

EN 15650:2010-09

# MANDÍK<sup>®</sup>

## FIRE DAMPER FDMA



These technical specifications state a row of manufactured sizes and models of fire dampers (further only dampers) FDMA. 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. The shutting spring is started by releasing an initiation lever. The impulse for releasing the lever can be either a manual one, a thermal one or an electromagnetic one. 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.

rectangular dampers have two inspection holes.

Round dampers have one inspection hole, since the shutting device and the inspection hole can be set into the most advantageous position (with respect to the operation and manipulation with the control device).

**Fig. 1** Rectangular FDMA - design with actuating mechanism



**Fig. 2** Round FDMA - design with actuating mechanism



**1.2.** Damper characteristics

- CE certified acc. to EN 15650
- Tested in accordance with EN 1366-2
- Classified acc. to EN 13501-3+A1
- Fire resistance EIS 120, EIS 90
- External Casing leakage class C, Internal leakage class 2 acc. to EN 1751
- Cycling test in class C 10000 acc. to EN 15650
- Corrosion resistant acc. to EN 15650
- ES Certificate of conformity No. 1391-CPR-2016/0158
- Declaration of Performance No. PM/PKTM\_90/01/16/1
- Hygienic assessment of fire dampers - Report No. 1.6/13/16/1

### 1.3. Working conditions

Right damper function is secured under the following conditions:

- a) Maximum air circulation speed: 12 m.s<sup>-1</sup>  
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.

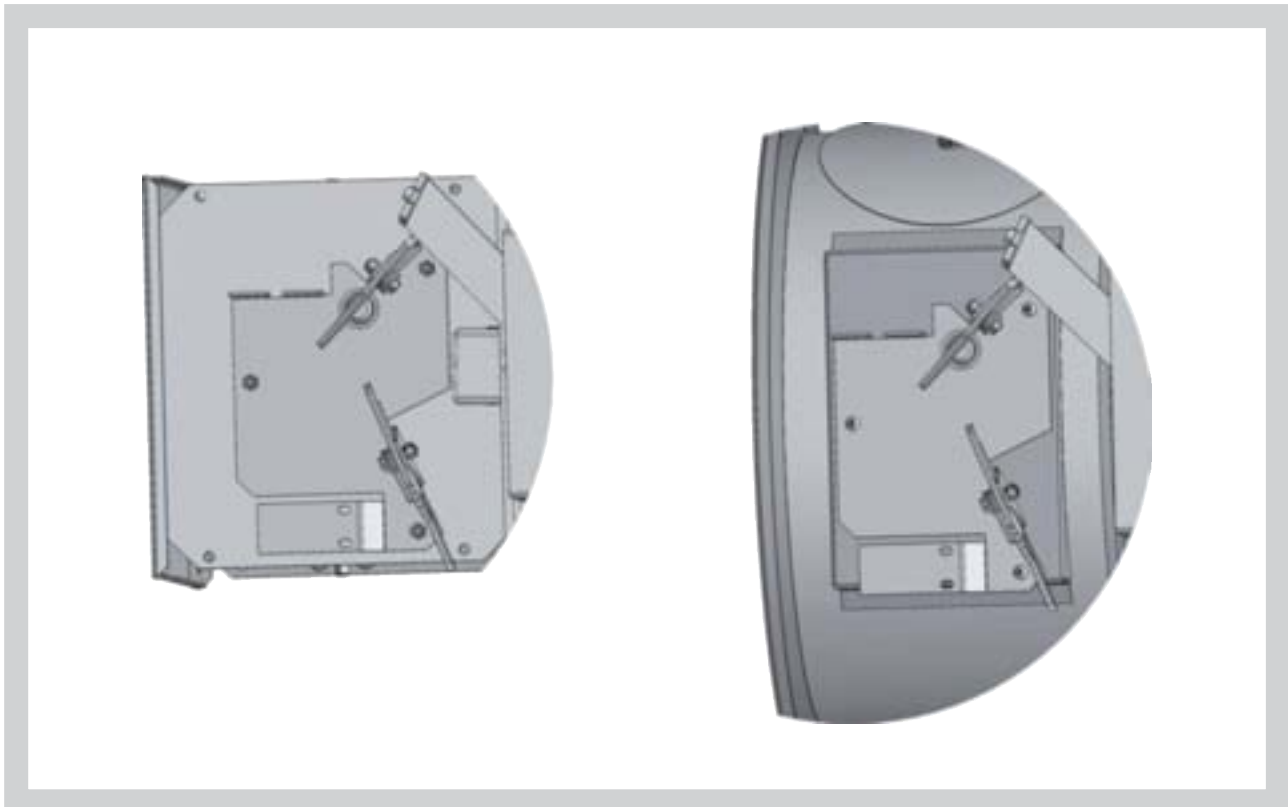
## 2. Design

### 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).

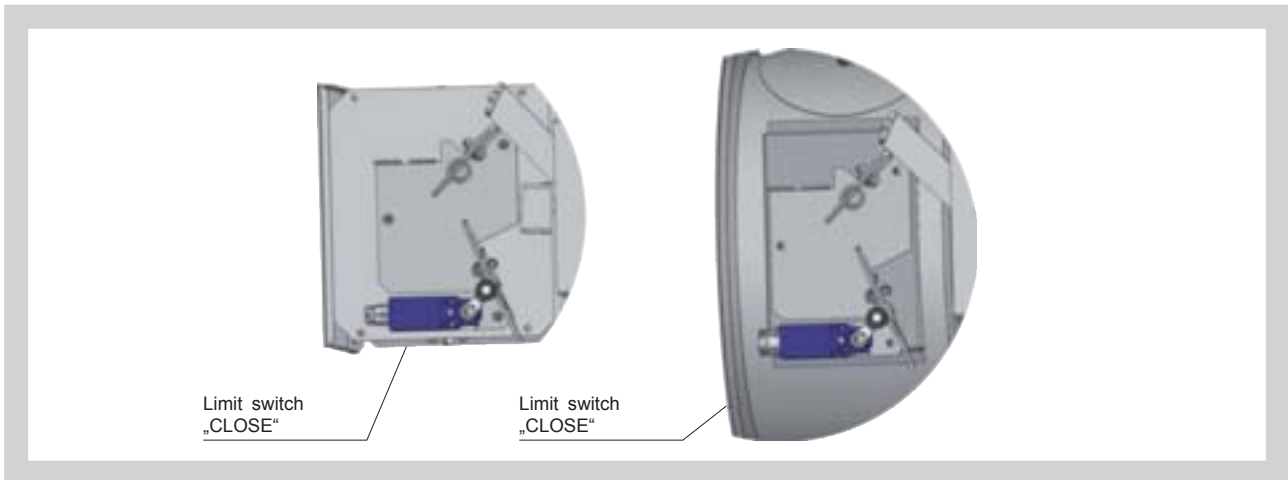
Fig. 3 Design with mechanical control



**Design .11**

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

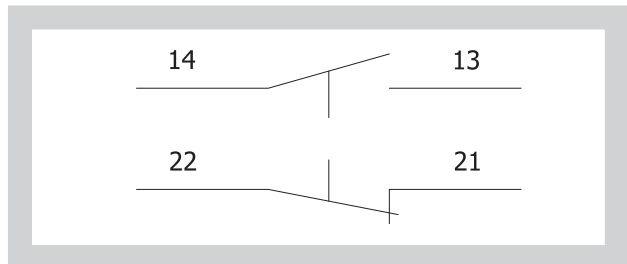
**Fig.4 Design with mechanical control and limit switch**



**Tab. 2.1.1. Limit switch XCKN2118G-11**

| Koncový spínač XCKN2118G-11 |                                  |
|-----------------------------|----------------------------------|
| Jmenovité napětí, proud     | AC 240 V; 3 A<br>DC 250 V; 0,1 A |
| Krytí                       | IP 65                            |
| Teplota okolí provozní      | -15 °C ... +70 °C                |

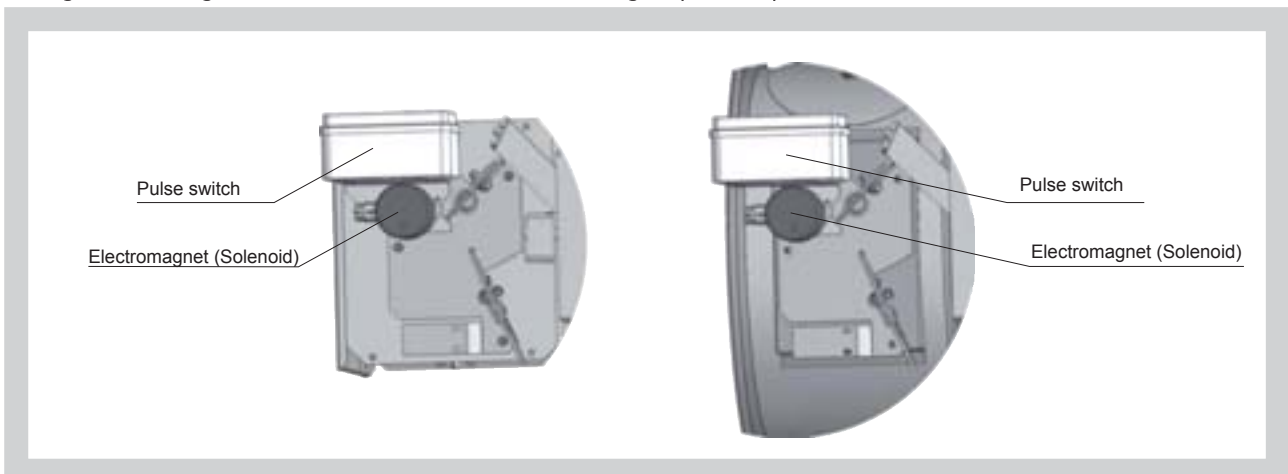
**Fig. 5 Limit switch XCKN2118G-11**



**Design .20 and .21**

Design .01 with mechanical control can be complemented with initiation by means of an electromagnet (solenoid). The voltage of the electromagnet (solenoid) can be AC 230V, AC/DC 24V. By voltage AC 230 V is damper equipped by electromagnet EM230. By voltage AC/DC 24 V is damper equipped by electromagnet EM230 with pre-pulse switch SIEM24. SEIM24 activates the electromagnet after capacitor charge witch is placed inside of SIEM24. It takes about 10 sec. Charging time depends on the current supply. For reliable operation is necessary connect to electromagnet or pre-pulse switch appropriate supply for 20 to 30 sec. After activation of electromagnet is released initiation lever and damper is closed. After activation is initiation lever released. If is damper set up in position "OPEN" is necessary unlock initiation lever by pulling of electromagnet core.

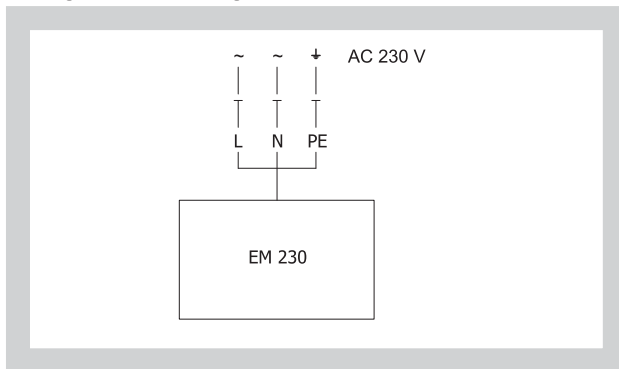
**Fig. 6 Design with mechanical control and electromagnet (solenoid)**



Tab. 2.1.2. Elektromagnet EM230

| Elektromagnet EM230  |                                 |
|----------------------|---------------------------------|
| Nominal voltage      | AC 230 V / 50 Hz                |
| Attraction current   | 1,2 A                           |
| Degree of protection | IP 40                           |
| Ambient temperature  | -10 °C ... +40 °C               |
| Connection           | cable 1m, 3x0,75mm <sup>2</sup> |

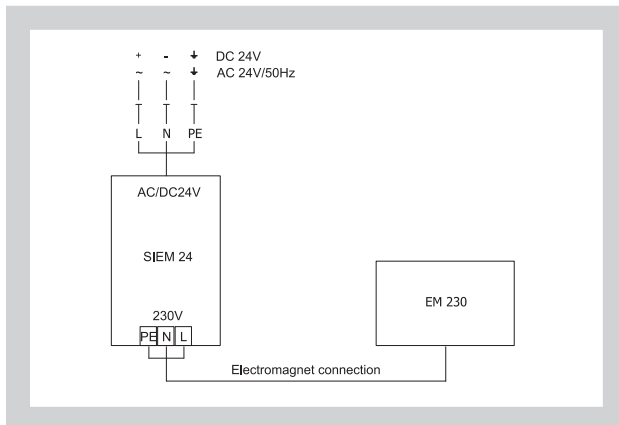
Fig. 7 Elektromagnet EM230



Tab. 2.1.3. Elektromagnet EM230 with pulse switch SIEM24

| Elektromagnet EM230 with pulse switch SIEM24 |                                 |
|--|---------------------------------|
| Nominal voltage                              | AC 24 V / 50 Hz<br>DC 24 V      |
| Attraction current                           | 1 A                             |
| Degree of protection                         | IP 40                           |
| Ambient temperature                          | -10 °C ... +40 °C               |
| Switching frequency                          | max. 1x per minute              |
| Connection                                   | cable 1m, 3x0,75mm <sup>2</sup> |

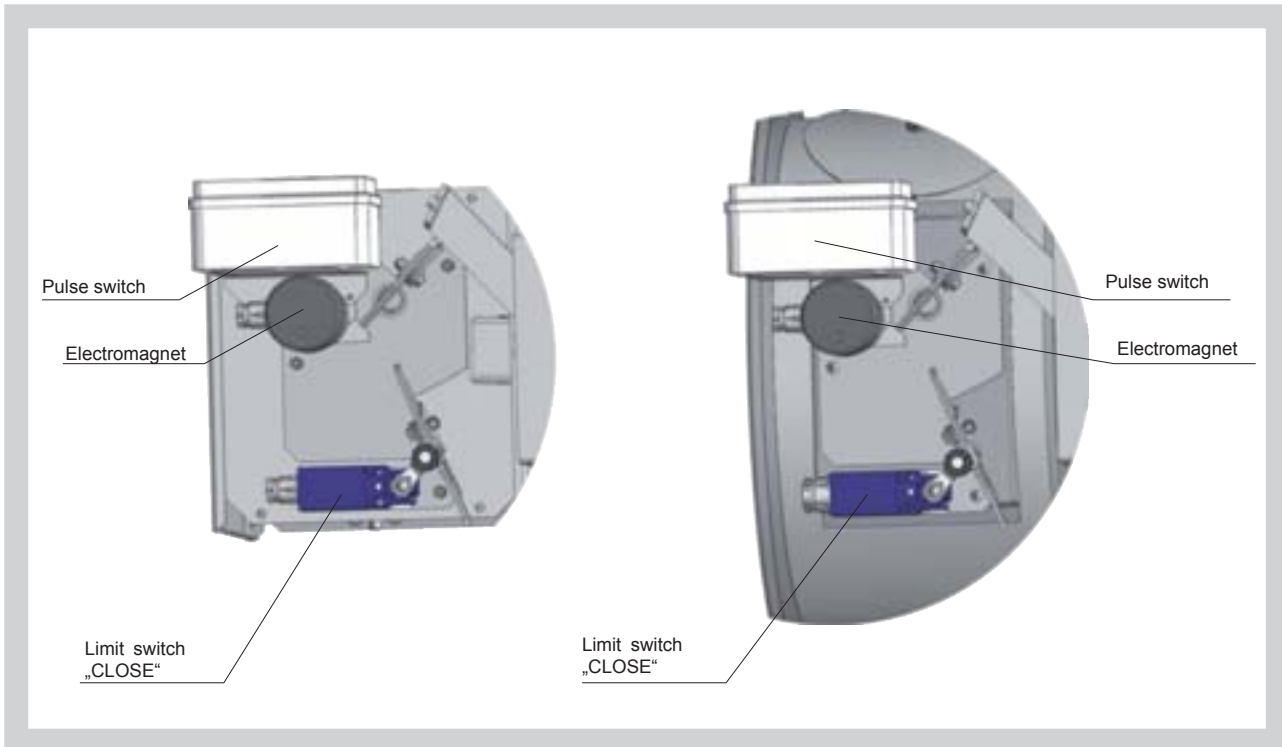
Fig. 8 Elektromagnet EM230 with pulse switch SIEM24



**Design .23 and .24**

Design .20 or .21 with mechanical control and electromagnet can be complemented with limit switch signalling of the damper blade position "CLOSE".

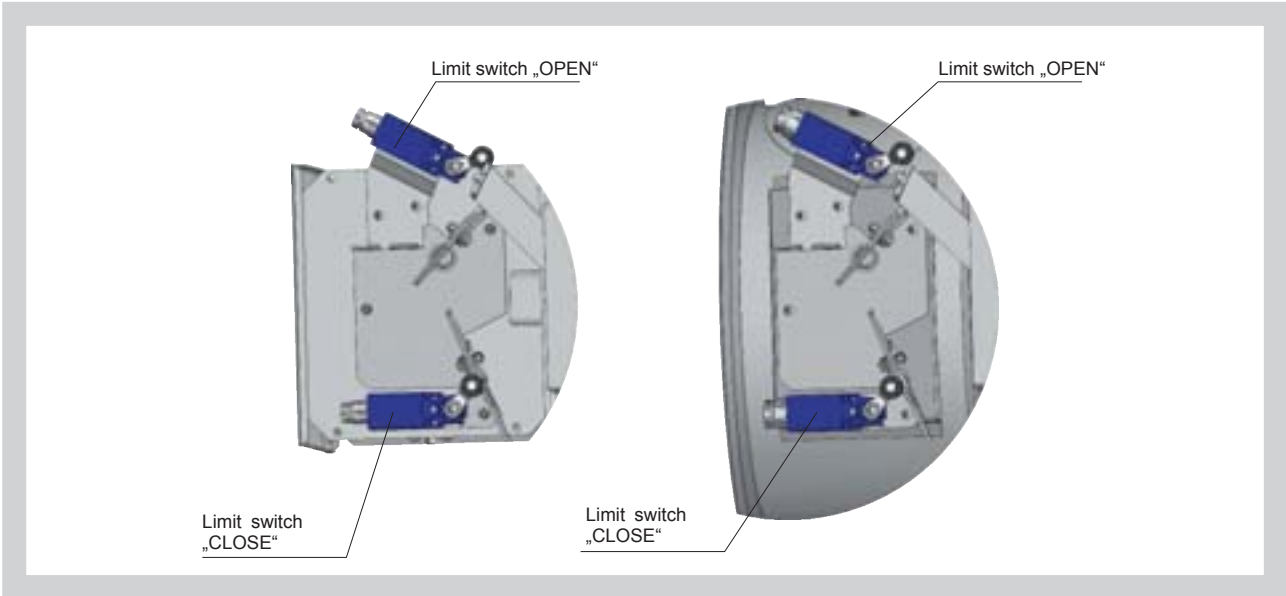
Fig. 9 Design with mechanical control, electromagnet (solenoid) and limit switch



**Design .80**

Design .11 can be complemented with a terminal switch signalling of the damper blade position "OPEN".

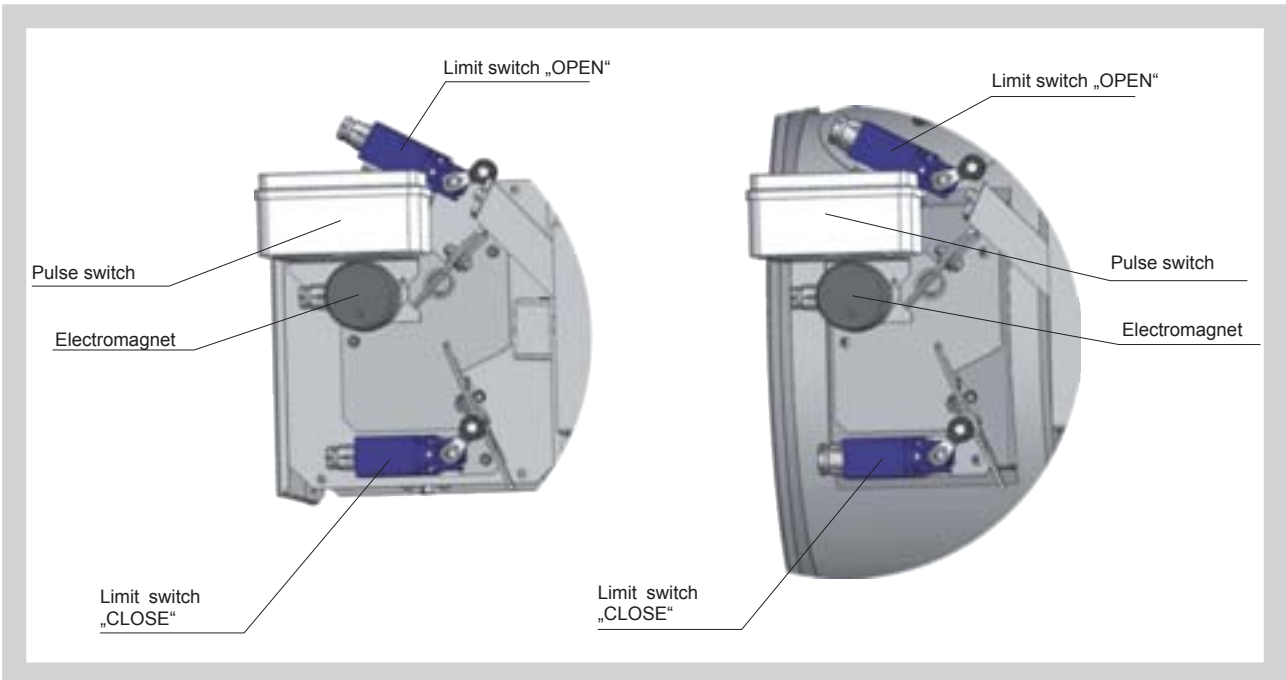
**Fig. 10 Design with mechanical control and limit switches**



**Design .82 and .83**

Design .23, or .24 can be complemented with a terminal switch signalling of the damper blade position "OPEN".

**Fig. 11 Design with mechanical control, electromagnet (solenoid) and limit switches**



**Product designed into the Zone 2 (designs .30, .33, .85)**

Product is designed to the Zone 2 with mechanical actuating mechanism and fusible link, electromagnetic initiator (AC 230V) and auxiliary with end-switches (signalling the position of the blade "Open" or/and "Close"). Such designs are the same as the designs .23, .24 and .83 and they are adapted to fulfill the requirements of the usage in the Non- explosive environment.

2.2. Design with electric actuating mechanism

**Design .40, .50**

FDMA is always equipped by electric actuating mechanism BFL, BFN, BF 230-TN or BFL, BFN, BF 230-TN (further only "actuating mechanism"). 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 140 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. 12 Design .40, .50

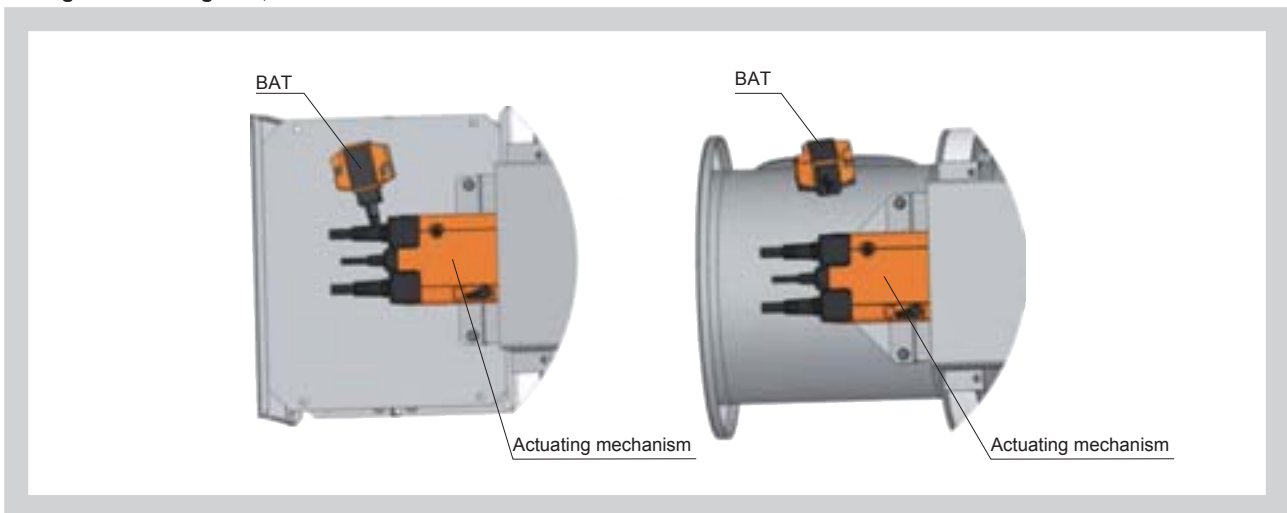


Fig. 13 Actuating mechanism BELIMO BFL (BFN) 230-T

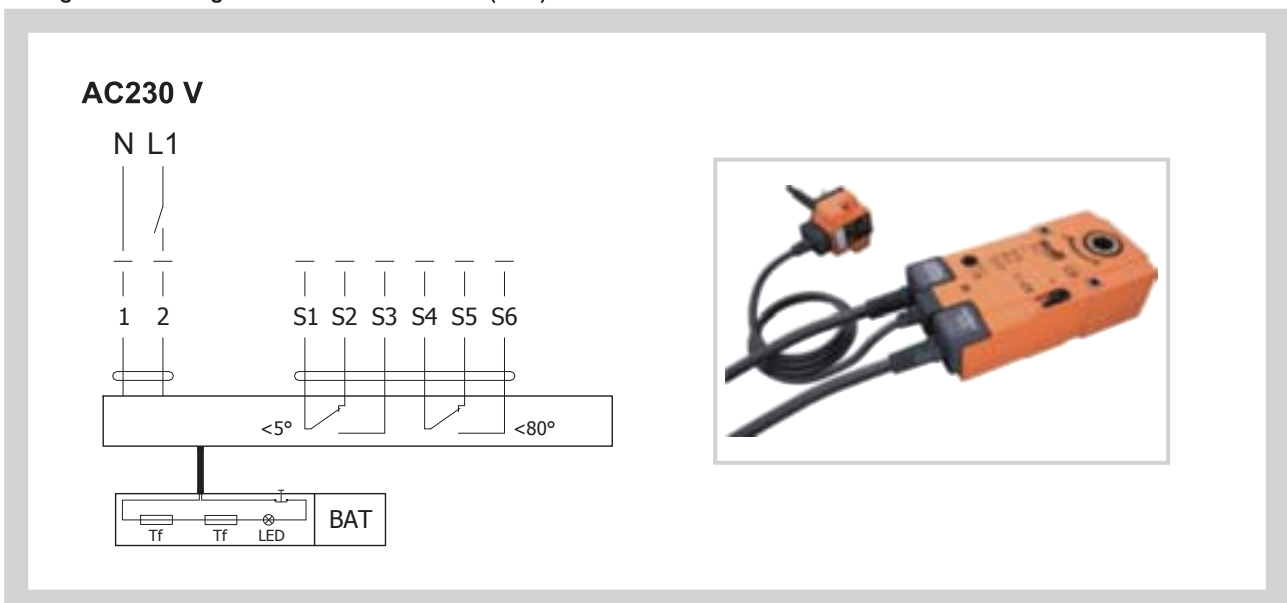
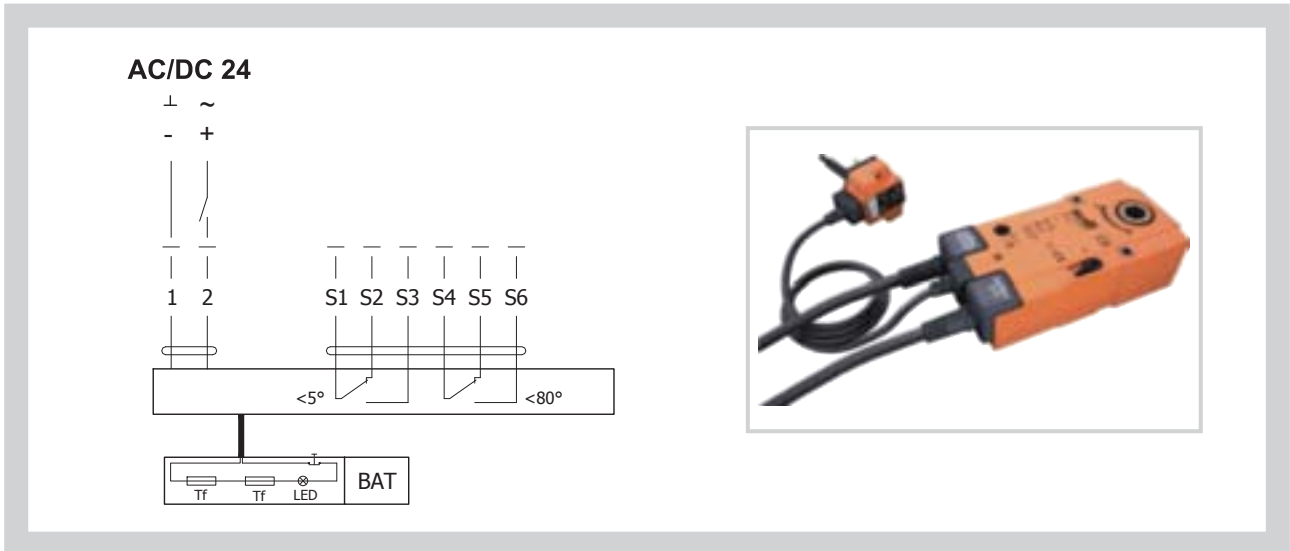




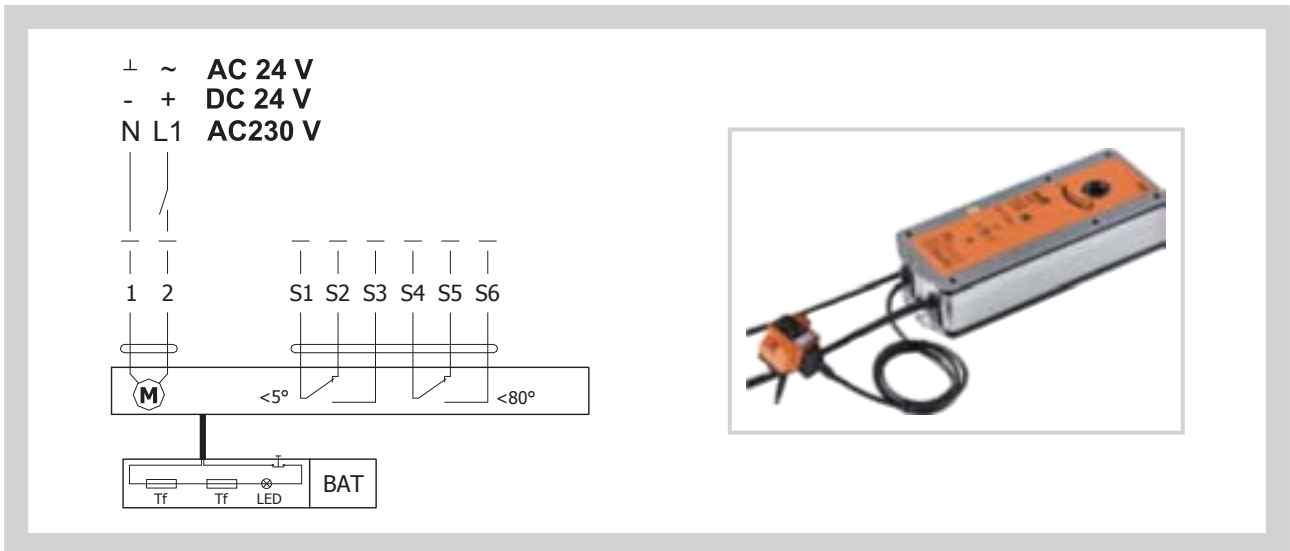
Fig. 14 Actuating mechanism BELIMO BFL, BFN 24-T(-ST)



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<br>DC 24 V            |
| Power consumption - motoring<br>- holding  | 3,5/5 W<br>1,1/2,1 W   | 2,5/4 W<br>0,8/1,4 W                   |
| Dimensioning   | 6,5/10 VA (I <sub>max</sub> 4 A @ 5 ms)  | 4/6 VA (I <sub>max</sub> 8,3 A @ 5 ms) |
| Protection class   | II   | III                                    |
| Degree of protection   | IP 54  |  |
| Running time - motor<br>- spring return  | <60 s<br>~ 20 s  |  |
| Ambient temperature<br>- normal duty<br>- safety duty<br>- non-operating temperature | - 30°C ... +55°C<br>The safe position will be attained up to max. +75°C<br>- 40°C ... +55°C  |  |
| Connecting - motor<br>- auxiliary switch   | cable 1 m, 2 x 0,75 mm <sup>2</sup> (BFL/BFN 24-T(-ST)) with 3-pin plug-in connectors<br>cable 1 m, 6 x 0,75 mm <sup>2</sup> (BFL/BFN 24-T(-ST)) with 6-pin plug-in connectors |  |
| Thermal trips  | duct outside temperature +72°C<br>duct inside temperature +72°C  |  |

Fig. 15 Actuating mechanism BELIMO BF 230-TN, BF 24-TN (-ST)



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

| <b>Actuating mechanism BELIMO</b>  | <b>BF 24-TN(-ST)</b>   | <b>BF 230-TN</b>             |
|--|--|------------------------------|
| Nominal voltage  | AC 24 V 50/60 Hz<br>DC 24 V  | AC 230 V 50/60 Hz            |
| Power consumption - motoring<br>- holding  | 7 W<br>2 W   | 8 W<br>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<br>- spring return  | 140 sec<br>~ 16 sec  |                              |
| Ambient Temperature<br>- normal duty<br>- safety duty<br>- non-operating temperature | -30°C ... +50°C<br>The safe position will be attained up to max. 75°C<br>-40°C ... +50°C                           |                              |
| Connecting - motor<br>- auxiliary switch   | cable 1 m, 2 x 0,75 mm <sup>2</sup><br>cable 1 m, 6 x 0,75 mm <sup>2</sup><br>(BF 24-T-ST) with plug-in connectors |                              |
| Thermal trips  | Tf1: duct outside temperature Duct +72°C<br>Tf2/Tf3: duct inside temperature Duct +72°C                            |                              |

**Design .41, .51**

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

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

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

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

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

Fig. 16 Smoke detector ORS 142 K and socket 143A

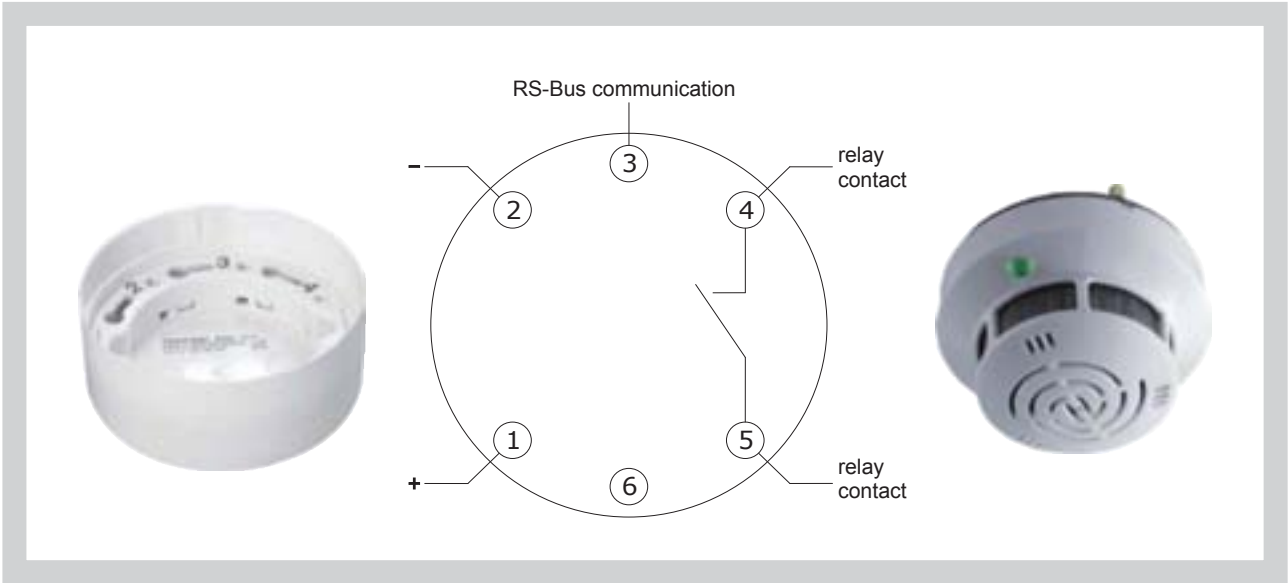


Fig. 17 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T) , with smoke detector ORS 142 K and with communication and supply device BKN 230-24-MOD (voltage AC 230 V)

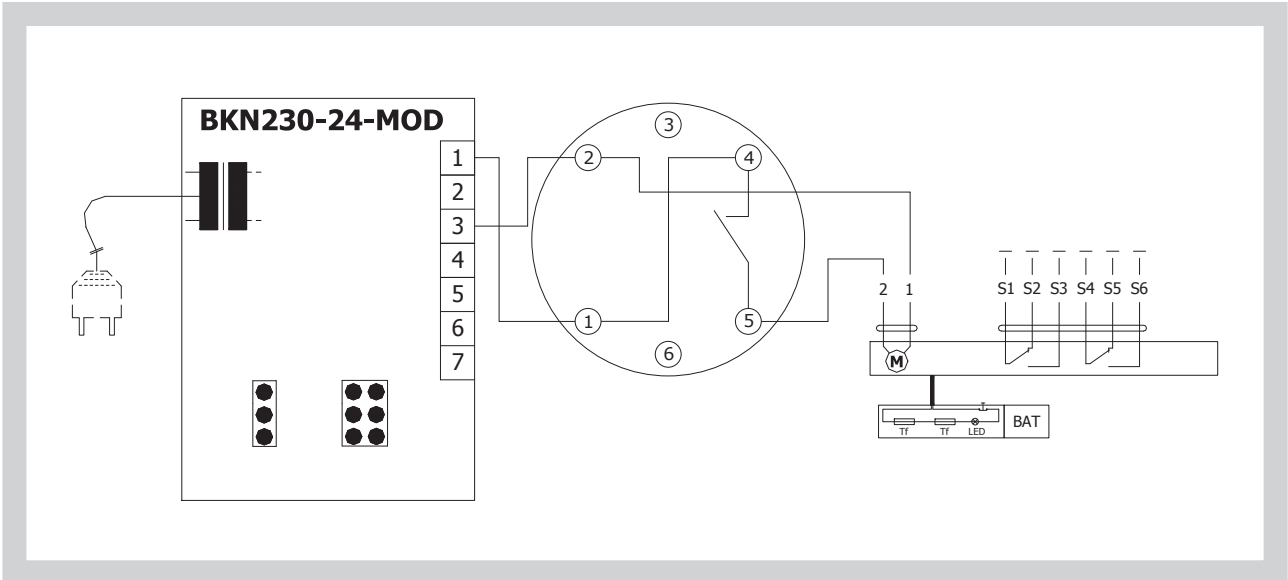
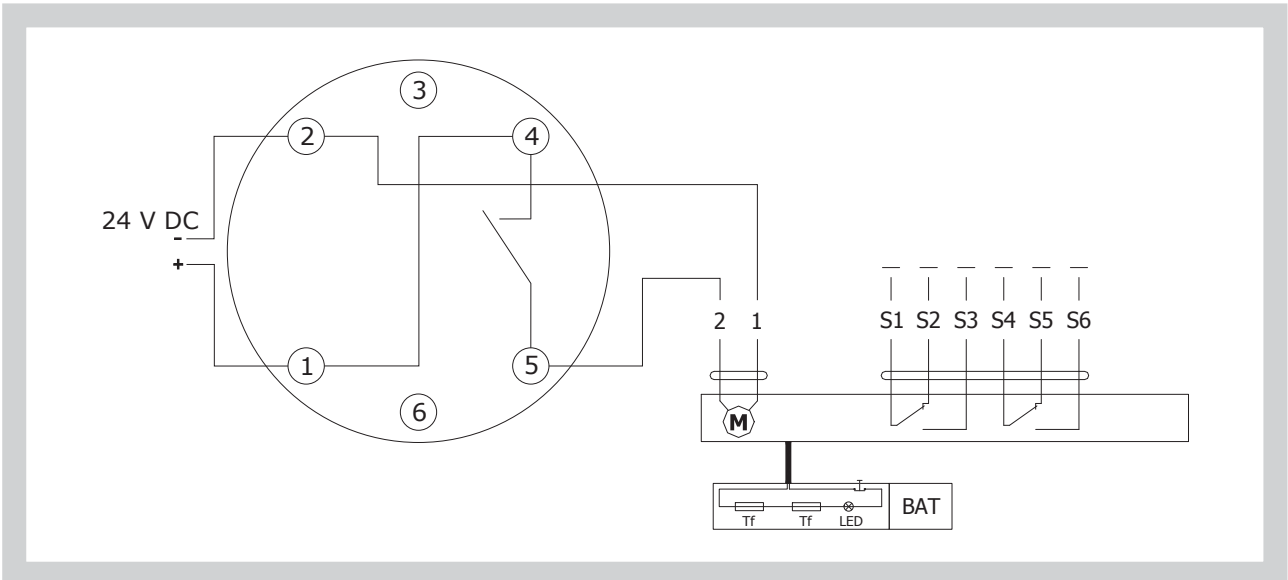


Fig. 18 Design with actuating mechanism BF 24-TN (BFL, BFN 24-T) , with smoke detector ORS 142 K (voltage 24 V DC)



2.3. Design with the communication and supply device

**Design .60**

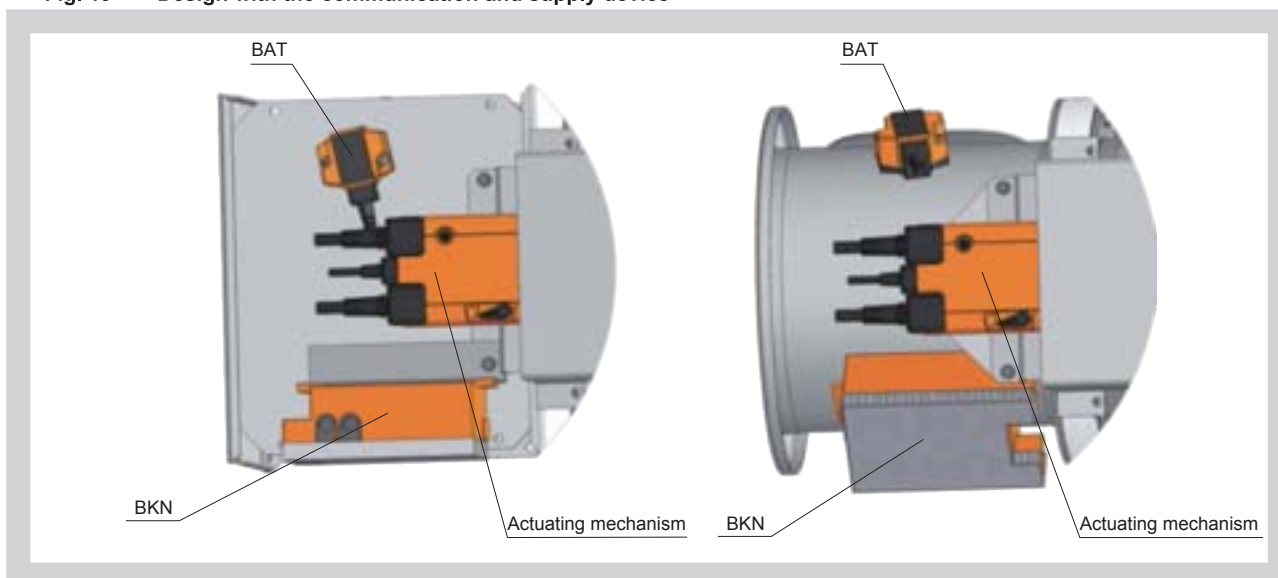
Design with the communication and supply device BKN 230-24 and the actuating mechanism BF 24-TN-ST (BFL 24-T, BFN 24-T). It simplifies electrical wiring and interconnection of fire flap valves. It facilitates on site check and enables central control and checks of fire damper by means of a simple 2-conductor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

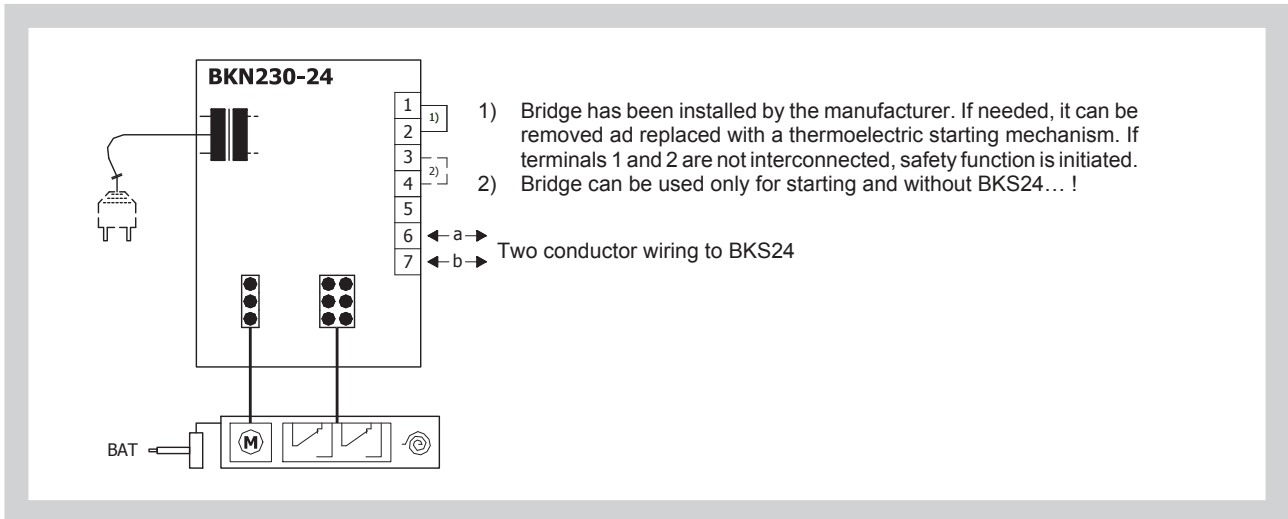
Fig. 19 Design with the communication and supply device



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<br>Non-operating temperature | -20°C ... +50°C<br>-40°C ... +80°C  |
| Connection - net<br>- motor<br>- terminal board  | cable 0,9 m with EURO plug type 26<br>6-pole connector, 3-pole connector<br>screw terminals for cable 2x1,5 mm <sup>2</sup> |

Fig. 20 Communication and supply device BKN 230-24, with act. mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST)



**Design .61**

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

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

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

Fig. 21 Communication and supply device BKN 230-24-C-MP

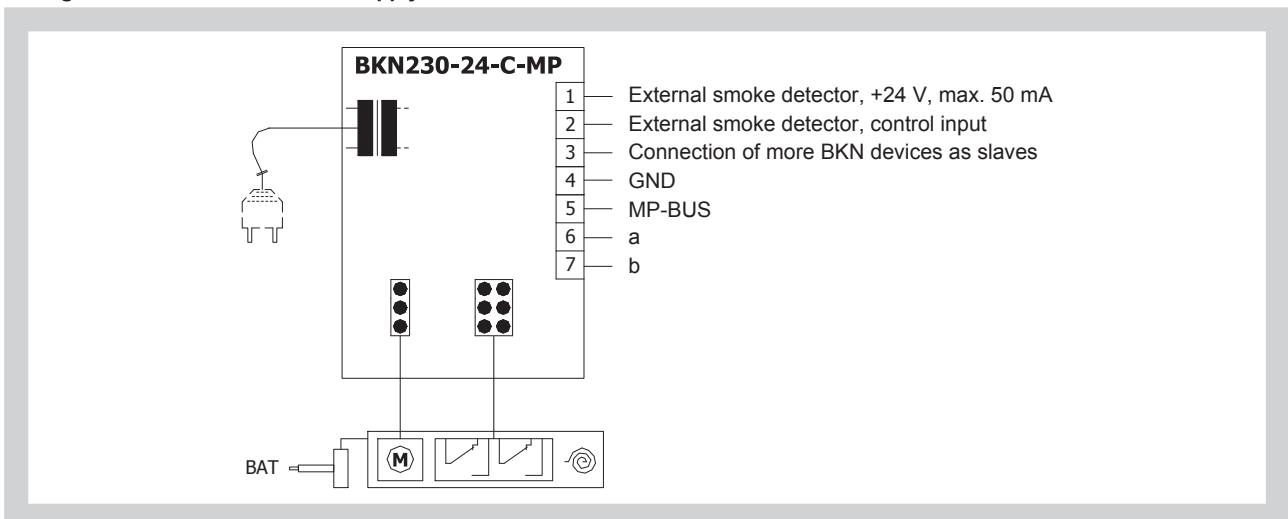
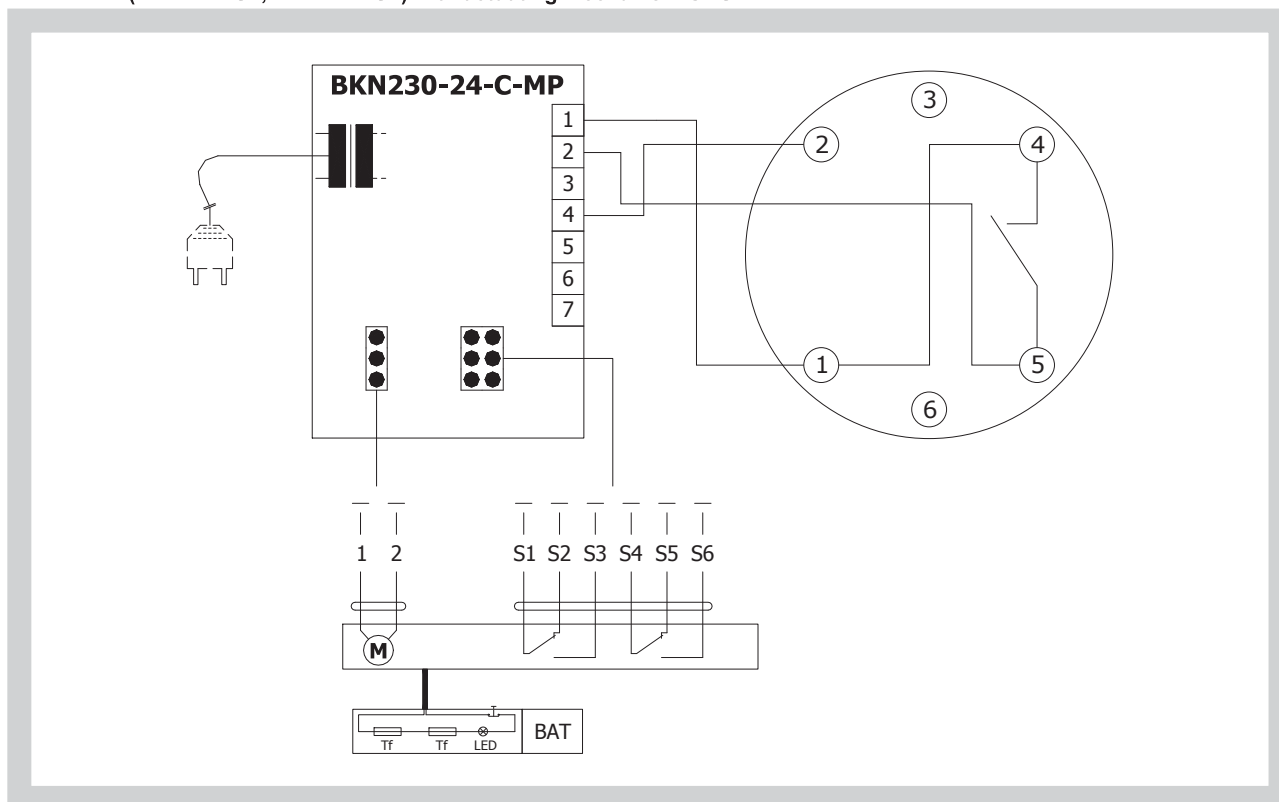


Fig. 22 Design with communication and supply device BKN 230-24-C-MP, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) with actuating mechanism ORS 142 K



**Design .63**

Design .60 with communication and supply device can be complemented with smoke detector ORS 142 K. For supply and communication is used BKN 230-24-MOD, which is used together with the BF 24TN-ST (BFL 24T-ST, BFN 24T-ST) for communication with control systems using the Modbus RTU or BACnet MS / TP protocol. The wiring of the line is to be carried out in accordance with applicable RS485 regulations. Parameterization of the communication is done using DIL switches. The BKN 230-24-MOD can be installed separately, without a connection to a master control system, in which case the connection bridge between the terminals 1 and 4 must be installed. For more information, see the Belimo catalog.

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

| Communication and supply device                  | BKN 230-24-MOD  |
|--|---|
| Nominal voltage                                  | AC 230 V 50/60Hz  |
| Power consumption                                | 3 W (operating position)  |
| Dimensioning                                     | 14 VA (including actuating mechanism with spring return)  |
| Protection Class                                 | II  |
| Degree of protection                             | IP 40   |
| Ambient temperature<br>Non-operating temperature | -20°C ... +50°C<br>-40°C ... +80°C  |
| Connection - net<br>- motor<br>- terminal board  | cable 0,9 m with EURO plug type 26<br>6-pole connector, 3-pole connector<br>screw terminals for cable 2x1,5 mm² |

Fig. 23 Communication and supply device BKN 230-24-MOD, with act. mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST)

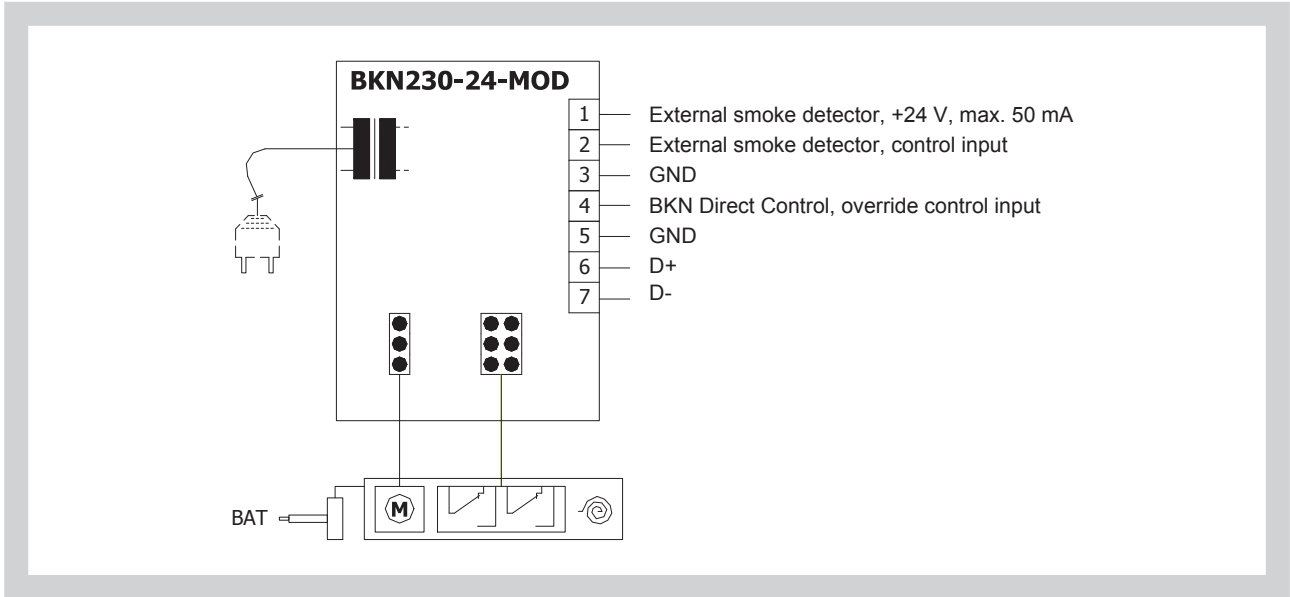
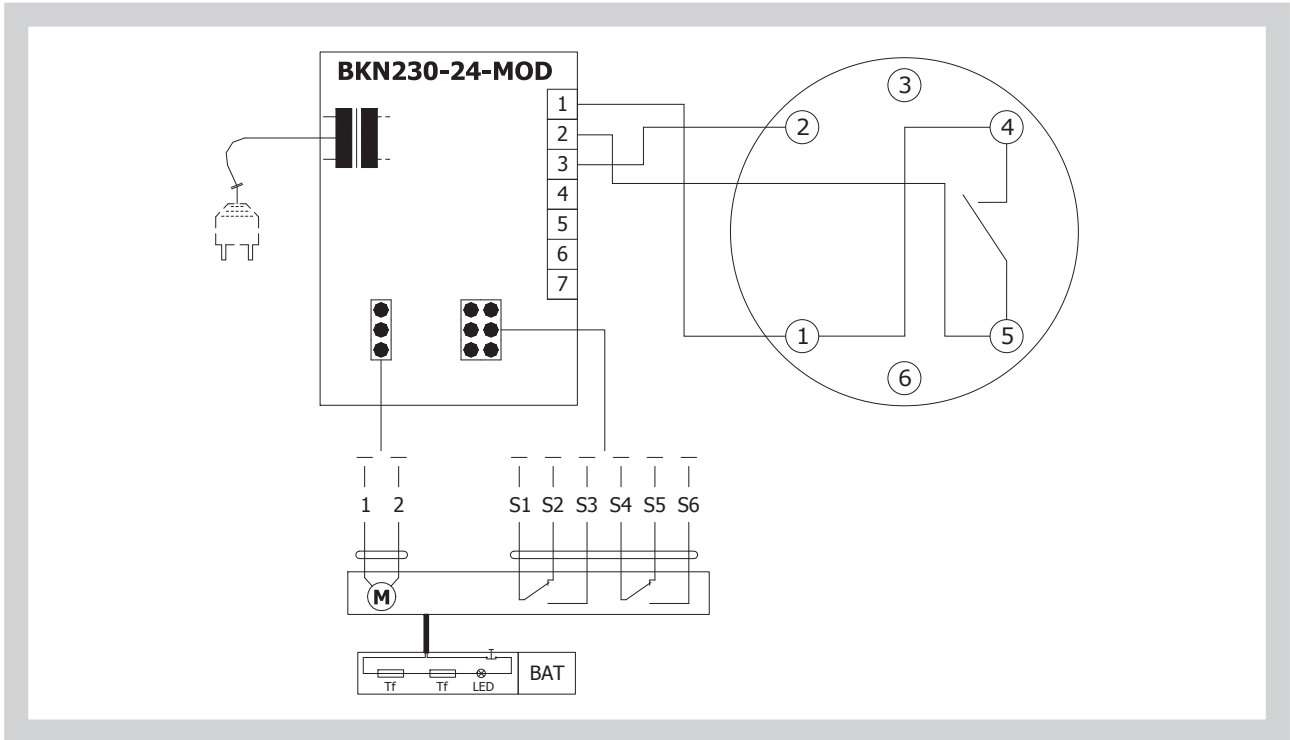


Fig. 24 Design with communication and supply device BKN 230-24-MOD, with actuating mechanism BF 24-TN-ST (BFL 24-T-ST, BFN 24-T-ST) and smoke detector ORS 142 K



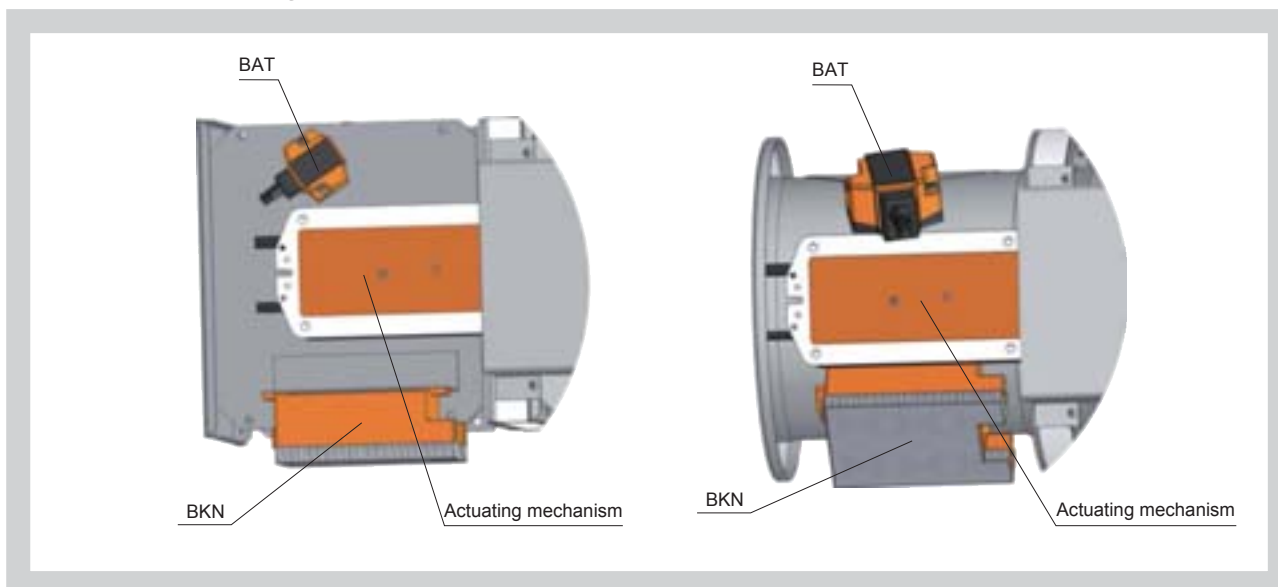
**Design .62**

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



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

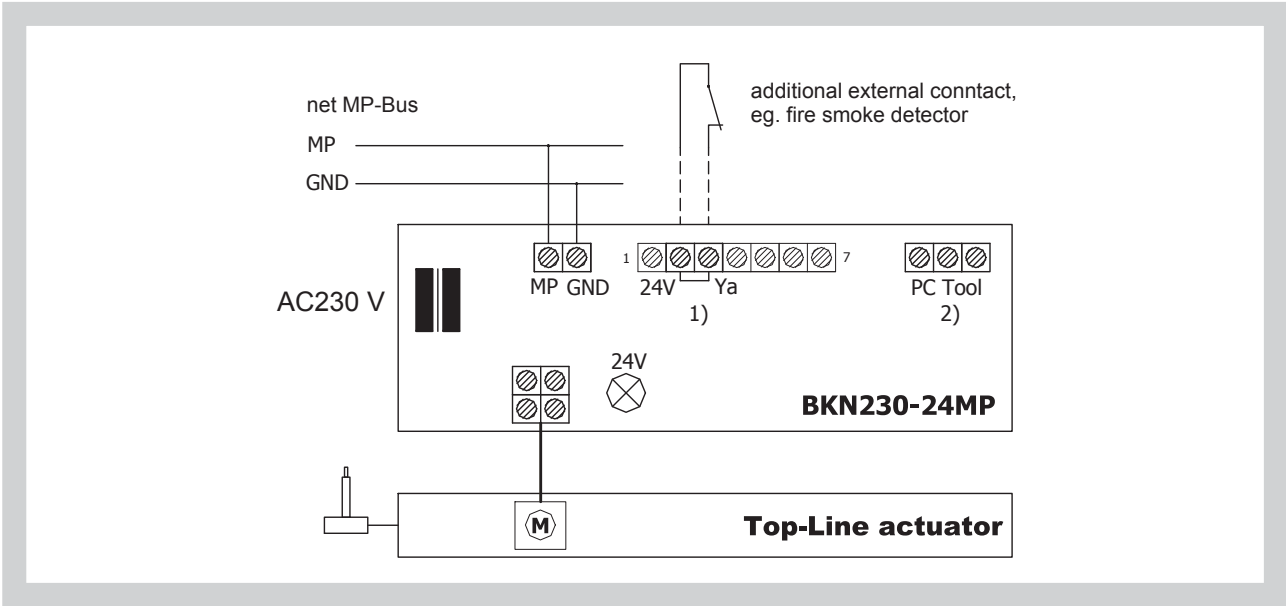
| Actuating mechanism BELIMO                       | BF 24TL-TN-ST  |
|--|--|
| Nominal voltage                                  | AC 24 V 50/60Hz<br>DC 24 V   |
| Power consumption - motoring<br>- holding        | 7 W<br>2 W   |
| Dimensioning                                     | 10 VA (Imax 8,3 A @ 5 ms)  |
| Protection class                                 | III  |
| Degree of protection                             | IP 54  |
| Running time - motor<br>- spring return          | 140 sec<br>~ 16 sec  |
| Ambient temperature<br>Non-operating temperature | -30°C ... +50°C<br>-40°C ... +50°C   |
| Connection                                       | Connector for BKN 230-24LON and BKN 230-24MP<br>cable 1 m, 4 x 0,75 mm <sup>2</sup> halogen-free |

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

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



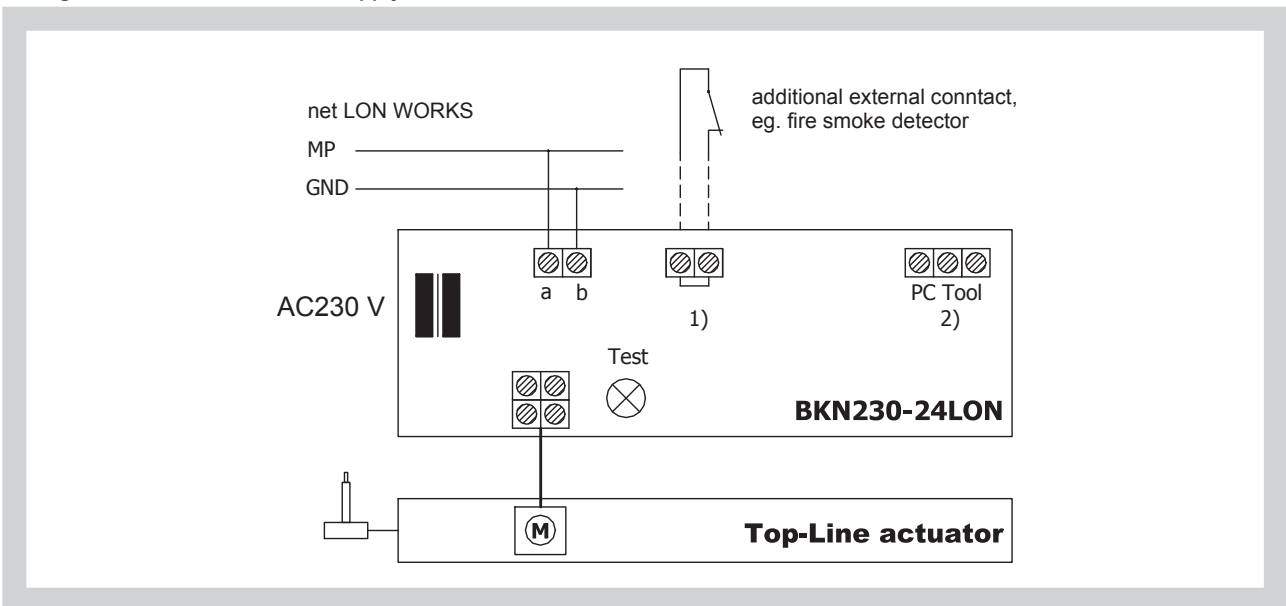
Fig. 26 Communication and supply device BKN 230-24MP



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

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

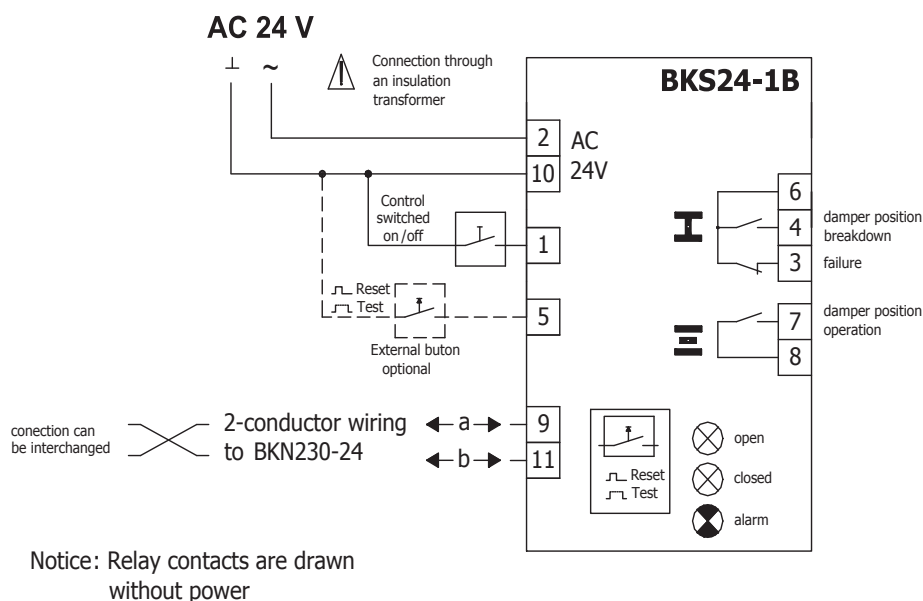
Fig. 27 Communication and supply device BKN 230-24LON



### 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-T-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 (signalling 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. 28 Communication and control device BKS 24-1B



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

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






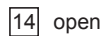
| Communication and control device | BKS 24-1B   |
|----------------------------------|---|
| Nominal voltage                  | AC 24 V 50/60Hz   |
| Power consumption                | 2,5 W (operating position)  |
| Dimensioning                     | 5 VA  |
| Protection Class                 | III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

**3.2.** BKS 24-9A communication and control device is used for group control and checks of 1 to 9 fire dampers with the actuating mechanism BF 24-T-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

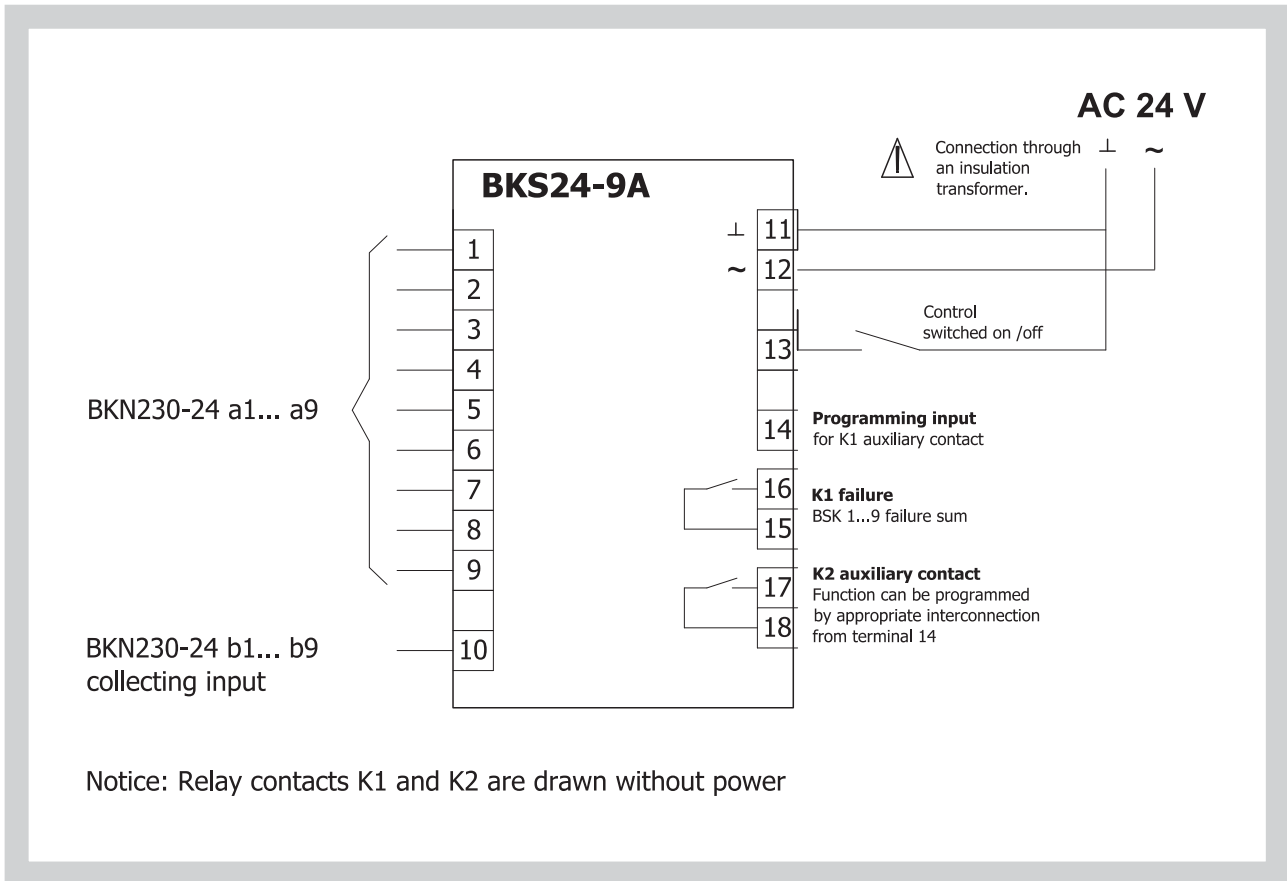
If the fire damper do not reach the given position in time tolerable for displacing, the appropriate light diode FAILURE starts to flash and K1 contact is opened (current failure). In case that the faulty damper finally reaches its given position, K1 is closed and the failure report light shines (the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

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

| Function contact K1 |   | Programming K2 Auxiliary Contact             |  |   |
|---------------------|---|--|--|---|
| situation           | state   | function                                     | interconnection  | state   |
| current failure     |  | K2 contact is on if all the flaps are open   |  |  |
|                     |   | K2 contact is on if the flap No. 1 is open   |  |   |
| no failure          |  | K2 contact is on if all the flaps are closed |  |   |

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. 29 Communication and control device BKS 24-9A



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

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

4. Dimensions, weights

4.1. Rectangular dampers

Fig. 30 FDMA - design manual and thermal

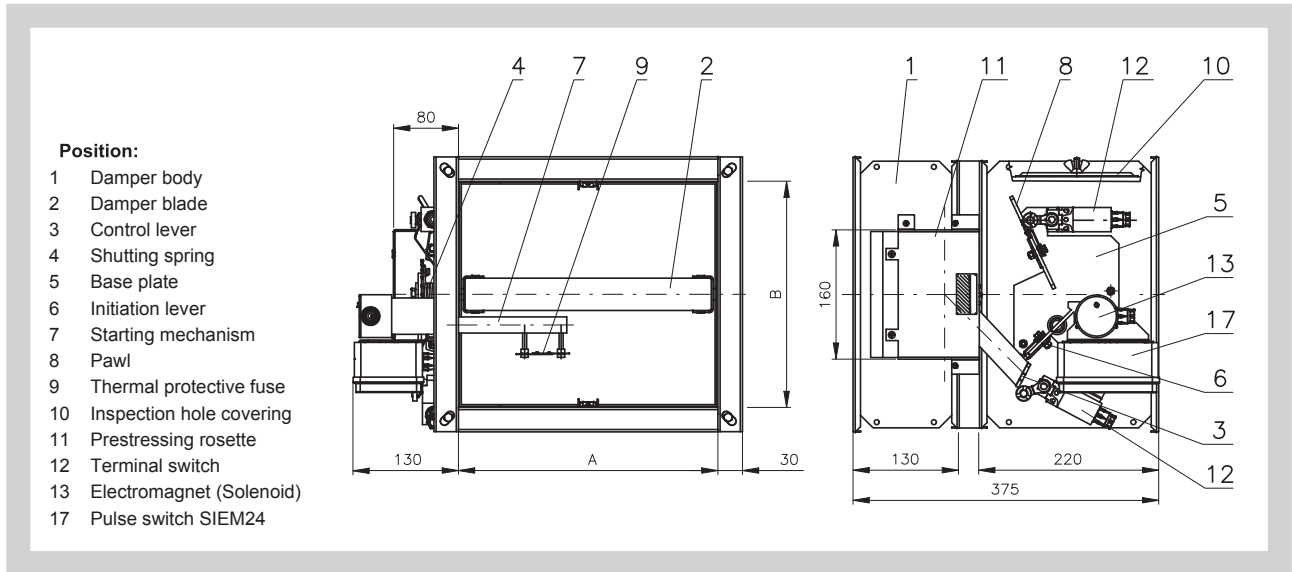


Fig. 31 FDMA - C - with covered control mechanism

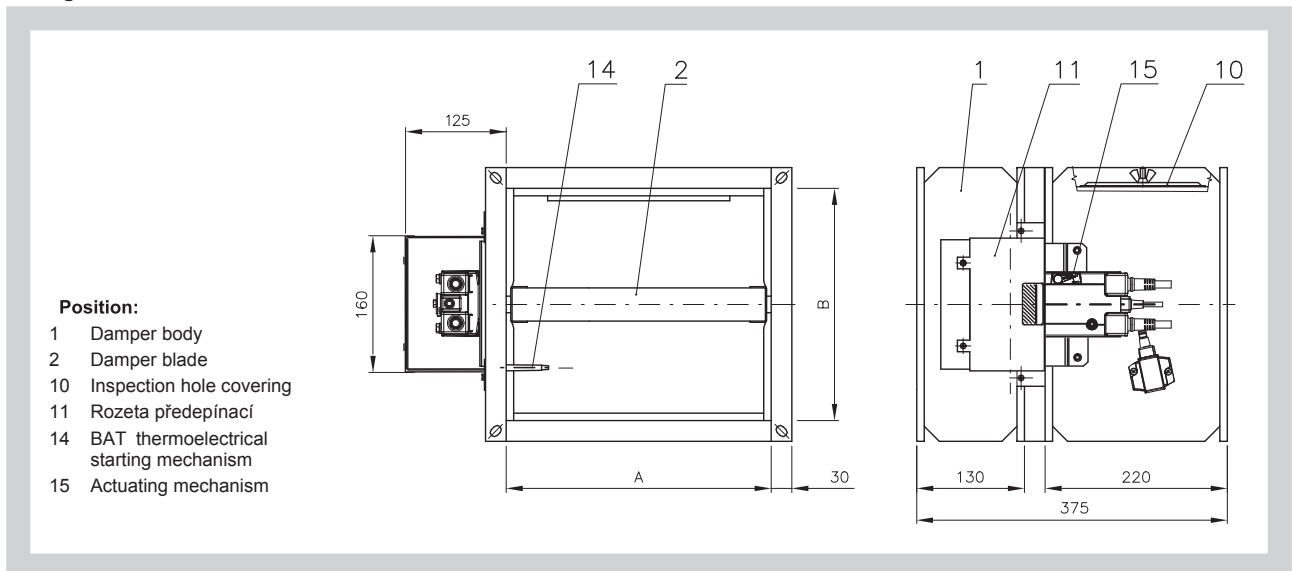
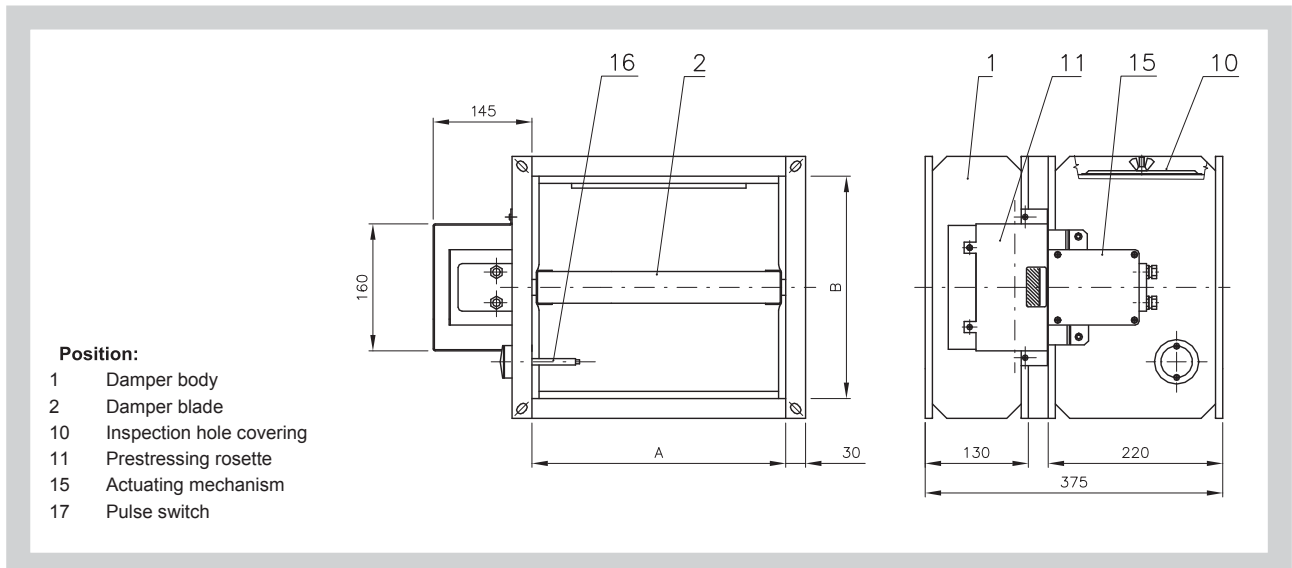


Fig. 32 FDMA - C - with covered control mechanism into (ZONE 1,2)



4.2. Round dampers

Fig. 33 FDMA - K - design manual and thermal

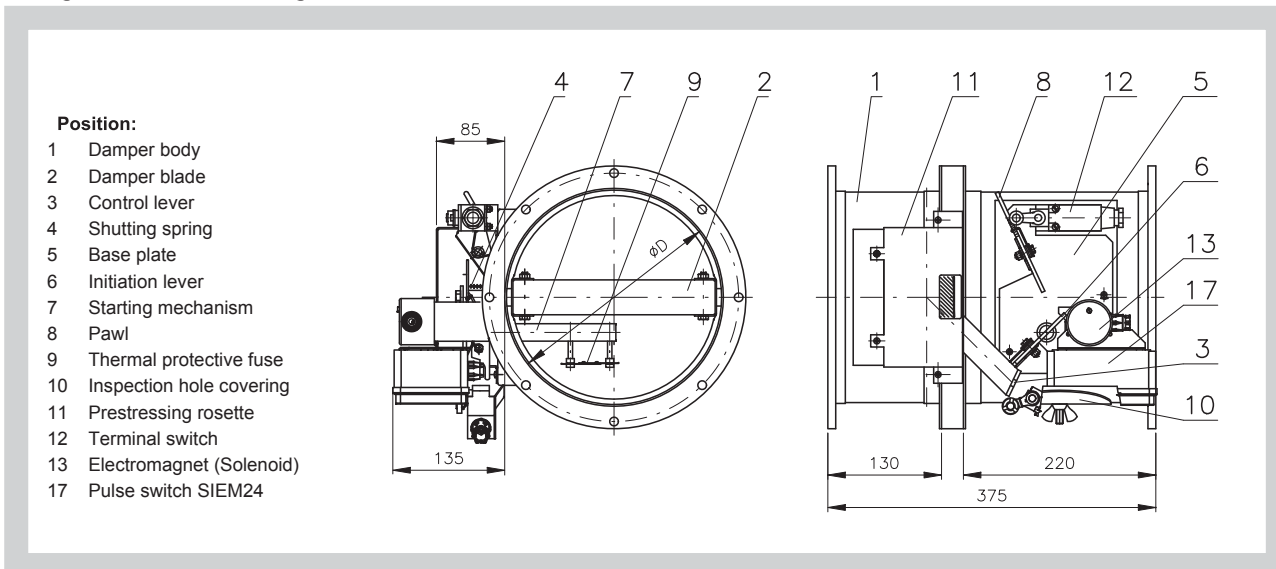


Fig. 34 FDMA - K - design with actuating mechanism

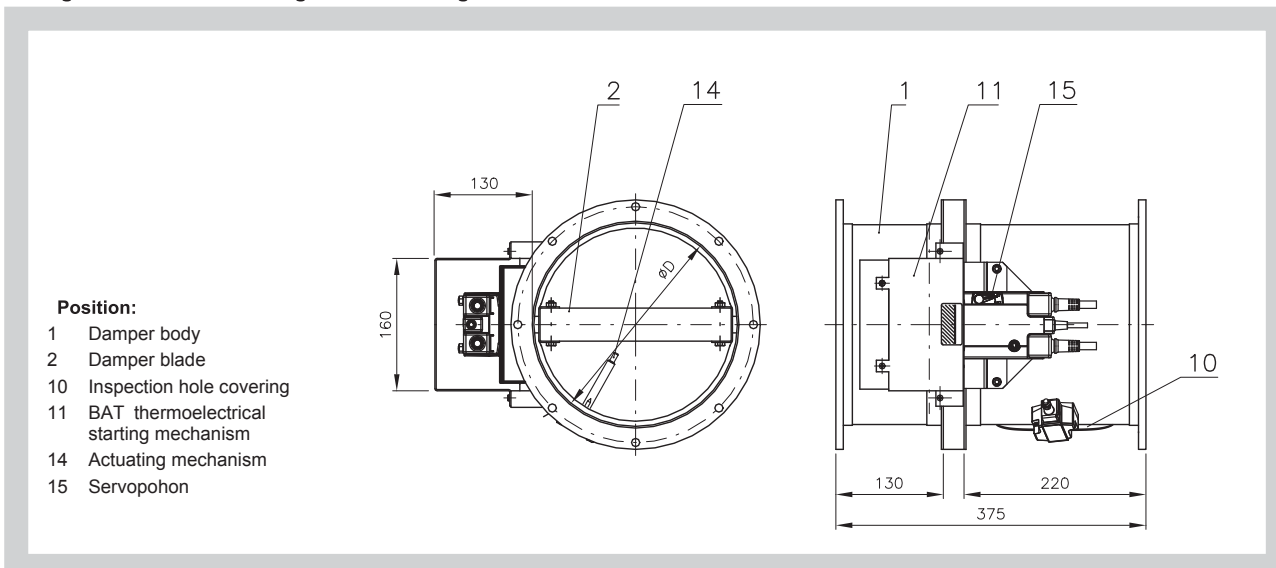
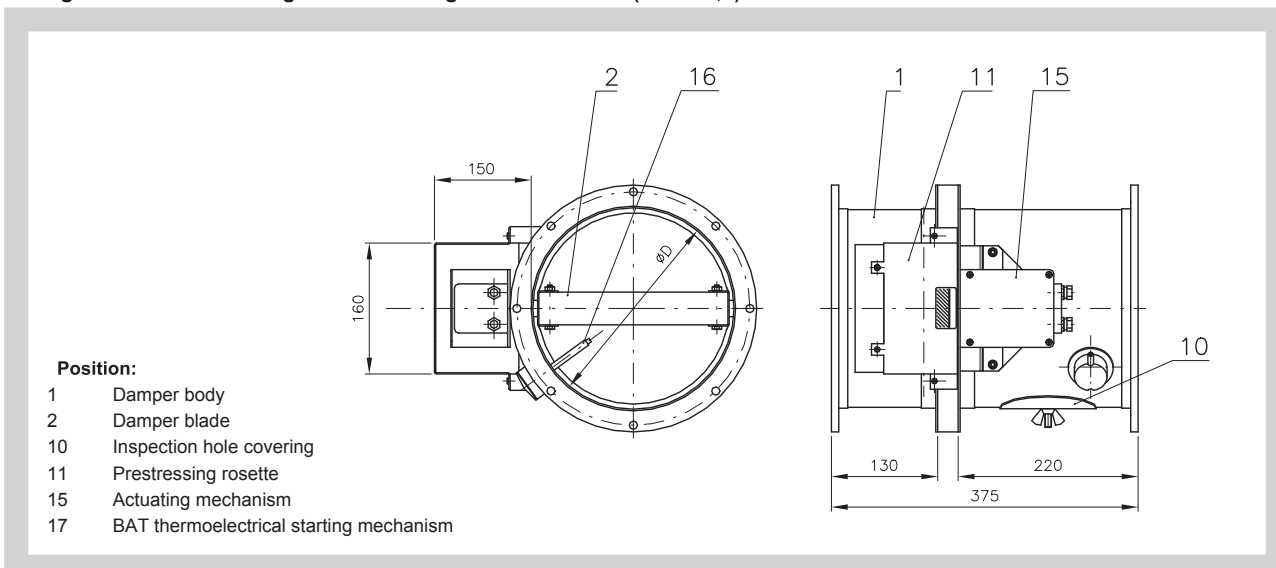


Fig. 35 FDMA - K - design with actuating mechanism into (ZONE 1,2)



## 4.3. Rectangular dampers - dimensions, weights and effective area

Tab. 4.3.1. rectangular dampers - dimensions, weights and effective area

| A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|------------|-----|-----|--------|---------------|--|--------------------|------------|-----|-----|--------|---------------|--|--------------------|
|            |     |     | Design |               |  |                    |            |     |     | Design |               |  |                    |
|            |     |     | Manual | Actuat. mech. |  |                    |            |     |     | Manual | Actuat. mech. |  |                    |
| 180 x 180  | -   | -   | 9,0    | 10,7          | 0,0192   | BFL                | 225 x 630  | 50  | 195 | 20,0   | 23,0          | 0,1169   | BFN                |
| 180 x 200  | -   | -   | 9,4    | 11,1          | 0,0224   | BFL                | 225 x 650  | 60  | 205 | 20,4   | 23,4          | 0,1210   | BFN                |
| 180 x 225  | -   | -   | 9,9    | 11,6          | 0,0264   | BFL                | 225 x 700  | 85  | 230 | 21,5   | 24,5          | 0,1312   | BFN                |
| 180 x 250  | -   | 5   | 10,5   | 12,2          | 0,0304   | BFL                | 225 x 710  | 90  | 235 | 21,8   | 24,8          | 0,1333   | BFN                |
| 180 x 280  | -   | 20  | 11,1   | 12,8          | 0,0352   | BFL                | 225 x 750  | 110 | 255 | 22,7   | 25,7          | 0,1415   | BFN                |
| 180 x 300  | -   | 30  | 11,5   | 13,2          | 0,0384   | BFL                | 225 x 800  | 135 | 280 | 23,8   | 26,8          | 0,1517   | BFN                |
| 180 x 315  | -   | 37  | 11,8   | 13,5          | 0,0408   | BFL                | 225 x 900  | 185 | 330 | 26,0   | 29,0          | 0,1722   | BFN                |
| 180 x 355  | -   | 57  | 12,7   | 14,4          | 0,0472   | BFL                | 225 x 1000 | 235 | 380 | 28,3   | 31,3          | 0,1927   | BF                 |
| 180 x 400  | -   | 80  | 13,6   | 15,3          | 0,0544   | BFL                | 250 x 180  | -   | -   | 10,3   | 12,0          | 0,0276   | BFL                |
| 180 x 450  | -   | 105 | 14,6   | 17,6          | 0,0624   | BFL                | 250 x 200  | -   | -   | 10,7   | 12,4          | 0,0322   | BFL                |
| 180 x 500  | -   | 130 | 15,7   | 18,7          | 0,0704   | BFL                | 250 x 225  | -   | -   | 11,3   | 13,0          | 0,0380   | BFL                |
| 180 x 550  | 10  | 155 | 16,7   | 19,7          | 0,0784   | BFL                | 250 x 250  | -   | 5   | 11,9   | 13,6          | 0,0437   | BFL                |
| 180 x 560  | 15  | 160 | 16,9   | 19,9          | 0,0800   | BFL                | 250 x 280  | -   | 20  | 12,6   | 14,3          | 0,0506   | BFL                |
| 180 x 600  | 35  | 180 | 17,8   | 20,8          | 0,0864   | BFL                | 250 x 300  | -   | 30  | 13,1   | 14,8          | 0,0552   | BFL                |
| 180 x 630  | 50  | 195 | 18,4   | 21,4          | 0,0912   | BFL                | 250 x 315  | -   | 37  | 13,4   | 15,1          | 0,0587   | BFL                |
| 180 x 650  | 60  | 205 | 18,8   | 21,8          | 0,0944   | BFL                | 250 x 355  | -   | 57  | 14,4   | 16,1          | 0,0679   | BFL                |
| 180 x 700  | 85  | 230 | 19,9   | 22,9          | 0,1024   | BFN                | 250 x 400  | -   | 80  | 15,4   | 17,1          | 0,0782   | BFL                |
| 180 x 710  | 90  | 235 | 20,1   | 23,1          | 0,1040   | BFN                | 250 x 450  | -   | 105 | 16,6   | 19,6          | 0,0897   | BFL                |
| 180 x 750  | 110 | 255 | 20,9   | 23,9          | 0,1104   | BFN                | 250 x 500  | -   | 130 | 17,8   | 20,8          | 0,1012   | BFL                |
| 180 x 800  | 135 | 280 | 22,0   | 25,0          | 0,1184   | BFN                | 250 x 550  | 10  | 155 | 18,9   | 21,9          | 0,1127   | BFL                |
| 200 x 180  | -   | -   | 9,4    | 11,1          | 0,0216   | BFL                | 250 x 560  | 15  | 160 | 19,2   | 22,2          | 0,1150   | BFL                |
| 200 x 200  | -   | -   | 9,8    | 11,5          | 0,0252   | BFL                | 250 x 600  | 35  | 180 | 20,1   | 23,1          | 0,1242   | BFN                |
| 200 x 225  | -   | -   | 10,3   | 12,0          | 0,0297   | BFL                | 250 x 630  | 50  | 195 | 20,8   | 23,8          | 0,1311   | BFN                |
| 200 x 250  | -   | 5   | 10,9   | 12,6          | 0,0396   | BFL                | 250 x 650  | 60  | 205 | 21,3   | 24,3          | 0,1357   | BFN                |
| 200 x 280  | -   | 20  | 11,5   | 13,2          | 0,0342   | BFL                | 250 x 700  | 85  | 230 | 22,5   | 25,5          | 0,1472   | BFN                |
| 200 x 300  | -   | 30  | 12,0   | 13,7          | 0,0432   | BFL                | 250 x 710  | 90  | 235 | 22,7   | 25,7          | 0,1495   | BFN                |
| 200 x 315  | -   | 37  | 12,3   | 14,0          | 0,0459   | BFL                | 250 x 750  | 110 | 255 | 23,6   | 26,6          | 0,1587   | BFN                |
| 200 x 355  | -   | 57  | 13,1   | 14,8          | 0,0531   | BFL                | 250 x 800  | 135 | 280 | 24,8   | 27,8          | 0,1702   | BFN                |
| 200 x 400  | -   | 80  | 14,1   | 15,8          | 0,0612   | BFL                | 250 x 900  | 185 | 330 | 27,2   | 30,2          | 0,1932   | BFN                |
| 200 x 450  | -   | 105 | 15,2   | 18,2          | 0,0702   | BFL                | 250 x 1000 | 235 | 380 | 29,5   | 32,5          | 0,2162   | BF                 |
| 200 x 500  | -   | 130 | 16,3   | 19,3          | 0,0792   | BFL                | 280 x 180  | -   | -   | 10,8   | 12,5          | 0,0312   | BFL                |
| 200 x 550  | 10  | 155 | 17,4   | 20,4          | 0,0882   | BFL                | 280 x 200  | -   | -   | 11,3   | 13,0          | 0,0364   | BFL                |
| 200 x 560  | 15  | 160 | 17,6   | 20,6          | 0,0900   | BFL                | 280 x 225  | -   | -   | 11,9   | 13,6          | 0,0429   | BFL                |
| 200 x 600  | 35  | 180 | 18,4   | 21,4          | 0,0972   | BFL                | 280 x 250  | -   | 5   | 12,5   | 14,2          | 0,0494   | BFL                |
| 200 x 630  | 50  | 195 | 19,1   | 22,1          | 0,1026   | BFL                | 280 x 280  | -   | 20  | 13,3   | 15,0          | 0,0572   | BFL                |
| 200 x 650  | 60  | 205 | 19,5   | 22,5          | 0,1062   | BFL                | 280 x 300  | -   | 30  | 13,8   | 15,5          | 0,0624   | BFL                |
| 200 x 700  | 85  | 230 | 20,6   | 23,6          | 0,1152   | BFN                | 280 x 315  | -   | 37  | 14,1   | 15,8          | 0,0663   | BFL                |
| 200 x 710  | 90  | 235 | 20,8   | 23,8          | 0,1170   | BFN                | 280 x 355  | -   | 57  | 15,1   | 16,8          | 0,0767   | BFL                |
| 200 x 750  | 110 | 255 | 21,7   | 24,7          | 0,1242   | BFN                | 280 x 400  | -   | 80  | 16,2   | 17,9          | 0,0884   | BFL                |
| 200 x 800  | 135 | 280 | 22,8   | 25,8          | 0,1332   | BFN                | 280 x 450  | -   | 105 | 17,4   | 20,4          | 0,1014   | BFL                |
| 200 x 900  | 185 | 330 | 24,9   | 27,9          | 0,1512   | BFN                | 280 x 500  | -   | 130 | 18,7   | 21,7          | 0,1144   | BFL                |
| 200 x 1000 | 235 | 380 | 27,1   | 30,1          | 0,1692   | BFN                | 280 x 550  | 10  | 155 | 19,9   | 22,9          | 0,1274   | BFL                |
| 225 x 180  | -   | -   | 9,8    | 11,5          | 0,0246   | BFL                | 280 x 560  | 15  | 160 | 20,1   | 23,1          | 0,1300   | BFN                |
| 225 x 200  | -   | -   | 10,3   | 12,0          | 0,0287   | BFL                | 280 x 600  | 35  | 180 | 21,1   | 24,1          | 0,1404   | BFN                |
| 225 x 225  | -   | -   | 10,8   | 12,5          | 0,0338   | BFL                | 280 x 630  | 50  | 195 | 21,9   | 24,9          | 0,1482   | BFN                |
| 225 x 250  | -   | 5   | 11,4   | 13,1          | 0,0390   | BFL                | 280 x 650  | 60  | 205 | 22,4   | 25,4          | 0,1534   | BFN                |
| 225 x 280  | -   | 20  | 12,1   | 13,8          | 0,0451   | BFL                | 280 x 700  | 85  | 230 | 23,6   | 26,6          | 0,1664   | BFN                |
| 225 x 300  | -   | 30  | 12,5   | 14,2          | 0,0492   | BFL                | 280 x 710  | 90  | 235 | 23,8   | 26,8          | 0,1690   | BFN                |
| 225 x 315  | -   | 37  | 12,9   | 14,6          | 0,0523   | BFL                | 280 x 750  | 110 | 255 | 24,8   | 27,8          | 0,1794   | BFN                |
| 225 x 355  | -   | 57  | 13,8   | 15,5          | 0,0605   | BFL                | 280 x 800  | 135 | 280 | 26,0   | 29,0          | 0,1924   | BFN                |
| 225 x 400  | -   | 80  | 14,8   | 16,5          | 0,0697   | BFL                | 280 x 900  | 185 | 330 | 28,5   | 31,5          | 0,2184   | BF                 |
| 225 x 450  | -   | 105 | 15,9   | 18,9          | 0,0800   | BFL                | 280 x 1000 | 235 | 380 | 30,9   | 33,9          | 0,2444   | BF                 |
| 225 x 500  | -   | 130 | 17,0   | 20,0          | 0,0902   | BFL                | 300 x 180  | -   | -   | 11,2   | 12,9          | 0,0336   | BFL                |
| 225 x 550  | 10  | 155 | 18,2   | 21,2          | 0,1005   | BFL                | 300 x 200  | -   | -   | 11,7   | 13,4          | 0,0392   | BFL                |
| 225 x 560  | 15  | 160 | 18,4   | 21,4          | 0,1025   | BFL                | 300 x 225  | -   | -   | 12,3   | 14,0          | 0,0462   | BFL                |
| 225 x 600  | 35  | 180 | 19,3   | 22,3          | 0,1107   | BFL                | 300 x 250  | -   | 5   | 13,0   | 14,7          | 0,0532   | BFL                |

| A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|------------|-----|-----|--------|---------------|--|--------------------|------------|-----|-----|--------|---------------|--|--------------------|
|            |     |     | Design |               |  |                    |            |     |     | Design |               |  |                    |
|            |     |     | Manual | Actuat. mech. |  |                    |            |     |     | Manual | Actuat. mech. |  |                    |
| 300 x 280  | -   | 20  | 13,7   | 15,4          | 0,0616   | BFL                | 355 x 710  | 90  | 235 | 26,6   | 29,6          | 0,2178   | BFN                |
| 300 x 300  | -   | 30  | 14,2   | 15,9          | 0,0672   | BFL                | 355 x 750  | 110 | 255 | 27,7   | 30,7          | 0,2312   | BFN                |
| 300 x 315  | -   | 37  | 14,6   | 16,3          | 0,0714   | BFL                | 355 x 800  | 135 | 280 | 29,1   | 32,1          | 0,2479   | BF                 |
| 300 x 355  | -   | 57  | 15,6   | 17,3          | 0,0826   | BFL                | 355 x 900  | 185 | 330 | 31,8   | 34,8          | 0,2814   | BF                 |
| 300 x 400  | -   | 80  | 16,8   | 18,5          | 0,0952   | BFL                | 355 x 1000 | 235 | 380 | 34,5   | 37,5          | 0,3149   | BF                 |
| 300 x 450  | -   | 105 | 18,0   | 21,0          | 0,1092   | BFL                | 400 x 180  | -   | -   | 13,0   | 14,7          | 0,0456   | BFL                |
| 300 x 500  | -   | 130 | 19,3   | 22,3          | 0,1232   | BFL                | 400 x 200  | -   | -   | 13,6   | 15,3          | 0,0532   | BFL                |
| 300 x 550  | 10  | 155 | 20,5   | 23,5          | 0,1372   | BFN                | 400 x 225  | -   | -   | 14,3   | 16,0          | 0,0627   | BFL                |
| 300 x 560  | 15  | 160 | 20,8   | 23,8          | 0,1400   | BFN                | 400 x 250  | -   | 5   | 15,1   | 16,8          | 0,0722   | BFL                |
| 300 x 600  | 35  | 180 | 21,8   | 24,8          | 0,1512   | BFN                | 400 x 280  | -   | 20  | 15,9   | 17,6          | 0,0836   | BFL                |
| 300 x 630  | 50  | 195 | 22,6   | 25,6          | 0,1596   | BFN                | 400 x 300  | -   | 30  | 16,5   | 18,2          | 0,0912   | BFL                |
| 300 x 650  | 60  | 205 | 23,1   | 26,1          | 0,1652   | BFN                | 400 x 315  | -   | 37  | 16,9   | 18,6          | 0,0969   | BFL                |
| 300 x 700  | 85  | 230 | 24,3   | 27,3          | 0,1792   | BFN                | 400 x 355  | -   | 57  | 18,1   | 19,8          | 0,1121   | BFL                |
| 300 x 710  | 90  | 235 | 24,6   | 27,6          | 0,1820   | BFN                | 400 x 400  | -   | 80  | 19,4   | 21,1          | 0,1292   | BFL                |
| 300 x 750  | 110 | 255 | 25,6   | 28,6          | 0,1932   | BFN                | 400 x 450  | -   | 105 | 20,8   | 23,8          | 0,1482   | BFL                |
| 300 x 800  | 135 | 280 | 26,8   | 29,8          | 0,2072   | BFN                | 400 x 500  | -   | 130 | 22,3   | 25,3          | 0,1672   | BFN                |
| 300 x 900  | 185 | 330 | 29,4   | 32,4          | 0,2352   | BF                 | 400 x 550  | 10  | 155 | 23,7   | 26,7          | 0,1862   | BFN                |
| 300 x 1000 | 235 | 380 | 31,9   | 34,9          | 0,2632   | BF                 | 400 x 560  | 15  | 160 | 24,0   | 27,0          | 0,1900   | BFN                |
| 315 x 180  | -   | -   | 11,5   | 13,2          | 0,0354   | BFL                | 400 x 600  | 35  | 180 | 25,1   | 28,1          | 0,2052   | BFN                |
| 315 x 200  | -   | -   | 12,0   | 13,7          | 0,0413   | BFL                | 400 x 630  | 50  | 195 | 26,0   | 29,0          | 0,2166   | BFN                |
| 315 x 225  | -   | -   | 12,6   | 14,3          | 0,0487   | BFL                | 400 x 650  | 60  | 205 | 26,6   | 29,6          | 0,2242   | BFN                |
| 315 x 250  | -   | 5   | 13,3   | 15,0          | 0,0561   | BFL                | 400 x 700  | 85  | 230 | 28,0   | 31,0          | 0,2432   | BFN                |
| 315 x 280  | -   | 20  | 14,1   | 15,8          | 0,0649   | BFL                | 400 x 710  | 90  | 235 | 28,3   | 31,3          | 0,2470   | BFN                |
| 315 x 300  | -   | 30  | 14,6   | 16,3          | 0,0708   | BFL                | 400 x 750  | 110 | 255 | 29,5   | 32,5          | 0,2622   | BF                 |
| 315 x 315  | -   | 37  | 15,0   | 16,7          | 0,0752   | BFL                | 400 x 800  | 135 | 280 | 30,9   | 33,9          | 0,2812   | BF                 |
| 315 x 355  | -   | 57  | 16,0   | 17,7          | 0,0870   | BFL                | 400 x 900  | 185 | 330 | 33,8   | 36,8          | 0,3192   | BF                 |
| 315 x 400  | -   | 80  | 17,1   | 18,8          | 0,1003   | BFL                | 400 x 1000 | 235 | 380 | 36,7   | 39,7          | 0,3572   | BF                 |
| 315 x 450  | -   | 105 | 18,4   | 21,4          | 0,1151   | BFL                | 450 x 180  | -   | -   | 14,0   | 15,7          | 0,0516   | BFL                |
| 315 x 500  | -   | 130 | 19,7   | 22,7          | 0,1298   | BFL                | 450 x 200  | -   | -   | 14,6   | 16,3          | 0,0602   | BFL                |
| 315 x 550  | 10  | 155 | 21,0   | 24,0          | 0,1446   | BFN                | 450 x 225  | -   | -   | 15,3   | 17,0          | 0,0710   | BFL                |
| 315 x 560  | 15  | 160 | 21,3   | 24,3          | 0,1475   | BFN                | 450 x 250  | -   | 5   | 16,1   | 17,8          | 0,0817   | BFL                |
| 315 x 600  | 35  | 180 | 22,3   | 25,3          | 0,1593   | BFN                | 450 x 280  | -   | 20  | 17,0   | 18,7          | 0,0946   | BFL                |
| 315 x 630  | 50  | 195 | 23,1   | 26,1          | 0,1682   | BFN                | 450 x 300  | -   | 30  | 17,6   | 19,3          | 0,1032   | BFL                |
| 315 x 650  | 60  | 205 | 23,6   | 26,6          | 0,1741   | BFN                | 450 x 315  | -   | 37  | 18,1   | 19,8          | 0,1097   | BFL                |
| 315 x 700  | 85  | 230 | 24,9   | 27,9          | 0,1888   | BFN                | 450 x 355  | -   | 57  | 19,3   | 21,0          | 0,1269   | BFL                |
| 315 x 710  | 90  | 235 | 25,1   | 28,1          | 0,1918   | BFN                | 450 x 400  | -   | 80  | 20,7   | 22,4          | 0,1462   | BFL                |
| 315 x 750  | 110 | 255 | 26,2   | 29,2          | 0,2036   | BFN                | 450 x 450  | -   | 105 | 22,2   | 25,2          | 0,1677   | BFN                |
| 315 x 800  | 135 | 280 | 27,5   | 30,5          | 0,2183   | BFN                | 450 x 500  | -   | 130 | 23,8   | 26,8          | 0,1892   | BFN                |
| 315 x 900  | 185 | 330 | 30,0   | 33,0          | 0,2478   | BF                 | 450 x 550  | 10  | 155 | 25,3   | 28,3          | 0,2107   | BFN                |
| 315 x 1000 | 235 | 380 | 32,6   | 35,6          | 0,2773   | BF                 | 450 x 560  | 15  | 160 | 25,6   | 28,6          | 0,2150   | BFN                |
| 355 x 180  | -   | -   | 12,2   | 13,9          | 0,0402   | BFL                | 450 x 600  | 35  | 180 | 26,8   | 29,8          | 0,2322   | BFN                |
| 355 x 200  | -   | -   | 12,8   | 14,5          | 0,0469   | BFL                | 450 x 630  | 50  | 195 | 27,7   | 30,7          | 0,2451   | BFN                |
| 355 x 225  | -   | -   | 13,4   | 15,1          | 0,0553   | BFL                | 450 x 650  | 60  | 205 | 28,4   | 31,4          | 0,2537   | BFN                |
| 355 x 250  | -   | 5   | 14,1   | 15,8          | 0,0737   | BFL                | 450 x 700  | 85  | 230 | 29,9   | 32,9          | 0,2752   | BF                 |
| 355 x 280  | -   | 20  | 14,9   | 16,6          | 0,0637   | BFL                | 450 x 710  | 90  | 235 | 30,2   | 33,2          | 0,2795   | BF                 |
| 355 x 300  | -   | 30  | 15,5   | 17,2          | 0,0804   | BFL                | 450 x 750  | 110 | 255 | 31,4   | 34,4          | 0,2967   | BF                 |
| 355 x 315  | -   | 37  | 15,9   | 17,6          | 0,0854   | BFL                | 450 x 800  | 135 | 280 | 33,0   | 36,0          | 0,3182   | BF                 |
| 355 x 355  | -   | 57  | 17,0   | 18,7          | 0,0988   | BFL                | 450 x 900  | 185 | 330 | 36,0   | 39,0          | 0,3612   | BF                 |
| 355 x 400  | -   | 80  | 18,2   | 19,9          | 0,1139   | BFL                | 450 x 1000 | 235 | 380 | 39,1   | 42,1          | 0,4042   | BF                 |
| 355 x 450  | -   | 105 | 19,6   | 22,6          | 0,1307   | BFL                | 500 x 180  | -   | -   | 14,9   | 16,6          | 0,0576   | BFL                |
| 355 x 500  | -   | 130 | 20,9   | 23,9          | 0,1474   | BFN                | 500 x 200  | -   | -   | 15,5   | 17,2          | 0,0672   | BFL                |
| 355 x 550  | 10  | 155 | 22,3   | 25,3          | 0,1642   | BFN                | 500 x 225  | -   | -   | 16,3   | 18,0          | 0,0792   | BFL                |
| 355 x 560  | 15  | 160 | 22,6   | 25,6          | 0,1675   | BFN                | 500 x 250  | -   | 5   | 17,1   | 18,8          | 0,0912   | BFL                |
| 355 x 600  | 35  | 180 | 23,6   | 26,6          | 0,1809   | BFN                | 500 x 280  | -   | 20  | 18,1   | 19,8          | 0,1056   | BFL                |
| 355 x 630  | 50  | 195 | 24,5   | 27,5          | 0,1910   | BFN                | 500 x 300  | -   | 30  | 18,8   | 20,5          | 0,1152   | BFL                |
| 355 x 650  | 60  | 205 | 25,0   | 28,0          | 0,1977   | BFN                | 500 x 315  | -   | 37  | 19,3   | 21,0          | 0,1224   | BFL                |
| 355 x 700  | 85  | 230 | 26,4   | 29,4          | 0,2144   | BFN                | 500 x 355  | -   | 57  | 20,6   | 22,3          | 0,1416   | BFL                |



| A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|------------|-----|-----|--------|---------------|--|--------------------|------------|-----|-----|--------|---------------|--|--------------------|
|            |     |     | Design |               |  |                    |            |     |     | Design |               |  |                    |
|            |     |     | Manual | Actuat. mech. |  |                    |            |     |     | Manual | Actuat. mech. |  |                    |
| 500 x 400  | -   | 80  | 22,0   | 23,7          | 0,1632   | BFL                | 560 x 900  | 185 | 330 | 40,9   | 43,9          | 0,4536   | BF                 |
| 500 x 450  | -   | 105 | 23,6   | 26,6          | 0,1872   | BFN                | 560 x 1000 | 235 | 380 | 44,4   | 47,4          | 0,5076   | BF                 |
| 500 x 500  | -   | 130 | 25,3   | 28,3          | 0,2112   | BFN                | 600 x 180  | -   | -   | 16,7   | 19,7          | 0,0696   | BFL                |
| 500 x 550  | 10  | 155 | 26,9   | 29,9          | 0,2352   | BFN                | 600 x 200  | -   | -   | 17,4   | 20,4          | 0,0812   | BFL                |
| 500 x 560  | 15  | 160 | 27,2   | 30,2          | 0,2400   | BFN                | 600 x 225  | -   | -   | 18,3   | 21,3          | 0,0957   | BFL                |
| 500 x 600  | 35  | 180 | 28,5   | 31,5          | 0,2592   | BFN                | 600 x 250  | -   | 5   | 19,2   | 22,2          | 0,1102   | BFL                |
| 500 x 630  | 50  | 195 | 29,5   | 32,5          | 0,2736   | BFN                | 600 x 280  | -   | 20  | 20,3   | 23,3          | 0,1276   | BFL                |
| 500 x 650  | 60  | 205 | 30,1   | 33,1          | 0,2832   | BF                 | 600 x 300  | -   | 30  | 21,0   | 24,0          | 0,1392   | BFL                |
| 500 x 700  | 85  | 230 | 31,7   | 34,7          | 0,3072   | BF                 | 600 x 315  | -   | 37  | 21,6   | 24,6          | 0,1479   | BFL                |
| 500 x 710  | 90  | 235 | 32,1   | 35,1          | 0,3120   | BF                 | 600 x 355  | -   | 57  | 23,0   | 26,0          | 0,1711   | BFL                |
| 500 x 750  | 110 | 255 | 33,4   | 36,4          | 0,3312   | BF                 | 600 x 400  | -   | 80  | 24,6   | 27,6          | 0,1972   | BFN                |
| 500 x 800  | 135 | 280 | 35,0   | 38,0          | 0,3552   | BF                 | 600 x 450  | -   | 105 | 26,4   | 29,4          | 0,2262   | BFN                |
| 500 x 900  | 185 | 330 | 38,2   | 41,2          | 0,4032   | BF                 | 600 x 500  | -   | 130 | 28,3   | 31,3          | 0,2552   | BFN                |
| 500 x 1000 | 235 | 380 | 41,5   | 44,5          | 0,4512   | BF                 | 600 x 550  | 10  | 155 | 30,1   | 33,1          | 0,2842   | BFN                |
| 550 x 180  | -   | -   | 15,8   | 17,5          | 0,0636   | BFL                | 600 x 560  | 15  | 160 | 30,4   | 33,4          | 0,2900   | BFN                |
| 550 x 200  | -   | -   | 16,5   | 18,2          | 0,0742   | BFL                | 600 x 600  | 35  | 180 | 31,9   | 34,9          | 0,3132   | BF                 |
| 550 x 225  | -   | -   | 17,3   | 19,0          | 0,0875   | BFL                | 600 x 630  | 50  | 195 | 32,9   | 35,9          | 0,3306   | BF                 |
| 550 x 250  | -   | 5   | 18,2   | 19,9          | 0,1007   | BFL                | 600 x 650  | 60  | 205 | 33,7   | 36,7          | 0,3422   | BF                 |
| 550 x 280  | -   | 20  | 19,2   | 20,9          | 0,1166   | BFL                | 600 x 700  | 85  | 230 | 35,5   | 38,5          | 0,3712   | BF                 |
| 550 x 300  | -   | 30  | 19,9   | 21,6          | 0,1272   | BFL                | 600 x 710  | 90  | 235 | 35,8   | 38,8          | 0,3770   | BF                 |
| 550 x 315  | -   | 37  | 20,4   | 22,1          | 0,1352   | BFL                | 600 x 750  | 110 | 255 | 37,3   | 40,3          | 0,4002   | BF                 |
| 550 x 355  | -   | 57  | 21,8   | 23,5          | 0,1564   | BFL                | 600 x 800  | 135 | 280 | 39,1   | 42,1          | 0,4292   | BF                 |
| 550 x 400  | -   | 80  | 23,3   | 25,0          | 0,1802   | BFN                | 600 x 900  | 185 | 330 | 42,7   | 45,7          | 0,4872   | BF                 |
| 550 x 450  | -   | 105 | 25,0   | 28,0          | 0,2067   | BFN                | 600 x 1000 | 235 | 380 | 46,3   | 49,3          | 0,5452   | BF                 |
| 550 x 500  | -   | 130 | 26,8   | 29,8          | 0,2332   | BFN                | 630 x 180  | -   | -   | 17,3   | 20,3          | 0,0732   | BFL                |
| 550 x 550  | 10  | 155 | 28,5   | 31,5          | 0,2597   | BFN                | 630 x 200  | -   | -   | 18,0   | 21,0          | 0,0854   | BFL                |
| 550 x 560  | 15  | 160 | 28,8   | 31,8          | 0,2650   | BFN                | 630 x 225  | -   | -   | 18,9   | 21,9          | 0,1007   | BFL                |
| 550 x 600  | 35  | 180 | 30,2   | 33,2          | 0,2862   | BFN                | 630 x 250  | -   | 5   | 19,9   | 22,9          | 0,1159   | BFL                |
| 550 x 630  | 50  | 195 | 31,2   | 34,2          | 0,3021   | BF                 | 630 x 280  | -   | 20  | 21,0   | 24,0          | 0,1342   | BFL                |
| 550 x 650  | 60  | 205 | 31,9   | 34,9          | 0,3127   | BF                 | 630 x 300  | -   | 30  | 21,7   | 24,7          | 0,1464   | BFL                |
| 550 x 700  | 85  | 230 | 33,6   | 36,6          | 0,3392   | BF                 | 630 x 315  | -   | 37  | 22,3   | 25,3          | 0,1556   | BFL                |
| 550 x 710  | 90  | 235 | 33,9   | 36,9          | 0,3445   | BF                 | 630 x 355  | -   | 57  | 23,8   | 26,8          | 0,1800   | BFL                |
| 550 x 750  | 110 | 255 | 35,3   | 38,3          | 0,3657   | BF                 | 630 x 400  | -   | 80  | 25,4   | 28,4          | 0,2074   | BFN                |
| 550 x 800  | 135 | 280 | 37,0   | 40,0          | 0,3922   | BF                 | 630 x 450  | -   | 105 | 27,3   | 30,3          | 0,2379   | BFN                |
| 550 x 900  | 185 | 330 | 40,4   | 43,4          | 0,4452   | BF                 | 630 x 500  | -   | 130 | 29,1   | 32,1          | 0,2684   | BFN                |
| 550 x 1000 | 235 | 380 | 43,9   | 46,9          | 0,4982   | BF                 | 630 x 550  | 10  | 155 | 31,0   | 34,0          | 0,2989   | BFN                |
| 560 x 180  | -   | -   | 16,0   | 17,7          | 0,0648   | BFL                | 630 x 560  | 15  | 160 | 31,4   | 34,4          | 0,3050   | BFN                |
| 560 x 200  | -   | -   | 16,7   | 18,4          | 0,0756   | BFL                | 630 x 600  | 35  | 180 | 32,9   | 35,9          | 0,3294   | BF                 |
| 560 x 225  | -   | -   | 17,5   | 19,2          | 0,0891   | BFL                | 630 x 630  | 50  | 195 | 34,0   | 37,0          | 0,3477   | BF                 |
| 560 x 250  | -   | 5   | 18,4   | 20,1          | 0,1026   | BFL                | 630 x 650  | 60  | 205 | 34,7   | 37,7          | 0,3599   | BF                 |
| 560 x 280  | -   | 20  | 19,4   | 21,1          | 0,1188   | BFL                | 630 x 700  | 85  | 230 | 36,6   | 39,6          | 0,3904   | BF                 |
| 560 x 300  | -   | 30  | 20,1   | 21,8          | 0,1296   | BFL                | 630 x 710  | 90  | 235 | 36,9   | 39,9          | 0,3965   | BF                 |
| 560 x 315  | -   | 37  | 20,7   | 22,4          | 0,1377   | BFL                | 630 x 750  | 110 | 255 | 38,4   | 41,4          | 0,4209   | BF                 |
| 560 x 355  | -   | 57  | 22,0   | 23,7          | 0,1593   | BFL                | 630 x 800  | 135 | 280 | 40,3   | 43,3          | 0,4514   | BF                 |
| 560 x 400  | -   | 80  | 23,6   | 25,3          | 0,1836   | BFN                | 630 x 900  | 185 | 330 | 44,0   | 47,0          | 0,5124   | BF                 |
| 560 x 450  | -   | 105 | 25,3   | 28,3          | 0,2106   | BFN                | 630 x 1000 | 235 | 380 | 47,7   | 50,7          | 0,5734   | BF                 |
| 560 x 500  | -   | 130 | 27,1   | 30,1          | 0,2376   | BFN                | 650 x 180  | -   | -   | 17,6   | 20,6          | 0,0756   | BFL                |
| 560 x 550  | 10  | 155 | 28,8   | 31,8          | 0,2646   | BFN                | 650 x 200  | -   | -   | 18,4   | 21,4          | 0,0882   | BFL                |
| 560 x 560  | 15  | 160 | 29,1   | 32,1          | 0,2700   | BFN                | 650 x 225  | -   | -   | 19,3   | 22,3          | 0,1040   | BFL                |
| 560 x 600  | 35  | 180 | 30,5   | 33,5          | 0,2916   | BFN                | 650 x 250  | -   | 5   | 20,3   | 23,3          | 0,1197   | BFL                |
| 560 x 630  | 50  | 195 | 31,6   | 34,6          | 0,3078   | BF                 | 650 x 280  | -   | 20  | 21,4   | 24,4          | 0,1386   | BFL                |
| 560 x 650  | 60  | 205 | 32,2   | 35,2          | 0,3186   | BF                 | 650 x 300  | -   | 30  | 22,2   | 25,2          | 0,1512   | BFL                |
| 560 x 700  | 85  | 230 | 34,0   | 37,0          | 0,3456   | BF                 | 650 x 315  | -   | 37  | 22,7   | 25,7          | 0,1607   | BFL                |
| 560 x 710  | 90  | 235 | 34,3   | 37,3          | 0,3510   | BF                 | 650 x 355  | -   | 57  | 24,3   | 27,3          | 0,1859   | BFL                |
| 560 x 750  | 110 | 255 | 35,7   | 38,7          | 0,3726   | BF                 | 650 x 400  | -   | 80  | 26,0   | 29,0          | 0,2142   | BFN                |
| 560 x 800  | 135 | 280 | 37,4   | 40,4          | 0,3996   | BF                 | 650 x 450  | -   | 105 | 27,9   | 30,9          | 0,2457   | BFN                |

| A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B      | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|------------|-----|-----|--------|---------------|--|--------------------|------------|-----|-----|--------|---------------|--|--------------------|
|            |     |     | Design |               |  |                    |            |     |     | Design |               |  |                    |
|            |     |     | Manual | Actuat. mech. |  |                    |            |     |     | Manual | Actuat. mech. |  |                    |
| 650 x 500  | -   | 130 | 29,7   | 32,7          | 0,2772   | BFN                | 750 x 180  | -   | -   | 19,5   | 22,5          | 0,0876   | BFL                |
| 650 x 550  | 10  | 155 | 31,6   | 34,6          | 0,3087   | BFN                | 750 x 200  | -   | -   | 20,3   | 23,3          | 0,1022   | BFL                |
| 650 x 560  | 15  | 160 | 32,0   | 35,0          | 0,3150   | BF                 | 750 x 225  | -   | -   | 21,3   | 24,3          | 0,1205   | BFL                |
| 650 x 600  | 35  | 180 | 33,5   | 36,5          | 0,3402   | BF                 | 750 x 250  | -   | 5   | 22,4   | 25,4          | 0,1387   | BFL                |
| 650 x 630  | 50  | 195 | 34,7   | 37,7          | 0,3591   | BF                 | 750 x 280  | -   | 20  | 23,6   | 26,6          | 0,1606   | BFL                |
| 650 x 650  | 60  | 205 | 35,4   | 38,4          | 0,3717   | BF                 | 750 x 300  | -   | 30  | 24,5   | 27,5          | 0,1752   | BFL                |
| 650 x 700  | 85  | 230 | 37,3   | 40,3          | 0,4032   | BF                 | 750 x 315  | -   | 37  | 25,1   | 28,1          | 0,1862   | BFL                |
| 650 x 710  | 90  | 235 | 37,7   | 40,7          | 0,4095   | BF                 | 750 x 355  | -   | 57  | 26,7   | 29,7          | 0,2154   | BFN                |
| 650 x 750  | 110 | 255 | 39,2   | 42,2          | 0,4347   | BF                 | 750 x 400  | -   | 80  | 28,6   | 31,6          | 0,2482   | BFN                |
| 650 x 800  | 135 | 280 | 41,1   | 44,1          | 0,4662   | BF                 | 750 x 450  | -   | 105 | 30,7   | 33,7          | 0,2847   | BFN                |
| 650 x 900  | 185 | 330 | 44,9   | 47,9          | 0,5292   | BF                 | 750 x 500  | -   | 130 | 32,7   | 35,7          | 0,3212   | BFN                |
| 650 x 1000 | 235 | 380 | 48,7   | 51,7          | 0,5922   | BF                 | 750 x 550  | 10  | 155 | 34,8   | 37,8          | 0,3577   | BF                 |
| 700 x 180  | -   | -   | 18,6   | 21,6          | 0,0816   | BFL                | 750 x 560  | 15  | 160 | 35,2   | 38,2          | 0,3650   | BF                 |
| 700 x 200  | -   | -   | 19,4   | 22,4          | 0,0952   | BFL                | 750 x 600  | 35  | 180 | 36,9   | 39,9          | 0,3942   | BF                 |
| 700 x 225  | -   | -   | 20,3   | 23,3          | 0,1122   | BFL                | 750 x 630  | 50  | 195 | 38,1   | 41,1          | 0,4161   | BF                 |
| 700 x 250  | -   | 5   | 21,3   | 24,3          | 0,1292   | BFL                | 750 x 650  | 60  | 205 | 39,0   | 42,0          | 0,4307   | BF                 |
| 700 x 280  | -   | 20  | 22,5   | 25,5          | 0,1496   | BFL                | 750 x 700  | 85  | 230 | 41,0   | 44,0          | 0,4672   | BF                 |
| 700 x 300  | -   | 30  | 23,3   | 26,3          | 0,1632   | BFL                | 750 x 710  | 90  | 235 | 41,4   | 44,4          | 0,4745   | BF                 |
| 700 x 315  | -   | 37  | 23,9   | 26,9          | 0,1734   | BFL                | 750 x 750  | 110 | 255 | 43,1   | 46,1          | 0,5037   | BF                 |
| 700 x 355  | -   | 57  | 25,5   | 28,5          | 0,2006   | BFN                | 750 x 800  | 135 | 280 | 45,2   | 48,2          | 0,5402   | BF                 |
| 700 x 400  | -   | 80  | 27,3   | 30,3          | 0,2312   | BFN                | 750 x 900  | 185 | 330 | 49,3   | 52,3          | 0,6132   | BF                 |
| 700 x 450  | -   | 105 | 29,3   | 32,3          | 0,2652   | BFN                | 750 x 1000 | 235 | 380 | 53,5   | 56,5          | 0,6862   | BF                 |
| 700 x 500  | -   | 130 | 31,2   | 34,2          | 0,2992   | BFN                | 800 x 180  | -   | -   | 20,4   | 23,4          | 0,0936   | BFL                |
| 700 x 550  | 10  | 155 | 33,2   | 36,2          | 0,3332   | BF                 | 800 x 200  | -   | -   | 21,3   | 24,3          | 0,1092   | BFL                |
| 700 x 560  | 15  | 160 | 33,6   | 36,6          | 0,3400   | BF                 | 800 x 225  | -   | -   | 22,3   | 25,3          | 0,1287   | BFL                |
| 700 x 600  | 35  | 180 | 35,2   | 38,2          | 0,3672   | BF                 | 800 x 250  | -   | 5   | 23,4   | 26,4          | 0,1482   | BFL                |
| 700 x 630  | 50  | 195 | 36,4   | 39,4          | 0,3876   | BF                 | 800 x 280  | -   | 20  | 24,7   | 27,7          | 0,1716   | BFL                |
| 700 x 650  | 60  | 205 | 37,2   | 40,2          | 0,4012   | BF                 | 800 x 300  | -   | 30  | 25,6   | 28,6          | 0,1872   | BFL                |
| 700 x 700  | 85  | 230 | 39,2   | 42,2          | 0,4352   | BF                 | 800 x 315  | -   | 37  | 26,2   | 29,2          | 0,1989   | BFL                |
| 700 x 710  | 90  | 235 | 39,6   | 42,6          | 0,4420   | BF                 | 800 x 355  | -   | 57  | 28,0   | 31,0          | 0,2301   | BFN                |
| 700 x 750  | 110 | 255 | 41,2   | 44,2          | 0,4692   | BF                 | 800 x 400  | -   | 80  | 29,9   | 32,9          | 0,2652   | BFN                |
| 700 x 800  | 135 | 280 | 43,1   | 46,1          | 0,5032   | BF                 | 800 x 450  | -   | 105 | 32,1   | 35,1          | 0,3042   | BFN                |
| 700 x 900  | 185 | 330 | 47,1   | 50,1          | 0,5712   | BF                 | 800 x 500  | -   | 130 | 34,2   | 37,2          | 0,3432   | BFN                |
| 700 x 1000 | 235 | 380 | 51,1   | 54,1          | 0,6392   | BF                 | 800 x 550  | 10  | 155 | 36,4   | 39,4          | 0,3822   | BF                 |
| 710 x 180  | -   | -   | 18,7   | 21,7          | 0,0828   | BFL                | 800 x 560  | 15  | 160 | 36,8   | 39,8          | 0,3900   | BF                 |
| 710 x 200  | -   | -   | 19,5   | 22,5          | 0,0966   | BFL                | 800 x 600  | 35  | 180 | 38,6   | 41,6          | 0,4212   | BF                 |
| 710 x 225  | -   | -   | 20,5   | 23,5          | 0,1139   | BFL                | 800 x 630  | 50  | 195 | 39,9   | 42,9          | 0,4446   | BF                 |
| 710 x 250  | -   | 5   | 21,5   | 24,5          | 0,1311   | BFL                | 800 x 650  | 60  | 205 | 40,7   | 43,7          | 0,4602   | BF                 |
| 710 x 280  | -   | 20  | 22,7   | 25,7          | 0,1518   | BFL                | 800 x 700  | 85  | 230 | 42,9   | 45,9          | 0,4992   | BF                 |
| 710 x 300  | -   | 30  | 23,5   | 26,5          | 0,1656   | BFL                | 800 x 710  | 90  | 235 | 43,3   | 46,3          | 0,5070   | BF                 |
| 710 x 315  | -   | 37  | 24,1   | 27,1          | 0,1760   | BFL                | 800 x 750  | 110 | 255 | 45,0   | 48,0          | 0,5382   | BF                 |
| 710 x 355  | -   | 57  | 25,7   | 28,7          | 0,2036   | BFN                | 800 x 800  | 135 | 280 | 47,2   | 50,2          | 0,5772   | BF                 |
| 710 x 400  | -   | 80  | 27,5   | 30,5          | 0,2346   | BFN                | 800 x 900  | 185 | 330 | 51,5   | 54,5          | 0,6552   | BF                 |
| 710 x 450  | -   | 105 | 29,5   | 32,5          | 0,2691   | BFN                | 800 x 1000 | 235 | 380 | 55,9   | 58,9          | 0,7332   | BF                 |
| 710 x 500  | -   | 130 | 31,5   | 34,5          | 0,3036   | BFN                | 900 x 180  | -   | -   | 22,2   | 25,2          | 0,1056   | BFL                |
| 710 x 550  | 10  | 155 | 33,5   | 36,5          | 0,3381   | BF                 | 900 x 200  | -   | -   | 23,2   | 26,2          | 0,1232   | BFL                |
| 710 x 560  | 15  | 160 | 33,9   | 36,9          | 0,3450   | BF                 | 900 x 225  | -   | -   | 24,3   | 27,3          | 0,1452   | BFL                |
| 710 x 600  | 35  | 180 | 35,5   | 38,5          | 0,3726   | BF                 | 900 x 250  | -   | 5   | 25,5   | 28,5          | 0,1672   | BFL                |
| 710 x 630  | 50  | 195 | 36,7   | 39,7          | 0,3933   | BF                 | 900 x 280  | -   | 20  | 26,9   | 29,9          | 0,1936   | BFL                |
| 710 x 650  | 60  | 205 | 37,5   | 40,5          | 0,4071   | BF                 | 900 x 300  | -   | 30  | 27,9   | 30,9          | 0,2112   | BFL                |
| 710 x 700  | 85  | 230 | 39,5   | 42,5          | 0,4416   | BF                 | 900 x 315  | -   | 37  | 28,6   | 31,6          | 0,2244   | BFN                |
| 710 x 710  | 90  | 235 | 39,9   | 42,9          | 0,4485   | BF                 | 900 x 355  | -   | 57  | 30,4   | 33,4          | 0,2596   | BFN                |
| 710 x 750  | 110 | 255 | 41,5   | 44,5          | 0,4761   | BF                 | 900 x 400  | -   | 80  | 32,5   | 35,5          | 0,2992   | BFN                |
| 710 x 800  | 135 | 280 | 43,5   | 46,5          | 0,5106   | BF                 | 900 x 450  | -   | 105 | 34,9   | 37,9          | 0,3432   | BFN                |
| 710 x 900  | 185 | 330 | 47,5   | 50,5          | 0,5796   | BF                 | 900 x 500  | -   | 130 | 37,2   | 40,2          | 0,3872   | BF                 |
| 710 x 1000 | 235 | 380 | 51,5   | 54,5          | 0,6486   | BF                 | 900 x 550  | 10  | 155 | 39,6   | 42,6          | 0,4312   | BF                 |

| A x B       | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B        | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|-------------|-----|-----|--------|---------------|--|--------------------|--------------|-----|-----|--------|---------------|--|--------------------|
|             |     |     | Design |               |  |                    |              |     |     | Design |               |  |                    |
|             |     |     | Manual | Actuat. mech. |  |                    |              |     |     | Manual | Actuat. mech. |  |                    |
| 900 x 560   | 15  | 160 | 40,0   | 43,0          | 0,4400   | BF                 | 1250 x 225   | -   | -   | 31,4   | 34,4          | 0,2030   | BFL                |
| 900 x 600   | 35  | 180 | 41,9   | 44,9          | 0,4752   | BF                 | 1250 x 250   | -   | 5   | 32,8   | 35,8          | 0,2337   | BFL                |
| 900 x 630   | 50  | 195 | 43,3   | 46,3          | 0,5016   | BF                 | 1250 x 280   | -   | 20  | 34,6   | 37,6          | 0,2706   | BFN                |
| 900 x 650   | 60  | 205 | 44,3   | 47,3          | 0,5192   | BF                 | 1250 x 300   | -   | 30  | 35,8   | 38,8          | 0,2952   | BFN                |
| 900 x 700   | 85  | 230 | 46,6   | 49,6          | 0,5632   | BF                 | 1250 x 315   | -   | 37  | 36,7   | 39,7          | 0,3137   | BFN                |
| 900 x 710   | 90  | 235 | 47,1   | 50,1          | 0,5720   | BF                 | 1250 x 355   | -   | 57  | 39,1   | 42,1          | 0,3629   | BFN                |
| 900 x 750   | 110 | 255 | 48,9   | 51,9          | 0,6072   | BF                 | 1250 x 400   | -   | 80  | 41,8   | 44,8          | 0,4182   | BFN                |
| 900 x 800   | 135 | 280 | 51,3   | 54,3          | 0,6512   | BF                 | 1250 x 450   | -   | 105 | 44,7   | 47,7          | 0,4797   | BF                 |
| 900 x 900   | 185 | 330 | 56,0   | 59,0          | 0,7392   | BF                 | 1250 x 500   | -   | 130 | 47,7   | 50,7          | 0,5412   | BF                 |
| 900 x 1000  | 235 | 380 | 60,6   | 63,6          | 0,8272   | BF                 | 1250 x 550   | 10  | 155 | 50,7   | 53,7          | 0,6027   | BF                 |
| 1000 x 180  | -   | -   | 24,1   | 27,1          | 0,1176   | BFL                | 1250 x 560   | 15  | 160 | 51,3   | 54,3          | 0,6150   | BF                 |
| 1000 x 200  | -   | -   | 25,1   | 28,1          | 0,1372   | BFL                | 1250 x 600   | 35  | 180 | 53,6   | 56,6          | 0,6642   | BF                 |
| 1000 x 225  | -   | -   | 26,4   | 29,4          | 0,1617   | BFL                | 1250 x 630   | 50  | 195 | 55,4   | 58,4          | 0,7011   | BF                 |
| 1000 x 250  | -   | 5   | 27,6   | 30,6          | 0,1862   | BFL                | 1250 x 650   | 60  | 205 | 56,6   | 59,6          | 0,7257   | BF                 |
| 1000 x 280  | -   | 20  | 29,1   | 32,1          | 0,2156   | BFL                | 1250 x 700   | 85  | 230 | 59,6   | 62,6          | 0,7872   | BF                 |
| 1000 x 300  | -   | 30  | 30,1   | 33,1          | 0,2352   | BFN                | 1250 x 710   | 90  | 235 | 60,2   | 63,2          | 0,7995   | BF                 |
| 1000 x 315  | -   | 37  | 30,9   | 33,9          | 0,2499   | BFN                | 1250 x 750   | 110 | 255 | 62,6   | 65,6          | 0,8487   | BF                 |
| 1000 x 355  | -   | 57  | 32,9   | 35,9          | 0,2891   | BFN                | 1250 x 800   | 135 | 280 | 65,5   | 68,5          | 0,9102   | BF                 |
| 1000 x 400  | -   | 80  | 35,2   | 38,2          | 0,3332   | BFN                | 1250* x 900  | 185 | 330 | 71,5   | 74,5          | 1,0332   | BF                 |
| 1000 x 450  | -   | 105 | 37,7   | 40,7          | 0,3822   | BFN                | 1250* x 1000 | 235 | 380 | 77,4   | 80,4          | 1,1562   | BF                 |
| 1000 x 500  | -   | 130 | 40,2   | 43,2          | 0,4312   | BF                 | 1400 x 180   | -   | -   | 31,4   | 34,4          | 0,1656   | BFL                |
| 1000 x 550  | 10  | 155 | 42,7   | 45,7          | 0,4802   | BF                 | 1400 x 200   | -   | -   | 32,7   | 35,7          | 0,1932   | BFL                |
| 1000 x 560  | 15  | 160 | 43,2   | 46,2          | 0,4900   | BF                 | 1400 x 225   | -   | -   | 34,4   | 37,4          | 0,2277   | BFL                |
| 1000 x 600  | 35  | 180 | 45,3   | 48,3          | 0,5292   | BF                 | 1400 x 250   | -   | 5   | 36,0   | 39,0          | 0,2622   | BFN                |
| 1000 x 630  | 50  | 195 | 46,8   | 49,8          | 0,5586   | BF                 | 1400 x 280   | -   | 20  | 37,9   | 40,9          | 0,3036   | BFN                |
| 1000 x 650  | 60  | 205 | 47,8   | 50,8          | 0,5782   | BF                 | 1400 x 300   | -   | 30  | 39,2   | 42,2          | 0,3312   | BFN                |
| 1000 x 700  | 85  | 230 | 50,3   | 53,3          | 0,6272   | BF                 | 1400 x 315   | -   | 37  | 40,2   | 43,2          | 0,3519   | BFN                |
| 1000 x 710  | 90  | 235 | 50,8   | 53,8          | 0,6370   | BF                 | 1400 x 355   | -   | 57  | 42,8   | 45,8          | 0,4071   | BFN                |
| 1000 x 750  | 110 | 255 | 52,8   | 55,8          | 0,6762   | BF                 | 1400 x 400   | -   | 80  | 45,7   | 48,7          | 0,4692   | BF                 |
| 1000 x 800  | 135 | 280 | 55,3   | 58,3          | 0,7252   | BF                 | 1400 x 450   | -   | 105 | 48,9   | 51,9          | 0,5382   | BF                 |
| 1000 x 900  | 185 | 330 | 60,4   | 63,4          | 0,8232   | BF                 | 1400 x 500   | -   | 130 | 52,2   | 55,2          | 0,6072   | BF                 |
| 1000 x 1000 | 235 | 380 | 65,4   | 68,4          | 0,9212   | BF                 | 1400 x 550   | 10  | 155 | 55,4   | 58,4          | 0,6762   | BF                 |
| 1100 x 180  | -   | -   | 25,9   | 28,9          | 0,1296   | BFL                | 1400 x 560   | 15  | 160 | 56,1   | 59,1          | 0,6900   | BF                 |
| 1100 x 200  | -   | -   | 27,0   | 30,0          | 0,1512   | BFL                | 1400 x 600   | 35  | 180 | 58,7   | 61,7          | 0,7452   | BF                 |
| 1100 x 225  | -   | -   | 28,4   | 31,4          | 0,1782   | BFL                | 1400* x 630  | 50  | 195 | 60,6   | 63,6          | 0,7866   | BF                 |
| 1100 x 250  | -   | 5   | 29,7   | 32,7          | 0,2052   | BFL                | 1400* x 650  | 60  | 205 | 61,9   | 64,9          | 0,8142   | BF                 |
| 1100 x 280  | -   | 20  | 31,3   | 34,3          | 0,2376   | BFL                | 1400* x 700  | 85  | 230 | 65,2   | 68,2          | 0,8832   | BF                 |
| 1100 x 300  | -   | 30  | 32,4   | 35,4          | 0,2592   | BFN                | 1400* x 710  | 90  | 235 | 65,8   | 68,8          | 0,8970   | BF                 |
| 1100 x 315  | -   | 37  | 33,2   | 36,2          | 0,2754   | BFN                | 1400* x 750  | 110 | 255 | 68,4   | 71,4          | 0,9522   | BF                 |
| 1100 x 355  | -   | 57  | 35,4   | 38,4          | 0,3186   | BFN                | 1400* x 800  | 135 | 280 | 71,6   | 74,6          | 1,0212   | BF                 |
| 1100 x 400  | -   | 80  | 37,8   | 40,8          | 0,3672   | BFN                | 1400* x 900  | 185 | 330 | 78,1   | 81,1          | 1,1592   | BF                 |
| 1100 x 450  | -   | 105 | 40,5   | 43,5          | 0,4212   | BF                 | 1400* x 1000 | 235 | 380 | 84,6   | 87,6          | 1,2972   | BF                 |
| 1100 x 500  | -   | 130 | 43,2   | 46,2          | 0,4752   | BF                 | 1500 x 180   | -   | -   | 33,3   | 36,3          | 0,1776   | BFL                |
| 1100 x 550  | 10  | 155 | 45,9   | 48,9          | 0,5292   | BF                 | 1500 x 200   | -   | -   | 34,7   | 37,7          | 0,2072   | BFL                |
| 1100 x 560  | 15  | 160 | 46,5   | 49,5          | 0,5400   | BF                 | 1500 x 225   | -   | -   | 36,4   | 39,4          | 0,2442   | BFL                |
| 1100 x 600  | 35  | 180 | 48,6   | 51,6          | 0,5832   | BF                 | 1500 x 250   | -   | 5   | 38,1   | 41,1          | 0,2812   | BFN                |
| 1100 x 630  | 50  | 195 | 50,2   | 53,2          | 0,6156   | BF                 | 1500 x 280   | -   | 20  | 40,1   | 43,1          | 0,3256   | BFN                |
| 1100 x 650  | 60  | 205 | 51,3   | 54,3          | 0,6372   | BF                 | 1500 x 300   | -   | 30  | 41,5   | 44,5          | 0,3552   | BFN                |
| 1100 x 700  | 85  | 230 | 54,0   | 57,0          | 0,6912   | BF                 | 1500 x 315   | -   | 37  | 42,5   | 45,5          | 0,3774   | BFN                |
| 1100 x 710  | 90  | 235 | 54,6   | 57,6          | 0,7020   | BF                 | 1500 x 355   | -   | 57  | 45,3   | 48,3          | 0,4366   | BFN                |
| 1100 x 750  | 110 | 255 | 56,7   | 59,7          | 0,7452   | BF                 | 1500 x 400   | -   | 80  | 48,3   | 51,3          | 0,5032   | BF                 |
| 1100 x 800  | 135 | 280 | 59,4   | 62,4          | 0,7992   | BF                 | 1500 x 450   | -   | 105 | 51,8   | 54,8          | 0,5772   | BF                 |
| 1100 x 900  | 185 | 330 | 64,8   | 67,8          | 0,9072   | BF                 | 1500 x 500   | -   | 130 | 55,2   | 58,2          | 0,6512   | BF                 |
| 1100 x 1000 | 235 | 380 | 70,2   | 73,2          | 1,0152   | BF                 | 1500 x 550   | 10  | 155 | 58,6   | 61,6          | 0,7252   | BF                 |
| 1250 x 180  | -   | -   | 28,7   | 31,7          | 0,1476   | BFL                | 1500 x 560   | 15  | 160 | 59,3   | 62,3          | 0,7400   | BF                 |
| 1250 x 200  | -   | -   | 29,9   | 32,9          | 0,1722   | BFL                | 1500 x 600   | 35  | 180 | 62,0   | 65,0          | 0,7992   | BF                 |

| A x B        | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type | A x B        | a   | c   | Weight |               | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuat. mech. type |
|--------------|-----|-----|--------|---------------|--|--------------------|--------------|-----|-----|--------|---------------|--|--------------------|
|              |     |     | Design |               |  |                    |              |     |     | Design |               |  |                    |
|              |     |     | Manual | Actuat. mech. |  |                    |              |     |     | Manual | Actuat. mech. |  |                    |
| 1500* x 630  | 50  | 195 | 64,1   | 67,1          | 0,8436   | BF                 | 1600 x 355   | -   | 57  | 47,7   | 50,7          | 0,4661   | BFN                |
| 1500* x 650  | 60  | 205 | 65,4   | 68,4          | 0,8732   | BF                 | 1600 x 400   | -   | 80  | 51,0   | 54,0          | 0,5372   | BF                 |
| 1500* x 700  | 85  | 230 | 68,9   | 71,9          | 0,9472   | BF                 | 1600 x 450   | -   | 105 | 54,6   | 57,6          | 0,6162   | BF                 |
| 1500* x 710  | 90  | 235 | 69,6   | 72,6          | 0,9620   | BF                 | 1600 x 500   | -   | 130 | 58,2   | 61,2          | 0,6952   | BF                 |
| 1500* x 750  | 110 | 255 | 72,3   | 75,3          | 1,0212   | BF                 | 1600 x 550   | 10  | 155 | 61,8   | 64,8          | 0,7742   | BF                 |
| 1500* x 800  | 135 | 280 | 75,7   | 78,7          | 1,0952   | BF                 | 1600 x 560   | 15  | 160 | 62,5   | 65,5          | 0,7900   | BF                 |
| 1500* x 900  | 185 | 330 | 82,6   | 85,6          | 1,2432   | BF                 | 1600 x 600   | 35  | 180 | 65,4   | 68,4          | 0,8532   | BF                 |
| 1500* x 1000 | 235 | 380 | 89,4   | 92,4          | 1,3912   | BF                 | 1600* x 630  | 50  | 195 | 67,5   | 70,5          | 0,9006   | BF                 |
| 1600 x 180   | -   | -   | 35,1   | 38,1          | 0,1896   | BFL                | 1600* x 650  | 60  | 205 | 69,0   | 72,0          | 0,9322   | BF                 |
| 1600 x 200   | -   | -   | 36,6   | 39,6          | 0,2212   | BFL                | 1600* x 700  | 85  | 230 | 72,6   | 75,6          | 1,0112   | BF                 |
| 1600 x 225   | -   | -   | 38,4   | 41,4          | 0,2607   | BFL                | 1600* x 710  | 90  | 235 | 73,3   | 76,3          | 1,0270   | BF                 |
| 1600 x 250   | -   | 5   | 40,2   | 43,2          | 0,3002   | BFN                | 1600* x 750  | 110 | 255 | 76,2   | 79,2          | 1,0902   | BF                 |
| 1600 x 280   | -   | 20  | 42,3   | 45,3          | 0,3476   | BFN                | 1600* x 800  | 135 | 280 | 79,8   | 82,8          | 1,1692   | BF                 |
| 1600 x 300   | -   | 30  | 43,8   | 46,8          | 0,3792   | BFN                | 1600* x 900  | 185 | 330 | 87,0   | 90,0          | 1,3272   | BF                 |
| 1600 x 315   | -   | 37  | 44,8   | 47,8          | 0,4029   | BFN                | 1600* x 1000 | 235 | 380 | 94,2   | 97,2          | 1,4852   | BF                 |

\* for these dimensions are used two closing springs

#### 4.4. Round dampers - weight and dimensions

Tab. 4.4.1. Round dampers - weight and dimensions

| Nominal size øD | e   | f   | g   | h   | Weight |              | Effective area S <sub>ef</sub> [m <sup>2</sup> ] | Actuating mechanism type |
|-----------------|-----|-----|-----|-----|--------|--------------|--|--------------------------|
|                 |     |     |     |     | design |              |  |                          |
|                 |     |     |     |     | manual | act. mechan. |  |                          |
| 180             | -   | -   | -   | -   | 7,0    | 8,5          | 0,0137   | BFL                      |
| 200             | -   | -   | -   | -   | 8,0    | 9,5          | 0,0182   | BFL                      |
| 225             | -   | -   | -   | -   | 8,5    | 10,0         | 0,0248   | BFL                      |
| 250             | -   | 5   | -   | -   | 9,0    | 10,5         | 0,0323   | BFL                      |
| 280             | -   | 20  | -   | -   | 10,0   | 11,5         | 0,0427   | BFL                      |
| 315             | -   | 37  | -   | -   | 11,0   | 12,5         | 0,0565   | BFL                      |
| 355             | -   | 57  | -   | 7   | 13,0   | 14,5         | 0,0747   | BFL                      |
| 400             | -   | 80  | -   | 30  | 15,0   | 18,0         | 0,0982   | BFL                      |
| 450             | -   | 105 | -   | 55  | 17,0   | 20,0         | 0,1279   | BFN                      |
| 500             | -   | 130 | -   | 80  | 20,0   | 23,0         | 0,1617   | BFN                      |
| 560             | 15  | 160 | -   | 110 | 23,0   | 26,0         | 0,2073   | BFN                      |
| 630             | 50  | 195 | -   | 145 | 27,0   | 30,0         | 0,2677   | BF                       |
| 710             | 90  | 235 | 40  | 185 | 32,0   | 35,0         | 0,3461   | BF                       |
| 800             | 135 | 280 | 85  | 230 | 38,0   | 41,0         | 0,4464   | BF                       |
| 900             | 185 | 330 | 135 | 280 | 56,0   | 59,0         | 0,5727   | BF                       |
| 1000            | 235 | 380 | 185 | 330 | 74,0   | 77,0         | 0,7147   | BF                       |

**Notice:** For the design .60 (with BKN supply and communication device) add to weight of the damper with an actuating mechanism (from the Tab. 4.3.1. and 4.4.1.) the weight of BKN (0.5 kg).

4.5. Blades overlaps

Tab. 4.5.1 Blades overlaps

| Blades overlaps                 |                             | Dimension | Overlaps   |
|---------------------------------|-----------------------------|-----------|------------|
| RECTANGULAR DAMPERS<br>Fig. 36a | Act. mechanism side         | "a"       | Tab. 4.3.1 |
|                                 | Side without act. mechanism | "c"       | Tab. 4.3.1 |
| ROUND DAMPERS<br>Fig. 36b       | Act. mechanism side         | "e"       | Tab. 4.4.1 |
|                                 | Side without act. mechanism | "f"       | Tab. 4.4.1 |
| ROUND DAMPERS SPIRO<br>Fig. 33c | Act. mechanism side         | "g"       | Tab. 4.4.1 |
|                                 | Side without act. mechanism | "h"       | Tab. 4.4.1 |

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

Fig. 36a Blade overlaps - rectangular damper

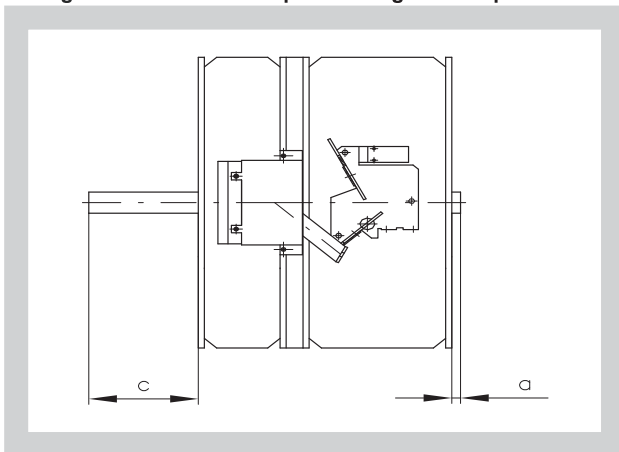


Fig. 36b Blade overlaps - round damper

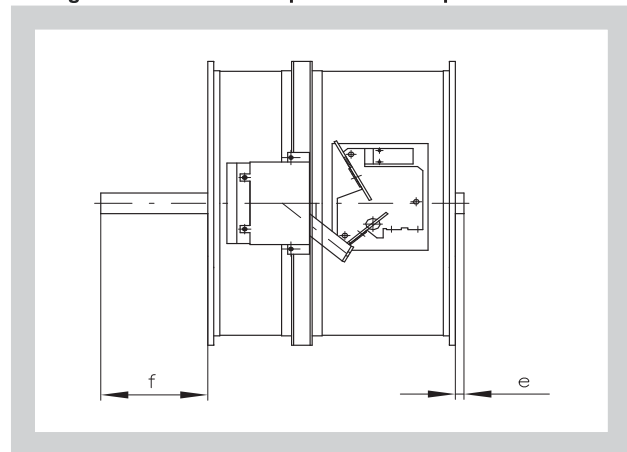
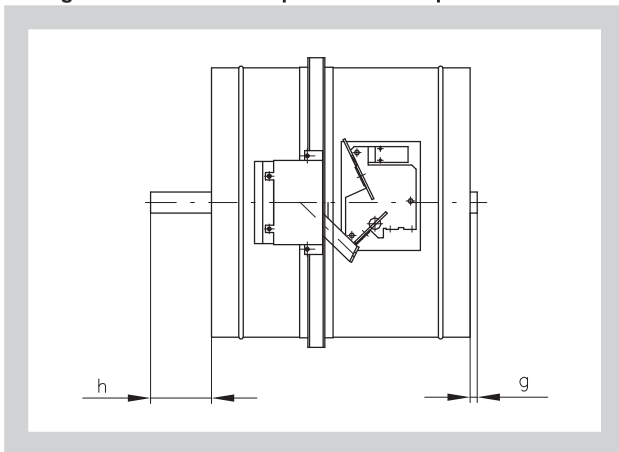


Fig. 36c Blade overlaps - round damper SPIRO



- 4.6. For the design .60 (with BKN supply and communication device) add to weight of the damper with an actuating mechanism (from the Tab. 4.3.1. and 4.4.1.) the weight of BKN (0.5 kg).
- 4.7. rectangular dampers can be supplied on the customer´s demands in all subdimension of the above mentioned range.
- 4.8. Flanges of rectangular fire dampers are 30 mm wide with oval hole (Fig. 37). Dimensions of damper connecting flanges are in accordance with EN 12 220. In case of damper installation into SPIRO duct, round dampers are supplied without the flanges so as it is possible to connect them with external joints (it is necessary to specify this requirement in the order). Damper length for SPIRO duct is 475 mm (Fig. 38).

Fig. 37 Flage of rectangular damper

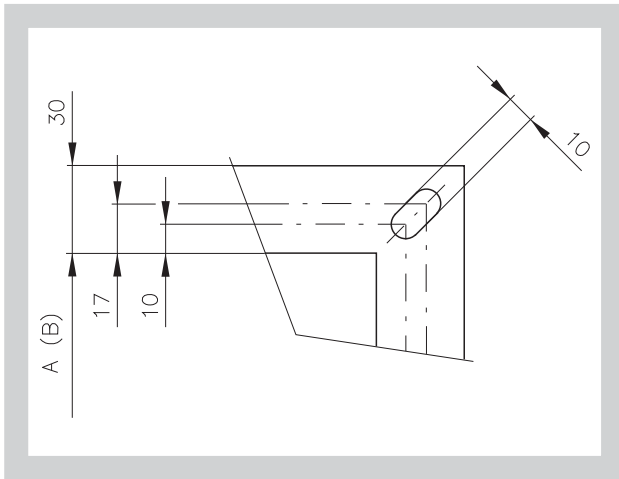
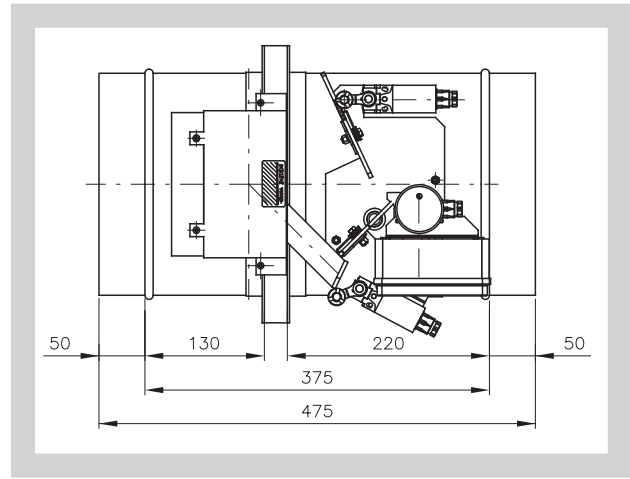


Fig. 38 Damper for SPIRO duct



**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 (see Fig. 40).

The distance between the fire damper and the construction (wall, ceiling) must be minimal in range from 10 to 50 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 50 mm.

Exceptions are given in chapter 6.

Fig. 39 The distance between the fire damper and the construction

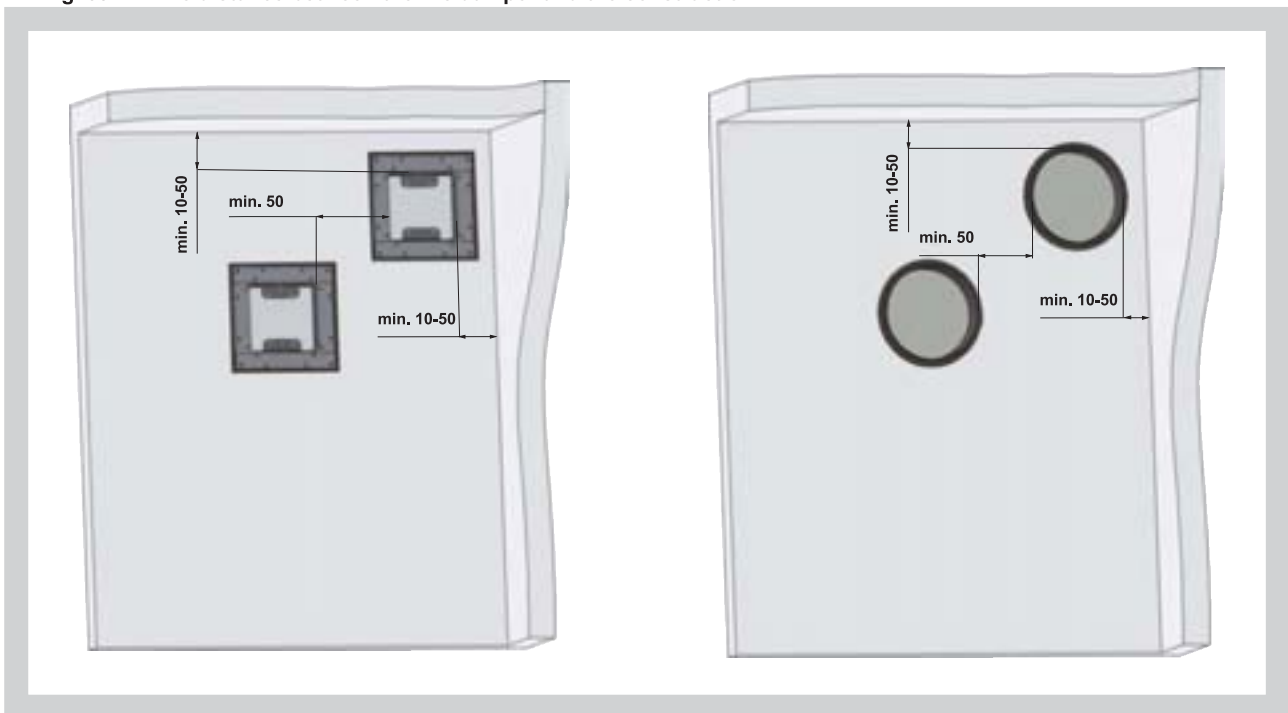
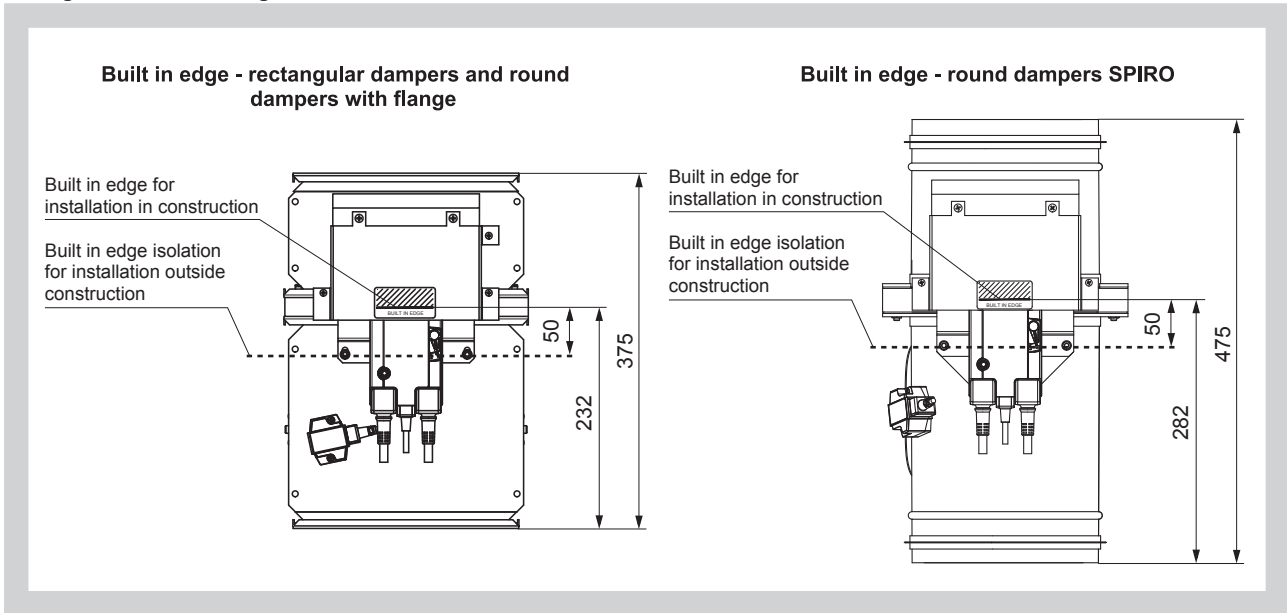


Fig. 40 Built in edge



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.

5.3. Installation opening dimensions

Fig. 41 Installation opening

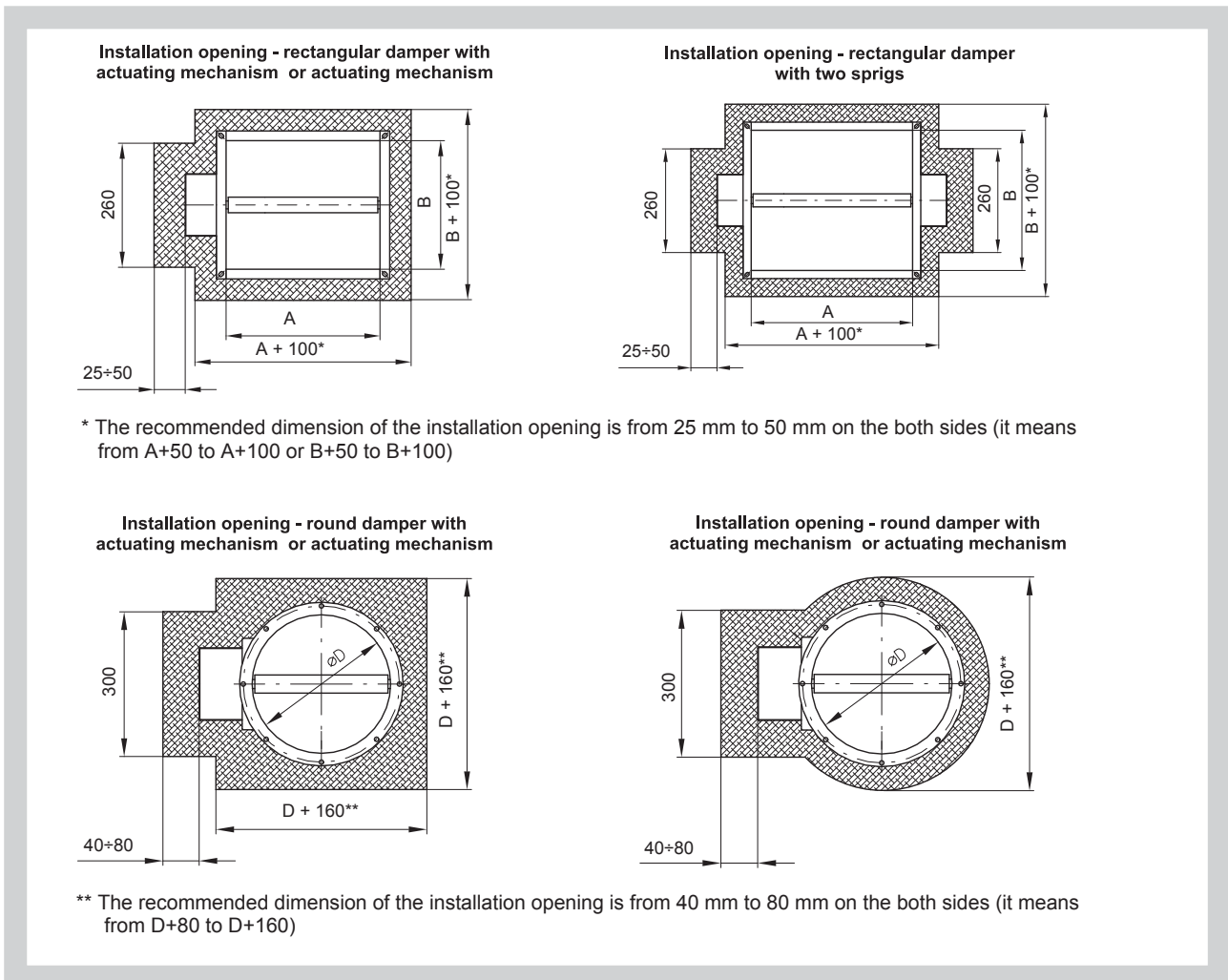
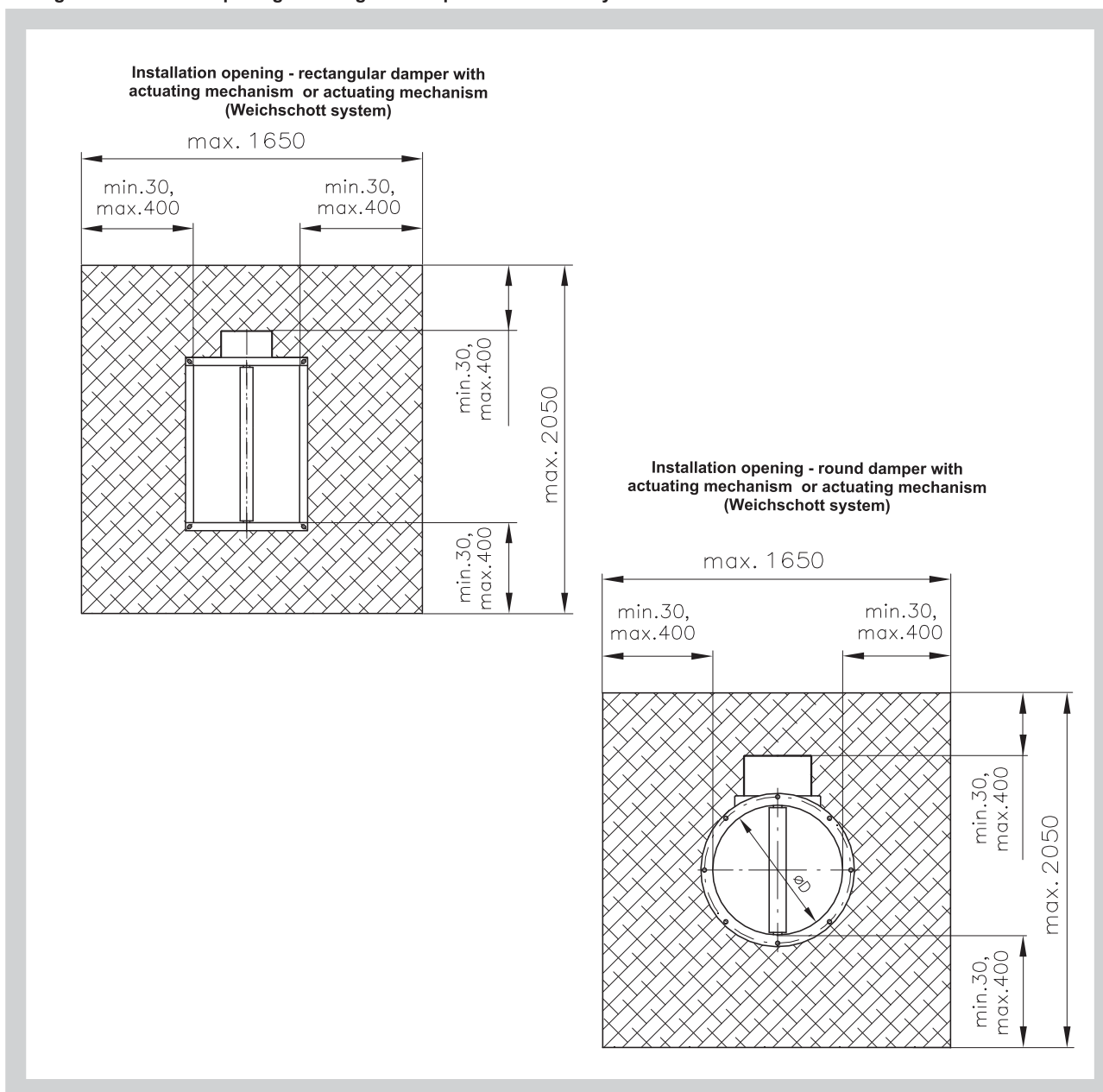


Fig. 42 Installation opening - rectangular damper Weichschott system



**5.4. Examples of fire damper installing**

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

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

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

If is rectangular damper installed outside a construction it is necessary to use reinforcement VRM for dampers with dimension A ≥ 800 mm.



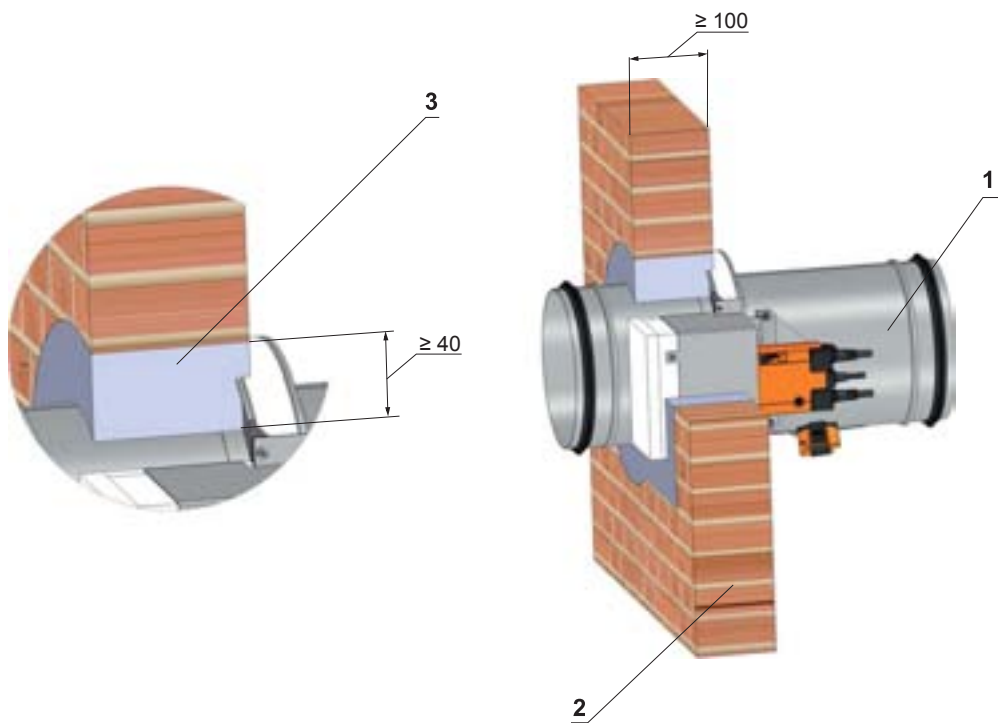
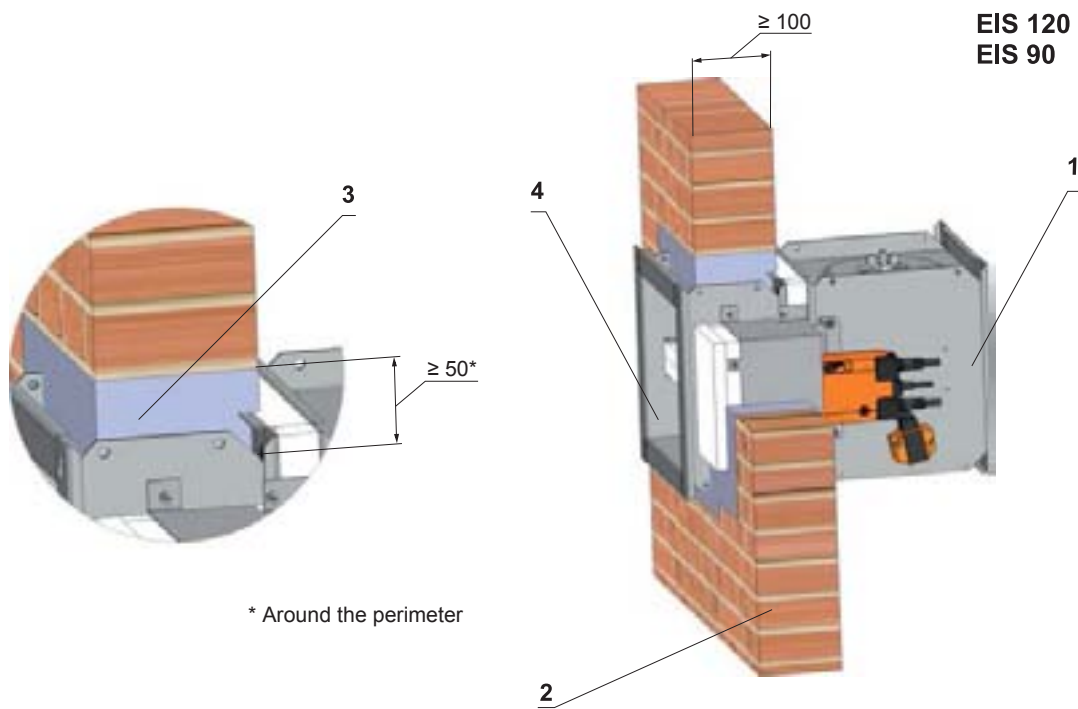
## 6 Statement of installations

### 6.1. Statement of installations the fire dampers FDMA and their fire resistance Tab. 6.1.1.

Tab. 6.1.1. Statement of installations

| Fire separating construction       | Wall/Ceiling        | Installation                                  | Fire resistance            | Page |
|------------------------------------|---------------------|---|----------------------------|------|
|                                    | Min. thickness [mm] |   |                            |      |
| Solid wall construction            | 100                 | Mortar or gypsum                              | EIS 120<br>EIS 90          | 34   |
|                                    | 100                 | Stuffing box + mastic and cement lime plate   | EIS 90                     | 35   |
|                                    | 100                 | Weichschott                                   | EIS 90                     | 36   |
|                                    | 100                 | Fire resistant foam covered by stucco plaster | EIS 60<br>EIS 45<br>EIS 30 | 47   |
| Solid ceiling construction         | 110                 | Mortar or gypsum                              | EIS 120<br>EIS 90          | 38   |
|                                    | 110                 | Stuffing box + mastic and cement lime plate   | EIS 90                     | 39   |
|                                    | 110                 | Weichschott                                   | EIS 90                     | 40   |
| Gypsum wall construction           | 100                 | Mortar or gypsum                              | EIS 120<br>EIS 90          | 42   |
|                                    | 100                 | Stuffing box + mastic and cement lime plate   | EIS 90                     | 43   |
|                                    | 100                 | Weichschott                                   | EIS 90                     | 44   |
|                                    | 100                 | Fire resistant foam covered by stucco plaster | EIS 60<br>EIS 45<br>EIS 30 | 48   |
| Outside solid wall construction    | 100                 | Insulating mineral wool                       | EIS 90                     | 37   |
|                                    | 100                 | Insulating mineral wool - Mortar or gypsum    | EIS 60<br>EIS 45           | 49   |
|                                    | 100                 | Insulating mineral wool - stone wool + mastic | EIS 60<br>EIS 45           | 50   |
| Outside gypsum wall construction   | 100                 | Insulating mineral wool                       | EIS 90                     | 45   |
|                                    | 100                 | Insulating mineral wool - Mortar or gypsum    | EIS 60<br>EIS 45           | 51   |
|                                    | 100                 | Insulating mineral wool - stone wool + mastic | EIS 60<br>EIS 45           | 52   |
| Outside solid ceiling construction | 110                 | Insulating mineral wool                       | EIS 90                     | 41   |

Fig. 43 Solid wall construction - mortar or gypsum



POSITION:

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

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

Fig. 44 Solid wall construction - stuffing box, fire protection mastic and cement lime plate

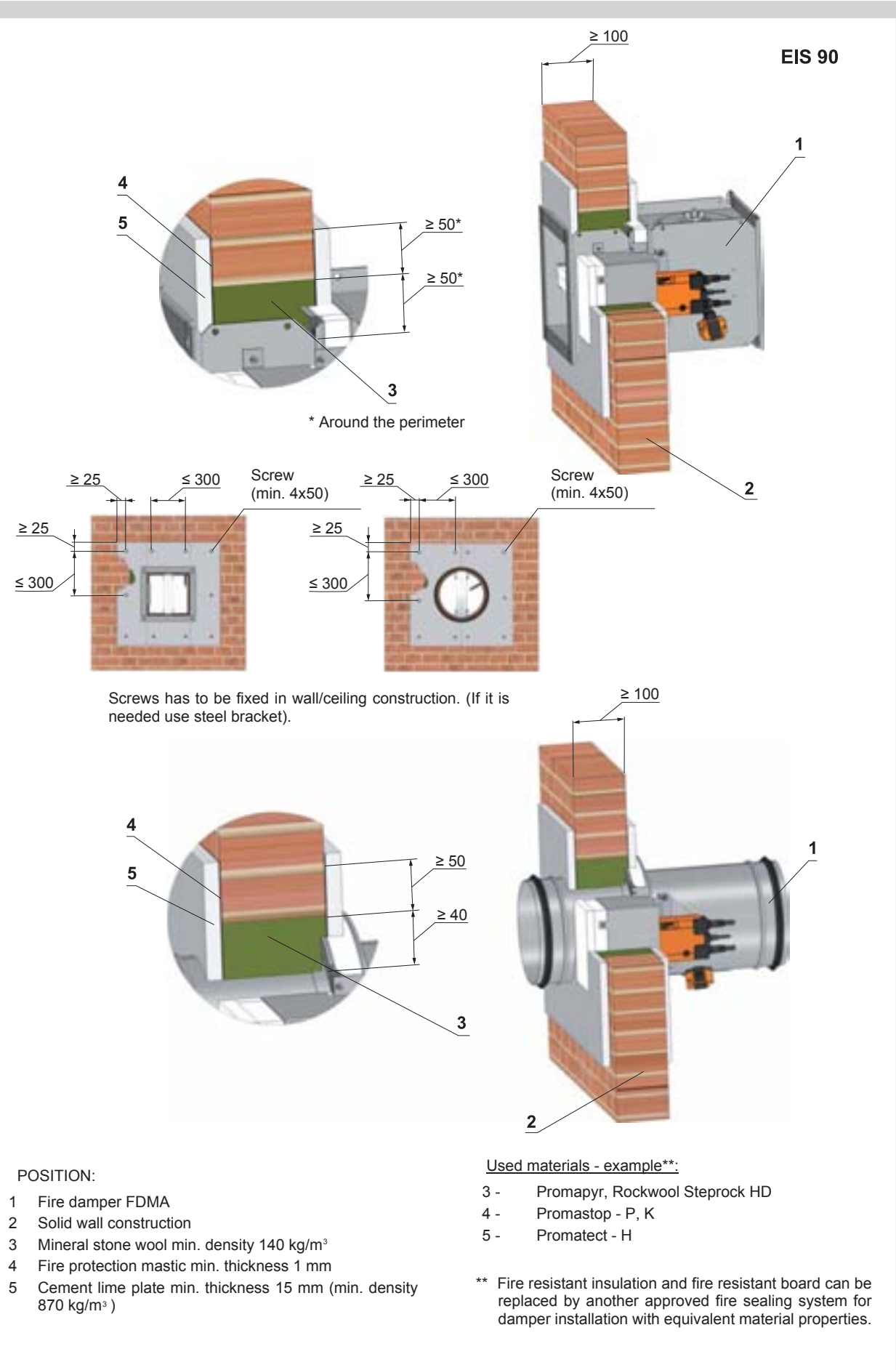
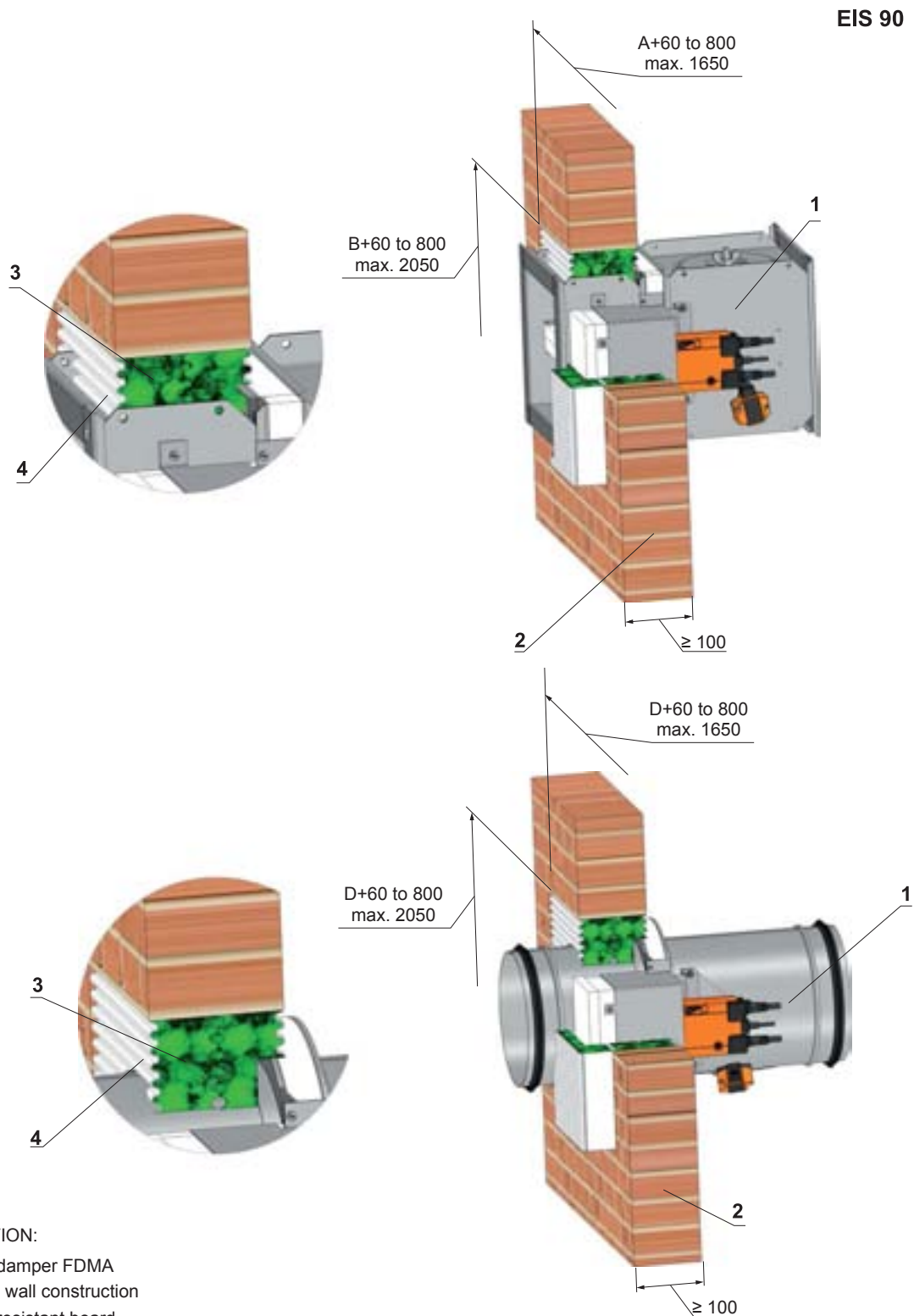


Fig. 45 Solid wall construction - Weichschott



POSITION:

- 1 Fire damper FDMA
- 2 Solid wall construction
- 3 Fire resistant board
- 4 Fire stop coating thickness 1 mm

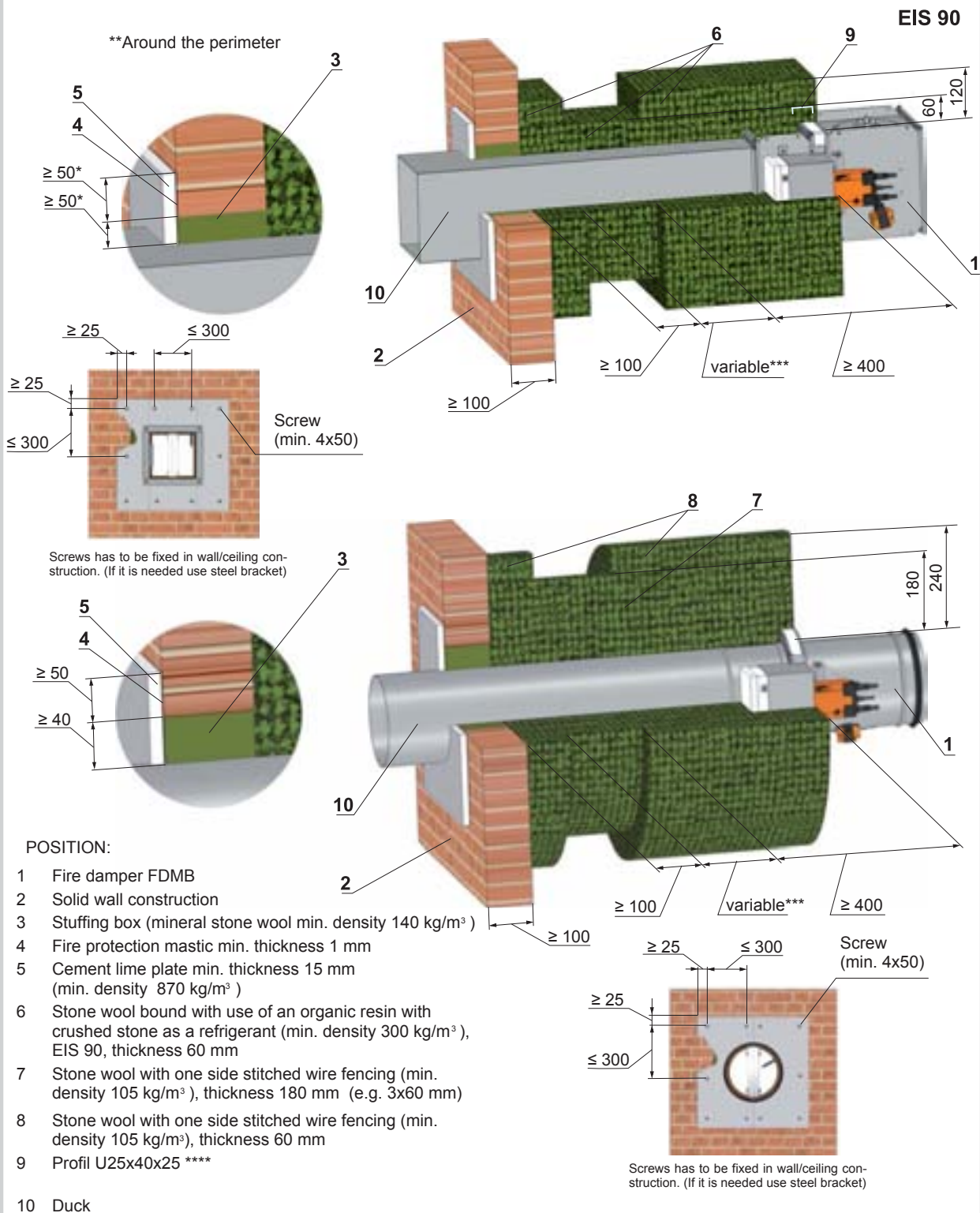
Used materials - example\*:

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

**Notice:**

\* Fire resistant insulation and fire resistant board can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

Fig. 46 Installation outside of solid wall construction - mineral wool



POSITION:

- 1 Fire damper FDMB
- 2 Solid wall construction
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Cement lime plate min. thickness 15 mm (min. density 870 kg/m<sup>3</sup>)
- 6 Stone wool bound with use of an organic resin with crushed stone as a refrigerant (min. density 300 kg/m<sup>3</sup>), EIS 90, thickness 60 mm
- 7 Stone wool with one side stitched wire fencing (min. density 105 kg/m<sup>3</sup>), thickness 180 mm (e.g. 3x60 mm)
- 8 Stone wool with one side stitched wire fencing (min. density 105 kg/m<sup>3</sup>), thickness 60 mm
- 9 Profil U25x40x25 \*\*\*\*
- 10 Duck

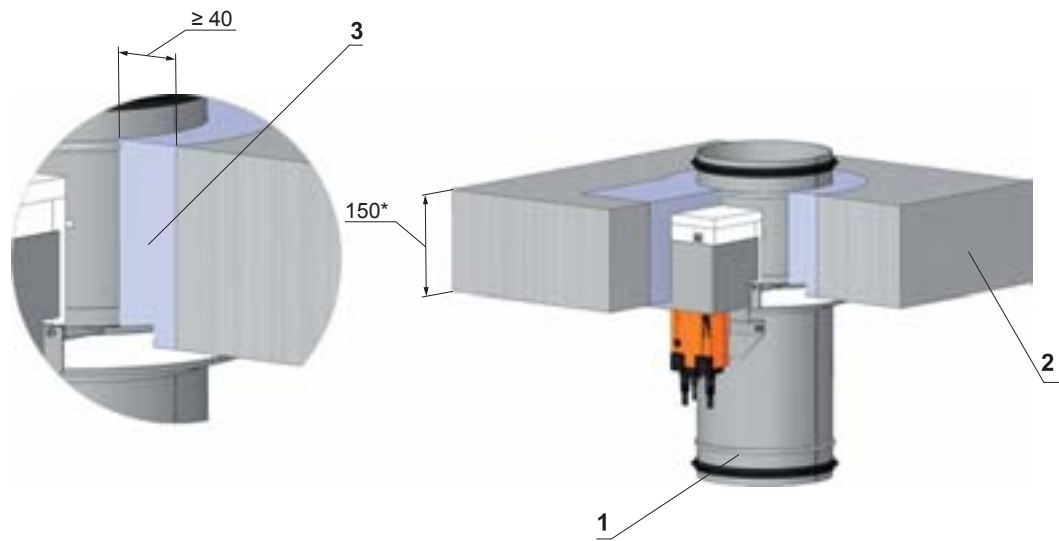
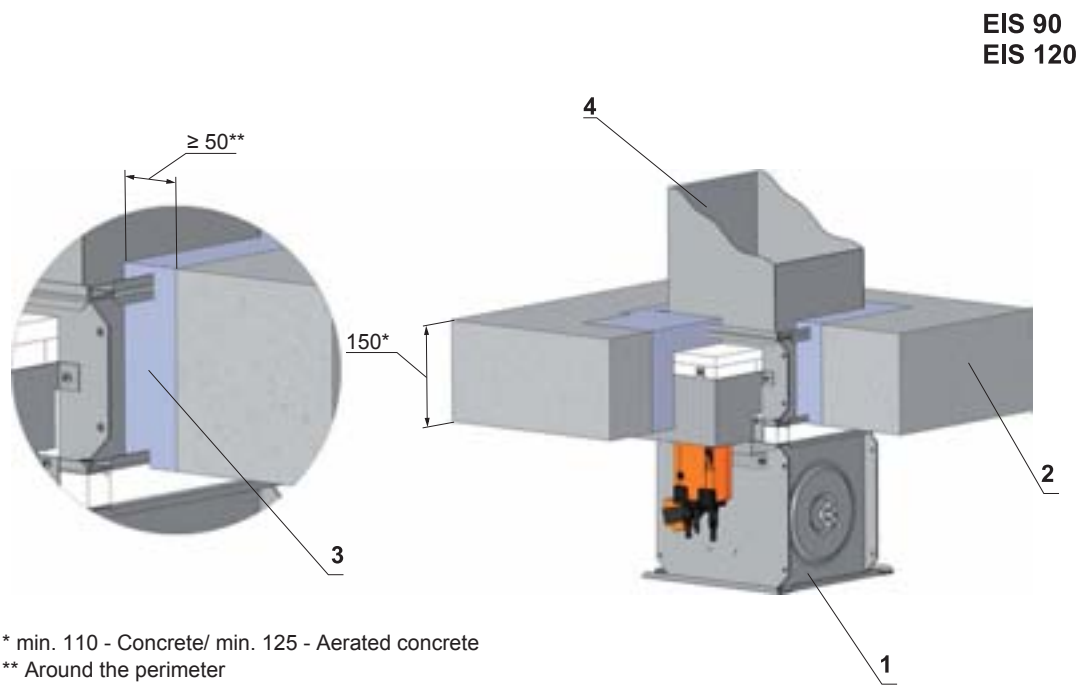
Used materials - example\*\*:

- 3 - Promapyr, Rockwool Steprock HD
- 4 - Promastop - P, K
- 5 - Promatect - H
- 6 - Rockwool Conlit Ductrock EIS 90, Dicke 60 mm
- 7 - Rockwool Wired Mat 105 Dicke 3x60 mm
- 8 - Rockwool Wired Mat 105 Dicke 60 mm

Notice:

- \*\* Stuffing box, fire protection mastic, cement lime plate and insulation materials can be replaced by another approved fire sealing system for damper installation with equivalent material properties.
- \*\*\* Depends on the distance of the flap from the construction, when the maximum distance from the construct is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.
- \*\*\*\* Installation of profile U25x40x25 see Fig.56

Fig. 47 Solid wall construction - stuffing box and fire protection mastic

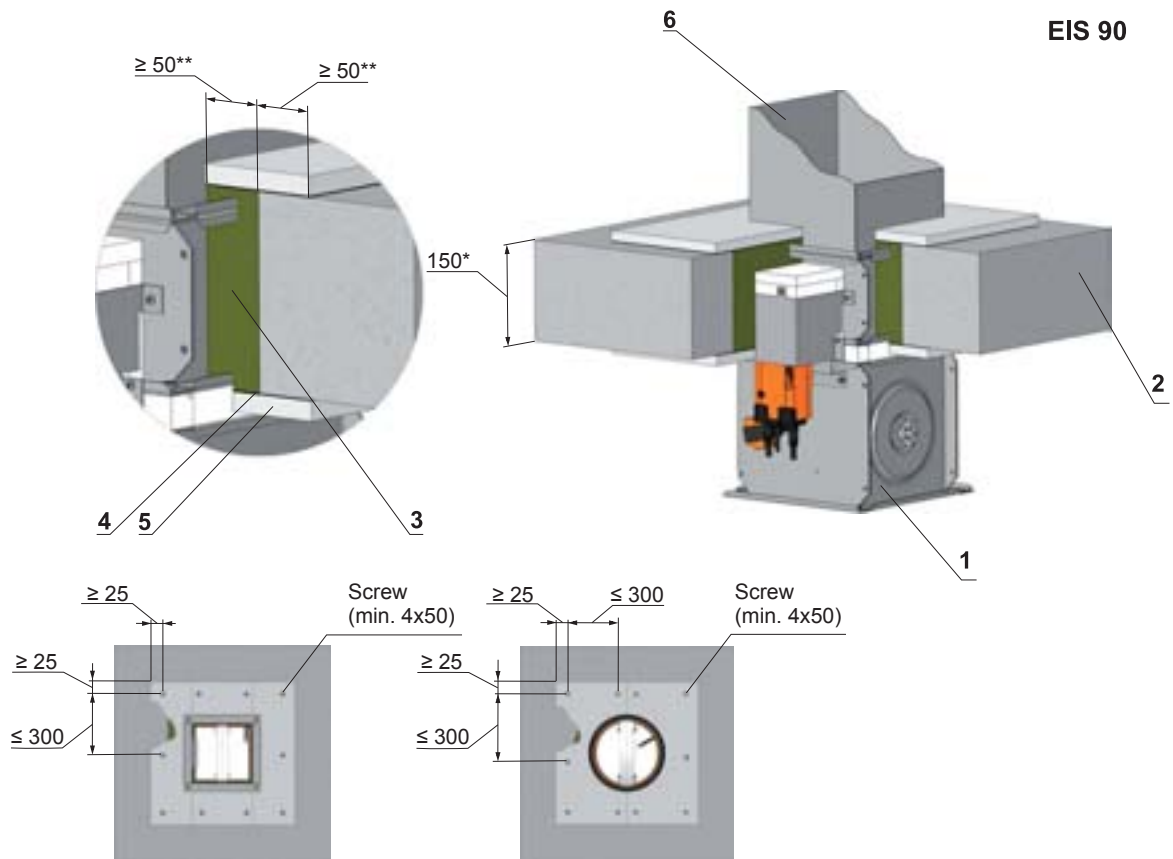


POSITION:

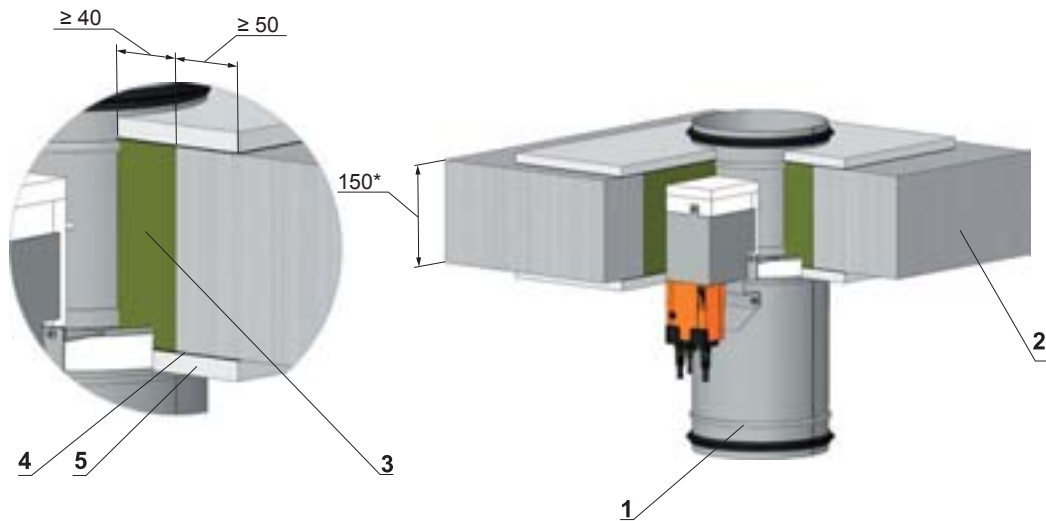
- 1 Fire damper FDMA
- 2 Solid ceiling construction
- 3 Mortar or gypsum
- 4 Duct

**Notice:** The requirement to EIS 120 must be specified in the order alone. Without specification is supplied the standard flap EIS90.

Fig. 48 Solid ceiling construction - stuffing box, fire protection mastic and cement lime plate



Screws has to be fixed in wall/ceiling construction. (If it is min. 110 - Concrete/ min. 125 - Aerated concrete needed use steel bracket).  
 \*\* Around the perimeter



POSITION:

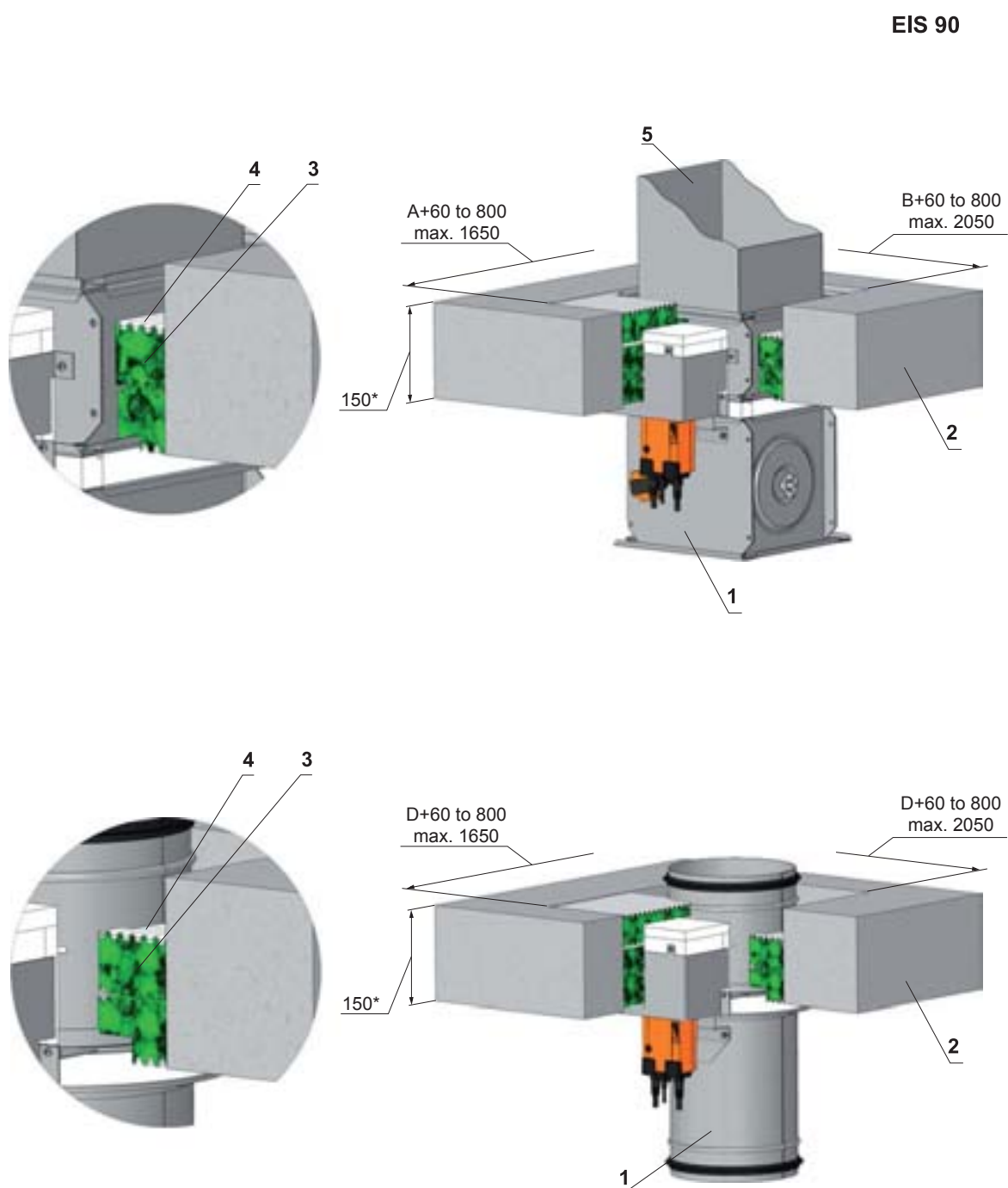
- 1 Fire damper FDMA
- 2 Solid ceiling construction
- 3 Mineral stone wool min. density 140 kg/m<sup>3</sup>
- 4 Fire protection mastic min. thickness 1 mm
- 5 Cement lime plate min. thickness 15 mm (min. density 870 kg/m<sup>3</sup>)
- 6 Duct

Used materials - example\*\*:

- 3 - Promapyr, Rockwool Steprock HD
- 4 - Promastop - P, K
- 5 - Promatect - H

\*\* Fire resistant insulation and fire resistant board can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

Fig. 49 Solid ceiling construction - Weichschott



EIS 90

POSITION:

- 1 Fire damper FDMA
- 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

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

Notice:

\*\* Fire resistant insulation and fire resistant board can be replaced by another approved fire sealing system for damper installation with equivalent material properties.



Fig. 50 Installation outside of solid ceiling construction - mineral wool

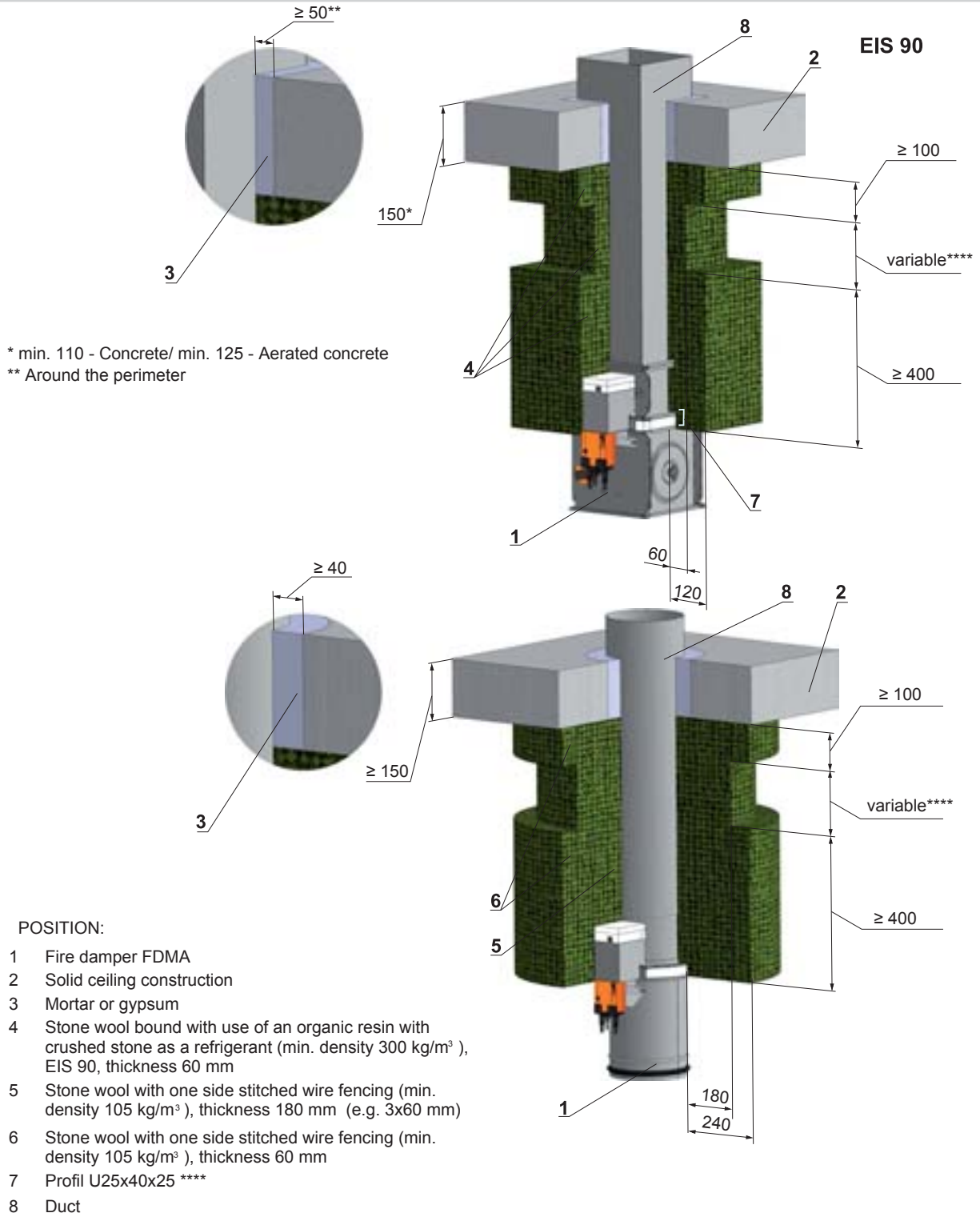
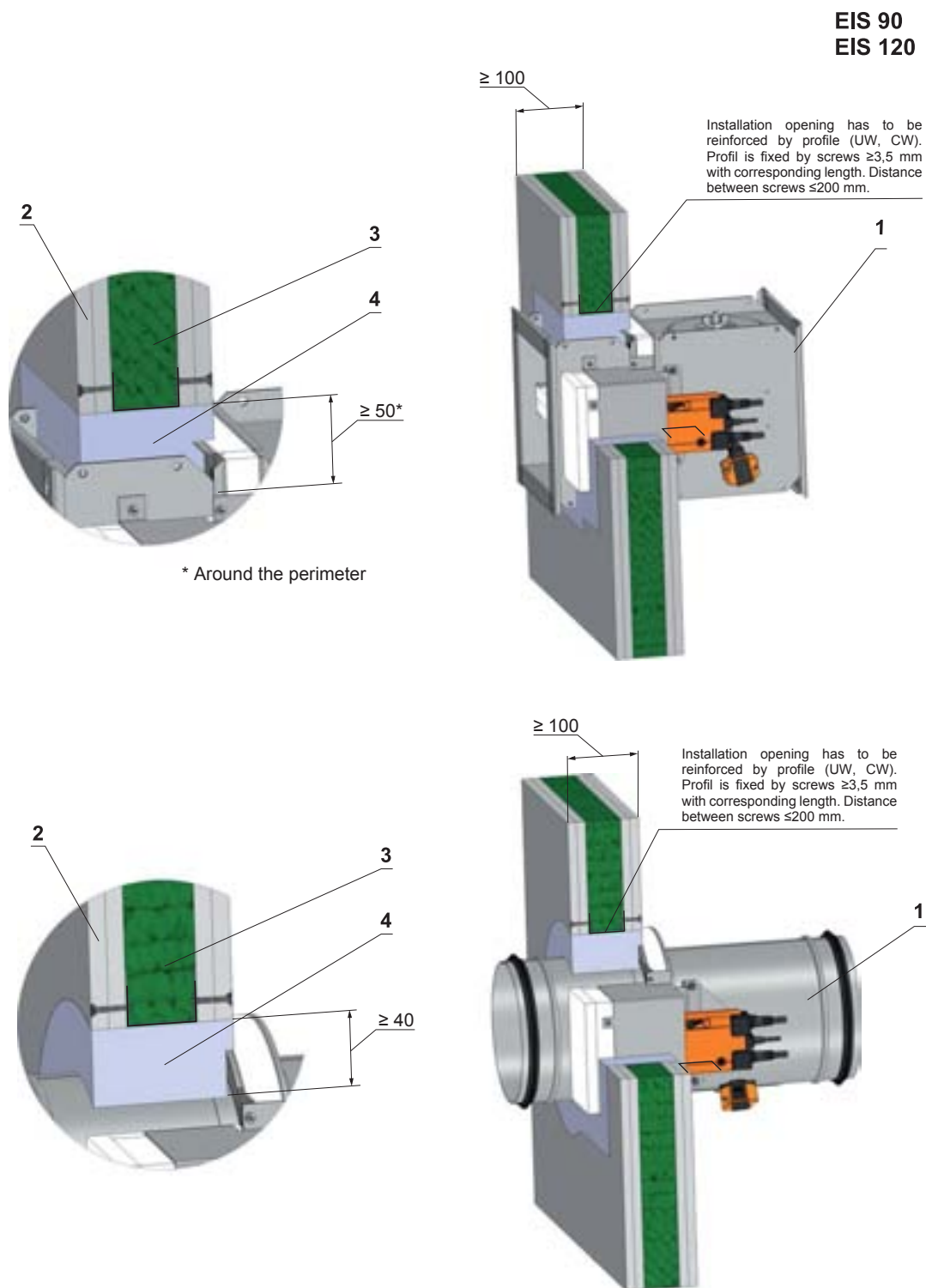


Fig. 51 Gypsum wall construction - mortar or gypsum

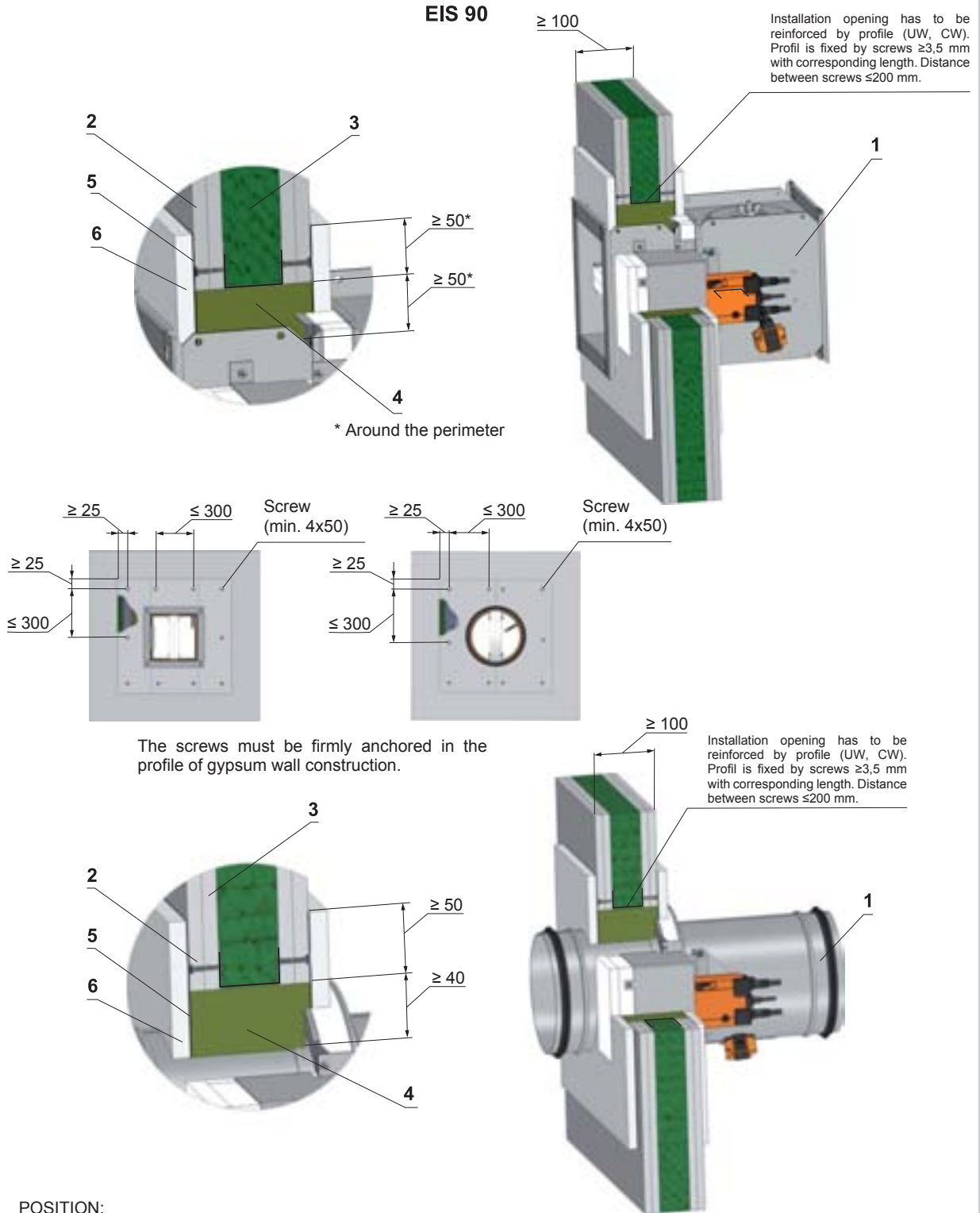


POSITION:

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

**Notice:** The requirement to EIS 120 must be specified in the order alone. Without specification is supplied the standard flap EIS90.

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



POSITION:

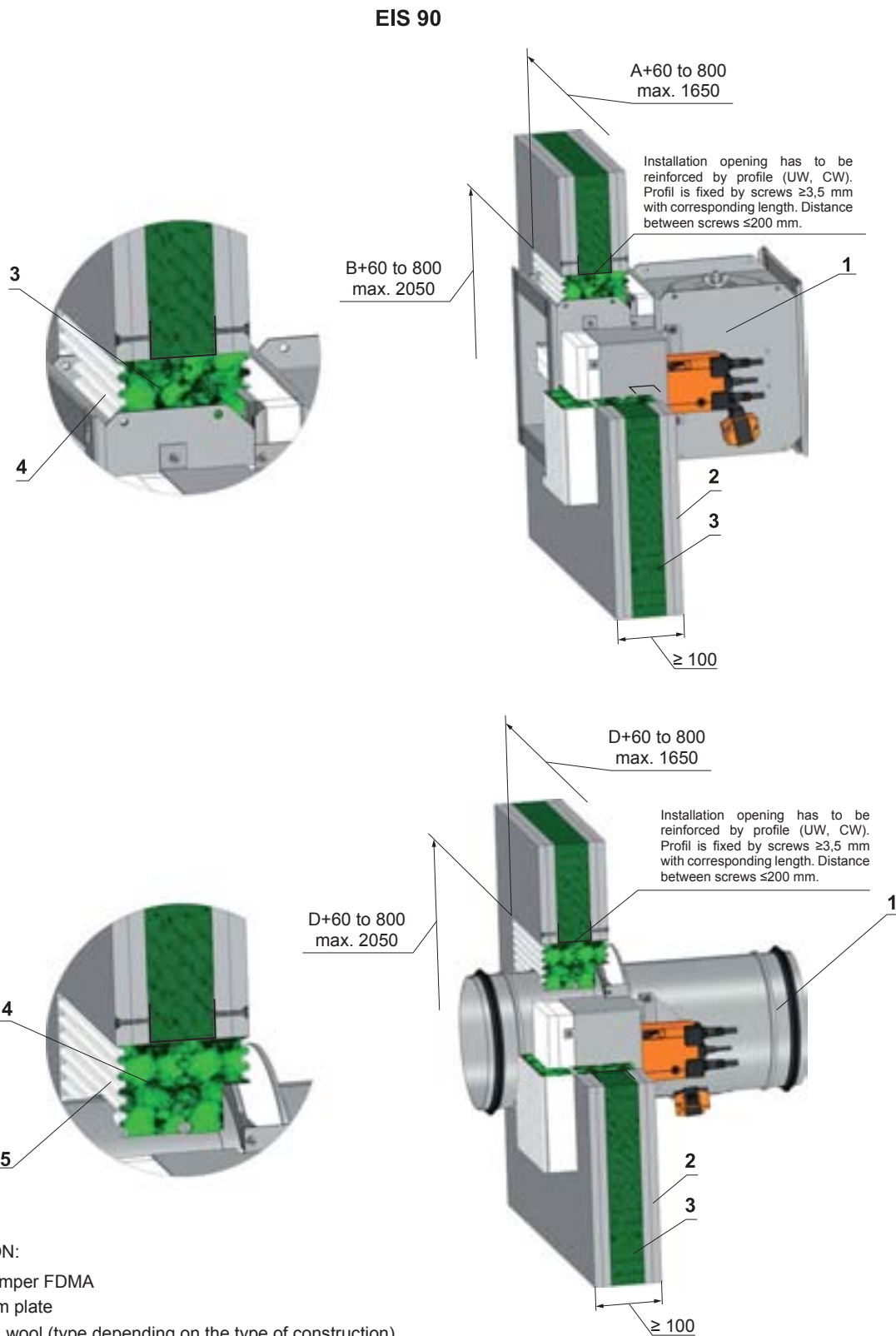
- 1 Fire damper FDMA
- 2 Gypsum plate
- 3 Solid ceiling construction
- 4 Mineral stone wool min. density 140 kg/m<sup>3</sup>
- 5 Fire protection mastic min. thickness 1 mm
- 6 Cement lime plate min. thickness 15 mm (min. density 870 kg/m<sup>3</sup>)

Used materials - example\*:

- 3 - Promapyr, Rockwool Steprock HD
- 4 - Promastop - P, K
- 5 - Promatect - H

\* Fire resistant insulation and fire resistant board can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

Fig. 53 Gypsum wall construction - Weichschott



Used materials - example\*:

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

**Notice:**

\* Fire resistant insulation and fire resistant board can be replaced by another approved fire sealing system for damper installation with equivalent material properties.

Fig. 54 Installation outside of gypsum wall construction - mineral wool

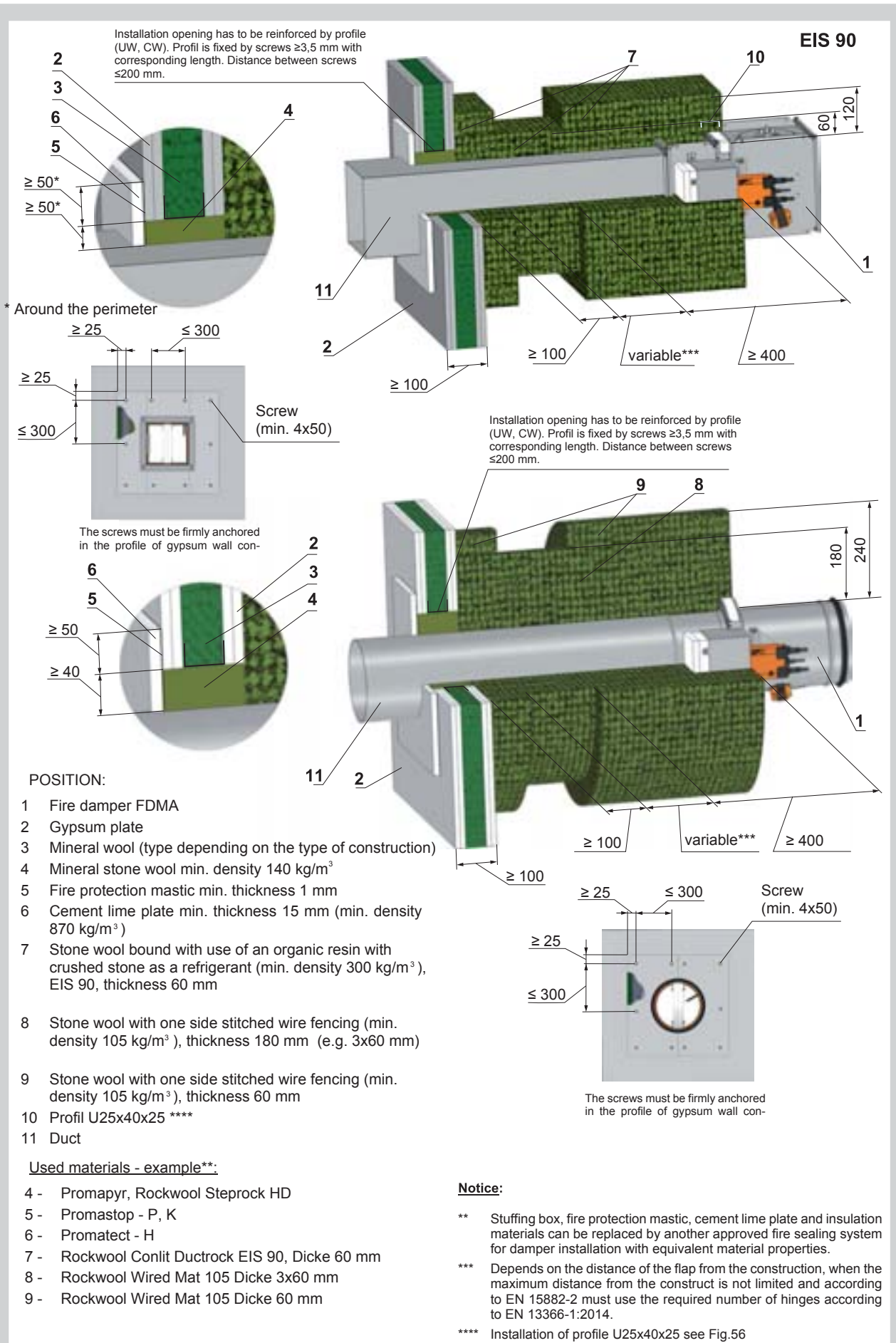
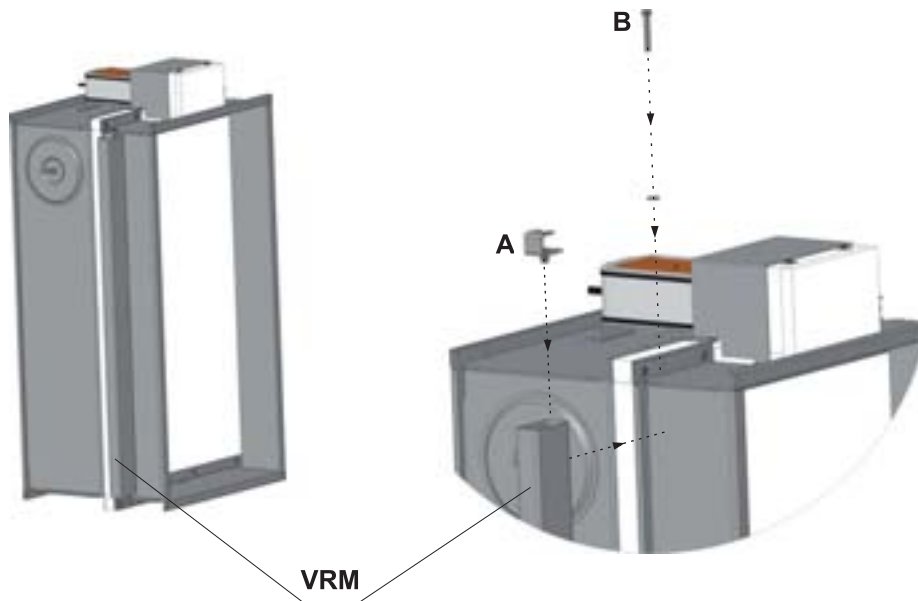


Fig 55 Fixing of reinforcement to damper body

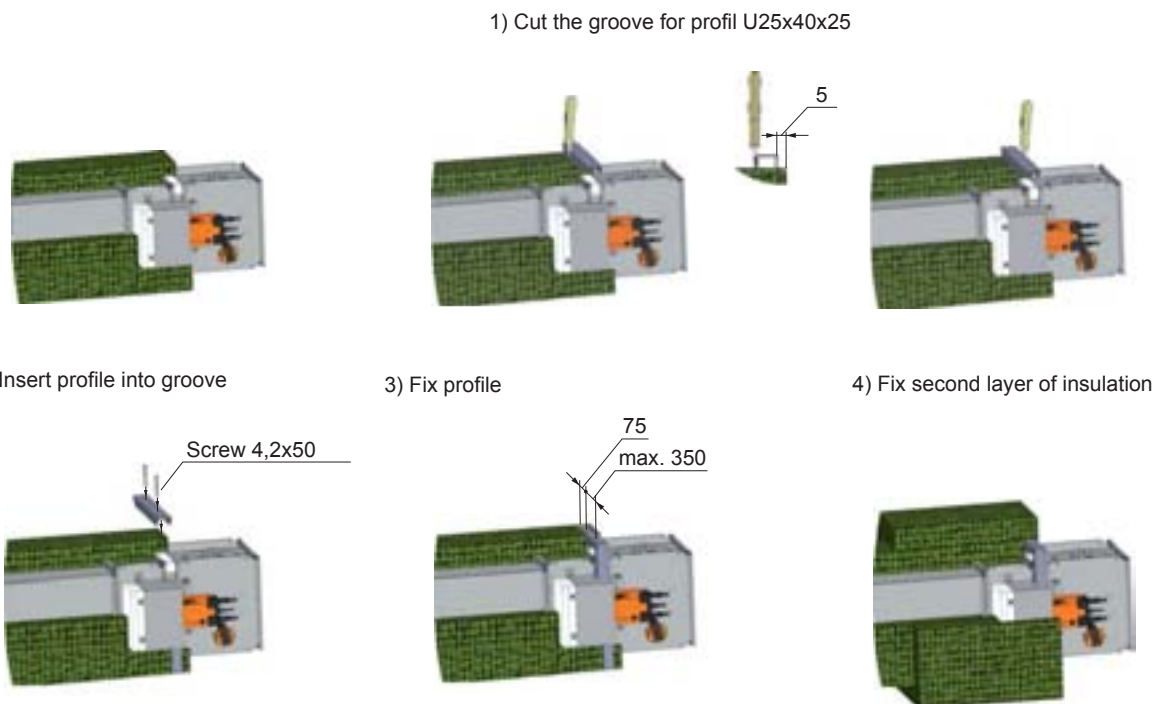
**Important: For lower fire resistance than EI90 the reinforcement VRM is not necessary !!!**



- 1.) Insert part A into reinforcement VRM-PM
- 2.) Set up nut of the part A under correct hole
- 3.) Lock screw B
- 4.) It has to be done on each side of VRM-90

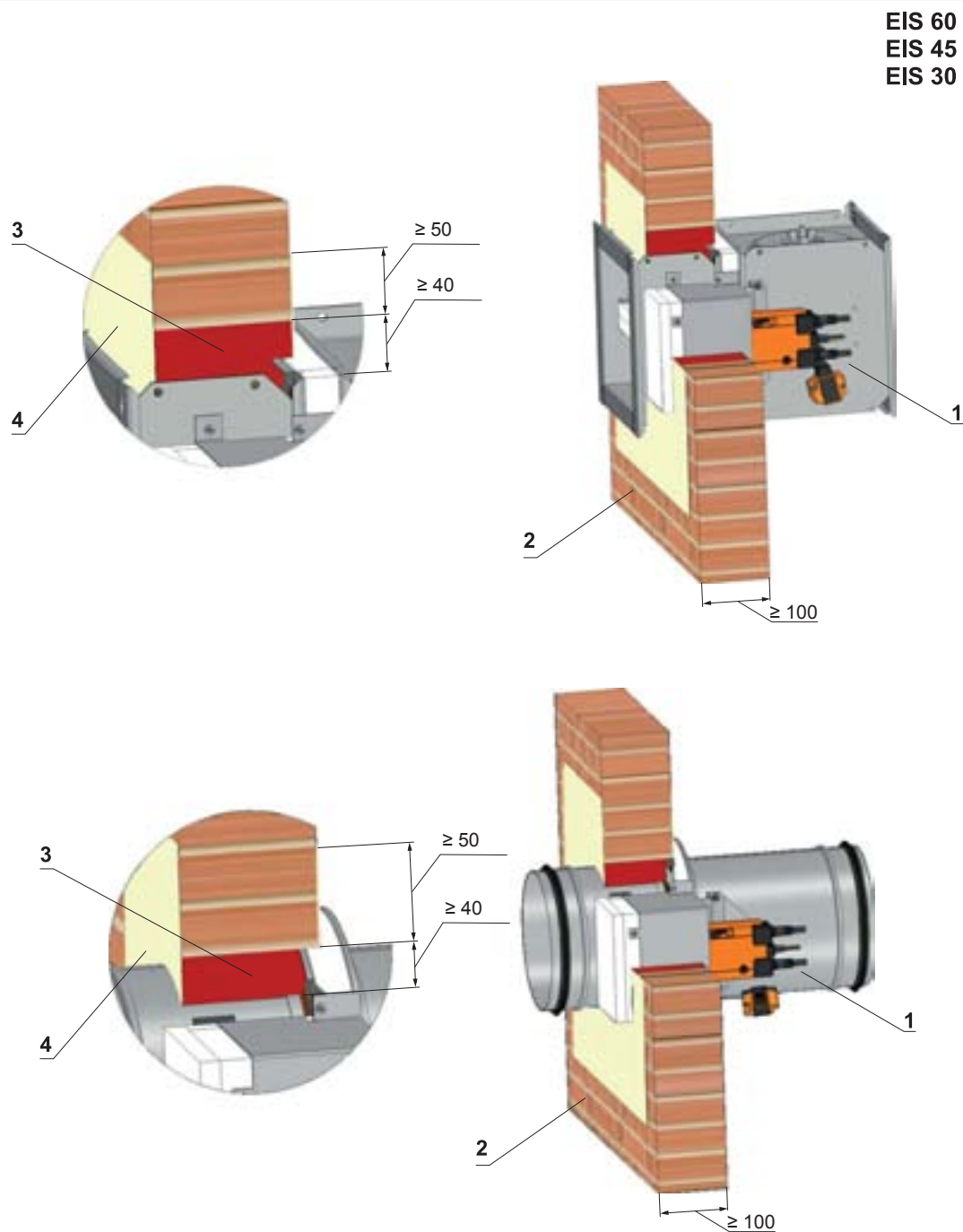
NOTICE: For dampers with  $A \geq 800$  and damper placement outside wall construction is necessary to use reinforcement VRM.

Fig. 56



7. Installation in Fire resistant foam

Fig. 57 Solid wall construction - Fire resistant foam covered by stucco plaster



POSITION:

- 1 Fire damper FDMA
- 2 Solid wall
- 3 Fire resistant foam
- 4 Stucco plaster

Used materials - example\*:

- 3 - HILTI CFS-F FX - EIS 60
- PROMAFOAM-C - EIS 45
- SODAL, Soudafoam FR-B1 - EIS 30
- DenBraven, Fire resistant foam PUR - EIS 30

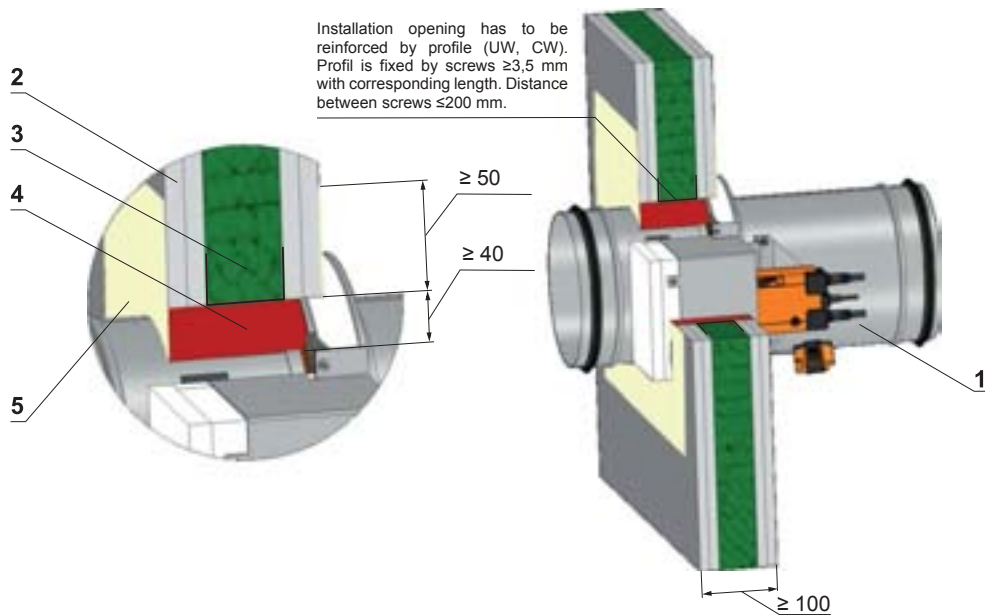
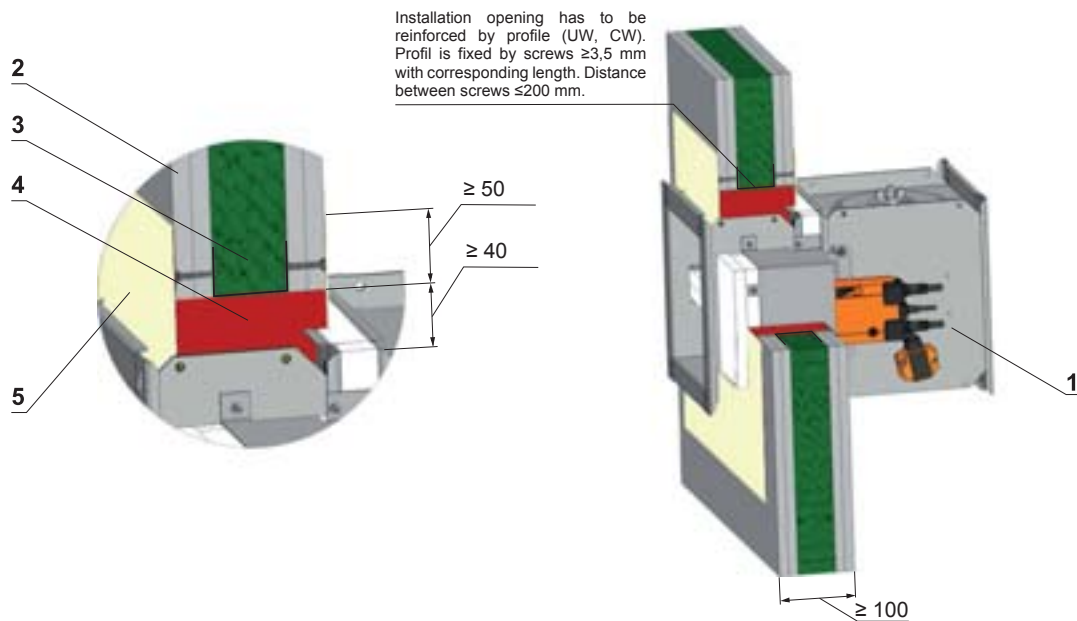
Maximal damper dimensions:

Square 400 x 400 mm

Round 200 mm

Fig. 58 Gypsum wall construction - Fire resistant foam covered by stucco plaster

EIS 60  
EIS 45  
EIS 30



POSITION:

- 1 Fire damper FDMA
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Fire resistant foam
- 5 Stucco plaster

Used materials - example\*:

- 3 - HILTI CFS-F FX - EIS 60
- PROMAFOAM-C - EIS 45
- SODAL, Soudafoam FR-B1 - EIS 30
- DenBraven, Fire resistant foam PUR - EIS 30

Maximal damper dimensions:

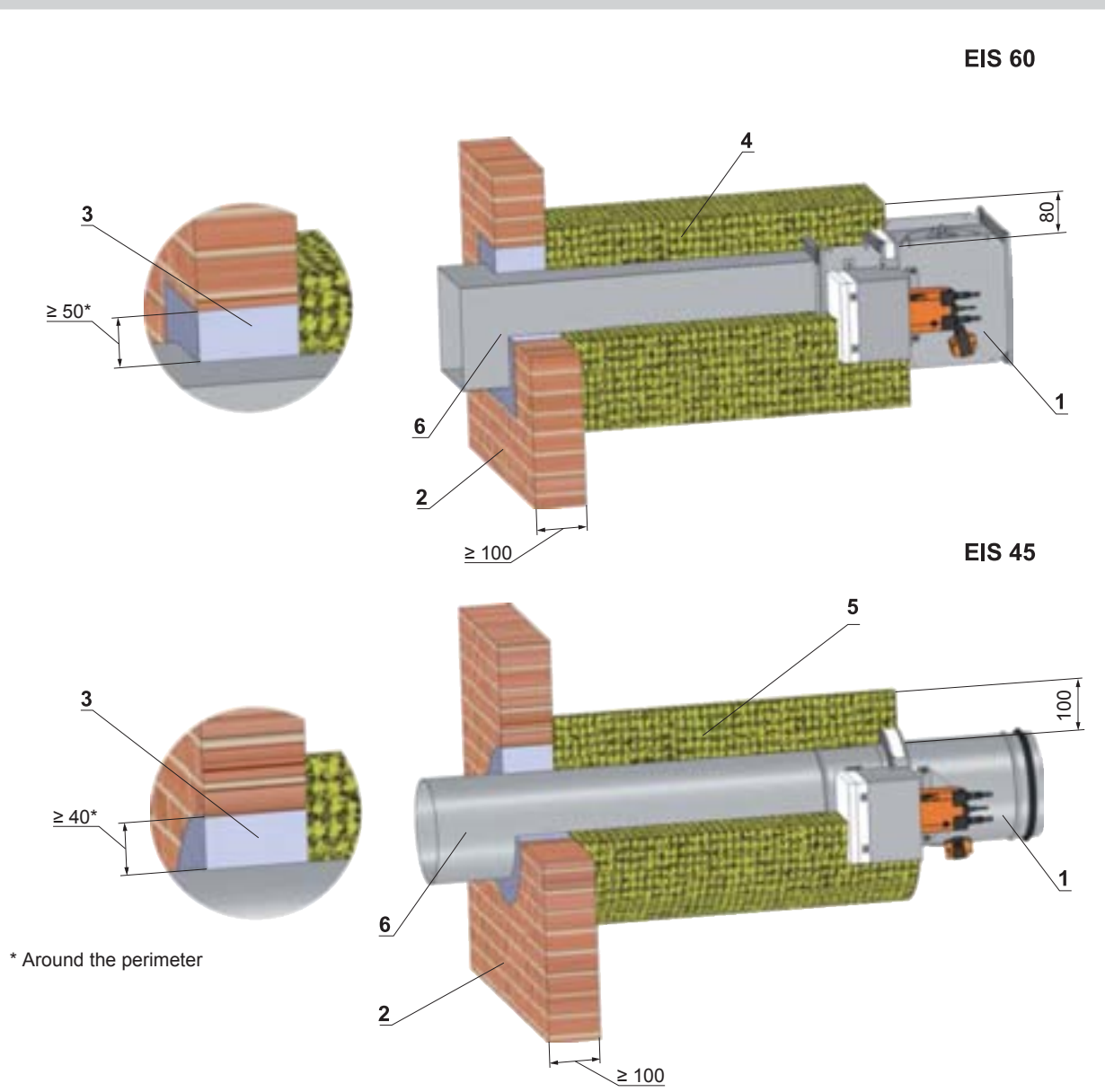
Square 400 x 400 mm

Round 200 mm



8. Installation outside of wall construction EIS60, EIS45

Fig. 59 Installation outside of solid wall construction - mineral wool



\* Around the perimeter

POSITION:

- 1 Fire damper FDMA
- 2 Solid wall
- 3 Mortar or gypsum
- 4 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 80 mm
- 5 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 100 mm
- 6 Duct

Used materials - example\*\*:

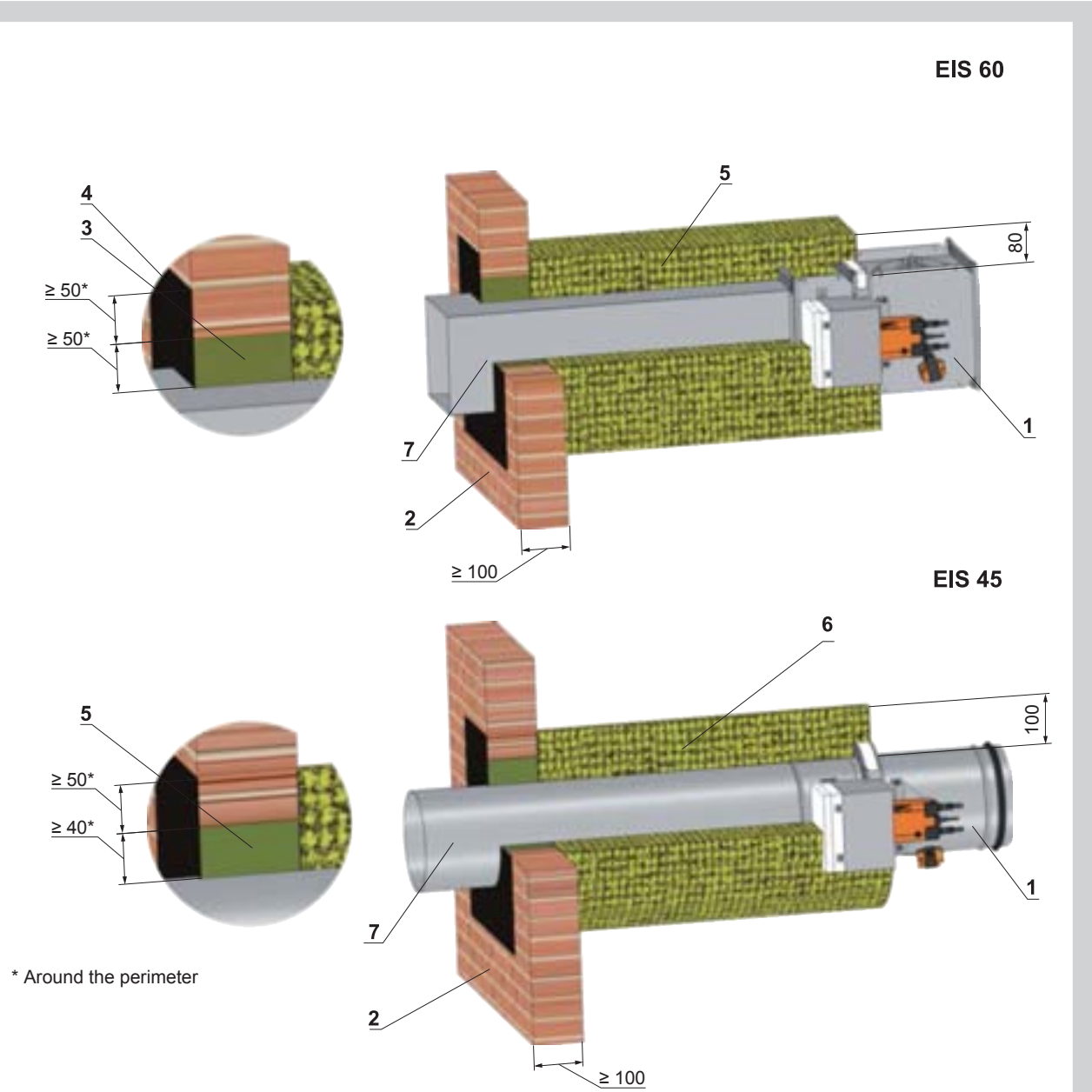
- 4 - Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1
- 5 - Isover Ultimate Protect Wired MAT 4.0, th. 100 mm ALU1

**Notice:**

\*\*\* 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.

The maximum distance from the construction of fire dampers is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

Fig. 60 Installation outside of solid wall construction - mineral wool



\* Around the perimeter

POSITION:

- 1 Fire damper FDMA
- 2 Solid wall
- 3 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 4 Fire protection mastic min. thickness 1 mm
- 5 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 80 mm
- 6 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 100 mm
- 7 Duct

Used materials - example\*\*:

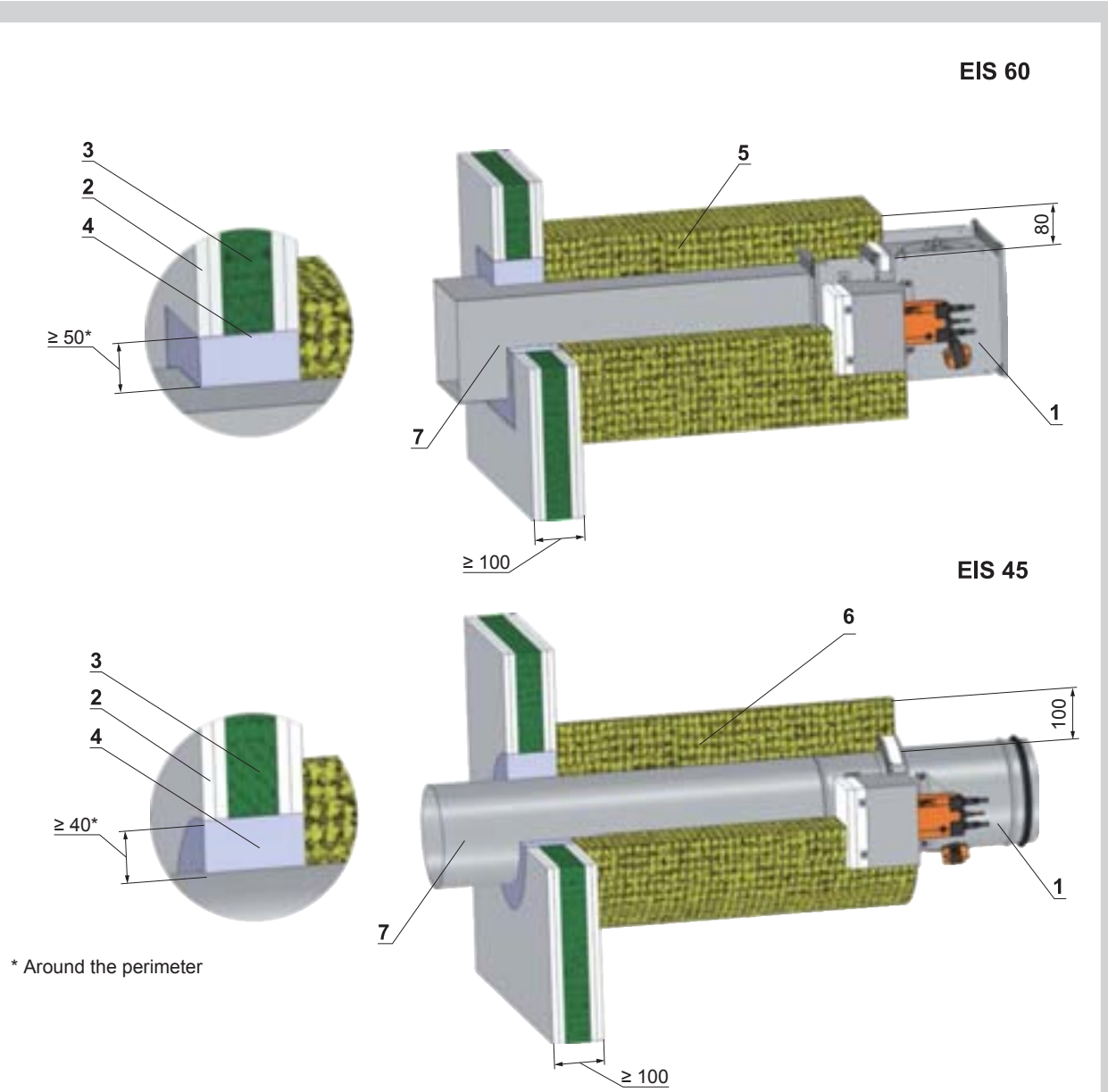
- 3 - Promapyr, Rockwool Steprock HD
- 4 - Promastop - P, K
- 5 - Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1
- 6 - Isover Ultimate Protect Wired MAT 4.0, th. 100 mm ALU1

**Notice:**

\*\*\* 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.

The maximum distance from the construction of fire dampers is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

Fig. 61 Installation outside of gypsum wall construction - mineral wool



\* Around the perimeter

**POSITION:**

- 1 Fire damper FDMA
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Mortar or gypsum
- 5 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 80 mm
- 6 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 100 mm
- 7 Duct

Used materials - example\*\*:

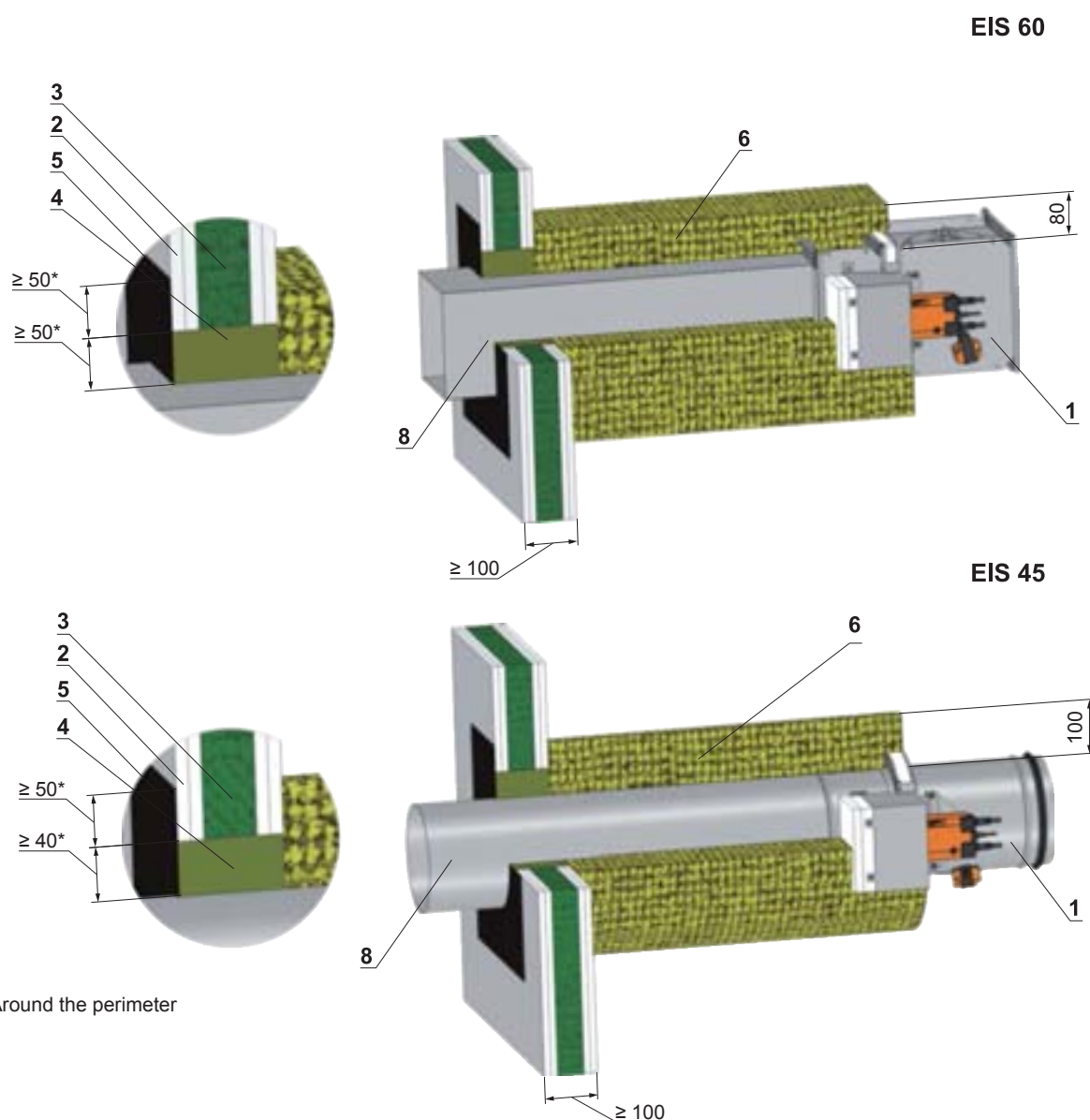
- 5 - Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1
- 6 - Isover Ultimate Protect Wired MAT 4.0, th. 100 mm ALU1

**Notice:**

\*\*\* 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.

The maximum distance from the construction of fire dampers is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

Fig. 62 Installation outside of gypsum wall construction - mineral wool



\* Around the perimeter

POSITION:

- 1 Fire damper FDMA
- 2 Gypsum plate
- 3 Mineral wool (type depending on the type of construction)
- 4 Stuffing box (mineral stone wool min. density 140 kg/m<sup>3</sup>)
- 5 Fire protection mastic min. thickness 1 mm
- 6 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 80 mm
- 7 Stone wool with fire resistance EI 60, (min. density 66 kg/m<sup>3</sup>), thickness 100 mm
- 8 Duct

Used materials - example\*\*:

- 4 - Promapyr, Rockwool Steprock HD
- 5 - Promastop - P, K
- 6 - Isover Ultimate Protect SLAB 4.0, th. 80 mm ALU1
- 7 - Isover Ultimate Protect Wired MAT 4.0, th. 100 mm ALU1

**Notice:**

\*\*\* 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.

The maximum distance from the construction of fire dampers is not limited and according to EN 15882-2 must use the required number of hinges according to EN 13366-1:2014.

9. Suspension systems

9.1. Mounting to the ceiling wall

Fig. 63 Mounting to the ceiling wall

**Without anchor**      **With anchor**      **With hinge plate and anchors**

1 2 3

5 4 1 5 6 2 1

**Hinge plates**

120  
80  
50  
2x Ø 9  
M8 - M16

4x Ø 9  
M20  
100  
150

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

| Size | A <sub>s</sub> [mm <sup>2</sup> ] | Weight G [kg] |            |
|------|-----------------------------------|---------------|------------|
|      |                                   | for 1 piece   | for 1 pair |
| M8   | 36,6                              | 22            | 44         |
| M10  | 58,0                              | 35            | 70         |
| M12  | 84,3                              | 52            | 104        |
| M14  | 115                               | 70            | 140        |
| M16  | 157                               | 96            | 192        |
| M18  | 192                               | 117           | 234        |
| M20  | 245                               | 150           | 300        |

Position:

- 1 Threaded rod M8 – M20
- 2 Nut
- 3 Washer
- 4 Coupling Nut
- 5 Anchor
- 6 Hinge plate - min. thickness 10 mm

9.2. Horizontal installation

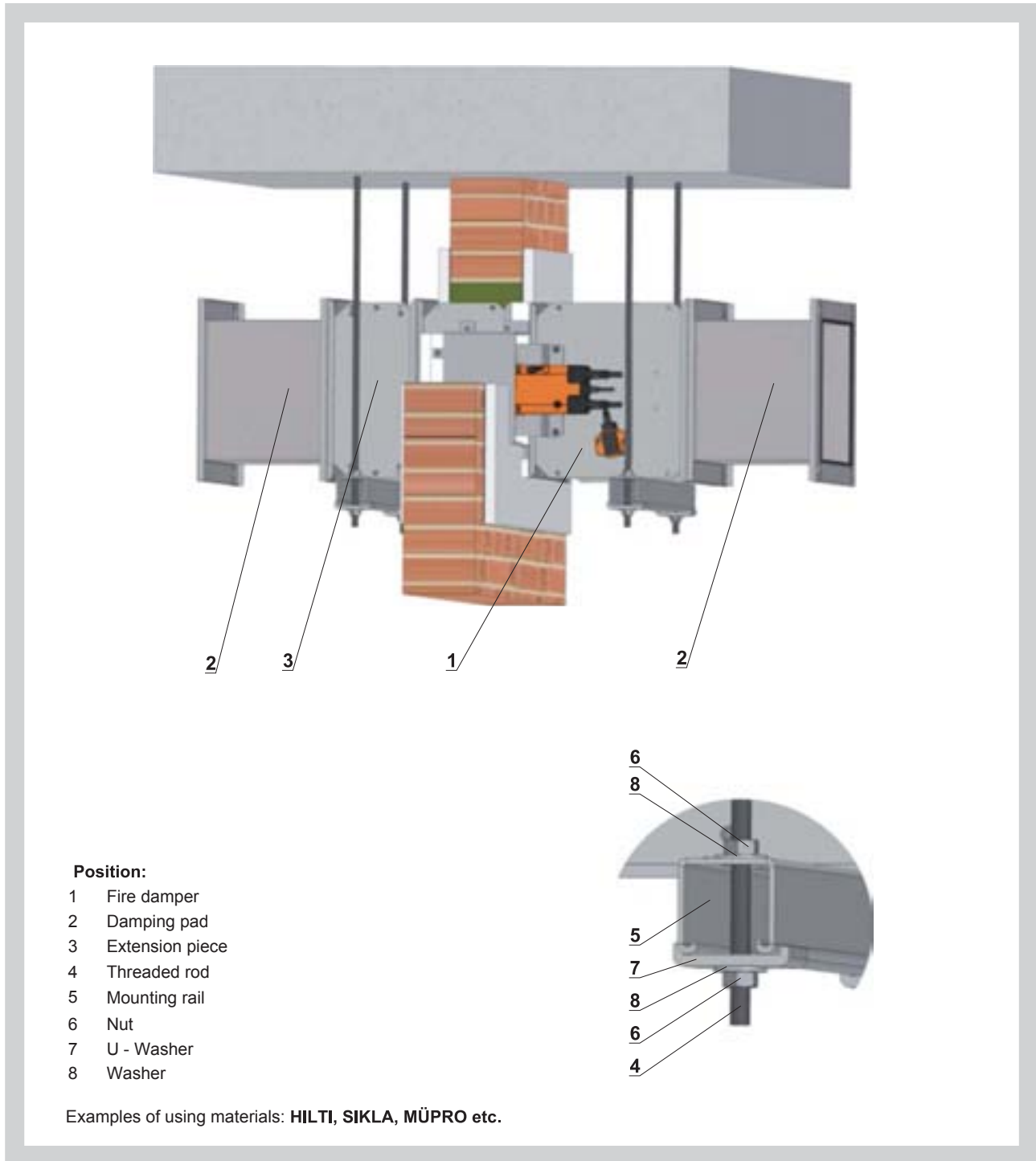
Fire dampers can be suspended by using threaded rods and a mounting profiles. Load the suspension system depend on weight of the fire damper.

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. 63

Fig. 64 Suspension - horizontal duct



### 9.3. Vertical installation

Fire dampers can be suspended by using threaded rods and a mounting profiles. Load the suspension system depend on weight of the fire damper.

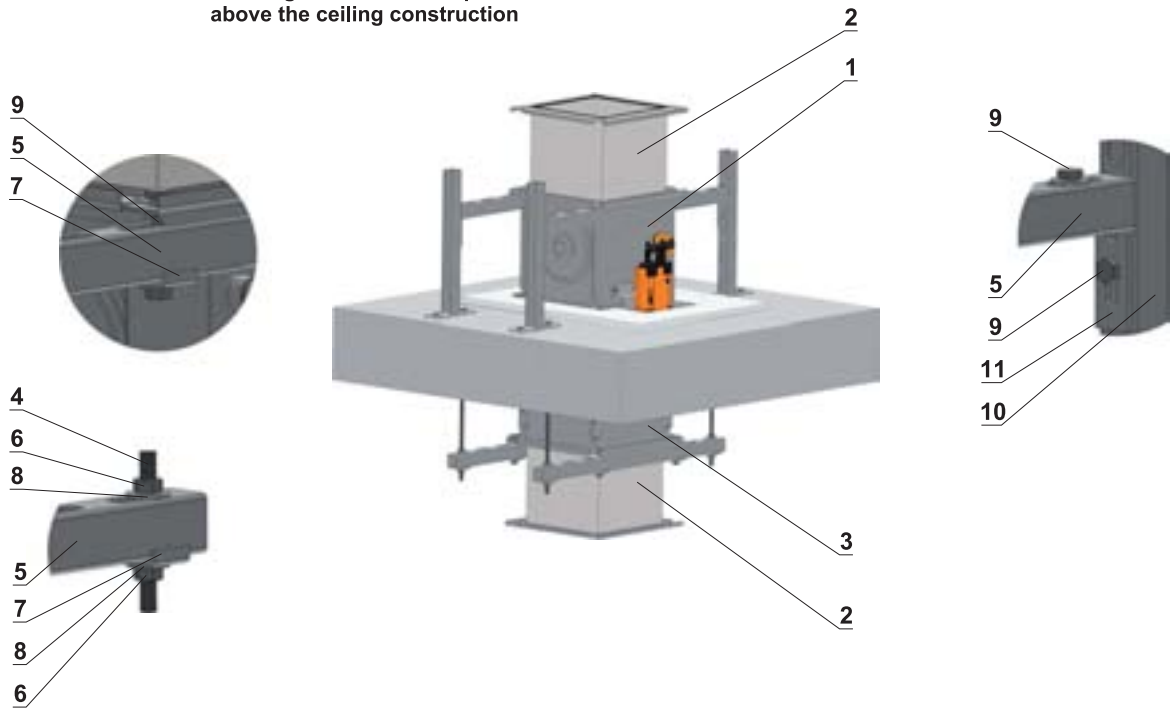
Damper can be suspended from the ceiling construction or supported above the ceiling construction.

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.

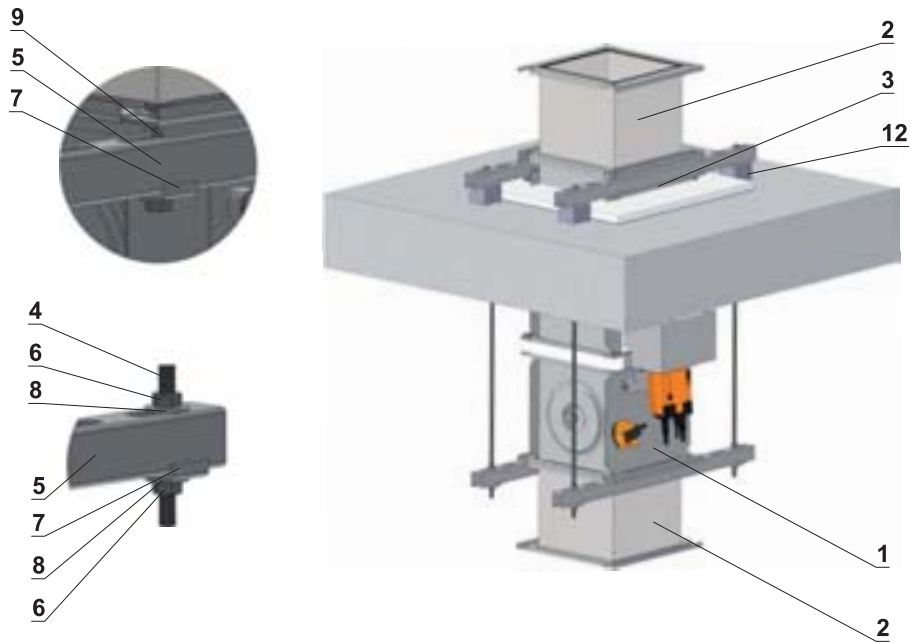
Threaded rods longer than 1,5 m require fire-resistant insulation.

Fig. 65 Suspension - vertical duct

Actuating mechanism is placed above the ceiling construction



Actuating mechanism is placed under the ceiling construction



Position:

- 1 Fire damper
- 2 Damping pad
- 3 Extension piece
- 4 Threaded rod
- 5 Mounting rail
- 6 Nut
- 7 U - Washer
- 8 Washer
- 9 Screw connection
- 10 Mounting profile
- 11 Mounting bracket
- 12 Fire-resistant board

The examples of using materials: **HILTI, SIKLA, MÜPRO** etc.

**9.4 Rectangular fire damper suspension on the wall - horizontal installation**

Duct between fire damper and fire separating construction can be suspended by using threaded rods and mounting profiles. 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.

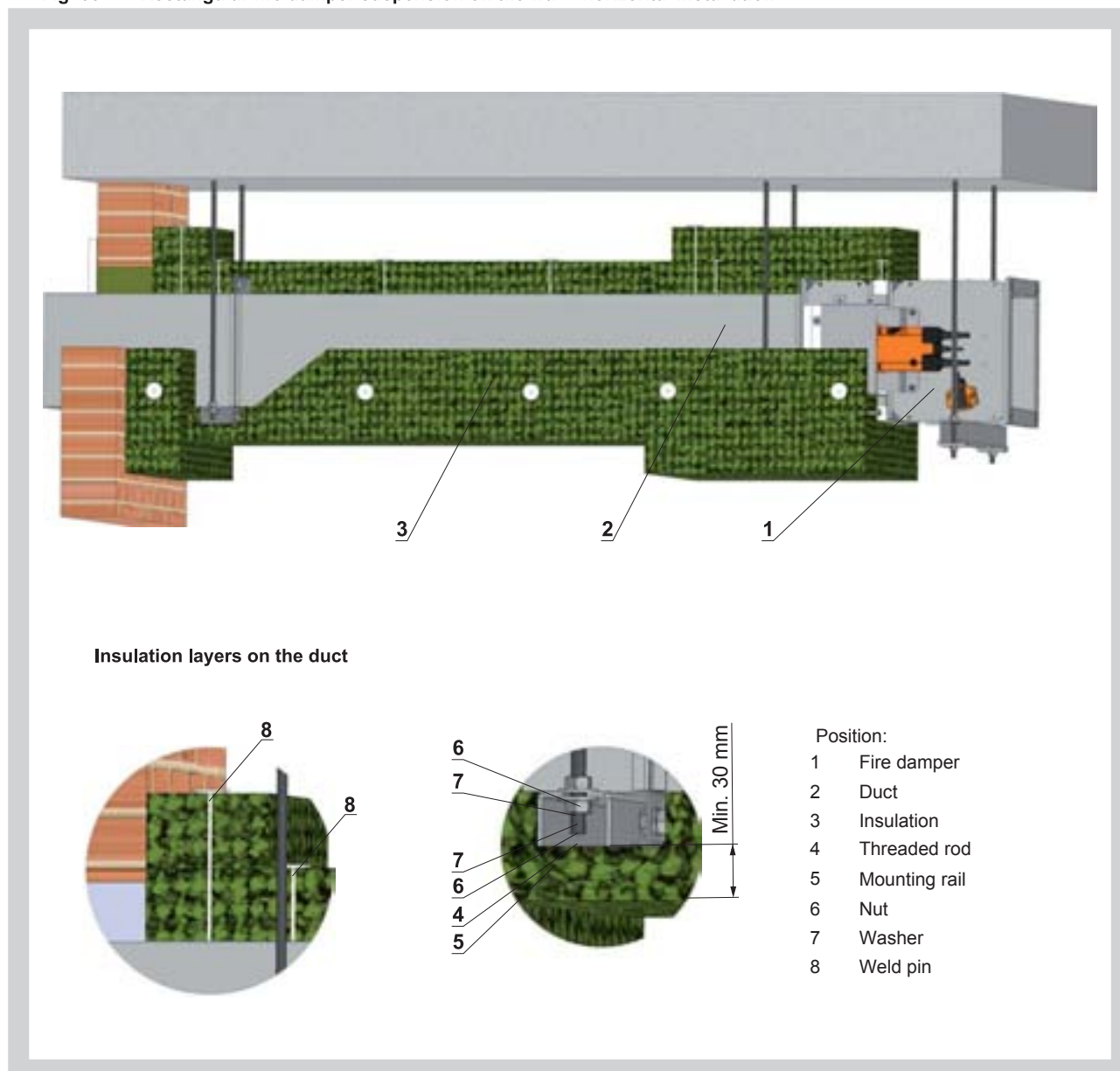
Threaded rods longer than 1,5 m require fire-resistant insulation.

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. 63

The insulation boards are fastened to the duct by weld pins. Distance between weld pins, distance between weld pins and flanges is dependent on the materials. For more information see documentation of insulation manufacturer.

**Fig. 66 Rectangular fire damper suspension on the wall - horizontal installation**





## 9.5 Horizontal installation

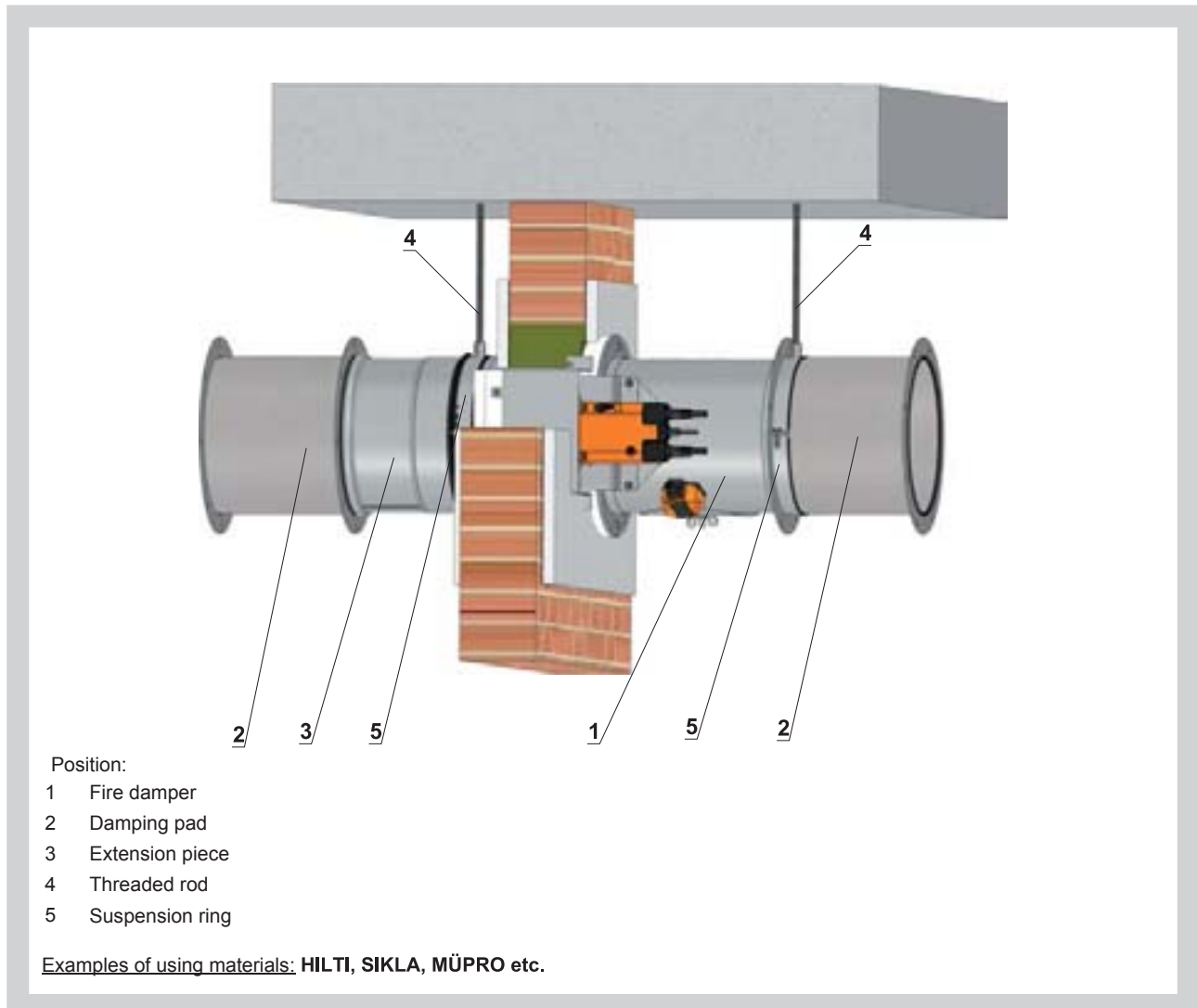
Fire dampers can be suspended by using threaded rods and a mounting profiles. Load the suspension system depend on weight of the fire damper.

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. 63

Fig. 67 Suspension - horizontal duct



## 9.6. Vertical installation

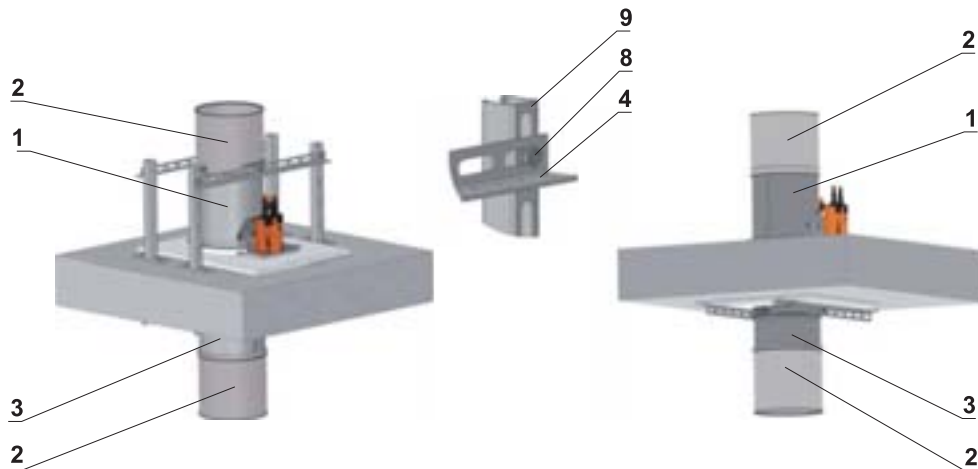
Fire dampers can be suspended by using threaded rods and a mounting profiles. Load the suspension system depend on weight of the fire damper.

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.

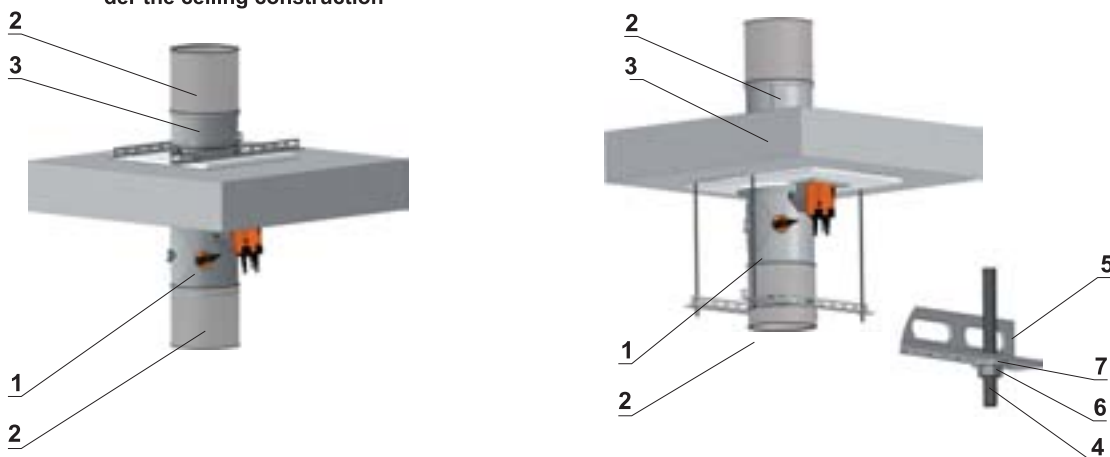
Threaded rods longer than 1,5 m require fire-resistant insulation.

Fig. 68 Suspension - vertical duct

Actuating mechanism is placed above the ceiling construction

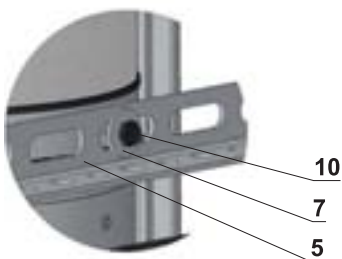


Actuating mechanism is placed under the ceiling construction

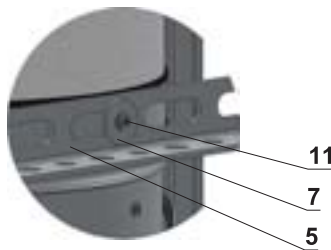


**Notice:** Damper must be firmly connected with extension piece by screws or rivets.

Suspension ring and mounting rail connected by bolt



Suspension ring and mounting rail connected by screw or rivet



Position:

- 1 Fire damper
- 2 Damping pad
- 3 Extension piece
- 4 Threaded rod
- 5 Mounting rail
- 6 Nut
- 7 Washer
- 8 Screw connection
- 9 Mounting profile
- 10 Bolt
- 11 Screw or rivet

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

9.7. Duct between fire damper and fire separating construction can be suspended by using threaded rods and suspension rings. Load the suspension system depend on weight of the fire damper and duct system.

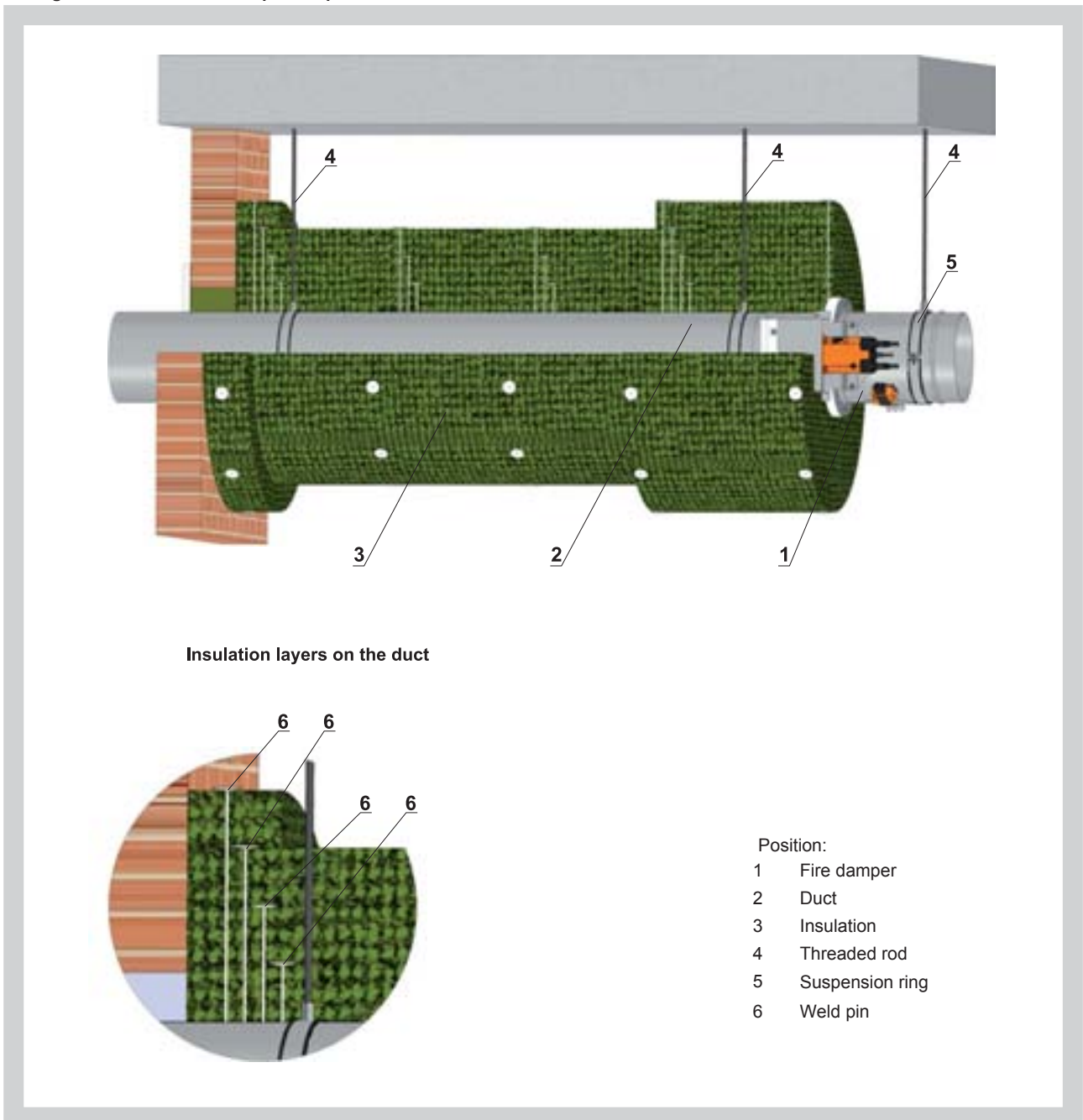
Max. length between two suspension systems is 1500 mm.

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 rod fixing to the ceiling construction - see fig. 63

The insulation boards are fastened to the duct by weld pins. Distance between weld pins, distance between weld pins and flanges is dependent on the materials. For more information see documentation of insulation manufacturer.

Fig. 69 Round fire damper suspension on the wall - horizontal installation



III. TECHNICAL DATA

10. Pressure loss

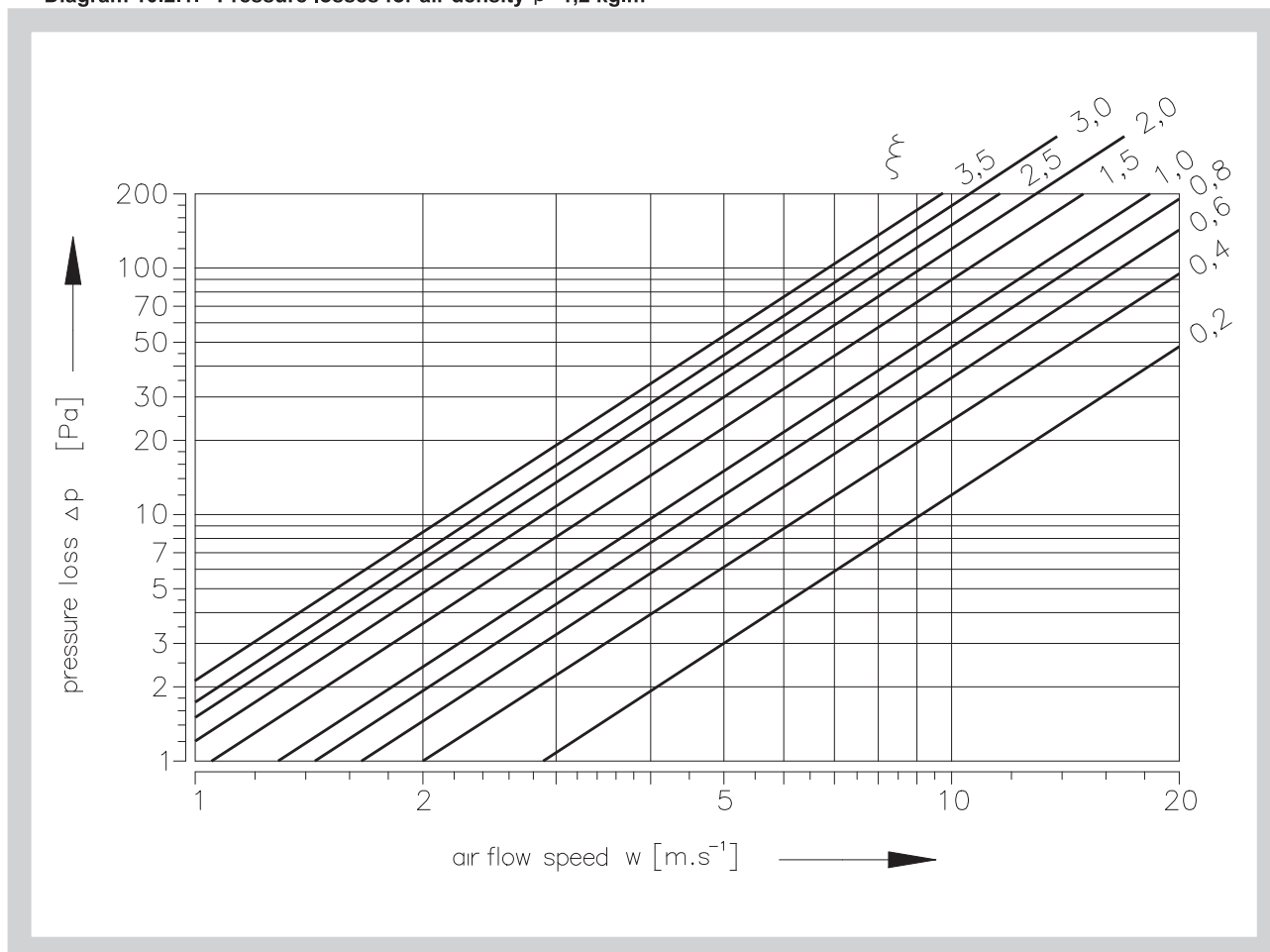
10.1. Pressure loss calculation

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

|            |                       |  |
|------------|-----------------------|--|
| $\Delta p$ | [Pa]                  | Pressure loss  |
| $w$        | [m.s <sup>-1</sup> ]  | air flow speed in nominal damper section   |
| $\rho$     | [kg.m <sup>-3</sup> ] | Air density  |
| $\xi$      | [-]                   | coefficient of local pressure loss for the nominal damper section<br>(see Tab. 11.1.1. and Tab. 11.2.1.) |

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

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



## 11. Coefficient of local pressure loss

### 11.1. Coefficient of local pressure loss $\xi$ (-) - square dampers

Tab. 11.1.1. Coefficient of local pressure loss - square dampers

| A    | B     |       |       |       |       |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|      | 180   | 200   | 225   | 250   | 280   | 300   | 315   | 355   | 400   | 450   | 500   |
| 180  | 1,849 | 1,476 | 1,210 | 0,983 | 0,888 | 0,823 | 0,703 | 0,608 | 0,535 | 0,478 | 0,437 |
| 200  | 1,737 | 1,385 | 1,095 | 0,921 | 0,862 | 0,782 | 0,658 | 0,569 | 0,500 | 0,446 | 0,407 |
| 225  | 1,678 | 1,333 | 0,995 | 0,887 | 0,832 | 0,754 | 0,638 | 0,545 | 0,479 | 0,430 | 0,393 |
| 250  | 1,613 | 1,286 | 0,978 | 0,859 | 0,805 | 0,722 | 0,613 | 0,524 | 0,462 | 0,414 | 0,381 |
| 280  | 1,538 | 1,218 | 0,954 | 0,814 | 0,768 | 0,682 | 0,583 | 0,499 | 0,438 | 0,395 | 0,358 |
| 300  | 1,482 | 1,178 | 0,926 | 0,772 | 0,722 | 0,642 | 0,549 | 0,475 | 0,422 | 0,372 | 0,342 |
| 315  | 1,415 | 1,124 | 0,894 | 0,743 | 0,682 | 0,598 | 0,528 | 0,456 | 0,400 | 0,356 | 0,325 |
| 355  | 1,359 | 1,079 | 0,852 | 0,713 | 0,635 | 0,573 | 0,506 | 0,436 | 0,383 | 0,341 | 0,311 |
| 400  | 1,312 | 1,041 | 0,811 | 0,687 | 0,618 | 0,562 | 0,487 | 0,420 | 0,368 | 0,328 | 0,299 |
| 450  | 1,271 | 1,009 | 0,798 | 0,665 | 0,602 | 0,533 | 0,471 | 0,406 | 0,356 | 0,317 | 0,289 |
| 500  | 1,240 | 0,983 | 0,773 | 0,648 | 0,592 | 0,526 | 0,459 | 0,395 | 0,346 | 0,308 | 0,281 |
| 550  | 1,225 | 0,971 | 0,752 | 0,638 | 0,586 | 0,522 | 0,451 | 0,389 | 0,341 | 0,306 | 0,278 |
| 560  | 1,211 | 0,960 | 0,744 | 0,632 | 0,572 | 0,519 | 0,447 | 0,385 | 0,337 | 0,300 | 0,274 |
| 600  | 1,198 | 0,945 | 0,738 | 0,626 | 0,568 | 0,507 | 0,441 | 0,381 | 0,334 | 0,297 | 0,270 |
| 630  | 1,184 | 0,938 | 0,728 | 0,617 | 0,565 | 0,493 | 0,437 | 0,376 | 0,329 | 0,293 | 0,267 |
| 650  | 1,173 | 0,928 | 0,711 | 0,610 | 0,544 | 0,490 | 0,431 | 0,371 | 0,324 | 0,289 | 0,266 |
| 700  | 1,165 | 0,922 | 0,705 | 0,609 | 0,539 | 0,489 | 0,429 | 0,369 | 0,323 | 0,288 | 0,263 |
| 710  | 1,160 | 0,919 | 0,697 | 0,604 | 0,535 | 0,488 | 0,427 | 0,368 | 0,322 | 0,287 | 0,261 |
| 750  | 1,150 | 0,911 | 0,691 | 0,600 | 0,530 | 0,482 | 0,422 | 0,363 | 0,318 | 0,284 | 0,258 |
| 800  | 1,140 | 0,903 | 0,686 | 0,593 | 0,523 | 0,475 | 0,419 | 0,361 | 0,316 | 0,281 | 0,256 |
| 900  | 1,122 | 0,888 | 0,674 | 0,583 | 0,517 | 0,467 | 0,412 | 0,355 | 0,310 | 0,276 | 0,252 |
| 1000 | 1,108 | 0,877 | 0,666 | 0,576 | 0,509 | 0,453 | 0,407 | 0,350 | 0,306 | 0,273 | 0,248 |
| 1100 | 1,095 | 0,867 | 0,657 | 0,569 | 0,498 | 0,443 | 0,402 | 0,345 | 0,302 | 0,269 | 0,245 |
| 1250 | 1,084 | 0,857 | 0,643 | 0,562 | 0,486 | 0,438 | 0,397 | 0,342 | 0,299 | 0,266 | 0,242 |
| 1400 | 1,073 | 0,849 | 0,632 | 0,557 | 0,478 | 0,436 | 0,393 | 0,338 | 0,296 | 0,263 | 0,240 |
| 1500 | 1,067 | 0,844 | 0,628 | 0,554 | 0,469 | 0,429 | 0,391 | 0,336 | 0,294 | 0,262 | 0,238 |
| 1600 | 1,062 | 0,840 | 0,610 | 0,551 | 0,450 | 0,420 | 0,389 | 0,334 | 0,293 | 0,260 | 0,237 |

| A    | B     |       |       |       |       |       |       |       |       |       |       |
|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|      | 550   | 560   | 600   | 630   | 650   | 700   | 710   | 750   | 800   | 900   | 1000  |
| 180  | 0,418 | 0,400 | 0,378 | 0,369 | 0,352 | 0,349 | 0,343 | 0,331 | 0,322 | 0,304 | 0,291 |
| 200  | 0,389 | 0,373 | 0,356 | 0,344 | 0,332 | 0,325 | 0,320 | 0,309 | 0,300 | 0,284 | 0,271 |
| 225  | 0,375 | 0,361 | 0,342 | 0,333 | 0,319 | 0,313 | 0,309 | 0,302 | 0,292 | 0,272 | 0,262 |
| 250  | 0,362 | 0,345 | 0,331 | 0,321 | 0,308 | 0,302 | 0,297 | 0,291 | 0,281 | 0,263 | 0,253 |
| 280  | 0,342 | 0,325 | 0,312 | 0,302 | 0,291 | 0,288 | 0,283 | 0,271 | 0,267 | 0,249 | 0,241 |
| 300  | 0,321 | 0,312 | 0,296 | 0,287 | 0,279 | 0,273 | 0,269 | 0,256 | 0,251 | 0,236 | 0,228 |
| 315  | 0,305 | 0,297 | 0,282 | 0,274 | 0,267 | 0,259 | 0,254 | 0,246 | 0,238 | 0,225 | 0,215 |
| 355  | 0,296 | 0,284 | 0,271 | 0,262 | 0,251 | 0,248 | 0,243 | 0,234 | 0,228 | 0,215 | 0,205 |
| 400  | 0,281 | 0,273 | 0,265 | 0,252 | 0,243 | 0,237 | 0,234 | 0,226 | 0,219 | 0,207 | 0,197 |
| 450  | 0,271 | 0,264 | 0,255 | 0,243 | 0,237 | 0,231 | 0,226 | 0,219 | 0,211 | 0,199 | 0,190 |
| 500  | 0,269 | 0,257 | 0,244 | 0,236 | 0,228 | 0,223 | 0,219 | 0,212 | 0,205 | 0,194 | 0,185 |
| 550  | 0,262 | 0,254 | 0,239 | 0,225 | 0,217 | 0,211 | 0,208 | 0,209 | 0,202 | 0,191 | 0,182 |
| 560  | 0,259 | 0,250 | 0,231 | 0,230 | 0,221 | 0,210 | 0,208 | 0,206 | 0,200 | 0,189 | 0,180 |
| 600  | 0,256 | 0,248 | 0,229 | 0,228 | 0,218 | 0,209 | 0,207 | 0,202 | 0,197 | 0,186 | 0,178 |
| 630  | 0,253 | 0,244 | 0,228 | 0,225 | 0,215 | 0,209 | 0,207 | 0,199 | 0,195 | 0,184 | 0,176 |
| 650  | 0,248 | 0,242 | 0,226 | 0,222 | 0,213 | 0,208 | 0,206 | 0,197 | 0,193 | 0,182 | 0,174 |
| 700  | 0,244 | 0,241 | 0,225 | 0,221 | 0,212 | 0,207 | 0,205 | 0,196 | 0,192 | 0,181 | 0,173 |
| 710  | 0,242 | 0,239 | 0,224 | 0,220 | 0,211 | 0,205 | 0,204 | 0,195 | 0,191 | 0,180 | 0,172 |
| 750  | 0,240 | 0,236 | 0,220 | 0,218 | 0,209 | 0,203 | 0,202 | 0,194 | 0,189 | 0,178 | 0,170 |
| 800  | 0,239 | 0,234 | 0,217 | 0,215 | 0,206 | 0,201 | 0,200 | 0,192 | 0,187 | 0,176 | 0,168 |
| 900  | 0,234 | 0,230 | 0,215 | 0,212 | 0,200 | 0,198 | 0,196 | 0,189 | 0,184 | 0,173 | 0,165 |
| 1000 | 0,231 | 0,227 | 0,211 | 0,209 | 0,198 | 0,195 | 0,193 | 0,185 | 0,181 | 0,171 | 0,163 |
| 1100 | 0,229 | 0,224 | 0,208 | 0,206 | 0,196 | 0,194 | 0,191 | 0,182 | 0,179 | 0,168 | 0,161 |
| 1250 | 0,224 | 0,221 | 0,205 | 0,203 | 0,192 | 0,191 | 0,189 | 0,180 | 0,176 | 0,166 | 0,159 |
| 1400 | 0,221 | 0,219 | 0,203 | 0,201 | 0,189 | 0,188 | 0,187 | 0,178 | 0,175 | 0,165 | 0,157 |
| 1500 | 0,220 | 0,218 | 0,201 | 0,200 | 0,187 | 0,186 | 0,185 | 0,176 | 0,174 | 0,164 | 0,156 |
| 1600 | 0,220 | 0,216 | 0,200 | 0,199 | 0,187 | 0,186 | 0,185 | 0,175 | 0,173 | 0,163 | 0,155 |

**11.2. Coefficient of local pressure loss  $\xi$  (-) - round dampers**

**Tab. 11.2.1. Coefficient of local pressure loss - round dampers**

| D     | 180   | 200   | 225   | 250   | 280   | 315   | 355   | 400   | 450   | 500   | 560   | 630   | 710   | 800   | 900  | 1000  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| $\xi$ | 3,546 | 2,124 | 1,291 | 0,877 | 0,609 | 0,438 | 0,328 | 0,255 | 0,205 | 0,173 | 0,147 | 0,127 | 0,111 | 0,099 | 0,09 | 0,083 |

## 12. Noise data

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

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

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

$L_{W1}$  [dB] level of acoustic output  $L_{W1}$  related to the 1 m<sup>2</sup> section (see Tab. 12.3.1. and 12.3.2)

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

$K_A$  [DB] correction to the weight filter A (see 12.3.3.)

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

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

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

$L_{W1}$  [dB] level of acoustic output  $L_{w1}$  related to the 1 m<sup>2</sup> section (see Tab. 12.3.1. and 12.3.2)

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

$L_{rel}$  [dB] relative level expressing the shape of the spectrum (see Tab. 12.3.4.)

### 12.3. Table of acoustics values

Tab. 12.3.1. Level of acoustic output  $L_{w1}$ [dB] related to the 1 m<sup>2</sup> section - square dampers

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

Tab. 12.3.2. Level of acoustic output  $L_{w1}$ [dB] related to the 1 m<sup>2</sup> section - round dampers

| w [m.s <sup>-1</sup> ] | $\xi$ [-] |      |      |      |      |      |      |      |      |      |      |      |
|------------------------|-----------|------|------|------|------|------|------|------|------|------|------|------|
|                        | 0,1       | 0,2  | 0,3  | 0,4  | 0,6  | 0,8  | 1    | 1,5  | 2    | 2,5  | 3    | 3,5  |
| 2                      | 9,0       | 11,5 | 14,7 | 16,9 | 20,1 | 22,3 | 24,1 | 27,2 | 29,4 | 31,2 | 32,6 | 33,8 |
| 3                      | 16,7      | 22,1 | 25,3 | 27,5 | 30,7 | 32,9 | 34,6 | 37,8 | 40,0 | 41,7 | 43,2 | 44,4 |
| 4                      | 24,2      | 29,6 | 32,8 | 35,0 | 38,1 | 40,4 | 42,1 | 45,3 | 47,5 | 49,2 | 50,7 | 51,9 |
| 5                      | 30,0      | 35,4 | 38,6 | 40,8 | 44,0 | 46,2 | 47,9 | 51,1 | 53,3 | 55,1 | 56,5 | 57,7 |
| 6                      | 34,8      | 40,2 | 43,3 | 45,6 | 48,7 | 51,0 | 52,7 | 55,8 | 58,1 | 59,8 | 61,2 | 62,4 |
| 7                      | 38,8      | 44,2 | 47,3 | 49,6 | 52,7 | 55,0 | 56,7 | 59,9 | 62,1 | 63,8 | 65,2 | 66,4 |
| 8                      | 42,3      | 47,7 | 50,8 | 53,1 | 56,2 | 58,4 | 60,2 | 63,3 | 65,6 | 67,3 | 68,7 | 69,9 |
| 9                      | 45,4      | 50,7 | 53,9 | 56,1 | 59,3 | 61,5 | 63,3 | 66,4 | 68,6 | 70,4 | 71,8 | 73,0 |
| 10                     | 48,1      | 53,5 | 56,6 | 58,9 | 62,0 | 64,3 | 66,0 | 69,1 | 71,4 | 73,1 | 74,5 | 75,7 |
| 11                     | 50,6      | 56,0 | 59,1 | 61,4 | 64,5 | 66,7 | 68,5 | 71,6 | 73,9 | 75,6 | 77,0 | 78,2 |
| 12                     | 52,8      | 58,2 | 61,4 | 63,6 | 66,8 | 69,0 | 70,7 | 73,9 | 76,1 | 77,9 | 79,3 | 80,5 |

Tab. 12.3.3. Correction to the weight filter A - square and round dampers

| w [m.s <sup>-1</sup> ] | 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. 12.3.4. Relative level expressing the shape of the spectrum  $L_{rel}$  - square and round dampers

| w [m.s <sup>-1</sup> ] | f [Hz] |      |       |       |       |       |       |       |
|------------------------|--------|------|-------|-------|-------|-------|-------|-------|
|                        | 63     | 125  | 250   | 500   | 1000  | 2000  | 4000  | 8000  |
| 2                      | -4,5   | -6,9 | -10,9 | -16,7 | -24,1 | -33,2 | -43,9 | -56,4 |
| 3                      | -3,9   | -5,3 | -8,4  | -13,1 | -19,5 | -27,6 | -37,4 | -48,9 |
| 4                      | -3,9   | -4,5 | -6,9  | -10,9 | -16,7 | -24,1 | -33,2 | -43,9 |
| 5                      | -4,0   | -4,1 | -5,9  | -9,4  | -14,6 | -21,5 | -30,0 | -40,3 |
| 6                      | -4,2   | -3,9 | -5,3  | -8,4  | -13,1 | -19,5 | -27,6 | -37,4 |
| 7                      | -4,5   | -3,9 | -4,9  | -7,5  | -11,9 | -17,9 | -25,7 | -35,1 |
| 8                      | -4,9   | -3,9 | -4,5  | -6,9  | -10,9 | -16,7 | -24,1 | -33,2 |
| 9                      | -5,2   | -3,9 | -4,3  | -6,4  | -10,1 | -15,6 | -22,7 | -31,5 |
| 10                     | -5,5   | -4,0 | -4,1  | -5,9  | -9,4  | -14,6 | -21,5 | -30,0 |
| 11                     | -5,9   | -4,1 | -4,0  | -5,6  | -8,9  | -13,8 | -20,4 | -28,8 |
| 12                     | -6,2   | -4,3 | -3,9  | -5,3  | -8,4  | -13,1 | -19,5 | -27,6 |



## IV. MATERIAL, FINISHING

### 13. Material

- 13.1.** Damper bodies are supplied in the standard design made of galvanized plate without any other surface finish.  
Damper blades are made of fire resistant asbestos free boards made of mineral fibres.  
Damper controls are made of galvanized materials with no other surface finish.  
Springs are galvanized.  
Thermal protective fuses are made of sheet brass, thickness = 0.5 mm.  
Fasteners is galvanized.
- 13.2.** According to the customer's requirements, damper body, control, springs and jointing material can be made of stainless material.

## V. INSPECTION, TESTING

### 14. Inspection, testing

- 14.1.** The appliance is constructed and 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.** Assembly, maintenance and damper function check can be done only by qualified and trained person, i.e. "AUTHORIZED PERSON" according to the manufacturer documentation. All works done on the fire dampers must be done according international and local norms and laws.
- 16.2.** All effective safety standards and directives must be observed during fire damper assembly.
- 16.3.** Flange and screw joints must be conductively connected to protect against dangerous contact. 2 galvanized fan shape pads that are placed under the head of one screw and a fastened nut are used for conductive connection.
- 16.4.** To ensure reliable fire damper function it is necessary to avoid blocking the closing mechanism and contact surfaces with collected dust, fibre and sticky materials and solvents.

**16.5. 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. Entry into service and revisions****17.1.** Before entering the dampers into operation after assembly and after sequential revisions, checks and functionality tests of all designs including operation of the electrical components must be done. After entering into operation, these revisions must be done according to requirement set by national regulations.

In case that dampers are found unable to serve for their function for any cause, it must be clearly marked. The operator is obliged to ensure so that the damper is put into condition in which it is able to function and meanwhile he is obliged to provide the fire protection another appropriate way.

Results of regular checks, imperfections found and all-important facts connected with the damper function must be recorded in the "FIRE BOOK" and immediately reported to the operator.

**17.2.** Before entering the dampers into operation after their assembly and by sequential checks, the following checks must be carried out for all designs.

Visual inspection of proper damper integration, inside damper area, damper blade, contact surfaces and silicon sealing.

Inspection hole disassembly: release the covering lid by turning the wing nut and while turning the lid right or left release it from the security belt. Then tilt the lid and remove it from its original position.

**17.3.** Before entering the dampers with manual control into operation after their assembly and by sequential checks, checks according 16.2. and following checks must be carried out.

Check of thermal protective fuse and closing mechanism.

Exert pressure on double arm initiation lever with a spring to release the control lever and check its displacement into the "CLOSED" position. Closing must be smart and the control lever must be firmly locked with a pawl. In case that the closing is not smart enough and the control lever is not locked with the pawl in the "CLOSED" position, higher pre-stretch of the closing spring must be set using a ratchet wheel.

Proper function of the thermal fuse can be checked when the fuse is removed from the starting mechanism pin. The pin must be taken out and the initiation lever must be turned over. If this is not possible, then the pin and the starting mechanism spring must be checked or the base plate must be replaced. The base plate is attached to the damper body with three M5 screws and nuts.

Displacing the damper blade into "OPEN" position is done the following way:

Release the pawl exerting pressure and return the control lever into the second outlying position where the lever is hold by the initiation lever.

In case of the flap valve with an electromagnet check the control lever displacement into the "CLOSED" position after connecting to power supply.

**17.4.** Before entering the dampers with actuating mechanism into operation after their assembly and by sequential checks, checks according 16.2. and following checks must be carried out.

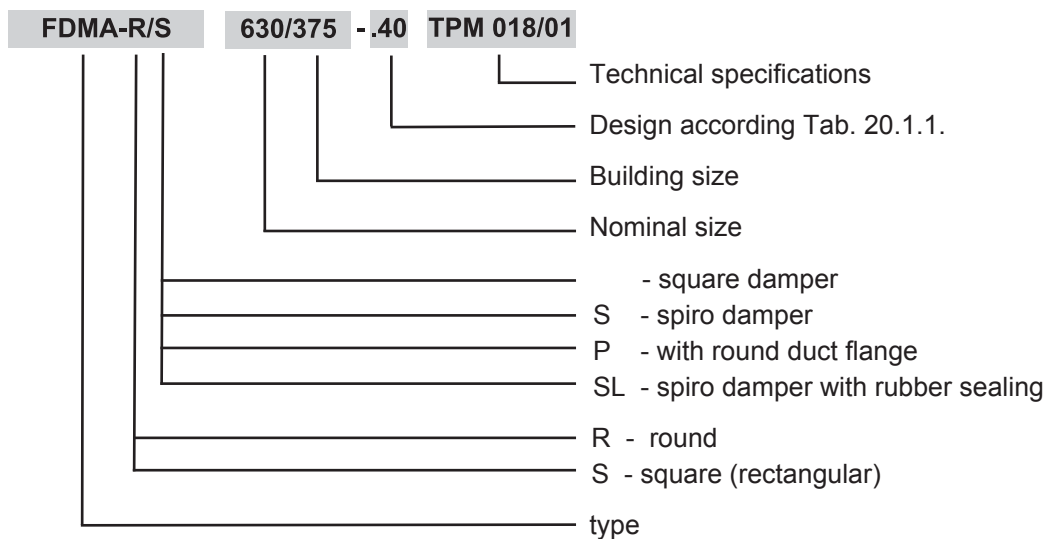
Check of blade displacement into the breakdown position "CLOSED" can be done after cutting off the actuating mechanism supply (e.g. by pressing the RESET button at the thermoelectrical starting mechanism BAT72B-S or cutting off the supply from ELECTRICAL FIRE SIGNALISATION). Check of blade displacement 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).

**17.5.** 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.**18.2.** Control for square damper and round damper is identical.**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

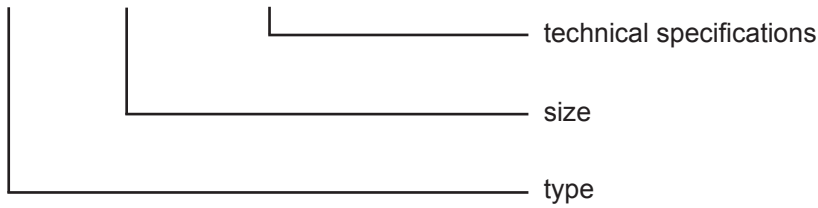


Tab. 20.1.1. Dampers design

| 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              |
| Manual, thermal and with an electromagnet AC 230 V   | .20              |
| Manual, thermal and with an electromagnet AC/DC 24 V   | .21              |
| Manual, thermal and with an electromagnet AC 230 V, with a terminal switch („CLOSED“)  | .23              |
| Manual, thermal and with an electromagnet AC/DC 24 V, with a terminal switch („CLOSED“)  | .24              |
| Manual, thermal and with an electromagnet AC 230 V (ZONE 2)  | .30              |
| Manual, thermal and with an electromagnet AC 230 V, with a terminal switch („CLOSED“) (ZONE 2)   | .33              |
| With actuating mechanism BF 230-TN (BFL, BFN 230-T)  | .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 thermoelectrical starting mechanism (ZONE 1,2)                                  | .42              |
| With actuating mechanism BF 24-TN (BFL, BFN 24-T)  | .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 with actuating mechanism BF 24-TN-ST (BFL, BFN 24-T-ST)                                      | .60              |
| With communication and supply device BKN 230-24-C-MOD, 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 230-24LON 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              |
| Manual, thermal and with an electromagnet AC 230 V, with two terminal switches („OPEN“, „CLOSED“)  | .82              |
| Manual, thermal and with an electromagnet AC/DC 24 V, with two terminal switches („OPEN“, „CLOSED“)  | .83              |
| Manual, thermal and with an electromagnet AC 230 V, with two terminal switches („OPEN“, „CLOSED“) (ZONE 2)                                       | .85              |

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

**VRM-90 800x400 TPM 018/01**

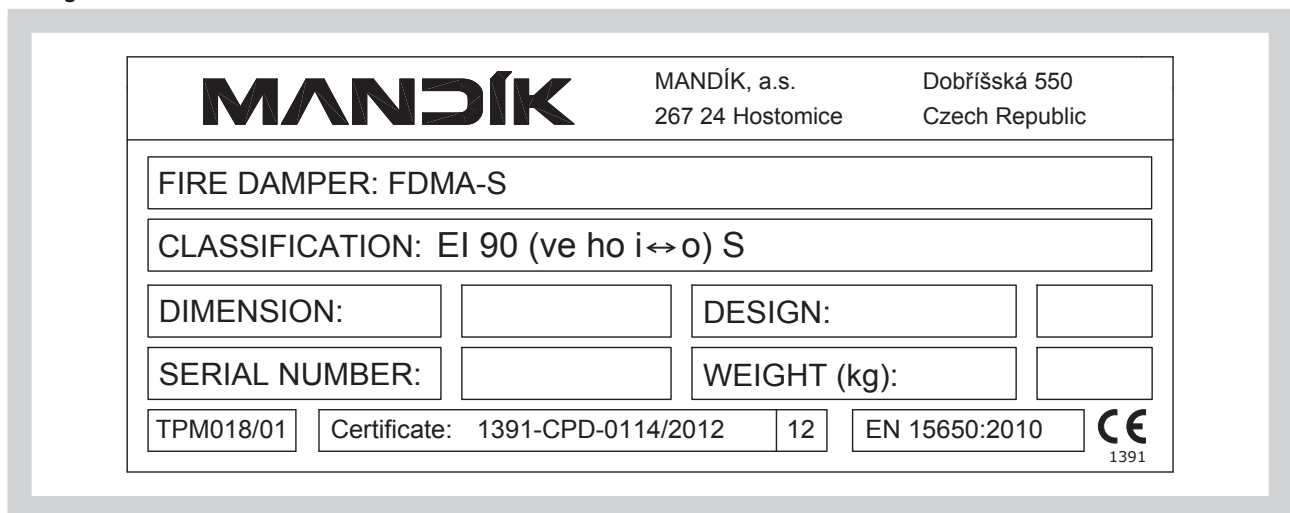


**IX. PRODUCT DATA**

**21. Data label**

**21.1.** Data label is placed on the damper body.

**Fig. 70** Data label



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