ExDoor AxB M
EXPLOSION DOORS

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2023

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1. INTRODUCTION

Technical conditions have been elaborated for assembly of ExDoor A x B M (hereinafter ExDoor), which is designed to vent off an explosion that occurs inside a protected vessel such as tanks, silos, separators, filters and sorters, and any environment where there is the risk of an explosion from industrial dust. This guide covers the installation, operation and maintenance of the device.

The original user manual for operation and maintenance is available in the Czech language, other language versions are a translation of the original. In case of any ambiguity, the original Czech version shall prevail.

1.1. TERMINOLOGY

ExDoor - explosion doors	is designed to vent off explosive pressure at a value lower than the safe static overpressure of the inner space of the protected device. This reduces the explosion to a value lower than the permissible pressure capacity of the protected equipment. Under the designed operating conditions, the inner space of protected equipment of the ExDoor is sealed off. The vent panel on the frame bursts during an explosion, causing the vent path to open up.
The vent panel	is structurally designed with permanent magnets attached to the frame of the assembly around the circumference of the ExDoor. The number of magnets for the assembly of vent panel determines the magnitude of the pulling force. These magnets hold the vent panel in the closed position. When pressure under the vent panel exceeds the pulling force of the magnets, the vent panel bursts open. Anchoring equipment retains the vent panel while the explosion is vented through the relief path.
Explosion pressure	is a rapid, physical-chemical process in which a large amount of energy is suddenly released, which is manifested by an increase in pressure and accompanied by a light and heat effect.
Reduced explosion pressure	is the low explosion pressure created inside the protected space of the equipment after the explosion is vented through the relief opening fitted with the assembly of vent panel. The reduced explosion is designated Pred.
Maximum rate of increase in reduced explosion pressure	is the highest rate of increase in pressure from the course of the explosion vented from the protected space via the ExDoor. The quantity is designated (dp/dt) Pred max.
Permissible ExDoor load pressure	is the highest reduced explosion pressure at which the frame will not be damaged or ruptured, neither the anchoring device nor the vent panel will be sheared off, and the surroundings will not be at risk from the loose parts of the vent panel-fitted frame. The permissible ExDoor load pressure is dependent on the value (p) red,max. The permissible load pressure is designated as

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	pperm ExDoor. From a safety point of view, the following inequality must be met: pstat < pperm ExDoor ≥ pperm of the protected object
Static safety pressure of the vent panel	is the lowest pressure (overpressure, underpressure) which, at the static load (dp/dt) = 0, bursts the vent panel from the framework. It is designated as pstat. From an operational safety point of view, the following inequality must be met: Pstat > Poperating. Static safety pressure is the lowest overpressure at which the vent panel bursts.
ExDoor vent area	is the clear cross-section of ExDoor.

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2. WORKING PRINCIPLE OF THE EXDOOR

Under normal operating conditions, the vent opening of the protected equipment is covered by the vent panel. When the operating pressure inside the equipment is exceeded, the vent panel on the shell bursts opens and releases the pressure from within the system. The keeps the pressure within the system lower than its pressure resistance and therefore prevents its destruction.

The ExDoor is used to reduce the explosion pressure from an explosive dispersion mixture of dust and air or a hybrid mixture that develops inside the protected space (this does not apply to the transmission of an explosion from predated or future equipment).

2.1 MAIN PARTS OF THE EXDOOR

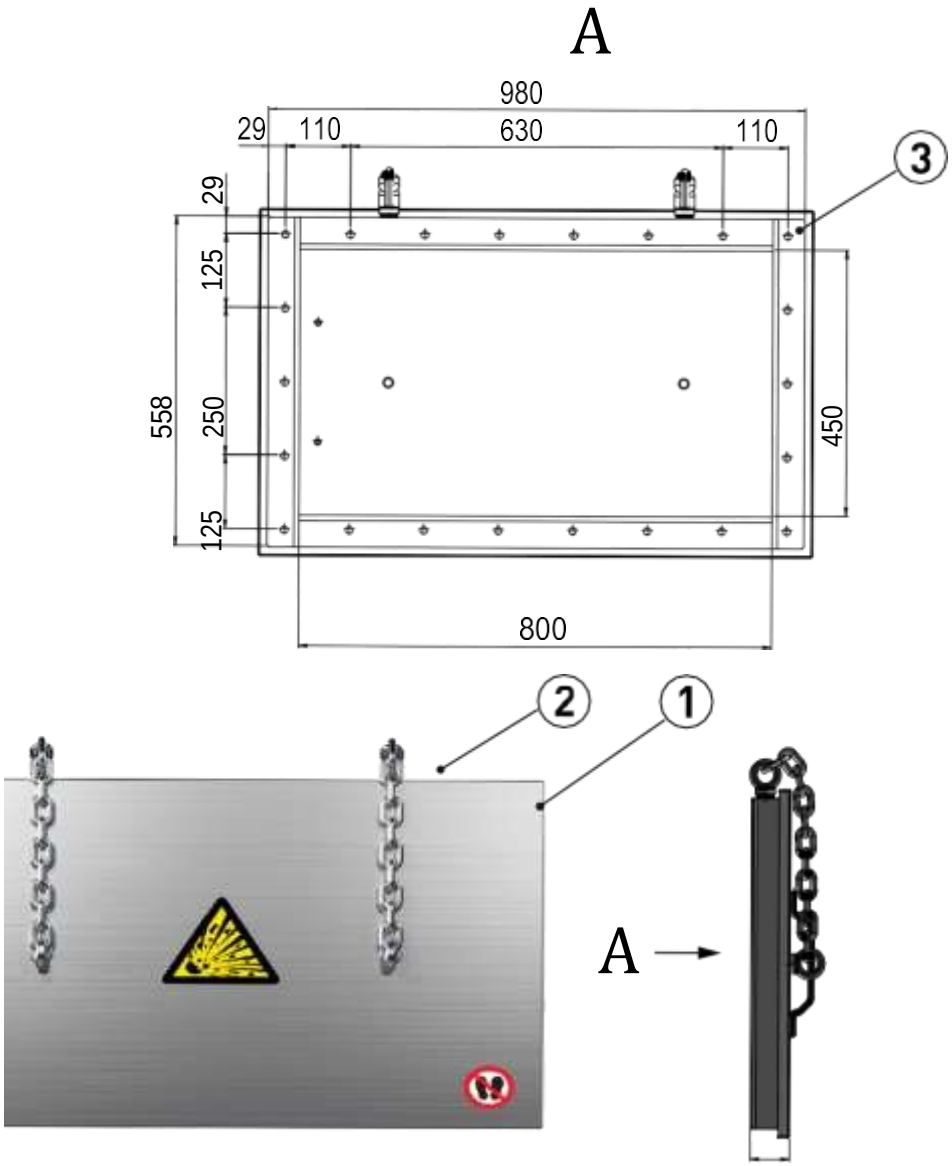

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Fig. 1 - Main parts of the ExDoor

1 – ExDoor
2 – Anchoring device
3 – Frame

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ExDoor frames are made of stainless steel material with an unpainted surface or constructional steel with the surface painted or galvanized. They are designed for a permissible load pressure of 50 kPa.

The ExDoor frame is connected to the protected object with screws. It is necessary to use a flange seal or sealant between the flange and the frame. The frame is fitted with attachment points for the permanent magnets. The screws of the ExDoor frame are made of a material 8.8.

Anchor slings are weaved through the eyebolts attached to holes in the vent panel. The sling is closed in a loop through the pin in the anchor bracket. The eyebolts are connected to the vent panel with M16 nuts, while a washer is installed between the M16 nuts and the vent panel in order to reinforce the vent panel. The flange sheet is connected to the counter flange using M10 screws, material 8.8.

The ExDoor can be equipped with an indicator that monitors the position of the vent panel and any change to it causes the contacts of the indicator to disconnect. This disconnection interrupts the intrinsically safe circuit and the change in the position of the vent panel is indicated, for example, on the control panel of the control room.

Instead of anchor ropes, anchor chains can be used – long-link chains calibrated with high-strength 10x35.

2.2 THE DESIGNATION OF THE PRODUCT

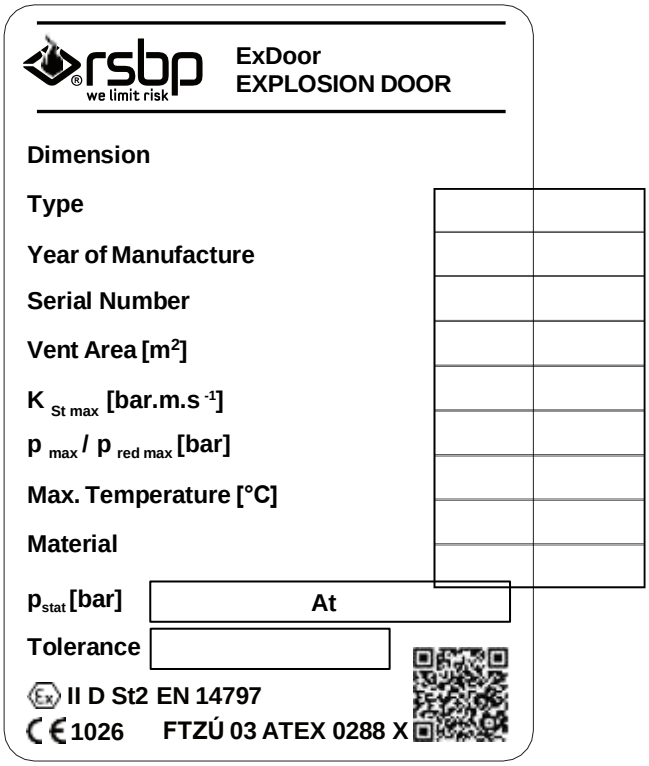

Fig. 2 - ExDoor nameplate

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2.3 MOST IMPORTANT RELATED STANDARDS

- ČSN 33 2000-1 ed. 2 Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions
- ČSN CLC/TR 60079-32-1 Explosive atmospheres - Part 32-1: Electrostatic Hazards - Guidance
- ČSN EN ISO 9692-1 Welding and allied processes - Types of joint preparation - Part 1: Manual metal arc welding, gas-shielded metal arc welding, gas welding, TIG welding and beam welding of steels
- ČSN 05 01 20 Calculation of welded joints of machinery constructions
- ČSN 69 25 01 Bursting discs. Bursting discs for pressure vessels
- ČSN EN 14797 Explosion venting devices
- ČSN EN IEC 60079-10-1 ed. 3 Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres
- ČSN EN 60079-14 ed. 4 Explosive atmospheres - Part 14: Electrical installations design, selection and erection
- ČSN EN 1127-1 ed. 3 Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology
- ČSN 02 1369 Eye bolts with collar, undercut at neck
- Decree No. 48/1982 Coll
- Decree No. 246/2001 Coll

3. TECHNICAL PARAMETERS

The ExDoor does not need an operator to work. It works automatically, and only once, in response to an increase in pressure in the protected space. On the contrary, moving around or lingering in the area of the equipment outside of prescribed checks is prohibited.

4. MAINTENANCE

The ExDoor requires:

consistent compliance with the provisions ensuring safety during full operation and prohibition against entry into the protected area
regular shift checks
an inspection once a year performed by RSBP spol. s r.o. or a person trained by RSBP spol. s r.o. in accordance with § 7 of Decree No. 246/2001 Coll.
regular replacement of the vent panels
the equipment to be kept clean at all times
regular occupational safety training for workers entering these areas

Regular shift checks mean to visually check, at least once per shift and from a safe distance, the outer surface of the device for cleanliness, dust deposits, deposits of snow or ice in the winter months, whether the device is mechanically or otherwise damaged. Starting up operations or operating a membrane-fitted system with snow and ice deposits on the vent panel is prohibited.

Any deposits must be removed mechanically during shutdown and without damaging the vent panel.

The regular annual inspection means inspecting the device while it is shut down, at least once a year, and checking the external condition of the vent panel and anchoring device.

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The device must not show signs of damage or deterioration. The entire device must be cleaned of any dust deposits. The screws must be kept tight and the screw threads preserved.

This inspection is performed by RSBP spol. s r.o. or a person trained by RSBP spol. s r.o. in accordance with § 7 of Decree No. 246/2001 Coll.

Regularly replacing the vent panel means complying with the maximum service life of the vent panel of 2 years. After this time, the ExDoor must be replaced if the results of the quarterly inspection show, i.e. that the vent panel exhibits signs of damage (change in thickness).

The consistent maintaining of cleanliness means preventing the formation of dust deposits, especially flammable ones, both on the surface of the ExDoor and in the safety zone.

The regular training of employees means warning them of the danger of any accidental or prescribed movement in the area of the safety equipment and instructing them about this danger (their protection) once a year, including new employees.

5. SAFETY INSTRUCTIONS

The products of the explosion and pressure wave are discharged through the vent panel. The zone into which the products of the explosion and the pressure wave is demarcated by a cone protruding from the vent opening (clear cross- section vent panel). This zone must be reserved as a safety area prohibiting entry, passage, workplaces, measuring instruments, wiring, flammable substances, the storage of objects and other obstacles. There must also be no suction openings here or explosions of air conditioning and ventilation units. The safety zone must not include the walls of buildings. No windows may be installed in the immediate vicinity of the safety zone.
These safety requirements and the determination of the scope and size of the safety zone must be observed during design.

This safety zone must be operationally marked with visible signs with inscriptions prohibiting entry and warning of the danger of explosion. Allowing layers of combustible dust to build up in this area is not permitted. It is an area with the risk of an industrial dust explosion and is subject to relevant legislation.

Designing the location of assembly of vent panel is and specifying the number and type is determined by the conditions of the customer (operator) in a professional assessment of the equipment or technology where the ExDoor is to be used.

6. REVISION

An initial electrical inspection on the vent panel is not performed. Inspections or the requirements for maintenance, inspection and service are described in section 5.

7. INSTALLATION

The installation procedure is determined by the installation technician. All installation work must be carried out in compliance with all safety regulations of the assembly plant.

7.1 EXDOOR INSTALLATION PROCEDURE

- Unpack the ExDoor from the crate, check its condition, for damage, etc.,
- Clean the contact surface where the ExDoor is to be mounted,

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- Align the ExDoor in place and fasten it with the connecting screws,
- If the ExDoor has an indicator, connect the wires for the signalling device.
- Avoid any mechanical damage when handling the ExDoor,
- If the ExDoor has an indicator, do not damage the wires for the signalling device.

*note: Principles of correct installation:
Insert the M16 eyebolts into the holes of the vent panel and on the other side of the vent panel insert a washer onto the bolts. Screw on the M16 nut and tighten to a torque of 275 Nm.

The holes of the eyebolts must be installed so that their axis is parallel to the axis of the bracket pin.

The vent panel is set centrically on the lower flange sheet-frame so that it rests evenly on all the permanent magnets.

After fitting the vent panel, thread the steel sling through the M16 eyebolts and the bracket on the frame of the assembly of vent panel and close it in a loop using the clamps no. 2. When using anchor chains, first attach the M16 eyebolts to the frame and then to the vent panel by tightening them with the M16 nuts. Finally, insert the contact for the signalling device through the 5 mm Ø hole and connect it. During the operation of the protected equipment, the signalling device is fixed under the M10 screw on the frame of the assembly of vent panel and connected to an intrinsically safe power source.
Care must be taken during all handling to avoid damaging the vent panel, frame and other parts of the ExDoor.

The employees of RSBP spol. s r.o. are trained in installation in regular cycles. These employees install the ExDooron the user's protected equipment. In the event the operator does the installation alone without the consent or knowledge of RSBP spol. s r.o., all responsibility for the correctness, completeness and safe placement passes tothe personnel undertaking these works.

8. PACKAGING, TRANSPORT AND STORAGE

8.1 PACKAGING AND SHIPPING

ExDoors are delivered packed on pallets or in a separate package in non-returnable package. They can be transported by truck or train like this. ExDoor must be secured during transport against unwanted movement of the product.

8.2 STORAGE

Vent panels must be stored horizontally at the site or on the premises of the user in a dry, lockable warehouse, protected from the weather and from intentional or accidental damage during storage.

9. SPECIFICATIONS

The task of the ExDoor is to reduce high pressures during an explosion inside a protected area. The explosion pressure is vented off through a relief hole. The size of the vent area for individual types of vent panel is given in the drawing of the respective type of vent panel.

The value of the working pressure inside the protected object is important for choosing pstat.underpressure or poverpressure. The permissible pressure capacity of the protected equipment must not be exceeded for a specific assembly of vent panel. The ratios of maximum operating pressures with regard to the service life of the vent panel should be chosen at 50% of the magnitude of the static safety pressures.

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Notes: