

## ПРЕДПРИЯТИЕ МАКСАЭРО

- Производство воздуховодов и систем вентиляции
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# Противопожарный клапан FDMQ



The **FDMA-PM** fire damper has changed its trade name and is still manufactured under the trade name **FDMQ**.

These technical specifications state a row of manufactured sizes and models of fire dampers (further only dampers) FDMQ. It is valid for production, designing, ordering, delivery, assembly and operation.

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## II. GENERAL INFORMATION

### 1. Description

- 1.1.** Fire dampers are shutters in ducts of air-conditioning devices that prevent spreading the 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.

Dampers blade automatically closes air duct using a shutting spring or an actuating mechanism back spring. Closing spring is released either by pushing of the button or by thermal fuse.

The back spring of the actuating mechanism is started when the thermoelectrical starting mechanism BAT is activated, when a reset button on BAT is pushed or when a power supply of the actuating mechanism is stopped.

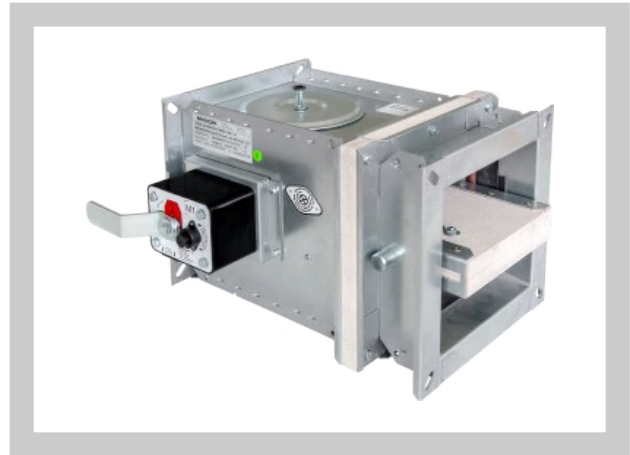
The damper is sealed with a silicon packing against smoke penetration after closing the blade. At the same time, the damper blade is bedded in a material which enlarges its capacity and air proofs the air duct.

Dampers have two inspection holes.

**Fig. 1** FDMQ with actuating mechanism



**Fig. 2** FDMQ with mechanical control



- 1.2.** Damper characteristics

- CE certified acc. to EN 15650
- Tested in accordance with EN 1366-2
- Classified acc. to EN 13501-3+A1
- Fire resistance EIS 120, EIS 90
- External Casing leakage class C, Internal leakage class 2 acc. to EN 1751
- Cycling test in class C 10 000 acc. to EN 15650
- Corrosion resistant acc. to EN 15650
- ES Certificate of conformity No. 1391-CPR-2021/0144
- Declaration of Performance No. PM/FDMQ/01/22/1
- Hygienic assessment of fire dampers - Report No. 1.6/pos/19/19b

- 1.3.** Working conditions

Right damper function is secured under the following conditions:

- a) Maximum air circulation speed: 12 m/s  
Maximum pressure difference: 1200 Pa
- b) The air circulation in the whole damper section must be secured as steady on whole surface.

Operation of the dampers does not depend on the direction of air circulation. The dampers can be located in an 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 60 721-3-3.

Temperature in the place of installation is permitted to range from -30°C to +50°C.

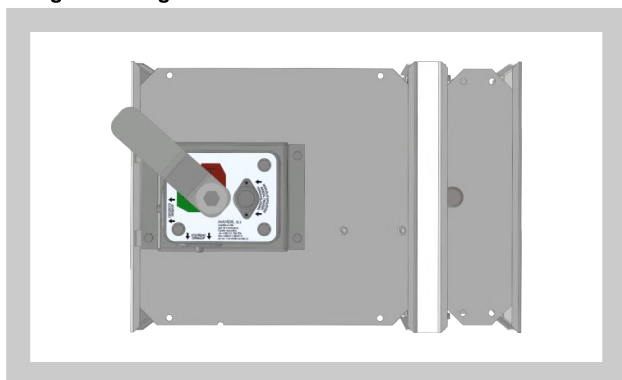
2. Design

2.1. Design with mechanical control

Design .01

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

Fig. 3 Design .01



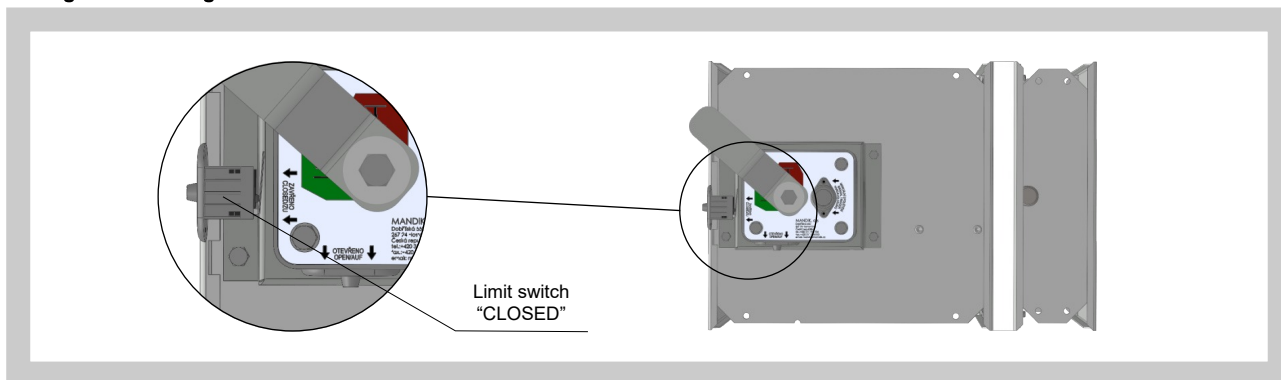
ATTENTION:

Mechanisms are produced in five designs **M1** to **M5**, difference is only in size of inner spring, which closes the fire damper. For the size of fire dampers is always assigned the size of mechanism - **Tab 4.2.1**. It is not recommended to use different size of mechanism, than given by the manufacturer, otherwise, there is a risk of fire damper destruction.

Design .11

Design .01 with mechanical control can be complemented with a limit switch signalling of the damper blade position "CLOSED". Cable is connected directly to limit switch.

Fig. 4 Design .11



Design .80

Design .01 with mechanical control can be complemented with a terminal switches signaling of the damper blade position "CLOSED" and "OPEN". Limit switches are connected via damper casing, cables are connected directly to limit switches.

Fig. 5 Design .80

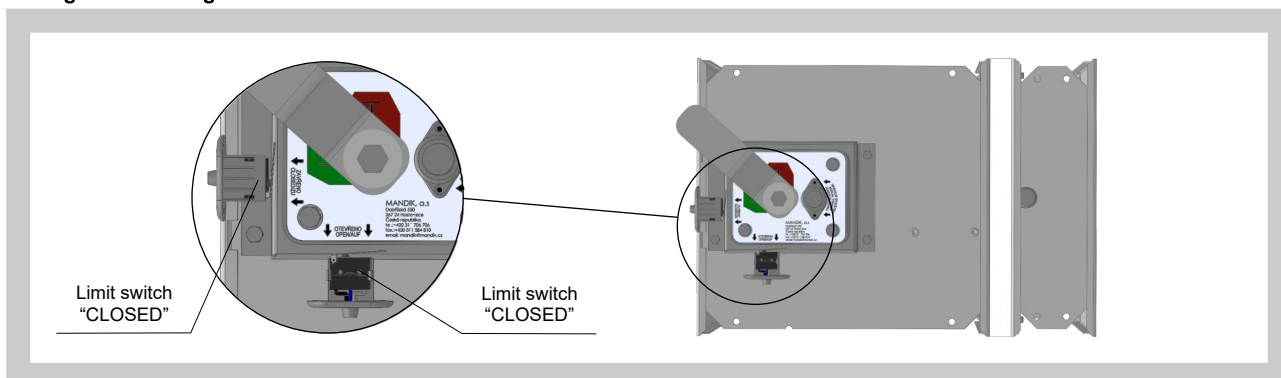


Fig. 6 Limit switch G905-300E03W1

1(COM) - black wire  
2(NC) - gray wire  
4(NO) - blue wire

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 following two versions:  
 a) **CUT-OFF** if the arm is moving ... connect wire 1+2  
 b) **SWITCH-ON** if the arm is moving ... connect wire 1+4

Fig. 7 Change of mechanical design for the motorised one or vice versa

**Position:**

- 1 Damper
- 2 Mounting plate
- 3 Sealing cover
- 4 Seal plates
- 5 Mounting plate cover
- 6 Thermal fuse
- 7 Mechanics
- 8 Actuator
- 9 Temperature sensor
- 10 Sensor sticker

2.2. Design with actuating mechanism

**Design .40, .50**

The damper are equipped by Belimo actuators with spring return and thermoelectric activation device of BFL, BFN or BF depending on the damper size (further mentioned as „actuators“). After being connected to power supply AC/DC 24V or 230V, the actuating mechanism displaces the damper blade into operation position "OPEN" and at the same time it pre-stretches its back spring. When the actuating mechanism is under voltage, the damper blade is in the position "OPEN" and the back spring is pre-stretched. Time needed for full opening of the flap blade from the position "CLOSED" to the position "OPEN" is maximum 120 sec. If the actuating power supply is cut off (due to loss of supply voltage, or pushing the reset button on the thermoelectrical starting mechanism BAT), the back spring displaces the damper blade into the breakdown position "CLOSED". The time of displacing the 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 actuating mechanism starts to re-displace the damper blade into the position "OPEN". A thermoelectrical starting mechanism BAT, which contains two thermal fuses Tf1 and Tf2, is a part of the actuating mechanism. These fuses are activated when temperature +72°C has been exceeded (the fuse Tf1 when the temperature around the damper and the fuses Tf2 when the temperature inside the air-conditioning piping has been exceeded). After the thermal fuse Tf1 or Tf2 has been activated, the power supply is permanently and irreversibly cut off and the actuating mechanism, by means of the pre-stretched spring, displaces the damper blade into the breakdown position "CLOSED".

Signalisation of damper blade position "OPEN" a "CLOSE" is provided by two limit switches.

Fig. 8 Design .40, .50

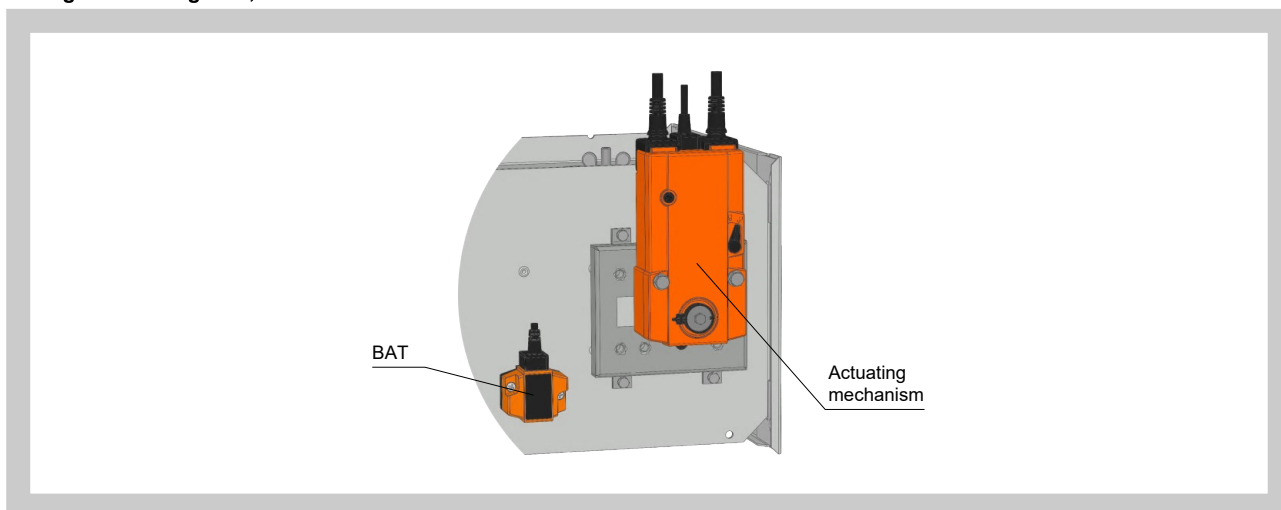


Fig. 9 Actuating mechanism BELIMO BFL (BFN) 230-T

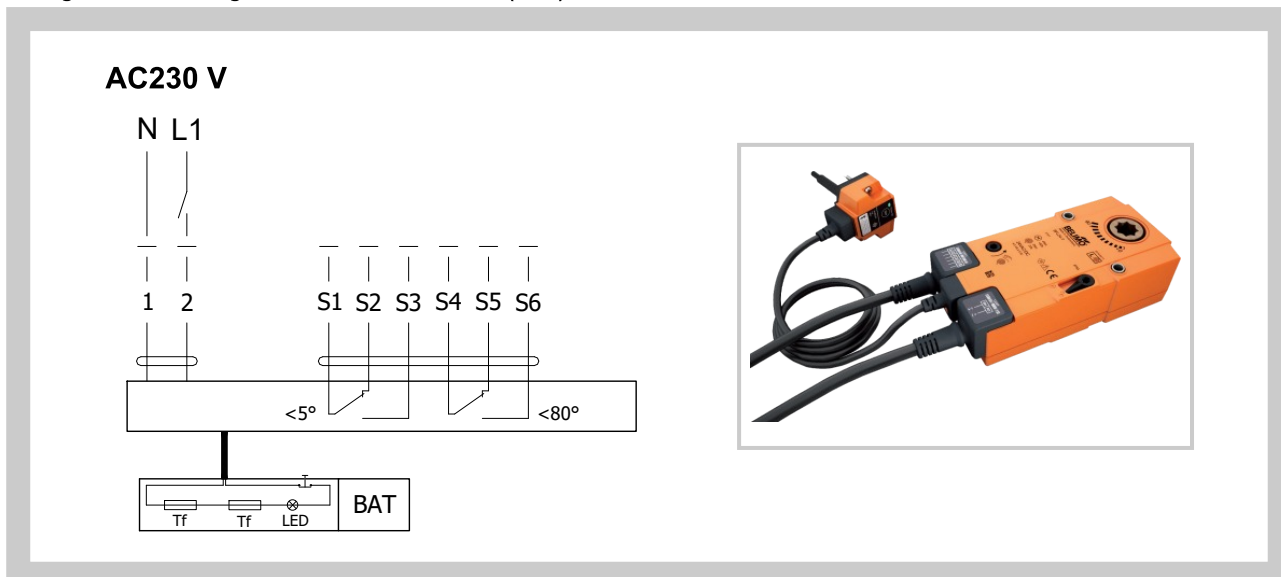
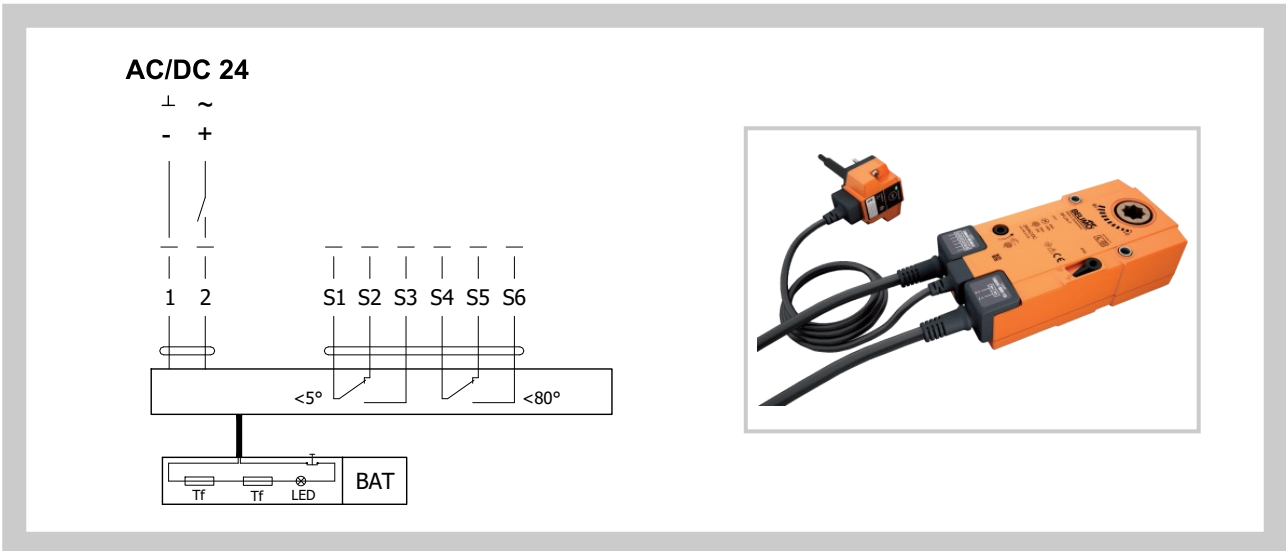


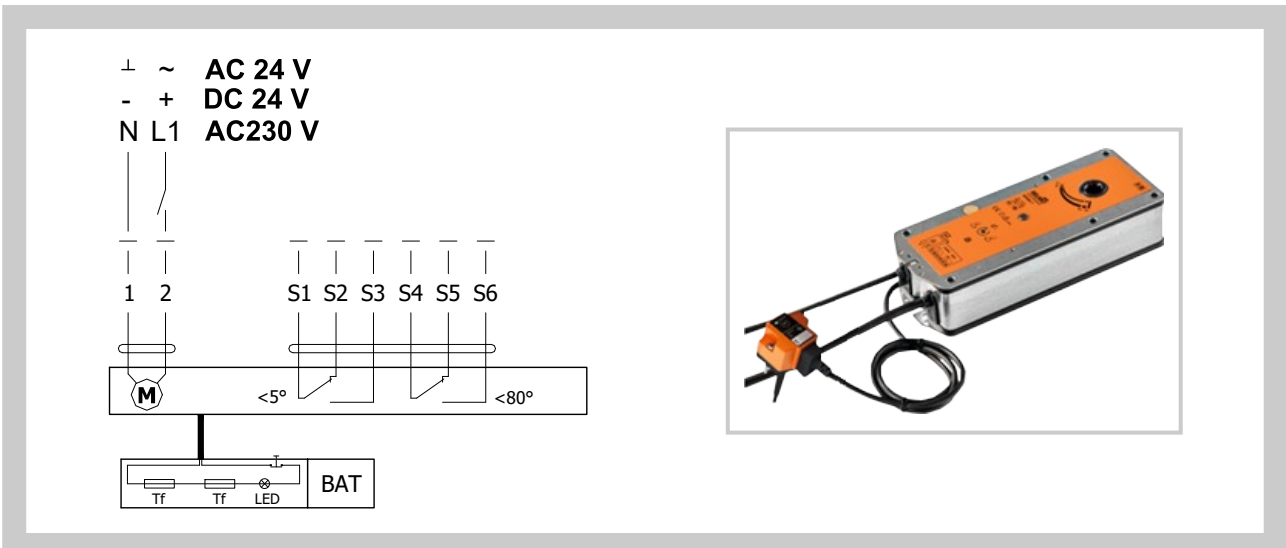
Fig. 10 Actuating mechanism BELIMO BFL, BFN 24-T(-ST)



Tab. 2.2.1. Actuating mechanism BELIMO BFL 24-T(-ST), BFN 24-T(-ST), BFL 230-T a BFN 230-T

Actuating mechanism BELIMO	BFL, BFN 230-T	BFL, BFN 24-T(-ST)
Nominal voltage	AC 230 V 50/60 Hz	AC 24 V 50/60 Hz DC 24 V
Power consumption - motoring - holding	3,5/5 W 1,1/2,1 W	2,5/4 W 0,8/1,4 W
Dimensioning	6,5/10 VA (I <sub>max</sub> 4 A @ 5 ms)	4/6 VA (I <sub>max</sub> 8,3 A @ 5 ms)
Protection class	II	III
Degree of protection	IP 54	
Running time - motor - spring return	<math><60\text{ s}</math> ~ 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	
Connecting - motor - auxiliary switch	cable 1 m, 2 x 0,75 mm <sup>2</sup> (BFL/BFN 24-T(-ST)) with 3-pin plug-in connectors cable 1 m, 6 x 0,75 mm <sup>2</sup> (BFL/BFN 24-T(-ST)) with 6-pin plug-in connectors	
Thermal trips	duct outside temperature +72°C duct inside temperature +72°C	

Fig. 11 Actuating mechanism BELIMO BF 230-TN, BF 24-TN (-ST)



**Tab. 2.2.2. Actuating mechanism BELIMO BF 24-TN(-ST), BF 230-TN**

<b>Actuating mechanism BELIMO</b>	<b>BF 24-TN(-ST)</b>	<b>BF 230-TN</b>
Nominal voltage	AC 24 V 50/60 Hz DC 24 V	AC 230 V 50/60 Hz
Power consumption - motoring - holding	7 W 2 W	8 W 3 W
Dimensioning	10 VA (Imax 8,3 A @ 5 ms)	12,5 VA (Imax 500 mA @ 5 ms)
Protection class	III	II
Degree of protection	IP 54	
Running time - motor - spring return	120 sec ~ 16 sec	
Ambient Temperature - normal duty - safety duty - non-operating temperature	-30°C ... +50°C The safe position will be attained up to max. 75°C -40°C ... +50°C	
Connecting - motor - auxiliary switch	cable 1 m, 2 x 0,75 mm <sup>2</sup> cable 1 m, 6 x 0,75 mm <sup>2</sup> (BF 24-T-ST) with plug-in connectors	
Thermal trips	Tf1: duct outside temperature Duct +72°C Tf2/Tf3: duct inside temperature Duct +72°C	

**Design .41, .51**

Design .41 or .51 with actuating mechanism can be complemented with smoke detector ORS 142 K. The voltage can be AC 230 V or 24 V DC. Design with voltage AC 230 V is equipped with Communication and supply device BKN 230-24-MOD and with actuating mechanism BF 24-TN (BFL 24-T, BFN 24-T).

The smoke detector is activated when smoke spreads in air duct system. Deactivation of smoke detector is provided by interruption of supply voltage for min. 2s.

Signalisation of damper blade position "OPEN" a "CLOSE" is provided by two limit switches..

**Tab. 2.2.3. Optical smoke detector ORS 142 K with the socket 143A**

<b>Optical smoke detector</b>	<b>ORS 142 K with socket 143A</b>
Operating voltage	18 ... 28 V DC
Residual ripple	≤ 200 mV
Power Consumption Socket (without actuating mechanism)	max. 22 mA
Degree of protection	IP 42
Ambient temperature	-20°C ... +75°C
Additional temperature sensor	+70°C
Connection - net - motor - communication and supply device BKN	Cabel 1m, connected to terminals 1, 2 and 4 Actuator connected on the terminals 2 and 5 Cabel 1m, connected to terminals 1, 2, 4 and 5

Fig. 12 Smoke detector ORS 142 K and socket 143A

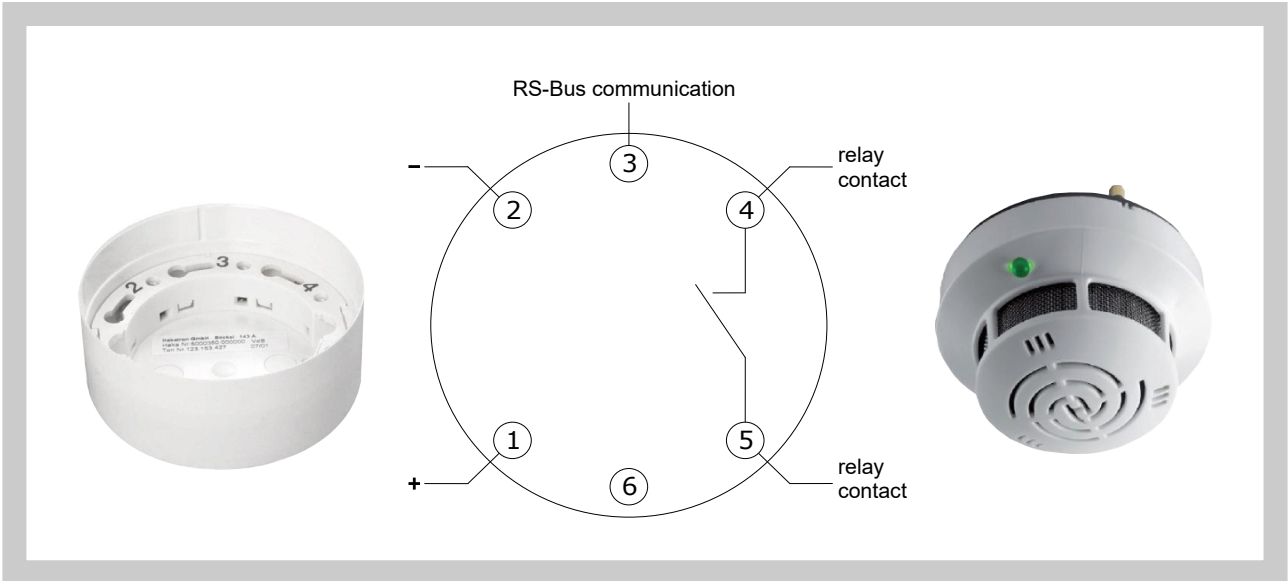


Fig. 13 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K and with communication and supply device BKN 230-24-MOD (voltage AC 230 V)

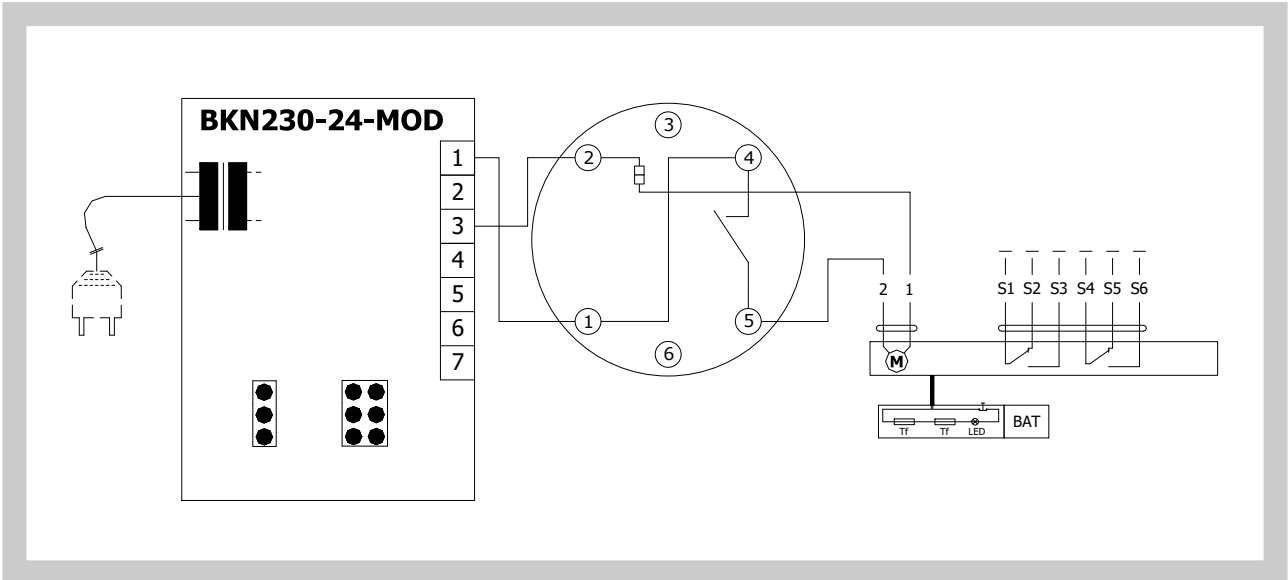
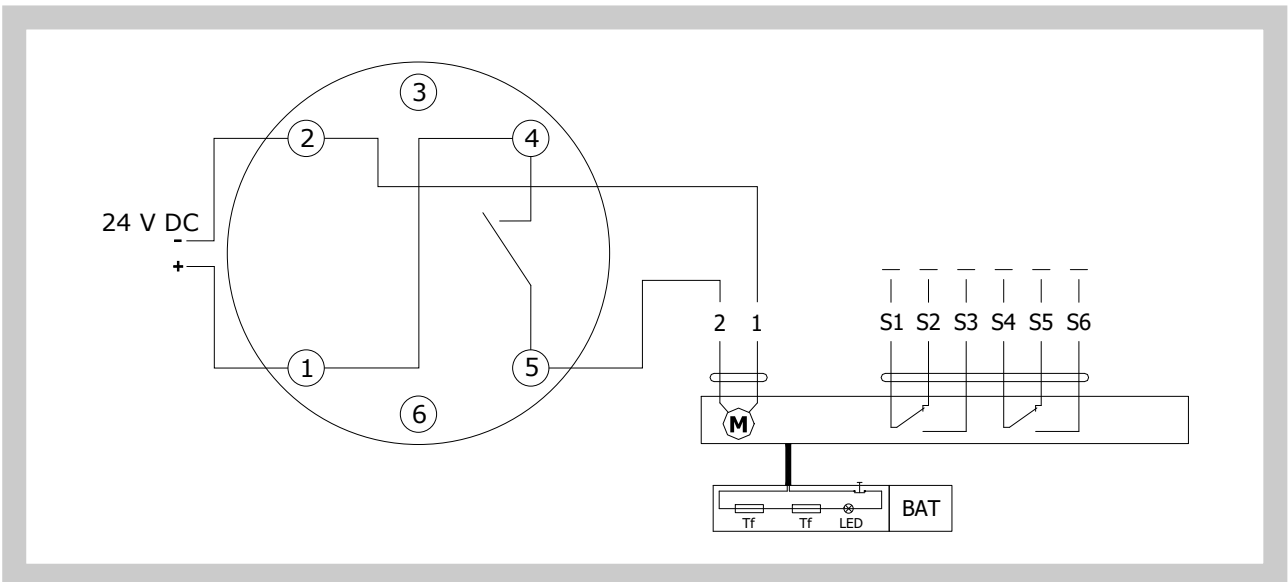


Fig. 14 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T), with smoke detector ORS 142 K (voltage 24 V DC)



**2.3. Design with the communication and supply device**

**Design .60**

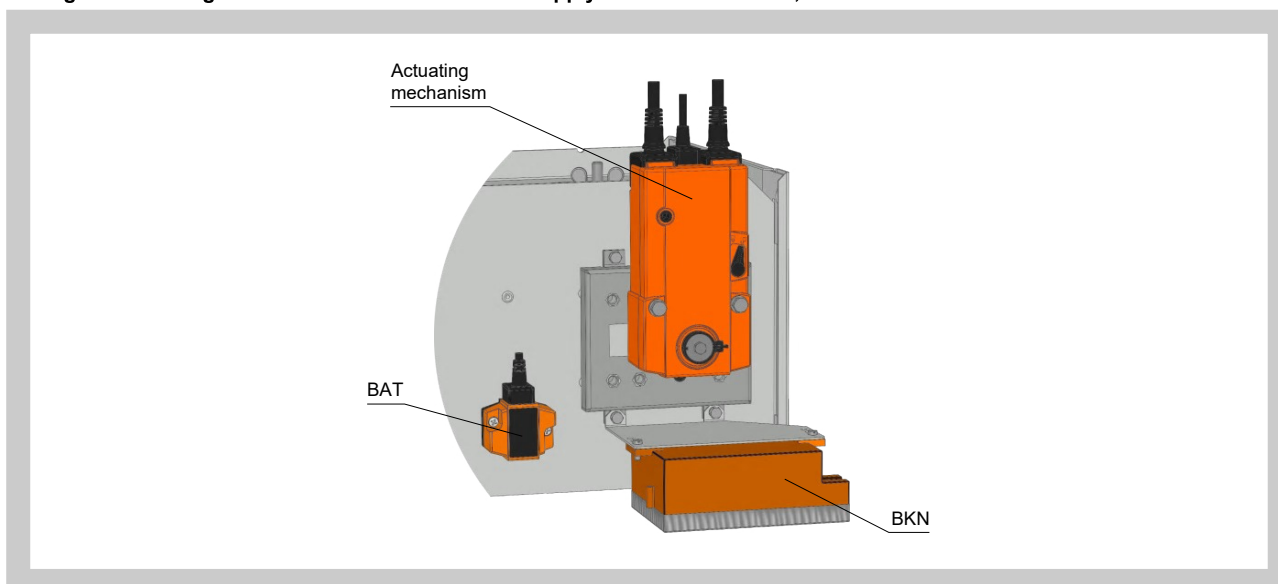
Design with the communication and supply device BKN 230-24 and the actuating mechanism BF 24-TN-ST (BFL 24-T, BFN 24-T). It simplifies electrical wiring and interconnection of fire flap valves. It facilitates on site check and enables central control and checks of fire damper by means of a simple 2-conductor wiring.

BKN 230-24 functions as a decentralized network device for supplying the actuating mechanism BF 24-TN-ST (BFL 24-T, BFN 24-T) with a spring back drive on one hand and on the other hand it transmits the signal informing about the flap valve position OPERATION and FAILURE through 2-conductor wiring to the central. Control command SWITCHED ON - SWITCHED OFF from the central through BKN 230-24 goes through the same wiring to the actuating mechanism.

To simplify the connection, the actuating mechanism BF 24-TN-ST (BFL 24-T, BFN 24-T) is equipped with connecting plugs that are inserted directly to BKN 230-24. BKN 230-24 is supplied with a conductor and an EURO plug to be connected to the 230V mains. 2- conductor wiring is connected to BKN 230-24 by means of terminals 6 and 7. If the drive is supposed to be controlled without any signal from the central, it can be switched on by means of a bridge between the terminals 3 and 4. A green LED pilot light on BKN 230-24 is on when voltage is present in the drive (AC 24V).

If the button on BAT is switched on or if the power supply (e.g. by a signal from ELECTRICAL FIRE SIGNALISATION ) is disconnected, the damper position will be "FAILURE".

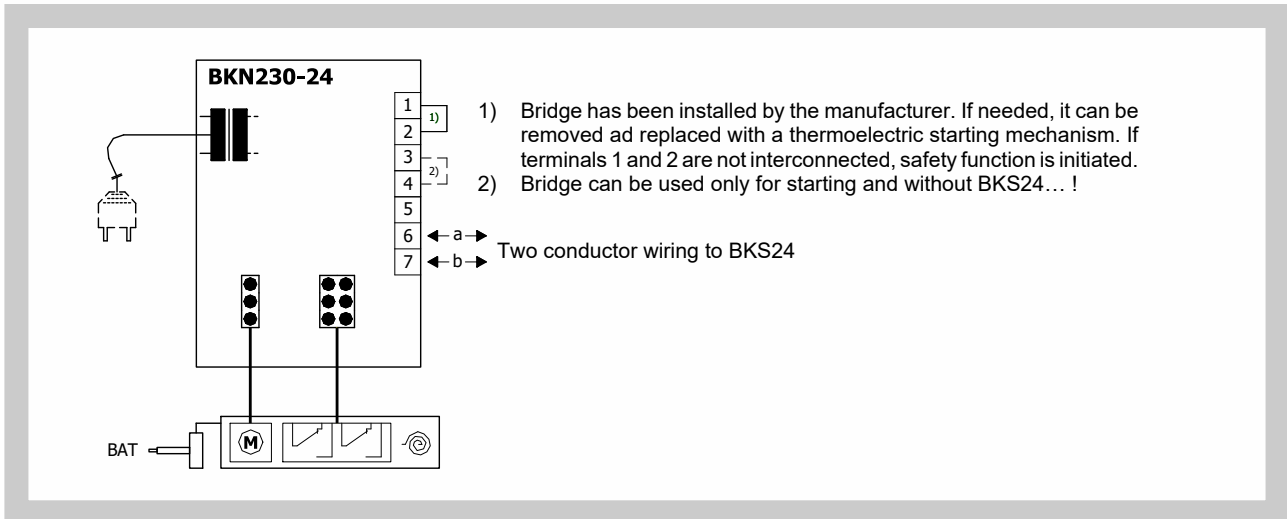
**Fig. 15 Design with the communication and supply device BKN 230-24, BKN230-24-C-MP or BKN 230-24-MOD**



**Tab. 2.3.1. Communication and supply device BKN 230-24**

Communication and supply device	BKN 230-24
Nominal voltage	AC 230 V 50/60Hz
Power consumption	3,5 W (operating position)
Dimensioning	11 VA (including actuating mechanism with spring return)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-20°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net - motor - terminal board	cable 0,9 m with EURO plug type 26 6-pole connector, 3-pole connector screw terminals for cable 2x1,5 mm²

Fig. 16 Communication and supply device BKN 230-24, with act. mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST)



**Design .61**

Design .61 with communication and supply device can be complemented with smoke detector ORS 142 K. For supply and communication is used BKN 230-24-C-MP, which together with the BF 24TN-ST (BFL 24T-ST, BFN 24T-ST ) enables central control and checks of fire damper by means of a simple 2-conductor wiring and it also allows connection to the system via MP-BUS communication. More information in the Belimo catalog.

Tab. 2.3.2. Communication and supply device BKN 230-24-C-MP

Communication and supply device	BKN 230-24-C-MP
Nominal voltage	AC 230 V 50/60Hz
Power consumption	3,5 W (operating position)
Dimensioning	10 VA (including actuating mechanism with spring return)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-20°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net - motor - terminal board	cable 0,9 m with EURO plug type 26 6-pole connector, 3-pole connector screw terminals for cable 2x1,5 mm <sup>2</sup>

Fig. 17 Communication and supply device BKN 230-24-C-MP

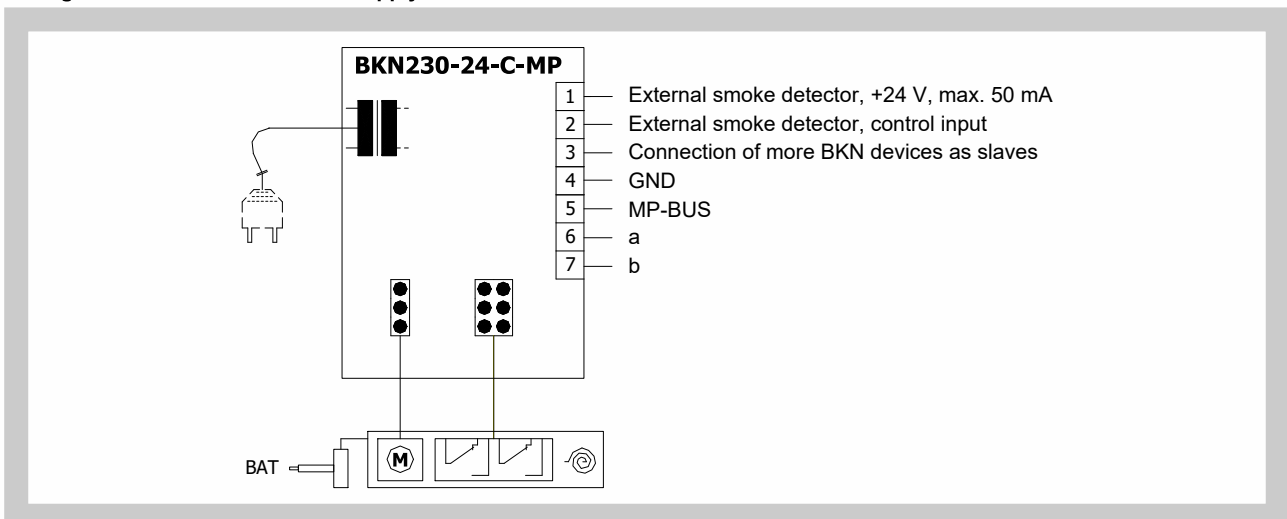
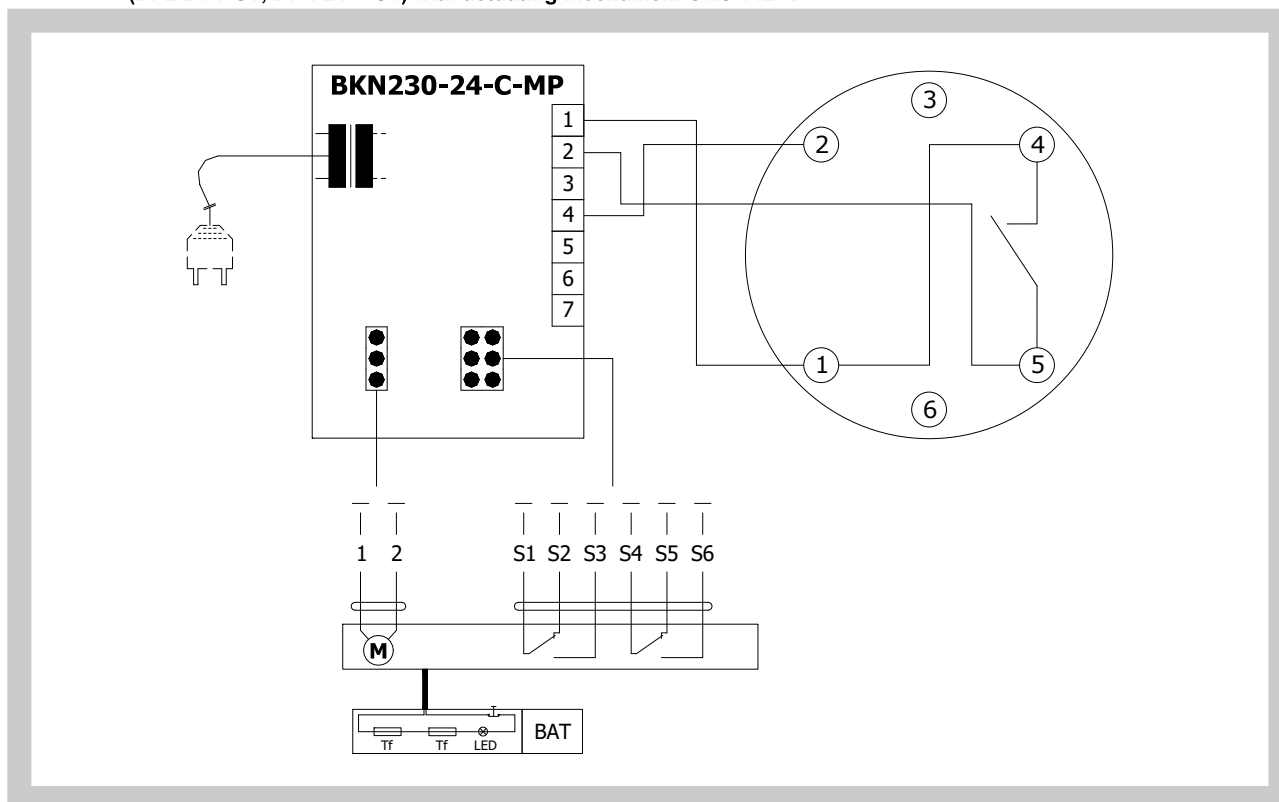


Fig. 18 Design with communication and supply device BKN 230-24-C-MP, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) with actuating mechanism ORS 142 K



**Design .63**

Design .60 with communication and supply device can be complemented with smoke detector ORS 142 K. For supply and communication is used BKN 230-24-MOD, which is used together with the BF 24TN-ST (BFL 24T-ST, BFN 24T-ST) for communication with control systems using the Modbus RTU or BACnet MS / TP protocol. 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. The 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. For more information, see the Belimo catalog.

Tab. 2.3.3. Communication and supply device BKN 230-24-MOD

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 actuating mechanism with spring return)
Protection Class	II
Degree of protection	IP 40
Ambient temperature Non-operating temperature	-20°C ... +50°C -40°C ... +80°C
Connection - net - motor - terminal board	cable 0,9 m with EURO plug type 26 6-pole connector, 3-pole connector screw terminals for cable 2x1,5 mm²

Fig. 19 Communication and supply device BKN 230-24-MOD, with act. mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST)

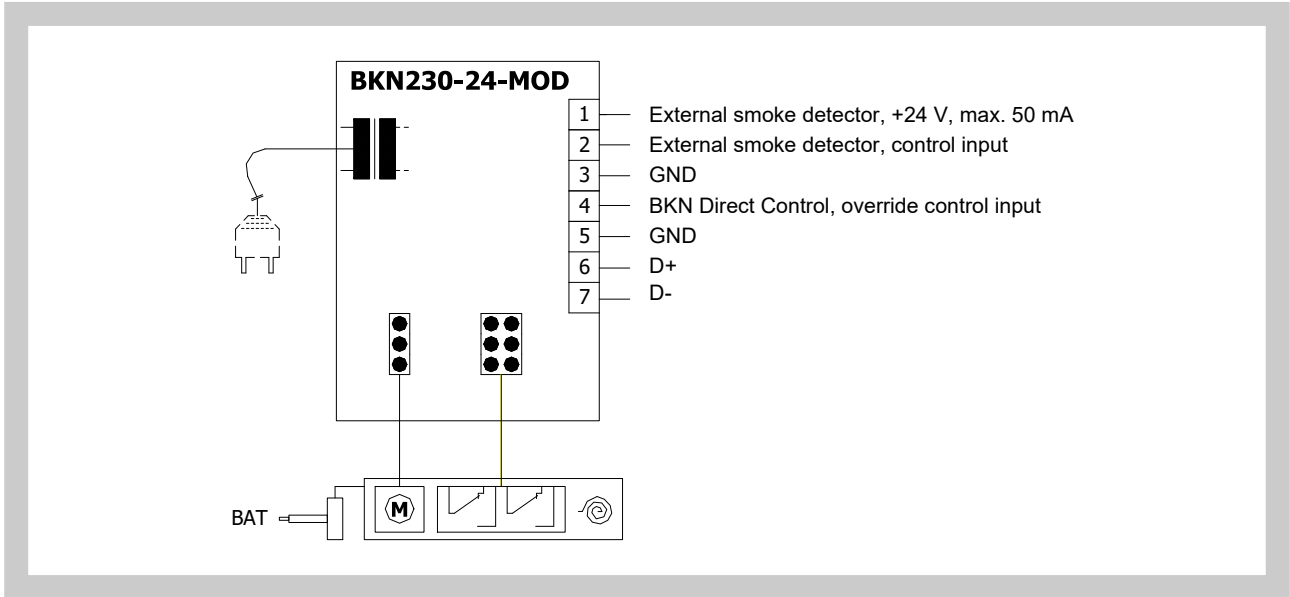
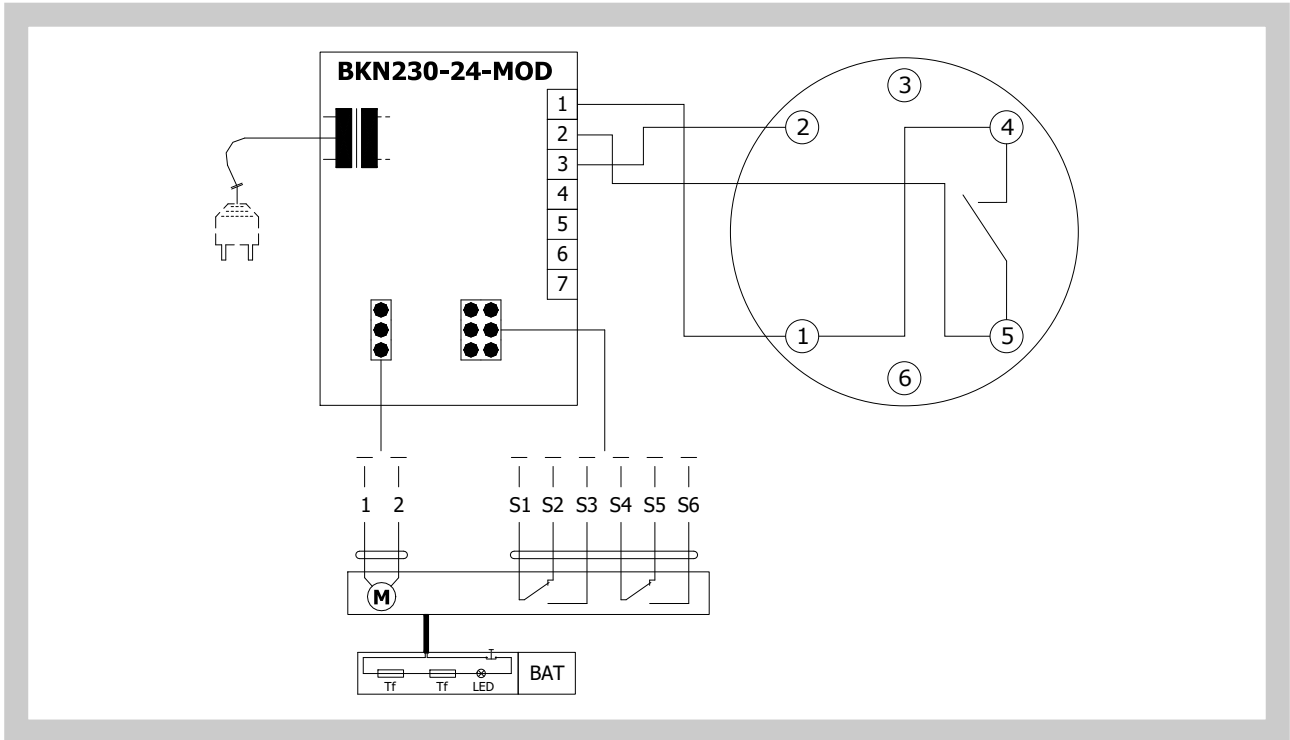


Fig. 20 Design with communication and supply device BKN 230-24-MOD, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) and smoke detector ORS 142 K



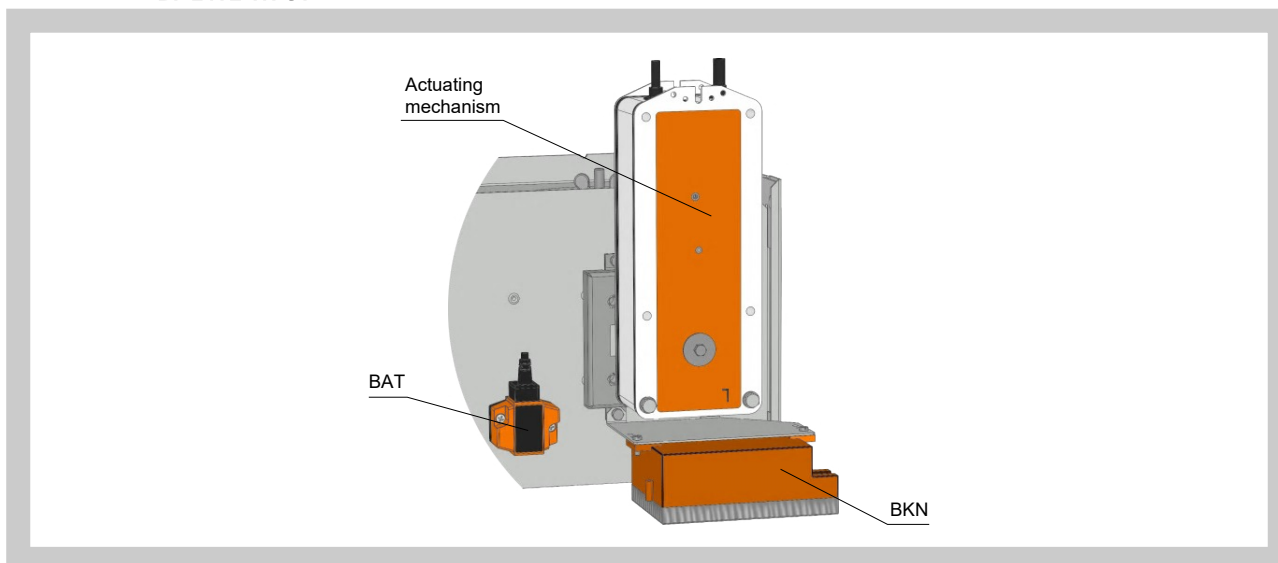
**Design .62**

Design with the communication and supply device BKN 230-24MP and actuating mechanism BF 24TL-TN-ST for connection to MP-Bus. BKN 230-24MP supplies to intelligent actuating mechanisms of fire dampers BF 24TL-TN-ST decentrally needed power supply. In this way can be realize long MP-Bus communications (up to 800 m). Up to 8 Bus nodes can be parallel connected and controlled by Master device (DDC with interface). More information in Belimo catalogue.

**Design .64**

Design with the communication and supply device BKN 230-24LON and actuating mechanisms of fire dampers BF 24TL-TN-ST for cooperation with control units based on technology LonWorks. BKN 230-24LON complements actuating mechanism for integrated safety function and converts digital protocol MP from actuating mechanism to LonTalk and back. More information in Belimo catalogue.

Fig. 21 Design with communication and supply device BKN 230-24MP or BKN 230-24LON and actuating mechanism BF 24TL-TN-ST



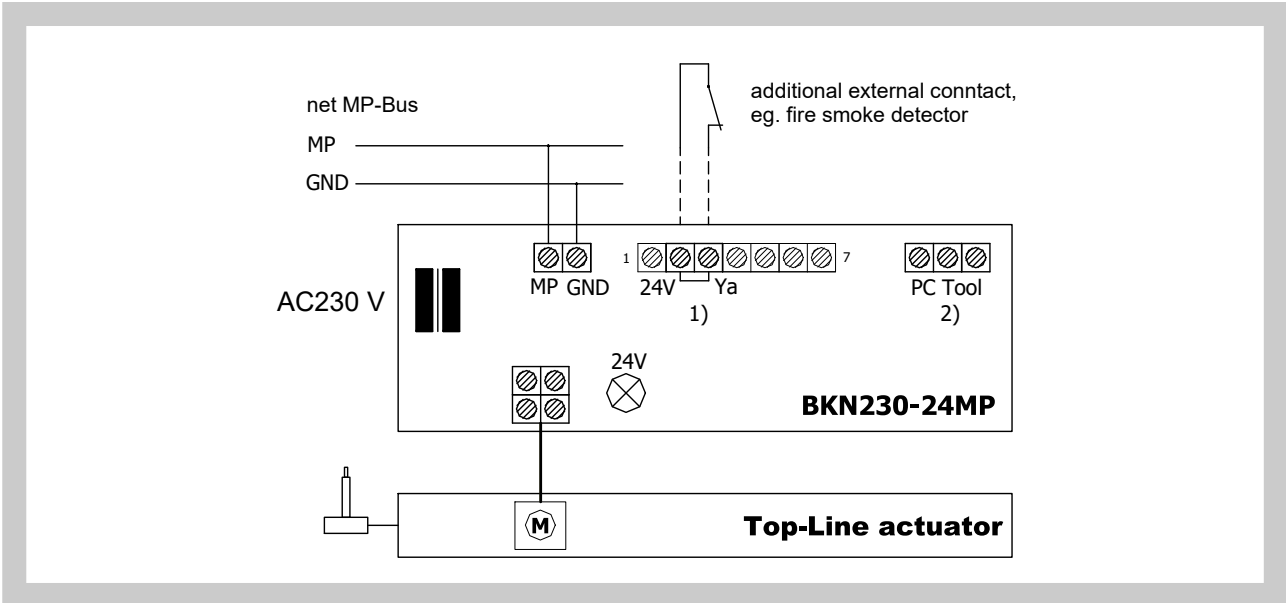
Tab. 2.3.4. Actuating mechanism BELIMO BF 24TL-TN-ST

Actuating mechanism BELIMO	BF 24TL-TN-ST
Nominal voltage	AC 24 V 50/60Hz DC 24 V
Power consumption - motoring - holding	7 W 2 W
Dimensioning	10 VA (I <sub>max</sub> 8,3 A @ 5 ms)
Protection class	III
Degree of protection	IP 54
Running time - motor - spring return	120 sec ~ 16 sec
Ambient temperature Non-operating temperature	-30°C ... +50°C -40°C ... +50°C
Connection	Connector for BKN 230-24LON and BKN 230-24MP cable 1 m, 4 x 0,75 mm <sup>2</sup> halogen-free

Tab. 2.3.5. Communication and supply device BKN 230-24MP

Communication and supply device	BKN 230-24MP
Nominal voltage	AC 230 V 50/60Hz
Power consumption	11 W (including actuator mechanism)
Dimensioning	13 VA (including actuator mechanism)
Protection Class	II
Degree of protection	IP 40
Ambient temperature Non-operating temperature	-30°C ... +50°C -40°C ... +80°C
Connection - net - motor (BF...-Top) - net MP - starting mechanism (variable) - Top-Line PC-Tool (via ZIP-RS232)	cable 1m, with EURO plug 4-pole connector screw terminal 2-pole screw terminal 2-pole 3-pole connector

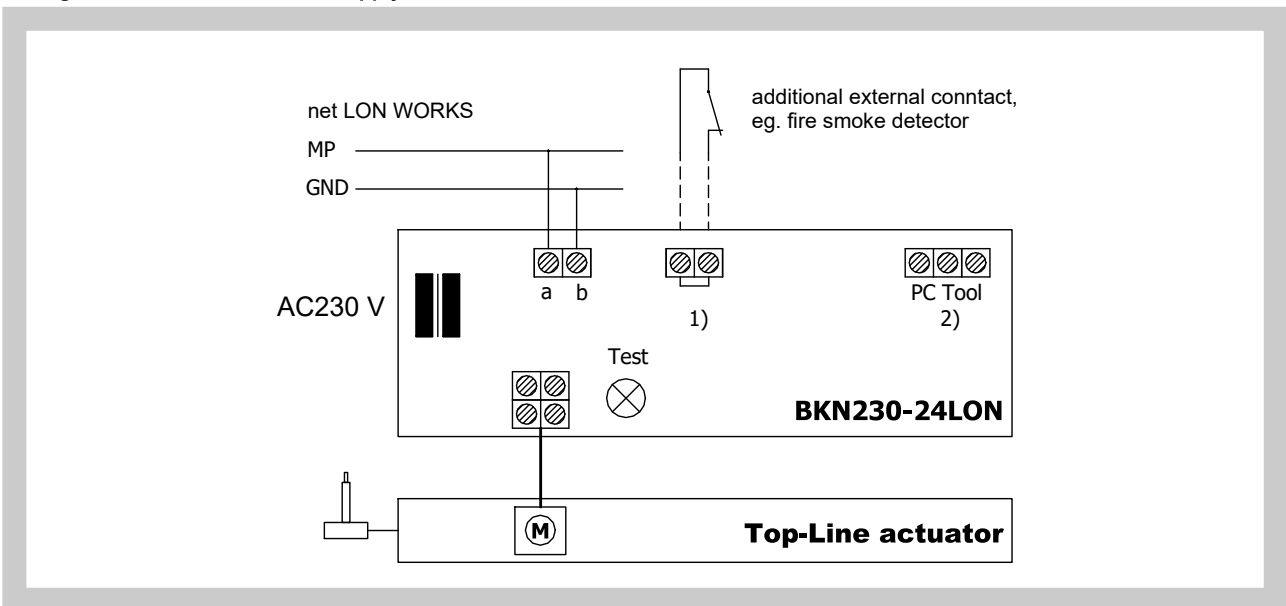
Fig. 22 Communication and supply device BKN 230-24MP



Tab. 2.3.6. Communication and supply device BKN 230-24LON

Communication and supply device	BKN 230-24LON
Nominal voltage	AC 230 V 50/60Hz
Power consumption	14 W (including actuating mechanism)
Dimensioning	16 VA (including actuating mechanism)
Protection Class	II
Degree of protection	IP 40
Ambient temperature	-30°C ... +50°C
Non-operating temperature	-40°C ... +80°C
Connection - net - actuator (BF...-Top) - net LonWorks - starting mechanism (optional) - Top-Line PC-Tool (via ZIP-RS232)	cable 1m, with Euro plug 4-pole connector screw terminal 2-pole screw terminal 2-pole 3-pole connector

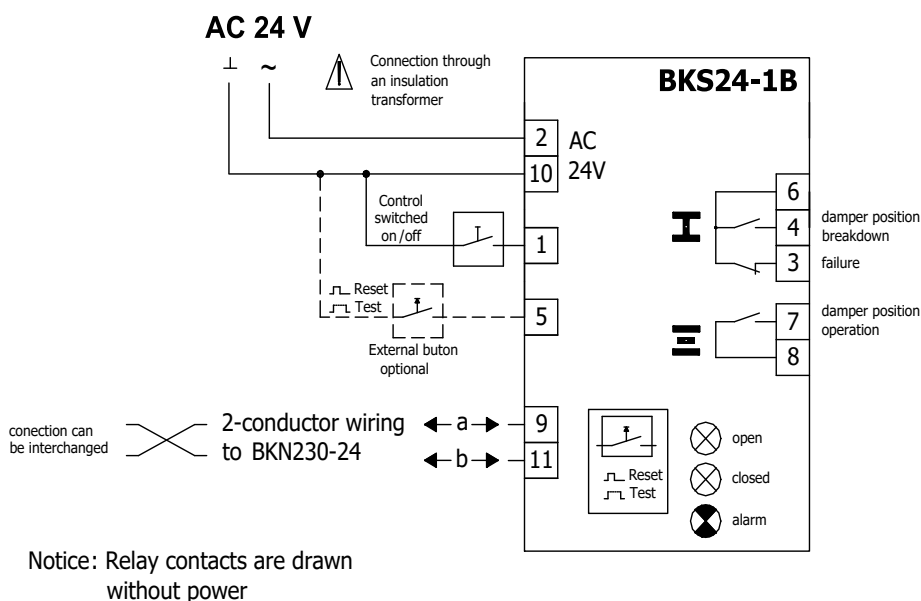
Fig. 23 Communication and supply device BKN 230-24LON



3. Communication and control devices

3.1. BKS 24-1B communication and control device is used for control and checks of fire dampers with the BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) actuating mechanism in conjunction with the BKN 230-24 supply and communication device. BKS 24-1B receives information about the situation of the fire damper through the BKN 230-24 supply and communication device and issues controlling commands. The device is intended for building in into the distribution board. Light diodes on the front side of the device signalise the operating situations of the damper and breakdowns of the whole system. Potentialless auxiliary contacts enable connection to the master control system (signaling of the damper position, failure reports, release of the ventilators etc.). While a flashing green LED pilot light signalises damper blade motion towards the given position, the same pilot light reports reaching the required position when shining constantly. If the flap blade, with respect to the given time, does not reach the required position, then a red LED pilot light starts to flash and at the same time, the failure contact is active. Once the damper blade reaches the given position, this contact is deactivated. The LED pilot light keeps flashing unless the failure is unblocked by means of the RESET button. Except for reporting failures, other three auxiliary contacts are available. Contacts showing operating and failure position of the damper are active when the damper is in the given position. Function check can be done by pressing and holding the button "RESET/TEST" for longer time. While holding the button, the damper blade moves in the direction of the failure position. Fault function is indicated by the LED pilot light. BKS 24-1B can be connected by means of ZSO-11 11 pole connector for DIN 35 mm panel.

Fig. 24 Communication and control device BKS 24-1B



light diodes			contacts	Description
open	closed	alarm	state	Cause/Course
⊗ closed	⊗ closed	⊙ closed	[6] — [3]	<b>Power supply AC 24V</b> not available
⊗ open	⊗ open	⊗ open	[6] — [3]	<b>Check test cca 35sec</b> , starting with switching AC 24 on or pressing «Reset/Test» button
⊗ closed	⊗ closed	⊗ flashing	[6] — [3]	<b>Current failure</b> , possible cause: • short circuit or interruption of 2-conductor wiring or damper failure (at BKN..) • Power supply AC 230V missing • defective thermoelectrical starting • smoke detector activated • exceeded operation time • damper blocked
⊗ closed	⊗ closed	⊗ open	[6] — [3]	<b>Failure saved in memory</b> • Fault in system signalled, system check should be done
⊗ closed	⊗ flashing	⊙ closed	[6] — [4]	Damper (drive) turning into <b>the direction</b> of breakdown position
⊗ closed	⊗ open	⊙ closed	[6] — [4]	Damper (drive) in <b>breakdown position</b> I
⊗ flashing	⊗ closed	⊙ closed	[6] — [7]	Damper (drive) turning into <b>the direction</b> of operating position
⊗ open	⊗ closed	⊙ closed	[6] — [7]	Damper (drive) in <b>operating position</b> II

Tab. 3.1.1. Communication and control device BKS 24-1B


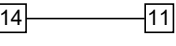


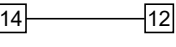
Communication and control device	BKS 24-1B
Nominal voltage	AC 24 V 50/60Hz
Power consumption	2,5 W (operating position)
Dimensioning	5 VA
Protection Class	III
Degree of protection	IP 30
Ambient temperature	0 ... +50°C
Connection	11-pole connector ZSO-11, it is not part of BKS24-1B, ZSO-11 is 11-pole screw terminal 11 x 1,5 mm <sup>2</sup>

**3.2.** BKS 24-9A communication and control device is used for group control and checks of 1 to 9 fire dampers with the actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) in connection with the supply and communication device BKN 230-24. Signalisation of the damper position is individual; the damper can be controlled and tested only as a group. BKS 24-9A is intended for use in the distribution board and displays the operation situations and failure reports of the connected fire dampers. It is possible to signalise functions such as the damper position and failure reports or to transmit them further to the system by means of integrated auxiliary switches. BKS 24-9A receives signals from BKN 230-24 through the two-conductor wiring and issues control commands. Proper damper operation is indicated by two light LED diodes:

Control ON = position OPERATION  
 Control OFF = position FAILURE

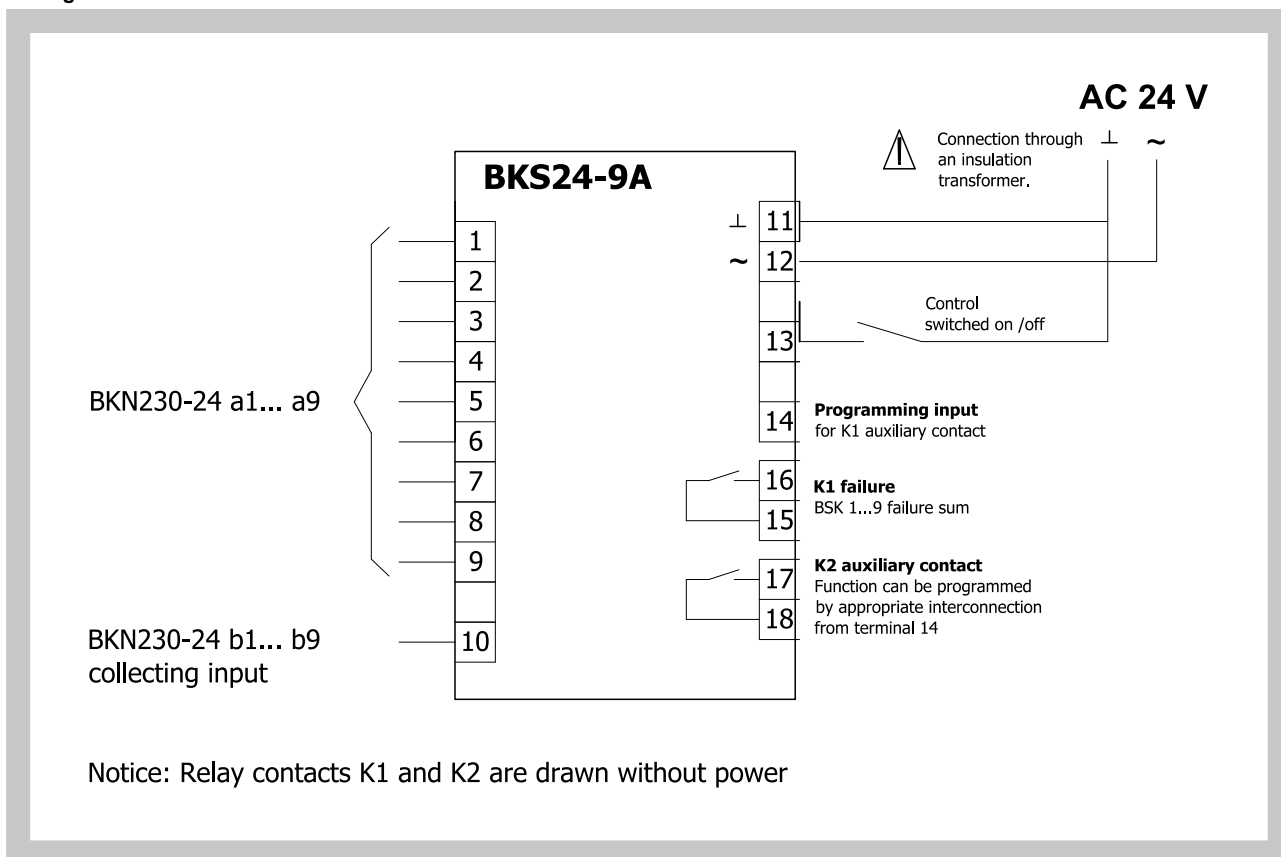
If the fire damper do not reach the given position in time tolerable for displacing, the appropriate light diode FAILURE starts to flash and K1 contact is opened (current failure). In case that the faulty damper finally reaches its given position, K1 is closed and the failure report light shines (the failure is saved in memory). K2 - the auxiliary contact - is used for signaling of the flap position to the master device. Function of this auxiliary contact can be programmed through the terminal 14 according to the Tab. 3.2.1.

Tab. 3.2.1. BKS 24 -9A contacts K1 and K2

Function contact K1		Programming K2 Auxiliary Contact		
situation	state	function	interconnection	state
current failure	15  16	K2 contact is on if all the flaps are open	14  11	17  18
no failure	15  16	K2 contact is on if the flap No. 1 is open	14  12	
		K2 contact is on if all the flaps are closed	14 open	

Function check can be done in the position OPERATION by means of pushing the TEST button. While the button is pushed, the flap blade is turning into the position FAILURE. Fault function is indicated by a report "FAILURE". Assembly and connection BKS 24 - 9A can be made by DIN 35 mm panel. It is connected by two 9-pole plug-in connectors.

Fig. 25 Communication and control device BKS 24-9A



Tab. 3.2.2. Communication and control device BKS 24-9A

Communication and control device	BKS 24-9A
Nominal voltage	AC 24 V 50/60Hz
Power consumption	3,5 W
Dimensioning	5,5 VA
Protection Class	III
Degree of protection	IP 30
Ambient temperature	0 ... +50°C
Connection	terminal 2 x 1,5 mm <sup>2</sup>

4. Dimensions, weights and effective area

4.1. Dimensions

Fig. 26 Design with mechanical control

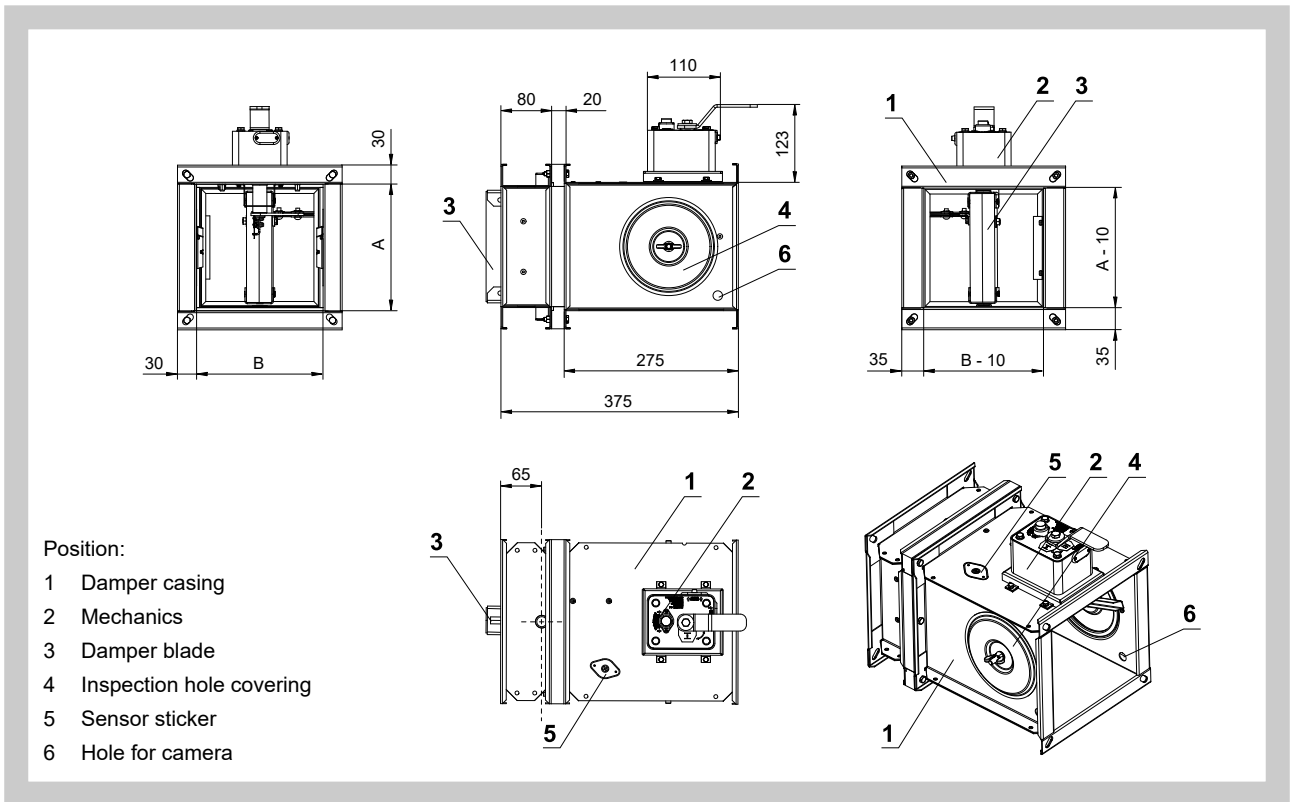
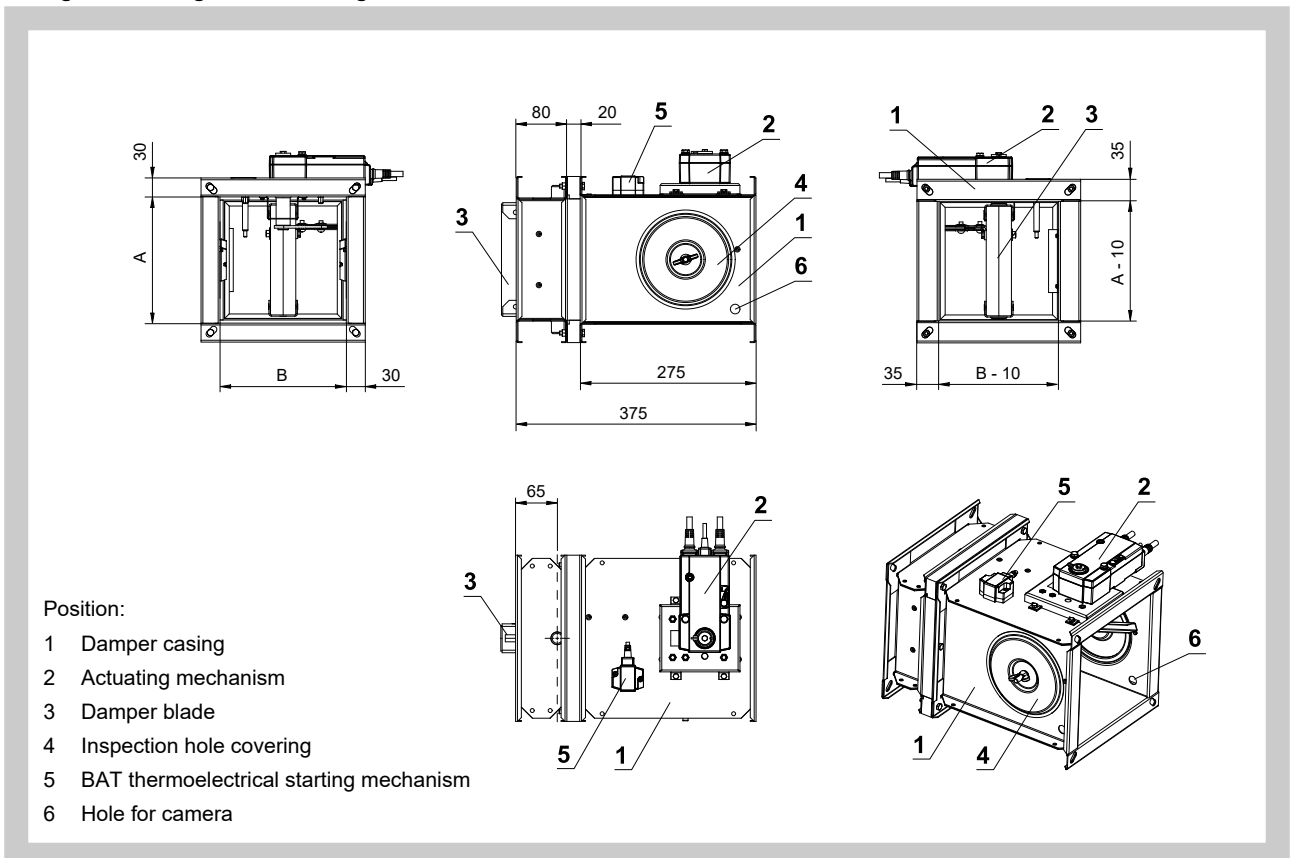


Fig. 27 Design with actuating mechanism



4.2. Dimensions, weights and effective area

Tab. 4.2.1. Dimensions, weights and effective area

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
150 x 150	-	-	8,0	8,1	0,0106	BFL	M1	200 x 650	3	248	19,5	22,5	0,1024	BFL	M2
x 180	-	13	8,5	8,6	0,0144	BFL	M1	x 700	28	273	20,5	25,0	0,1111	BFN	M2
x 200	-	23	8,9	9,0	0,0169	BFL	M1	x 710	33	278	21,0	24,0	0,1129	BFN	M2
x 225	-	35,5	9,4	9,5	0,0200	BFL	M1	x 750	53	298	21,5	24,5	0,1199	BFN	M2
x 250	-	48	9,9	10,0	0,0231	BFL	M1	x 800	78	323	23,0	26,0	0,1286	BFN	M2
x 280	-	63	10,5	10,6	0,0269	BFL	M1	225 x 150	-	-	9,5	9,7	0,0170	BFL	M1
x 300	-	73,0	11,1	11,2	0,0294	BFL	M1	x 180	-	13	10,0	11,5	0,0230	BFL	M1
x 315	-	80,5	11,4	11,5	0,0313	BFL	M1	x 200	-	23	10,5	12,0	0,0270	BFL	M1
x 355	-	100,5	12,4	12,6	0,0363	BFL	M1	x 225	-	36	11,0	12,5	0,0320	BFL	M1
x 400	-	123	13,5	13,6	0,0419	BFL	M1	x 250	-	48	11,5	13,0	0,0370	BFL	M1
x 450	-	148	14,5	14,6	0,0481	BFL	M1	x 280	-	63	12,0	13,5	0,0430	BFL	M1
x 500	-	173	15,5	15,6	0,0544	BFL	M1	x 300	-	73	12,5	14,0	0,0470	BFL	M1
x 550	-	198	16,4	16,6	0,0606	BFL	M1	x 315	-	80,5	13,0	14,5	0,0500	BFL	M1
x 560	-	203	16,6	16,8	0,0619	BFL	M2	x 355	-	100,5	14,0	15,5	0,0580	BFL	M1
x 600	-	223	17,4	17,5	0,0669	BFL	M2	x 400	-	123	15,0	16,5	0,0670	BFL	M1
x 630	-	238	18,0	18,1	0,0706	BFL	M2	x 450	-	148	16,0	17,5	0,0770	BFL	M1
180 x 150	-	-	8,8	8,9	0,0132	BFL	M1	x 500	-	173	17,0	18,5	0,0870	BFL	M2
x 180	-	13	9,0	10,5	0,0178	BFL	M1	x 550	-	198	18,0	19,5	0,0970	BFL	M2
x 200	-	23	9,5	11,0	0,0209	BFL	M1	x 560	-	203	18,0	19,5	0,0990	BFL	M2
x 225	-	36	10,0	11,5	0,0248	BFL	M1	x 600	-	223	19,0	20,5	0,1070	BFL	M2
x 250	-	48	10,5	12,0	0,0287	BFL	M1	x 630	-	238	19,5	21,0	0,1130	BFN	M2
x 280	-	63	11,0	12,5	0,0333	BFL	M1	x 650	3	248	20,0	21,5	0,1170	BFN	M2
x 300	-	73	11,5	13,0	0,0364	BFL	M1	x 700	28	273	21,0	22,5	0,1270	BFN	M2
x 315	-	80,5	12,0	13,5	0,0388	BFL	M1	x 710	33	278	21,0	22,5	0,1290	BFN	M2
x 355	-	100,5	13,0	14,5	0,0450	BFL	M1	x 750	53	298	22,0	23,5	0,1370	BFN	M2
x 400	-	123	14,0	15,5	0,0519	BFL	M1	x 800	78	323	23,0	24,5	0,1470	BFN	M2
x 450	-	148	15,0	16,5	0,0597	BFL	M1	250 x 150	-	-	10,0	10,1	0,0191	BFL	M1
x 500	-	173	16,0	17,5	0,0674	BFL	M2	x 180	-	13	10,5	12,0	0,0259	BFL	M1
x 550	-	198	17,0	18,5	0,0752	BFL	M2	x 200	-	23	10,5	12,5	0,0304	BFL	M1
x 560	-	203	17,0	18,5	0,0767	BFL	M2	x 225	-	36	11,0	13,0	0,0360	BFL	M1
x 600	-	223	18,0	19,5	0,0829	BFL	M2	x 250	-	48	12,0	13,5	0,0416	BFL	M1
x 630	-	238	18,5	20,0	0,0876	BFL	M2	x 280	-	63	13,0	14,5	0,0484	BFL	M1
x 650	3	248	19,0	20,5	0,0907	BFL	M2	x 300	-	73	13,0	15,0	0,0529	BFL	M1
x 700	28	273	20,0	21,5	0,0984	BFN	M2	x 315	-	80,5	13,5	15,0	0,0563	BFL	M1
x 710	33	278	20,0	21,5	0,1000	BFN	M2	x 355	-	100,5	14,5	16,0	0,0653	BFL	M1
x 750	53	298	21,0	22,5	0,1062	BFN	M2	x 400	-	123	15,5	17,0	0,0754	BFL	M1
x 800	78	323	22,0	23,5	0,1139	BFN	M2	x 450	-	148	16,5	19,5	0,0866	BFL	M1
200 x 150	-	-	9,1	9,2	0,0149	BFL	M1	x 500	-	173	18,0	21,0	0,0979	BFL	M2
x 180	-	13	9,5	11,0	0,0201	BFL	M1	x 550	-	198	19,0	22,0	0,1091	BFL	M2
x 200	-	23	10,0	11,5	0,0236	BFL	M1	x 560	-	203	19,0	22,0	0,1114	BFL	M2
x 225	-	36	10,5	13,5	0,0280	BFL	M1	x 600	-	223	20,0	23,0	0,1204	BFN	M2
x 250	-	48	11,0	12,5	0,0324	BFL	M1	x 630	-	238	21,0	24,0	0,1271	BFN	M2
x 280	-	63	11,5	14,5	0,0376	BFL	M1	x 650	3	248	21,5	24,5	0,1316	BFN	M2
x 300	-	73	12,0	13,5	0,0411	BFL	M1	x 700	28	273	22,5	25,5	0,1429	BFN	M2
x 315	-	80,5	12,5	14,0	0,0438	BFL	M1	x 710	33	278	23,0	26,0	0,1451	BFN	M2
x 355	-	100,5	13,0	15,0	0,0508	BFL	M1	x 750	53	298	23,5	26,5	0,1541	BFN	M3
x 400	-	123	14,0	16,0	0,0586	BFL	M1	x 800	78	323	25,0	28,0	0,1654	BFN	M3
x 450	-	148	15,0	18,0	0,0674	BFL	M1	280 x 150	-	-	10,5	10,6	0,0217	BFL	M1
x 500	-	173	16,5	18,0	0,0761	BFL	M2	x 180	-	13	11,0	12,5	0,0293	BFL	M1
x 550	-	198	17,5	20,5	0,0849	BFL	M2	x 200	-	23	11,5	13,5	0,0344	BFL	M1
x 560	-	203	17,5	20,5	0,0866	BFL	M2	x 225	-	36	12,0	14,0	0,0408	BFL	M1
x 600	-	223	18,5	23,0	0,0936	BFL	M2	x 250	-	48	13,0	14,5	0,0472	BFL	M1
x 630	-	238	19,0	22,0	0,0989	BFL	M2	x 280	-	63	14,0	15,5	0,0548	BFL	M1

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
280 x 300	-	73	14,0	16,0	0,0599	BFL	M1	315 x 710	33	278	25,0	28,0	0,1871	BFN	M2
x 315	-	80,5	14,5	16,5	0,0638	BFL	M1	x 750	53	298	26,0	29,0	0,1987	BFN	M3
x 355	-	100,5	15,5	17,5	0,0740	BFL	M1	x 800	78	323	27,5	30,5	0,2132	BFN	M3
x 400	-	123	17,0	18,5	0,0854	BFL	M1	355 x 150	-	-	11,8	11,9	0,0281	BFL	M1
x 450	-	148	18,0	21,0	0,0982	BFL	M1	x 180	-	13	13,0	14,5	0,0380	BFL	M1
x 500	-	173	19,5	22,5	0,1109	BFL	M2	x 200	-	23	13,0	14,5	0,0446	BFL	M1
x 550	-	198	20,5	23,5	0,1237	BFL	M2	x 225	-	36	13,5	15,0	0,0528	BFL	M1
x 560	-	203	21,0	24,0	0,1262	BFN	M2	x 250	-	48	14,0	16,0	0,0611	BFL	M1
x 600	-	223	22,0	25,0	0,1364	BFN	M2	x 280	-	63	15,0	17,0	0,0710	BFL	M1
x 630	-	238	22,5	25,5	0,1441	BFN	M2	x 300	-	73	15,5	17,0	0,0776	BFL	M1
x 650	3	248	23,0	26,0	0,1492	BFN	M2	x 315	-	80,5	16,0	17,5	0,0825	BFL	M1
x 700	28	273	24,5	27,5	0,1619	BFN	M2	x 355	-	100,5	17,0	18,5	0,0957	BFL	M1
x 710	33	278	24,5	27,5	0,1645	BFN	M2	x 400	-	123	18,0	20,0	0,1106	BFL	M1
x 750	53	298	25,5	28,5	0,1747	BFN	M3	x 450	-	148	19,5	22,5	0,1271	BFL	M1
x 800	78	323	27,0	30,0	0,1874	BFN	M3	x 500	-	173	21,0	24,0	0,1436	BFN	M2
300 x 150	-	-	10,8	11,0	0,0234	BFL	M1	x 550	-	198	22,5	25,5	0,1601	BFN	M2
x 180	-	13	11,5	13,0	0,0316	BFL	M1	x 560	-	203	22,5	25,5	0,1634	BFN	M2
x 200	-	23	11,5	13,5	0,0371	BFL	M1	x 600	-	223	23,5	26,5	0,1766	BFN	M2
x 225	-	36	12,0	14,0	0,0440	BFL	M1	x 630	-	238	24,5	27,5	0,1865	BFN	M2
x 250	-	48	13,0	14,5	0,0509	BFL	M1	x 650	3	248	25,0	28,0	0,1931	BFN	M2
x 280	-	63	14,0	15,5	0,0591	BFL	M1	x 700	28	273	26,5	29,5	0,2096	BFN	M2
x 300	-	73	14,0	16,0	0,0646	BFL	M1	x 710	33	278	26,5	29,0	0,2129	BFN	M2
x 315	-	80,5	14,5	16,5	0,0688	BFL	M1	x 750	53	298	27,5	30,5	0,2261	BFN	M3
x 355	-	100,5	15,5	17,5	0,0798	BFL	M1	x 800	78	323	29,0	32,0	0,2426	BF	M3
x 400	-	123	17,0	18,5	0,0921	BFL	M1	400 x 150	-	-	12,6	12,7	0,0319	BFL	M1
x 450	-	148	18,0	21,0	0,1059	BFL	M1	x 180	-	13	13,5	15,5	0,0431	BFL	M1
x 500	-	173	19,5	22,5	0,1196	BFL	M2	x 200	-	23	14,0	15,5	0,0506	BFL	M1
x 550	-	198	20,5	23,5	0,1334	BFN	M2	x 225	-	36	14,5	16,5	0,0600	BFL	M1
x 560	-	203	21,0	24,0	0,1361	BFN	M2	x 250	-	48	15,0	17,0	0,0694	BFL	M1
x 600	-	223	22,0	25,0	0,1471	BFN	M2	x 280	-	63	16,0	18,0	0,0806	BFL	M1
x 630	-	238	22,5	25,5	0,1554	BFN	M2	x 300	-	73	16,5	18,0	0,0881	BFL	M1
x 650	3	248	23,0	26,0	0,1609	BFN	M2	x 315	-	80,5	17,0	18,5	0,0938	BFL	M1
x 700	28	273	24,5	27,5	0,1746	BFN	M2	x 355	-	100,5	18,0	20,0	0,1088	BFL	M1
x 710	33	278	24,5	27,5	0,1774	BFN	M2	x 400	-	123	19,5	21,0	0,1256	BFL	M1
x 750	53	298	25,5	28,5	0,1884	BFN	M3	x 450	-	148	21,0	24,0	0,1444	BFL	M1
x 800	78	323	27,0	30,0	0,2021	BFN	M3	x 500	-	173	22,5	25,5	0,1631	BFN	M2
315 x 150	-	-	11,8	11,9	0,0281	BFL	M1	x 550	-	198	23,5	26,5	0,1819	BFN	M2
x 180	-	13	12,0	13,5	0,0334	BFL	M1	x 560	-	203	24,0	27,0	0,1856	BFN	M2
x 200	-	23	12,0	13,5	0,0392	BFL	M1	x 600	-	223	25,5	28,5	0,2006	BFN	M2
x 225	-	36	12,5	14,0	0,0464	BFL	M1	x 630	-	238	26,0	29,0	0,2119	BFN	M2
x 250	-	48	13,5	15,0	0,0537	BFL	M1	x 650	3	248	26,5	29,5	0,2194	BFN	M2
x 280	-	63	14,5	16,0	0,0624	BFL	M1	x 700	28	273	28,0	31,5	0,2381	BFN	M2
x 300	-	73	14,5	16,5	0,0682	BFL	M1	x 710	33	278	28,5	31,5	0,2419	BFN	M2
x 315	-	80,5	15,0	16,5	0,0725	BFL	M1	x 750	53	298	29,5	32,5	0,2569	BF	M3
x 355	-	100,5	16,0	17,5	0,0841	BFL	M1	x 800	78	323	31,0	34,0	0,2756	BF	M3
x 400	-	123	17,0	19,0	0,0972	BFL	M1	450 x 150	-	-	13,5	13,6	0,0361	BFL	M1
x 450	-	148	18,5	21,5	0,1117	BFL	M1	x 180	-	13	14,5	16,5	0,0489	BFL	M1
x 500	-	173	19,5	22,5	0,1262	BFL	M2	x 200	-	23	15,0	16,5	0,0574	BFL	M1
x 550	-	198	21,0	24,0	0,1407	BFN	M2	x 225	-	36	15,5	17,5	0,0680	BFL	M1
x 560	-	203	21,5	24,5	0,1436	BFN	M2	x 250	-	48	16,0	18,0	0,0786	BFL	M1
x 600	-	223	22,5	25,5	0,1639	BFN	M2	x 280	-	63	17,0	19,0	0,0914	BFL	M1
x 630	-	238	23,0	26,0	0,1697	BFN	M2	x 300	-	73	17,5	19,5	0,0999	BFL	M1
x 650	3	248	23,5	26,5	0,1712	BFN	M2	x 315	-	80,5	18,0	20,0	0,1063	BFL	M1
x 700	28	273	25,0	28,0	0,1842	BFN	M2	x 355	-	100,5	19,5	21,0	0,1233	BFL	M1

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
450 x 400	-	123	20,5	22,5	0,1424	BFL	M1	560 x 150	-	-	15,4	15,5	0,0455	BFL	M1
x 450	-	148	22,0	25,0	0,1636	BFN	M2	x 180	-	13	16,5	18,5	0,0615	BFL	M1
x 500	-	173	24,0	27,0	0,1849	BFN	M2	x 200	-	23	17,0	18,5	0,0722	BFL	M1
x 550	-	198	25,5	28,5	0,2061	BFN	M2	x 225	-	36	17,5	19,5	0,0856	BFL	M1
x 560	-	203	25,5	28,5	0,2104	BFN	M2	x 250	-	48	18,5	20,0	0,0990	BFL	M1
x 600	-	223	27,0	30,0	0,2274	BFN	M2	x 280	-	63	19,5	21,0	0,1150	BFL	M1
x 630	-	238	27,5	30,5	0,2401	BFN	M2	x 300	-	73	20,0	22,0	0,1257	BFL	M1
x 650	3	248	28,5	31,5	0,2486	BFN	M2	x 315	-	80,5	20,5	22,5	0,1338	BFL	M1
x 700	28	273	30,0	33,0	0,2699	BF	M2	x 355	-	100,5	22,0	23,5	0,1552	BFL	M1
x 710	33	278	30,0	33,0	0,2741	BF	M2	x 400	-	123	23,5	25,5	0,1792	BFN	M2
x 750	53	298	31,5	34,5	0,2911	BF	M3	x 450	-	148	25,5	28,5	0,2060	BFN	M2
x 800	78	323	33,0	36,0	0,3124	BF	M3	x 500	-	173	27,0	30,0	0,2327	BFN	M2
500 x 150	-	-	14,3	14,5	0,0404	BFL	M1	x 550	-	198	29,0	32,0	0,2595	BFN	M2
x 180	-	13	15,5	17,0	0,0546	BFL	M1	x 560	-	203	29,5	32,5	0,2648	BFN	M2
x 200	-	23	16,0	17,5	0,0641	BFL	M1	x 600	-	223	31,0	34,0	0,2862	BFN	M2
x 225	-	36	16,5	18,0	0,0760	BFL	M1	x 630	-	238	31,5	34,5	0,3023	BF	M2
x 250	-	48	17,0	19,0	0,0879	BFL	M1	x 650	3	248	32,0	35,0	0,3130	BF	M2
x 280	-	63	18,0	20,0	0,1021	BFL	M1	x 700	28	273	34,0	37,0	0,3397	BF	M2
x 300	-	73	19,0	20,5	0,1116	BFL	M1	x 710	33	278	34,5	37,5	0,3451	BF	M2
x 315	-	80,5	19,5	21,0	0,1188	BFL	M1	x 750	53	298	35,5	38,5	0,3665	BF	M3
x 355	-	100,5	20,5	22,5	0,1378	BFL	M1	x 800	78	323	37,5	40,5	0,3932	BF	M3
x 400	-	123	22,0	23,5	0,1591	BFL	M2	600 x 150	-	-	16,1	16,2	0,0489	BFL	M1
x 450	-	148	23,5	26,5	0,1829	BFN	M2	x 180	-	13	17,5	19,5	0,0661	BFL	M1
x 500	-	173	25,5	28,5	0,2066	BFN	M2	x 200	-	23	18,0	20,5	0,0776	BFL	M1
x 550	-	198	27,0	30,0	0,2304	BFN	M2	x 225	-	36	18,5	21,5	0,0920	BFL	M1
x 560	-	203	27,0	30,0	0,2351	BFN	M2	x 250	-	48	19,0	22,0	0,1064	BFL	M1
x 600	-	223	28,5	31,5	0,2541	BFN	M2	x 280	-	63	20,0	23,0	0,1236	BFL	M1
x 630	-	238	29,5	32,5	0,2684	BFN	M2	x 300	-	73	21,0	24,0	0,1351	BFL	M1
x 650	3	248	30,0	33,0	0,2779	BF	M2	x 315	-	80,5	21,5	24,5	0,1438	BFL	M1
x 700	28	273	32,0	35,0	0,3016	BF	M2	x 355	-	100,5	23,0	26,0	0,1668	BFL	M2
x 710	33	278	32,0	35,0	0,3064	BF	M2	x 400	-	123	24,5	27,5	0,1926	BFN	M2
x 750	53	298	33,5	36,5	0,3254	BF	M3	x 450	-	148	26,5	29,5	0,2214	BFN	M2
x 800	78	323	35,0	38,0	0,3491	BF	M3	x 500	-	173	28,5	31,5	0,2501	BFN	M2
550 x 150	-	-	15,2	15,3	0,0446	BFL	M1	x 550	-	198	30,0	33,0	0,2789	BFN	M2
x 180	-	13	16,5	18,0	0,0604	BFL	M1	x 560	-	203	30,5	33,5	0,2846	BFN	M2
x 200	-	23	17,0	18,5	0,0709	BFL	M1	x 600	-	223	32,0	35,0	0,3076	BF	M2
x 225	-	36	17,5	19,0	0,0840	BFL	M1	x 630	-	238	33,0	36,0	0,3249	BF	M2
x 250	-	48	18,0	20,0	0,0971	BFL	M1	x 650	3	248	33,5	36,5	0,3364	BF	M2
x 280	-	63	19,0	21,0	0,1129	BFL	M1	x 700	28	273	35,5	38,5	0,3651	BF	M2
x 300	-	73	20,0	21,5	0,1234	BFL	M1	x 710	33	278	36,0	39,0	0,3709	BF	M2
x 315	-	80,5	20,5	22,0	0,1313	BFL	M1	x 750	53	298	37,5	40,5	0,3939	BF	M3
x 355	-	100,5	22,0	23,5	0,1523	BFL	M1	x 800	78	323	39,0	42,0	0,4226	BF	M3
x 400	-	123	23,5	25,0	0,1759	BFN	M2	630 x 150	-	-	16,6	16,7	0,0514	BFL	M1
x 450	-	148	25,0	28,0	0,2021	BFN	M2	x 180	-	13	18,0	20,0	0,0696	BFL	M1
x 500	-	173	27,0	30,0	0,2284	BFN	M2	x 200	-	23	18,5	21,0	0,0817	BFL	M1
x 550	-	198	28,5	31,5	0,2546	BFN	M2	x 225	-	36	19,0	22,0	0,0968	BFL	M1
x 560	-	203	29,0	32,0	0,2599	BFN	M2	x 250	-	48	20,0	23,0	0,1119	BFL	M1
x 600	-	223	30,5	33,5	0,2809	BFN	M2	x 280	-	63	21,0	24,0	0,1301	BFL	M1
x 630	-	238	31,0	34,0	0,2966	BF	M2	x 300	-	73	21,5	24,5	0,1422	BFL	M1
x 650	3	248	32,0	35,0	0,3071	BF	M2	x 315	-	80,5	22,5	25,5	0,1513	BFL	M1
x 700	28	273	34,0	37,0	0,3334	BF	M2	x 355	-	100,5	24,0	27,0	0,1755	BFL	M2
x 710	33	278	34,0	37,0	0,3386	BF	M2	x 400	-	123	25,5	28,5	0,2027	BFN	M2
x 750	53	298	35,5	38,5	0,3596	BF	M3	x 450	-	148	27,5	30,5	0,2329	BFN	M2
x 800	78	323	37,0	40,0	0,3859	BF	M3	x 500	-	173	29,0	32,0	0,2632	BFN	M2

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m²]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
630 x 550	-	198	31,0	34,0	0,2934	BFN	M2	710 x 225	-	36	21,5	23,5	0,1096	BFL	M1
x 560	-	203	31,5	34,5	0,2995	BFN	M2	x 250	-	48	22,0	24,5	0,1267	BFL	M1
x 600	-	223	33,0	36,0	0,3237	BF	M2	x 280	-	63	23,0	26,0	0,1473	BFL	M1
x 630	-	238	34,0	37,0	0,3418	BF	M2	x 300	-	73	23,5	26,5	0,1610	BFL	M2
x 650	3	248	34,5	37,5	0,3539	BF	M2	x 315	-	80,5	24,0	27,0	0,1713	BFL	M2
x 700	28	273	36,5	39,5	0,3842	BF	M2	x 355	-	100,5	25,5	28,5	0,1987	BFN	M2
x 710	33	278	37,0	40,0	0,3902	BF	M2	x 400	-	123	27,5	30,5	0,2295	BFN	M2
x 750	53	298	38,5	41,5	0,4144	BF	M3	x 450	-	148	29,5	32,5	0,2637	BFN	M2
x 800	78	323	40,5	43,5	0,4447	BF	M4	x 500	-	173	31,5	34,5	0,2980	BFN	M2
650 x 150	-	-	17,0	17,1	0,0531	BFL	M1	x 550	-	198	33,5	36,5	0,3322	BF	M2
x 180	-	13	19,0	20,5	0,0719	BFL	M1	x 560	-	203	34,0	37,0	0,3391	BF	M2
x 200	-	23	20,0	21,5	0,0844	BFL	M1	x 600	-	223	35,5	38,5	0,3665	BF	M2
x 225	-	36	21,0	22,5	0,1000	BFL	M1	x 630	-	238	36,5	39,5	0,3870	BF	M2
x 250	-	48	22,0	23,5	0,1156	BFL	M1	x 650	3	248	37,5	40,5	0,4007	BF	M2
x 280	-	63	23,0	24,5	0,1344	BFL	M1	x 700	28	273	39,5	42,5	0,4350	BF	M2
x 300	-	73	24,0	25,5	0,1469	BFL	M1	x 710	33	278	40,0	43,0	0,4418	BF	M3
x 315	-	80,5	24,5	26,0	0,1563	BFL	M2	x 750	53	298	41,5	44,5	0,4692	BF	M3
x 355	-	100,5	26,0	27,5	0,1813	BFL	M2	x 800	78	323	43,5	46,5	0,5035	BF	M4
x 400	-	123	28,0	29,5	0,2094	BFN	M2	750 x 150	-	-	18,7	18,8	0,0616	BFL	M1
x 450	-	148	30,0	31,5	0,2406	BFN	M2	x 180	-	13	21,0	22,5	0,0834	BFL	M1
x 500	-	173	32,0	33,5	0,2719	BFN	M2	x 200	-	23	22,0	23,5	0,0979	BFL	M1
x 550	-	198	34,0	35,5	0,3031	BFN	M2	x 225	-	36	22,5	24,5	0,1160	BFL	M1
x 560	-	203	34,5	37,5	0,3094	BF	M2	x 250	-	48	23,0	25,5	0,1341	BFL	M1
x 600	-	223	36,0	39,0	0,3344	BF	M2	x 280	-	63	24,0	27,0	0,1559	BFL	M2
x 630	-	238	37,0	40,0	0,3531	BF	M2	x 300	-	73	24,5	27,5	0,1704	BFL	M2
x 650	3	248	38,0	41,0	0,3656	BF	M2	x 315	-	80,5	25,0	28,0	0,1813	BFL	M2
x 700	28	273	40,0	43,0	0,3969	BF	M2	x 355	-	100,5	26,5	29,5	0,2103	BFN	M2
x 710	33	278	40,5	43,5	0,4031	BF	M2	x 400	-	123	28,5	31,5	0,2429	BFN	M2
x 750	53	298	42,0	45,0	0,4281	BF	M3	x 450	-	148	30,5	33,5	0,2791	BFN	M2
x 800	78	323	44,0	47,0	0,4594	BF	M4	x 500	-	173	32,5	35,5	0,3154	BFN	M2
700 x 150	-	-	17,8	18,0	0,0574	BFL	M1	x 550	-	198	35,0	38,0	0,3516	BF	M2
x 180	-	13	20,0	21,5	0,0776	BFL	M1	x 560	-	203	35,0	38,5	0,3589	BF	M2
x 200	-	23	21,0	22,5	0,0911	BFL	M1	x 600	-	223	37,0	40,5	0,3879	BF	M2
x 225	-	36	22,0	23,5	0,1080	BFL	M1	x 630	-	238	38,0	41,0	0,4096	BF	M2
x 250	-	48	23,0	24,5	0,1249	BFL	M1	x 650	3	248	39,0	42,0	0,4241	BF	M2
x 280	-	63	24,5	26,0	0,1451	BFL	M1	x 700	28	273	41,5	44,5	0,4604	BF	M3
x 300	-	73	25,5	27,0	0,1586	BFL	M2	x 710	33	278	41,5	44,5	0,4676	BF	M3
x 315	-	80,5	26,0	27,5	0,1688	BFL	M2	x 750	53	298	43,0	46,0	0,4966	BF	M3
x 355	-	100,5	27,5	29,0	0,1958	BFN	M2	x 800	78	323	45,0	48,0	0,5329	BF	M4
x 400	-	123	29,5	31,0	0,2261	BFN	M2	800 x 150	-	-	19,6	19,7	0,0659	BFL	M1
x 450	-	148	31,5	33,0	0,2599	BFN	M2	x 180	-	13	22,0	23,5	0,0891	BFL	M1
x 500	-	173	33,5	35,0	0,2936	BFN	M2	x 200	-	23	23,0	24,5	0,1046	BFL	M1
x 550	-	198	35,5	38,5	0,3274	BF	M2	x 225	-	36	23,5	25,5	0,1240	BFL	M1
x 560	-	203	36,0	39,0	0,3341	BF	M2	x 250	-	48	24,0	26,5	0,1434	BFL	M2
x 600	-	223	37,5	40,5	0,3611	BF	M2	x 280	-	63	25,0	28,0	0,1666	BFL	M2
x 630	-	238	39,0	42,0	0,3814	BF	M2	x 300	-	73	25,5	28,5	0,1821	BFL	M2
x 650	3	248	40,0	43,0	0,3949	BF	M2	x 315	-	80,5	26,5	29,5	0,1938	BFL	M2
x 700	28	273	42,0	45,0	0,4286	BF	M2	x 355	-	100,5	28,0	31,0	0,2248	BFN	M2
x 710	33	278	42,5	45,5	0,4354	BF	M2	x 400	-	123	30,0	33,0	0,2596	BFN	M2
x 750	53	298	44,0	47,0	0,4624	BF	M3	x 450	-	148	32,0	35,0	0,2984	BFN	M2
x 800	78	323	46,0	49,0	0,4961	BF	M4	x 500	-	173	34,0	37,0	0,3371	BFN	M2
710 x 150	-	-	18,0	18,1	0,0582	BFL	M1	x 550	-	198	36,5	39,5	0,3759	BF	M2
x 180	-	13	20,0	21,5	0,0788	BFL	M1	x 560	-	203	37,0	40,0	0,3836	BF	M2
x 200	-	23	21,0	22,5	0,0925	BFL	M1	x 600	-	223	39,0	42,0	0,4146	BF	M2

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
800 x 630	-	238	40,0	43,0	0,4379	BF	M3	1100 x 315	-	80,5	36,0	37,5	0,2688	BFN	M2
x 650	3	248	40,5	43,5	0,4534	BF	M3	x 355	-	100,5	38,0	40,0	0,3118	BFN	M2
x 700	28	273	43,0	46,0	0,4921	BF	M3	x 400	-	123	38,5	41,0	0,3601	BFN	M2
x 710	33	278	43,5	46,5	0,4999	BF	M3	x 450	-	148	40,5	43,5	0,4139	BF	M2
x 750	53	298	45,0	48,0	0,5309	BF	M3	x 500	-	173	43,0	46,0	0,4676	BF	M3
x 800	78	323	47,0	50,0	0,5696	BF	M4	x 550	-	198	46,0	49,0	0,5214	BF	M3
900 x 150	-	-	21,3	21,5	0,0744	BFL	M1	x 560	-	203	46,5	49,5	0,5321	BF	M3
x 180	-	13	24,0	25,5	0,1006	BFL	M1	x 600	-	223	49,0	52,0	0,5751	BF	M3
x 200	-	23	25,0	26,5	0,1181	BFL	M1	x 630	-	238	50,0	53,0	0,6074	BF	M3
x 225	-	36	26,5	28,0	0,1400	BFL	M2	x 650	3	248	51,5	54,5	0,6289	BF	M3
x 250	-	48	28,0	29,5	0,1619	BFL	M2	x 700	28	273	54,5	57,5	0,6826	BF	M3
x 280	-	63	29,5	31,0	0,1881	BFL	M2	x 710	33	278	54,5	57,5	0,6934	BF	M3
x 300	-	73	30,0	31,5	0,2056	BFL	M2	x 750	53	298	56,5	59,5	0,7364	BF	M3
x 315	-	80,5	30,5	32,0	0,2188	BFN	M2	x 800	78	323	59,5	62,5	0,7901	BF	M4
x 355	-	100,5	31,0	33,5	0,2538	BFN	M2	1250 x 180	-	13	31,0	32,5	0,1409	BFL	M2
x 400	-	123	32,5	35,5	0,2931	BFN	M2	x 200	-	23	32,5	34,0	0,1654	BFL	M2
x 450	-	148	35,0	38,0	0,3369	BFN	M2	x 225	-	36	34,0	35,5	0,1960	BFL	M2
x 500	-	173	37,0	40,0	0,3806	BF	M2	x 250	-	48	35,5	37,0	0,2266	BFL	M2
x 550	-	198	39,5	42,5	0,4244	BF	M2	x 280	-	63	37,5	39,0	0,2634	BFN	M2
x 560	-	203	40,0	43,0	0,4331	BF	M3	x 300	-	73	39,0	40,5	0,2879	BFN	M2
x 600	-	223	42,0	45,0	0,4681	BF	M3	x 315	-	80,5	40,0	41,5	0,3063	BFN	M2
x 630	-	238	43,5	46,5	0,4944	BF	M3	x 355	-	100,5	42,5	45,5	0,3553	BFN	M2
x 650	3	248	44,5	47,5	0,5119	BF	M3	x 400	-	123	45,5	48,5	0,4104	BFN	M2
x 700	28	273	47,0	50,0	0,5556	BF	M3	x 450	-	148	49,0	52,0	0,4716	BF	M3
x 710	33	278	47,0	50,0	0,5644	BF	M3	x 500	-	173	47,5	50,5	0,5329	BF	M3
x 750	53	298	49,0	52,0	0,5994	BF	M3	x 550	-	198	50,5	53,5	0,5941	BF	M3
x 800	78	323	51,5	54,5	0,6431	BF	M4	x 560	-	203	51,5	54,5	0,6064	BF	M3
1000 x 150	-	-	23,1	23,2	0,0829	BFL	M1	x 600	-	223	54,0	57,0	0,6554	BF	M3
x 180	-	13	26,0	27,5	0,1121	BFL	M1	x 630	-	238	55,5	58,5	0,6921	BF	M3
x 200	-	23	27,0	28,5	0,1316	BFL	M2	x 650	3	248	56,5	59,5	0,7166	BF	M3
x 225	-	36	28,5	30,0	0,1560	BFL	M2	x 700	28	273	60,0	63,0	0,7779	BF	M4
x 250	-	48	30,0	31,5	0,1804	BFL	M2	x 710	33	278	60,0	63,0	0,7901	BF	M4
x 280	-	63	31,5	33,0	0,2096	BFL	M2	x 750	53	298	62,5	65,5	0,8391	BF	M5
x 300	-	73	32,5	34,0	0,2291	BFN	M2	x 800	78	323	65,5	68,5	0,9004	BF	M5
x 315	-	80,5	33,5	35,0	0,2438	BFN	M2	1400 x 180	-	13	34,0	35,5	0,1581	BFL	M2
x 355	-	100,5	35,5	37,0	0,2828	BFN	M2	x 200	-	23	35,5	37,0	0,1856	BFL	M2
x 400	-	123	35,0	38,0	0,3266	BFN	M2	x 225	-	36	37,5	39,0	0,2200	BFL	M2
x 450	-	148	37,5	40,5	0,3754	BFN	M2	x 250	-	48	39,5	41,0	0,2544	BFN	M2
x 500	-	173	40,0	43,0	0,4241	BF	M2	x 280	-	63	41,5	43,0	0,2956	BFN	M2
x 550	-	198	42,5	45,5	0,4729	BF	M3	x 300	-	73	43,0	44,5	0,3231	BFN	M2
x 560	-	203	43,0	46,0	0,4826	BF	M3	x 315	-	80,5	44,0	47,0	0,3438	BFN	M2
x 600	-	223	45,0	48,0	0,5216	BF	M3	x 355	-	100,5	47,0	50,0	0,3988	BFN	M2
x 630	-	238	47,0	50,0	0,5509	BF	M3	x 400	-	123	50,0	53,0	0,4606	BF	M3
x 650	3	248	48,0	51,0	0,5704	BF	M3	x 450	-	148	53,5	56,5	0,5294	BF	M3
x 700	28	273	51,0	54,0	0,6191	BF	M3	x 500	-	173	52,0	55,0	0,5981	BF	M3
x 710	33	278	51,0	54,0	0,6289	BF	M3	x 550	-	198	55,5	58,5	0,6669	BF	M3
x 750	53	298	53,0	56,0	0,6679	BF	M3	x 560	-	203	56,0	59,0	0,6806	BF	M3
x 800	78	323	55,5	58,5	0,7166	BF	M4	x 600	-	223	59,0	62,0	0,7356	BF	M3
1100 x 180	-	13	28,0	29,5	0,1236	BFL	M1	x 630	-	238	60,5	63,5	0,7769	BF	M4
x 200	-	23	29,0	30,5	0,1451	BFL	M2	x 650	3	248	62,0	65,0	0,8044	BF	M5
x 225	-	36	30,5	32,0	0,1720	BFL	M2	x 700	28	273	65,5	68,5	0,8731	BF	M5
x 250	-	48	32,0	33,5	0,1989	BFL	M2	x 710	33	278	66,0	69,0	0,8869	BF	M5
x 280	-	63	34,0	35,5	0,2311	BFL	M2	x 750	53	298	68,5	71,5	0,9419	BF	M5
x 300	-	73	35,0	36,5	0,2526	BFN	M2	x 800	78	323	71,5	74,5	1,0106	BF	M5

A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight		Effect. area Sef [m <sup>2</sup> ]	Actu. mech.	Mech. contr.
			Design								Design				
			mech [kg]	servo [kg]							mech [kg]	servo [kg]			
<b>1500 x 180</b>	-	13	36,0	37,5	0,1696	BFL	M2	<b>1500 x 500</b>	-	173	57,0	60,0	0,6416	BF	M3
<b>x 200</b>	-	23	37,5	39,0	0,1991	BFL	M2	<b>x 550</b>	-	198	58,5	61,5	0,7154	BF	M3
<b>x 225</b>	-	36	39,5	41,0	0,2360	BFL	M2	<b>x 560</b>	-	203	59,5	62,5	0,7301	BF	M3
<b>x 250</b>	-	48	41,5	43,0	0,2729	BFN	M2	<b>x 600</b>	-	223	62,5	65,5	0,7891	BF	M4
<b>x 280</b>	-	63	44,0	45,5	0,3171	BFN	M2	<b>x 630</b>	-	238	64,0	67,0	0,8334	BF	M5
<b>x 300</b>	-	73	45,5	48,5	0,3466	BFN	M2	<b>x 650</b>	3	248	65,5	68,5	0,8629	BF	M5
<b>x 315</b>	-	80,5	46,5	49,5	0,3688	BFN	M2	<b>x 700</b>	28	273	69,5	72,5	0,9366	BF	M5
<b>x 355</b>	-	100,5	49,5	52,5	0,4278	BFN	M3	<b>x 710</b>	33	278	69,5	79,5	0,9514	BF	M5
<b>x 400</b>	-	123	53,0	56,0	0,4941	BF	M3	<b>x 750</b>	53	298	72,5	75,5	1,0104	BF	M5
<b>x 450</b>	-	148	55,0	58,0	0,5679	BF	M3	<b>x 800</b>	78	323	75,5	78,5	1,0841	BF	M5

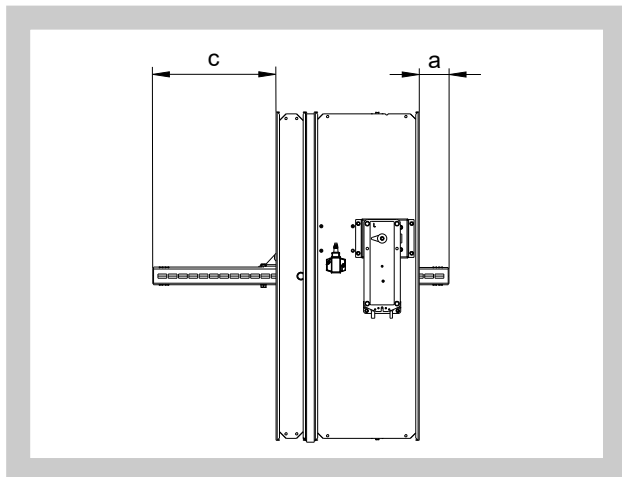
4.3. Blades overlaps

Tab. 4.3.1 Blades overlaps

Blades overlaps		Dimension	Overlaps
DAMPER OVERLAPS Fig. 28	Act. mechanism side	"a"	Tab. 4.2.1
	Side without act. mechanism	"c"	Tab. 4.2.1

These values has to be respected when projecting related air-conditioning ducts.

Fig. 28 Damper overlaps



- 4.4. For the design .60 (with BKN supply and communication device) add to weight of the damper with an actuating mechanism (Tab. 4.2.1.) the weight of BKN (0.5 kg).
- 4.5. Dampers can be supplied on the customer's demands in all subdimension of the above mentioned range.
- 4.6. Flanges of rectangular fire dampers are 30 mm wide with oval hole

Fig. 29 Flange of Damper - OPERATORS SIDE

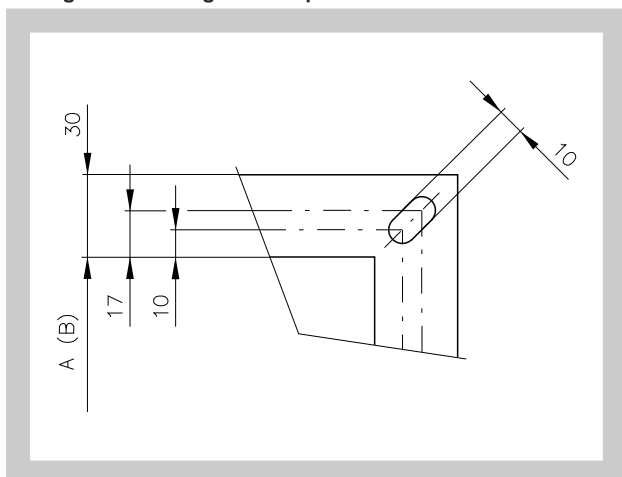
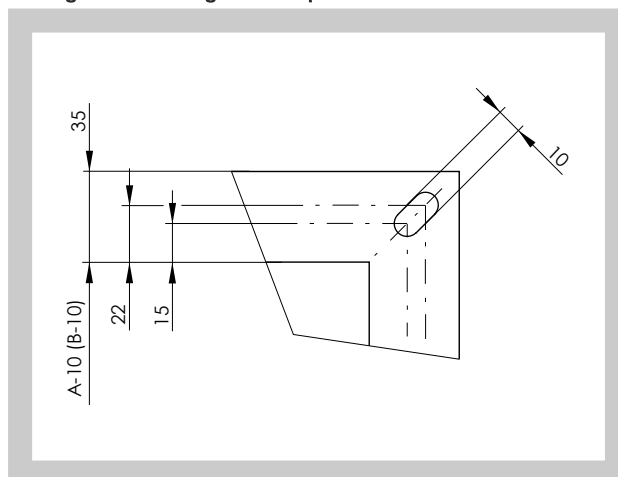


Fig. 30 Flange of Damper - INSTALLATIONS SIDE



**5. Placement and Assembly**

**5.1.** The fire dampers are suitable for installation in arbitrary position in vertical and horizontal passages of fire separating structures. The damper assembly procedures must be done so that all load transfer from the fire separating constructions to the damper body is absolutely excluded. The back-to-back air-conditioning piping must be suspended or supported so that all load transfer from the back-to-back piping to the damper flanges is absolutely excluded. The gap between the installed damper and the building structure must be perfectly filled with approved material all over its volume.

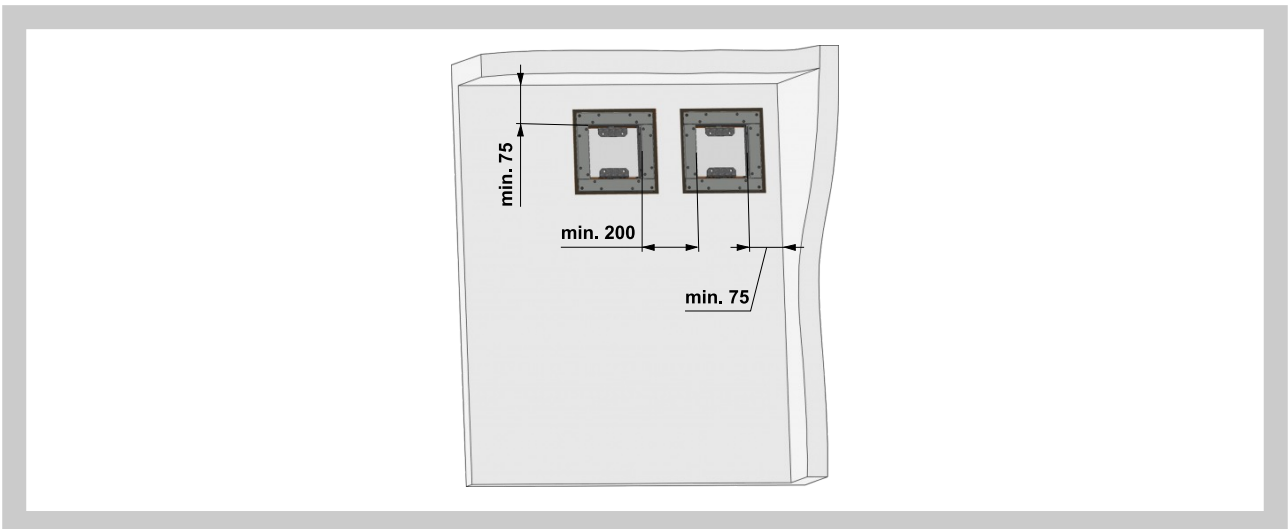
To provide the necessary space for access to the control device, all other items must be situated at least 350 mm from the control parts of the damper. At least one inspection hole must be accessible.

The damper must be installed so that the damper blade (in closed position) is situated in the fire separating structure - marked by the label BUILD-IN EDGE on the damper body. If such solution is not possible, the piping between the fire separating structure and the damper blade must be protected according to the certified installation method, see [Section 6](#).

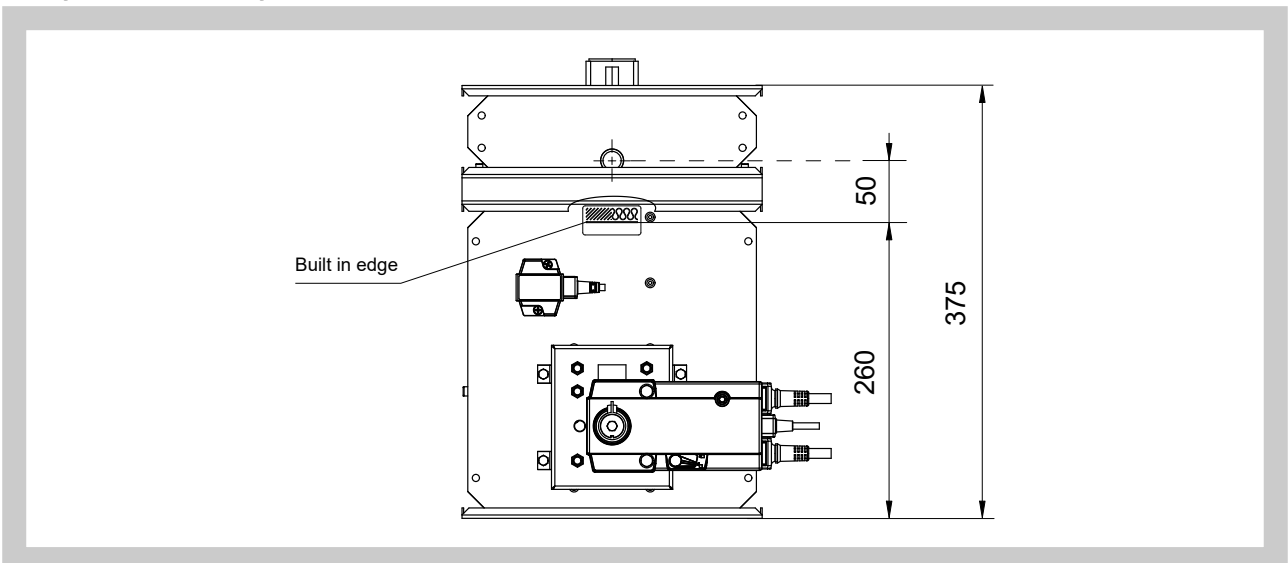
During the installation and plastering process, the control mechanism must be protected (covered) against damage and pollution. The damper body should not be deformed during bricking in. Once the damper is built in, the damper blade should not grind on the damper body during opening or closing.

The distance between the fire damper and the structure (wall, ceiling) must be 75 mm at the minimum. If two or more dampers are to be installed in one fire separating structure, the distance between adjacent dampers must be 200 mm at the minimum, according to EN 1366-2 paragraph 13.5. For admissible exceptions see [Section 6](#).

**Fig. 31 The distance between the fire damper and the construction**



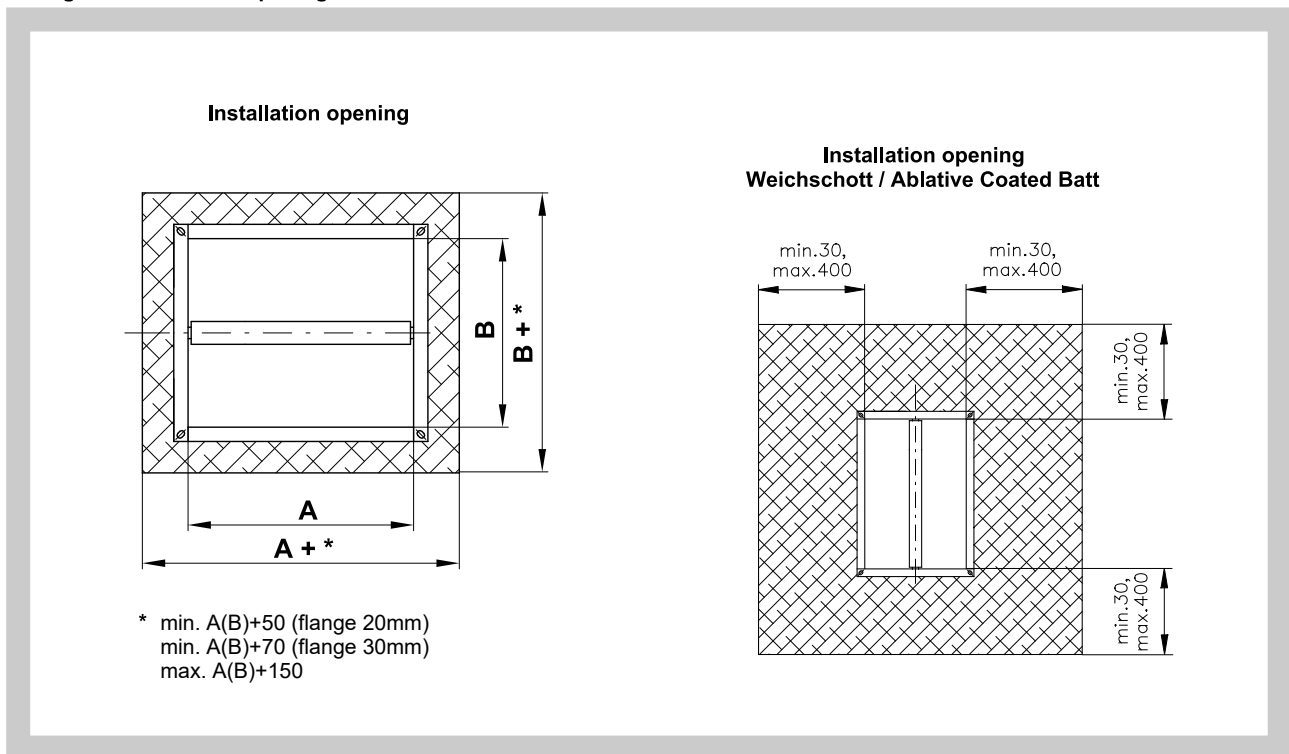
**Fig. 32 Built in edge**



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

5.2. Installation opening dimensions

Fig. 33 Installation opening dimensions



5.3. Examples of fire damper installing

The fire damper can be integrated into a solid wall construction made e.g. of normal concrete/ masonry, porous concrete with minimum thickness 100 mm or into solid ceiling construction made e.g. of normal concrete with minimum thickness 110 mm or porous concrete with minimum thickness 125 mm.

The fire damper can be integrated into a gypsum wall construction with fire classification EI120 or EI 90.

The fire damper can also be integrated outside the wall construction. Duct and the damper part between the wall construction and the damper blade (labelled with BUILD IN EDGE on the protective covering) must be protected with fire-fighting insulation.

If is damper installed outside a construction it is necessary to use reinforcement VRM-Q for dampers with dimension  $A \geq 800$  mm.

**Important:** For lower fire resistance than EI90 the reinforcement VRM-Q is not necessary !!!

## 6 Statement of installations

### 6.1. Installation method list

Tab. 6.1.1. Installation method list

Fire separating constru.	Wall/Ceiling	Installation	Fire resist.	Page
	Min. thickness [mm]			
Solid wall construction	100	Mortar or gypsum	EIS 120 EIS 90	30
	100	Fire protection foam with stucco plaster	EIS 60 EIS 45 EIS 30	30
	100	Battery - mortar or gypsum	EIS 90	31
	100	Installation next to wall - mortar or gypsum and mineral wool	EIS 90	32
	100	Stuffing box with fire protection mastic and cement lime plate	EIS 90	33
	100	Installation frame E1, E2, E4	EIS 90	34
	100	Weichschott / Ablative Coated Batt	EIS 90	35
	100	Battery - installation frame E1	EIS 90	36
Outside solid wall construction	100	Mineral wool - mortar or gypsum	EIS 60	37
	100	Mineral wool - stuffing box and fire protection mastic	EIS 60	37
	100	Mineral wool, stuffing box, fire protection mastic and cement lime plate	EIS 90	38
	100	Insulating with cement lime plates - installation frame E6	EIS 90	39
Gypsum wall construction	100	Mortar or gypsum	EIS 120 EIS 90	40
	100	Fire protection foam with stucco plaster	EIS 60 EIS 45 EIS 30	40
	100	Battery - mortar or gypsum	EIS 90	41
	100	Installation next to wall - mortar or gypsum and mineral wool	EIS 90	42
	100	Stuffing box with fire protection mastic and cement lime plate	EIS 90	43
	100	Installation frame E1, E3, E4	EIS 90	44
	100	Weichschott / Ablative Coated Batt	EIS 90	45
	100	Battery - installation frame E1	EIS 90	46
Outside gypsum wall construction	100	Mineral wool - mortar or gypsum	EIS 60	48
	100	Mineral wool - stuffing box and fire protection mastic	EIS 60	48
	100	Mineral wool, stuffing box, fire protection mastic and cement lime plate	EIS 90	49
Solid ceiling construction	110 - Concrete 125 - Aerated concrete	Mortar or gypsum	EIS 120 EIS 90	50
		Battery - mortar or gypsum	EIS 90	51
		Stuffing box with fire protection mastic and cement lime plate	EIS 90	52
		Installation frame E1, E2, E4	EIS 90	53
		Weichschott / Ablative Coated Batt	EIS 90	54
		Battery - installation frame E1	EIS 90	55
Outside solid ceiling construction	110 - Concrete 125 - Aerated concrete	Mineral wool - mortar or gypsum	EIS 90	56
		Concrete	EIS 90	57
		Concrete with installation frame E4	EIS 90	57
		Insulating with cement lime plates - installation frame E6	EIS 90	58
Sandwich wall construction	100	Stuffing box and fire protection mastic, coating and cement lime plate	EIS 90	59
Shaft walls Rigips	-	Mortar or gypsum	EIS 90	61
	-	Installation frame E1	EIS 90	62
Shaft walls British gypsum	-	Mortar or gypsum	EIS 120	64

6.2. Installation in solid wall construction

Fig. 34 Solid wall construction - mortar or gypsum

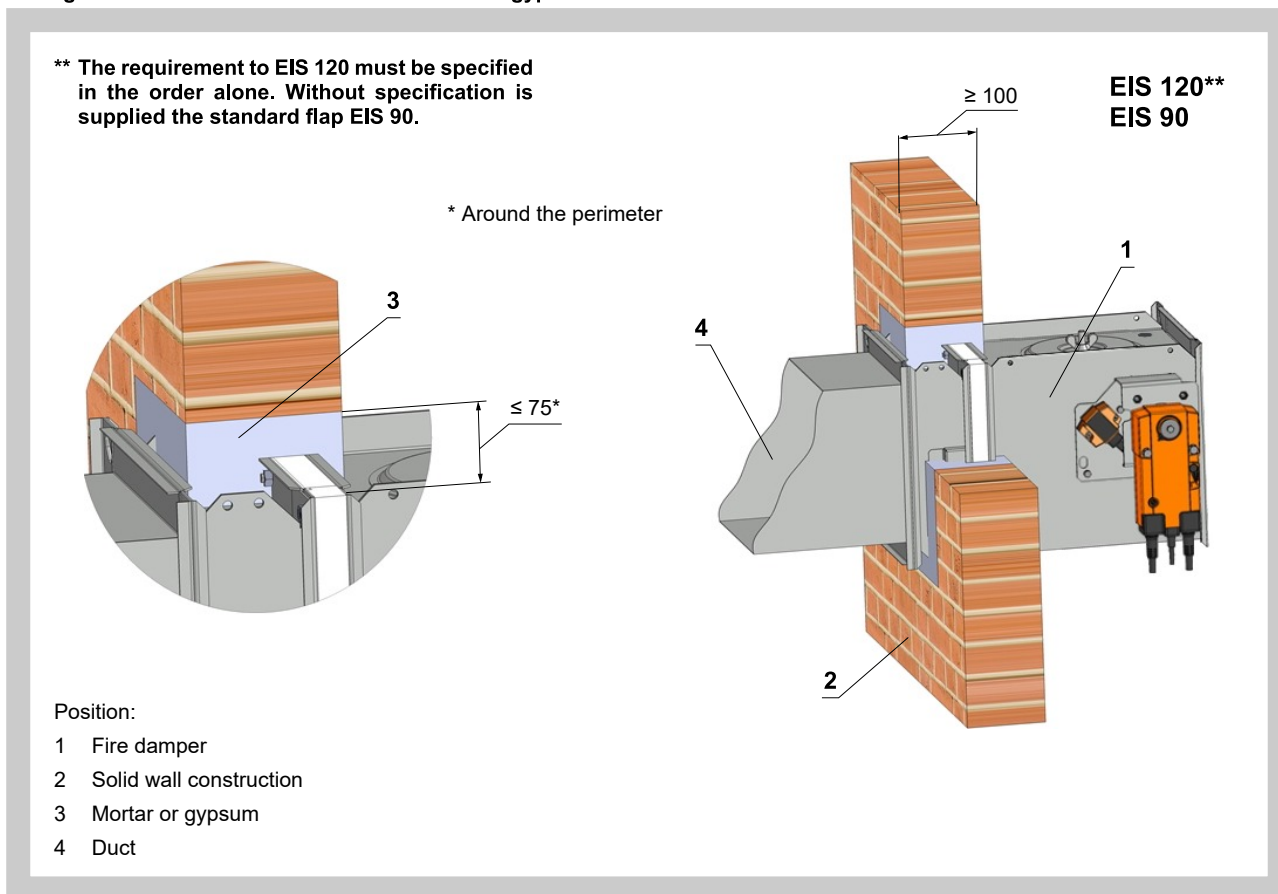


Fig. 35 Solid wall construction - fire protection foam with stucco plaster

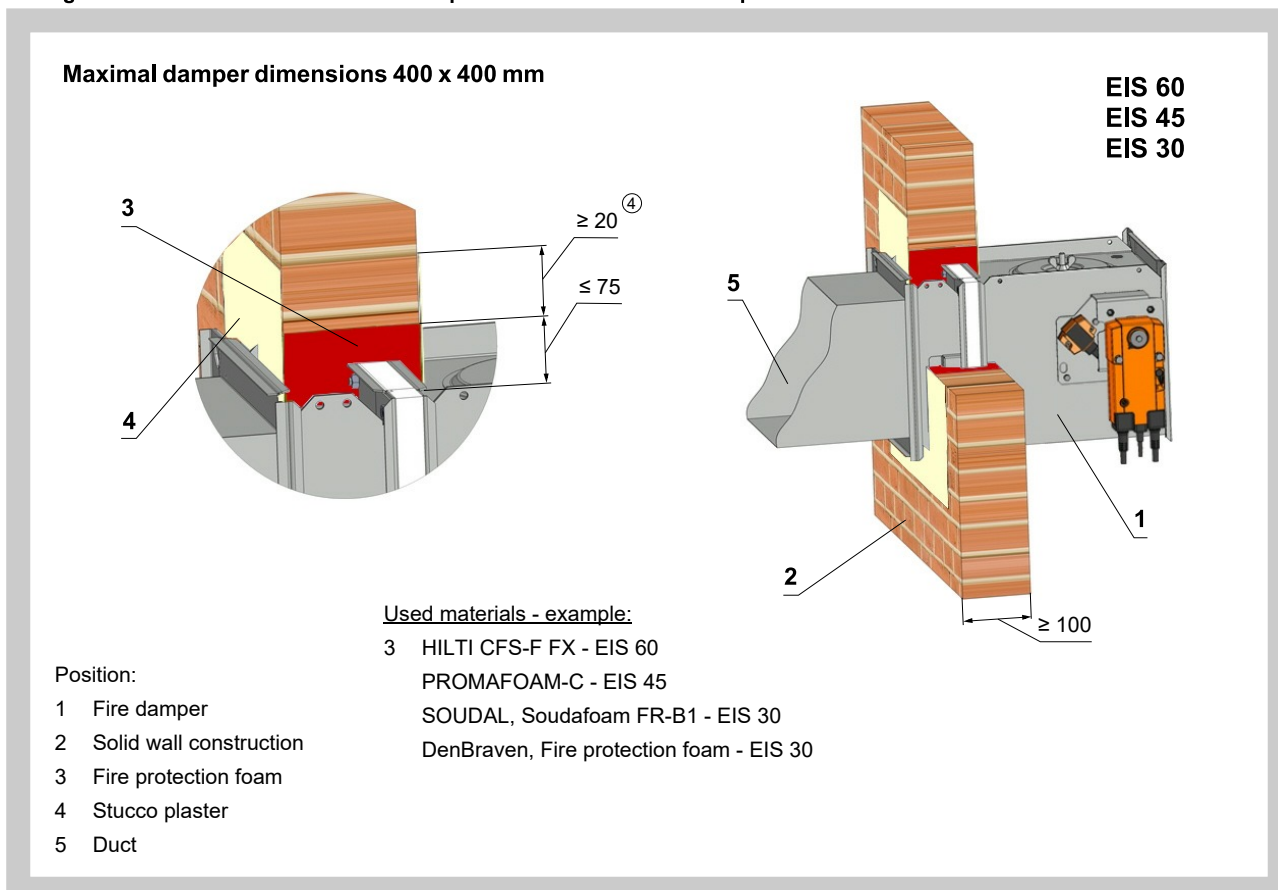
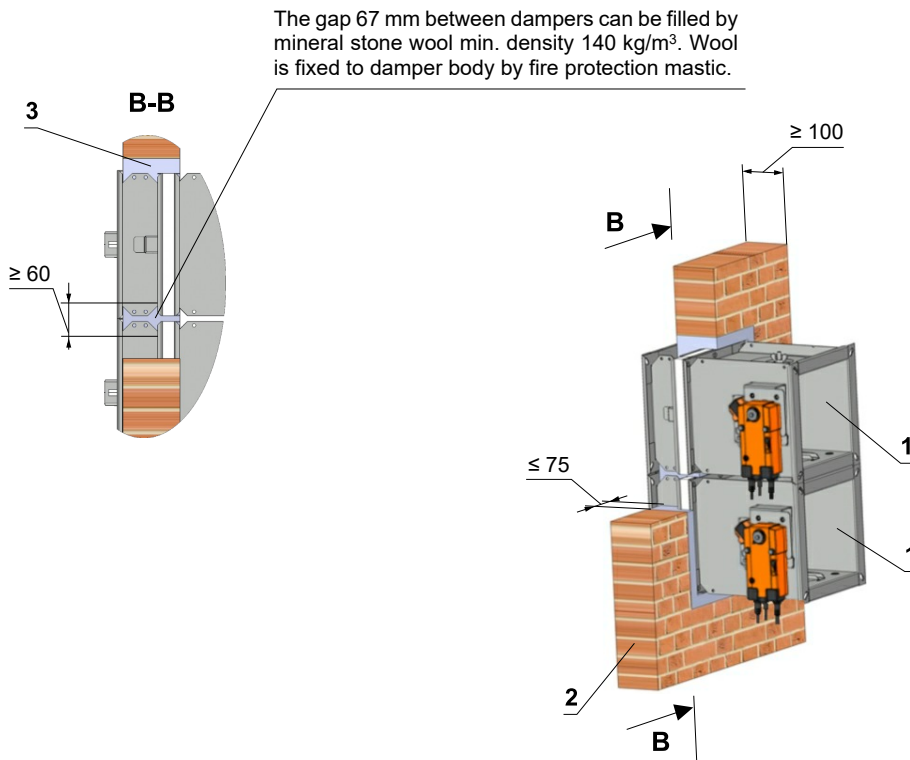
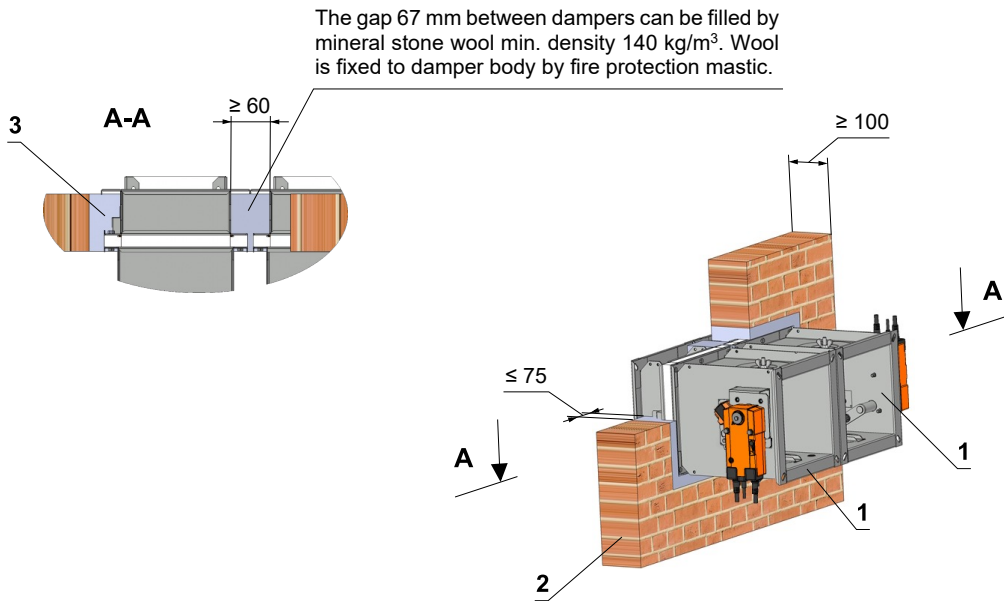


Fig. 36 Solid wall construction - battery - mortar or gypsum

EIS 90



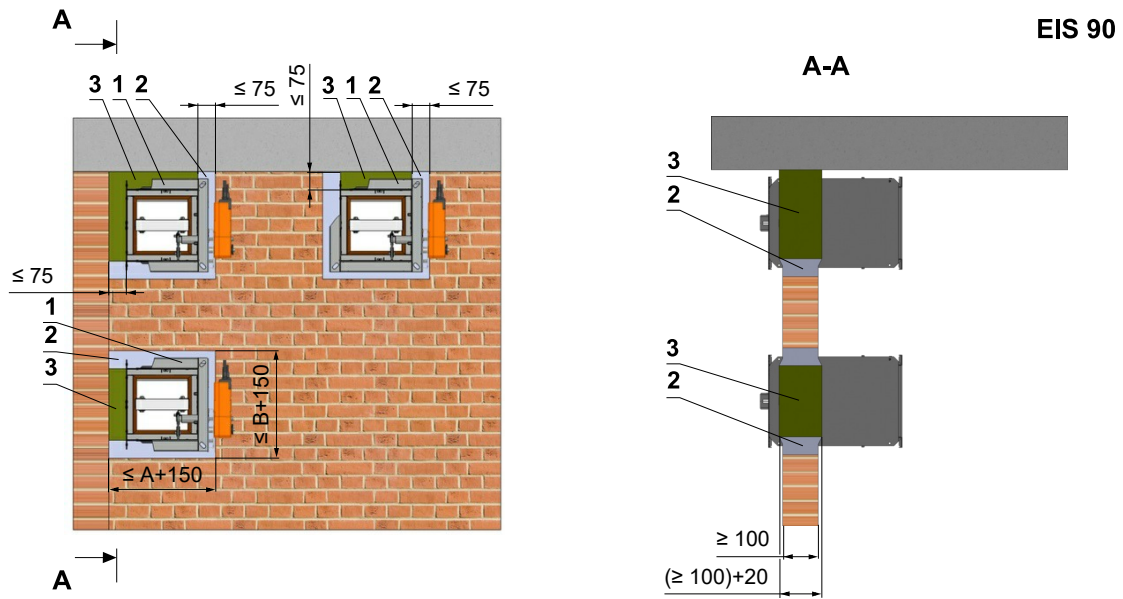
Position:

- 1 Fire damper
- 2 Solid wall construction
- 3 Mortar or gypsum

**Notice:**

- Installation opening for each damper has minimal dimensions  $a \times b = (A+100) \times (2 \times B + 100)$  mm or  $(2 \times A + 100) \times (B + 100)$  mm
- Gap between damper and construction is filled by mortar or gypsum
- Distance between dampers 60 mm
- Flange to flange connection - Up to four dampers can be installed

Fig. 37 Solid wall construction - installation next to wall - mortar or gypsum and mineral wool



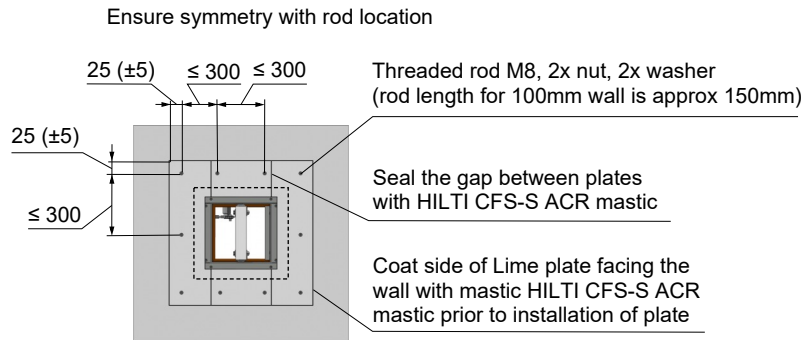
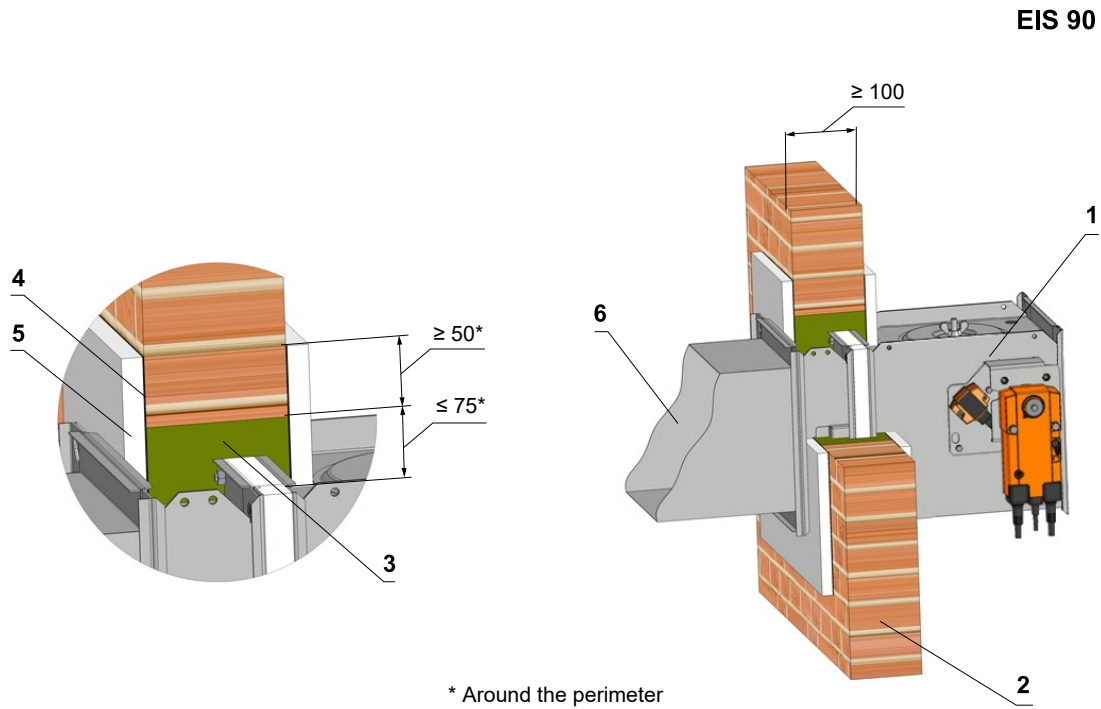
Position:

- 1 Fire damper
- 2 Mortar or gypsum
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)

**Notice:**

- Gap between damper and construction is filled by mortar or gypsum and mineral wool
- Wool is fixed to damper body and construction by fire protection mastic.
- Mineral wool thickness = construction thickness + 20 mm or 50 mm
- Installation is valid for ceiling construction

Fig. 38 Solid wall construction - stuffing box, fire protection mastic and cement lime plate



Screws has to be fixed in wall/ceiling construction.  
(If it is needed use steel bracket).

Used materials - example:

- 3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 4 Promastop - P, K, Hilti CFS-CT
- 5 Promatect - H

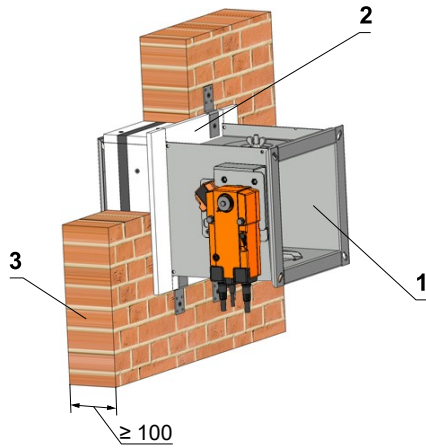
Position:

- 1 Fire damper
- 2 Solid wall construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m³)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Cement lime plate min. thickness 15 mm min. density 870 kg/m³
- 6 Duct

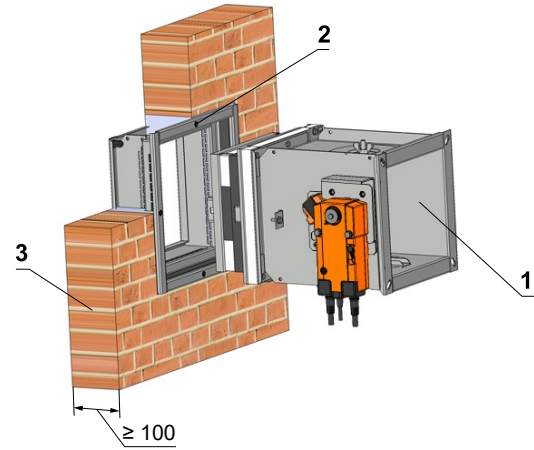
Fig. 39 Solid wall construction - installation frame E1, E2, E4

EIS 90

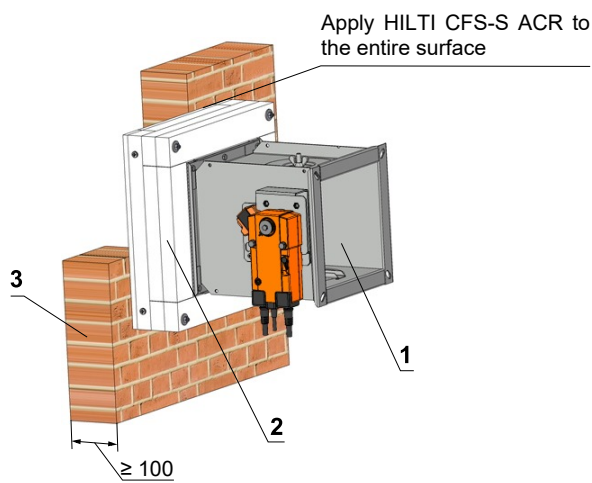
Installation frame E1



Installation frame E2



Installation frame E4

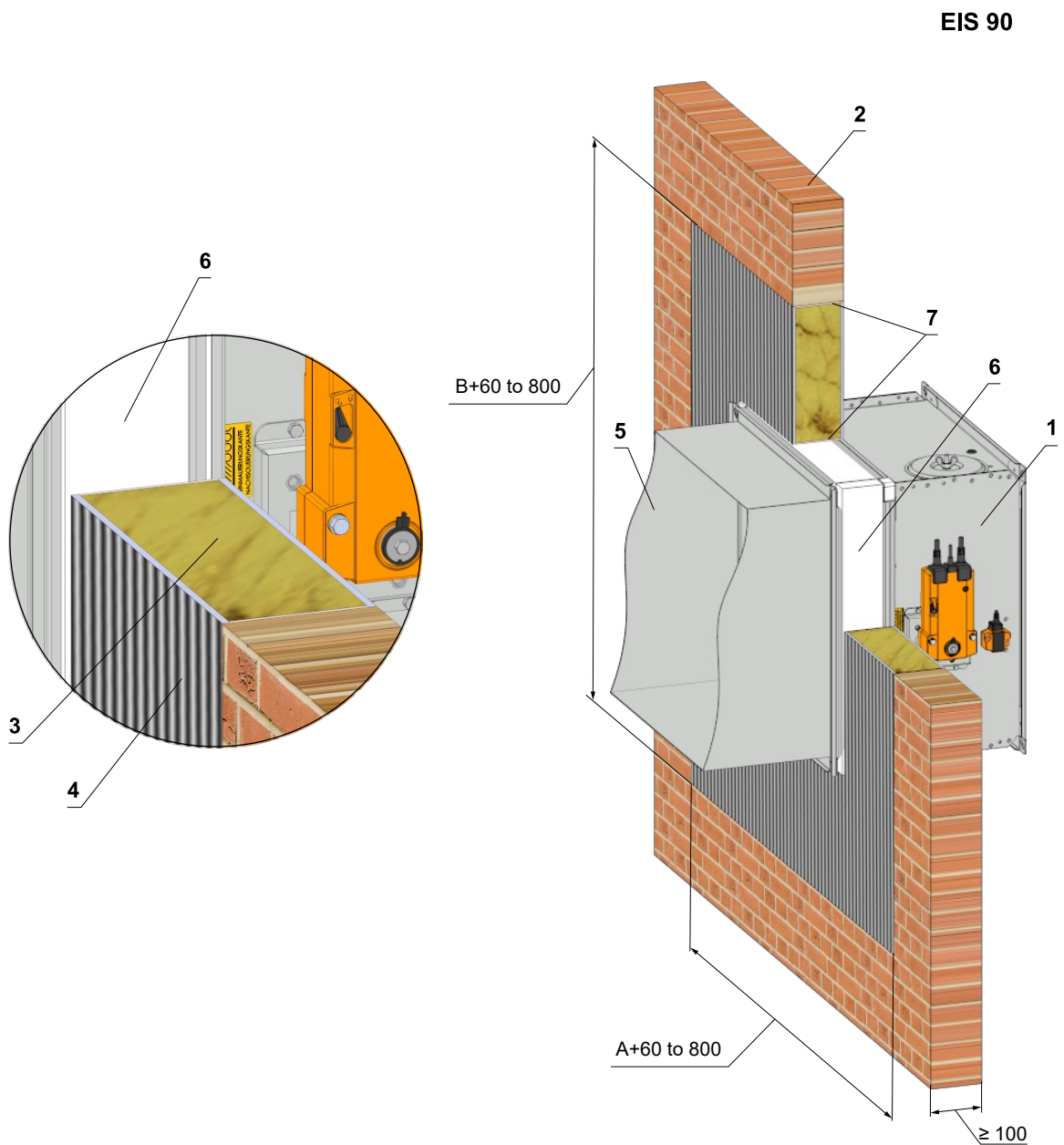


Position:

- 1 Fire damper
- 2 Installation frame
- 3 Solid wall construction

Installation details see chapter 8

Fig. 40 Solid wall construction - Weichschott / Ablative Coated Batt



Position:

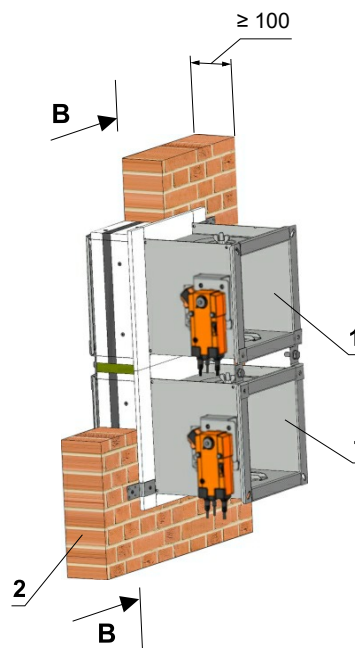
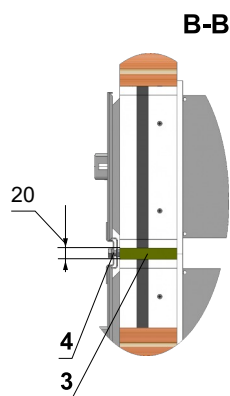
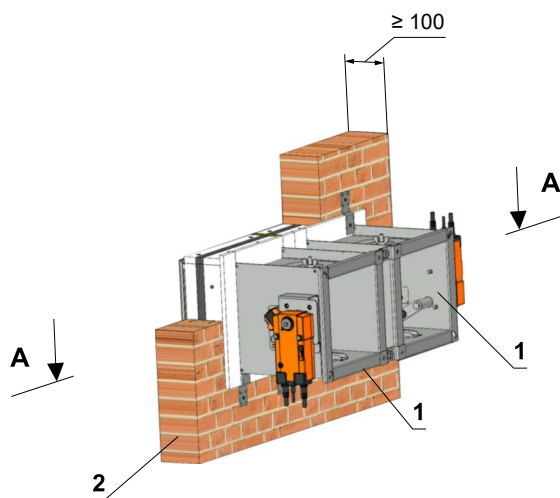
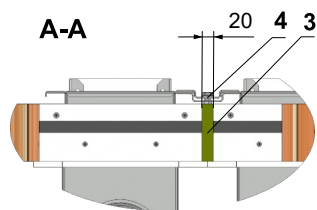
- 1 Fire damper
- 2 Solid wall construction
- 3 Fire resistant board
- 4 Fire stop coating thickness 1 mm
- 5 Duct
- 6 Protective cladding boards - (not part of the damper) but must be used as part of the penetration filling. It can be ordered from MANDÍK as an accessory.
- 7 Fire resistant mastic - fill the gap on both sides of the fire separation construction and around the perimeter of penetration and damper body.

Used materials - example:

- 3 Hilti CFS-CT B 1S 140/50
- 4 Hilti CFS-CT
- 6 PROMATECT-H, th. 35 mm
- 7 Hilti CFS-S ACR

Fig. 41 Solid wall construction - battery - installation frame E1

EIS 90



A = max. 1000 mm

It is possible to use corresponding number of holes and screws

Holders No. X = (2xZB1) + (2xZH1)  
Screws No. Y = 2xX

Dimensions	Number ZB1	Number ZH1
A1, B1 ≤ 400	1	1
400 < A1, B1 ≤ 800	2	2
800 < A1 ≤ 1200	3	3
1200 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5
2000 < A1 ≤ 2400	6	6
2400 < A1 ≤ 2800	7	7
2800 < A1 ≤ 3000	8	8

A1 = A or A1 = 2xA  
B1 = B or B1 = 2xB

Position:

- 1 Fire damper with installation frame E1
- 2 Solid wall construction
- 3 Mineral stone wool min. density 140 kg/m<sup>3</sup>
- 4 Flange connection

Notice:

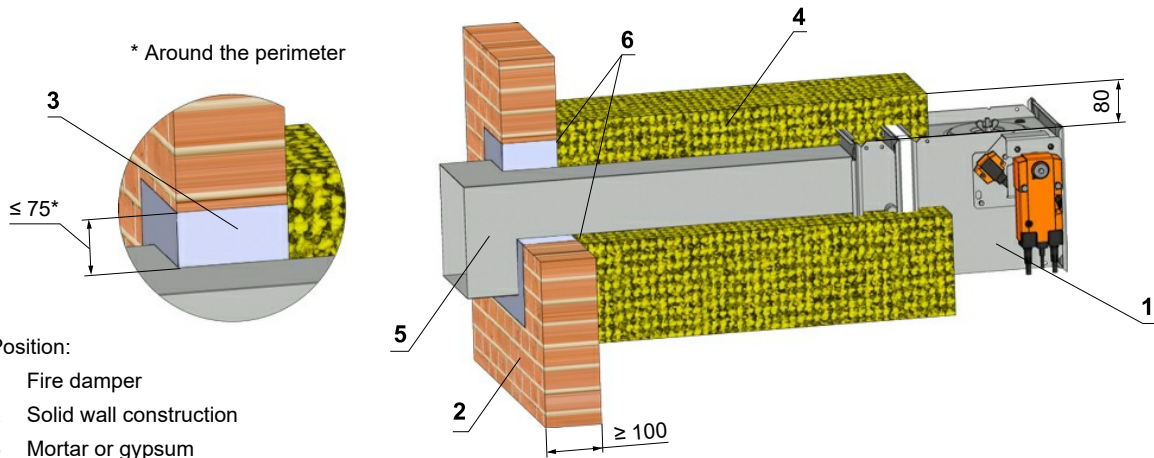
- Installation opening dimensions:  
a x b = (2x(A + 85<sup>-3</sup> mm) + 20 mm) x (B + 85<sup>-3</sup> mm)  
or a x b = (A + 85<sup>-3</sup> mm) x (2x(B + 85<sup>-3</sup> mm) + 20 mm)
- Gap between frame and damper body and frame and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to four dampers can be installed

6.3. Installation outside solid wall construction

Fig. 42 Outside solid wall construction - mineral wool - mortar or gypsum

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 60



Position:

- 1 Fire damper
- 2 Solid wall construction
- 3 Mortar or gypsum
- 4 Insulation board made of stone wool, with a surface treatment of aluminum foil, density 66 kg/m<sup>3</sup>
- 5 Duct
- 6 Apply ISOVER Protect BSK glue on the insulation and stick it to the fire separation construction \*\*\*

Used materials - example:\*\*

- 4 Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1

\*\* Insulation materials can be replaced by another approved fire sealing system with equivalent properties.  
The maximum distance of the fire damper from the structure is not limited.

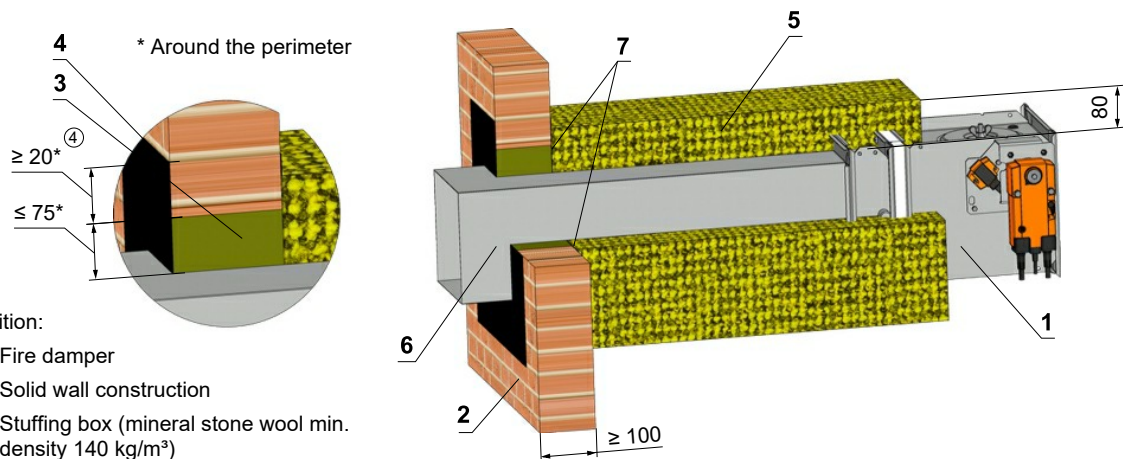
\*\*\* When installing the insulation, follow the ISOVER manufacturer's instructions.

The duct at the point of penetration does not have to be anchored to the fire wall construction, see chapter 9.

Fig. 43 Outside solid wall construction - mineral wool - stuffing box and fire protection mastic

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 60



Position:

- 1 Fire damper
- 2 Solid wall construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Insulation board made of stone wool, with a surface treatment of aluminum foil, density 66 kg/m<sup>3</sup>
- 6 Duct
- 7 Apply ISOVER Protect BSK glue on the insulation and stick it to the fire separation construction \*\*\*

Used materials - example:\*\*

- 3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 4 Promastop - P, K, Hilti CFS-CT
- 5 Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1

\*\* Insulation materials can be replaced by another approved fire sealing system with equivalent properties.  
The maximum distance of the fire damper from the structure is not limited.

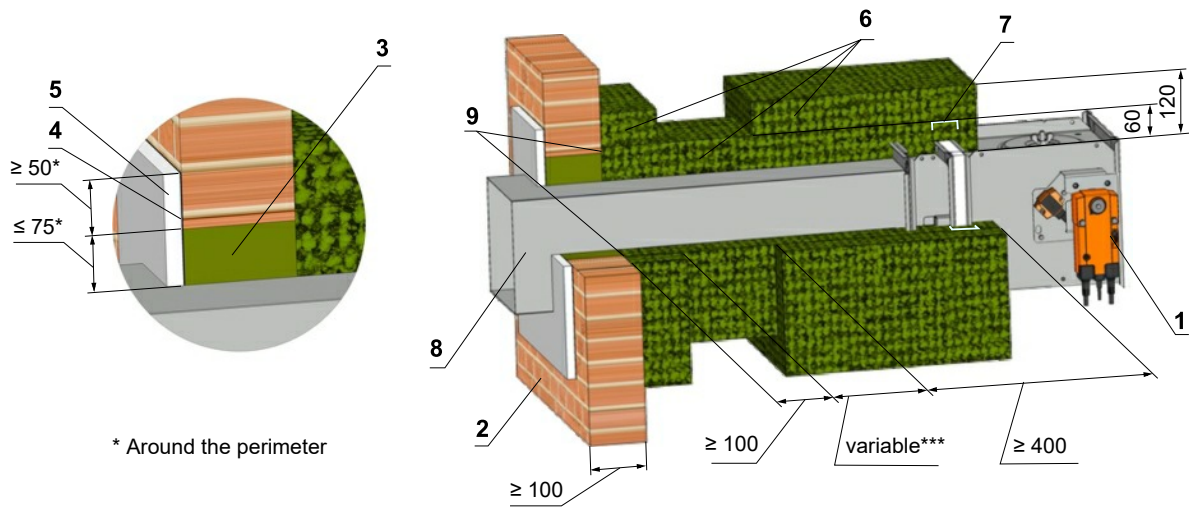
\*\*\* When installing the insulation, follow the ISOVER manufacturer's instructions.

The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

Fig. 44 Outside solid wall construction - mineral wool, stuffing box, fire protection mastic and cement lime plate

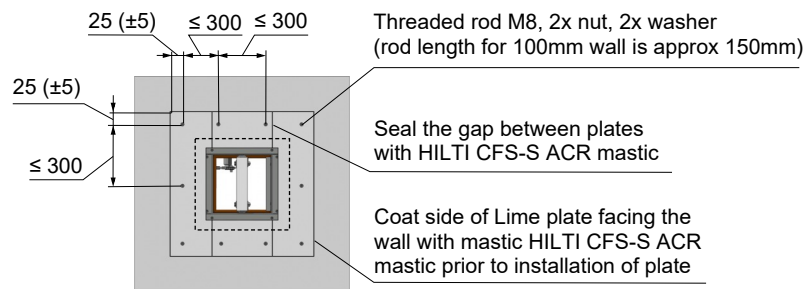
Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 90



\* Around the perimeter

Ensure symmetry with rod location



Screws has to be fixed in wall/ceiling construction.  
(If it is needed use steel bracket).

Used materials - example:\*\*

- 3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 4 Promastop - P, K, Hilti CFS-CT
- 5 Promatect - H
- 6 Rockwool Conlit Ductrock EIS 90, th. 60 mm

Position:

- 1 Fire damper
- 2 Solid wall construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Cement lime plate min. thickness 15 mm (min. density 870 kg/m<sup>3</sup>)
- 6 Stone wool with one side stitched wire fencing (min. density 105 kg/m<sup>3</sup>), thickness 60 mm
- 7 Steel sheet reinforcement U25x40x25 placed between layers of stone wool \*\*\*\*
- 8 Duct
- 9 Apply Rockwool Firepro glue on the insulation and stick it to the fire separation construction \*\*\*\*\*

\*\* Stuffing box, fire protection mastic, cement lime plate and insulation materials can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

\*\*\* Depends on the distance of the flap from the construction, when the maximum distance from the construct is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

\*\*\*\* For installation methods outside a construction, when the damper size is A ≥ 800 mm, it is necessary to use the VRM-Q reinforcing frame, see Fig.80. Assembly - reinforcing frame U25x40x25 see Fig.81.

\*\*\*\*\* When installing the insulation, follow the Rockwool manufacturer's instructions.

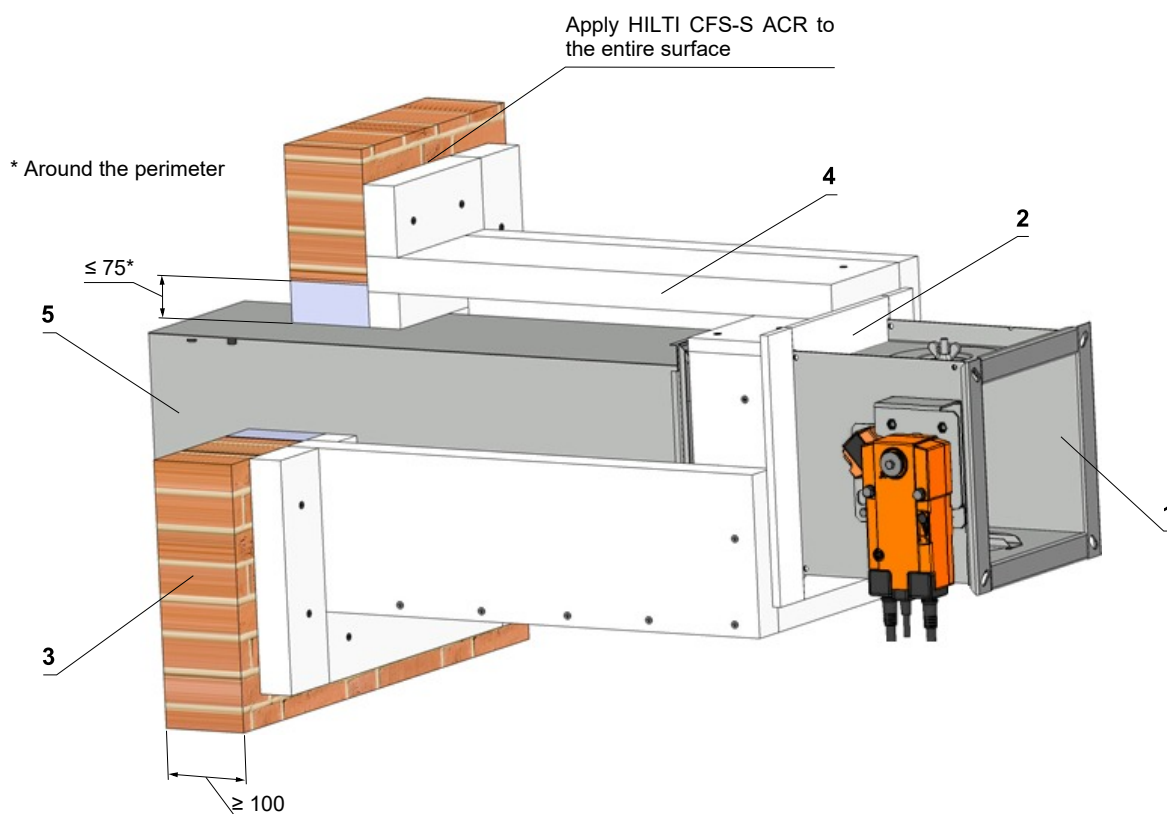
The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

Fig. 45 Outside solid wall construction - installation frame E6 with cement lime plates

Installation frame E6

EIS 90

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.



Position:

- 1 Fire damper
- 2 Installation frame E6
- 3 Solid wall construction
- 4 Cement lime plate - all parts are glued with glue Promat K84 and secured by screws.
- 5 Duct

Installation details see chapter 8

6.4. Installation in gypsum wall construction

Fig. 46 Gypsum wall construction - mortar or gypsum

\*\* The requirement to EIS 120 must be specified in the order alone. Without specification is supplied the standard flap EIS 90.

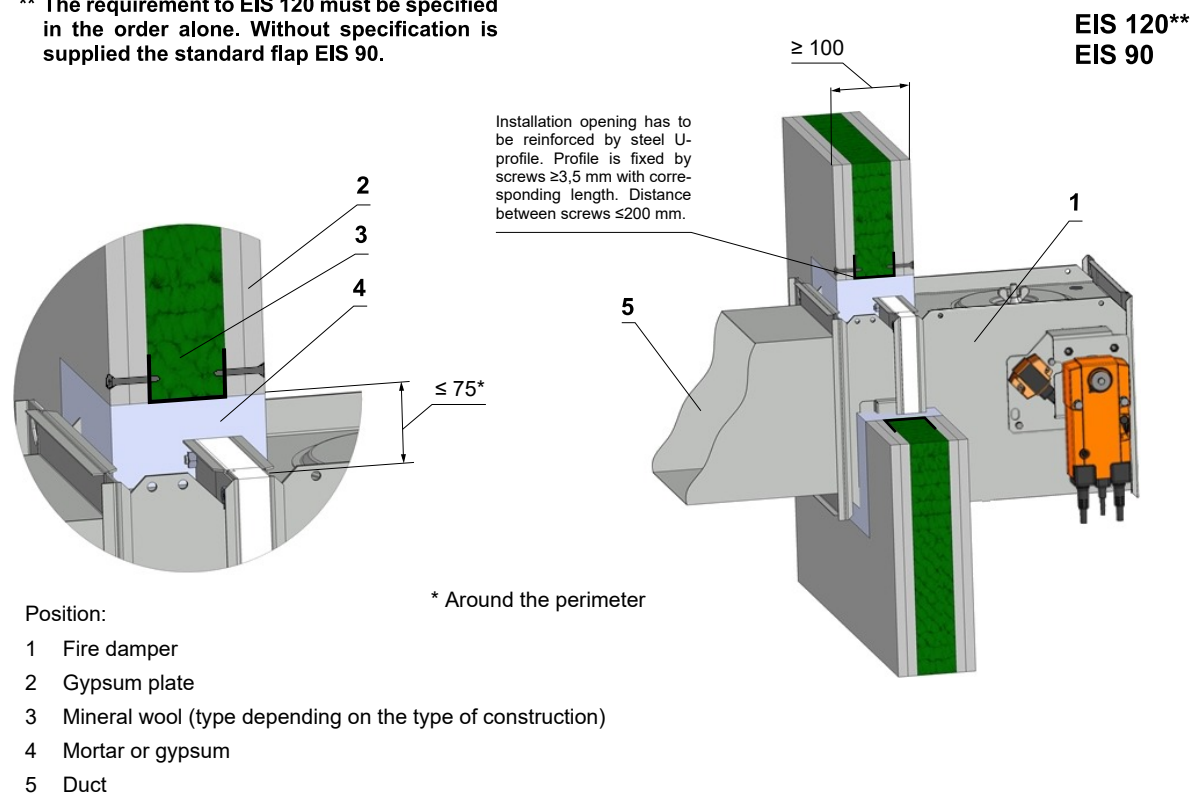


Fig. 47 Gypsum wall construction - fire protection foam with stucco plaster

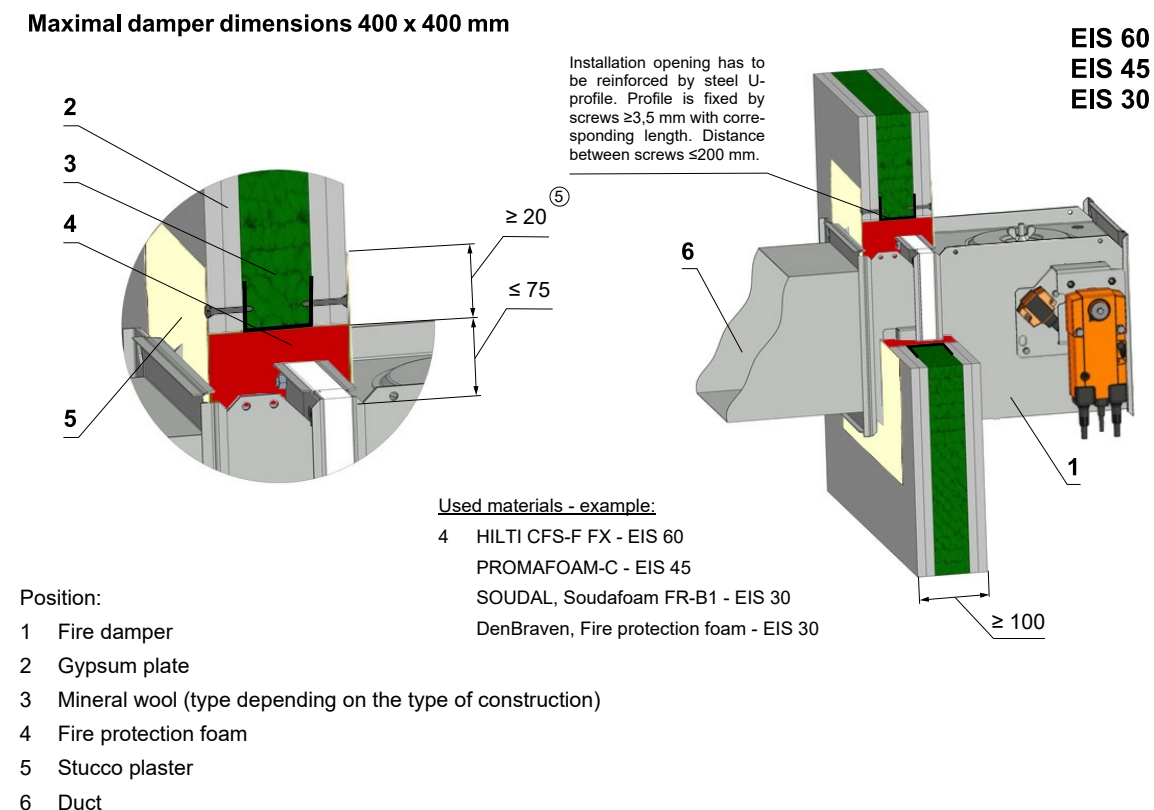
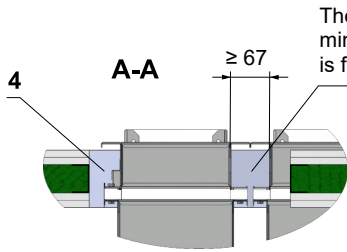
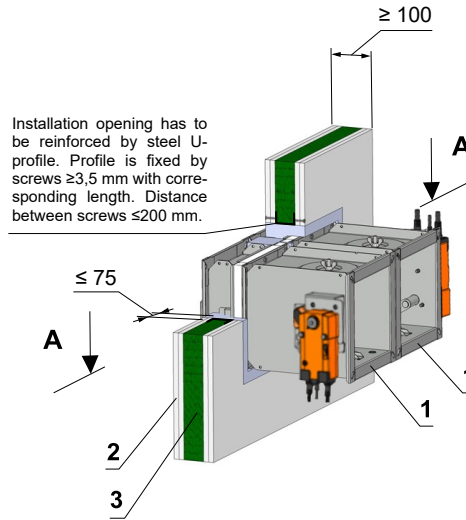


Fig. 48 Gypsum wall construction - battery - mortar or gypsum

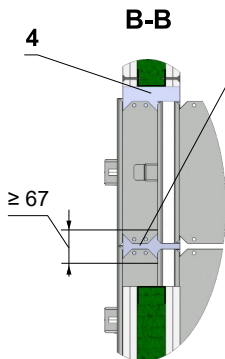
EIS 90



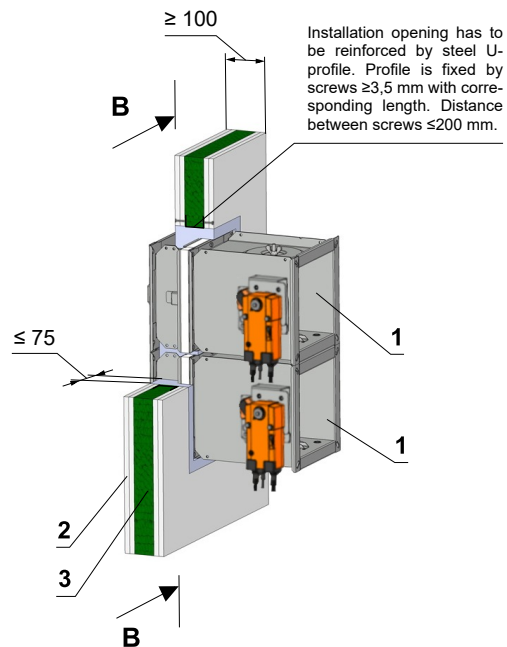
The gap 67 mm between dampers can be filled by mineral stone wool min. density 140 kg/m<sup>3</sup>. Wool is fixed to damper body by fire protection mastic.



Installation opening has to be reinforced by steel U-profile. Profile is fixed by screws  $\geq 3,5$  mm with corresponding length. Distance between screws  $\leq 200$  mm.



The gap 67 mm between dampers can be filled by mineral stone wool min. density 140 kg/m<sup>3</sup>. Wool is fixed to damper body by fire protection mastic.



Installation opening has to be reinforced by steel U-profile. Profile is fixed by screws  $\geq 3,5$  mm with corresponding length. Distance between screws  $\leq 200$  mm.

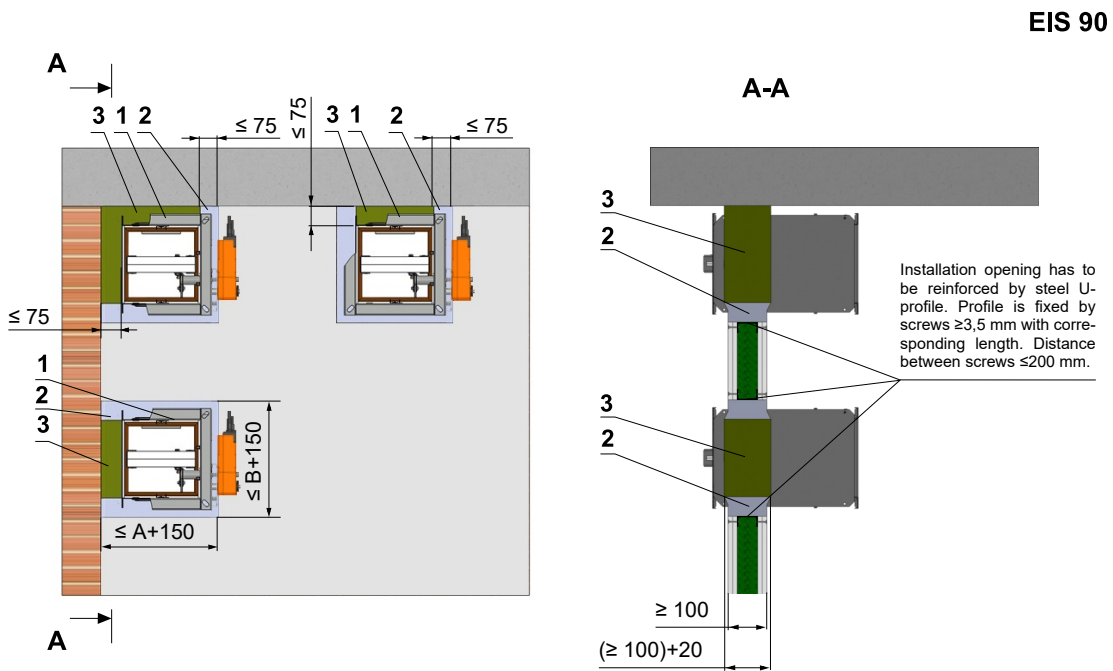
**Position:**

- 1 Fire damper
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Mortar or gypsum

**Notice:**

- Installation opening for each damper has minimal dimensions  $a \times b = (A+100) \times (2 \times B + 100)$  mm or  $(2 \times A + 100) \times (B + 100)$  mm
- Gap between damper and construction is filled by mortar or gypsum
- Distance between dampers 60 mm
- Flange to flange connection - Up to four dampers can be installed

Fig. 49 Gypsum wall construction - installation next to wall - mortar or gypsum and mineral wool



Position:

- 1 Fire damper
- 2 Mortar or gypsum
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)

**Notice:**

- Gap between damper and construction is filled by mortar or gypsum and mineral wool
- Wool is fixed to damper body and construction by fire protection mastic.
- Mineral wool thickness = construction thickness + 20 mm or 50 mm
- Installation is valid for ceiling construction

Fig. 50 Gypsum wall construction - stuffing box, fire protection mastic and cement lime plate

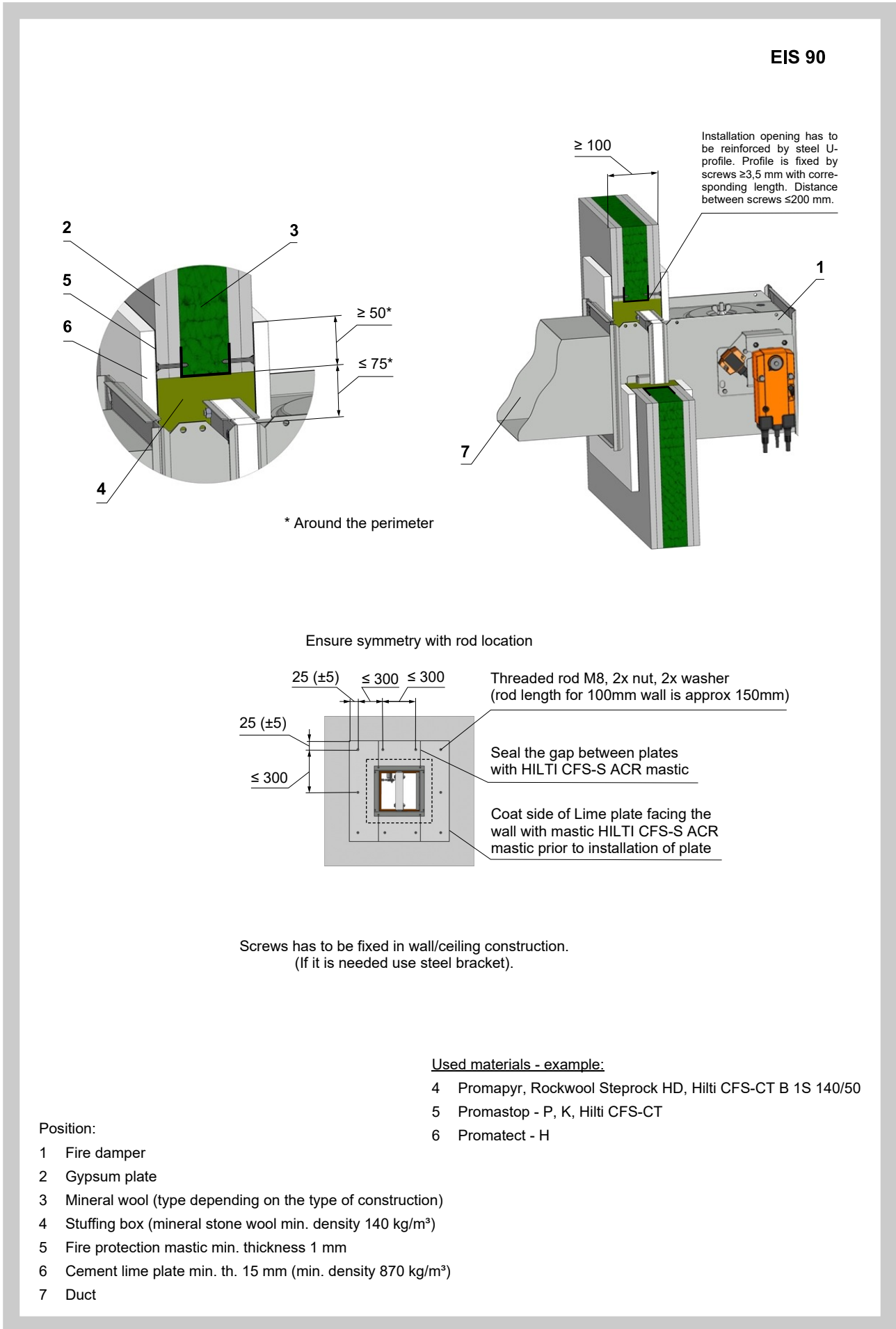
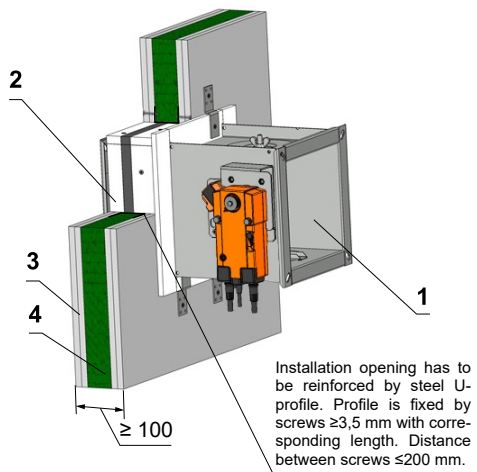


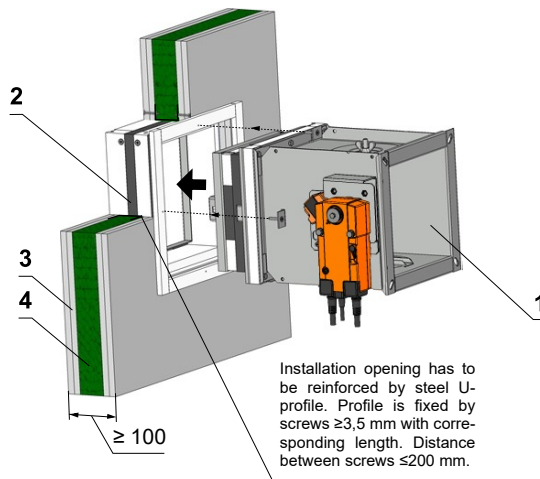
Fig. 51 Gypsum wall construction - installation frame E1, E3, E4

EIS 90

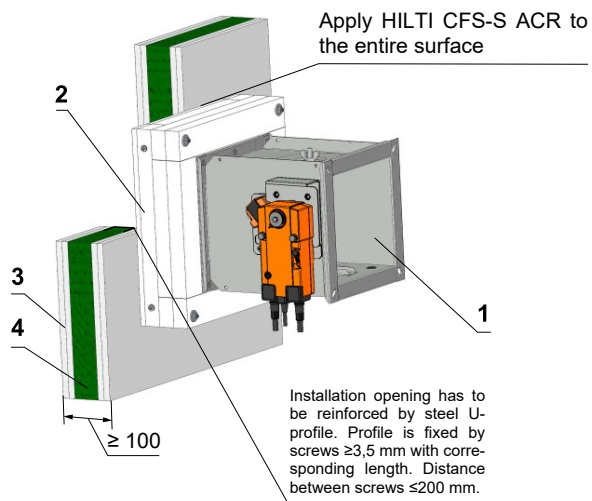
Installation frame E1



Installation frame E3



Installation frame E4

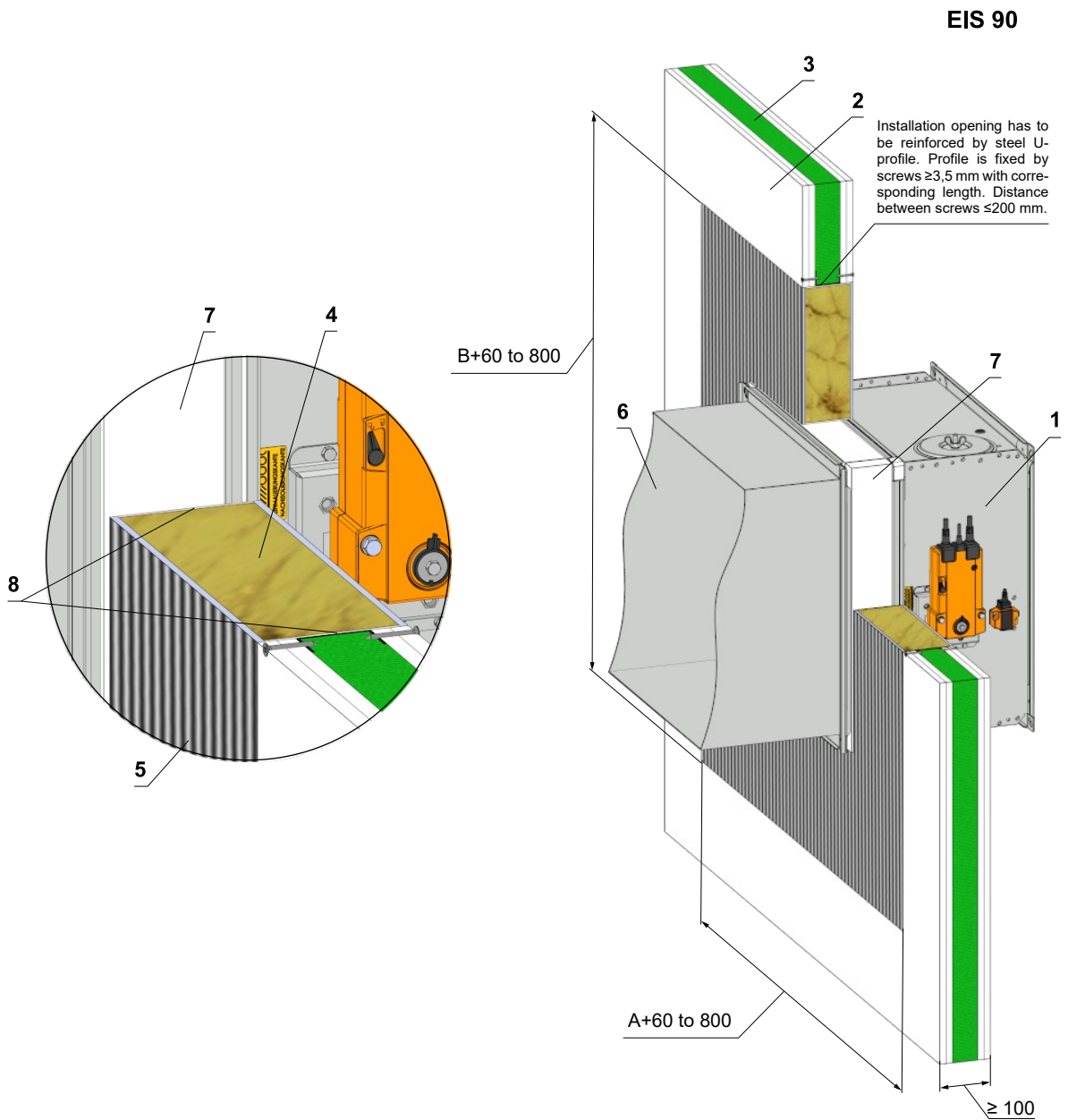


Position:

- 1 Fire damper
- 2 Installation frame
- 3 Gypsum plate
- 4 Mineral wool (type depending on the type of construction)

Installation details see chapter 8

Fig. 52 Gypsum wall construction - Weichschott / Ablative Coated Batt



Position:

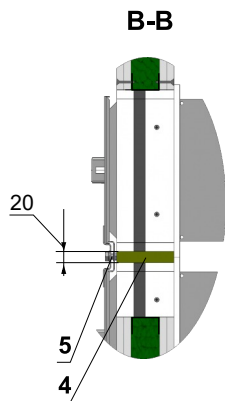
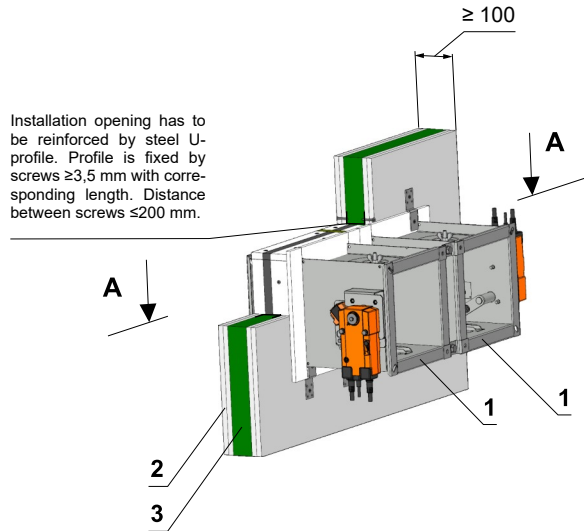
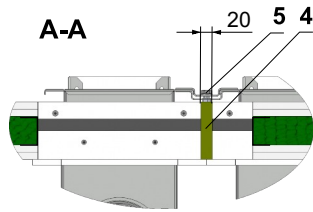
- 1 Fire damper
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Fire resistant board
- 5 Fire stop coating thickness 1 mm
- 6 Duct
- 7 Protective cladding boards - (not part of the damper) but must be used as part of the penetration filling. It can be ordered from MANDÍK as an accessory.
- 8 Fire resistant mastic - fill the gap on both sides of the fire separation construction and around the perimeter of penetration and damper body.

Used materials - example:

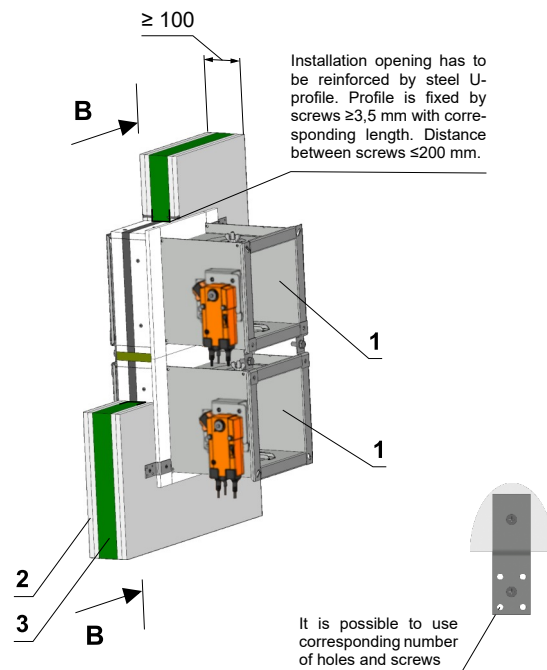
- 4 Hilti CFS-CT B 1S 140/50
- 5 Hilti CFS-CT
- 7 PROMATECT-H, th. 35 mm
- 8 Hilti CFS-S ACR

Fig. 53 Gypsum wall construction - battery - installation frame E1

EIS 90



A = max. 1000 mm



It is possible to use corresponding number of holes and screws

Holders No. X = (2xZB1) + (2xZH1)  
Screws No. Y = 2xX

Dimensions	Number ZB1	Number ZH1
A1, B1 ≤ 400	1	1
400 < A1, B1 ≤ 800	2	2
800 < A1 ≤ 1200	3	3
1200 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5
2000 < A1 ≤ 2400	6	6
2400 < A1 ≤ 2800	7	7
2800 < A1 ≤ 3000	8	8

A1 = A or A1 = 2xA  
B1 = B or B1 = 2xB

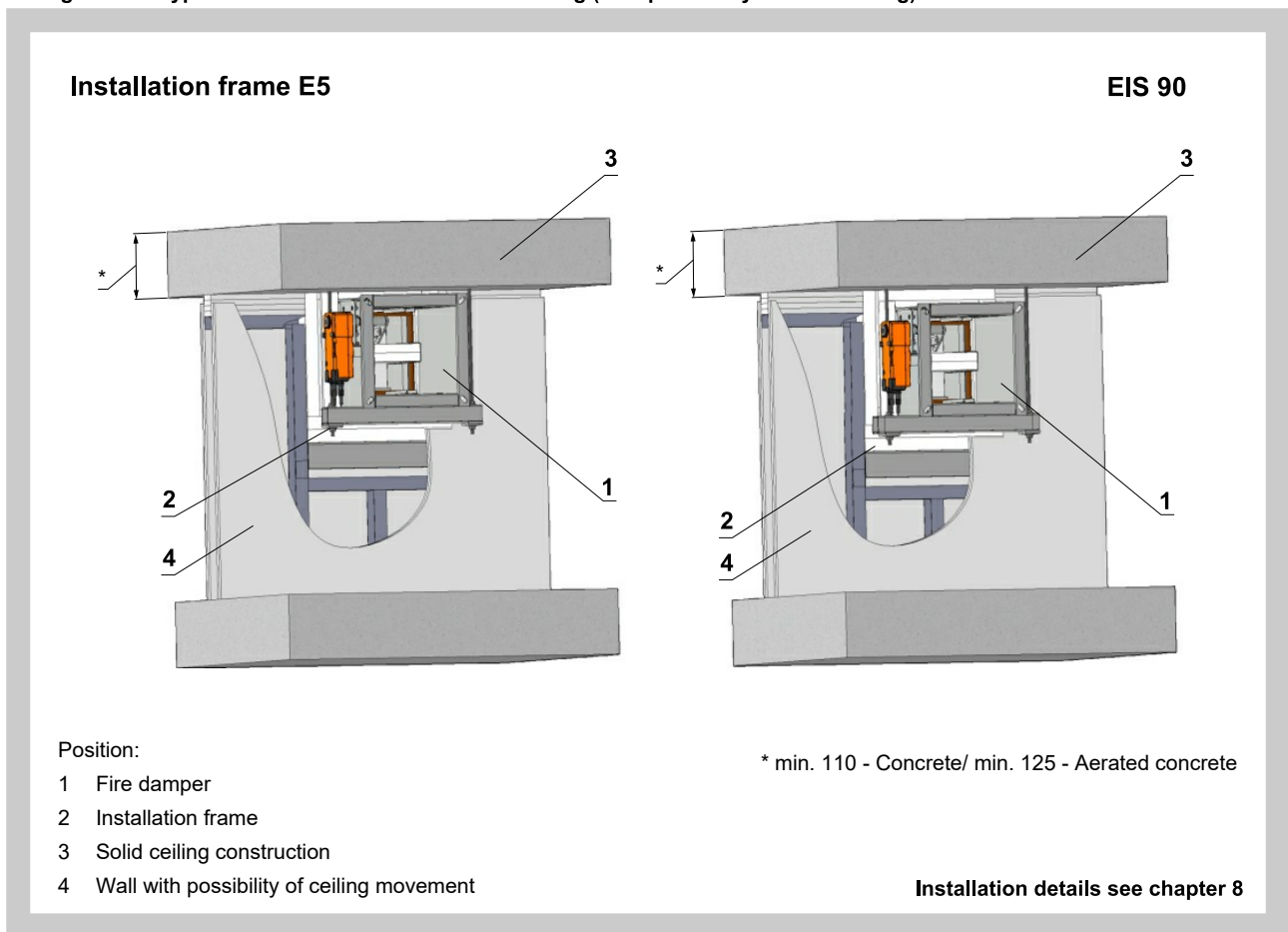
Position:

- 1 Fire damper with installation frame E1
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 5 Flange connection

Notice:

- Installation opening dimensions:  
a x b = (2x(A + 85<sup>+3</sup> mm) + 20 mm) x (B + 85<sup>+3</sup> mm)  
or a x b = (A + 85<sup>+3</sup> mm) x (2x(B + 85<sup>+3</sup> mm) + 20 mm)
- Gap between frame and damper body and frame and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to four dampers can be installed

Fig. 54 Gypsum wall construction - flexible ceiling (with possibility to move/to sag) - installation frame E5

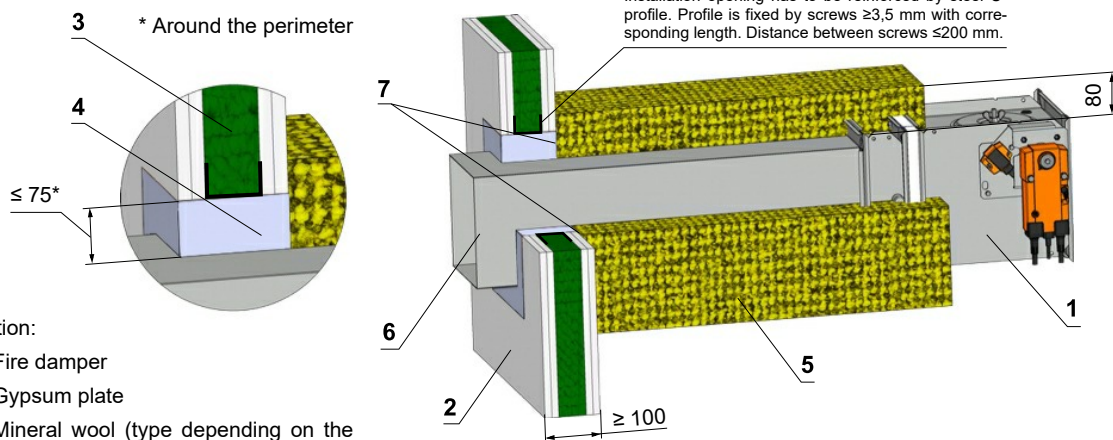


6.5. Installation outside gypsum wall construction

Fig. 55 Outside gypsum wall construction - mineral wool - mortar or gypsum

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 60



Position:

- 1 Fire damper
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Mortar or gypsum
- 5 Insulation board made of stone wool, with a surface treatment of aluminum foil, density 66 kg/m<sup>3</sup>
- 6 Duct
- 7 Apply ISOVER Protect BSK glue on the insulation and stick it to the fire separation construction \*\*\*

Used materials - example:\*\*

- 5 Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1

\*\* Insulation materials can be replaced by another approved fire sealing system with equivalent properties.  
The maximum distance of the fire damper from the structure is not limited.

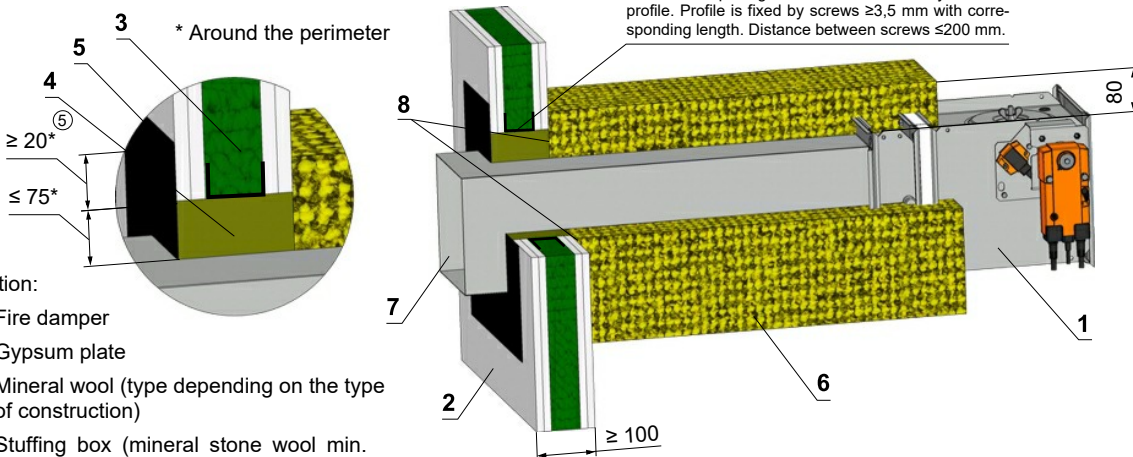
\*\*\* When installing the insulation, follow the ISOVER manufacturer's instructions.

The duct at the point of penetration does not have to be anchored to the fire wall construction, see chapter 9.

Fig. 56 Outside gypsum wall construction - mineral wool - stuffing box and fire protection mastic

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 60



Position:

- 1 Fire damper
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 5 Fire protection mastic min. thickness 1 mm
- 6 Insulation board made of stone wool, with a surface treatment of aluminum foil, density 66 kg/m<sup>3</sup>
- 7 Duct
- 8 Apply ISOVER Protect BSK glue on the insulation and stick it to the fire separation construction \*\*\*

Used materials - example:\*\*

- 4 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 5 Promastop - P, K, Hilti CFS-CT
- 6 Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1

\*\* Insulation materials can be replaced by another approved fire sealing system with equivalent properties.  
The maximum distance of the fire damper from the structure is not limited.

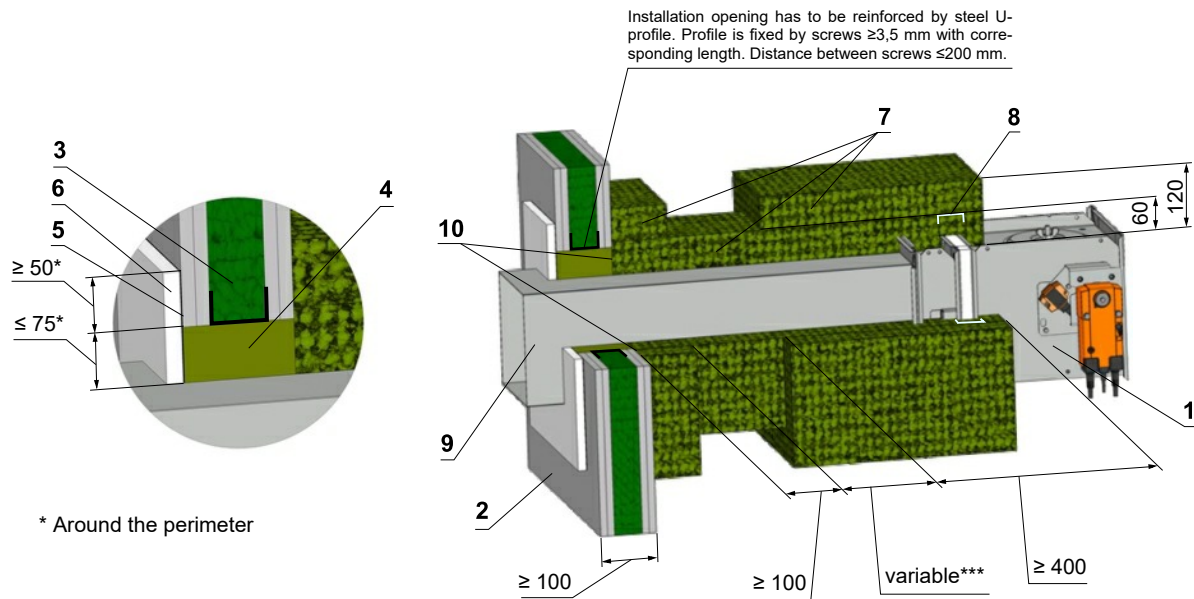
\*\*\* When installing the insulation, follow the ISOVER manufacturer's instructions.

The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

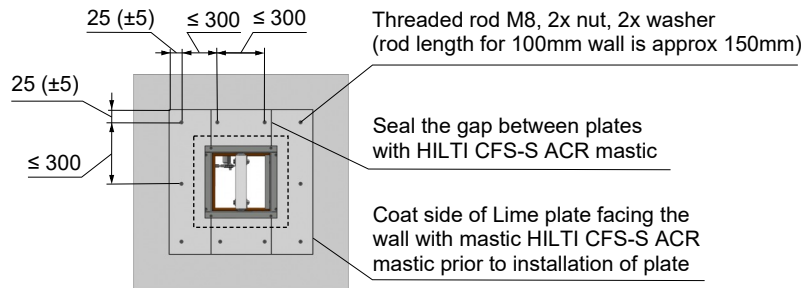
Fig. 57 Outside gypsum wall construction - mineral wool, stuffing box, fire protection mastic and cement lime plate

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 90



Ensure symmetry with rod location



Screws has to be fixed in wall/ceiling construction.  
(If it is needed use steel bracket).

Position:

- 1 Fire damper
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 5 Fire protection mastic min. thickness 1 mm
- 6 Cement lime plate min. thickness 15 mm (min. density 870 kg/m<sup>3</sup>)
- 7 Stone wool with one side stitched wire fencing (min. density 105 kg/m<sup>3</sup>), thickness 60 mm
- 8 Steel sheet reinforcement U25x40x25 placed between layers of stone wool \*\*\*\*
- 9 Duct
- 10 Apply Rockwool Firepro glue on the insulation and stick it to the fire separation construction \*\*\*\*\*

Used materials - example:\*\*

- 4 Promapyr. Rockwool Steprock HD. Hilti CFS-CT C 1S 140/50
- 5 Promastop - P, K, Hilti CFS-CT
- 6 Promatect - H
- 7 Rockwool Conlit Ductrock EIS 90, th. 60 mm

\*\* Stuffing box, fire protection mastic, cement lime plate and insulation materials can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

\*\*\* Depends on the distance of the flap from the construction, when the maximum distance from the construct is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

\*\*\*\* For installation methods outside a construction, when the damper size is A ≥ 800 mm, it is necessary to use the VRM-Q reinforcing frame, see Fig.80.  
Assembly - reinforcing frame U25x40x25 see Fig.81.

\*\*\*\*\* When installing the insulation, follow the Rockwool manufacturer's instructions.

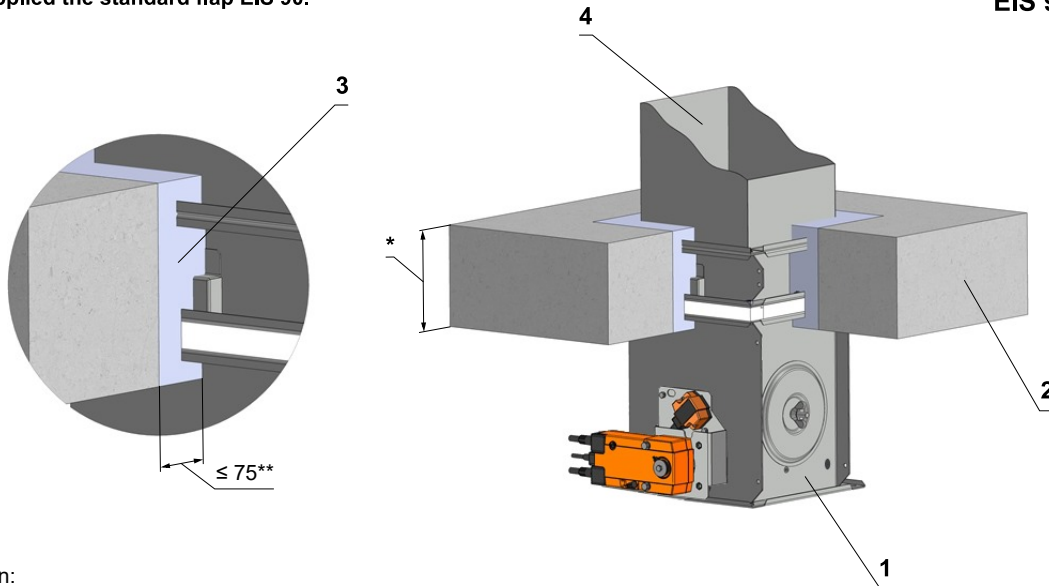
The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

6.6. Installation in solid ceiling construction

Fig. 58 Solid ceiling construction - mortar or gypsum

\*\*\* The requirement to EIS 120 must be specified in the order alone. Without specification is supplied the standard flap EIS 90.

EIS 120\*\*\*  
EIS 90



Position:

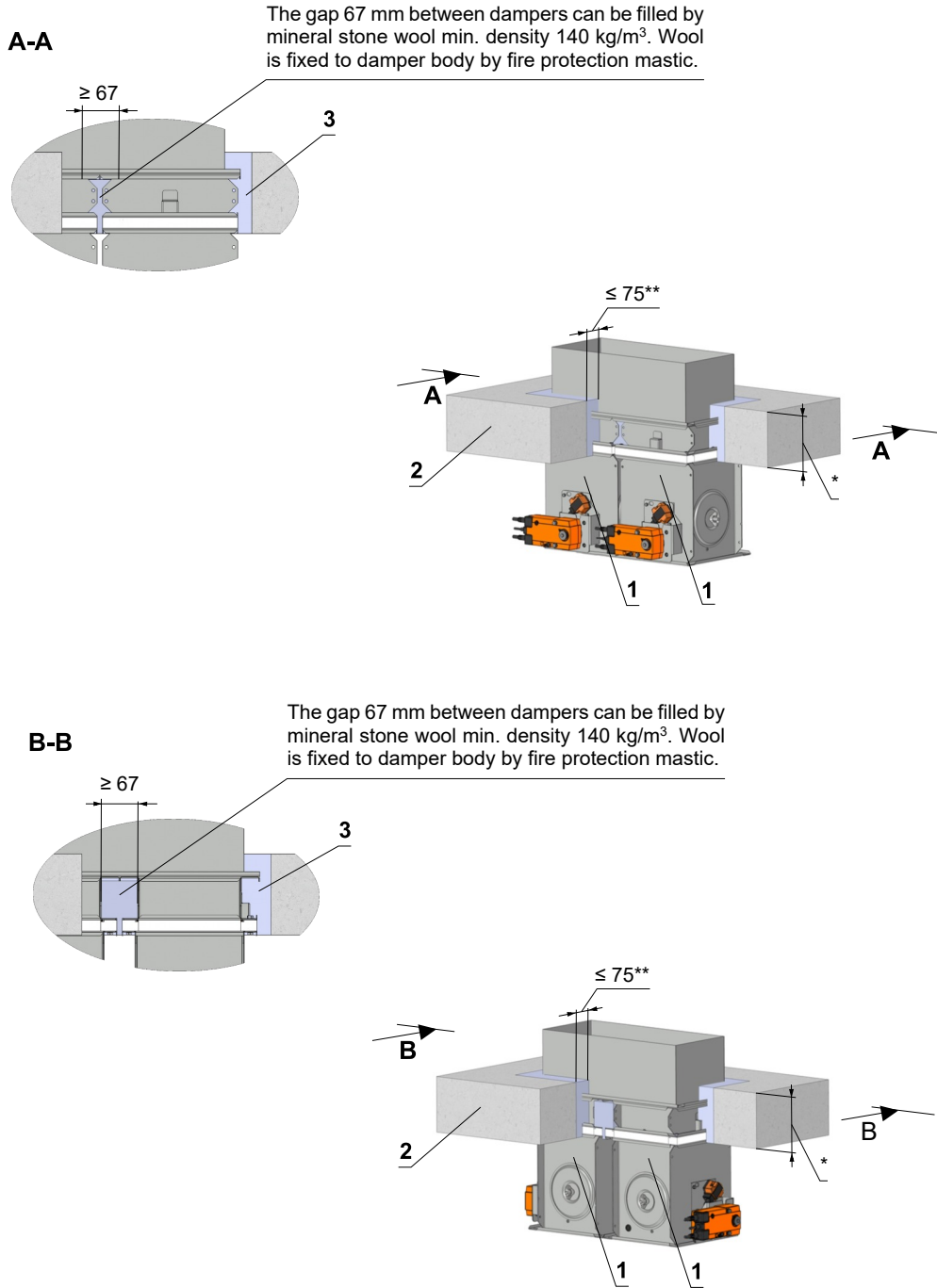
- 1 Fire damper
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Duct

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

\*\* Around the perimeter

Fig. 59 Solid ceiling construction - battery - mortar or gypsum

EIS 90



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

\*\* Around the perimeter

**Notice:**

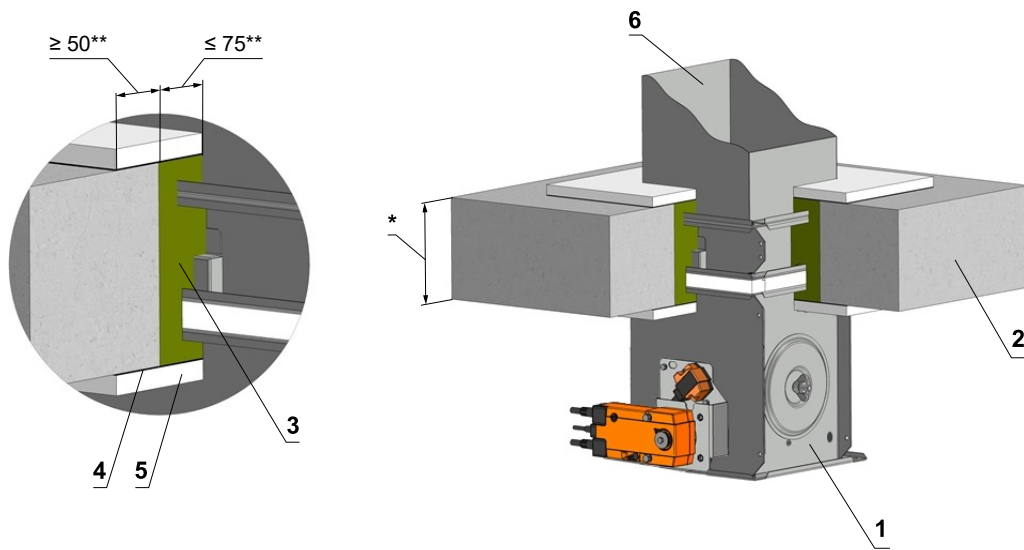
- Installation opening for each damper has minimal dimensions  $a \times b = (A+100) \times (2 \times B + 100)$  mm or  $(2 \times A + 100) \times (B + 100)$  mm
- Gap between damper and construction is filled by mortar or gypsum
- Distance between dampers 60 mm
- Flange to flange connection - Up to four dampers can be installed

**Position:**

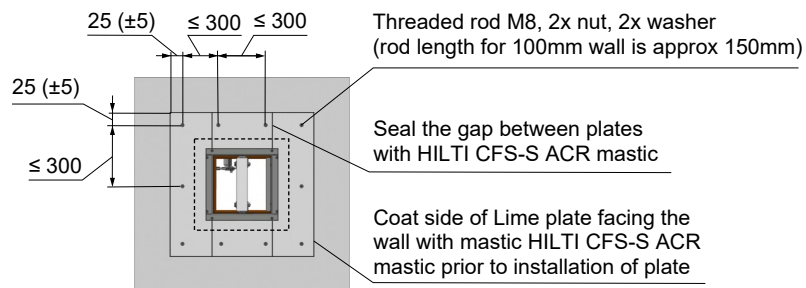
- 1 Fire damper
- 2 Solid ceiling construction
- 3 Mortar or gypsum

Fig. 60 Solid ceiling construction - stuffing box, fire protection mastic and cement lime plate

EIS 90



Ensure symmetry with rod location



Screws has to be fixed in wall/ceiling construction.  
(If it is needed use steel bracket).

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

\*\* Around the perimeter

Used materials - example:

- 3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 4 Promastop - P, K, Hilti CFS-CT
- 5 Promatect - H

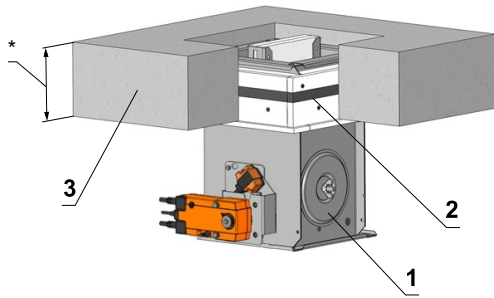
Position:

- 1 Fire damper
- 2 Solid ceiling construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Cement lime plate min. thickness 15 mm, min. density 870 kg/m<sup>3</sup>
- 6 Duct

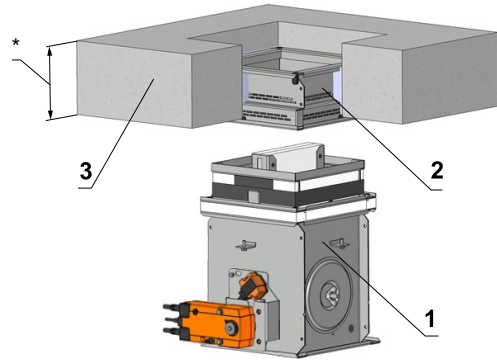
Fig. 61 Solid ceiling construction - installation frame E1, E2, E4

EIS 90

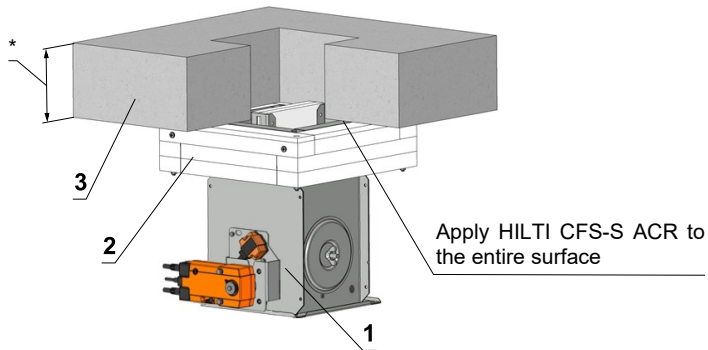
Installation frame E1



Installation frame E2



Installation frame E4



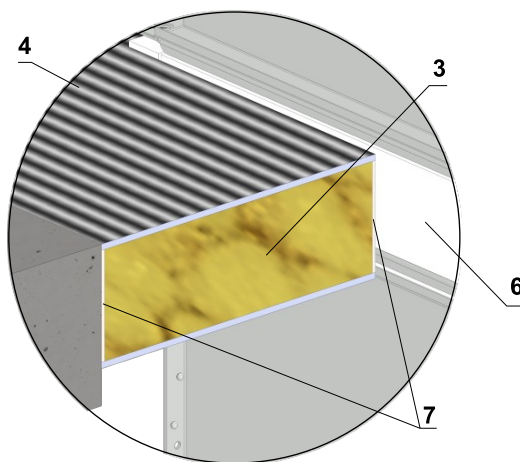
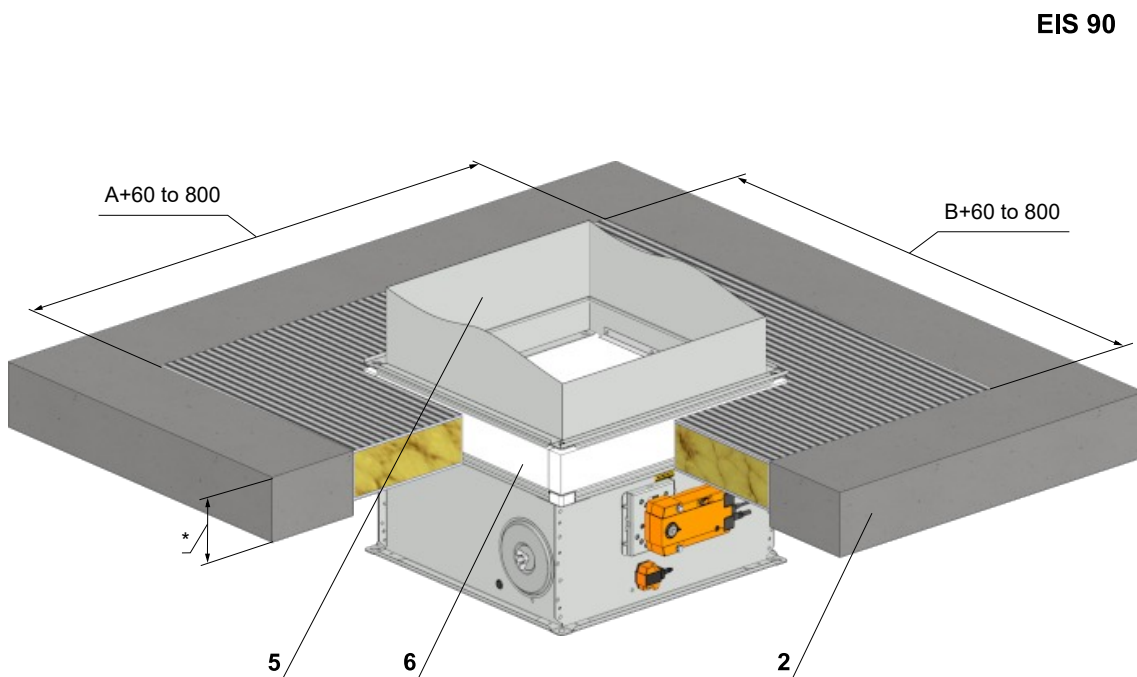
Position:

- 1 Fire damper
- 2 Installation frame
- 3 Solid ceiling construction

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

Installation details see chapter 8

Fig. 62 Solid ceiling construction - Weichschott / Ablative Coated Batt



Position:

- 1 Fire damper
- 2 Solid ceiling construction
- 3 Fire resistant board
- 4 Fire stop coating thickness 1 mm
- 5 Duct
- 6 Protective cladding boards - (not part of the damper) but must be used as part of the penetration filling. It can be ordered from MANDÍK as an accessory.
- 7 Fire resistant mastic - fill the gap on both sides of the fire separation construction and around the perimeter of penetration and damper body.

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

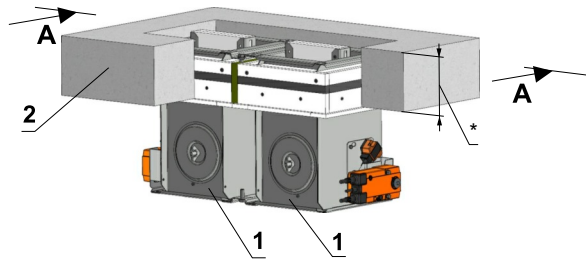
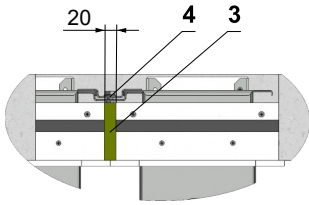
Used materials - example:

- 3 Hilti CFS-CT B 1S 140/50
- 4 Hilti CFS-CT
- 6 PROMATECT-H th. 35 mm
- 7 Hilti CFS-S ACR

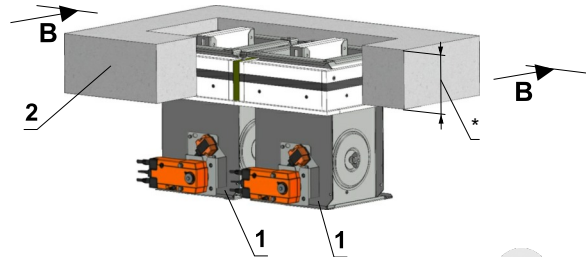
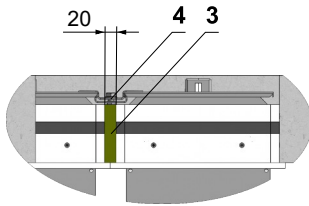
Fig. 63 Solid ceiling construction - battery - installation frame E1

EIS 90

A-A

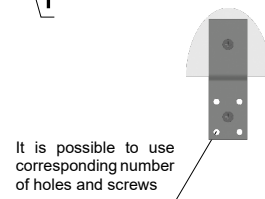


B-B



B = max. 1000 mm

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



Holders No. X = (2xZB1) + (2xZH1)  
Screws No. Y = 2xX

Dimensions	Number ZB1	Number ZH1
A1, B1 ≤ 400	1	1
400 < A1, B1 ≤ 800	2	2
800 < A1 ≤ 1200	3	3
1200 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5
2000 < A1 ≤ 2400	6	6
2400 < A1 ≤ 2800	7	7
2800 < A1 ≤ 3000	8	8

A1 = A or A1 = 2xA  
B1 = B or B1 = 2xB

Position:

- 1 Fire damper with installation frame E1
- 2 Solid ceiling construction
- 3 Mineral stone wool min. density 140 kg/m<sup>3</sup>
- 4 Flange connection

**Notice:**

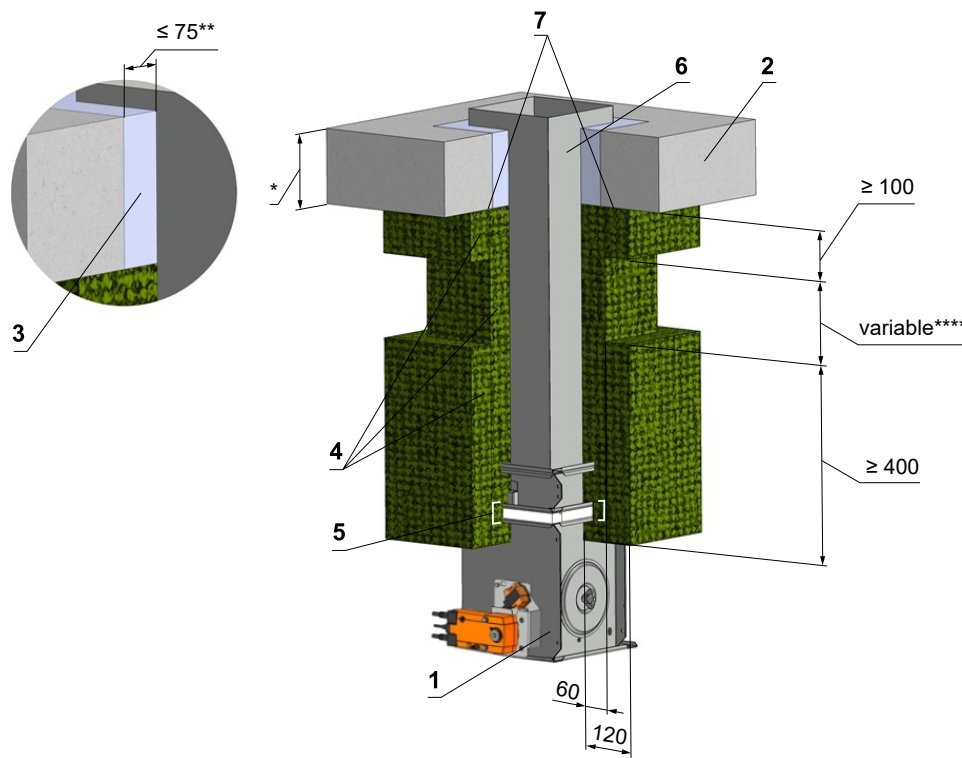
- Installation opening dimensions:  
a x b = (2x(A + 85<sup>+3</sup> mm) + 20 mm) x (B + 85<sup>+3</sup> mm)  
or a x b = (A + 85<sup>+3</sup> mm) x (2x(B + 85<sup>+3</sup> mm) + 20 mm)
- Gap between frame and damper body and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to four dampers can be installed

6.7. Installation outside solid ceiling construction

Fig. 64 Outside solid ceiling construction - mineral wool - mortar or gypsum

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.

EIS 90



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

\*\* Around the perimeter

Used materials - example:\*\*\*

4 Rockwool Conlit Ductrock EIS 90, th. 60 mm

\*\*\* Stuffing box, fire protection mastic, cement lime plate and insulation materials can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

\*\*\*\* Depends on the distance of the flap from the construction, when the maximum distance from the construct is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

\*\*\*\*\* For installation methods outside a construction, when the damper size is  $A \geq 800$  mm, it is necessary to use the VRM-Q reinforcing frame, see Fig.80. Assembly - reinforcing frame U25x40x25 see Fig.81.

Position:

- 1 Fire damper
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Stone wool with one side stitched wire fencing (min. density 105 kg/m<sup>3</sup>), thickness 60 mm
- 5 Steel sheet reinforcement U25x40x25 placed between layers of stone wool \*\*\*\*\*
- 6 Duct
- 7 Apply Rockwool Firepro glue on the insulation and stick it to the fire separation construction \*\*\*\*\*

\*\*\*\*\* When installing the insulation, follow the Rockwool manufacturer's instructions.

The duct at the point of penetration does not have to be anchored to the fire wall construction, see chapter 9.

Fig. 65 Outside solid ceiling construction - concrete

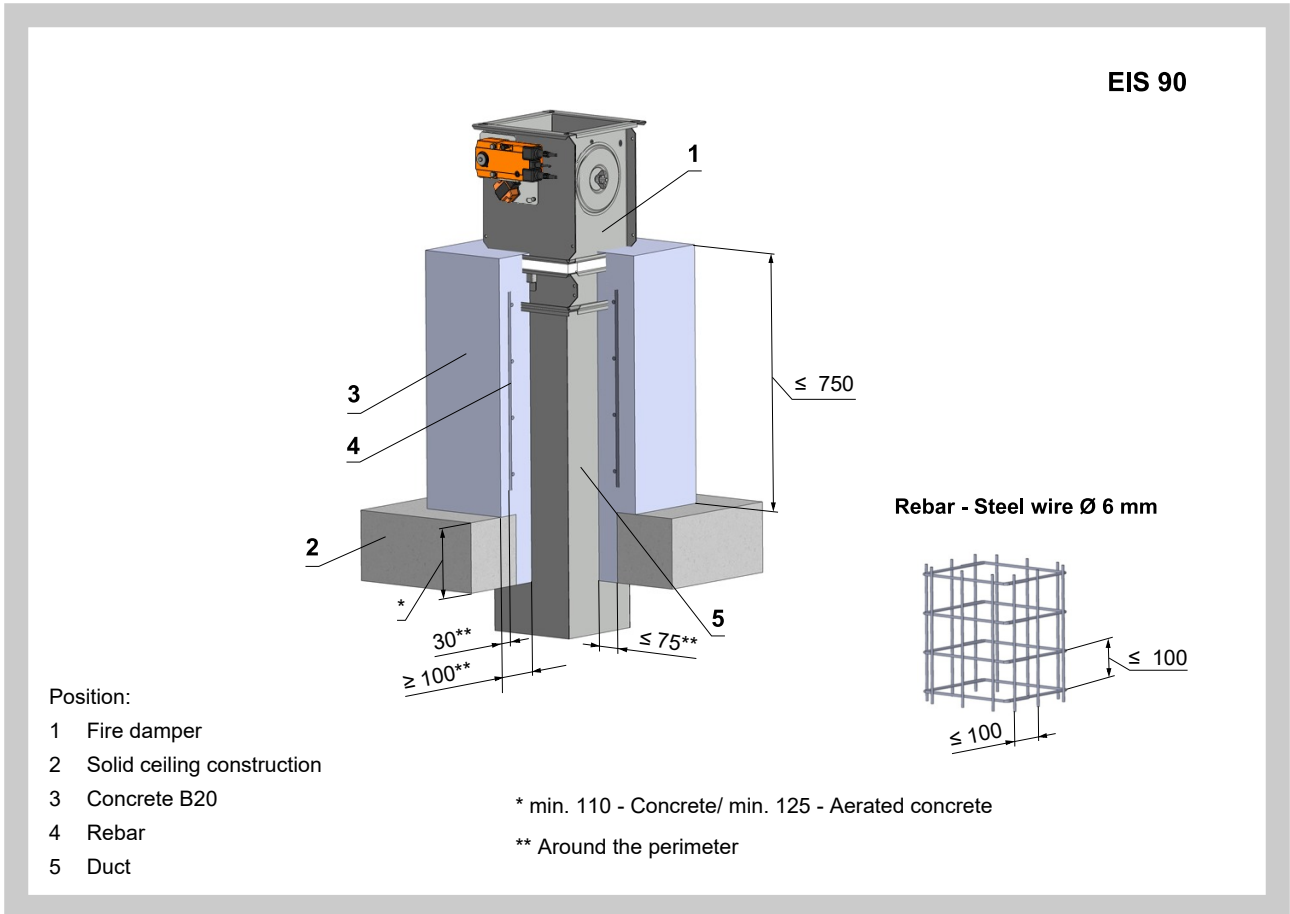


Fig. 66 Outside solid ceiling construction - concrete - installation frame E4

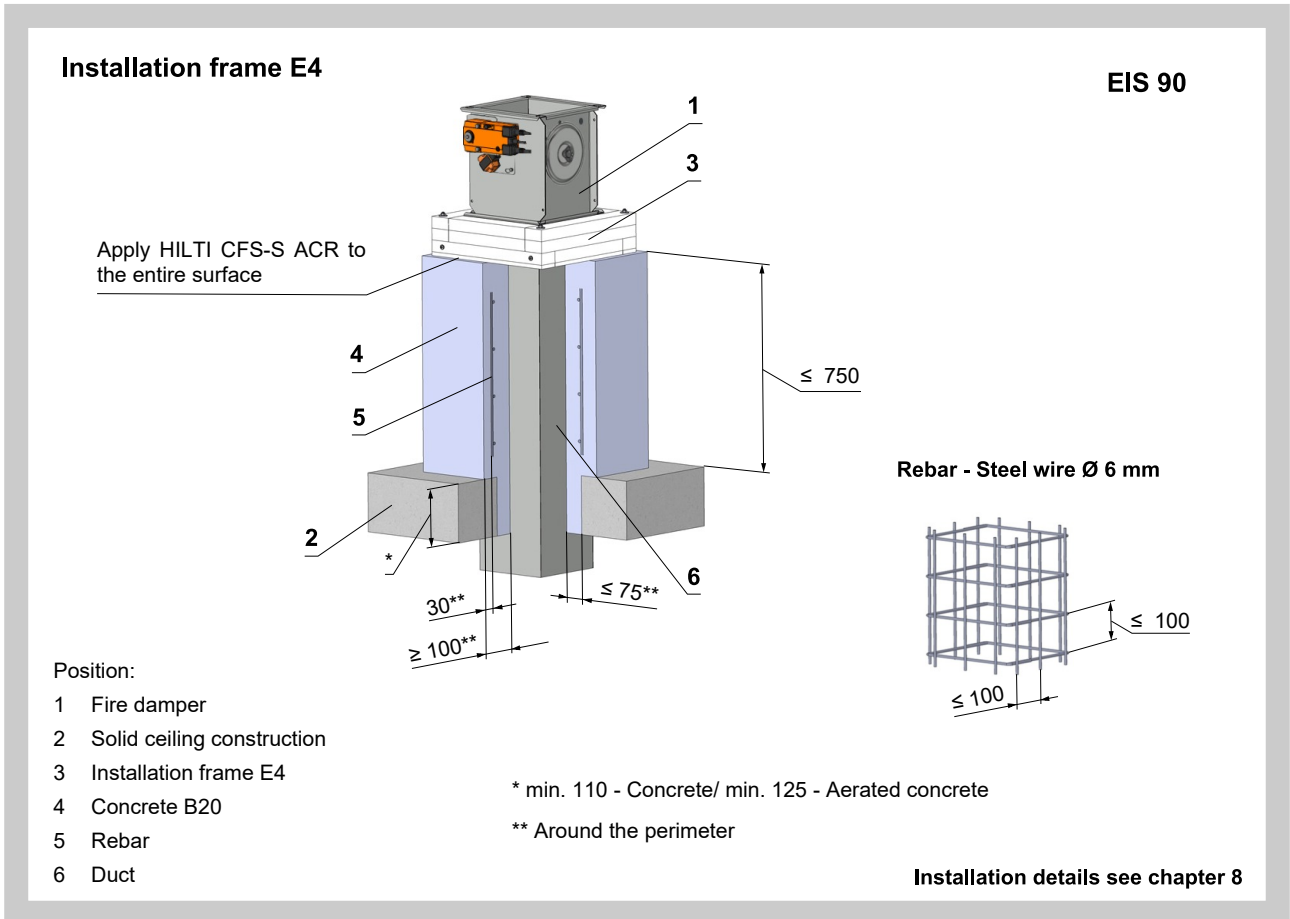
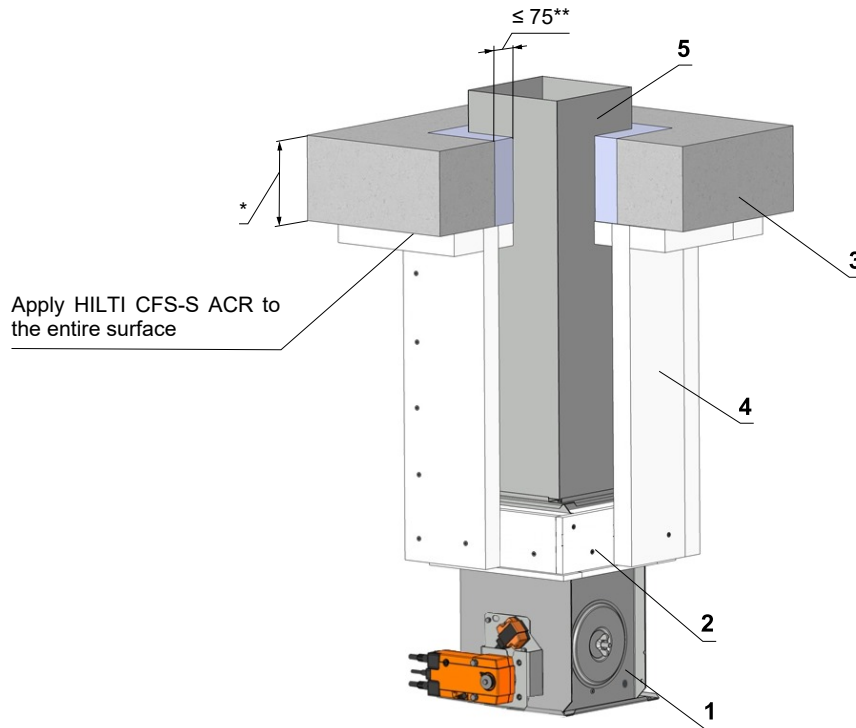


Fig. 67 Outside solid ceiling construction - installation frame E6 with cement lime plates

Installation frame E6

EIS 90

Minimum and maximum distance between the wall and fire damper when installation remote from the wall is unlimited.



Position:

- 1 Fire damper
- 2 Installation frame E6
- 3 Solid ceiling construction
- 4 Cement lime plate - all parts are glued with glue Promat K84 and secured by screws.
- 5 Duct

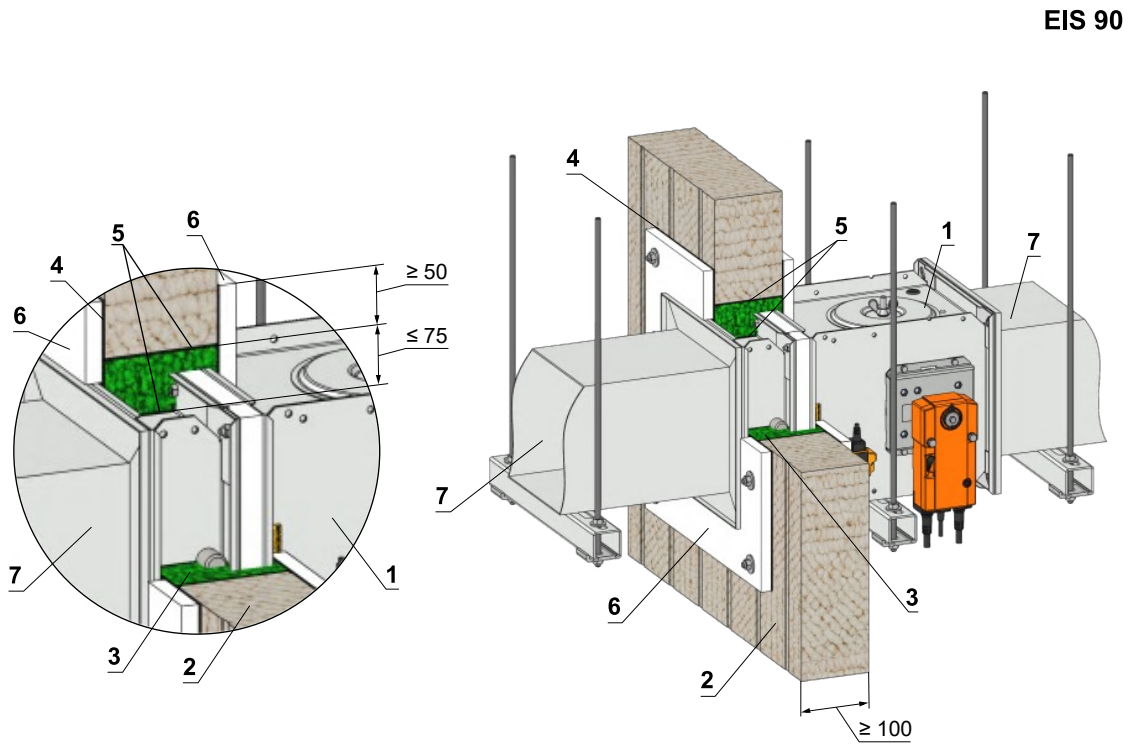
\* min. 110 - Concrete/ min. 125 - Aerated concrete

\*\* Around the perimeter

**Installation details see chapter 8.**

6.8. Installation in sandwich wall construction

Fig. 68 Sandwich wall construction - stuffing box and fire protection mastic, coating and cement lime plate



Screws has to be fixed in wall/ceiling construction.  
(If it is needed use steel bracket).

Position:

- 1 Fire damper
- 2 Sandwich wall construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection coating th. 1 mm
- 5 Fire protection mastic th. 1 mm
- 6 Cement lime plate min. thickness 15 mm min. density 870 kg/m<sup>3</sup>
- 7 Duct

Used materials - example:

- 2 Paroc AST S th. 100 mm or RUUKKI SPB W th. 100 mm
- 3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
- 4 Promastop - P, K, Hilti CFS-CT
- 5 HILTI CFS-S ACR

## 7. Shaft walls

### 7.1. Shaft wall Rigips

Shaft wall is a vertical, non-bearing partition construction meeting the double-sided fire requirements. The shaft wall can be mounted only from one side. No mineral insulation is used in the construction.

First of all, the shaft wall structure must be laid out. Apart from other vertical constructions, the perimeter sections must be fitted with connection sealing made from A1 or A2 fire reaction materials (for instance floor strips Orsil N/PP). The perimeter sections must be anchored using steel plugs  $\varnothing$  6 mm (for example DN6 or ZHOP) with 500 mm span.

Sheathing is carried out using two layers of Glasroc F boards Ridurit with 20 mm thickness, the boards are oriented horizontally. First sheathing layer is fixed with TN 212 screws in spacing 200mm to the support structure. The boards are mounted to tight butt joints without need of cementing. The second sheathing layer is screwed to the first sheathing layer using screws Rodurit in square net 250 mm. Reset of joints of the first and second layer of Ridurit sheathing is set to 600 mm vertically and 300 mm horizontally.

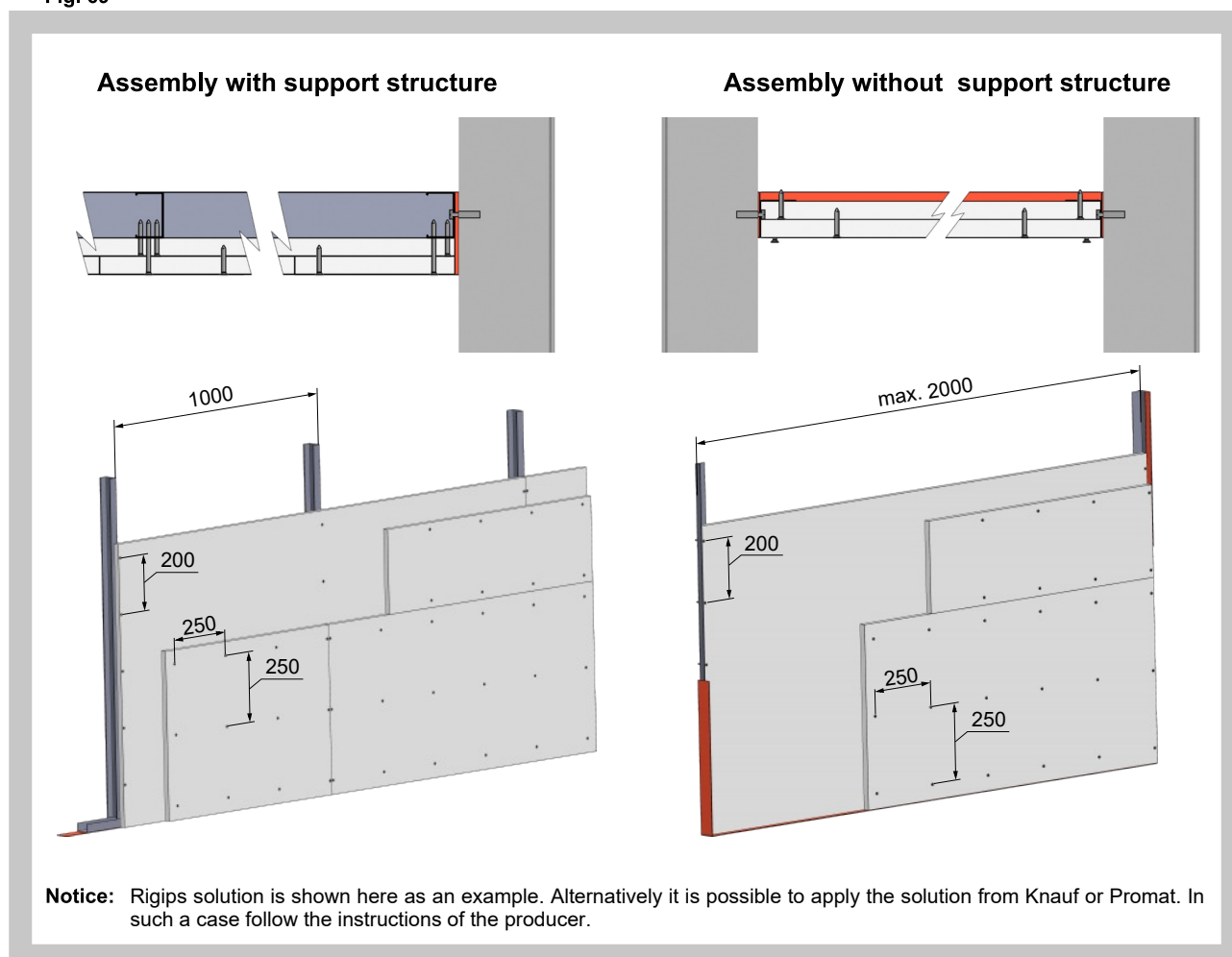
#### Assembly with support structure

Vertical intermediate R-CW sections are fixed in 1000 mm layout spacing between R-UW sections and vertical perimeter R-CW sections.

#### Assembly without support structure

Maximum width of the shaft wall is 2 metres in this case (board length). Steel squares made from steel galvanized plate metal 40/20/1 mm are used as perimeter sections, they are anchored to bearing wall using  $\varnothing$  6 mm steel plugs (for example DN6 or ZHOP) with 500 mm spacing.

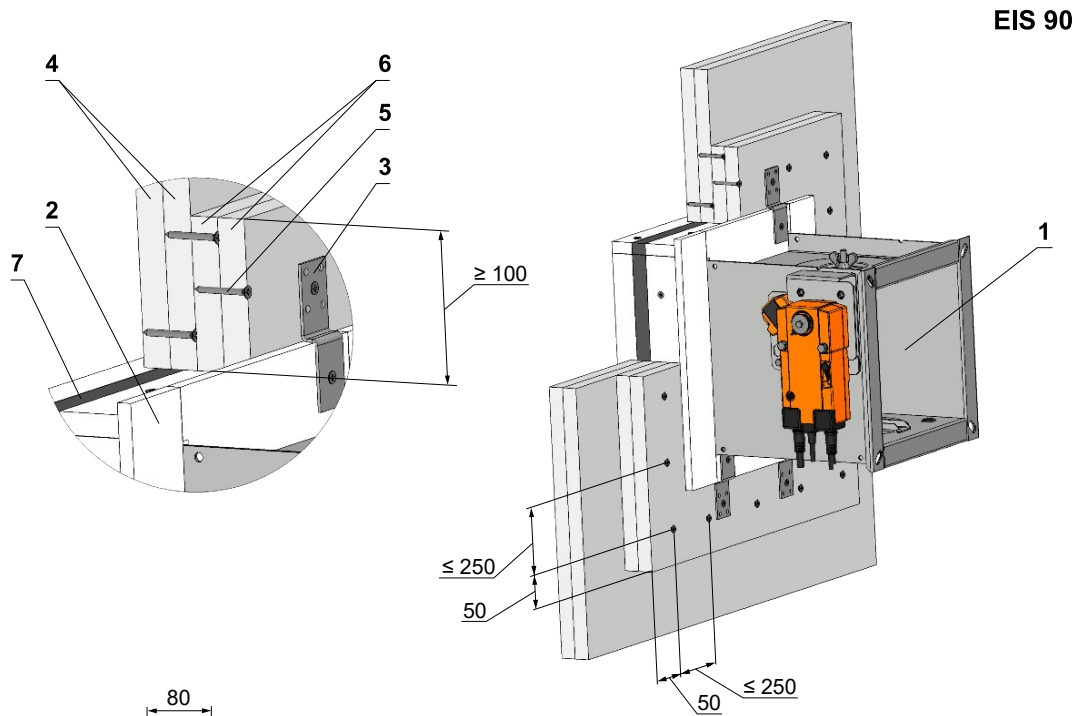
Fig. 69



**Notice:** Rigips solution is shown here as an example. Alternatively it is possible to apply the solution from Knauf or Promat. In such a case follow the instructions of the producer.



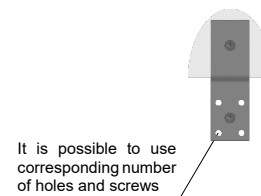
Fig. 71 Shaft wall Rigips - installation frame E1



EIS 90

**Installation opening:**

$a \times b = (A + 105^{+3}mm) \times (B + 105^{+3}mm)$



Holders No. X = (2xZB) + (2xZH)  
Screws No. Y = 2xX

Dimensions	Number ZB1	Number ZH1
A,B ≤ 400	1	1
400 < A,B ≤ 800	2	2
800 < B ≤ 1200	3	3
1200 < B ≤ 1500	4	4

**Position:**

- 1 Fire damper
- 2 Installation frame E1
- 3 Holder (including in installation frame E1 packing)
- 4 Fire resistant board
- 5 Screw
- 6 Additional fire resistant board
- 7 Fire resistant foam tape

Used materials - example:\*

- 4 Glasroc F Ridurit th. 20 mm
- 5 Screw Ridurit
- 6 Glasroc F Ridurit th. 20 mm
- 7 Promaseal XT

\* It is alternatively possible to use Knauf or Promat solution.

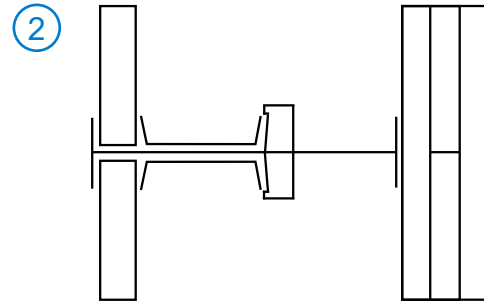
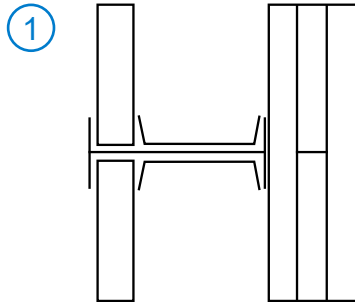
**Notice:** Gap between frame and thin shaft wall construction must be filled by glue (PROMAT K84).  
Dampers has to be suspended in an appropriate manner see chapter 9.

**7.2. EN Spec British Gypsum shaftwall construction EI 120**

ShaftWall provides a lightweight, fire resistant structure to protect elements in confined spaces wherever access is limited to one side only.

The system provides a protective structure which can be incorporated at an early stage of the construction without the need for scaffolding.

The structure is composed of steel profiles (Gypframe) and plasterboard (Gyproc). The Gyproc CoreBoard plasterboard is inserted into the profile on the side of the shaft, and the profiles are lined with Gyproc FireLine plasterboard on the visible side.



Gypframe 60, 70 or 92mm 'I' Stud framework with Gyproc CoreBoard between studs, secured by Gypframe Retaining Channel. 25mm Isover Acoustic Partition Roll (APR 1200) in cavity (optional). Lining boards to non-shaft side, see table 7.2.1. Studs at 600mm centres.

Gypframe 146 TI 90 Tabbed 'I' Stud framework with Gyproc CoreBoard between studs, secured by Gypframe Retaining Channel. 25mm Isover Acoustic Partition Roll (APR 1200) in cavity (optional). Lining boards to non-shaft side, see table 7.2.1. Studs at 600mm centres.

Tab. 7.2.1. Parameters of British Gypsum shaft walls

Detail	Partition thickness [mm]	Lining boards to non-shaft side		Max. partition height [mm]	Stud size [mm]	Sound insulation [R <sub>v</sub> ,dB]		Approx. weight [kg/m <sup>2</sup> ]
		Board type	Lining thickness [mm]			No Insulation	Sealed structure +25mm insulation	
<b>EI 120</b>								
①	107	Gyproc FireLine	3 x 15	4400	60	43	45	55
①	117	Gyproc FireLine	3 x 15	4400	70	43	45	55
②	139	Gyproc FireLine	3 x 15	6000	92	45	46	56
②	193	Gyproc FireLine	3 x 15	6000	146	49	50	58



8. Installation frames

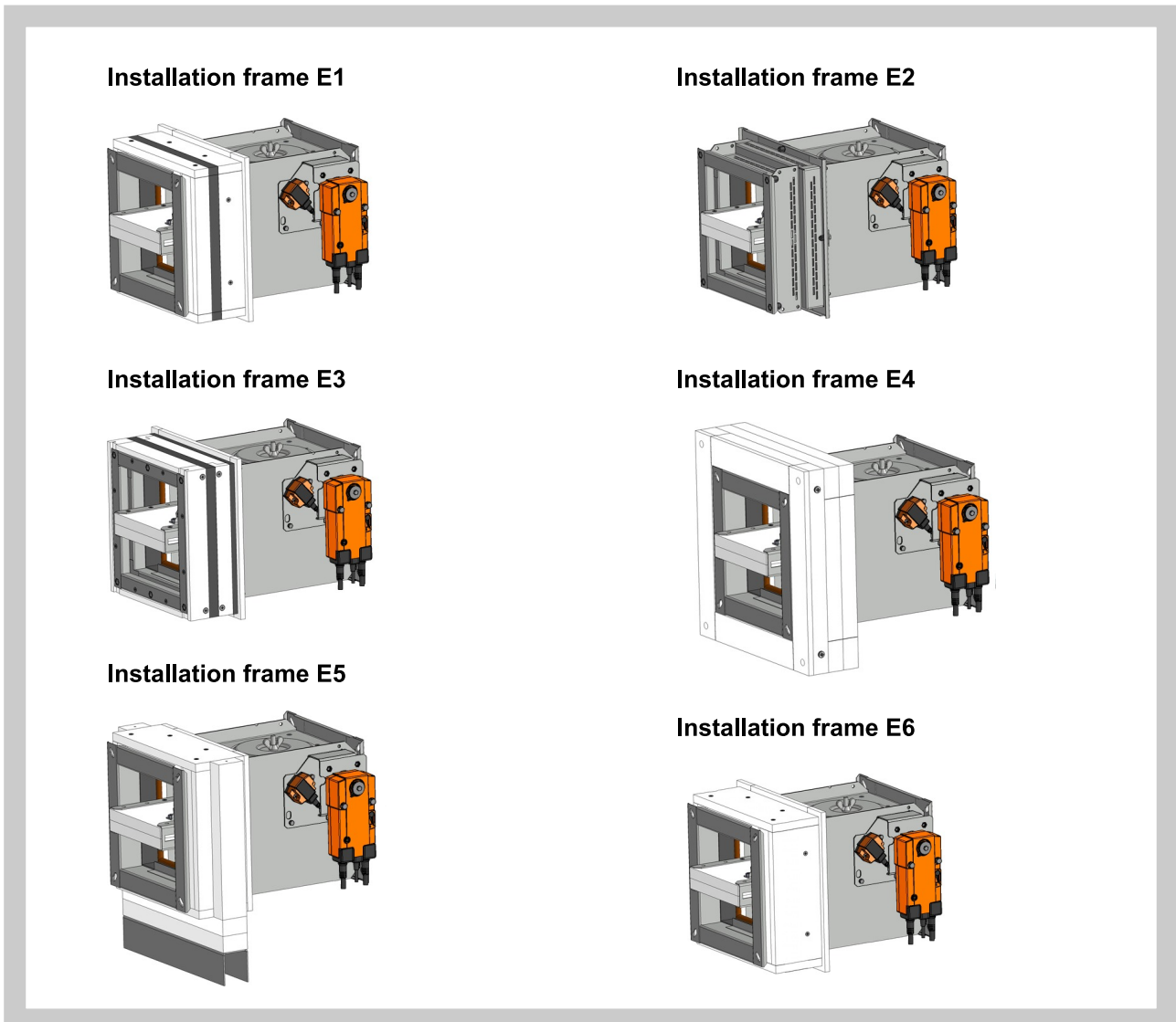
Tab. 8.1.1.

Frame / Material	Wall thickness [mm]								
	Solid wall construction			Solid ceiling construction			Plasterboard construction		
	In construction	Outside construction	On construction	In construction	Outside construction	On construction	In construction	Outside construction	On construction
E1 / Cement lime	≥100	-	-	≥110 / 125	-	-	≥100	-	-
E2 / Galvanized plate	≥100	-	-	≥110 / 125	-	-	-	-	-
E3 / Cement lime	-	-	-	-	-	-	≥100	-	-
E4 / Cement lime	-	-	≥100	-	≥110 / 125*	≥110 / 125	-	-	≥100
E5 / Cement lime	-	-	-	-	-	-	≥100**	-	-
E6 / Cement lime	-	≥100	-	-	≥110 / 125	-	-	-	-

\*With concrete

\*\*Ceiling with movement possibility

Fig. 73



Installation frame can be delivered mounted on the damper body or separately.

**Installation frame E1**

Installation frame E1 is suitable for:

- Solid wall construction
- Gypsum wall construction
- Solid ceiling construction

On the inside and outside is installation frame equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between damper body and installation frame and between installation frame and wall construction.

**Installation:**

- Gypsum wall construction has to be installed according manufacture requirements.

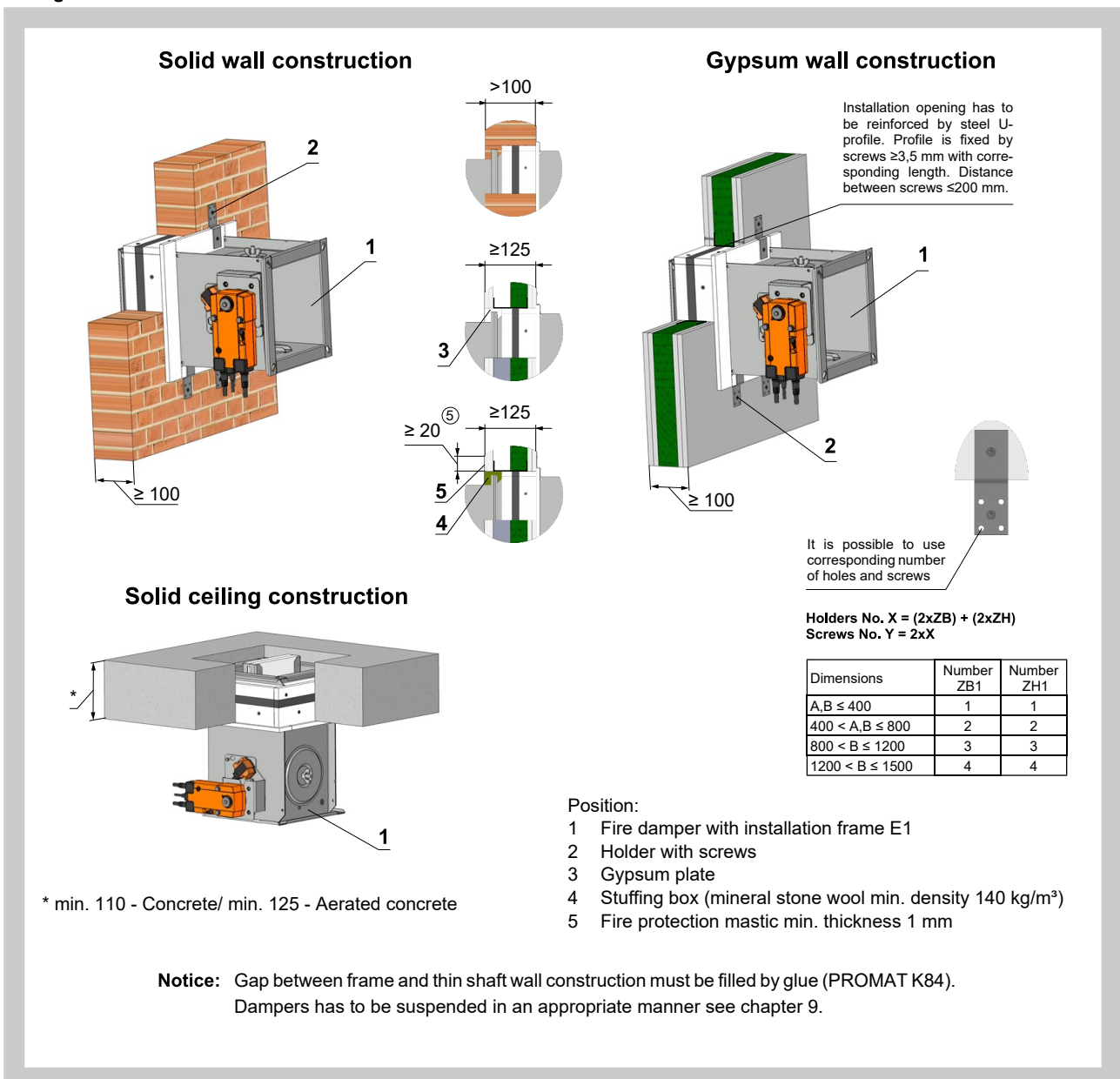
**Material:**

- Installation frame: cement lime plates
- Fasteners: galvanized plate

**Installation opening:**

- $a \times b = (A + 105^{+3}mm) \times (B + 105^{+3}mm)$

Fig. 74 Installation frame E1



**Installation frame E2**

Installation frame E2 is suitable for:

- Solid wall construction
- Solid ceiling construction

Damper is on the body equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between damper body and steel cartridge.

**Installation:**

- Gypsum wall construction has to be installed according manufacture requirements.

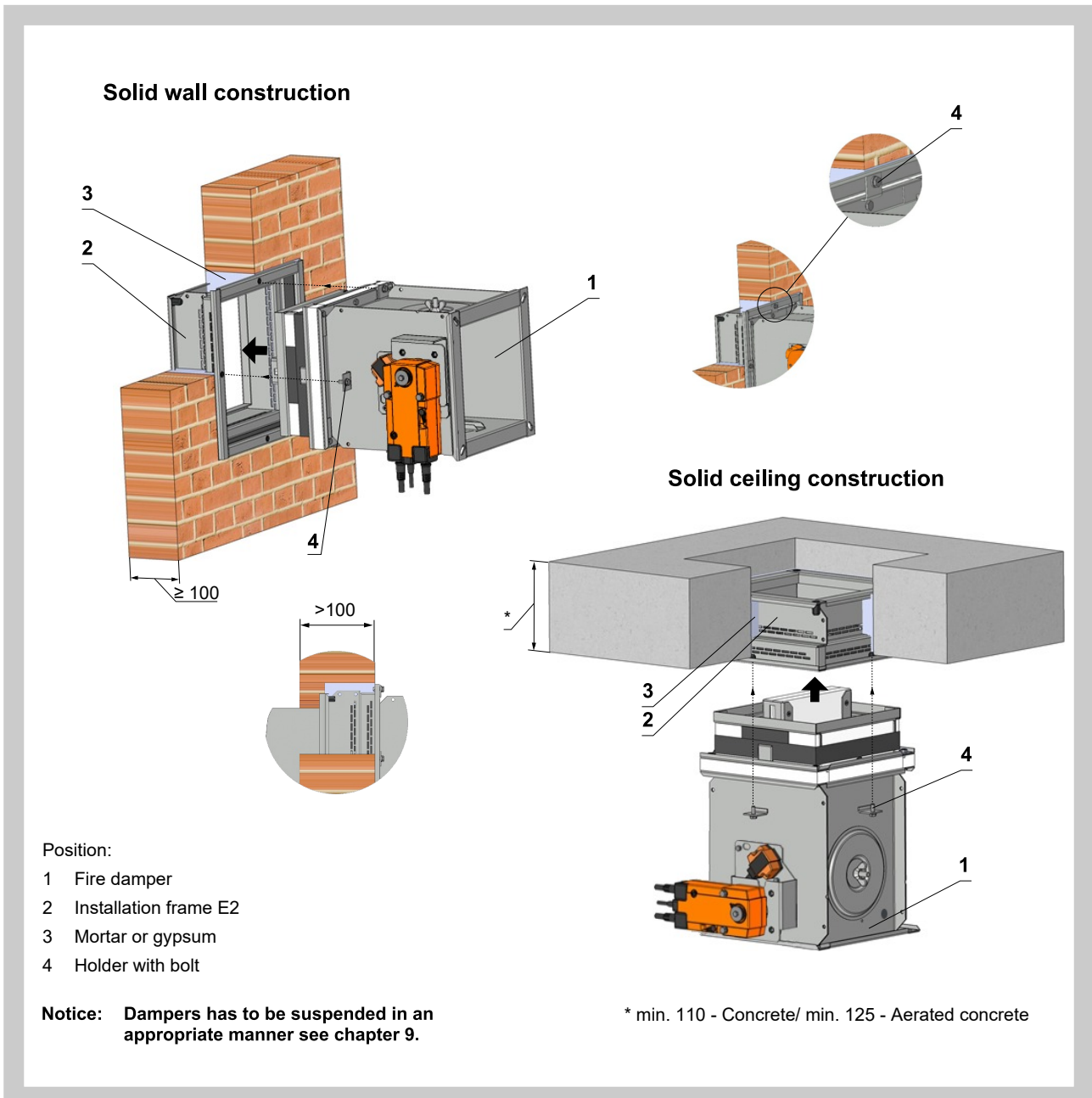
**Material:**

- Installation frame: cement lime plates and galvanized plate
- Fasteners: galvanized plate

**Installation opening:**

- $a \times b = (A + 100^{+3}mm) \times (B + 100^{+3}mm)$

Fig. 75 Installation frame E2



**Installation frame E3**

Installation frame E3 is suitable for:

- Gypsum wall construction

Damper is on the body equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between damper body and cement lime cartridge.

On the outside is cement lime cartridge equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between cement lime cartridge and construction.

**Installation:**

- Gypsum wall construction has to be installed according manufacture requirements.

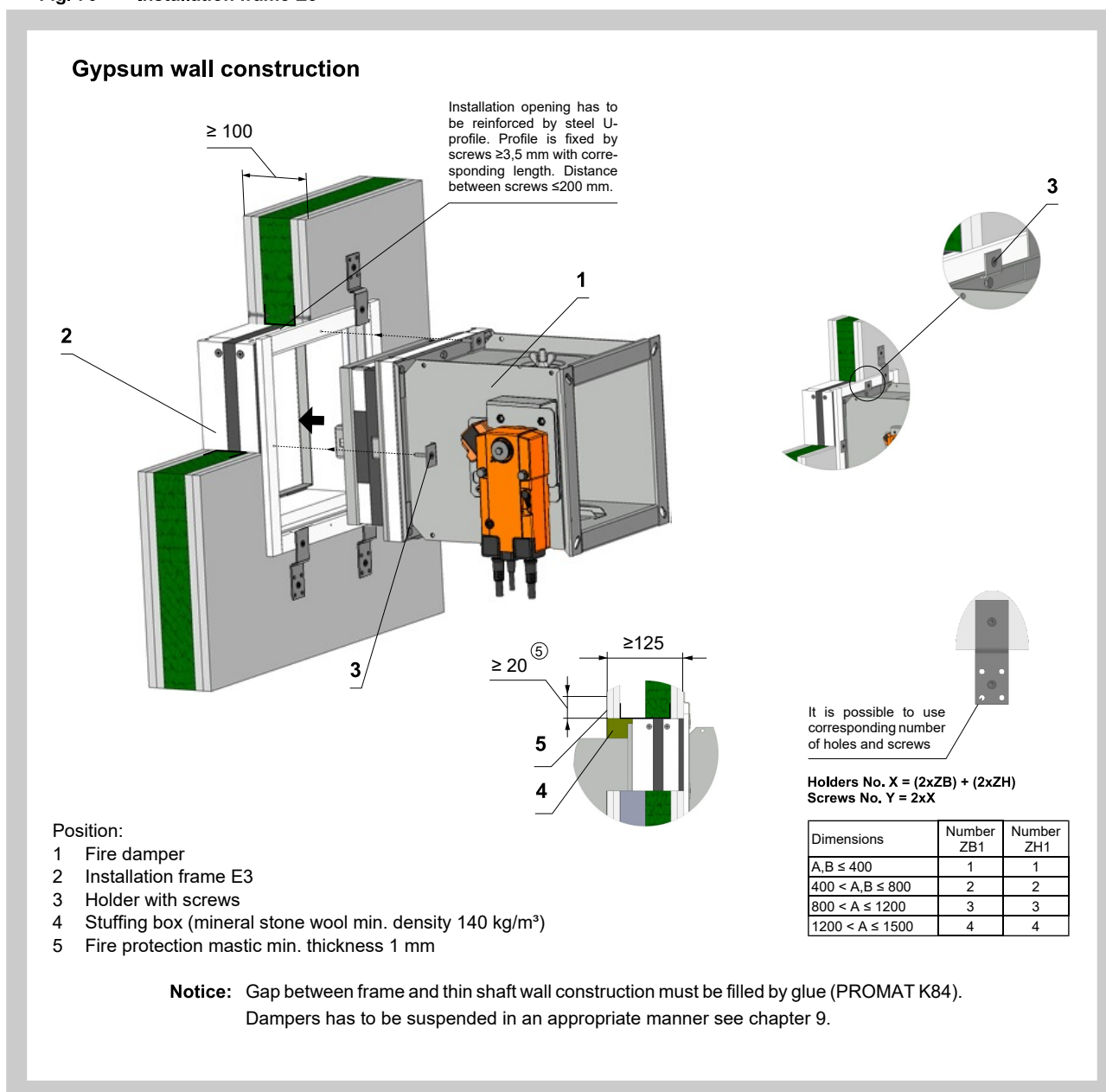
**Material:**

- Installation frame: cement lime plates
- Fasteners: galvanized plate

**Installation opening:**

- $a \times b = (A + 103^{+3}mm) \times (B + 103^{+3}mm)$

Fig. 76 Installation frame E3



**Installation frame E4**

Installation frame E4 is suitable for:

- Installation on solid wall/ceiling construction
- Installation on gypsum wall construction
- Installation outside solid ceiling constructions with concrete

On the inside is installation frame equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between installation frame and damper body.

**Installation:**

- Gypsum wall construction has to be installed according manufacture requirements.

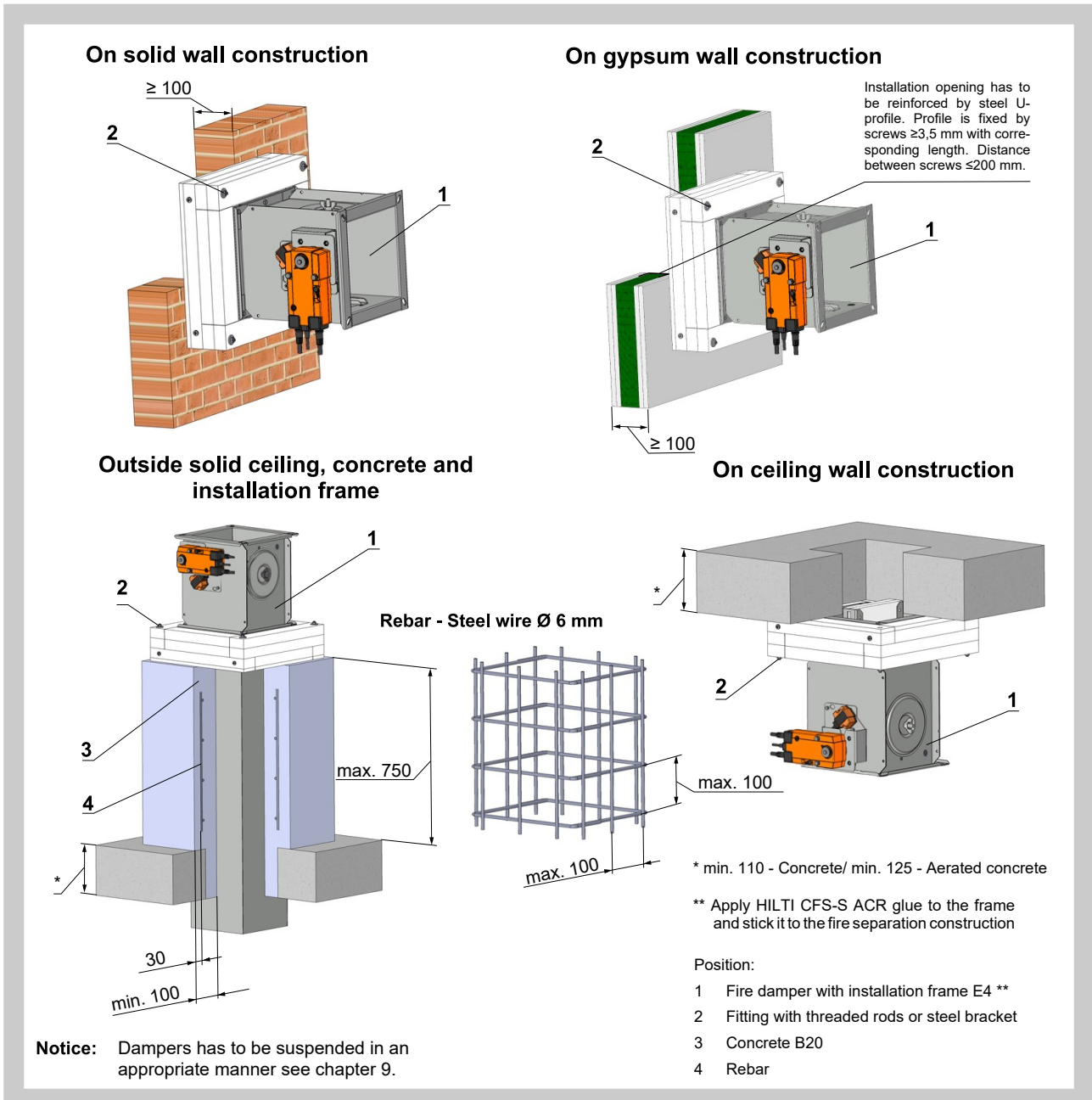
**Material:**

- Installation frame: cement lime plates
- Fasteners: galvanized plate

**Installation opening:**

- $a \times b = (A + 5^{+3}mm) \times (B + 5^{+3}mm)$
- $a \times b = (A + 100^{+3}mm) \times (B + 100^{+3}mm)$  installation with concrete

Fig. 77 Installation frame E4



**Installation frame E5**

Installation frame E5 is suitable for gypsum wall construction with ceiling movement possibility. Distance of movement "x".

On the inside and outside is installation frame equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between damper body and installation frame and between installation frame and wall construction.

**Installation:**

Damper position:

- Directly on the ceiling
- In distance from ceiling max. 80 mm

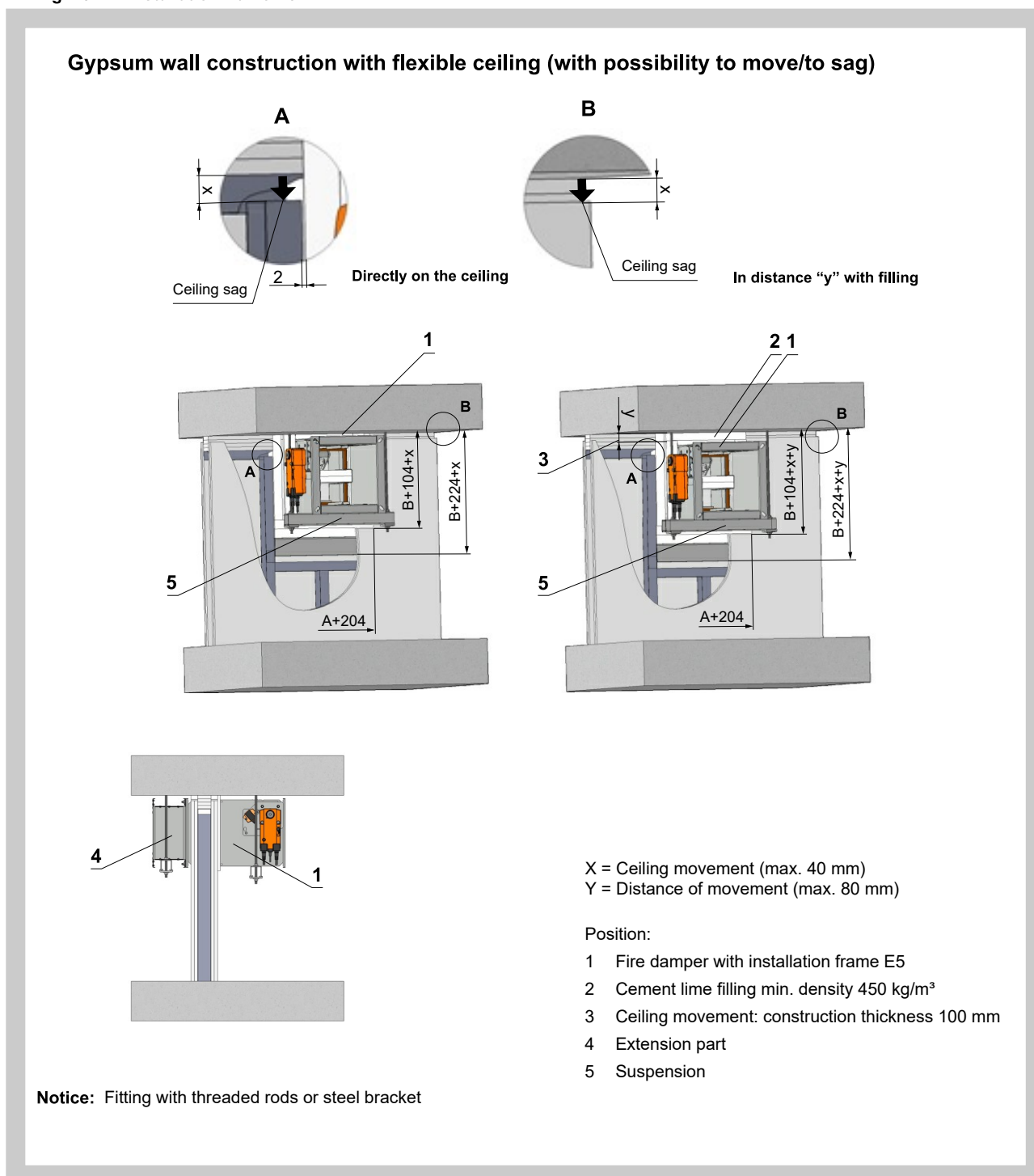
**Material:**

- Installation frame: cement lime plates
- Fasteners: galvanized plate

**Notice:**

- For ceiling movement  $\geq 10$  mm

Fig. 78 Installation frame E5



**Installation frame E6**

Installation frame E6 is suitable for:

- Installation outside solid wall/ceiling construction with cement lime plates
- On the inside is installation frame equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between installation frame and damper body.

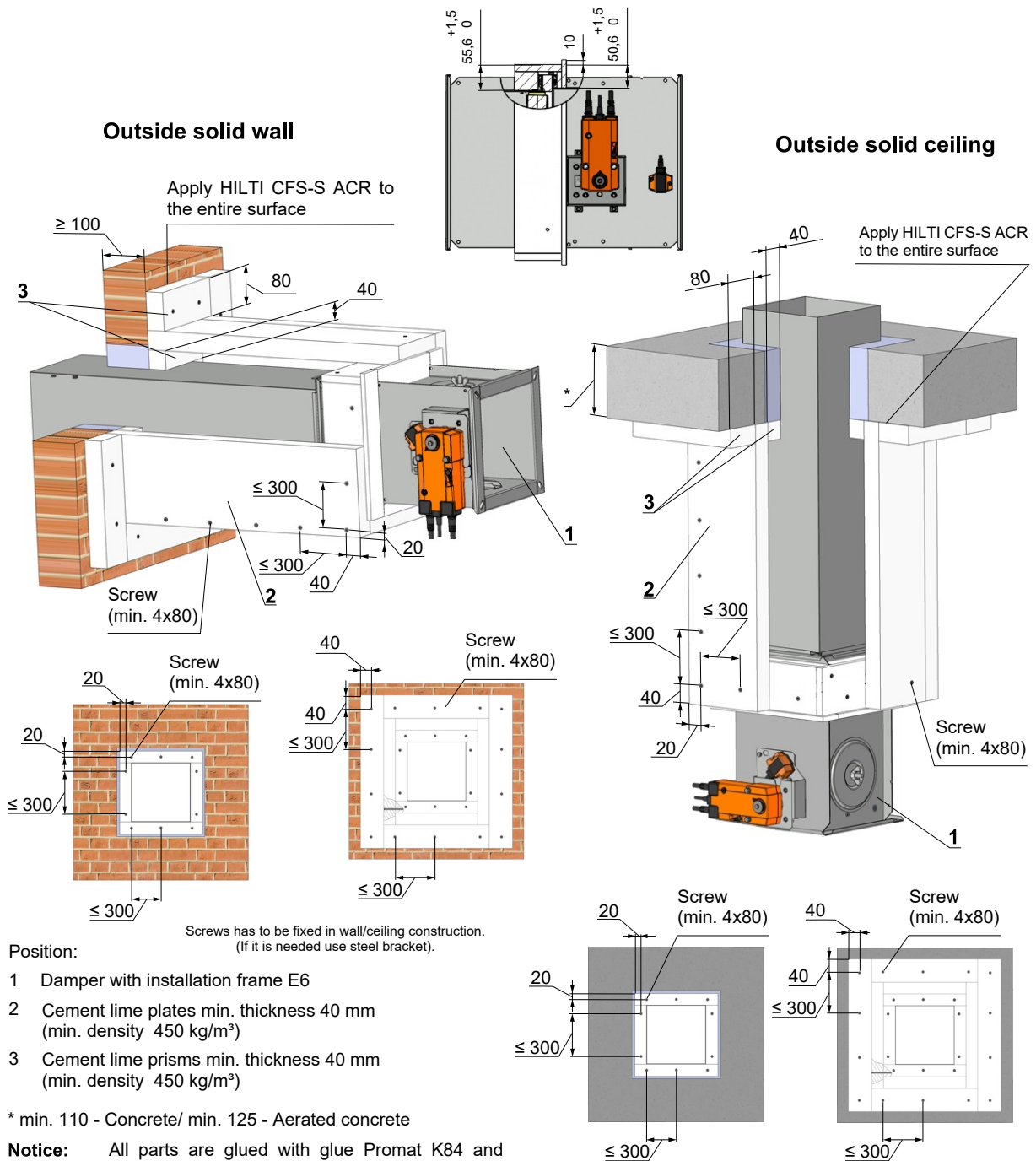
**Material:**

- Installation frame: cement lime plates
- Fasteners: galvanized plate

**Installation opening:**

- $a \times b = (A + 105^{+3}mm) \times (B + 105^{+3}mm)$

Fig. 79 Installation frame E6



**Position:**

- 1 Damper with installation frame E6
- 2 Cement lime plates min. thickness 40 mm (min. density 450 kg/m<sup>3</sup>)
- 3 Cement lime prisms min. thickness 40 mm (min. density 450 kg/m<sup>3</sup>)

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

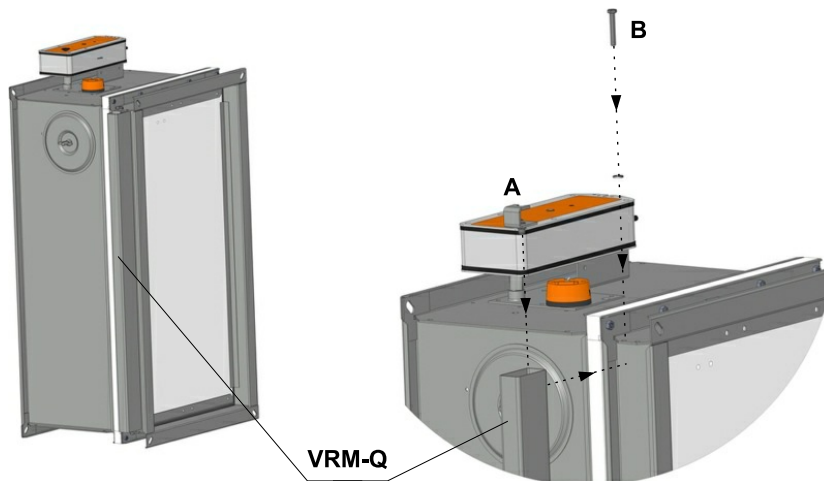
**Notice:** All parts are glued with glue Promat K84 and secured by screws. Dampers has to be suspended in an appropriate manner see chapter 9.

**VRM-Q reinforcing frame**

For dampers with  $A \geq 800$  and damper placement outside wall construction is necessary to use reinforcement VRM-Q.

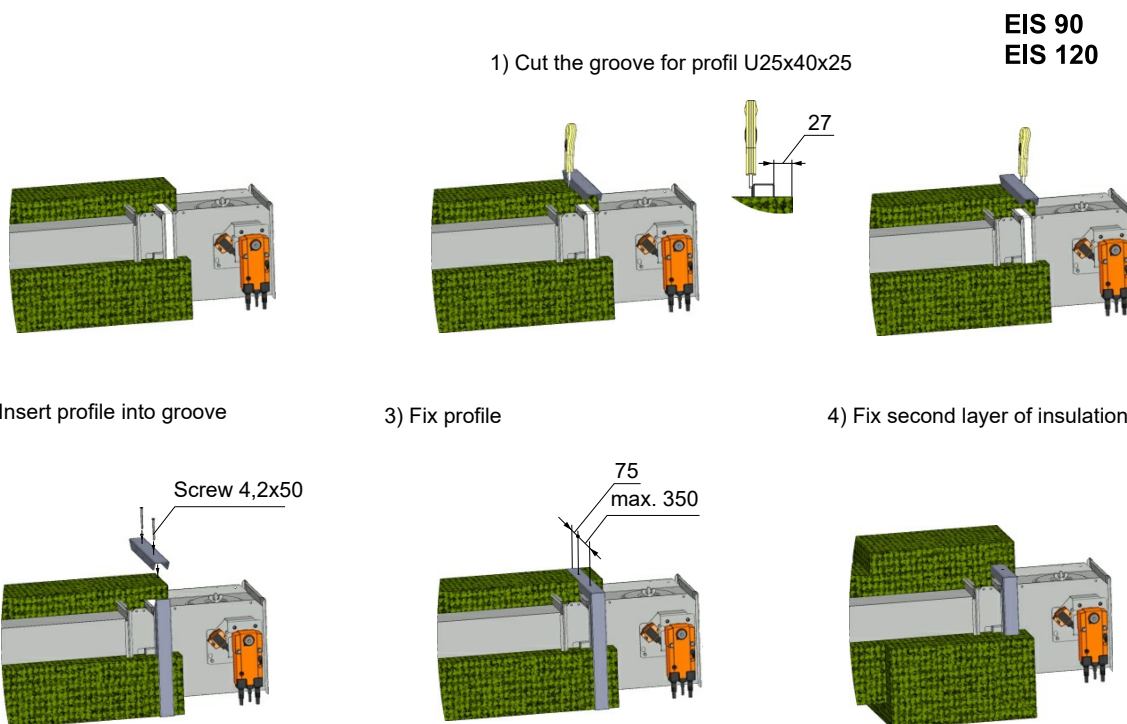
**Fig. 80 Fixing of reinforcement to damper body VRM-Q**

**Important: For lower fire resistance than EI90 the reinforcement VRM-Q is not necessary !!!**



- 1.) Insert part A into reinforcement VRM-Q
- 2.) Set up nut of the part A under correct hole
- 3.) Lock screw B
- 4.) It has to be done on each side of VRM-Q

**Fig. 81 Installation procedure**



Installation details see chapter 9.

9. Suspension systems

9.1. Mounting to the ceiling wall

Fig. 82 Mounting to the ceiling wall

**Anchoring possible after national standards**

**Hinge plates**

**Screw with internal thread and hexagon drive**

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

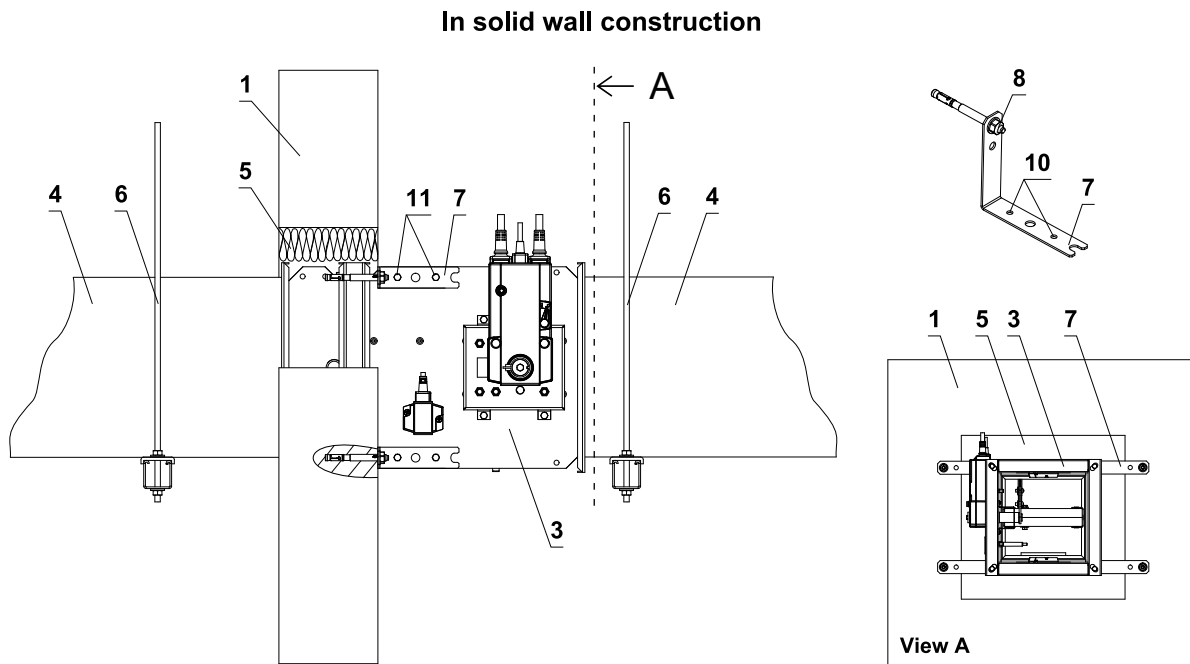
Size	A <sub>s</sub> [mm <sup>2</sup> ]	Weight G [kg]	
		for 1 piece	for 1 pair
M8	36,6	22	44
M10	58	35	70
M12	84,3	52	104
M14	115	70	140
M16	157	96	192
M18	192	117	234
M20	245	150	300

Position:

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

9.2. Fixing fire damper to the wall with stuffing box (stone wool + mastic)

Fig. 83 Fixing fire damper to the wall with stuffing box (stone wool + mastic)



Position:

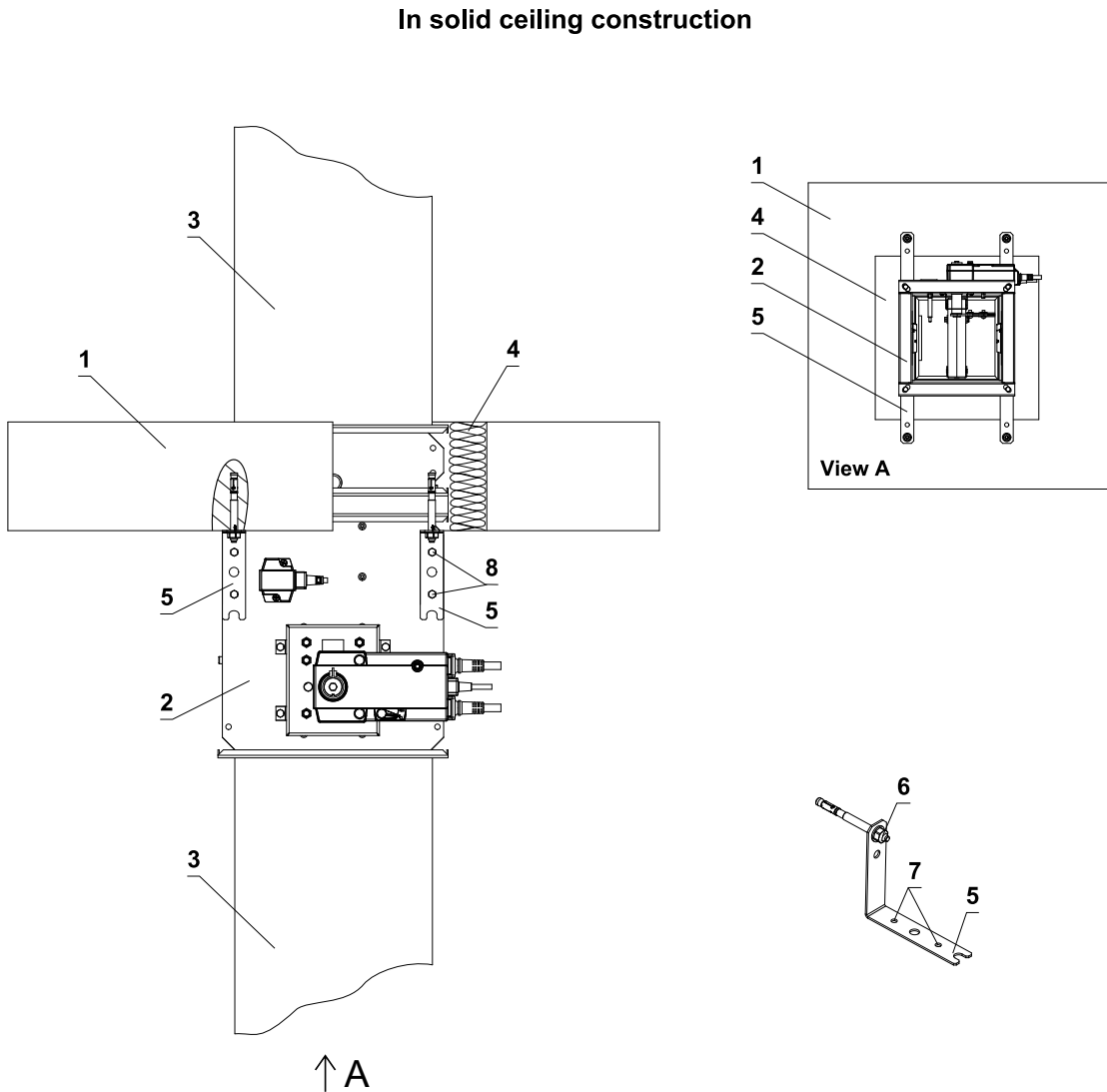
- 1 Solid wall construction
- 2 Gypsum wall construction
- 3 Fire damper
- 4 Duct
- 5 Stuffing box (stone wool+mastic)
- 6 Illustrative example of duct anchoring
- 7 Fixing element/steel holder for connecting damper to the wall (recommended type)
- 8 Nut M8 with anchor
- 9 Screw with hexagon head
- 10 Installation holes
- 11 Screw M6x10+Nut M6
- 12 Gypsum grid from "C" profile

**Notice:**

Assembly and mounting shown on the picture are illustrative and serve as a guide. 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.

9.3. Fixing fire damper to the ceiling with stuffing box (stone wool + mastic)

Fig. 84 Fixing fire damper to the ceiling with stuffing box (stone wool + mastic)



Position:

- 1 Solid ceiling construction
- 2 Fire damper
- 3 Duct
- 4 Stuffing box (stone wool+mastic)
- 5 Fixing element/steel holder for connecting damper to the wall (recommended type)
- 6 Nut M8 with anchor
- 7 Installation holes
- 8 Screw M6x10+Nut M6

**Notice:**

Assembly and mounting shown on the picture are illustrative and serve as a guide. 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.

**9.4. Horizontal installation**

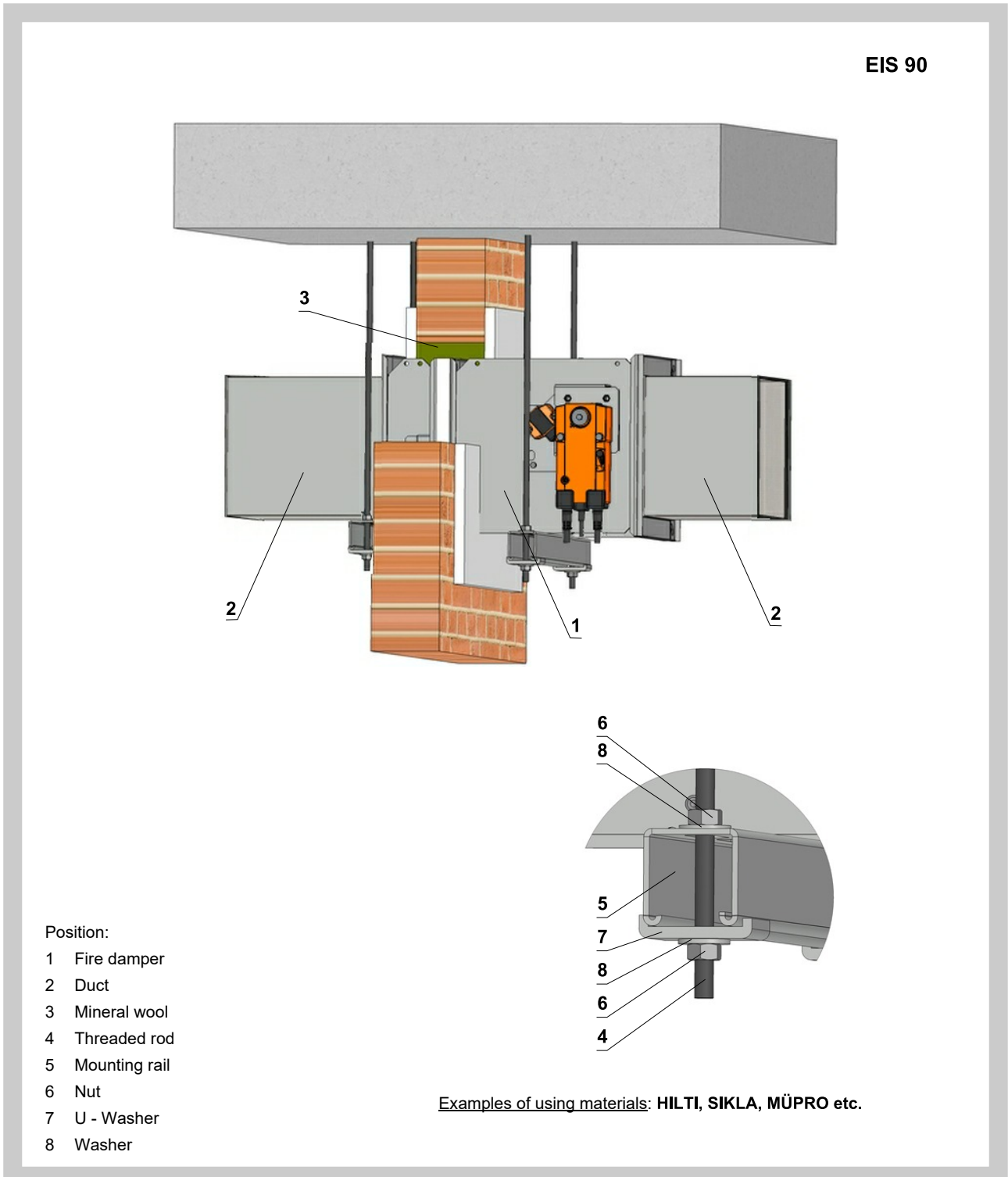
Damper assembly procedures must be done so as all load transfer from the fire separating constructions to the damper body is absolutely excluded. Back-to-back air-conditioning piping must be hung or supported so as all load transfer from the back-to-back piping to the damper is absolutely excluded.

On Fig. 85 is typical mounting situation as an example.

Threaded rods longer than 1,5 m require fire-resistant insulation.

Threaded rod fixing to the ceiling construction - see fig. 82

**Fig. 85 Suspension - horizontal duct (soft padding - mineral wool + fire boards)**



- Position:
- 1 Fire damper
  - 2 Duct
  - 3 Mineral wool
  - 4 Threaded rod
  - 5 Mounting rail
  - 6 Nut
  - 7 U - Washer
  - 8 Washer

Examples of using materials: **HILTI, SIKLA, MÜPRO** etc.

**9.5. Vertical installation**

The damper must not be suspended or anchored. The duct must be anchored after national rules, like in fig. 86 - as an example. It can be suspended by using threaded rods and a mounting profiles. Load the suspension system depend on weight of the fire damper.

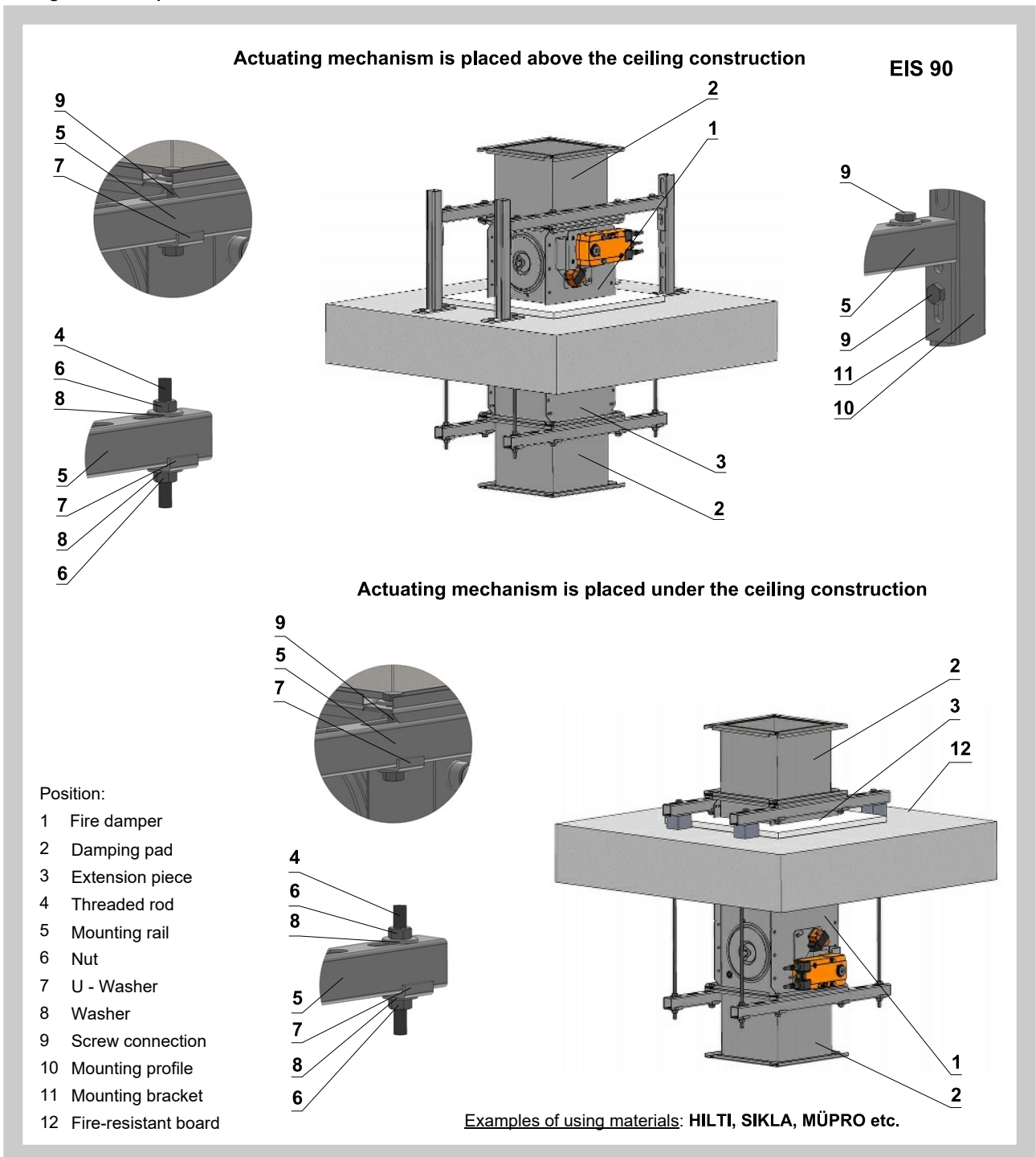
Damper can be suspended from the ceiling construction or supported above the ceiling construction.

Damper assembly procedures must be done so as all load transfer from the fire separating constructions to the damper body is absolutely excluded. Back-to-back air-conditioning piping must be hung or supported so as all load transfer from the back-to-back piping to the damper is absolutely excluded.

Threaded rods longer than 1,5 m require fire-resistant insulation.

Threaded rod fixing to the ceiling construction - see fig. 82

**Fig. 86 Suspension - vertical duct**



**9.6. Rectangular fire damper suspension remote from the wall - horizontal installation**

Fire dampers installed remote from the wall must be suspended.  
The duct must be suspended on both sides of damper after national rules.

Duct between fire damper and fire separating construction must be suspended by using threaded rods and mounting profiles, or another anchoring system according national standards. Load the suspension system depend on weight of the fire damper and duct system.

Max. length between two suspension systems is 1500 mm.

Damper assembly procedures must be done so as all load transfer from the fire separating constructions to the damper body is absolutely excluded. Back-to-back air-conditioning piping must be hung or supported so as all load transfer from the back-to-back piping to the damper is absolutely excluded.

Threaded rods longer than 1,5 m require fire-resistant insulation.

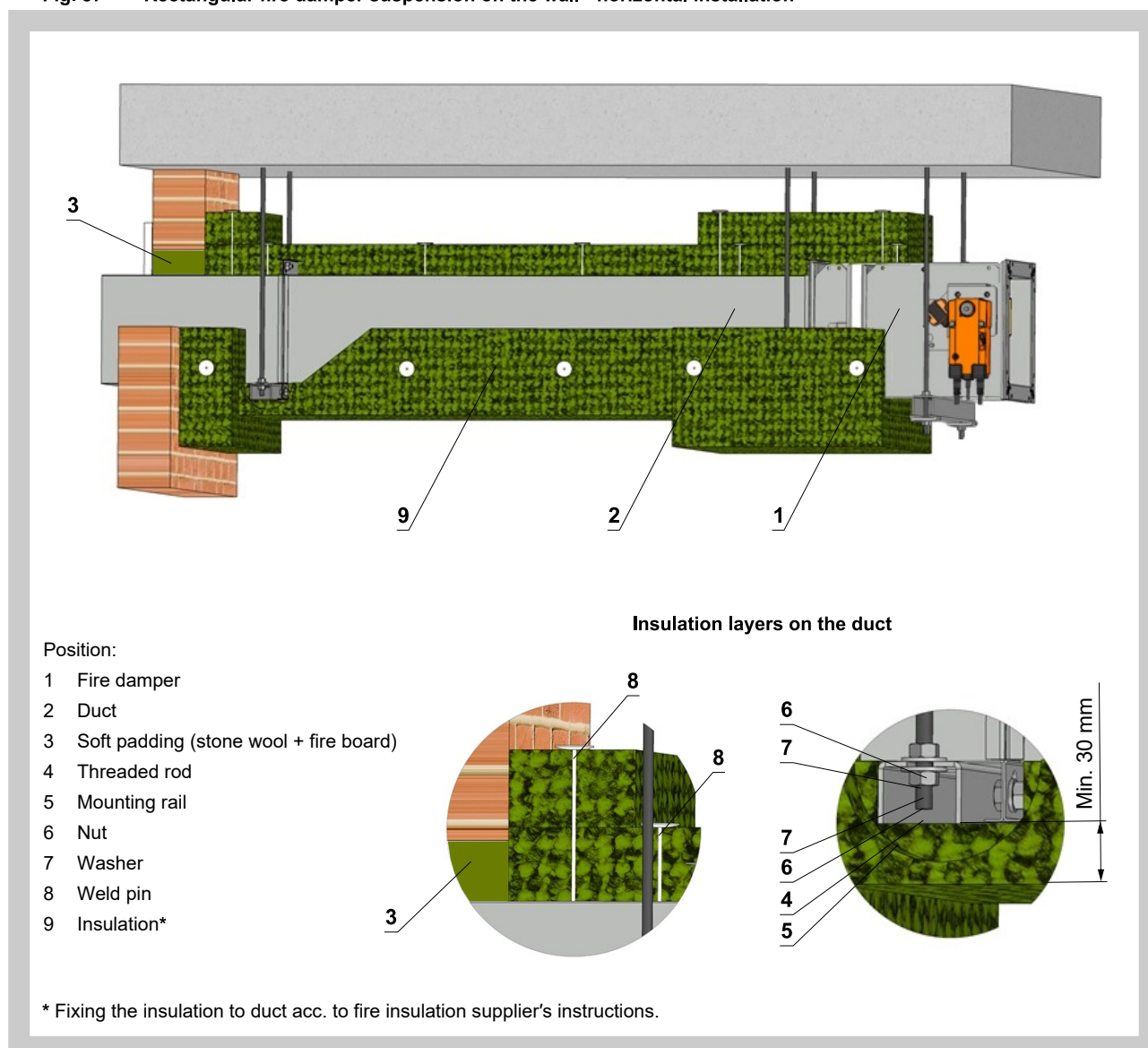
If the threaded rod is located inside the duct insulation, distance between threaded rod and duct is max 30 mm. If the treaded rod is located outside the duct isolation, distance between threaded rod and isolation is max. 40 mm. Thickness of the insulation under mounting profile must be min. 30 mm.

Threaded rod fixing to the ceiling construction - see fig. 82

The insulation boards are fastened to the duct.

For more information see documentation of insulation manufacturer.

**Fig. 87 Rectangular fire damper suspension on the wall - horizontal installation**



III. TECHNICAL DATA

10. Pressure loss

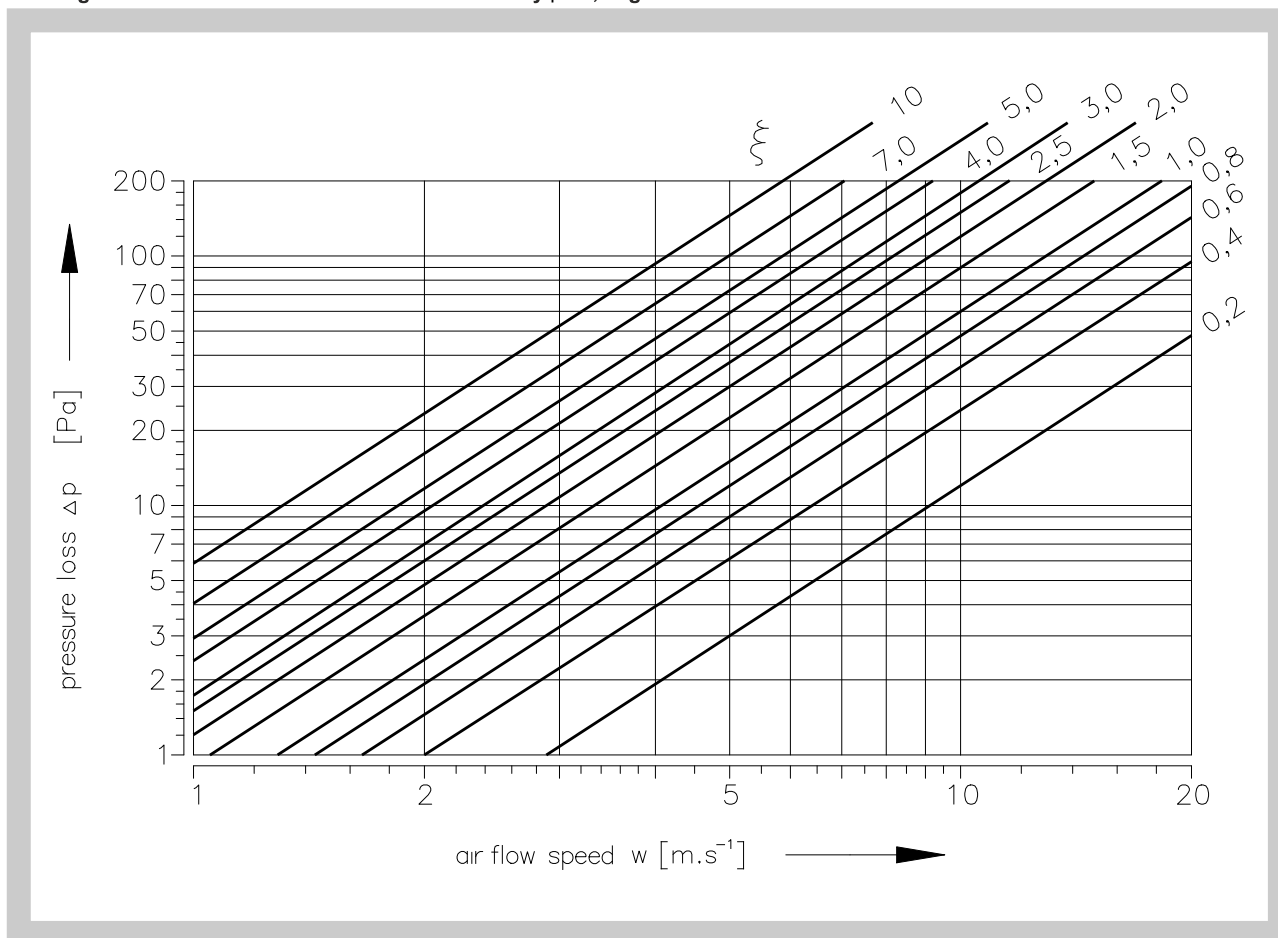
10.1. Pressure loss calculation

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

$\Delta p$	[Pa]	pressure loss
$w$	[m.s <sup>-1</sup> ]	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 Tab. 11.1.1.)

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

Diagram 10.2.1. Pressure losses for air density  $\rho = 1,2 \text{ kg.m}^3$



11. Coefficient of local pressure loss

11.1. Coefficient of local pressure loss  $\xi$  (-) for FDMQ

Tab. 11.1.1. Coefficient of local pressure loss for FDMQ

B	A													
	150	180	200	225	250	280	300	315	355	400	450	500	550	560
150	2,742	2,575	2,399	2,320	2,219	2,105	2,047	1,954	1,885	1,811	1,753	1,703	1,686	1,665
180	2,132	1,992	1,864	1,795	1,721	1,636	1,575	1,502	1,440	1,387	1,342	1,308	1,290	1,275
200	1,691	1,580	1,477	1,417	1,363	1,288	1,244	1,186	1,136	1,094	1,059	1,030	1,017	1,005
225	1,338	1,288	1,161	1,052	1,031	1,003	0,972	0,938	0,892	0,847	0,833	0,806	0,783	0,774
250	1,118	1,042	0,969	0,934	0,902	0,852	0,807	0,776	0,741	0,715	0,691	0,673	0,661	0,655
280	1,030	0,938	0,911	0,873	0,842	0,801	0,752	0,710	0,662	0,641	0,623	0,612	0,605	0,591
300	0,954	0,868	0,821	0,789	0,754	0,710	0,668	0,621	0,594	0,582	0,551	0,543	0,538	0,535
315	0,797	0,740	0,690	0,667	0,639	0,606	0,570	0,548	0,524	0,503	0,486	0,473	0,464	0,460
355	0,685	0,638	0,595	0,568	0,545	0,518	0,492	0,472	0,450	0,433	0,418	0,406	0,399	0,395
400	0,602	0,561	0,522	0,498	0,479	0,453	0,436	0,413	0,395	0,378	0,366	0,355	0,349	0,345
450	0,538	0,500	0,465	0,446	0,429	0,408	0,384	0,367	0,351	0,337	0,325	0,315	0,313	0,307
500	0,491	0,456	0,423	0,407	0,394	0,369	0,352	0,334	0,319	0,306	0,296	0,287	0,284	0,280
550	0,470	0,436	0,404	0,388	0,374	0,352	0,330	0,313	0,304	0,288	0,277	0,275	0,267	0,264
560	0,450	0,417	0,388	0,374	0,356	0,335	0,321	0,305	0,291	0,279	0,270	0,262	0,259	0,255
600	0,423	0,394	0,370	0,354	0,342	0,321	0,304	0,290	0,278	0,271	0,260	0,249	0,244	0,235
630	0,414	0,384	0,357	0,344	0,331	0,311	0,295	0,281	0,268	0,258	0,248	0,241	0,229	0,234
650	–	0,366	0,344	0,330	0,318	0,299	0,287	0,274	0,257	0,248	0,242	0,232	0,221	0,225
700	–	0,363	0,337	0,323	0,311	0,296	0,280	0,266	0,254	0,242	0,236	0,227	0,215	0,214
710	–	0,357	0,332	0,319	0,306	0,291	0,276	0,260	0,249	0,239	0,230	0,223	0,212	0,212
750	–	0,344	0,320	0,312	0,300	0,278	0,263	0,252	0,239	0,231	0,223	0,216	0,213	0,209
800	–	0,335	0,311	0,301	0,289	0,274	0,257	0,244	0,233	0,223	0,215	0,209	0,205	0,203

B	A												
	600	630	650	700	710	750	800	900	1000	1100	1250	1400	1500
150	1,644	1,628	1,622	1,609	1,605	1,591	1,580	1,551	1,535	–	–	–	–
180	1,261	1,246	1,234	1,225	1,219	1,208	1,197	1,177	1,162	1,148	1,136	1,124	1,117
200	0,989	0,981	0,970	0,963	0,960	0,951	0,942	0,926	0,914	0,903	0,892	0,884	0,878
225	0,768	0,757	0,739	0,732	0,724	0,718	0,712	0,699	0,690	0,681	0,666	0,654	0,650
250	0,649	0,639	0,631	0,630	0,625	0,620	0,613	0,602	0,595	0,587	0,580	0,574	0,571
280	0,586	0,583	0,561	0,556	0,551	0,546	0,539	0,532	0,524	0,512	0,499	0,491	0,482
300	0,522	0,508	0,504	0,503	0,502	0,496	0,488	0,480	0,465	0,455	0,449	0,447	0,440
315	0,454	0,449	0,443	0,441	0,439	0,433	0,430	0,423	0,417	0,412	0,407	0,402	0,400
355	0,391	0,386	0,380	0,378	0,377	0,372	0,370	0,363	0,358	0,353	0,349	0,345	0,343
400	0,342	0,337	0,331	0,330	0,329	0,325	0,323	0,316	0,312	0,308	0,305	0,302	0,299
450	0,303	0,299	0,295	0,294	0,293	0,290	0,286	0,281	0,278	0,274	0,271	0,267	0,266
500	0,275	0,272	0,271	0,268	0,266	0,263	0,261	0,256	0,252	0,249	0,246	0,244	0,242
550	0,261	0,258	0,253	0,248	0,246	0,244	0,243	0,238	0,235	0,232	0,227	0,224	0,223
560	0,253	0,249	0,246	0,245	0,243	0,240	0,238	0,234	0,230	0,227	0,224	0,222	0,221
600	0,233	0,232	0,230	0,229	0,228	0,224	0,220	0,218	0,214	0,211	0,208	0,206	0,204
630	0,232	0,229	0,226	0,225	0,224	0,221	0,218	0,215	0,212	0,209	0,206	0,204	0,202
650	0,222	0,219	0,217	0,215	0,214	0,212	0,209	0,203	0,201	0,199	0,194	0,191	0,189
700	0,212	0,212	0,211	0,210	0,208	0,206	0,204	0,201	0,198	0,196	0,193	0,190	0,188
710	0,210	0,210	0,209	0,208	0,207	0,205	0,203	0,199	0,195	0,193	0,191	0,189	0,187
750	0,205	0,202	0,200	0,199	0,198	0,197	0,195	0,191	0,187	0,184	0,182	0,180	0,178
800	0,200	0,198	0,196	0,195	0,194	0,192	0,189	0,186	0,183	0,181	0,178	0,177	0,176

11.2. Coefficient of local pressure loss  $\xi$  (-) for FDMQ 120

Tab. 11.2.1. Coefficient of local pressure loss for FDMQ 120

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

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

**12. Noise data**

**12.1. Level of acoustic output corrected with filter A.**

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

$L_{WA}$  [dB(A)] level of acoustic output corrected with filter A.

$L_{W1}$  [dB] level of acoustic output  $L_{W1}$  related to the 1 m<sup>2</sup> section (see Tab. 12.3.1.)

$S$  [m<sup>2</sup>] duct cross section

$K_A$  [dB] correction to the weight filter A (see Tab. 12.3.2.)

**12.2. Level of acoustic output in octave ranges.**

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

$L_{Woct}$  [dB] spectrum of acoustic output in octave range

$L_{W1}$  [dB] level of acoustic output  $L_{W1}$  related to the 1 m<sup>2</sup> section (see Tab. 12.3.1.)

$S$  [m<sup>2</sup>] duct cross section

$L_{rel}$  [dB] relative level expressing the shape of the spectrum (see Tab. 12.3.3.)

**12.3. Table of acoustics values**

**Tab. 12.3.1. Level of acoustic output  $L_{W1}$ [dB] related to the 1 m<sup>2</sup> section**

v [m/s]	[-] ξ																
	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,5	2,0	2,5	3,0	4,0	5,0	8,0	10,0
2	15,5	18,7	20,9	22,6	24,0	25,2	26,3	27,2	28,0	31,2	33,4	35,1	36,5	38,8	40,5	44,2	45,9
3	26,1	29,2	31,5	33,2	34,6	35,8	36,9	37,8	38,6	41,7	44,0	45,7	47,1	49,4	51,1	54,7	56,5
4	33,6	36,7	39,0	40,7	42,1	43,3	44,3	45,3	46,1	49,2	51,5	53,2	54,6	56,9	58,6	62,2	64,0
5	39,4	42,5	44,8	46,5	47,9	49,1	50,2	51,1	51,9	55,0	57,3	59,0	60,4	62,7	64,4	68,0	69,8
6	44,1	47,3	49,5	51,3	52,7	53,9	54,9	55,8	56,6	59,8	62,0	63,8	65,2	67,4	69,2	72,8	74,5
7	48,2	51,3	53,5	55,3	56,7	57,9	58,9	59,8	60,7	63,8	66,1	67,8	69,2	71,4	73,2	76,8	78,6
8	51,6	54,8	57,0	58,8	60,2	61,4	62,4	63,3	64,1	67,3	69,5	71,3	72,7	74,9	76,7	80,3	82,0
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	78,0	79,7	83,4	85,1
10	57,4	60,6	62,8	64,6	66,0	67,2	68,2	69,1	70,0	73,1	75,3	77,1	78,5	80,7	82,5	86,1	87,9
11	59,9	63,1	65,3	67,1	68,5	69,7	70,7	71,6	72,4	75,6	77,8	79,6	81,0	83,2	85,0	88,6	90,3
12	62,2	65,4	67,6	69,3	70,7	71,9	73,0	73,9	74,7	77,9	80,1	81,8	83,2	85,5	87,2	90,9	92,6

**Tab. 12.3.2. Correction to the weight filter A**

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

Tab. 12.3.3. 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	-4,0	-4,1	-5,9	-9,4	-14,6	-21,5	-30	-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

## IV. MATERIAL, FINISHING

### 13. Material

- 13.1.** Damper bodies are supplied in the design made of galvanized plate without any other surface finishing.

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

Control devices of dampers has cover from mechanically resistant and standing plastic and rest of the parts is galvanised without further surface treatment.

Springs are galvanized.

Thermal protective fuses are made of sheet brass, thickness = 0.5 mm.

Fasteners is galvanized. Fasteners is galvanized.

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

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

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

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

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

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

The leaf of the damper is made from a single piece of homogeneous material Promatect-MST, thickness 40 mm or is composite from two piece Promatect-H, thickness 20 mm, connected with galvanised nailed "U" connectors which are sealed with Promat K84 from the outside.

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

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

The temperature-dependent initiator of the servo drive (sensor) is modified for stainless-steel variants of the dampers; the standard galvanised screws are replaced with stainless-steel M4 screws of corresponding class the counterpart has stainless-steel riveting M4 nuts.

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

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

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

## V. INSPECTION, TESTING

### 14. Inspection

- 14.1.** Sizes are checked by common measuring instruments according to the standard of non-tolerated sizes, used in air conditioning industry.

Interoperational checks of components and main sizes are carried out according to drawing documentation.

### 15. Testing

- 15.1.** After workshop installation, a 100% check of function of closing mechanism and electric components is carried out.

## VI. TRANSPORTATION AND STORAGE

### 16. Logistic terms

- 16.1.** The dampers are delivered as bulk cargo. Any other packing methods must be agreed with the manufacturer in advance. The potential packages will be considered non-returnable and their price will not be included in the product price.

The dampers are transported by box freight vehicles; no sharp shocks must occur and the ambient temperature must not exceed +40°C. For handling during transport, the dampers must be protected against mechanical damages and weather impact. If the customer wishes it, the dampers can be transported on pallets. During transport, the damper blade must be in the "CLOSED" position.

Unless another method of reception is specified in the purchase order, the handover of the dampers to the forwarder shall be understood as reception.

- 16.2.** The dampers must be stored in covered buildings, in an environment without aggressive vapours, gases and dust. A temperature in a range of -5°C and +40°C and a relative humidity of max. 80% must be maintained in the buildings.

For handling during storage, the dampers must be protected against mechanical damage.

- 16.3.** The delivery includes the complete damper and the delivery note.

### 17. Warranty

- 17.1.** The manufacturer provides a warranty of 24 months from the date of dispatch for the dampers. In the case of using the Schischek actuator, the manufacturer provides a 12-month warranty for the actuator from the date of shipment.

The warranty for fire dampers FDMQ, provided by the manufacturer, shall become completely null and void if the starting, closing and control devices are unprofessionally handled by untrained workers or if electric components, i.e. limit switches, actuating mechanisms, communication and supply devices and thermoelectric starting mechanisms are dismantled. The warranty shall also become null and void if the 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.

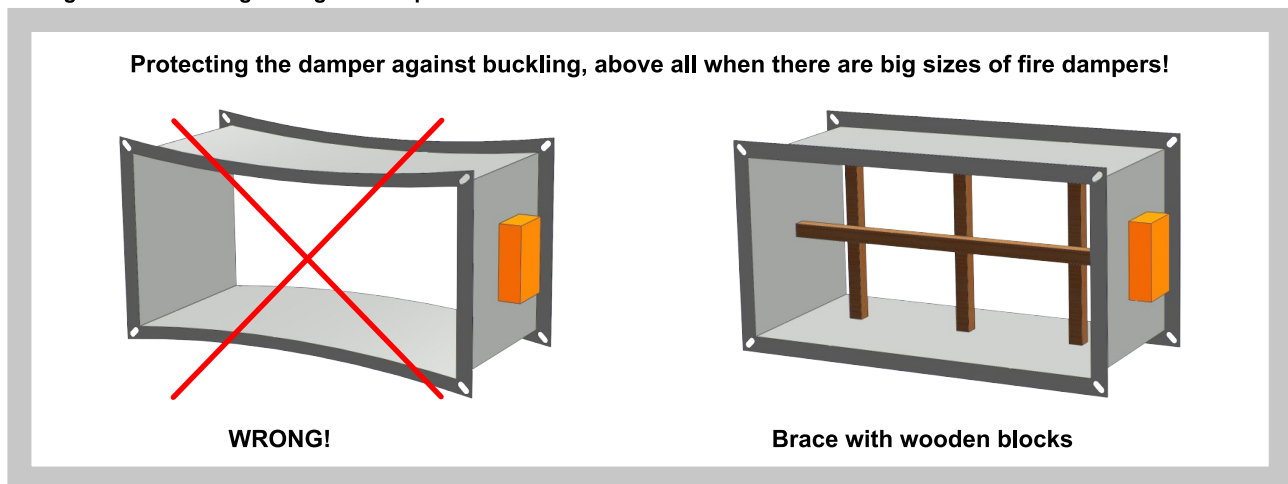
- 17.2.** If the dampers are damaged by transport, a record must be written down with the forwarder at reception for later complaint.

**VII. ASSEMBLY, ATTENDANCE, MAINTENANCE AND REVISIONS**

**18. Assembly**

- 18.1. The assembly of the dampers must be carried out while observing all applicable safety standards and regulations.
- 18.2. The damper body should not be deformed in the course of bricking in. Once the damper is built in, its blade should not grind on the damper body during opening or closing.

Fig. 88 Embedding / fixing the damper



- 18.3. All flange and screw joints must be conductively connected during the assembly to provide protection against dangerous contact. 2 fan-shaped washers in galvanized version are to be used for conductive connection; they are to be situated under the head of one bolt and under the screwed nut.
- 18.4. If the damper is equipped with limit switches and the said devices 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 a limit switch is to be added to the damper design, the change can be implemented by adding the required device to the base plate of the damper. The said 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.
- 18.5. For a reliable function of the dampers, their closing mechanism and the seating faces of the blade must be protected from dust, fibrous or adhesive masses and solvents.
- 18.6. Actuator control without electric voltage:  
 A special lever (part of the actuator) may be used to manually set the dampers to any position. When the lever is turned in the direction of the arrow, the damper blade turns to its open position. As the blade movement 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.

**WARNING!**

**If the actuator is manually locked, the damper blade will not close in the event of a fire after the activation of the BAT thermoelectric trigger. To restore correct damper operation, the actuator must be unlocked (manually or by applying power supply).**

## 19. Entry into service and revisions

- 19.1.** Before entering the dampers into operation after their assembly and by sequential checks, the following checks must be carried out. Visual inspection of proper damper integration , inside damper area, damper blade, contact surfaces and silicon sealing. Check of thermal protective fuse and closing mechanism. Check the closing function of the damper blade. This can be done by removing of thermal fuse from damper body.

Before entering the dampers with actuating mechanism into operation after their assembly and by sequential checks. Check of blade displacement into the breakdown position "CLOSED" can be done after cutting off the actuating mechanism supply (e.g. by pressing the RESET button at the thermoelectrical starting mechanism BAT or cutting off the supply from ELECTRICAL FIRE SIGNALISATION). Check of blade displacement back into the "OPEN" position can be done after restoration of power supply (e.g. by releasing the RESET 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.

For regular or exceptional inspection of interior of fire damper, micro-camera device can be used. On each fire damper is inspection hole. 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.

- 19.2.** For dampers with mechanical control (designs .01, .11, .80), the following checks must be carried out:

### **Check of closing mechanism and thermal fuse**

**To check the function of the mechanism proceed as follows:**

Move the damper blade to "CLOSED" position as follows:

- The damper is in "OPEN" position.
- Press the control button of the mechanism to move the damper to "CLOSED" position.
- Check the damper blade shift to "CLOSED" position.
- Damper closing shall be sharp, the control lever shall be in „CLOSED“ position.

Move the damper blade to "OPEN" position as follows:

- Turn the control lever by 90°.
- The lever will automatically lock in "OPEN" position.
- Check the damper blade shift to "OPEN" position.

**Check of function and condition of the thermal fuse:**

- To check the function and the status of the fuse is possible to remove whole mechanism from the body of fire damper - mechanism is attached to the dampers body with four screws M6.
- Removing the thermal fuse from the fuse holder of initiation device, check its correct functionality.
- The mechanism is identified as M1 to M5, depending on the closing spring strongness.

**19.3.** For the designs with actuating mechanisms, the following checks must be carried out:

Check the shift of the blade to "CLOSED" failure position after cutting off the power supply to the actuating mechanism (e.g. by pressing the reset button on the thermoelectric starting mechanism BAT, by cutting off the power supply from electrical fire signalization). Check the shift of the blade back to "OPEN" position by restoring the power supply to the actuating mechanism (e.g. by releasing the reset button, by restoring the power supply from electrical fire signalization).

**19.4.** The check of function of the damper with actuating mechanism can be carried out as follows:

- a) by cutting off and restoring the power supply, e.g. by a signal from electrical fire signalization
- b) directly on the installed damper, with the help of the button on the thermoelectric starting mechanism BAT (simulating fuse tripping).

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

The function checks of the optical smoke detector are to be carried out by employees of an authorized organization who have corresponding electrotechnical qualification and have been provably 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.

**19.6.** For the function checks, the dampers should be moved to "CLOSED" position with the fan off or with closed regulation valve situated between the fan and the fire damper.**20. Spare parts****20.1.** Spare parts are supplied only on basis of an order.**21. Restore function of actuating mechanism after fuses initiation**

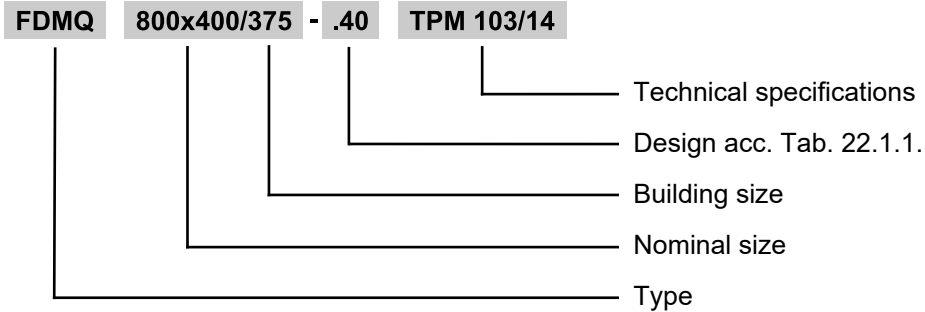
**21.1.** If fuse Tf1 is initiated (duct outside temperature) than is necessary to change thermoelectrical starting mechanism BAT72B-S. Whereas is initiation temperature higher than actuator mechanism operating temperature +50°C, recommended actuating mechanism manufacturer make complete revision or change actuating mechanism and thermoelectrical starting mechanism.

**21.2.** If fuses Tf2/Tf3 are initiated (duct inside temperature) than is possible change only part ZBAT72 or ZBAT95 (according initiating temperature).

**VIII. ORDERING INFORMATION**

**22. Ordering key**

**22.1. Fire damper**



If installation frame or design for installation in Weichschott / Ablative Coated Batt system are requested, it has to be mentioned separately in the order. Installation frame could be fixed to the damper body or supplied separately.

Tab. 22.1.1. Dampers design

Dampers design	Additional digit
Manual and thermal	.01
Manual and thermal (Zone 1,2)	.02*
Manual and thermal with a terminal switch („CLOSED“)	.11
Manual and thermal with a terminal switch („CLOSED“) (Zone 1,2)	.12*
With actuating mechanism BF 230-TN (BFL, BFN 230-T) - voltage AC 230 V	.40
With actuating mechanism 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 actuating mechanism ExMax-15-BF (AC 230 V, AC/DC 24 V) with thermoelectric activation mechanism (Zone 1,2)	.42*
With actuating mechanism BF 24-TN (BFL, BFN 24-T) - voltage AC/DC 24 V	.50
With actuating mechanism 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 and actuating mechanism BF 24-TN-ST (BFL, BFN 24-T-ST)	.60
With communication and supply device BKN 230-24-C-MP, with actuating mechanism BF 24-TN-ST (BFL, BFN 24-T-ST) and with smoke detector ORS 142 K	.61
With communication and supply device BKN 230-24MP and with actuating mechanism BF 24TL-TN-ST (Top-Line) for connection to MP-Bus	.62
With communication and supply device BKN 230-24-MOD, with actuating mechanism BF 24-TN-ST (BFL, BFN 24-T-ST) and with smoke detector ORS 142 K	.63
With communication and supply device BKN 230-24LON and with actuating mechanism BF 24TL-TN-ST (Top-Line) for connection to LonWorks	.64
Manual and thermal with two terminal switches („OPEN“, „CLOSED“)	.80
Manual and thermal with two terminal switches („OPEN“, „CLOSED“) (Zone 1,2)	.81*

\* Not possible with class of fire resistance EI 120 (ve ho i↔o) S.

**22.2. Reinforcement - damper placement outside wall or ceiling construction**

