CE

TPM 075/09

Revision 15
Valid from 22/2/21

EN 15650:2010-09

MANDÍK®

FIRE DAMPER

FDMB

These technical specifications state a row of manufactured sizes and models of fire dampers (further only dampers) FDMB. 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 FDMB with actuating mechanism

Fig. 2 FDMB 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 - 500 Pa, EIS 120, EIS 90
- External Casing leakage class C, Internal leakage class 2 acc. to EN 1751
- Cycling test in class C 10000 acc. to EN 15650
- Corrosion resistant acc. to EN 15650
- ES Certificate of conformity No. 1391-CPR-2020/0136
- Declaration of Performance No. PM/FDMB/01/20/2
- 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.

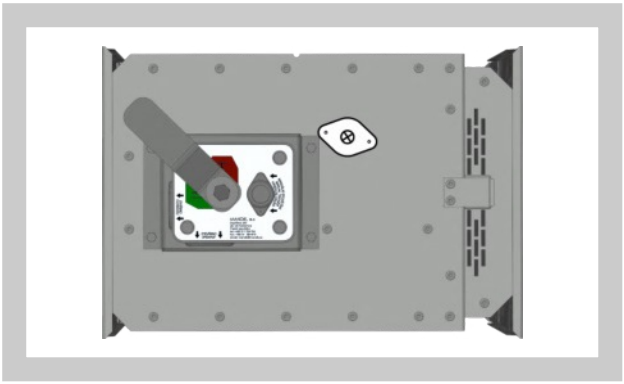
2. Design

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



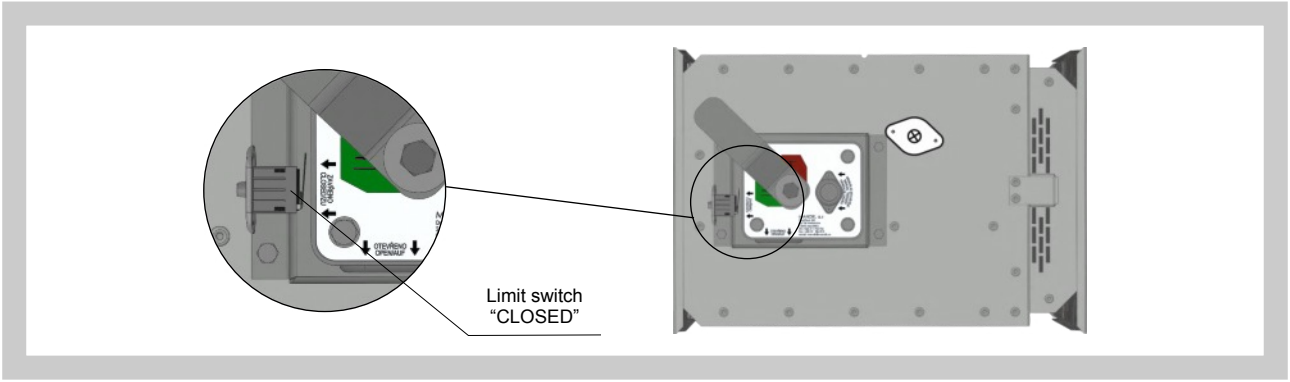
ATTENTION:

Mechanisms are produced in four designs **M1** to **M4**, 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

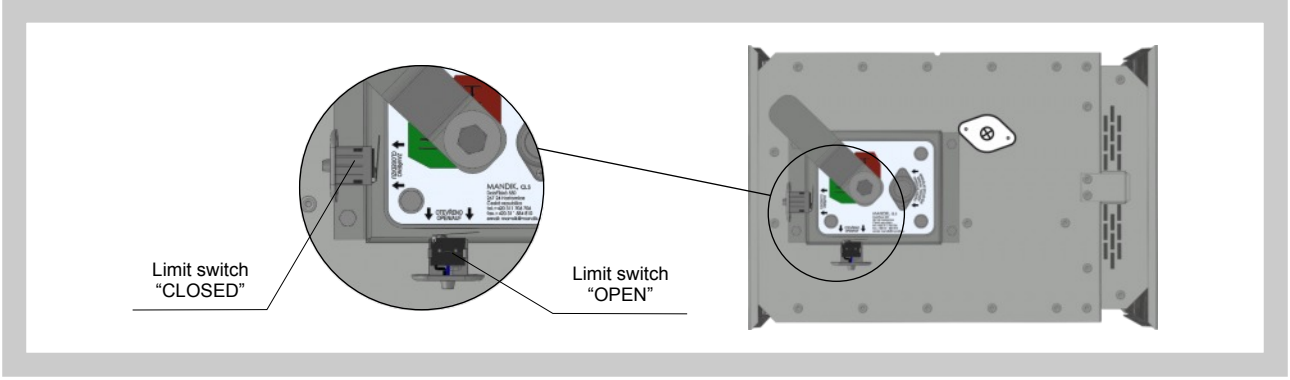
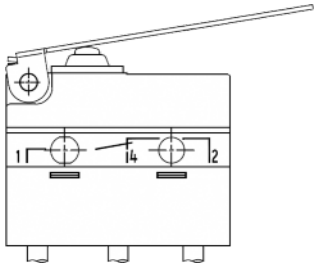
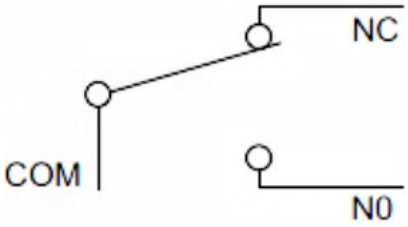


Fig. 6 Limit switch G905-300E03W1



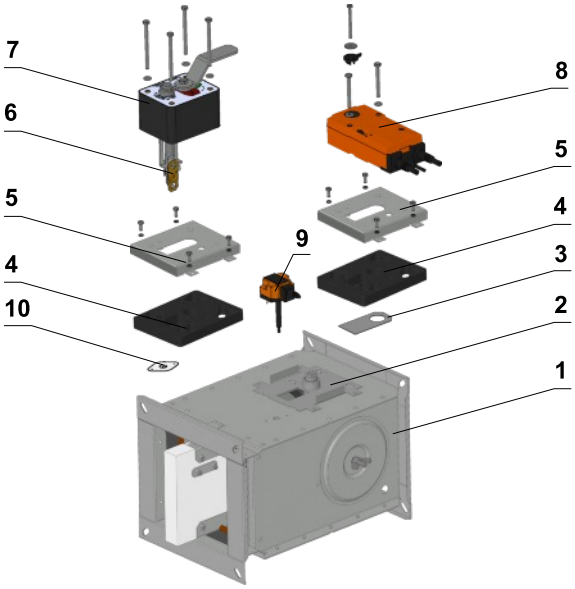


1(COM) - black wire
2(NC) - gray wire
4(NO) - blue wire

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 (furher 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

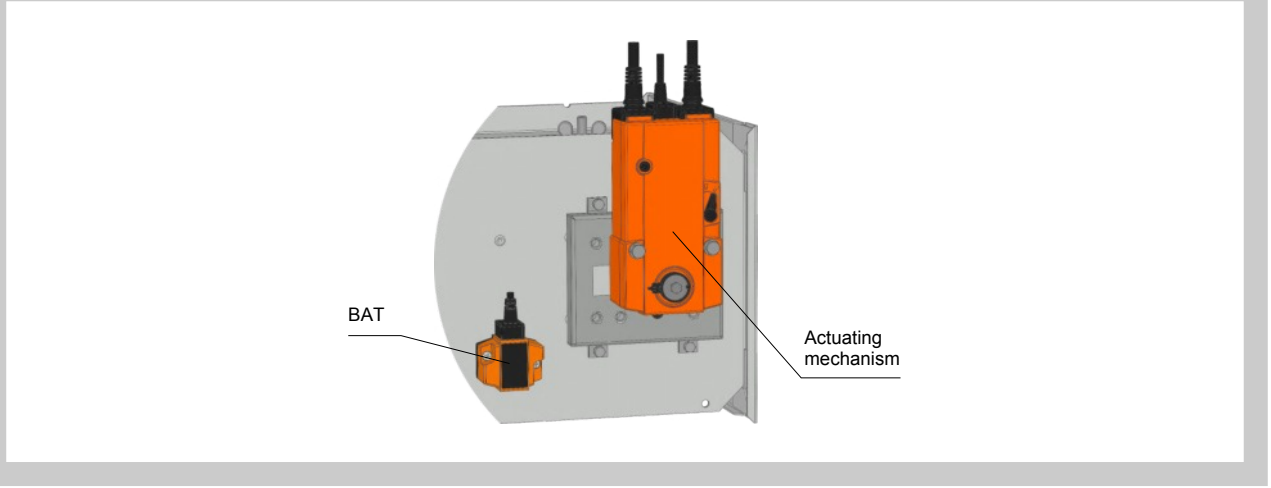


Fig. 9 Actuating mechanism BELIMO BFL (BFN) 230-T

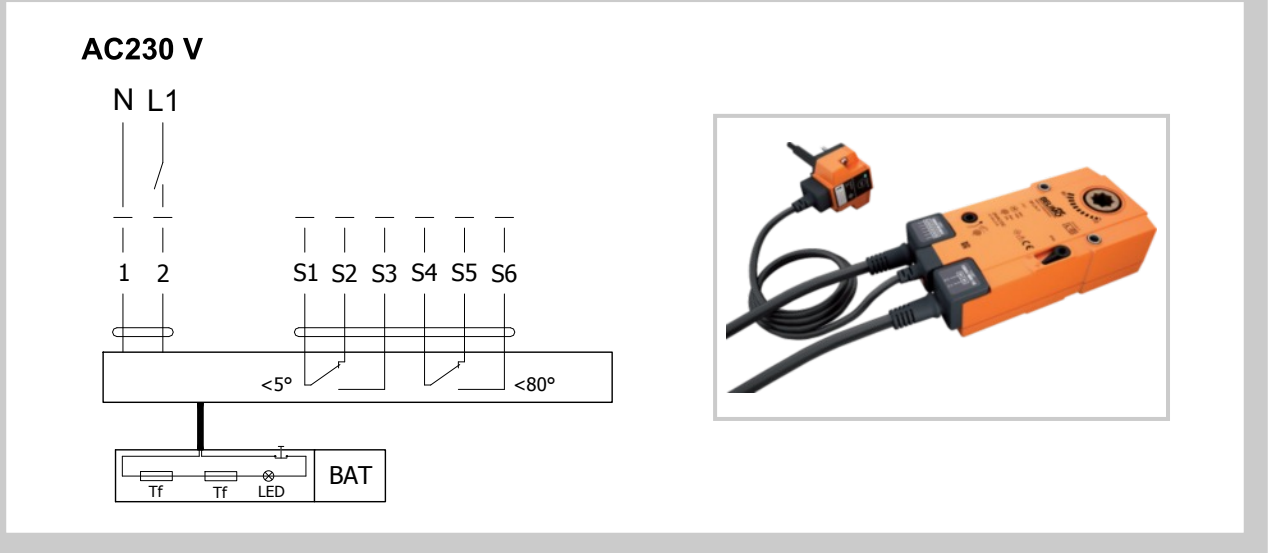
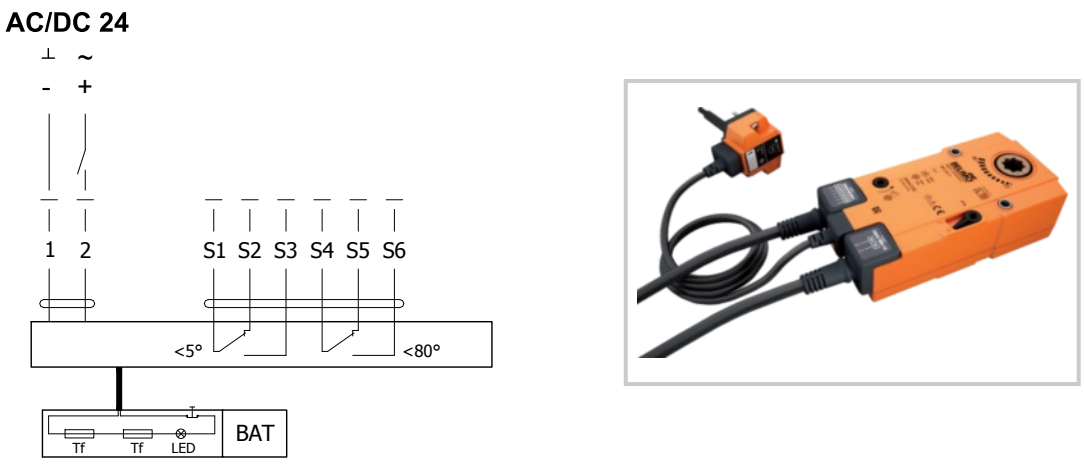


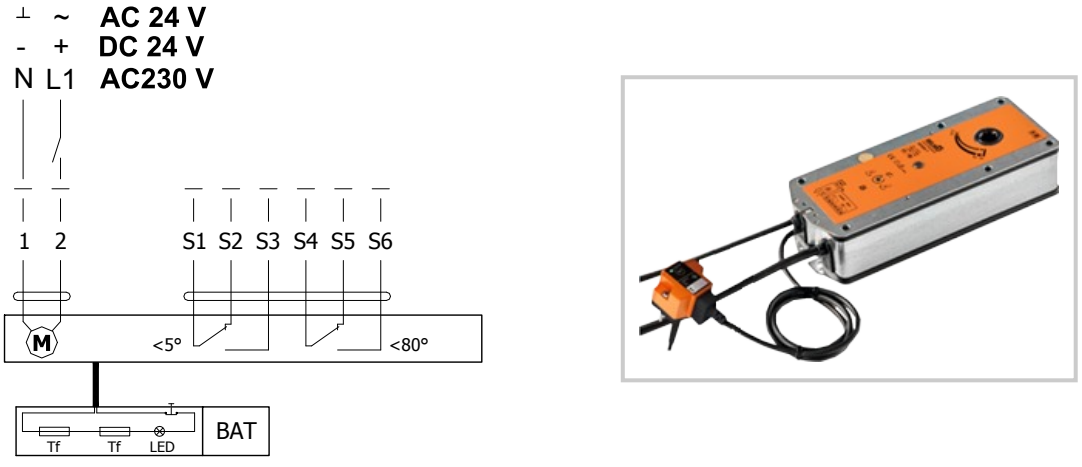
Fig. 10 Actuating mechanism BELIMO BFL, BFN 24-T(-ST)



Tab. 2.2.1. Actuating mechanism BELIMO BFL24-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 (Imax 4 A @ 5 ms)	4/6 VA (Imax 8,3 A @ 5 ms)
Protection class	II	III
Degree of protection	IP 54	
Running time - motor - spring return	<60 s ~ 20 s	
Ambient temperature - normal duty - safety duty - non-operating temperature	- 30°C … +55°C The safe position will be attained up to max. +75°C - 40°C … +55°C	
Connecting - motor - auxiliary switch	cable 1 m, 2 x 0,75 mm² (BFL/BFN 24-T-ST) with 3-pin plug-in connectors cable 1 m, 6 x 0,75 mm² (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

Actuating mechanism BELIMO	BF 24-TN(-ST)	BF 230-TN
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 mm² cable 1 m, 6 x 0,75 mm² (BF 24-T-ST) with plug-in connectors	
Thermal trips	Tf1: duct outside temperature Duct +72°C Tf2/Tf3: duct intside 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 equpped 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.

The smoke detector sensor is not part of the fire damper in the case of dampers from A<160 or B<160. The smoke sensor is supplied separately.

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

Optical smoke detector	ORS 142 K with socket 143A
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
Aditional temperature senzor	+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

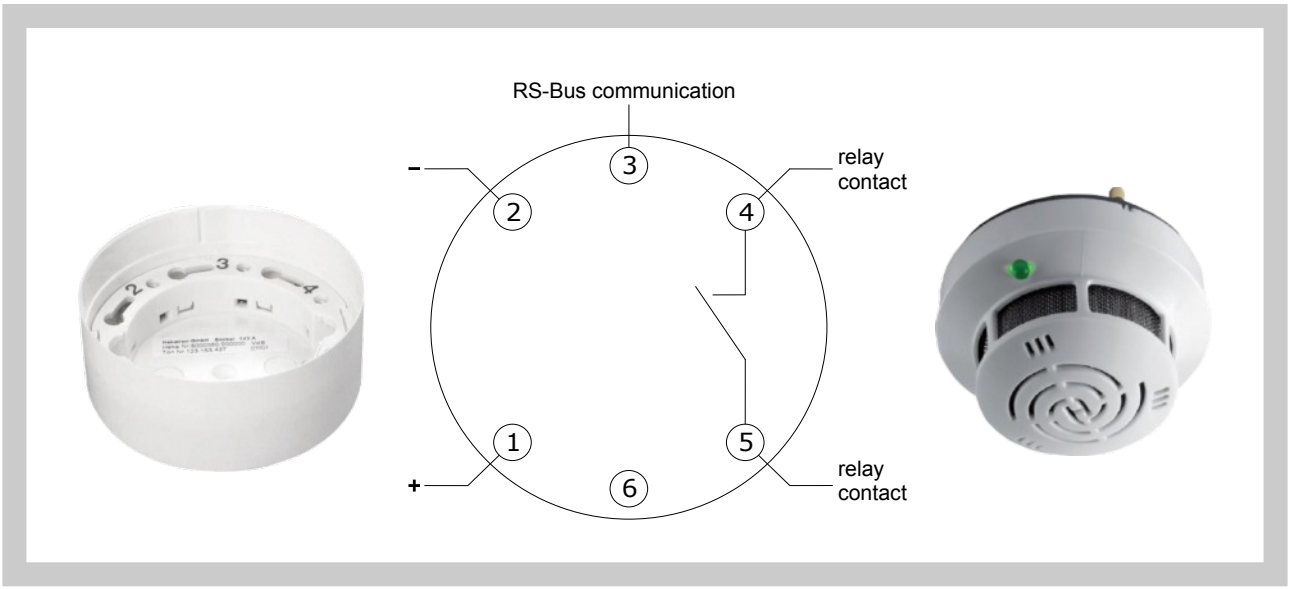


Fig. 13 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T) , with smoke detector ORS 142 K and with communication and supply device BKN 230-24-MOD (voltage AC 230 V)

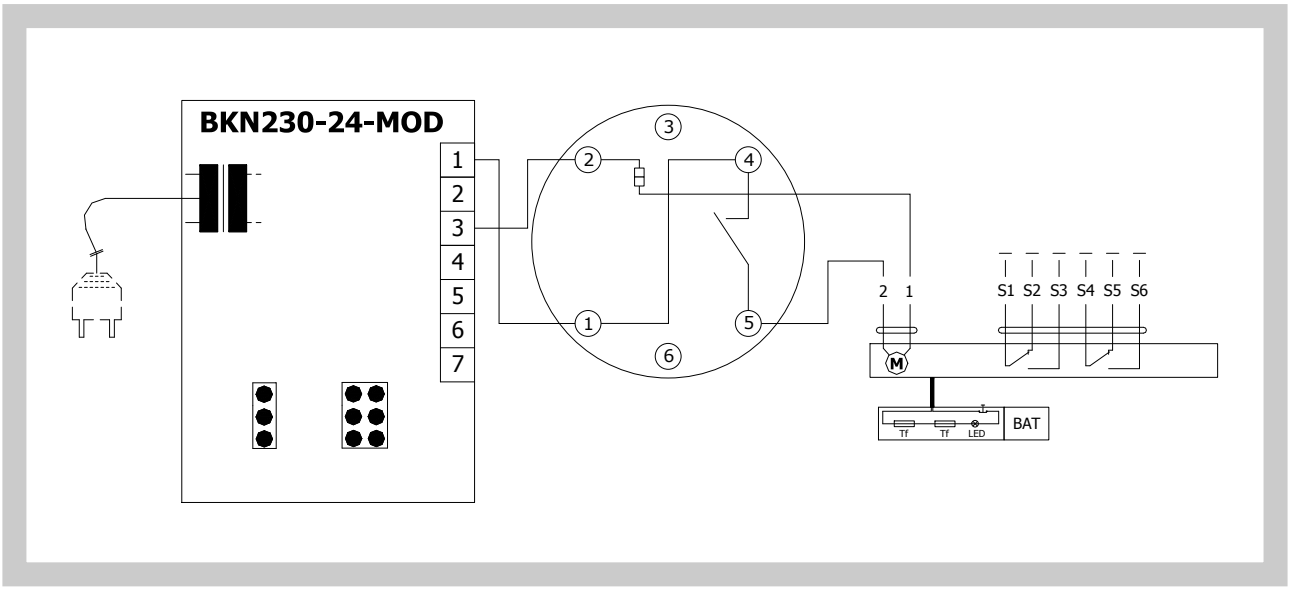
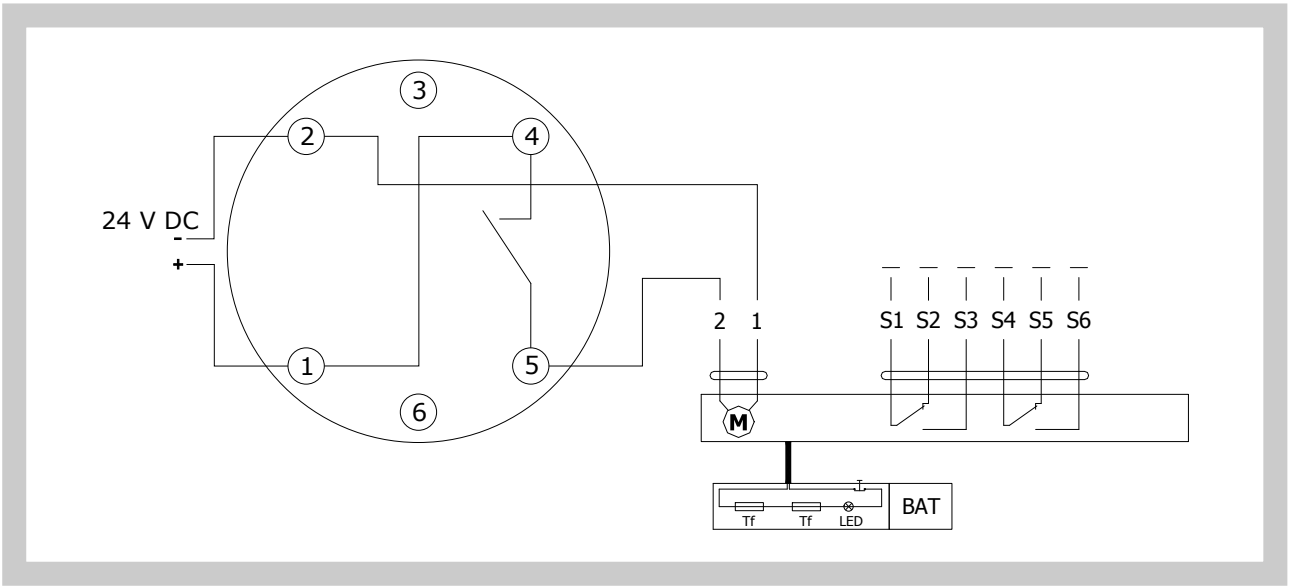


Fig. 14 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T) , with smoke detector ORS 142 K (voltage 24 V DC)



2.3. Design with the communication and supply device

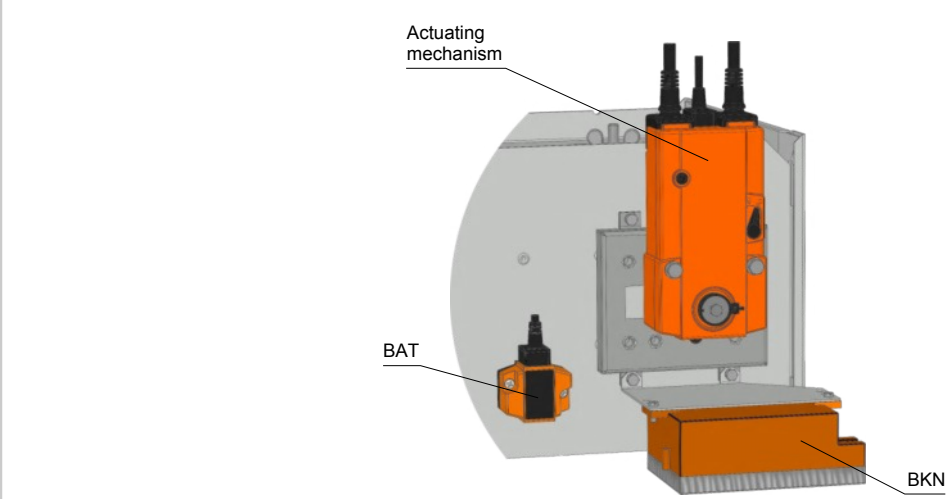
Design .60

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".

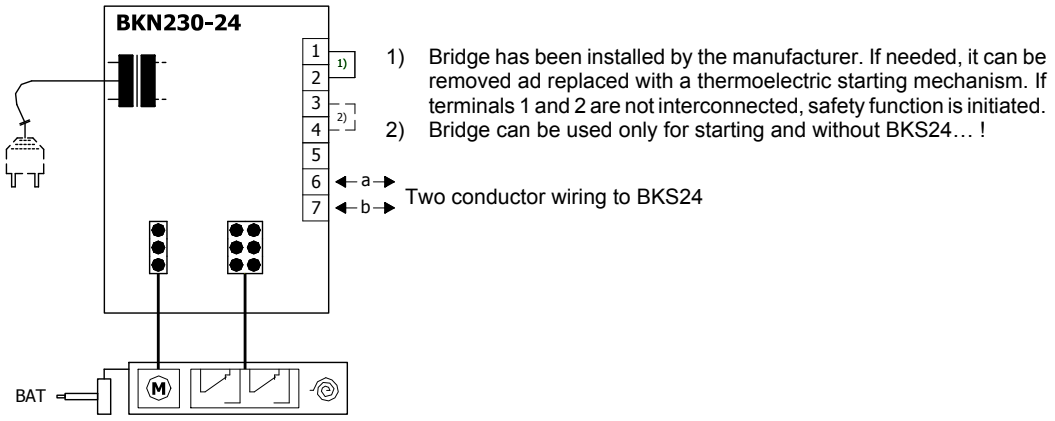
Fig. 15 Design with the communication and supply device BKN 230-24, BKN230-24-C-MP or BKN 230-24-MOD



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

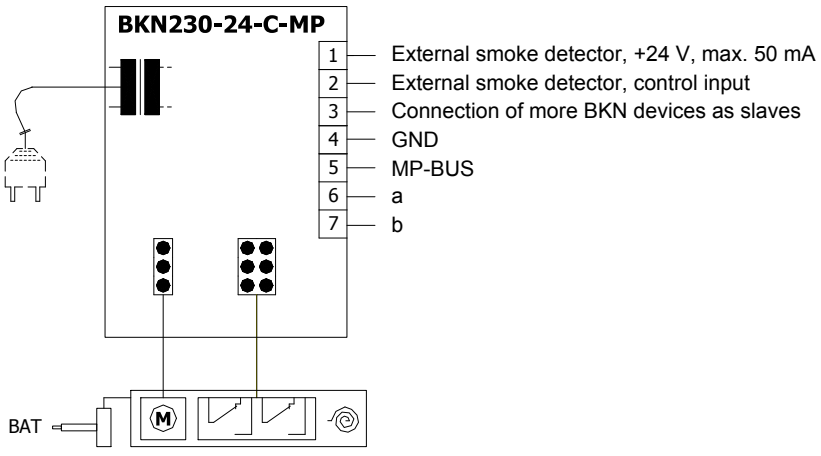
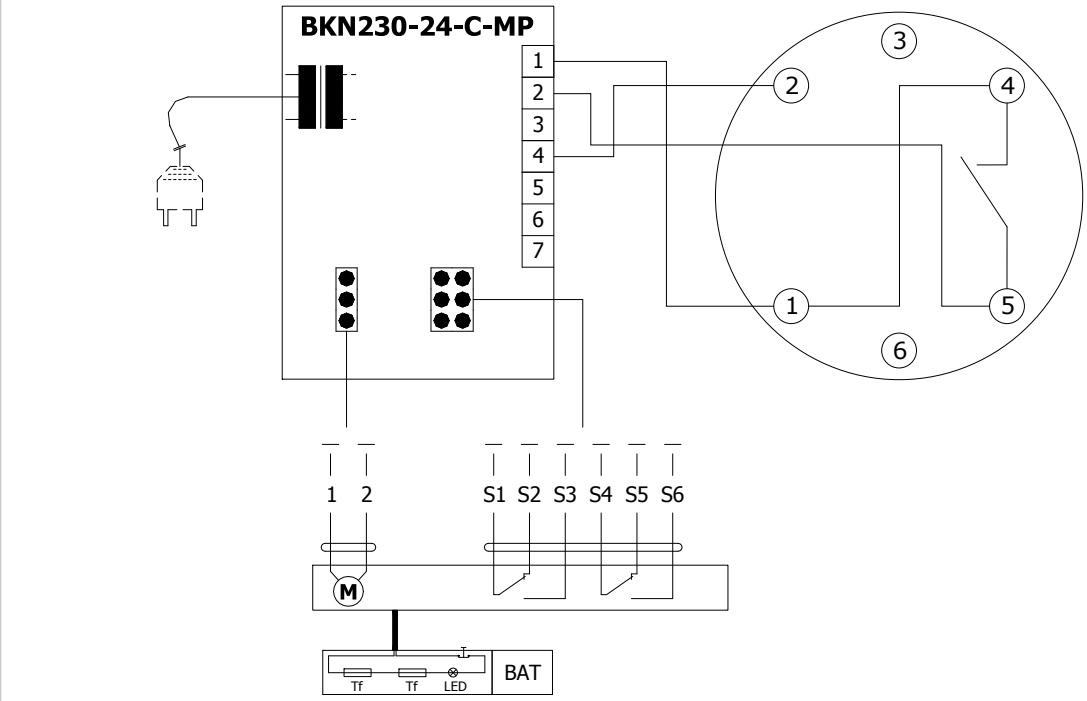


Fig. 18 Design with communication and supply device BKN 230-24-C-MP, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) with actuating mechanism ORS 142 K



Design .63

Design .60 with communication and supply device can be complemented with smoke detector ORS 142 K. For supply and comunnication 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)

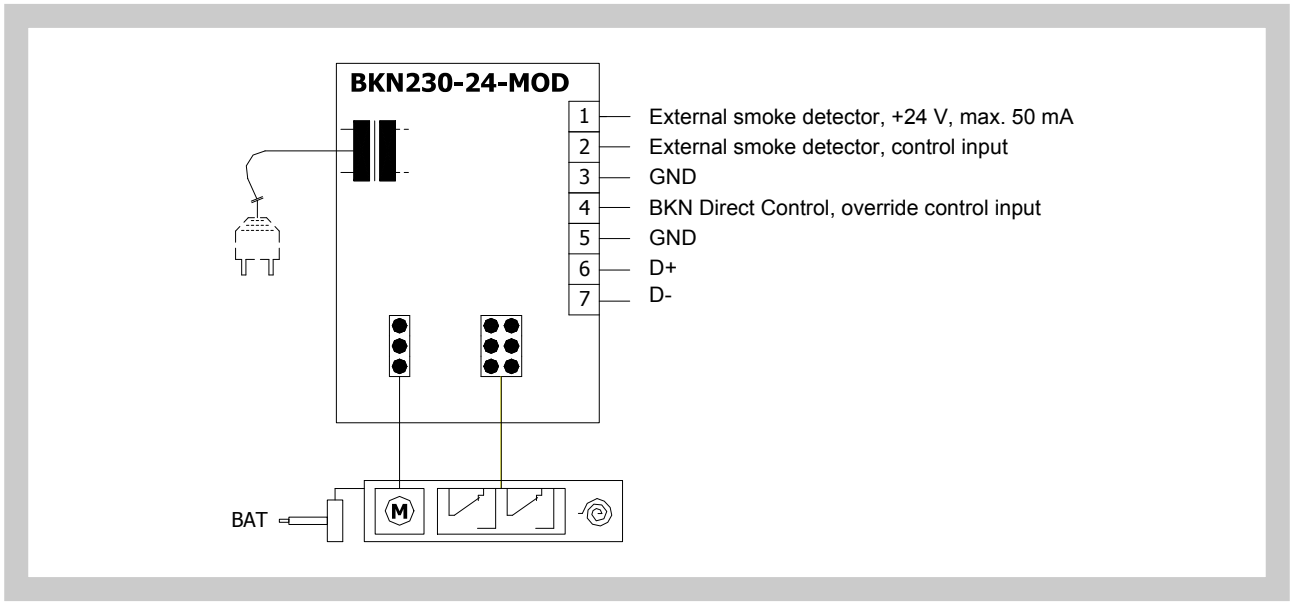
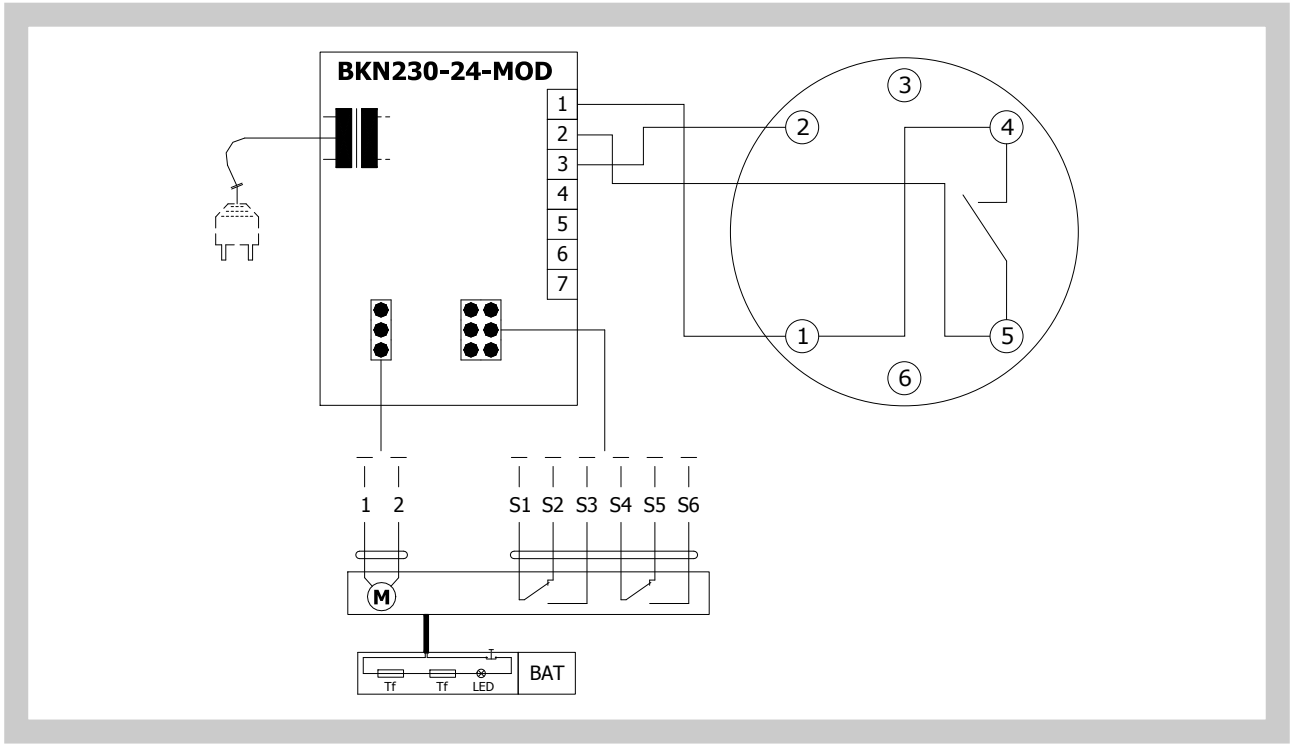


Fig. 20 Design with communication and supply device BKN 230-24-MOD, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) and smoke detector ORS 142 K



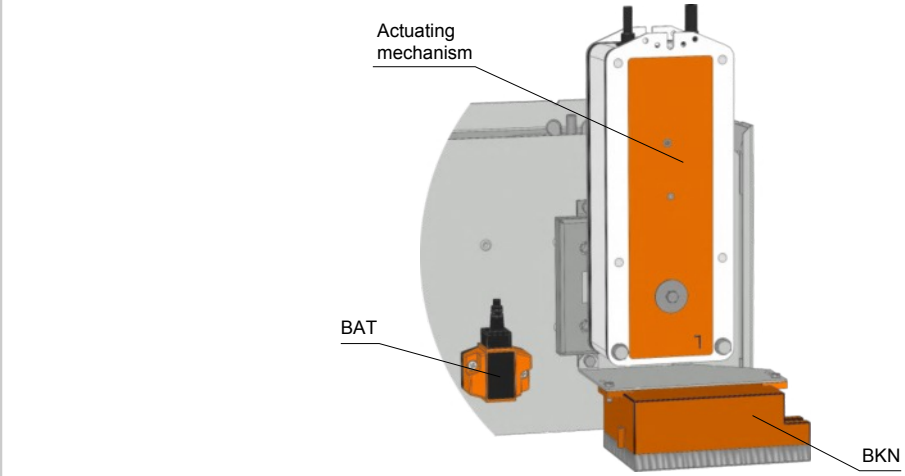
Design .62

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 actuationg mechanism BF 24TL-TN-ST**



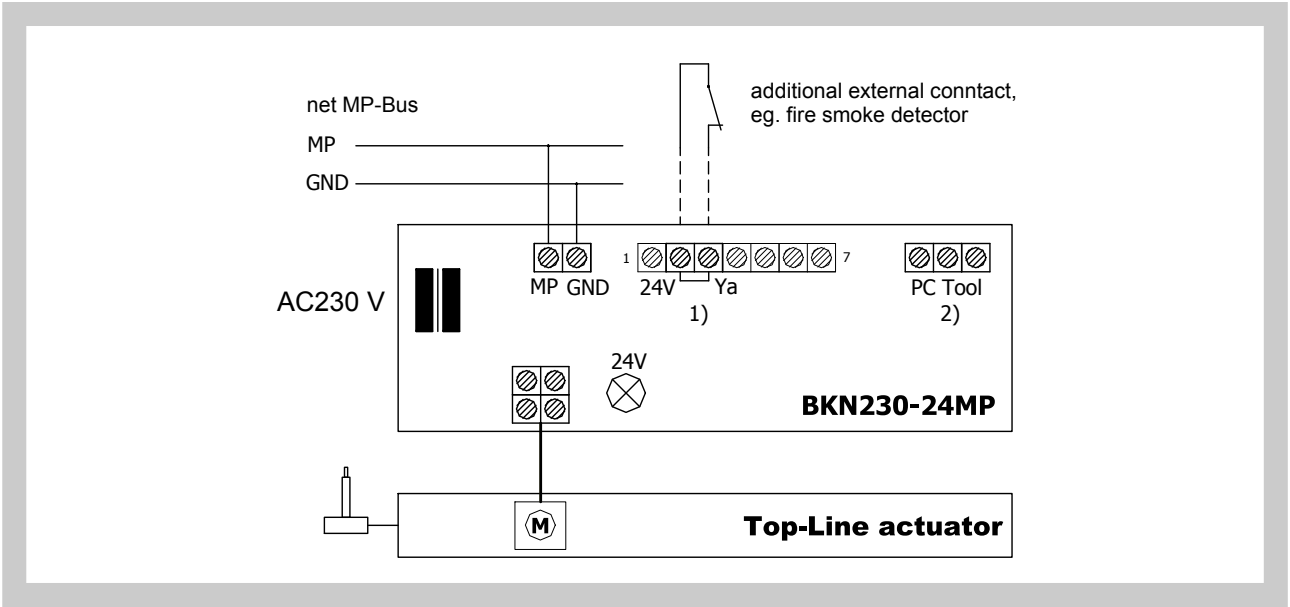
Tab. 2.3.4. **Actuating mechanism BELIMO BF 24TL-TN-ST**

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 (Imax 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 mm² 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 (volitelné) - 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

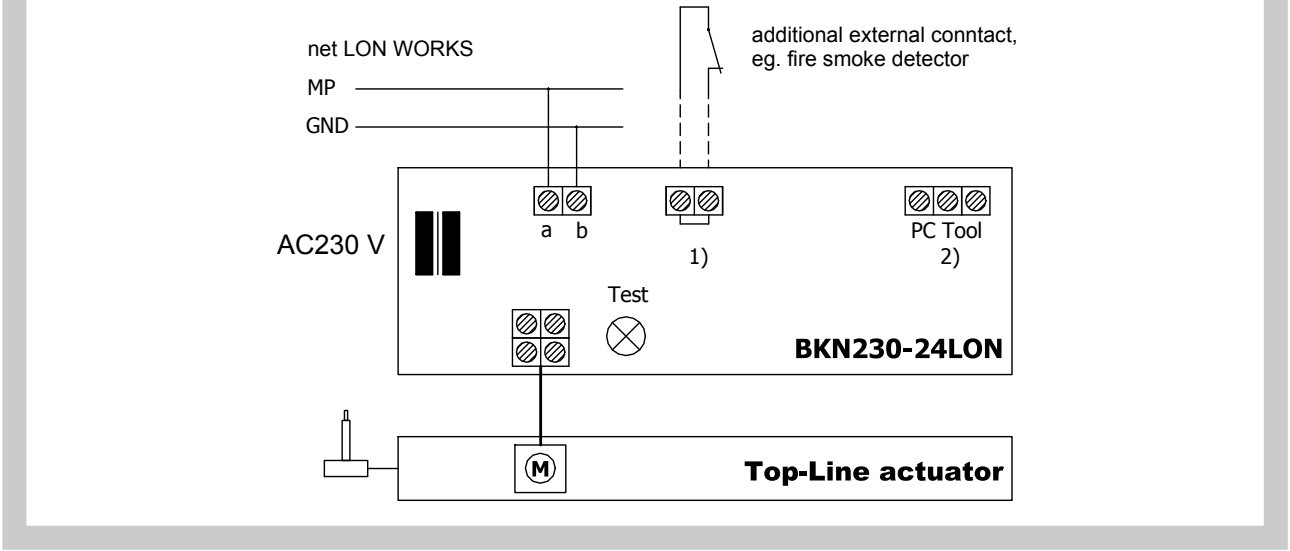
Fig. 22 Communication and supply device BKN 230-24MP



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 Non-operating temperature	-30°C … +50°C -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

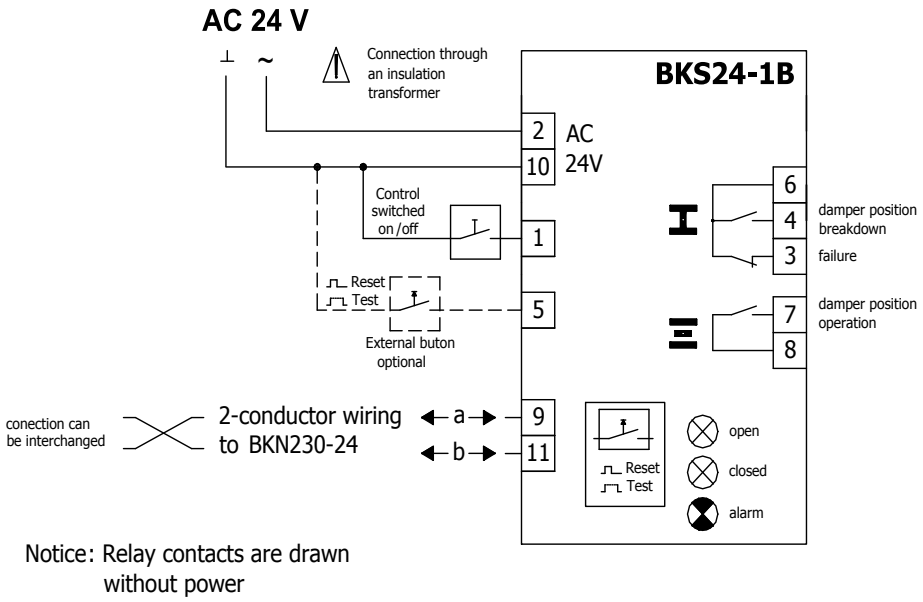
Fig. 23 Communication and supply device BKN 230-24LON



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



Notice: Relay contacts are drawn without power

Signals and diagnosis				
light diodes			contacts	Description
⊗ open	⊗ closed	◙ alarm	state	Cause/Course
⊗ closed	⊗ closed	◙ closed	6–3	**Power supply AC 24V**not available
☼ open	☼ open	☼ open	6–3	**Check test cca 35sec**, starting with switching AC 24 on or pressing «Reset/Test» button
⊗ closed	⊗ closed	☼ flashing	6–3	**Current failure,** 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	**Failure saved in memory** • Fault in system signalled, system check should be done
⊗ closed	☼ flashing	◙ closed	6–4	Damper (drive) turning into **the direction** of breakdown position
⊗ closed	☼ open	◙ closed	6–4	Damper (drive) in **breakdown position** I
☼ flashing	⊗ closed	◙ closed	6–7	Damper (drive) turning into **the direction** of operating position
☼ open	⊗ closed	◙ closed	6–7	Damper (drive) in **operating position** =

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 mm²

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.

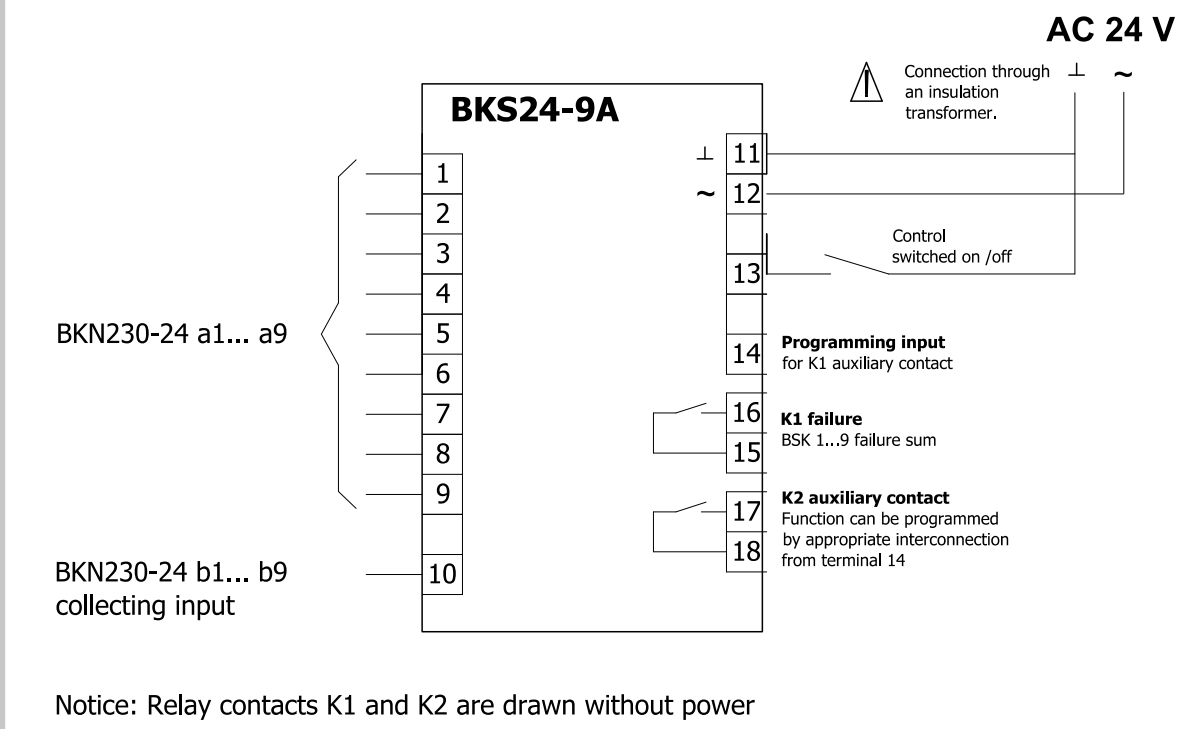
Tab. 3.2.1. **BKS 24 -9A contacts K1 and K2**

Function contact K1	
situation	**state**
current failure	15 — 16
no failure	15 — 16

Programming K2 Auxiliary Contact		
function	**interconnection**	**state**
K2 contact is on if all the flaps are open	14 — 11	17 — 18
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



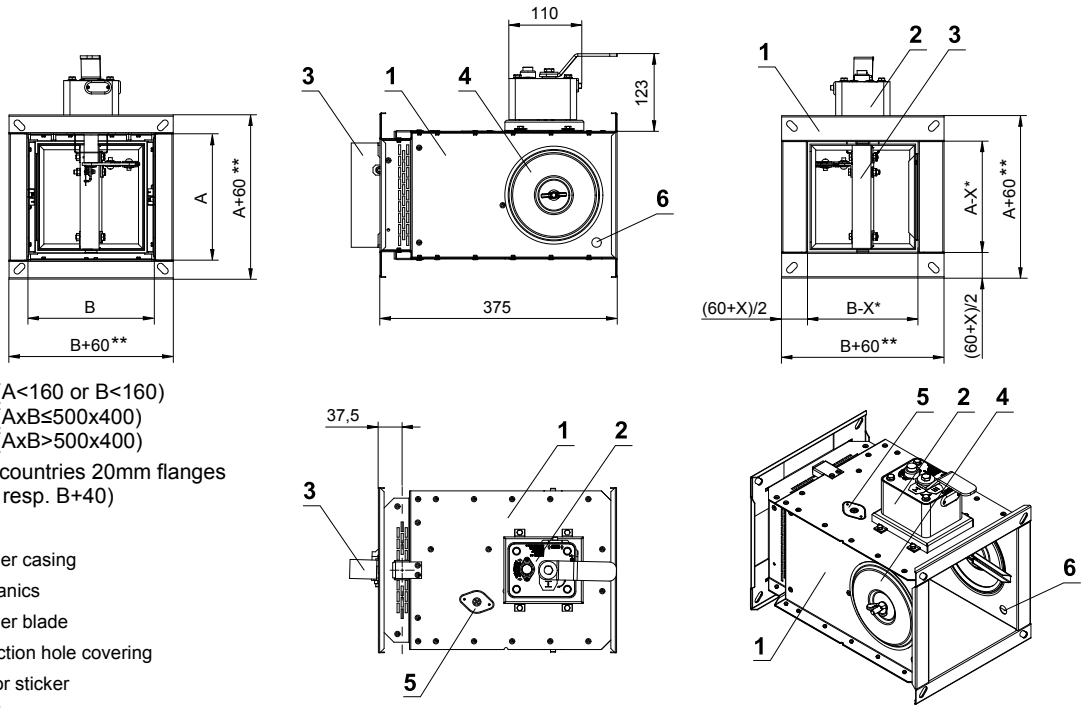
Tab. 3.2.2. Communication and control device BKS 24-9A

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 mm²

4. Dimensions, weights and effective area

4.1. Dimensions

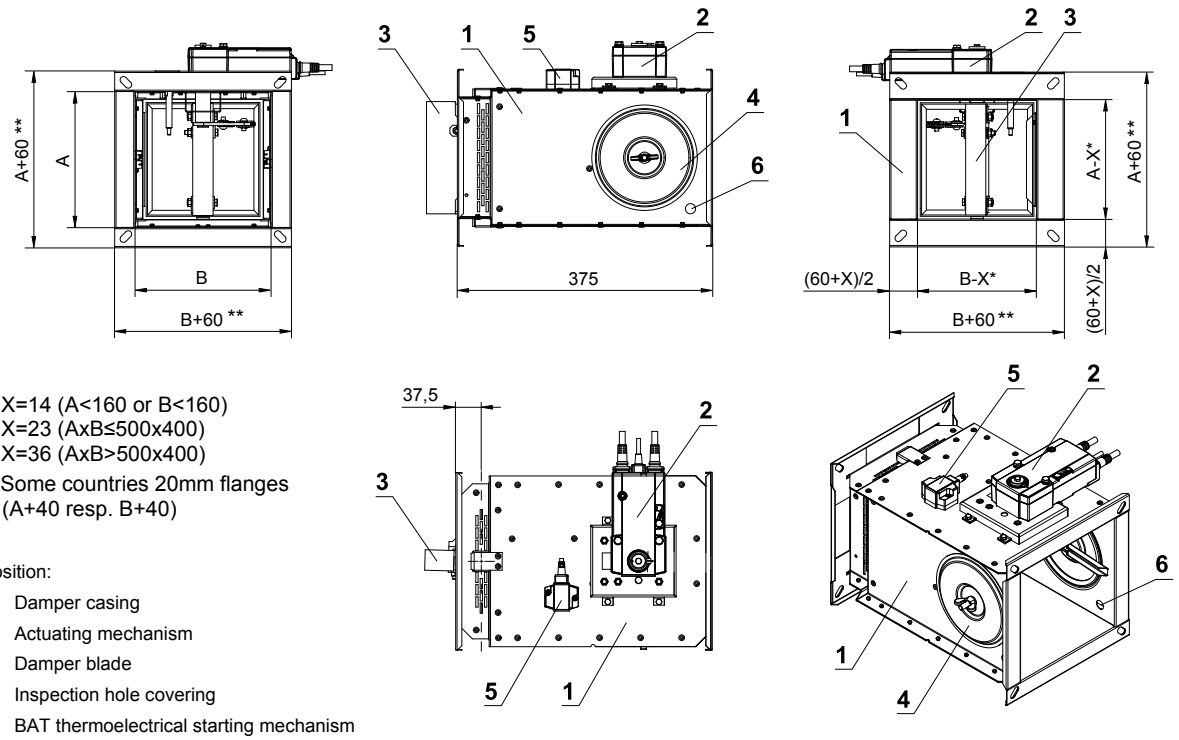
Fig. 26 Design with mechanical control



* X=14 (A<160 or B<160)
* X=23 (AxB≤500x400)
* X=36 (AxB>500x400)
** Some countries 20mm flanges (A+40 resp. B+40)

Position:
1 Damper casing
2 Mechanics
3 Damper blade
4 Inspection hole covering
5 Sensor sticker
6 Hole for camera

Fig. 27 Design with actuating mechanism



* X=14 (A<160 or B<160)
* X=23 (AxB≤500x400)
* X=36 (AxB>500x400)
** Some countries 20mm flanges (A+40 resp. B+40)

Position:
1 Damper casing
2 Actuating mechanism
3 Damper blade
4 Inspection hole covering
5 BAT thermoelectrical starting mechanism
6 Hole for camera

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 Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
100 x 100	-	-	4,5	5,7	0,0030	BFL	M1	**150 x 250**	-	65	7,0	8,2	0,0234	BFL	M1
x 110	-	-	4,6	5,8	0,0037	BFL	M1	**x 280**	-	80	7,5	8,7	0,0271	BFL	M1
x 125	-	-	4,8	6,0	0,0048	BFL	M1	**160 x 100**	-	-	5,1	6,3	0,0055	BFL	M1
x 140	-	5	5,0	6,2	0,0059	BFL	M1	**x 110**	-	-	5,2	6,4	0,0069	BFL	M1
x 150	-	15	5,2	6,4	0,0066	BFL	M1	**x 125**	-	-	5,5	6,7	0,0088	BFL	M1
x 160	-	20	5,5	6,7	0,0073	BFL	M1	**x 140**	-	5	5,7	6,9	0,0108	BFL	M1
x 180	-	30	5,7	6,9	0,0088	BFL	M1	**x 150**	-	15	5,8	7,0	0,0121	BFL	M1
x 200	-	40	5,9	7,1	0,0102	BFL	M1	**x 160**	-	20	6,1	7,3	0,0113	BFL	M1
x 225	-	52,5	6,1	7,3	0,0120	BFL	M1	**x 180**	-	30	6,4	7,6	0,0137	BFL	M1
x 250	-	65	6,4	7,6	0,0138	BFL	M1	**x 200**	-	40	6,6	7,8	0,0161	BFL	M1
x 280	-	80	6,9	8,1	0,0160	BFL	M1	**x 225**	-	52,5	6,8	8,0	0,0191	BFL	M1
110 x 100	-	-	4,6	5,8	0,0034	BFL	M1	**x 250**	-	65	7,1	8,3	0,0222	BFL	M1
x 110	-	-	4,7	5,9	0,0043	BFL	M1	**x 280**	-	80	7,7	8,9	0,0258	BFL	M1
x 125	-	-	4,9	6,1	0,0055	BFL	M1	**x 300**	-	90	8,0	9,2	0,0282	BFL	M1
x 140	-	5	5,2	6,4	0,0067	BFL	M1	**x 315**	-	97,5	8,2	9,4	0,0300	BFL	M1
x 150	-	15	5,3	6,5	0,0075	BFL	M1	**x 355**	-	117,5	9,0	10,2	0,0349	BFL	M1
x 160	-	20	5,6	6,8	0,0084	BFL	M1	**x 400**	-	140	9,6	10,8	0,0403	BFL	M1
x 180	-	30	5,8	7,0	0,0100	BFL	M1	**x 450**	-	165	10,2	11,4	0,0392	BFL	M1
x 200	-	40	6,0	7,2	0,0116	BFL	M1	**x 500**	-	190	10,8	12,0	0,0446	BFL	M2
x 225	-	52,5	6,2	7,4	0,0137	BFL	M1	**x 550**	-	215	11,7	12,9	0,0500	BFL	M2
x 250	-	65	6,5	7,7	0,0157	BFL	M1	**x 560**	-	220	11,8	13,0	0,0511	BFL	M2
x 280	-	80	7,0	8,2	0,0182	BFL	M1	**x 600**	-	240	12,0	13,2	0,0554	BFL	M2
125 x 100	-	-	4,7	5,9	0,0041	BFL	M1	**x 630**	-	255	12,3	13,5	0,0586	BFL	M2
x 110	-	-	4,9	6,1	0,0050	BFL	M1	**x 650**	-	265	12,5	13,7	0,0608	BFL	M2
x 125	-	-	5,1	6,3	0,0065	BFL	M1	**x 700**	-	290	13,1	14,3	0,0662	BFL	M2
x 140	-	5	5,3	6,5	0,0080	BFL	M1	**x 710**	-	295	13,3	14,5	0,0673	BFL	M2
x 150	-	15	5,4	6,6	0,0089	BFL	M1	**x 750**	15	315	13,5	15,0	0,0716	BFN	M2
x 160	-	20	5,7	6,9	0,0099	BFL	M1	**x 800**	40	340	14,2	15,7	0,0770	BFN	M2
x 180	-	30	6,0	7,2	0,0118	BFL	M1	**x 900**	90	390	14,8	16,3	0,0878	BFN	M2
x 200	-	40	6,2	7,4	0,0138	BFL	M1	**x 1000**	140	440	19,8	21,3	0,0986	BFN	M2
x 225	-	52,5	6,4	7,6	0,0162	BFL	M1	**180 x 100**	-	-	5,3	6,5	0,0064	BFL	M1
x 250	-	65	6,7	7,9	0,0186	BFL	M1	**x 110**	-	-	5,4	6,6	0,0079	BFL	M1
x 280	-	80	7,2	8,4	0,0215	BFL	M1	**x 125**	-	-	5,6	6,8	0,0102	BFL	M1
140 x 100	-	-	4,9	6,1	0,0047	BFL	M1	**x 140**	-	5	5,9	7,1	0,0125	BFL	M1
x 110	-	-	5,0	6,2	0,0058	BFL	M1	**x 150**	-	15	6,0	7,2	0,0140	BFL	M1
x 125	-	-	5,2	6,4	0,0075	BFL	M1	**x 160**	-	20	6,3	7,5	0,0131	BFL	M1
x 140	-	5	5,5	6,7	0,0092	BFL	M1	**x 180**	-	30	6,6	7,8	0,0159	BFL	M1
x 150	-	15	5,6	6,8	0,0103	BFL	M1	**x 200**	-	40	6,8	8,0	0,0187	BFL	M1
x 160	-	20	5,9	7,1	0,0114	BFL	M1	**x 225**	-	52,5	7,0	8,2	0,0222	BFL	M1
x 180	-	30	6,1	7,3	0,0137	BFL	M1	**x 250**	-	65	7,5	8,7	0,0258	BFL	M1
x 200	-	40	6,3	7,5	0,0159	BFL	M1	**x 280**	-	80	7,9	9,1	0,0300	BFL	M1
x 225	-	52,5	6,5	7,7	0,0187	BFL	M1	**x 300**	-	90	8,2	9,4	0,0328	BFL	M1
x 250	-	65	6,9	8,1	0,0215	BFL	M1	**x 315**	-	97,5	8,4	9,6	0,0349	BFL	M1
x 280	-	80	7,4	8,6	0,0249	BFL	M1	**x 355**	-	117,5	9,2	10,4	0,0406	BFL	M1
150 x 100	-	-	5,0	6,2	0,0051	BFL	M1	**x 400**	-	140	10,0	11,2	0,0469	BFL	M1
x 110	-	-	5,1	6,3	0,0063	BFL	M1	**x 450**	-	165	10,5	11,7	0,0465	BFL	M1
x 125	-	-	5,3	6,5	0,0082	BFL	M1	**x 500**	-	190	11,2	12,4	0,0529	BFL	M2
x 140	-	5	5,6	6,8	0,0100	BFL	M1	**x 550**	-	215	12,0	13,2	0,0593	BFL	M2
x 150	-	15	5,7	6,9	0,0112	BFL	M1	**x 560**	-	220	12,1	13,3	0,0605	BFL	M2
x 160	-	20	6,0	7,2	0,0124	BFL	M1	**x 600**	-	240	12,3	13,5	0,0657	BFL	M2
x 180	-	30	6,2	7,4	0,0149	BFL	M1	**x 630**	-	255	12,7	13,9	0,0695	BFL	M2
x 200	-	40	6,5	7,7	0,0173	BFL	M1	**x 650**	-	265	12,9	14,1	0,0721	BFL	M2
x 225	-	52,5	6,7	7,9	0,0204	BFL	M1	**x 700**	-	290	13,6	15,1	0,0785	BFN	M2

A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
180 x 710	-	295	13,8	15,3	0,0797	BFN	M2	**225 x 710**	-	295	14,8	16,3	0,1078	BFN	M2
x 750	15	315	14,0	15,5	0,0849	BFN	M2	**x 750**	15	315	15,2	16,7	0,1147	BFN	M2
x 800	40	340	14,8	16,3	0,0913	BFN	M2	**x 800**	40	340	15,9	17,4	0,1233	BFN	M2
x 900	90	390	15,3	16,8	0,1041	BFN	M2	**x 900**	90	390	16,5	18,0	0,1406	BFN	M3
x 1000	140	440	20,0	21,5	0,1169	BFN	M2	**x 1000**	140	440	20,5	23,3	0,1579	BF	M3
200 x 100	-	-	5,5	6,7	0,0072	BFL	M1	**250 x 100**	-	-	5,9	7,1	0,0093	BFL	M1
x 110	-	-	5,6	6,8	0,0089	BFL	M1	**x 110**	-	-	6,1	7,3	0,0115	BFL	M1
x 125	-	-	5,9	7,1	0,0115	BFL	M1	**x 125**	-	-	6,4	7,6	0,0149	BFL	M1
x 140	-	5	6,1	7,3	0,0141	BFL	M1	**x 140**	-	5	6,6	7,8	0,0182	BFL	M1
x 150	-	15	6,2	7,4	0,0158	BFL	M1	**x 150**	-	15	6,8	8,0	0,0204	BFL	M1
x 160	-	20	6,6	7,8	0,0149	BFL	M1	**x 160**	-	20	7,1	8,3	0,0194	BFL	M1
x 180	-	30	6,8	8,0	0,0181	BFL	M1	**x 180**	-	30	7,4	8,6	0,0236	BFL	M1
x 200	-	40	7,0	8,2	0,0213	BFL	M1	**x 200**	-	40	7,6	8,8	0,0278	BFL	M1
x 225	-	52,5	7,2	8,4	0,0253	BFL	M1	**x 225**	-	52,5	8,0	9,2	0,0331	BFL	M1
x 250	-	65	7,8	9,0	0,0294	BFL	M1	**x 250**	-	65	8,2	9,4	0,0384	BFL	M1
x 280	-	80	8,1	9,3	0,0342	BFL	M1	**x 280**	-	80	8,8	10,0	0,0447	BFL	M1
x 300	-	90	8,5	9,7	0,0374	BFL	M1	**x 300**	-	90	9,2	10,4	0,0489	BFL	M1
x 315	-	97,5	8,7	9,9	0,0398	BFL	M1	**x 315**	-	97,5	9,5	10,7	0,0521	BFL	M1
x 355	-	117,5	9,4	10,6	0,0463	BFL	M1	**x 355**	-	117,5	10,3	11,5	0,0605	BFL	M1
x 400	-	140	10,3	11,5	0,0535	BFL	M1	**x 400**	-	140	11,1	12,3	0,0700	BFL	M1
x 450	-	165	10,9	12,1	0,0537	BFL	M1	**x 450**	-	165	11,7	12,9	0,0719	BFL	M1
x 500	-	190	11,5	12,7	0,0611	BFL	M2	**x 500**	-	190	12,4	13,6	0,0818	BFL	M2
x 550	-	215	12,4	13,6	0,0685	BFL	M2	**x 550**	-	215	13,1	14,3	0,0917	BFL	M2
x 560	-	220	12,6	13,8	0,0700	BFL	M2	**x 560**	-	220	13,2	14,4	0,0937	BFL	M2
x 600	-	240	12,7	13,9	0,0759	BFL	M2	**x 600**	-	240	13,7	15,2	0,1016	BFN	M2
x 630	-	255	13,1	14,3	0,0804	BFL	M2	**x 630**	-	255	14,2	15,7	0,1075	BFN	M2
x 650	-	265	13,3	14,5	0,0833	BFL	M2	**x 650**	-	265	14,4	15,9	0,1115	BFN	M2
x 700	-	290	14,0	15,5	0,0907	BFN	M2	**x 700**	-	290	15,2	16,7	0,1214	BFN	M2
x 710	-	295	14,2	15,7	0,0922	BFN	M2	**x 710**	-	295	15,4	16,9	0,1234	BFN	M2
x 750	15	315	14,7	16,2	0,0981	BFN	M2	**x 750**	15	315	15,8	17,3	0,1313	BFN	M3
x 800	40	340	15,7	17,2	0,1055	BFN	M2	**x 800**	40	340	16,3	17,8	0,1412	BFN	M3
x 900	90	390	16,0	17,5	0,1203	BFN	M2	**x 900**	90	390	17,2	18,7	0,1610	BFN	M3
x 1000	140	440	20,2	21,7	0,1351	BFN	M2	**x 1000**	140	440	21,0	23,8	0,1808	BF	M3
225 x 100	-	-	5,6	6,8	0,0083	BFL	M1	**280 x 100**	-	-	6,2	7,4	0,0106	BFL	M1
x 110	-	-	5,8	7,0	0,0102	BFL	M1	**x 110**	-	-	6,4	7,6	0,0131	BFL	M1
x 125	-	-	6,1	7,3	0,0132	BFL	M1	**x 125**	-	-	6,6	7,8	0,0169	BFL	M1
x 140	-	5	6,3	7,5	0,0162	BFL	M1	**x 140**	-	5	6,9	8,1	0,0207	BFL	M1
x 150	-	15	6,5	7,7	0,0181	BFL	M1	**x 150**	-	15	7,1	8,3	0,0232	BFL	M1
x 160	-	20	6,8	8,0	0,0171	BFL	M1	**x 160**	-	20	7,4	8,6	0,0221	BFL	M1
x 180	-	30	7,0	8,2	0,0209	BFL	M1	**x 180**	-	30	7,7	8,9	0,0269	BFL	M1
x 200	-	40	7,3	8,5	0,0246	BFL	M1	**x 200**	-	40	8,0	9,2	0,0317	BFL	M1
x 225	-	52,5	7,7	8,9	0,0292	BFL	M1	**x 225**	-	52,5	8,3	9,5	0,0377	BFL	M1
x 250	-	65	8,0	9,2	0,0339	BFL	M1	**x 250**	-	65	8,5	9,7	0,0438	BFL	M1
x 280	-	80	8,4	9,6	0,0395	BFL	M1	**x 280**	-	80	9,1	10,3	0,0510	BFL	M1
x 300	-	90	8,8	10,0	0,0432	BFL	M1	**x 300**	-	90	9,6	10,8	0,0558	BFL	M1
x 315	-	97,5	9,1	10,3	0,0460	BFL	M1	**x 315**	-	97,5	9,8	11,0	0,0594	BFL	M1
x 355	-	117,5	10,0	11,2	0,0534	BFL	M1	**x 355**	-	117,5	10,7	11,9	0,0691	BFL	M1
x 400	-	140	10,7	11,9	0,0618	BFL	M1	**x 400**	-	140	11,6	12,8	0,0799	BFL	M1
x 450	-	165	11,3	12,5	0,0628	BFL	M1	**x 450**	-	165	12,3	13,5	0,0828	BFL	M1
x 500	-	190	12,0	13,2	0,0714	BFL	M2	**x 500**	-	190	13,0	14,2	0,0942	BFL	M2
x 550	-	215	12,8	14,0	0,0801	BFL	M2	**x 550**	-	215	13,6	14,8	0,1056	BFL	M2
x 560	-	220	12,9	14,1	0,0818	BFL	M2	**x 560**	-	220	13,8	15,3	0,1078	BFN	M2
x 600	-	240	13,3	14,5	0,0887	BFL	M2	**x 600**	-	240	14,4	15,9	0,1170	BFN	M2
x 630	-	255	13,7	15,2	0,0939	BFN	M2	**x 630**	-	255	14,8	16,3	0,1238	BFN	M2
x 650	-	265	13,9	15,4	0,0974	BFN	M2	**x 650**	-	265	15,0	16,5	0,1284	BFN	M2
x 700	-	290	14,6	16,1	0,1060	BFN	M2	**x 700**	-	290	15,8	17,3	0,1398	BFN	M2

A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
280 x 710	-	295	16,0	17,5	0,1420	BFN	M2	**315 x 710**	-	295	16,9	18,4	0,1638	BFN	M2
x 750	15	315	16,5	18,0	0,1512	BFN	M3	**x 750**	15	315	17,2	18,7	0,1744	BFN	M3
x 800	40	340	17,1	18,6	0,1626	BFN	M3	**x 800**	40	340	18,0	19,5	0,1875	BFN	M3
x 900	90	390	18,2	21,0	0,1854	BF	M3	**x 900**	90	390	19,3	22,1	0,2138	BF	M3
x 1000	140	440	21,5	24,3	0,2082	BF	M3	**x 1000**	140	440	22,2	25,0	0,2401	BF	M3
300 x 100	-	-	6,4	7,6	0,0114	BFL	M1	**355 x 100**	-	-	6,9	8,1	0,0137	BFL	M1
x 110	-	-	6,5	7,7	0,0141	BFL	M1	**x 110**	-	-	7,1	8,3	0,0170	BFL	M1
x 125	-	-	6,8	8,0	0,0182	BFL	M1	**x 125**	-	-	7,3	8,5	0,0219	BFL	M1
x 140	-	5	7,1	8,3	0,0223	BFL	M1	**x 140**	-	5	7,6	8,8	0,0268	BFL	M1
x 150	-	15	7,3	8,5	0,0250	BFL	M1	**x 150**	-	15	7,8	9,0	0,0301	BFL	M1
x 160	-	20	7,6	8,8	0,0239	BFL	M1	**x 160**	-	20	8,2	9,4	0,0288	BFL	M1
x 180	-	30	7,9	9,1	0,0291	BFL	M1	**x 180**	-	30	8,5	9,7	0,0352	BFL	M1
x 200	-	40	8,2	9,4	0,0343	BFL	M1	**x 200**	-	40	8,8	10,0	0,0415	BFL	M1
x 225	-	52,5	8,5	9,7	0,0408	BFL	M1	**x 225**	-	52,5	9,2	10,4	0,0494	BFL	M1
x 250	-	65	8,9	10,1	0,0474	BFL	M1	**x 250**	-	65	9,6	10,8	0,0573	BFL	M1
x 280	-	80	9,5	10,7	0,0552	BFL	M1	**x 280**	-	80	10,2	11,4	0,0668	BFL	M1
x 300	-	90	9,9	11,1	0,0604	BFL	M1	**x 300**	-	90	10,7	11,9	0,0731	BFL	M1
x 315	-	97,5	10,1	11,3	0,0643	BFL	M1	**x 315**	-	97,5	10,9	12,1	0,0778	BFL	M1
x 355	-	117,5	11,1	12,3	0,0748	BFL	M1	**x 355**	-	117,5	11,9	13,1	0,0905	BFL	M1
x 400	-	140	11,9	13,1	0,0865	BFL	M1	**x 400**	-	140	12,8	14,0	0,1047	BFL	M1
x 450	-	165	12,6	13,8	0,0900	BFL	M1	**x 450**	-	165	13,6	14,8	0,1100	BFL	M1
x 500	-	190	13,3	14,5	0,1024	BFL	M2	**x 500**	-	190	14,3	17,3	0,1251	BFN	M2
x 550	-	215	14,1	15,6	0,1148	BFN	M2	**x 550**	-	215	15,1	18,1	0,1403	BFN	M2
x 560	-	220	14,2	15,7	0,1173	BFN	M2	**x 560**	-	220	15,3	18,3	0,1433	BFN	M2
x 600	-	240	14,8	16,3	0,1272	BFN	M2	**x 600**	-	240	15,9	18,9	0,1554	BFN	M2
x 630	-	255	15,2	16,7	0,1347	BFN	M2	**x 630**	-	255	16,4	19,4	0,1645	BFN	M2
x 650	-	265	15,4	16,9	0,1396	BFN	M2	**x 650**	-	265	16,7	19,7	0,1706	BFN	M2
x 700	-	290	16,2	17,7	0,1520	BFN	M2	**x 700**	-	290	17,5	20,5	0,1857	BFN	M2
x 710	-	295	16,5	18,0	0,1545	BFN	M2	**x 710**	-	295	17,7	20,7	0,1888	BFN	M2
x 750	15	315	17,0	18,5	0,1644	BFN	M3	**x 750**	15	315	18,0	21,0	0,2009	BFN	M3
x 800	40	340	17,5	19,0	0,1768	BFN	M3	**x 800**	40	340	19,1	21,9	0,2160	BF	M3
x 900	90	390	18,7	21,5	0,2016	BF	M3	**x 900**	90	390	20,5	23,3	0,2463	BF	M3
x 1000	140	440	21,9	24,7	0,2264	BF	M3	**x 1000**	140	440	22,8	25,6	0,2766	BF	M4
315 x 100	-	-	6,6	7,8	0,0121	BFL	M1	**400 x 100**	-	-	7,4	8,6	0,0156	BFL	M1
x 110	-	-	6,7	7,9	0,0149	BFL	M1	**x 110**	-	-	7,6	8,8	0,0193	BFL	M1
x 125	-	-	7,0	8,2	0,0192	BFL	M1	**x 125**	-	-	7,9	9,1	0,0249	BFL	M1
x 140	-	5	7,3	8,5	0,0235	BFL	M1	**x 140**	-	5	8,2	9,4	0,0305	BFL	M1
x 150	-	15	7,5	8,7	0,0264	BFL	M1	**x 150**	-	15	8,4	9,6	0,0342	BFL	M1
x 160	-	20	7,8	9,0	0,0252	BFL	M1	**x 160**	-	20	8,7	9,9	0,0329	BFL	M1
x 180	-	30	8,1	9,3	0,0308	BFL	M1	**x 180**	-	30	9,1	10,3	0,0401	BFL	M1
x 200	-	40	8,4	9,6	0,0363	BFL	M1	**x 200**	-	40	9,4	10,6	0,0473	BFL	M1
x 225	-	52,5	8,7	9,9	0,0432	BFL	M1	**x 225**	-	52,5	9,8	11,0	0,0563	BFL	M1
x 250	-	65	9,1	10,3	0,0501	BFL	M1	**x 250**	-	65	10,2	11,4	0,0654	BFL	M1
x 280	-	80	9,7	10,9	0,0584	BFL	M1	**x 280**	-	80	10,6	11,8	0,0762	BFL	M1
x 300	-	90	10,1	11,3	0,0639	BFL	M1	**x 300**	-	90	11,3	12,5	0,0834	BFL	M1
x 315	-	97,5	10,3	11,5	0,0680	BFL	M1	**x 315**	-	97,5	11,5	12,7	0,0888	BFL	M1
x 355	-	117,5	11,3	12,5	0,0791	BFL	M1	**x 355**	-	117,5	12,6	13,8	0,1033	BFL	M1
x 400	-	140	12,1	13,3	0,0915	BFL	M1	**x 400**	-	140	13,5	14,7	0,1195	BFL	M1
x 450	-	165	12,9	14,1	0,0955	BFL	M1	**x 450**	-	165	14,3	15,5	0,1263	BFL	M1
x 500	-	190	13,6	14,8	0,1086	BFL	M2	**x 500**	-	190	15,2	16,7	0,1437	BFN	M2
x 550	-	215	14,3	15,8	0,1218	BFN	M2	**x 550**	-	215	16,0	17,5	0,1611	BFN	M2
x 560	-	220	14,5	16,0	0,1244	BFN	M2	**x 560**	-	220	16,1	17,6	0,1646	BFN	M2
x 600	-	240	15,1	16,6	0,1349	BFN	M2	**x 600**	-	240	16,8	18,3	0,1785	BFN	M2
x 630	-	255	15,5	17,0	0,1428	BFN	M2	**x 630**	-	255	17,3	18,8	0,1890	BFN	M2
x 650	-	265	15,8	17,3	0,1481	BFN	M2	**x 650**	-	265	17,6	19,1	0,1959	BFN	M2
x 700	-	290	16,5	18,0	0,1612	BFN	M2	**x 700**	-	290	18,7	20,2	0,2133	BFN	M2

A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
400 x 710	-	295	18,8	20,3	0,2168	BFN	M2	**500 x 1000**	140	440	26,5	29,3	0,4090	BF	M4
x 750	15	315	19,0	21,8	0,2307	BF	M3	**550 x 125**	-	-	9,3	10,5	0,0350	BFL	M1
x 800	40	340	20,3	23,1	0,2481	BF	M3	**x 140**	-	5	9,7	10,9	0,0428	BFL	M1
x 900	90	390	21,9	24,7	0,2829	BF	M3	**x 150**	-	15	9,9	11,1	0,0480	BFL	M1
x 1000	140	440	23,6	26,4	0,3177	BF	M4	**x 160**	-	20	10,4	11,6	0,0364	BFL	M1
450 x 125	-	-	8,4	9,6	0,0283	BFL	M1	**x 180**	-	30	10,7	11,9	0,0463	BFL	M1
x 140	-	5	8,7	9,9	0,0346	BFL	M1	**x 200**	-	40	11,1	12,3	0,0563	BFL	M1
x 150	-	15	8,9	10,1	0,0388	BFL	M1	**x 225**	-	52,5	11,6	12,8	0,0687	BFL	M1
x 160	-	20	9,3	10,5	0,0374	BFL	M1	**x 250**	-	65	12,1	13,3	0,0812	BFL	M1
x 180	-	30	9,6	10,8	0,0456	BFL	M1	**x 280**	-	80	12,6	13,8	0,0961	BFL	M1
x 200	-	40	9,9	11,1	0,0538	BFL	M1	**x 300**	-	90	13,4	14,6	0,1061	BFL	M1
x 225	-	52,5	10,4	11,6	0,0641	BFL	M1	**x 315**	-	97,5	13,7	14,9	0,1135	BFL	M1
x 250	-	65	10,8	12,0	0,0744	BFL	M1	**x 355**	-	117,5	14,9	16,1	0,1335	BFL	M1
x 280	-	80	11,4	12,6	0,0867	BFL	M1	**x 400**	-	140	15,9	17,4	0,1559	BFN	M2
x 300	-	90	12,0	13,2	0,0949	BFL	M1	**x 450**	-	165	16,9	18,4	0,1808	BFN	M2
x 315	-	97,5	12,2	13,4	0,1011	BFL	M1	**x 500**	-	190	17,9	19,4	0,2057	BFN	M2
x 355	-	117,5	13,3	14,5	0,1175	BFL	M1	**x 550**	-	215	18,9	20,4	0,2306	BFN	M2
x 400	-	140	14,3	15,5	0,1360	BFL	M1	**x 560**	-	220	19,1	20,6	0,2356	BFN	M2
x 450	-	165	15,2	16,7	0,1445	BFN	M2	**x 600**	-	240	20,0	21,5	0,2555	BFN	M2
x 500	-	190	16,0	17,5	0,1644	BFN	M2	**x 630**	-	255	20,4	23,2	0,2704	BF	M2
x 550	-	215	17,0	18,5	0,1843	BFN	M2	**x 650**	-	265	20,8	23,6	0,2804	BF	M2
x 560	-	220	17,1	18,6	0,1883	BFN	M2	**x 700**	-	290	21,8	24,6	0,3053	BF	M2
x 600	-	240	17,9	19,4	0,2042	BFN	M2	**x 710**	-	295	22,0	24,8	0,3103	BF	M2
x 630	-	255	18,4	19,9	0,2161	BFN	M2	**x 750**	15	315	22,3	25,1	0,3302	BF	M3
x 650	-	265	18,7	20,2	0,2241	BFN	M2	**x 800**	40	340	23,9	26,7	0,3551	BF	M3
x 700	-	290	19,5	22,3	0,2440	BF	M2	**x 900**	90	390	25,7	28,5	0,4049	BF	M3
x 710	-	295	19,7	22,5	0,2480	BF	M2	**560 x 125**	-	-	9,4	10,6	0,0356	BFL	M1
x 750	15	315	20,0	22,8	0,2639	BF	M3	**x 140**	-	5	9,8	11,0	0,0436	BFL	M1
x 800	40	340	21,5	24,3	0,2838	BF	M3	**x 150**	-	15	10,0	11,2	0,0489	BFL	M1
x 900	90	390	23,2	26,0	0,3236	BF	M3	**x 160**	-	20	10,5	11,7	0,0371	BFL	M1
x 1000	140	440	24,8	27,6	0,3634	BF	M4	**x 180**	-	30	10,8	12,0	0,0472	BFL	M1
500 x 125	-	-	8,8	10,0	0,0316	BFL	M1	**x 200**	-	40	11,2	12,4	0,0574	BFL	M1
x 140	-	5	9,2	10,4	0,0387	BFL	M1	**x 225**	-	52,5	11,7	12,9	0,0701	BFL	M1
x 150	-	15	9,4	10,6	0,0434	BFL	M1	**x 250**	-	65	12,2	13,4	0,0828	BFL	M1
x 160	-	20	9,8	11,0	0,0419	BFL	M1	**x 280**	-	80	12,8	14,0	0,0980	BFL	M1
x 180	-	30	10,2	11,4	0,0511	BFL	M1	**x 300**	-	90	13,3	14,5	0,1082	BFL	M1
x 200	-	40	10,5	11,7	0,0603	BFL	M1	**x 315**	-	97,5	13,8	15,0	0,1158	BFL	M1
x 225	-	52,5	11,0	12,2	0,0718	BFL	M1	**x 355**	-	117,5	15,0	16,2	0,1361	BFL	M1
x 250	-	65	11,4	12,6	0,0834	BFL	M1	**x 400**	-	140	16,1	17,6	0,1590	BFN	M2
x 280	-	80	12,0	13,2	0,0972	BFL	M1	**x 450**	-	165	17,1	18,6	0,1844	BFN	M2
x 300	-	90	12,7	13,9	0,1064	BFL	M1	**x 500**	-	190	18,1	19,6	0,2098	BFN	M2
x 315	-	97,5	13,0	14,2	0,1133	BFL	M1	**x 550**	-	215	19,1	20,6	0,2352	BFN	M2
x 355	-	117,5	14,1	15,3	0,1318	BFL	M1	**x 560**	-	220	19,3	20,8	0,2403	BFN	M2
x 400	-	140	15,1	16,3	0,1525	BFL	M2	**x 600**	-	240	20,2	21,7	0,2606	BFN	M2
x 450	-	165	16,1	17,6	0,1626	BFN	M2	**x 630**	-	255	20,5	23,3	0,2758	BF	M2
x 500	-	190	17,0	18,5	0,1850	BFN	M2	**x 650**	-	265	21,0	23,8	0,2860	BF	M2
x 550	-	215	17,9	19,4	0,2074	BFN	M2	**x 700**	-	290	22,0	24,8	0,3114	BF	M2
x 560	-	220	18,2	19,7	0,2119	BFN	M2	**x 710**	-	295	22,2	25,0	0,3165	BF	M2
x 600	-	240	18,9	20,4	0,2298	BFN	M2	**x 750**	15	315	22,4	25,2	0,3368	BF	M3
x 630	-	255	19,5	21,0	0,2433	BFN	M2	**x 800**	40	340	24,2	27,0	0,3622	BF	M3
x 650	-	265	19,8	22,6	0,2522	BF	M2	**600 x 140**	-	5	10,2	11,4	0,0469	BFL	M1
x 700	-	290	20,9	23,7	0,2746	BF	M2	**x 150**	-	15	10,5	11,7	0,0526	BFL	M1
x 710	-	295	21,0	23,8	0,2791	BF	M2	**x 160**	-	20	10,9	12,1	0,0400	BFL	M1
x 750	15	315	21,2	24,0	0,2970	BF	M3	**x 180**	-	30	11,3	12,5	0,0510	BFL	M1
x 800	40	340	22,8	25,6	0,3194	BF	M3	**x 200**	-	40	11,7	12,9	0,0619	BFL	M1
x 900	90	390	24,6	27,4	0,3642	BF	M3	**x 225**	-	52,5	12,3	13,5	0,0756	BFL	M1

A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
600 x 250	-	65	12,7	13,9	0,0893	BFL	M1	**650 x 630**	-	255	22,6	25,4	0,3247	BF	M2
x 280	-	80	13,3	14,5	0,1058	BFL	M1	**x 650**	-	265	23,0	25,8	0,3367	BF	M2
x 300	-	90	14,1	15,3	0,1167	BFL	M1	**x 700**	-	290	24,0	26,8	0,3666	BF	M2
x 315	-	97,5	14,4	15,6	0,1249	BFL	M1	**x 710**	-	295	24,3	27,1	0,3726	BF	M2
x 355	-	117,5	15,6	16,8	0,1469	BFL	M2	**x 750**	15	315	24,5	27,3	0,3965	BF	M3
x 400	-	140	16,8	18,3	0,1715	BFN	M2	**700 x 150**	-	15	11,6	12,8	0,0618	BFL	M1
x 450	-	165	17,8	19,3	0,1989	BFN	M2	**x 160**	-	20	12,0	13,2	0,0473	BFL	M1
x 500	-	190	18,9	20,4	0,2263	BFN	M2	**x 180**	-	30	12,5	13,7	0,0603	BFL	M1
x 550	-	215	19,9	21,4	0,2537	BFN	M2	**x 200**	-	40	12,9	14,1	0,0732	BFL	M1
x 560	-	220	20,1	21,6	0,2592	BFN	M2	**x 225**	-	52,5	13,5	14,7	0,0894	BFL	M1
x 600	-	240	20,9	23,7	0,2811	BF	M2	**x 250**	-	65	14,0	15,2	0,1056	BFL	M1
x 630	-	255	21,5	24,3	0,2976	BF	M2	**x 280**	-	80	14,7	15,9	0,1251	BFL	M1
x 650	-	265	21,8	24,6	0,3085	BF	M2	**x 300**	-	90	15,5	16,7	0,1380	BFL	M2
x 700	-	290	23,2	26,0	0,3359	BF	M2	**x 315**	-	97,5	15,9	17,1	0,1477	BFL	M2
x 710	-	295	23,4	26,2	0,3414	BF	M2	**x 355**	-	117,5	17,1	18,6	0,1737	BFN	M2
x 750	15	315	23,5	26,3	0,3633	BF	M3	**x 400**	-	140	18,4	19,9	0,2028	BFN	M2
x 800	40	340	25,3	28,1	0,3907	BF	M3	**x 450**	-	165	19,5	21,0	0,2352	BFN	M2
630 x 140	-	5	10,5	11,7	0,0494	BFL	M1	**x 500**	-	190	20,7	22,2	0,2676	BFN	M2
x 150	-	15	10,7	11,9	0,0554	BFL	M1	**x 550**	-	215	21,5	24,3	0,3000	BF	M2
x 160	-	20	11,2	12,4	0,0422	BFL	M1	**x 560**	-	220	21,9	24,7	0,3065	BF	M2
x 180	-	30	11,5	12,7	0,0538	BFL	M1	**x 600**	-	240	23,0	25,8	0,3324	BF	M2
x 200	-	40	12,1	13,3	0,0653	BFL	M1	**x 630**	-	255	23,6	26,4	0,3519	BF	M2
x 225	-	52,5	12,6	13,8	0,0798	BFL	M1	**x 650**	-	265	24,1	26,9	0,3648	BF	M2
x 250	-	65	13,1	14,3	0,0942	BFL	M1	**x 700**	-	290	25,4	28,2	0,3972	BF	M2
x 280	-	80	13,7	14,9	0,1116	BFL	M1	**x 710**	-	295	25,8	28,6	0,4037	BF	M2
x 300	-	90	14,5	15,7	0,1231	BFL	M1	**710 x 150**	-	15	11,7	12,9	0,0627	BFL	M1
x 315	-	97,5	14,8	16,0	0,1318	BFL	M1	**x 160**	-	20	12,1	13,3	0,0480	BFL	M1
x 355	-	117,5	16,1	17,3	0,1549	BFL	M2	**x 180**	-	30	12,6	13,8	0,0612	BFL	M1
x 400	-	140	17,2	18,7	0,1809	BFN	M2	**x 200**	-	40	13,0	14,2	0,0744	BFL	M1
x 450	-	165	18,3	19,8	0,2098	BFN	M2	**x 225**	-	52,5	13,6	14,8	0,0908	BFL	M1
x 500	-	190	19,4	20,9	0,2387	BFN	M2	**x 250**	-	65	14,1	15,3	0,1073	BFL	M1
x 550	-	215	20,4	21,9	0,2676	BFN	M2	**x 280**	-	80	14,8	16,0	0,1270	BFL	M1
x 560	-	220	20,7	22,2	0,2734	BFN	M2	**x 300**	-	90	15,6	16,8	0,1402	BFL	M2
x 600	-	240	21,5	24,3	0,2965	BF	M2	**x 315**	-	97,5	16,0	17,2	0,1500	BFL	M2
x 630	-	255	22,2	25,0	0,3139	BF	M2	**x 355**	-	117,5	17,2	18,7	0,1763	BFN	M2
x 650	-	265	22,5	25,3	0,3254	BF	M2	**x 400**	-	140	18,5	20,0	0,2060	BFN	M2
x 700	-	290	23,5	26,3	0,3543	BF	M2	**x 450**	-	165	19,7	21,2	0,2389	BFN	M2
x 710	-	295	23,7	26,5	0,3601	BF	M2	**x 500**	-	190	20,9	22,4	0,2718	BFN	M2
x 750	15	315	24,0	26,8	0,3832	BF	M3	**x 550**	-	215	21,7	24,5	0,3047	BF	M2
650 x 140	-	5	10,9	12,1	0,0510	BFL	M1	**x 560**	-	220	22,2	25,0	0,3112	BF	M2
x 150	-	15	11,2	12,4	0,0572	BFL	M1	**x 600**	-	240	23,2	26,0	0,3376	BF	M2
x 160	-	20	11,5	12,7	0,0437	BFL	M1	**x 630**	-	255	23,8	26,6	0,3573	BF	M2
x 180	-	30	12,0	13,2	0,0556	BFL	M1	**x 650**	-	265	24,2	27,0	0,3705	BF	M2
x 200	-	40	12,6	13,8	0,0676	BFL	M1	**x 700**	-	290	25,7	28,5	0,4034	BF	M2
x 225	-	52,5	13,0	14,2	0,0825	BFL	M1	**750 x 150**	-	15	12,1	13,3	0,0664	BFL	M1
x 250	-	65	13,4	14,6	0,0975	BFL	M1	**x 160**	-	20	12,6	13,8	0,0510	BFL	M1
x 280	-	80	14,2	15,4	0,1154	BFL	M1	**x 180**	-	30	13,0	14,2	0,0649	BFL	M1
x 300	-	90	14,8	16,0	0,1274	BFL	M1	**x 200**	-	40	13,5	14,7	0,0789	BFL	M1
x 315	-	97,5	15,1	16,3	0,1363	BFL	M2	**x 225**	-	52,5	14,2	15,4	0,0963	BFL	M1
x 355	-	117,5	16,4	17,6	0,1603	BFL	M2	**x 250**	-	65	14,7	15,9	0,1138	BFL	M1
x 400	-	140	17,6	19,1	0,1872	BFN	M2	**x 280**	-	80	15,5	16,7	0,1347	BFL	M2
x 450	-	165	18,7	20,2	0,2171	BFN	M2	**x 300**	-	90	16,2	17,4	0,1487	BFL	M2
x 500	-	190	19,8	21,3	0,2470	BFN	M2	**x 315**	-	97,5	16,7	17,9	0,1591	BFL	M2
x 550	-	215	20,9	22,4	0,2769	BFN	M2	**x 355**	-	117,5	17,9	19,4	0,1871	BFN	M2
x 560	-	220	21,1	23,9	0,2829	BF	M2	**x 400**	-	140	19,2	20,7	0,2185	BFN	M2
x 600	-	240	21,9	24,7	0,3068	BF	M2	**x 450**	-	165	20,3	21,8	0,2534	BFN	M2

A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.	A x B [mm]	a [mm]	c [mm]	Weight Design mech [kg]	Weight Design servo [kg]	Effect. area Sef [m²]	Actu. mech.	Mech. contr.
750 x 500	-	190	21,6	23,1	0,2883	BFN	M2	**900 x 200**	-	40	15,2	16,4	0,0958	BFL	M1
x 550	-	215	22,6	25,4	0,3232	BF	M2	**x 225**	-	52,5	16,0	17,2	0,1170	BFL	M2
x 560	-	220	22,9	25,7	0,3302	BF	M2	**x 250**	-	65	16,6	17,8	0,1382	BFL	M2
x 600	-	240	23,9	26,7	0,3581	BF	M2	**x 280**	-	80	17,4	18,6	0,1637	BFL	M2
x 630	-	255	24,6	27,4	0,3790	BF	M2	**x 300**	-	90	18,3	19,5	0,1806	BFL	M2
x 650	-	265	25,1	27,9	0,3930	BF	M2	**x 315**	-	97,5	18,7	20,2	0,1933	BFN	M2
800 x 150	-	15	12,7	13,9	0,0710	BFL	M1	**x 355**	-	117,5	20,2	21,7	0,2273	BFN	M2
x 160	-	20	13,1	14,3	0,0546	BFL	M1	**x 400**	-	140	21,6	23,1	0,2654	BFN	M2
x 180	-	30	13,7	14,9	0,0696	BFL	M1	**x 450**	-	165	23,0	24,5	0,3078	BFN	M2
x 200	-	40	14,1	15,3	0,0845	BFL	M1	**x 500**	-	190	24,3	27,1	0,3502	BF	M2
x 225	-	52,5	14,8	16,0	0,1032	BFL	M1	**x 550**	-	215	25,7	28,5	0,3926	BF	M2
x 250	-	65	15,3	16,5	0,1219	BFL	M2	**1000 x 160**	-	20	15,0	16,2	0,0692	BFL	M1
x 280	-	80	16,1	17,3	0,1444	BFL	M2	**x 180**	-	30	15,7	16,9	0,0882	BFL	M1
x 300	-	90	16,9	18,1	0,1593	BFL	M2	**x 200**	-	40	16,4	17,6	0,1071	BFL	M2
x 315	-	97,5	17,3	18,5	0,1705	BFL	M2	**x 225**	-	52,5	17,1	18,3	0,1308	BFL	M2
x 355	-	117,5	18,7	20,2	0,2005	BFN	M2	**x 250**	-	65	17,9	19,1	0,1545	BFL	M2
x 400	-	140	20,0	21,5	0,2341	BFN	M2	**x 280**	-	80	18,8	20,0	0,1830	BFL	M2
x 450	-	165	21,3	22,8	0,2715	BFN	M2	**x 300**	-	90	19,7	21,2	0,2019	BFN	M2
x 500	-	190	22,5	24,0	0,3089	BFN	M2	**x 315**	-	97,5	20,1	21,6	0,2161	BFN	M2
x 550	-	215	23,7	26,5	0,3463	BF	M2	**x 355**	-	117,5	21,7	23,2	0,2541	BFN	M2
x 560	-	220	24,0	26,8	0,3538	BF	M2	**x 400**	-	140	23,2	24,7	0,2967	BFN	M2
x 600	-	240	25,0	27,8	0,3837	BF	M2	**x 450**	-	165	24,7	26,2	0,3441	BFN	M2
900 x 160	-	20	14,1	15,3	0,0619	BFL	M1	**x 500**	-	190	26,1	28,9	0,3915	BF	M2
x 180	-	30	14,7	15,9	0,0789	BFL	M1								

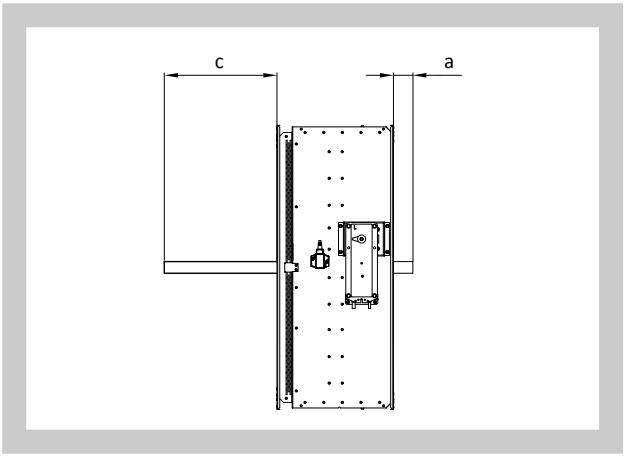
4.3. Blades overlaps

Tab. 4.3.1 Blades overlaps

Blades overlaps		Dimension	Overlaps
Blades 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 Blades overlaps



4.4. For the design .60 (with BKN supply and communication device) add to weight of the damper with an actuating mechanism (from the 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 dampers (Fig. 29, 30).

Fig. 29 Flange of Damper - OPERATORS SIDE

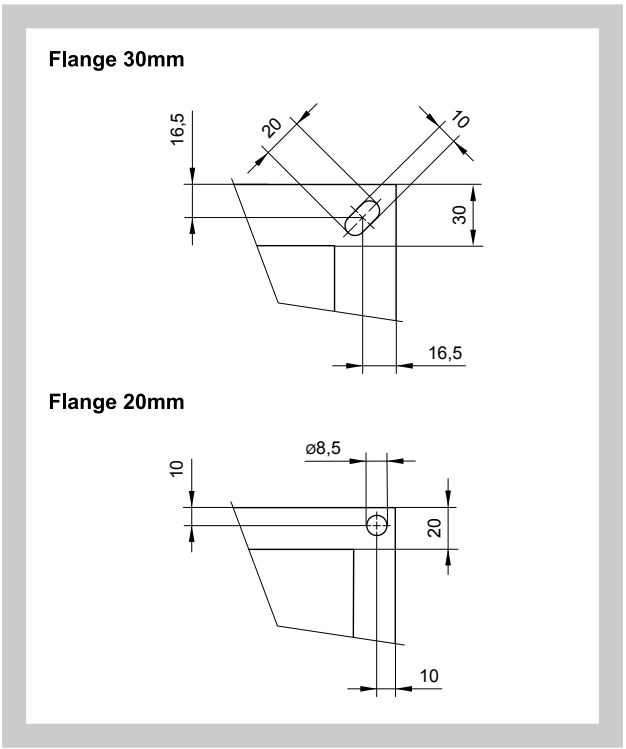
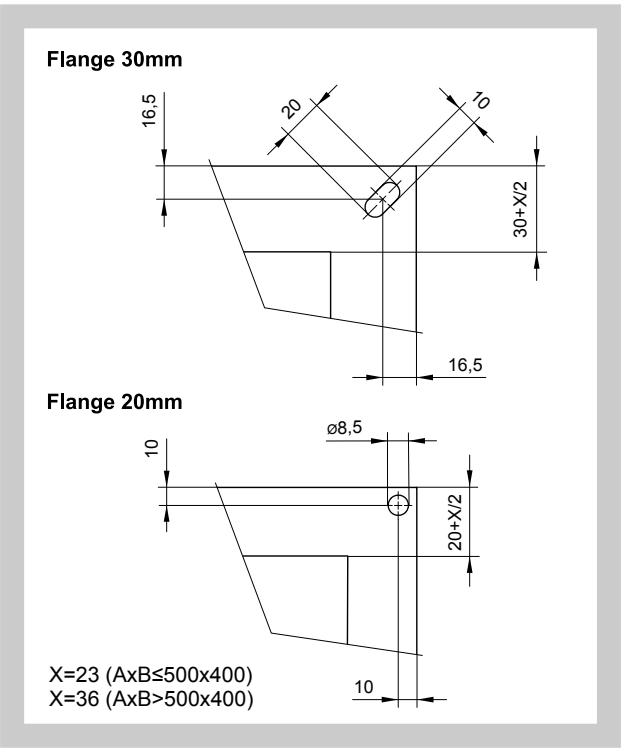


Fig. 30 Flange of Damper - INSTALLATIONS SIDE



5. Placement and Assembly

5.1. Fire dampers are suitable for installation in arbitrary position in vertical and horizontal passages of fire separating constructions. 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. Installation gap must be filled by approved material perfectly in all the installation space volume (installation gap).

To provide needed access space to the control device, all other objects must be situated at least 350 mm from the control parts of the damper. Inspection hole must be accessible.

Damper blade has to be inside of construction (labelled with BUILD IN EDGE on the damper body) after installation. The fire damper can also be installed 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 firefighting insulation.

The distance between the fire damper and the construction (wall, ceiling) must be minimum 75 mm. In case that two or more dampers are supposed to be installed in one fire separating construction, the distance between the adjacent dampers must be at least 200 mm according to EN 1366-2 paragraph 13.5.
Exceptions are given in chapter 6.

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

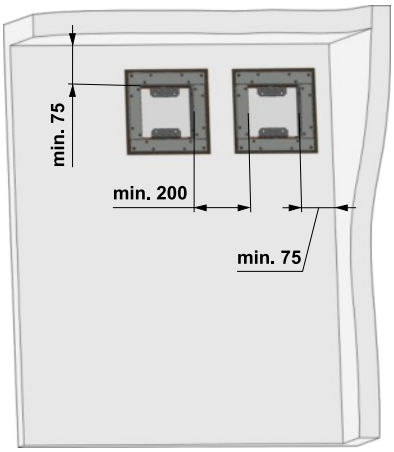
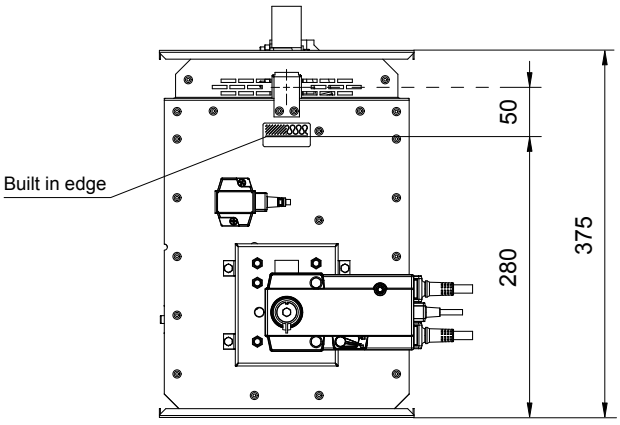


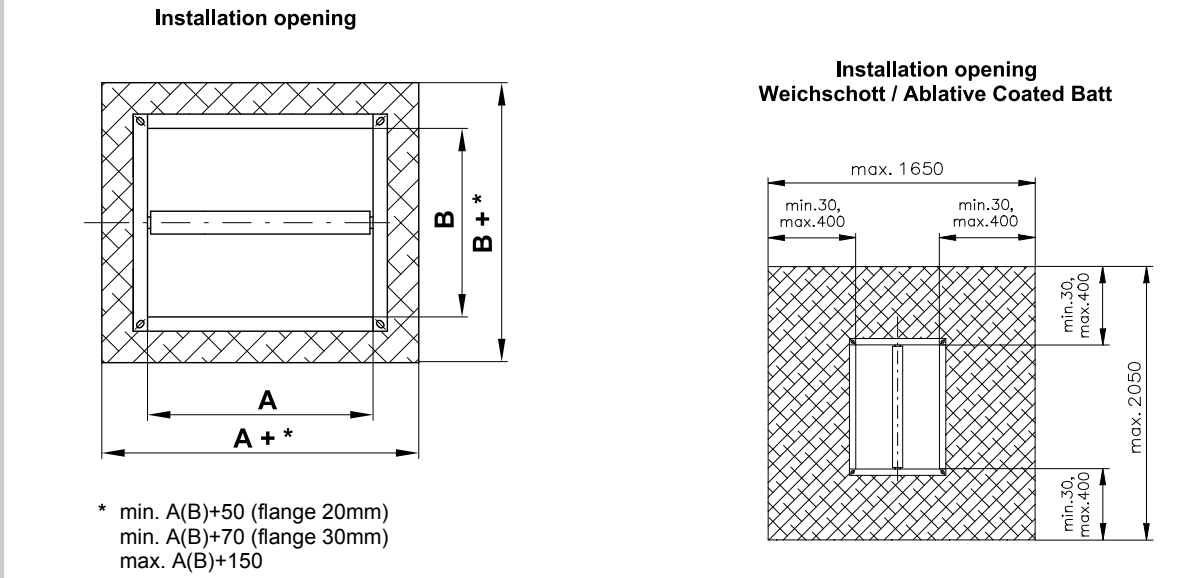
Fig. 32 Built in edge



"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. The control mechanism has to be protected (covered) against damage and pollution during installation process. All fire dampers has to be closed during installation process. 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. 33 Installation opening



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 EI 120 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.

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

6 Statement of installations

6.1. Installation method list

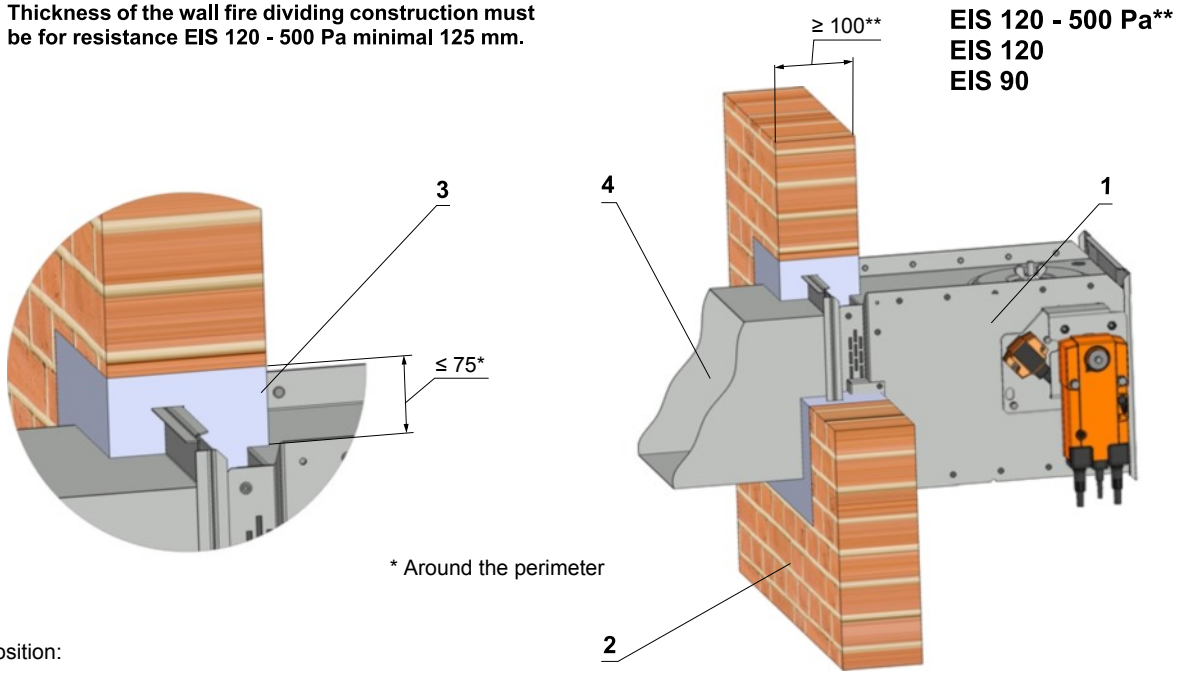
Tab. 6.1.1. Installation method list

Fire separating constru.	Wall/Ceiling Min. thickness [mm]	Installation	Fire resist.	Page
Solid wall construction	100	Mortar or gypsum	EIS 120 - 500 Pa EIS 120 EIS 90	30
	100	Stuffing box with fire protection mastic	EIS 60	30
	100	Fire protection foam with stucco plaster	EIS 60 EIS 45 EIS 30	31
	100	Battery - mortar or gypsum	EIS 90	32
	100	Installation next to wall - mortar or gypsum and mineral wool	EIS 90	33
	100	Stuffing box with fire protection mastic and cement lime plate	EIS 90	34
	100	Installation frame E1, E2, E4	EIS 90	35
	100	Weichschott / Ablative Coated Batt	EIS 90	36
	100	Battery - installation frame E1	EIS 90	37
Outside solid wall construction	100	Mineral wool - mortar or gypsum	EIS 60	38
	100	Mineral wool - stuffing box and fire protection mastic	EIS 60	38
	100	Mineral wool, stuffing box, fire protection mastic and cement lime plate	EIS 90 EIS 120	39
	100	Insulating with cement lime plates - installation frame E6	EIS 90	40
Gypsum wall construction	100	Mortar or gypsum	EIS 120 - 500 Pa EIS 120 EIS 90	41
	100	Stuffing box with fire protection mastic	EIS 60	41
	100	Fire protection foam with stucco plaster	EIS 60 EIS 45 EIS 30	42
	100	Battery - mortar or gypsum	EIS 90	43
	100	Installation next to wall - mortar or gypsum and mineral wool	EIS 90	44
	100	Stuffing box with fire protection mastic and cement lime plate	EIS 90	45
	100	Installation frame E1, E3, E4	EIS 90	46
	100	Weichschott / Ablative Coated Batt	EIS 90	47
	100	Battery - installation frame E1	EIS 90	48
	100	Flexible ceiling - installation frame E5	EIS 90	49
Outside gypsum wall construction	100	Mineral wool - mortar or gypsum	EIS 60	50
	100	Mineral wool - stuffing box and fire protection mastic	EIS 60	50
	100	Mineral wool, stuffing box, fire protection mastic and cement lime plate	EIS 90 EIS 120	51
Solid ceiling construction	110 - Concrete 125 - Aerated concrete	Mortar or gypsum	EIS 120 - 500 Pa EIS 120 EIS 90	52
		Stuffing box with fire protection mastic	EIS 60	52
		Battery - mortar or gypsum	EIS 90	53
		Stuffing box with fire protection mastic and cement lime plate	EIS 90	54
		Installation frame E1, E2, E4	EIS 90	55
		Weichschott / Ablative Coated Batt	EIS 90	56
		Battery - installation frame E1	EIS 90	57
Outside solid ceiling construction	110 - Concrete 125 - Aerated concrete	Mineral wool - mortar or gypsum	EIS 90 EIS 120	58
		Concrete	EIS 90	59
		Concrete with installation frame E4	EIS 90	59
		Insulating with cement lime plates - installation frame E6	EIS 90	60
Thin shaft wall	100	Mortar or gypsum	EIS 90	62
	100	Installation frame E1	EIS 90	63

6.2. Installation in solid wall construction

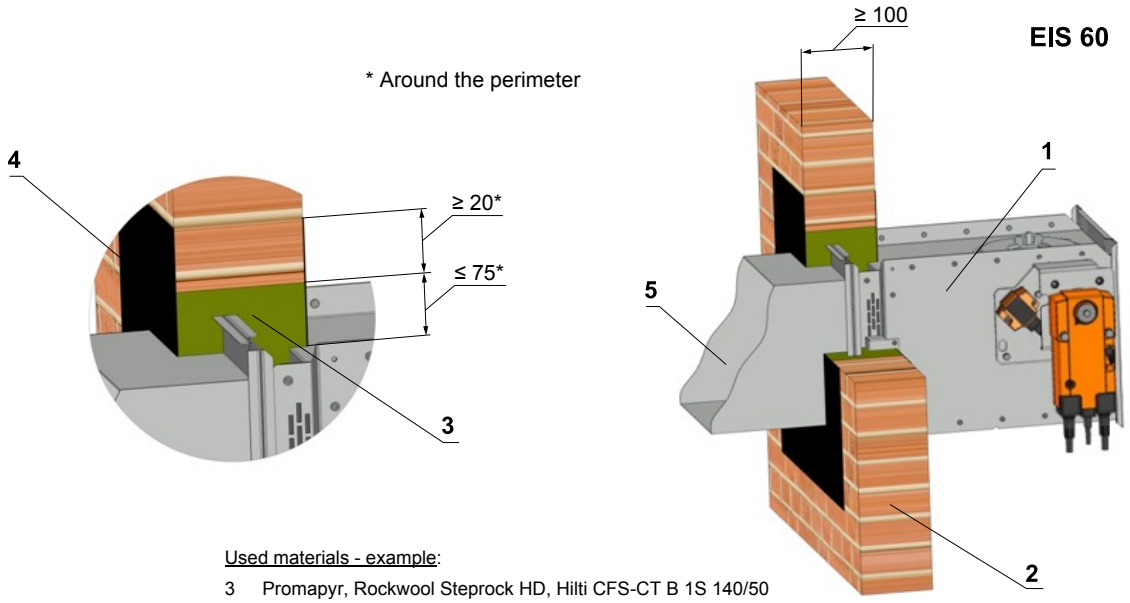
Fig. 34 Solid wall construction - mortar or gypsum

** Thickness of the wall fire dividing construction must be for resistance EIS 120 - 500 Pa minimal 125 mm.



Position:
1 Fire damper
2 Solid wall construction
3 Mortar or gypsum
4 Duct

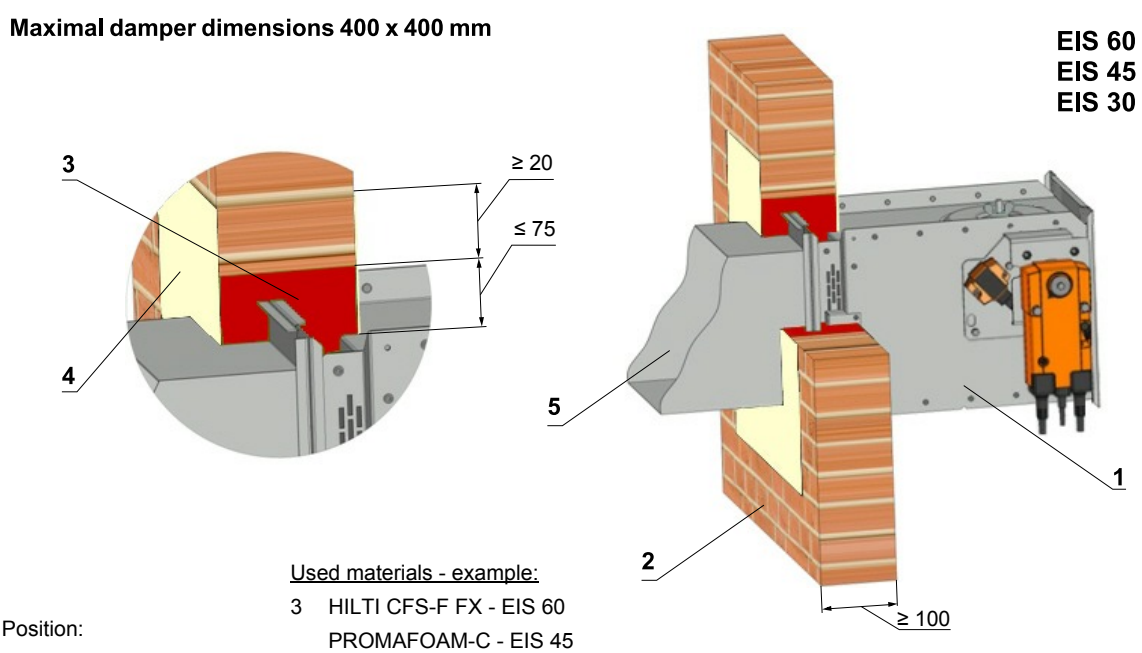
Fig. 35 Solid wall construction - stuffing box and fire protection mastic



Used materials - example:
3 Promapyr, Rockwool Steprock HD, Hilti CFS-CT B 1S 140/50
4 Promastop - P, K, Hilti CFS-CT

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 Duct

Fig. 36 Solid wall construction - fire protection foam with stucco plaster



Position:

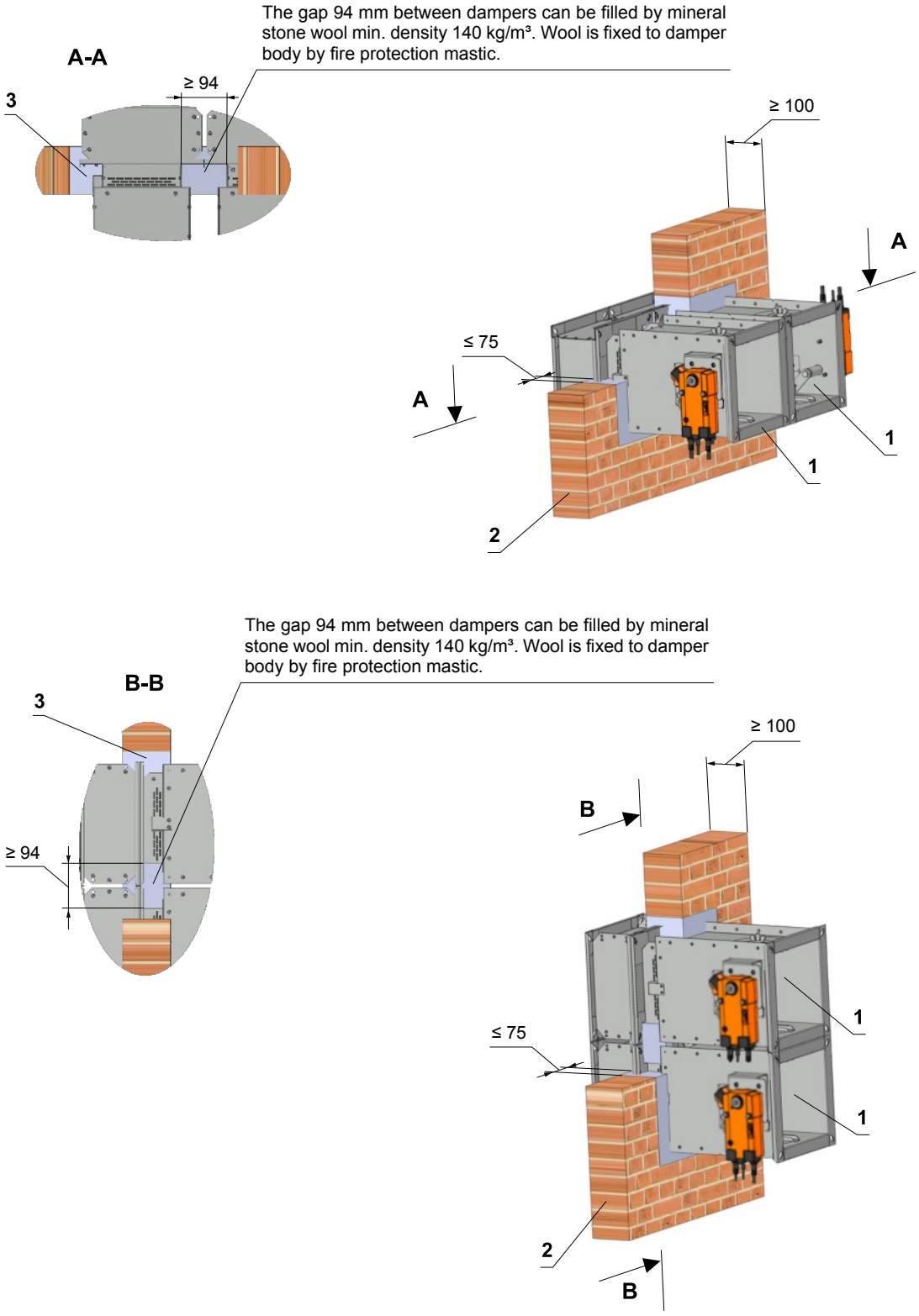
1 Fire damper
2 Solid wall construction
3 Fire protection foam
4 Stucco plaster
5 Duct

Used materials - example:

3 HILTI CFS-F FX - EIS 60
PROMAFOAM-C - EIS 45
SOUDAL, Soudafoam FR-B1 - EIS 30
DenBraven, Fire protection foam - EIS 30

Fig. 37 Solid wall construction - battery - mortar or gypsum

EIS 90



Position:

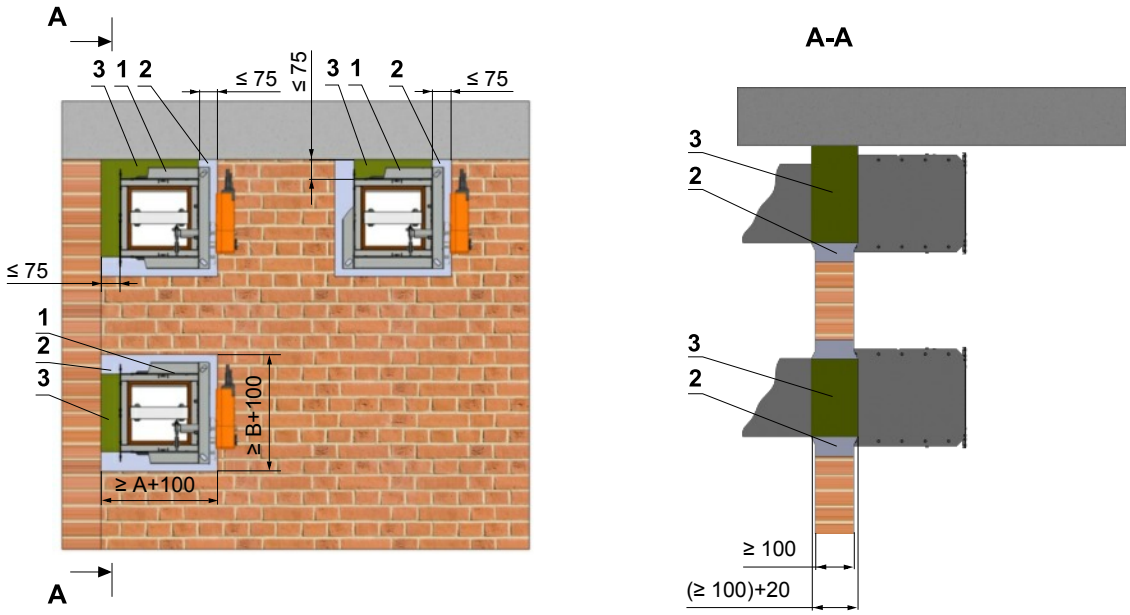
1 Fire damper
2 Solid wall construction
3 Mortar or gypsum

Notice:

- Installation opening for each damper has minimal dimensions a x b = (A+100) x (2xB +100) mm or (2xA+100) x (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 4 dampers can be installed

Fig. 38 Solid wall construction - installation next to wall, ceiling - mortar or gypsum and mineral wool

EIS 90



Position:

1 Fire damper

2 Mortar or gypsum

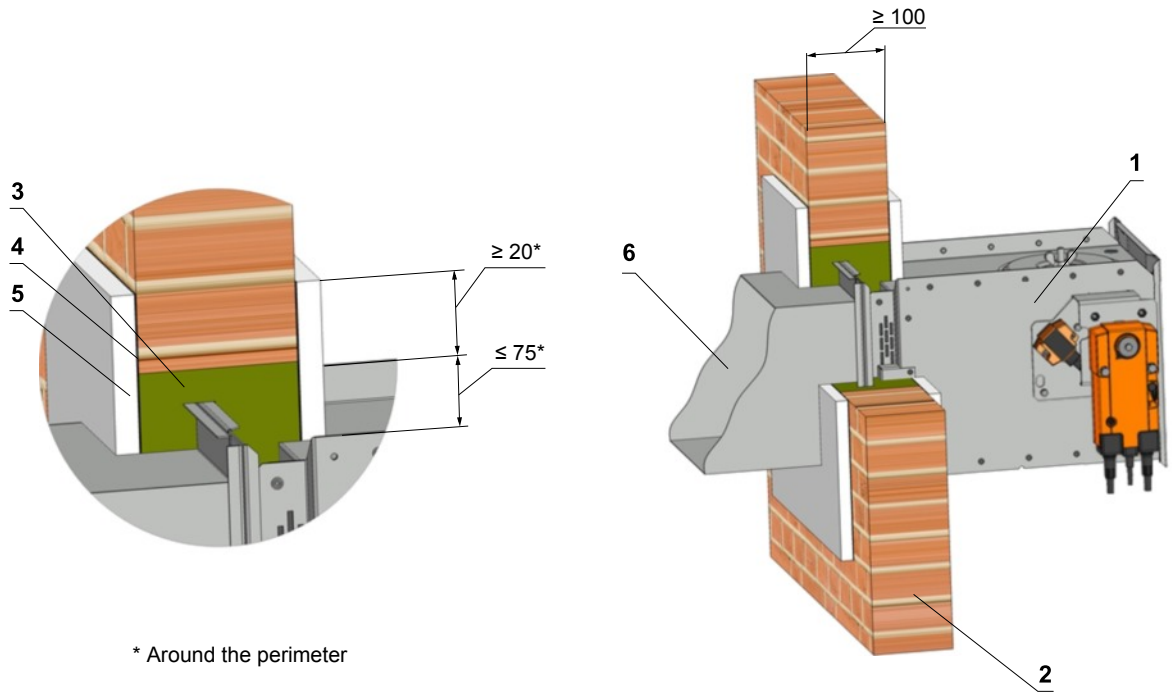
3 Mineral stone wool min. density 140 kg/m³

Notice:

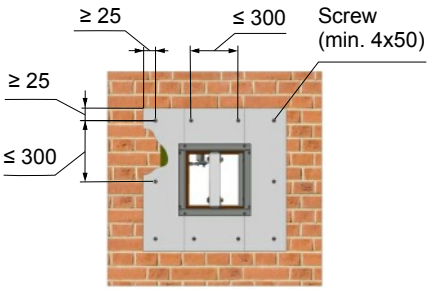
- Gap between damper and construction is filled by mortar or gypsum and mineral wool
- Wool is fixed to damper body and construction by fire protection mastic
- Mineral wool thickness = construction thickness + 20 mm or 50 mm
- Installation is valid for ceiling construction

Fig. 39 Solid wall construction - stuffing box, fire protection mastic and cement lime plate

EIS 90



* Around the perimeter



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

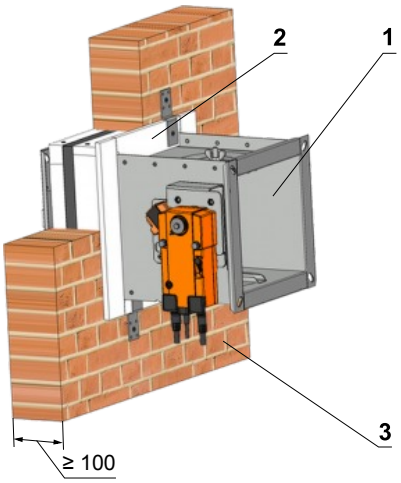
Position:

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

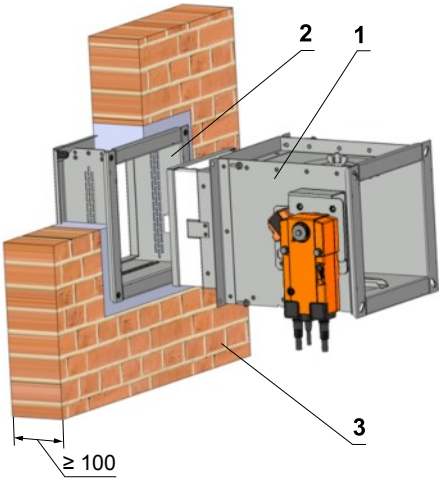
Fig. 40 Solid wall construction - installation frame E1, E2, E4

EIS 90

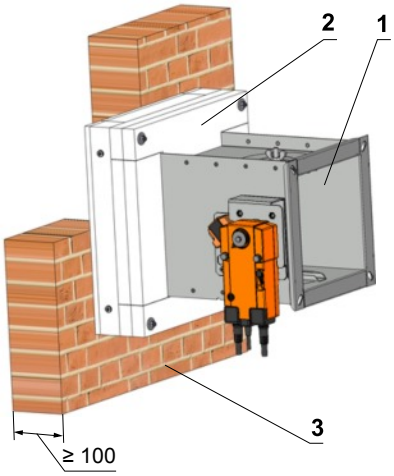
Installation frame E1



Installation frame E2



Installation frame E4



Position:

1 Fire damper

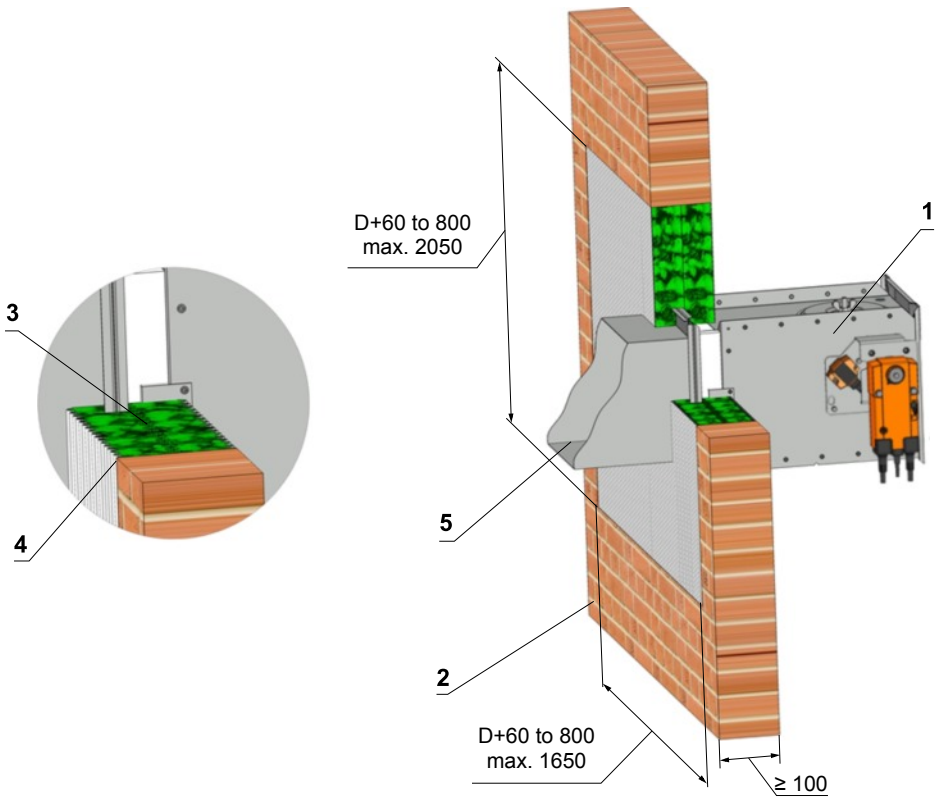
2 Installation frame

3 Solid wall construction

Installation details see chapter 8.

Fig. 41 Solid wall construction - Weichschott / Ablative Coated Batt

EIS 90



Position:

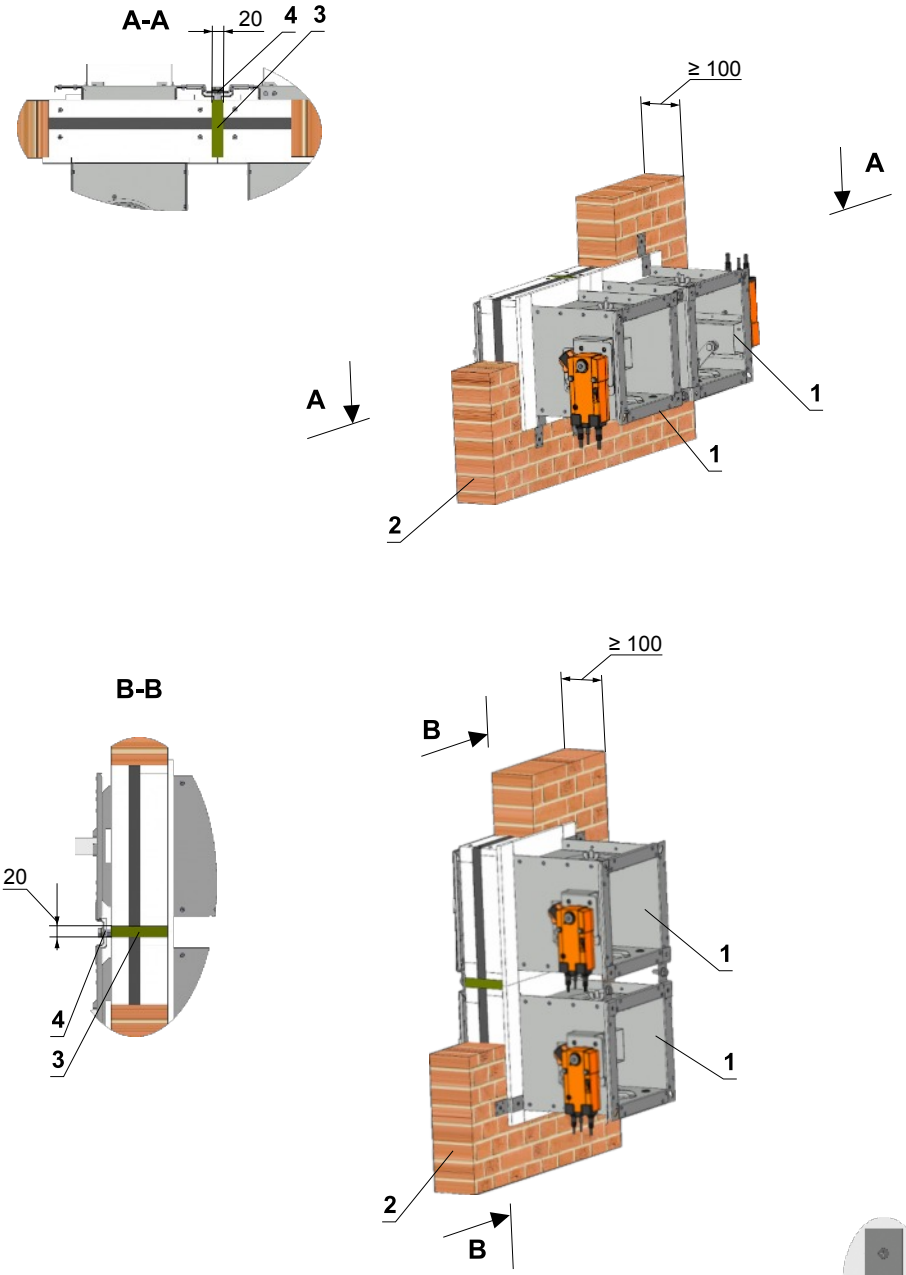
1 Fire damper
2 Solid wall construction
3 Fire resistant board
4 Fire stop coating thickness 1 mm
5 Duct

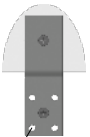
Used materials - example:

3 Hilti CFS-CT B 1S 140/50
4 Hilti CFS-CT

Fig. 42 Solid wall construction - battery - installation frame E1

EIS 90





It is possible to use corresponding number of holes and screws

A = max. 1000 mm

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 ≤ 1260	3	3
1260 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5

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/m³
4 Flange connection

Notice:

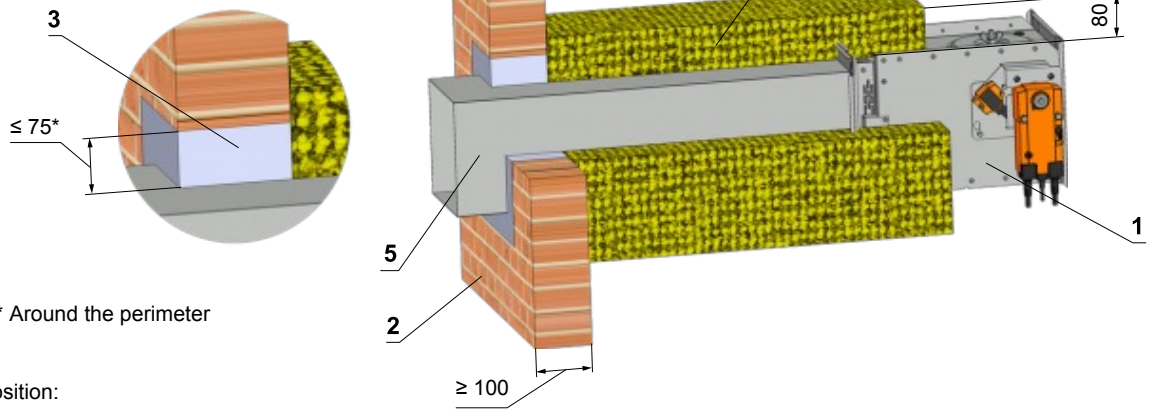
- Installation opening dimensions
  a x b = (2x(A + 85^{+3}mm) + 20 mm) x (B + 85^{+3}mm)
  or a x b = (A + 85^{+3}mm) x (2x(B + 85^{+3}mm) + 20 mm)
- Gap between frame and damper body and frame and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to 4 dampers can be installed

6.3. Installation outside solid wall construction

Fig. 43 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



* Around the perimeter

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/m³
5 Duct

Used materials - example:**

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

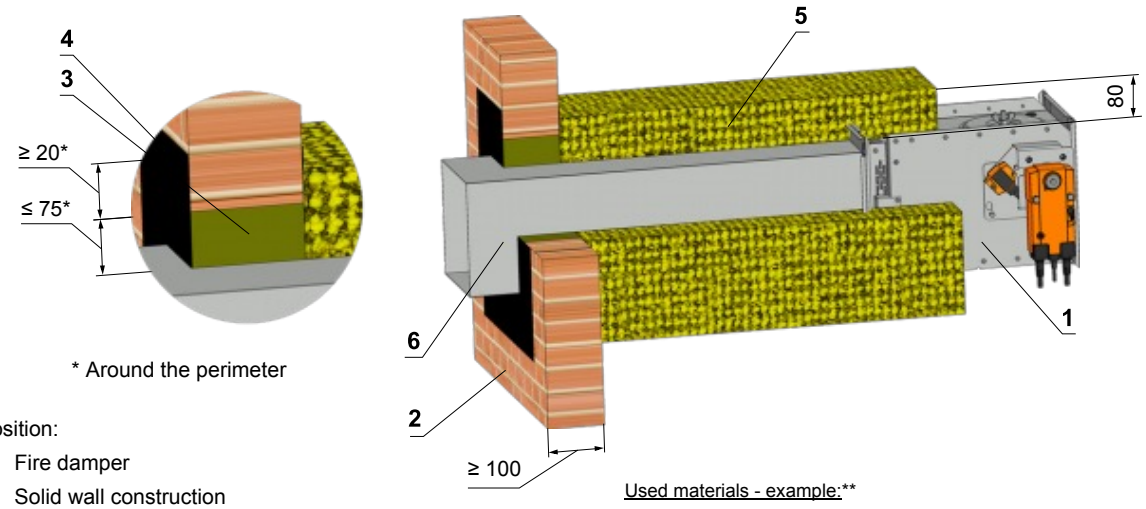
** Insulation materials can be replaced by another approved fire sealing system with equivalent properties.
The maximum distance of the fire damper from the structure is not limited.

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

Fig. 44 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



* Around the perimeter

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 Insulation board made of stone wool, with a surface treatment of aluminum foil, density 66 kg/m³
6 Duct

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

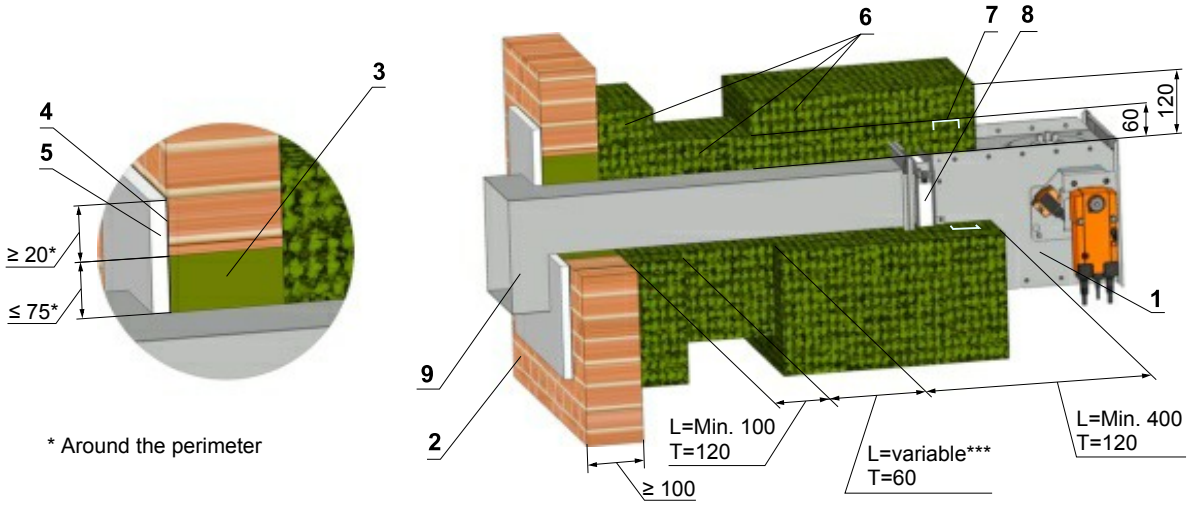
** Insulation materials can be replaced by another approved fire sealing system with equivalent properties.
The maximum distance of the fire damper from the structure is not limited.

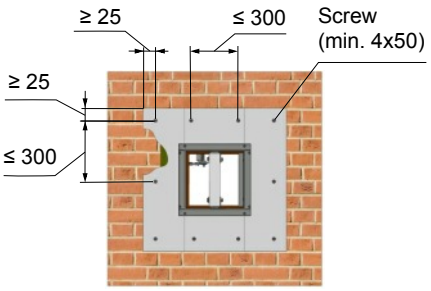
The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

Fig. 45 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
EIS 120 ***





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 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 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ and min. thickness 60 mm
7 Profil U25x40x25
8 VRM****
9 Duct

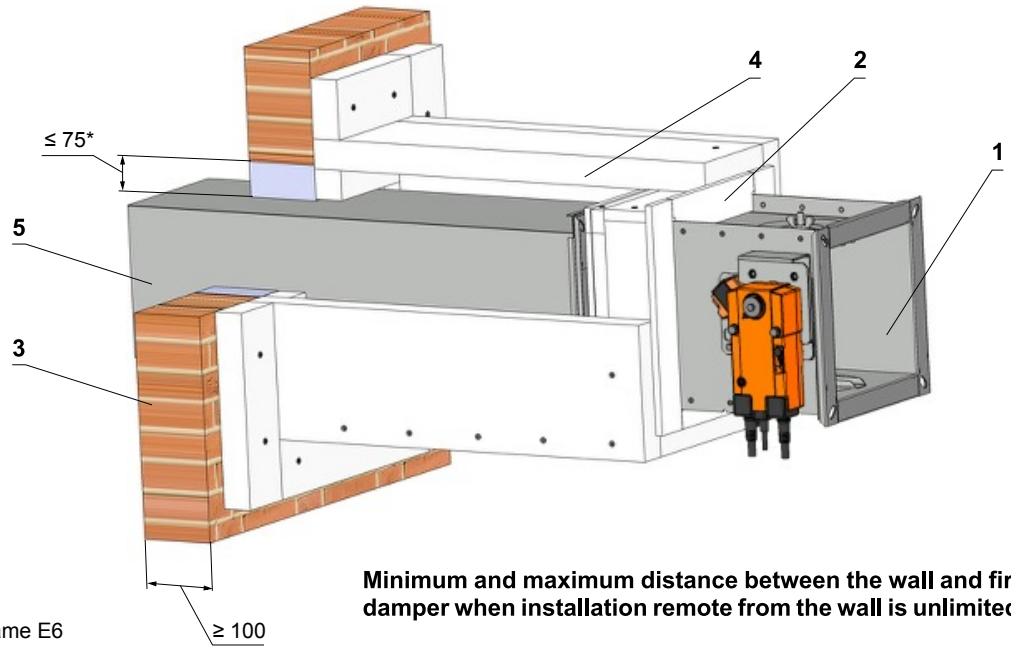
** Stuffing box, fire protection mastic, cement lime plate and insulation materials can be replaced by another approved fire sealing system for damper installation with equivalent material properties.
*** Depends on the distance of the flap from the construction, when the maximum distance from the construct is not limited and according to EN 15882-2 must use the required number of hinges according to EN 1366-1:2014.
**** Reinforcement fixing VRM see Fig. 81
Installation of profile U25x40x25 see Fig. 82
***** When using Rockwool Conlit Ductrock EIS 120, th. 60 mm, the overall fire resistance of the EIS 120 can be achieved.
T - thickness of the insulation (mm)

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

Fig. 46 Outside solid wall construction - installation frame E6 with cement lime plates

Installation frame E6

EIS 90



Position:

1 Fire damper
2 Installation frame E6
3 Solid wall construction
4 Cement lime plate
5 Duct

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

* Around the perimeter

Installation details see chapter 8.

6.4. Installation in gypsum wall construction

Fig. 47 Gypsum wall construction - mortar or gypsum

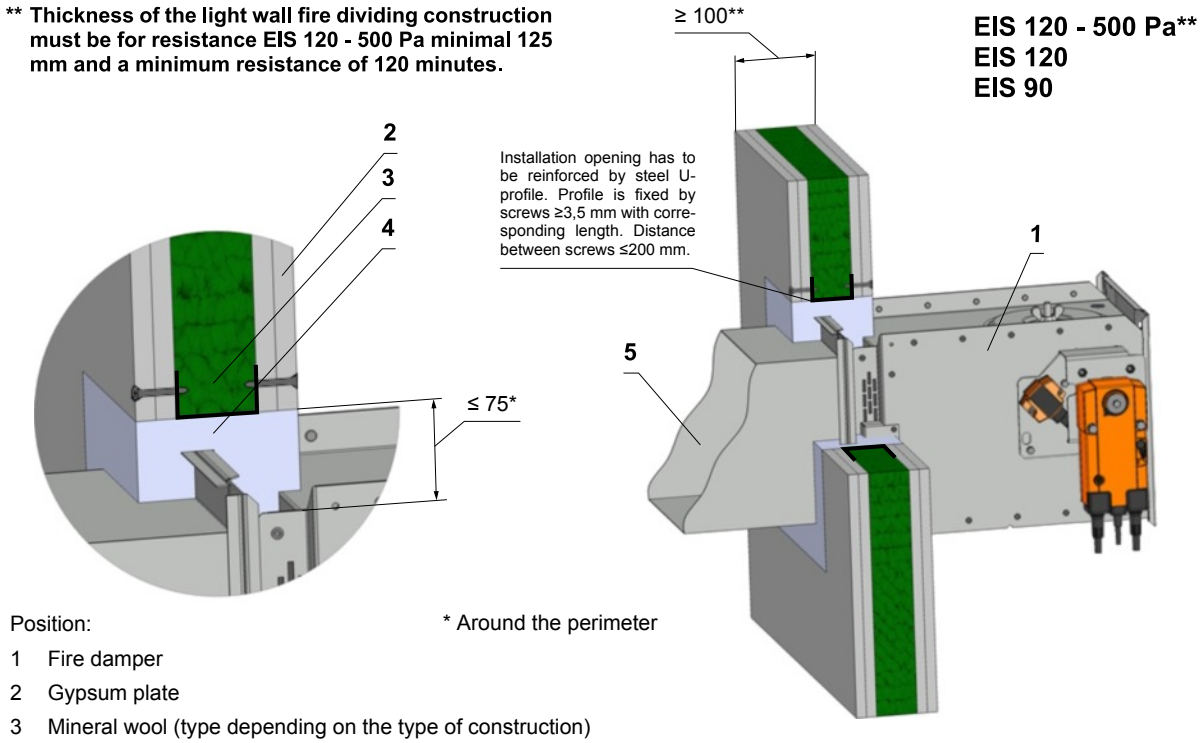


Fig. 48 Gypsum wall construction - stuffing box and fire protection mastic

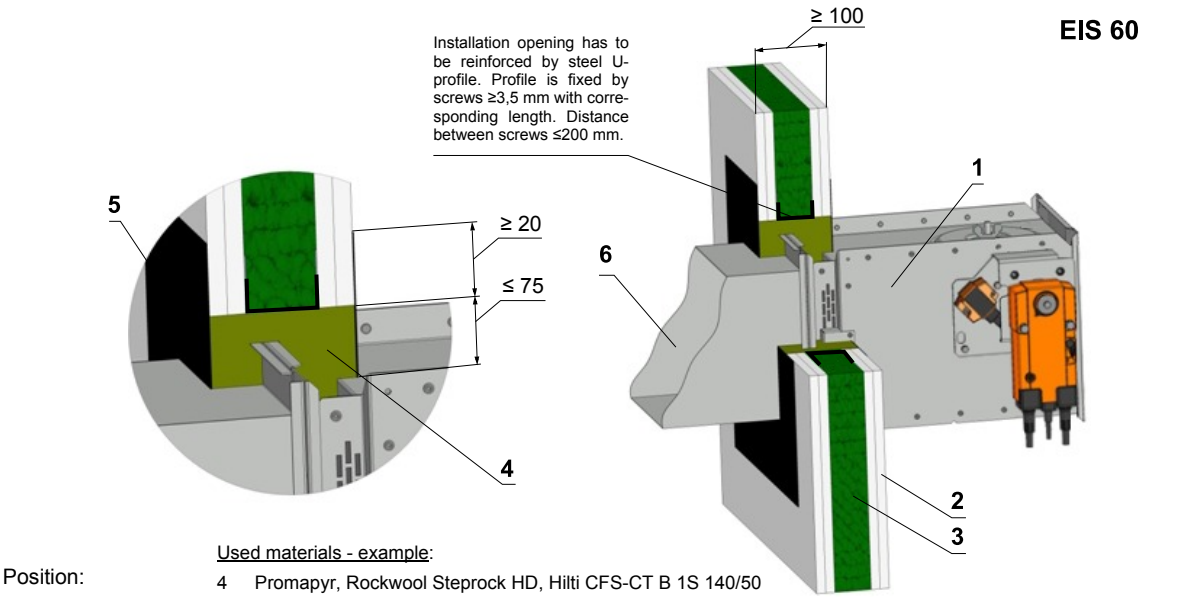
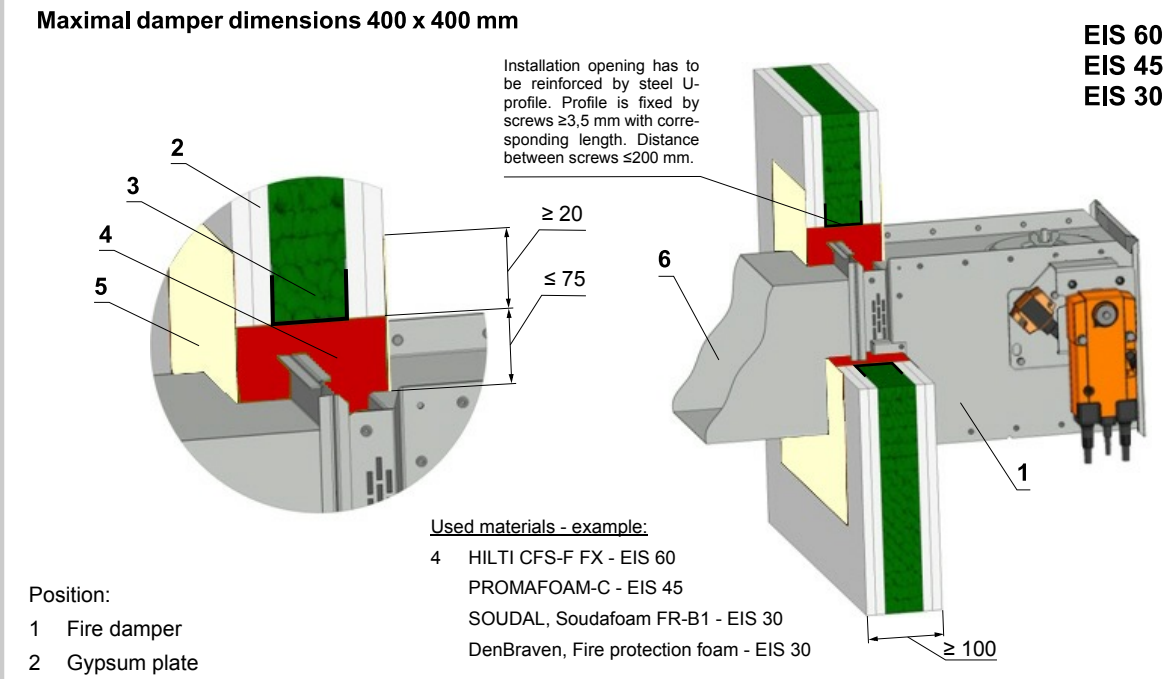


Fig. 49 Gypsum wall construction - fire protection foam with stucco plaster

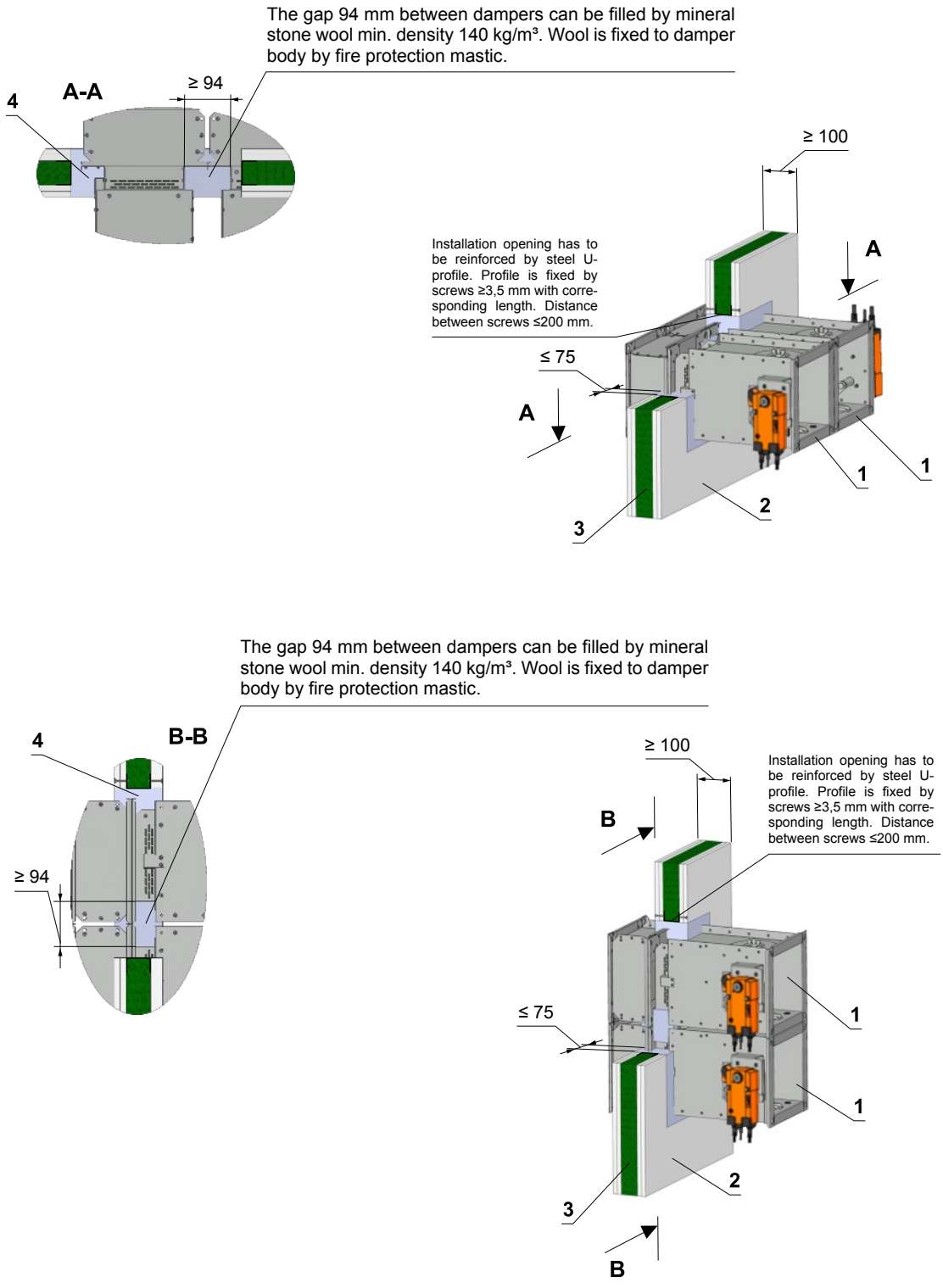


Position:

1 Fire damper
2 Gypsum plate
3 Mineral wool (type depending on the type of construction)
4 Fire protection foam
5 Stucco plaster
6 Duct

Fig. 50 Gypsum wall construction - battery - mortar or gypsum

EIS 90



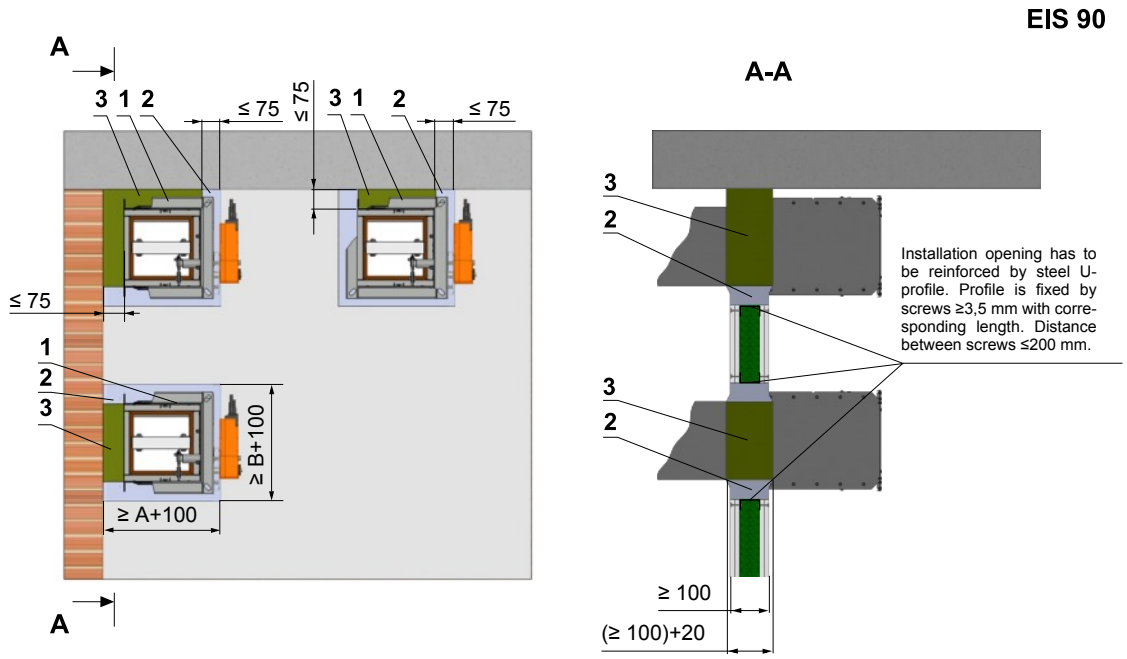
Position:

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 x b = (A+100) x (2xB +100) mm or (2xA+100) x (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 4 dampers can be installed

Fig. 51 Gypsum wall construction - installation next to wall, ceiling - mortar or gypsum and mineral wool



Position:

1 Fire damper

2 Mortar or gypsum

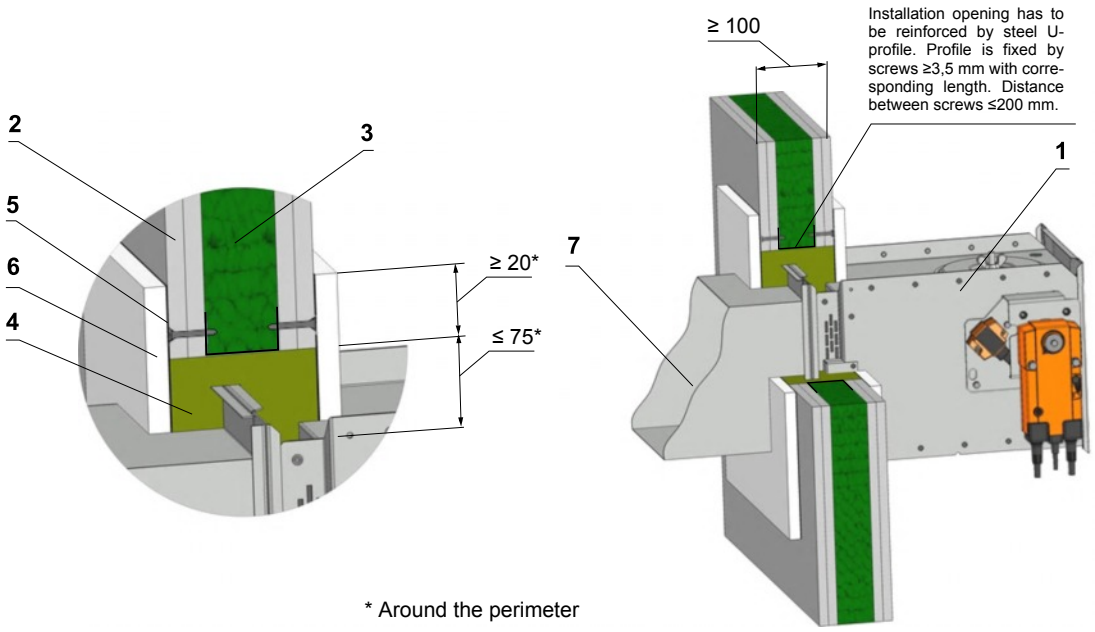
3 Mineral stone wool min. density 140 kg/m³

Notice:

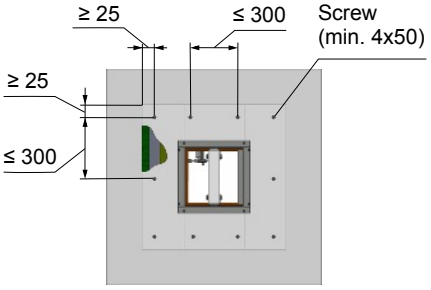
- Gap between damper and construction is filled by mortar or gypsum and mineral wool
- Wool is fixed to damper body and construction by fire protection mastic
- Mineral wool thickness = construction thickness + 20 mm or 50 mm
- Installation is valid for ceiling construction

Fig. 52 Gypsum wall construction - stuffing box, fire protection mastic and cement lime plate

EIS 90



* Around the perimeter



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

Used materials - example:

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

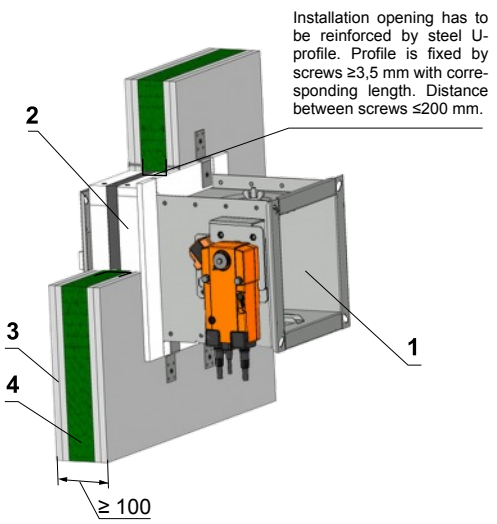
Position:

1 Fire damper
2 Gypsum plate
3 Mineral wool (type depending on the type of construction)
4 Mineral stone wool min. density 140 kg/m³
5 Fire protection mastic min. thickness 1 mm
6 Cement lime plate min. thickness 15 mm
(min. density 870 kg/m³)
7 Duct

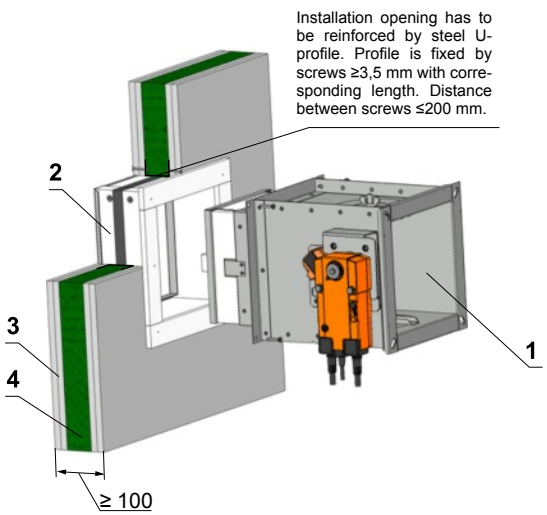
Fig. 53 Gypsum wall construction - installation frame E1, E3, E4

EIS 90

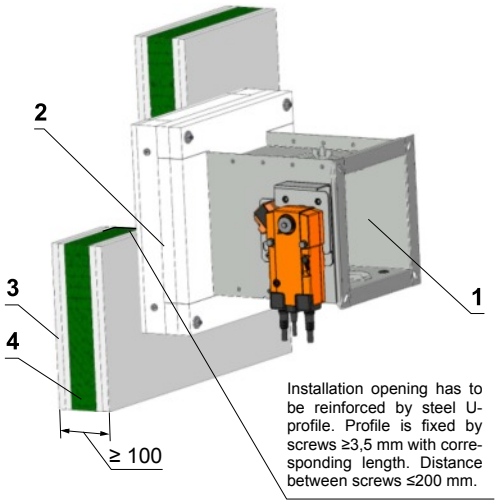
Installation frame E1



Installation frame E3



Installation frame E4



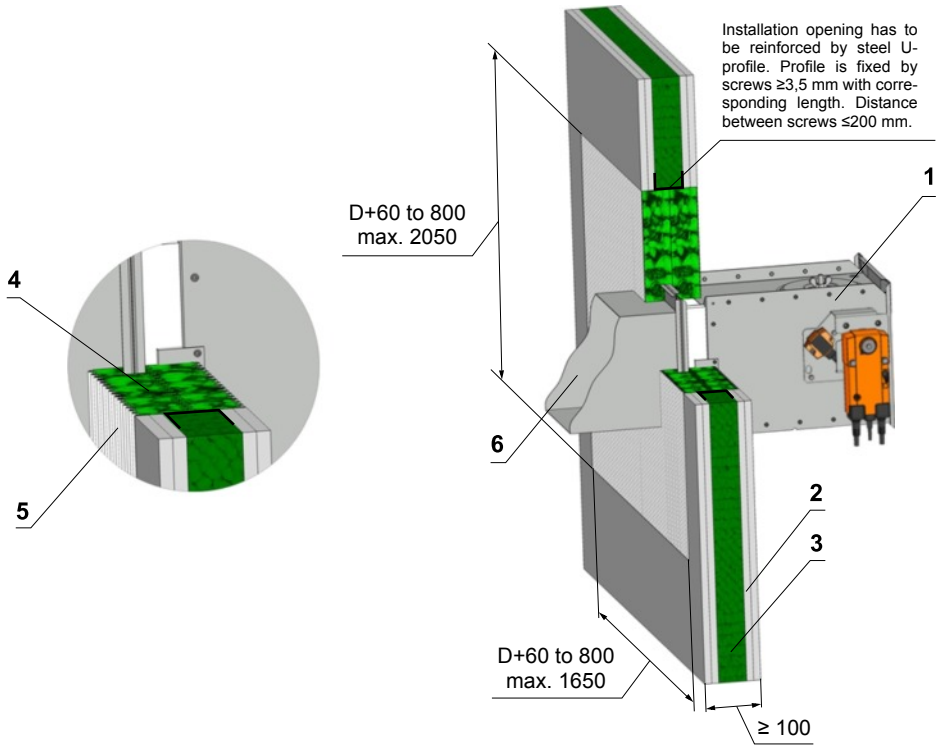
Position:

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. 54 Gypsum wall construction - Weichschott / Ablative Coated Batt

EIS 90



Position:

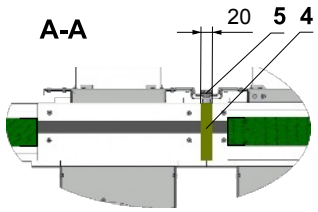
1 Fire damper
2 Gypsum plate
3 Mineral wool (type depending on the type of construction)
4 Fire resistant board
5 Fire stop coating thickness 1 mm
6 Duct

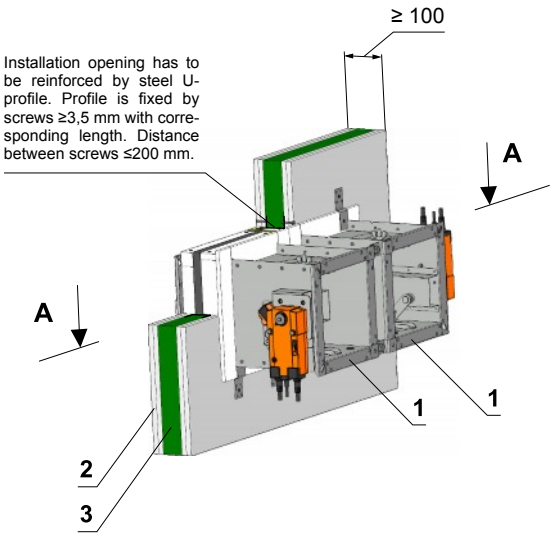
Used materials - example:

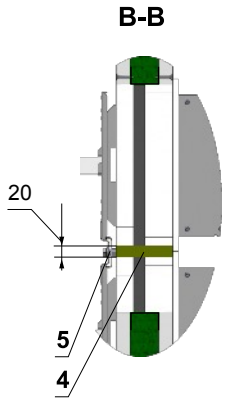
3 Hilti CFS-CT B 1S 140/50
4 Hilti CFS-CT

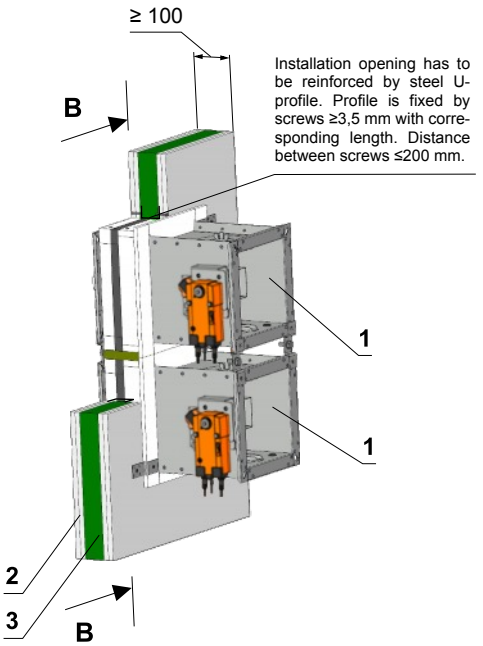
Fig. 55 Gypsum wall construction - battery - Installation frame E1

EIS 90

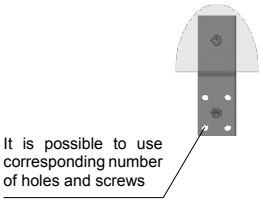








A = max. 1000 mm



Position:

1 Fire damper with Installation frame E1
2 Gypsum plate
3 Mineral wool (type depending on the type of construction)
4 Mineral stone wool min. density 140 kg/m³
5 Flange connection

Notice:

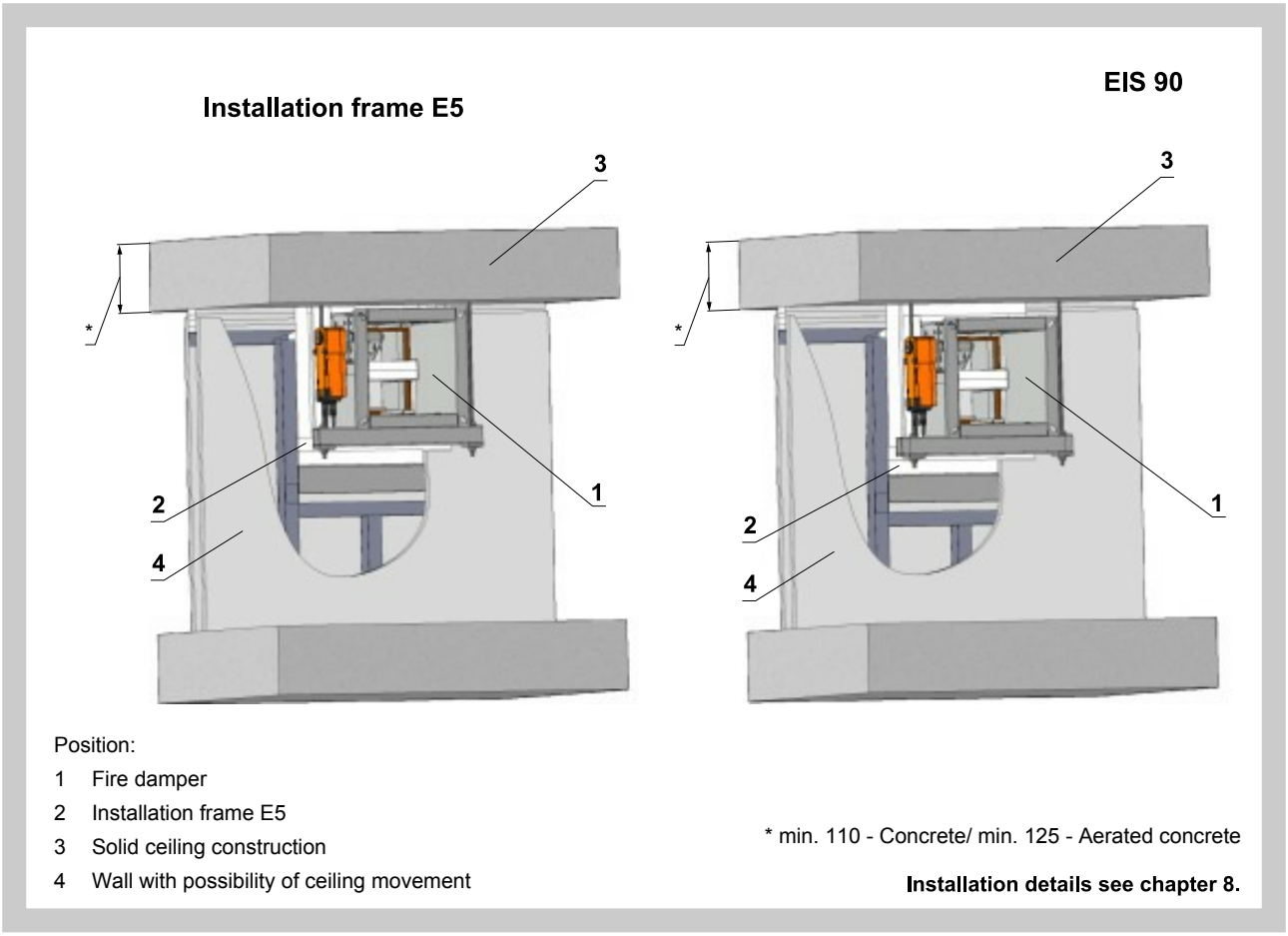
- Installation opening dimensions
  a x b = (2x(A + 85^{+3}mm) + 20 mm) x (B + 85^{+3}mm)
  or a x b = (A + 85^{+3}mm) x (2x(B + 85^{+3}mm) + 20 mm)
- Gap between frame and damper body and frame and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to 4 dampers can be installed

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 ≤ 1260	3	3
1260 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5

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

Fig. 56 Gypsum wall construction - flexible ceiling (with possibility to move/to sag) - installation frame E5



Position:

1 Fire damper
2 Installation frame E5
3 Solid ceiling construction
4 Wall with possibility of ceiling movement

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

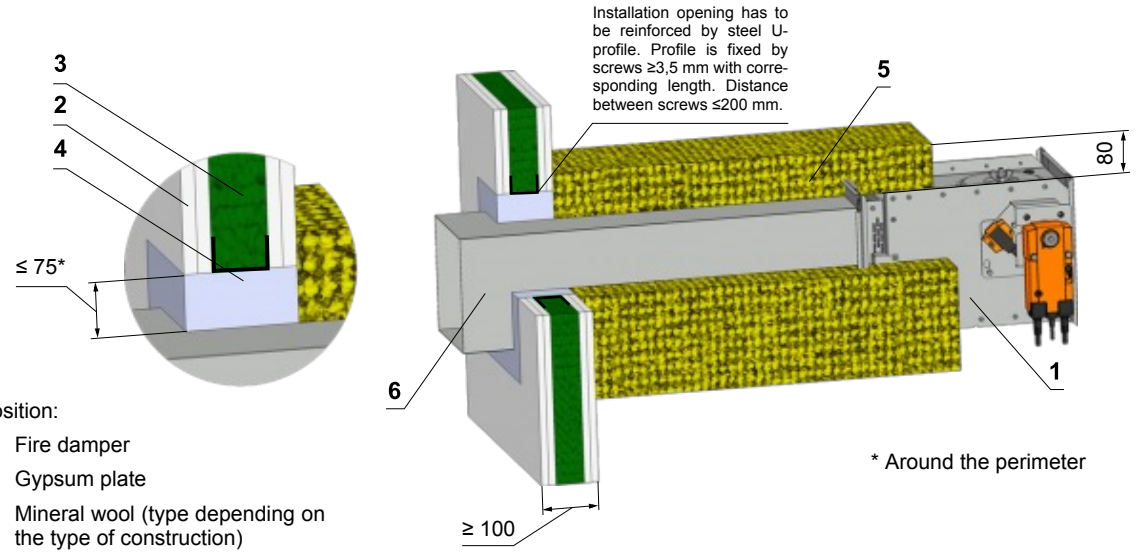
Installation details see chapter 8.

6.5. Installation outside gypsum wall construction

Fig. 57 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/m³
6 Duct

* Around the perimeter

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.

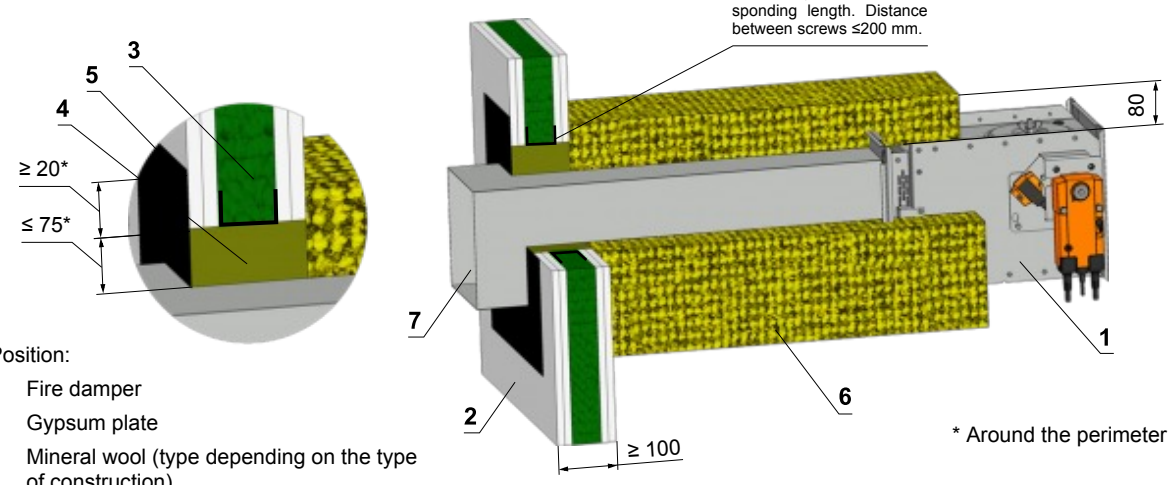
The maximum distance of the fire damper from the structure is not limited.

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

Fig. 58 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/m³)
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/m³
7 Duct

* Around the perimeter

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.

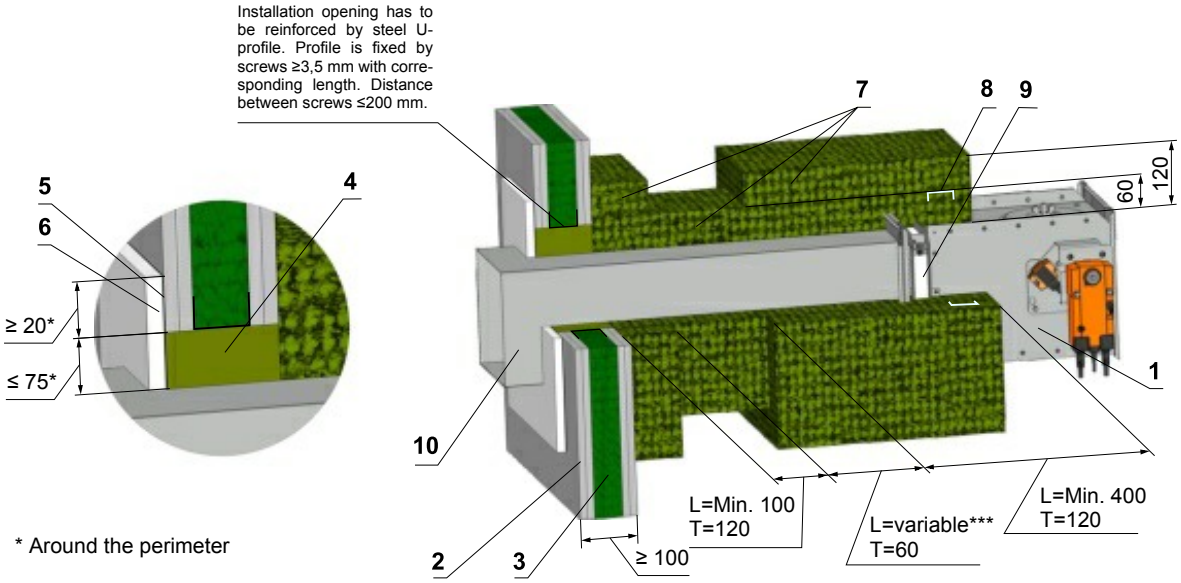
The maximum distance of the fire damper from the structure is not limited.

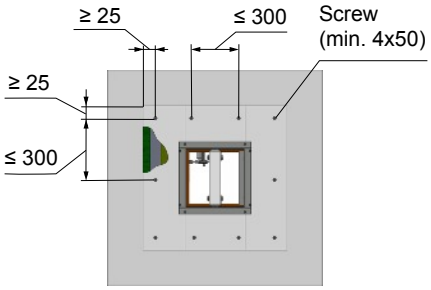
The duct at the point of penetration must be anchored to the fire wall construction, see chapter 9.

Fig. 59 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
EIS 120 ***





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 Mineral stone wool min. density 140 kg/m³
5 Fire protection mastic min. thickness 1 mm
6 Cement lime plate min. thickness 15 mm (min. density 870 kg/m³)
7 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ and min. thickness 60 mm
8 Profil U25x40x25
9 VRM****
10 Duct

Used materials - example:**

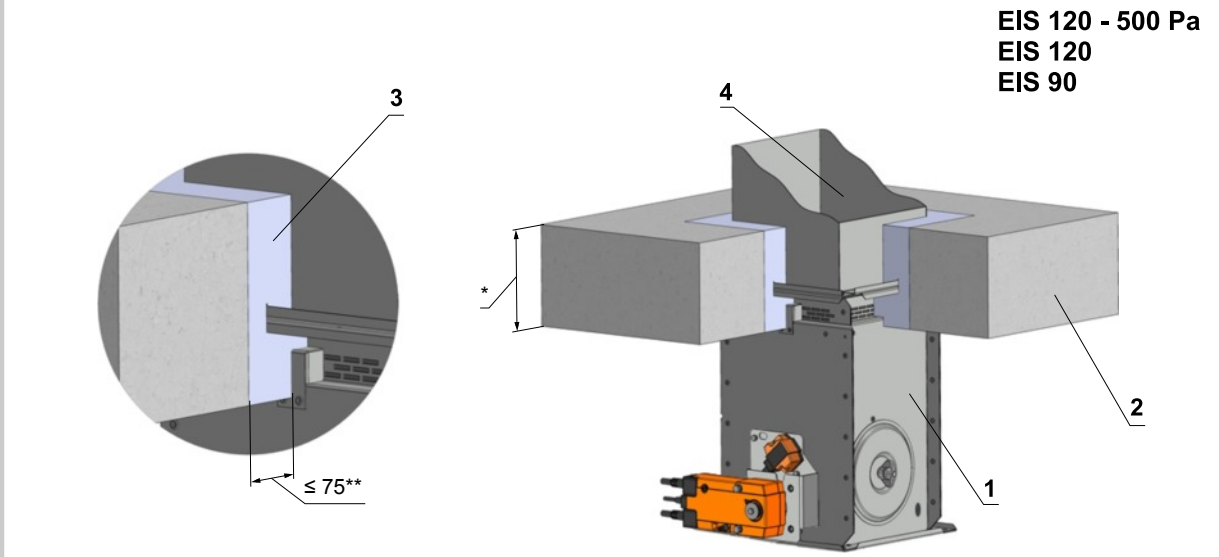
4 Promapyr. Rockwool Steprock HD. Hilti CFS-CT C 1S 140/50
5 Promastop - P, K, Hilti CFS-CT
6 Promatect - H
7 Rockwool Conlit Ductrock EIS 90, th. 60 mm

** 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 1366-1:2014.
**** Reinforcement fixing VRM see Fig. 81
Installation of profile U25x40x25 see Fig. 82
***** When using Rockwool Conlit Ductrock EIS 120, th. 60 mm, the overall fire resistance of the EIS 120 can be achieved.
T - thickness of the insulation (mm)

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. 60 Solid ceiling construction - mortar or gypsum



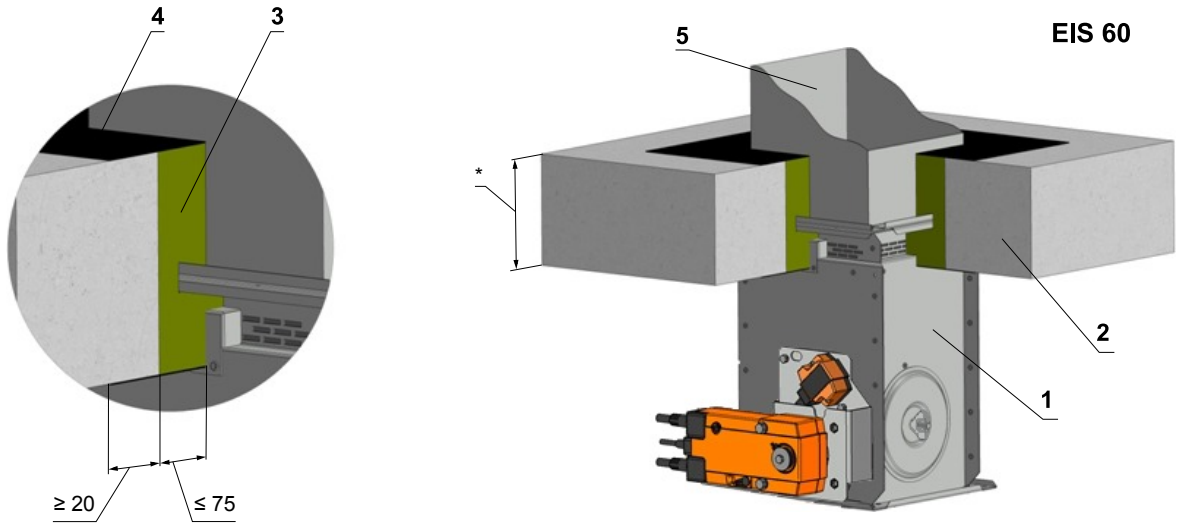
Position:

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

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

** Around the perimeter

Fig. 61 Solid ceiling construction - stuffing box and fire protection mastic



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

Position:

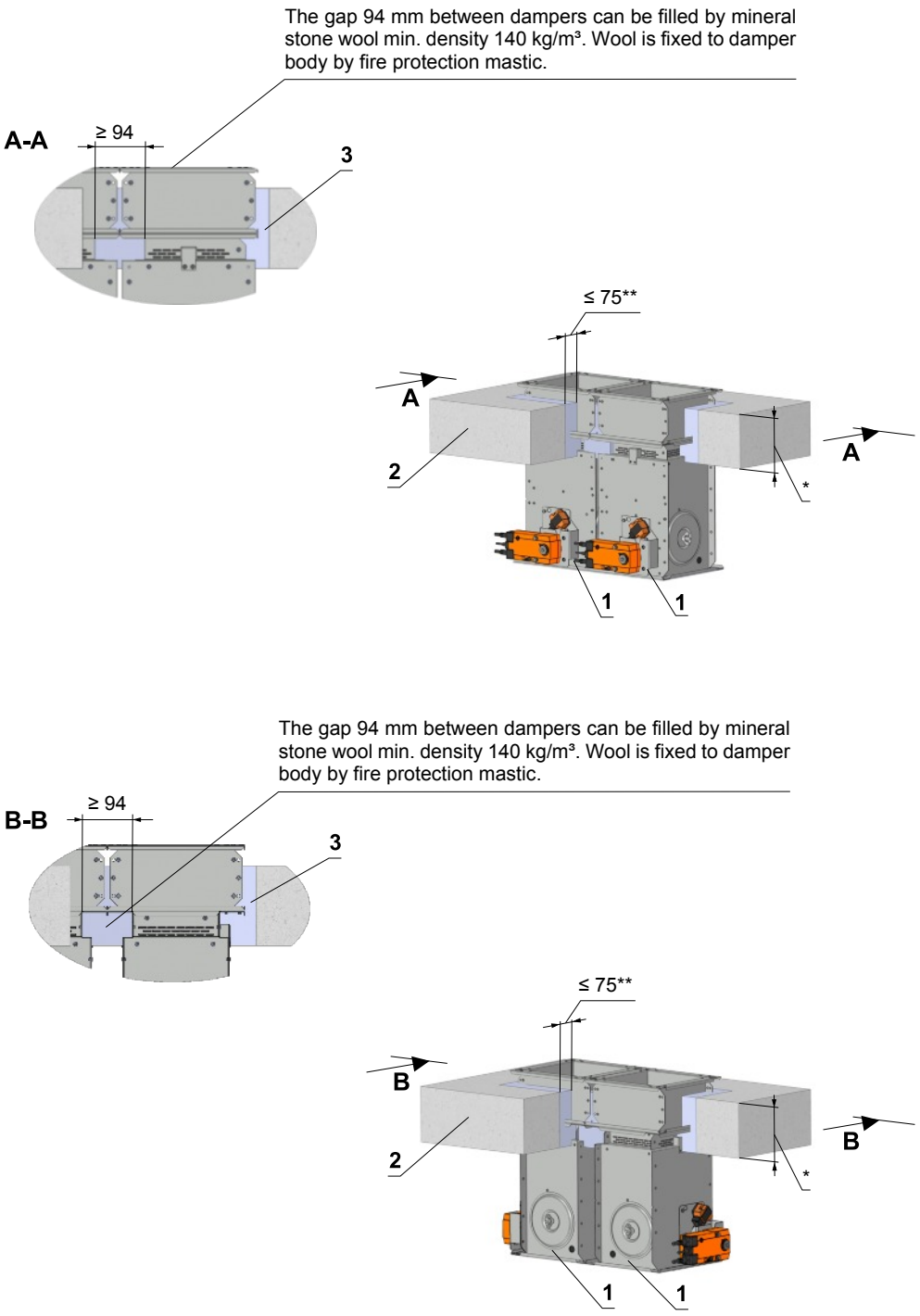
1 Fire damper
2 Solid ceiling construction
3 Stuffing box (mineral stone wool min. density 140 kg/m³)
4 Fire protection mastic min. thickness 1 mm
5 Duct

Used materials - example:

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

Fig. 62 Solid ceiling construction - battery - mortar or gypsum

EIS 90



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

** Around the perimeter

Position:

1 Fire damper

2 Solid wall construction

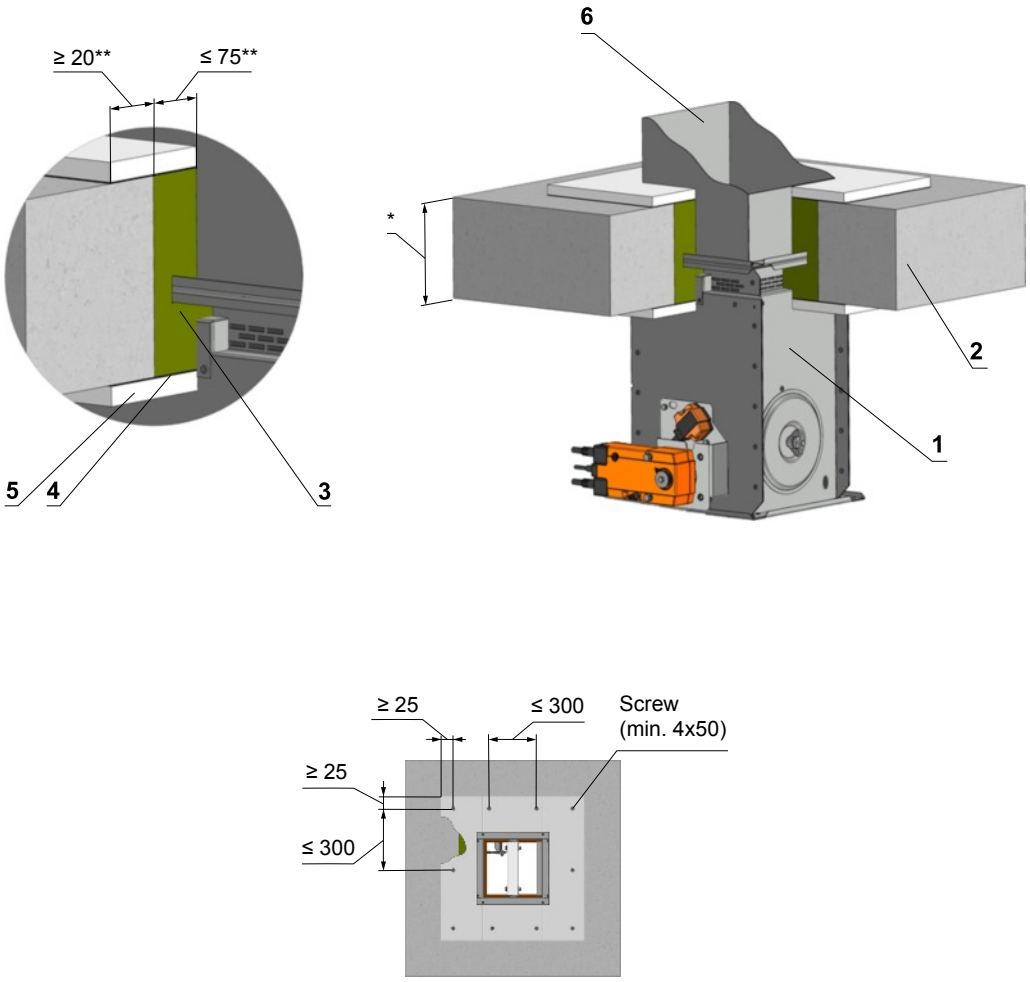
3 Mortar or gypsum

Notice:

- Installation opening for each damper has minimal dimensions a x b = (A+100) x (2xB +100) mm or (2xA+100) x (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 4 dampers can be installed

Fig. 63 Solid ceiling construction - stuffing box, fire protection mastic and cement lime plate

EIS 90



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/m³)

4 Fire protection mastic min. thickness 1 mm

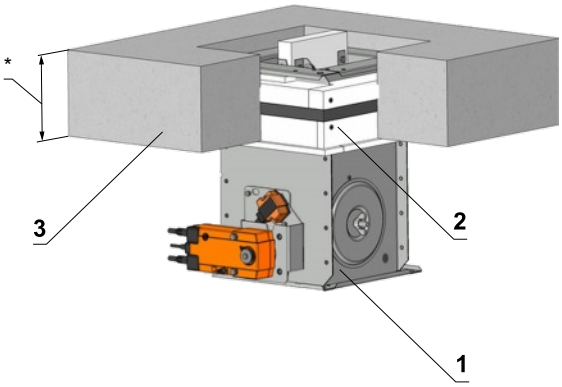
5 Cement lime plate min. thickness 15 mm,
min. density 870 kg/m³

6 Duct

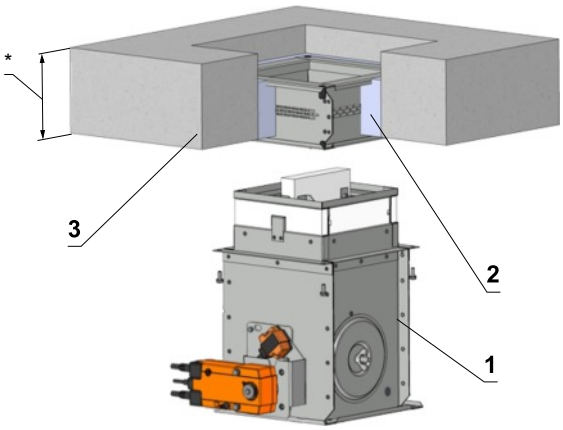
Fig. 64 Solid ceiling construction - installation frame E1, E2, E4

EIS 90

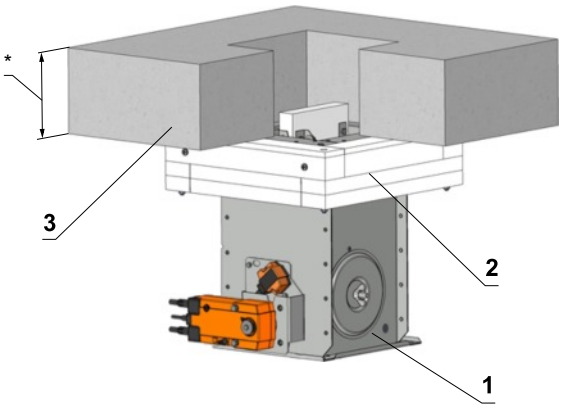
Installation frame E1



Installation frame E2



Installation frame E4



Position:

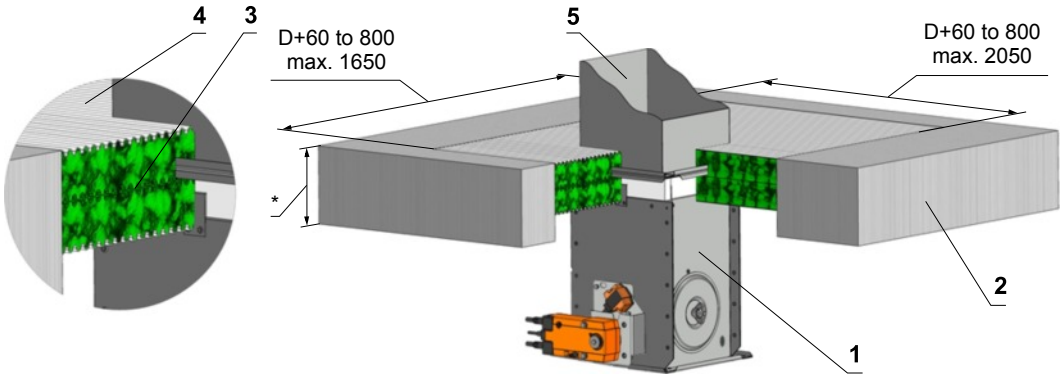
1 Fire damper
2 Installation frame
3 Solid ceiling construction

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

Installation details see chapter 8.

Fig. 65 Solid ceiling construction - Weichschott / Ablative Coated Batt

EIS 90



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

Position:

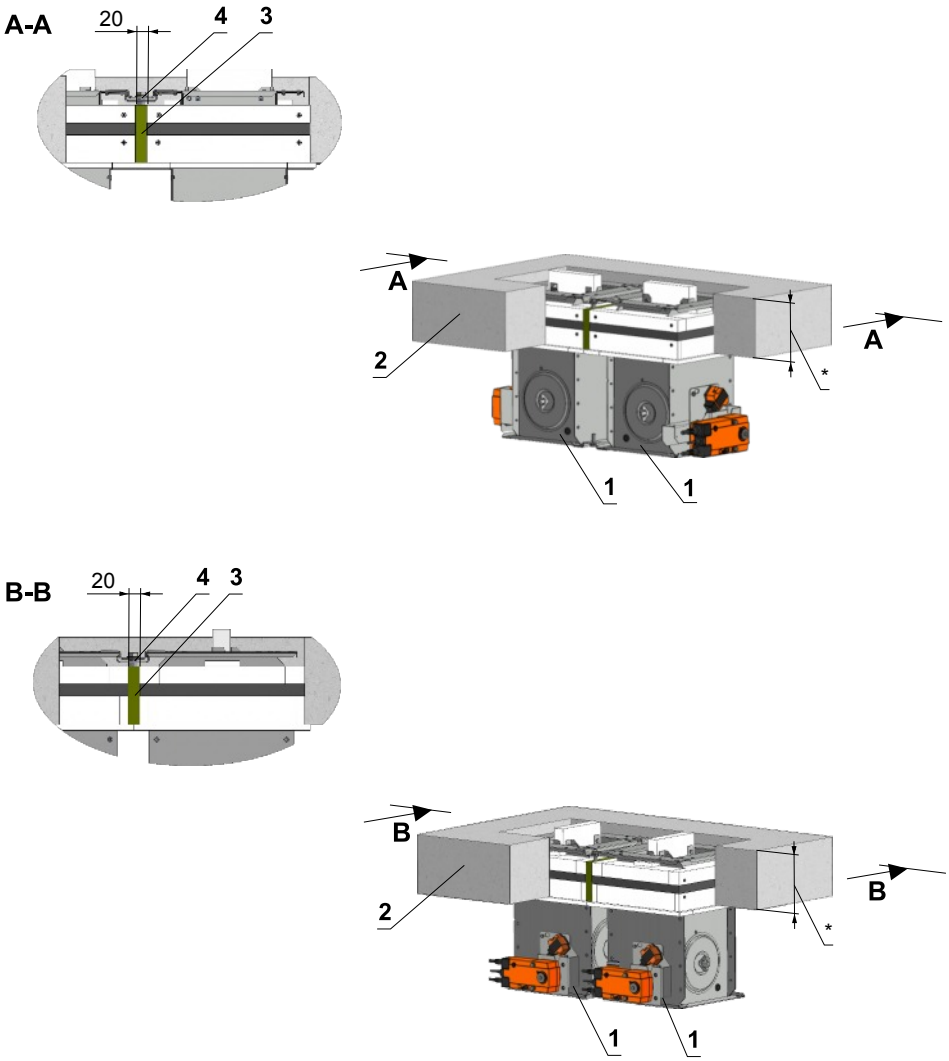
1 Fire damper
2 Solid ceiling construction
3 Fire resistant board
4 Fire stop coating thickness 1 mm
5 Duct

Used materials - example:

3 Hilti CFS-CT B 1S 140/50
4 Hilti CFS-CT

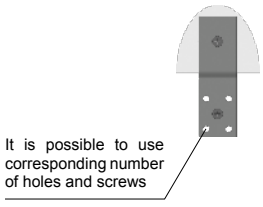
Fig. 66 Solid ceiling construction - battery - installation frame E1

EIS 90



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

A = max. 1000 mm



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 ≤ 1260	3	3
1260 < A1 ≤ 1600	4	4
1600 < A1 ≤ 2000	5	5

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/m³
4 Flange connection

Notice:

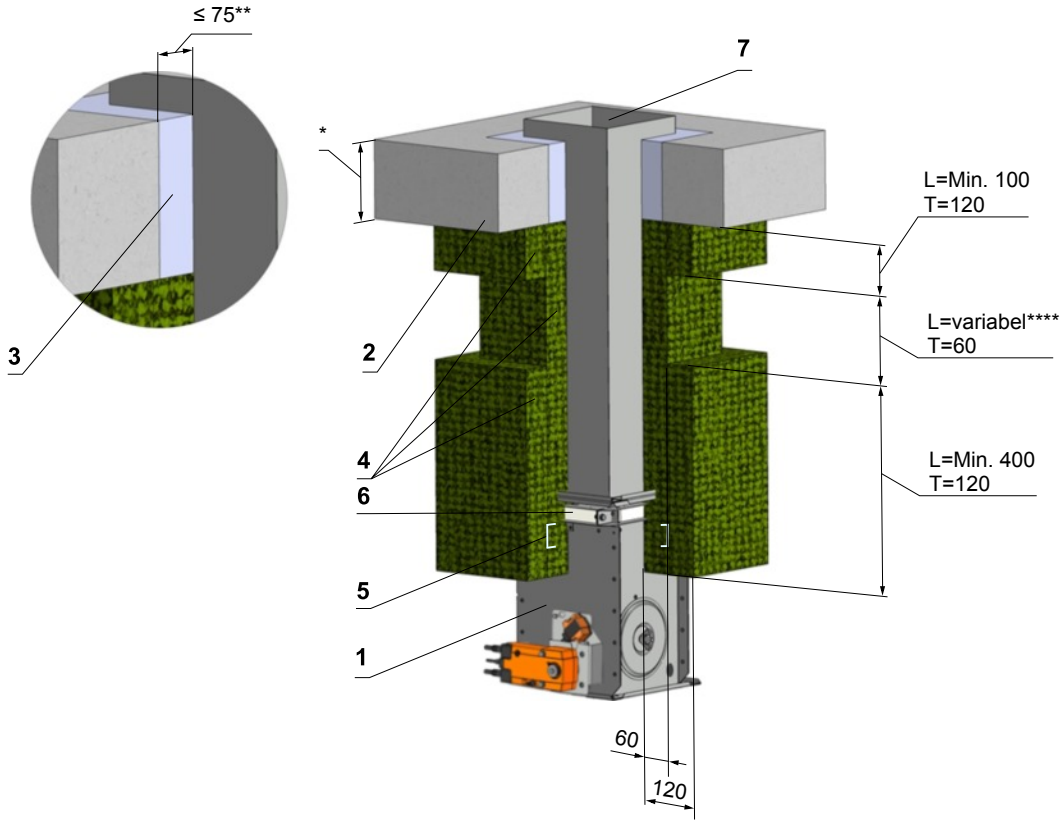
- Installation opening dimensions
  a x b = (2x(A + 85^{+3}mm) + 20 mm) x (B + 85^{+3}mm)
  or a x b = (A + 85^{+3}mm) x (2x(B + 85^{+3}mm) + 20 mm)
- Gap between frame and damper body and frame and construction must be filled by glue (PROMAT K84)
- Distance between dampers 104 mm
- Flange to flange connection - Up to 4 dampers can be installed

6.7. Installation outside solid ceiling construction

Fig. 67 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
EIS 120 ****



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

** Around the perimeter

Used materials - example:***

4 Rockwool Conlit Ductrock EIS 90, th. 60 mm

Position:

1 Fire damper
2 Solid ceiling construction
3 Mortar or gypsum
4 Stone wool bound with use of an organic resin with crushed stone as a refrigerant, min. density 300 kg/m³ and min. thickness 60 mm
5 Profil U25x40x25
6 VRM*****
7 Duct

*** 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 1366-1:2014.

***** Reinforcement fixing VRM see Fig. 81
Installation of profile U25x40x25 see Fig. 82

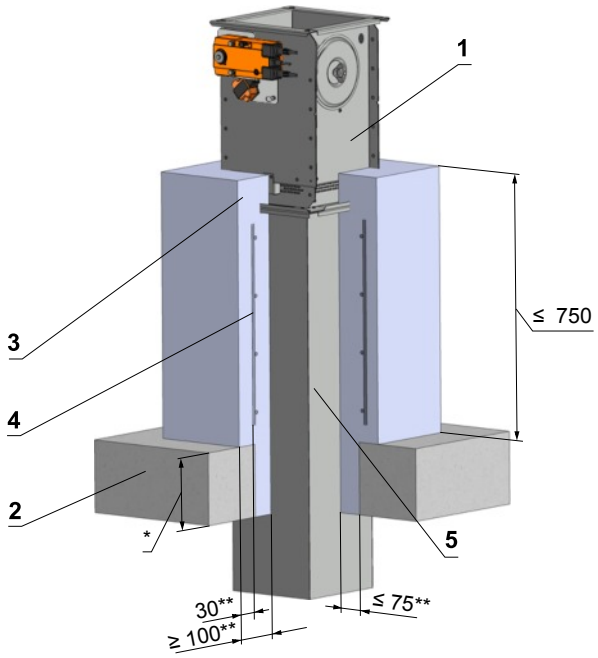
****** When using Rockwool Conlit Ductrock EIS 120, th. 60 mm, the overall fire resistance of the EIS 120 can be achieved.

T - thickness of the insulation (mm)

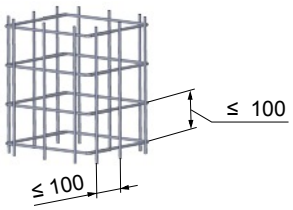
The duct at the point of penetration does not have to be anchored to the fire wall construction, see chapter 9.

Fig. 68 Outside solid ceiling construction - concrete

EIS 90



Rebar - Steel wire Ø 6 mm



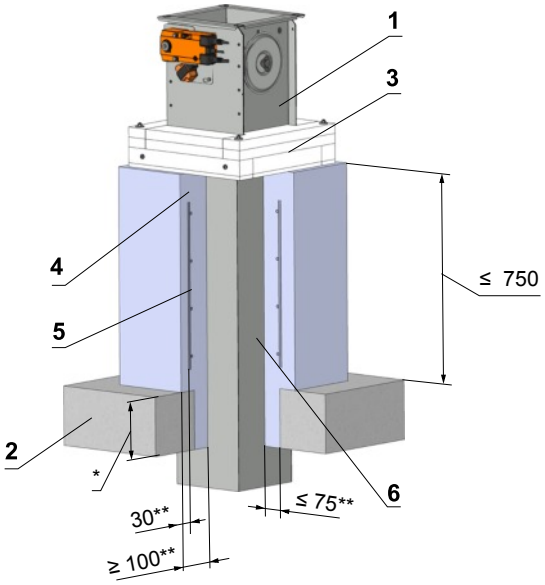
Position:
1 Fire damper
2 Solid ceiling construction
3 Concrete B20
4 Rebar
5 Duct

* min. 110 - Concrete/ min. 125 - Aerated concrete
** Around the perimeter

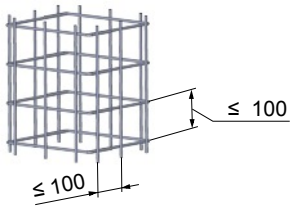
Fig. 69 Outside solid ceiling construction - concrete - installation frame E4

Installation frame E4

EIS 90



Rebar - Steel wire Ø 6 mm



Position:
1 Fire damper
2 Solid ceiling construction
3 Installation frame E4
4 Concrete B20
5 Rebar
6 Duct

Installation details see chapter 8.

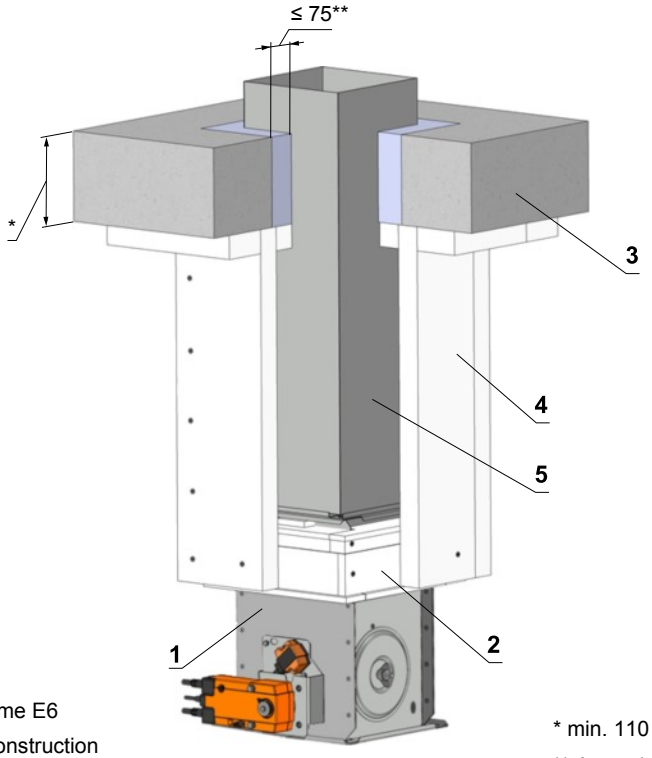
* min. 110 - Concrete/ min. 125 - Aerated concrete
** Around the perimeter

Fig. 70 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
5 Duct

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

** Around the perimeter

Installation details see chapter 8.

7. Thin shaft walls

Thin shaft wall description

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 Ø 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.

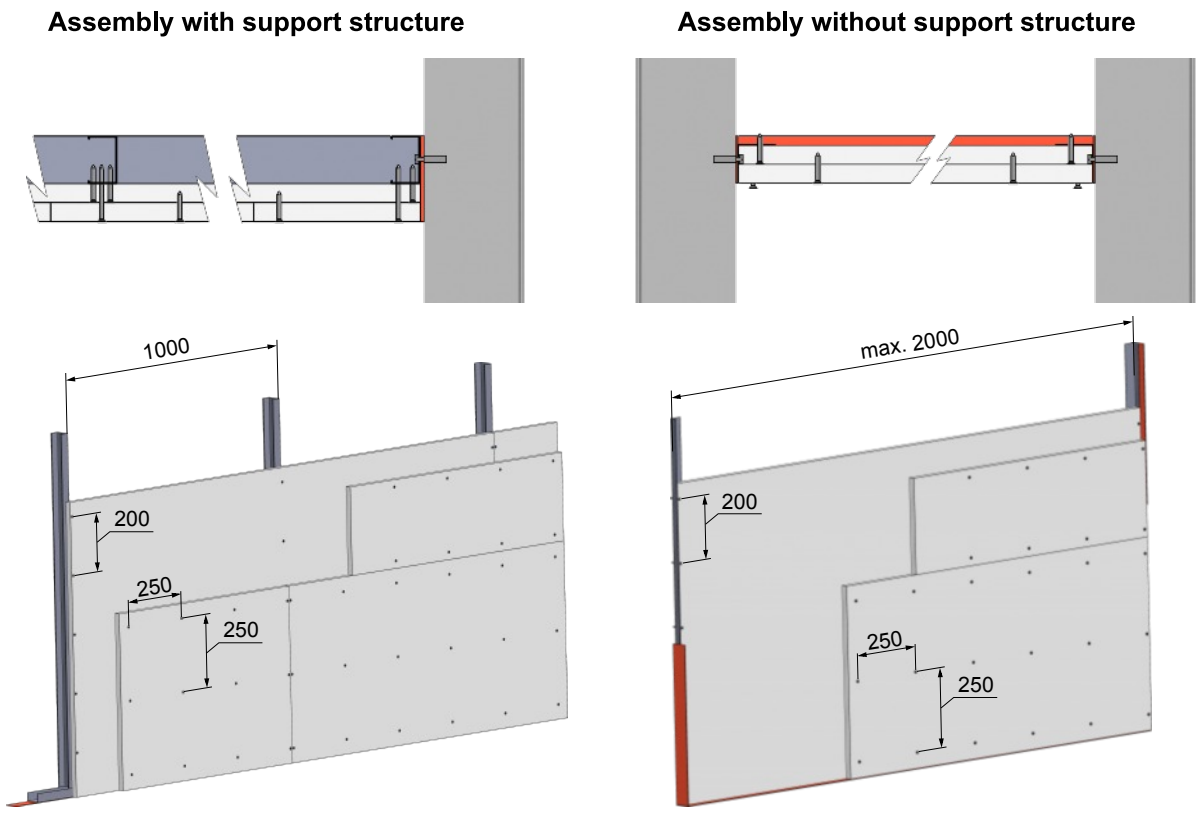
Assembly with support structure

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 Ø 6 mm steel plugs (for example DN6 or ZHOP) with 500 mm spacing.

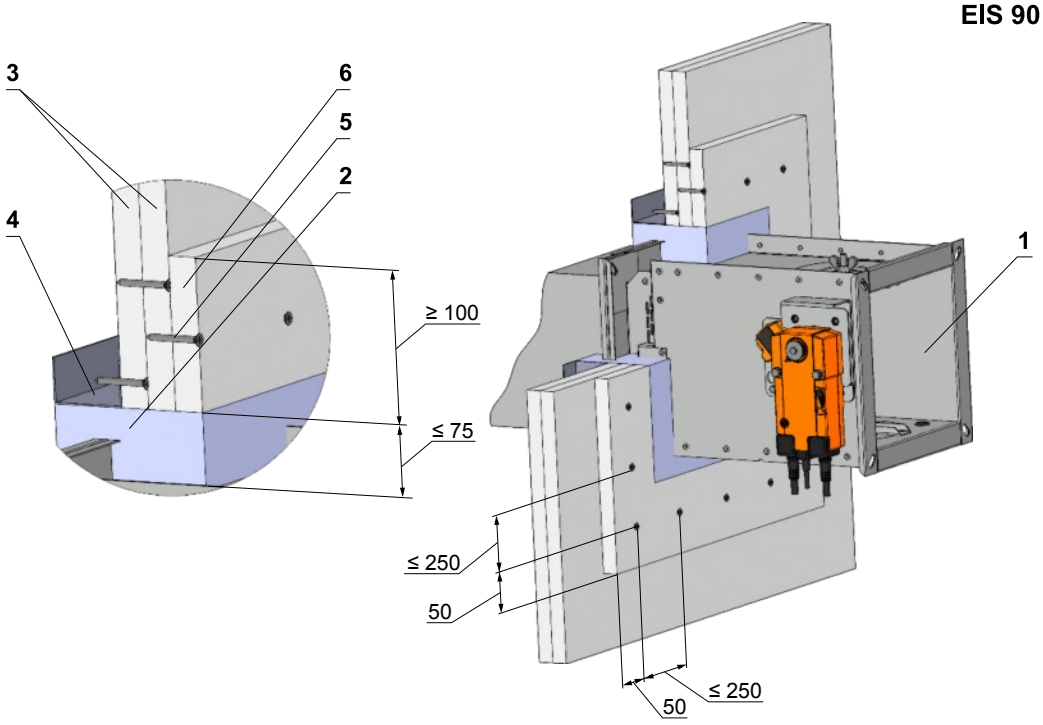
Fig. 71

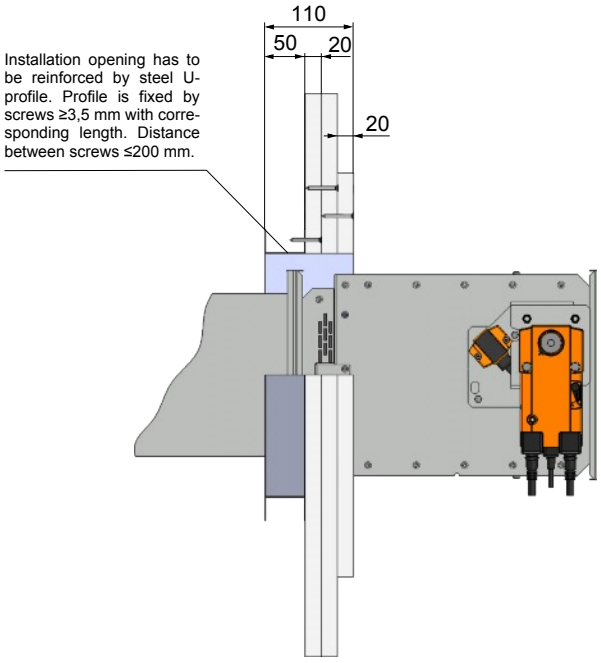


Notice: Rigips solution is shown here as an example. Alternatively it is possible to apply the solution from Knauf or Promat. In such a case follow the instructions of the producer.

Fig. 72 Thin shaft wall - mortar or gypsum

EIS 90

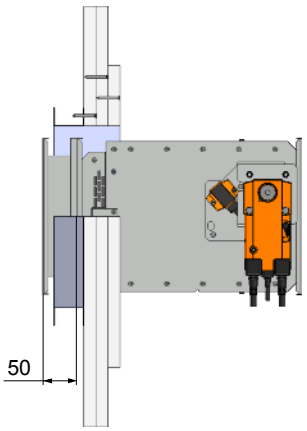




Installation opening:

a x b = (A + 100 mm) x (B + 100 mm)

If there isn't connected duct to the damper, it is necessary use extension piece 50 mm



Position:

1 Fire damper
2 Mortar or gypsum
3 Fire resistant board
4 Steel U-profile
5 Screw
6 Additional fire resistant board

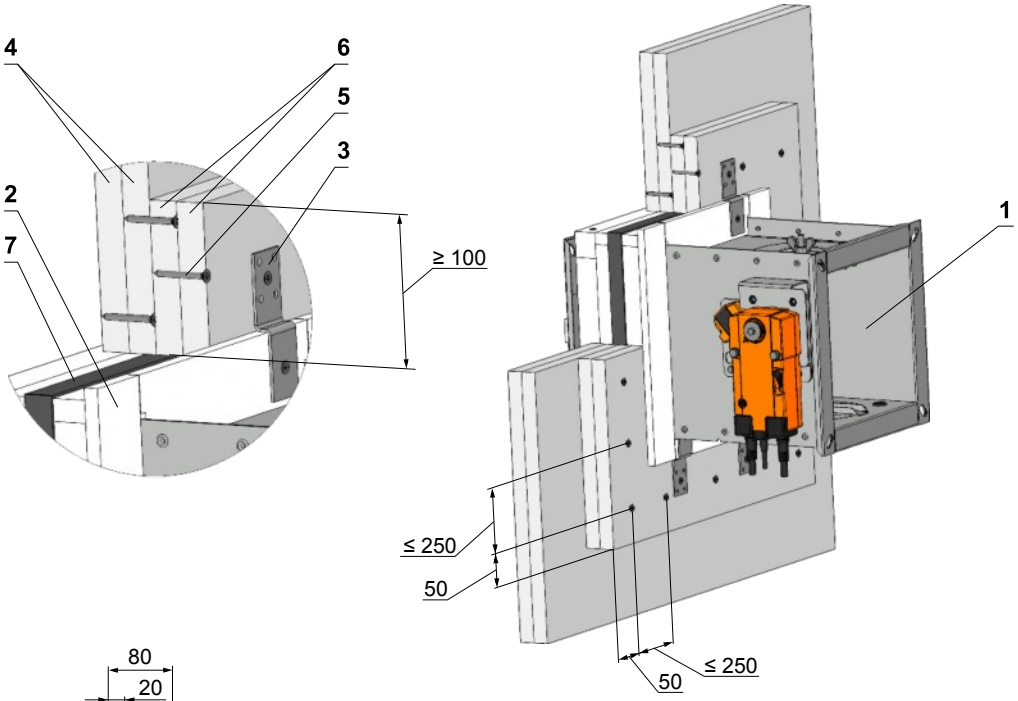
Used materials - example:*

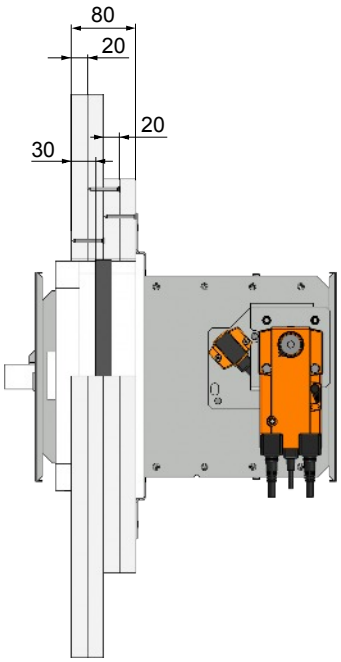
3 Glasroc F Ridurit th. 20 mm
4 Steel U-profile 50
5 Screw Ridurit
6 Glasroc F Ridurit th. 20 mm

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

Fig. 73 Thin shaft wall - installation frame E1

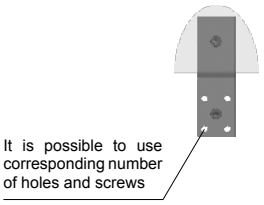
EIS 90





Installation opening:

a x b = (A + 85^{+3}mm) x (B + 85^{+3}mm)



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

Dimensions	Number ZB1	Number ZH1
A,B ≤ 400	1	1
400 < A,B ≤ 800	2	2
800 < A ≤ 1000	3	3

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 protection 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 end damper body and frame and solid (gypsum) wall construction must be filled by glue (PROMAT K84).
Dampers has to be suspended in an appropriate manner see chapter 9.

8. Installation frames

Tab. 8.1.1.

Installation frame											
Type	Material	Installation type									
		Solid wall constr.	Th. [mm]	Solid ceiling const.	Th. [mm]	Gypsum wall constr.	Th. [mm]	Outside solid wall con./solid ceiling con.	Th. [mm]	On solid wall constr./Solid ceiling constr.	Th. [mm]
E1	Cement lime	√	≥100	√	≥150	√	≥100	-	-	-	-
E2	Galvanized plate	√	≥100	√	≥150	-	-	-	-	-	-
E3	Cement lime	-	-	-	-	√	≥100	-	-	-	-
E4	Cement lime	√	≥100	√ *)	≥150	-	-	Solid ceiling construction *)	≥150	√	≥100/ ≥150
E5	Cement lime	-	-	-	-	√ **)	≥100	-	-	-	-
E6	Cement lime	-	-	-	-	-	-	√	≥100/ ≥150	-	-

* With concrete
** Ceiling with movement possibility

Fig. 74

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:

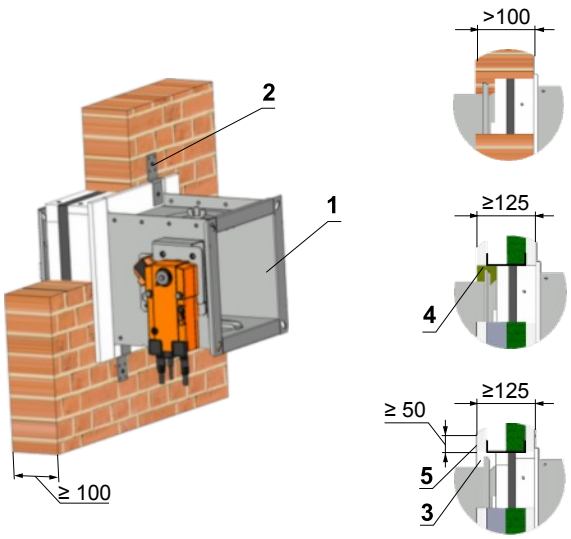
- Installation frame: cement lime plates
- Fasteners: galvanized plate

Installation opening:

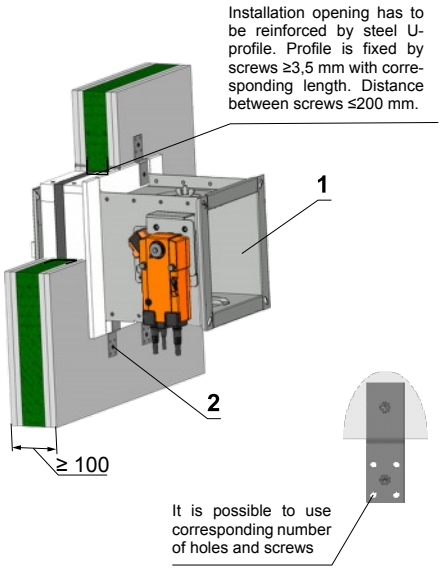
- a x b = (A + 105^{+3}mm) x (B + 105^{+3}mm)

Fig. 75 Installation frame E1

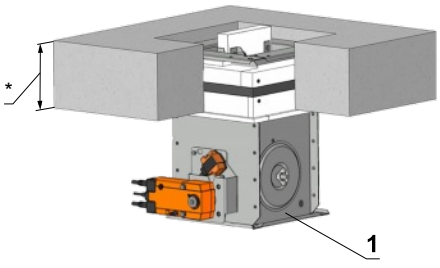
Solid wall construction



Gypsum wall construction



Solid ceiling construction



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

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

Dimensions	Number ZB1	Number ZH1
A,B ≤ 400	1	1
400 < A,B ≤ 800	2	2
800 < A ≤ 1000	3	3

Position:

1 Fire damper with installation frame E1
2 Holder with screws
3 Gypsum plate
4 Mineral stone wool min. density 140 kg/m³
5 Fire protection mastic min. thickness 1 mm

Notice: Gap between frame end damper body and frame and solid (gypsum) wall construction must be filled by glue (PROMAT K84).
Dampers has to be suspended in an appropriate manner see chapter 9.

Installation frame E2

Installation frame E2 is suitable for:

- Solid wall construction
- Solid ceiling construction

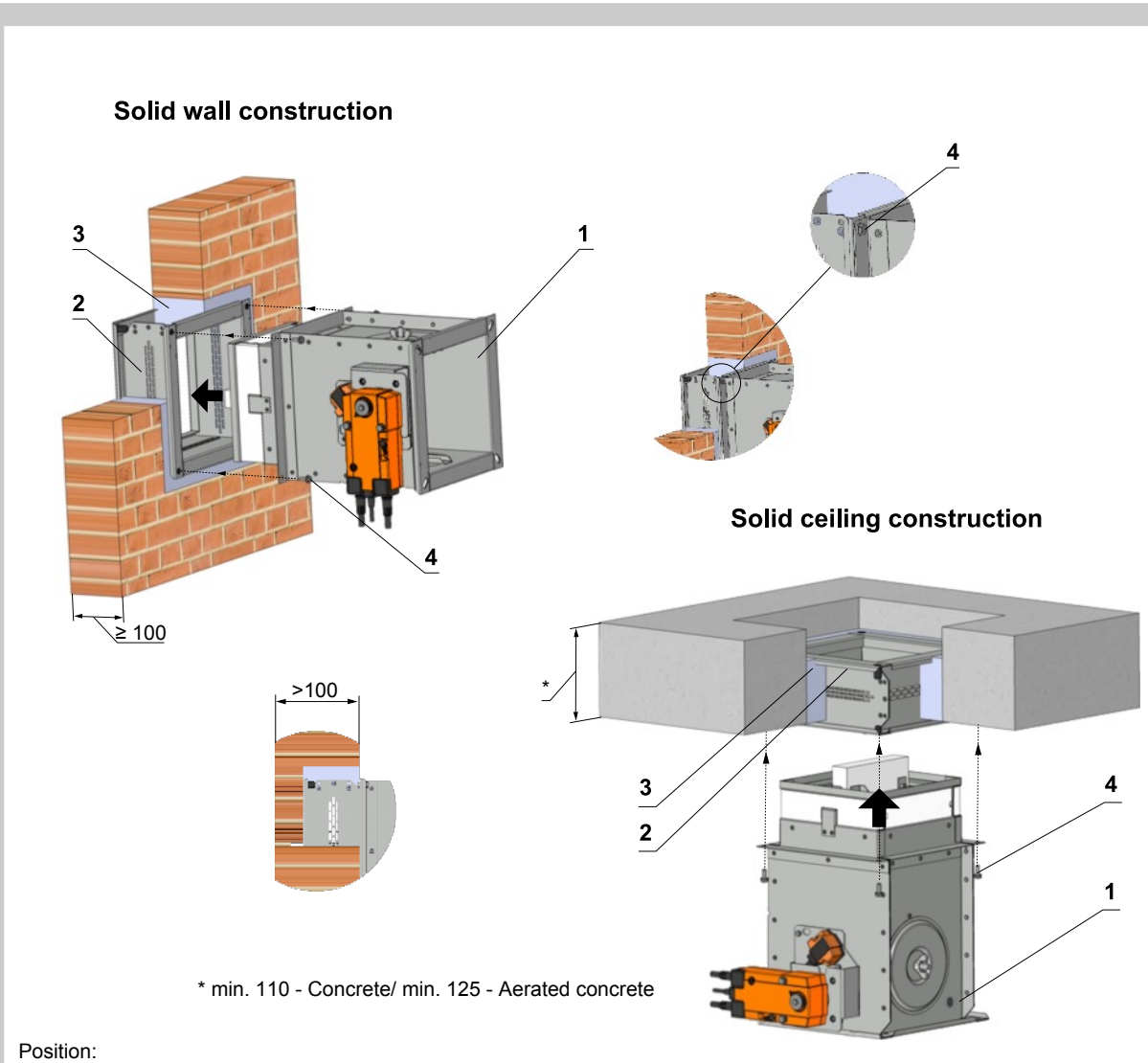
Damper is on the body equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between damper body and steel cartridge.

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 x b = (A + 100^{+3}mm) x (B + 100^{+3}mm)

Fig. 76 Installation frame E2



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

Position:
1 Fire damper
2 Installation frame E2
3 Mortar or gypsum
4 Holder with bolt

Notice: Dampers has to be suspended in an appropriate manner see chapter 9.

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.

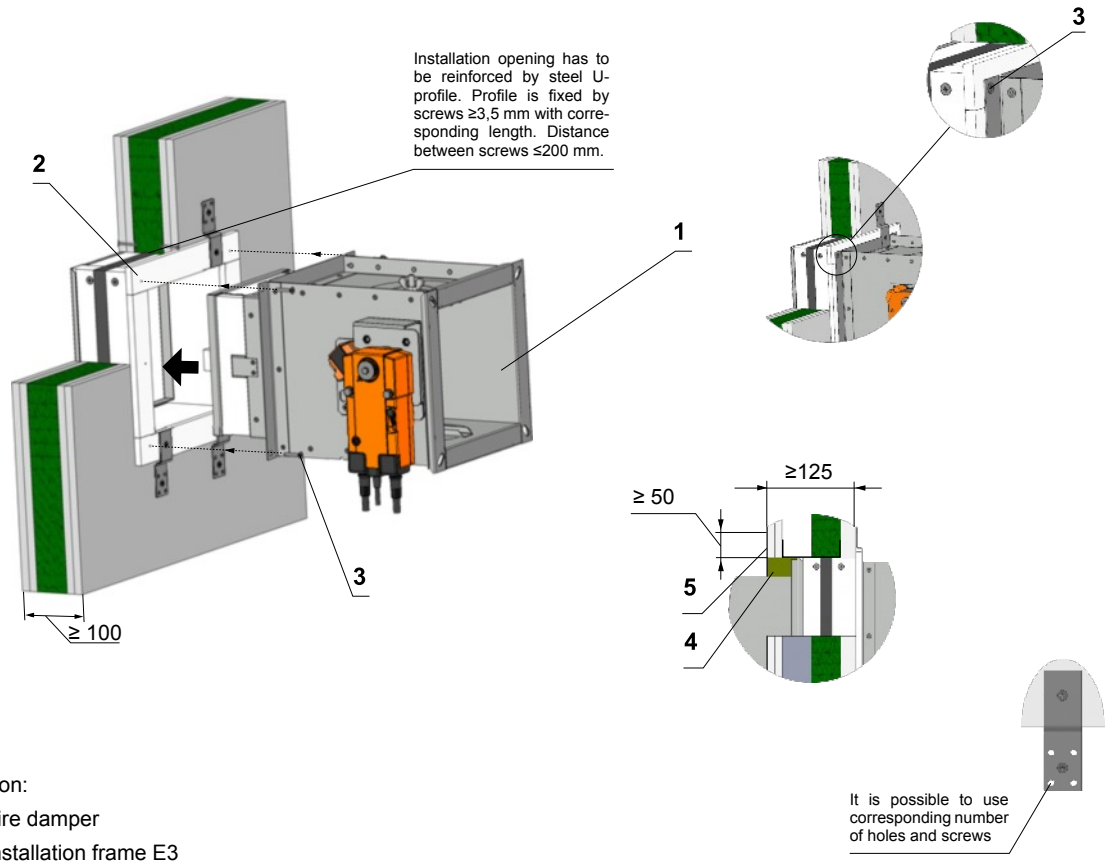
Installation:
- Gypsum wall construction has to be installed according manufacture requirements.

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

Installation opening:
- a x b = (A + 67^{+3}mm) x (B + 67^{+3}mm)

Fig. 77 Installation frame E3

Gypsum wall construction



Position:
1 Fire damper
2 Installation frame E3
3 Screw
4 Mineral stone wool min. density 140 kg/m³
5 Fire protection mastic min. thickness 1 mm

Notice: Gap between frame end damper body and frame and solid (gypsum) wall construction must be filled by glue (PROMAT K84).
Dampers has to be suspended in an appropriate manner see chapter 9.

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

Dimensions	Number ZB1	Number ZH1
A,B ≤ 400	1	1
400 < A,B ≤ 800	2	2
800 < A ≤ 1000	3	3

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

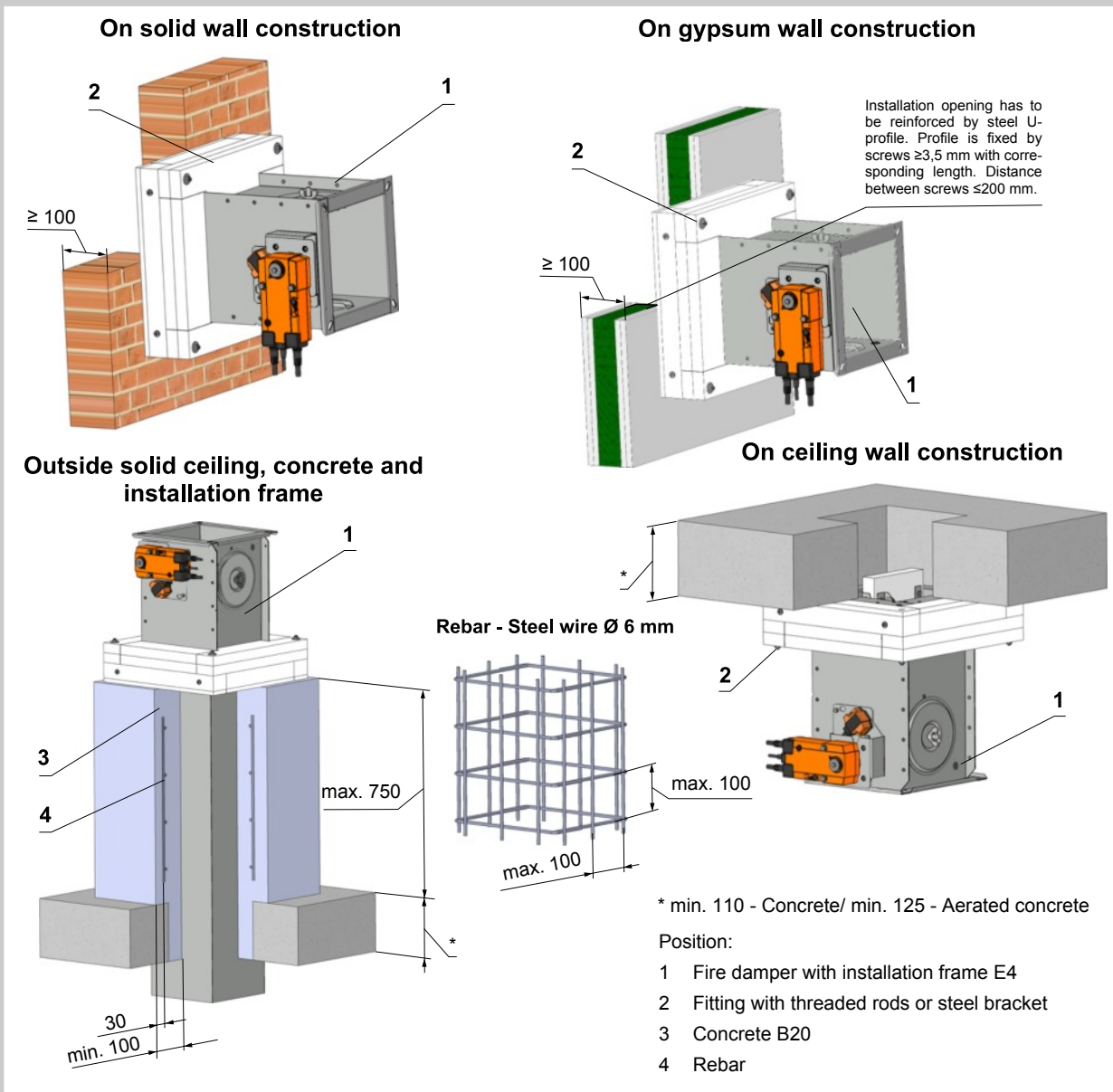
On the inside is installation frame equipped by intumescent sealing. It enlarges its capacity and air proofs the gap between installation frame and damper body.

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

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

Installation opening:
- a x b = (A + 5^{+3}mm) x (B + 5^{+3}mm)
- a x b = (A + 100^{+3}mm) x (B + 100^{+3}mm) installation with concrete

Fig. 78 Installation frame E4



Notice: Dampers has to be suspended in an appropriate manner see chapter 9.

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:

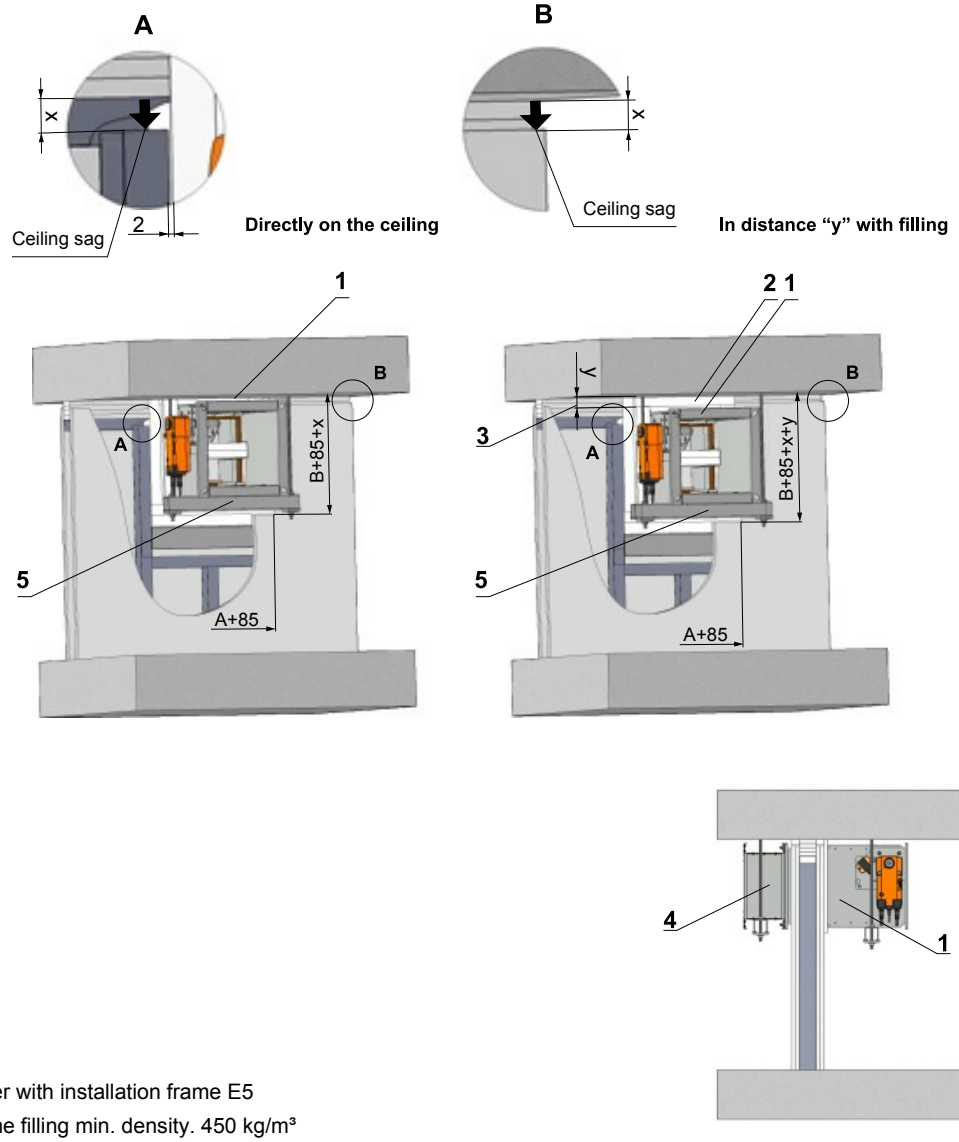
- Installation frame: cement lime plates
- Fasteners: galvanized plate

Notice:

- For ceiling movement ≥10 mm

Fig. 79 Installation frame E5

Gypsum wall construction with flexible ceiling (with possibility to move/to sag)



Position:

1 Fire damper with installation frame E5
2 Cement lime filling min. density. 450 kg/m³
3 Ceiling movement: construction thickness 100 mm
4 Extension piece
5 Suspension

X = Ceiling movement (max. 40 mm)
Y = Distance of movement (max. 80 mm)

Notice: Fitting with threaded rods or steel bracket

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.

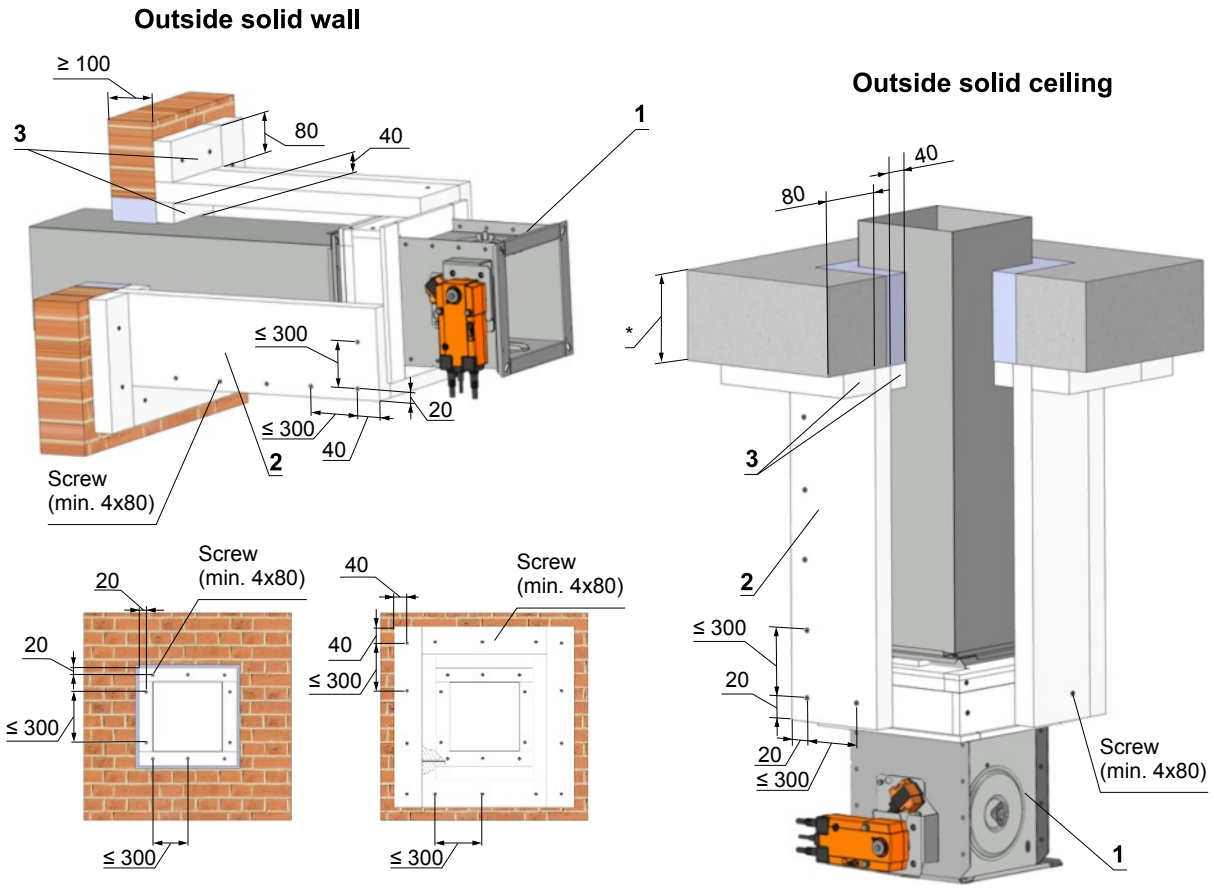
Material:

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

Installation opening:

- a x b = (A + 105^{+3}mm) x (B + 105^{+3}mm)

Fig. 80 Installation frame E6



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

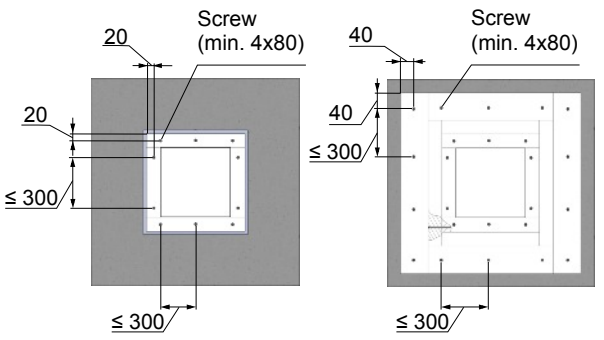
* min. 110 - Concrete/ min. 125 - Aerated concrete

Position:

1 Damper with installation frame E6

2 Cement lime plates min. thickness 40 mm
(min. density 450 kg/m³)

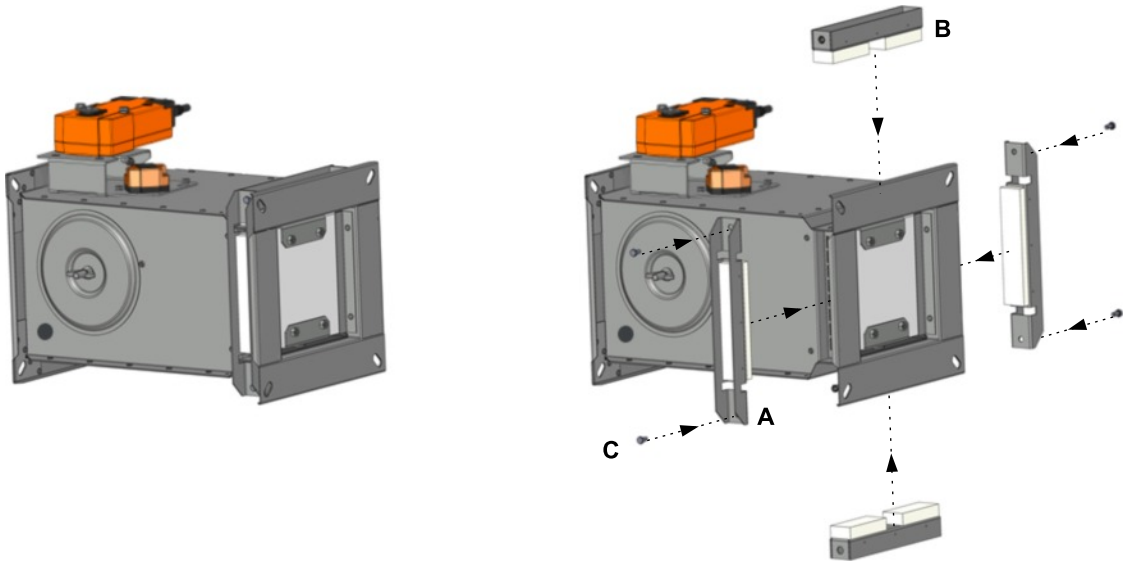
3 Cement lime prisms min. thickness 40 mm
(min. density 450 kg/m³)



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.

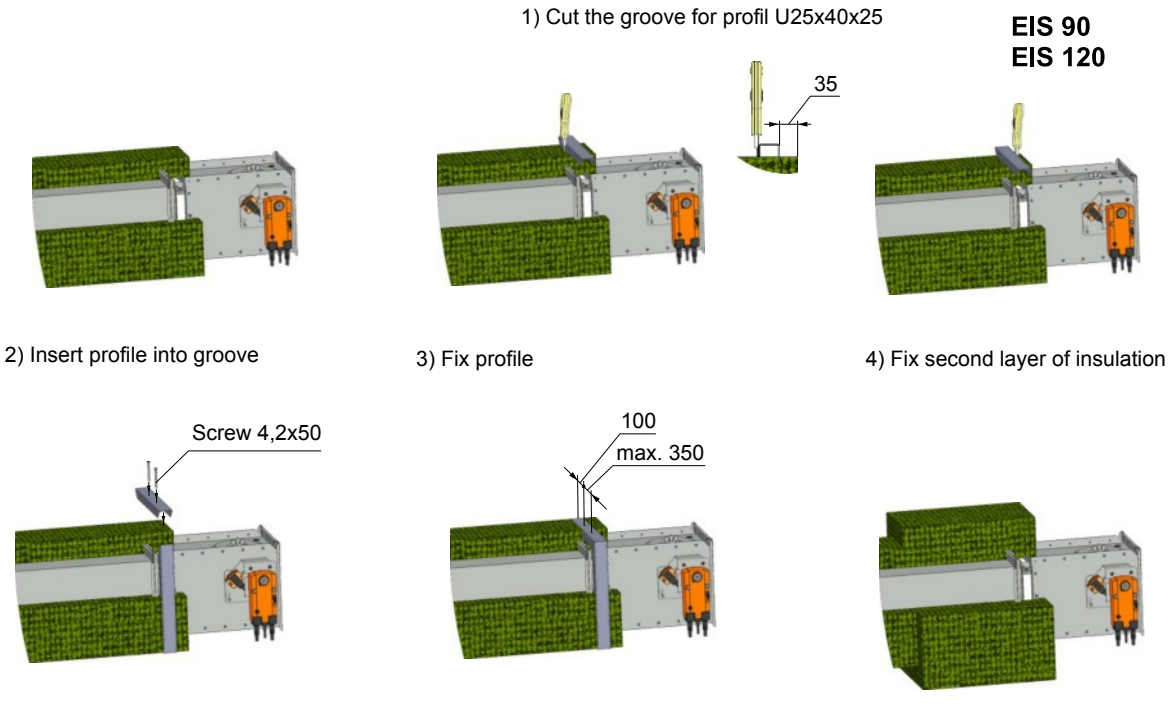
Fig. 81 Fixing of reinforcement to damper body VRM

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



1.) Insert part A, B on body of fire damper in correct position
2.) Lock screw C
3.) It has to be done on each corner of VRM

Fig. 82 Installation procedure



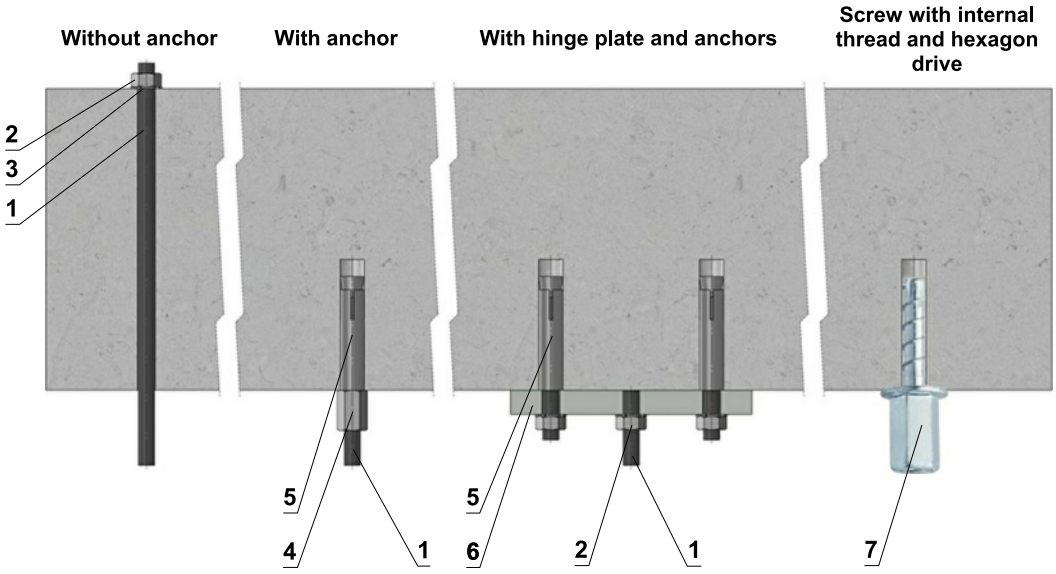
Installation details see chapter 9.

9. Suspension systems

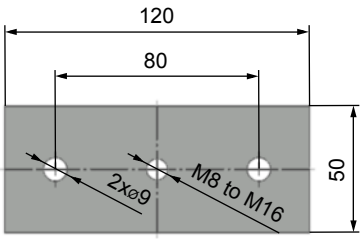
9.1. Mounting to the ceiling wall

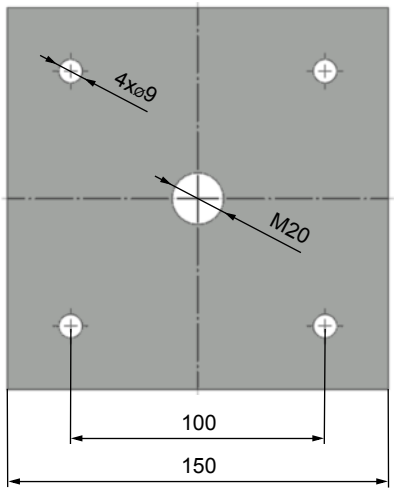
Fig. 83 Mounting to the ceiling wall

Anchoring possible after national standards

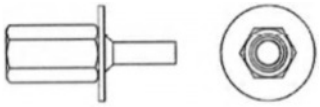


Hinge plates





Screw with internal thread and hexagon drive



Position:

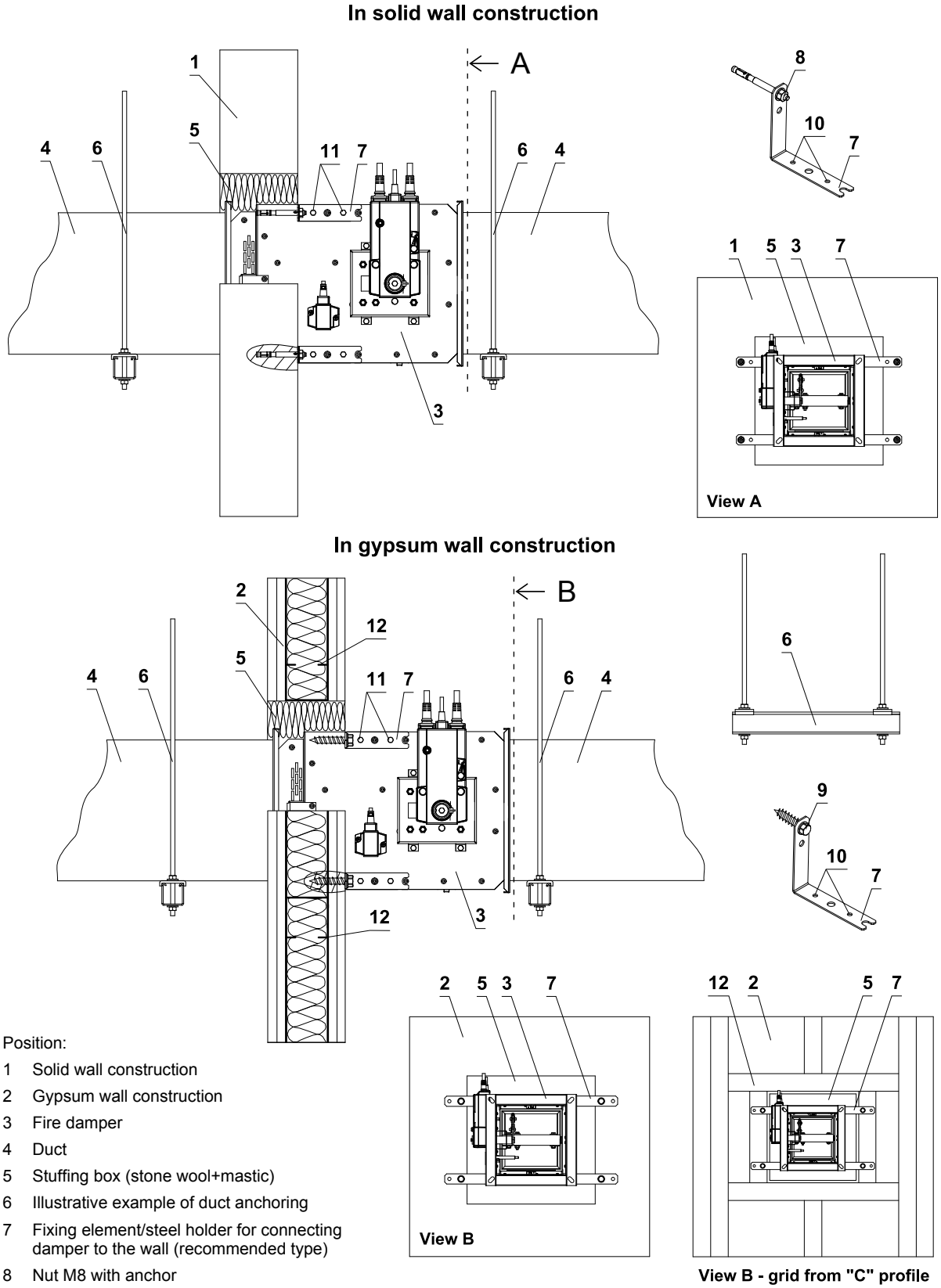
1 Threaded rod M8 – M20
2 Nut
3 Washer
4 Coupling Nut
5 Anchor
6 Hinge plate - min. thickness 10 mm
7 Concrete screw tested for fire resistance R30-R90, max. Tension up to 0.75 KN (length 35 mm)

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

Size	A_s [mm²]	Weight G [kg]	
		for 1 piece	for 1 pair
M8	36,6	22	44
M10	58	35	70
M12	84,3	52	104
M14	115	70	140
M16	157	96	192
M18	192	117	234
M20	245	150	300

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

Fig. 84 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 hols
11 Screw M6x10+Nut M6
12 Gypsum grid from "C" profile

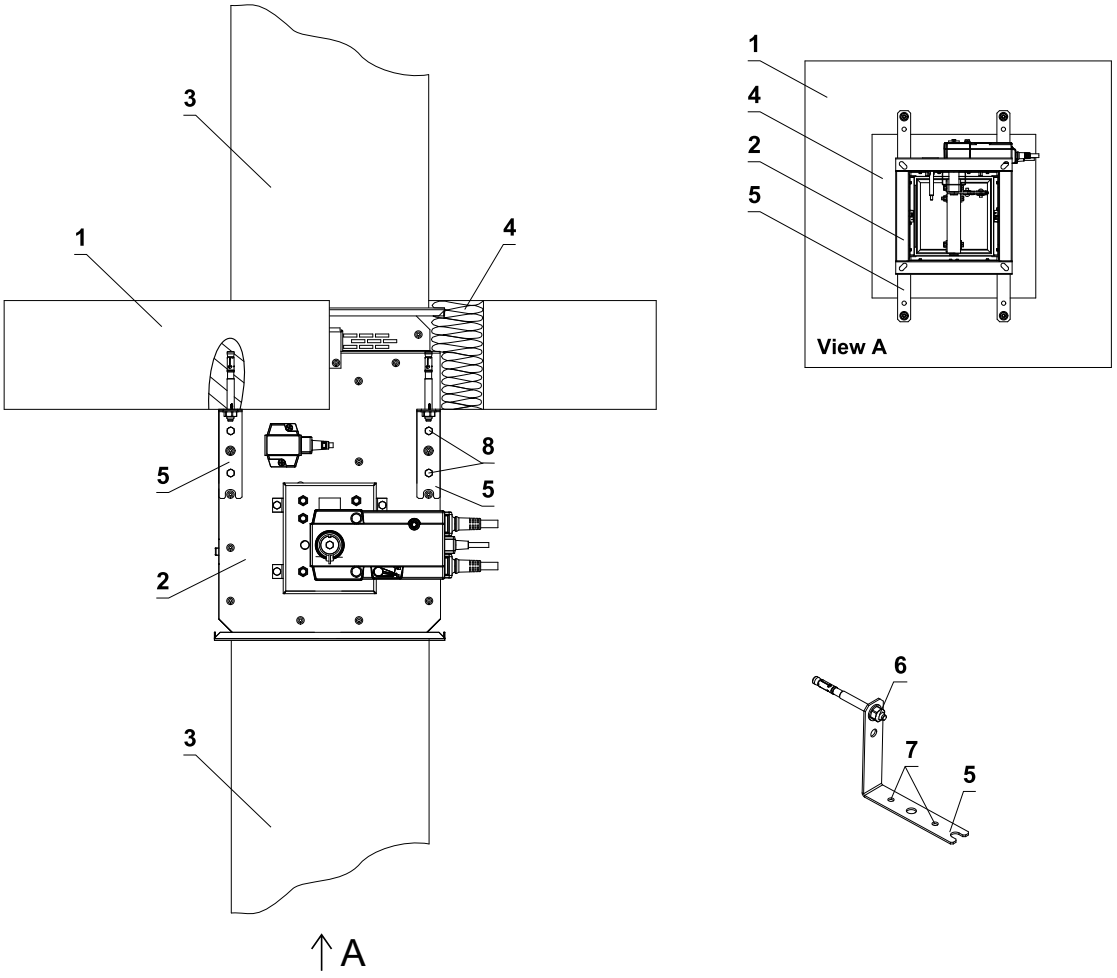
Notice:

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

In solid ceiling construction



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 hols
8 Screw M6x10+Nut M6

Notice:

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.

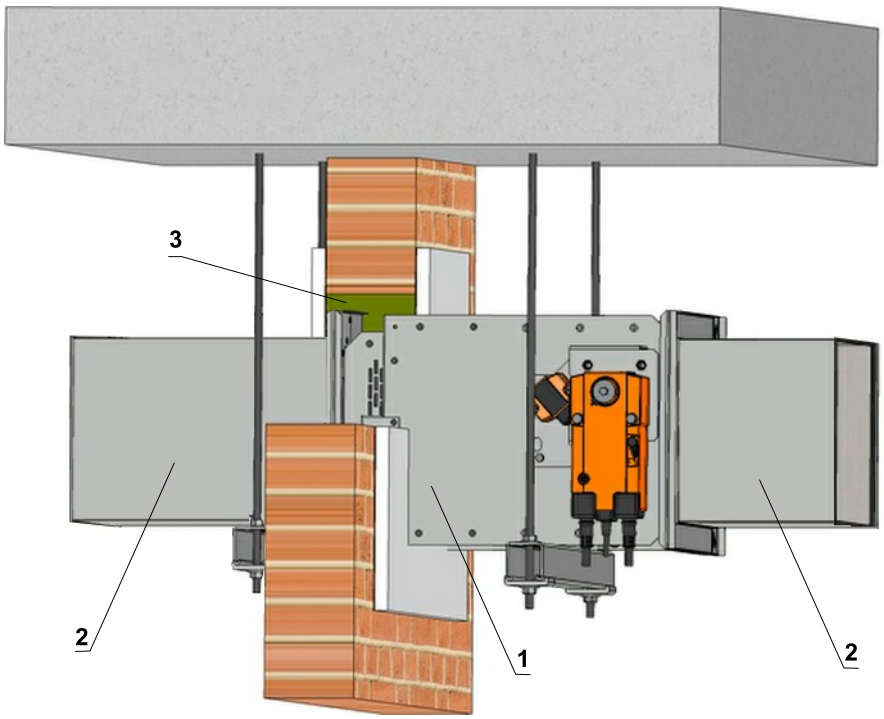
On Fig. 86 is typical mounting situation as an example.

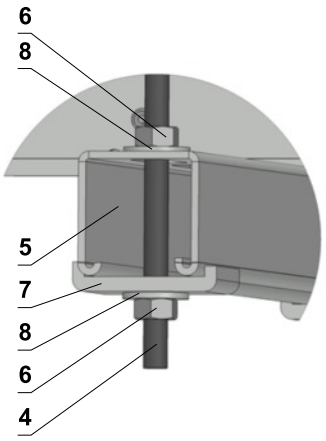
Threaded rods longer than 1,5 m require fire-resistant insulation.

Threaded rod fixing to the ceiling construction - see fig. 83

Fig. 86 Suspension - horizontal duct (soft padding - mineral wool + fire boards)

EIS 90





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. 87 - 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.

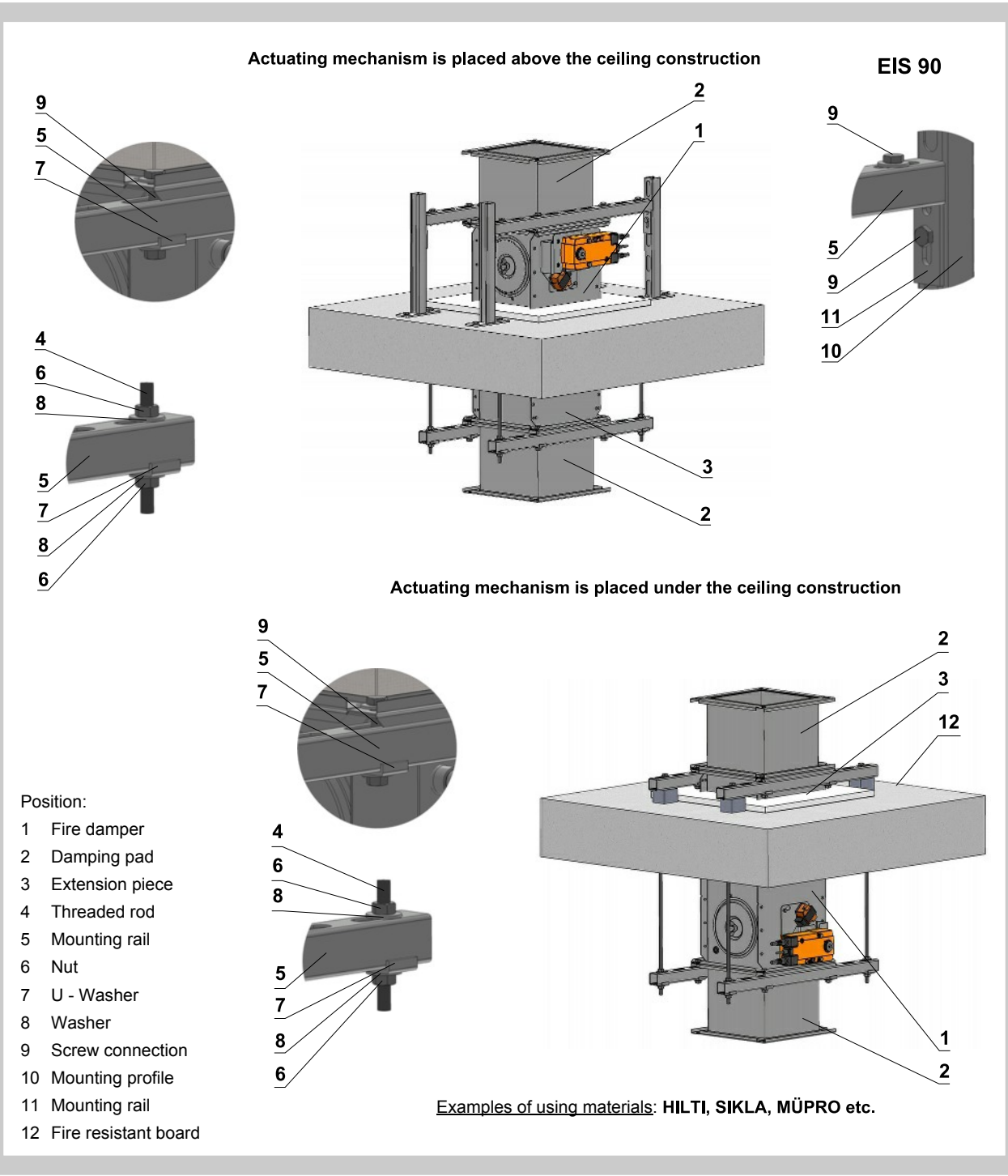
Damper can be suspended from the ceiling construction or supported above the ceiling construction.

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. 83

Fig. 87 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.

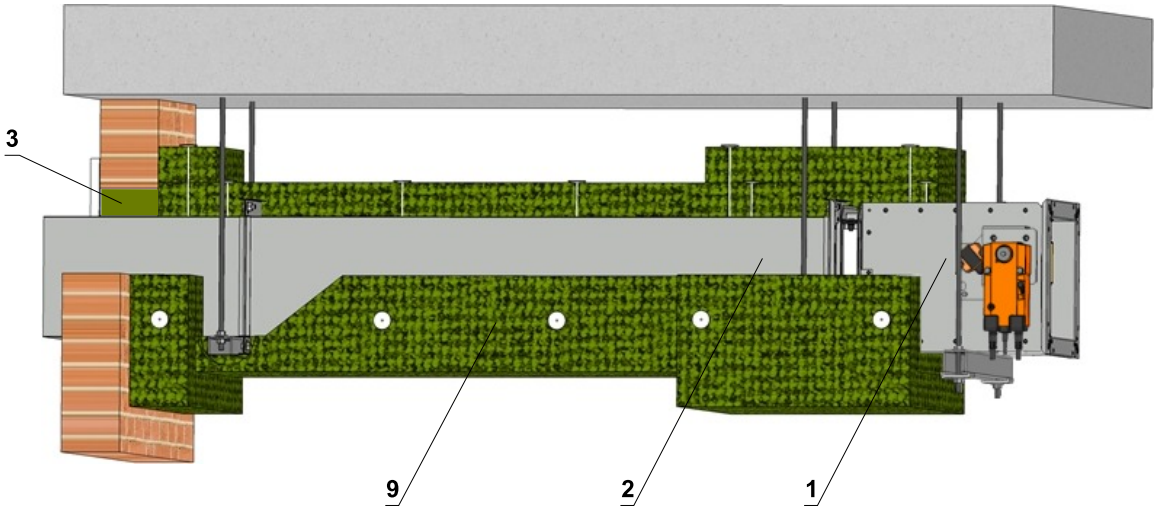
Max. length between two suspension systems is 1500 mm.

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. 83
The insulation boards are fastened to the duct.
For more information see documentation of insulation manufacturer.

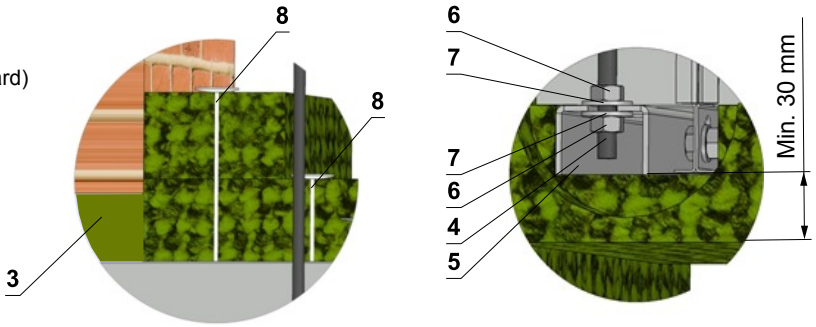
Fig. 88 Suspension remote from the wall - horizontal installation



Position:

1 Fire damper
2 Duct
3 Soft padding (stone wool + fire board)
4 Threaded rod
5 Mounting rail
6 Nut
7 Washer
8 Weld pin
9 Insulation*

Insulation layers on the duct



* Fixing the insulation to duct acc. to fire insulation supplier's instructions.

III. TECHNICAL DATA

10. Pressure loss

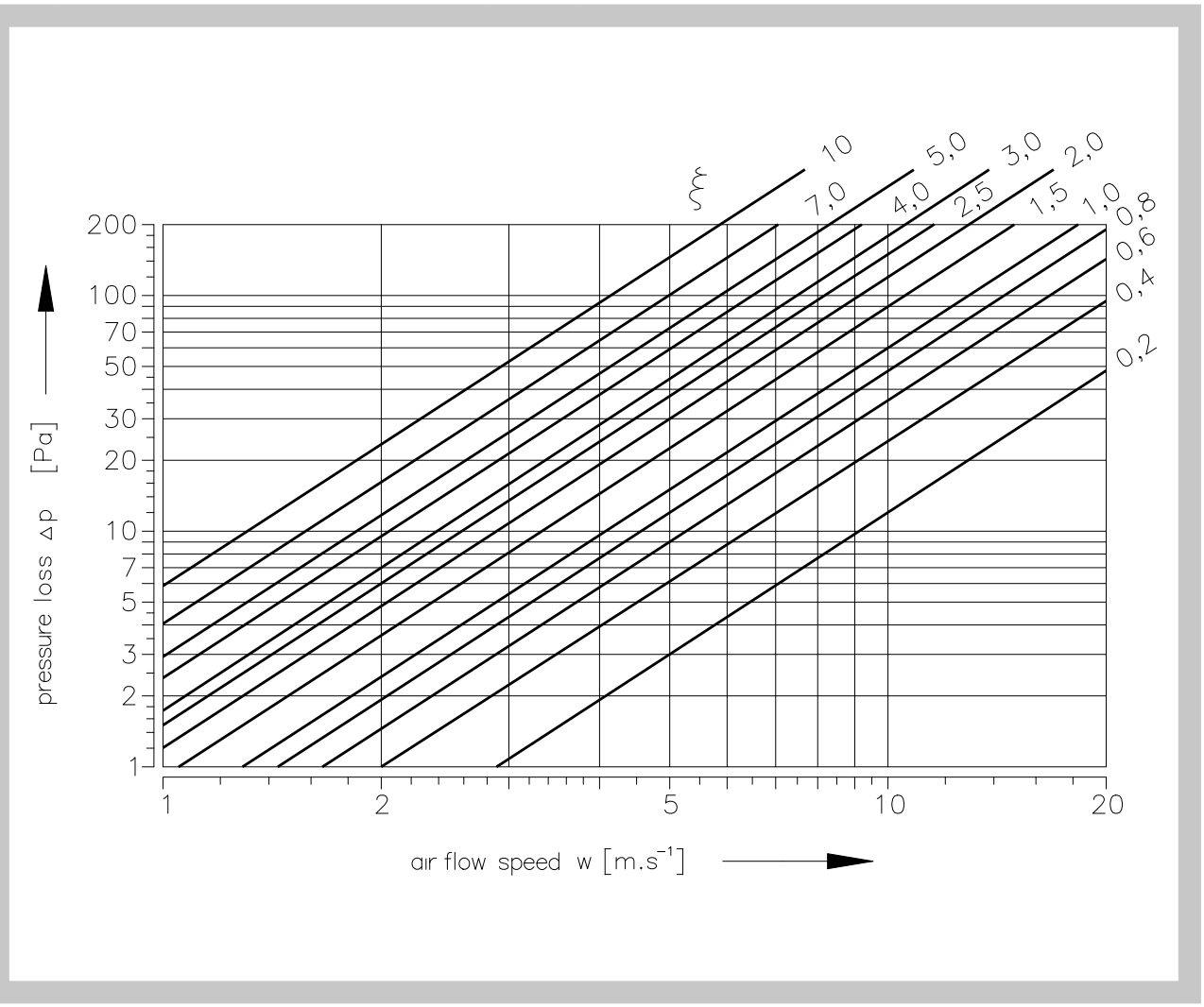
10.1. Pressure loss calculation

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

Δp	[Pa]	presure loss
w	[m.s^{-1}]	air flow speed in nominal damper section
ρ	[kg.m^{-3}]	air density
ξ	[-]	coefficient of local pressure loss for the nominal damper section (see Tab. 11.1.1.)

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

Diagram 10.2.1. Pressure losses for air density ρ=1,2 kg.m^{-3}



11. Coefficient of local pressure loss

11.1. Coefficient of local pressure loss ξ (-)

Tab. 11.1.1. Coefficient of local pressure loss

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

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

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 m² section (see Tab. 12.3.1.)
S	[m²]	duct cross section
K_A	[dB]	correction to the weight filter A (viz 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 m² section (see Tab. 12.3.1.)
S	[m²]	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 LW1[dB] related to the 1 m² section

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

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}**

	f [Hz]							
w [m/s]	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**
2	-4,5	-6,9	-10,9	-16,7	-24,1	-33,2	-43,9	-56,4
3	-3,9	-5,3	-8,4	-13,1	-19,5	-27,6	-37,4	-48,9
4	-3,9	-4,5	-6,9	-10,9	-16,7	-24,1	-33,2	-43,9
5	-4,0	-4,1	-5,9	-9,4	-14,6	-21,5	-30	-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 30 mm.

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

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, testing

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

VI. TRANSPORTATION AND STORAGE

15. Logistic terms

15.1. Dampers are transported by box freight vehicles without direct weather impact, there must not occur any sharp shocks and ambient temperature must not exceed +40°C. Dampers must be protected against mechanic damages when transported and manipulated. During transportation, the damper blade must be in the "CLOSED" position.

15.2. Dampers are stored indoor in environment without any aggressive vapours, gases or dust. Indoor temperature must be in the range from -30°C to +40°C and maximum relative humidity 95 % (avoid condensation on the damper body). Dampers must be protected against mechanic damages when transported and manipulated.

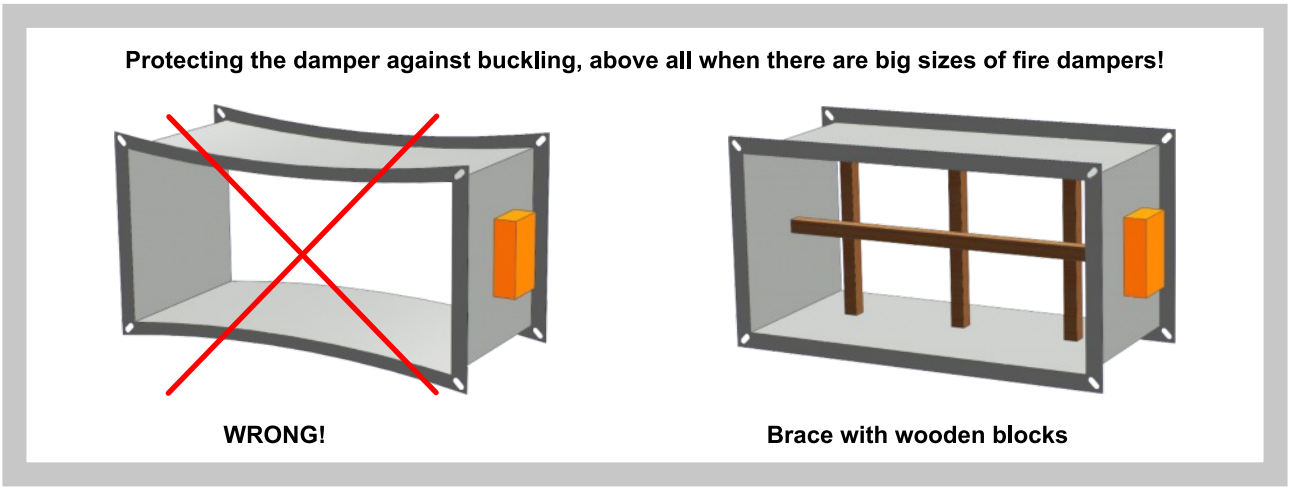
VII. ASSEMBLY, ATTENDANCE, MAINTENANCE AND REVISIONS

16. Assembly

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

16.2. 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. 89 Embedding / fixing the damper



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

17. Entry into service and revisions

17.1. 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 ispection 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.

17.2. 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 M4, depending on the closing spring strongness.

17.3. Before entering the dampers with actuating mechanism into operation after their assembly and by sequential checks and following checks must be carried out.

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).

17.4. Manual operation

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.

17.5. It is recommended to provide periodical checks, maintenance and service actions on Fire Equipment by Authorized persons schooled by Producer.

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

17.7. Dampers could be displaced into position “CLOSED” only in case that ventilator, or Air Handling Unit is switched off. The goal is the securing of proper closing and safe function of Fire Damper in case of Fire.

18. Spare parts

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

19. Restore function of actuating mechanism after fuses initiation

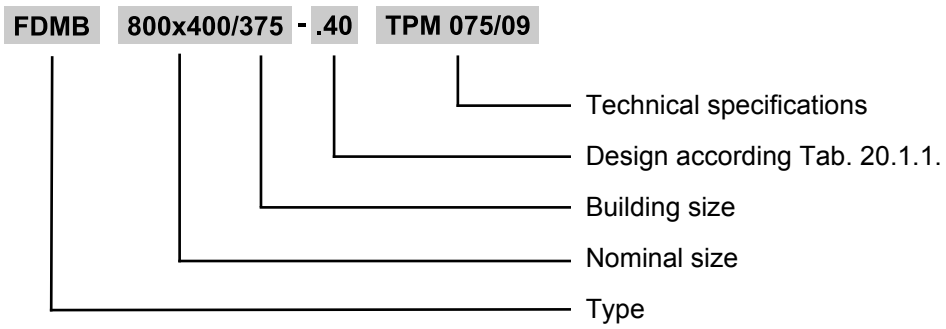
19.1. If fuse Tf1 is initiated (duct outside temperature) than is necessary to change thermoelectrical starting mechanism BAT72B-S. Whereas is initiation temperature higher than actuator mechanism operating temperature +50°C, recommended actuating mechanism manufacturer make complete revision or change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

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

VIII. ORDERING INFORMATION

20. Ordering key

20.1. Fire damper



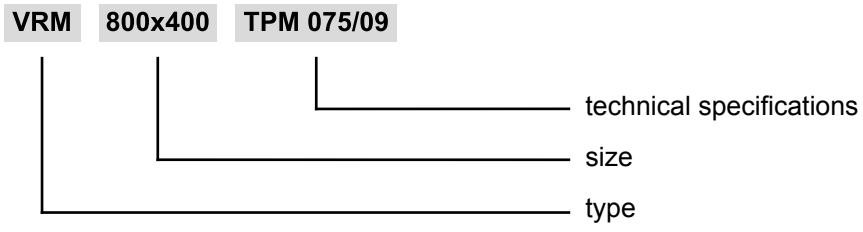
If installation holders, installation frame or design for installation in Weichschott / Ablative Coated Batt system are requested, it has to be mentioned separately in the order. Installation frame could be fixed to the damper body or supplied separately.

Tab. 20.1.1. 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

Some designs are possible to supply with optical smoke detector ORS 142 K. For more information contact manufacturer.

20.2. Reinforcement - damper placement outside wall or ceiling construction

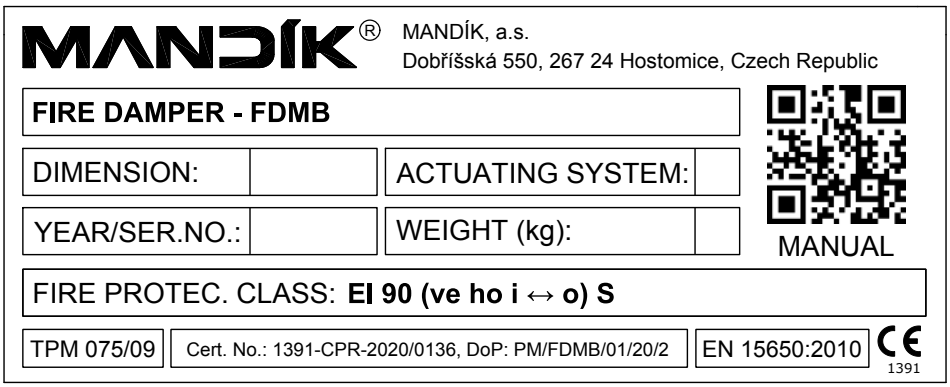


IX. PRODUCT DATA

21. Data label

21.1. Data label is placed on the damper body.

Fig. 90 Data label



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