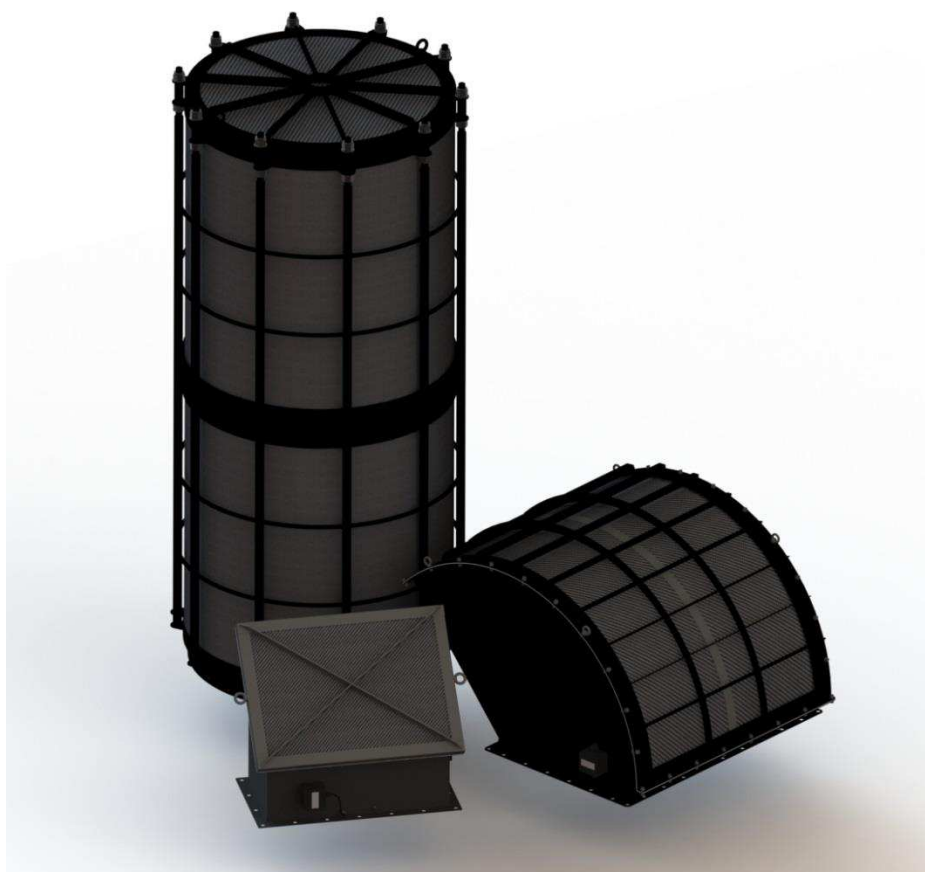




User Manual

Flameless Explosion Venting Device – FLEX



	Author	Approved
Position	Designer	Technical Manager
Name	Ing. Petr Grygar	Ing. Tomáš Wyka
Date	10. 5. 2016	10. 5. 2016
Version	1	



INDEX

- 1. INTRODUCTION 4
 - 1.1 IDENTIFICATION OF THE OPERATING AND MAINTENANCE INSTRUCTIONS 4
 - 1.2 FLEX CLASSIFICATION 4
 - 1.3 THE PURPOSE OF THE OPERATING AND MAINTENANCE INSTRUCTIONS..... 5
 - 1.4 WARRANTY CONDITIONS 5
 - 1.5 STORAGE 6
 - 1.6 TERMS AND DEFINITIONS 6
- 2. GENERAL SAFETY INSTRUCTIONS..... 7
- 3. PRODUCT DESCRIPTION 8
 - 3.1 OPERATING PRINCIPLE 8
 - 3.2 TECHNICAL SPECIFICATIONS 9
 - 3.3 THE PARAMETERS ENSURING THE SAFE USE OF FLEX ACCORDING TO THE ATEX CERTIFICATE 14
 - 3.4 SAFETY ZONE..... 14
 - 3.5 FORMATION OF OVERPRESSURE IN SURROUNDING VOLUME ACCORDING TO EN 16009 16
- 4. THE INSTALLATION TO THE PROTECTED EQUIPMENT 17
 - 4.1 THE INSPECTION OF THE FLEX BEFORE INSTALLATION 17
 - 4.2 GENERAL INSTALLATION GUIDELINES..... 17
 - 4.3 THE INSTALLATION TO THE PROTECTED EQUIPMENT 20
- 5. MEMBRANE OPENING SIGNALLING DEVICE 23
 - 5.1 ELECTRICAL CONNECTION..... 23
 - 5.2 PROHIBITED ACTIVITIES 24
- 6. OPERATORS, MAINTENANCE, AND STAFF TRAINING..... 25
- 7. SERVICE AND MAINTENANCE..... 27
 - 7.1 SERVICE 27
 - 7.2 FLEX SERVICE AFTER EXPLOSION OR WHEN THE MEMBRANE IS DAMAGED 28
- 8. SPARE PART LIST..... 34



9. ANNEXES 35



1. INTRODUCTION

1.1 IDENTIFICATION OF THE OPERATING AND MAINTENANCE INSTRUCTIONS

This user manual is drawn up for the flameless explosion venting device - FLEX (hereinafter referred to as FLEX) of the dimensional series F1 to F3, R1 to R4 and C1 to C5. The original user manual containing the operating and maintenance instructions is drawn up in the Czech language; other language versions are the translations of the original manual. If in any doubts, the original wording of the manual shall be considered decisive.

The following documents concerning FLEX are also supplied with this manual.

- ✓ Delivery note
- ✓ EU Declaration of Conformity under 2014/34/EU
- ✓ FLEX control sheet
- ✓ Operation Log Book

The following can be supplied on request:

- ✓ Drawing of the connecting flanges
- ✓ The data sheet of the intrinsically safe relay (if included in the delivery)

1.2 FLEX CLASSIFICATION

FLEX is designed in accordance with the European Directive 2014/34EU:

Table No. 1 - FLEX Classification

Equipment group	II
Explosive atmosphere	D
Equipment category, interior/exterior	1 D 3G / 3G D
Zone Interior:	20, 21, 22
Exterior:	2, 22



The electrical components (intrinsically safe relays) installed in FLEX must be certified to the appropriate zone or category.



1.3 THE PURPOSE OF THE OPERATING AND MAINTENANCE INSTRUCTIONS

These operating and maintenance instructions are intended for all the staff who are expected to come into contact with the FLEX device during their work.

The operating and maintenance instructions are an integral part of the product and the manufacturer cannot be held liable for any damage or injuries caused as a result of insufficient knowledge of these instructions. Therefore, it is necessary that the user reads through this manual and any other documents thoroughly and communicates them to the appropriately qualified personnel (electric, mechanical, technological, safety engineers and others). The provisions concerning the operation and maintenance should be incorporated into the operating rules, maintenance schedules and other documents by the user.

If the user is in doubt, he/she should contact the company RSBP spol. s r.o. or its authorized representative.



The customer should pay increased attention mainly to chapter 4 concerning the proper installation because FLEX is the device, whose improper installation, operation and maintenance may endanger the human life.



FLEX can be installed, operated, serviced and repaired only by an authorized person. The authorized person must be trained and certified either by the company RSBP spol. s r.o., or by its authorized representative. The certification must be renewed every 2 years.

1.4 WARRANTY CONDITIONS

This product was manufactured with the most advanced, high-quality materials, and it was thoroughly inspected before dispatch. However, if any defect or damage occurs during storage, installation, operation, cleaning or servicing, the user is obliged to notify the manufacturer immediately and in writing.

The manufacturer shall replace the damaged or missing parts of the products in the shortest possible time.

This product is covered by a warranty period of 2 years.

The warranty cannot be exercised in the following situations:

- ✓ The user did not familiarize himself/herself with these operating and maintenance instructions.
- ✓ The product was not used in accordance with these operating and maintenance instructions.
- ✓ The authorized person performed insufficient or improper installation or maintenance.



- ✓ Unsuitable spare parts were used (only the genuine spare parts distributed by the manufacturer can be used).
- ✓ Inappropriate accessories, which had not been approved by the manufacturer, were used.



The warranty can be exercised only provided that the damaged part, including the description of the defect and the product serial number, will be sent in to the manufacturer's address.

1.5 STORAGE

Prior to the installation to the protected technology, the product must be stored in a clean and dry place, and it must not be exposed to the weather. The product shall be stored in the original packaging. Under no circumstances can the product be exposed to rain, freeze, dust or any other weather conditions that affect the functions of the FLEX device.

The operating and maintenance instructions must be kept throughout the life of the product and it must be readily accessible to all employees.

If the product is removed from service or sold, it must be handed over to the new user together with these operating and maintenance instructions.

In the event of the loss of these instructions, they can be re-ordered from the manufacturer.

1.6 TERMS AND DEFINITIONS

The flameless explosion venting device - FLEX consists of the equipment for explosion venting (membrane) and the device for the absorption of the released energy (FLEX), which spreads during the dust explosion in a confined space. FLEX prevents the transmission of the explosion pressure and flame through the release opening of the membrane, thereby protecting people and equipment in its vicinity. FLEX must be used in the event of the membrane installation inside the building, where the protected equipment is located.

The membrane - is the device protecting a vessel or other closed volumes using the explosion venting - releasing the explosion pressure to the surrounding space. The membrane prevents the explosion pressure inside the vessel or any other closed volumes from exceeding the structural strength of the vessel and reduces the explosion pressure to a lower value than the allowable pressure load-capacity of the vessel.

The signalling device - is a device monitoring the position of the membrane (closing/opening). It works on the principle of breaking the wire firmly connected with the membrane and passed through a cable entry in the FLEX body. Upon breaking, the safety circuit is interrupted and the membrane opening is indicated.



2. GENERAL SAFETY INSTRUCTIONS

The user must ensure that the product is used and operated only in a technically perfect condition. The recommended inspection and maintenance intervals must be observed, and the required service or repairs performed by the certified person must be provided for.



The activities performed with the product must all be recorded in the Operation Log Vook, which is included in the delivery, so that the history of these activities can be traced at any time.



3. PRODUCT DESCRIPTION

If the explosive atmosphere in the form of a whirled dust cloud occurs in the technology and if the atmosphere comes into contact with a source of ignition, there may be immediate explosion. FLEX protects the technology, operators and the environment from the destructive effects of such explosions.

The FLEX devices of the F and R series feature the base, therefore the rectangular membrane. The FLEX devices of the C series feature the base, therefore the round membrane.

3.1 OPERATING PRINCIPLE

The flameless explosion venting device - FLEX consists of the equipment for explosion venting (membrane) and the device for the absorption of the released energy (FLEX), which spreads during the dust explosion in a confined space. FLEX prevents the transmission of the explosion pressure and flame through the release opening of the membrane, thereby protecting people and equipment in its vicinity. FLEX must be used in the event of the membrane installation inside the building, where the protected equipment is located. In the event of explosion, FLEX captures the explosion energy (flame, pressure) coming from the open membrane. Any damage to the product may result in the product failure. This could cause the transmission of the dust explosion from the protected vessel to the operators' zone. For this reason, it is very important to read through these instructions prior to the commencement of the installation.

The distances of the installed FLEX devices to the adjacent machinery or walls must be approved by the manufacturer. This distance is required for the proper function of FLEX. The minimum distance between FLEX and the nearest machinery (or the building wall) must be at least 500 mm (see chapter 3.4).

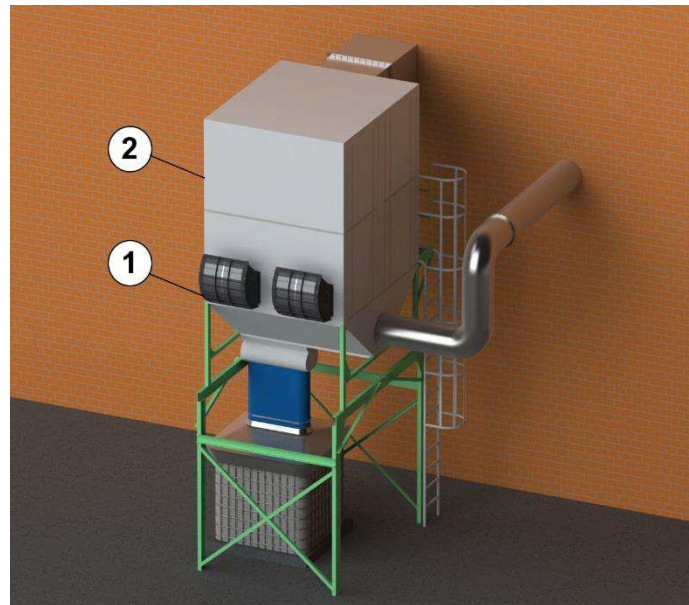


Fig. 1 - An Example of the Installation of FLEX Devices in the Protected Equipment (1 - FLEX, 2 - Filter)

3.2 TECHNICAL SPECIFICATIONS

Below, there are listed the dimensions of the designs together with the relevant drawings.

3.2.1 BASIC DIMENSIONS OF ROUND FLEX DEVICES - TYPE C (FLEX-C)

Table No. 2 - Basic Dimensions of the Round FLEX Devices (C-Series)

TYPE	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	d - the diameter of the opening for bolts [mm]	n - the number of openings for bolts [pieces]	Weight [kg]
FLEX C1	315	580	485	320	350	5	375	11	12	30
FLEX C2	445	795	635	450	486	5	525	13	12	71
FLEX C3	505	990	705	510	550	6	585	13	20	104
FLEX C4	625	1640	825	630	680	6	705	13	20	177
FLEX C5	815	2215	1020	820	860	6	895	13	24	291

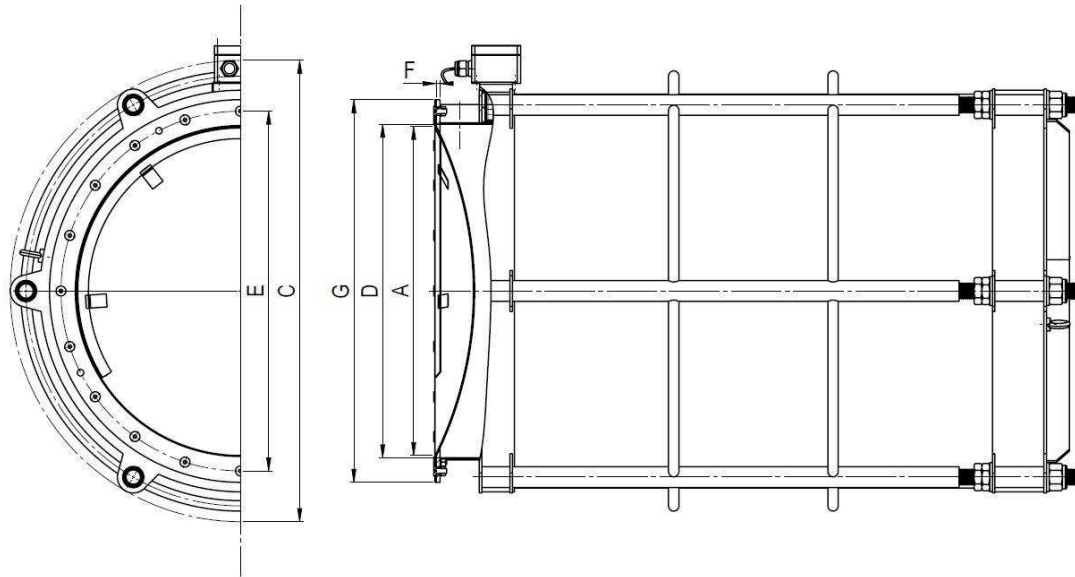


Fig. 2 - The Drawing of the Round FLEX Devices (C1-C5)



3.2.2 BASIC DIMENSIONS OF THE RECTANGULAR FLEX DEVICES OF THE R AND F TYPES (FLEX-R / FLEX-F)

Table No. 3 - Basic Dimensions of the Rectangular FLEX Devices (R-Series)

TYPE	A [mm]	B [mm]	C [mm]	D [mm]	d - the diameter of the opening for bolts [mm]	n - the number of openings for bolts [pieces]	Weight [kg]
FLEX R1	390	710	635	410	14	18	40
FLEX R2	540	890	900	580	14	22	74
FLEX R3	666	1000	1130	735	14	34	109
FLEX R4	996	1198	1660	1070	14	42	215

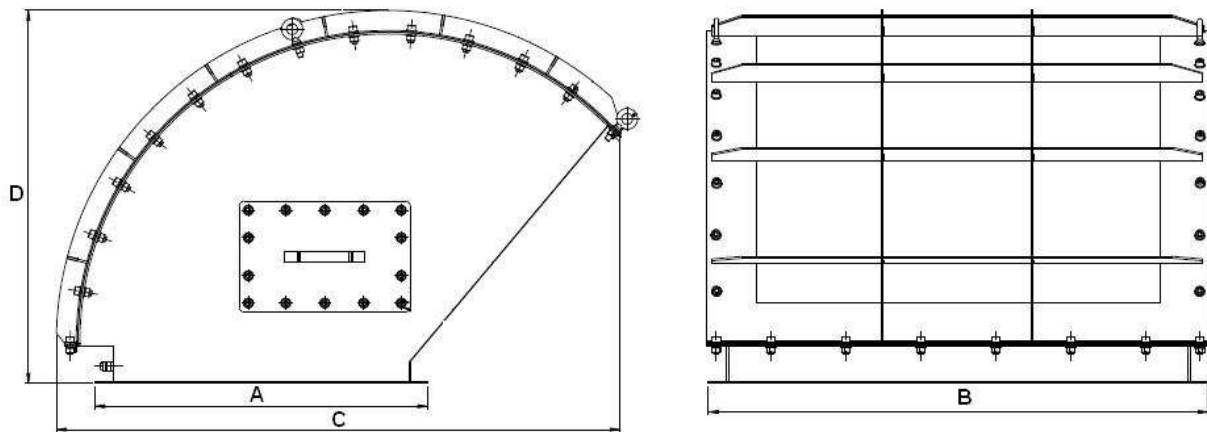


Fig. 3 - The Drawing of the Rectangular FLEX - Pie (R1 - R4)

Table No. 4 - Basic Dimensions of the Rectangular FLEX Devices (F-Series)

TYPE	A [mm]	B [mm]	C [mm]	D [mm]	d - the diameter of the opening for bolts [mm]	n - the number of openings for bolts [pieces]	Weight [kg]
FLEX F1	225	675	265	465	14	20	24
FLEX F2	305	625	335	530	14	18	28
FLEX F3	390	710	420	620	14	18	35

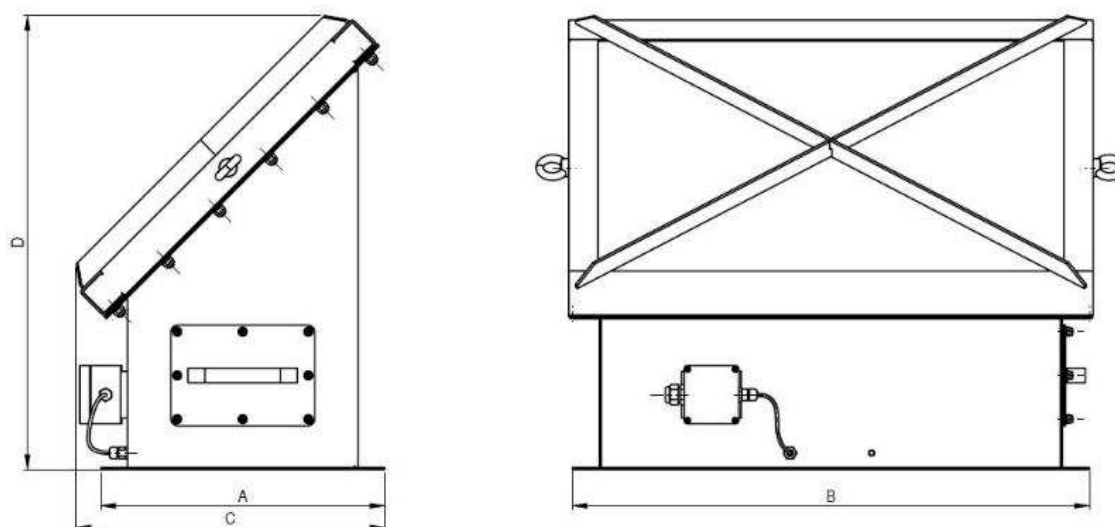


Fig. 4 - The Drawing of the Rectangular FLEX - Flat (F1 - F3)

3.2.3 MATERIAL DESIGN

FLEX is normally supplied in the material design of structural steel, with the surface treatment KOMAXIT RAL 9005 (black). Different colors can be supplied upon the customer's request.

3.2.4 OPTIONAL ACCESSORIES (INTRINSICALLY SAFE RELAY)

- a) **The intrinsically safe relay** forms the interface between the safe and the hazardous zones (Zone 20). The intrinsically safe relay requires power supply of 230V/50 Hz, protection with the circuit breaker of at least 1 A (tripping characteristics B or C). The intrinsically safe relay contains a throw-over contact, where the operational state of the membrane (closed/opened) is signalled.



Fig. 5 - Intrinsically Safe Relay

The intrinsically safe relay can be supplied as an optional accessory (also separately) upon the customer's requests. For more details, please refer to chapter No. 5. The intrinsically safe relay must always be used with the installation of the FLEX device.



The power supply and control cabling for the intrinsically safe relay is included in the delivery and it should be provided for by the customer (if not agreed otherwise in the contract).

- b) **The flange packing** (gasket) must be used between the flange of the protected device and the membrane, which is sealed to the flange of the FLEX device. This gasket can be supplied by the company RSBP spol. s.r.o. according to parameters fit for the particular installation. However, the customer can get it by himself/herself. The gasket is shown in fig. 12 and 13. The gasket supplied by the company RSBP spol. s. r. o. is made of the EPDM material, which can be used in all common applications with the ambient temperature between -40 °C to 80 ° C all the time. For the application with special requirements for the features of the gasket, we can supply the gasket made of the material that meets the requirements. In the event that the operator decides to use his/her own gasket, neither the supplier nor the manufacturer is responsible for the problems related to the its inappropriate selection.
- c) **The protective bag** is intended to cover the functional area of the FLEX flame filter, so that any penetration of foreign particles in the filter meshes reducing the functionality of FLEX is prevented. The protective bag is recommended for the use in dusty premises with the significant clogging risk of the flame filter. In the event of explosion, the bag breaks and the energy is absorbed without any disturbance. However, if the bag is damaged, either during the explosion or otherwise, it must be replaced with the new one.



Fig. 6 - Protective Bag (1 - Protective Bag, 2 - FLEX)



3.3 THE PARAMETERS ENSURING THE SAFE USE OF FLEX ACCORDING TO THE ATEX CERTIFICATE

All relevant parameters are summarized in the Table No. 5. If any other range of ambient temperatures is required, the manufacturer should be contacted.

Table No. 5 - The Parameters Ensuring the Safe Use of FLEX

Size	Max. Kst [bar·m/s]	Ambient temperature [°C]
FLEX - F1	220	-20 to 60
FLEX - F2		
FLEX - F3		
FLEX - R1	220	
FLEX - R2		
FLEX - R3		
FLEX - R4		
FLEX - C1	300	
FLEX - C2		
FLEX - C3		
FLEX - C4		
FLEX - C5		



In the event of explosion, FLEX must be inspected by the manufacturer or by a trained person; they should determine the proper servicing, so that the proper function for the further safe use is ensured.

3.4 SAFETY ZONE

The area in front of the free space of the flame filter at a distance of 1 - 2.5 m from FLEX must be defined as the safety zone. The specific value is given in the Technical Data Sheet supplied with each FLEX device. **No people can access the zone** because there is a danger of noise, smoke and water steam associated with the explosion. It is recommended that no equipment which could be destroyed in such an event is located in this zone. The safety zone for the round FLEX is shown in fig. 7, for the rectangular one in fig. 8.

If the operators must regularly work in the close proximity of FLEX, a flat panel or a welding curtain for the separation of the personnel and the device can be used; the distance from the FLEX surface must be at least 500 mm. The specific solution must always be approved by the manufacturer of the FLEX supplier.



The safety zone can be accessed only for the purpose of service or device maintenance. However, only provided that the entire technology has been shut down, the explosive atmosphere has been vented and if there is no explosion risk inside the protected technology.

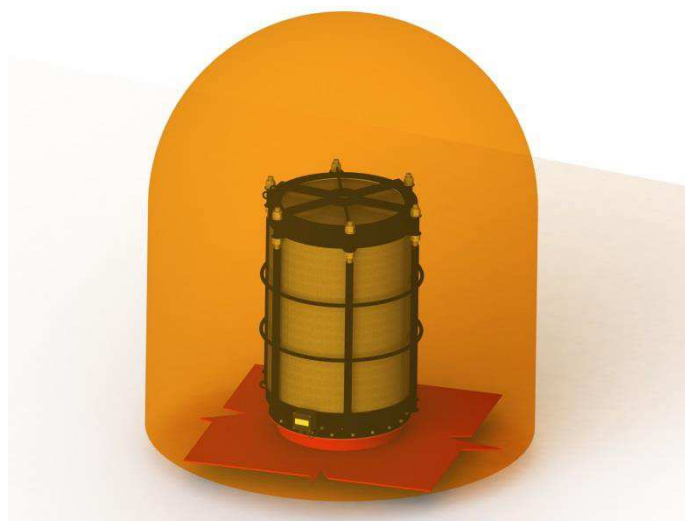


Fig. No. 7 - Safety Zone for the Round FLEX Devices

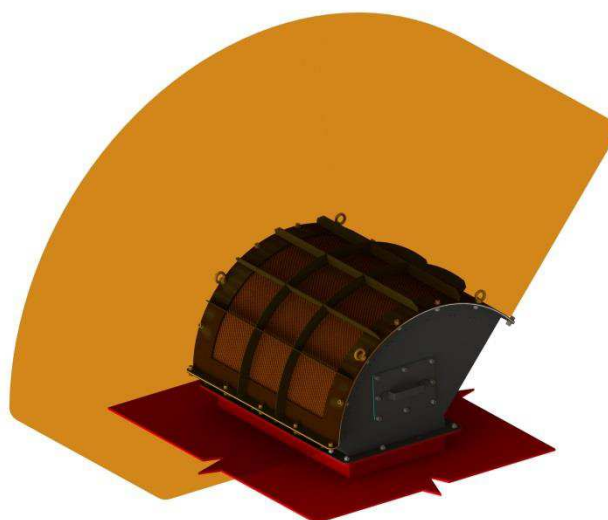


Fig. No. 8 - Safety Zone for the Rectangular FLEX Devices



3.5 FORMATION OF OVERPRESSURE IN SURROUNDING VOLUME ACCORDING TO EN 16009

When using the flameless venting device for explosion venting, rises the pressure inside the room where is such device installed. This effect is obvious especially for installations inside small rooms. In such situation is necessary to check, if is the room volume according to the volume of protected vessel large enough, to avoid a damage of this room. Generally, is necessary to consider a reinforcement of the room if the room is 300x smaller than protected vessel. This is valid for buildings and rooms with common constructional strength 0,01 bar. This is described within following formula:

$$\frac{V_0}{V} = \alpha \cdot \frac{p_0}{\Delta p}$$

Where

p_0 is the ambient pressure;

Δp is the maximum pressure rise in the room or building;

α is the expansion constant, empirical derived from the gas volume and temperature outside protected vessel;

V_0 is the volume of the room or building;

V is the volume of the protected vessel;



4. THE INSTALLATION TO THE PROTECTED EQUIPMENT

FLEX is supplied assembled. The membrane is sealed and bolted to FLEX. These bolts must be removed prior to the installation (see chapter 4.3). The installation of the device shall be carried out according to the manufacturer's documents concerning the specific use.

4.1 THE INSPECTION OF THE FLEX BEFORE INSTALLATION

Immediately after the delivery and then before the commencement of FLEX installation, the following basic checks must be performed:

- ✓ Check the integrity of the original packaging of FLEX.
- ✓ Check the integrity and flawlessness of the top coat of FLEX.
- ✓ Check the integrity of the membrane.
- ✓ Check whether no fasteners (bolts, nuts, washers) holding the top lid (cover) of FLEX are missing.
- ✓ Check the integrity of the cabling.

After successful inspection, FLEX is ready to be installed. In the event of any defects or deficiencies, contact the manufacturer or the distributor immediately.

4.2 GENERAL INSTALLATION GUIDELINES

- A) Only lifting eyes can be used for the transport and handling FLEX. The lifting eyes of the FLEX devices of the C and F series are firmly welded to the FLEX structure; as to the FLEX devices of the R series, they are bolted between the FLEX body and its lid.
- B) The flange of the vessel must have the same connecting dimensions as the FLEX flange and it must be located, if possible, on the lowest possible branch extrusion, ensuring easy installation and sufficient strength for carrying the FLEX weight. The pressure resistance of the device must comply with the legislation relating to the device for explosion venting and flameless explosion venting devices.
- C) Both the sealing faces, both on the FLEX device and on the connecting flange of the vessel, must be thoroughly cleaned and degreased. The material for the flange gasket (packing) must be fit for the respective operation and meet all necessary requirements (temperature, chemical resistance, tightness and others). The recommended gasket is the gasket supplied by the company RSBP spol. s r.o., which is made of EPDM for common operations. For special requirements, the gasket meeting the special requirements of the customer can also be supplied.



- D) The FLEX devices can be installed vertically, horizontally or at an angle. The goal consists in the prevention of sticking an excessive amount of dust and dirt from the technology on the membrane. The allowed positioning of the installation is shown in fig. 9.

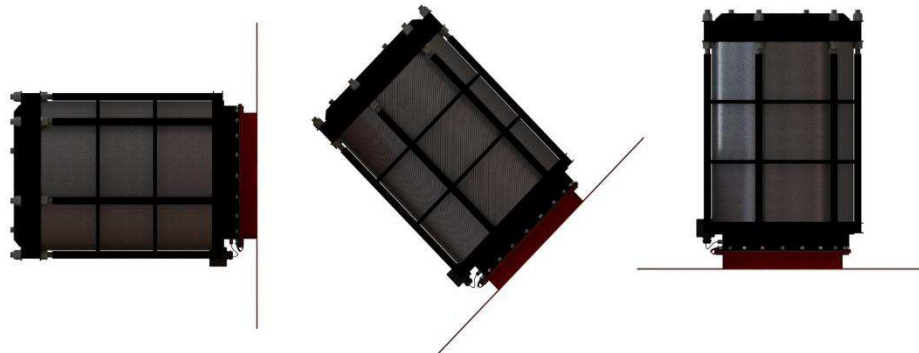


Fig. 9 - The Allowed Positioning of the Installation

- E) If FLEX C3, C4 or C5 is positioned otherwise than vertically, the end of the device must be fixed in the way that the load from the FLEX weight is distributed evenly between both the ends of the device. The end of FLEX must be hung by the welded eyes on the FLEX cover (lid) using a suitable structure. An example of such suspension is shown in fig. 10. The specific fastening method must be discussed with the manufacturer or the supplier. The dimension of the structure as well as all suspension components must be fit for the load from the FLEX weight for all FLEX types and sizes. In the event of installation, the device must also be sufficiently sized to withstand the weight of the FLEX device.

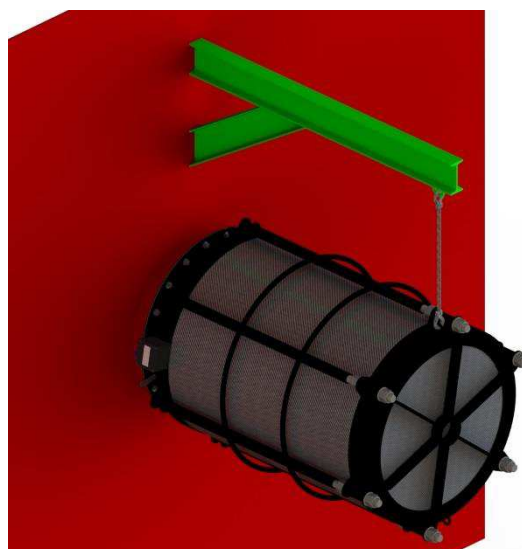
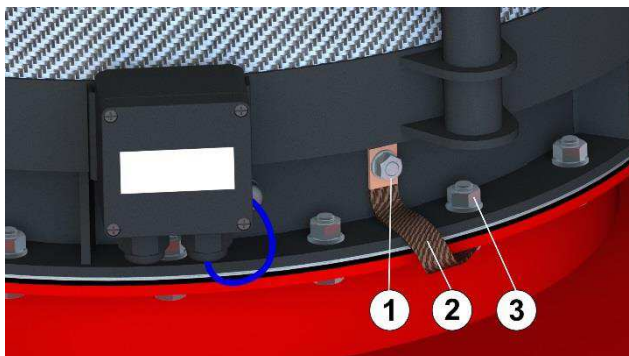


Fig. 10 - The Proper Positioning of FLEX



Flameless Explosion Venting Device – FLEX

- F) FLEX must be installed in the way that the membrane is facing the free volume of the protected vessel. For instance, the space in front of the membrane must not be blocked with filter cartridges or any other elements.
- G) The membrane opening signalling device must be properly connected in each FLEX, so that the operators can surely distinguish, whether no membrane is opened. The opening signalling device must always be connected to the intrinsically safe relay.
- H) The outdoor installation is allowable only provided that the FLEX device is under the roof, so that the penetration of water, snow, ice and other particles in the flame filter meshes of FLEX is avoided. The protective bag must also be used in this situation. In the event of intrusion of any particles into the meshes of FLEX due to climatic effects, the manufacturer or the distributor of FLEX cannot be held liable for the functionality of the device.
- I) FLEX grounding must be made using the appropriate grounding element (earth termination, earth wire), by means of which the earth bolt with one of the flange bolts connecting FLEX with the protected device is connected. The contact faces for the placement of the earth element must be cleaned appropriately and their coating must be removed. The fasteners used for attaching the grounding element to the FLEX earth bolt must be galvanized. Specifically, the nut M8 (ISO 4032), property class 8, and serrated lock washer (DIN 6798) and plain washer (ISO 7090) - both of them with the size 8. First, the serrated lock washer should be put on the earth bolt, then the grounding element, the plain washer; finally the nut should be tightened with a torque 15 Nm. The other end of the grounding element should be placed under the head of one of the FLEX flange bolts. Between the grounding element and the actual FLEX, the serrated lock washer (DIN 6798) of the same size as the flange bolts FLEX must be inserted; tighten with the same tightening torque as the other flange bolts. The example of the proper grounding is shown in Fig. 11. The grounding must comply with the legislative requirements of the country where FLEX is installed.



- 1 - Fasteners
 2 - Grounding element (earth terminal/wire)
 3 - Fasteners of FLEX and the protected vessel

Fig. No. 11 - Flex Grounding

- J) FLEX should be connected to the prepared flange on the vessel using the fasteners listed in table No. 6. In this table, all types of bolts, nuts and washers necessary for



the proper installation must be listed. All fasteners must be galvanized, the property class of bolts must be 8.8 (ISO 4017) and the property class of nuts must be 8 (ISO 7040). The washers (ISO 7090) should be put under the nut. The table also shows the specific tightening torques for individual bolts.

Table No. 6 - Fasteners for the Installation of FLEX

FLEX	Number of bolts, nuts and washers [pcs]	Bolt ISO 4017 - 8.8 - A3L	Nut ISO 7040 - 8 - A3L	Washer ISO 7090 - A3L	Tightening torque [N·m]
F1	20	M10 x 35	M10	10	21
F2	18	M10 x 35	M10	10	21
F3	18	M10 x 35	M10	10	21
R1	18	M10 x 35	M10	10	21
R2	22	M10 x 35	M10	10	21
R3	34	M10 x 35	M10	10	21
R4	42	M10 x 35	M10	10	21
C1	12	M8 x 30	M8	8	15
C2	12	M10 x 35	M10	10	21
C3	20	M10 x 35	M10	10	21
C4	20	M10 x 40	M10	10	21
C5	24	M10 x 40	M10	10	21

4.3 THE INSTALLATION TO THE PROTECTED EQUIPMENT

The installation of the FLEX device can be summarized in the following steps:

- 1) Removing the transport bolts (ISO 10642) which, together with the sealant, hold the membrane firmly on the FLEX body.
- 2) Cleaning and degreasing of the flange contact face on the vessel and the FLEX device (the underside of the membrane). **Do not remove the membrane! Leave it intact, sealed to the underside of FLEX.**
- 3) The installation of the appropriate flange gasket, either the gasket supplied by the company RSBP spol. s r.o., or the customer's own gasket.
- 4) For FLEX C3, C4, C5 or any other type or size, for which it was decided that the following procedure is required due to the total size of the protected device, the FLEX devices should be supported (suspended); see chapter 4.2 (E).



- 5) Strong tightening of the flange bolts listed in table No. 5 using the prescribed tightening torque (tab. 6), except for the selected bolt which is intended for the connection of the other end of the grounding element; see chapter 4.2 (I).
- 6) For the FLEX device mentioned under 4, the suspension of the overhanging end of FLEX on the prepared structure; see chapter 4.2 (E).
- 7) Grounding of the flameless device, see the previous chapter (I) and fig. 11.

The figures 12 a 13 show the exploded view of the entire assembly system.

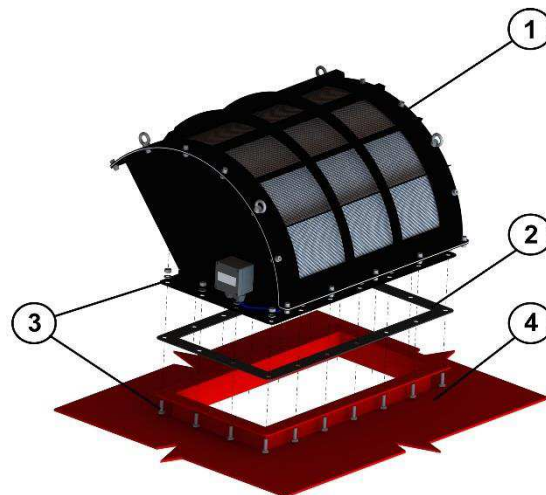


Fig. 12 - The Exploded View of the Rectangular FLEX (1 - FLEX, 2 - flange gasket, 3 - fasteners, 4 - protected technology)



Fig. 13 - The Exploded View of the Round FLEX (1 - FLEX, 2 - flange gasket, 3 - fasteners, 4 - protected technology)

5. MEMBRANE OPENING SIGNALLING DEVICE

The membrane opening signalling device is an electronic component supplied by the company RSBP spol. s r.o. and it is an integral part of the technological system FLEX, which is also supplied by this company.



The entire installation (mechanical and electrical preparation, the actual installation, parametrization, setting) associated with the FLEX closing sensor should be performed by the company RSBP spol. s r.o. or by its authorized representative.

The intrinsically safe relay should be installed into a plastic box, distribution boards, switchboards and other similar devices, in the proximity of FLEX or beyond its proximity (control room, switch room).

5.1 ELECTRICAL CONNECTION

The electrical connection should be made according to the drawing FLEX - signalling connection 4-001-1069. These drawings list the recommended cable types and the precise values of the supply voltage protection.

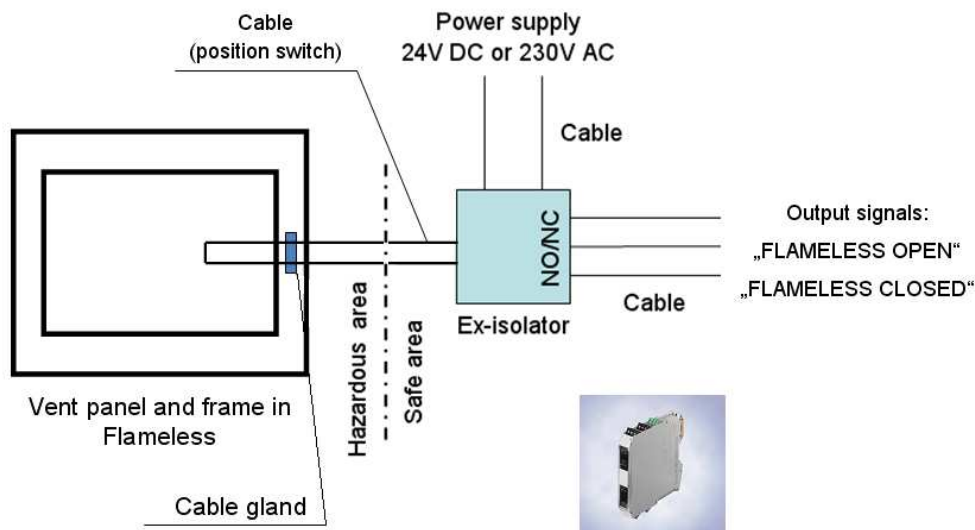


Fig. 14 - Signalling Device Wiring Diagram



5.2 PROHIBITED ACTIVITIES

Operators, any other customer's employees or other entities cannot perform the following prohibited actions:

- ✓ damage FLEX or its components,
- ✓ damage the membrane (and all its components) mechanically,
- ✓ damage the electric cabling (power, signal) for membrane opening.



All the activities listed above (installation, dismantling, maintenance, service, operation, damage, defects) should be demonstrably recorded in the Operation Log Book for the technological unit, indicating the date, name and signature of the worker who performed the intervention.



6. OPERATORS, MAINTENANCE, AND STAFF TRAINING

The device can be operated only by the person who is physically and mentally capable and who has been demonstrably trained in this activity. Under normal operating conditions, there is no risk of electric shock or heat injury.

The maintenance interval performed by the operator must be specified on the basis of operating conditions for the given technology, in particular on the basis of the overall dust nuisance. It is recommended that the following procedure is observed:

1. maintenance 2 weeks after commissioning
2. maintenance 6 weeks after commissioning
3. maintenance 8 weeks after commissioning

Based on the identified operational data (the clogging rate of the flame filter meshes and other), the customer shall specify the FLEX maintenance interval (for example once a month). The lowest maintenance frequency is once a year. Each maintenance must be recorded in the operation log book, highlighting the information on the date and time of the respective maintenance activity. Furthermore, it must be indicated whether the activity was inspection, maintenance, change or repair, or what exactly was done with FLEX and why. Last but not least, the name of the worker who performed the operation and his/her signature must be indicated.

The FLEX maintenance consists in the following steps:

- 1) Check for any mechanical damage to FLEX.
- 2) Check of FLEX cleanliness. The flame filter meshes must be maintained in a perfectly clean condition; no dust or other dirt may stick on the surface or inside the FLEX device. Therefore, the meshes must be cleaned using an industrial vacuum cleaner and/or mechanical means (a dry cloth, broom or others) within each maintenance. If the FLEX is fitted with a protective bag, the bag must also be cleaned from dust and dirt regularly. The bag can also be washed.
- 3) For the rectangular FLEX devices (of the F and R series), the membrane integrity can be checked through the inspection hole. After the inspection and possible cleaning of dirt, the hole must be thoroughly sealed using the inspection hole gasket. In the event of damage, the new one can be ordered from the manufacturer. The original cover (lid) of the inspection hole and the original fasteners, a self-locking nut (ISO 7040, property class 8) and the plain washer (ISO 7090), both galvanized, should be used for covering the hole. In the event of loss, you can replace the fasteners with the new ones; for the FLEX devices of the F series and the FLEX device R1, they include the nuts and washers M6, for FLEX R2, R3 and R4 M8. The M6 nuts must be tightened



using the tightening torque of 6 Nm, whereas the M8 nut with the tightening torque of 15 Nm.

The regular training of the staff means their warning against the danger of accidental or ordered movement within the area of FLEX and their instruction on this danger (on protection) once a year, including the newly hired staff.

The user is obliged to include the instructions from this chapter to his/her operational and safety rules.



All activities performed with the product must be recorded in the Operation Log Book, so that the history of these tasks can be traced at any time.



7. SERVICE AND MAINTENANCE

7.1 SERVICE



The general inspection and service of FLEX can be performed only by the manufacturer or the person certified by the manufacturer for these activities (authorized person).

The following service interval is recommended for the flawless functionality of FLEX:

1. service (functionality check)	3 weeks after commissioning
2. service (functionality check)	6 weeks after commissioning
3. service	6 months after commissioning
4. service	1 year after commissioning
Each additional service (under flawless operation)	Once a year

The Scope of Service Activities:

- 1) Check for any mechanical damage to FLEX.
- 2) Gasket and sealing inspection (flange gasket inspection, inspection hole gasket check with the rectangular FLEX device (of the F and R series)).
- 3) Check of FLEX cleanliness. The flame filter meshes must be maintained in a perfectly clean condition; no dust or other dirt may stick on the surface or inside the FLEX device. Therefore, the meshes must be cleaned using an industrial vacuum cleaner and/or mechanical means (a dry cloth, broom or others) within each service inspection. If the FLEX is fitted with a protective bag, the bag must also be cleaned from dust and dirt. Extensive bag cleaning should be ensured by the operator (washing of the bag).
- 4) The opening signalling device - the inspection of the supply cable, signalling operability and the settings.
- 5) For the rectangular FLEX devices (of the F and R series), the membrane integrity can be checked through the inspection hole. After the inspection and possible cleaning of dirt, the hole must be thoroughly sealed using the inspection hole gasket. In the event of damage, the new one can be ordered from the manufacturer. The original cover (lid) of the inspection hole and the original fasteners, a self-locking nut (ISO 7040, property class 8) and the plain washer (ISO 7090), both galvanized, should be used for covering the hole. In the event of loss, you can replace the fasteners with the new



ones; for the FLEX devices of the F series and the FLEX device R1, they include the nuts and washers M6, for FLEX R2, R3 and R4 M8. The M6 nuts must be tightened using the tightening torque of 6 Nm, whereas the M8 nut with the tightening torque of 15 Nm.



In the event of explosion, FLEX must be inspected by the manufacturer or by the trained person, so that the proper function for the further safe use is ensured.

7.2 FLEX SERVICE AFTER EXPLOSION OR WHEN THE MEMBRANE IS DAMAGED

In the chapters below, the procedure for the FLEX service in the event of the explosion in the protected technology or after the damage to the membrane is detailed.

7.2.1 FLEX SERVICE AFTER EXPLOSION

In the event that the explosion occurs in the protected technology or the flame filter mesh is heavily polluted with dust and other dirt, the following procedure of the flame filter replacement must be observed. This procedure is different for individual types of FLEX.

FLEX, R-Series:

- 1) Stop the production process in the protected technology immediately.
- 2) Let FLEX and its surrounding cool down to the acceptable level, so that it is possible to work in the vicinity of FLEX as well as with the actual device.
- 3) In the event of explosion, FLEX must be dismantled from the equipment.
- 4) After the dismantling, check whether no visible damage and plastic deformation to the FLEX body and lid has occurred and whether its integrity is maintained. If not, the further use of FLEX is prohibited!
- 5) Then disassemble the entire FLEX, remove the top cover and pull the flame filter out. Remove the used membrane.
- 6) In two places in FLEX, in the vicinity of the flame filter, there are two ALSIFLEX 1430 (thick. 2) gaskets applied (see fig. 15). If these gaskets are not damaged or polluted after the explosion, or if their integrity is not infringed, there is no need to change them. Otherwise, replace them with the new ones.
- 7) This dismantled FLEX must be thoroughly cleaned and the residue materials after the explosion must all be removed. During this cleaning, pay attention to the surfaces, on which there is the gasket from the previous clause; it must not be damaged.
- 8) This cleaned FLEX can be further repaired and used. A new flame filter (a spare part delivered by the supplier) should be inserted into the upper part of the frame, or the gasket should be replaced and the FLEX lid should be tightened, using the original



fasteners. For this purpose, there are galvanized fasteners, i.e. the bolts ISO 4762 with a property class 8.8, locking nuts with a property class 8 ISO 7040 and plain round washers ISO 7090, all sized M8 (for FLEX R4 M10). If they have been damaged or lost, they can be replaced with the new ones. The connections must all be tightened with a tightening torque 15 Nm (21 Nm for FLEX R4).

- 9) A new membrane (a spare part from the supplier) can be sealed from the underside to this prepared FLEX, using the silicone sealant suitable for this application. The identical flange gasket supplied by the company RSBP spol. s r.o. can also be used; the gasket is commonly used between the membrane and the flange on the technology. Please note that the membrane must face with the signalling device towards the FLEX entry and the signalling device must be wired properly.
- 10) Further installation is identical with the new FLEX, i.e. the same as the procedure detailed in chapter 4.

FLEX, F-Series:

- 1) Stop the production process in the protected technology immediately.
- 2) Let FLEX and its surrounding cool down to the acceptable level, so that it is possible to work in the vicinity of FLEX as well as with the actual device.
- 3) In the event of explosion, FLEX must be dismantled from the equipment.
- 4) After the dismantling, check whether no visible plastic deformation to the FLEX body has occurred and whether its integrity is maintained. If not, the further use of FLEX is prohibited!
- 5) Then remove the flame filter from FLEX; the filter is attached to the FLEX body using the welded bolts. Then remove the membrane.
- 6) The ALSIFLEX 1430 (thick. 2) gasket is applied on the FLEX body under the flame filter (see fig. 15). If this gasket is not damaged or polluted after the explosion, or if its integrity is not infringed, there is no need to change it. Otherwise, replace it with a new one.
- 7) This dismantled FLEX must be thoroughly cleaned and the residue materials after the explosion must all be removed. During this cleaning, pay attention to the surfaces, on which there is the gasket from the previous clause; it must not be damaged.
- 8) This cleaned FLEX can be further repaired and used. A new flame filter (a spare part delivered by the supplier) should be inserted into the upper part of the FLEX body, or the gasket should be replaced and the new flame filter should be tightened to the FLEX body, using the original fasteners. For this purpose, there are galvanized fasteners, i.e. locking nuts with a property class 8 ISO 7040 and plain round washers



ISO 7090, all sized M8. If they have been damaged or lost, they can be replaced with the new ones. The connections must all be tightened with a tightening torque 15 Nm.

- 9) A new membrane (a spare part from the supplier) can be sealed from the underside to this prepared FLEX, using the silicone sealant suitable for this application. The identical flange gasket supplied by the company RSBP spol. s r.o. can also be used; the gasket is commonly used between the membrane and the flange on the technology. Please note that the membrane must face with the signalling device towards the FLEX entry and the signalling device must be wired properly.
- 10) Further installation is identical with the new FLEX, i.e. the same as the procedure detailed in chapter 4.

FLEX, C-Series:

- 1) Stop the production process in the protected technology immediately.
- 2) Let FLEX and its surrounding cool down to the acceptable level, so that it is possible to work in the vicinity of FLEX as well as with the actual device.
- 3) In the event of explosion, FLEX must be dismantled from the equipment.
- 4) After the dismantling, check whether no visible plastic deformation to the FLEX body or the lid has occurred and whether its integrity is maintained. If not, the further use of FLEX is prohibited!
- 5) Then the entire FLEX must be disassembled. Remove the top lid and pull the flame filter out under the lid as well as the actual cylindrical flame filter (there are two cylindrical flame filters in the FLEX devices C4 and C5). Remove the used membrane. Do not interfere with the low counter nuts, which are located on the underside of the FLEX cover on the welded threaded rods; have them in the position set by the manufacturer!
- 6) All metal-metal interfaces of this series FLEX are fitted with the gaskets of ALSIFLEX 1430 (thickness 10) (see fig. 15). These gaskets must always be replaced.
- 7) This dismantled FLEX must be thoroughly cleaned and the residue materials after the explosion must all be removed.
- 8) This cleaned FLEX can be further repaired and used. First, one sealing ring ALSIFLEX 1430 (thickness 10) should be inserted into the body. The new cylindrical flame filter should be put on this gasket; the filter should be turned to the position that the end of the mesh installed in the filter with pins is opposite the membrane entry. Again, place the ALSIFLEX 1430 sealing ring (thickness 10) onto the cylindrical flame filter. A new flame filter should be put onto this layer under the lid and another

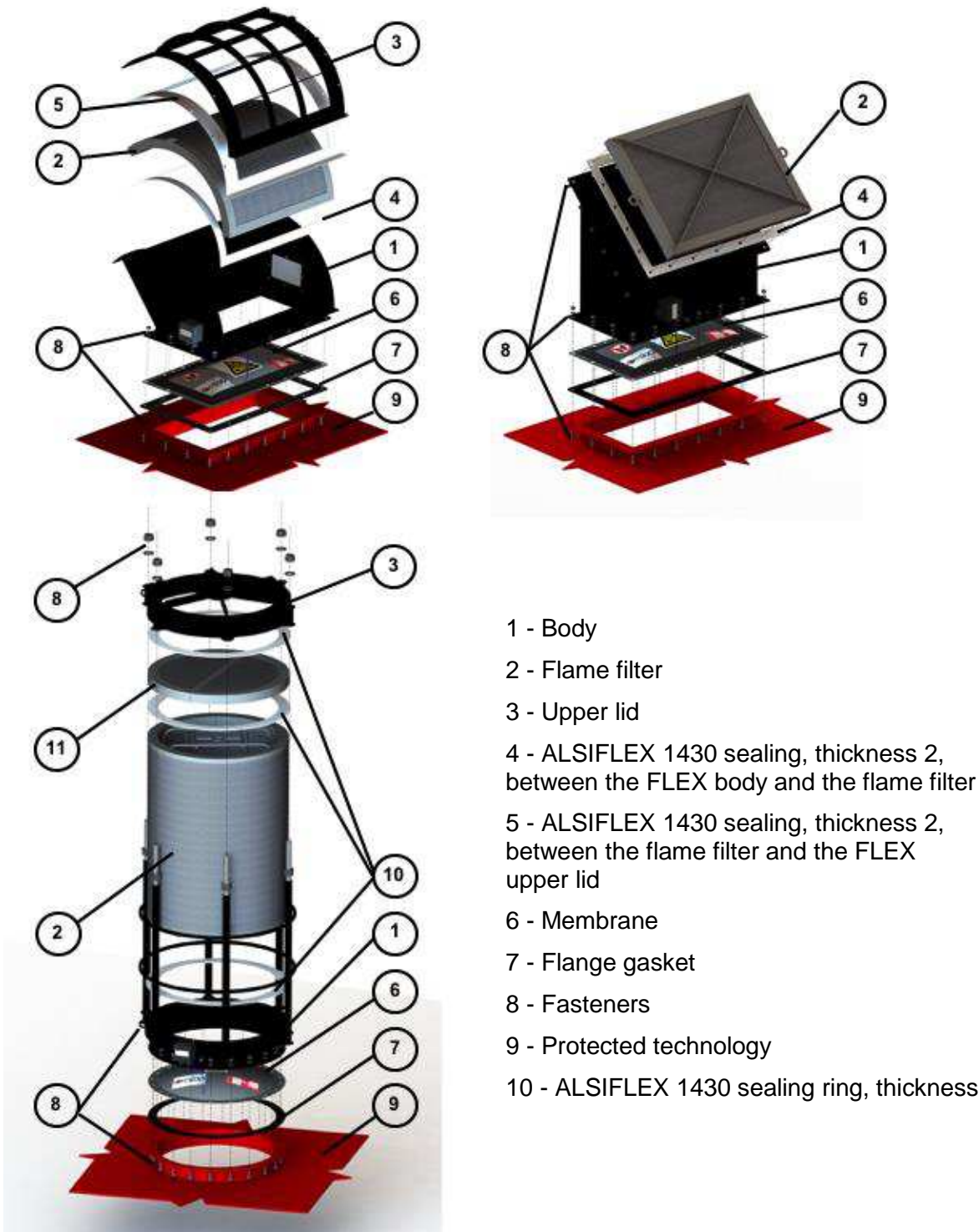


ALSIFLEX 1430 sealing ring (thickness 10) should be placed on it. This procedure applies to the FLEX devices C1, C2 and C3. There are two cylindrical flame filters in the FLEX devices C4 and C5. The procedure differs from the previous one only with the fact that an adaptor should be inserted between these cylindrical flame filters, and between the adaptor and the new cylindrical flame filters the sealing ring ALSIFLEX 1430 (thickness 10) should be installed. The entire FLEX should then be covered with the lid; it should be slipped over the welded threaded rods and fastened tightly against the low nuts, which were adjusted into the correct position by the manufacturer. Do not tamper with the low nuts. The tightening of the upper nuts should be performed using the “cross” method; after tightening, check each nut again.

- 9) A new membrane (a spare part from the supplier) can be sealed from the underside to this prepared FLEX, using the silicone sealant suitable for this application. The identical flange gasket supplied by the company RSBP spol. s r.o. can also be used; the gasket is commonly used between the membrane and the flange on the technology. Please note that the membrane must face with the signalling device towards the FLEX entry and the signalling device must be wired properly.
- 10) Further installation is identical with the new FLEX, i.e. the same as the procedure detailed in chapter 4.



Below, in fig. 15, there is an exploded diagram of each FLEX design



- 1 - Body
- 2 - Flame filter
- 3 - Upper lid
- 4 - ALSIFLEX 1430 sealing, thickness 2, between the FLEX body and the flame filter
- 5 - ALSIFLEX 1430 sealing, thickness 2, between the flame filter and the FLEX upper lid
- 6 - Membrane
- 7 - Flange gasket
- 8 - Fasteners
- 9 - Protected technology
- 10 - ALSIFLEX 1430 sealing ring, thickness

Fig. 15 - Exploded View



7.2.2 FLEX SERVICE IN THE EVENT OF DAMAGE TO THE MEMBRANE

In the event that the maintenance or the service reveals any damage to the membrane but no explosion occurs, the membrane must be replaced. The procedure is similar to the procedure detailed in the previous chapter (7.2.1), but there is no need to change the flame filter(s) of FLEX.

- 1) In the event of damage to the membrane, FLEX must be dismantled from the equipment. This is possible only if the entire technology is shut down and therefore there is no explosion hazard.
- 2) Then remove the old membrane from the FLEX and check whether FLEX was not polluted during this process; pay particular attention to the meshes in its flame filter. If so, remove the dirt. If it is not possible, the flame filter(s) must also be replaced; proceed according to chapter 7.2.1 as though there was an explosion.
- 3) A new membrane (a spare part from the supplier) can be sealed from the bottom using suitable silicone sealant to this prepared FLEX. The identical flange gasket supplied by the company RSBP spol. s r.o. can also be used; the gasket is commonly used between the membrane and the flange on the technology. Please note that the membrane must face with the signalling device towards the FLEX entry and the signalling device must be wired properly.
- 4) Further installation is identical with the new FLEX, i.e. the same as the procedure detailed in chapter 4.



8. SPARE PART LIST

Spare parts include all optional accessories from chapter 3.2.4 (Intrinsically Safe Relay, Flange Sealing, Protective Bag). In particular, they include the following components:

- a) **The membrane** must be replaced after each explosion in the protected equipment or if any damage to it is found during the maintenance or servicing. Should this be the case, proceed according to chapters 7.2.1 or 7.2.2. The type of the membrane used is stated on the FLEX plate; the identical membrane can also be used as a spare part.
- b) **The FLEX flame filter** must be replaced after each explosion or if it is strongly contaminated. Each FLEX has its unique size of the flame filter, therefore, for instance, the filter from FLEX R2 is fit only for FLEX R2, but not for other FLEX devices; therefore, note the filter type while ordering spare flame filters.
- c) **The inspection hole lid gasket** is used for the sealing of the inspection hole in the rectangular FLEX devices (series F and R). If damaged during the service or activation of the device, the new one can be ordered from the manufacturer of the supplier. The gaskets of the same dimensions are included in the series FLEX F and FLEX R1; the other identical group include the FLEX devices R2, R3 and R4.
- d) Gasket ALSIFLEX (pos. 4, 5 & 10 from Fig. No. 15) if damaged, must be replaced together with flame filter (mesh). Each type of FLEX has a unique size of this gasket.



9. ANNEXES

List of Annexes:

FLEX signaling connection (dr.nr. 4-001-1069 page 1)

FLEX signalling connection (dr.nr. 4-001-1069 page 2)