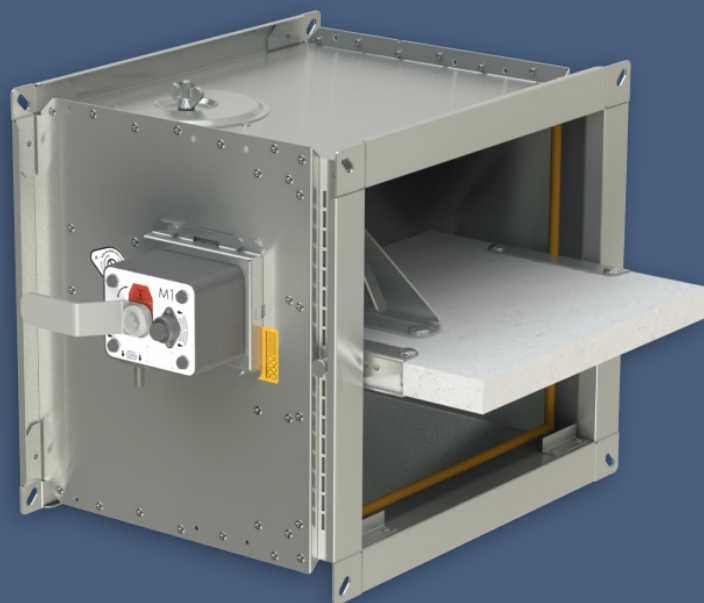
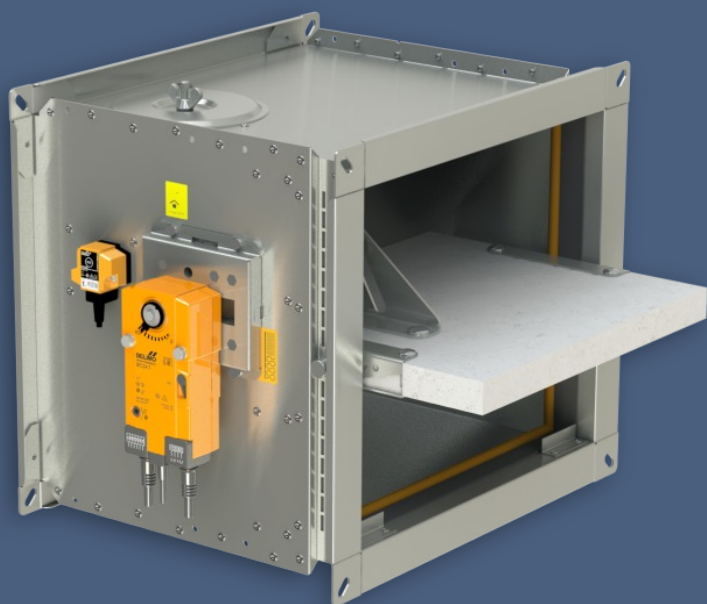


## FDMB

### Fire damper

Technical Documentation

Installation, Commissioning, Operation, Maintenance and Service Manual



CE  
1391

These technical specifications state a row of manufactured sizes and models of fire dampers FDMB.  
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.

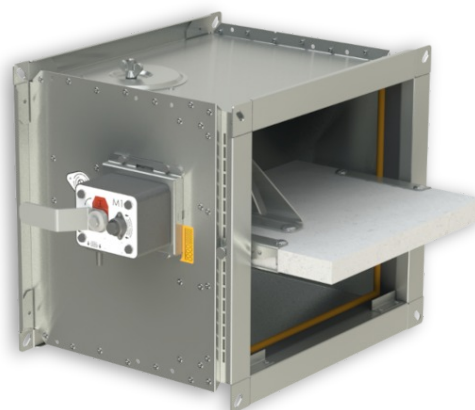
Damper blade automatically closes air duct using a closing spring or a spring return actuator. The closing spring is actuated by pressing a button on the manual control or by melting a thermal fuse.

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.



*FDMB with spring return actuator*



*FDMB 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 for size: A<160 or B<160 class ATC 4 (old marking "B"), A≥160 a B≥160 class ATC 3 (old marking "C"), Internal leakage 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/FDMB/01/XX/X
- Hygienic assessment of fire dampers - Report No. 1.6/pos/19/19b

### Working conditions

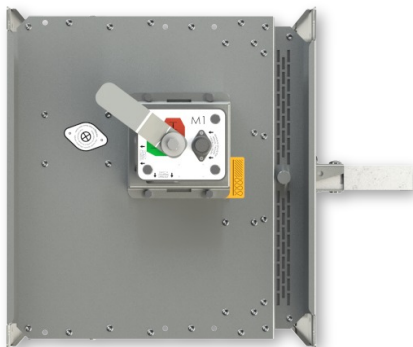
- Exact damper function is provided under the following conditions:
  - maximum air velocity 12 m/s
  - maximum pressure difference 1200 Pa
  - the air circulation in the whole damper section must be secured steady over the entire surface.
- Dampers can be installed in arbitrary position
- Dampers are 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).



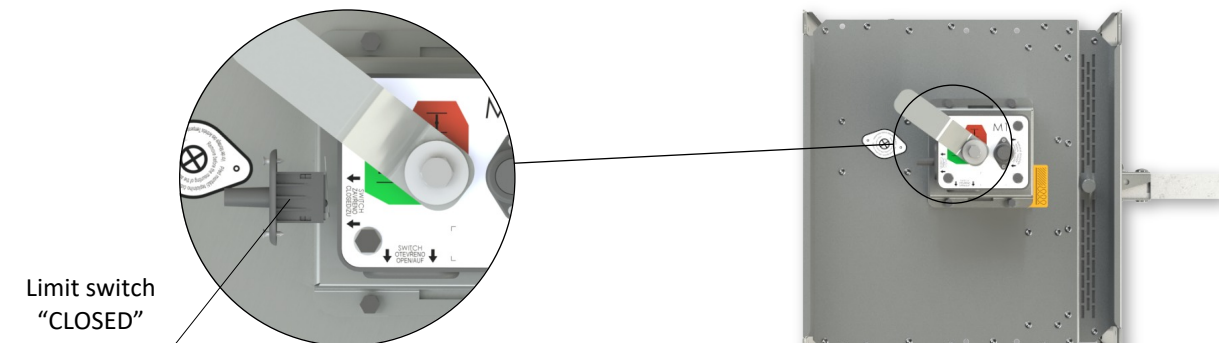
Design .01

#### ATTENTION:

- Manual controls are produced in three sizes M1 to M3, 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

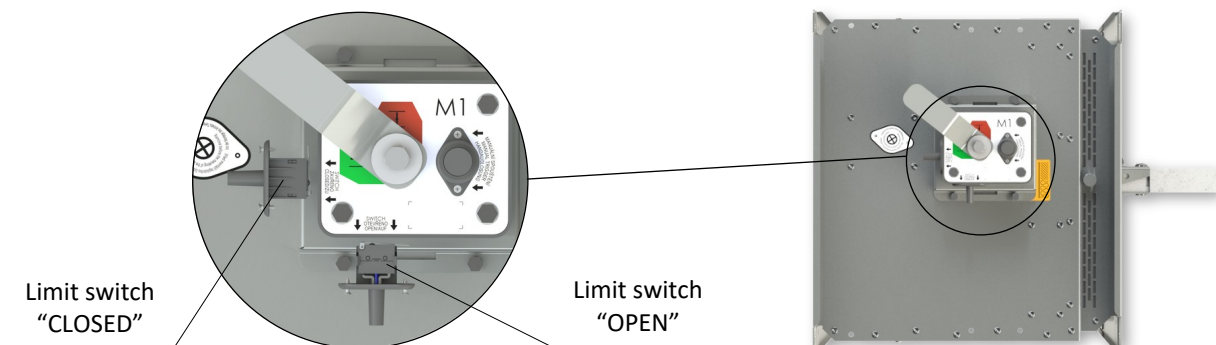
- Design .01 with manual control can be complemented with a limit switch signaling of the damper blade position "CLOSED".
- Cable is connected directly to limit switch.
- Limit switch detail → see page 5



Design .11

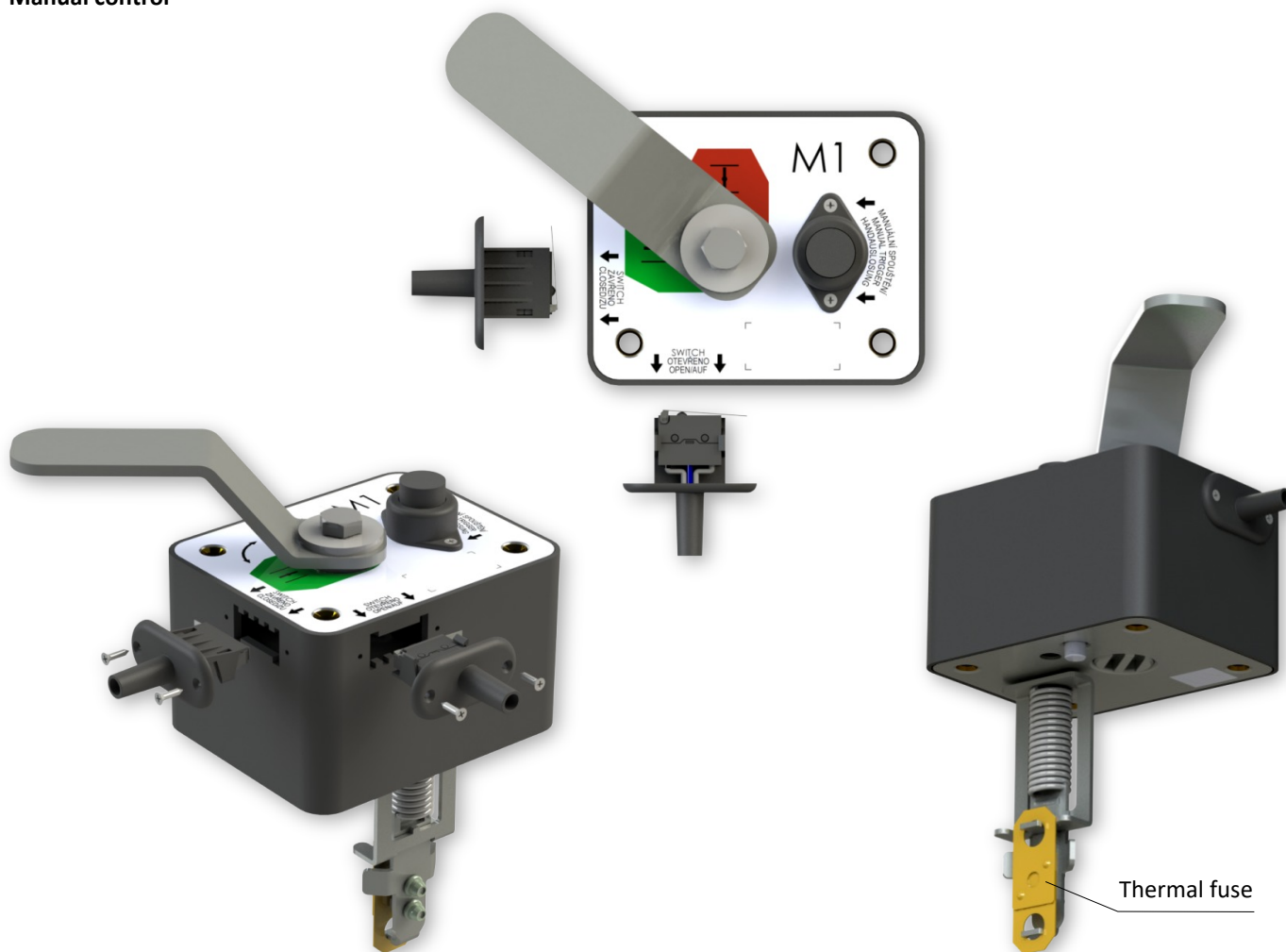
#### Design .80

- 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

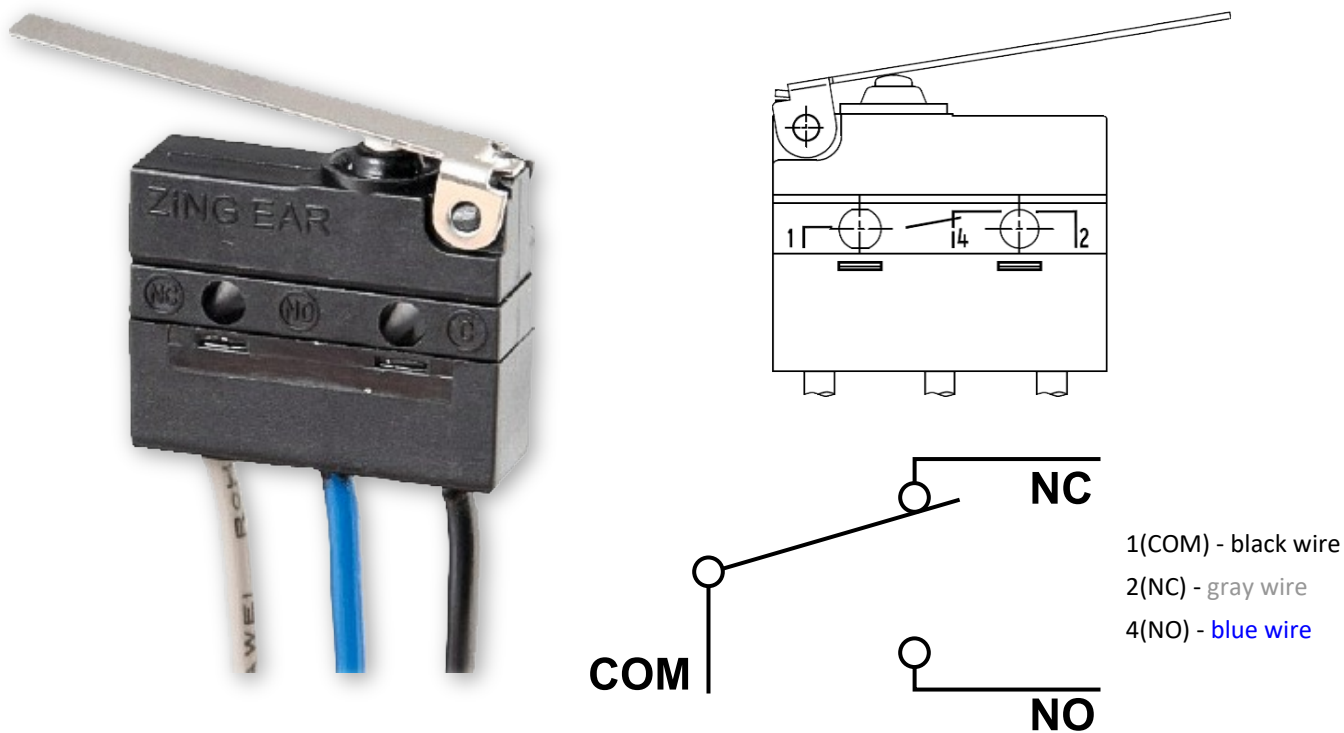


Design .80

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

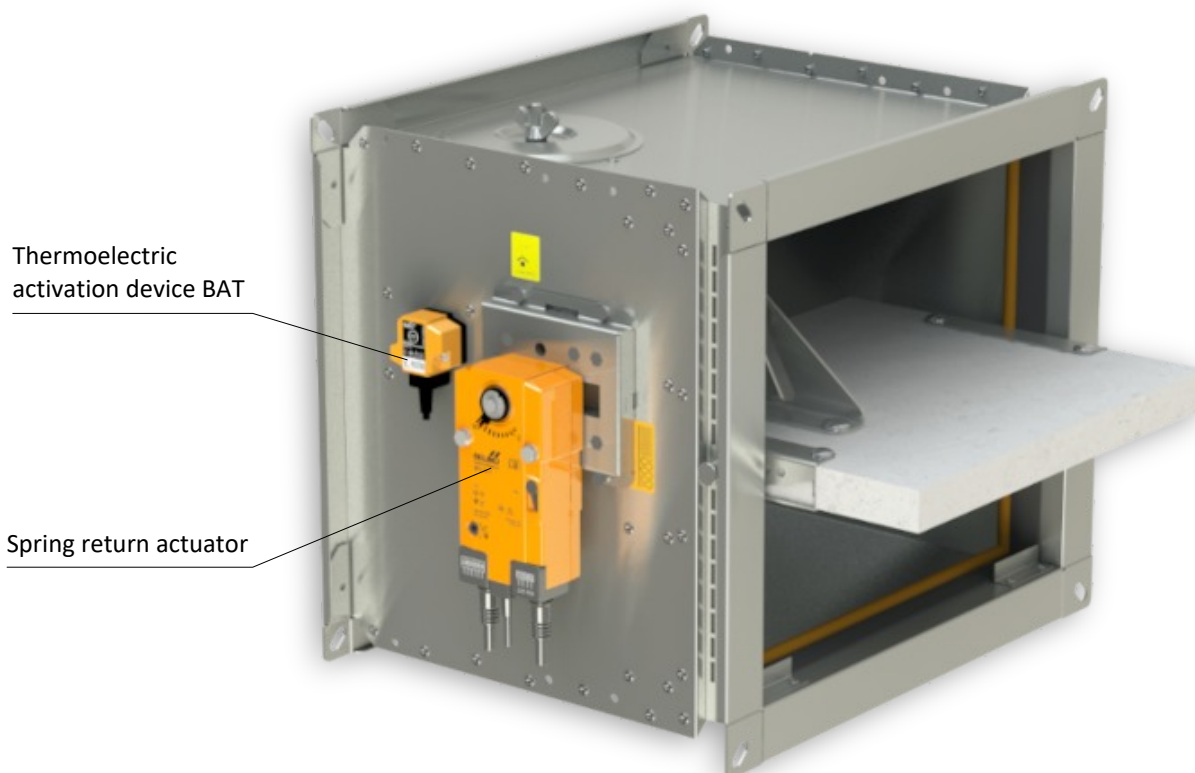
This limit switch is possible to connect in two following ways

- 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

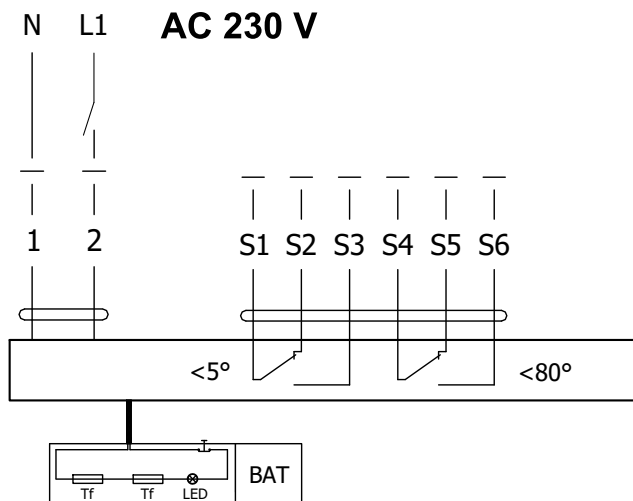
### Design .40 and .50

- 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.

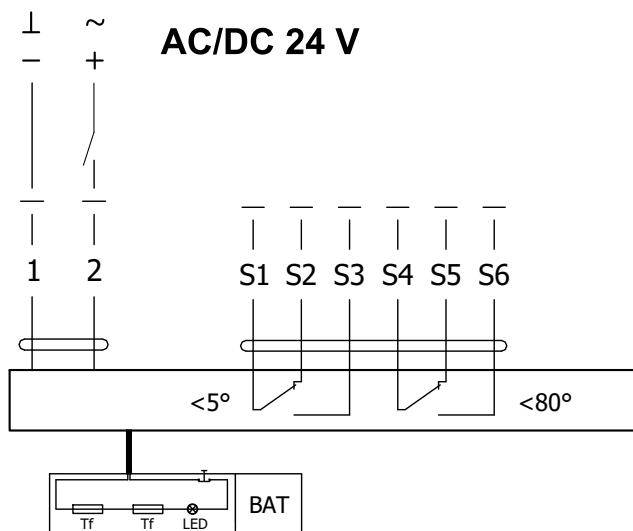


Design .40 and .50

**Actuator BELIMO BFL 230-T**



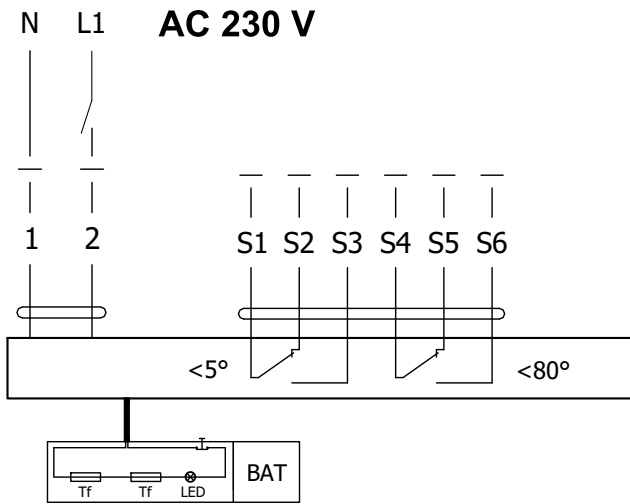
**Actuator BELIMO BFL 24-T(-ST)**



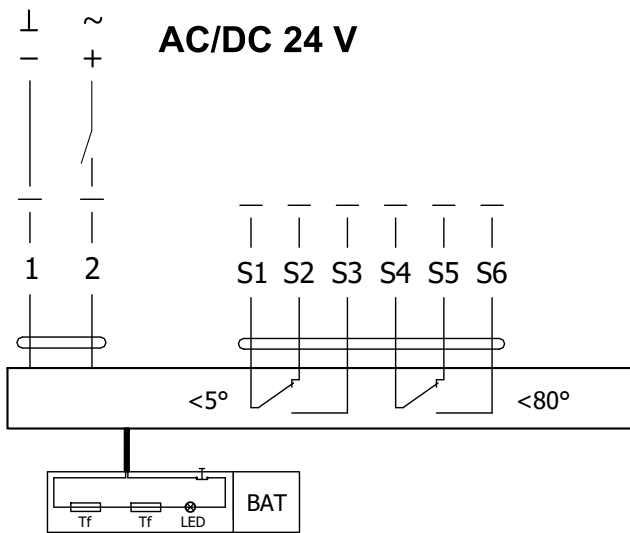
**Actuator BELIMO BFL 230-T(-ST), BFL 24-T(-ST)**

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	3,5 W 1,1 W	2,5 W 0,8 W
Dimensioning	6,5 VA (Imax 4 A @ 5 ms)	4 VA (Imax 8,3 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)

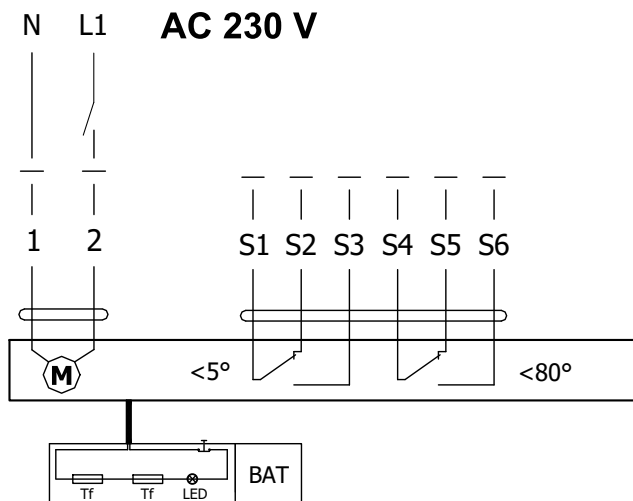


Actuator BELIMO BFN 230-T(-ST), BFN 24-T(-ST)

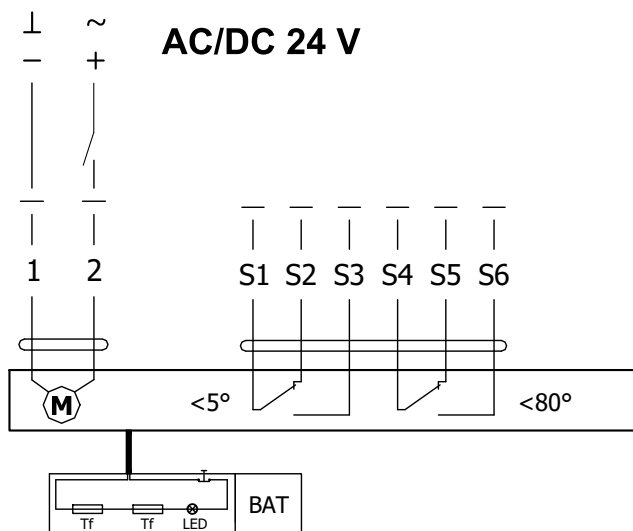
Actuator BELIMO - 9 Nm/ 7 Nm Spring	BFN 230-T(-ST)	BFN 24-T(-ST)
Power voltage	AC 230 V 50/60Hz	AC/DC 24 V 50/60Hz
Power consumption - in operation	5 W	4 W
- in rest position	2,1 W	1,4 W
Dimensioning	10 VA (I <sub>max</sub> 4 A @ 5 ms)	6 VA (I <sub>max</sub> 8,3 A @ 5 ms)
Protection class	II	III
Degree of protection	IP 54	
Running time - motor	< 60 s	
- spring return	~ 20 s	
Ambient temperature	-30°C ... +55°C	
- normal duty	The safe position will be attained up to max. +75°C	
- safety duty		
- non-operating temperature	-40°C ... +55°C	
Connection - supply/control	cable 1 m, 2 x 0,75 mm <sup>2</sup> (BFN 2xx-T-ST) with 3-pin plug-in connectors	
- auxiliary switch	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)**

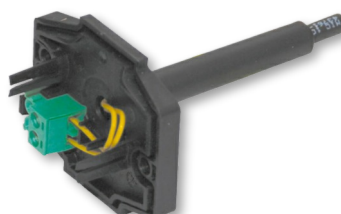
Actuator BELIMO - 18 Nm/ 12 Nm Spring	BF 230-TN(-ST)	BF 24-TN(-ST)
Power voltage	AC 230 V 50/60Hz	AC/DC 24 V 50/60Hz
Power consumption - in operation - in rest position	8,5 W 3 W	7 W 2 W
Dimensioning	11 VA (I <sub>max</sub> 8,3 A @ 5 ms)	10 VA (I <sub>max</sub> 8,3 A @ 5 ms)
Protection class	II	III
Degree 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**

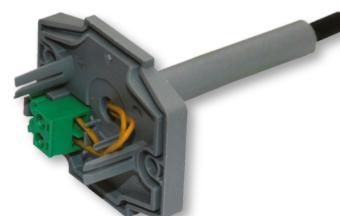
- If the thermal fuse Tf1 is interrupted (due to temperature outside the duct), it is necessary to replace the spring return actuator. Thermoelectric activation device BAT is integral part of the actuator.
- If the thermal fuse Tf2 is interrupted (due to temperature inside the duct), only the spare part 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.



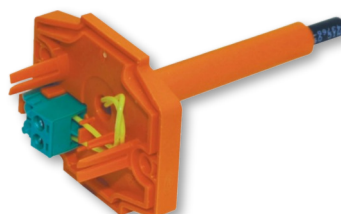
**BELIMO ZBAT 72**  
Black (BK) = 72°C (standard)



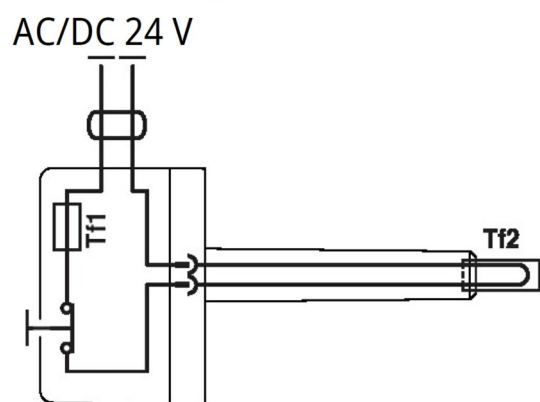
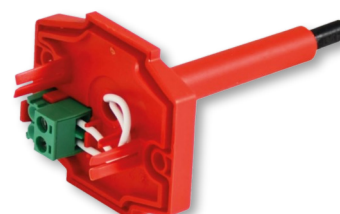
**BELIMO ZBAT 95**  
Grey (GY) = 95°C



**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

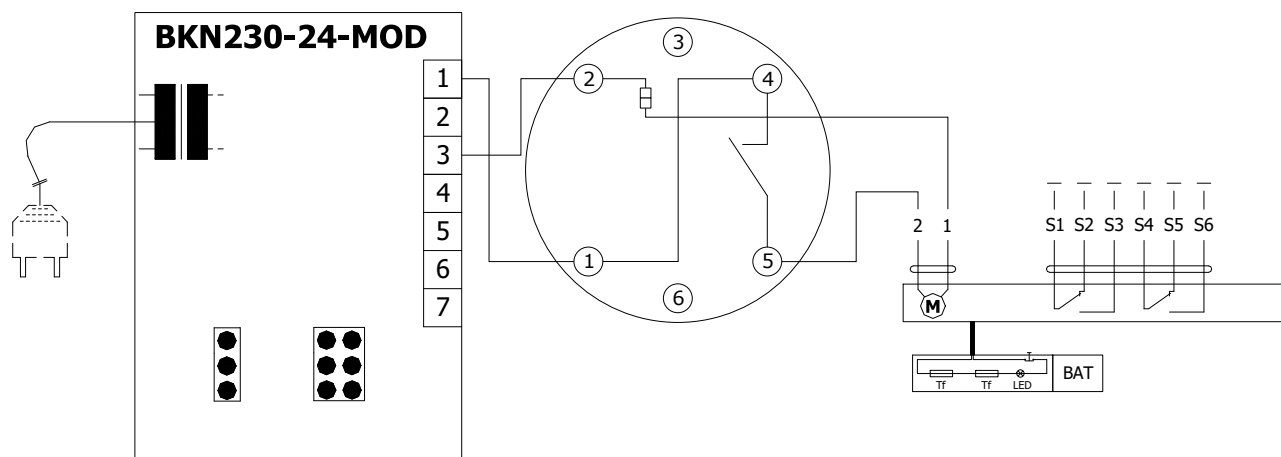
**Design .41 and .51**

- 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

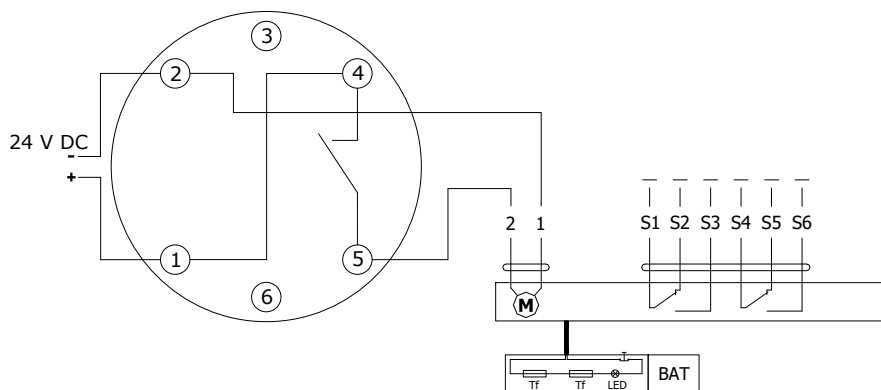
status is provided by interruption of supply voltage for min. 2s.

- Signalisation of damper blade position "OPEN" and "CLOSE" is provided by two microswitches.
- 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.

**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**

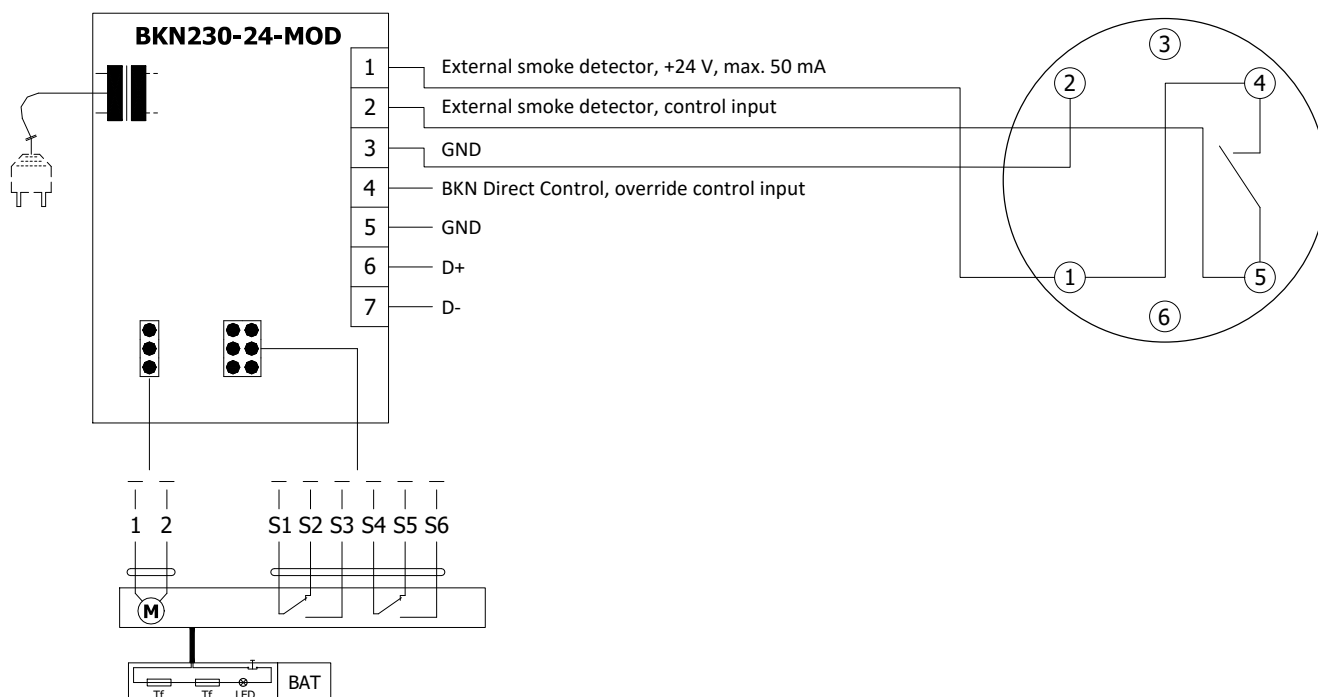
Nominal voltage	AC 230 V 50/60Hz
Power consumption	3 W (operating position)
Dimensioning	14 VA (including actuator)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-20°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net	cable 0,9 m with EURO plug type 26
- motor	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.
- 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.

### 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.

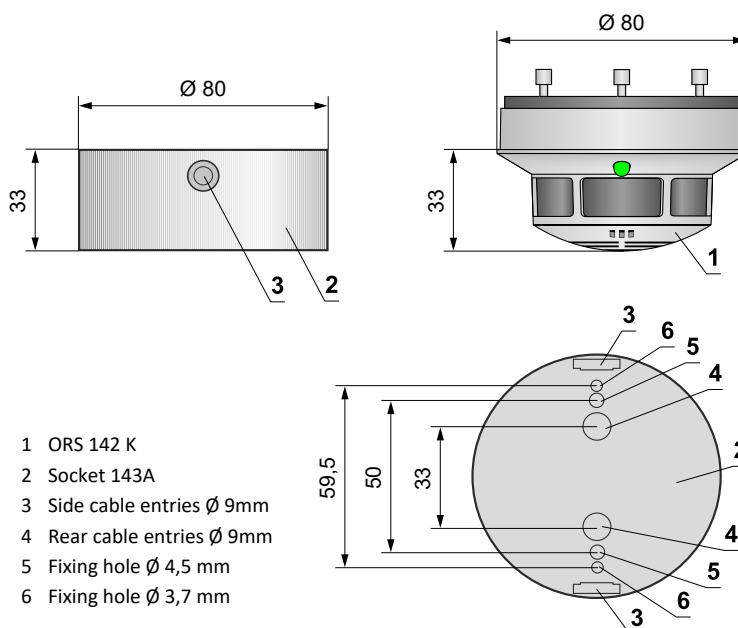
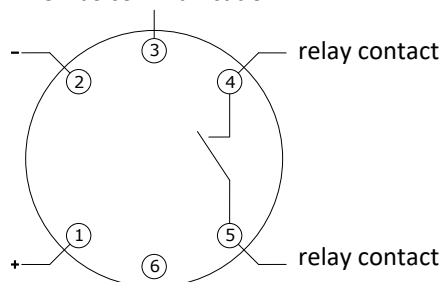
**ORS 142 K**



**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	-

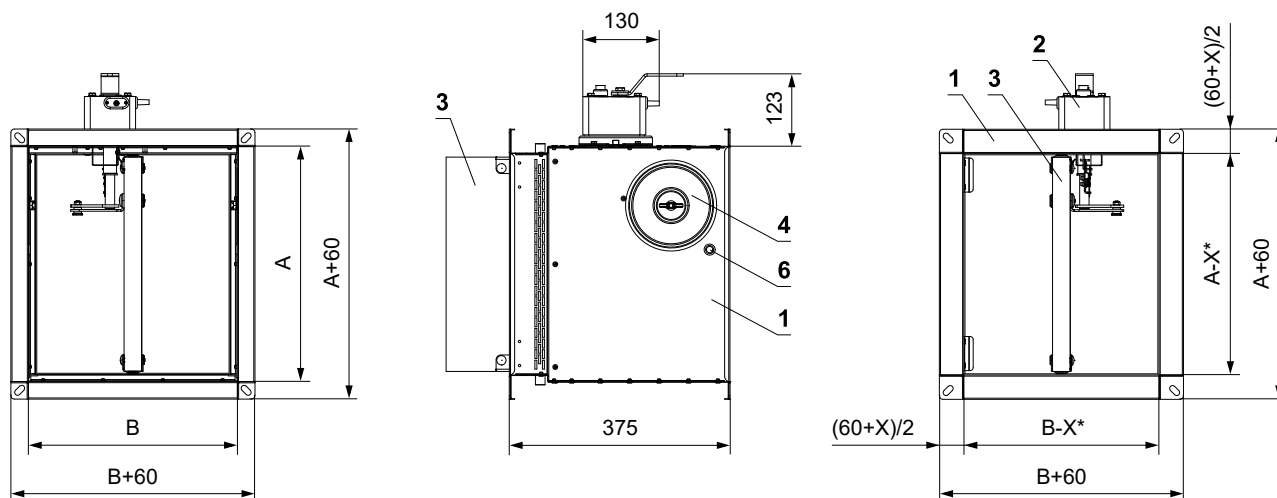
- 1 ORS 142 K
- 2 Socket 143A
- 3 Side cable entries Ø 9mm
- 4 Rear cable entries Ø 9mm
- 5 Fixing hole Ø 4,5 mm
- 6 Fixing hole Ø 3,7 mm

**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

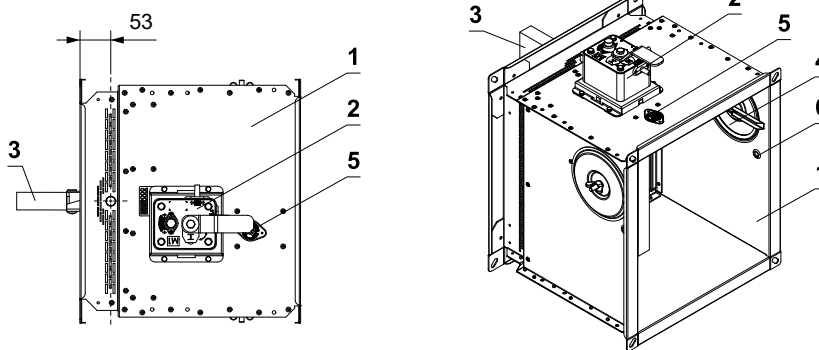
### III. DIMENSIONS

**FDMB with manual control**

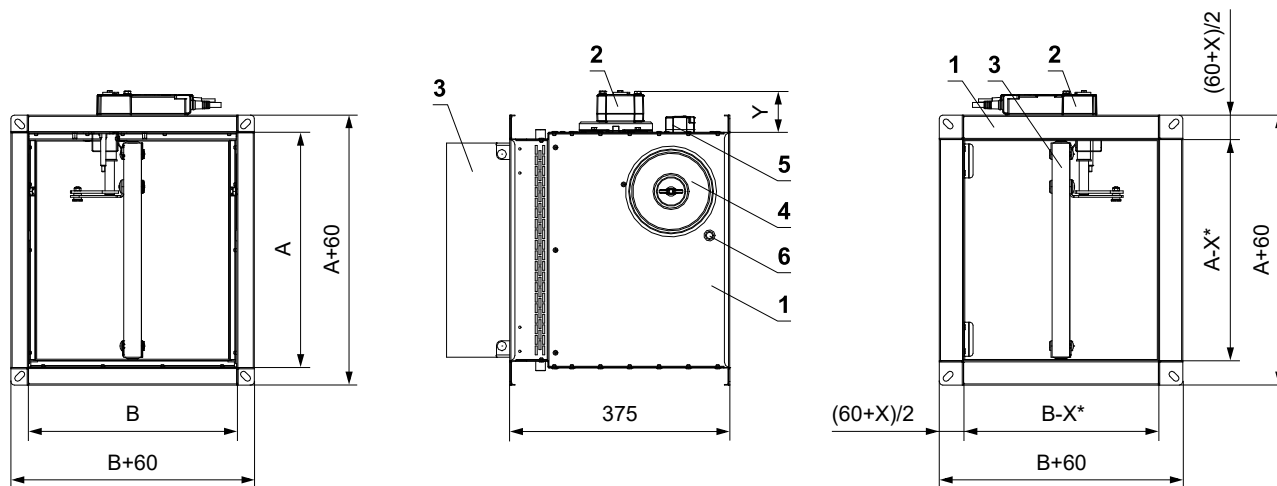


- \* X=14 (A<160 or B<160)
- \* X=23 (AxB≤500x400)
- \* X=36 (AxB>500x400)

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

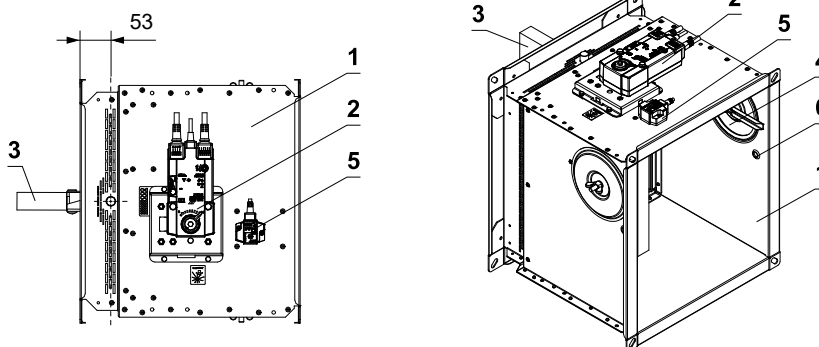


**FDMB with spring return actuator**



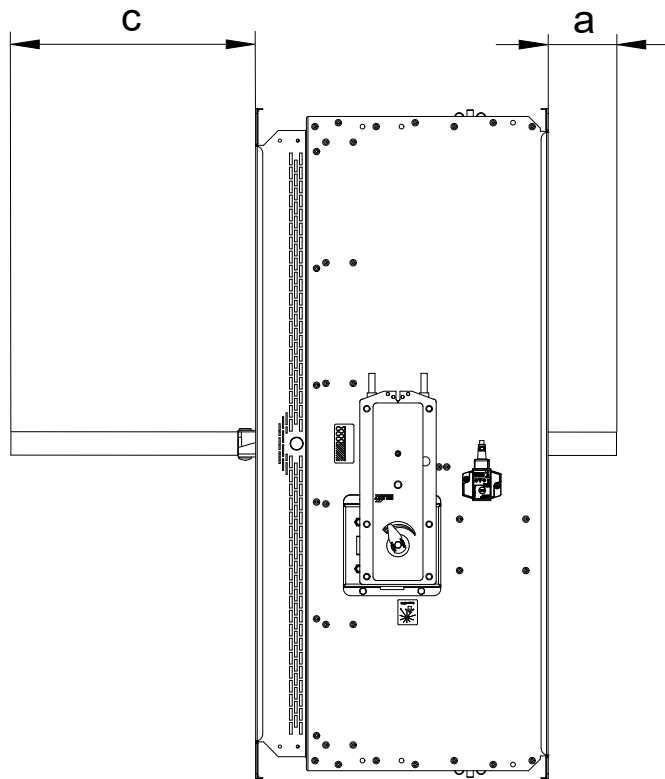
- \* X=14 (A<160 or B<160)      Y=72 mm (BFL)
- \* X=23 (AxB≤500x400)        Y=76 mm (BFN)
- \* X=36 (AxB>500x400)        Y=83 mm (BF)

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



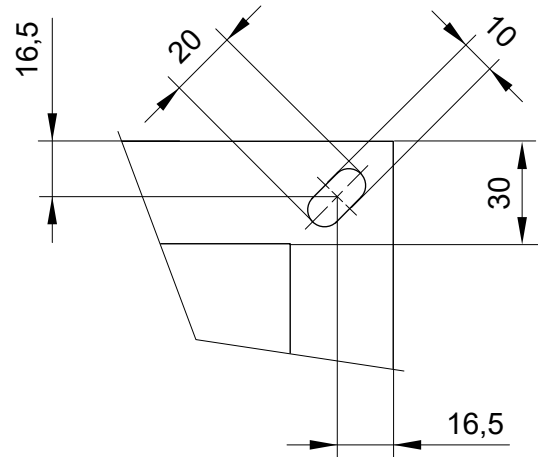
**Damper blade overlaps**

- 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

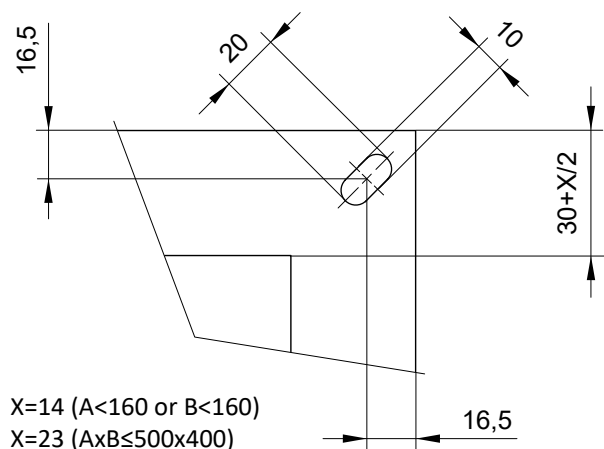


Values "a" and "c" has to be respected when projecting following air-conditioning duct.

**Flange of a damper - CONTROL SIDE**



**Flange of a damper - INSTALLATION SIDE**



- X=14 (A<160 or B<160)
- X=23 (AxB≤500x400)
- X=36 (AxB>500x400)

*30 mm wide flanges are fitted with oval holes in the corners*

Technical parameters

A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [m²]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [m²]	Spring return actuator	Manual control																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	a [mm]	c [mm]	Man. [kg]	Actu. [kg]*					a [mm]	c [mm]	Man. [kg]	Actu. [kg]*																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
100 x	100	-	-	4,8	4,9	0,0030	BFL	150 x	250	-	60	6,9	7,0	0,0234	BFL	M1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	110	-	-	4,9	5,0	0,0037			125	-	-	5,1	5,2	0,0048			140	-	5	5,2	5,3	0,0059	150	-	10	5,3	5,4	0,0066	160	-	15	5,4	5,5	0,0073	180	-	25	5,6	5,7	0,0088	200	-	35	5,8	5,9	0,0102	225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0	0,0034	BFL	160 x	280	-	75	6,5	6,6	0,0160	BFL	M1	110	-	-	5,0	5,1	0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-	85	8,3	8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	150 x	100	-	-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3	5,4	0,0058	125	-	-	5,5	5,6	0,0075	140	-	5	5,6	5,7	0,0092	150	-	10	5,7	5,8	0,0103	160	-	15	5,8	5,9	0,0114	180	-	25	6,0	6,1	0,0137	200	-	35	6,2	6,3	0,0159	225	-	47	6,5	6,6	0,0187	250	-	60	6,8	6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																																																																			
	125	-	-	5,1	5,2	0,0048			140	-	5	5,2	5,3	0,0059			150	-	10	5,3	5,4	0,0066	160	-	15	5,4	5,5	0,0073	180	-	25	5,6	5,7	0,0088	200	-	35	5,8	5,9	0,0102	225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-	75			6,5	6,6	0,0160	BFL	M1	110			-	-	5,0	5,1	0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x		100	-	-	5,1	5,2	0,0041			BFL	180 x	300	-	85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-		60	6,6	6,7	0,0186	140 x	100			-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47		6,3	6,4	0,0162	250	-	60			6,6	6,7	0,0186	150 x	100	-			-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3	5,4	0,0058	125	-	-	5,5	5,6	0,0075	140	-	5	5,6	5,7	0,0092	150	-	10	5,7	5,8	0,0103	160	-	15	5,8	5,9	0,0114	180	-	25	6,0	6,1	0,0137	200	-	35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																																																
	140	-	5	5,2	5,3	0,0059			150	-	10	5,3	5,4	0,0066			160	-	15	5,4	5,5	0,0073	180	-	25	5,6	5,7	0,0088	200	-	35	5,8	5,9	0,0102	225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6	0,0160			BFL	M1	110			-			-	5,0	5,1	0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x			100	-	-	5,1	5,2	0,0041					BFL	180 x	300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3		6,4	0,0162	250	-		60			6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118		200	-	35	6,1	6,2	0,0138			225	-	47		6,3	6,4			0,0162	250	-	60			6,6	6,7	0,0186	150 x	100	-			-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3	5,4	0,0058	125	-	-	5,5	5,6	0,0075	140	-	5	5,6	5,7	0,0092	150	-	10	5,7	5,8	0,0103	160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																													
	150	-	10	5,3	5,4	0,0066			160	-	15	5,4	5,5	0,0073			180	-	25	5,6	5,7	0,0088	200	-	35	5,8	5,9	0,0102	225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1	110					-			-			5,0	5,1	0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x				100	-	-	5,1	5,2	0,0041							BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138		225	-	47	6,3		6,4			0,0162	250	-		60					6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15		5,7	5,8	0,0099	180	-	25			5,9	6,0	0,0118		200	-			35	6,1	6,2	0,0138			225	-	47		6,3	6,4			0,0162	250	-	60			6,6	6,7	0,0186	150 x	100	-			-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3	5,4	0,0058	125	-	-	5,5	5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																										
	160	-	15	5,4	5,5	0,0073			180	-	25	5,6	5,7	0,0088			200	-	35	5,8	5,9	0,0102	225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1		110					-					-			5,0			5,1	0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x					100	-	-	5,1	5,2	0,0041											BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-		35	6,1	6,2	0,0138		225			-	47	6,3		6,4					0,0162	250	-		60					6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080		150	-	10	5,6	5,7	0,0089			160	-	15		5,7	5,8			0,0099	180	-	25			5,9	6,0	0,0118		200	-			35	6,1	6,2	0,0138			225	-	47		6,3	6,4			0,0162	250	-	60			6,6	6,7	0,0186	150 x	100	-			-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4	9,5	0,0349		BFL	M2	110	-	-	5,3			5,4	0,0058	125	-	-	5,5			5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																							
	180	-	25	5,6	5,7	0,0088			200	-	35	5,8	5,9	0,0102			225	-	47	6,0	6,1	0,0120	250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1		110						-					-					5,0			5,1			0,0043	125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x						100	-	-	5,1	5,2	0,0041															BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9		6,0	0,0118	200	-		35			6,1	6,2	0,0138		225					-	47	6,3		6,4					0,0162	250	-		60					6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-		5,3	5,4	0,0065	140	-	5			5,5	5,6	0,0080		150	-			10	5,6	5,7	0,0089			160	-	15		5,7	5,8			0,0099	180	-	25			5,9	6,0	0,0118		200	-			35	6,1	6,2	0,0138			225	-	47		6,3	6,4			0,0162	250	-	60			6,6	6,7	0,0186	150 x	100	-				-	5,2	5,3	0,0047			BFL	180 x	355	-	112	9,4			9,5	0,0349		BFL	M2	110	-	-	5,3			5,4	0,0058	125	-	-	5,5			5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																				
	200	-	35	5,8	5,9	0,0102			225	-	47	6,0	6,1	0,0120			250	-	60	6,2	6,3	0,0138	110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1		110						-						-					5,0					5,1			0,0043			125	-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x							100	-	-	5,1	5,2	0,0041																			BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099		180	-	25	5,9		6,0			0,0118	200	-		35					6,1	6,2	0,0138		225					-	47	6,3		6,4					0,0162	250	-		60					6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL			180 x	315	-	92	8,5	8,6	0,0300	BFL	M1		110	-	-	5,2	5,3	0,0050			125	-	-		5,3	5,4			0,0065	140	-	5			5,5	5,6	0,0080		150	-			10	5,6	5,7	0,0089			160	-	15		5,7	5,8			0,0099	180	-	25			5,9	6,0	0,0118		200	-			35	6,1	6,2	0,0138			225	-	47		6,3	6,4				0,0162	250	-	60					6,6	6,7	0,0186	150 x			100	-				-	5,2	5,3	0,0047			BFL	180 x	355	-	112	9,4			9,5	0,0349		BFL	M2	110	-	-	5,3			5,4	0,0058	125	-	-	5,5			5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																	
	225	-	47	6,0	6,1	0,0120			250	-	60	6,2	6,3	0,0138			110 x	100	-	-	4,9	5,0		0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1		110						-						-						5,0					5,1					0,0043			125			-	-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x								100	-	-	5,1	5,2	0,0041																							BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089	160	-		15	5,7	5,8	0,0099		180			-	25	5,9		6,0					0,0118	200	-		35					6,1	6,2	0,0138		225					-	47	6,3		6,4					0,0162	250	-		60					6,6	6,7	0,0186	140 x	100					-	-	5,1	5,2	0,0041	BFL				180 x	315	-	92	8,5	8,6			0,0300	BFL	M1		110	-			-	5,2	5,3	0,0050			125	-	-		5,3	5,4			0,0065	140	-	5			5,5	5,6	0,0080		150	-			10	5,6	5,7	0,0089			160	-	15		5,7	5,8			0,0099	180	-	25			5,9	6,0	0,0118		200	-				35	6,1	6,2	0,0138					225	-	47				6,3	6,4				0,0162	250	-	60					6,6	6,7	0,0186	150 x			100	-				-	5,2	5,3	0,0047			BFL	180 x	355	-	112	9,4			9,5	0,0349		BFL	M2	110	-	-	5,3			5,4	0,0058	125	-	-	5,5			5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215														
	250	-	60	6,2	6,3	0,0138			110 x	100	-	-	4,9	5,0				0,0034	BFL	160 x	280	-		75			6,5	6,6		0,0160			BFL	M1		110						-						-						5,0						5,1					0,0043					125			-			-	5,2	5,3	0,0055	140	-	5	5,3	5,4	0,0067	150	-	10	5,4	5,5	0,0075	160	-	15	5,5	5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x									100	-	-	5,1	5,2	0,0041																											BFL	180 x			300	-			85	8,3			8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050	125	-	-	5,3	5,4	0,0065	140	-	5	5,5	5,6	0,0080	150	-	10	5,6		5,7	0,0089	160	-		15			5,7	5,8	0,0099		180					-	25	5,9		6,0					0,0118	200	-		35					6,1	6,2	0,0138		225					-	47	6,3		6,4					0,0162	250	-		60					6,6	6,7	0,0186	140 x	100						-	-	5,1	5,2	0,0041			BFL				180 x	315			-	92	8,5	8,6			0,0300	BFL	M1		110	-			-	5,2	5,3	0,0050			125	-	-		5,3	5,4			0,0065	140	-	5			5,5	5,6	0,0080		150	-			10	5,6	5,7	0,0089			160	-	15		5,7	5,8				0,0099	180	-	25					5,9	6,0	0,0118				200	-				35	6,1	6,2	0,0138					225	-	47				6,3	6,4				0,0162	250	-	60					6,6	6,7	0,0186	150 x			100	-				-	5,2	5,3	0,0047			BFL	180 x	355	-	112	9,4			9,5	0,0349		BFL	M2	110	-	-	5,3			5,4	0,0058	125	-	-	5,5			5,6	0,0075		140	-	5	5,6	5,7	0,0092			150	-	10	5,7	5,8	0,0103			160	-		15	5,8	5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063	125	-	-	5,6	5,7	0,0082	140	-	5	5,7	5,8	0,0100	150	-	10	5,8	5,9	0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250
110 x	100	-	-	4,9	5,0	0,0034	BFL	160 x		280	-	75	6,5	6,6	0,0160	BFL		M1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	110	-	-	5,0	5,1	0,0043				125	-	-	5,2	5,3	0,0055						140	-		5			5,3	5,4		0,0067						150						-						10						5,4					5,5	0,0075					160	-	15			5,5			5,6	0,0084	180	-	25	5,7	5,8	0,0100	200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-	85	8,3	8,4	0,0282	BFL	M1	110	-	-	5,2	5,3	0,0050									125	-	-	5,3	5,4	0,0065	140	-	5							5,5	5,6																					0,0080	150			-	10			5,6	5,7			0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-		60	6,6	6,7	0,0186	140 x	100		-		-	5,1		5,2	0,0041	BFL		180 x					315	-	92		8,5					8,6	0,0300	BFL		M1					110	-	-		5,2					5,3	0,0050	125		-					-	5,3	5,4		0,0065				140		-	5	5,5	5,6	0,0080	150	-						10	5,6	5,7	0,0089	160	-	15			5,7				5,8	0,0099			180	-	25	5,9			6,0	0,0118	200		-	35			6,1	6,2	0,0138	225			-	47	6,3		6,4	0,0162			250	-	60	6,6			6,7	0,0186	150 x		100	-	-			5,2	5,3	0,0047	BFL	180 x	355			-	112	9,4		9,5	0,0349	BFL	M2				110	-	-	5,3					5,4	0,0058	125				-	-				5,5	5,6	0,0075	140					-	5	5,6				5,7	0,0092				150	-	10	5,7					5,8	0,0103	160	-			15	5,8				5,9	0,0114	180	-			25	6,0	6,1	0,0137	200	-			35	6,2		6,3	0,0159	225	-	47	6,5			6,6	0,0187	250	-	60	6,8			6,9	0,0215		150 x	100	-	-	5,3	5,4			0,0051	BFL	180 x	400	-	135			10,5	10,6		0,0392	BFL	M2	110	-	-			5,4	5,5	0,0063	125	-	-			5,6	5,7		0,0082	140	-	5	5,7	5,8			0,0100	150	-	10	5,8	5,9			0,0112	160	-	15	5,9	6,0	0,0124	180	-	25	6,2	6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																		
	125	-	-	5,2	5,3	0,0055				140	-	5	5,3	5,4	0,0067						150	-		10			5,4	5,5		0,0075						160						-						15					5,5	5,6					0,0084	180	-	25			5,7	5,8	0,0100			200	-	35	5,9	6,0	0,0116	225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-		85	8,3	8,4	0,0282	BFL	M1			110	-	-	5,2	5,3	0,0050			125	-	-	5,3	5,4	0,0065								140	-	5	5,5	5,6	0,0080	150	-	10	5,6	5,7	0,0089					160	-			15	5,7																	5,8	0,0099			180	-			25	5,9			6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	315	-	92		8,5		8,6	0,0300	BFL	M1	110	-	-					5,2	5,3		0,0050	125	-		-					5,3	5,4								0,0065	140	-		5					5,5	5,6	0,0080		150					-	10	5,6		5,7				0,0089		160	-	15	5,7	5,8	0,0099	180				-		25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138				225	-	47	6,3	6,4	0,0162	250	-			60	6,6	6,7		0,0186	150 x			100	-	-	5,2			5,3	0,0047	BFL		180 x	355			-	112	9,4	9,5			0,0349	BFL			M2	110	-			-	5,3	5,4			0,0058			125	-	-		5,5	5,6			0,0075			140	-	5	5,6	5,7	0,0092			150	-	10		5,7	5,8	0,0103	160				-	15	5,8	5,9					0,0114	180	-				25	6,0				6,1	0,0137	200	-					35	6,2	6,3	0,0159			225	-				47	6,5	6,6	0,0187			250	-	60	6,8	6,9	0,0215			150 x	100		-	-	5,3	5,4	0,0051	BFL			180 x	400	-	135	10,5	10,6			0,0392	BFL			M2	110	-	-	5,4			5,5			0,0063	125	-			-	5,6		5,7			0,0082	140	-			5	5,7	5,8	0,0100	150	-			10	5,8		5,9	0,0112	160	-	15	5,9			6,0	0,0124	180	-	25	6,2			6,3	0,0149	200	-	35	6,4	6,5	0,0173	225	-	47	6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																													
	140	-	5	5,3	5,4	0,0067				150	-	10	5,4	5,5	0,0075						160	-		15			5,5	5,6		0,0084						180						-					25	5,7					5,8	0,0100	200	-			35	5,9	6,0	0,0116			225	-	47	6,1	6,2	0,0137	250	-	60	6,4	6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-		85	8,3	8,4	0,0282	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-	-	5,3	5,4	0,0065			140	-	5	5,5	5,6	0,0080							150	-	10	5,6	5,7	0,0089	160	-	15	5,7	5,8	0,0099	180	-	25			5,9	6,0			0,0118	200			-	35													6,1	6,2			0,0138	225			-	47			6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	315	-		92	8,5	8,6	0,0300	BFL	M1			110	-	-		5,2	5,3	0,0050	125			-	-	5,3				5,4	0,0065	140	-	5	5,5	5,6		0,0080		150	-		10	5,6								5,7	0,0089	160		-					15	5,7	5,8		0,0099					180	-	25		5,9				6,0		0,0118	200	-	35	6,1	6,2	0,0138				225		-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7			0,0186	150 x	100	-	-	5,2	5,3	0,0047	BFL	180 x	355	-	112	9,4		9,5		0,0349	BFL	M2	110	-	-			5,3	5,4				0,0058			125	-	-	5,5			5,6					0,0075	140			-	5	5,6			5,7			0,0092	150	-		10	5,7			5,8			0,0103	160	-	15	5,8	5,9			0,0114	180	-		25	6,0	6,1	0,0137	200			-	35	6,2	6,3	0,0159	225			-	47	6,5		6,6	0,0187	250	-				60	6,8	6,9	0,0215					150 x	100	-	-			5,3	5,4				0,0051	BFL	180 x	400			-	135	10,5	10,6	0,0392	BFL				M2		110	-	-	5,4	5,5					0,0063	125	-	-	5,6			5,7					0,0082	140	-	5			5,7			5,8	0,0100	150			-	10		5,8			5,9	0,0112	160			-	15	5,9	6,0	0,0124	180			-	25		6,2	6,3	0,0149	200	-	35			6,4	6,5	0,0173	225	-	47			6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																								
	150	-	10	5,4	5,5	0,0075				160	-	15	5,5	5,6	0,0084						180	-		25			5,7	5,8		0,0100						200					-	35					5,9	6,0	0,0116	225			-	47	6,1	6,2			0,0137	250	-	60	6,4	6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-		85	8,3	8,4	0,0282	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-	5	5,5	5,6	0,0080			150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-			47	6,3			6,4	0,0162			250	-									60	6,6			6,7	0,0186			140 x	100			-	-	5,1	5,2	0,0041	BFL	180 x	315	-		92	8,5	8,6	0,0300	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-	-		5,3	5,4	0,0065	140			-	5	5,5		5,6		0,0080	150	-	10	5,6	5,7	0,0089		160	-	15	5,7	5,8	0,0099	180					-	25		5,9	6,0	0,0118		200					-	35	6,1		6,2					0,0138	225	-		47				6,3		6,4	0,0162	250	-	60	6,6	6,7				0,0186		150 x	100	-	-	5,2	5,3	0,0047	BFL	180 x	355			-		112	9,4	9,5	0,0349	BFL	M2			110	-	-	5,3	5,4	0,0058		125			-	-	5,5	5,6	0,0075	140	-				5	5,6	5,7	0,0092	150	-	10			5,7					5,8	0,0103			160	-	15			5,8			5,9	0,0114	180		-	25			6,0			6,1	0,0137	200	-	35	6,2			6,3	0,0159	225		-	47	6,5	6,6	0,0187			250	-	60	6,8	6,9	0,0215			150 x	100	-		-	5,3	5,4	0,0051	BFL			180 x	400	-	135	10,5	10,6				0,0392	BFL	M2	110	-	-	5,4				5,5			0,0063			125	-	-	5,6	5,7							0,0082	140	-	5	5,7					5,8	0,0100	150	-	10			5,8					5,9	0,0112	160	-			15			5,9	6,0	0,0124			180	-		25			6,2	6,3	0,0149			200	-	35	6,4	6,5	0,0173			225	-		47	6,6	6,7	0,0204	250	-			60	6,9	7,0	0,0215																																																					
	160	-	15	5,5	5,6	0,0084				180	-	25	5,7	5,8	0,0100						200	-		35			5,9	6,0		0,0116					225	-					47	6,1	6,2	0,0137			250	-	60	6,4			6,5	0,0157	125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x	300	-		85	8,3	8,4	0,0282	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-	10	5,6	5,7	0,0089			160	-	15	5,7	5,8	0,0099					180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x			100	-			-	5,1			5,2	0,0041					BFL	180 x			315	-				92			8,5	8,6	0,0300	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-	5		5,5	5,6	0,0080	150			-	10	5,6		5,7		0,0089	160	-	15	5,7	5,8	0,0099	180	-	25	5,9	6,0	0,0118	200	-				35	6,1	6,2	0,0138	225	-	47		6,3		6,4	0,0162		250	-	60		6,6					6,7	0,0186	150 x		100				-		-	5,2	5,3	0,0047	BFL	180 x	355				-			112	9,4	9,5	0,0349	BFL	M2			110			-		-	5,3	5,4	0,0058					125	-	-	5,5	5,6	0,0075		140			-	5	5,6	5,7	0,0092	150	-		10		5,7	5,8	0,0103	160	-	15	5,8	5,9	0,0114	180					-	25	6,0	6,1	0,0137	200	-			35			6,2	6,3	0,0159		225	-			47			6,5	6,6	0,0187	250	-	60			6,8	6,9	0,0215		150 x	100	-	-	5,3			5,4	0,0051	BFL	180 x	400	-				135	10,5		10,6	0,0392	BFL	M2					110	-	-	5,4	5,5				0,0063			125	-	-	5,6	5,7			0,0082			140	-	5	5,7	5,8	0,0100	150	-		10	5,8				5,9	0,0112	160	-	15					5,9	6,0	0,0124	180	-			25					6,2	6,3	0,0149	200			-			35	6,4	6,5			0,0173	225		-			47	6,6	6,7			0,0204	250	-	60	6,9	7,0			0,0215																																																																			
	180	-	25	5,7	5,8	0,0100				200	-	35	5,9	6,0	0,0116						225	-		47			6,1	6,2	0,0137	250					-	60	6,4	6,5			0,0157	125 x	100	-			-	5,1	5,2	0,0041	BFL	180 x	300	-		85	8,3	8,4	0,0282	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-	15	5,7	5,8	0,0099			180	-	25	5,9	6,0	0,0118				200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041		BFL	180 x	315	-			92	8,5			8,6	0,0300			BFL	M1					110	-				-			5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-	10		5,6	5,7	0,0089	160			-	15	5,7		5,8		0,0099	180	-	25	5,9	6,0	0,0118	200	-	35	6,1	6,2	0,0138	225	-		47		6,3	6,4	0,0162	250	-	60	6,6		6,7	0,0186	150 x	100	-	-	5,2	5,3		0,0047		BFL	180 x		355	-			112				9,4		9,5	0,0349	BFL	M2			110				-			-	5,3	5,4	0,0058					125			-		-	5,5	5,6	0,0075					140	-	5	5,6	5,7	0,0092		150			-	10	5,7	5,8	0,0103	160	-		15		5,8	5,9	0,0114	180	-	25	6,0	6,1	0,0137	200			-		35	6,2	6,3	0,0159	225	-	47			6,5	6,6	0,0187	250	-	60		6,8	6,9			0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL			180 x	400	-			135	10,5	10,6	0,0392			BFL	M2			110	-				-	5,4		5,5	0,0063							125	-	-	5,6	5,7				0,0082			140	-	5	5,7	5,8			0,0100			150	-	10	5,8	5,9	0,0112	160	-		15	5,9			6,0	0,0124	180	-	25	6,2		6,3	0,0149		200	-	35	6,4	6,5	0,0173	225	-					47	6,6	6,7	0,0204			250			-	60	6,9			7,0	0,0215																																																																																					
	200	-	35	5,9	6,0	0,0116				225	-	47	6,1	6,2	0,0137						250	-	60	6,4			6,5	0,0157	125 x	100	-	-			5,1	5,2	0,0041	BFL			180 x		300	-	85	8,3	8,4	0,0282	BFL	M1			110	-		-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-		15	5,7	5,8	0,0099					180	-	25	5,9	6,0	0,0118			200	-	35	6,1	6,2	0,0138			225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041		BFL	180 x	315	-	92	8,5				8,6	0,0300	BFL	M1	110	-			-	5,2							5,3	0,0050	125	-				-			5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-	15		5,7	5,8	0,0099	180			-	25	5,9		6,0		0,0118	200	-	35	6,1	6,2	0,0138	225	-	47	6,3	6,4	0,0162	250	-		60		6,6	6,7	0,0186	150 x	100	-	-	5,2	5,3	0,0047		BFL	180 x	355	-	112		9,4	9,5			0,0349	BFL	M2			110		-	-	5,3		5,4	0,0058					125				-			-	5,5	5,6	0,0075					140			-		5	5,6	5,7	0,0092					150	-	10	5,7	5,8	0,0103		160			-	15	5,8	5,9	0,0114	180	-		25		6,0	6,1	0,0137	200	-	35	6,2	6,3	0,0159	225			-		47	6,5	6,6	0,0187	250	-	60			6,8	6,9	0,0215	150 x	100	-	-	5,3	5,4			0,0051		BFL	180 x	400	-	135	10,5		10,6	0,0392		BFL	M2			110	-	-	5,4	5,5	0,0063					125	-				-	5,6		5,7	0,0082							140	-	5	5,7	5,8				0,0100			150	-	10	5,8	5,9			0,0112			160	-	15	5,9	6,0	0,0124	180	-		25	6,2			6,3	0,0149	200	-	35	6,4		6,5	0,0173		225	-	47	6,6	6,7	0,0204	250	-		60			6,9	7,0	0,0215																																																																																																		
	225	-	47	6,1	6,2	0,0137				250	-	60	6,4	6,5	0,0157		125 x				100	-	-	5,1	5,2	0,0041	BFL	180 x		300	-	85			8,3	8,4	0,0282		BFL	M1			110	-	-	5,2	5,3	0,0050					125	-		-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-		15	5,7	5,8	0,0099					180	-		25	5,9	6,0	0,0118					200	-	35	6,1	6,2	0,0138			225	-	47	6,3	6,4	0,0162		250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041		BFL	180 x	315	-	92	8,5				8,6	0,0300	BFL	M1				110	-			-	5,2	5,3	0,0050	125	-							-	5,3	5,4	0,0065	140	-		5			5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-		15	5,7	5,8	0,0099					180	-	25		5,9	6,0	0,0118	200			-	35	6,1		6,2		0,0138	225	-	47	6,3	6,4	0,0162	250	-	60	6,6	6,7	0,0186	150 x	100		-		-	5,2	5,3		0,0047	BFL	180 x	355	-	112				9,4	9,5	0,0349	BFL	M2	110			-					-	5,3	5,4	0,0058	125	-	-	5,5					5,6		0,0075	140	-			5	5,6	5,7	0,0092					150			-		10	5,7	5,8	0,0103					160	-	15	5,8	5,9	0,0114		180			-	25	6,0	6,1	0,0137	200	-		35		6,2	6,3	0,0159	225	-	47	6,5	6,6	0,0187	250			-		60	6,8	6,9	0,0215	150 x	100	-			-	5,3	5,4		0,0051	BFL	180 x	400	-			135				10,5	10,6	0,0392	BFL		M2	110				-		-	5,4	5,5	0,0063	125	-					-	5,6	5,7	0,0082		140	-		5	5,7				5,8	0,0100		150	-	10	5,8	5,9				0,0112			160	-	15	5,9	6,0			0,0124			180	-	25	6,2	6,3	0,0149	200	-		35	6,4			6,5	0,0173	225	-	47	6,6		6,7	0,0204		250	-	60	6,9	7,0	0,0215																																																																																																											
	250	-	60	6,4	6,5	0,0157			125 x	100	-	-	5,1	5,2	0,0041				BFL	180 x	300	-	85	8,3	8,4	0,0282				BFL	M1	110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065					140	-		5	5,5	5,6	0,0080					150	-		10	5,6	5,7	0,0089					160	-		15	5,7	5,8	0,0099					180	-		25	5,9	6,0	0,0118					200	-		35	6,1	6,2	0,0138					225	-	47	6,3	6,4	0,0162			250	-	60	6,6	6,7	0,0186	140 x	100	-	-	5,1	5,2	0,0041		BFL	180 x	315	-	92	8,5				8,6	0,0300	BFL	M1				110	-						-	5,2			5,3	0,0050	125	-	-	5,3	5,4	0,0065					140	-	5	5,5	5,6	0,0080		150	-	10	5,6	5,7	0,0089					160	-		15	5,7	5,8	0,0099					180	-		25	5,9	6,0	0,0118					200	-	35		6,1	6,2	0,0138	225			-	47	6,3		6,4		0,0162	250	-	60	6,6	6,7	0,0186	150 x	100	-	-	5,2	5,3		0,0047		BFL		180 x	355	-		112			9,4	9,5	0,0349				BFL	M2	110			-			-				5,3	5,4	0,0058	125	-	-	5,5	5,6	0,0075					140	-	5	5,6	5,7	0,0092		150	-	10	5,7					5,8	0,0103	160	-		15	5,8	5,9	0,0114					180	-	25	6,0	6,1	0,0137		200			-	35	6,2	6,3	0,0159	225	-		47		6,5	6,6	0,0187	250	-	60	6,8	6,9	0,0215	150 x			100		-	-	5,3	5,4		0,0051	BFL			180 x	400	-		135			10,5	10,6			0,0392				BFL	M2	110				-				-		5,4	5,5	0,0063	125	-	-					5,6	5,7	0,0082	140		-	5	5,7	5,8	0,0100				150	-		10	5,8	5,9	0,0112	160	-	15		5,9			6,0	0,0124	180	-	25	6,2	6,3	0,0149			200	-	35	6,4	6,5	0,0173	225	-		47	6,6			6,7	0,0204	250	-	60	6,9		7,0	0,0215																																																																																																																		
125 x	100	-	-	5,1	5,2	0,0041	BFL	180 x		300	-	85	8,3	8,4	0,0282	BFL		M1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	110	-	-	5,2	5,3	0,0050				125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099					180	-		25	5,9	6,0	0,0118					200	-		35	6,1	6,2	0,0138					225	-		47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x	315	-	92	8,5	8,6	0,0300	BFL	M1	110	-	-	5,2	5,3	0,0050		125	-	-	5,3	5,4	0,0065				140	-	5	5,5				5,6	0,0080						150	-						10	5,6			5,7	0,0089	160	-	15	5,7	5,8	0,0099					180	-	25	5,9	6,0	0,0118		200	-	35	6,1	6,2	0,0138					225	-		47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					150 x	100	-	-	5,2	5,3	0,0047	BFL			180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3		5,4	0,0058	125	-	-		5,5	5,6		0,0075		140	-		5			5,6	5,7	0,0092						150			-			10				5,7	5,8	0,0103	160	-	15	5,8	5,9	0,0114					180	-	25	6,0	6,1	0,0137		200	-	35	6,2					6,3	0,0159	225	-		47	6,5	6,6	0,0187					250	-	60	6,8	6,9	0,0215		150 x			100	-	-	5,3	5,4	0,0051	BFL		180 x		400	-	135	10,5	10,6	0,0392	BFL	M2	110			-	-		5,4	5,5	0,0063	125		-		-	5,6		5,7	0,0082		140			-	5	5,7	5,8	0,0100						150				-				10		5,8	5,9	0,0112	160	-	15					5,9	6,0	0,0124	180		-	25	6,2	6,3	0,0149				200	-		35	6,4	6,5	0,0173	225	-	47		6,6			6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																																																										
	125	-	-	5,3	5,4	0,0065				140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118					200	-		35	6,1	6,2	0,0138					225	-		47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x		315	-	92	8,5	8,6	0,0300	BFL	M1			110	-	-	5,2	5,3	0,0050			125	-	-	5,3	5,4	0,0065		140	-	5	5,5	5,6	0,0080				150	-	10	5,6				5,7	0,0089						160	-						15	5,7			5,8	0,0099	180	-	25	5,9	6,0	0,0118					200	-	35	6,1	6,2	0,0138		225	-	47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					150 x	100	-	-	5,2	5,3	0,0047			BFL	180 x		355	-	112	9,4	9,5	0,0349		BFL	M2		110	-	-	5,3	5,4	0,0058			125	-	-	5,5		5,6	0,0075	140	-	5		5,6	5,7		0,0092		150	-		10			5,7	5,8	0,0103						160			-			15				5,8	5,9	0,0114	180	-	25	6,0	6,1	0,0137					200	-	35	6,2	6,3	0,0159		225	-	47	6,5					6,6	0,0187	250	-		60	6,8	6,9	0,0215					150 x	100	-	-	5,3	5,4	0,0051				BFL	180 x	400	-	135	10,5		10,6		0,0392	BFL	M2	110	-	-	5,4			5,5		0,0063	125	-	-	5,6	5,7	0,0082	140		-		5	5,7		5,8	0,0100		150			-	10	5,8	5,9	0,0112						160				-				15		5,9	6,0	0,0124	180	-	25					6,2	6,3	0,0149	200		-	35	6,4	6,5	0,0173				225	-		47	6,6	6,7	0,0204	250	-	60		6,9			7,0	0,0215																																																																																																																																																
	140	-	5	5,5	5,6	0,0080				150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138					225	-		47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x		315	-	92	8,5	8,6	0,0300	BFL	M1				110	-	-	5,2	5,3	0,0050					125	-	-	5,3	5,4	0,0065			140	-	5	5,5	5,6	0,0080		150	-	10	5,6	5,7	0,0089				160	-	15	5,7				5,8	0,0099						180	-						25	5,9			6,0	0,0118	200	-	35	6,1	6,2	0,0138					225	-	47	6,3	6,4	0,0162		250	-	60	6,6	6,7	0,0186					150 x	100	-	-	5,2	5,3	0,0047			BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058					125	-	-	5,5	5,6	0,0075			140	-	5	5,6		5,7	0,0092	150	-	10		5,7	5,8		0,0103		160	-		15			5,8	5,9	0,0114						180			-			25				6,0	6,1	0,0137	200	-	35	6,2	6,3	0,0159					225	-	47	6,5	6,6	0,0187		250	-	60	6,8					6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051			BFL	180 x		400	-	135	10,5	10,6	0,0392		BFL	M2			110	-	-	5,4		5,5		0,0063			125	-	-	5,6			5,7		0,0082	140	-	5	5,7	5,8	0,0100	150		-		10	5,8		5,9	0,0112		160			-	15	5,9	6,0	0,0124						180				-				25		6,2	6,3	0,0149	200	-	35					6,4	6,5	0,0173	225		-	47	6,6	6,7	0,0204				250	-		60	6,9	7,0	0,0215																																																																																																																																																									
	150	-	10	5,6	5,7	0,0089				160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138						225	-	47	6,3	6,4	0,0162					250	-		60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x		315	-	92	8,5	8,6	0,0300	BFL	M1				110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065					140	-	5	5,5	5,6	0,0080			150	-	10	5,6	5,7	0,0089		160	-	15	5,7	5,8	0,0099				180	-	25	5,9				6,0	0,0118						200	-						35	6,1			6,2	0,0138	225	-	47	6,3	6,4	0,0162					250	-	60	6,6	6,7	0,0186	150 x	100	-	-	5,2	5,3	0,0047			BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075					140	-	5	5,6	5,7	0,0092			150	-	10	5,7		5,8	0,0103	160	-	15		5,8	5,9		0,0114		180	-		25			6,0	6,1	0,0137						200			-			35				6,2	6,3	0,0159	225	-	47	6,5	6,6	0,0187					250	-	60	6,8	6,9	0,0215	150 x	100	-	-	5,3			5,4	0,0051	BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6		5,7		0,0082			140	-	5	5,7			5,8		0,0100	150	-	10	5,8	5,9	0,0112	160		-		15	5,9		6,0	0,0124		180			-	25	6,2	6,3	0,0149						200				-				35		6,4	6,5	0,0173	225	-	47					6,6	6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																																																																																				
	160	-	15	5,7	5,8	0,0099				180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138						225	-	47	6,3	6,4	0,0162						250	-	60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x		315	-	92	8,5	8,6	0,0300	BFL	M1				110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080					150	-	10	5,6	5,7	0,0089			160	-	15	5,7	5,8	0,0099		180	-	25	5,9	6,0	0,0118				200	-	35	6,1				6,2	0,0138						225	-			47			6,3	6,4			0,0162	250	-	60	6,6	6,7	0,0186	150 x			100	-	-	5,2	5,3	0,0047	BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075						140	-	5	5,6	5,7	0,0092					150	-	10	5,7	5,8	0,0103			160	-	15	5,8		5,9	0,0114	180	-	25		6,0	6,1		0,0137		200	-		35			6,2	6,3	0,0159						225			-			47			6,5	6,6	0,0187	250	-	60	6,8	6,9	0,0215	150 x			100	-	-	5,3	5,4	0,0051	BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7		5,8		0,0100			150	-	10	5,8			5,9		0,0112	160	-	15	5,9	6,0	0,0124	180		-		25	6,2		6,3	0,0149		200			-	35	6,4	6,5	0,0173						225				-				47	6,6	6,7	0,0204	250	-	60	6,9			7,0	0,0215																																																																																																																																																																													
	180	-	25	5,9	6,0	0,0118				200	-	35	6,1	6,2	0,0138						225	-	47	6,3	6,4	0,0162						250	-	60	6,6	6,7	0,0186					140 x	100	-	-	5,1	5,2	0,0041			BFL	180 x		315	-	92	8,5	8,6	0,0300	BFL	M1				110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089					160	-	15	5,7	5,8	0,0099			180	-	25	5,9	6,0	0,0118		200	-	35	6,1	6,2	0,0138				225	-	47	6,3				6,4	0,0162			250			-	60			6,6	6,7	0,0186	150 x	100			-	-	5,2	5,3	0,0047	BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075						140	-	5	5,6	5,7	0,0092						150	-	10	5,7	5,8	0,0103					160	-	15	5,8	5,9	0,0114			180	-	25	6,0		6,1	0,0137	200	-	35		6,2	6,3		0,0159		225	-		47			6,5	6,6	0,0187	250					-			60	6,8	6,9	0,0215			150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8		5,9		0,0112			160	-	15	5,9			6,0		0,0124	180	-	25	6,2	6,3	0,0149	200		-		35	6,4		6,5	0,0173		225			-	47	6,6	6,7	0,0204	250					-		60		6,9	7,0			0,0215																																																																																																																																																																																								
	200	-	35	6,1	6,2	0,0138				225	-	47	6,3	6,4	0,0162						250	-	60	6,6	6,7	0,0186			140 x			100	-	-	5,1	5,2	0,0041	BFL			180 x		315	-	92	8,5	8,6	0,0300	BFL	M1				110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099					180	-	25	5,9	6,0	0,0118			200	-	35	6,1	6,2	0,0138		225	-	47	6,3	6,4	0,0162				250	-	60	6,6	6,7			0,0186	150 x			100	-	-	5,2	5,3			0,0047	BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075						140	-	5	5,6	5,7	0,0092						150	-	10	5,7	5,8	0,0103						160	-	15	5,8	5,9	0,0114					180	-	25	6,0	6,1	0,0137			200	-	35	6,2		6,3	0,0159	225	-	47		6,5	6,6		0,0187		250	-	60	6,8			6,9	0,0215	150 x	100	-	-			5,3			5,4	0,0051	BFL	180 x	400	-		135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9		6,0		0,0124			180	-	25	6,2			6,3		0,0149	200	-	35	6,4	6,5	0,0173	225		-		47	6,6		6,7	0,0204	250	-			60	6,9	7,0	0,0215																																																																																																																																																																																																							
	225	-	47	6,3	6,4	0,0162				250	-	60	6,6	6,7	0,0186		140 x				100	-	-	5,1	5,2	0,0041	BFL	180 x				315	-	92	8,5	8,6	0,0300		BFL	M1			110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118					200	-	35	6,1	6,2	0,0138			225	-	47	6,3	6,4	0,0162		250	-	60	6,6	6,7	0,0186	150 x			100	-	-	5,2	5,3	0,0047	BFL	180 x				355	-	112	9,4	9,5	0,0349	BFL	M2				110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075						140	-	5	5,6	5,7	0,0092						150	-	10	5,7	5,8	0,0103						160	-	15	5,8	5,9	0,0114						180	-	25	6,0	6,1	0,0137					200	-	35	6,2	6,3	0,0159			225	-	47	6,5		6,6	0,0187	250	-	60	6,8	6,9	0,0215		150 x		100	-	-	5,3	5,4	0,0051	BFL	180 x		400	-	135			10,5	10,6	0,0392	BFL	M2			110	-		-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2		6,3		0,0149			200	-	35	6,4			6,5		0,0173	225	-	47	6,6	6,7	0,0204	250	-	60		6,9	7,0		0,0215																																																																																																																																																																																																																
	250	-	60	6,6	6,7	0,0186			140 x	100	-	-	5,1	5,2	0,0041				BFL	180 x	315	-	92	8,5	8,6	0,0300				BFL	M1	110	-	-	5,2	5,3	0,0050						125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138					225	-	47	6,3	6,4	0,0162			250	-	60	6,6	6,7	0,0186	150 x	100	-	-	5,2	5,3	0,0047		BFL	180 x	355	-	112	9,4	9,5	0,0349				BFL	M2	110	-	-	5,3	5,4	0,0058						125	-	-	5,5	5,6	0,0075						140	-	5	5,6	5,7	0,0092						150	-	10	5,7	5,8	0,0103						160	-	15	5,8	5,9	0,0114						180	-	25	6,0	6,1	0,0137						200	-	35	6,2	6,3	0,0159					225	-	47	6,5	6,6	0,0187			250	-	60	6,8	6,9	0,0215	150 x	100	-	-	5,3	5,4	0,0051	BFL		180 x	400	-	135	10,5	10,6	0,0392				BFL	M2	110	-	-	5,4	5,5	0,0063					125	-		-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4		6,5		0,0173			225	-	47	6,6			6,7	0,0204	250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																									
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	110	-	-	5,2	5,3	0,0050				125	-	-	5,3	5,4	0,0065						140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138						225	-	47	6,3	6,4	0,0162						250	-	60	6,6	6,7	0,0186					150 x	100	-	-	5,2	5,3	0,0047			BFL	180 x	355	-	112	9,4	9,5	0,0349	BFL	M2	110	-	-	5,3	5,4	0,0058		125	-	-	5,5	5,6	0,0075				140	-	5	5,6	5,7	0,0092						150	-	10	5,7	5,8	0,0103						160	-	15	5,8	5,9	0,0114						180	-	25	6,0	6,1	0,0137						200	-	35	6,2	6,3	0,0159						225	-	47	6,5	6,6	0,0187						250	-	60	6,8	6,9	0,0215					150 x	100	-	-	5,3	5,4	0,0051	BFL			180 x	400	-	135	10,5	10,6	0,0392	BFL	M2	110	-	-	5,4	5,5	0,0063		125	-	-	5,6	5,7	0,0082				140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112					160	-		15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																						
	125	-	-	5,3	5,4	0,0065				140	-	5	5,5	5,6	0,0080						150	-	10	5,6	5,7	0,0089						160	-	15	5,7	5,8	0,0099						180	-	25	5,9	6,0	0,0118						200	-	35	6,1	6,2	0,0138						225	-	47	6,3	6,4	0,0162						250	-	60	6,6	6,7	0,0186					150 x	100	-	-	5,2	5,3	0,0047			BFL	180 x		355	-	112	9,4	9,5	0,0349	BFL	M2			110	-	-	5,3	5,4	0,0058			125	-	-	5,5	5,6	0,0075		140	-	5	5,6	5,7	0,0092				150	-	10	5,7	5,8	0,0103						160	-	15	5,8	5,9	0,0114						180	-	25	6,0	6,1	0,0137						200	-	35	6,2	6,3	0,0159						225	-	47	6,5	6,6	0,0187						250	-	60	6,8	6,9	0,0215					150 x	100	-	-	5,3	5,4	0,0051			BFL	180 x		400	-	135	10,5	10,6	0,0392		BFL	M2		110	-	-	5,4	5,5	0,0063			125	-	-	5,6	5,7	0,0082		140	-	5	5,7	5,8	0,0100				150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124					180	-		25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																	
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	160	-	15	5,8	5,9	0,0114				180	-	25	6,0	6,1	0,0137						200	-	35	6,2	6,3	0,0159						225	-	47	6,5	6,6	0,0187						250	-	60	6,8	6,9	0,0215					150 x	100	-	-	5,3	5,4	0,0051			BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100					150	-	10	5,8	5,9	0,0112			160	-	15	5,9	6,0	0,0124		180	-	25	6,2	6,3	0,0149				200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																	
	180	-	25	6,0	6,1	0,0137				200	-	35	6,2	6,3	0,0159						225	-	47	6,5	6,6	0,0187						250	-	60	6,8	6,9	0,0215					150 x	100	-	-	5,3	5,4	0,0051			BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112					160	-	15	5,9	6,0	0,0124			180	-	25	6,2	6,3	0,0149		200	-	35	6,4	6,5	0,0173				225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																												
	200	-	35	6,2	6,3	0,0159				225	-	47	6,5	6,6	0,0187						250	-	60	6,8	6,9	0,0215			150 x			100	-	-	5,3	5,4	0,0051	BFL			180 x		400	-	135	10,5	10,6	0,0392	BFL	M2				110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124					180	-	25	6,2	6,3	0,0149			200	-	35	6,4	6,5	0,0173		225	-	47	6,6	6,7	0,0204				250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																							
	225	-	47	6,5	6,6	0,0187				250	-	60	6,8	6,9	0,0215		150 x				100	-	-	5,3	5,4	0,0051	BFL	180 x				400	-	135	10,5	10,6	0,0392		BFL	M2			110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149					200	-	35	6,4	6,5	0,0173			225	-	47	6,6	6,7	0,0204		250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																
	250	-	60	6,8	6,9	0,0215			150 x	100	-	-	5,3	5,4	0,0051				BFL	180 x	400	-	135	10,5	10,6	0,0392				BFL	M2	110	-	-	5,4	5,5	0,0063						125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173					225	-	47	6,6	6,7	0,0204			250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																							
150 x	100	-	-	5,3	5,4	0,0051	BFL	180 x		400	-	135	10,5	10,6	0,0392	BFL		M2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	110	-	-	5,4	5,5	0,0063				125	-	-	5,6	5,7	0,0082						140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
	125	-	-	5,6	5,7	0,0082				140	-	5	5,7	5,8	0,0100						150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	140	-	5	5,7	5,8	0,0100				150	-	10	5,8	5,9	0,0112						160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
	150	-	10	5,8	5,9	0,0112				160	-	15	5,9	6,0	0,0124						180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	160	-	15	5,9	6,0	0,0124				180	-	25	6,2	6,3	0,0149						200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	180	-	25	6,2	6,3	0,0149				200	-	35	6,4	6,5	0,0173						225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
	200	-	35	6,4	6,5	0,0173				225	-	47	6,6	6,7	0,0204						250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	225	-	47	6,6	6,7	0,0204				250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	250	-	60	6,9	7,0	0,0215																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										

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 blade overlaps		Weight		Effective area Sef [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [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]*				
180 x	710	10	280	13,6	14,0	0,0797	BFN	M2	710	10	280	14,7	15,1	0,1078	BFN	M2
	750	30	300	14,1	14,5	0,0849			750	30	300	15,2	15,6	0,1147		
	800	55	325	14,7	15,1	0,0913			800	55	325	15,8	16,2	0,1233		
	900	105	375	15,9	16,3	0,1041			900	105	375	17,1	17,5	0,1406		
	1000	155	425	17,0	17,4	0,1169			1000	155	425	18,4	20,5	0,1579		
200 x	100	-	-	6,0	6,1	0,0072	BFL	M1	100	-	-	6,4	6,5	0,0093	BFL	M1
	110	-	-	6,1	6,2	0,0089			110	-	-	6,6	6,7	0,0115		
	125	-	-	6,3	6,4	0,0115			125	-	-	6,8	6,9	0,0149		
	140	-	5	6,4	6,5	0,0141			140	-	5	7,0	7,1	0,0182		
	150	-	10	6,6	6,7	0,0158			150	-	10	7,1	7,2	0,0204		
	160	-	15	7,0	7,1	0,0149			160	-	15	7,5	7,6	0,0194		
	180	-	25	7,2	7,3	0,0181			180	-	25	7,7	7,8	0,0236		
	200	-	35	7,4	7,5	0,0213			200	-	35	8,0	8,1	0,0278		
	225	-	47	7,7	7,8	0,0253			225	-	47	8,3	8,4	0,0331		
	250	-	60	8,0	8,1	0,0294			250	-	60	8,6	8,7	0,0384		
	280	-	75	8,3	8,4	0,0342	280	-	75	9,0	9,1	0,0447				
	300	-	85	8,9	9,0	0,0374	300	-	85	9,6	9,7	0,0489				
	315	-	92	9,1	9,2	0,0398	315	-	92	9,8	9,9	0,0521				
	355	-	112	10,0	10,1	0,0463	355	-	112	10,7	10,8	0,0605				
	400	-	135	10,5	10,6	0,0535	400	-	135	11,3	11,4	0,0700				
	450	-	150	11,2	11,3	0,0537	450	-	150	12,0	12,1	0,0719				
	500	-	175	11,8	11,9	0,0611	500	-	175	12,7	12,8	0,0818				
	550	-	200	12,1	12,2	0,0685	550	-	200	13,1	13,2	0,0917				
	560	-	205	12,3	12,4	0,0700	560	-	205	13,2	13,3	0,0937				
	600	-	225	12,8	12,9	0,0759	600	-	225	13,8	14,2	0,1016				
630	-	240	13,1	13,2	0,0804	630	-	240	14,2	14,6	0,1075					
650	-	250	13,4	13,5	0,0833	650	-	250	14,4	14,8	0,1115					
700	5	275	14,0	14,4	0,0907	700	5	275	15,1	15,5	0,1214					
710	10	280	14,1	14,5	0,0922	710	10	280	15,2	15,6	0,1234					
750	30	300	14,6	15,0	0,0981	750	30	300	15,8	16,2	0,1313					
800	55	325	15,2	15,6	0,1055	800	55	325	16,5	16,9	0,1412					
900	105	375	16,4	16,8	0,1203	900	105	375	17,8	18,2	0,1610					
1000	155	425	17,6	18,0	0,1351	1000	155	425	19,1	21,2	0,1808					
225 x	100	-	-	6,2	6,3	0,0083	BFL	M1	100	-	-	6,7	6,8	0,0106	BFL	M1
	110	-	-	6,3	6,4	0,0102			110	-	-	6,8	6,9	0,0131		
	125	-	-	6,5	6,6	0,0132			125	-	-	7,1	7,2	0,0169		
	140	-	5	6,7	6,8	0,0162			140	-	5	7,3	7,4	0,0207		
	150	-	10	6,8	6,9	0,0181			150	-	10	7,4	7,5	0,0232		
	160	-	15	7,2	7,3	0,0171			160	-	15	7,8	7,9	0,0221		
	180	-	25	7,5	7,6	0,0209			180	-	25	8,1	8,2	0,0269		
	200	-	35	7,7	7,8	0,0246			200	-	35	8,3	8,4	0,0317		
	225	-	47	8,0	8,1	0,0292			225	-	47	8,7	8,8	0,0377		
	250	-	60	8,3	8,4	0,0339			250	-	60	9,0	9,1	0,0438		
	280	-	75	8,7	8,8	0,0395	280	-	75	9,1	9,2	0,0510				
	300	-	85	9,2	9,3	0,0432	300	-	85	9,4	9,5	0,0558				
	315	-	92	9,4	9,5	0,0460	315	-	92	10,0	10,1	0,0594				
	355	-	112	10,3	10,4	0,0534	355	-	112	10,2	10,3	0,0691				
	400	-	135	10,9	11,0	0,0618	400	-	135	11,2	11,3	0,0799				
	450	-	150	11,6	11,7	0,0628	450	-	150	11,8	11,9	0,0828				
	500	-	175	12,2	12,3	0,0714	500	-	175	12,5	12,6	0,0942				
	550	-	200	12,6	12,7	0,0801	550	-	200	13,2	13,3	0,1056				
	560	-	205	12,8	12,9	0,0818	560	-	205	13,7	14,1	0,1078				
	600	-	225	13,3	13,4	0,0887	600	-	225	13,8	14,2	0,1170				
630	-	240	13,7	14,1	0,0939	630	-	240	14,4	14,8	0,1238					
650	-	250	13,9	14,3	0,0974	650	-	250	14,8	15,2	0,1284					
700	5	275	14,5	14,9	0,1060	700	5	275	15,1	15,5	0,1398					

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 blade overlaps		Weight		Effective area Sef [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [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]*			
280 x	710	10	280	15,8	16,2	0,1420		710	10	280	16,7	17,1	0,1638		M2
	750	30	300	15,9	16,3	0,1512	BFN	750	30	300	17,3	17,7	0,1744	BFN	M2
	800	55	325	16,5	16,9	0,1626		800	55	325	18,1	18,5	0,1875		M3
	900	105	375	17,2	19,3	0,1854	BF	900	105	375	19,6	21,7	0,2138	BF	M3
	1000	155	425	18,6	20,7	0,2082		1000	155	425	21,0	23,1	0,2401		
300 x	100	-	-	6,9	7,0	0,0114		100	-	-	7,7	7,8	0,0137		
	110	-	-	7,0	7,1	0,0141		110	-	-	7,9	8,0	0,0170		
	125	-	-	7,3	7,4	0,0182		125	-	-	8,1	8,2	0,0219		
	140	-	5	7,5	7,6	0,0223		140	-	5	8,4	8,5	0,0268		
	150	-	10	7,6	7,7	0,0250		150	-	10	8,5	8,6	0,0301		
	160	-	15	8,0	8,1	0,0239		160	-	15	8,6	8,7	0,0288		
	180	-	25	8,3	8,4	0,0291		180	-	25	8,9	9,0	0,0352		
	200	-	35	8,6	8,7	0,0343		200	-	35	9,2	9,3	0,0415		
	225	-	47	8,9	9,0	0,0408	BFL	225	-	47	9,6	9,7	0,0494	BFL	M1
	250	-	60	9,3	9,4	0,0474		250	-	60	10,0	10,1	0,0573		
	280	-	75	9,7	9,8	0,0552		280	-	75	10,4	10,5	0,0668		
	300	-	85	10,3	10,4	0,0604		300	-	85	11,0	11,1	0,0731		
	315	-	92	10,5	10,6	0,0643		315	-	92	11,3	11,4	0,0778		
	355	-	112	11,5	11,6	0,0748		355	-	112	12,3	12,4	0,0905		
	400	-	135	12,1	12,2	0,0865		400	-	135	13,0	13,1	0,1047		
	450	-	150	12,9	13,0	0,0900		450	-	150	13,8	13,9	0,1100		
	500	-	175	13,6	13,7	0,1024		500	-	175	14,6	15,0	0,1251		
	550	-	200	14,1	14,5	0,1148		550	-	200	15,1	15,5	0,1403		
	560	-	205	14,2	14,6	0,1173		560	-	205	15,3	15,7	0,1433		
600	-	225	14,8	15,2	0,1272		600	-	225	15,9	16,3	0,1554			
630	-	240	15,2	15,6	0,1347		630	-	240	16,4	16,8	0,1645	BFN	M2	
650	-	250	15,5	15,9	0,1396	BFN	650	-	250	16,7	17,1	0,1706			
700	5	275	16,2	16,6	0,1520		700	5	275	17,5	17,9	0,1857			
710	10	280	16,4	16,8	0,1545		710	10	280	17,7	18,1	0,1888			
750	30	300	17,0	17,4	0,1644		750	30	300	18,3	18,7	0,2009			
800	55	325	17,7	18,1	0,1768		800	55	325	19,1	21,2	0,2160			
900	105	375	19,2	21,3	0,2016		900	105	375	20,6	22,7	0,2463	BF	M3	
1000	155	425	20,6	22,7	0,2264	BF	1000	155	425	22,2	24,3	0,2766			
315 x	100	-	-	7,0	7,1	0,0121		100	-	-	8,2	8,3	0,0156		
	110	-	-	7,2	7,3	0,0149		110	-	-	8,4	8,5	0,0193		
	125	-	-	7,4	7,5	0,0192		125	-	-	8,6	8,7	0,0249		
	140	-	5	7,6	7,7	0,0235		140	-	5	8,9	9,0	0,0305		
	150	-	10	7,8	7,9	0,0264		150	-	10	9,0	9,1	0,0342		
	160	-	15	8,2	8,3	0,0252		160	-	15	9,1	9,2	0,0329		
	180	-	25	8,5	8,6	0,0308		180	-	25	9,4	9,5	0,0401		
	200	-	35	8,7	8,8	0,0363		200	-	35	9,7	9,8	0,0473		
	225	-	47	9,1	9,2	0,0432	BFL	225	-	47	10,1	10,2	0,0563	BFL	M1
	250	-	60	9,5	9,6	0,0501		250	-	60	10,5	10,6	0,0654		
	280	-	75	9,9	10,0	0,0584		280	-	75	11,0	11,1	0,0762		
	300	-	85	10,5	10,6	0,0639		300	-	85	11,7	11,8	0,0834		
	315	-	92	10,7	10,8	0,0680		315	-	92	11,9	12,0	0,0888		
	355	-	112	11,7	11,8	0,0791		355	-	112	13,0	13,1	0,1033		
	400	-	135	12,3	12,4	0,0915		400	-	135	13,7	13,8	0,1195		
	450	-	150	13,2	13,3	0,0955		450	-	150	14,6	14,7	0,1263		
	500	-	175	13,9	14,0	0,1086		500	-	175	15,4	15,8	0,1437		
	550	-	200	14,4	14,8	0,1218		550	-	200	16,0	16,4	0,1611		
	560	-	205	14,5	14,9	0,1244		560	-	205	16,2	16,6	0,1646		
600	-	225	15,1	15,5	0,1349		600	-	225	16,9	17,3	0,1785	BFN	M2	
630	-	240	15,6	16,0	0,1428	BFN	630	-	240	17,4	17,8	0,1890			
650	-	250	15,9	16,3	0,1481		650	-	250	17,7	18,1	0,1959			
700	5	275	16,6	17,0	0,1612		700	5	275	18,5	18,9	0,2133			

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 blade overlaps		Weight		Effective area Sef [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [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]*							
400 x	710	10	280	18,7	19,1	0,2168	BFN	M2	500 x 1000	125	-	-	10,3	10,4	0,0350	BF	M3		
	750	30	300	19,4	21,5	0,2307	140	-		5	10,5	10,6	0,0428						
	800	55	325	20,2	22,3	0,2481	150	-		10	10,7	10,8	0,0480						
	900	105	375	21,9	24,0	0,2829	160	-		15	10,8	10,9	0,0364						
	1000	155	425	23,5	25,6	0,3177	180	-		25	11,1	11,2	0,0463						
450 x	125	-	-	9,2	9,3	0,0283	BFL	M1	550 x	200	-	35	11,5	11,6	0,0563	BFL	M1		
	140	-	5	9,4	9,5	0,0346				225	-	47	12,0	12,1	0,0687				
	150	-	10	9,6	9,7	0,0388				250	-	60	12,5	12,6	0,0812				
	160	-	15	9,6	9,7	0,0374				280	-	75	13,1	13,2	0,0961				
	180	-	25	10,0	10,1	0,0456				300	-	85	13,8	13,9	0,1061				
	200	-	35	10,3	10,4	0,0538				315	-	92	14,1	14,2	0,1135				
	225	-	47	10,7	10,8	0,0641				355	-	112	15,3	15,4	0,1335				
	250	-	60	11,2	11,3	0,0744				400	-	135	16,2	16,6	0,1559				
	280	-	75	11,7	11,8	0,0867				450	-	150	17,2	17,6	0,1808				
	300	-	85	12,3	12,4	0,0949				500	-	175	18,2	18,6	0,2057				
	315	-	92	12,6	12,7	0,1011				550	-	200	18,9	19,3	0,2306				
	355	-	112	13,7	13,8	0,1175				560	-	205	19,1	19,5	0,2356				
	400	-	135	14,5	14,6	0,1360				600	-	225	19,9	20,3	0,2555				
	450	-	150	15,5	15,9	0,1445				630	-	240	20,5	22,6	0,2704				
	500 x	500	-	175	16,4	16,8				0,1644	BFN	M2	600 x	650	-			250	20,9
550		-	200	17,0	17,4	0,1843	700	5	275	21,9				24,0	0,3053				
560		-	205	17,2	17,6	0,1883	710	10	280	22,1				24,2	0,3103				
600		-	225	17,9	18,3	0,2042	750	30	300	23,0				25,1	0,3302				
630		-	240	18,4	18,8	0,2161	800	55	325	24,0				26,1	0,3551				
650		-	250	18,8	19,2	0,2241	900	105	375	26,0				28,1	0,4049				
700		5	275	19,7	21,8	0,2440	125	-	-	10,4				10,5	0,0356	BFL	M1		
710		10	280	19,8	21,9	0,2480	140	-	5	10,7				10,8	0,0436				
750		30	300	20,6	22,7	0,2639	150	-	10	10,8				10,9	0,0489				
800		55	325	21,5	23,6	0,2838	160	-	15	10,9				11,0	0,0371				
900		105	375	23,2	25,3	0,3236	180	-	25	11,2				11,3	0,0472				
1000		155	425	25,0	27,1	0,3634	200	-	35	11,6				11,7	0,0574				
125		-	-	9,7	9,8	0,0316	225	-	47	12,1				12,2	0,0701				
140		-	5	10,0	10,1	0,0387	250	-	60	12,6				12,7	0,0828				
150		-	10	10,2	10,3	0,0434	280	-	75	13,2				13,3	0,0980				
160	-	15	10,1	10,2	0,0419	300	-	85	13,9	14,0	0,1082								
180	-	25	10,5	10,6	0,0511	315	-	92	14,2	14,3	0,1158								
200	-	35	10,9	11,0	0,0603	355	-	112	15,4	15,5	0,1361								
225	-	47	11,3	11,4	0,0718	400	-	135	16,3	16,7	0,1590								
250	-	60	11,8	11,9	0,0834	450	-	150	17,4	17,8	0,1844								
280	-	75	12,3	12,4	0,0972	500	-	175	18,4	18,8	0,2098								
300	-	85	13,0	13,1	0,1064	550	-	200	19,1	19,5	0,2352								
315	-	92	13,3	13,4	0,1133	560	-	205	19,3	19,7	0,2403								
355	-	112	14,5	14,6	0,1318	600	-	225	20,1	20,5	0,2606								
400	-	135	15,3	15,4	0,1525	630	-	240	20,8	22,9	0,2758								
450	-	150	16,3	16,7	0,1626	650	-	250	21,2	23,3	0,2860								
500	-	175	17,3	17,7	0,1850	700	5	275	22,2	24,3	0,3114								
550	-	200	18,0	18,4	0,2074	710	10	280	22,4	24,5	0,3165								
560	-	205	18,1	18,5	0,2119	750	30	300	23,2	25,3	0,3368								
600	-	225	18,9	19,3	0,2298	800	55	325	24,2	26,3	0,3622								
630	-	240	19,5	19,9	0,2433	140	-	5	11,1	11,2	0,0469								
650	-	250	19,9	22,0	0,2522	150	-	10	11,3	11,4	0,0526								
700	5	275	20,8	22,9	0,2746	160	-	15	11,3	11,4	0,0400								
710	10	280	21,0	23,1	0,2791	180	-	25	11,7	11,8	0,0510								
750	30	300	21,8	23,9	0,2970	200	-	35	12,1	12,2	0,0619								
800	55	325	22,7	24,8	0,3194	225	-	47	12,6	12,7	0,0756								
900	105	375	24,6	26,7	0,3642														

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 blade overlaps		Weight		Effective area Sef [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [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]*																																																																																																																																																																																																																																																																																																																																																																																																				
600 x	250	-	60	13,1	13,2	0,0893	BFL	M1	630	-	240	22,7	24,8	0,3247	BF	M2																																																																																																																																																																																																																																																																																																																																																																																																
	280	-	75	13,7	13,8	0,1058			300	-	85	14,5	14,6	0,1167			315	-	92	14,8	14,9	0,1249	355	-	112	16,1	16,2	0,1469	400	-	135	17,0	17,4	0,1715	450	-	150	18,0	18,4	0,1989	500	-	175	19,1	19,5	0,2263	550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1	20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3	25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6	0,0494	BFL	M1	500	-	175	20,9	21,3	0,2676	BFN	M2	150	-	10	11,7	11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																				
	300	-	85	14,5	14,6	0,1167			315	-	92	14,8	14,9	0,1249			355	-	112	16,1	16,2	0,1469	400	-	135	17,0	17,4	0,1715	450	-	150	18,0	18,4	0,1989	500	-	175	19,1	19,5	0,2263	550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10			280	23,3	25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140		-	5	11,5	11,6	0,0494	BFL			M1	500	-	175	20,9	21,3			0,2676	BFN	M2	150	-	10	11,7	11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135			17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650			-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1		0,3601	750	30	300	24,9	27,0			0,3832	650 x	140	-	5	11,7			11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603			400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1			23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500				
	315	-	92	14,8	14,9	0,1249			355	-	112	16,1	16,2	0,1469			400	-	135	17,0	17,4	0,1715	450	-	150	18,0	18,4	0,1989	500	-	175	19,1	19,5	0,2263	550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494		BFL	M1	500	-	175					20,9	21,3	0,2676	BFN	M2			150			-	10	11,7	11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450			-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700			5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601		750	30	300	24,9	27,0	0,3832			650 x		140	-	5	11,7			11,8	0,0510			BFL	M1	560	-	205	22,3			24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9			19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6			27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500
	355	-	112	16,1	16,2	0,1469			400	-	135	17,0	17,4	0,1715			450	-	150	18,0	18,4	0,1989	500	-	175	19,1	19,5	0,2263	550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175				20,9	21,3	0,2676					BFN	M2	150					-			10	11,7	11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN			M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF			M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750		30	300	24,9	27,0	0,3832	650 x					140	-	5	11,7			11,8	0,0510					BFL	M1	560	-			205	22,3			24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9			19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6			27,7	0,4034	BFN	M2	750	30
	400	-	135	17,0	17,4	0,1715			450	-	150	18,0	18,4	0,1989			500	-	175	19,1	19,5	0,2263	550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175			20,9	21,3		0,2676				BFN	M2	150							-					10			11,7	11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN		M2	450		-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF		M3	700		5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30		300	24,9	27,0	0,3832	650 x						140	-	5	11,7			11,8	0,0510							BFL	M1			560	-			205	22,3			24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9			19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6			27,7	0,4034
	450	-	150	18,0	18,4	0,1989			500	-	175	19,1	19,5	0,2263			550	-	200	19,9	20,3	0,2537	BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175			20,9	21,3		0,2676			BFN	M2		150						-							10					11,7			11,8	0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN		M2		450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF		M3		700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300		24,9	27,0	0,3832	650 x							140	-	5	11,7			11,8	0,0510											BFL	M1			560	-			205	22,3			24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9			19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6
	500	-	175	19,1	19,5	0,2263			550	-	200	19,9	20,3	0,2537			BFN	M2	560	-	205	20,1			20,5	0,2592	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175			20,9	21,3		0,2676			BFN	M2		150						-						10							11,7					11,8			0,0554	160	-	15	11,6	11,7	0,0422	180	-	25	12,1	12,2	0,0538	200	-	35	12,5	12,6	0,0653	225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN		M2		450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF		M3		700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9		27,0	0,3832	650 x								140	-	5	11,7			11,8	0,0510															BFL	M1			560	-			205	22,3			24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9			19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068
	550	-	200	19,9	20,3	0,2537	BFN	M2																																																																																																																																																																																																																																																																																																																																																																																																								
	560	-	205	20,1	20,5	0,2592			600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3	25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6	0,0494	BFL	M1	500	-	175	20,9	21,3	0,2676	BFN	M2	150	-	10		11,7	11,8	0,0554	160	-		15			11,6	11,7		0,0422			180	-		25						12,1						12,2						0,0538		200	-				35			12,5	12,6	0,0653			225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1	150	-	10	11,9		12,0	0,0572					160	-			15	11,8	11,9	0,0437	180	-	25	12,3																			12,4	0,0556			200	-			35	12,7			12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500										
	600	-	225	21,0	23,1	0,2811	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3	25,4	0,3414			750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-	175			20,9	21,3	0,2676	BFN	M2	150			-	10	11,7		11,8	0,0554	160	-	15		11,6			11,7	0,0422		180			-	25		12,1						12,2						0,0538						200	-	35	12,5	12,6			0,0653			225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150			18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700			5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x		140	-	5	11,7	11,8	0,0510			BFL	M1	560	-	205	22,3			24,4	0,3112	BF	M1		150	-					10	11,9			12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-							25	12,3									12,4	0,0556			200	-			35	12,7			12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171			BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6			27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500						
	630	-	240	21,6	23,7	0,2976	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175			20,9	21,3	0,2676			BFN	M2	150			-			10	11,7	11,8		0,0554	160	-	15	11,6		11,7			0,0422	180		-			25	12,1		12,2						0,0538						200		-	35			12,5	12,6	0,0653	225	-			47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150			18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275			23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7			11,8	0,0510	BFL	M1	560	-					205	22,3	24,4	0,3112			BF	M1				150	-					10	11,9			12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3					12,4	0,0556			200	-					35	12,7			12,8	0,0676			225	-			47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0			29,1	0,4500										
	650	-	250	22,0	24,1	0,3085	700	5	275	23,1	25,2	0,3359	BF	M3	710	10	280	23,3			25,4	0,3414	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-		175			20,9	21,3		0,2676			BFN	M2	150					-			10			11,7	11,8	0,0554		160	-	15	11,6	11,7		0,0422			180	-		25			12,1	12,2		0,0538						200	-	35				12,5		12,6	0,0653			225	-	47	13,0	13,1	0,0798	250	-	60	13,5	13,6	0,0942	280	-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150			18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275			23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7		11,8	0,0510	BFL	M1			560	-			205	22,3					24,4	0,3112	BF	M1								150	-					10	11,9			12,0	0,0572	160	-	15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556			200	-			35	12,7			12,8	0,0676	225	-			47	13,3			13,4	0,0825			250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-			175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30			300	27,0	29,1	0,4500														
	700	5	275	23,1	25,2	0,3359	BF	M3																																																																																																																																																																																																																																																																																																																																																																																																								
	710	10	280	23,3	25,4	0,3414			750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6	0,0494	BFL	M1	500	-	175	20,9	21,3		0,2676	BFN	M2	150	-		10			11,7	11,8		0,0554			160	-		15					11,6					11,7			0,0422			180	-	25		12,1	12,2	0,0538	200	-		35			12,5	12,6		0,0653	225	-	47	13,0		13,1	0,0798	250				-	60	13,5	13,6	0,0942		280		-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1	150	-	10	11,9		12,0	0,0572	160	-		15	11,8					11,9	0,0437			180	-					25	12,3										12,4	0,0556					200	-			35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154			300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363			355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																										
	750	30	300	24,2	26,3	0,3633	800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6	0,0494	BFL		M1	500	-	175	20,9	21,3			0,2676	BFN	M2	150	-		10			11,7	11,8		0,0554			160	-		15			11,6	11,7		0,0422					180					-			25			12,1	12,2	0,0538		200	-	35	12,5	12,6		0,0653	225	-	47	13,0		13,1	0,0798	250	-	60		13,5	13,6	0,0942	280	-		75	14,2	14,3	0,1116	300		-		85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0			0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275			23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-		5	11,7	11,8	0,0510	BFL	M1			560	-	205	22,3	24,4	0,3112			BF	M1	150	-		10	11,9	12,0	0,0572		160	-					15	11,8			11,9	0,0437					180	-										25	12,3					12,4	0,0556			200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2			500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034			BFN	M2	750	30	300	27,0	29,1	0,4500																																								
800	55	325	25,2	27,3	0,3907	630 x	140	-	5	11,5	11,6	0,0494		BFL	M1	500	-	175	20,9				21,3	0,2676	BFN	M2	150			-			10	11,7		11,8			0,0554	160		-			15	11,6		11,7			0,0422	180		-					25					12,1			12,2			0,0538	200	-		35	12,5	12,6	0,0653	225		-	47	13,0	13,1	0,0798		250	-	60	13,5	13,6		0,0942	280	-	75	14,2		14,3	0,1116	300	-	85		14,9		15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2			450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3			700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140		-	5		11,7	11,8	0,0510	BFL					M1	560	-	205	22,3	24,4					0,3112	BF		M1	150	-	10		11,9	12,0					0,0572	160			-	15					11,8	11,9										0,0437	180					-	25			12,3	12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150			18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7			0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																					
630 x	140	-	5	11,5	11,6		0,0494	BFL	M1	500	-	175				20,9	21,3	0,2676	BFN				M2																																																																																																																																																																																																																																																																																																																																																																																									
	150	-	10	11,7	11,8		0,0554			160	-	15				11,6	11,7	0,0422						180			-			25			12,1	12,2		0,0538			200	-		35			12,5	12,6		0,0653			225	-		47	13,0	13,1			0,0798	250	-			60	13,5	13,6	0,0942	280	-	75	14,2	14,3		0,1116	300	-	85	14,9		15,0	0,1231	315	-	92		15,2	15,3	0,1318	355	-		112	16,5	16,6	0,1549	400		-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1	150	-	10	11,9	12,0	0,0572	160	-	15	11,8		11,9		0,0437	180		-	25	12,3							12,4	0,0556	200	-	35					12,7				12,8	0,0676	225		-	47					13,3	13,4			0,0825	250	-	60	13,8	13,9	0,0975	280			-	75			14,4	14,5	0,1154	300	-					85	15,2		15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																									
	160	-	15	11,6	11,7		0,0422			180	-	25				12,1	12,2	0,0538						200			-			35			12,5	12,6		0,0653			225	-		47			13,0	13,1		0,0798	250	-	60	13,5		13,6	0,0942	280			-	75	14,2	14,3	0,1116	300	-	85	14,9	15,0	0,1231	315	-	92		15,2	15,3	0,1318	355	-		112	16,5	16,6	0,1549	400		-	135	17,5	17,9	0,1809		BFN	M2	450	-	150	18,6	19,0	0,2098	500	-	175			19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710			10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3			24,4	0,3112	BF	M1	150	-			10	11,9	12,0	0,0572	160	-	15	11,8	11,9	0,0437		180		-	25		12,3	12,4	0,0556							200	-	35	12,7	12,8					0,0676				225	-	47		13,3	13,4					0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5			0,1154	300	-	85	15,2	15,3	0,1274	315	-					92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4			0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300			27,0	29,1	0,4500																																																																												
	180	-	25	12,1	12,2		0,0538			200	-	35				12,5	12,6	0,0653						225			-			47			13,0	13,1		0,0798			250	-		60	13,5	13,6	0,0942	280		-	75	14,2	14,3	0,1116		300	-	85	14,9	15,0	0,1231	315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400		-	135	17,5	17,9	0,1809		BFN	M2	450	-	150		18,6	19,0	0,2098	500	-	175			19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280			24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-		205	22,3	24,4	0,3112	BF	M1				150	-	10	11,9			12,0	0,0572			160	-			15	11,8	11,9	0,0437	180	-	25	12,3	12,4	0,0556		200		-	35		12,7	12,8	0,0676							225	-	47	13,3	13,4					0,0825				250	-	60		13,8	13,9	0,0975	280			-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603				400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																									
	200	-	35	12,5	12,6		0,0653			225	-	47				13,0	13,1	0,0798						250			-			60			13,5	13,6		0,0942			280	-		75	14,2	14,3	0,1116	300		-	85	14,9	15,0	0,1231		315	-	92	15,2	15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN		M2	450	-	150	18,6				19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3			24,4	0,3112		BF	M1	150	-						10	11,9	12,0	0,0572			160	-			15	11,8			11,9	0,0437	180	-	25	12,3	12,4	0,0556	200	-		35		12,7	12,8		0,0676	225	-							47	13,3	13,4	0,0825	250					-				60	13,8	13,9		0,0975	280	-	75			14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-			135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500			-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750			30	300	27,0	29,1	0,4500																																																																																										
	225	-	47	13,0	13,1		0,0798			250	-	60				13,5	13,6	0,0942						280			-	75	14,2	14,3			0,1116	300		-	85	14,9	15,0	0,1231		315	-	92	15,2	15,3		0,1318	355	-	112	16,5		16,6	0,1549	400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0	0,2098	500	-				175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280			24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-		205	22,3	24,4	0,3112	BF	M1				150	-	10	11,9			12,0	0,0572				160	-						15	11,8	11,9	0,0437			180	-			25	12,3			12,4	0,0556	200	-	35	12,7	12,8	0,0676	225	-		47		13,3	13,4		0,0825	250	-				60	13,8		13,9	0,0975	280	-	75	14,4	14,5			0,1154				300	-	85		15,2	15,3	0,1274	315			-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171		BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																							
	250	-	60	13,5	13,6		0,0942			280	-	75				14,2	14,3	0,1116		300		-		85			14,9	15,0	0,1231	315	-	92	15,2	15,3		0,1318	355	-	112	16,5		16,6	0,1549	400	-	135		17,5	17,9	0,1809	BFN	M2		450	-	150	18,6	19,0	0,2098	500	-			175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280			24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-		205	22,3	24,4	0,3112	BF	M1			150	-		10	11,9	12,0	0,0572						160	-	15	11,8			11,9	0,0437				180	-						25	12,3	12,4	0,0556			200	-			35	12,7			12,8	0,0676	225	-	47	13,3	13,4	0,0825	250	-		60		13,8	13,9		0,0975	280	-		75	14,4	14,5	0,1154		300	-	85	15,2	15,3	0,1274	315	-	92	15,5				15,6	0,1363	355		-	112	16,8	16,9			0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																		
	280	-	75	14,2	14,3		0,1116			300	-	85		14,9	15,0	0,1231	315	-		92		15,2		15,3	0,1318	355	-	112	16,5	16,6	0,1549	400	-	135		17,5	17,9	0,1809	BFN	M2		450	-	150	18,6	19,0		0,2098	500	-				175	19,7	20,1	0,2387	550	-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10			280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560		-	205	22,3	24,4	0,3112	BF			M1	150		-	10	11,9	12,0					0,0572	160		-	15	11,8	11,9						0,0437	180	-	25			12,3	12,4				0,0556	200						-	35	12,7	12,8			0,0676	225			-	47			13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975	280		-		75	14,4		14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603		400	-	135	17,8		18,2	0,1872	450	-			150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550			-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																											
	300	-	85	14,9	15,0		0,1231	315	-	92	15,2	15,3		0,1318	355	-	112	16,5	16,6	0,1549		400	-	135	17,5	17,9	0,1809	BFN	M2	450	-	150	18,6	19,0		0,2098	500	-				175	19,7	20,1	0,2387	550		-	200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280			24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-		205	22,3	24,4	0,3112	BF	M1			150		-	10	11,9	12,0	0,0572					160		-	15	11,8	11,9					0,0437	180		-	25	12,3	12,4						0,0556	200	-	35			12,7	12,8				0,0676	225						-	47	13,3	13,4			0,0825	250			-	60			13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300		-		85	15,2		15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872		450	-	150	18,9		19,3	0,2171	BFN	M2		500	-	175	20,0	20,4			0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																
	315	-	92	15,2	15,3		0,1318	355	-	112	16,5	16,6		0,1549	400	-	135	17,5	17,9	0,1809		BFN	M2	450	-	150	18,6			19,0	0,2098	500	-	175		19,7	20,1	0,2387	550	-		200	20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3			24,4	0,3112		BF	M1	150	-					10		11,9	12,0	0,0572	160	-					15		11,8	11,9	0,0437	180					-	25		12,3	12,4	0,0556	200						-	35	12,7	12,8			0,0676	225				-	47						13,3	13,4	0,0825	250	-	60	13,8	13,9			0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315		-		92	15,5		15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171		BFN	M2	500	-		175	20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																							
	355	-	112	16,5	16,6		0,1549	400	-	135	17,5	17,9		0,1809	BFN	M2	450	-	150	18,6				19,0	0,2098	500	-	175	19,7	20,1	0,2387	550	-	200		20,5	20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3				24,4	0,3112	BF	M1			150	-				10	11,9					12,0		0,0572	160	-	15	11,8					11,9		0,0437	180	-	25					12,3	12,4		0,0556	200	-	35						12,7	12,8	0,0676	225			-	47				13,3	13,4				0,0825	250	-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355		-		112	16,8		16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0				20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																														
	400	-	135	17,5	17,9		0,1809	BFN	M2																																																																																																																																																																																																																																																																																																																																																																																																							
	450	-	150	18,6	19,0		0,2098			500	-	175		19,7	20,1	0,2387	550	-	200	20,5		20,9	0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4	0,3112	BF	M1		150	-	10	11,9	12,0	0,0572				160	-	15	11,8				11,9	0,0437					180	-				25	12,3					12,4		0,0556	200	-	35	12,7					12,8		0,0676	225	-	47					13,3	13,4		0,0825	250	-	60				13,8	13,9	0,0975	280	-	75	14,4	14,5	0,1154	300		-	85	15,2	15,3	0,1274	315		-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500		-		175	20,0		20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																							
	500	-	175	19,7	20,1		0,2387	550	-	200	20,5	20,9		0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9	0,3543	710			10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3			24,4	0,3112	BF	M1	150	-				10	11,9	12,0	0,0572	160	-				15	11,8	11,9	0,0437				180	-					25	12,3				12,4	0,0556					200		-	35	12,7	12,8	0,0676					225		-	47	13,3	13,4			0,0825	250	-	60		13,8	13,9	0,0975	280	-	75		14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315		-	92	15,5	15,6	0,1363	355		-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0			20,4		0,2470		550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300			27,0	29,1	0,4500																																																																																																																																																																										
	550	-	200	20,5	20,9		0,2676	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3				24,4	0,3112	BF	M1			150	-			10	11,9				12,0	0,0572	160	-	15	11,8				11,9	0,0437	180	-				25	12,3					12,4	0,0556				200	-					35		12,7	12,8	0,0676	225	-		47	13,3		13,4		0,0825	250	-	60	13,8	13,9	0,0975	280	-	75		14,4	14,5	0,1154	300	-	85		15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355		-	112	16,8	16,9	0,1603	400		-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0			20,4	0,2470	550	-	200	20,9	21,3		0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																																																																	
	560	-	205	20,7	21,1	0,2734	600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3				24,4	0,3112	BF	M1				150	-					10	11,9			12,0	0,0572				160	-	15	11,8	11,9	0,0437				180	-	25	12,3				12,4	0,0556					200	-				35	12,7			12,8	0,0676	225		-	47	13,3	13,4	0,0825	250	-	60	13,8	13,9		0,0975	280	-	75	14,4	14,5	0,1154	300	-	85		15,2	15,3	0,1274	315	-	92		15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400		-	135	17,8	18,2	0,1872	450		-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																																																																								
600	-	225	21,6	23,7	0,2965	630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8	25,9			0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510		BFL	M1	560	-	205	22,3				24,4	0,3112	BF	M1				150	-						10	11,9					12,0	0,0572			160	-				15	11,8	11,9	0,0437	180	-				25	12,3	12,4	0,0556				200	-			35	12,7	12,8	0,0676				225	-	47	13,3	13,4	0,0825	250		-	60	13,8	13,9	0,0975	280	-	75	14,4	14,5		0,1154	300	-	85	15,2	15,3	0,1274	315	-	92		15,5	15,6	0,1363	355	-	112		16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450		-	150	18,9	19,3	0,2171	BFN		M2	500	-	175	20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0			29,1	0,4500																																																																																																																																																																																														
630	-	240	22,3	24,4	0,3139	650	-	250	22,7	24,8	0,3254	BF	M3	700	5	275	23,8			25,9	0,3543	710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8		0,0510	BFL	M1	560	-	205				22,3	24,4	0,3112	BF				M1	150						-	10						11,9	12,0					0,0572	160			-	15				11,8	11,9	0,0437	180	-	25				12,3	12,4	0,0556	200		-	35	12,7	12,8			0,0676	225	-	47		13,3	13,4	0,0825	250	-	60	13,8	13,9	0,0975		280	-	75	14,4	14,5	0,1154	300	-	85	15,2		15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-		112	16,8	16,9	0,1603	400	-		135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171		BFN	M2	500	-	175		20,0		20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0			29,1	0,4500																																																																																																																																																																																																				
650	-	250	22,7	24,8	0,3254	BF	M3																																																																																																																																																																																																																																																																																																																																																																																																									
700	5	275	23,8	25,9	0,3543			710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL	M1	560	-	205	22,3	24,4		0,3112	BF	M1	150	-		10			11,9	12,0	0,0572				160	-	15						11,8						11,9	0,0437						180	-					25	12,3			12,4	0,0556				200	-	35	12,7	12,8	0,0676		225	-	47	13,3	13,4	0,0825		250	-	60	13,8	13,9	0,0975	280	-	75	14,4		14,5	0,1154	300	-	85	15,2	15,3	0,1274	315		-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9		0,1603	400	-	135	17,8	18,2	0,1872	450	-	150		18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																							
710	10	280	24,0	26,1	0,3601	750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8	0,0510	BFL		M1	560	-	205	22,3	24,4			0,3112	BF	M1	150	-		10			11,9	12,0		0,0572			160	-	15				11,8	11,9	0,0437						180						-	25						12,3	12,4			0,0556	200	-	35			12,7	12,8	0,0676	225		-	47	13,3	13,4	0,0825	250		-	60	13,8	13,9	0,0975	280		-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3		0,1274	315	-	92	15,5	15,6	0,1363	355	-		112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872		450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470			550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0			29,1	0,4500																																																																																																																																																																																																																											
750	30	300	24,9	27,0	0,3832	650 x	140	-	5	11,7	11,8		0,0510	BFL	M1	560	-	205				22,3	24,4	0,3112	BF	M1			150			-	10		11,9			12,0	0,0572		160			-	15	11,8				11,9	0,0437	180						-						25	12,3				12,4	0,0556	200	-			35	12,7	12,8	0,0676	225	-	47	13,3	13,4	0,0825		250	-	60	13,8	13,9	0,0975		280	-	75	14,4	14,5	0,1154		300	-	85	15,2	15,3	0,1274	315	-	92	15,5		15,6	0,1363	355	-	112	16,8	16,9	0,1603	400		-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0			29,1	0,4500																																																																																																																																																																																																																																	
650 x	140	-	5	11,7	11,8		0,0510	BFL	M1	560	-		205			22,3	24,4	0,3112				BF	M1																																																																																																																																																																																																																																																																																																																																																																																									
	150	-	10	11,9	12,0		0,0572			160	-		15			11,8	11,9	0,0437						180					-			25	12,3		12,4			0,0556	200		-			35	12,7	12,8				0,0676	225	-			47	13,3		13,4				0,0825	250	-	60	13,8	13,9		0,0975	280	-	75	14,4	14,5	0,1154	300	-	85	15,2	15,3	0,1274	315	-	92		15,5	15,6	0,1363	355	-	112		16,8	16,9	0,1603	400	-	135		17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																												
	160	-	15	11,8	11,9		0,0437			180	-		25			12,3	12,4	0,0556						200					-			35	12,7		12,8			0,0676	225		-			47	13,3	13,4		0,0825	250	-	60	13,8			13,9	0,0975		280	-	75		14,4	14,5	0,1154	300	-	85		15,2	15,3	0,1274	315	-	92	15,5	15,6	0,1363	355	-	112	16,8	16,9	0,1603	400		-	135	17,8	18,2	0,1872	450		-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																					
	180	-	25	12,3	12,4		0,0556			200	-		35			12,7	12,8	0,0676						225					-			47	13,3		13,4			0,0825	250		-	60	13,8	13,9	0,0975	280		-	75	14,4	14,5	0,1154	300		-	85	15,2	15,3	0,1274	315		-	92	15,5	15,6	0,1363	355		-	112	16,8	16,9	0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3		0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																																
	200	-	35	12,7	12,8		0,0676			225	-		47			13,3	13,4	0,0825						250					-			60	13,8		13,9			0,0975	280		-	75	14,4	14,5	0,1154	300		-	85	15,2	15,3	0,1274	315		-	92	15,5	15,6	0,1363	355		-	112	16,8	16,9	0,1603	400		-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0	20,4			0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																																																																																																																																																																					
	225	-	47	13,3	13,4		0,0825			250	-		60			13,8	13,9	0,0975						280			-	75	14,4			14,5	0,1154		300	-	85	15,2	15,3		0,1274	315	-	92	15,5	15,6		0,1363	355	-	112	16,8	16,9		0,1603	400	-	135	17,8	18,2		0,1872	450	-	150	18,9	19,3		0,2171	BFN	M2	500	-	175	20,0	20,4	0,2470	550	-			200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																																																	
	250	-	60	13,8	13,9		0,0975			280	-		75			14,4	14,5	0,1154	300		-			85			15,2	15,3	0,1274	315	-	92	15,5		15,6	0,1363	355	-	112		16,8	16,9	0,1603	400	-	135		17,8	18,2	0,1872	450	-	150		18,9	19,3	0,2171	BFN	M2	500		-	175	20,0	20,4	0,2470	550	-	200			20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																																																												
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	300	-	85	15,2	15,3		0,1274	315	-	92	15,5		15,6	0,1363	355	-	112	16,8	16,9		0,1603	400	-	135	17,8	18,2	0,1872	450	-	150	18,9	19,3	0,2171		BFN	M2	500	-	175		20,0	20,4	0,2470	550	-				200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																																																																																		
	315	-	92	15,5	15,6		0,1363	355	-	112	16,8		16,9	0,1603	400	-	135	17,8	18,2		0,1872	450	-	150	18,9	19,3	0,2171	BFN	M2	500	-	175	20,0				20,4	0,2470	550		-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																																																																																																																																																																																																																							
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	400	-	135	17,8	18,2		0,1872	450	-	150	18,9		19,3	0,2171	BFN	M2	500	-	175		20,0			20,4	0,2470	550	-	200	20,9	21,3	0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1			0,4500																																																																																																																																																																																																																																																																																																																																																					
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	550	-	200	20,9	21,3		0,2769	560	-	205	21,1	23,2	0,2829	600	-	225	22,0	24,1	0,3068	700	5	275	25,6	27,7	0,4034	BFN	M2	750	30	300	27,0	29,1	0,4500																																																																																																																																																																																																																																																																																																																																																																															
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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 blade overlaps		Weight		Effective area Sef [m <sup>2</sup> ]	Spring return actuator	Manual control	A x B [mm]	Damper blade overlaps		Weight		Effective area Sef [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]*																																																																																																																																																																																																																																																																																						
750 x	500	-	175	21,9	22,3	0,2883	BFN	900 x	200	-	35	15,6	15,7	0,0958	M1																																																																																																																																																																																																																																																																																			
	550	-	200	22,8	24,9	0,3232			560	-	205	23,1	25,2	0,3302		600	-	225	24,1	26,2	0,3581	BF	630	-	240	24,8	26,9	0,3790		650	-	250	25,3	27,4	0,3930		800 x	150	-	10	13,6	13,7	0,0710		315	-	92	19,1	19,5	0,1933	M2	160	-	15	13,4	13,5	0,0546	M1	355	-	112	20,6	21,0	0,2273		180	-	25	13,9	14,0	0,0696		400	-	135	21,8	22,2	0,2654	BFN	200	-	35	14,4	14,5	0,0845		450	-	150	23,2	23,6	0,3078		225	-	47	15,1	15,2	0,1032	BFL	500	-	175	24,6	26,7	0,3502	BF	250	-	60	15,7	15,8	0,1219		550	-	200	25,7	27,8	0,3926		280	-	75	16,5	16,6	0,1444		160	-	15	15,6	15,7	0,0692	M1	300	-	85	17,3	17,4	0,1593		180	-	25	16,2	16,3	0,0882		315	-	92	17,7	17,8	0,1705		200	-	35	16,8	16,9	0,1071	BFL	355	-	112	19,1	19,5	0,2005	M2	225	-	47	17,5	17,6	0,1308		900 x	400	-	135	20,2	20,6	0,2341	BFN	250	-	60	18,2	18,3	0,1545		450	-	150	21,5	21,9	0,2715		280	-	75	19,1	19,2	0,1830		500	-	175	22,8	23,2	0,3089		300	-	85	20,0	20,4	0,2019	M2	550	-	200	23,8	25,9	0,3463		315	-	92	20,5	20,9	0,2161		560	-	205	24,1	26,2	0,3538	BF	355	-	112	22,1	22,5	0,2541	BFN	600	-	225	25,1	27,2	0,3837		400	-	135	23,4	23,8	0,2967		160	-	15	14,5	14,6	0,0619	BFL	450	-	150	24,9	25,3	0,3441		180	-	25	15,1	15,2	0,0789	M1	500	-	175	26,4	28,5	0,3915	BF
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	280	-	75	16,5	16,6	0,1444		160	-	15	15,6	15,7	0,0692	M1																																																																																																																																																																																																																																																																																				
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	500	-	175	22,8	23,2	0,3089		300	-	85	20,0	20,4	0,2019	M2																																																																																																																																																																																																																																																																																				
	550	-	200	23,8	25,9	0,3463		315	-	92	20,5	20,9	0,2161																																																																																																																																																																																																																																																																																					
	560	-	205	24,1	26,2	0,3538	BF	355	-	112	22,1	22,5	0,2541	BFN																																																																																																																																																																																																																																																																																				
	600	-	225	25,1	27,2	0,3837		400	-	135	23,4	23,8	0,2967																																																																																																																																																																																																																																																																																					
	160	-	15	14,5	14,6	0,0619	BFL	450	-	150	24,9	25,3	0,3441																																																																																																																																																																																																																																																																																					
	180	-	25	15,1	15,2	0,0789	M1	500	-	175	26,4	28,5	0,3915	BF																																																																																																																																																																																																																																																																																				

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

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

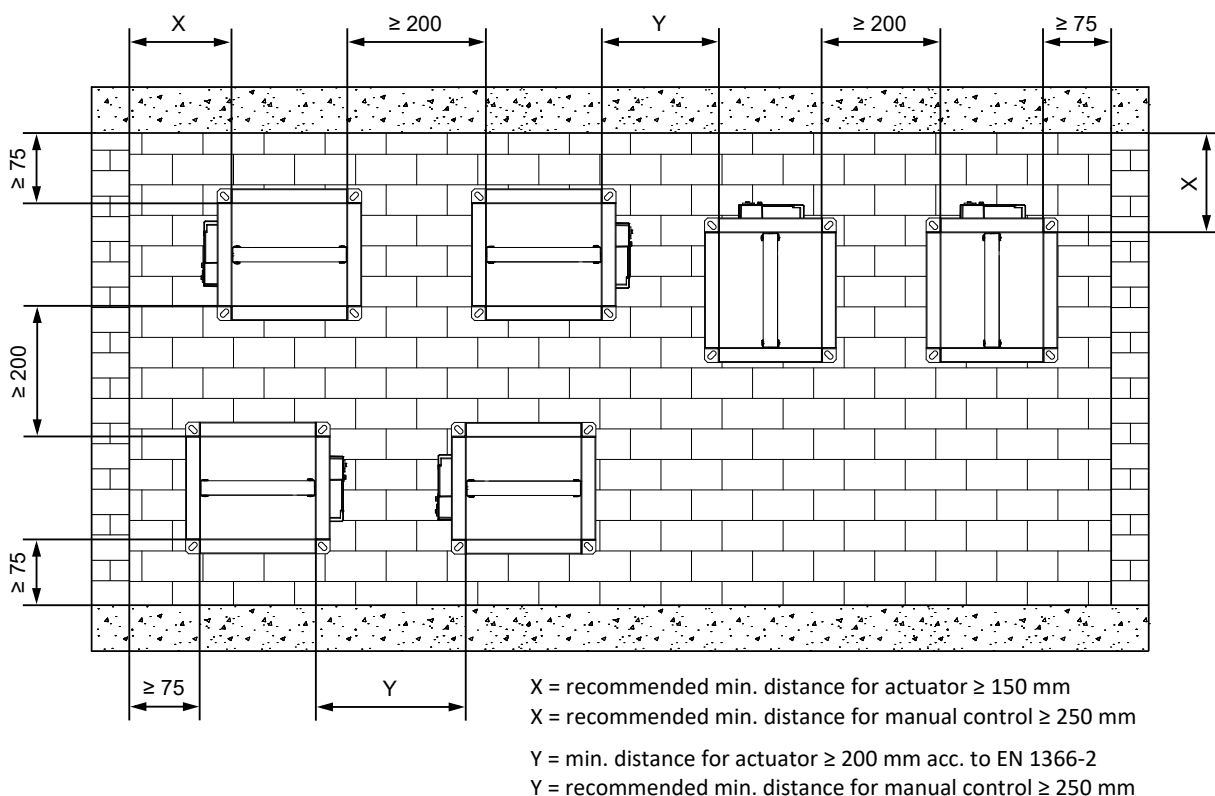
## IV. INSTALLATION

### Placement and installation

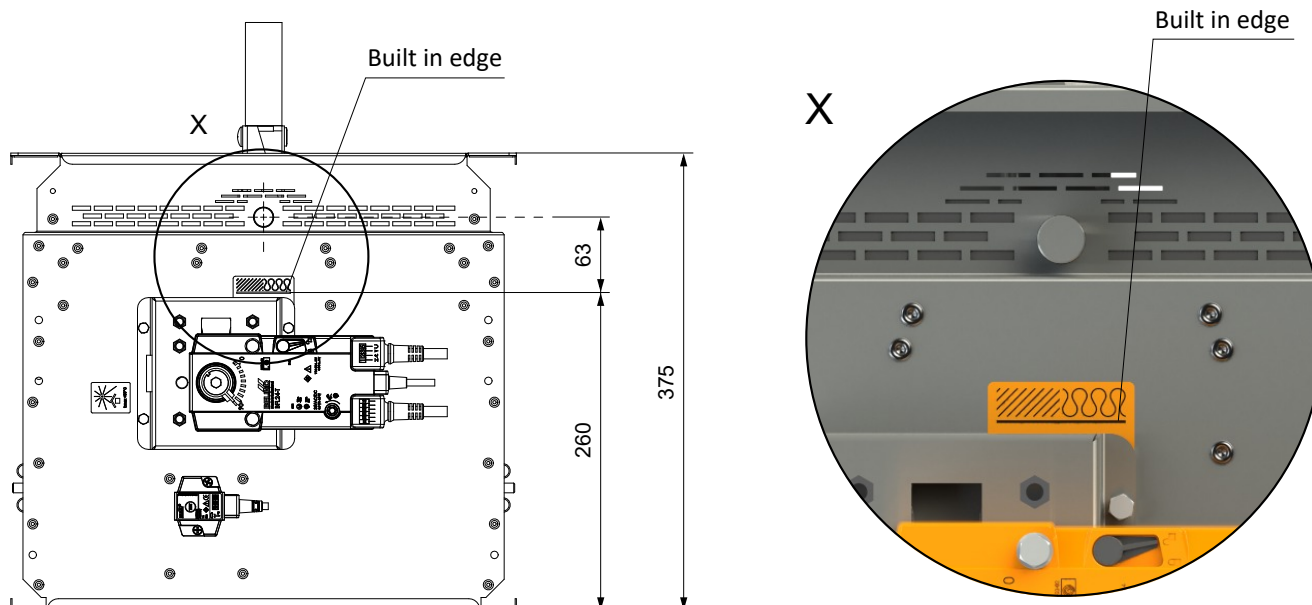
- The fire dampers are suitable for installation in arbitrary position in vertical and horizontal passages of fire separating constructions. The damper installation procedures must be done so that all load transfer from the fire separating constructions to the damper is absolutely excluded. Following 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 73
- 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.
- Fire dampers can be installed without following duct on one or both sides. Installation without following duct is only possible in vertical constructions. In this case, the fire dampers must be installed with cover grilles (additional extension parts may be required due to overlapping of the damper blade → see pages 16 to 21). The damper must be installed so that the activation device (thermal fuse/thermoelectric activation device/smoke detector) is located at the highest possible point of the damper (top of the casing).

#### 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

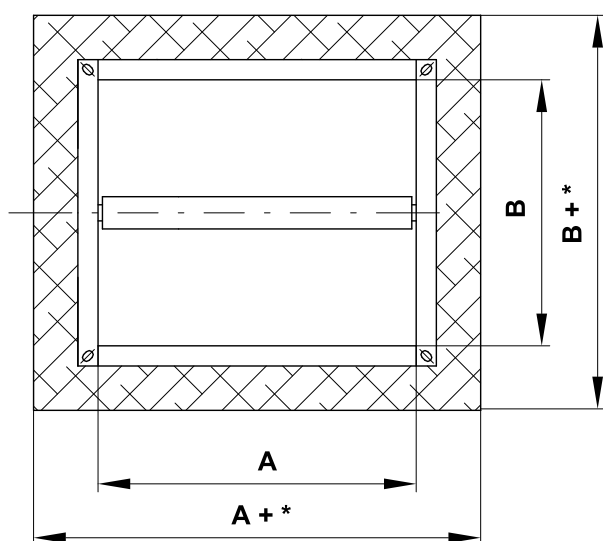


**Built in edge**



""BUILT IN EDGE label"" indicates the recommended edge of installation of a fire damper in the fire separating construction (wall/ceiling). The damper must be installed so that the entire damper blade (in the closed position) is located in the fire separating construction (wall/ceiling) and at the same time the actuating mechanism and inspection openings are freely accessible.

**Dimensions of an installation opening**



**\* Ablative Coated Batt, damper in solid/ceiling construction**

- min. A(B)+80
- max. A(B)+400

**\* Ablative Coated Batt 100 mm, damper in gypsum wall construction 100 mm**

- min. A(B)+80
- max. A(B)+400

**\* Ablative Coated Batt 50 mm, damper in gypsum wall construction 75 mm**

- min. A(B)+80
- max. A(B)+300

**\* Ablative Coated Batt, damper in shaft wall construction**

- min. A(B)+80
- max. A(B)+260

**\* Mortar or gypsum**

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

**\* Fire protective foam**

- min. A(B)+80
- max. A(B)+150

**\* Ablative Coated Batt, damper outside construction EI 60 S**

- min. A(B)+80
- max. A(B)+150

**\* Stuffing box with fire protective boards, damper in construction**

- min. A(B)+80
- max. A(B)+150

**\* Ablative Coated Batt, damper outside construction EI 90 S**

- min. A(B)+80
- max. A(B)+200

**\* Stuffing box with fire protective boards, damper outside construction**

- A(B)+100 mm for max. fire resistance of the installation EI 120 S
- min. A(B)+100 for max. fire resistance of the installation EI 90 S
- max. A(B)+300 for max. fire resistance of the installation EI 90 S

## 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> i↔o) S - 500 Pa	25
		2 dampers in battery - mortar or gypsum		26
		Ablative Coated Batt	EI 90 (v <sub>e</sub> i↔o) S	27
		Stuffing box with fire protective boards		28
		Fire-resistant foam with stucco plaster	EI 60 (v <sub>e</sub> i↔o) S	29
		Installation next to the wall/ceiling - mortar or gypsum + mineral wool	EI 90 (v <sub>e</sub> i↔o) S	30
Outside solid wall construction	100	ISOVER Ultimate Protect - Ablative Coated Batt	EI 60 (v <sub>e</sub> i↔o) S	31
		ISOVER Ultimate Protect - Ablative Coated Batt	EI 90 (v <sub>e</sub> i↔o) S	32
		Mineral wool ROCKWOOL - Mineral wool with fire-resistant coating and fireresistant board	EI 90 (v <sub>e</sub> i↔o) S EI 120 (v <sub>e</sub> i↔o) S	33
In gypsum wall construction	100	Mortar or gypsum	EI 120 (v <sub>e</sub> i↔o) S - 500 Pa	34
		2 dampers in battery - mortar or gypsum	EI 90 (v <sub>e</sub> i↔o) S	35
		Ablative Coated Batt - 100 mm	EI 60 (v <sub>e</sub> i↔o) S EI 90 (v <sub>e</sub> i↔o) S	36
	75	Ablative Coated Batt - 50 mm	EI 30 (v <sub>e</sub> i↔o) S EI 45 (v <sub>e</sub> i↔o) S	37
		Stuffing box with fire protective boards	EI 90 (v <sub>e</sub> i↔o) S	38
		100	Fire-resistant foam with stucco plaster	EI 60 (v <sub>e</sub> i↔o) S
Outside gypsum wall construction	100	Installation next to the wall/ceiling - mortar or gypsum + mineral wool	EI 90 (v <sub>e</sub> i↔o) S	40
		ISOVER Ultimate Protect - Ablative Coated Batt	EI 60 (v <sub>e</sub> i↔o) S	41
		ISOVER Ultimate Protect - Ablative Coated Batt	EI 90 (v <sub>e</sub> i↔o) S	42
		Mineral wool ROCKWOOL - Mineral wool with fire-resistant coating and fireresistant board	EI 90 (v <sub>e</sub> i↔o) S EI 120 (v <sub>e</sub> i↔o) S	43
In shaft wall construction	87	Ablative Coated Batt	EI 60 (v <sub>e</sub> i↔o) S EI 90 (v <sub>e</sub> i↔o) S	44
In CLT wall construction	100	Mortar or gypsum		45
		Ablative Coated Batt	EI 90 (v <sub>e</sub> i↔o) S	46
In solid ceiling construction	150	Mortar or gypsum	EI 120 (h <sub>o</sub> i↔o) S - 500 Pa	47
		2 dampers in battery - mortar or gypsum		48
		Ablative Coated Batt	EI 90 (h <sub>o</sub> i↔o) S	49
		Stuffing box with fire protective boards		50
Outside solid ceiling construction	150	Mineral wool ROCKWOOL - Mortar or gypsum	EI 90 (h <sub>o</sub> i↔o) S EI 120 (h <sub>o</sub> i↔o) S	51
		Concreting	EI 90 (h <sub>o</sub> i↔o) S	52
In CLT ceiling construction	140	Mortar or gypsum		53
		Ablative Coated Batt	EI 90 (h <sub>o</sub> i↔o) S	54
Installation frame in solid wall construction	100	Installation frame E1		57
		Installation frame E2	EI 90 (v <sub>e</sub> i↔o) S	61
		Installation frame E4		66
Installation frame outside solid wall construction	100	Insulation from fire-resistant boards - mortar or gypsum - Installation frame E6	EI 90 (v <sub>e</sub> i↔o) S	72
Installation frame in gypsum wall construction	100	Installation frame E1		58
		Installation frame E3	EI 90 (v <sub>e</sub> i↔o) S	64
		Flexible ceiling - Installation frame E5		69-70
Installation frame in solid ceiling construction	150	Installation frame E1		59
		Installation frame E2	EI 90 (h <sub>o</sub> i↔o) S	62
		Installation frame E4		67
Installation frame outside solid ceiling construction	150	Insulation from fire-resistant boards - mortar or gypsum - Installation frame E6	EI 90 (h <sub>o</sub> i↔o) S	73

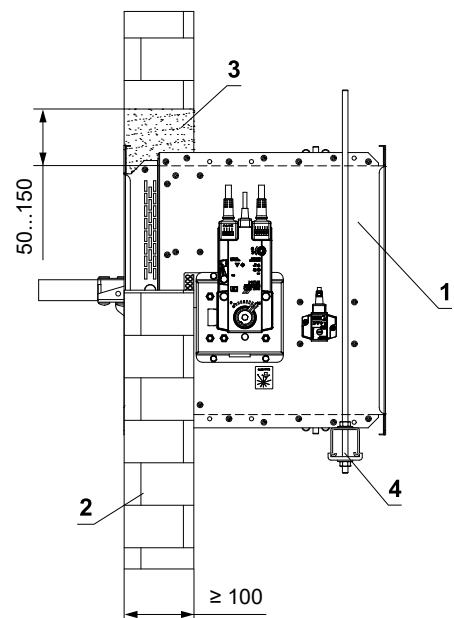
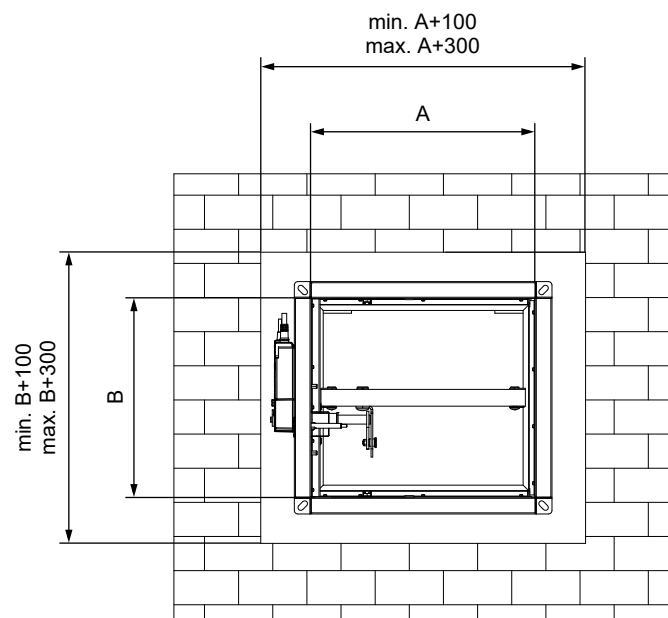
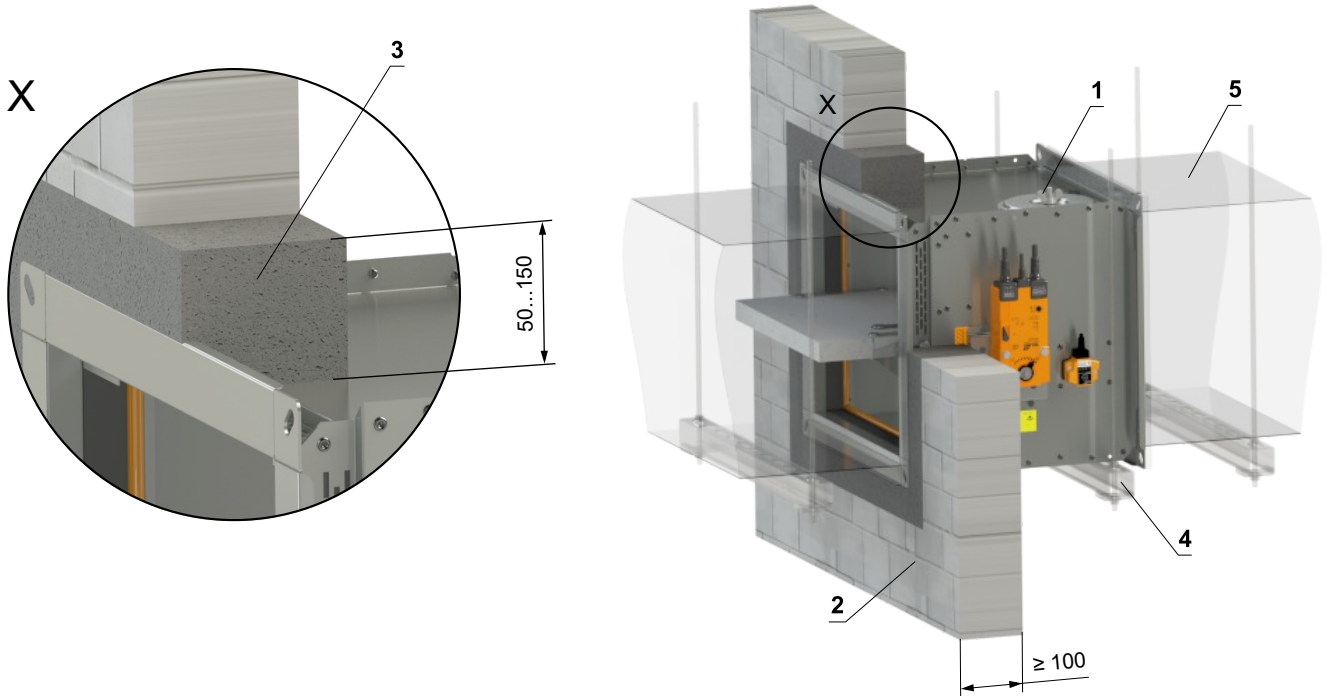


**In solid wall construction**

In solid wall construction - mortar or gypsum

EI 120 (v<sub>e</sub> i↔o) S - 500 Pa

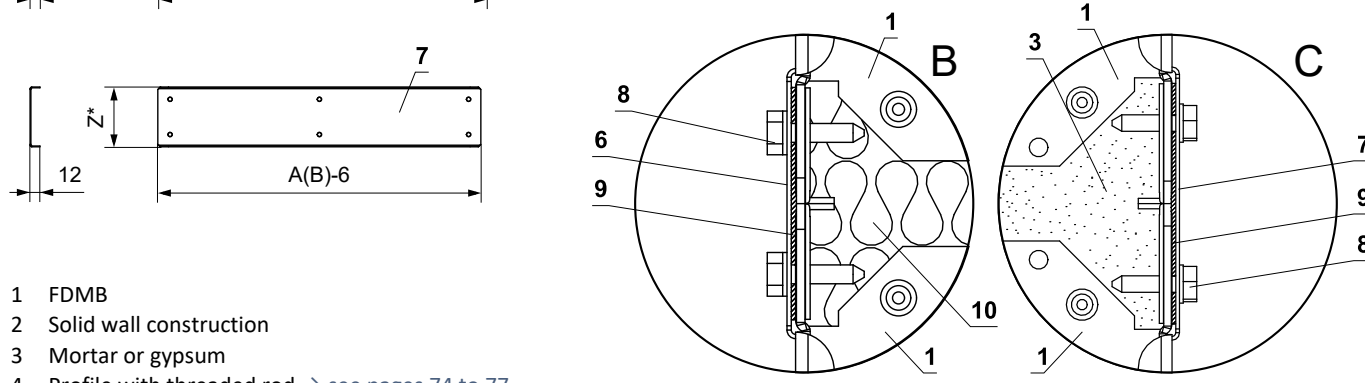
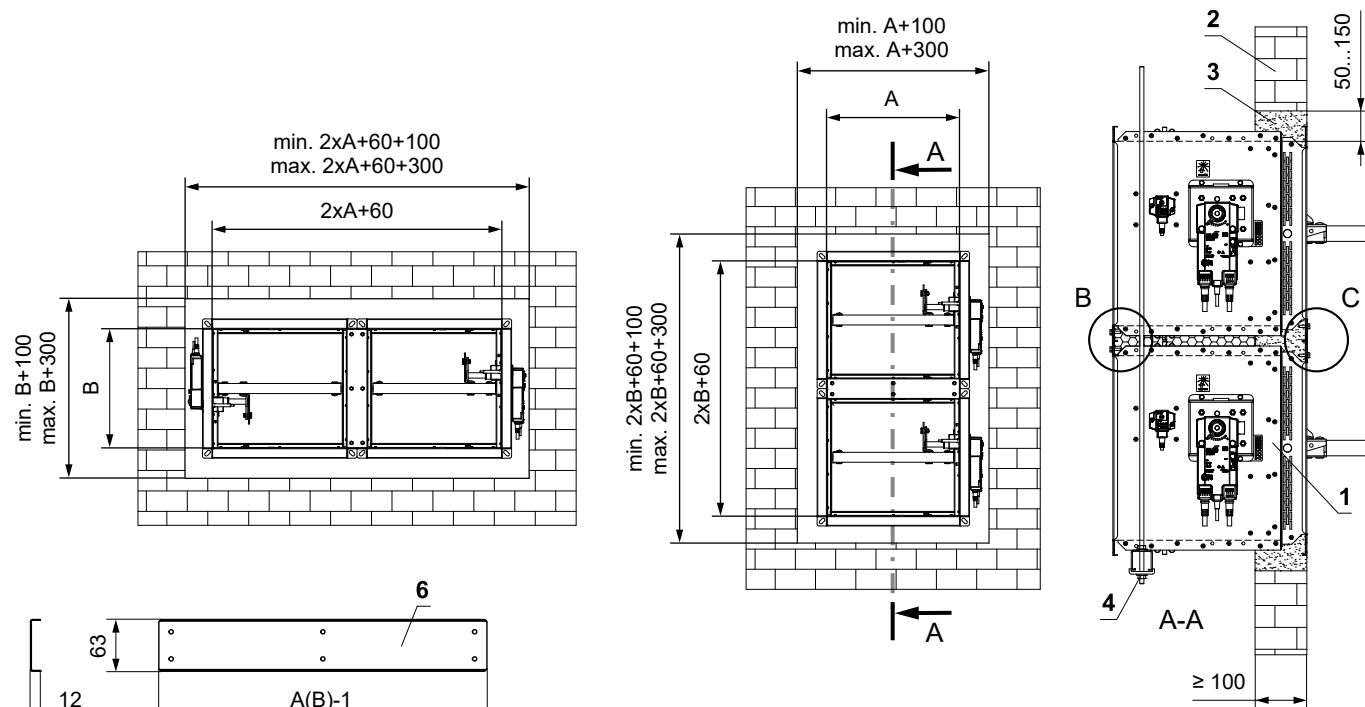
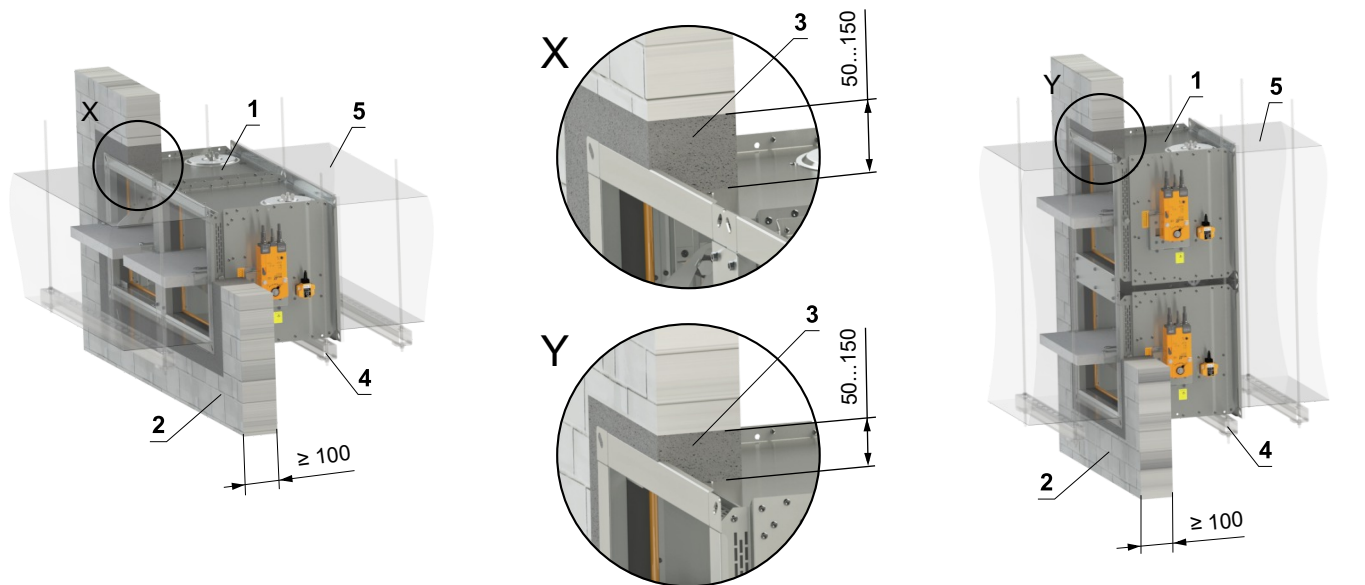
- For connection of following duct → see page 78



- 1 FDMB
- 2 Solid wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct

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

EI 90 (v<sub>e</sub> i↔o) S



- 1 FDMB
- 2 Solid wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEX 4,8x18 mm (pitch ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

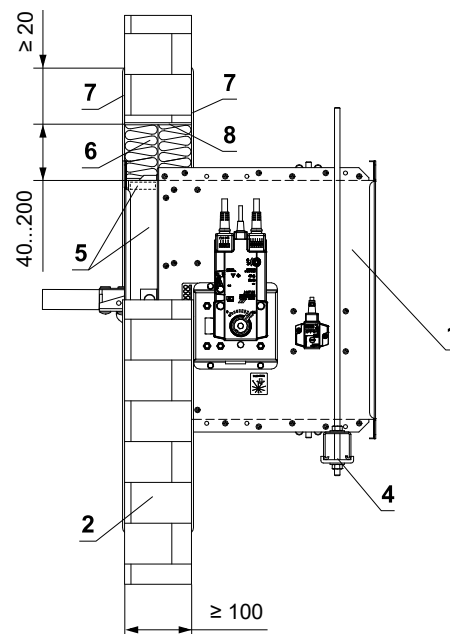
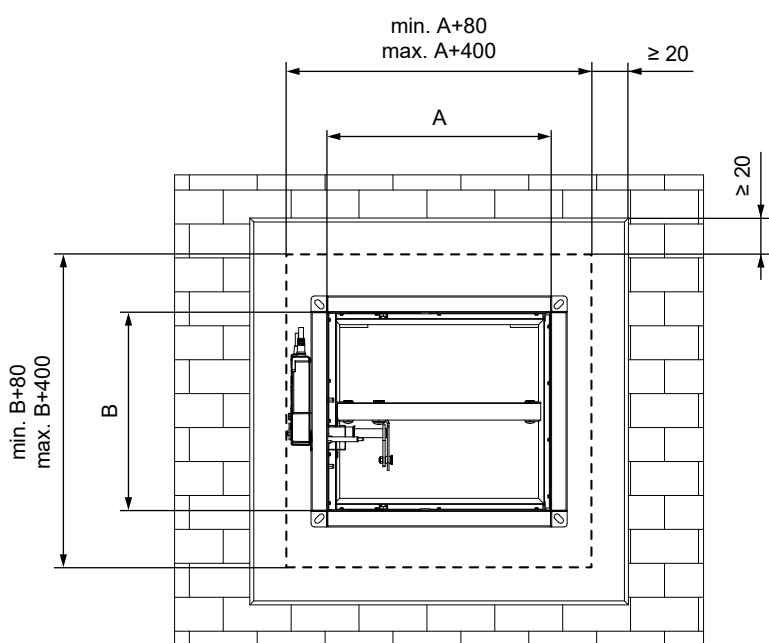
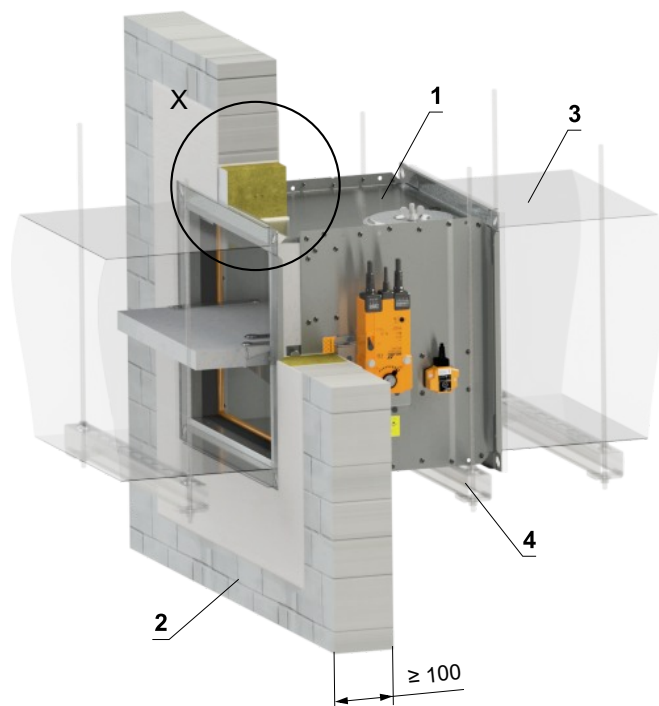
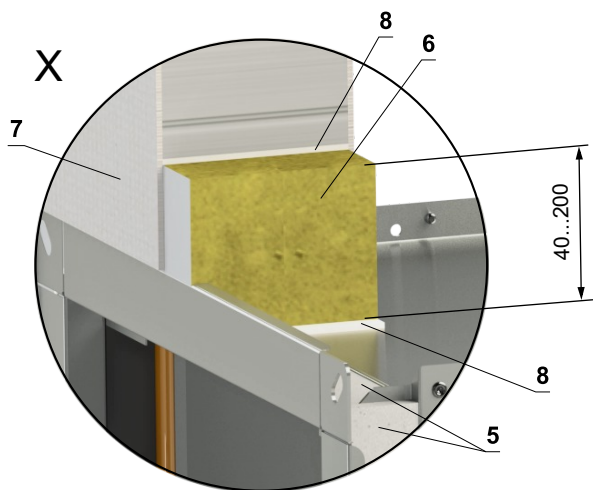
\* Z=86 (A≤500 and B≤400)  
 \* Z=99 (A>500 or B>400)

- For connection of following duct → see page 78
- The gap between the damper and construction is filled with mortar or gypsum

In solid wall construction - Ablative Coated Batt

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78



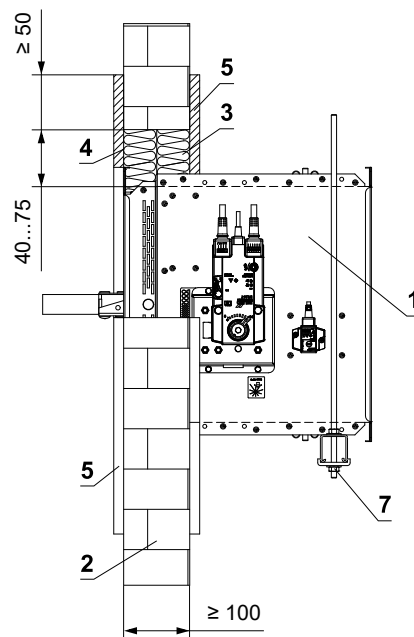
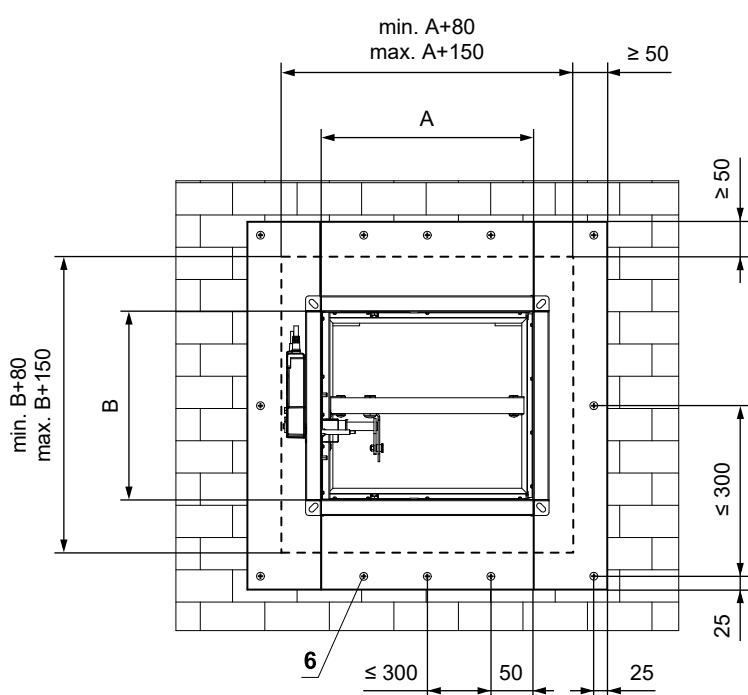
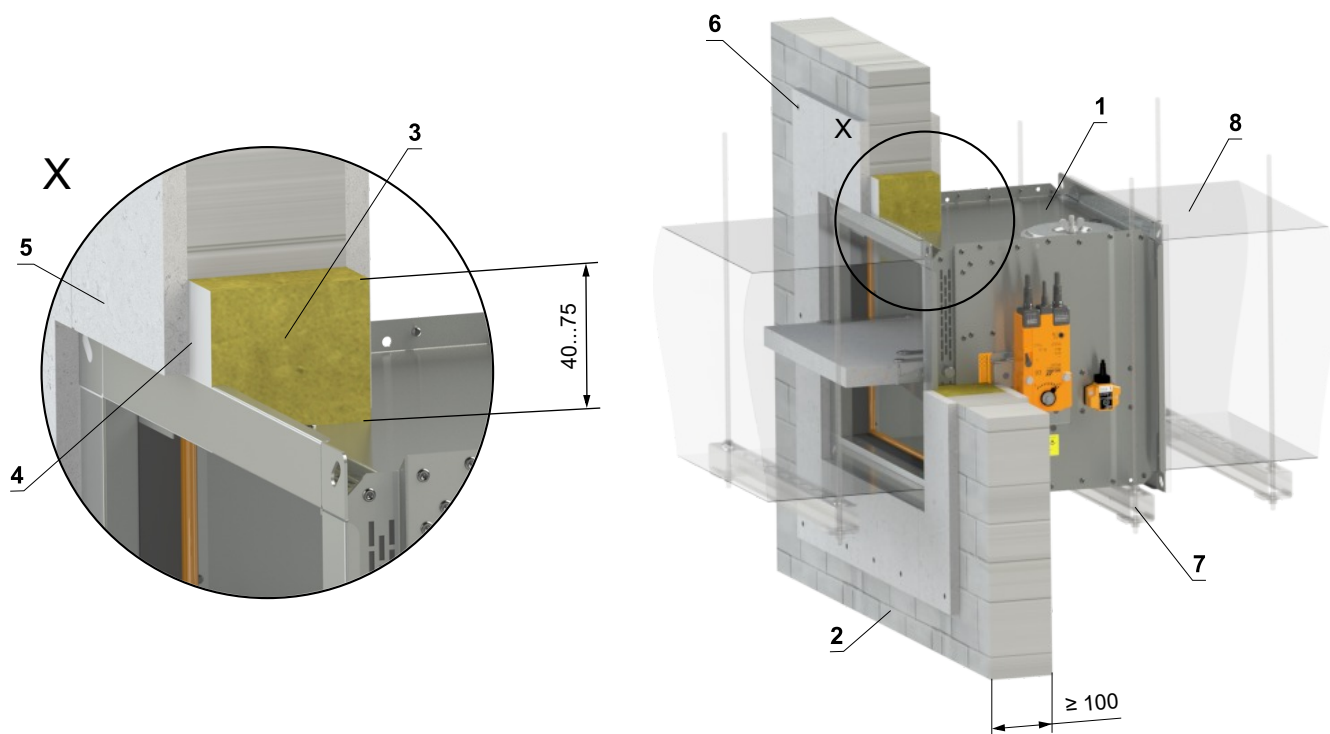
- 1 FDMB
- 2 Solid wall construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
Ablative Coated Batt System HILTI\*
- 6 Mineral wool board - min. density 140 kg/m<sup>3</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.

In solid wall construction - mineral wool with fire-resistant coating and fire-resistance boards

EI 90 (v<sub>e</sub> i↔o) S

■ For connection of following duct → see page 78

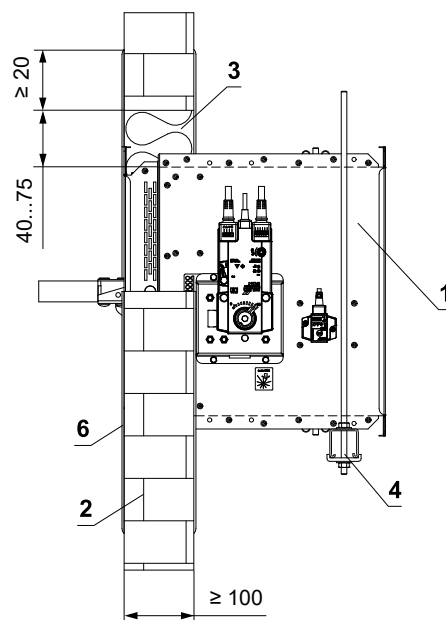
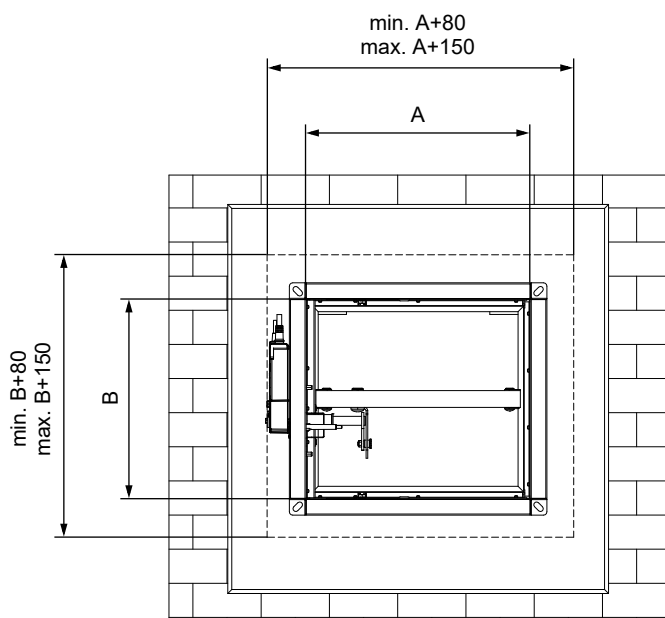
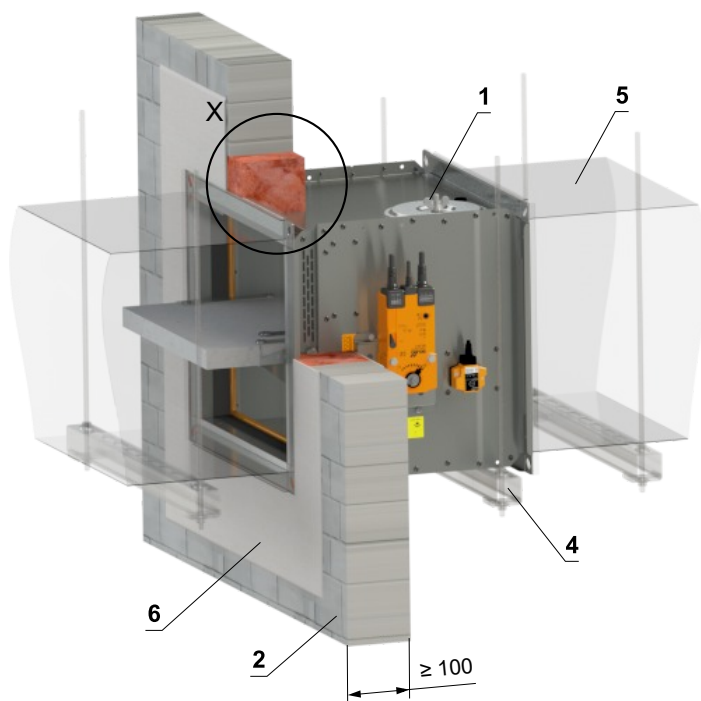
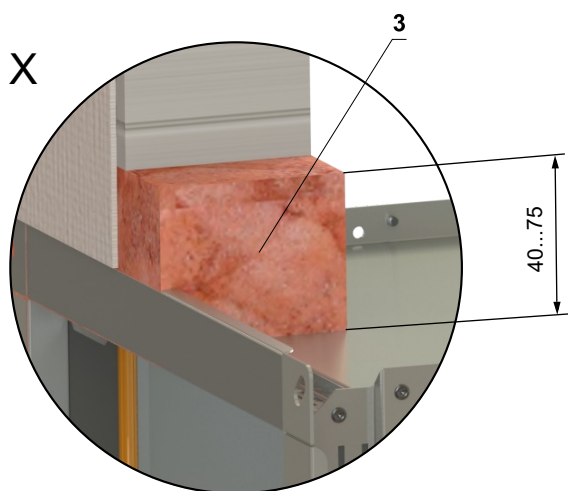


- 1 FDMB
- 2 Solid wall construction
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPROCK HD)
- 4 Fire-resistant coating - th. 1 mm (e.g. PROMASTOP-I)
- 5 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)
- 6 Screw 4x50 mm - screws must be fixed in the wall construction, use steel anchors if necessary
- 7 Profile with threaded rod → see pages 74 to 77
- 8 Duct

In solid wall construction - fire-resistant foam with stucco plaster

EI 60 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- This installation is only possible for maximum size of the fire damper 400x400 mm

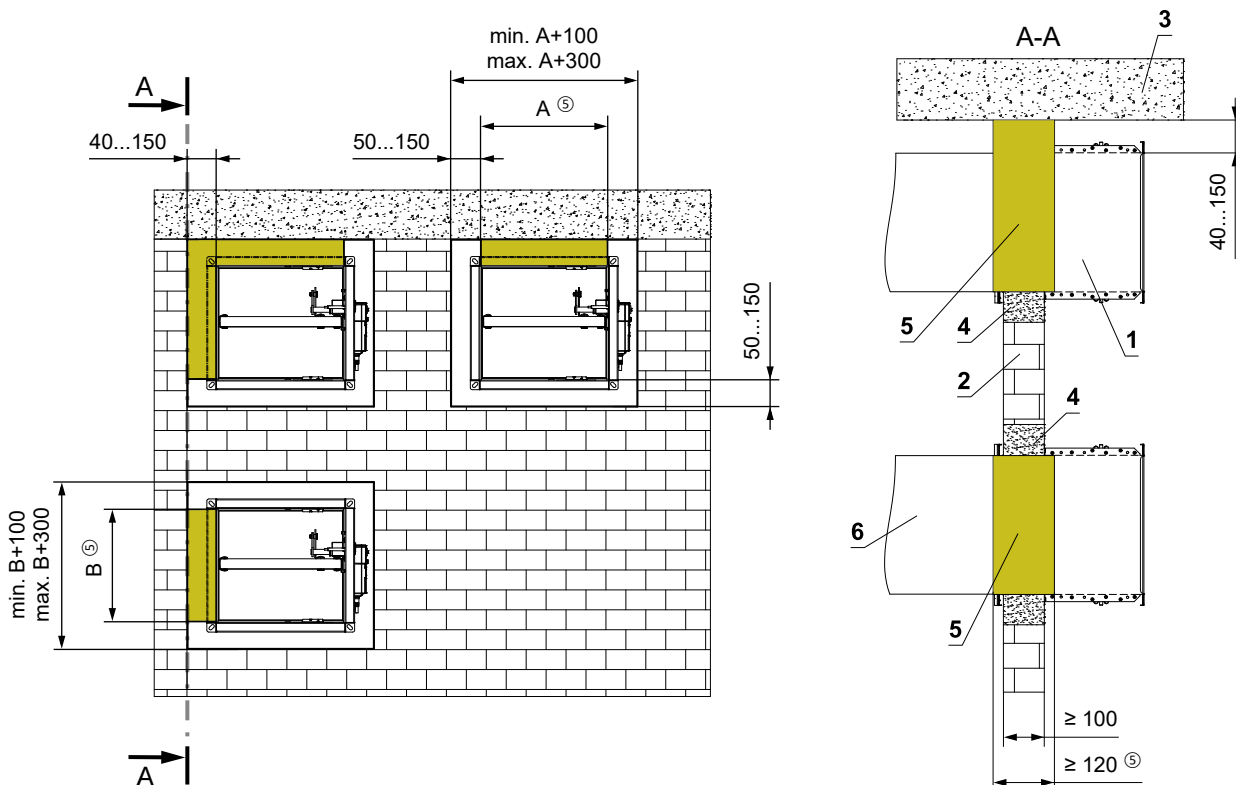
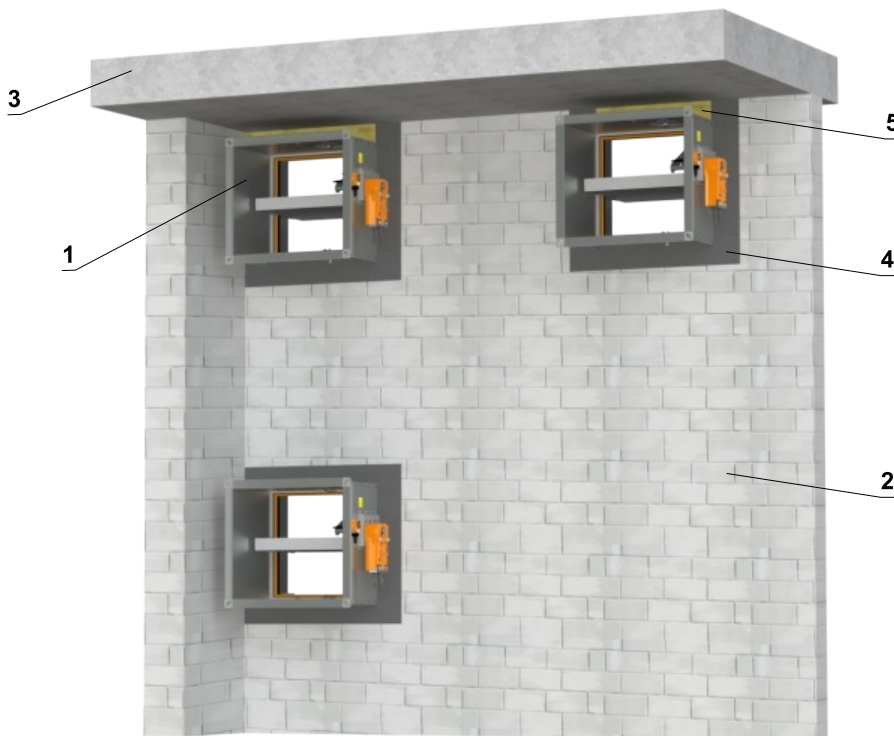


- 1 FDMB
- 2 Solid wall construction
- 3 Fire-resistant foam HILTI CFS-F FX
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct
- 6 Stucco plaster

In solid wall construction - installation next to the wall/ceiling - mortar or gypsum + mineral wool

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Conditions of this installation are also valid for the installation in **Solid ceiling construction**
- Penetration is filled with mortar or gypsum + mineral wool (shape, according to the location of the damper). Fix the mineral wool with glue (e.g. Promat K84 or equivalent) to the construction and damper casing



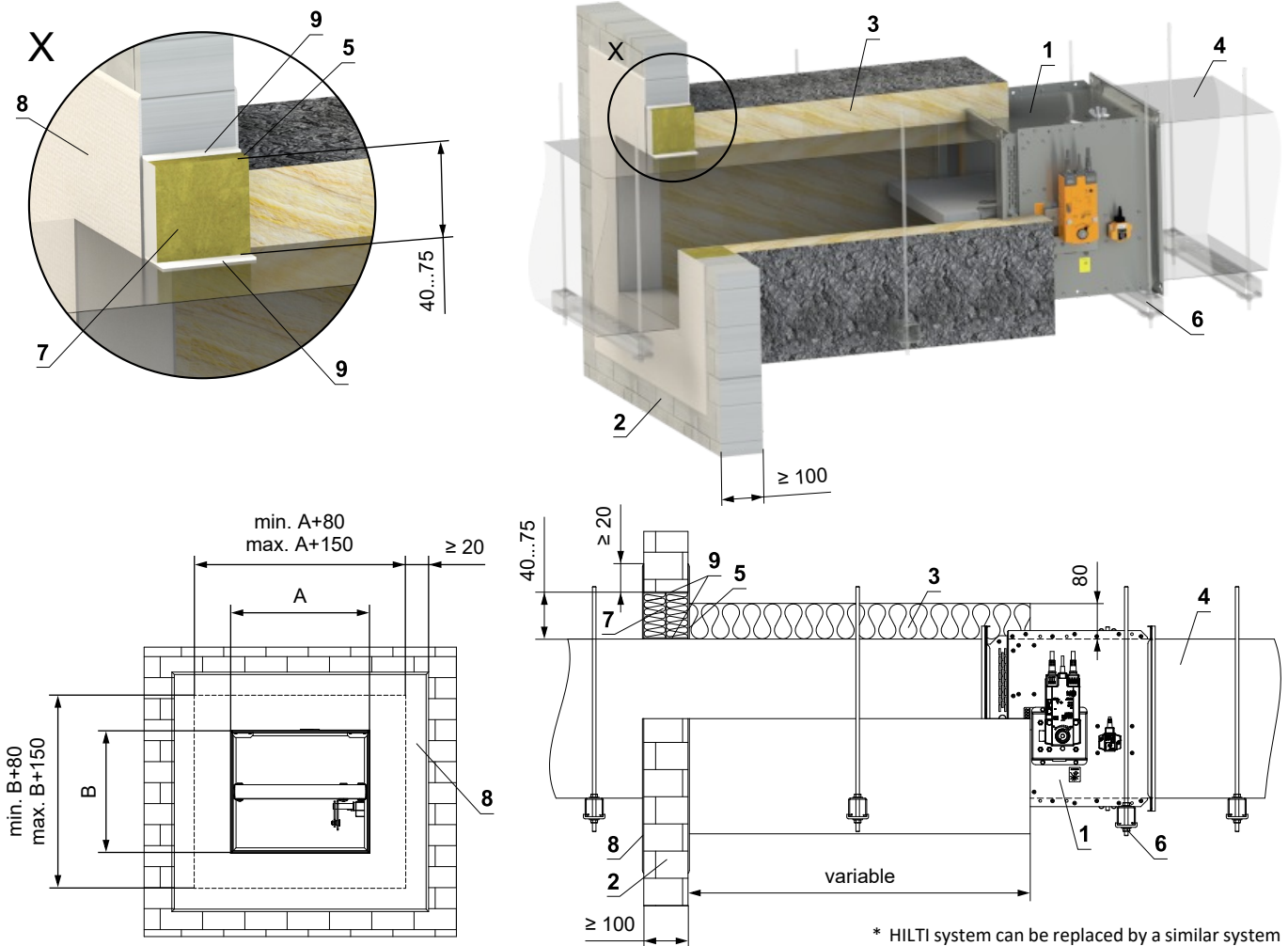
- 1 FDMB
- 2 Solid wall construction
- 3 Solid ceiling construction
- 4 Mortar or gypsum
- 5 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPROCK HD)
- 6 Duct

## Installation outside solid wall construction

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

EI 60 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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



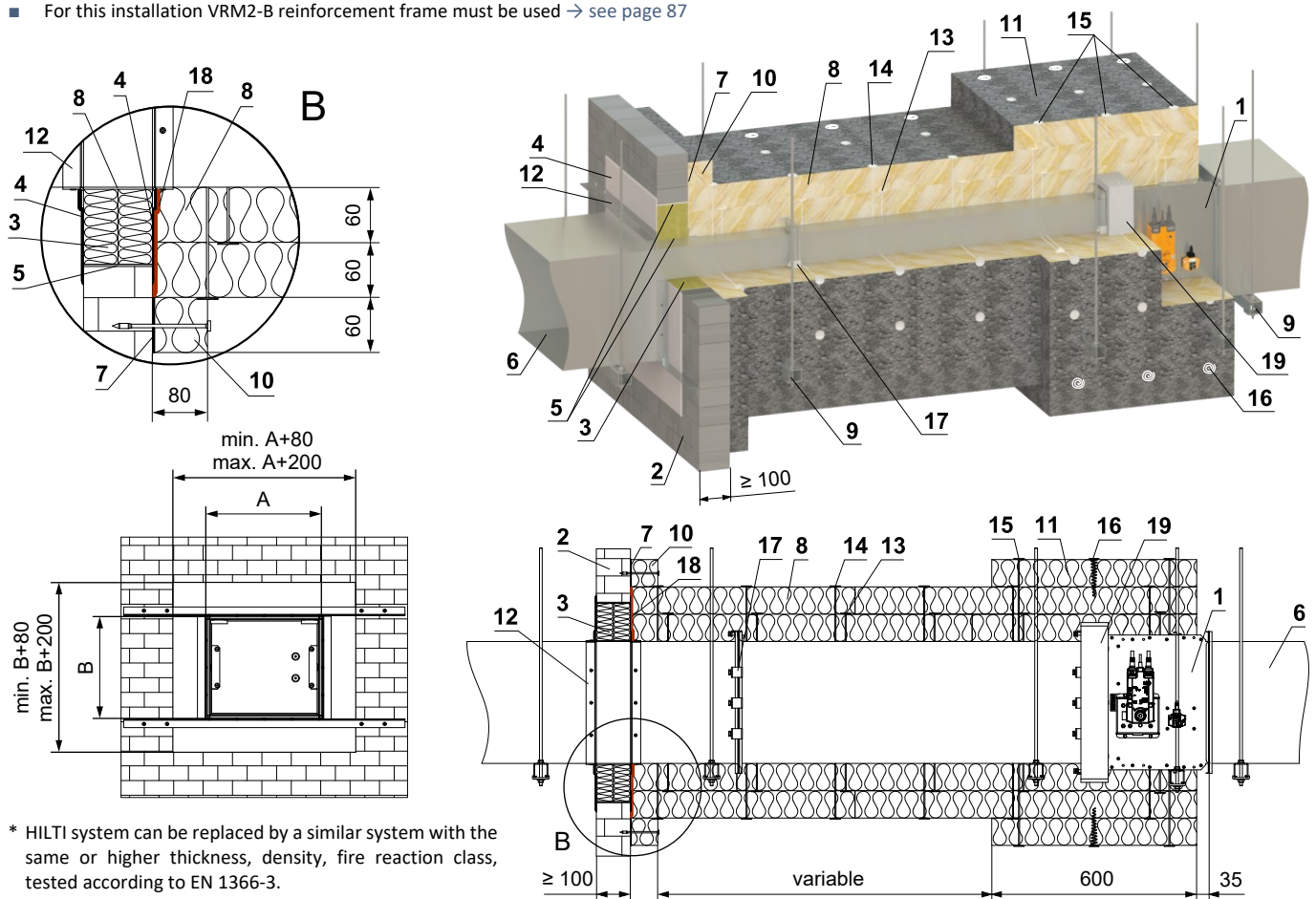
- 1 FDMB
- 2 Solid wall construction
- 3 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect Wired Mat 4.0 Alu1)
- 4 Standard air duct, made of galvanized sheet metal, thickness according to damper size
- 5 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 6 Profile with threaded rod → see pages 74 to 77  
Ablative Coated Batt System HILTI\*
- 7 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 8 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 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.

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

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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
- Damper inspection holes are covered with insulation, therefore it's necessary to make an inspection hole on the connecting duct
- 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
- For this installation VRM2-B reinforcement frame must be used → see page 87



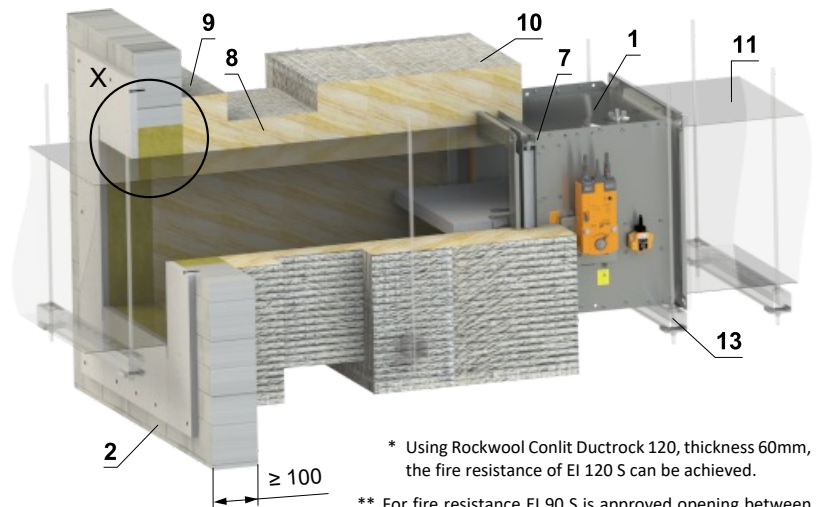
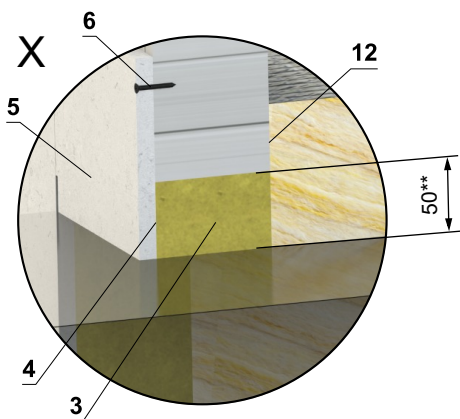
- 1 FDMB
- 2 Solid wall construction  
Ablative Coated Batt System HILTI\*
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 5 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, thickness according to damper size
- 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, thickness 60 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect Wired Mat 4.0 Alu1)
- 9 Profile with threaded rod → see pages 74 to 77
- 10 Duct penetration insulation collar - th. 60 mm - ISOVER Ultimate Protect SLAB 4.0 Alu1, - glued (pos. 7) and fixed with screws to the wall construction
- 11 Insulating collar of the damper and duct connection - th. 60 mm ISOVER Ultimate Protect SLAB 4.0 Alu1
- 12 L-profile 30x30x3 mm - installation acc. to ISOVER
- 13 Stud-welded pin 60 mm - quantity and placing acc. to ISOVER
- 14 Stud-welded pin 120 mm - quantity and placing acc. to ISOVER
- 15 Stud-welded pin 180 mm - quantity and placing acc. to ISOVER
- 16 Fire spiral shaped screw - quantity and placing acc. to ISOVER
- 17 Steel clamp min. bolt M8
- 18 ISOVER Protect BSF
- 19 VRM2-B → see page 87



**Outside solid wall construction - mineral wool ROCKWOOL - mineral wool with fire-resistant coating and fire-resistant board**

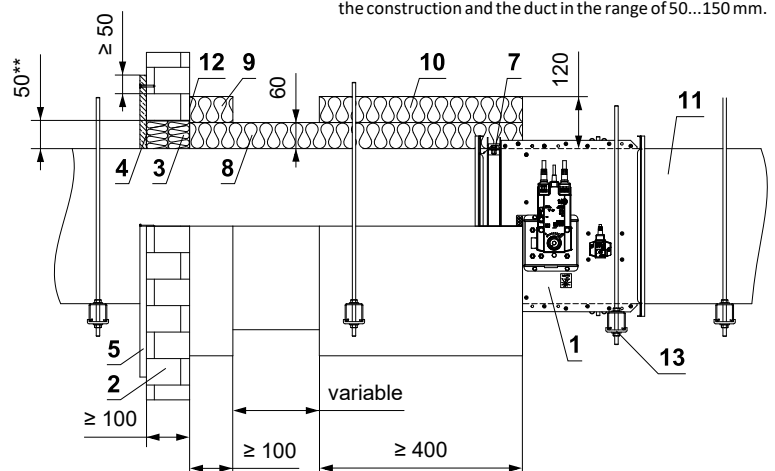
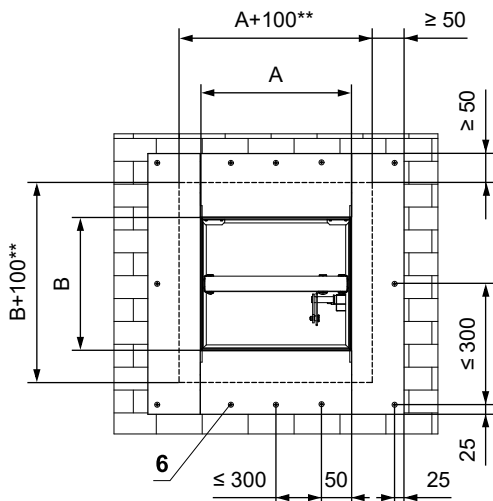
**EI 90 (v<sub>e</sub> i↔o) S**  
**\*EI 120 (v<sub>e</sub> i↔o) S**

- For connection of following duct → see page 78
- Minimum and maximum distance between the wall and fire damper is unlimited
- When installing the insulation, follow the ROCKWOOL 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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 insulation, distance between threaded rod and isolation is max. 40 mm
- For this installation VRM-B reinforcement frame must be used → see page 86



\* Using Rockwool Conlit Ductrock 120, thickness 60mm, the fire resistance of EI 120 S can be achieved.

\*\* For fire resistance EI 90 S is approved opening between the construction and the duct in the range of 50...150 mm.



- 1 FDMB
- 2 Solid wall construction
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPLOCK HD)
- 4 Fire-resistant coating - th. 1 mm (e.g. PROMASTOP-I)
- 5 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)
- 6 Screw 4x50 mm - screws must be fixed in the wall construction, use steel anchors if necessary
- 7 VRM-B → see page 86

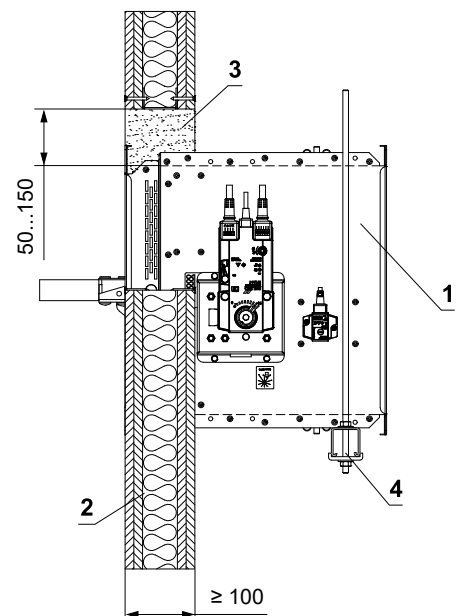
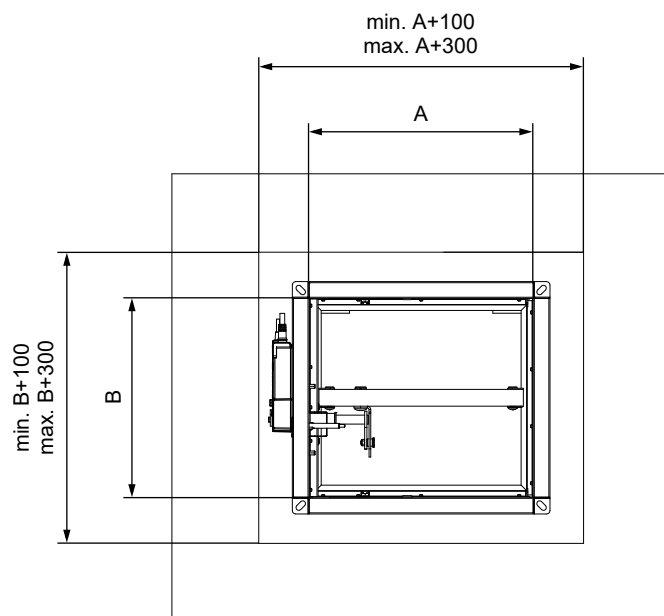
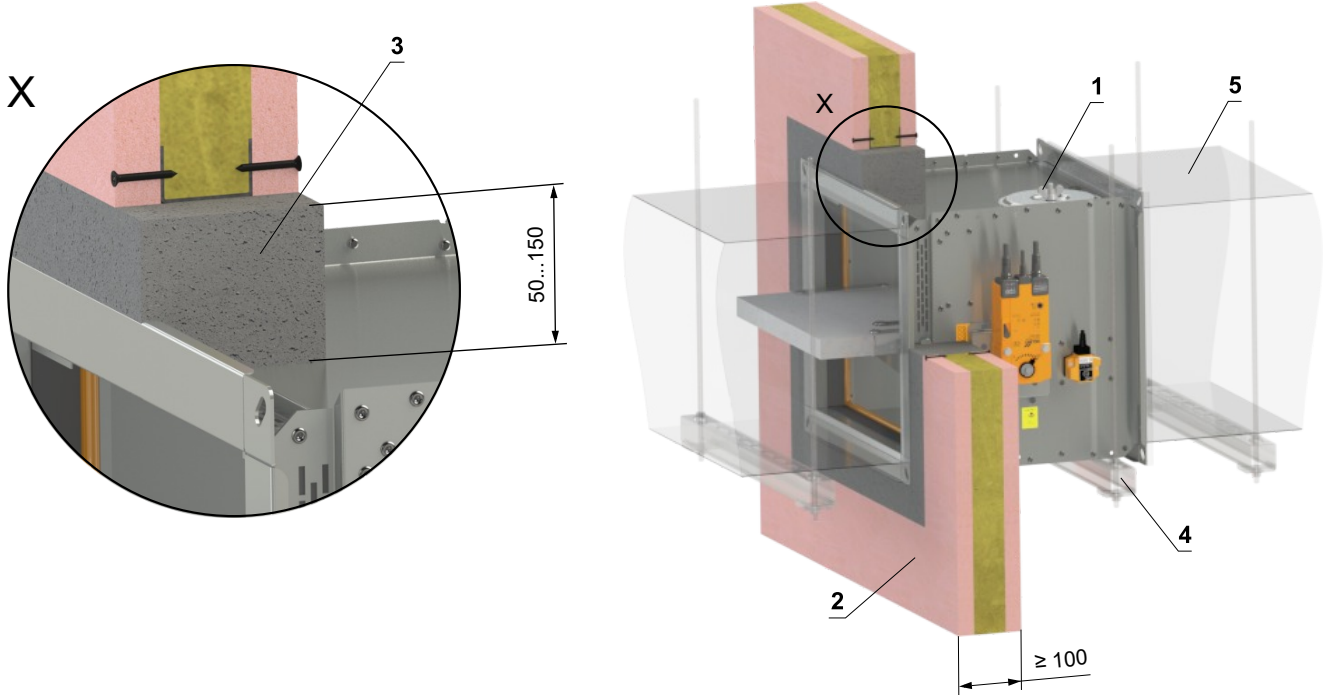
- 8 Insulation board made of mineral wool, with a surface treatment of aluminum foil - th. 60 mm, min. density 300 kg/m<sup>3</sup> - (System ROCKWOOL Conlit Ductrock 90(120\*))
- 9 Duct penetration insulation collar - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120\*)) - glued (pos. 12) and fixed with screws to the wall construction
- 10 Insulation collar of the damper and duct connection - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120\*))
- 11 Standard air duct, made of galvanized sheet metal, thickness according to damper size
- 12 ROCKWOOL Firepro glue - apply on the insulation and fix it to the fire separation construction
- 13 Profile with threaded rod → see pages 74 to 77

In gypsum wall construction

In gypsum wall construction - mortar or gypsum

EI 120 (v<sub>e</sub> i↔o) S - 500 Pa

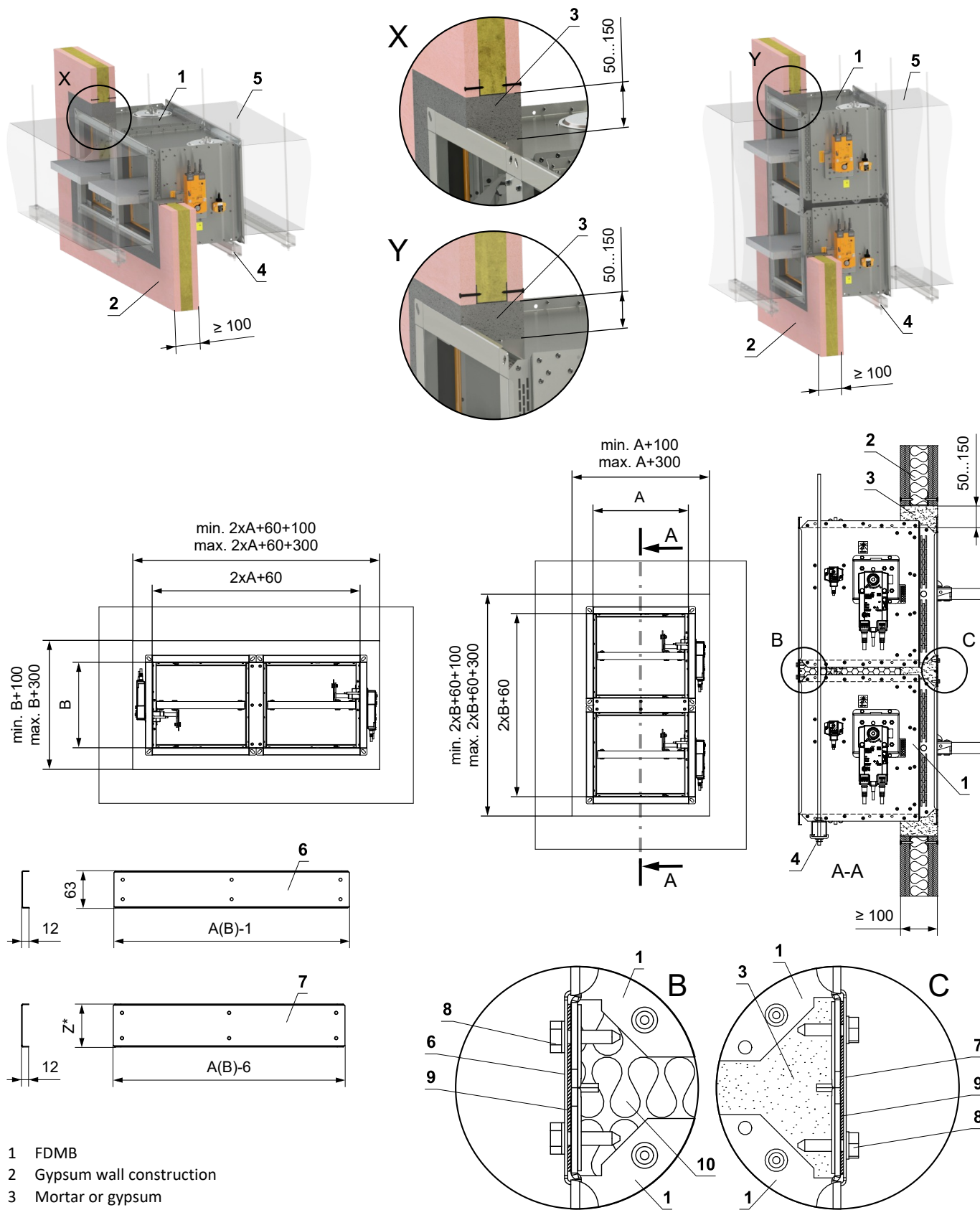
- For connection of following duct → see page 78



- 1 FDMB
- 2 Gypsum wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct

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

EI 90 (v<sub>e</sub> i↔o) S



- 1 FDMB
- 2 Gypsum wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEX 4,8x18 mm (pitch ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

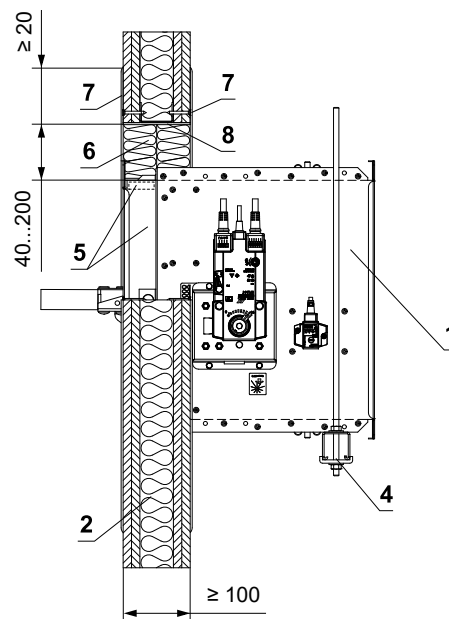
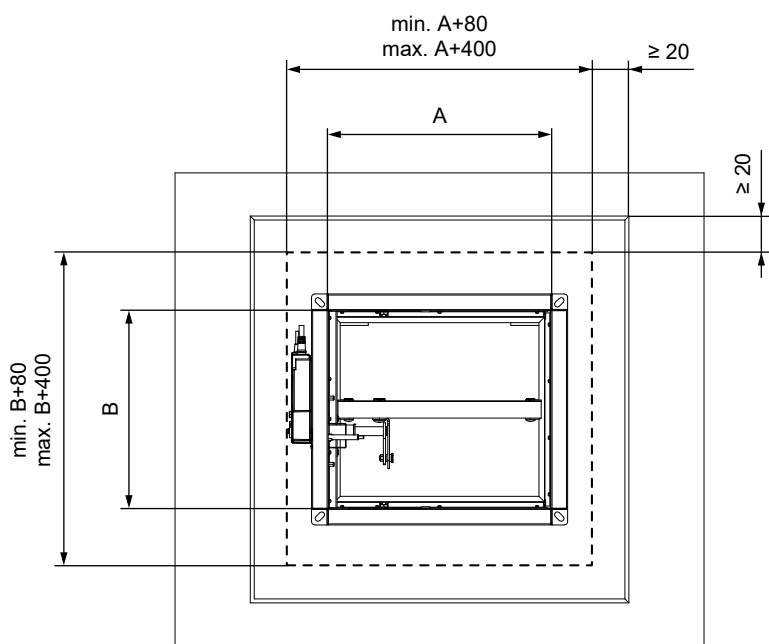
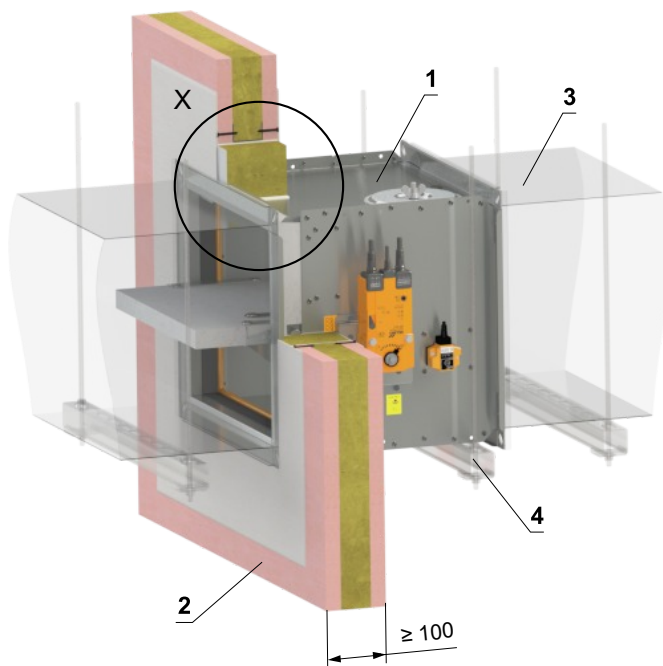
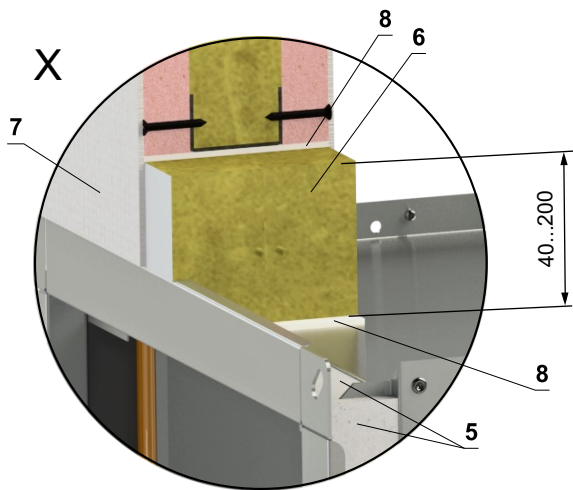
\* Z=86 (A≤500 and B≤400)  
 \* Z=99 (A>500 or B>400)

- For connection of following duct → see page 78
- The gap between the damper and construction is filled with mortar or gypsum

In gypsum wall construction - Ablative Coated Batt - 100 mm

EI 60 (v<sub>e</sub> i↔o) S with wall fire resistance EI 60  
EI 90 (v<sub>e</sub> i↔o) S with wall fire resistance EI 90

■ For connection of following duct → see page 78



- 1 FDMB
- 2 Gypsum wall construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
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

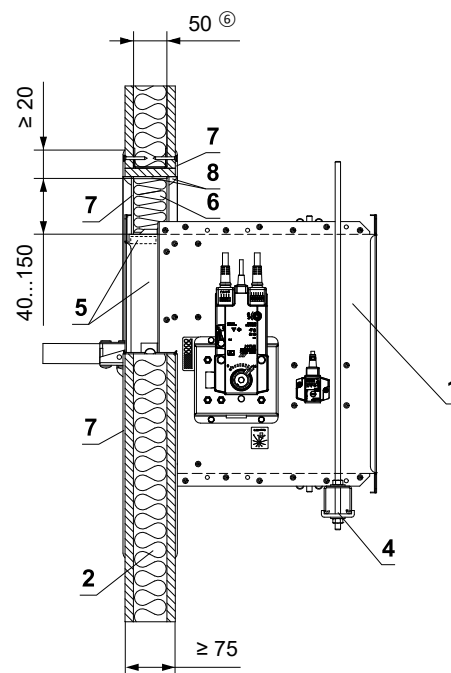
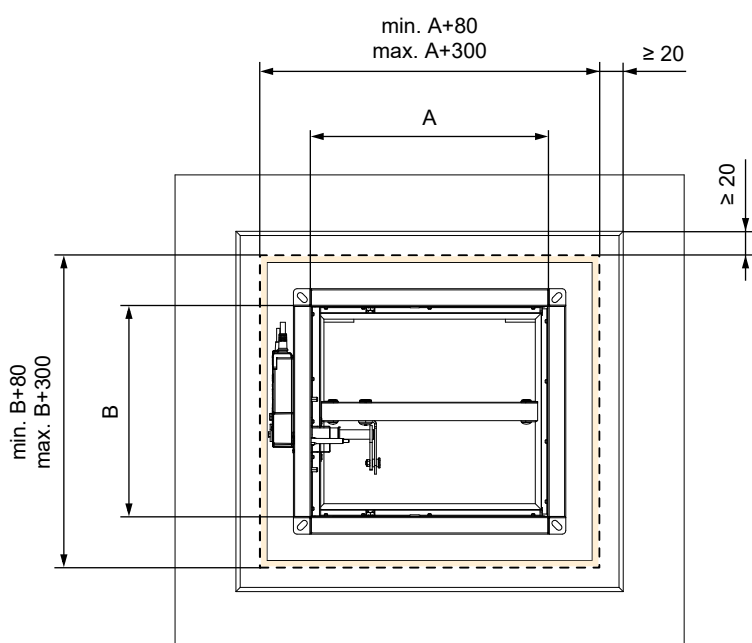
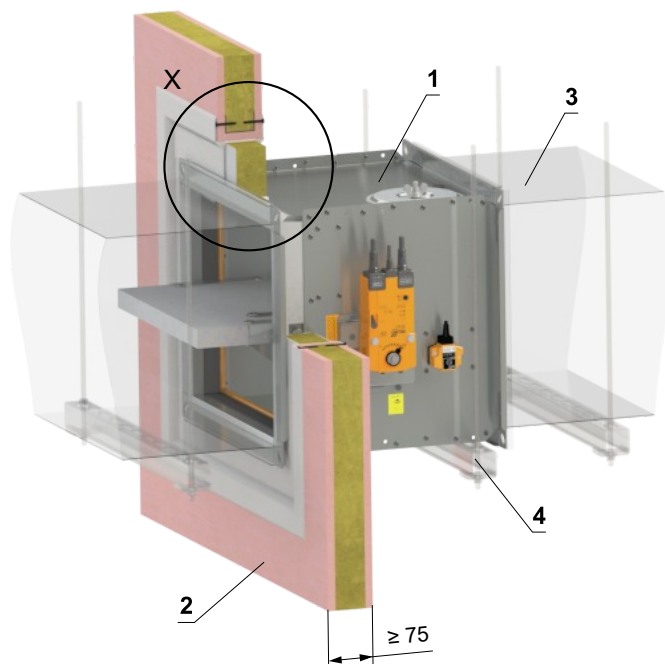
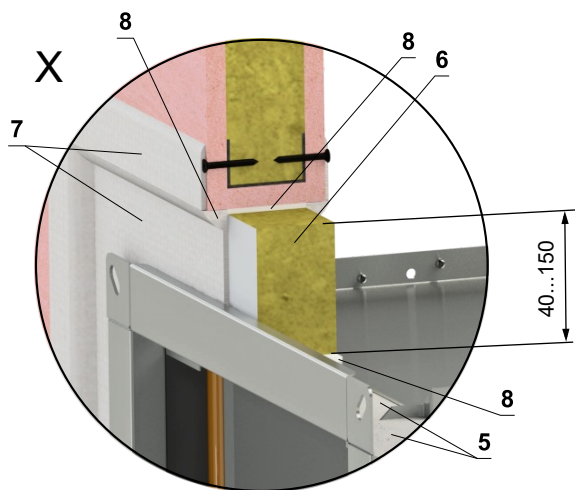
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

In gypsum wall construction - Ablative Coated Batt - 50 mm

EI 30 (v<sub>e</sub> i↔o) S

EI 45 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78



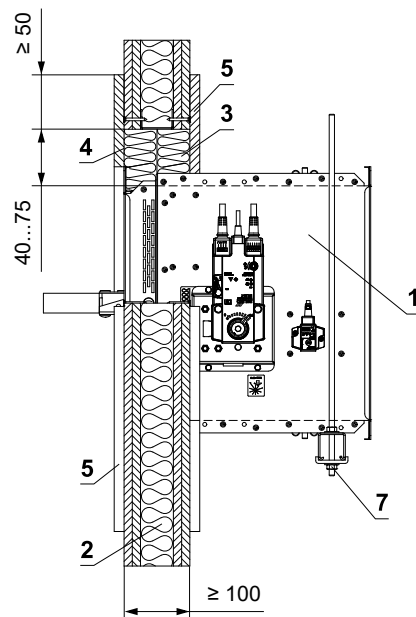
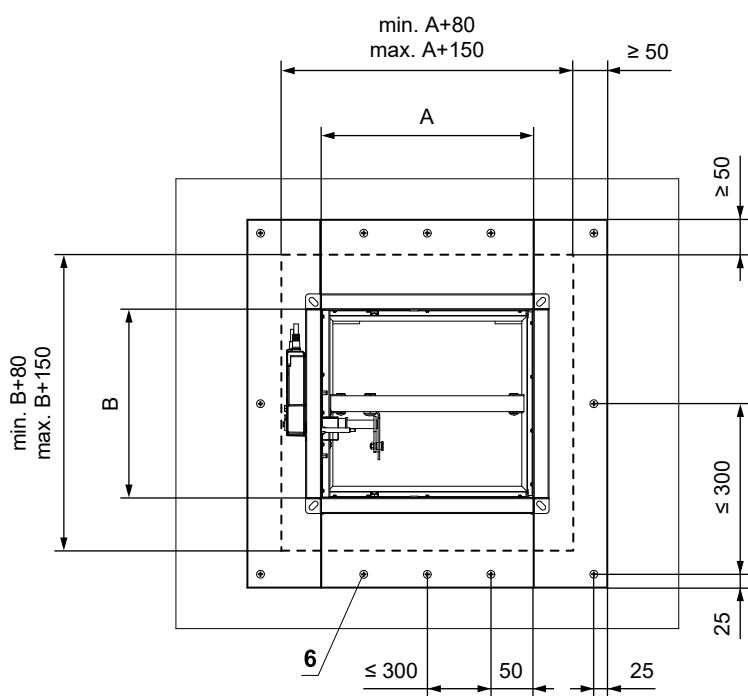
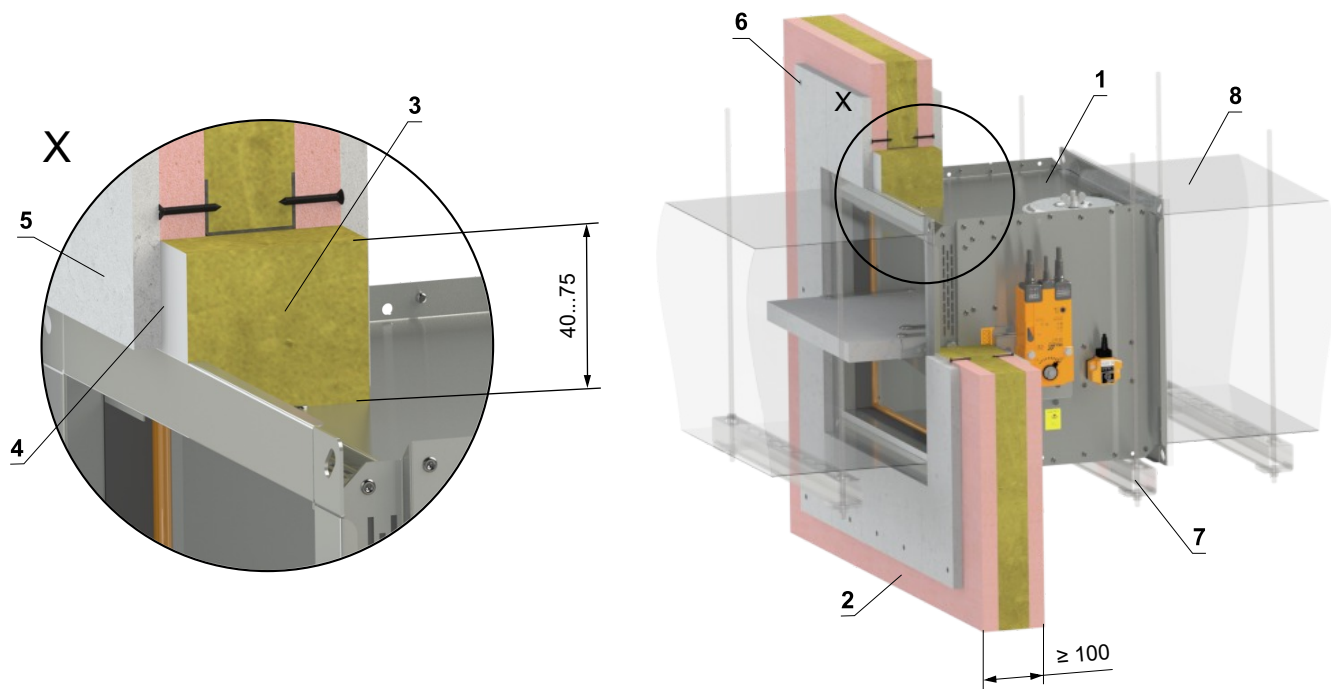
- 1 FDMB
- 2 Gypsum wall construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
Ablative Coated Batt System HILTI\*
- 6 Mineral wool board - min. density 140 kg/m<sup>3</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.

In gypsum wall construction - mineral wool with fire-resistant coating and fire-resistance boards

EI 90 (v<sub>e</sub> i↔o) S

■ For connection of following duct → see page 78

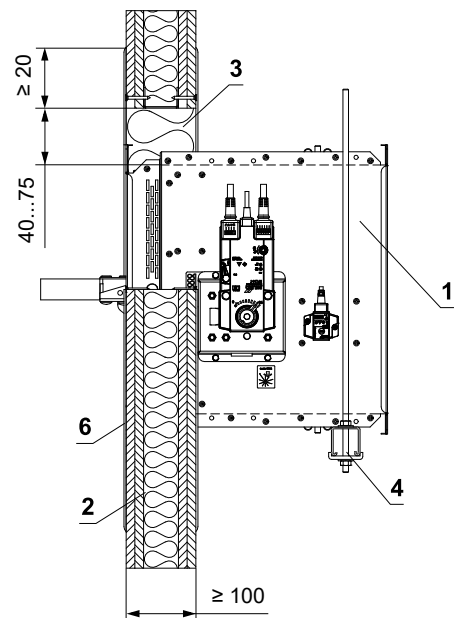
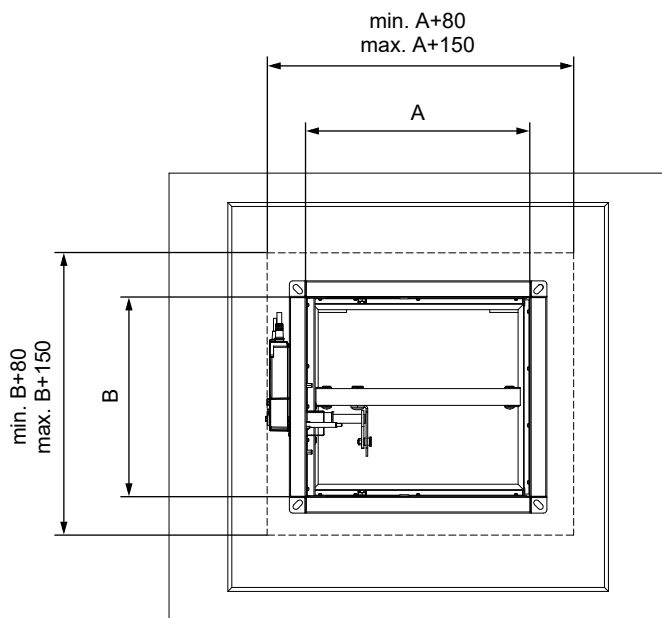
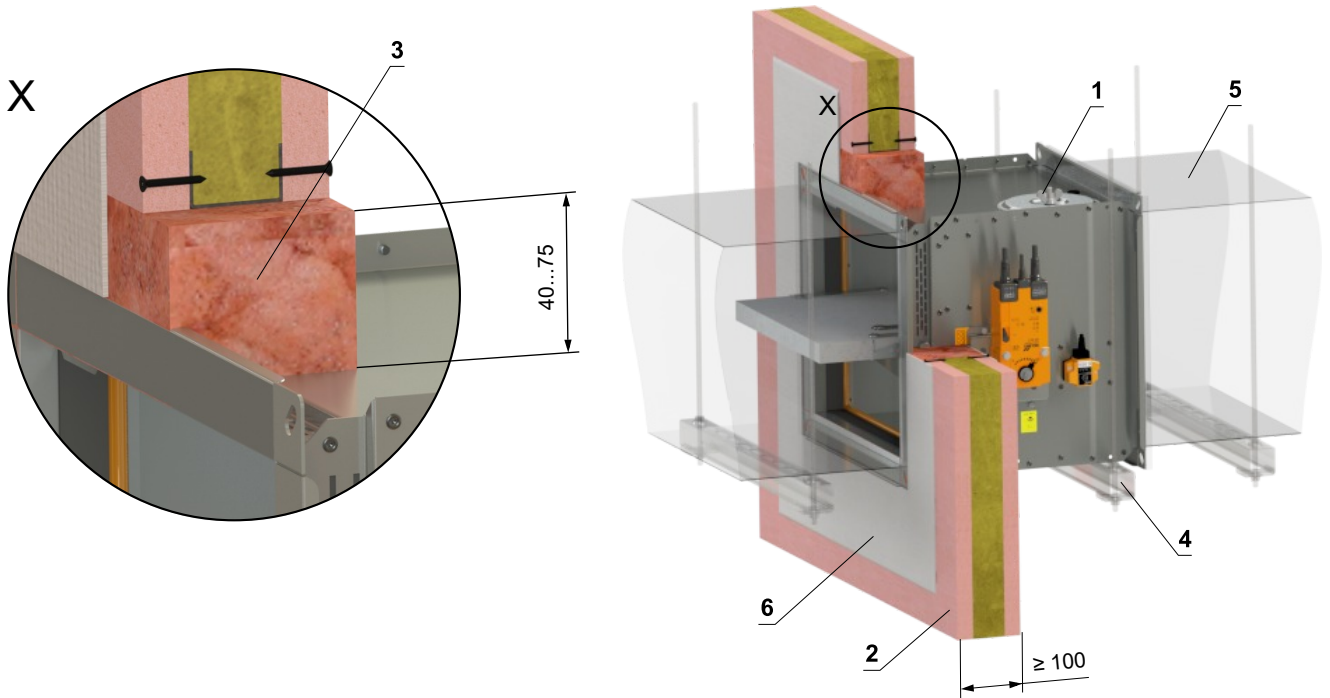


- 1 FDMB
- 2 Gypsum wall construction
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPROCK HD)
- 4 Fire-resistant coating - th. 1 mm (e.g. PROMASTOP-I)
- 5 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)
- 6 Screw 4x50 mm - screws must be fixed in the wall construction, use steel anchors if necessary
- 7 Profile with threaded rod → see pages 74 to 77
- 8 Duct

In gypsum wall construction - fire-resistant foam with stucco plaster

EI 60 (v<sub>e</sub> i↔o) S

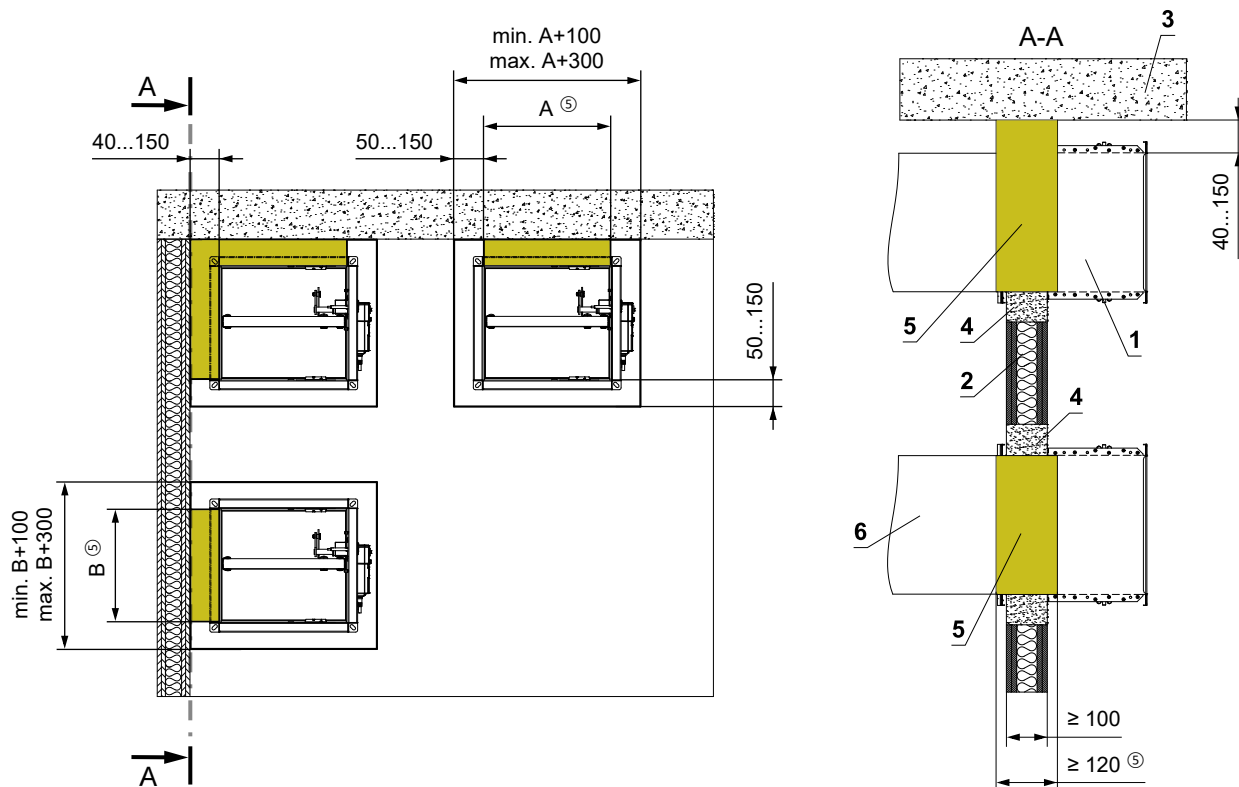
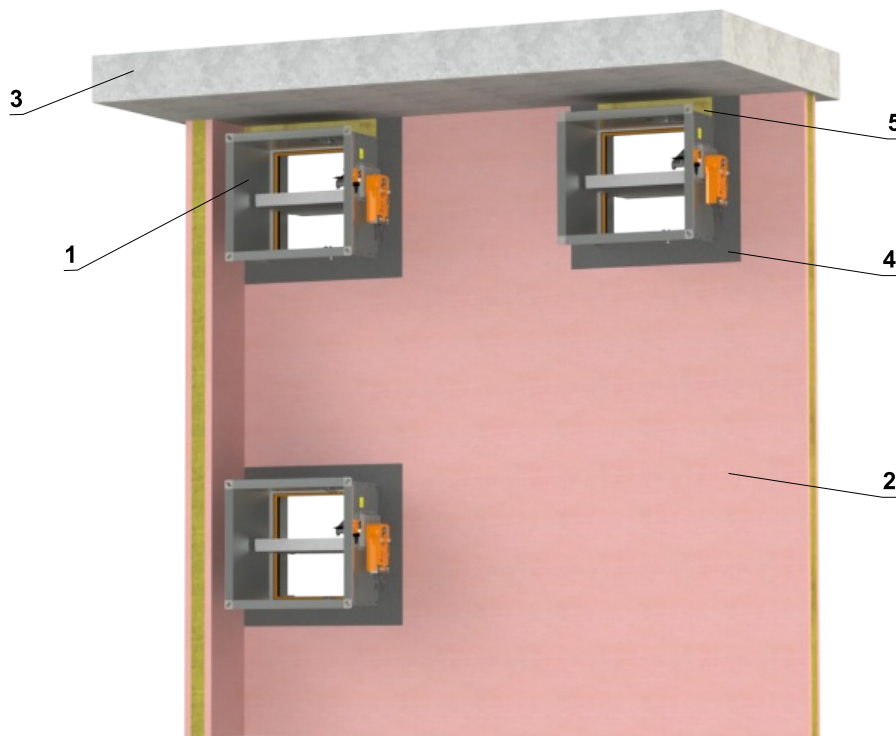
- For connection of following duct → see page 78
- This installation is only possible for maximum size of the fire damper 400x400 mm



- 1 FDMB
- 2 Gypsum wall construction
- 3 Fire-resistant foam HILTI CFS-F FX
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct
- 6 Stucco plaster

In gypsum wall construction - installation next to the wall/ceiling - mortar or gypsum + mineral wool EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Conditions of this installation are also valid for the installation in **Solid ceiling construction**
- Penetration is filled with mortar or gypsum + mineral wool (shape, according to the location of the damper). Fix the mineral wool with glue (e.g. Promat K84 or equivalent) to the construction and damper casing



- 1 FDMB
- 2 Gypsum wall construction
- 3 Solid ceiling construction
- 4 Mortar or gypsum
- 5 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEP ROCK HD)
- 6 Duct

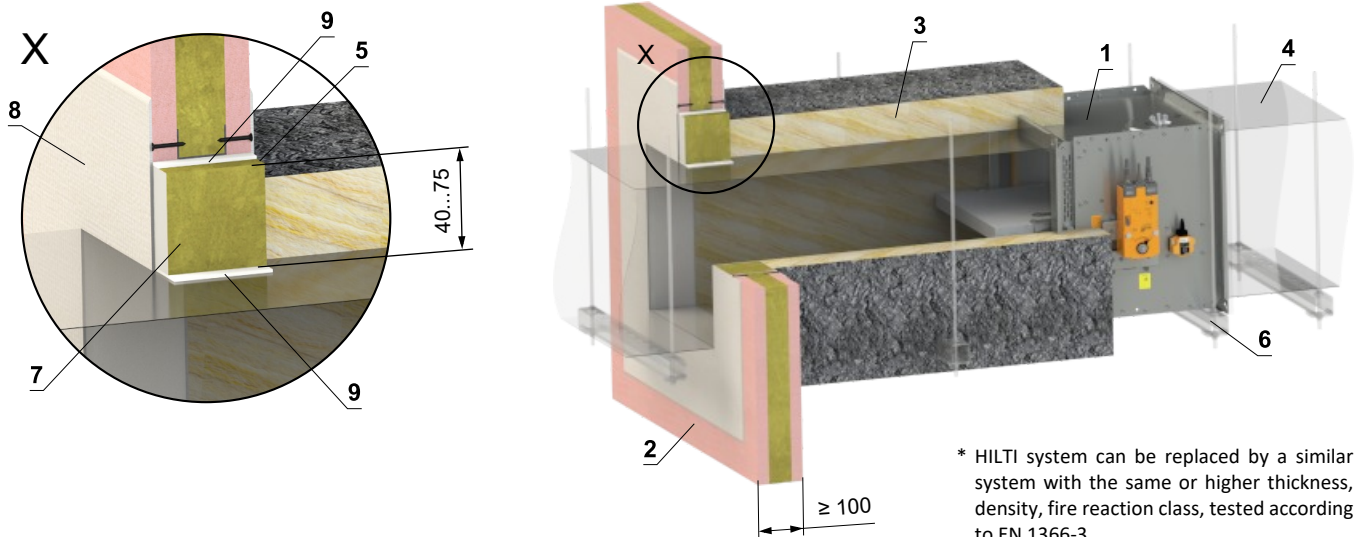


## Installation outside gypsum wall construction

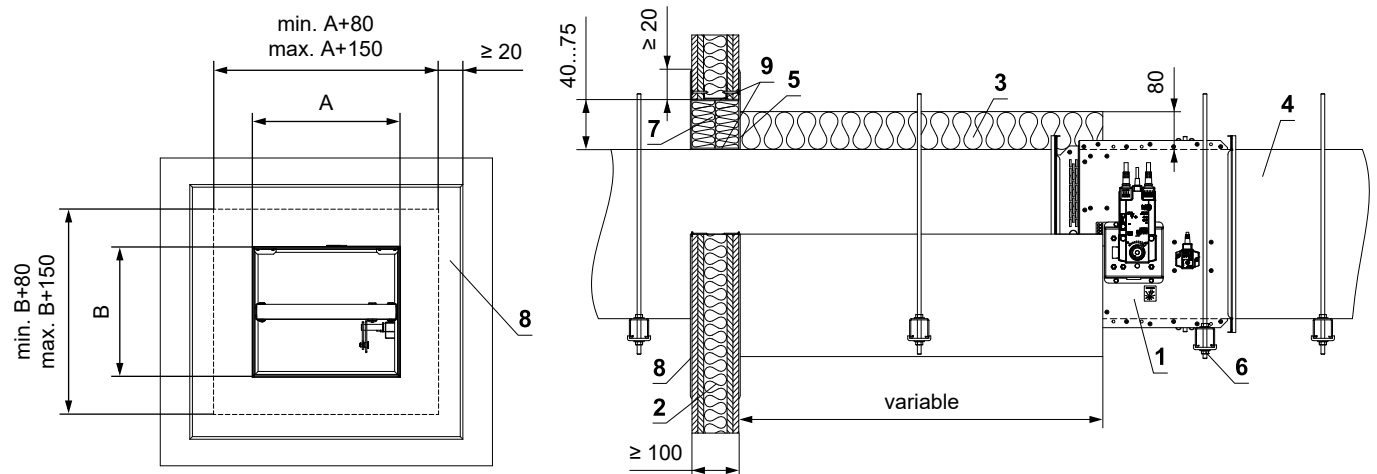
### Outside gypsum wall construction - ISOVER Ultimate Protect - Ablative Coated Batt

EI 60 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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



\* 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.

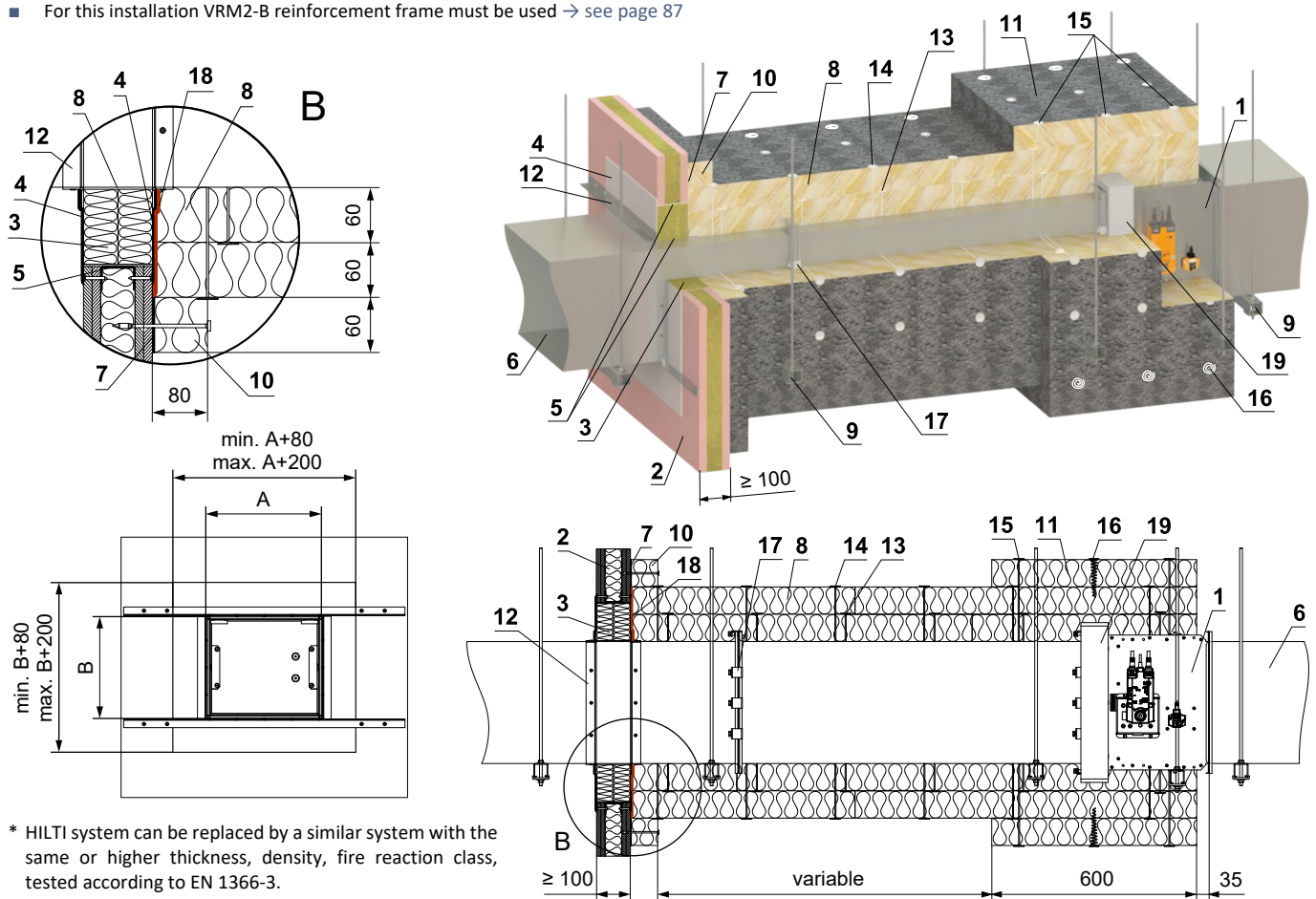


- 1 FDMB
- 2 Gypsum wall construction
- 3 Insulation board made of mineral wool, with a surface treatment of aluminum foil, min. thickness 80 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect Wired Mat 4.0 Alu1)
- 4 Standard air duct, made of galvanized sheet metal, thickness according to damper size
- 5 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction
- 6 Profile with threaded rod → see pages 74 to 77  
Ablative Coated Batt System HILTI\*
- 7 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)
- 8 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct
- 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

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

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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
- Damper inspection holes are covered with insulation, therefore it's necessary to make an inspection hole on the connecting duct
- 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
- For this installation VRM2-B reinforcement frame must be used → see page 87



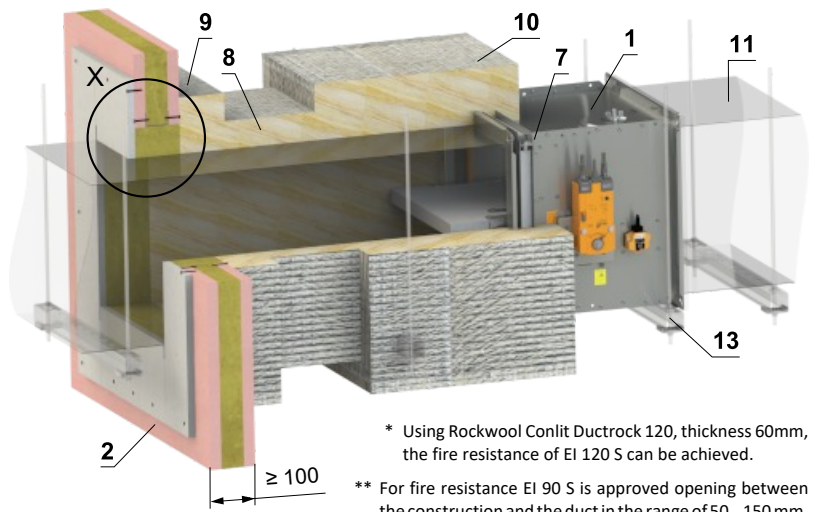
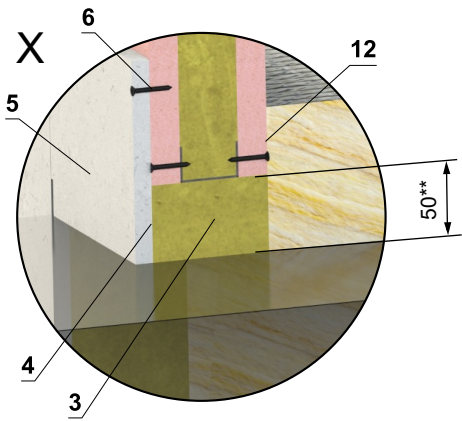
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1 FDMB</li> <li>2 Solid wall construction<br/>Ablative Coated Batt System HILTI*</li> <li>3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (HILTI CFS-CT B 1S 140/50...)</li> <li>4 Fire stop coating - th. 1 mm (HILTI CFS-CT...) - coating is overcoated on the support construction and on the damper casing/duct</li> <li>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</li> <li>6 Standard air duct, made of galvanized sheet metal, thickness according to damper size</li> <li>7 ISOVER Protect BSK glue - apply on the insulation and fix it to the fire separation construction</li> <li>8 Insulation board made of mineral wool, with a surface treatment of aluminum foil, thickness 60 mm, min. density 66 kg/m<sup>3</sup> (System ISOVER Ultimate Protect Wired Mat 4.0 Alu1)</li> </ol> | <ol style="list-style-type: none"> <li>9 Profile with threaded rod → see pages 74 to 77</li> <li>10 Duct penetration insulation collar - th. 60 mm - ISOVER Ultimate Protect SLAB 4.0 Alu1, - glued (pos. 7) and fixed with screws to the wall construction</li> <li>11 Insulating collar of the damper and duct connection - th. 60 mm ISOVER Ultimate Protect SLAB 4.0 Alu1</li> <li>12 L-profile 30x30x3 mm - installation acc. to ISOVER</li> <li>13 Stud-welded pin 60 mm - quantity and placing acc. to ISOVER</li> <li>14 Stud-welded pin 120 mm - quantity and placing acc. to ISOVER</li> <li>15 Stud-welded pin 180 mm - quantity and placing acc. to ISOVER</li> <li>16 Fire spiral shaped screw - quantity and placing acc. to ISOVER</li> <li>17 Steel clamp min. bolt M8</li> <li>18 ISOVER Protect BSF</li> <li>19 VRM2-B → see page 87</li> </ol> |
|---|---|

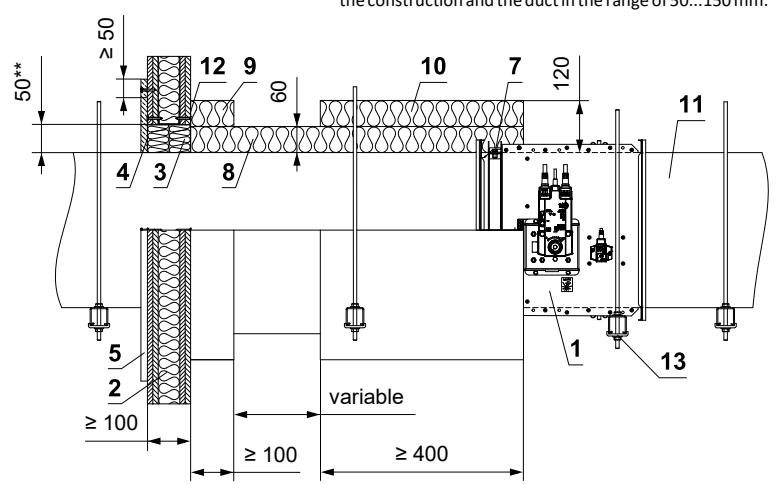
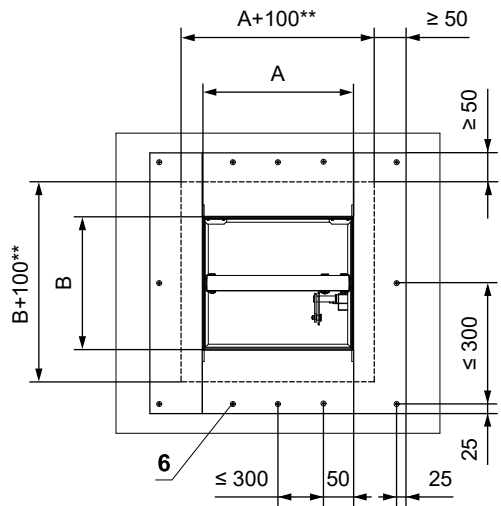
**Outside gypsum wall construction - mineral wool ROCKWOOL - mineral wool with fire-resistant coating and fire-resistant board**

**EI 90 (v<sub>e</sub> i↔o) S**  
**\*EI 120 (v<sub>e</sub> i↔o) S**

- For connection of following duct → see page 78
- Minimum and maximum distance between the wall and fire damper is unlimited
- When installing the insulation, follow the ROCKWOOL 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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
- For this installation VRM-B reinforcement frame must be used → see page 86



\* Using Rockwool Conlit Ductrock 120, thickness 60mm, the fire resistance of EI 120 S can be achieved.  
 \*\* For fire resistance EI 90 S is approved opening between the construction and the duct in the range of 50...150 mm.



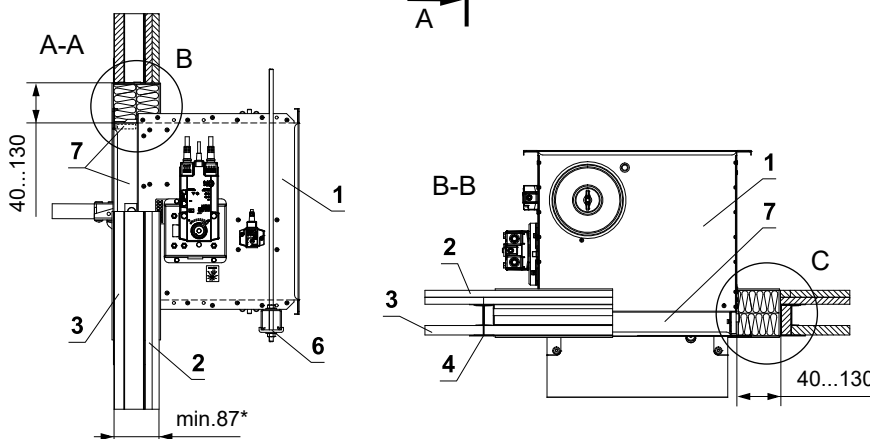
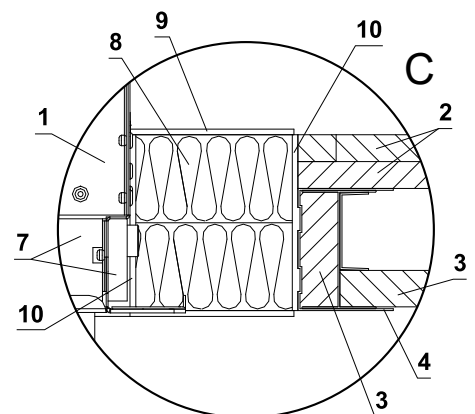
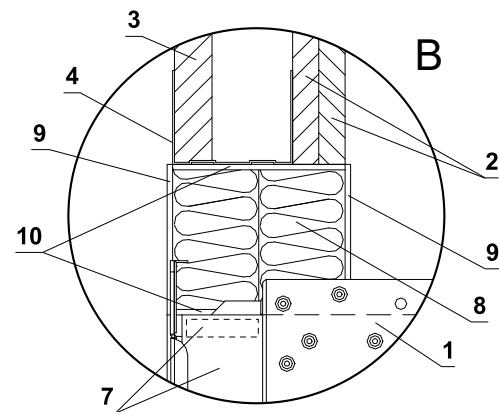
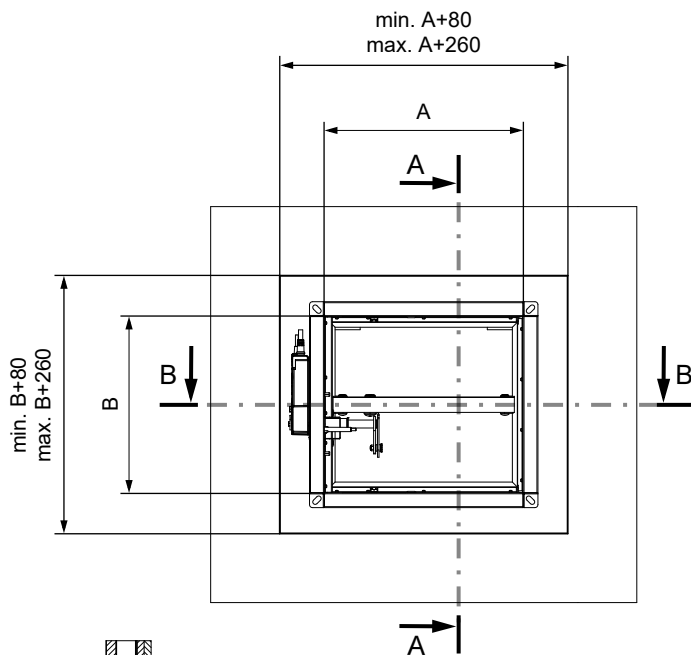
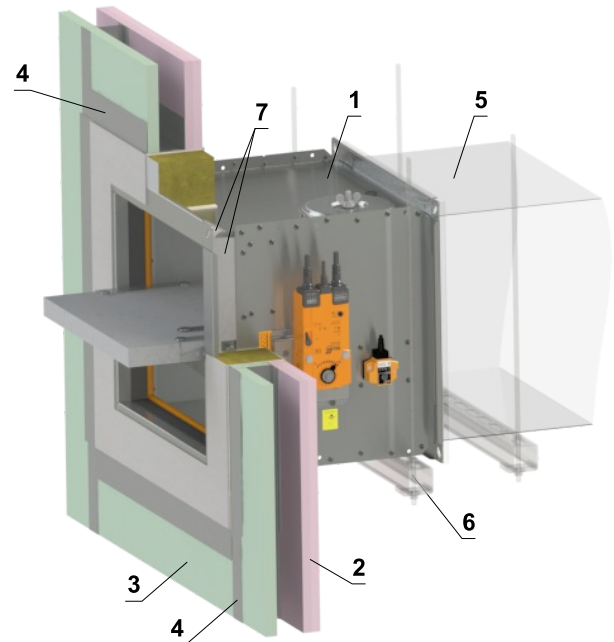
- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1 FDMB</li> <li>2 Gypsum wall construction</li> <li>3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPROCK HD)</li> <li>4 Fire-resistant coating - th. 1 mm (e.g. PROMASTOP-I)</li> <li>5 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)</li> <li>6 Screw 4x50 mm - screws must be fixed in the wall construction, use steel anchors if necessary</li> <li>7 VRM-B → see page 86</li> </ul> | <ul style="list-style-type: none"> <li>8 Insulation board made of mineral wool, with a surface treatment of aluminum foil - th. 60 mm, min. density 300 kg/m<sup>3</sup> - (System ROCKWOOL Conlit Ductrock 90(120*))</li> <li>9 Duct penetration insulation collar - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120*)) - glued (pos. 12) and fixed with screws to the wall construction</li> <li>10 Insulation collar of the damper and duct connection - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120*))</li> <li>11 Standard air duct, made of galvanized sheet metal, thickness according to damper size</li> <li>12 ROCKWOOL Firepro glue - apply on the insulation and fix it to the fire separation construction</li> <li>13 Profile with threaded rod → see pages 74 to 77</li> </ul> |
|---|---|

**In shaft wall construction**

**EI 60 S with shaftwall fire resistance EI 60**  
**EI 90 S with shaftwall fire resistance EI 90**

**In shaft wall construction - Ablative Coated Batt**

- For connection of following duct → see page 78
- Damper can be installed on either side of the wall
- It is possible to use e.g. wall type A306002 (EI 60 S), A306003 (EI 90 S)... from [www.british-gypsum.com](http://www.british-gypsum.com) or RNS 103, RNS 104 (EI 60 S)... 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 FDMB
- 2 Plasterboard EN 520 - Type F min. 2x12,5 mm\*
- 3 Plasterboard EN 520 - Type F min. 1x19 mm\*
- 4 Plasteboard profile
- 5 Duct
- 6 Profile with threaded rod → see pages 74 to 77
- 7 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
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

\* For fire resistance of the shaftwall EI 60 S

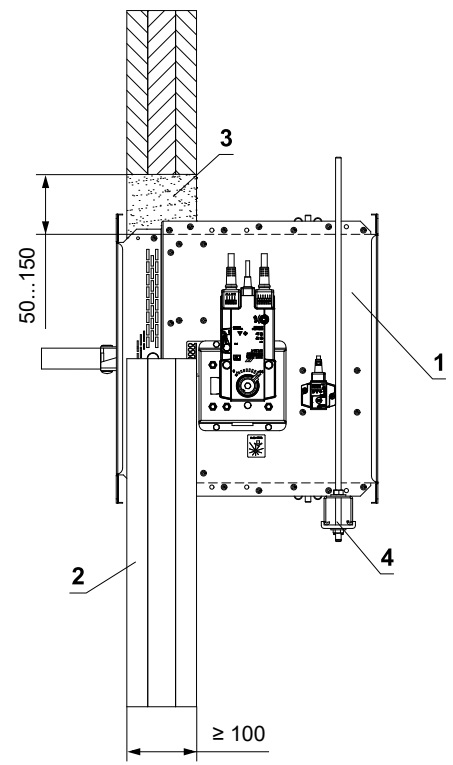
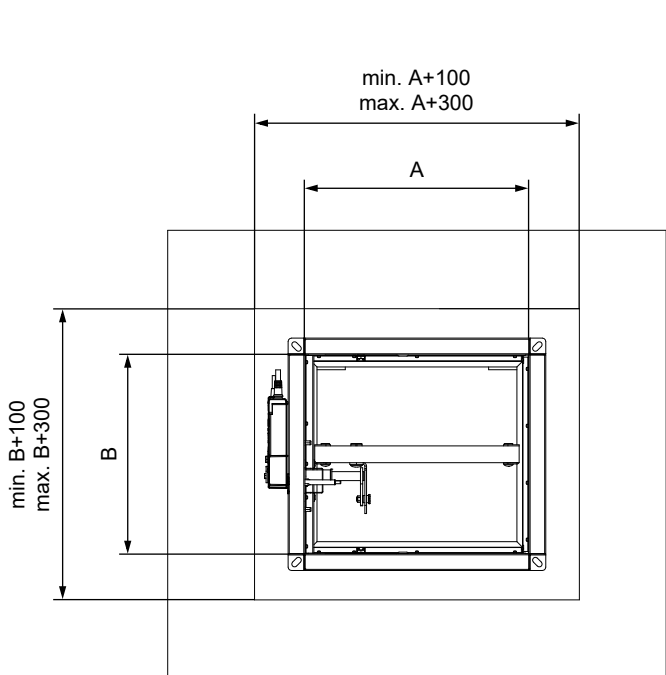
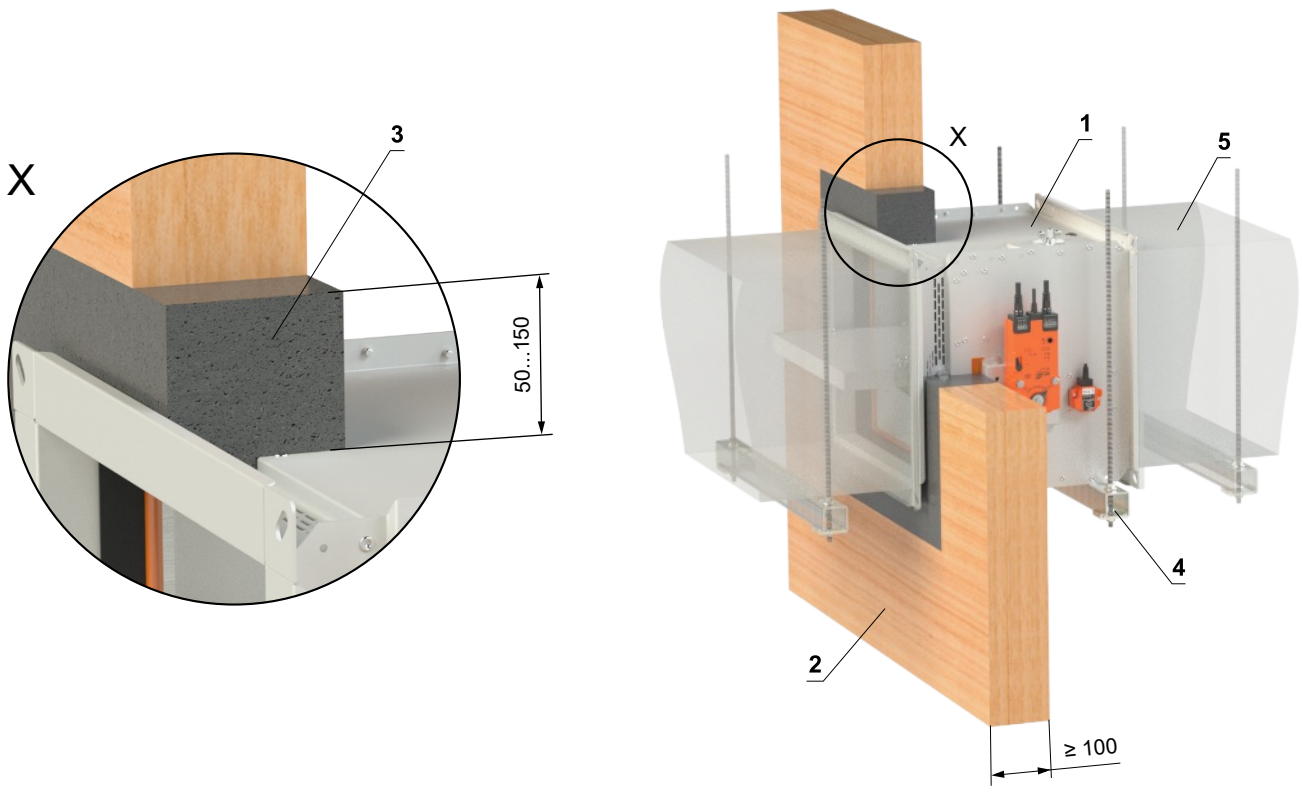
\*\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

**In CLT wall construction**

In CLT wall construction - mortar or gypsum

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78

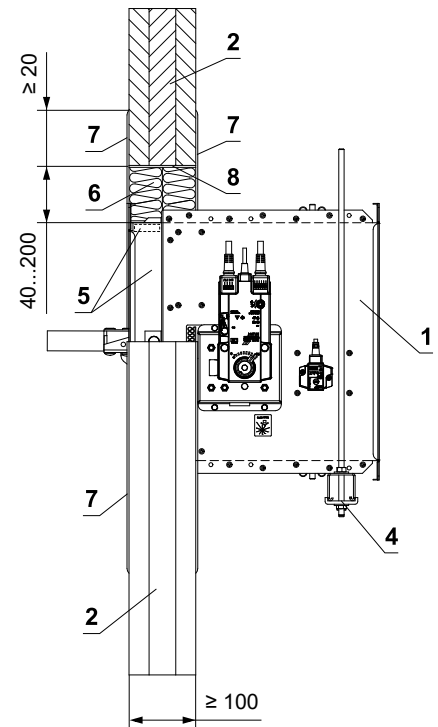
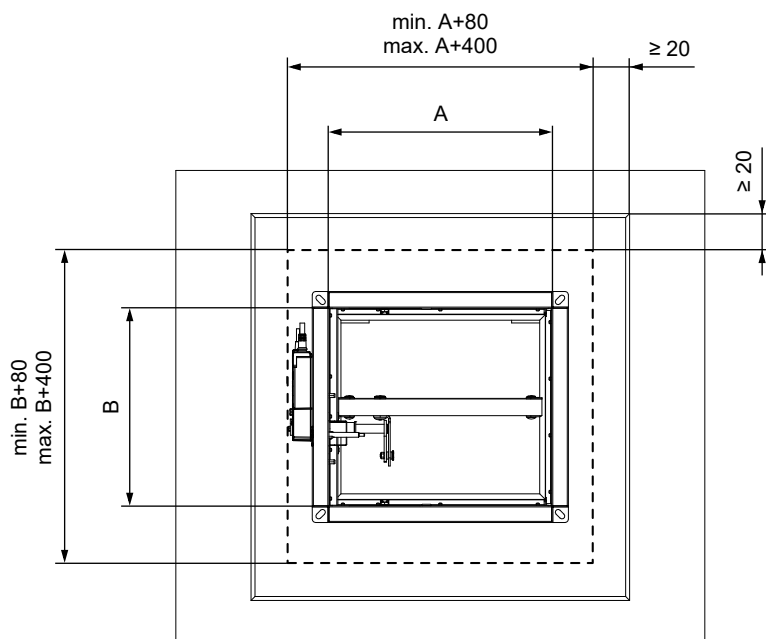
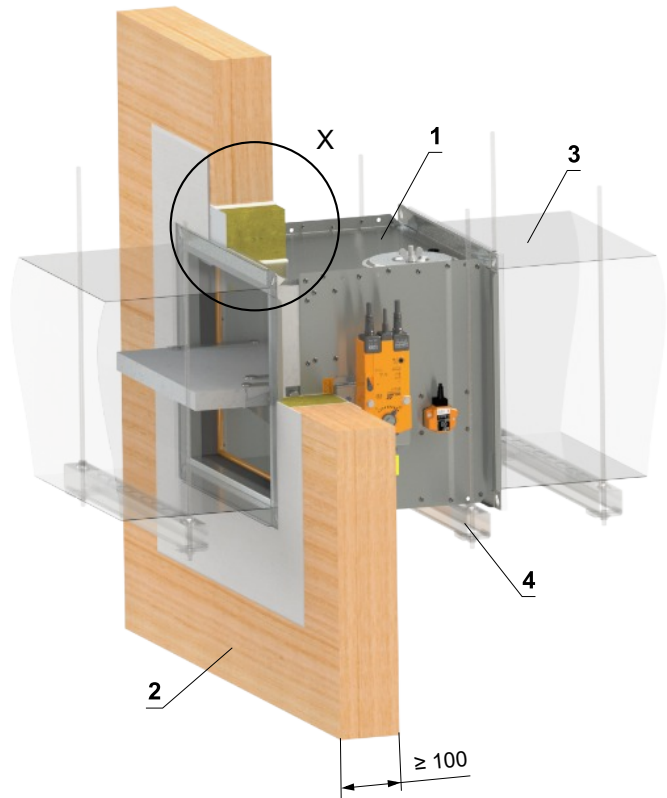
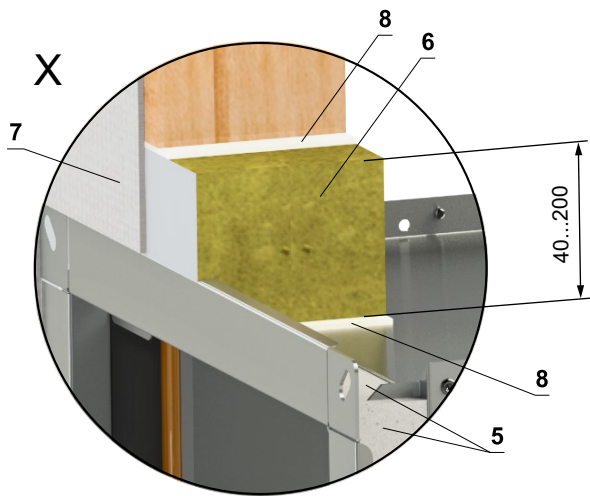


- 1 FDMB
- 2 CLT wall construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct

In CLT wall construction - Ablative Coated Batt

EI 90 (v<sub>e</sub> i↔o) S

■ For connection of following duct → see page 78



- 1 FDMB
- 2 CLT wall construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
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

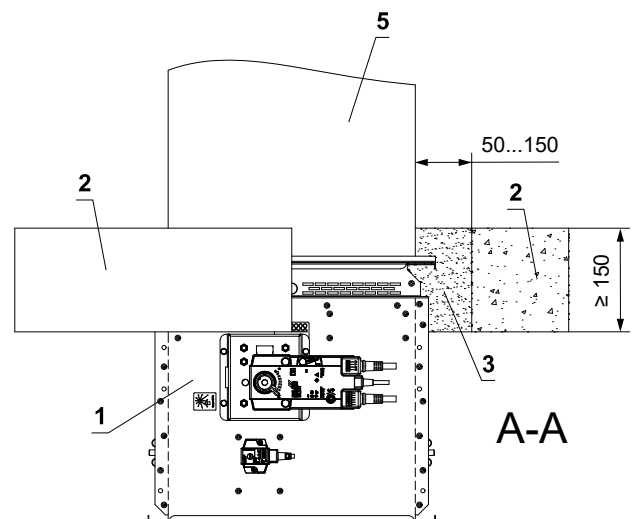
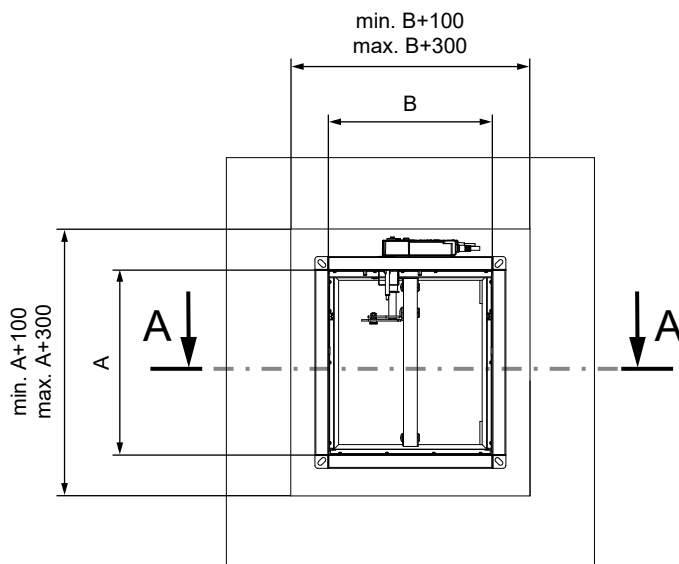
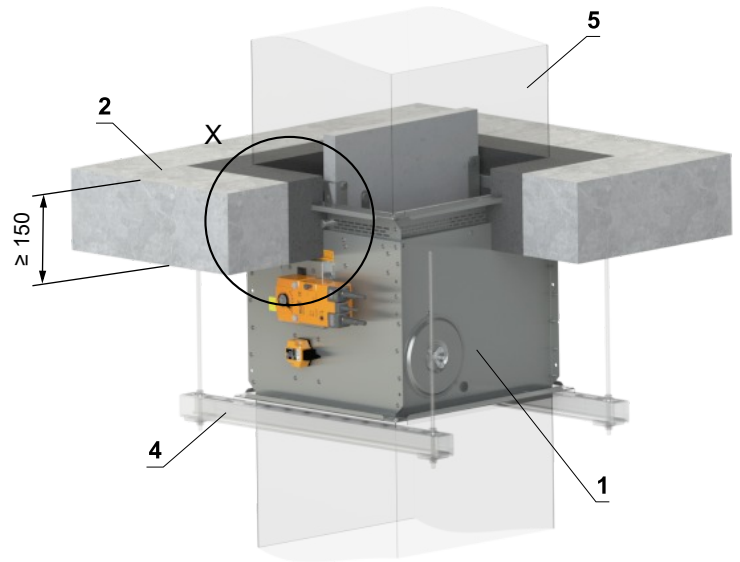
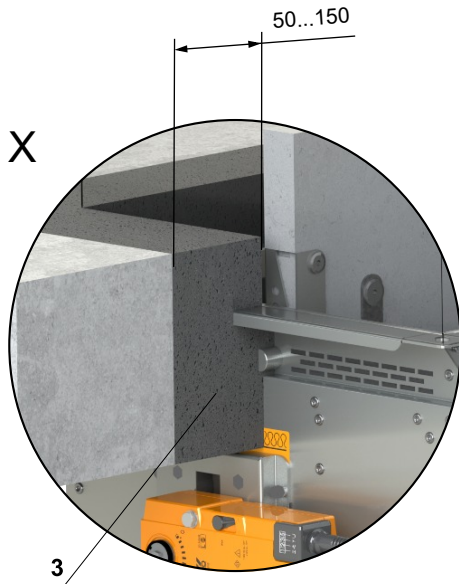
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

**In solid ceiling construction**

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

**EI 120 (h<sub>o</sub> i↔o) S - 500 Pa**

■ For connection of following duct → see page 78

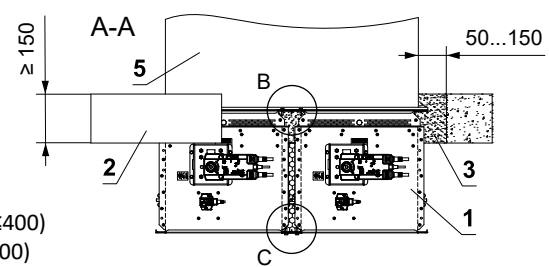
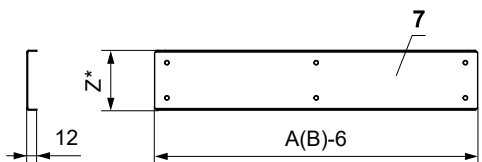
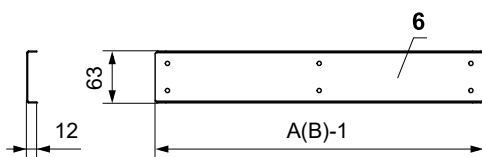
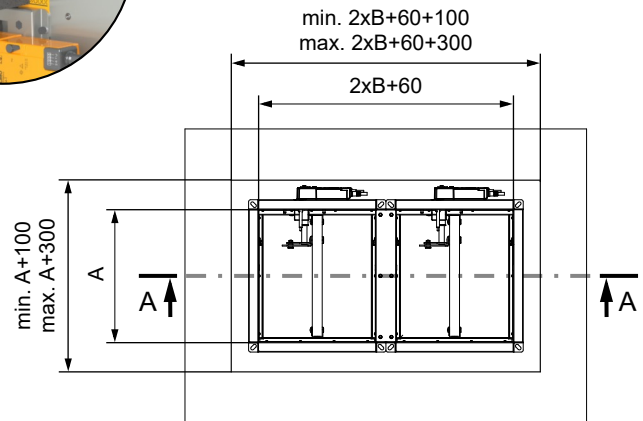
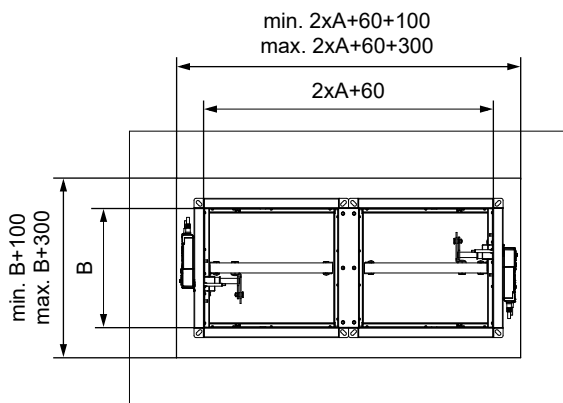
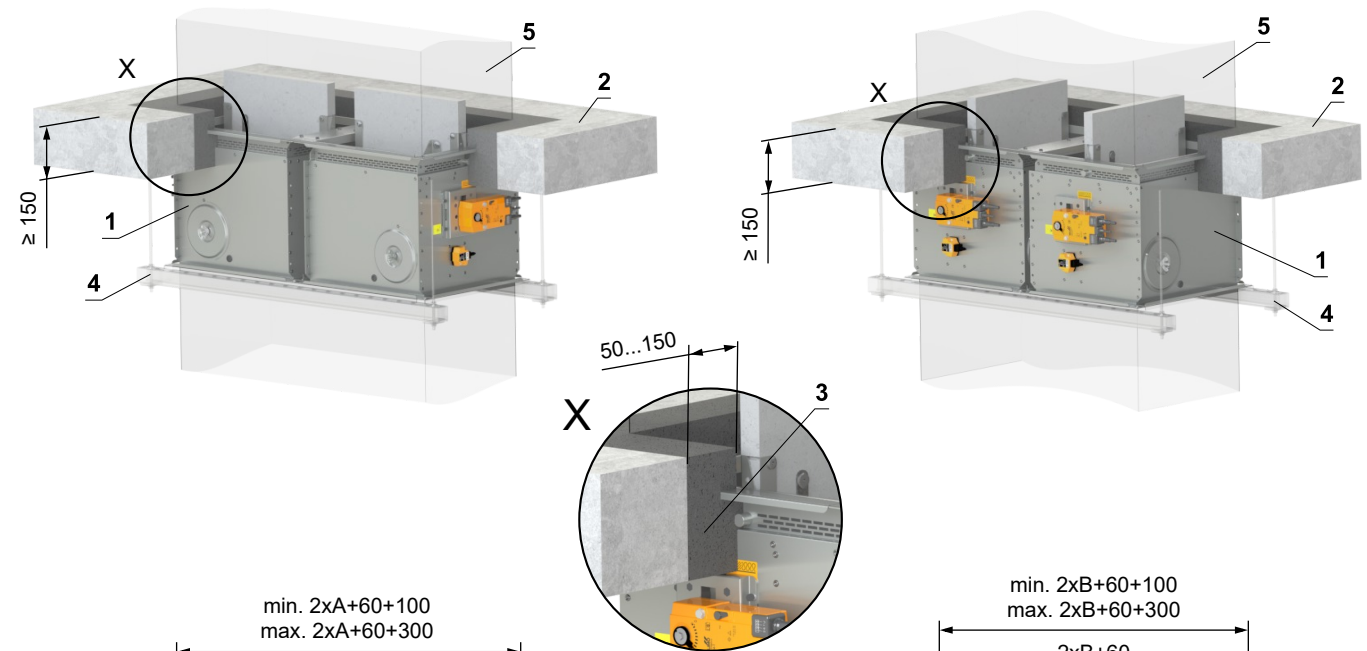


- 1 FDMB
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct

In solid ceiling construction - 2 dampers in one opening - mortar or gypsum

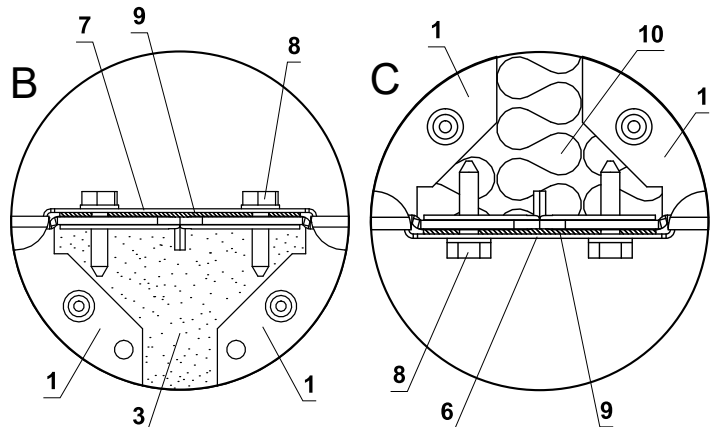
EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- The gap between the damper and construction is filled with mortar or gypsum



\* Z=86 (A≤500 and B≤400)  
\* Z=99 (A>500 or B>400)

- 1 FDMB
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct
- 6 U-profile type 3
- 7 U-profile type 1
- 8 Screw TEX 4,8x18 mm (pitch ≤ 200 mm)
- 9 Sealing
- 10 Insulation board made of mineral wool - recommended for easy filling of gap with mortar/gypsum.

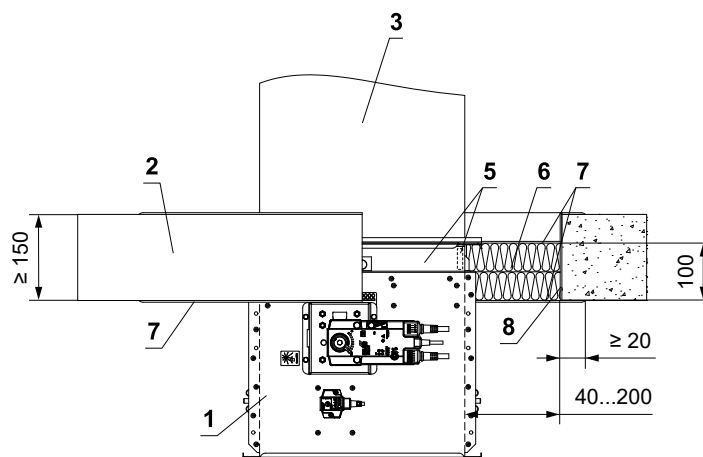
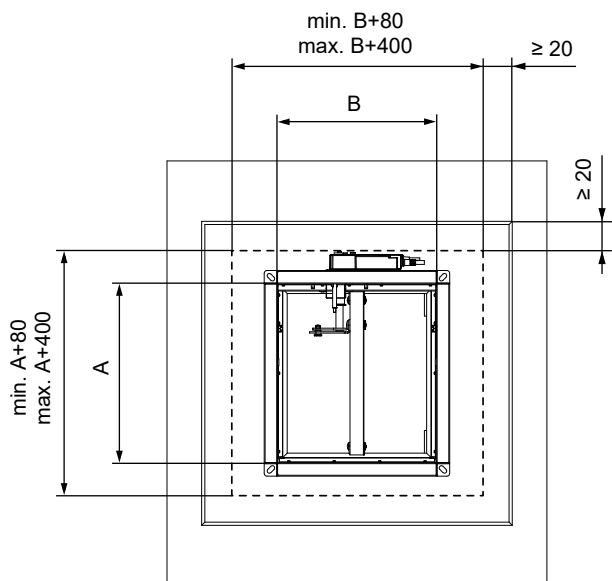
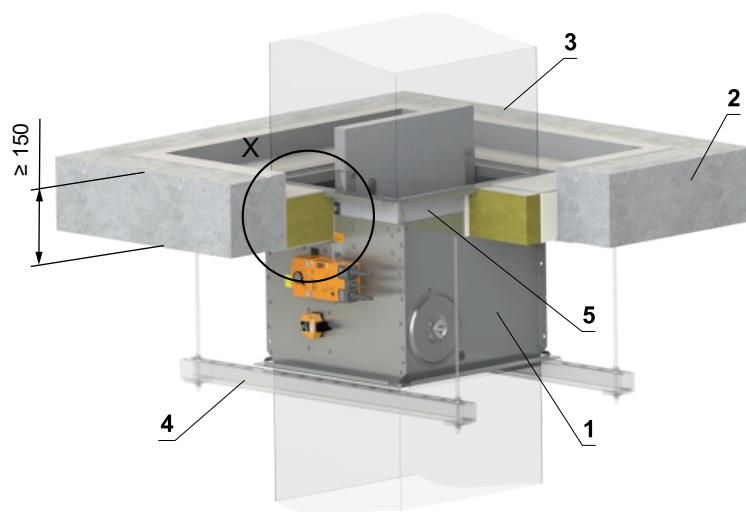
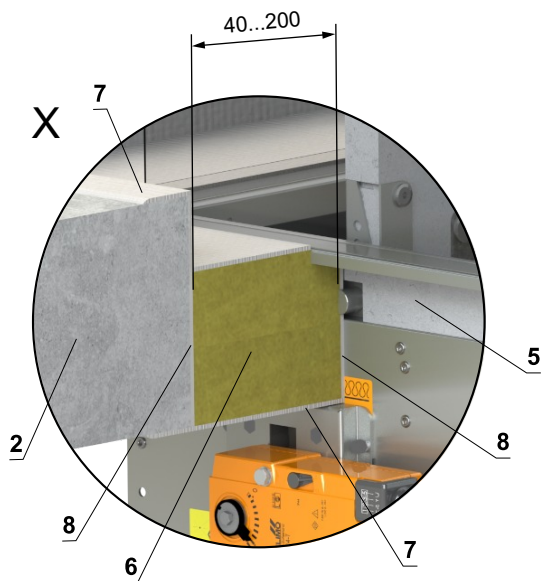




In solid ceiling construction - Ablative Coated Batt

EI 90 (h<sub>o</sub> i↔o) S

■ For connection of following duct → see page 78



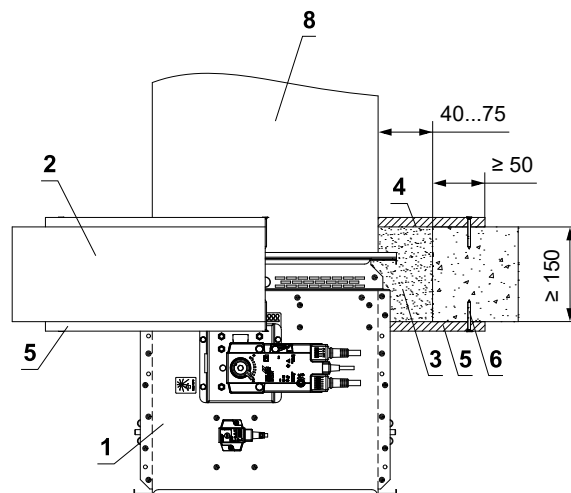
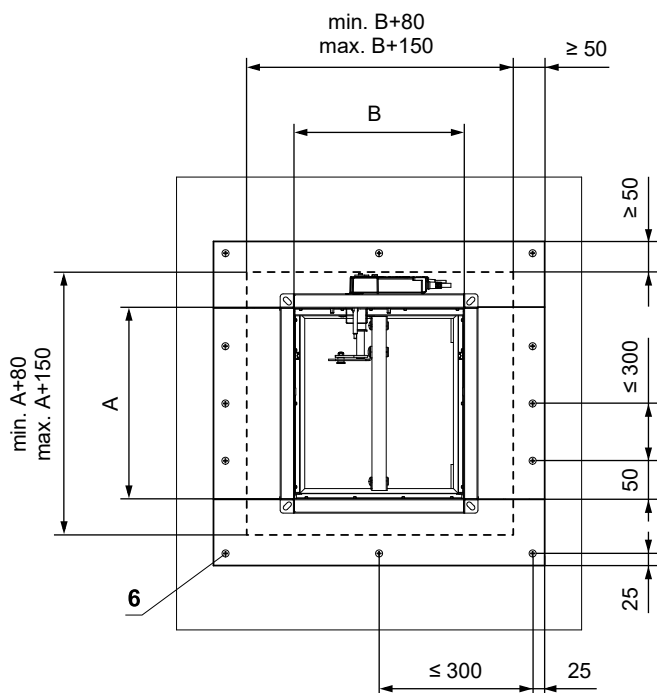
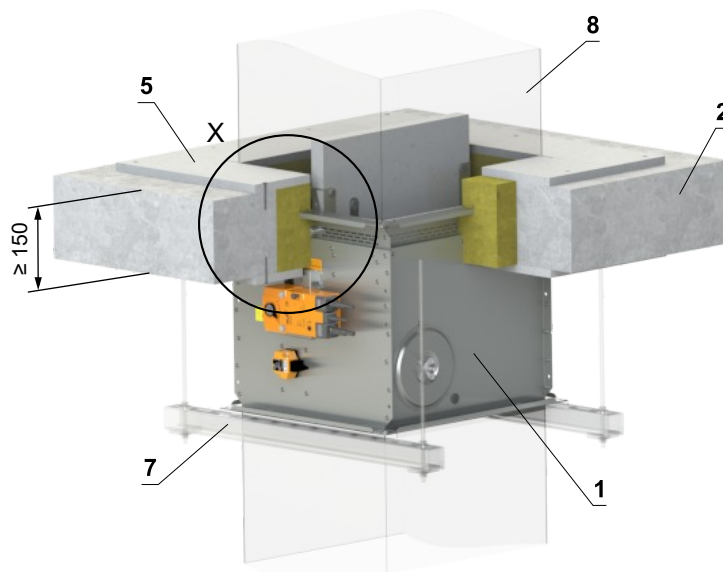
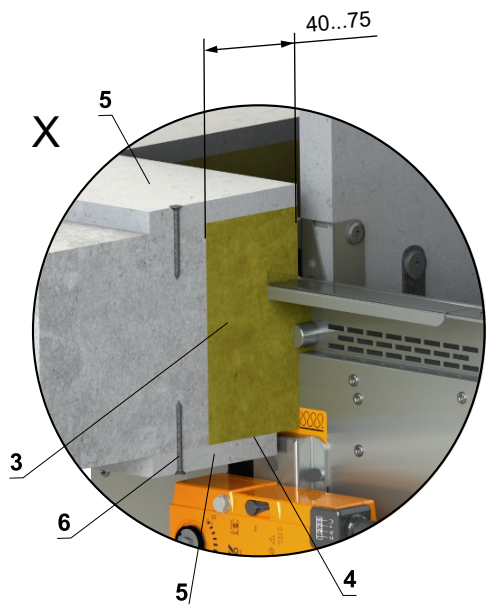
\* HILTI system can be replaced by a similar system with the same or higher thickness, density, fire reaction class, tested according to EN 1366-3.

- 1 FDMB
- 2 Solid ceiling construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
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

In solid ceiling construction - mineral wool with fire-resistant coating and fire-resistance boards

EI 90 (h<sub>o</sub> i↔o) S

■ For connection of following duct → see page 78



- 1 FDMB
- 2 Solid ceiling construction
- 3 Mineral wool board - min. density 140 kg/m<sup>3</sup> (e.g. PROMAPYR-T150, ROCKWOOL HARDROCK / STEPROCK HD)
- 4 Fire-resistant coating - th. 1 mm (e.g. PROMASTOP-I)
- 5 Fire-resistant board - min. th. 15 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H)
- 6 Screw 4x50 mm - screws must be fixed in the wall construction, use steel anchors if necessary
- 7 Profile with threaded rod → see pages 74 to 77
- 8 Duct

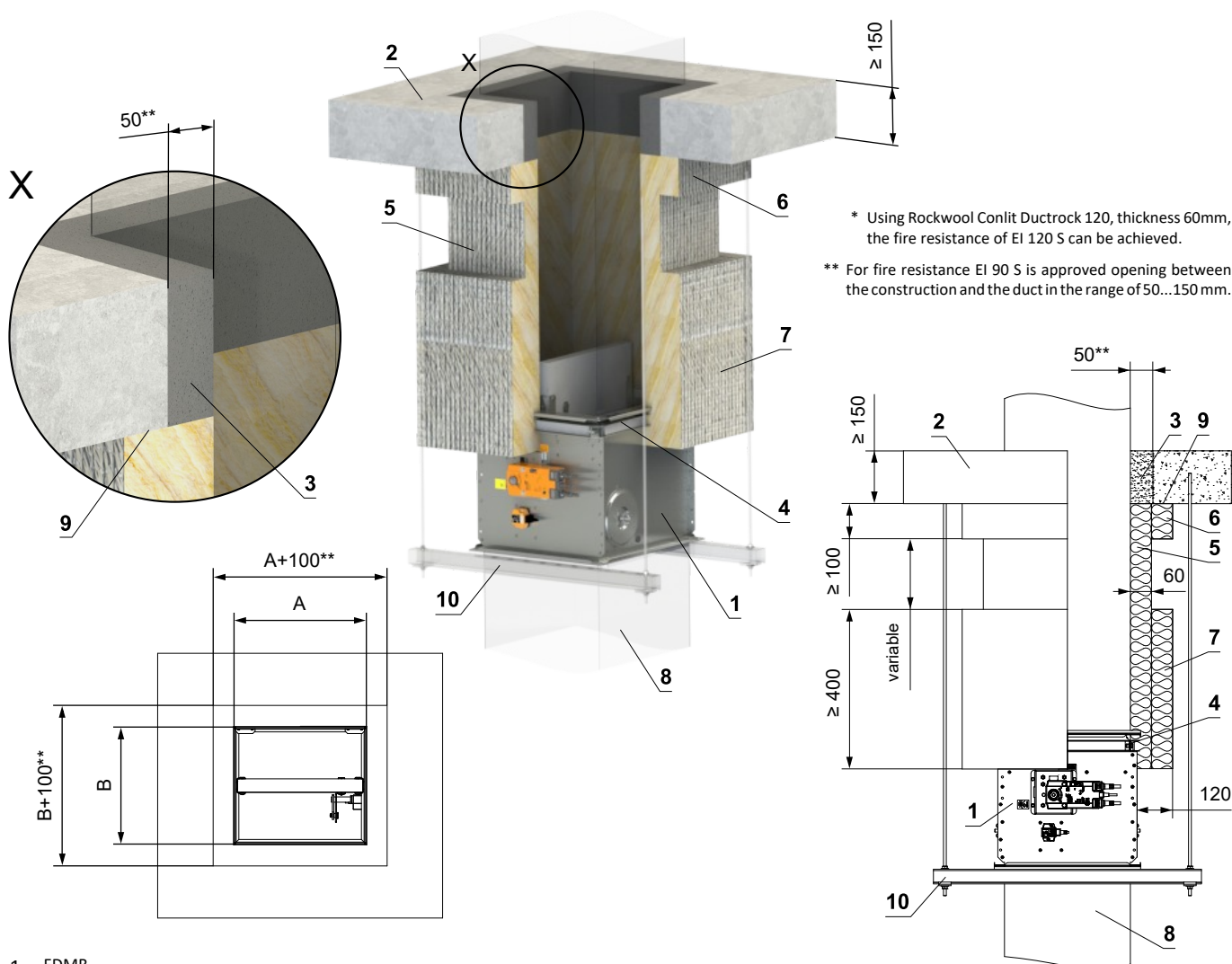
## Outside solid ceiling construction

### Outside solid wall construction - mineral wool ROCKWOOL - mortar or gypsum

EI 90 (h<sub>o</sub> i↔o) S

\*EI 120 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- Minimum and maximum distance between the ceiling and fire damper is unlimited
- When installing the insulation, follow the ROCKWOOL 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 mounting system acc. to national standards
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- 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
- For this installation VRM-B reinforcement frame must be used → see page 86



\* Using Rockwool Conlit Ductrock 120, thickness 60mm, the fire resistance of EI 120 S can be achieved.

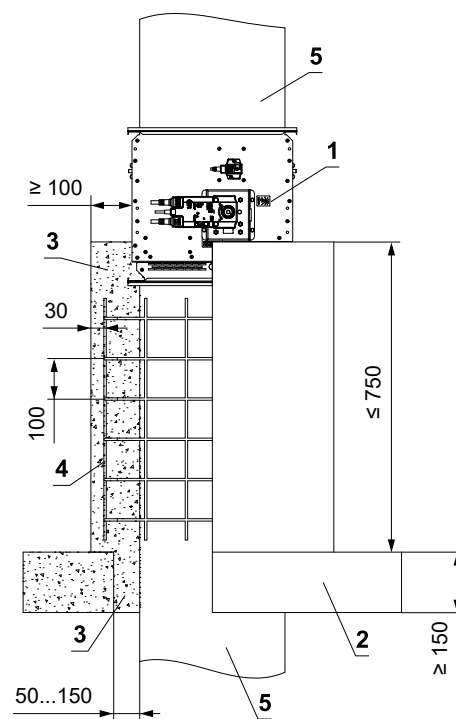
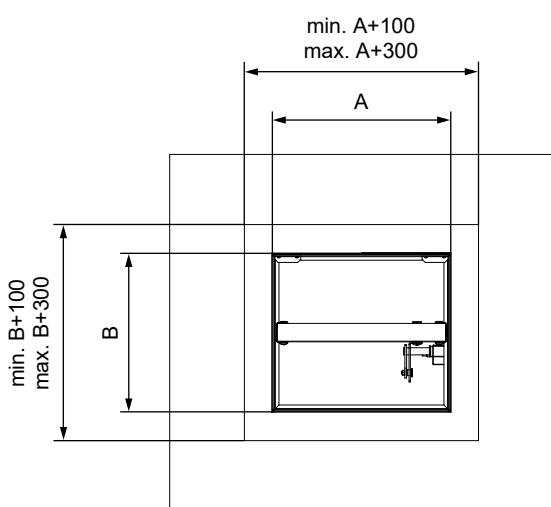
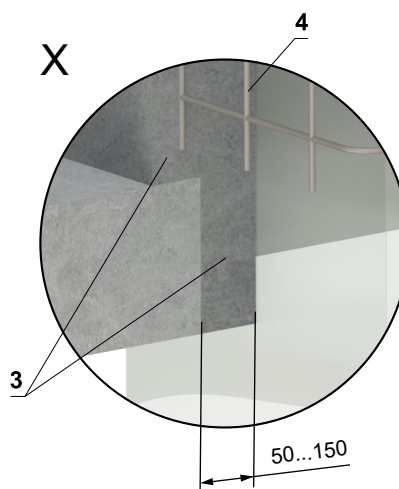
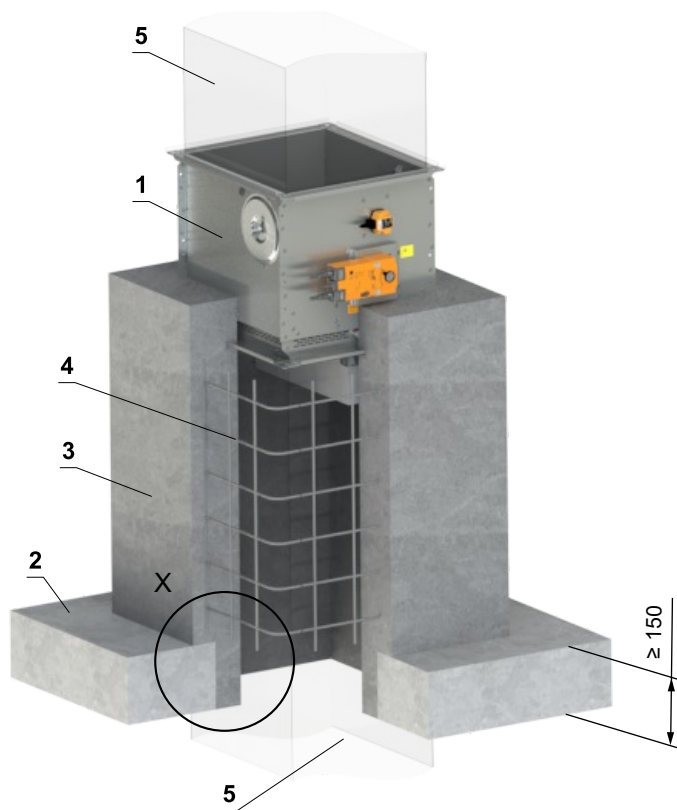
\*\* For fire resistance EI 90 S is approved opening between the construction and the duct in the range of 50...150 mm.

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1 FDMB</li> <li>2 Solid ceiling construction</li> <li>3 Mortar or gypsum</li> <li>4 VRM-B → see page 86</li> <li>5 Insulation board made of mineral wool, with a surface treatment of aluminum foil - th. 60 mm, min. density 300 kg/m<sup>3</sup> - (System ROCKWOOL Conlit Ductrock 90(120*))</li> <li>6 Duct penetration insulation collar - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120*)) - glued (pos. 9) and fixed with screws to the wall construction</li> </ol> | <ol style="list-style-type: none"> <li>7 Insulation collar of the damper and duct connection - th. 60 mm (System ROCKWOOL Conlit Ductrock 90(120*))</li> <li>8 Standard air duct, made of galvanized sheet metal, thickness according to damper size</li> <li>9 ROCKWOOL Firepro glue - apply on the insulation and fix it to the fire separation construction</li> <li>10 Profile with threaded rod → see pages 74 to 77</li> </ol> |
|--|--|

Outside solid ceiling construction - concreting

EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- The duct must be suspended or supported on both sides of the damper acc. to national rules
- Load of the suspension system depends on weight of the fire damper and duct system → see page 74
- Max. distance between two suspension systems is 1500 mm
- 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



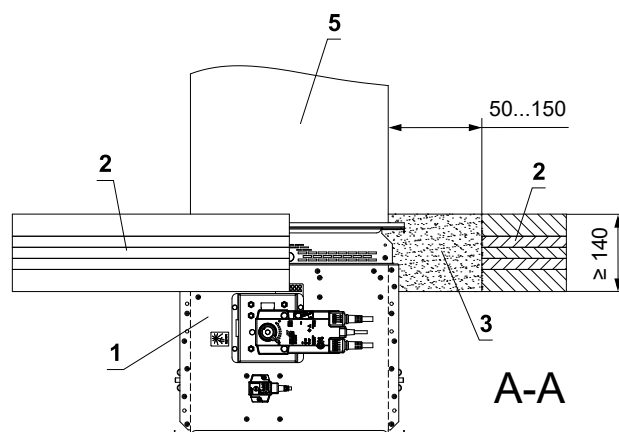
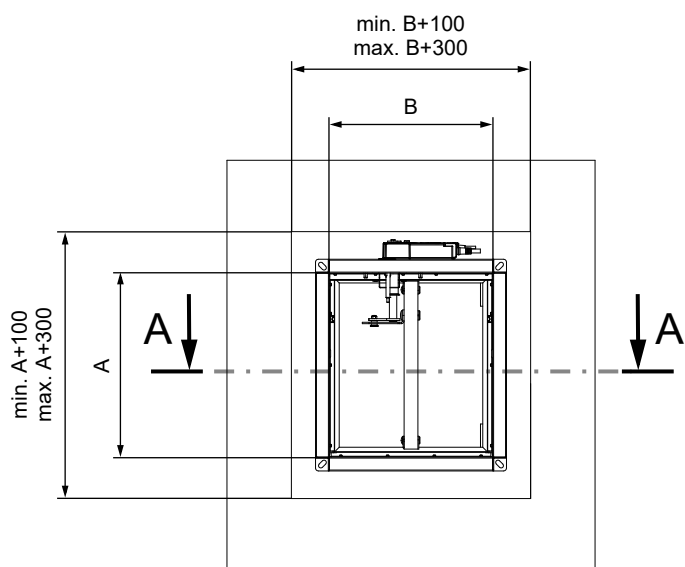
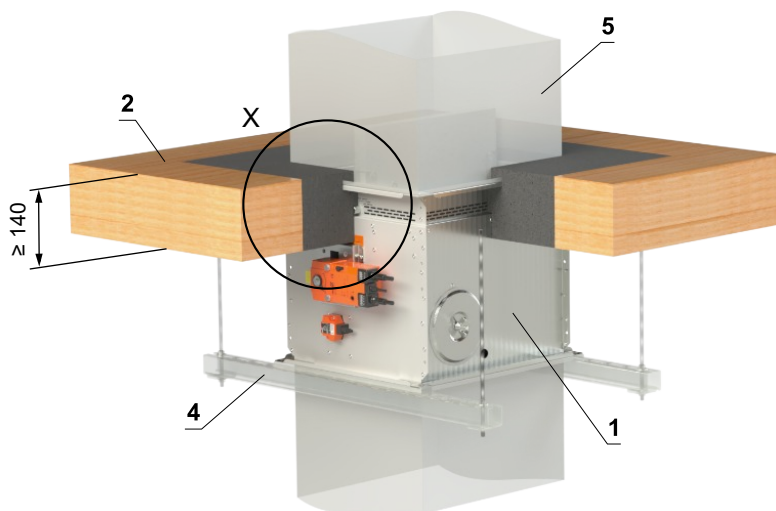
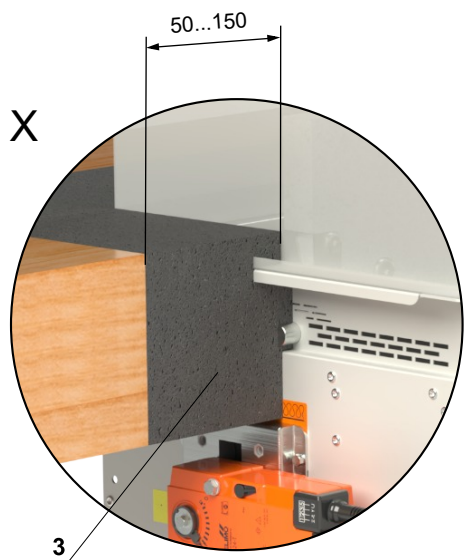
- 1 FDMB
- 2 Solid ceiling construction
- 3 Concrete B20
- 4 Rebar - steel rod  $\varnothing$  6 mm, mesh hole 100 mm
- 5 Standard air duct, made of galvanized sheet metal, thickness according to damper size

### In CLT ceiling construction

In CLT ceiling construction - mortar or gypsum

EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78

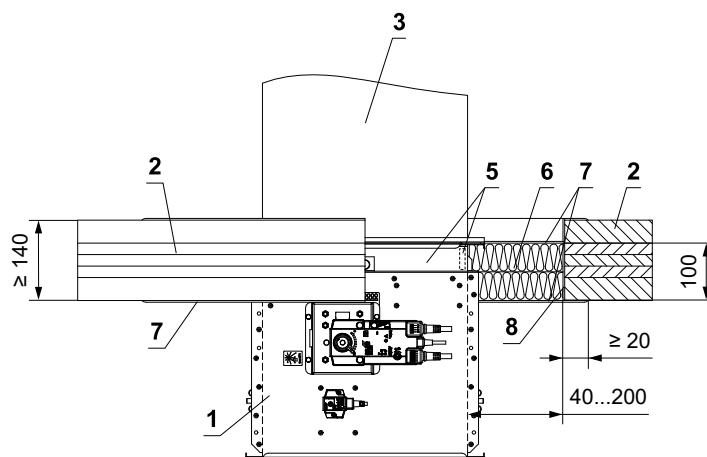
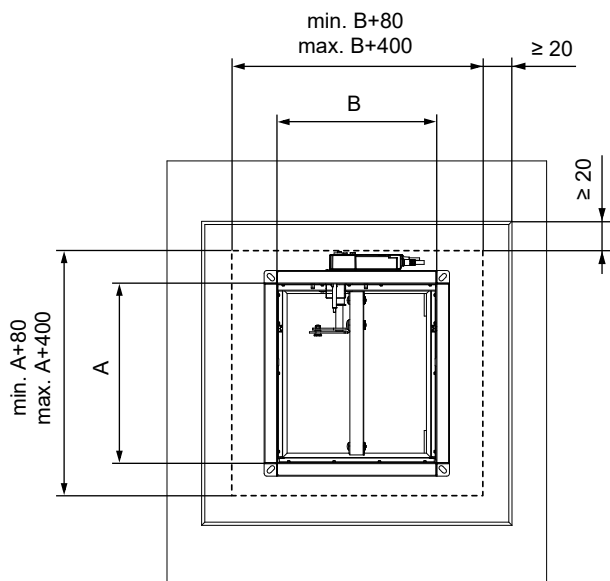
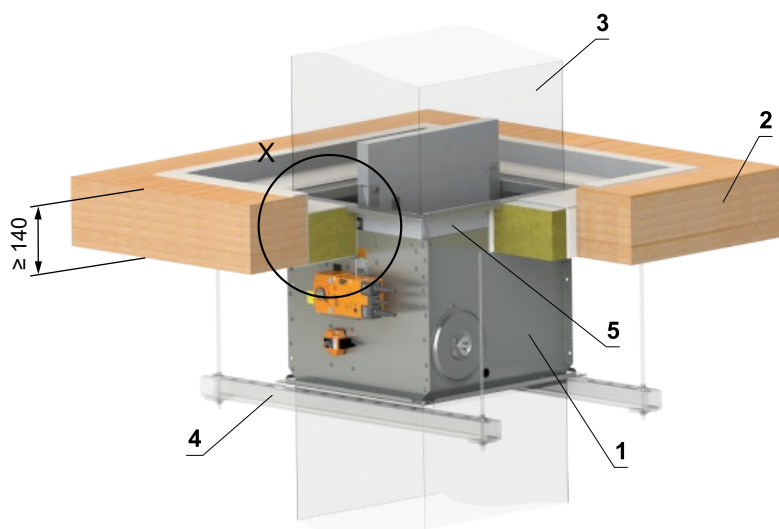
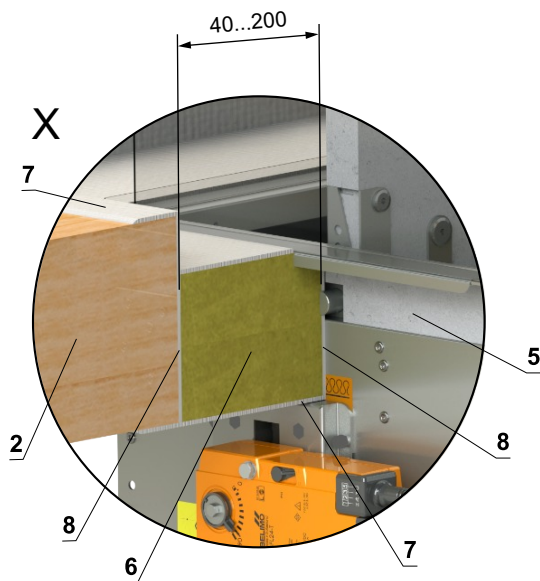


- 1 FDMB
- 2 CLT ceiling construction
- 3 Mortar or gypsum
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Duct

In CLT ceiling construction - Ablative Coated Batt

EI 90 (h<sub>o</sub> i↔o) S

■ For connection of following duct → see page 78



- 1 FDMB
- 2 CLT ceiling construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Protective cladding board - min. th. 10 mm, min. density 870 kg/m<sup>3</sup> (e.g. PROMATECT-H) → see page 88  
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 frames

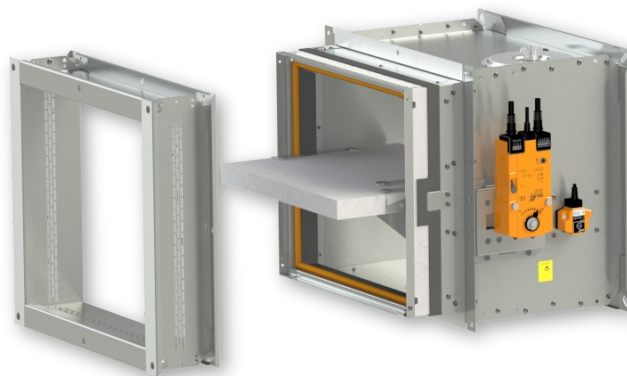
List of installation frames and installation options

Installation frame	Wall thickness (mm)								
	Solid wall construction			Gypsum wall construction			Solid ceiling construction		
	In construction	Outside construction	On construction	In construction	Outside construction	On construction	In construction	Outside construction	On construction
E1	≥ 100	–	–	≥ 100	–	–	≥ 150	–	–
E2	≥ 100	–	–	–	–	–	≥ 150	–	–
E3	–	–	–	≥ 100	–	–	–	–	–
E4	–	–	≥ 100	–	–	≥ 100	–	≥ 150	≥ 150
E5	–	–	–	≥ 100	–	–	–	–	–
E6	–	≥ 100	–	–	–	–	–	≥ 150	–

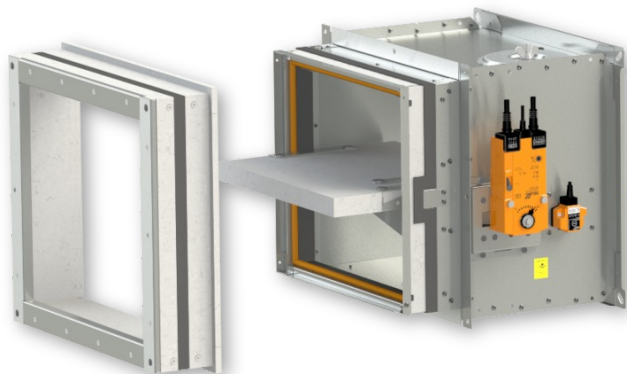
Installation frame E1



Installation frame E2



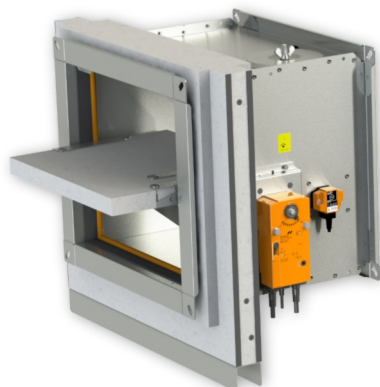
Installation frame E3



Installation frame E4



Installation frame E5



Installation frame E6

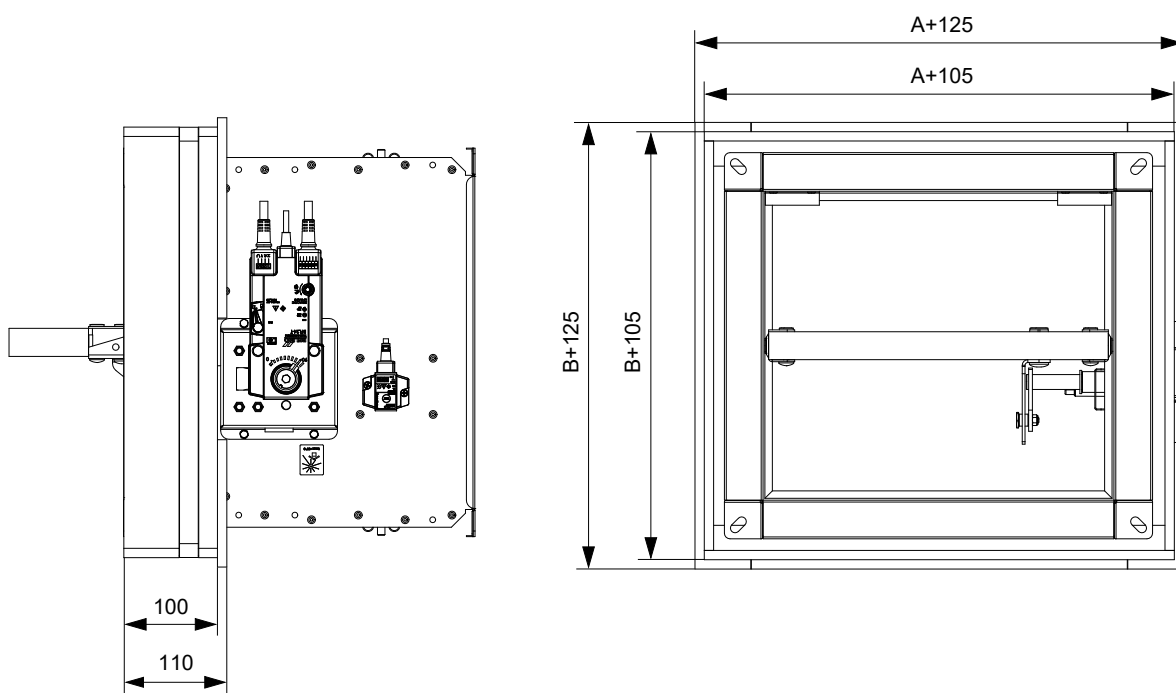


- Installation frame can be installed on the damper or delivered separately

### Installation frame E1

- Installation frame E1 is designed for installation without additional sealing of the penetration into:
  - Solid wall construction
  - Gypsum wall construction
  - Solid ceiling construction
- Installation frame is equipped with an intumescent sealing on the inside and outside. This sealing fills the gap between the damper casing and frame and between the frame and construction in the event of a fire
- **Solid wall/gypsum wall th. 100 mm or solid ceiling th. 150 mm**
- Material:
  - Installation frame - cement-lime boards
  - Fasteners - galvanized steel

Installation frame E1

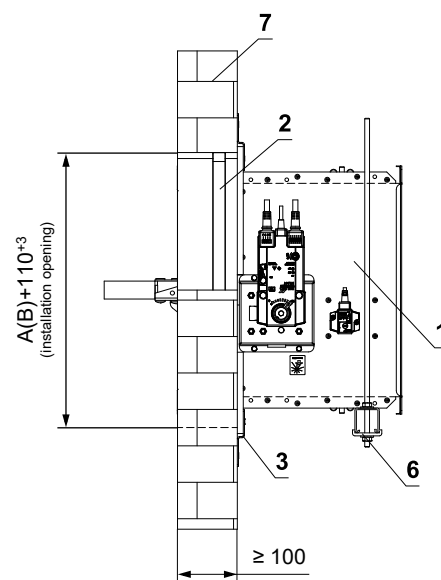
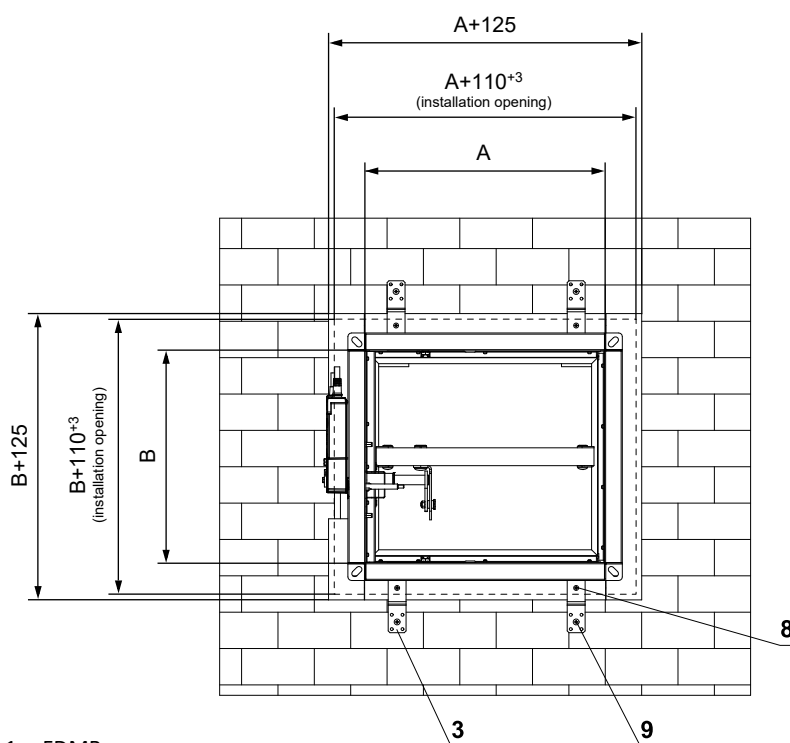
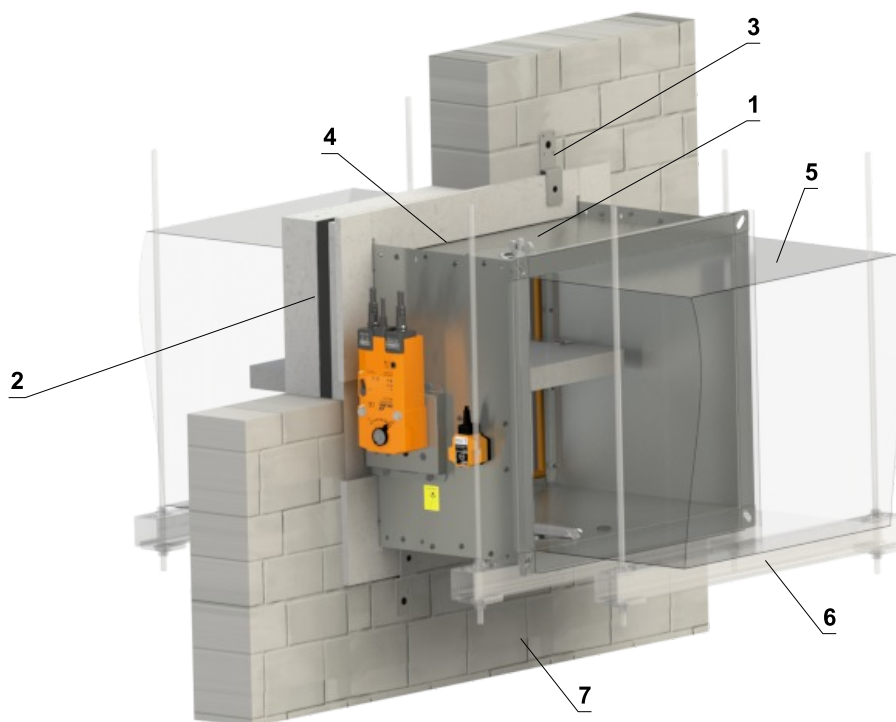




**In solid wall construction - installation frame E1**

**EI 90 (v<sub>e</sub> i↔o) S**

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately



- 1 FDMB
- 2 Installation frame
- 3 Bracket (fastening material included in frame delivery)
- 4 Fill the gaps with glue PROMAT K84
- 5 Duct
- 6 Profile with threaded rod → see pages 74 to 77
- 7 Solid wall construction
- 8 Screw 4x16 mm to attach bracket to the frame
- 9 Screw 5x60 mm to attach bracket to the construction

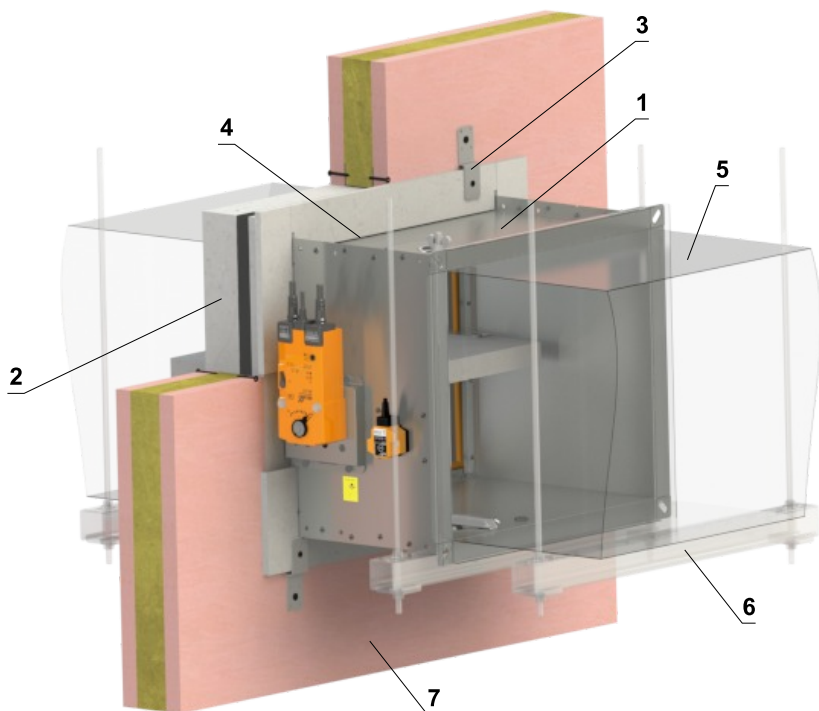
**Number of brackets X = ZA + ZB    Number of screws Y = 2 x X**

Side A	Number of brackets ZA	Side B	Number of brackets ZB
A ≤ 500	4	B ≤ 500	0
500 < A ≤ 1000	6		

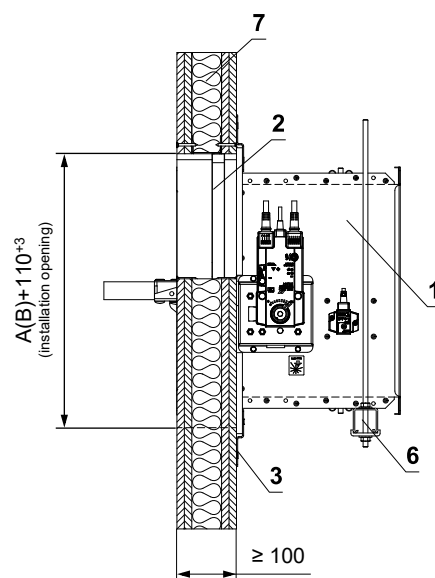
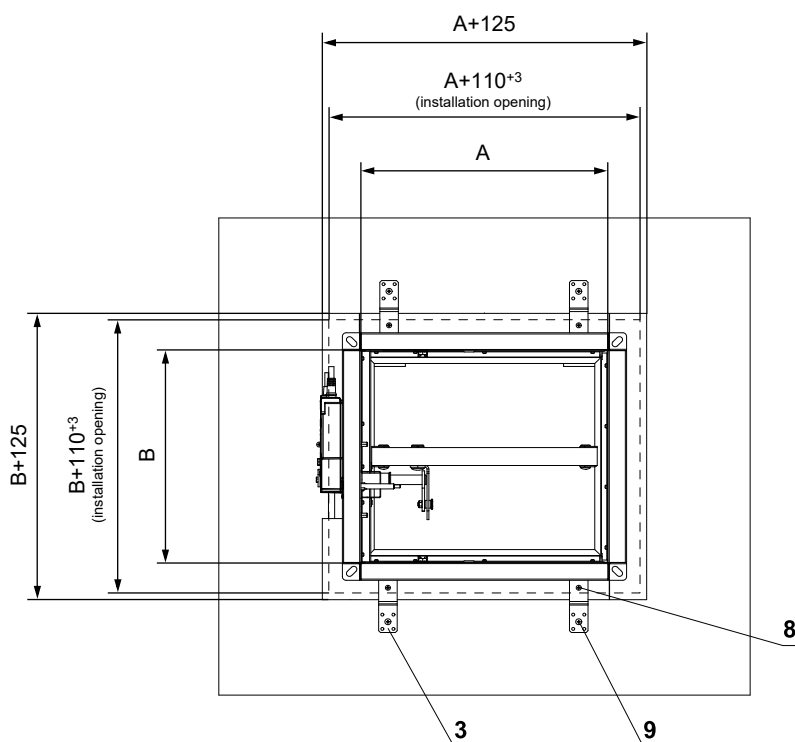
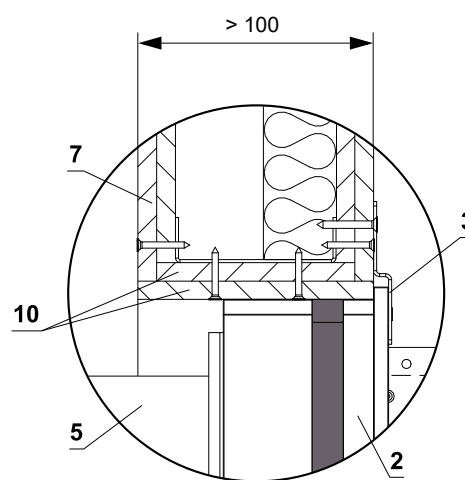
In gypsum wall construction - installation frame E1

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately



Detail of the wall > 100 mm



- 1 FDMB
- 2 Installation frame
- 3 Bracket (fastening material included in frame delivery)
- 4 Fill the gaps with glue PROMAT K84
- 5 Duct
- 6 Profile with threaded rod → see pages 74 to 77
- 7 Gypsum wall construction
- 8 Screw 4x16 mm to attach bracket to the frame
- 9 Screw 5x60 mm to attach bracket to the construction
- 10 Additional boards made from plasterboard

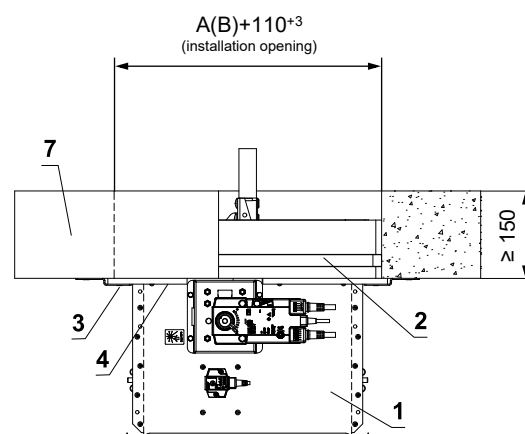
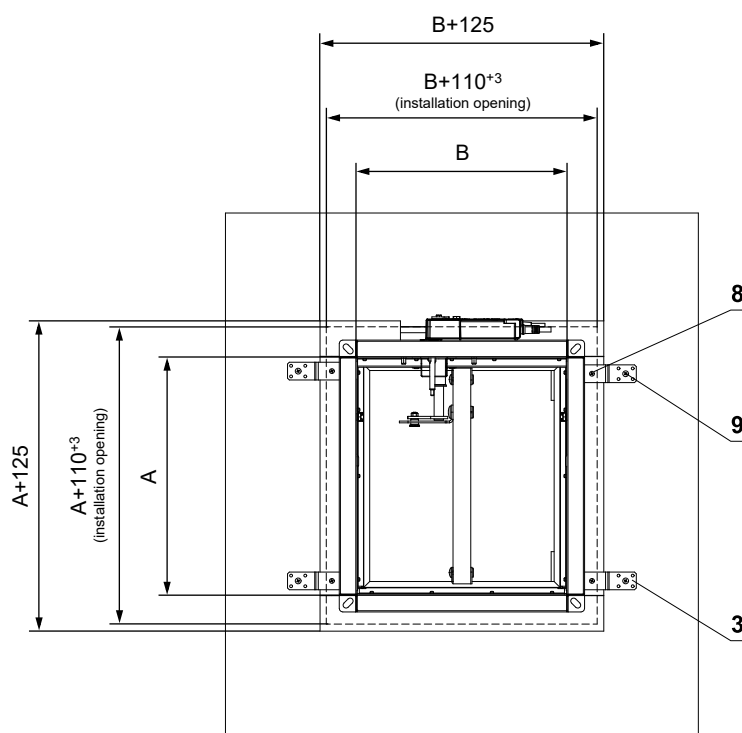
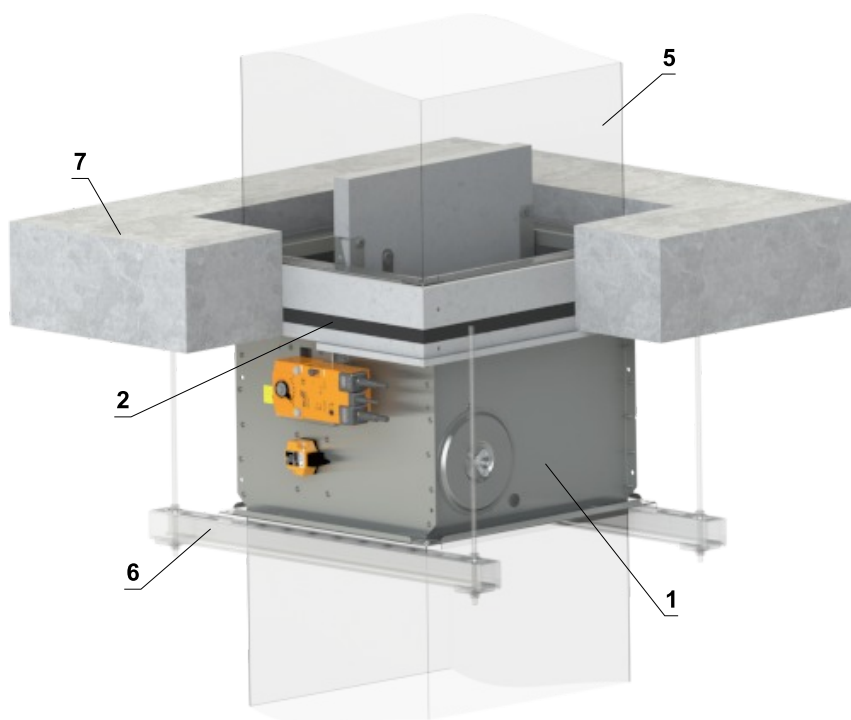
Number of brackets X = ZA + ZB    Number of screws Y = 2 x X

Side A	Number of brackets ZA	Side B	Number of brackets ZB
A ≤ 500	4	B ≤ 500	0
500 < A ≤ 1000	6		

**Solid ceiling construction - installation frame E1**

**EI 90 (h<sub>o</sub> i↔o) S**

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately



- 1 FDMB
- 2 Installation frame
- 3 Bracket (fastening material included in frame delivery)
- 4 Fill the gaps with glue PROMAT K84
- 5 Duct
- 6 Profile with threaded rod → see pages 74 to 77
- 7 Solid ceiling construction
- 8 Screw 4x16 mm to attach bracket to the frame
- 9 Screw 5x60 mm to attach bracket to the construction

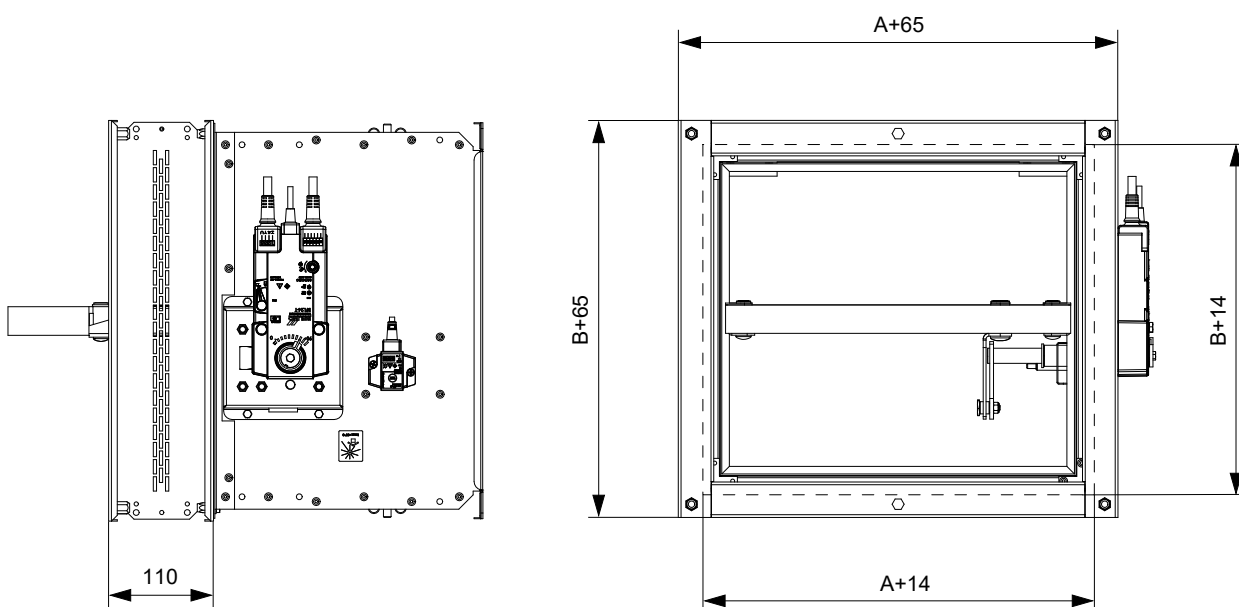
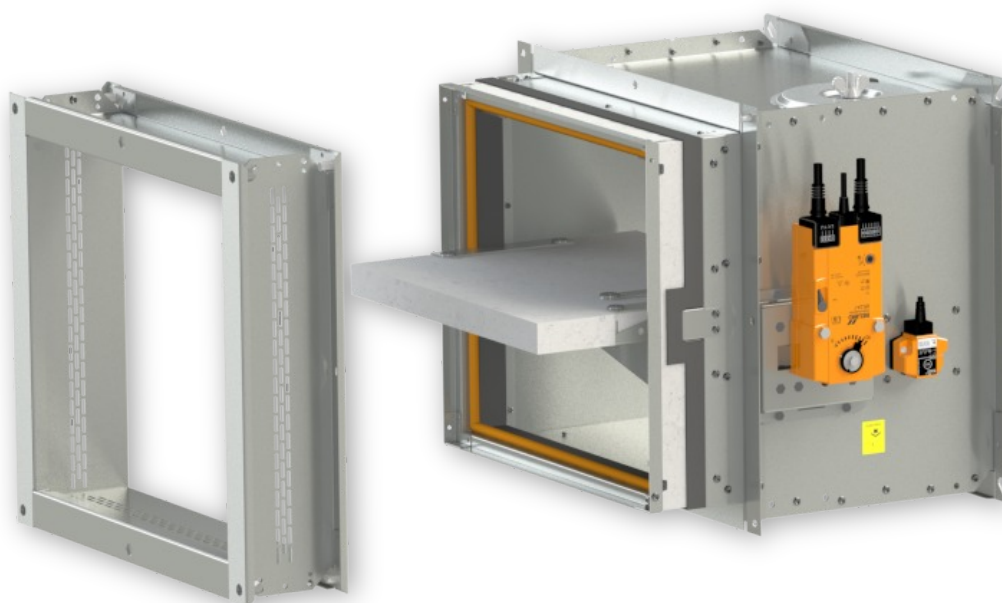
**Number of brackets X = ZA + ZB    Number of screws Y = 2 x X**

Side A	Number of brackets ZA	Side B	Number of brackets ZB
A ≤ 500	4	B ≤ 500	0
500 < A ≤ 1000	6		

### Installation frame E2

- Installation frame E2 is designed for installation with steel insert and mortar or gypsum into:
  - Solid wall construction
  - Solid ceiling construction
- The damper is equipped with an intumescent sealing on the casing. This sealing fills the gap between the steel insert and the damper in the event of a fire
- **Solid wall th. 100 mm or solid ceiling th. 150 mm**
- Material:
  - Installation frame - galvanized steel
  - Fasteners - galvanized steel

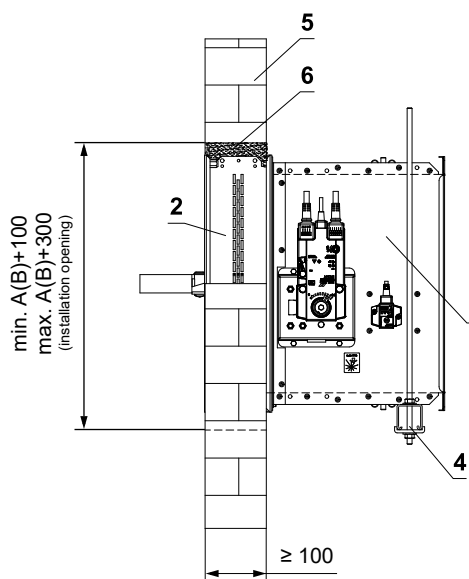
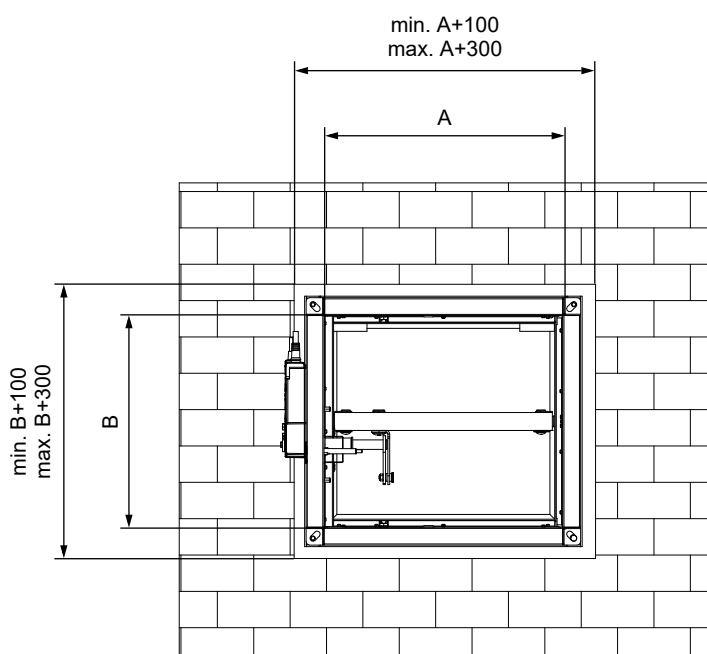
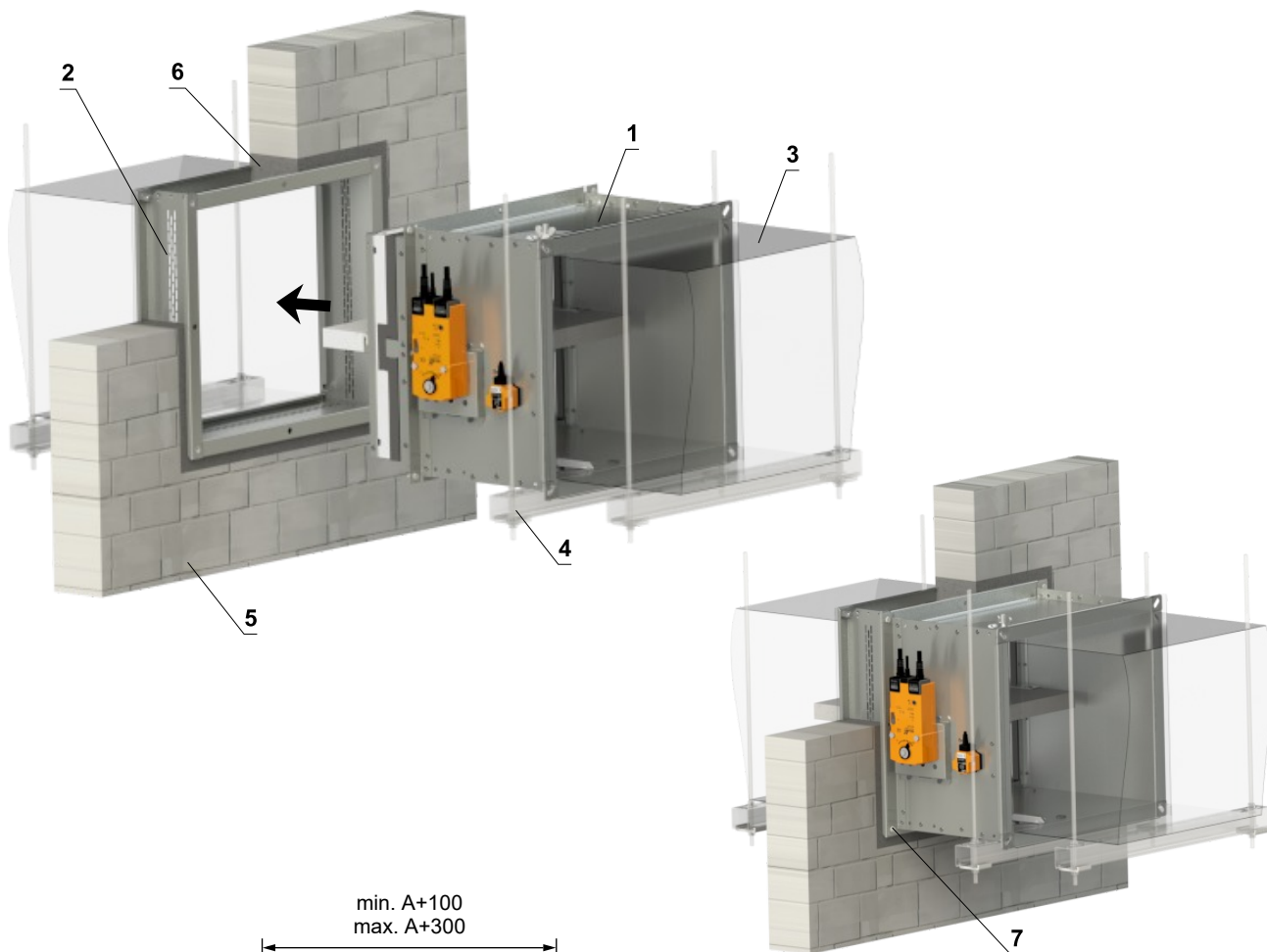
Installation frame E2



In solid wall construction - installation frame E2

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately

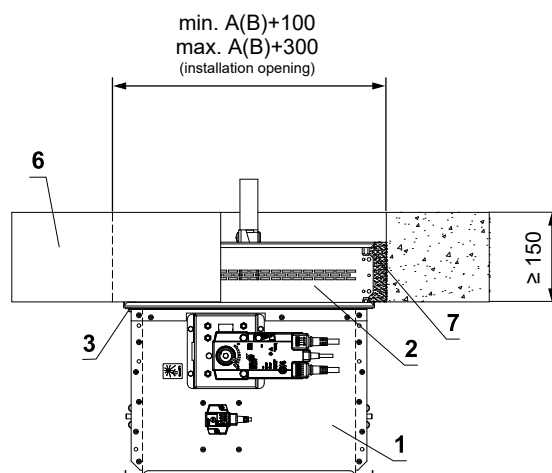
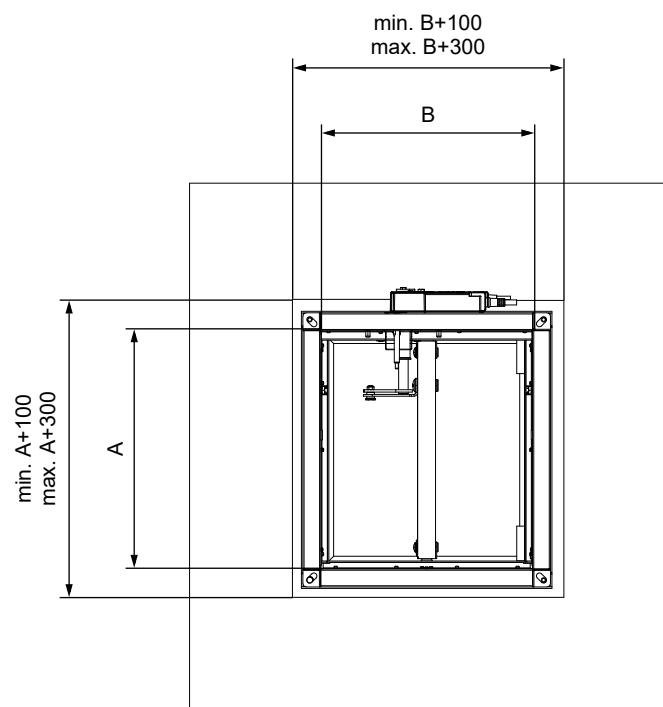
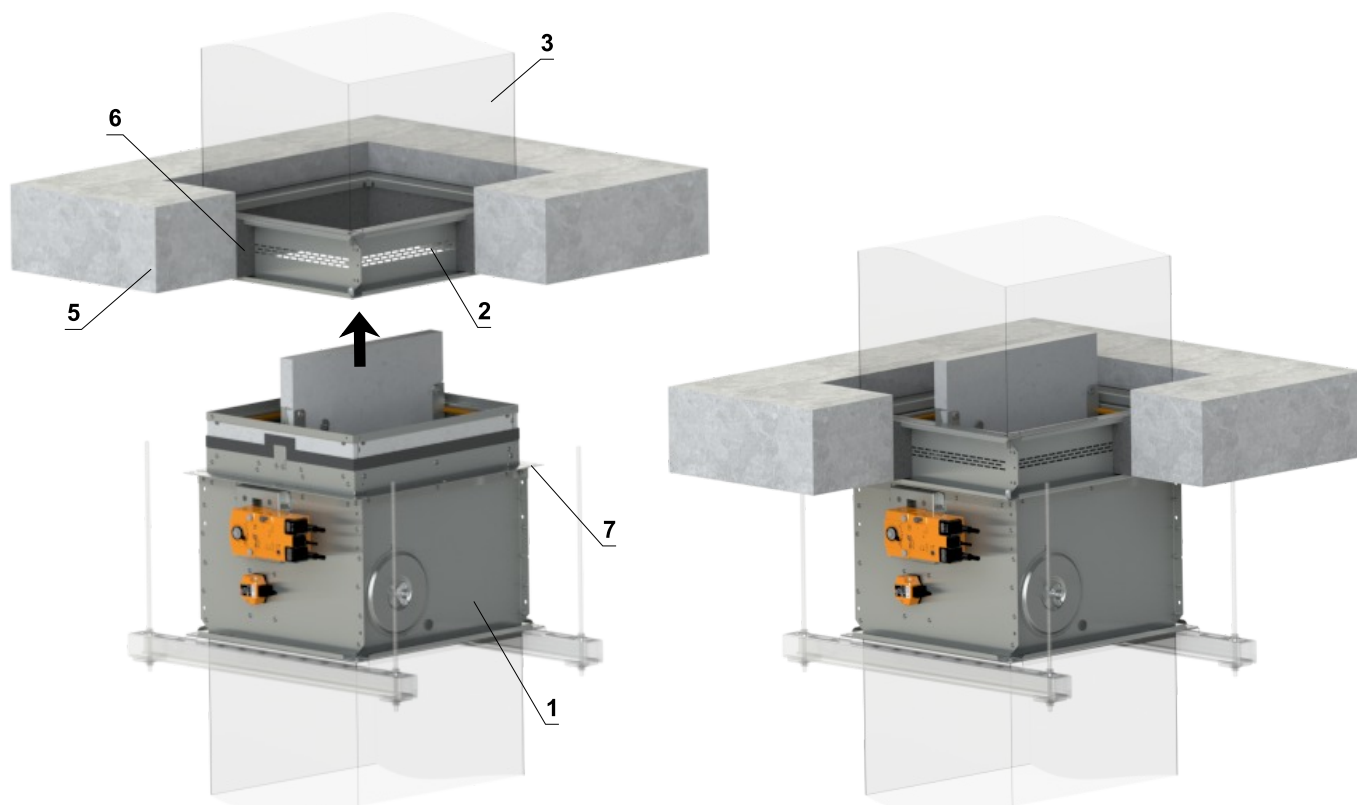


- 1 FDMB
- 2 Installation frame
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Solid wall construction
- 6 Mortar or gypsum
- 7 Screw M6x12 (4x)

In solid ceiling construction - installation frame E2

EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately

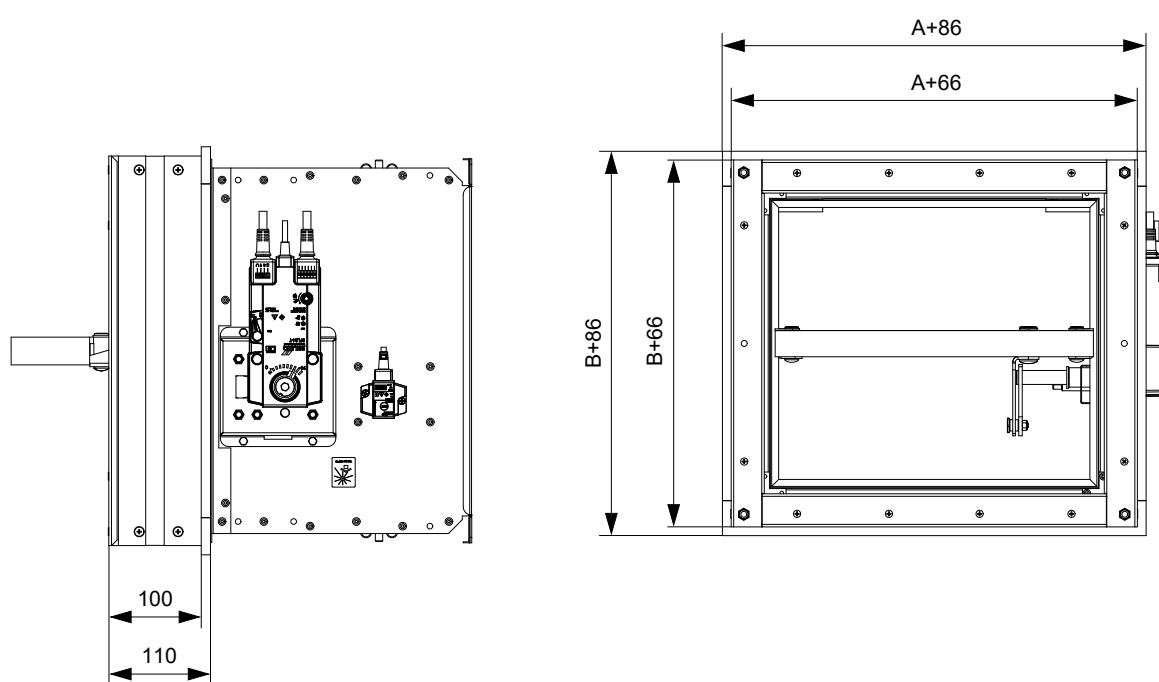
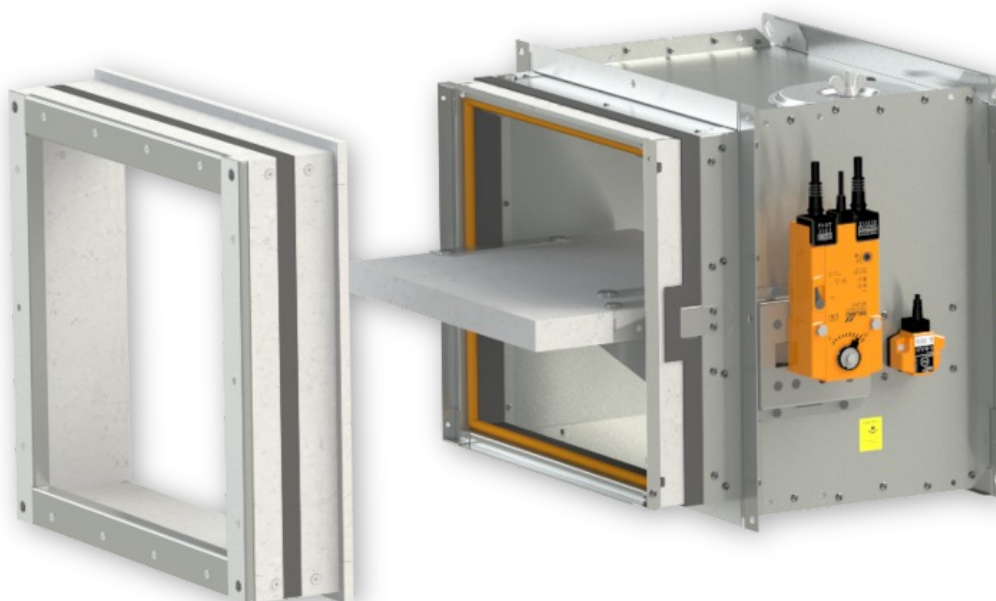


- 1 FDMB
- 2 Installation frame
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Solid ceiling construction
- 6 Mortar or gypsum
- 7 Screw M6x12 (4x)

## Installation frame E3

- Installation frame E2 is designed for installation into:
  - Gypsum wall construction
- The damper is equipped with an intumescent sealing on the casing. This sealing fills the gap between the damper casing and frame in the event of a fire. The frame is equipped with an intumescent sealing on external side. This sealing fills the gap between the frame and construction in the event of a fire
- **Gypsum wall th. 100 mm**
- Material:
  - Installation frame - cement-lime boards and galvanized steel
  - Fasteners - galvanized steel

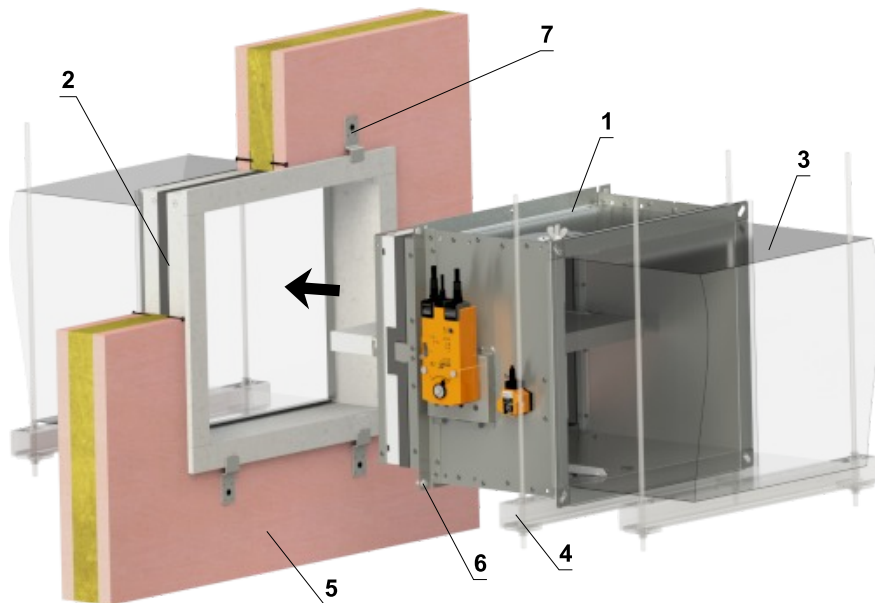
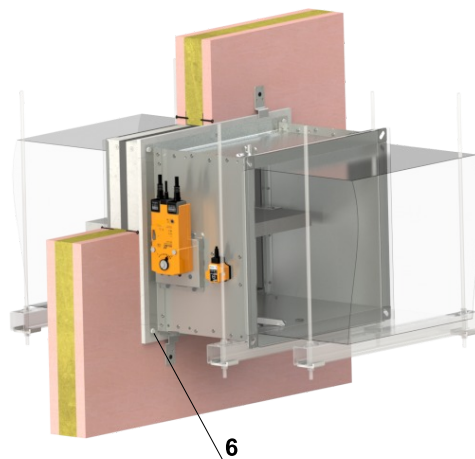
Installation frame E3



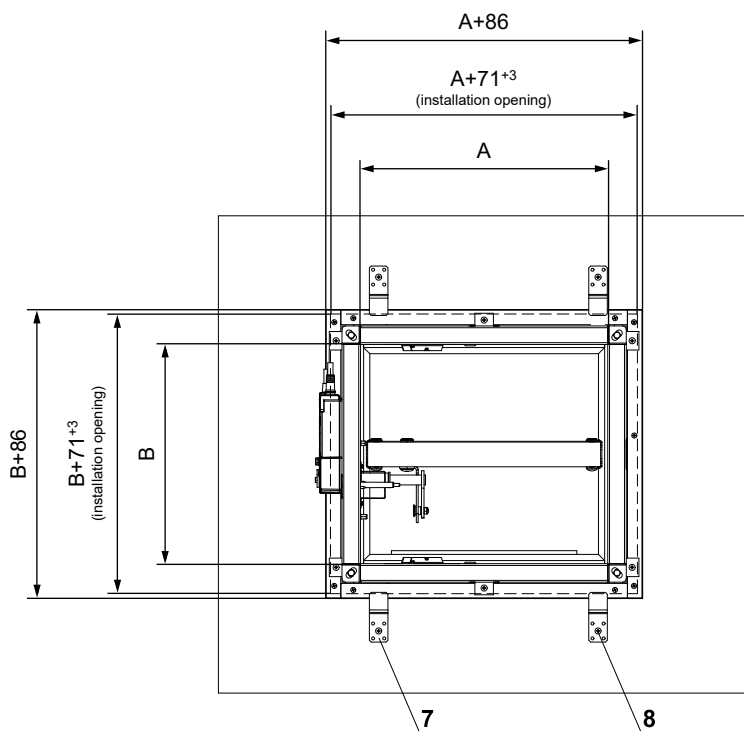
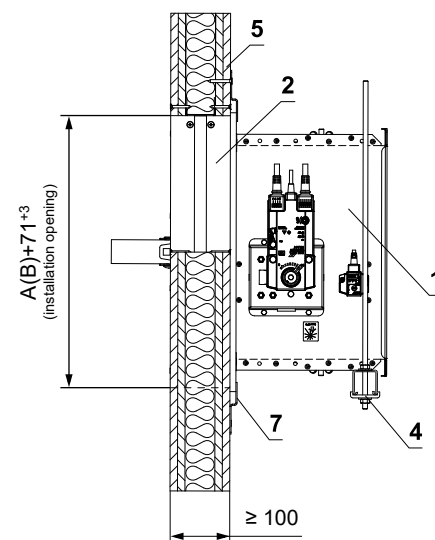
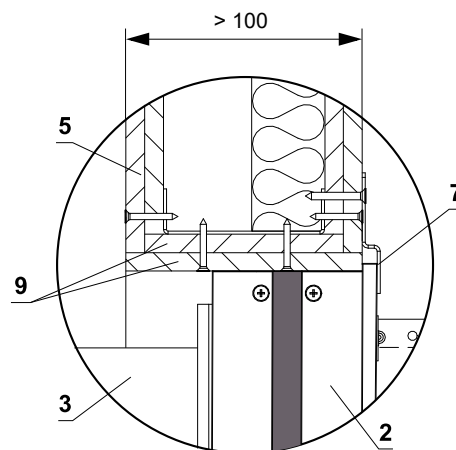
In gypsum wall construction - installation frame E3

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately



Detail of the wall > 100 mm



- 1 FDMB
- 2 Installation frame
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Gypsum wall construction
- 6 Screw 6x12 mm (4x)
- 7 Bracket (fastening material included in frame delivery)
- 8 Screw 5x60 mm to attach bracket to the construction
- 9 Additional boards made from plasterboard

Number of brackets X = ZA + ZB    Number of screws Y = 2 x X

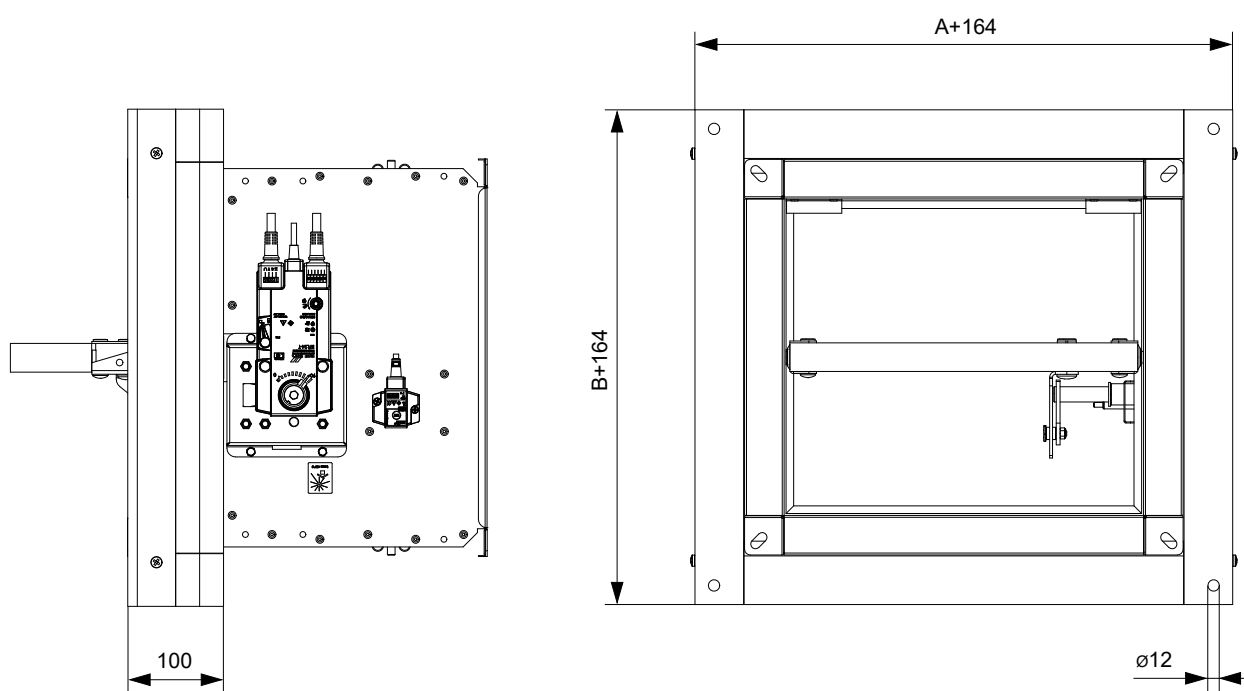
Side A	Number of brackets ZA	Side B	Number of brackets ZB
A ≤ 500	4	B ≤ 500	0
500 < A ≤ 1000	6		



## Installation frame E4

- Installation frame E4 is designed for installation on:
  - Solid wall construction
  - Solid ceiling construction
  - Outside solid ceiling construction with concreting
- Installation frame is equipped with an intumescent sealing on the inside. This sealing fills the gap between the damper casing and frame in the event of a fire
- Material:
  - Installation frame - cement-lime boards
  - Fasteners - galvanized steel

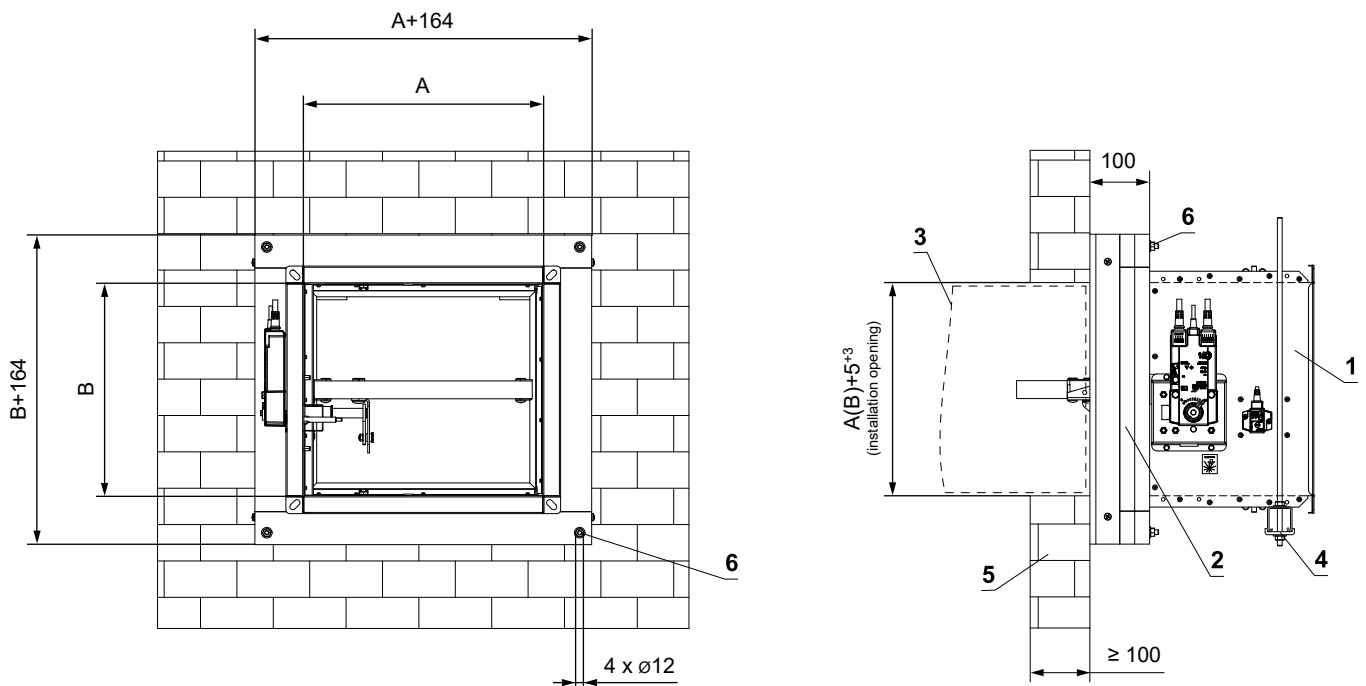
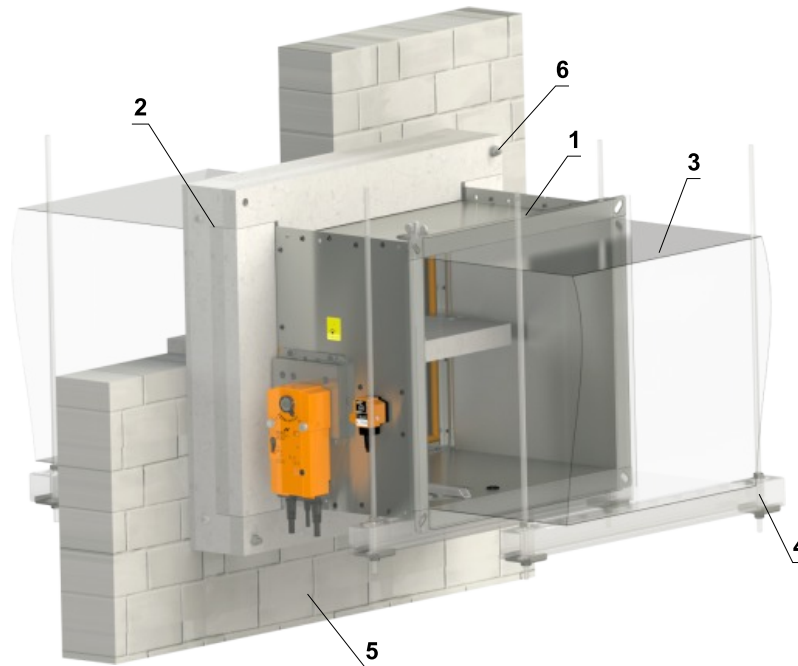
Installation frame E4



In solid wall construction - installation frame E4

EI 90 (v<sub>e</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately

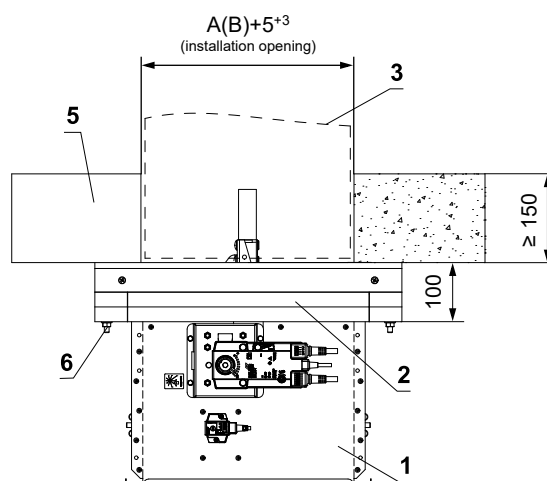
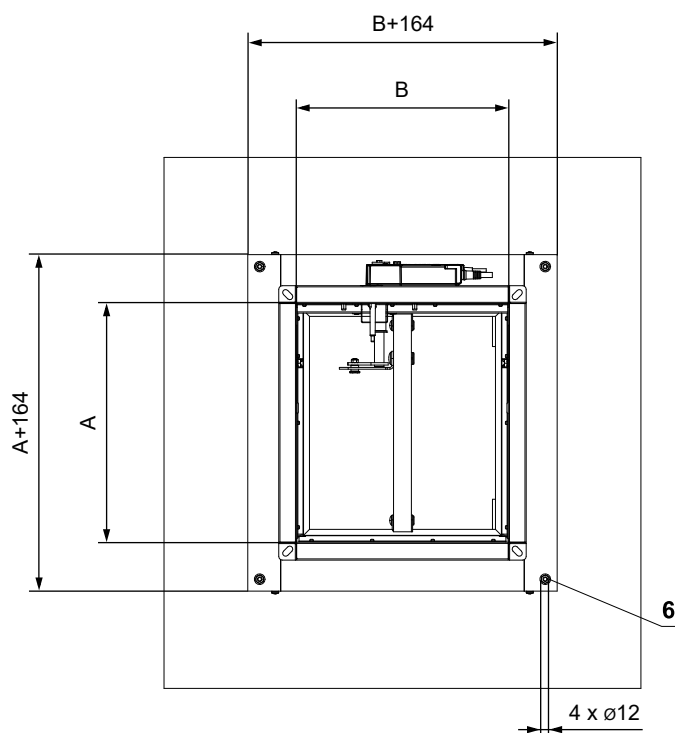
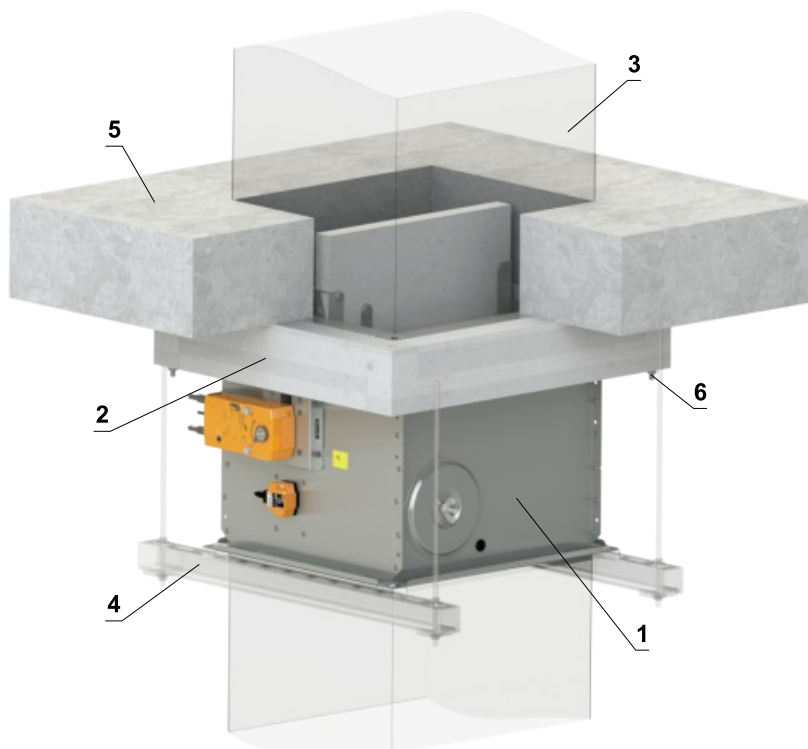


- 1 FDMB
- 2 Installation frame - apply HILTI CFS-S ACR mastic at the entire area and glue it to the fire separating construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Solid wall construction
- 6 Holes for fixing the frame with threaded rods or steel anchors (material for fixing the frame is not included)

**In solid ceiling construction - installation frame E4**

EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately

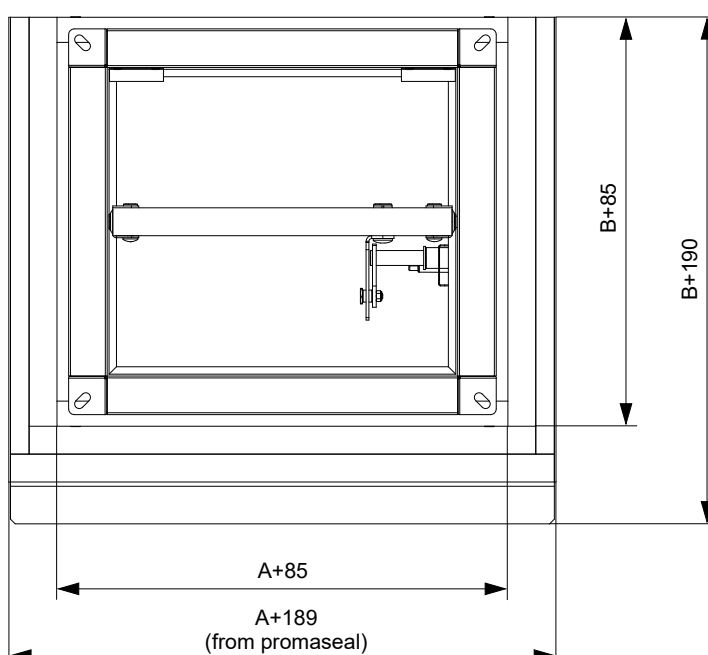
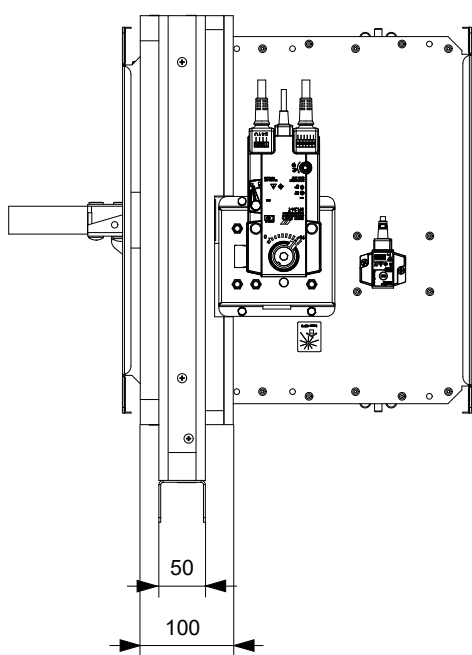
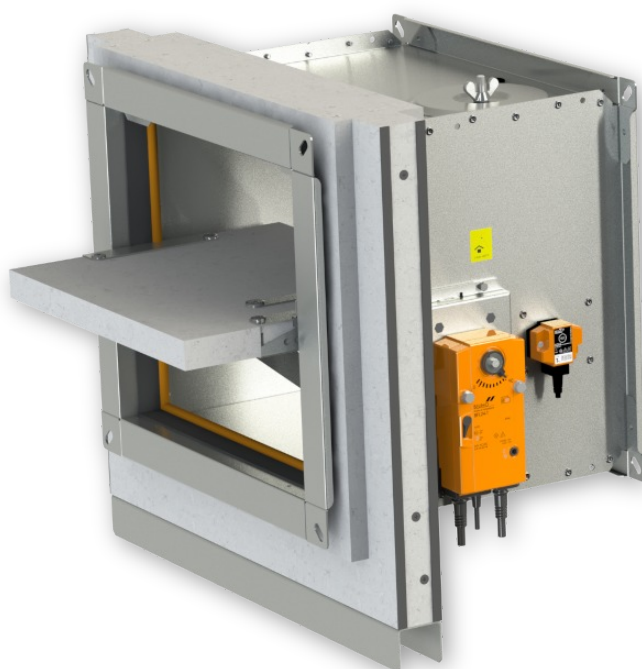


- 1 FDMB
- 2 Installation frame - apply HILTI CFS-S ACR mastic at the entire area and glue it to the fire separating construction
- 3 Duct
- 4 Profile with threaded rod → see pages 74 to 77
- 5 Solid ceiling construction
- 6 Holes for fixing the frame with threaded rods or steel anchors (material for fixing the frame is not included)

### Installation frame E5

- Installation frame E5 is designed for installation without additional sealing of the penetration for:
  - Installation in gypsum walls under flexible ceilings with a maximum movement of 40 mm
  - **Wall thicknesses of 100 or  $\geq 115$  mm**
- Installation frame is equipped with an intumescent sealing on the inside and outside. This sealing fills the gap between the damper casing and frame and between the frame and construction in the event of a fire
- Position of the damper can be directly on the ceiling or at a distance of max. 80 mm from the ceiling
- Material:
  - Installation frame - cement-lime boards and galvanized steel
  - Fasteners - galvanized steel

Installation frame E5

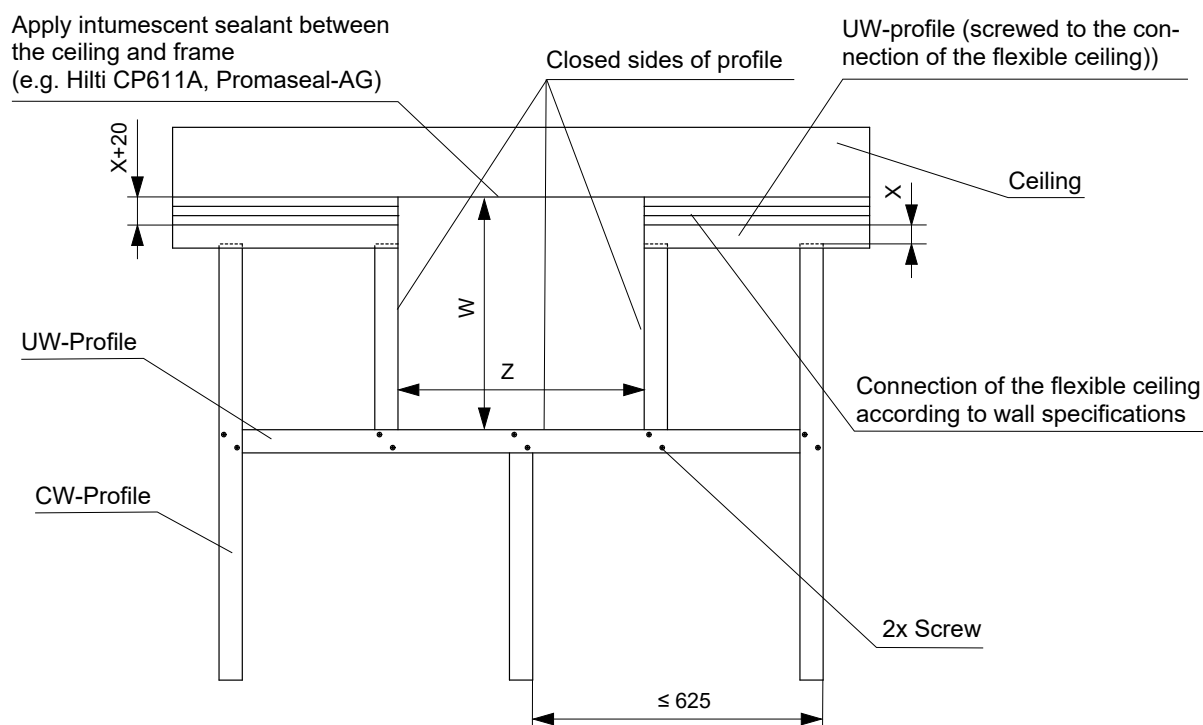
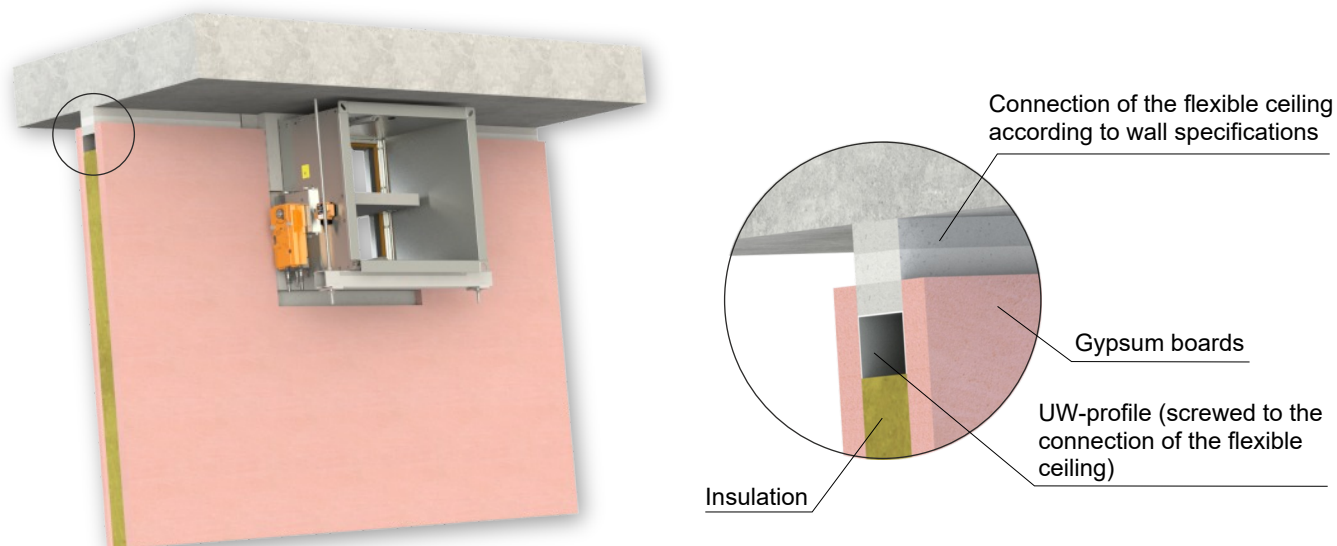


**In gypsum wall construction - flexible ceiling - installation frame E5**

**Installation directly on the ceiling**

**EI 90 (v<sub>e</sub> i↔o) S**

- Detailed instructions for installation E5 frame → see manual
- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately
- Gypsum construction must be made in accordance with the specifications of the wall system manufacturer



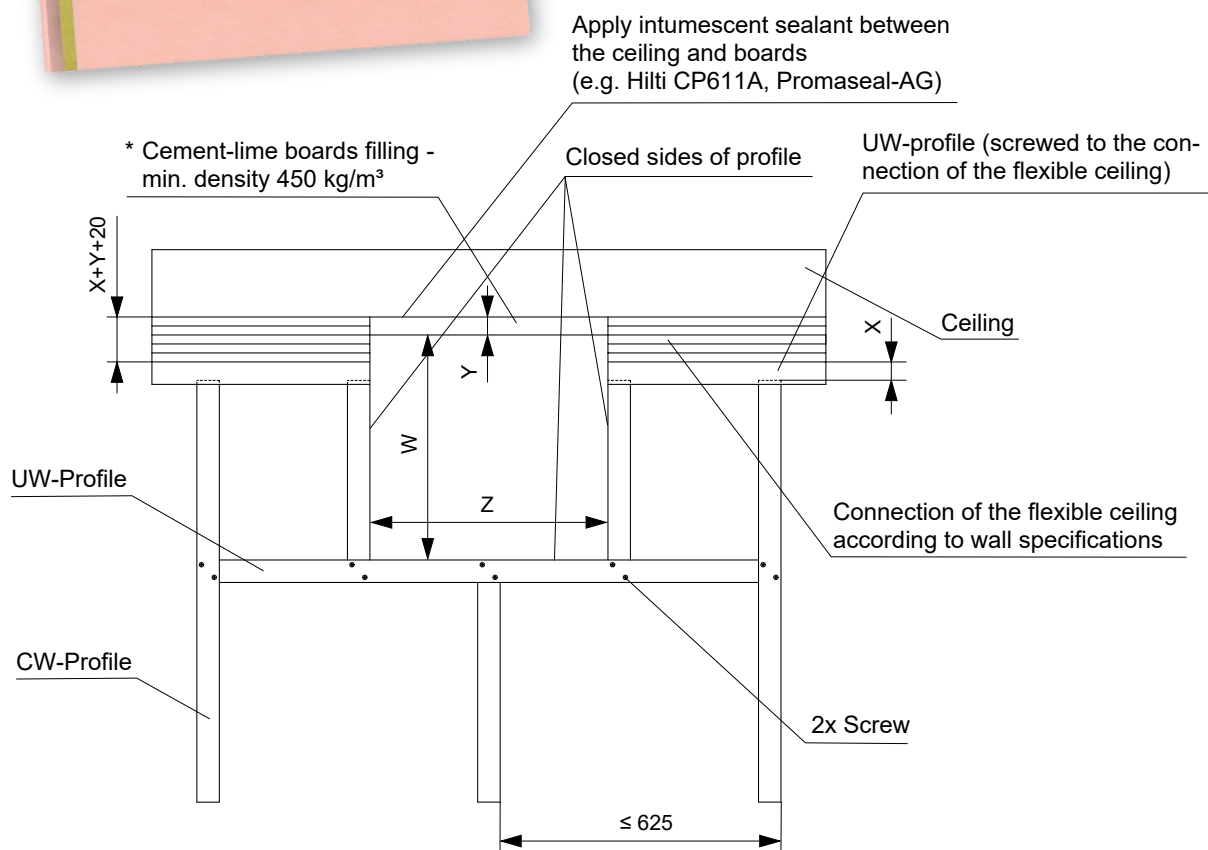
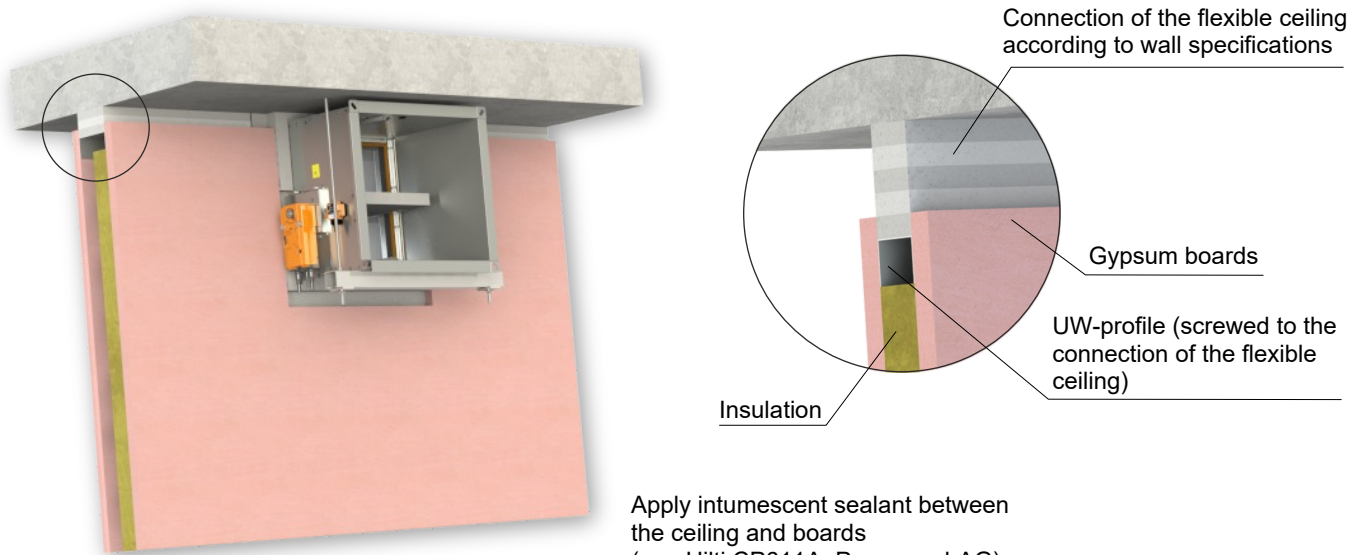
Installation frame	W [mm]	Z [mm]
E5	$B + 190 + X$	$A + 189 + (2 \times F)$

- X = ceiling movement ≤ 40 mm
- F = gap between frame (promaseal) and profile = 2 to 5 mm

Installation at a maximum distance of 80 mm from the ceiling

EI 90 (v<sub>e</sub> i↔o) S

- Detailed instructions for installation E5 frame → see manual
- For connection of following duct → see page 78
- Installation frame can be installed on the damper or delivered separately
- Gypsum construction must be made in accordance with the specifications of the wall system manufacturer



Installation frame	W [mm]	Z [mm]
E5	$B + 190 + X + Y$	$A + 189 + (2 \times F)$

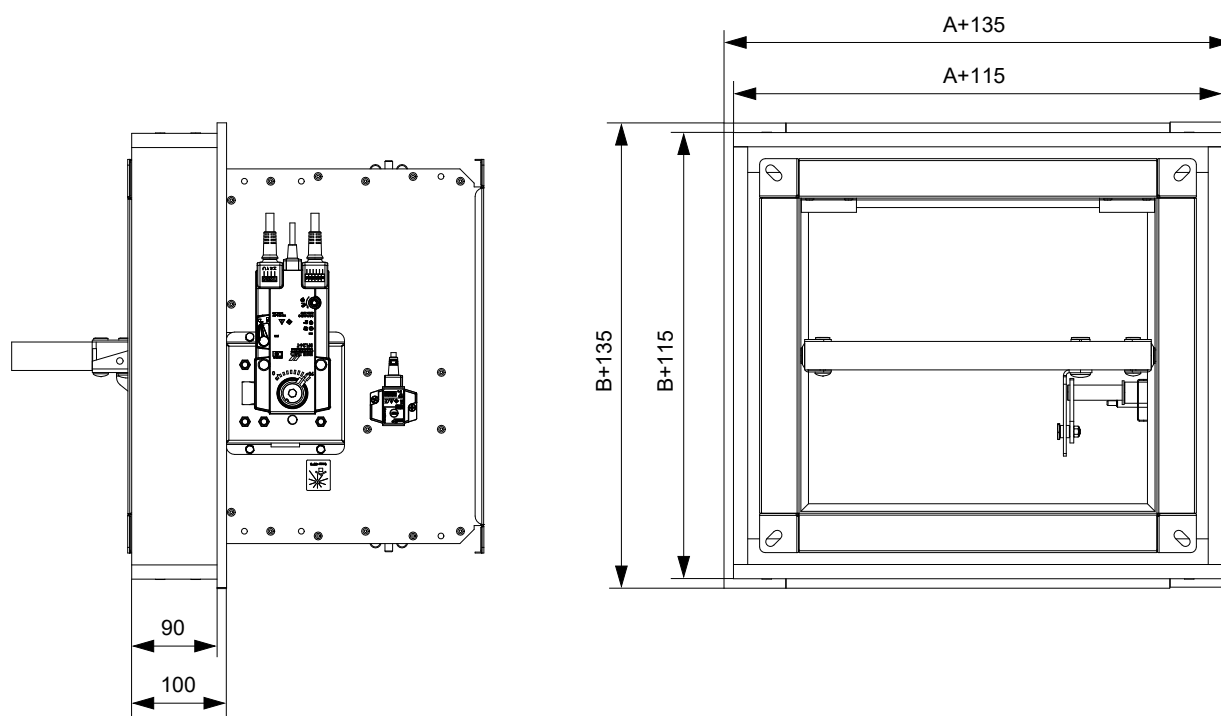
\* Width of the boards for frame E5 = 100 mm

- X = ceiling movement ≤ 40 mm
- Y = distance of frame from ceiling max. 80 mm
- F = gap between frame (promaseal) and profile = 2 to 5 mm

## Installation frame E6

- Installation frame E6 is designed for installation without additional sealing of the penetration into:
  - Installation outside solid wall/ceiling construction with insulation from fire-resistant boards
- Installation frame is equipped with an intumescent sealing on the inside. This sealing fills the gap between the damper casing and frame in the event of a fire
- Material:
  - Installation frame - cement-lime boards
  - Fasteners - galvanized steel

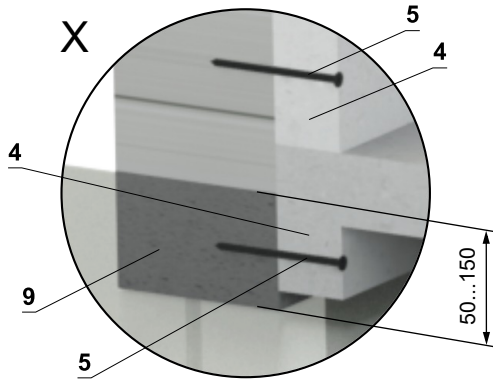
Installation frame E6



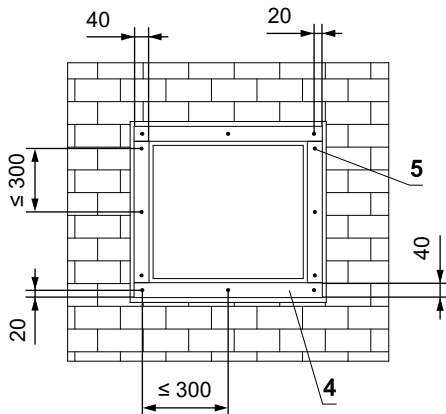
**Outside solid wall construction - insulation from fire-resistant boards - mortar or gypsum - installation frame E6**

**EI 90 (v<sub>e</sub> i↔o) S**

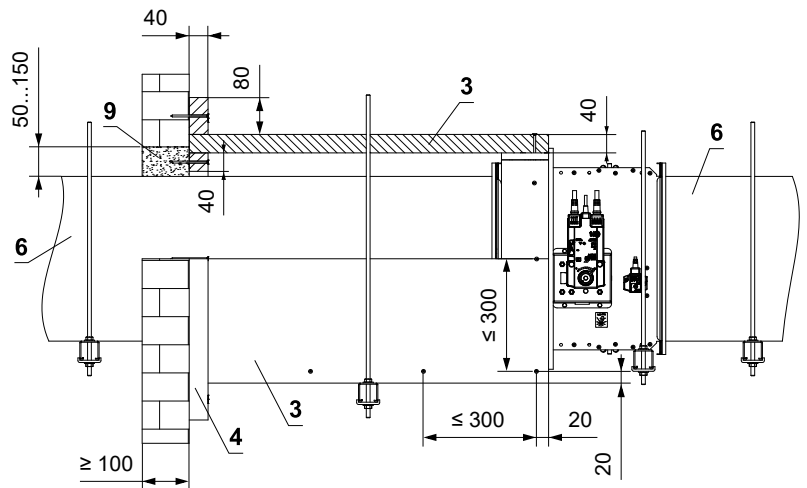
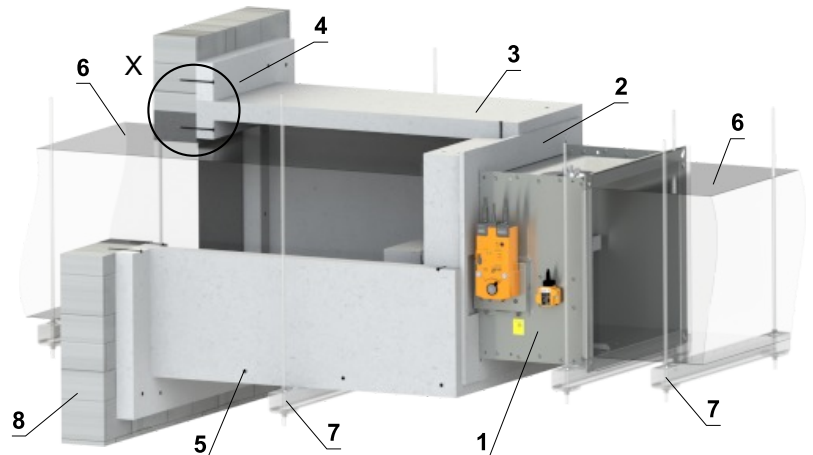
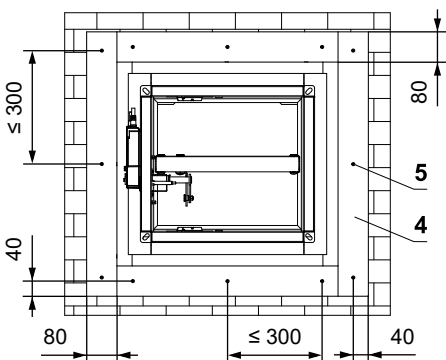
- For connection of following duct → see page 78
- Minimum and maximum distance between the wall and fire damper is unlimited
- Insulation must be suspended using threaded rods and mounting profiles or other mounting system, according to national standards
- Duct inside the insulation must be suitably supported. The insulation must be suspended at the point of the duct support using threaded rods and mounting profiles
- Load of the suspension system depends on weight of the fire damper, duct system and the insulation → see page 74
- Max. distance between two suspension systems is 1500 mm
- 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
- Installation frame can be installed on the damper or delivered separately



**Additional board of duct**



**Additional board of frame**



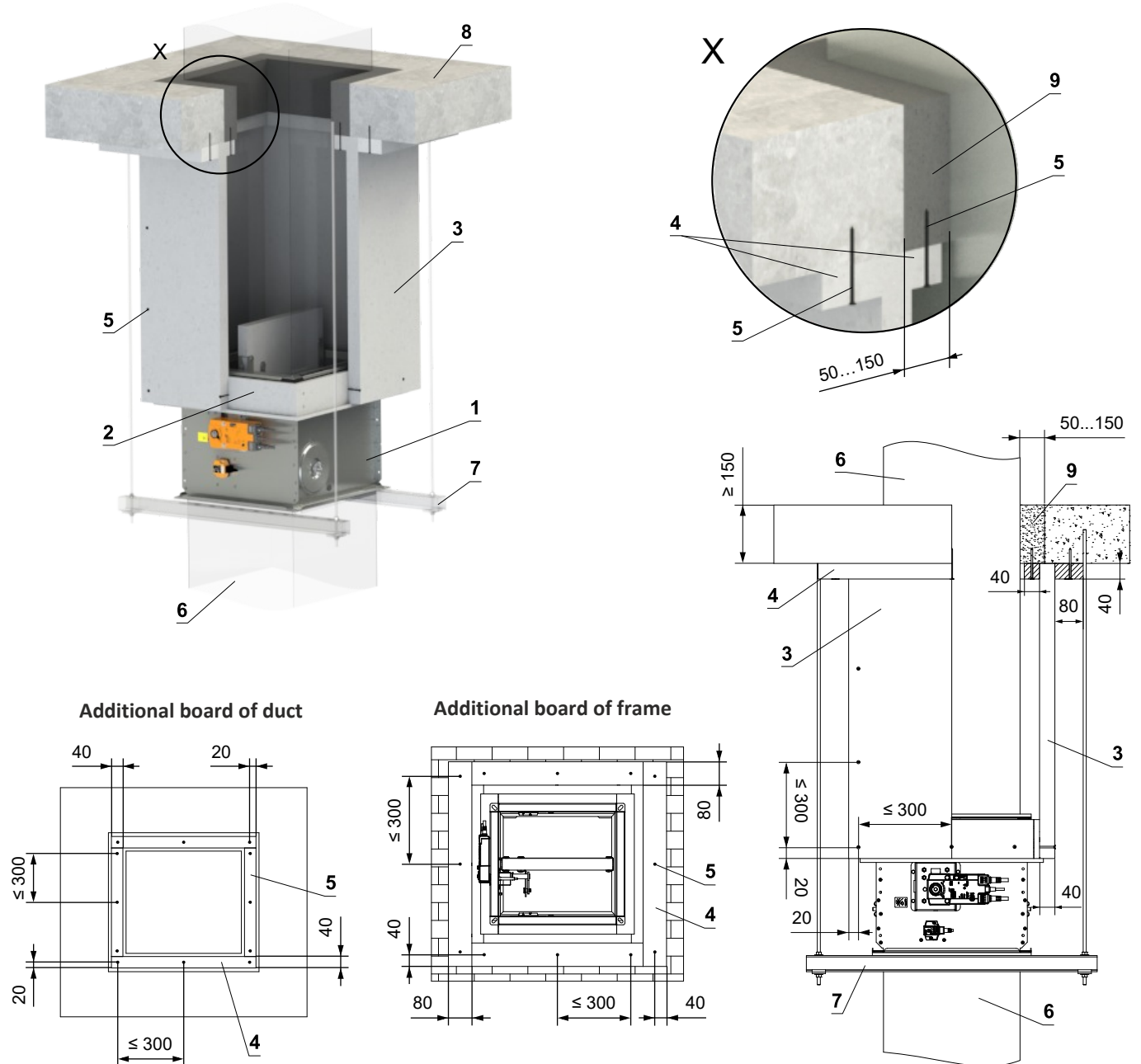
- |   |  |
|---|--|
| <ul style="list-style-type: none"> <li>1 FDMB</li> <li>2 Installation frame</li> <li>3 Insulation made of cement-lime board - min. thickness 40 mm, min. density 450 kg/m<sup>3</sup> (e.g. PROMATECT-L). All parts are glued with glue Promat K84 and secured with screws 4x80 mm</li> <li>4 Additional board made of cement-lime board - min. thickness 40 mm, min. density 450 kg/m<sup>3</sup> (e.g. PROMATECT-L). Apply HILTI CFS-S ACR mastic at the entire area and secure it with screws 4x80 mm</li> </ul> | <ul style="list-style-type: none"> <li>5 Screw 4x80 mm - screws must be firmly fixed in the wall construction, if necessary use steel anchors</li> <li>6 Standard air duct, made of galvanized sheet metal, thickness according to damper size</li> <li>7 Clamp with threaded rod → see pages 74 to 77</li> <li>8 Solid wall construction</li> <li>9 Mortar or gypsum</li> </ul> |
|---|--|



**Outside solid ceiling construction - insulation from fire-resistant boards - mortar or gypsum - installation frame E6**

EI 90 (h<sub>o</sub> i↔o) S

- For connection of following duct → see page 78
- Minimum and maximum distance between the ceiling and fire damper is unlimited
- Insulation must be suspended using threaded rods and mounting profiles or other mounting system, according to national standards
- Load of the suspension system depends on weight of the fire damper, duct system and the insulation → see page 74
- Max. distance between two suspension systems is 1500 mm
- 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
- Installation frame can be installed on the damper or delivered separately



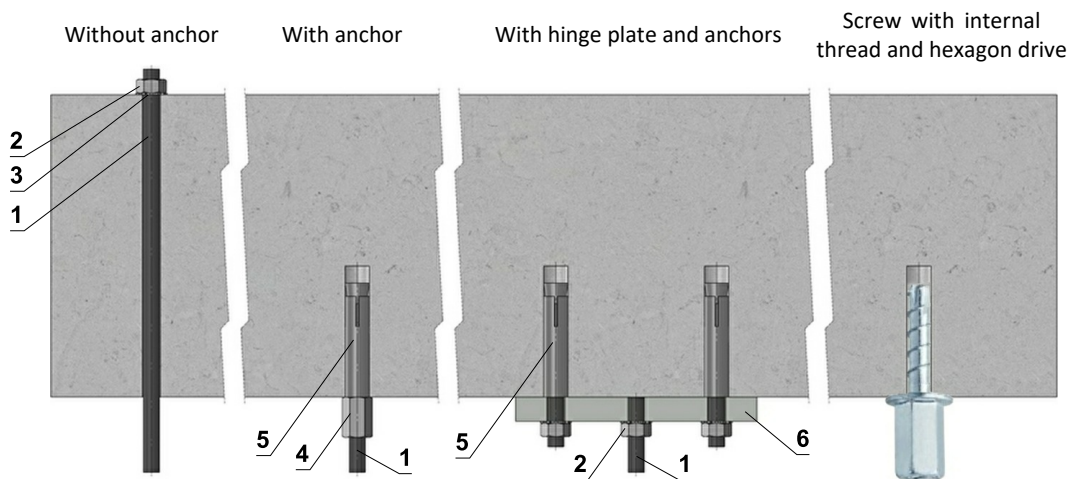
- |  |  |
|--|--|
| <p>1 FDMB</p> <p>2 Installation frame</p> <p>3 Insulation made of cement-lime board - min. thickness 40 mm, min. density 450 kg/m<sup>3</sup> (e.g. PROMATECT-L). All parts are glued with glue Promat K84 and secured with screws 4x80 mm</p> <p>4 Additional board made of cement-lime board - min. thickness 40 mm, min. density 450 kg/m<sup>3</sup> (e.g. PROMATECT-L). Apply HILTI CFS-S ACR mastic at the entire area and secure it with screws 4x80 mm</p> | <p>5 Screw 4x80 mm - screws must be firmly fixed in the wall construction, if necessary use steel anchors</p> <p>6 Standard air duct, made of galvanized sheet metal, thickness according to damper size</p> <p>7 Clamp with threaded rod → see pages 74 to 77</p> <p>8 Solid ceiling construction</p> <p>9 Mortar or gypsum</p> |
|--|--|

# V. SUSPENSION SYSTEMS

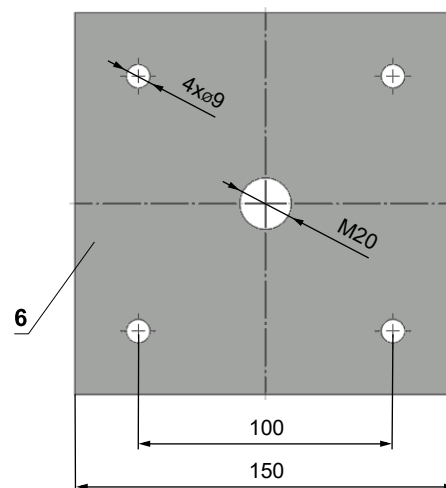
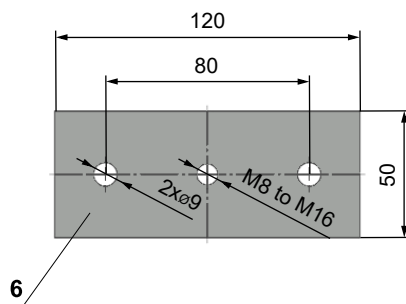
## Mounting to the ceiling wall

- 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.
- Threaded rods longer than 1,5 m must be protected by fire insulation.

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



Hinge plates



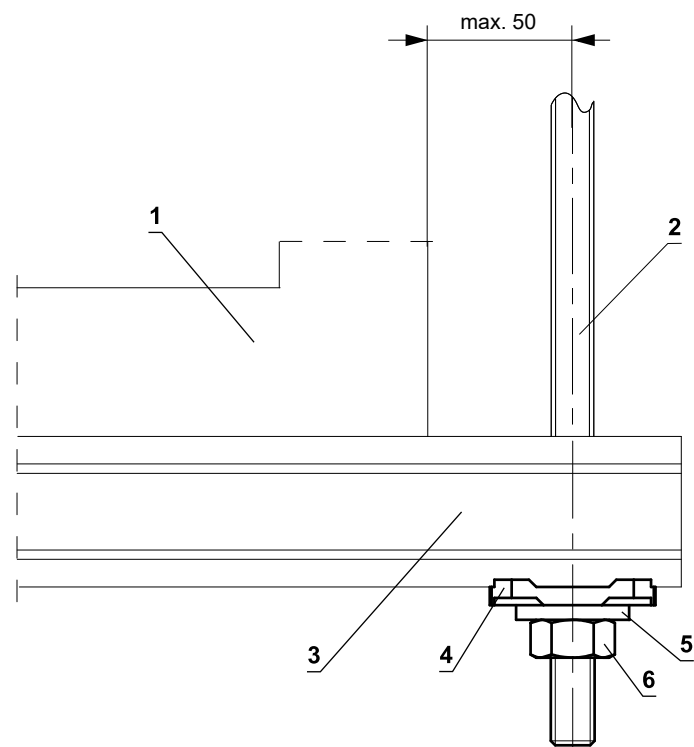
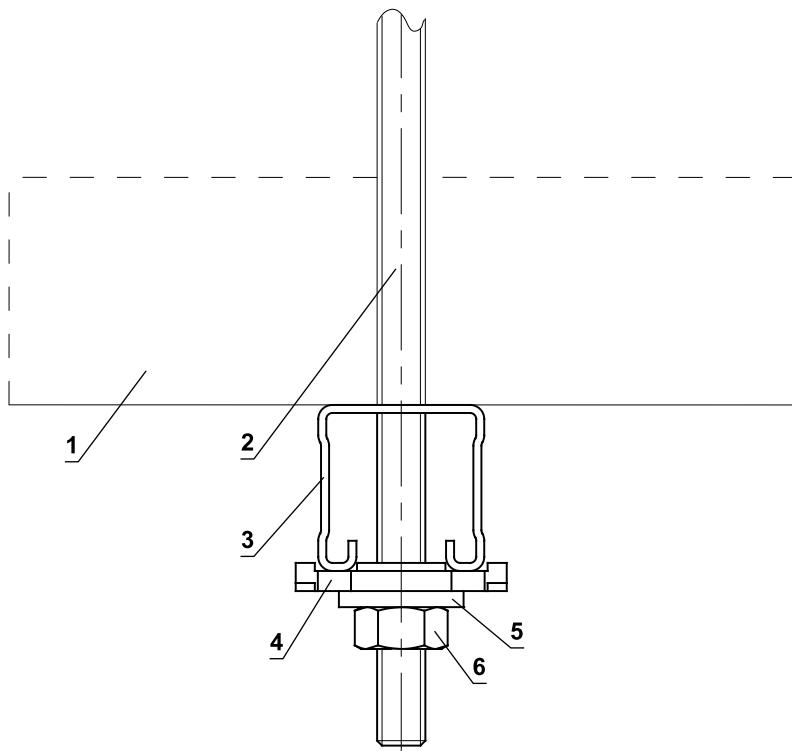
- If in doubt, always consult an anchor specialist engineer such as Halfen or Hilti.

#### 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)

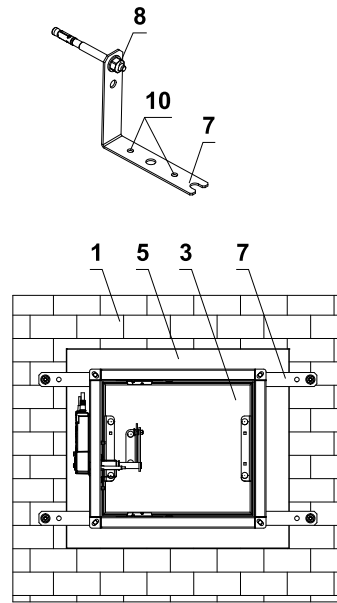
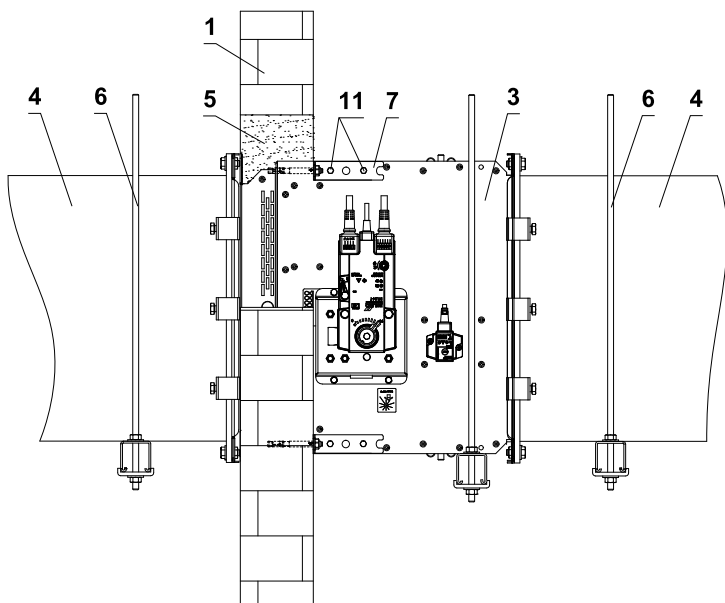
## Example of placing of mounting profiles HILTI



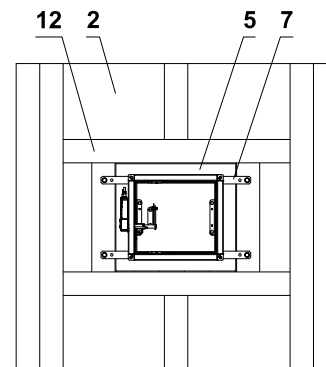
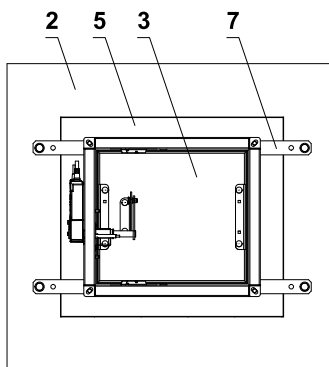
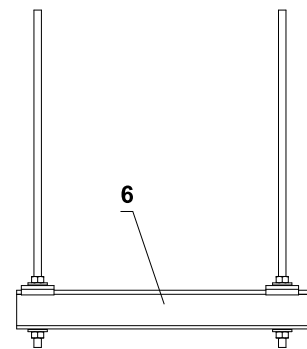
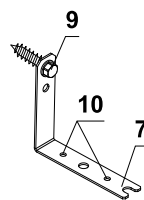
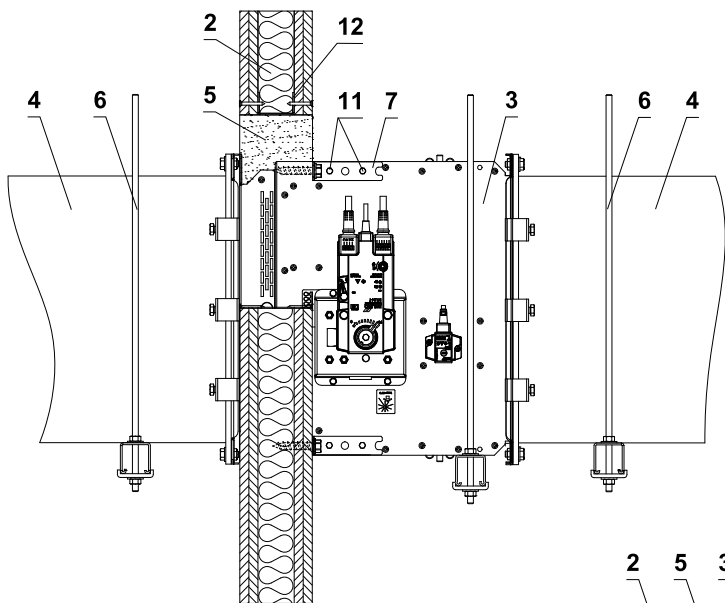
- 1 FDMB
- 2 Threaded rod M8 - M12
- 3 Support HILTI MQ-41 or MQ-41/3
- 4 Bored plate HILTI MQZ-L
- 5 Washer for M8 - M12
- 6 Nut M8 - M12

Example of fixing FDMB to the wall ceiling

In solid wall construction



In gypsum wall construction



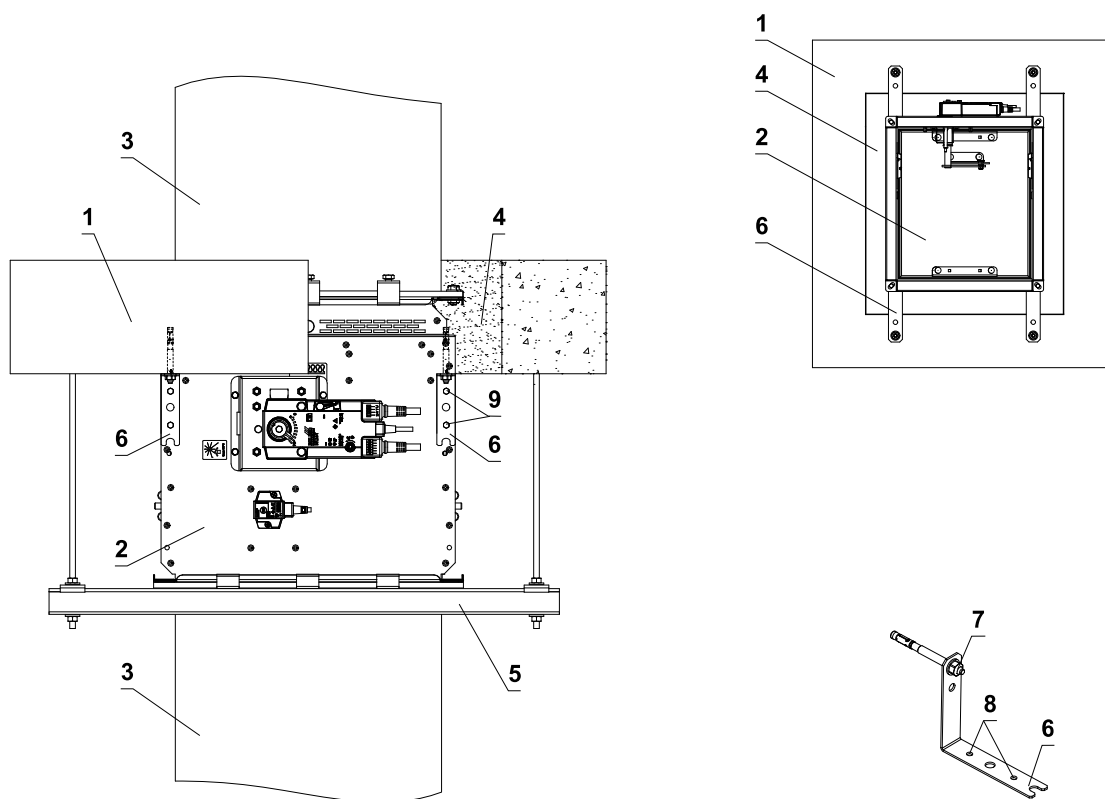
Grid from "U" profile

- 1 Solid wall construction
- 2 Gypsum wall construction
- 3 FDMB
- 4 Duct
- 5 Penetration
- 6 Profile with threaded rod → see page 75
- 7 Fixing element/steel bracket for fixing the damper to the wall (optional accessories from MANDÍK, a.s. or sheet metal min. thickness 2 mm and min. width 25 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 FDMB to the ceiling

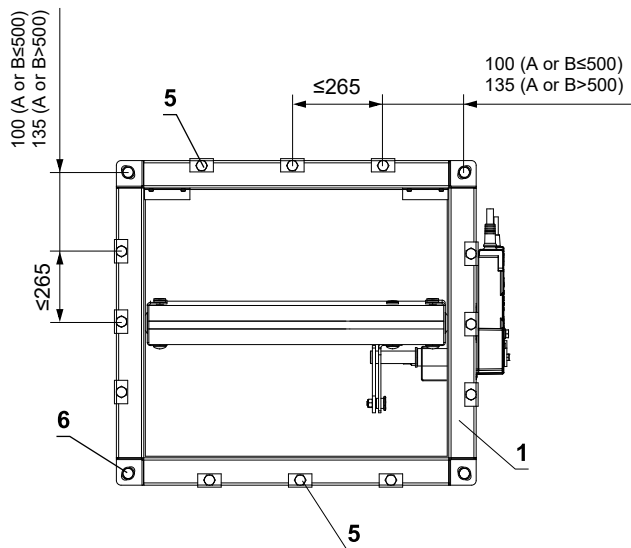
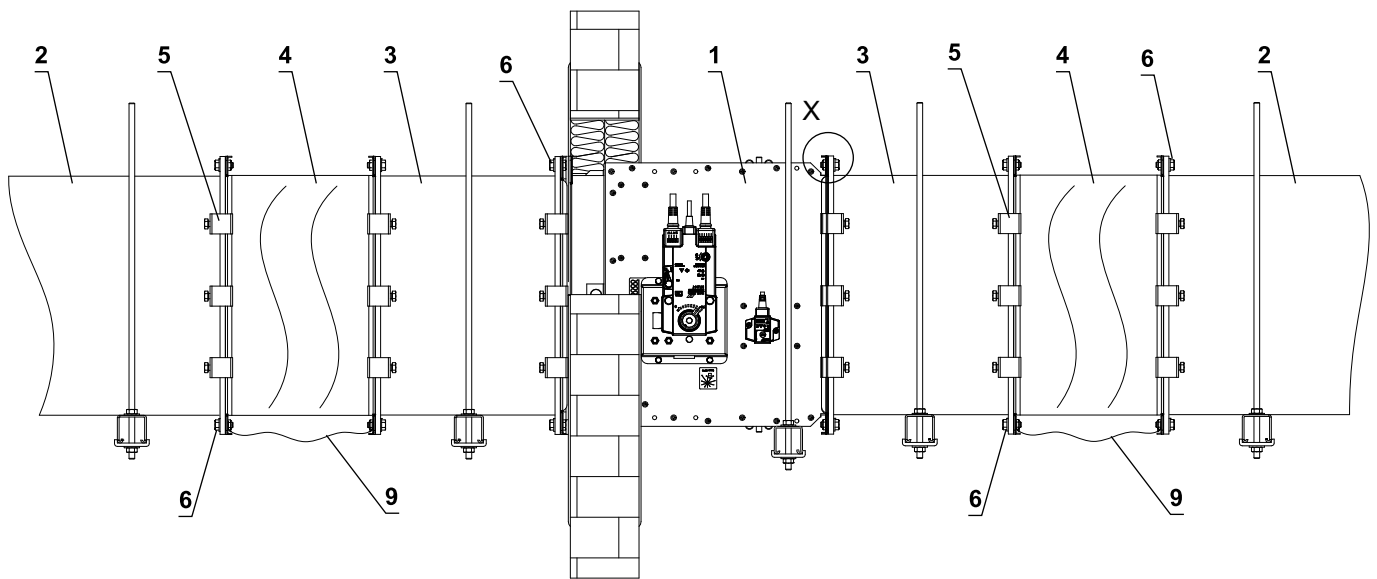
## In solid ceiling construction



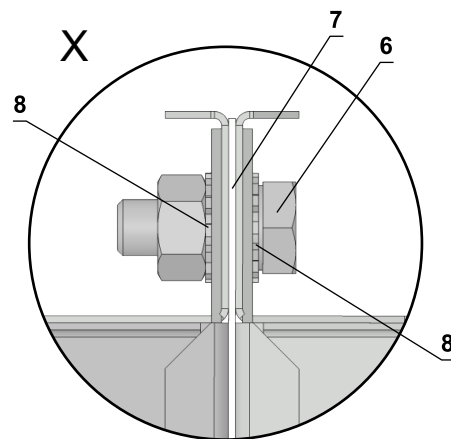
- 1 Solid ceiling construction
- 2 FDMB
- 3 Duct
- 4 Penetration
- 5 Profile with threaded rod → see page 75
- 6 Fixing element/steel bracket for fixing the damper to the wall (optional accessories from MANDÍK, a.s. or sheet metal min. thickness 2 mm and min. width 25 mm)
- 7 Nut M8 with anchor
- 8 Installation 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



\* at least one connection must be electrically conductive

- 1 FDMB
- 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

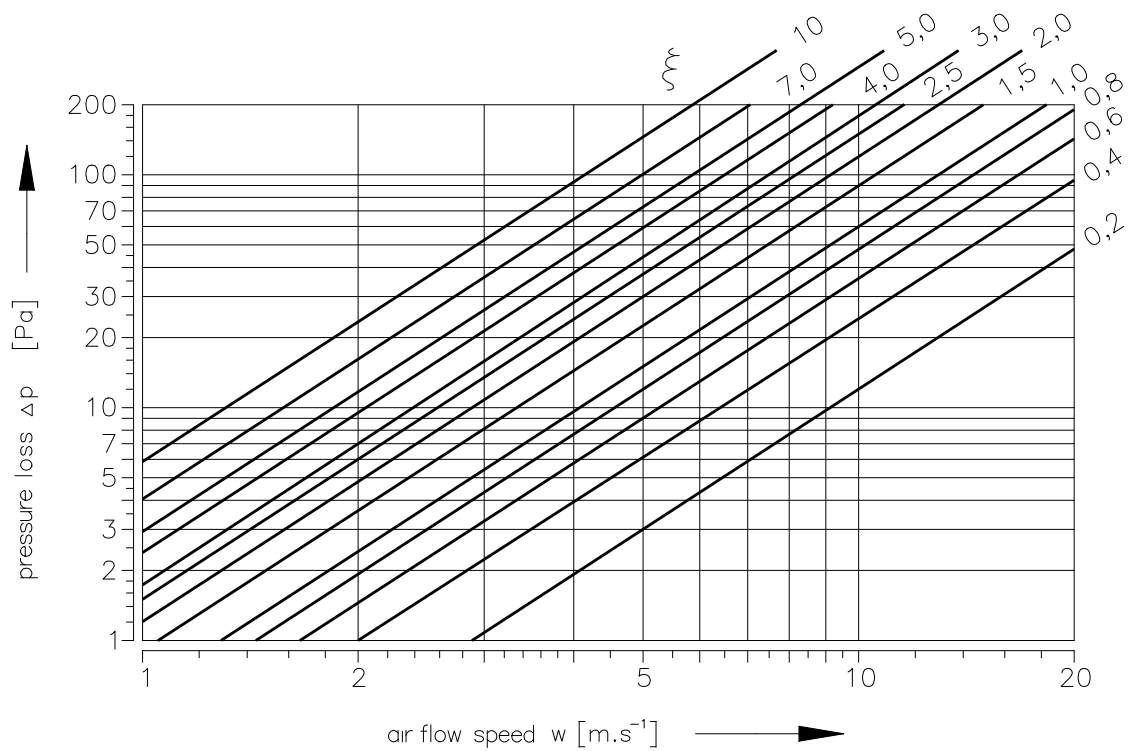
## Pressure loss

### 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 80

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



Coefficient of local pressure loss

A	B													
	100	110	125	140	150	160	180	200	225	250	280	300	315	355
100	19,025	15,910	11,370	7,983	6,374	5,264	2,959	2,962	2,162	1,548	1,399	-	-	-
110	15,690	12,678	9,499	6,910	5,576	4,528	2,743	2,649	1,978	1,459	1,299	-	-	-
125	11,247	9,984	7,440	5,444	4,529	3,773	2,461	2,208	1,744	1,327	1,163	-	-	-
140	8,673	7,669	5,933	4,489	3,755	3,195	2,204	1,893	1,552	1,217	1,044	-	-	-
150	7,408	6,620	5,144	4,007	3,388	2,899	2,091	1,728	1,443	1,160	0,985	-	-	-
160	6,659	5,813	4,748	3,683	3,129	4,771	3,458	2,717	2,285	1,813	1,538	1,407	1,327	1,165
180	4,528	4,270	3,630	3,000	2,644	4,102	3,251	2,351	2,016	1,676	1,342	1,221	1,136	0,986
200	4,490	4,170	3,466	2,807	2,446	3,701	2,951	2,105	1,867	1,554	1,302	1,113	1,052	0,933
225	4,220	3,969	3,379	2,767	2,431	3,654	2,873	2,056	1,726	1,475	1,226	1,067	1,029	0,917
250	4,120	3,904	3,306	2,744	2,405	3,588	2,793	2,005	1,675	1,386	1,155	1,033	0,987	0,893
280	3,520	3,404	3,005	2,551	2,266	3,411	2,692	1,975	1,599	1,341	1,123	0,986	0,916	0,822
300	3,307	3,225	2,876	2,457	2,189	3,288	2,599	1,903	1,536	1,315	1,101	0,974	0,911	0,787
315	3,219	3,139	2,760	2,338	2,072	3,102	2,454	1,833	1,489	1,289	0,988	0,933	0,833	0,721
355	2,914	2,842	2,550	2,195	1,963	2,955	2,302	1,796	1,412	1,199	0,956	0,902	0,799	0,678
400	3,291	3,125	2,665	2,196	1,926	2,833	2,159	1,703	1,356	1,126	0,931	0,825	0,711	0,635
450	-	-	2,690	2,176	1,884	2,732	2,055	1,623	1,302	1,103	0,852	0,777	0,677	0,599
500	-	-	2,590	2,110	1,836	2,670	1,988	1,587	1,251	1,025	0,796	0,725	0,618	0,529
550	-	-	1,976	1,885	1,731	4,219	2,941	2,237	1,687	1,402	1,156	1,039	0,968	0,827
560	-	-	1,978	1,884	1,727	4,194	2,922	2,222	1,623	1,392	1,147	1,031	0,910	0,820
600	-	-	-	1,841	1,696	4,104	2,857	2,170	1,573	1,357	1,117	1,004	0,935	0,797
630	-	-	-	1,828	1,682	4,046	2,814	2,137	1,553	1,334	1,098	0,986	0,918	0,782
650	-	-	-	1,814	1,670	4,010	2,788	2,116	1,526	1,320	1,086	0,975	0,908	0,773
700	-	-	-	-	1,664	3,975	2,759	2,098	1,515	1,297	1,071	0,965	0,892	0,761
710	-	-	-	-	1,645	3,918	2,720	2,062	1,496	1,284	1,055	0,947	0,881	0,749
750	-	-	-	-	1,630	3,865	2,682	2,032	1,475	1,264	1,037	0,931	0,866	0,736
800	-	-	-	-	1,612	3,808	2,640	1,999	1,445	1,241	1,018	0,913	0,849	0,721
900	-	-	-	-	-	3,715	2,572	1,946	1,414	1,205	0,988	0,885	0,822	0,697
1000	-	-	-	-	-	3,643	2,519	1,904	1,395	1,177	0,964	0,863	0,801	0,679

A	B													
	400	450	500	550	560	600	630	650	700	710	750	800	900	1000
100	-	-	-	-	-	-	-	-	-	-	-	-	-	-
110	-	-	-	-	-	-	-	-	-	-	-	-	-	-
125	-	-	-	-	-	-	-	-	-	-	-	-	-	-
140	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150	-	-	-	-	-	-	-	-	-	-	-	-	-	-
160	1,040	2,025	1,874	1,761	1,741	1,672	1,627	1,601	1,598	1,532	1,493	1,452	1,386	1,336
180	0,922	1,676	1,548	1,451	1,434	1,375	1,337	1,315	1,289	1,256	1,224	1,180	1,133	1,090
200	0,801	1,445	1,332	1,246	1,232	1,179	1,146	1,126	1,106	1,074	1,046	1,015	0,965	0,928
225	0,781	1,239	1,172	1,075	1,035	0,998	0,965	0,938	0,926	0,905	0,873	0,856	0,822	0,803
250	0,736	1,113	1,021	0,952	0,940	0,898	0,871	0,855	0,831	0,813	0,790	0,765	0,725	0,695
280	0,713	0,996	0,912	0,849	0,880	0,800	0,775	0,760	0,742	0,722	0,701	0,678	0,641	0,613
300	0,692	0,937	0,857	0,797	0,786	0,750	0,726	0,712	0,689	0,675	0,655	0,633	0,599	0,572
315	0,634	0,900	0,822	0,764	0,754	0,718	0,695	0,681	0,662	0,646	0,626	0,605	0,572	0,546
355	0,588	0,821	0,749	0,694	0,685	0,651	0,630	0,617	0,603	0,584	0,566	0,546	0,514	0,490
400	0,527	0,757	0,689	0,637	0,628	0,597	0,577	0,565	0,543	0,534	0,516	0,498	0,468	0,445
450	0,507	0,705	0,640	0,591	0,583	0,553	0,534	0,522	0,503	0,493	0,476	0,458	0,430	0,408
500	0,460	0,666	0,603	0,556	0,548	0,520	0,501	0,490	0,482	0,462	0,446	0,429	0,401	0,380
550	0,719	0,635	0,575	0,529	0,521	0,494	0,476	0,465	0,441	0,437	0,422	0,405	0,379	-
560	0,713	0,630	0,570	0,524	0,517	0,489	0,471	0,461	0,448	0,433	0,418	0,401	-	-
600	0,692	0,611	0,552	0,507	0,500	0,473	0,455	0,445	0,426	0,418	0,403	0,387	-	-
630	0,678	0,598	0,540	0,496	0,489	0,462	0,445	0,435	0,418	0,408	0,393	-	-	-
650	0,670	0,590	0,533	0,490	0,482	0,456	0,439	0,428	0,414	0,402	0,387	-	-	-
700	0,656	0,581	0,527	0,483	0,476	0,444	0,431	0,421	0,409	0,398	-	-	-	-
710	0,648	0,571	0,515	0,472	0,465	0,439	0,422	0,412	0,399	-	-	-	-	-
750	0,636	0,560	0,504	0,462	0,455	0,429	0,413	0,403	-	-	-	-	-	-
800	0,623	0,547	0,493	0,451	0,444	0,419	-	-	-	-	-	-	-	-
900	0,602	0,528	0,474	0,434	-	-	-	-	-	-	-	-	-	-
1000	0,585	0,512	0,460	-	-	-	-	-	-	-	-	-	-	-



## 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 acoustic values

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

w [m/s]	ξ [-]														
	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
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
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
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
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
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
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
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
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
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
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
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

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 a board of homogeneous material Promatect-MST, thickness 30 mm.

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 FDMB, 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).

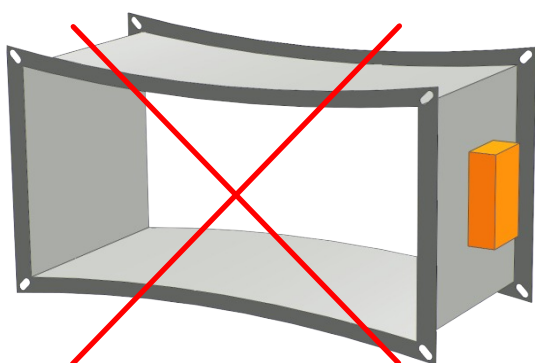
### Limit switches

- 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.

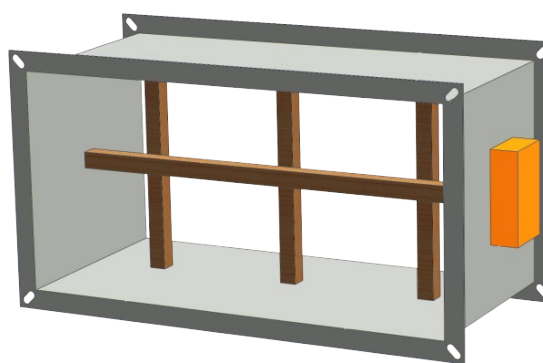
### Installation / fixing the damper

- 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!

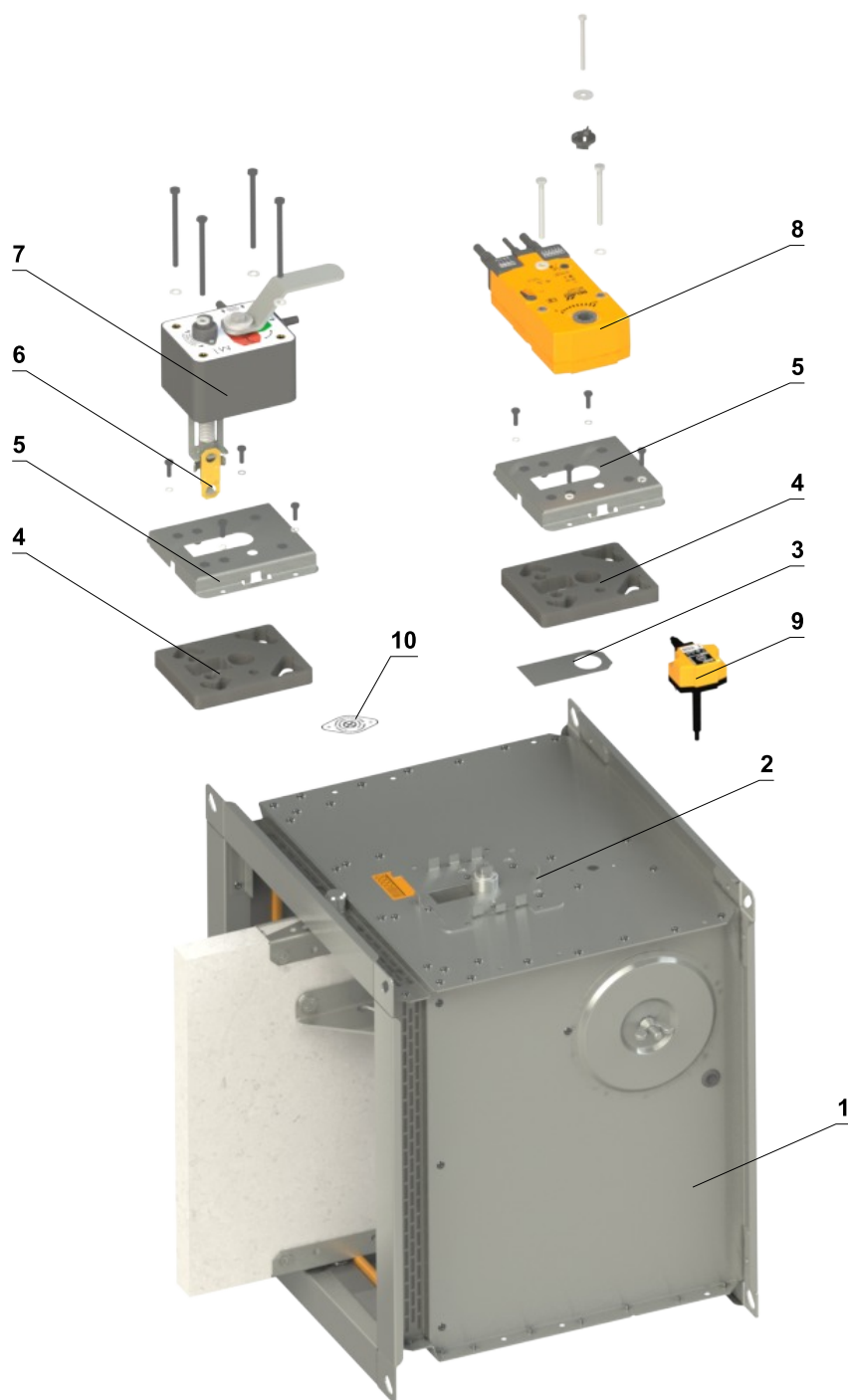


**WRONG!**



**Reinforcement of the casing with wooden beams**

Change of manual control for the actuator or vice versa

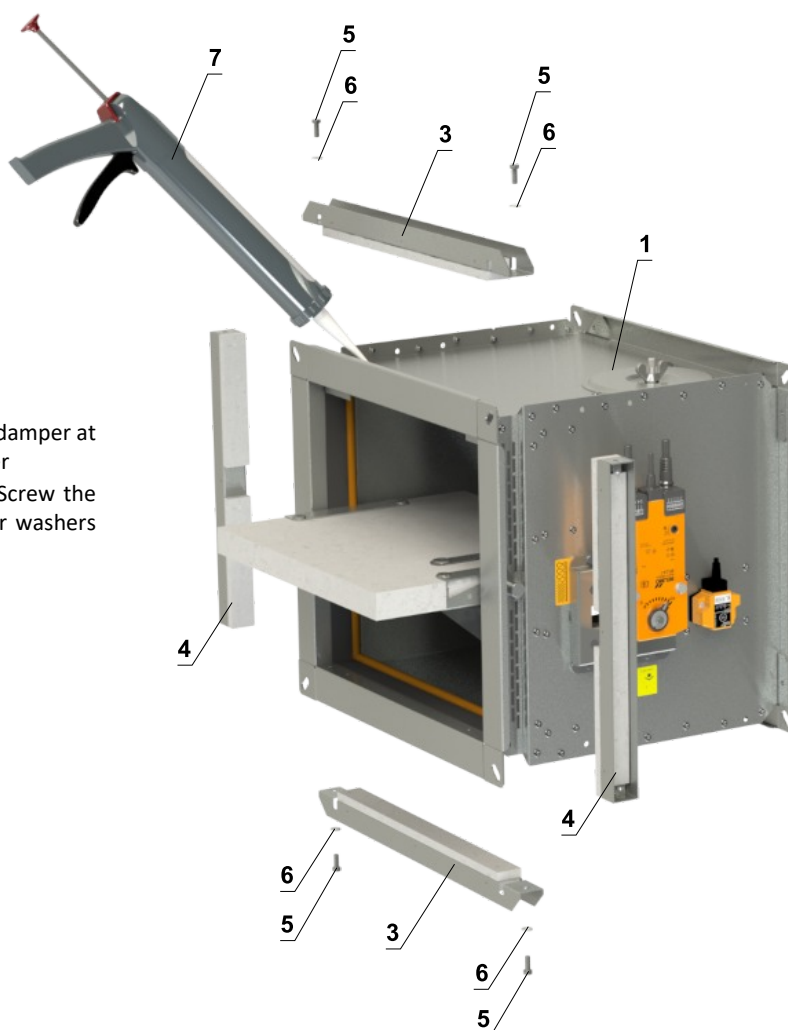
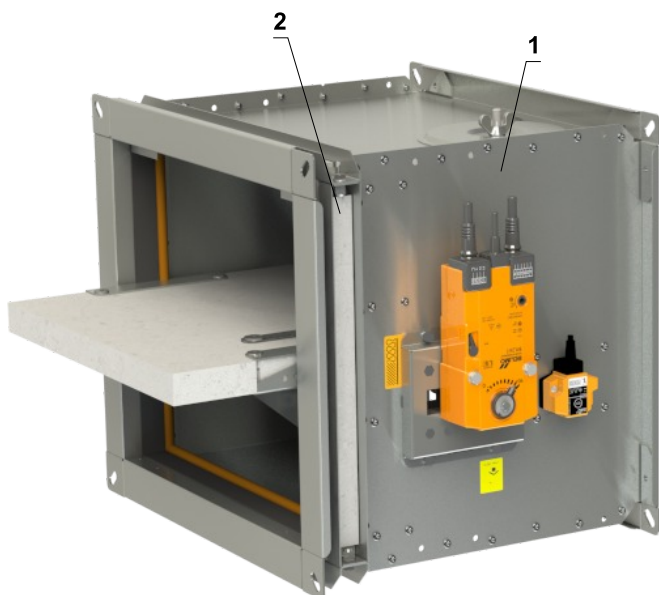


- |                               |  |
|-------------------------------|--|
| 1 Damper                      | 6 Thermal fuse                         |
| 2 Mounting plate              | 7 Manual control                       |
| 3 Sealing cover               | 8 Spring return actuator               |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

**Reinforcing frame VRM-B**

- If the damper is installed outside the fire separation construction with insulation from ROCKWOOL and fire resistance is  $\geq$  EI 90 S, VRM-B reinforcement frame must be used.
- For lower fire resistance than EI 90 S, VRM-B reinforcement frame is not necessary!
- Glue K84 is not included in the package

**Fixing of reinforcing frame VRM-B to the damper casing**



**Installation procedure**

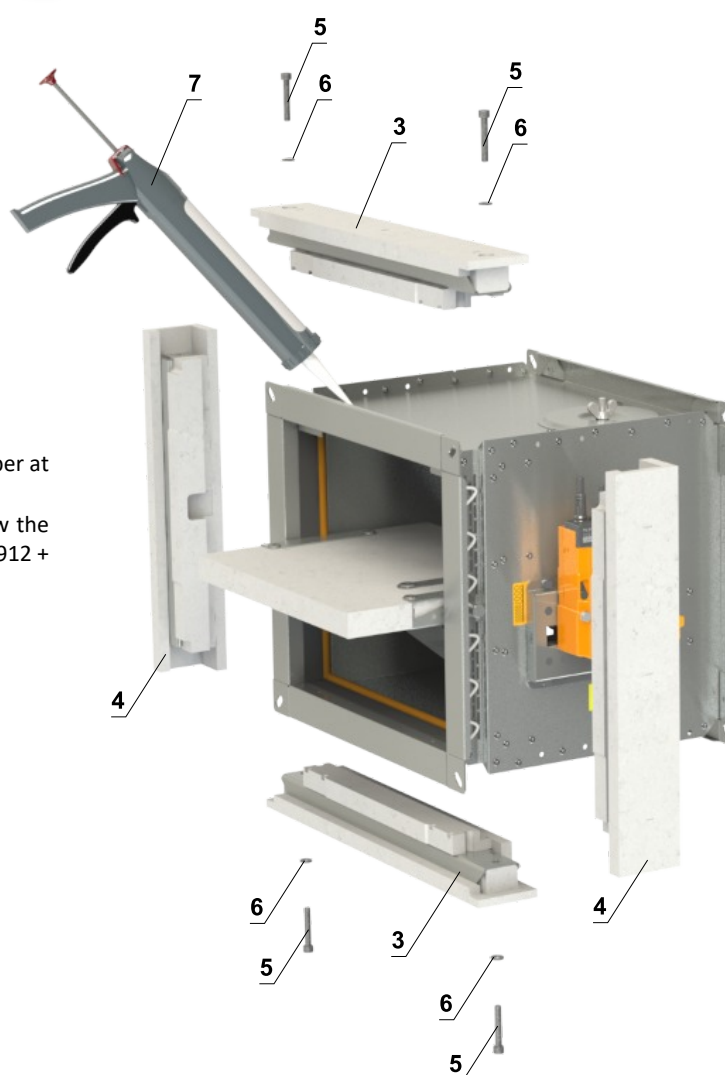
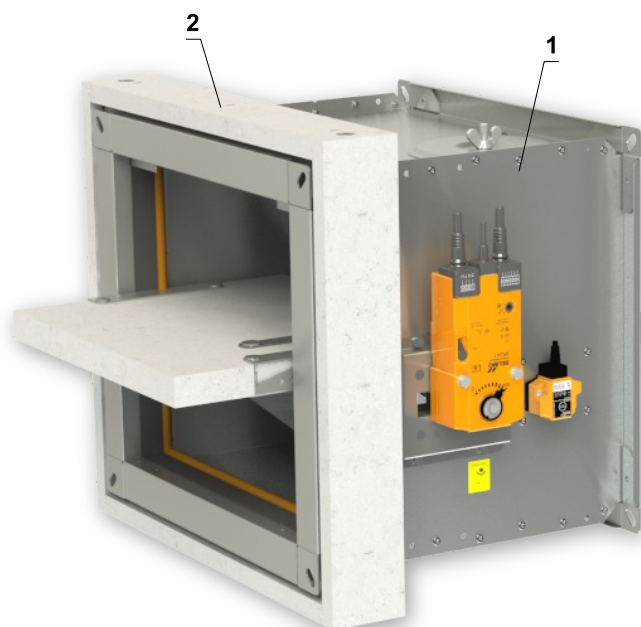
- 1) Apply glue PROMAT K-84 on the entire surface of the damper at the place of perforation on all four sides of the damper
- 2) Attach parts A and B of the VRM-B to the damper. Screw the parts together using four M6x16 mm DIN 933 + four washers M6/6,4 DIN 7349.

- 1 FDMB
- 2 VRM-B
- 3 Part A of VRM-B
- 4 Part B of VRM-B
- 5 Hexagon socket bolt M6x16 mm DIN 933
- 6 Washer M6/6,4 DIN 7349
- 7 Glue PROMAT K-84

### Reinforcing frame VRM2-B

- If the damper is installed outside the fire separation construction with insulation from ISOVER and fire resistance is  $\geq$  EI 90 S, VRM2-B reinforcement frame must be used.
- For lower fire resistance than EI 90 S, VRM2-B reinforcement frame is not necessary!
- Glue K84 is not included in the package

#### Fixing of reinforcing frame VRM2-B to the damper casing



#### Installation procedure

- 1) Apply glue PROMAT K-84 on the entire surface of the damper at the place of perforation on all four sides of the damper
- 2) Attach parts A and B of the VRM2-B to the damper. Screw the parts together using four M8x50 hexagon socket bolts DIN 912 + four M8 washers DIN 7349.

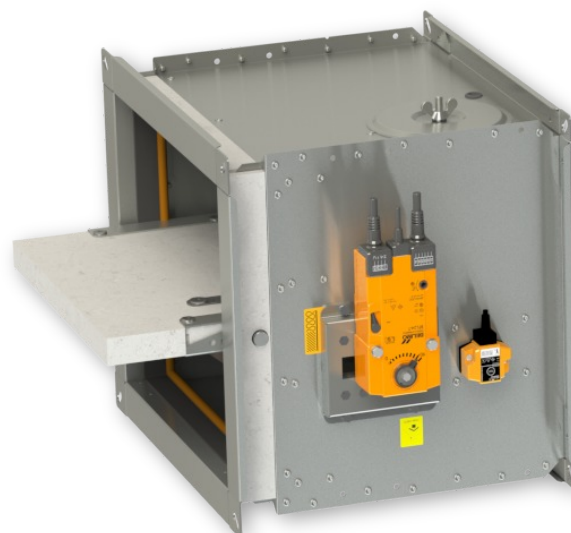
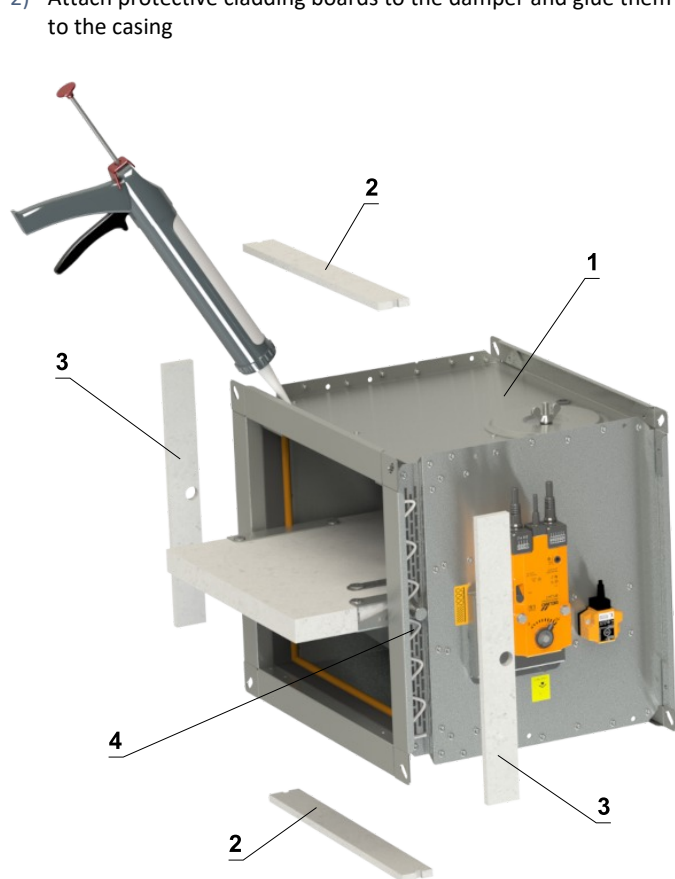
- 1 FDMB
- 2 VRM2-B
- 3 Part A of VRM2-B
- 4 Part B of VRM2-B
- 5 Hexagon socket bolt M8x50 DIN 912
- 6 Washer M8/8,4 DIN 7349
- 7 Glue PROMAT K-84

**Protective cladding boards**

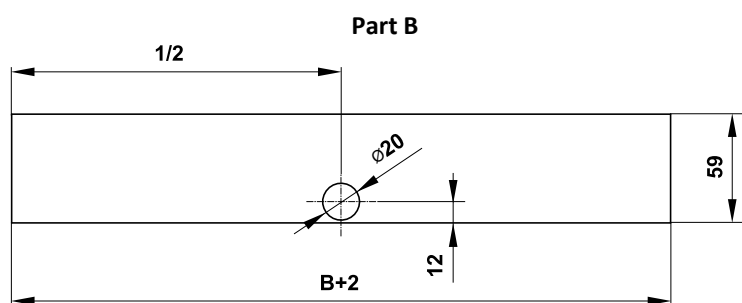
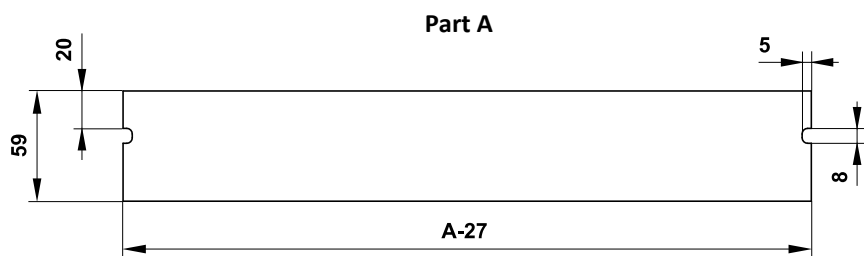
- Protective cladding boards must be used as part of the penetration filling of installation with Ablative Coated Batt.
- Can be ordered from MANDIK (installed on the damper or as an accessory) or can be sourced from local supplier
- If protective cladding boards are required, this must be specified in the ordering key
- Boards are made of PROMATECT-H, thickness 10 or 15 mm according to the damper size
- 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



- 1 FDMB
- 2 Part A
- 3 Part B
- 4 Glue K-84 PROMAT



- Thickness of protective cladding boards according to the damper size:
- for  $A \times B \leq 500 \times 400$ , thickness 10 mm
- for  $A \times B > 500 \times 400$ , thickness 15 mm



## Commissioning 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.

### Following checks must be carried out for dampers with manual control

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

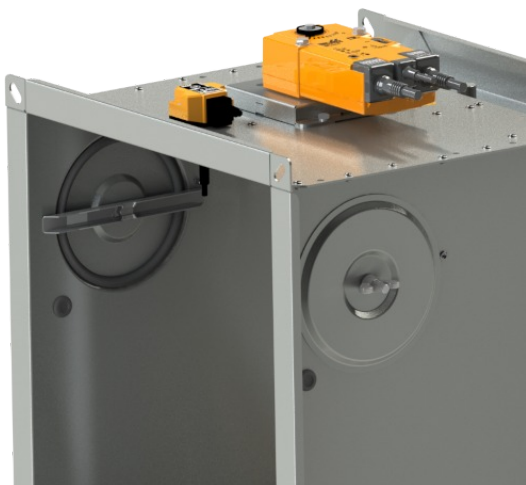
- **To check the function of the manual control proceed as follows:**
- Turn the damper blade to "CLOSED" position as follows:
  - The damper blade is in "OPEN" position.
  - Press the control button of the manual control to turn the damper blade to "CLOSED" position.
  - Check the damper blade rotation 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 M1 to M3, depending on the closing spring strength.

**Following checks must be carried out for dampers with actuator**

- 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).

**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.

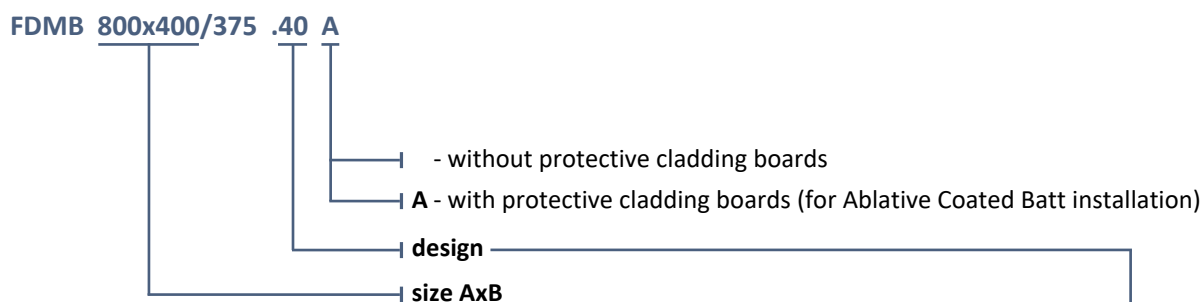
**How to proceed after Tf1 or Tf2 fuses have been activated**

- 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

### Fire damper



### EXAMPLE:

**FDMB EN 800x400/375 .40 A Q30-ZN** - 800x400-damper size, .40-damper design, A-with protective cladding boards

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

\* 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.

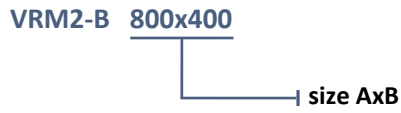
- If dampers with installation frame are required, that must be specified separately in the order. The installation frame can be installed on the damper or delivered separately.
- Detailed information for ATEX dampers (ZONE 1,2) → see Appendix

**Accessories**

**Reinforcing frame VRM-B**



**Reinforcing frame VRM2-B**




**Protective cladding boards**



**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				
DIMENSION:	<input type="text"/>	DESIGN:	<input type="text"/>	
SERIAL.NO.:	<input type="text"/>	WEIGHT (kg):	<input type="text"/>	
CLASSIFICATION:				MANUAL
TPM XXX/XX	Cert. No.: 1391-CPR-XXXX/XXXX, DoP: PM/XXXX/XX/XX/X	EN 15650:2010		CE 1391

The producer reserves the right for innovations of the product.  
For actual product information see [www.mandik.com](http://www.mandik.com)

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