	Flame Arrester 933-SE 400.1/9x0.3/D3IIB3P1T1 Instructions for Operation and Maintenance	REV 2.0
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This Instruction for Operation and Maintenance is applicable for the following flame arrester models:

Table Type description

Size	Type	EU-Type Examination Certificate Number
DN400 / 16"	933-SE 400.1/9x0.3/D3IIB3P1T1	IBExU21ATEX2032 X

The data sheet with dimensions and the pressure drop/volume flow rate diagram are available.

1. Use

The flame arrester type 933-SE 400.1/9x0.3/D3IIB3P1T1, type series 1 with the flange connection of nominal size of DN400, meets the requirements of the European Guideline 2014/34/EU and the harmonised standard for flame arresters EN ISO 16852:2016 as autonomous protection system for intended use in potentially explosive atmospheres.

Its general suitability as an **in-line stable detonation flame arrester** for use with inflammable gas/air mixture and vapour/air mixture of inflammable liquids of the explosion group IIB3 (MESG \geq 0.65 mm) has been verified by tests performed at the Institut für Sicherheitstechnik GmbH IBExU Freiberg, EUROPEAN NOTIFIED BODY no. 0637 according to Article 9 of the Guideline 2014/34/EU. Always use it within the purview of the entire safety concept of the corresponding system and combine additional explosion safety measures, if required.

For preventing a flame transmission, these detonation arresters in the pipes can be used in atmospheric conditions [pressure: 0.8 bar (absolute) to 1.1 bar (absolute), temperature: -20°C to +60°C] for protection against stable detonations, deflagrations and short time burning at the flame arresters for explosive vapour/gas-air mixtures of the explosion group IIB3.

Furthermore, the limit values according to Table 1 for the maximum permissible operating pressure p_0 considering the maximum permissible operating temperature T_0 must be adhered to:

Table 1: Limits for operation

Size	p_0 MPa (absolute)	T_0 °C
DN400 / 16"	0.11	60

The flame arrester can be equipped in the case of stabilized burning on the flame arrester element with one or more integrated temperature sensors (resistance thermometers) on both the sides.

A stabilized burning on the flame arrester element must be stopped by installing an integrated temperature sensor (resistance thermometer) at the unprotected side of the flame arrester in connection with an automatic triggering of emergency functions (interruption or inertization of the mixture flow) when the operation temperature of \geq 20 K is exceeded.

The maximum permissible burning duration t_{BT} for short time burning at the flame arrester is 1 min.

As part of the documentation package, the product is delivered with a factory Test Certificate according to EN 10204, which includes the technical features of the product as well as the EU-Type Examination Certificate number.

Also, as part of the documentation package, a Declaration of Conformity is issued, assuring compliance with standards EN ISO 16852 and EN 1127-1, as well as compliance with the ATEX directive 2014/34/EU.

Created By:	TMF	Date: 26.07.21	BS&B FlameSaf Limited, Limerick, Ireland
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2. Construction

The flame arrester consists of the flame arrester element (3) chucked between the eccentric covers (1) and (2), having O-rings (4) for the external sealing and bolts (5) and nuts (6), protected with protection covers (7), used to connect both covers to secure the flame arrester element (3).

The flame arrester's Element cage (8) has metal foil elements (9) and (10) with different winding directions: (9) - turned left, (10) - turned right.

The metal foil elements are made of one crimped and one flat ribbon. The ribbons are rolled along each other in compact layers and build a triangular channel in the centre.

The metal foil elements are kept apart with spacers (11 & 12) which are concentrically assembled with the star (13) using the screw (14). The screw (14) is securely held in place with the aid of a lock washer (15) and thread locker adhesive.

Using the lifting lugs (17), the Element bank is installed between the covers (1 & 2) and bolts (5) are installed through the holes of the covers and through the smaller holes of the lifting lugs, assuring a concentric installation in relation to the covers.

On the inner sides of the cover flanges some connecting screws have additional nuts (6) and washers (18) which enable an axial expansion for removing the flame arrester element bank (3).

The sensor port on the cover (1) is supplied with a plug and sealing ring (19 & 20). After installation of the flame arrester in the pipeline, and before operation, the plug shall be removed, and the resistance thermometer (21) shall be installed at the unprotected side.

In case of bi-directional flame arresters, resistance thermometers must be installed on both covers (1 & 2) before operation.

For flame arresters where the customer orders pressure monitoring ports, they are supplied with plug and sealing ring (22 & 23) and the customer may remove them after installation of the flame arrester in the pipeline, and before operation, and a pressure sensor/monitor may be installed.

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3. Marking

The product is supplied with nameplate (25) and labels (26 & 27) that provide important information to the customer about the product and its limitations. Below are some of the information provided:

Nameplate:

- Name and address of the Manufacturer
- Product Type (including element configuration)
- EU-Type Examination Certificate Number
- Serial Number and year of manufacture
- Number of the design standard: ISO 16852
- EX mark, followed by the device group information II and the letter “G” (for classified areas where explosive gases, vapors and/or air mixtures are present)
- Explosion group
- CE mark, followed by the Notified Body number (2460)

Warning Label:

- **Warning Flame arresters have installation and application limits**
Type designation in accordance with ISO 16852
- Flame Arrester Type mark: **DET3**
(Stable Detonation with restriction)
- Burn rating mark “BC” for stabilized burning, followed by the classification 'b' for short time burn or 'c' for No burn time; if 'b' has been specified, it will be followed by the burning duration time information $t_{BT} = 1 \text{ min.}$
- Explosion Group: **IIB3**
- Maximum Operational Temperature T_0 : **60°C**
- Maximum Operational pressure p_0 : **0.11 MPa**

The element bank cage (8) is marked on the outside with “BS&B-9x0.3”

The Arrester Elements are marked on the outside with the following information:

- Name of the manufacturer
- Gap width
- Material designation number
- Winding direction

Example: **BS&B-0.3-1.4571-R**

The protected side of the Flame Arrester is identified by a Red Dot sticker (28).

Optional: If the flame arrester has a resistance thermometer, the cover (1) will have an adhesive label (27) with warning notice for short time burning.

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4. Installation

The positioning and installation of the flame arrester in the plant must take place under the purview of the directives applicable at the place of use; it is particularly imperative to follow the accident prevention directives of the area of installation.

The flange covers/protections must be removed from the unit before installation in the pipeline.

The criteria mentioned in the EC-Type Examination Certificate under Point [17] - Special conditions for safe use - related to the installation must be adhered to. It is especially important to check the use of resistance thermometer for providing indication of any stabilized burning at the flame arrester.

The following assembly instructions must be observed:

- The flame arrester can only be installed in pipelines where the pipe diameter:
 - on the unprotected side is not greater than the flame arrester connection size
 - on the protected side is not smaller than the pipe diameter on the unprotected side
- If a continuous burning at the flame arrester cannot be ruled out, at least one resistance thermometer must be installed at the source of ignition side. The mark (red dot sticker) on the cover (2) indicates the protected side of the flame arrester, the side where the flame is not going to get to as it will be quenched by the Flame Arrester Element. If ignition/continuous burning is expected to happen at either side of Flame Arrester, then both sides of the Flame Arrester must be equipped with temperature sensors.

The flame arresters are fundamentally equipped with connecting flanges according to ISO 7005-1 (steel flanges) or ISO 7005-2 (cast iron flanges) in the pressure level PN10, PN16 or PN20. The pressure level PN20 is compatible with the American flange class 150 according to ANSI B16.5. If required, the flange connections can also be delivered in accordance with the Japanese industrial standard JIS B 2220.

Flat seals with sealing rated value of $k_0K_D \leq 25b_D$ are recommended for the flange connections. While installing flanges, it must be ensured that the seal faces are not damaged and there are no foreign bodies or dust between the flanges so that there are no gaps. The system should be checked thoroughly for proper sealing before commissioning it. The test pressures of the flame arrester specified in the test certificate must not be exceeded.

Vertical as well as horizontal installation on the system is permissible.

The flame arrester must not be a bed for the pipe and should be installed with low-stress.

For the removal of the flame arrester element (3) and the resistance thermometer (21) an assembly clearance of at least the dimensions shown on Table 2 is required (please refer to the Spare part drawing at the last page).

Table 2: Dismantling dimensions D and E and weight of the flame arrester element (3)

DN		400
D	mm	1050
E	mm	1600
Weight (SS)	kg	450

The assembly of the resistance thermometer delivered separately from the flame arrester must take place by replacing the screw plug in the corresponding threaded hole of the cover flange with corresponding sealing. The connection must be secured against accidental loosening in the thread with adhesive "Loctite 221".

The assembly guidelines of the resistance thermometer's manufacturer and the conditions for ensuring the conformity must be adhered to while connecting the temperature sensor to the measurement system. The switching between resistance thermometer and the device for stopping mixture flow or a similar measure

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(triggering emergency function) must take place in such a way that within 30 sec after the identification of the flame by the resistance thermometer, the risk status is recognised.

5. Maintenance

The maintenance includes a periodic visual inspection of the flame arrester, in particular the metal foil elements, with respect to contamination and periodic functional checks of the resistance thermometer. The time intervals for maintenance works depend on the operating conditions and contaminating level of the individual media and must be decided by the operator.

For cleaning works the flame arrester element has to be taken out of the plant. Therefore, the weights according to Table 2 shall be taken into consideration. The condition of the O-rings (4) shall be checked after the disassembly.

In case of negligible contamination, the flame arrester element (3) shall be blown up with compressed air or hot steam against the operating flow.

If the contamination level is high or there are impurities stuck to the surface of the metal foil element, rinsing with a cleaning agent may also be considered. However, all parts covered in the cleaning agent must then be blown dry.

Ensure that no mechanical modifications are made to the metal foil elements and housing parts of the flame arrester during the cleaning works. Check that screw (14) is secured and fastened properly (Table 3).

Table 3: Fastening torque of the screw (14)

DN	400
Torque Nm	600

Detonations or deflagrations, followed by stabilized burning at the flame arrester element can cause considerable mechanical and thermal stress. If any deformation in the foil element structure is found after a detonation or deflagration event or if the arrester element coils have unwound, the flame arrester element must be replaced.

The Arrester Element shall also be replaced by a new one if any of the situations below occur:

- If there was a fire on the flame arrester element
- If slackening or slipping in the structure of the metal foil elements is visible
- If there are visible damages on the metal foil elements from corrosion
- If a visible contamination of more than 30% of the free flow area has remained after cleaning

All works in connection with the cleaning and replacement of flame arrester element shall be executed only by trained and authorized skilled personnel.

After a fire on the flame arrester element the functionality of the resistance thermometer shall be checked.

While replacing the O-rings (4), ensure that they are lightly lubricated with conventional silicon grease (order no. 00 027 079); they must be protected from damage during the assembly.

The bolts (5) shall be slightly lubricated with Anti Seize lubricant (Loctite LB 8009) at the portion of thread engagement with the nuts (6) and shall be tightened in a criss-cross pattern with a torque as per Table 4.

Table 4: Fastening torque of the screw joint (5), (6)

DN	400
Torque Nm	300

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Attention: For “silicone and grease free flame arresters” all seals, threaded bolts and nuts should be assembled without using silicone or grease.

The sealing parts shall be checked against leakage.

It is recommended to always keep one spare Arrester Element (3) in stock for each Flame Arrester in operation.

Only genuine parts, supplied by BS&B FlameSaf Ltd, may be used for any maintenance/repair work performed on the Flame Arrester. Please refer to Table 5 (Spare Parts List) for the part numbers to be used to re-order parts.

6. Spare parts list

Table 5: Spare parts DN400

Item No.	Designation	No.	Material	Order-No.
				DN400
3*	Flame arrester element 9x0.3	1	NSt	FET15546630
	Flame arrester element 9x0.3-N			FET15546630N
	Flame arrester element 9x0.3-VF			FET15546630VF
4*	O-ring	2	NBR	780019100
			FPM	780019200
			FEP	780019300
5	Threaded bolt	18	St	222026126
			NSt	222026127
6	Hexagon nut	44	St	201521840
			NSt	201542823
7	Protection cap	36	K	702049700
18	Washer	8	St	52098300
			NSt	940131000
19	Screw plug	1	St	215031200
			NSt	212097500
20*	Sealing Ring	2	LM	504650200
21*	Ex(i)-thermometer	1	Endress & Hauser	652282970
	(Thermowell/Insertion length: 160mm)		Standard	662071923
22	Screw plug	2	St	215130500
			NSt	212025100
23*	Sealing Ring	2	LM	504580700

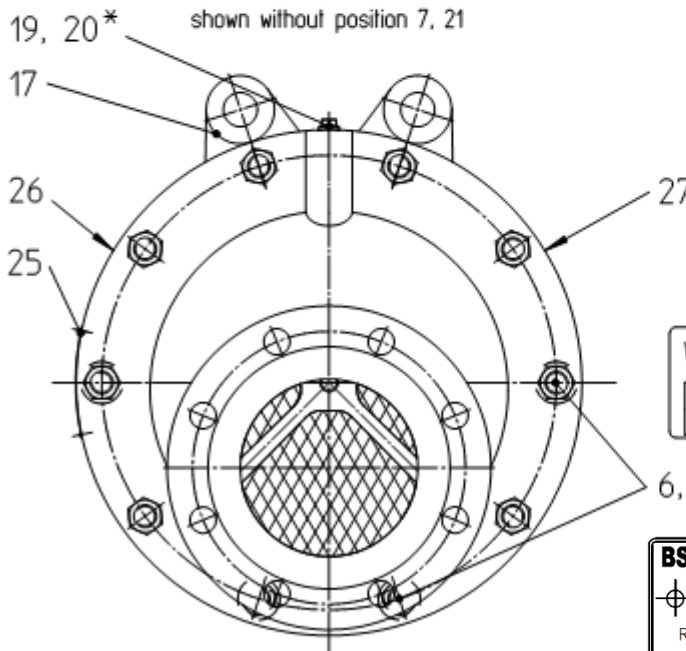
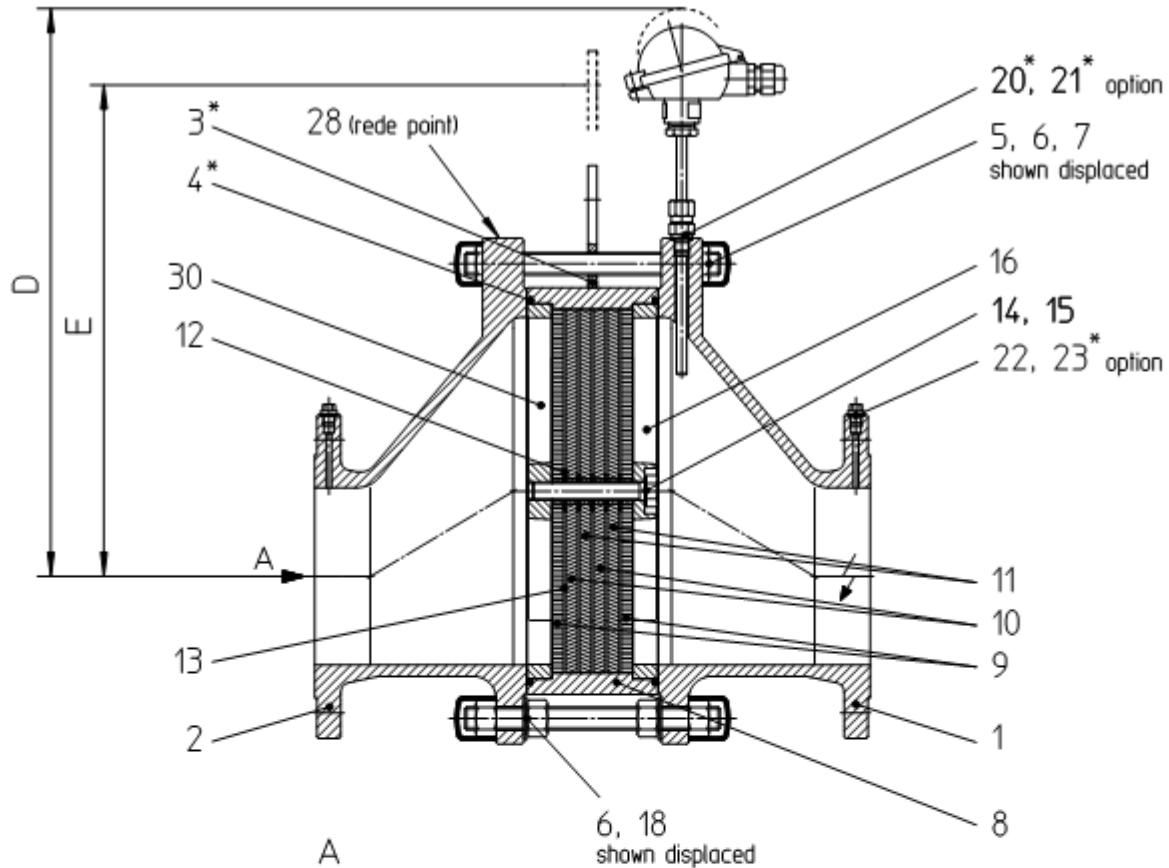
Note: Parts marked with * shall be available for maintenance works.

Material marks

St ... Carbon steel	LM ... light metal	NBR ... Nitrile Rubber	FEP ... Fluoro-plastic (VF)
NSt ... Stainless steel	K ... plastic	FPM ... Viton	

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Spare part drawing



Note : This flame arrester is safe for short line burning !
 Please refer to operating and maintenance instructions !

Warning	Flame arresters have installation and application limits. Type design in accordance with ISO 16852		
	DET3	$L_{fl}/D = \dots$ Ex. G IB3	BC : b $T_0 = 60^\circ\text{C}$
			IGT = 1 min $p_0 = 0.11 \text{ MPa}$

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	Type
	Cert.-No.
	Ser.-No.
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Note: Parts marked with * shall be available for maintenance works.
 Dimensions D and E are dismantling dimensions.

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