	Flame Arrester 933-G 2"/2x0.7/p 933-A 50/2x0.7/p 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 1: Type description

Size	Type	EC-Type Examination Certificate Number
DN50 / 2"	933-G 2"/2x0.7/p	IBExU14ATEX2008 X
	933-A 50/2x0.7/p	

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

1. Use

The listed flame arresters with the flange connection of nominal size of 2" / DN50, meet 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 deflagration flame arrester** for use with inflammable gas/air mixture and vapour/air mixture of inflammable liquids of the explosion group IIA (MESG \geq 0.90 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 IIA.

Furthermore, the limit values according to Table 2 for the maximum permissible operating pressure p_0 considering the maximum permissible operating temperature T_0 must be adhered to:

Table 2: Limits for the operation

Size	p_0 MPa (absolute)	T_0 °C	L_u m (Meter)
DN50 / 2"	0.15	60	2.50

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 EC Prototype Testing 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.

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2. Construction

The flame arrester consists of the flame arrester element (3) chucked between the 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, building a triangular channel in the centre.

The metal foil elements are kept apart with spacers (11 & 12) which are assembled aligned 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.

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 Flame Arrester as standard is provided with ports for a temperature sensor and a drain port. The drain port is located at the bottom of the covers and shall be regularly used to drain any liquids that can accumulate at the lower internal cavities of the unit.

The sensor port is located at the top of the cover (1) and is also 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)
- EC Prototype 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: **DEF**
(Deflagration)
- L_v/D Ratio (max distance from source of ignition/pipe diameter): **50**
- 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: **IIA**
- Maximum Operational Temperature T_0 : **60°C**
- Maximum Operational pressure p_0 : **0.15 MPa**

The element bank cage (8) is marked on the outside with "BS&B-2x0.7"

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-0.7-1.4571-R**

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

Optional: If the flame arrester is supplied with 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 before installing 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 signalling stabilized burning at the flame arrester.

The following assembly instructions must be observed:

- The flame arrester must be installed only on those pipelines, whose pipe diameter
 - on the unprotected side shall be no greater than the flame arrester connection
 - on the protected side shall be no less than the pipe diameter on the unprotected side
- The distance between potential source of ignition and place of installation in the pipeline must not exceed the ratio of $L_u/D = 50$.
- 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 connection side to be connected with the system component to be protected against flame transmission. If continuous burning is expected on both sides of the flame arrester, temperature sensors must be installed at both sides.

The flame arrester type 933-G 2”/2x0,7/p is equipped with a pipe internal thread Rp 2” according to ISO 7-1, BSP 2” according to BS 21 or tapered internal thread NPTF 2” according to ANSI B1.20.3. For the joint pipe line the suitable tapered outer pipe thread is recommended. If necessary a sealant in the thread may be used (see Table 2). For relieving the mounting and dismantling of the flame arrester use a suitable tube fitting.

Table 3: Connecting thread and width across flats 933-G

Internal thread of the flame arrester	Rp (BSP) 2“	NPTF 2“
Outer thread of the pipe line	R 2“	NPTF 2“
Width across flats	SW 75	

The flame arrester 933-A 50/2x0,7/p can be 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 / Flange gaskets 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 leak paths. 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 pipeline down and upstream must be properly supported so that the flame arrester doesn't bear any piping stress.

For the removal of the resistance thermometer (21) an assembly clearance of at least the dimensions shown on Table 4 is required (please refer to the Spare part drawing at the last page).

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Table 4: Dismantling dimensions D

DN	2" / 50
D mm	350

The assembly of the resistance thermometer is delivered separately from the flame arrester and must be installed by removing the screw plug provided in the sensor port and installing the sensor, along with its sealing ring. Thread locker (Loctite 221) may be used in the thread engagement for a secure installation.

If the unit is Bi-directional and there are chances of stabilized burning on both sides, both sides / covers (1 and 2) must be equipped with temperature sensors. If there are clearance restrictions for the sensors installation, they may be installed 90 degrees offset from each other.

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 system. The triggering system for the emergency shut down, or some device that will stop the mixture / process fluid flow, shall take effect to shut down the process within 30 seconds of the moment when the flame is identified by the temperature sensor.

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 removed from the process / pipeline. Therefore, the element bank weight shall be taken into consideration. The condition of the O-rings (4) shall be checked after the disassembly and if any damage, deformation, or deterioration is found, new O-rings shall be used.

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

If the contamination level is high or if there are sticky impurity to the surface of the metal foil element, rinsing with a cleaning agent may also be considered. However, the cleaning agent shall not be aggressive against the base metal and all parts covered with the cleaning agent must then be blown dry after cleaning.

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 the screw (14) is secured and fastened properly (Table 5).

Table 5: Fastening torque of the screw (14)

DN	2" / DN50
Torque Nm	12

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 flame arrester element must be replaced by a new one if

- There was a fire on the flame arrester element
- Slackening or slipping in the structure of the metal foil elements is visible
- There are visible damages on the metal foil elements from corrosion
- A visible residual contamination of more than 30% of the free flow area has remained despite cleaning a very dirty metal foil element

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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 must 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 tighten with in a criss-cross pattern with a torque as per Table 6.

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

DN	2" / DN50
Torque Nm	20

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 7 (Spare Parts List) for the part numbers to be used to re-order parts.

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6. Spare parts list

Table 7: Spare parts 933-G 2"/2x0.7/p
 933-A 50/2x0.7/p

Item No.	Designation	No.	Material	Order-No.
				2" / DN50
3*	Flame arrester element 2x0,7 Flame arrester element 2x0,7-N Flame arrester element 2x0,7-E Flame arrester element 2x0,7-VF	1	NSt	FET15513319 FET15513319N FET15513319E FET15513319VF
4*	O-ring	2	FPM NBR EPDM FEP	792079000 792075800 792080500 792081300
5	Threaded bolt	4	St NSt	222118439 222122339
6	Hexagon nut	8	St NSt	201222339 202040839
7	Protection cap	8	K	702140400
19	Screw plug	2	St NSt	215031200 212097500
20*	Sealing Ring	2	LM	504650200
21*	Ex(i)-thermometer 3-wire system 4-wire system 3-wire-system + transmitter	1	NSt	662025820 662059623 662064323

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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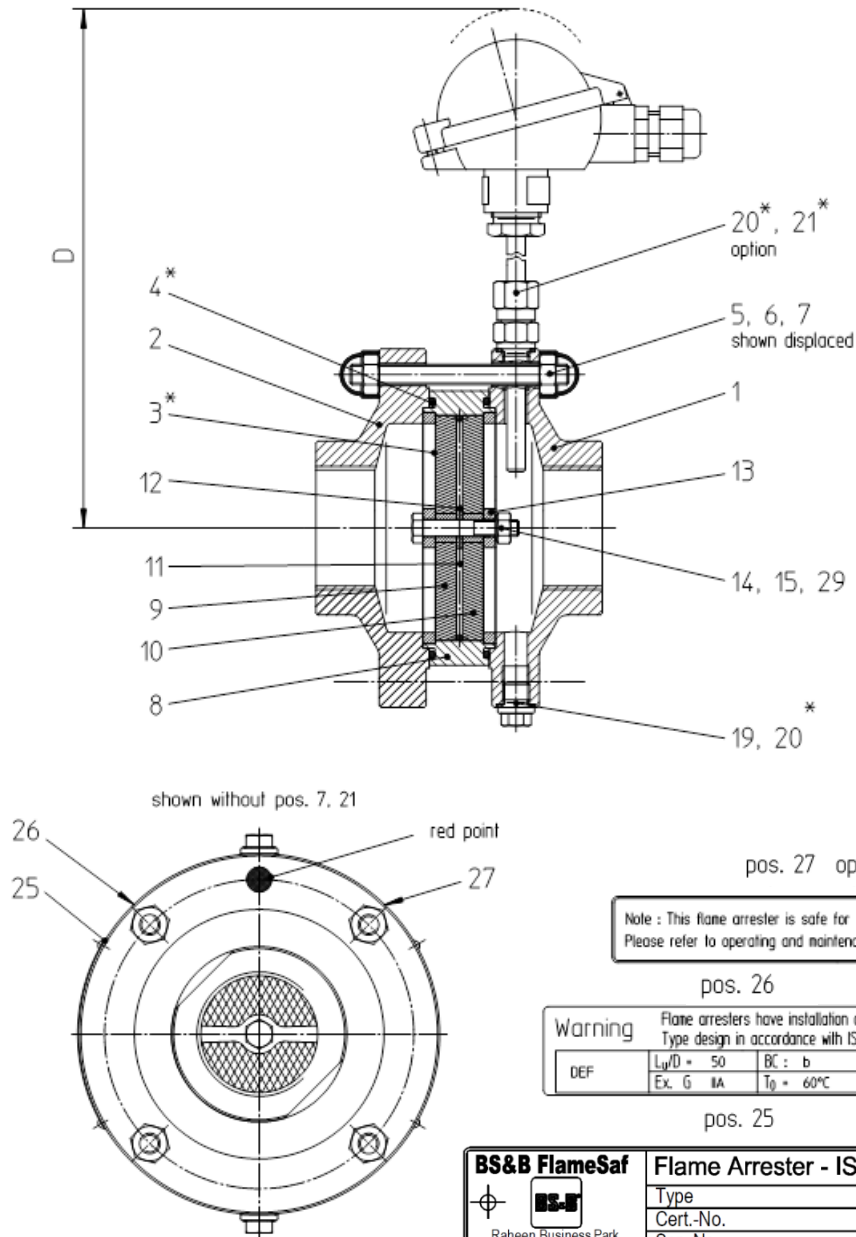
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Spare part drawing: 933-G 2"/2x0.7/p



Note: Parts marked with * shall be available for maintenance works.
 Dimensions D and E are dismantling dimensions.

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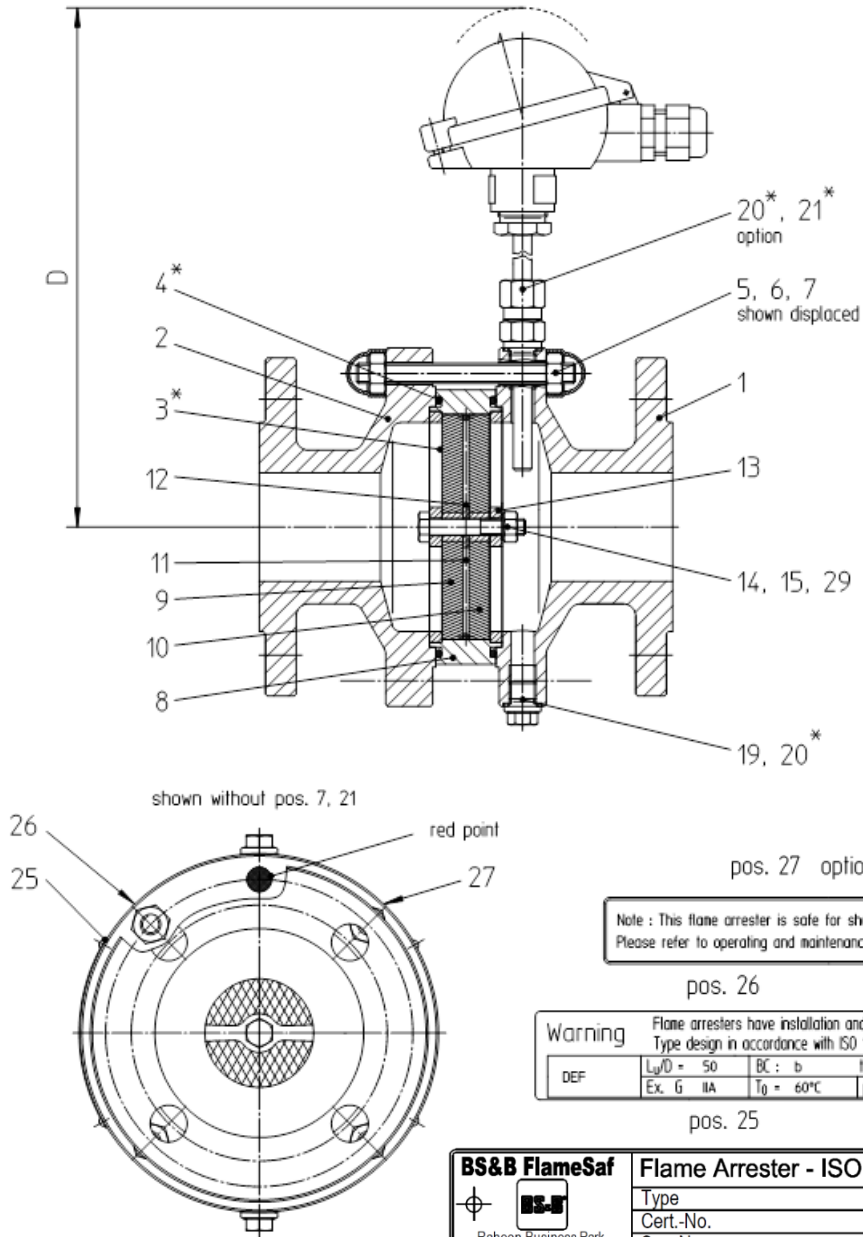
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Spare part drawing: 933-A 50/2x0.7/p



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