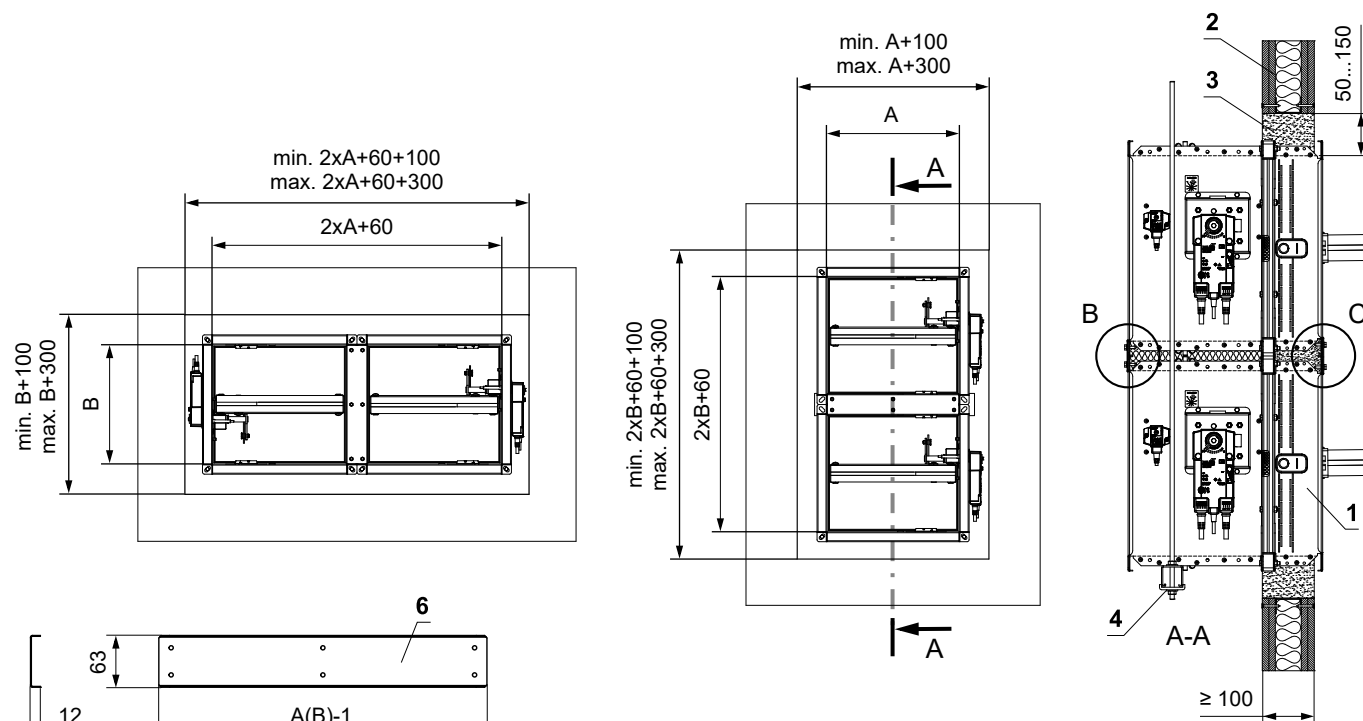
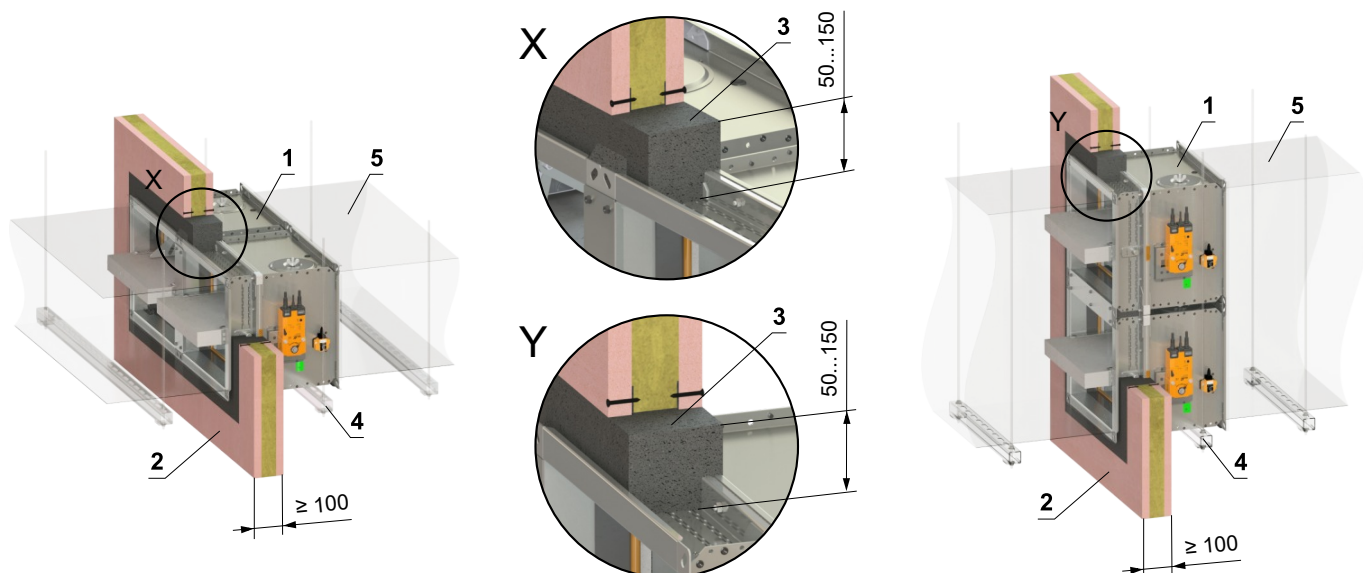
- For connection following duct → see page 52
- The installation opening is lined with a UW/CW profile.



- 1 FDMQ 120
- 2 Gypsum wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct

In gypsum wall construction - 2 dampers in battery - mortar or gypsum

EI 120 (v<sub>e</sub>) S [H]

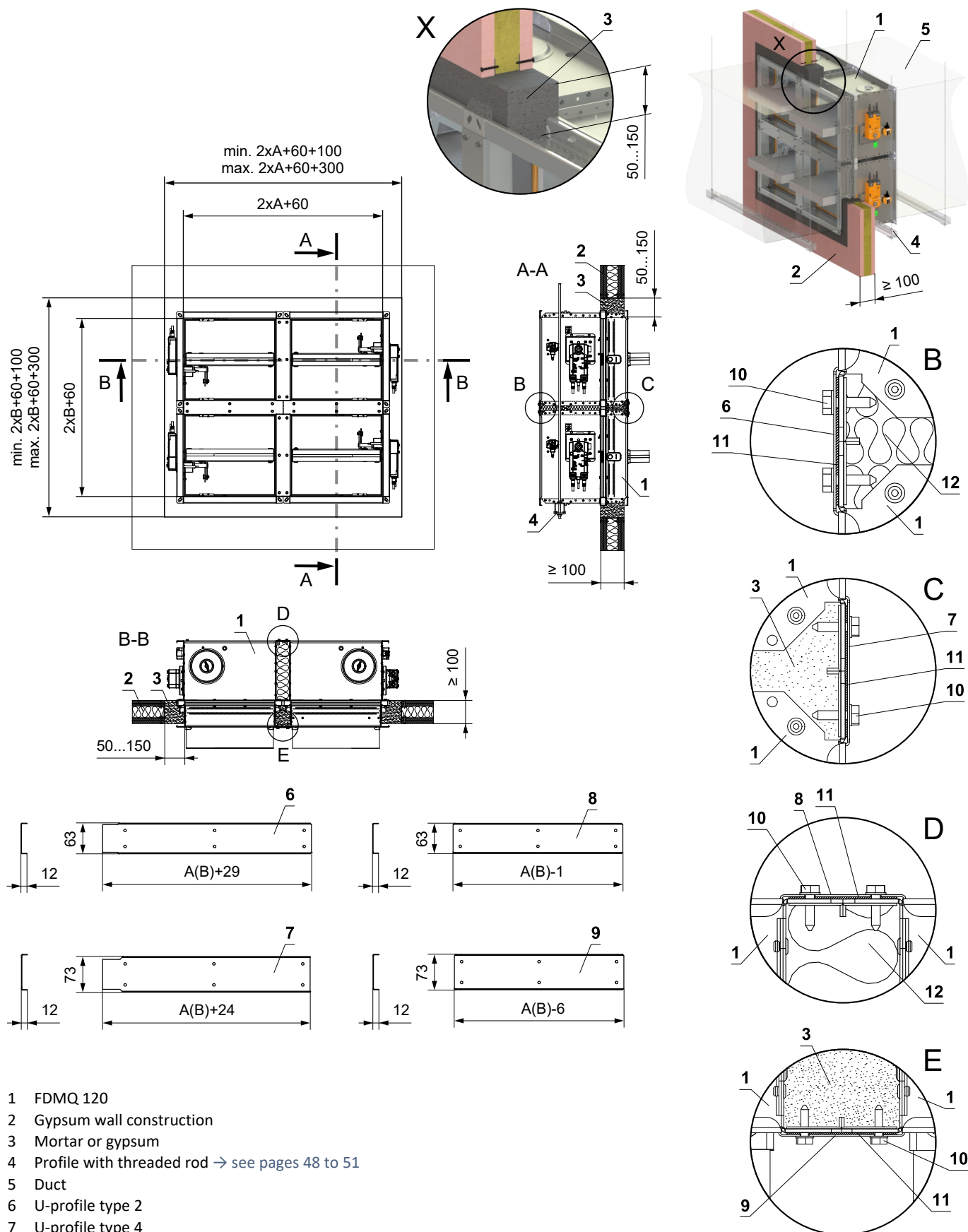


- 1 FDMQ 120
- 2 Gypsum wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEK 4,8x18 mm (span ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

- For connection following duct → see page 52
- Gap between damper and construction is filled by mortar or gypsum
- The installation opening is lined with a UW/CW profile.

In gypsum wall construction - 4 dampers in battery - mortar or gypsum

EI 120 (ve) S [H]



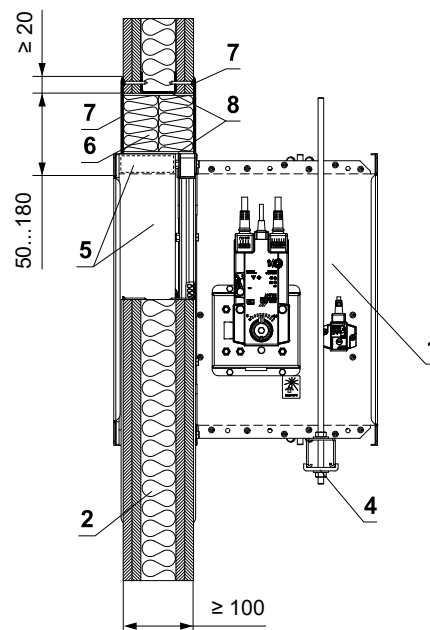
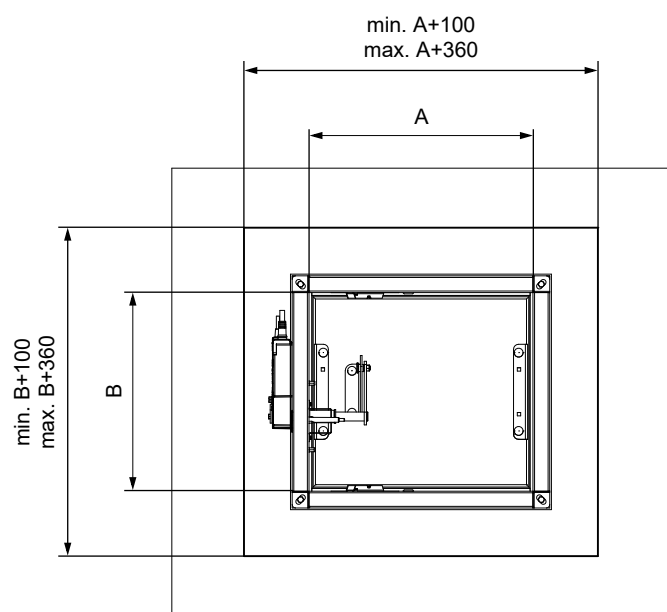
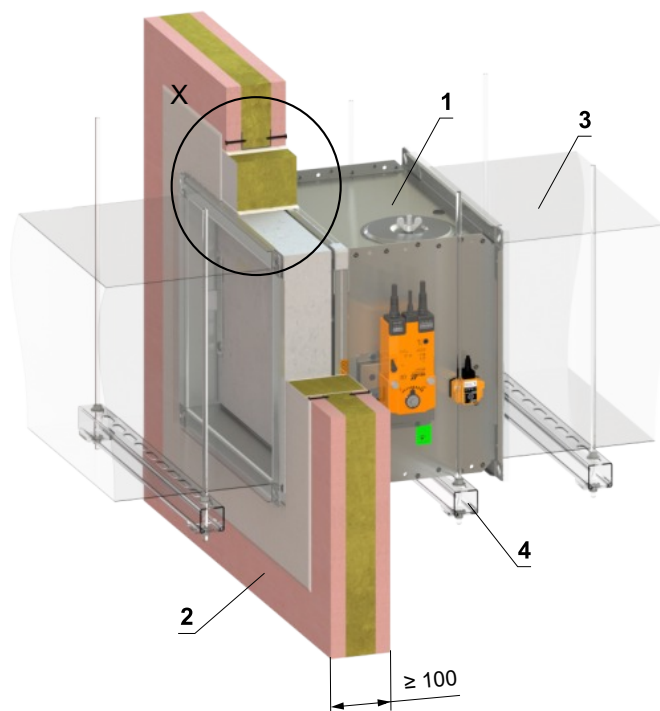
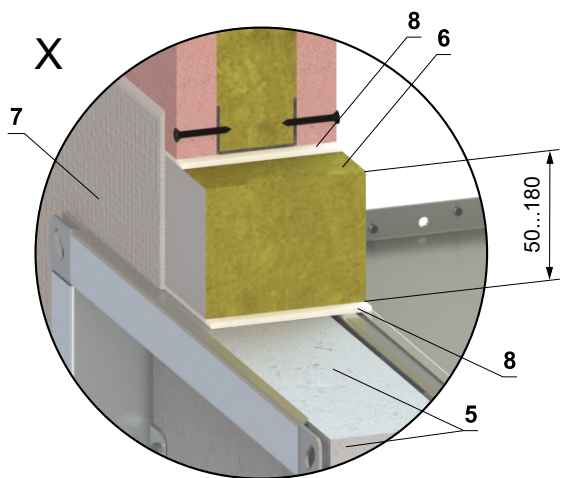
- 1 FDMQ 120
- 2 Gypsum wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct
- 6 U-profile type 2
- 7 U-profile type 4
- 8 U-profile type 1
- 9 U-profile type 3
- 10 Screw TEK 4,8x18 mm (span ≤ 200 mm)
- 11 Sealing
- 12 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

- For connection following duct → see page 52
- Gap between damper and construction is filled by mortar or gypsum
- The installation opening is lined with a UW/CW profile.

In gypsum wall construction - Ablative Coated Batt

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52
- The installation opening is lined with a UW/CW profile.



- 1 FDMQ 120
- 2 Gypsum wall construction
- 3 Duct
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Protective cladding board - min. th. 30 mm, min. density 750 kg/m<sup>3</sup> (e.g. PROMATECT-MST) → see page 61  
Ablative Coated Batt System HILTI\*
- 6 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 7 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 8 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing

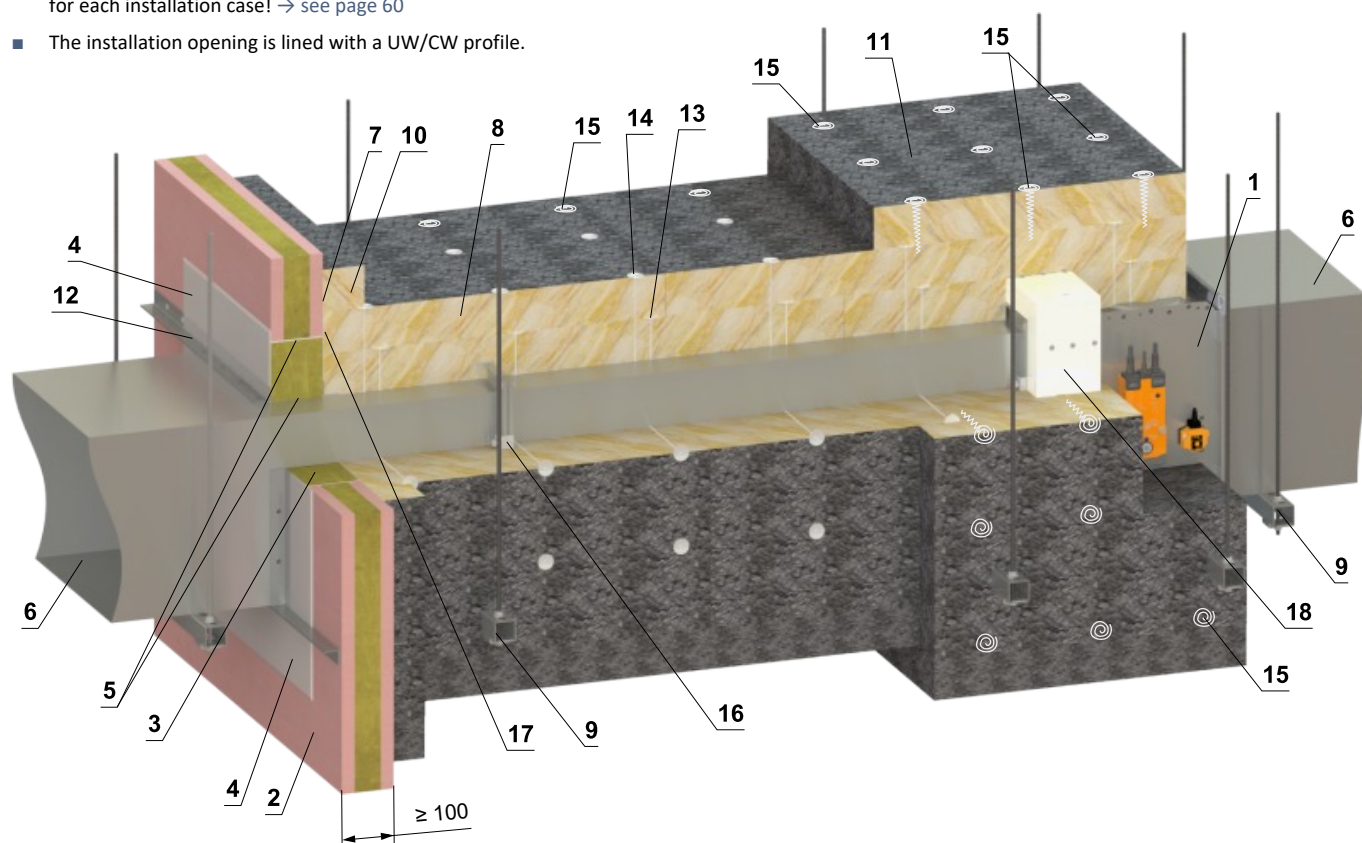
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

## Installation outside gypsum wall construction

### Outside gypsum wall construction - ISOVER Ultimate Protect - Ablative Coated Batt

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52
- Minimum and maximum distance between the wall and fire damper is unlimited.
- When installing the insulation, follow the ISOVER manufacturer's instructions.
- The damper and the duct must be suspended separately.
- The duct must be suspended on both sides of damper acc. to national rules.
- Duct between fire damper and fire separating construction must be suspended by using threaded rods and mounting profiles, or another anchoring system acc. to national standards.
- The damper inspection openings are covered by insulation and therefore it's necessary to make inspection openings on the connecting duct.
- Load of the suspension system depends on weight of the fire damper and duct system → see page 48
- Max. distance between two suspension systems is 1500 mm
- Duct at the point of penetration must be fixed to the fire separation structure
- Following air-conditioning duct must be suspended or supported so that all load transfer from the following duct to the fire damper is absolutely excluded. Adjacent duct must be suspended or supported, as required by the duct suppliers
- If the threaded rod is located inside the duct insulation, distance between threaded rod and duct is max 30 mm.
- If the threaded rod is located outside the duct isolation, distance between threaded rod and isolation is max. 40 mm.
- Reinforcing frame VRM-Q 120 must always be used for this type of installation. VRM-Q 120 is not a part of the fire damper and must be ordered separately for each installation case! → see page 60
- The installation opening is lined with a UW/CW profile.



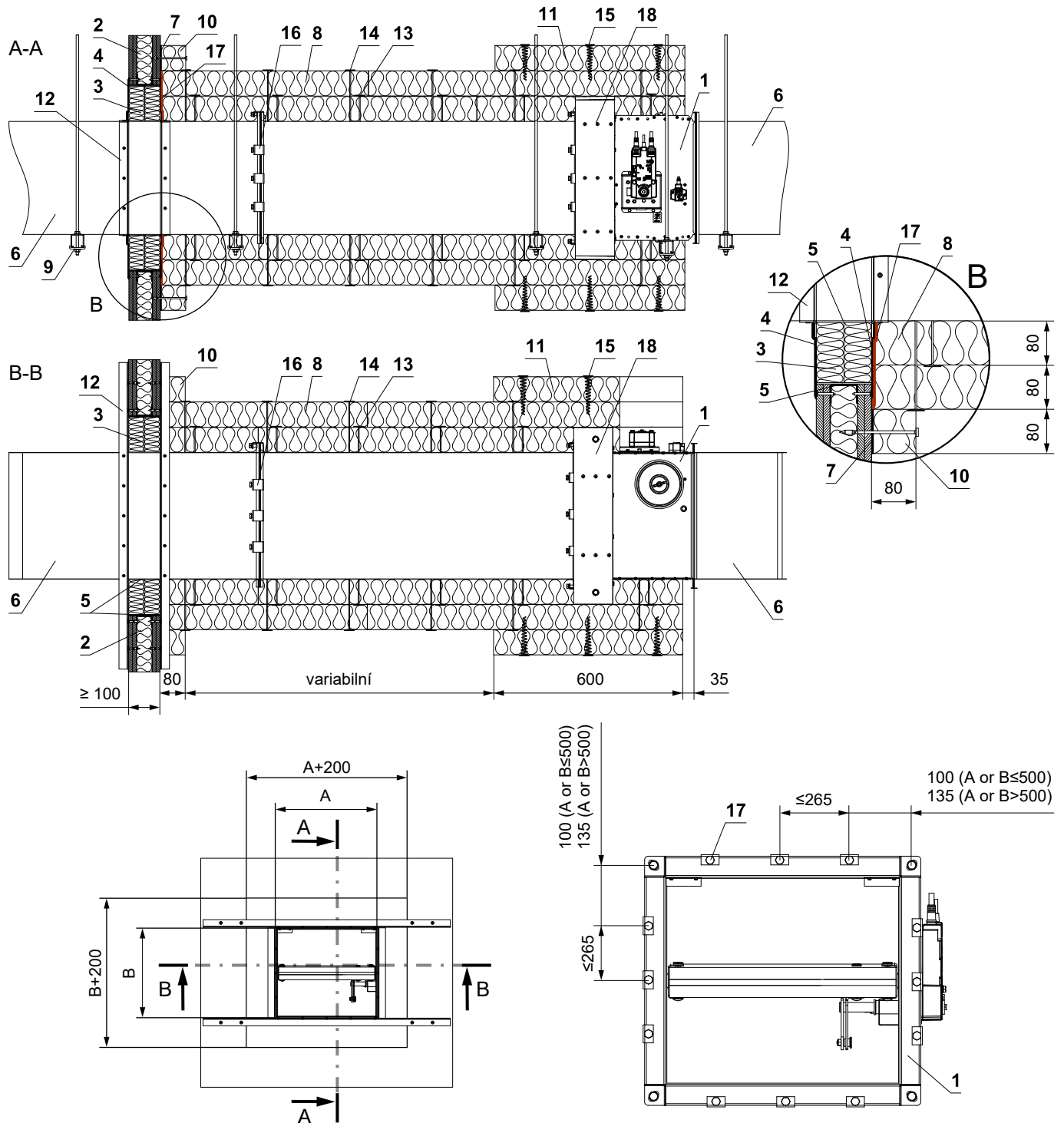
- 1 FDMQ 120
- 2 Gypsum wall construction  
Ablative Coated Batt System HILTI\*
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 5 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing
- 6 Standard air duct, made of galvanized sheet metal min. thickness 0,8 mm, flanges 30 mm, acc. to EN 1507 and DIN 24190
- 7 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 8 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect SLAB 4.0 Alu1)

\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

- 9 Profile with threaded rod → see pages 48 to 51
- 10 Duct penetration insulation collar - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm - glued (pos. 7) and fixed with screws to the wall construction
- 11 Insulating collar of the damper and duct connection - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm
- 12 L-profile 30x30x3 mm - dimensions and installation acc. to ISOVER manuf.
- 13 Stud-welded pins 80 mm - quantity and placing acc. to ISOVER manufa.
- 14 Stud-welded pins 160 mm - quantity and placing acc. to ISOVER manufa.
- 15 Fire spiral shaped screws - quantity and placing acc. to ISOVER manufa.
- 16 Steel clamp min. screw M8
- 17 ISOVER Protect BSF
- 18 VRM-Q 120 → see page 60

(continued on next page)

(continuation of installation Outside gypsum wall construction - ISOVER Ultimate Protect - Ablative Coated Batt)



- 1 FDMQ 120
- 2 Gypsum wall construction  
Ablative Coated Batt System HILTI\*
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 5 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing
- 6 Standard air duct, made of galvanized sheet metal min. thickness 0,8 mm, flanges 30 mm, acc. to EN 1507 and DIN 24190
- 7 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 8 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect SLAB 4.0 Alu1)

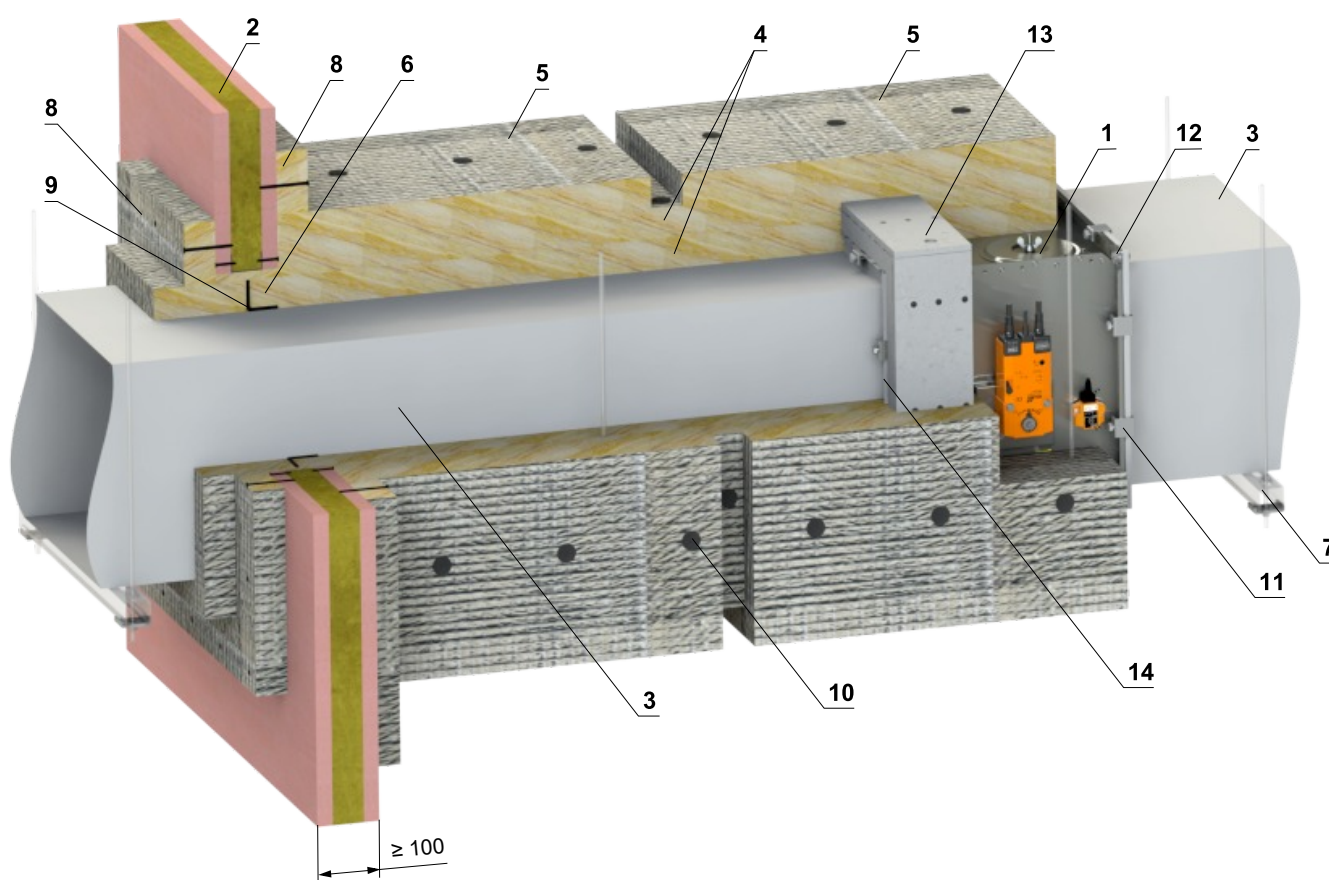
- 9 Profile with threaded rod → see pages 48 to 51
- 10 Duct penetration insulation collar - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm - glued (pos. 7) and fixed with screws to the wall construction
- 11 Insulating collar of the damper and duct connection - ISOVER Ultimate Protect SLAB 4.0 Alu1, th. 80 mm
- 12 L-profile 30x30x3 mm - dimensions and installation acc. to ISOVER manuf.
- 13 Stud-welded pins 80 mm - quantity and placing acc. to ISOVER manufa.
- 14 Stud-welded pins 160 mm - quantity and placing acc. to ISOVER manufa.
- 15 Fire spiral shaped screws - quantity and placing acc. to ISOVER manufa.
- 16 Steel clamp min. screw M8
- 17 ISOVER Protect BSF
- 18 VRM-Q 120 → see page 60

\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

## Outside gypsum wall construction - Flamebar EN Fire Duct - FPL 110 insulation

EI 120 (v<sub>e</sub>) S [H]

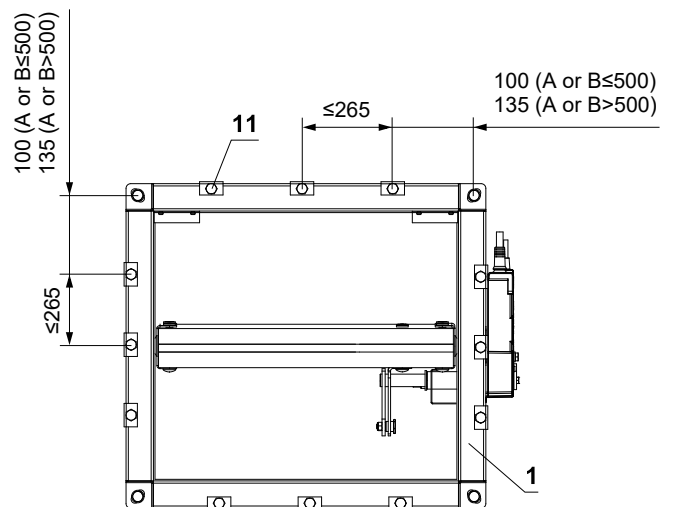
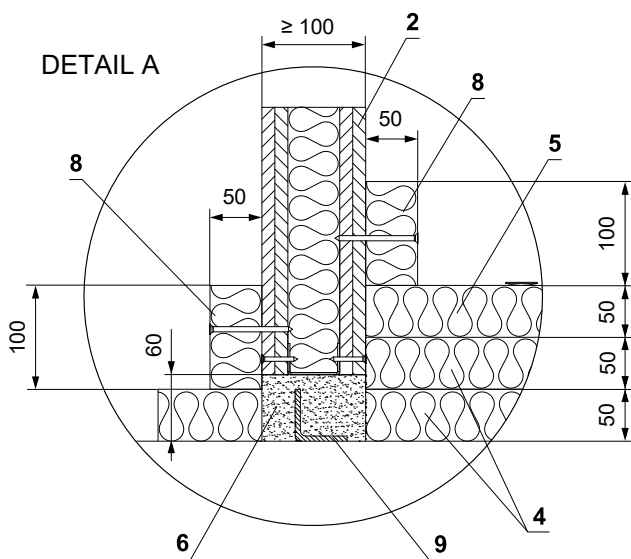
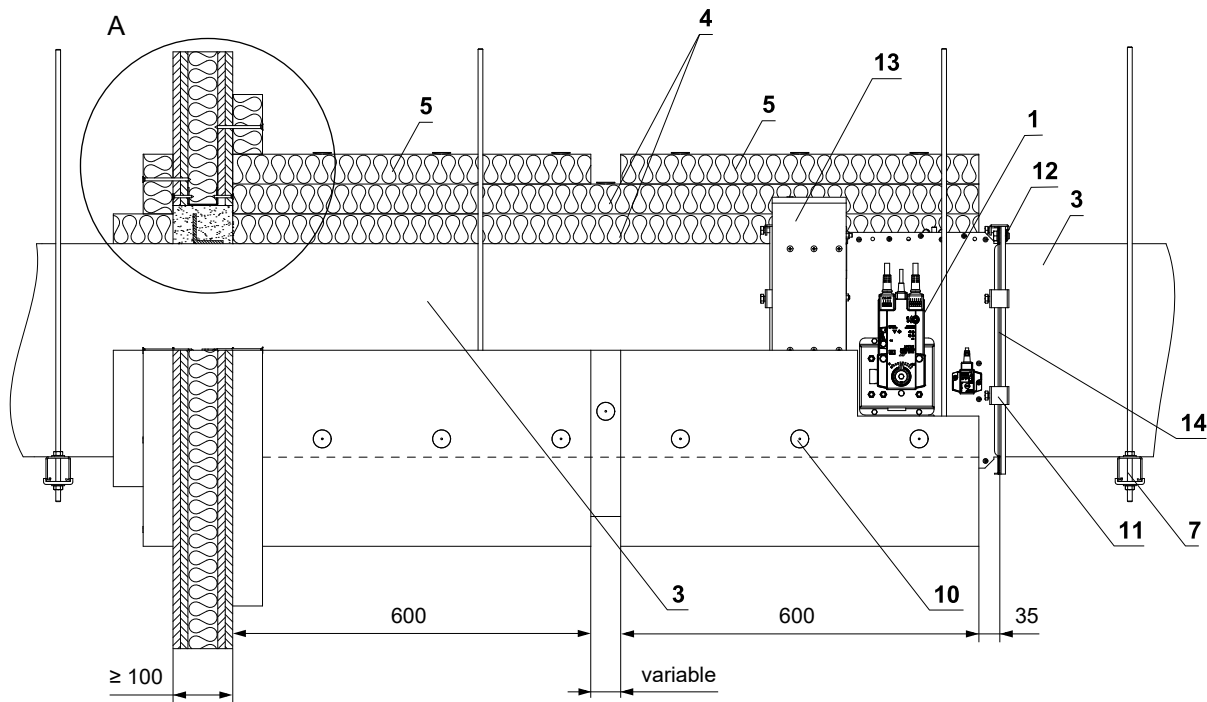
- Minimum and maximum distance between the wall and the fire damper is unlimited.
- The fire damper and duct must be suspended separately.
- The duct must be suspended on both sides of the fire damper in accordance with national standards.
- The duct between the fire damper and the fire separating construction must be suspended using threaded rods and mounting profiles or another suspension system in accordance with national standards.
- Fire damper inspection holes are covered with insulation, therefore it's necessary to install an access door in the connecting duct. (This must be a Flamebar access door if installed in the fire duct.)
- Load on suspension system depends on weight of the fire damper and duct system → see page 48
- Max. length between two suspension systems is 1500 mm.
- Installation must be done in such a way that all load transfer from the fire separating construction to the damper is completely eliminated.
- Reinforcing frame VRM-Q 120 must always be used for this type of installation. VRM-Q 120 is not part of the fire damper and must be ordered separately for each installation! → see page 60
- The installation opening is lined with a UW/CW profile.



- |  |  |
|--|--|
| <p>1 FDMQ 120</p> <p>2 Gypsum wall construction</p> <p>3 Flamebar EN fire Duct - made of galvanised sheet metal, thickness is dependant on duct size, type BW18 fire sprayed with Flamebar BW18 (insulated duct), type BW11 fire sprayed with Flamebar BW11 (not insulated duct)</p> <p>4 Insulation - two layers of stone wool FPL 110 SLAB, thickness 2x 50 mm, density 105 kg/m<sup>3</sup>, the second layer of insulation is provided with aluminium foil on the outside (FPL 110 FOIL FACED SLAB) - visible edges of mineral wool are covered with self-adhesive aluminium tape</p> <p>5 Insulation collar - additional insulation of the fire damper and gypsum wall construction - third layer of insulation FPL 110 FOIL FACED SLAB, thickness 50 mm and width 600 mm</p> <p>6 Filling - FPL 110 mineral wool - fill the gap between the duct and the wall</p> <p>7 Fixing profile with threaded rod → see pages 48 to 51</p> | <p>8 Penetration insulation pattress - FPL 110 FOIL FACED SLAB, thickness 50 mm - glued with Idenden 10-450 and fixed with screws to the wall construction</p> <p>9 Reinforcement of the duct - steel L-profile 50x50x5 mm or flange to Flamebar spec. on all sides of the duct within 100 mm of the wall</p> <p>10 Insulation pins - riveted to the duct - after the insulation boards are pushed over the insulation pins, secure the ends with disc plates in each insulation layer</p> <p>11 Steel clamp - flange connection with Flamebar G-Clamps with M8 bolts, max. spacing 200 mm</p> <p>12 Bolt assembly - flange connection at corners - M10 bolt and nut</p> <p>13 VRM-Q 120 → see page 60</p> <p>14 Sealing - all joints between duct segments are insulated with Flamebar Fibre Gasket self-adhesive tape and Flamebar Intumescent Sealant</p> |
|--|--|

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(continuation of installation Outside gypsum wall construction - FPL duct - Rockwool insulation)



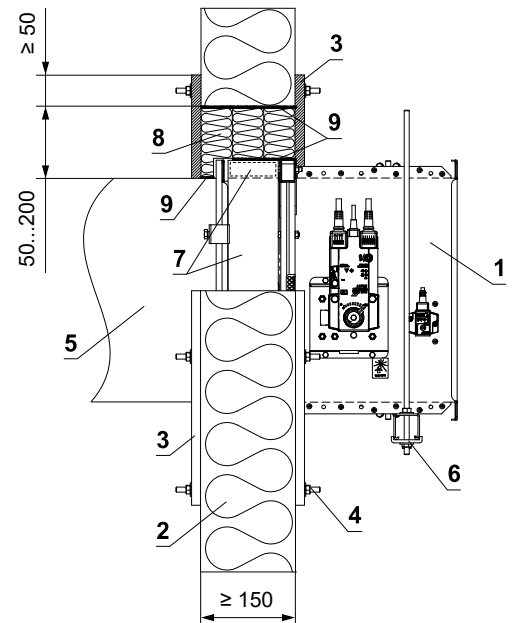
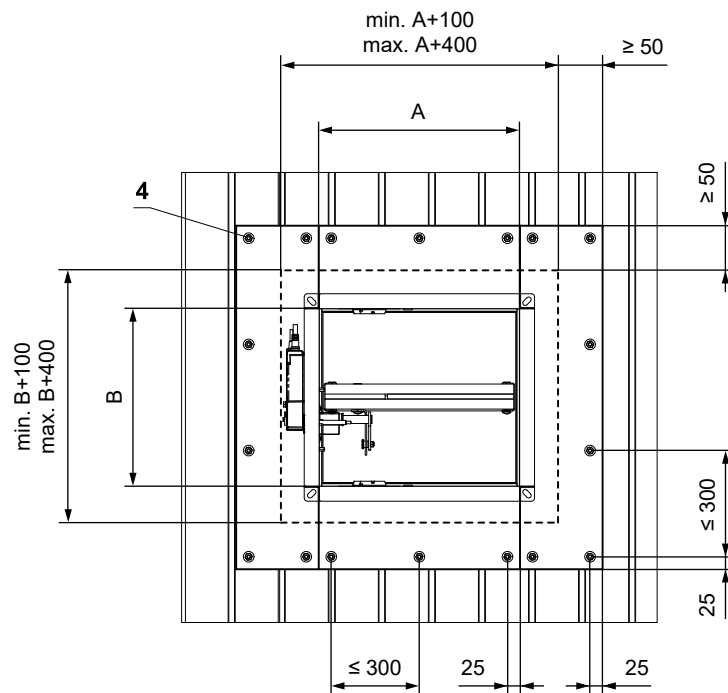
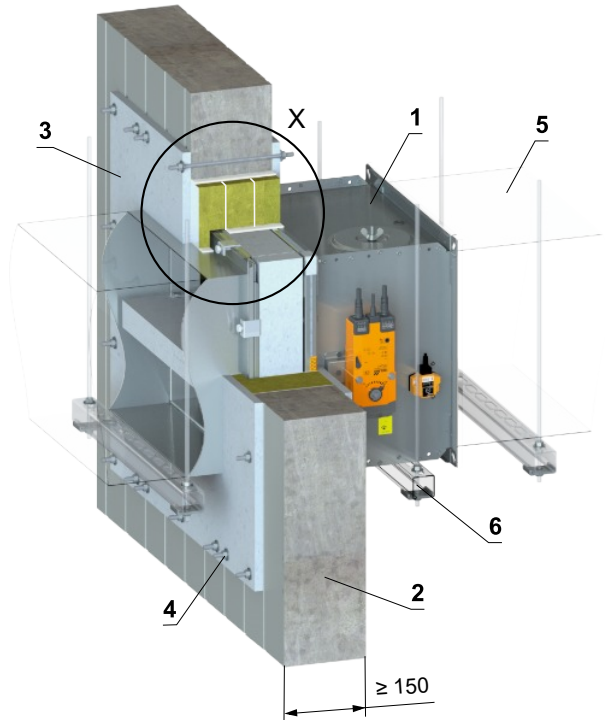
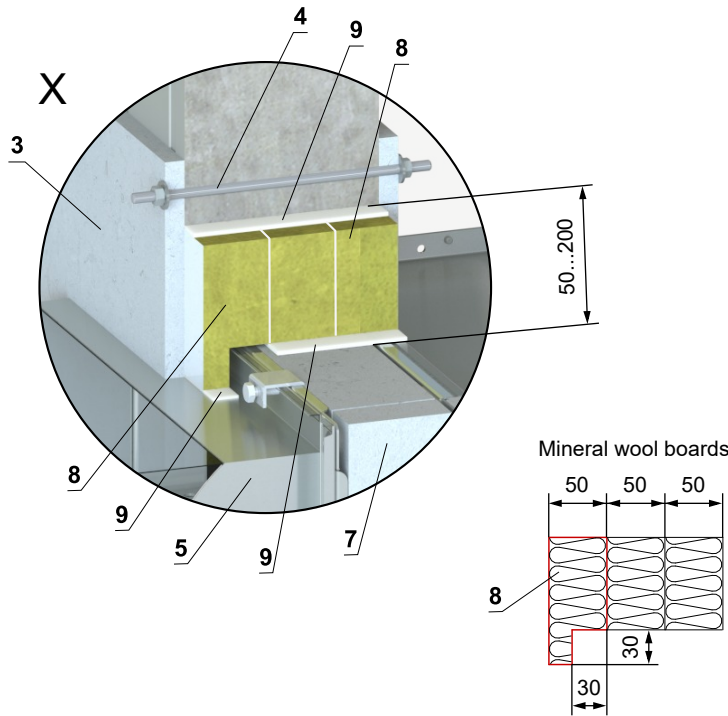
- 1 FDMQ 120
- 2 Gypsum wall construction
- 3 Flamebar EN fire Duct - made of galvanised sheet metal, thickness is dependant on duct size, type BW18 fire sprayed with Flamebar BW18 (insulated duct), type BW11 fire sprayed with Flamebar BW11 (not insulated duct)
- 4 Insulation - two layers of stone wool FPL 110 SLAB, thickness 2x 50 mm, density 105 kg/m<sup>3</sup>, the second layer of insulation is provided with aluminium foil on the outside (FPL 110 FOIL FACED SLAB) - visible edges of mineral wool are covered with self-adhesive aluminium tape
- 5 Insulation collar - additional insulation of the fire damper and gypsum wall construction - third layer of insulation FPL 110 FOIL FACED SLAB, thickness 50 mm and width 600 mm
- 6 Filling - FPL 110 mineral wool - fill the gap between the duct and the wall
- 7 Fixing profile with threaded rod → see pages 48 to 51
- 8 Penetration insulation pattress - FPL 110 FOIL FACED SLAB, thickness 50 mm - glued with Idenden 10-450 and fixed with screws to the wall construction
- 9 Reinforcement of the duct - steel L-profile 50x50x5 mm or flange to Flamebar spec. on all sides of the duct within 100 mm of the wall
- 10 Insulation pins - riveted to the duct - after the insulation boards are pushed over the insulation pins, secure the ends with disc plates in each insulation layer
- 11 Steel clamp - flange connection with Flamebar G-Clamps with M8 bolts, max. spacing 200 mm
- 12 Bolt assembly - flange connection at corners - M10 bolt and nut
- 13 VRM-Q 120 → see page 60
- 14 Sealing - all joints between duct segments are insulated with Flamebar Fibre Gasket self-adhesive tape and Flamebar Intumescent Sealant

### Installation in sandwich wall construction

In sandwich wall construction EUROCLAD - Ablative Coated Batt with fire-resistant boards

EI 120 (v<sub>e</sub>) S [H]

■ For connection following duct → see page 52



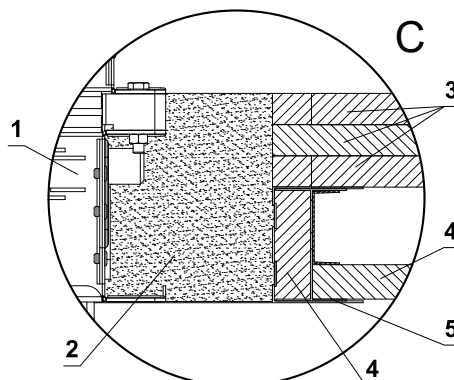
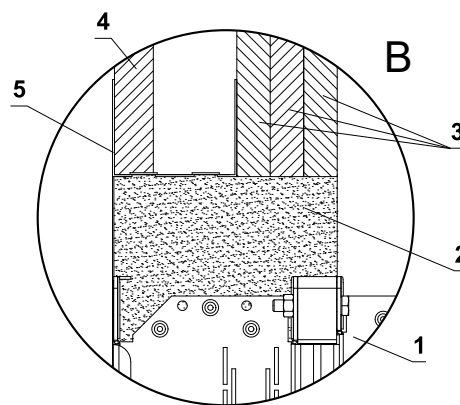
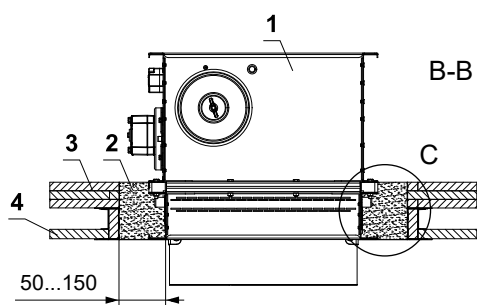
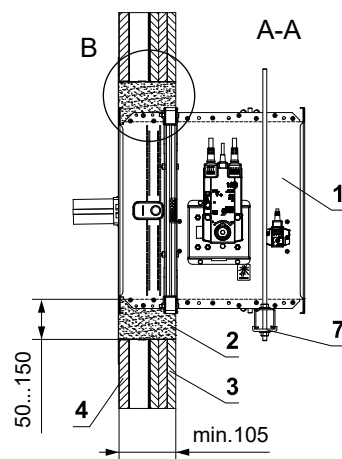
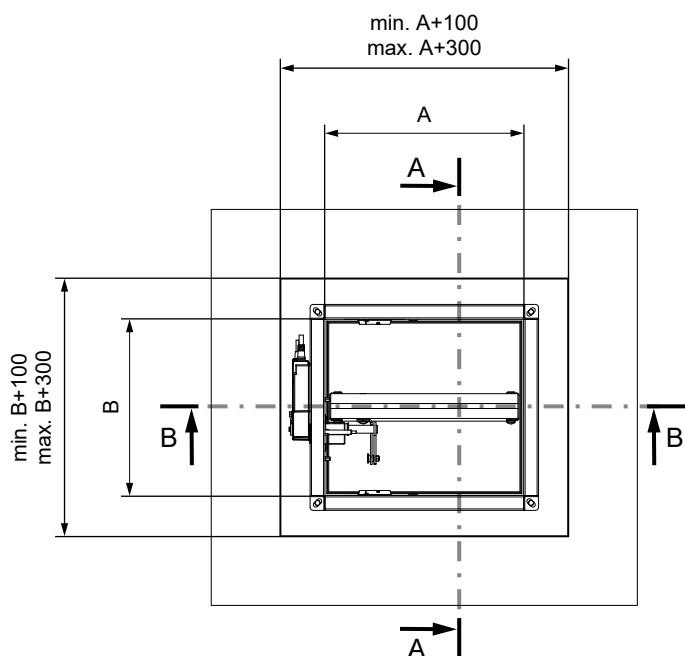
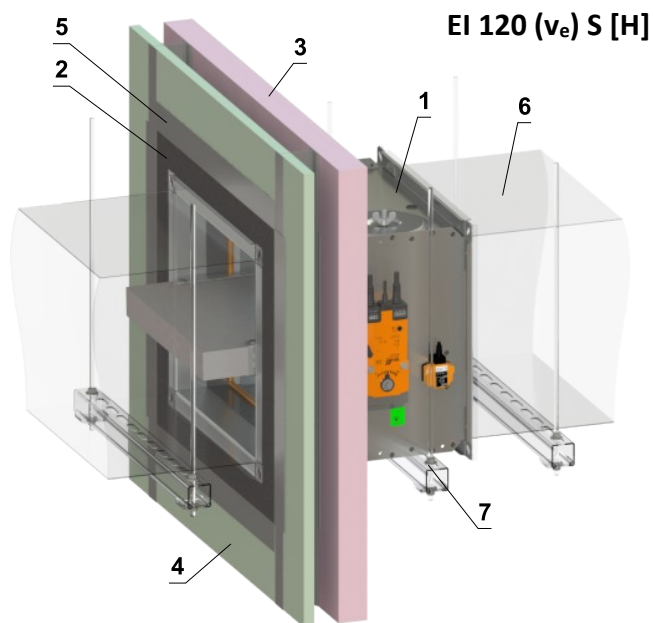
- 1 FDMQ 120
  - 2 Sandwich wall construction - min. th. 150 mm (Euroclad Firemaster Extra)
  - 3 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)
  - 4 Fixing connection of boards - threaded rod M8 (length of the threaded rod for 150 mm sandwich construction is min. 220 mm, 2 pcs large washer M8, 2 pcs nut M8). The boards must be tightly fixed to the sandwich wall construction!
  - 5 Duct
  - 6 Profile with threaded rod → see pages 48 to 51
  - 7 Protective cladding board - min. th. 30 mm, min. density 750 kg/m<sup>3</sup> (e.g. PROMATECT-MST) → see page 61
- Ablative Coated Batt System HILTI\*
- 8 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
  - 9 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing

\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

### Installation in shaft wall construction

#### In shaft wall construction - mortar or gypsum

- For connection following duct → see page 52
- Damper can be installed on either side of the wall.
- It is possible to use e.g. wall type A306030, A306035... from [www.british-gypsum.com](http://www.british-gypsum.com) or RNS 121, RNS 122... from [www.siniat.co.uk](http://www.siniat.co.uk)
- It is possible to use walls that have the same or greater thickness and density of boards than the walls listed below (more layers of boards can also be used)
- Follow the instructions of the shaft wall manufacturer.

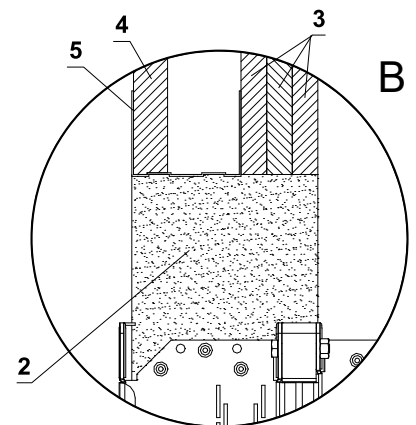
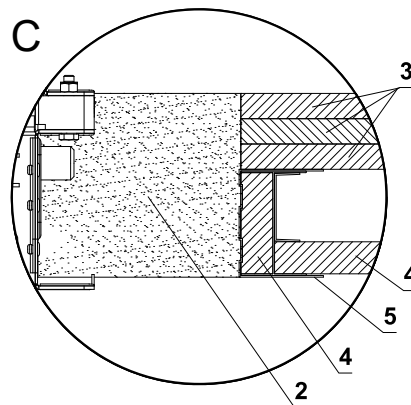
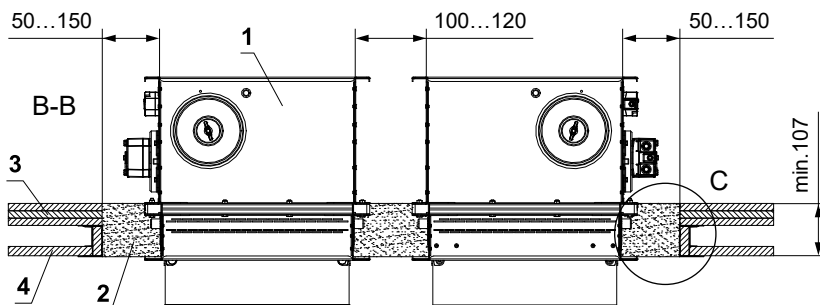
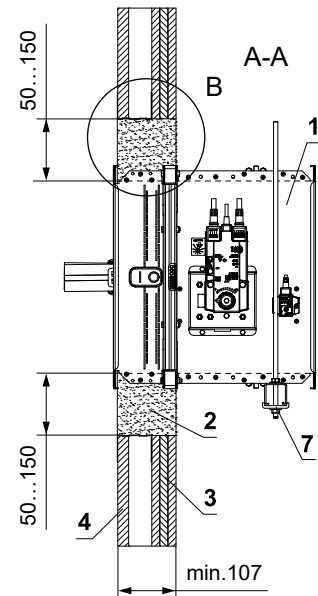
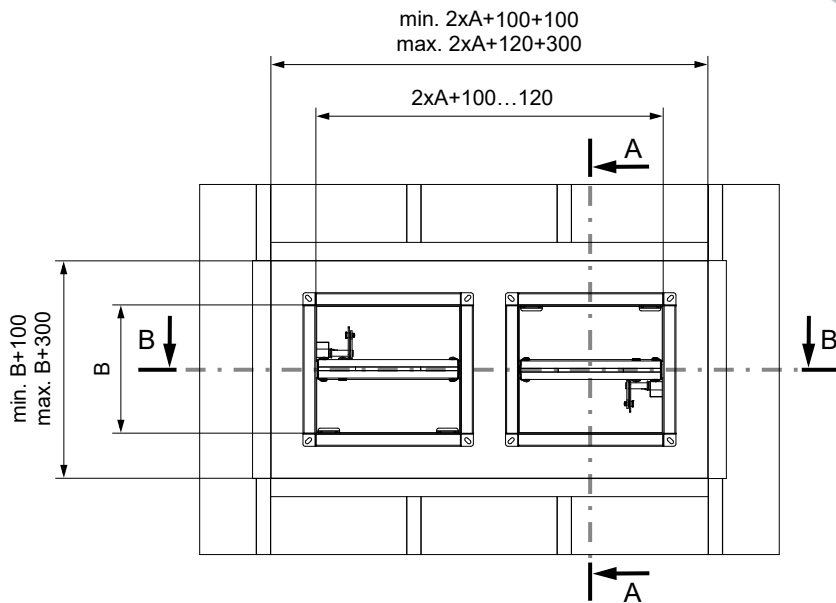
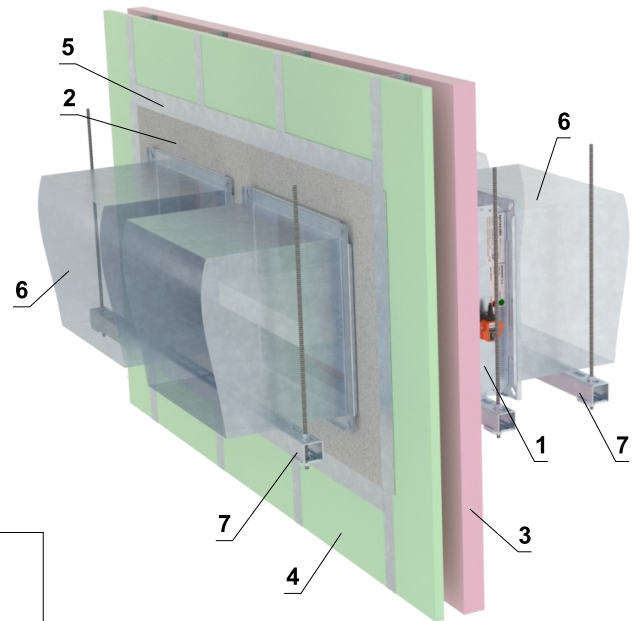


- 1 FDMQ 120
- 2 Mortar or gypsum
- 3 Plasterboard EN 520 - Type F - min. 3x15 mm
- 4 Plasterboard EN 520 - Type F - min. 1x19 mm
- 5 Plasterboard profile
- 6 Duct
- 7 Profile with threaded rod → see pages 48 to 51

**In shaft wall construction - 2 dampers in one opening - mortar or gypsum**

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52
- Damper can be installed on either side of the wall.
- It is possible to use e.g. wall type A306030, A306035... from [www.british-gypsum.com](http://www.british-gypsum.com)
- It is possible to use walls that have the same or greater thickness and density of boards than the walls listed below (more layers of boards can also be used)
- Follow the instructions of the shaft wall manufacturer.

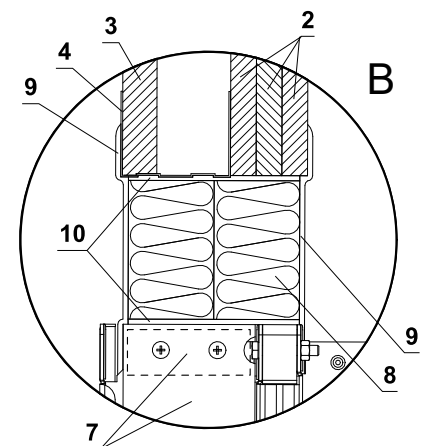
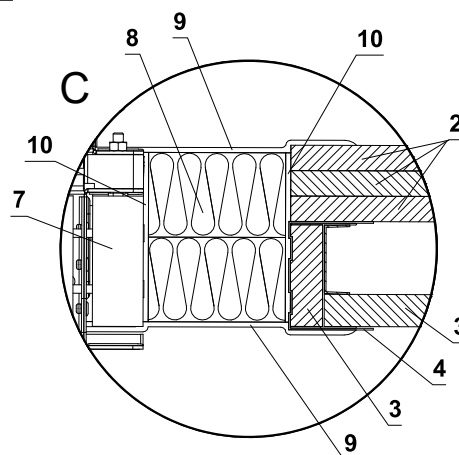
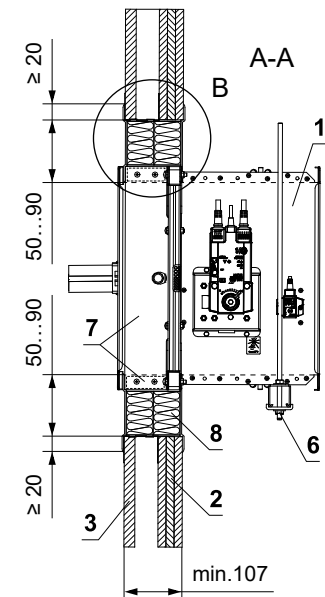
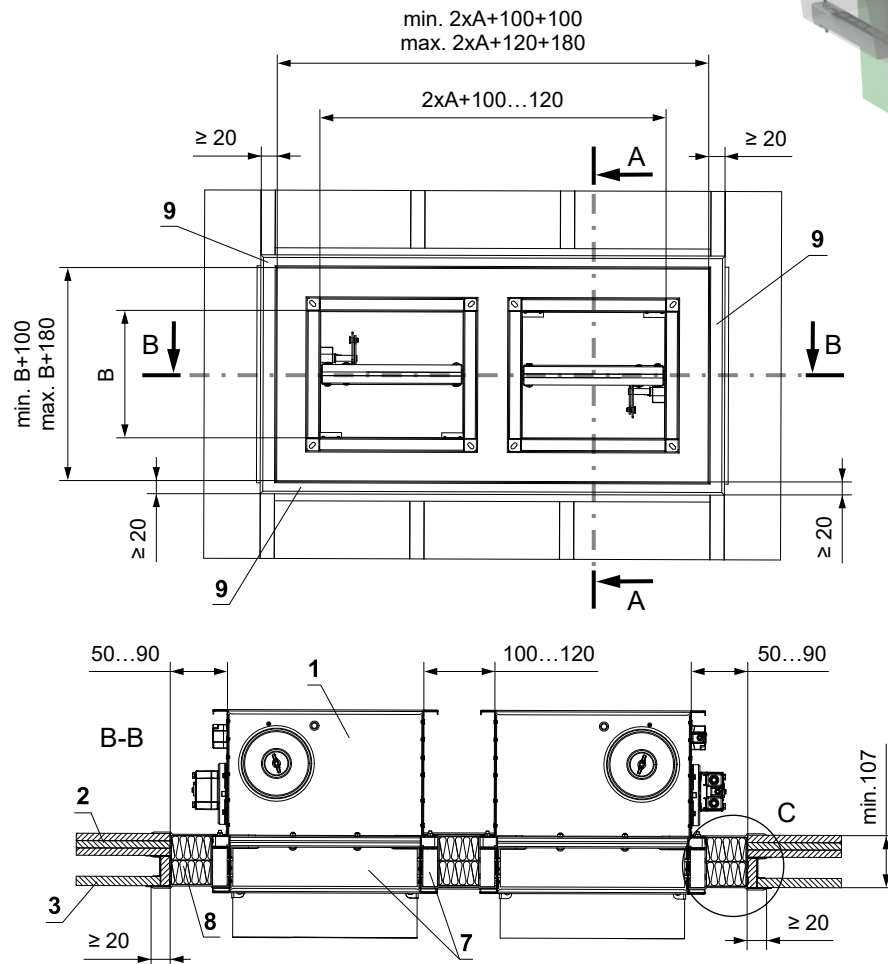
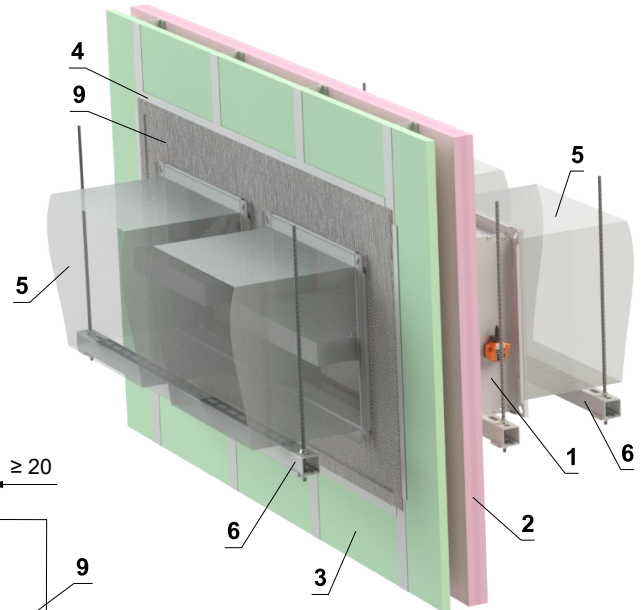


- 1 FDMQ 120
- 2 Mortar or gypsum
- 3 Plasterboard EN 520 - Type F - min. 3x15 mm
- 4 Plasterboard EN 520 - Type F - min. 1x19 mm
- 5 Plasteboard profile
- 6 Duct
- 7 Profile with threaded rod → see pages 48 to 51

In shaft wall construction - 2 dampers in one opening - Ablative Coated Batt

EI 120 (v<sub>e</sub>) S [H]

- For connection following duct → see page 52
- Damper can be installed on either side of the wall.
- It is possible to use e.g. wall type A306030, A306035... from [www.british-gypsum.com](http://www.british-gypsum.com)
- It is possible to use walls that have the same or greater thickness and density of boards than the walls listed below (more layers of boards can also be used)
- Follow the instructions of the shaft wall manufacturer.



\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

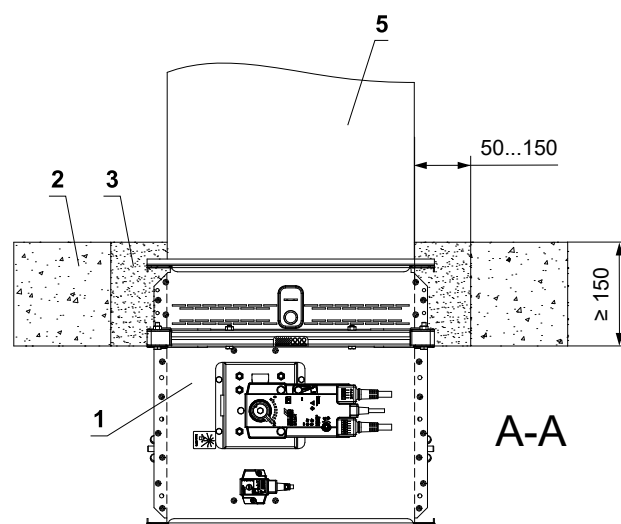
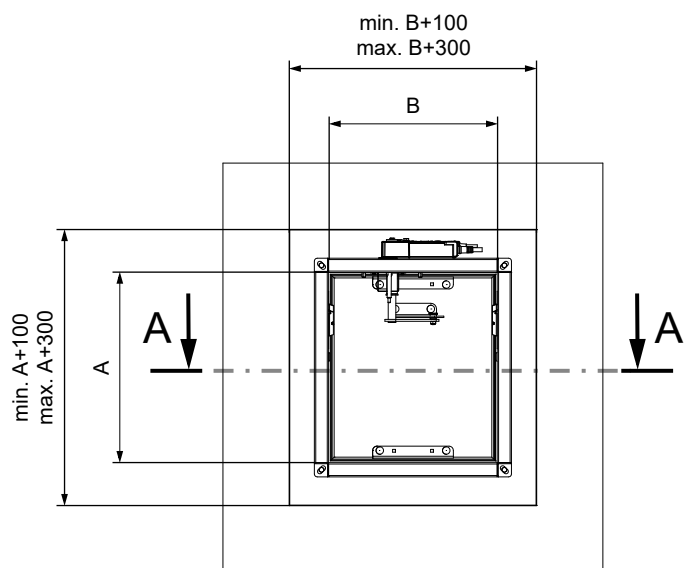
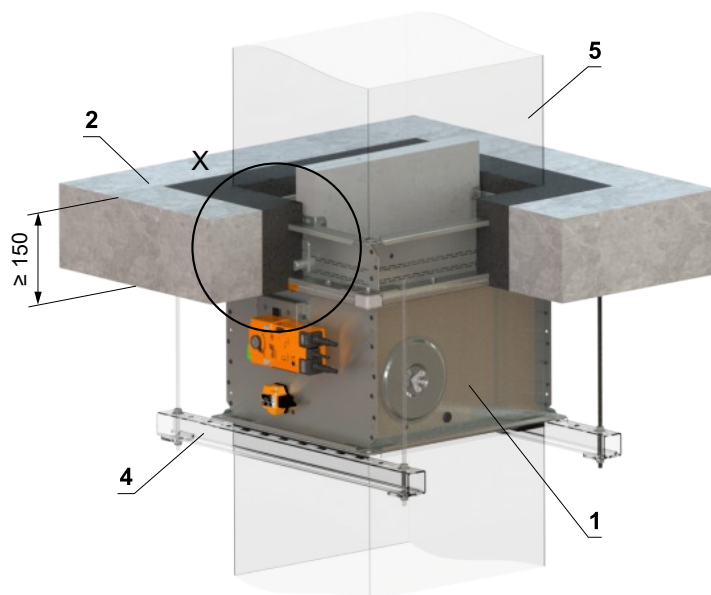
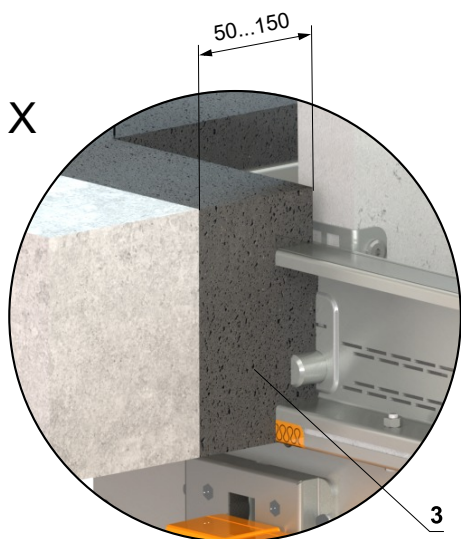
- 1 FDMQ 120
- 2 Plasterboard EN 520 - Type F - min. 3x15 mm
- 3 Plasterboard EN 520 - Type F - min. 1x19 mm
- 4 Plasteboard profile
- 5 Duct
- 6 Profile with threaded rod → see pages 48 to 51
- 7 Protective cladding board - min. th. 30 mm, min. density 750 kg/m<sup>3</sup> (e.g. PROMATECT-MST) → see page 61  
Ablative Coated Batt System HILTI\*
- 8 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 9 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 10 Fire-resistant mastic - (HILTI CFS-S ACR...) fill the gap from both sides of the fire separation construction and around the perimeter of penetration and damper casing

### Installation in solid ceiling construction

#### In solid ceiling construction - mortar or gypsum

EI 120 (h<sub>o</sub>) S [H] - 500 Pa

- For connection following duct → see page 52
- The damper can be installed from both sides of the construction, i.e. from the top or the bottom side of the ceiling.

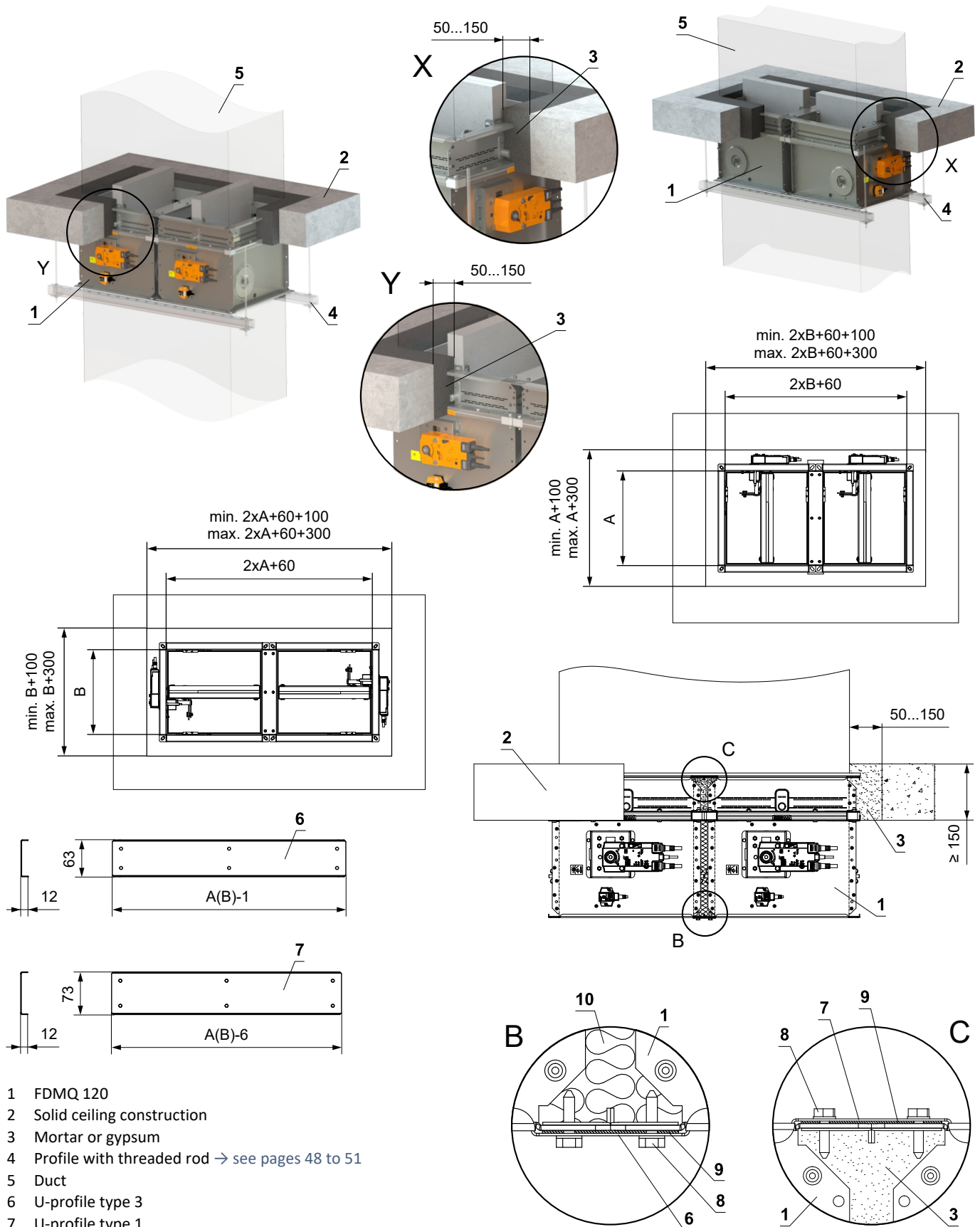


- 1 FDMQ 120
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct

In solid ceiling construction - 2 dampers in battery - mortar or gypsum

EI 120 (h<sub>o</sub>) S [H]

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



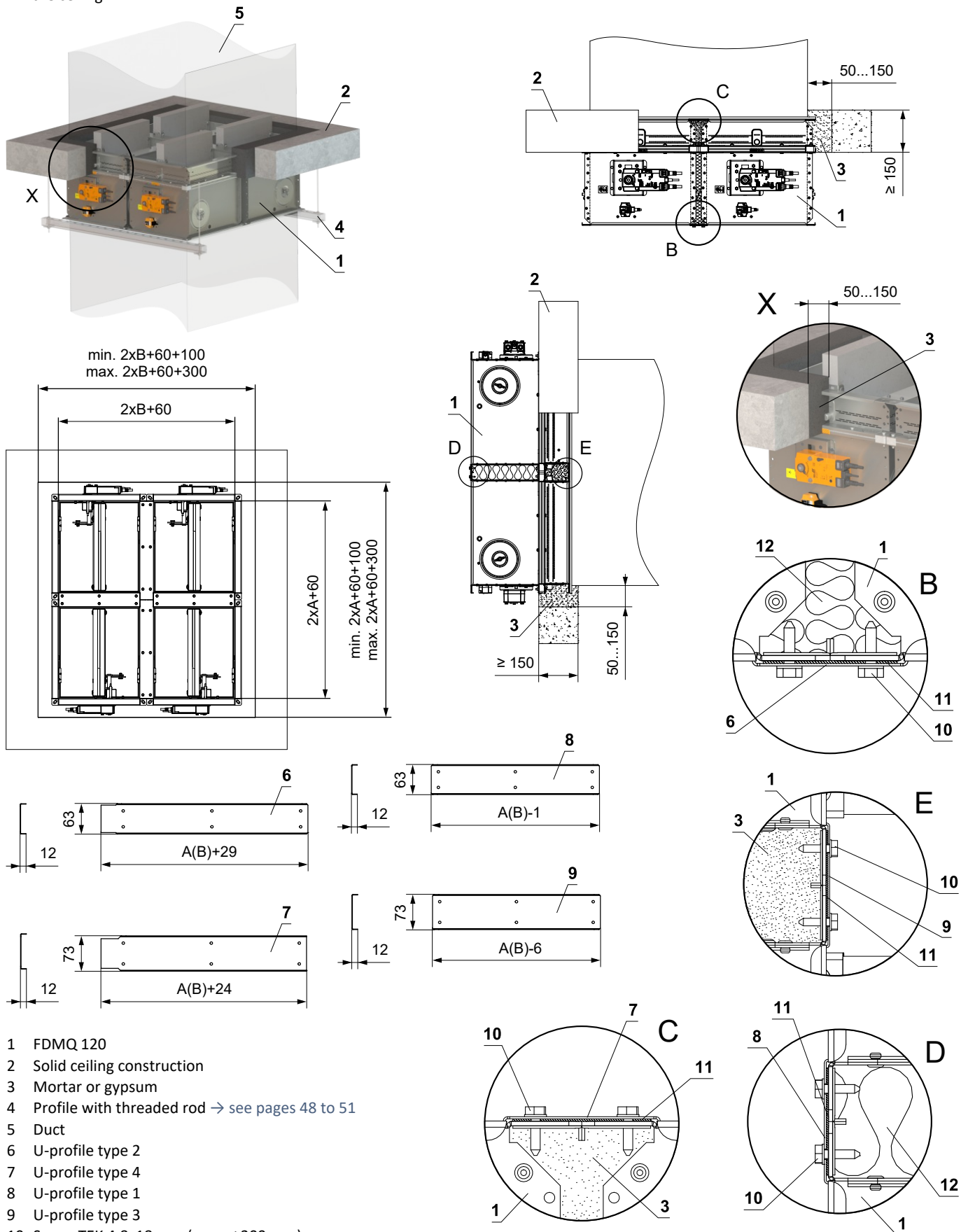
- 1 FDMQ 120
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEK 4,8x18 mm (span ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

- For connection following duct → see page 52
- Gap between damper and construction is filled by mortar or gypsum

In solid ceiling construction - 4 dampers in battery - mortar or gypsum

EI 120 (h<sub>o</sub>) S [H]

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



- 1 FDMQ 120
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 48 to 51
- 5 Duct
- 6 U-profile type 2
- 7 U-profile type 4
- 8 U-profile type 1
- 9 U-profile type 3
- 10 Screw TEK 4,8x18 mm (span ≤ 200 mm)
- 11 Sealing
- 12 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

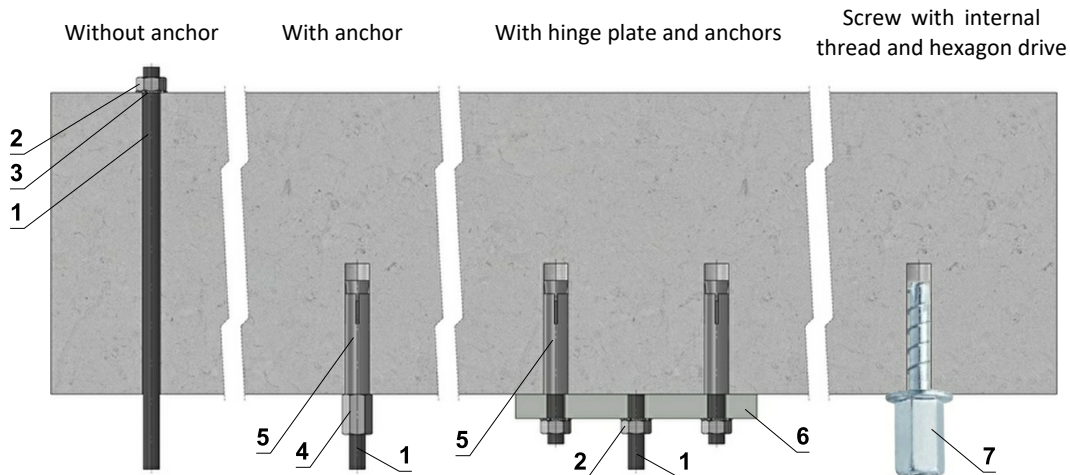
- For connection following duct → see page 52
- Gap between damper and construction is filled by mortar or gypsum

# V. SUSPENSION SYSTEMS

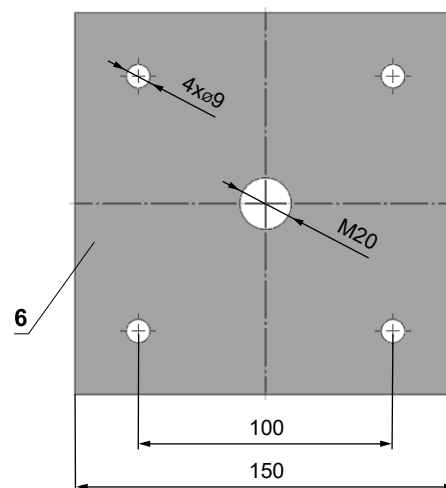
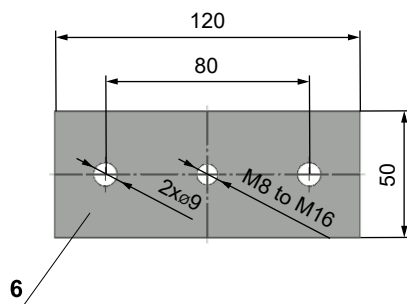
## Mounting to the ceiling wall

- The dampers must be suspended using threaded rods and mounting profiles. Their dimensioning depend on the weight of the damper.
- The dampers and the duct must be suspended separately.
- Following air-conditioning duct must be suspended or supported so that all load transfer from the following duct to the damper flanges is absolutely excluded. Adjacent duct must be suspended or supported, as required by the duct suppliers.

### Examples of anchoring to the ceiling construction Follow the instructions of fixing specialist or installation company



#### Hinge plates



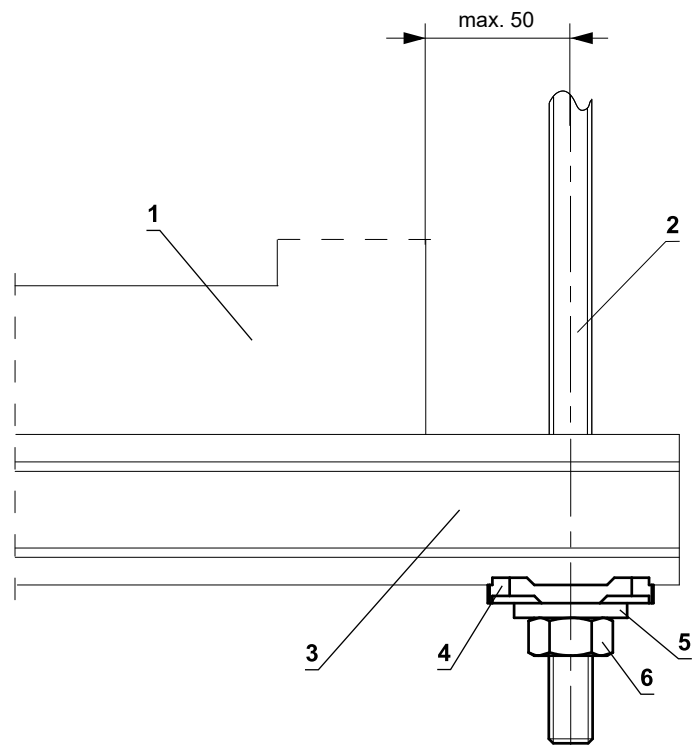
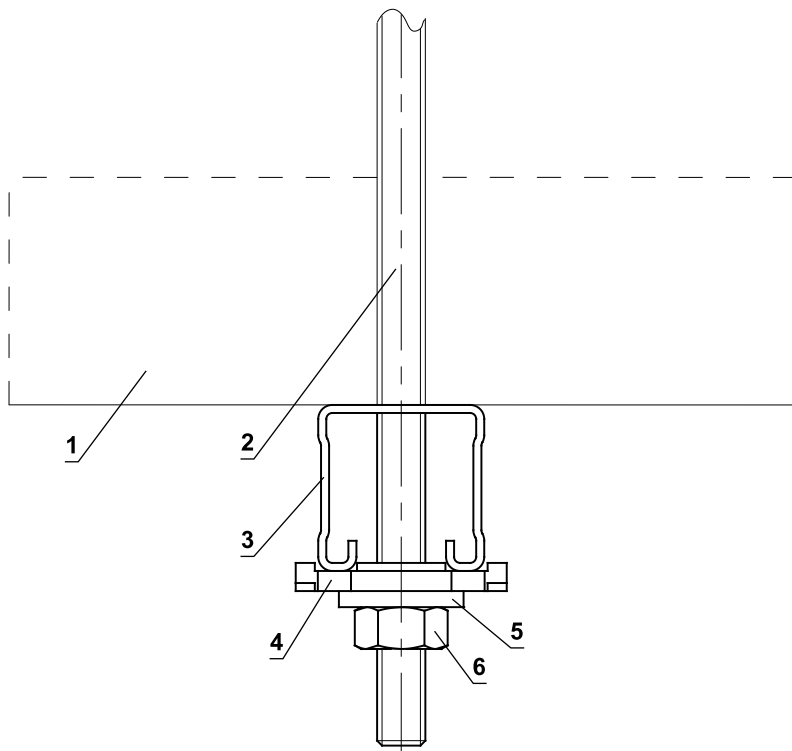
- If in doubt, always consult an anchor specialist engineer such as Halfen or Hilti.

#### Load capacities of threaded rods at the required fire resistance 60 min. <math>t \le 120 \text{ min.}</math>

Size	As [mm <sup>2</sup> ]	Weight [kg]	
		for 1 rod	for 2 rods
M8	36,6	22	44
M10	58	35	70
M12	84,3	52	104
M16	157	96	192
M18	192	117	234
M20	245	150	300

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

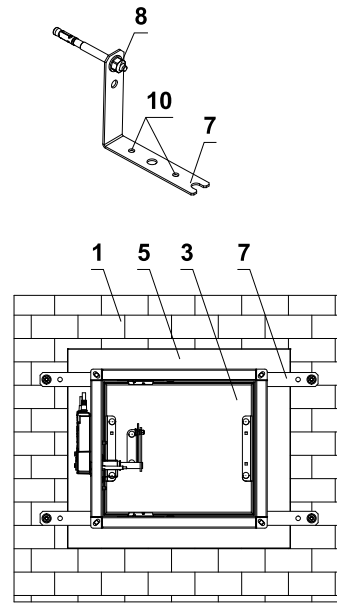
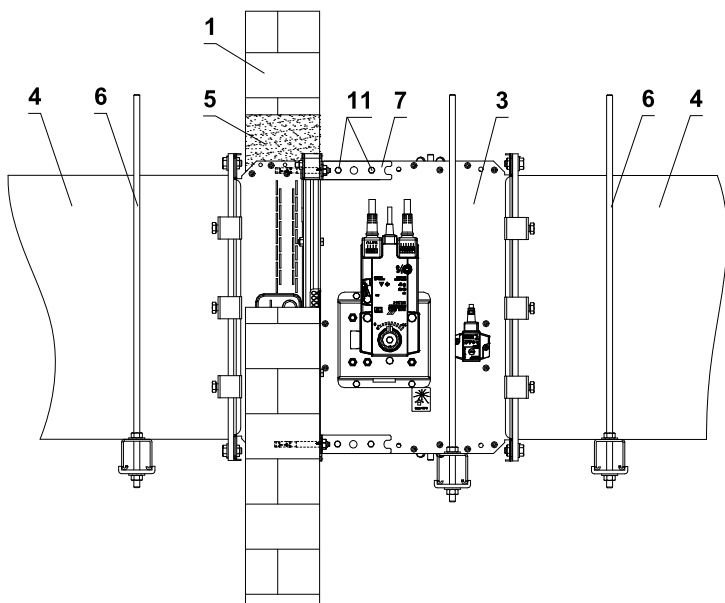
Example of placing of mounting profiles HILTI



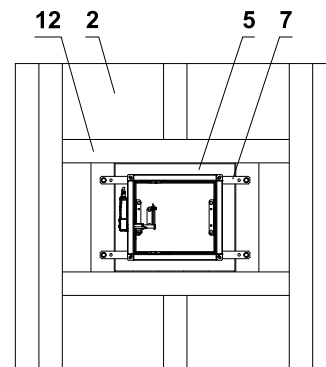
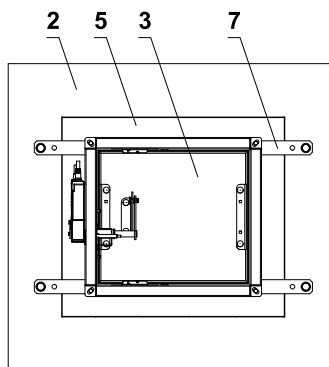
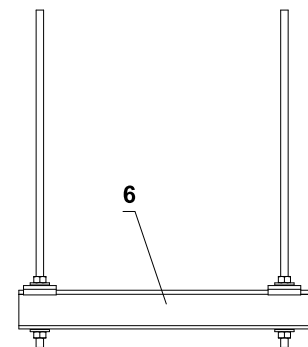
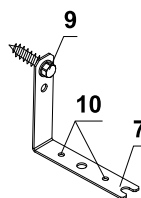
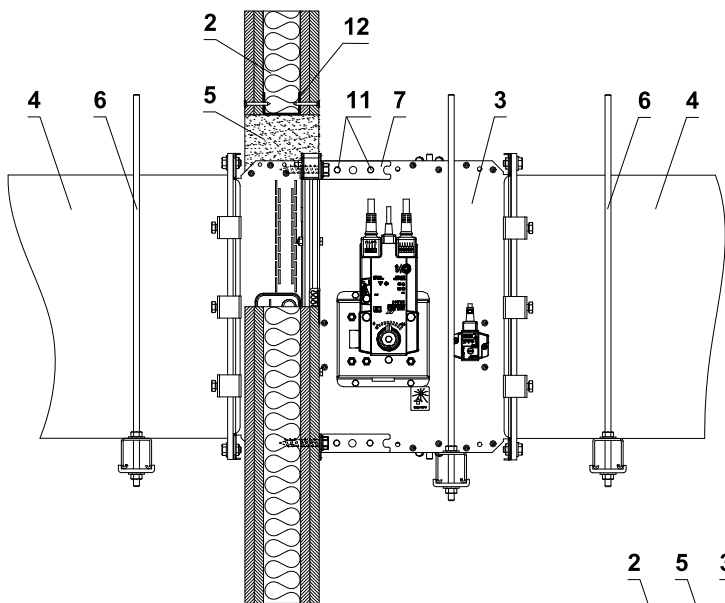
- 1 FDMQ 120
- 2 Threaded rod M8 - M12
- 3 Support HILTI MQ-41 or MQ-41/3
- 4 Bored plate HILTI MQZ-L
- 5 Washer for M8 - M12
- 6 Nut M8 - M12

Example of fixing FDMQ 120 to the wall

In solid wall construction



In gypsum wall construction



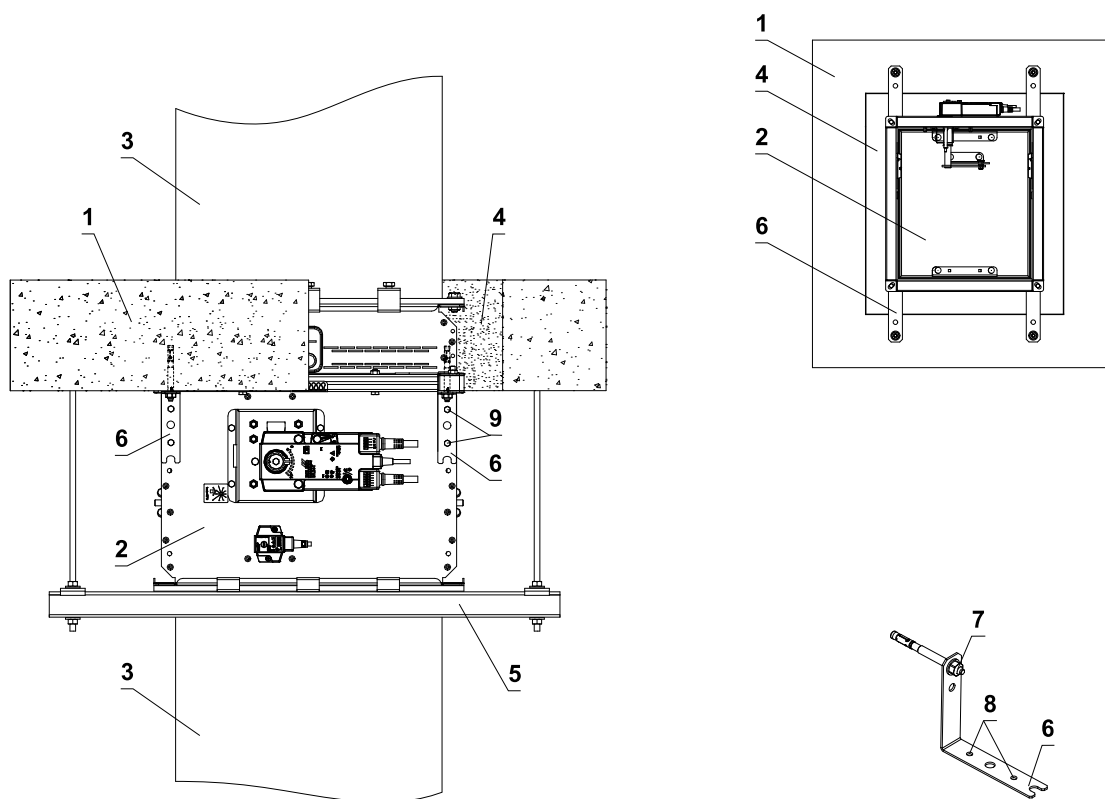
Grid from "U" profile

- 1 Solid wall construction
- 2 Gypsum wall construction
- 3 FDMQ 120
- 4 Duct
- 5 Penetration
- 6 Profile with threaded rod → see page 49
- 7 Fixing element/steel holder for connecting damper to the wall (optional accessories MANDIK, a.s. or sheet metal min. thickness 2 mm and min. width 60 mm)
- 8 Nut M8 with anchor
- 9 Hexagon head screw
- 10 Installation holes
- 11 Screw assembly M6 (screw M6x10, nut M6)
- 12 Gypsum grid from "U" profile

■ The method of attachment must follow the minimum requirements for attachment and connection of ductwork in accordance with national regulations. Also, the elements can be suspended from the top, or supported from bottom, or fastened from the side.

## Example of fixing FDMQ 120 to the ceiling

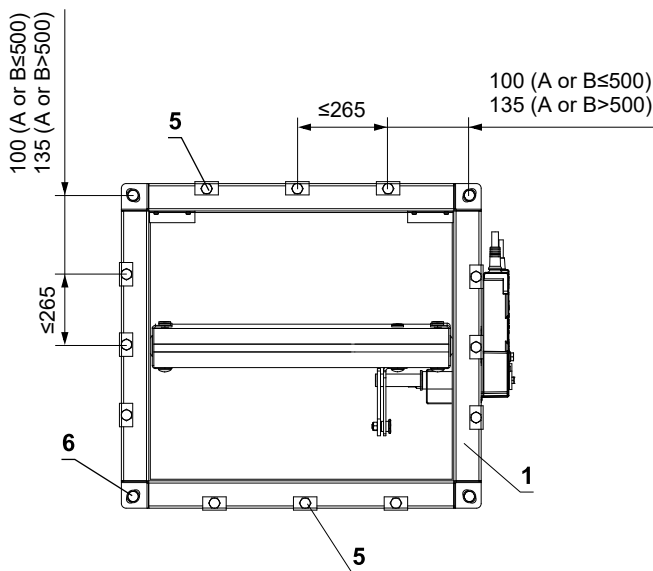
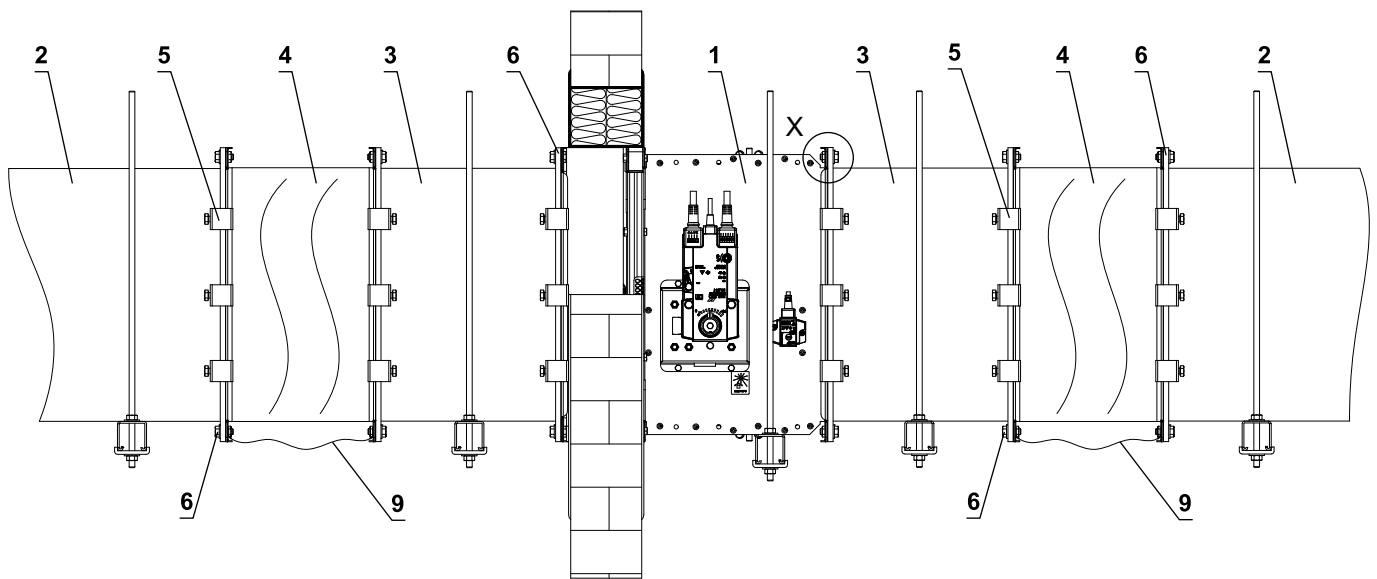
## In solid ceiling construction



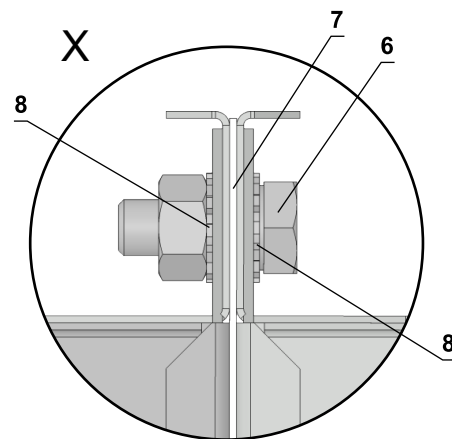
- 1 Solid ceiling construction
- 2 FDMQ 120
- 3 Duct
- 4 Penetration
- 5 Profile with threaded rod → see page 49
- 6 Fixing element/steel holder for connecting damper to the ceiling (optional accessories MANDIK, a.s. or sheet metal min. thickness 2 mm and min. width 60 mm)
- 7 Nut M8 with anchor
- 8 Installation holes
- 9 Screw assembly M6 (screw M6x10, nut M6)

- The method of attachment must follow the minimum requirements for attachment and connection of ductwork in accordance with national regulations. Also, the elements can be suspended from the top, or supported from bottom, or fastened from the side.

Example of duct connection



Electrically conductive connection



\* min. one connection must be electrically conductive

- 1 FDMQ 120
- 2 Duct
- 3 Extension piece (if required)
- 4 Damping pad
- 5 Steel clamp min. screw M8
- 6 Screw assembly M8 (screw M8x20 mm, 2 pcs toothed lock washer M8, nut M8) \*
- 7 Sealing
- 8 Toothed lock washer M8
- 9 Protective bonding conductor

# VI. TECHNICAL DATA

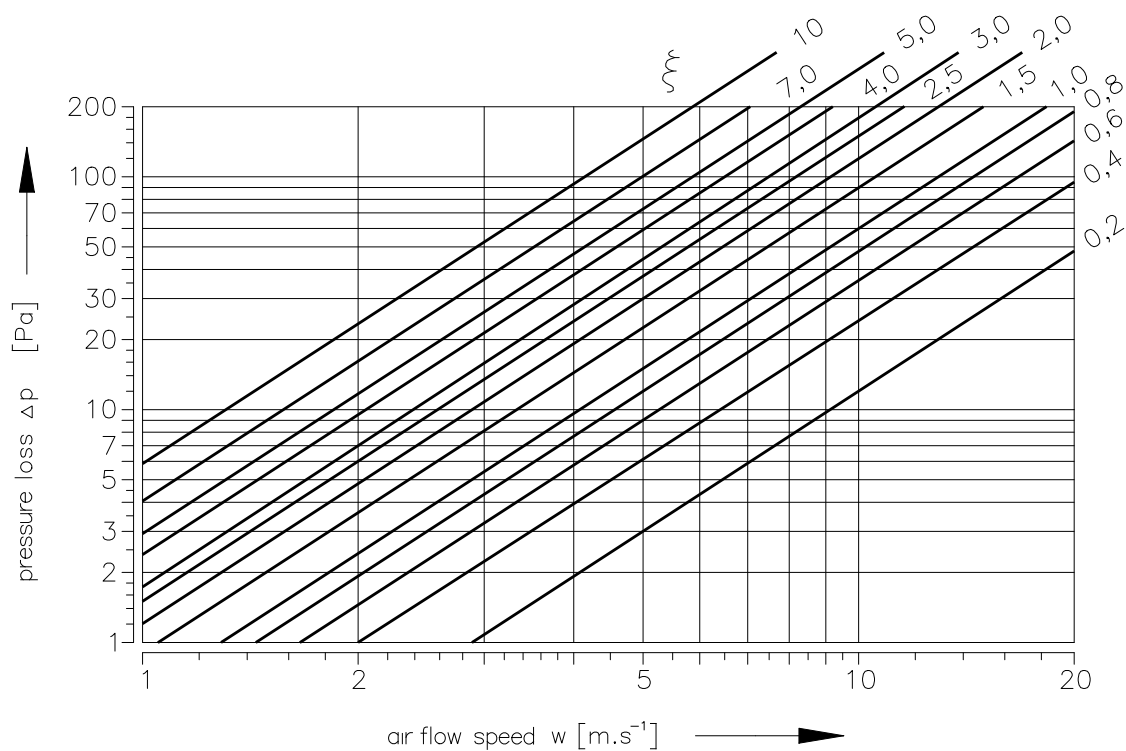
## Pressure loss

### Pressure loss calculation

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

$\Delta p$	[Pa]	pressure loss
$w$	[m/s]	air flow speed in nominal damper section
$\rho$	[kg/m <sup>3</sup> ]	air density
$\xi$	[-]	coefficient of local pressure loss for the nominal damper section → see page 54

### Determination of pressure loss by using diagram $\rho = 1,2 \text{ kg/m}^3$



**Coefficient of local pressure loss**

B	A													
	150	180	200	225	250	280	300	315	355	400	450	500	550	560
150	3,522	3,307	3,081	2,980	2,850	2,704	2,629	2,510	2,421	2,326	2,252	2,187	2,166	2,139
180	2,557	2,389	2,236	2,153	2,064	1,962	1,889	1,802	1,727	1,664	1,610	1,569	1,547	1,529
200	1,972	1,843	1,723	1,653	1,590	1,502	1,451	1,383	1,325	1,276	1,235	1,201	1,186	1,172
225	1,522	1,465	1,321	1,197	1,173	1,141	1,106	1,067	1,015	0,964	0,948	0,917	0,891	0,881
250	1,249	1,164	1,083	1,044	1,008	0,952	0,902	0,867	0,828	0,799	0,772	0,752	0,739	0,732
280	1,133	1,032	1,002	0,960	0,926	0,881	0,827	0,781	0,728	0,705	0,685	0,673	0,665	0,650
300	1,041	0,947	0,896	0,861	0,823	0,775	0,729	0,677	0,648	0,635	0,601	0,592	0,587	0,584
315	0,865	0,803	0,749	0,724	0,693	0,658	0,618	0,595	0,569	0,546	0,527	0,513	0,503	0,499
355	0,735	0,684	0,638	0,609	0,585	0,556	0,528	0,506	0,483	0,464	0,448	0,436	0,428	0,424
400	0,640	0,596	0,555	0,529	0,509	0,481	0,463	0,439	0,420	0,402	0,389	0,377	0,371	0,367
450	0,567	0,527	0,490	0,470	0,452	0,430	0,405	0,387	0,370	0,355	0,343	0,332	0,330	0,324
500	0,514	0,478	0,443	0,426	0,413	0,387	0,369	0,350	0,334	0,321	0,310	0,301	0,298	0,293
550	0,490	0,455	0,421	0,405	0,390	0,367	0,344	0,326	0,317	0,300	0,289	0,287	0,278	0,275
560	0,469	0,434	0,404	0,390	0,371	0,349	0,334	0,318	0,303	0,291	0,281	0,273	0,270	0,266
600	0,439	0,409	0,384	0,368	0,355	0,333	0,316	0,301	0,289	0,281	0,270	0,259	0,253	0,244
630	0,429	0,398	0,370	0,357	0,343	0,322	0,306	0,291	0,278	0,267	0,257	0,250	0,237	0,243
650	–	0,379	0,356	0,342	0,329	0,309	0,297	0,284	0,266	0,257	0,250	0,240	0,229	0,233
700	–	0,375	0,348	0,333	0,321	0,306	0,289	0,275	0,262	0,250	0,244	0,234	0,222	0,221
710	–	0,368	0,343	0,329	0,316	0,300	0,285	0,268	0,257	0,247	0,237	0,230	0,219	0,219
750	–	0,354	0,330	0,321	0,309	0,286	0,271	0,260	0,246	0,238	0,230	0,222	0,219	0,215
800	–	0,344	0,320	0,309	0,297	0,282	0,264	0,251	0,239	0,229	0,221	0,215	0,211	0,209

B	A													
	600	630	650	700	710	750	800	900	1000	1100	1250	1400	1500	
150	2,112	2,091	2,083	2,067	2,062	2,044	2,029	1,992	1,972	–	–	–	–	
180	1,513	1,495	1,480	1,469	1,462	1,449	1,436	1,412	1,394	1,377	1,363	1,348	1,340	
200	1,154	1,144	1,131	1,123	1,120	1,109	1,099	1,080	1,066	1,053	1,040	1,031	1,024	
225	0,874	0,861	0,841	0,833	0,824	0,817	0,810	0,795	0,785	0,775	0,758	0,744	0,740	
250	0,725	0,714	0,705	0,704	0,698	0,693	0,685	0,673	0,665	0,656	0,648	0,641	0,638	
280	0,645	0,641	0,617	0,612	0,606	0,601	0,593	0,585	0,576	0,563	0,549	0,540	0,530	
300	0,569	0,554	0,550	0,549	0,548	0,541	0,532	0,524	0,507	0,496	0,490	0,488	0,480	
315	0,493	0,487	0,481	0,479	0,476	0,470	0,467	0,459	0,452	0,447	0,442	0,436	0,434	
355	0,419	0,414	0,408	0,405	0,404	0,399	0,397	0,389	0,384	0,379	0,374	0,370	0,368	
400	0,363	0,358	0,352	0,351	0,350	0,345	0,343	0,336	0,331	0,327	0,324	0,321	0,318	
450	0,319	0,315	0,311	0,310	0,309	0,306	0,301	0,296	0,293	0,289	0,286	0,281	0,280	
500	0,288	0,285	0,284	0,281	0,279	0,276	0,273	0,268	0,264	0,261	0,258	0,256	0,254	
550	0,272	0,269	0,264	0,259	0,256	0,254	0,253	0,248	0,245	0,242	0,237	0,234	0,232	
560	0,264	0,259	0,256	0,255	0,253	0,250	0,248	0,244	0,240	0,236	0,233	0,231	0,230	
600	0,242	0,241	0,239	0,238	0,237	0,233	0,228	0,226	0,222	0,219	0,216	0,214	0,212	
630	0,240	0,237	0,234	0,233	0,232	0,229	0,226	0,223	0,220	0,217	0,213	0,211	0,209	
650	0,230	0,227	0,225	0,223	0,222	0,219	0,216	0,210	0,208	0,206	0,201	0,198	0,196	
700	0,219	0,219	0,218	0,217	0,215	0,213	0,211	0,207	0,204	0,202	0,199	0,196	0,194	
710	0,217	0,217	0,216	0,215	0,214	0,212	0,209	0,205	0,201	0,199	0,197	0,195	0,193	
750	0,211	0,208	0,206	0,205	0,204	0,203	0,201	0,197	0,193	0,189	0,187	0,185	0,183	
800	0,206	0,203	0,201	0,200	0,199	0,197	0,194	0,191	0,188	0,186	0,183	0,182	0,181	

## Noise data

## Level of acoustic output corrected with filter A

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

$L_{WA}$	[dB(A)]	level of acoustic output corrected with filter A
$L_{W1}$	[dB]	level of acoustic output $L_{W1}$ related to the 1 m <sup>2</sup> section
$S$	[m <sup>2</sup> ]	duct cross section
$K_A$	[dB]	correction to the weight filter A

## Level of acoustic output in octave ranges

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

$L_{Woct}$	[dB]	spectrum of acoustic output in octave range
$L_{W1}$	[dB]	level of acoustic output $L_{W1}$ related to the 1 m <sup>2</sup> section
$S$	[m <sup>2</sup> ]	duct cross section
$L_{rel}$	[dB]	relative level expressing the shape of the spectrum

## Tables of acoustics values

Level of acoustic output  $L_{W1}$ [dB] related to the 1 m<sup>2</sup> section

$w$ [m/s]	$\xi$ [-]																
	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1	1,5	2	2,5	3	4	5	8	10
2	15,5	18,7	20,9	22,6	24	25,2	26,3	27,2	28	31,2	33,4	35,1	36,5	38,8	40,5	44,2	45,9
3	26,1	29,2	31,5	33,2	34,6	35,8	36,9	37,8	38,6	41,7	44	45,7	47,1	49,4	51,1	54,7	56,5
4	33,6	36,7	39	40,7	42,1	43,3	44,3	45,3	46,1	49,2	51,5	53,2	54,6	56,9	58,6	62,2	64
5	39,4	42,5	44,8	46,5	47,9	49,1	50,2	51,1	51,9	55	57,3	59	60,4	62,7	64,4	68	69,8
6	44,1	47,3	49,5	51,3	52,7	53,9	54,9	55,8	56,6	59,8	62	63,8	65,2	67,4	69,2	72,8	74,5
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	69,2	71,4	73,2	76,8	78,6
8	51,6	54,8	57	58,8	60,2	61,4	62,4	63,3	64,1	67,3	69,5	71,3	72,7	74,9	76,7	80,3	82
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	75,7	78	79,7	83,4	85,1
10	57,4	60,6	62,8	64,6	66	67,2	68,2	69,1	70	73,1	75,3	77,1	78,5	80,7	82,5	86,1	87,9
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	81	83,2	85	88,6	90,3
12	62,2	65,4	67,6	69,3	70,7	71,9	73	73,9	74,7	77,9	80,1	81,8	83,2	85,5	87,2	90,9	92,6

Correction to the weight filter A

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

Relative level expressing the shape of the spectrum  $L_{rel}$ 

$w$ [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	-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	-4,1	-5,9	-9,4	-14,6	-21,5	-30
11	-5,9	-4,1	-4	-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

## VII. MATERIAL, FINISHING

- Damper casings are made from galvanized sheet metal without further surface treatment.
- Damper blades are made from fire resistant asbestos free boards made of mineral fibres.
- Manual control have cover made of mechanically resistant and durable plastic and the other parts are galvanized without further surface treatment.
- Thermal fuses are made of sheet brass, thickness 0,5 mm.
- Fasteners and springs are galvanized.
- According to the customer's requirements, dampers can be made of stainless steel material.

### Specifications for stainless-steel design:

- Class A2 – Food-grade stainless steel (AISI 304 – EN 1.4301)
- Class A4 – Chemistry-grade stainless steel (AISI 316, 316L – EN 1.4401, EN 1.4404)

The respective stainless steel is the material for all components that are located or entering the damper inner space; components outside the damper casing are typically from galvanised sheet metal (fasteners for mounting the actuator or manual control, mechanical components except Item 4), frame components.

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

- 1) Damper casing and all components permanently attached
- 2) Blade holders including pins, metal parts of blades
- 3) Control components inside the damper (L-profile, pin with lever, rod, fasteners)
- 4) Parts of a manual control entering the inner space of a damper casing (lower sheet of a manual control, lock holder "1", lock lever "2", closing spring, 8 dia. stopper pin, manual control pin)
- 5) Inspection opening cover including the stirrup and fasteners (if they are parts of the cover)
- 6) Bearing for torque transfer from the lever with pin on the blade L-profile (made from AISI 440C)

The damper blade is made from boards of homogeneous material Promatect-H, connected with galvanized "U" clips on the outside, sealed with Promat K84 glue.

Thermal fuse is identical for all material variants of the dampers. Upon specification by customer, the thermal fuse can be made from A4 from stainless steel sheet metal.

Thermoelectric activation device BAT is modified for stainless-steel variant of the dampers; standard galvanised screws are replaced with stainless-steel M4 screws of corresponding class. Damper casing has stainless-steel riveting M4 nuts.

Plastic, rubber and silicon components, sealants, foaming tapes, glass-ceramic seals, housings, brass bearings of the blade, actuators, and end switches are identical for all material variants of the dampers.

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

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

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

## VIII. TRANSPORTATION, STORAGE AND WARRANTY

### Logistic terms

- Dampers are delivered on pallets. As standard, the dampers are wrapped in plastic foil for protection during transport and must not be used for long-term storage. Temperature changes during transport can cause condensation of water inside the packaging and thereby cause corrosion of materials used in the dampers (e.g. white corrosion on zinc-coated items or mould on calcium silicate). Therefore, it is necessary to remove the transport packaging immediately after unloading to allow air to circulate around the product.
- The dampers must be stored in clean, dry, well ventilated and dust-free environment out of direct sunlight. Ensure protection against moisture and extreme temperatures (minimum temperature +5°C). The dampers must be protected against mechanical and accidental damage prior to installation.
- Another required packaging system should be approved and agreed by manufacturer. Packaging material is not returnable in case that another packaging system (material) is required and used and it is not included into final price of damper.
- Dampers are transported by box freight vehicles without direct weather impact, there must not occur any shocks and ambient temperature must not exceed +50°C. Dampers must be protected against impact when transported and manipulated. During transportation, the damper blade must be in the "CLOSED" position.
- Dampers must be 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%.

### Warranty

- The manufacturer provides a warranty of 24 months from the date of dispatch for the dampers.
- In case of using a Schischek actuator, the manufacturer provides a 12-month warranty for the actuator from the date of shipment.
- The warranty for fire dampers FDMQ 120, provided by the manufacturer, is completely void if actuating, closing and control devices are unprofessionally handled by untrained workers or if electric components, i.e. limit switches, actuators, communication and supply devices and thermoelectric activation devices are dismounted.
- The warranty is void if dampers are used for other purposes, devices and working conditions than those allowed by these technical conditions or if the dampers are mechanically damaged during handling.
- If the dampers are damaged by transport, a record must be written down with the forwarder at reception for later complaint.

## IX. ASSEMBLY, ATTENDANCE AND MAINTENANCE

- 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 fire dampers must be done according international and local norms and laws.
- All effective safety standards and directives must be observed during damper assembly.
- To ensure reliable damper function it is necessary to avoid blocking the actuating mechanism and contact surfaces with collected dust, fibre and sticky materials and solvents.
- Flange and screw joints must be conductively connected to protect against dangerous contact. 2 galvanized lock washers that are placed under the head of one screw and a fastened nut are used for conductive connection.

### Manual operation - actuator control without electric voltage

- A special wrench (part of the actuator) can be used to manually turn the damper blade to any position. When the wrench is turned in the direction of the arrow, the damper blade rotates to its open position. As the blade rotation is stopped, in every position, the actuator will be locked. Unlocking is possible even manually as per instructions on the actuator, or by the activation of the supply voltage.
- If the actuator is manually locked, the damper blade will not close in the event of a fire after the activation of the thermoelectric activation device BAT. To restore correct damper operation, the actuator must be unlocked (manually or by applying power supply).

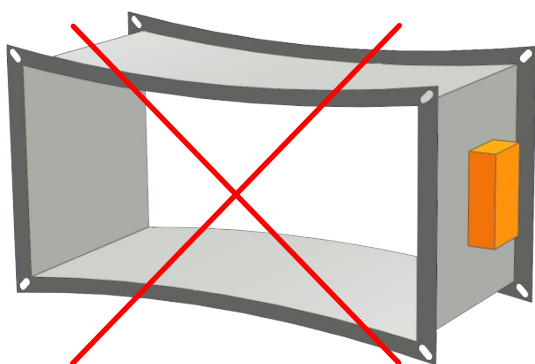
### Limit switches

- If the damper is equipped with limit switches and these switches are not used during operation (e.g. because of a project change), they can be left on the damper and not connected (they need not be dismantled).
- On the other hand, if the limit switch is to be added to the damper design, the change can be implemented by change kit.
- These facts must be recorded in the respective operation documentation of the damper (record books of the damper, fire logs, etc.) and subsequently, adequate function checks must be carried out.

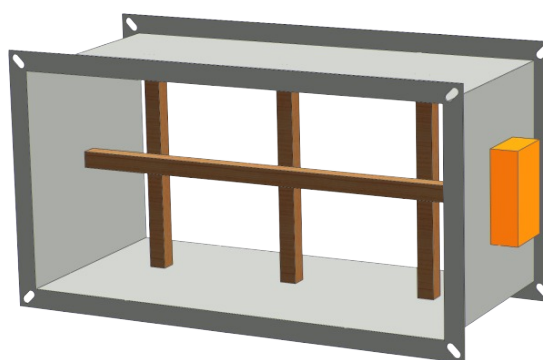
### Installation / fixing the damper

- The damper casing shall not be deformed in the course of bricking in.
- Once the damper is built in, the damper blade shall not grind on the damper casing during opening or closing.

#### Protection of the damper casing against buckling during installation, especially for large sizes!

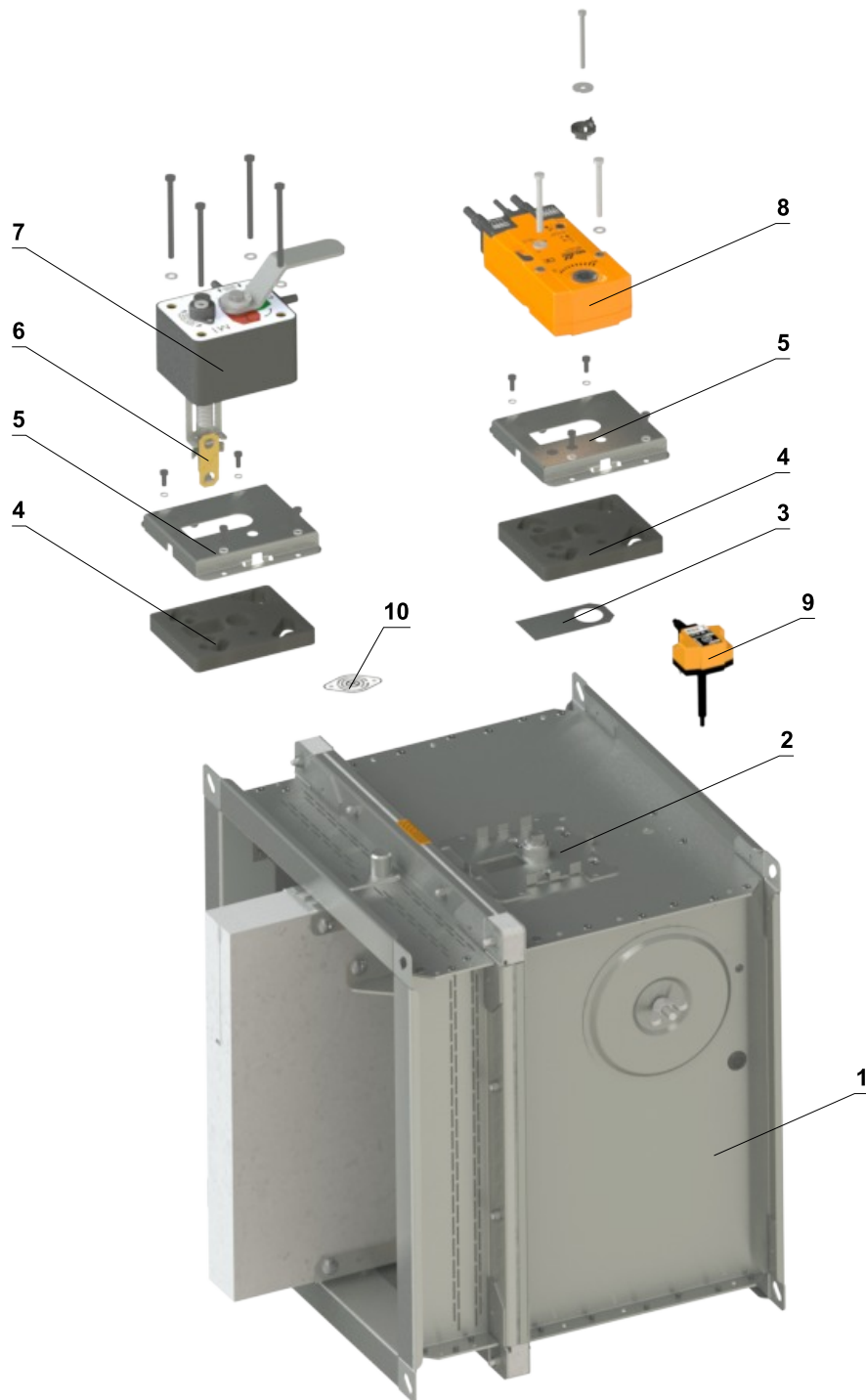


**WRONG!**



**Reinforcement of the casing with wooden beams**

Change of manual control for the actuator or vice versa

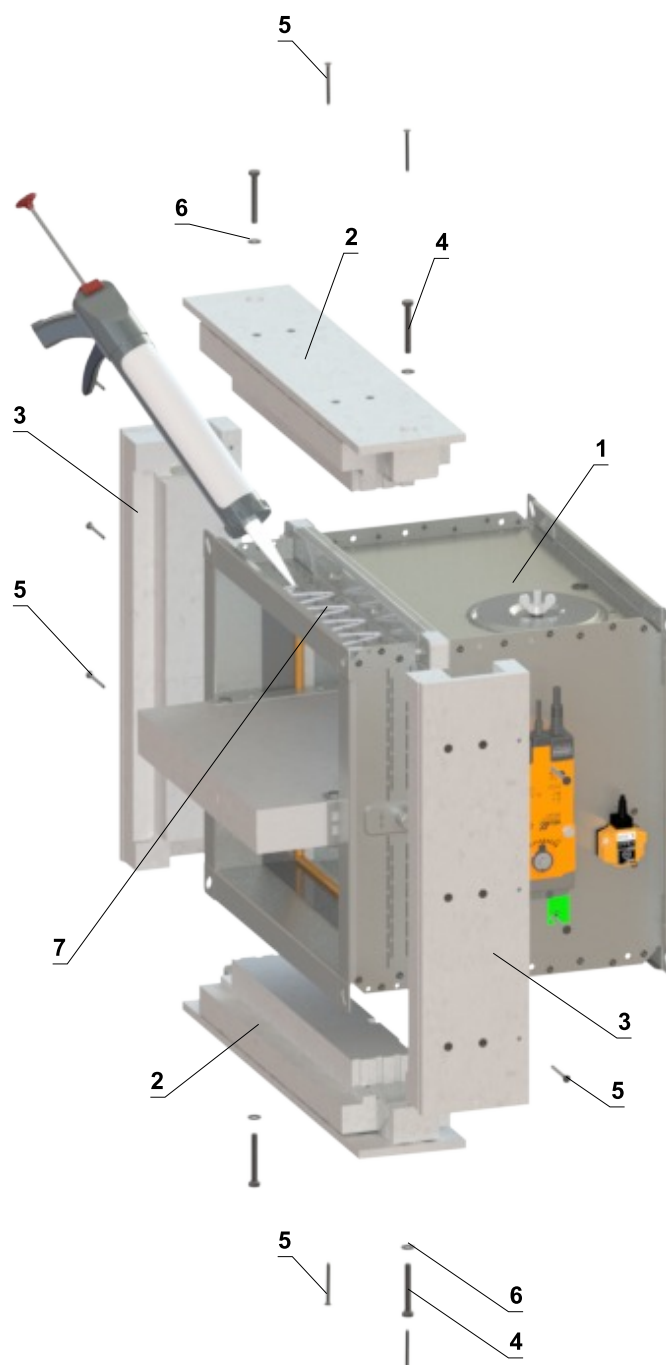
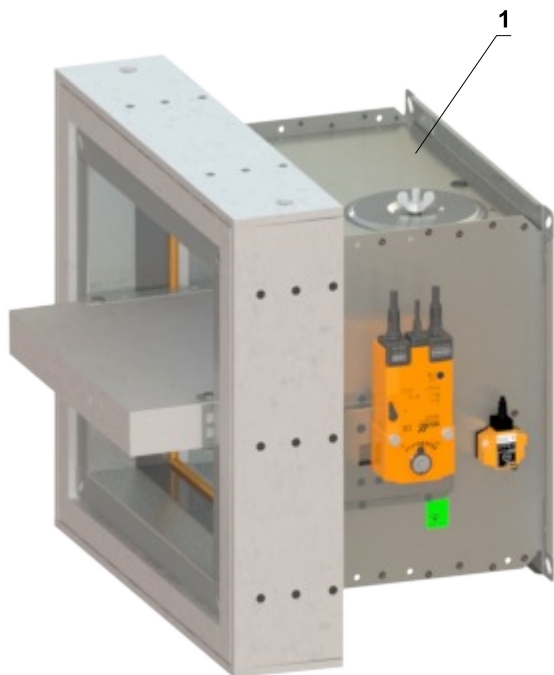


- |                               |  |
|-------------------------------|--|
| 1 Damper                      | 6 Thermal fuse                         |
| 2 Mounting plate              | 7 Manual control                       |
| 3 Sealing cover               | 8 Spring return actuator               |
| 4 Sealing of a mounting plate | 9 Thermoelectric activation device BAT |
| 5 Cover of a mounting plate   | 10 Sensor sticker                      |

**Reinforcing frame VRM-Q 120**

- For damper installation outside wall construction is necessary to use reinforcing frame VRM-Q 120
- Fastening material is included in the package except glue K84
- Install reinforcing frame only after connecting duct.

**Fixing reinforcing frame VRM-Q 120 to the damper casing**



**Installation procedure**

- 1) Apply K84 glue over the entire surface
- 2) Attach the frame parts to the damper and screw it in the corners using M8x60 mm hexagon head screws DIN 931 with M8/8.4 washers DIN 7349
- 3) Screw 5x60 mm screws into the predrilled holes

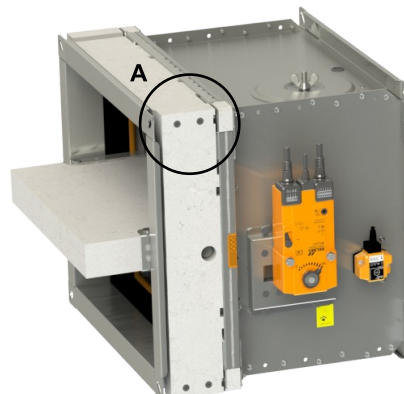
- 1 FDMQ 120
- 2 Part A of VRM-Q 120
- 3 Part B of VRM-Q 120
- 4 Hexagon head screw M8x60 mm DIN 931
- 5 Screw 5x60 mm
- 6 Washer M8/8,4 DIN 7349
- 7 Glue K-84 PROMAT

**Protective cladding boards**

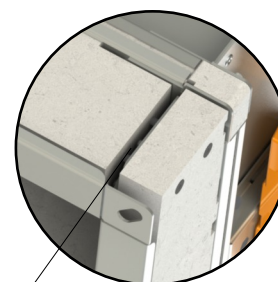
- Protective cladding boards must be used as part of the penetration filling of installation with Ablative Coated Batt.
- Can be ordered from MANDIK (installed on the damper or as an accessory) or can be sourced from local supplier
- If protective cladding boards are required, this must be specified in the ordering key
- Protective cladding boards are made of PROMATECT-MST, thickness 30 mm.
- Glue K84 is not included in the package

**Installation procedure**

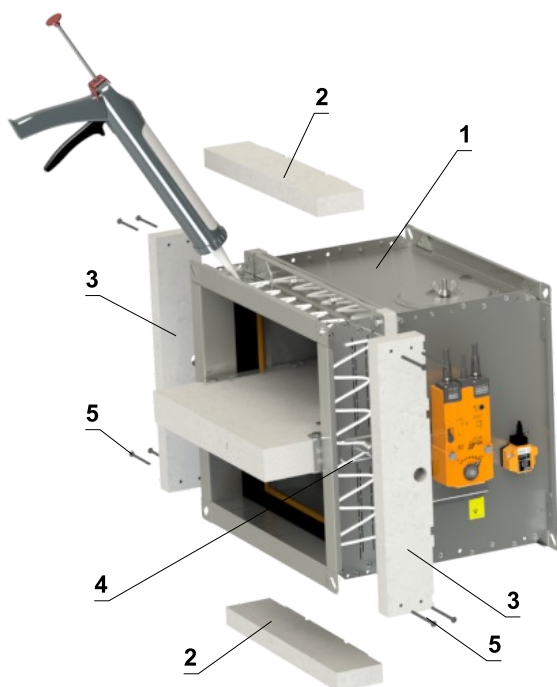
- 1) Apply K84 glue over the entire surface
- 2) Attach protective cladding boards to the damper and glue them to the casing
- 3) Screw parts A and B together using 4x screw 5x70 mm
- 4) Completely fill the gaps with glue



**DETAIL A**

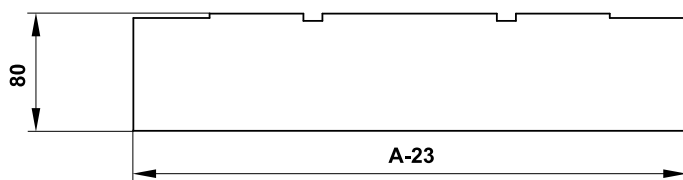


**Completely fill the gaps between boards!**

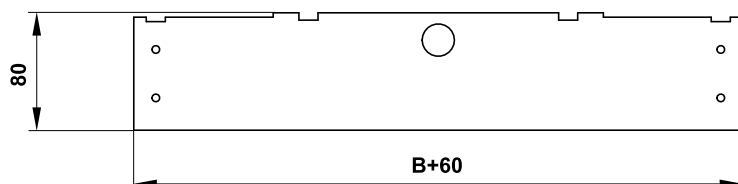


- 1 FDMQ 120
- 2 Part A of protective cladding boards
- 3 Part B of protective cladding boards
- 4 Glue PROMAT K-84
- 5 Screw 5x70 mm

**Part A**



**Part B**



- Detailed dimensions of protective cladding boards on request

## Entry into service and revisions

- Before putting the damper into operation, serviceability checks and functional tests must be carried out including testing of functionality of all electrical elements. After putting into operation these serviceability checks must be carried at least twice a year. If no defect is found during two subsequent serviceability checks, these checks can be carried out once a year.
- 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 that the damper is put into condition in which it is ready for function and meanwhile he is obliged to provide the fire protection by 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.
- Before entering the dampers with actuator into operation after their assembly and by sequential checks. Check of blade rotation into the breakdown position "CLOSED" can be done after disconnecting the actuator supply (e.g. by pressing the test button at the thermoelectric activation device BAT or disconnecting the supply from ELECTRICAL FIRE SIGNALISATION). Check of blade rotation back into the "OPEN" position can be done after restoration of power supply (e.g. by releasing the test button or restoration of supply from ELECTRICAL FIRE SIGNALISATION). Without power supply, the damper can be operated manually and fixed in any required position. Release of the locking mechanism can be achieved manually or automatically by applying the supply voltage. It is recommended to provide periodical checks, maintenance and service actions on fire equipment by authorized persons. The authorized persons can be trained by producer, or by authorized distributor. All effective safety standards and directives must be observed during fire damper assembly.
- Visual inspection of proper damper installation, inner area of a damper, damper blade, contact surfaces and silicon seal.
- For regular or exceptional inspection of interior of fire damper, micro-camera device can be used. On each fire damper is an inspection opening. In the case of inspection by camera, take out the black rubber cap, insert the camera inside the damper, check interior and at the end of inspection, put the rubber cap back tightly to cover the empty hole.

### For dampers with manual control, following checks must be carried out

#### Check of a manual control and thermal fuse

- **To check the function of the manual control proceed as follows:**
- Turn the damper blade to "CLOSED" position as follows:
  - The damper blade is in "OPEN" position.
  - Press the control button of the manual control to turn the damper blade to "CLOSED" position.
  - Check the damper blade rotation to "CLOSED" position.
  - Damper blade closing shall be smooth and fast, the control lever shall be in „CLOSED“ position.
- Turn the damper blade to "OPEN" position as follows:
  - Turn the control lever by 90°.
  - Check the damper blade rotation to "OPEN" position.
  - The lever will automatically lock in "OPEN" position.
- **Check of function and condition of the thermal fuse:**
  - To check the function and the status of the fuse it's possible to remove the manual control from the casing of the fire damper which is attached to the damper casing with four screws M6.
  - Removing the thermal fuse from the fuse holder of a manual control, checks its correct functionality.
  - The manual control is identified as M2 to M5, depending on the closing spring strength.

### For dampers with actuator, following checks must be carried out

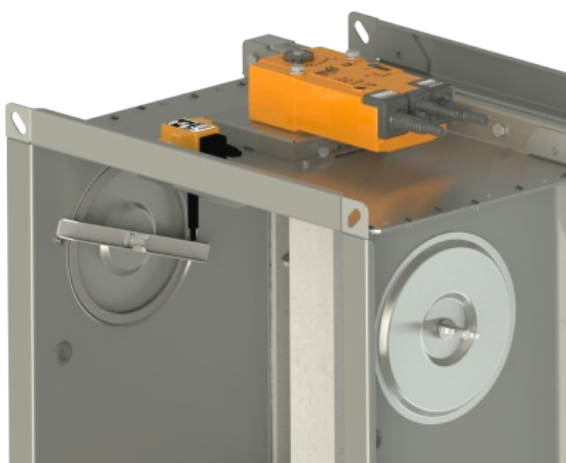
- Check the rotation of the blade to "CLOSED" failure position after disconnection the power supply of the actuator (e.g. by pressing the test button on the thermoelectric activation device BAT or by disconnection the power supply from electrical fire signalization). Check the rotation of the blade back to "OPEN" position by restoring the power supply to the actuator (e.g. by releasing the test button or by restoring the power supply from electrical fire signalization).

### The check of function of the damper with actuator can be carried out as follows

- By disconnecting and restoring the power supply, e.g. by a signal from electrical fire signalization.
- By pressing the test button on the thermoelectric activation device BAT (simulating fuse tripping).

### Before putting the dampers into operation and during subsequent function checks, the following checks must be carried out for dampers with optical smoke detector

- The function checks of the optical smoke detector are to be carried out by employees of an authorized organization who have corresponding electrotechnical qualification and have been properly trained by the manufacturer. The function checks are to be carried out as a part of function checks of the fire dampers, at least 1x a year.
- For the function checks, the damper blade should be in "CLOSED" position with the fan off or with closed air regulation situated between the fan and the fire damper.
- Inspection opening 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.



*Inspection opening detail*

- Ensure each damper is fully checked for operational capability, control should be initiated from the control system or by manual control. Damper blades should open and close correctly and operation should be visually inspected and documented prior to handover.

### How to proceed after Tf1 or Tf2 fuses have been activated

- If the thermal fuse **Tf1** is interrupted (due to temperature outside the duct), it is necessary to replace the spring return actuator. → see page 10
- If the thermal fuse **Tf2** is interrupted (due to temperature inside the duct) , only the spare part ZBAT 72 (95/120/140) needs to be replaced (acc.to the activation temperature). → see page 10

# X. ORDERING INFORMATIONS

## Ordering key



**EXAMPLES:**

**FDMQ 120 EN 500x250/375 .40 Q30-ZN**

Fire damper FDMQ 120, dimension 500x250 mm, built length 375 mm, control design with spring return actuator AC 230 V, standard activation temperature 72 °C, flange dimension 30 mm, galvanized material variant, without installation kit/frame, standard silicon seal.

**FDMQ 120 EN 500x250/375 .40 120 A Q30-ZN IW G**

Fire damper FDMQ 120, dimension 500x250 mm, built length 375 mm, control design with spring return actuator AC 230 V, activation temperature 120 °C, with protective cladding boards, flange dimension 30 mm, galvanized material variant, impregnation against humidity, rubber cold seal.

**1| Fire damper type - FDMQ 120**

**2| Country of destination**

**3| Damper dimensions A x B → see pages 16 to 21**

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

**4| Built length - 375 mm**

**5| Damper design**

.01	Manual control and thermal
.02	Manual control and thermal (Zone 1,2)
.11	Manual control and thermal with a terminal switch („CLOSED“)
.12	Manual control and thermal with a terminal switch („CLOSED“) (Zone 1,2)
.80	Manual control and thermal with two terminal switches („OPEN“, „CLOSED“)
.81	Manual control and thermal with two terminal switches („OPEN“, „CLOSED“) (Zone 1,2)
.40	With actuator BF 230-TN (BFL, BFN 230-T) - voltage AC 230 V
.41 *	With actuator BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K and with supply device BKN 230-24-MOD (voltage AC 230 V)
.42 **	With actuator ExMax-15-BF, with thermoelectric activation device ExPro-TT (Zone 1,2) - supply voltage range 24 to 230 VAC/DC
.50	With actuator BF 24-TN (BFL, BFN 24-T) - voltage AC/DC 24 V
.51 *	With actuator BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K (voltage AC/DC 24 V)
.63	With communication and supply device BKN 230-24-MOD, with actuator BF 24-TN-ST (BFL, BFN 24-T-ST)
.63S *	With communication and supply device BKN 230-24-MOD, with actuator BF 24-TN-ST (BFL, BFN 24-T-ST) and with smoke detector ORS 142 K

\* For sizes A<160 mm or B<160 mm, the optical smoke detector ORS 142 K is not part of the fire damper and is supplied separately.

\*\* These designs are supplied only with an activation temperature of 72 °C.

■ Detailed information for ATEX dampers (ZONE 1,2) → see Appendix

**6| Activation temperature**

Manual control		Spring return actuator control	
	72 °C *		72 °C *
104	104 °C	95	95 °C
147	147 °C	120	120 °C
		140	140 °C

\* Standard activation temperature

**7| Installation kit/frame**

	Without installation kit/frame
A	With protective cladding boards (for Ablative Coated Batt installation)
VRM-Q 120	Reinforcing frame VRM-Q 120

**8| Flange dimension**

Q30	Flange width 30 mm
Q20	Flange width 20 mm

**9| Material and other design options**

ZN	Galvanized
A2	Stainless steel 1.4301 (AISI 304)
A4	Stainless steel 1.4404 (AISI 316L) - included damper blade impregnation against chemical - type PROMAT SR

**10| Surface treatment**

	Without surface treatment
IW	Damper blade impregnation, impregnating agent PROMAT 2000 - impregnation against humidity
IA	Damper blade impregnation, impregnating agent PROMAT SR - impregnation against chemical

**11| Cold seal variant**

	Silicone rubber *
G	Silicone-free rubber

\* Standard cold seal

**Accessories**

**Protective cladding boards**



1| Accessory type - cladding boards

2| Fire damper type - FDMQ 120

3| Damper dimensions A x B → see pages 16 to 21

**Reinforcing frame VRM-Q 120**





1| Accessory type - reinforcing frame VRM-Q 120

2| Fire damper type - FDMQ 120

3| Damper dimensions A x B → see pages 16 to 21

## Data label

- Data label is placed on the damper casing (example)

<b>MANDÍK</b> <sup>®</sup>		MANDÍK, a.s. Dobříšská 550, 267 24 Hostomice, Czech Republic		
FIRE DAMPER - XXXX			 MANUAL 	
DIMENSION:		DESIGN:		
SERIAL.NO.:		WEIGHT (kg):		
CLASSIFICATION:				
TPM XXX/XX	Cert. No.: 1391-CPR-XXXX/XXXX, DoP: PM/XXXX/XX/XX/X	XX	EN 15650:2010	

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