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This Instruction for Operating and Maintenance is applicable for the following flame arrester models:

Table: Type description

Nominal width	Type	EC-Type Examination Certificate Number
1 1/2" / DN40	931-T Rp1 1/2/2x0,7	<b>IBExU15ATEX2070_X</b>
	931-T BSP1 1/2/2x0,7	
	931-T NPTF1 1/2/2x0,7	
	931-A-T DN40/2x0,7	

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

## 1. Use

The said models of the nominal width 1 1/2" / DN40 meet the requirements of the European Guideline 2014/34/EU and the harmonised standard for flame arresters EN ISO 16852:2016 as the autonomous protection systems for correct use in explosive zones.

Its general suitability as an **in-line deflagration flame arrester** for use in inflammable gas/air mixtures and vapour/air mixtures of inflammable liquids of explosion group IIA1 (standard gap width  $\geq 1,14$  mm) and IIA (standard gap width  $> 0,90$  mm) was proved in a test at BAM-Berlin as EUROPEAN NOTIFIED BODY no. 0589 according to Article 9 of the Guideline 2014/34/EU.

### Mixtures of explosion group IIA1:

For preventing a flame transmission, these in-line deflagration flame arresters 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 deflagrations and endurance burning for explosive vapour/gas-air mixtures of the explosion group IIA1. Furthermore, the limit values according to Table 1 for the maximum permissible operating pressure  $p_0$  considering the maximum permissible operating temperature  $T_0$  and the maximum permissible distance for potential source of ignition  $L_u/D$  must be adhered to:

Table 1: Limits for the operating status of IIA1-mixtures

Nominal width	$p_0$ MPa (absolute)	$T_0$ °C	$L_u/D$
1 1/2" / DN40	0,20	60	50

**Stabilized burning:** The flame arrester is safe against endurance burning up to an operating pressure of  $p_0 \leq 0,11$  MPa (absolute). In operating pressures in the range of  $0,11$  MPa (absolute)  $< p_0 \leq 0,20$  MPa (absolute), an endurance burning at the flame arrester must be stopped by installing at least one integrated temperature sensor (resistance thermometer) on 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.

### Mixtures of explosion group IIA:

For preventing a flame transmission, these in-line deflagration flame arresters 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 deflagrations and short time burning 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  $T_0$  and the maximum permissible distance for potential source of ignition  $L_u$  must be adhered to:

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Table 2: Limits for the operating status of IIA-mixtures

Nominal width	$p_0$ MPa (absolute)	$T_0$ °C	$L_u$ m
1 1/2" / DN40	0,14	60	2

*Stabilized burning:* The flame arrester can be equipped in the case of stabilized burning with one or more integrated temperature sensors (resistance thermometers).

An endurance burning must be stopped by installing a 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.

With the delivery of the flame arrester, the technical parameters are documented along with the EC-Type Examination Certificate Number in the respective factory test certificate.

In the declaration of compliance, the adherence to the Essential Health and Safety Requirements is confirmed in accordance with the standards EN ISO 16852:2016 and EN 1127-1:2007.

## 2. Construction

The flame arrester consists of a housing (1), a cover (2), the metal foil elements (3) and (4), the O-ring seal (5) for the external sealing as well as the joint elements hexagonal screw (6), hexagon nut (7) with a protective cap with 931-T or only hexagonal screw (6) with 931-A-T.

The housing (1) allocates two metal foil elements (3) and (4) with different winding directions in its drill hole: (3)- turned right, (4)- turned left. The metal foil elements are made of one crimped and one flat ribbon of 10 mm width and 0,15 mm thickness. The ribbons are rolled along each other in compact layers and build a triangular channel in the centre with a maximum height of 0,7 mm. With the help of a clamp (9) the metal foil elements are kept at a distance and fastened in an axial position above the stars (10) and (11) by means of the screw (12) with the hexagon nut (13) and lock washer (14).

Two threaded holes on the cover (2) are sealed with screw plug (19) and accompanying sealing ring (20). The screw plug on the bottom serves as condensation outlet; the screw plug on the upper flange is replaced on site along with the sealing by a resistance thermometer (21).

The inlet and outlet nozzles of the flame arrester have to be locked by means of sealing plug/flange cover (15) for the protection against impurities and moisture during the transport.

## 3. Marking

Information with which the flame arrester system is identified is mentioned on the type label (Item 16) and warning sign (Item 26). The following details are provided:

### TYPE LABEL

- name and address of the manufacturer
- type identification
- number of the certificate (EC-Type Examination Certificate Number)
- factory number with year of manufacture
- the international standard for flame arresters: "ISO 16852"
- the special mark for prevention of explosions and alphabet 'G' (for areas that have explosive gas, vapour, air-mixtures)
- explosion group IIA1 or IIA
- CE mark with number of the indicated inspection office for production monitoring phase: „2460“

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#### WARNING SIGN

- the word "Warning" with the note "Flame arresters have installation and application limits. Type design in accordance with ISO 16852
- the sign "DEF" for deflagration flame arresters
- the ratio  $L_w/D = 50$  (max. distance from source of ignition/pipe diameter = 50)
- the mark "BC" for stabilized burning plus the classification "a" for endurance burning or "b" for short time burning or "c" for no burn time; if "b" has been specified, then there will be an additional mention of the burning duration  $t_{BT} = 1$  min
- the explosion group IIA1 or IIA
- the maximum operating temperature  $T_0 = 60^\circ\text{C}$
- the maximum operating pressure
  - for explosion group IIA1:  $p_0 = 0,11$  MPa in the case of endurance burning ("a") or  $p_0 = 0,20$  MPa in all other individual cases ("b" or "c")
  - for explosion group IIA:  $p_0 = 0,14$  MPa

The metal foil element is labelled on the external ribbon as:

- short name of the manufacturer
- gap width
- material number
- direction of winding

Example: "BS&B-0,7-1.4571-R"

The parts tested for leak proofness and strength are indicated through a stamp.

The saved side is marked by a red sticker.

Warning notice for endurance burning (27): For IIA1-mixtures with  $p_0 \leq 0,11$  MPa (absolute), the cover (2) has an adhesive label with warning notice for endurance burning.

Warning notice for short time burning (27): If the flame arrester has a resistance thermometer, the cover (2) has an adhesive label with warning notice for short time burning.

#### 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 sealing plugs/flange covers (15) 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  $L_w/D = 50$ .
- At least 10% of the cross sectional area of the pipe shall be open at the ignition source
- Pipe branches and valves on the unprotected side shall be installed as close as possible to the flame arrester

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- Up to an operating pressure of  $p_0 \leq 0,11$  MPa (absolute), the flame arrester is safe against endurance burning for IIA1-mixtures, no resistance thermometer is required; installation can take place in the pipeline without considering the onset of flames.

**Caution:** The flame arrester must not be put in a housing or insulated.  
Unrestricted heat discharge must be ensured!

- If at operating pressure in the range of  $0,11$  MPa (absolute)  $< p_0 \leq 0,20$  MPa (absolute) for IIA1-mixtures and at operating pressure  $p_0 \leq 0,14$  MPa (absolute) for IIA-mixtures, an endurance 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 point) on the housing (1) indicates the connection side to be connected with the system component to be protected against flame transmission.
- The horizontal installation position is possible as well as the vertical.

The flame arrester 931-T is equipped with a pipe internal thread Rp 1 1/2" according to ISO 7-1 or BSP 1 1/2" according to BS 21 or with tapered internal pipe thread NPTF 1 1/2" according to ANSI B1.20.3. For the joint pipe line the suitable tapered outer pipe thread is recommended (see Table 3). If necessary a sealant in the thread may be used. For relieving the mounting and dismantling of the flame arrester using a suitable tube fitting is practical.

Table 3: Connecting thread and width across flat 931-T

Internal thread of the flame arrester	Rp (BSP) 1 1/2"	NPTF 1 1/2"
Tapered outer thread of the pipe line	R 1 1/2"	NPTF 1 1/2"
Width across flat	SW 60	

The flame arrester 931-A-T is fundamentally equipped with connecting flanges according to DIN 2501 in the pressure level PN10. If required, the flange connections can also be delivered with the American flange class 150 RF according to ANSI B16.5.

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.


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

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 screwing must be secured against accidental loosening in the thread with adhesive "Loctite 221".

For dismantling the resistance thermometer assembly clearance is necessary with at least 340 mm (see Spare part drawing – dimension D).

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 (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.

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## 5. Maintenance

The maintenance includes a periodic visual inspection of the flame arrester, in particular the metal foil elements, with respect to contamination and consistency and a periodic functions check 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 has to be taken out of the plant. With dismantling the cover (2) by loosening the joint elements (6) and (7) or only (6) it is possible to access the foil element (4).

Check the status of the sealing (5) after the disassembly.

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

If the contamination level is high or there are sticky impurity 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 (12) is secured and fastened properly (torque: 12 Nm).

Explosions along with stabilized burning at the metal foil elements lead to considerable mechanical and thermal stress. If changes in the foil element structure are visible during a fire or the coils have unwound, the metal foil element must be replaced.

On principle, the metal foil element must be replaced by a new one, if

- there was a fire on the metal foil 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

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

Check the functionality of the resistance thermometer after a fire on the flame arrester.

While replacing the sealing (5), 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 hexagon screws (6) shall be lightly greased with silicon grease around the threads and fastened with the torque according of 12 Nm.

**Caution:** For “silicone and grease free flame arresters” all seals, hexagon screws and nuts should be assembled without using silicone or grease.

Check the external sealing of all pressurised flange and threaded joints.

It is recommended to keep one suitable spare flame arrester available for every flame arrester in use for a fast exchange.

While replacing components, use only the original spare parts listed in the Spare parts list to ensure safety.

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## 6. Spare parts list

**Table 4: Spare parts 931-T**

Item No.	Designation	No.	Material	Order-No.
				1 1/2"
3*	Metal foil element 0,7-R	1	NSt	15 311 311
4*	Metal foil element 0,7-L	1	NSt	15 311 312
5*	O-ring	1	KV N	792041100 802006600
6	Hexagonal screw	4	St NSt	222088223 222089023
7	Hexagon nut	4	St NSt	200506439 202026423
8	Protectiv cap	4	K	700547800
9*	Clamp	2	NSt	15 311 316
10*	Star	1	NSt	15 309 734
11*	Star	1	NSt	15 309 733
12*	Hexagonal screw	1	NSt	212114800
13*	Hexagon nut	1	NSt	200069500
14*	Locking plate	1	NSt	319075300
15	Sealing plug	2	K	702106800
19	Screw plug	2	St NSt	215031200 212097500
20*	Gasket ring	2	LM	504650200
21*	Ex(i)-thermometer	1	NSt	662025820

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

### Material marks

St ... steel	LM ... light metal	N ... Perbunan
NSt ... stainless steel	K ... plastic	KV ... Viton

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**Table 5: Spare parts 931-A-T**

Item No.	Designation	No.	Material	Order-No.
				DN40
3*	Metal foil element 0,7-R	1	NSt	15 311 311
4*	Metal foil element 0,7-L	1	NSt	15 311 312
5*	O-ring	1	KV N	792041100 802006600
6	Hexagonal screw	4	St NSt	212072539 212073323
8	Sealing plug	4	K	702134000
9*	Clamp	2	NSt	15 311 316
10*	Star	1	NSt	15 309 734
11*	Star	1	NSt	15 309 733
12*	Hexagonal screw	1	NSt	212114800
13*	Hexagon nut	1	NSt	200069500
14*	Locking plate	1	NSt	319075300
15	Flange covering	2	K	702107600
19	Screw plug	2	St NSt	215031200 212097500
20*	Gasket ring	2	LM	504650200
21*	Ex(i)-thermometer	1	NSt	662025820

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

**Material marks**

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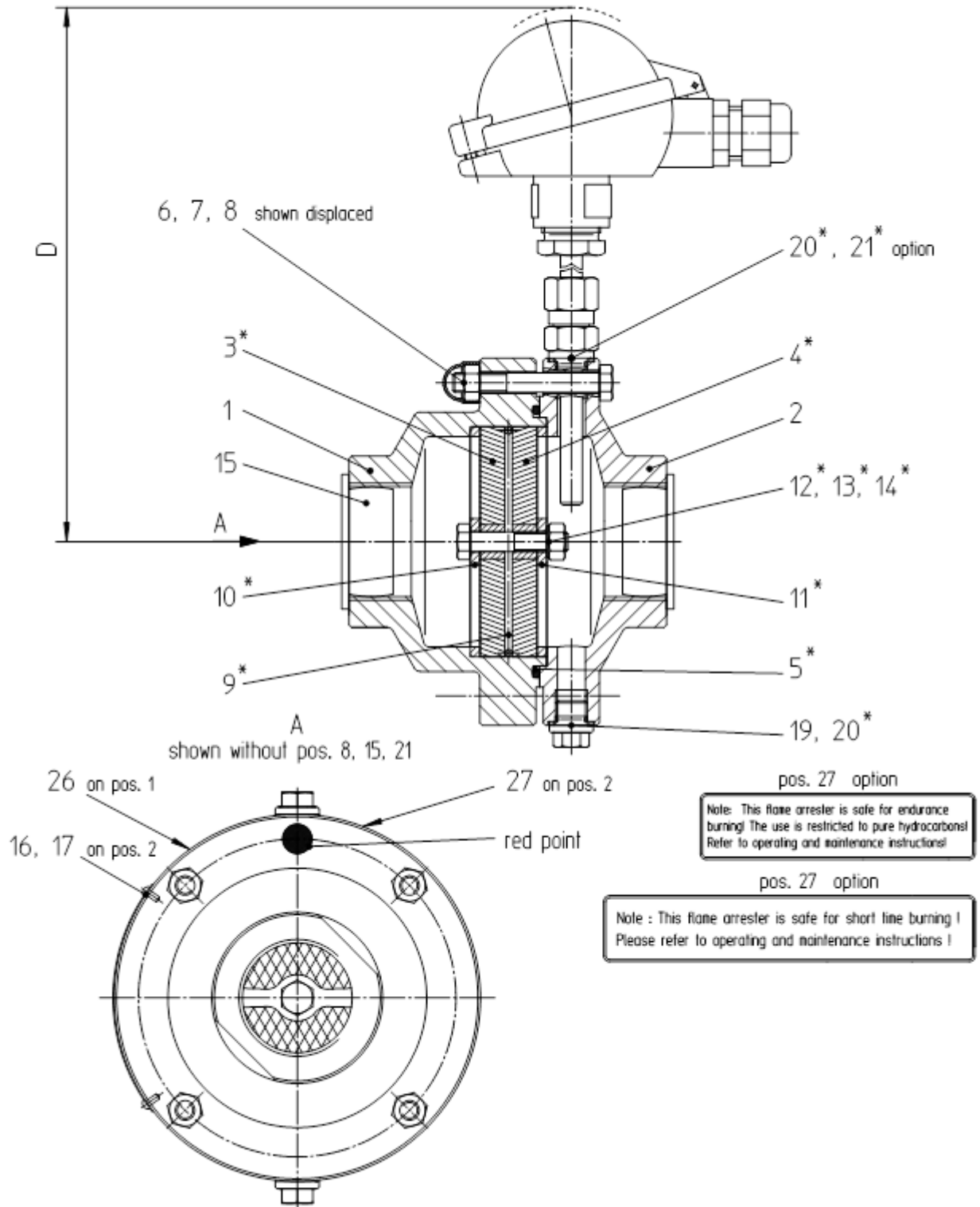


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Spare part drawing 931-T



Attention : Parts marked with \* shall be available for maintenance works.  
Dimension D is a size in dismantled condition.

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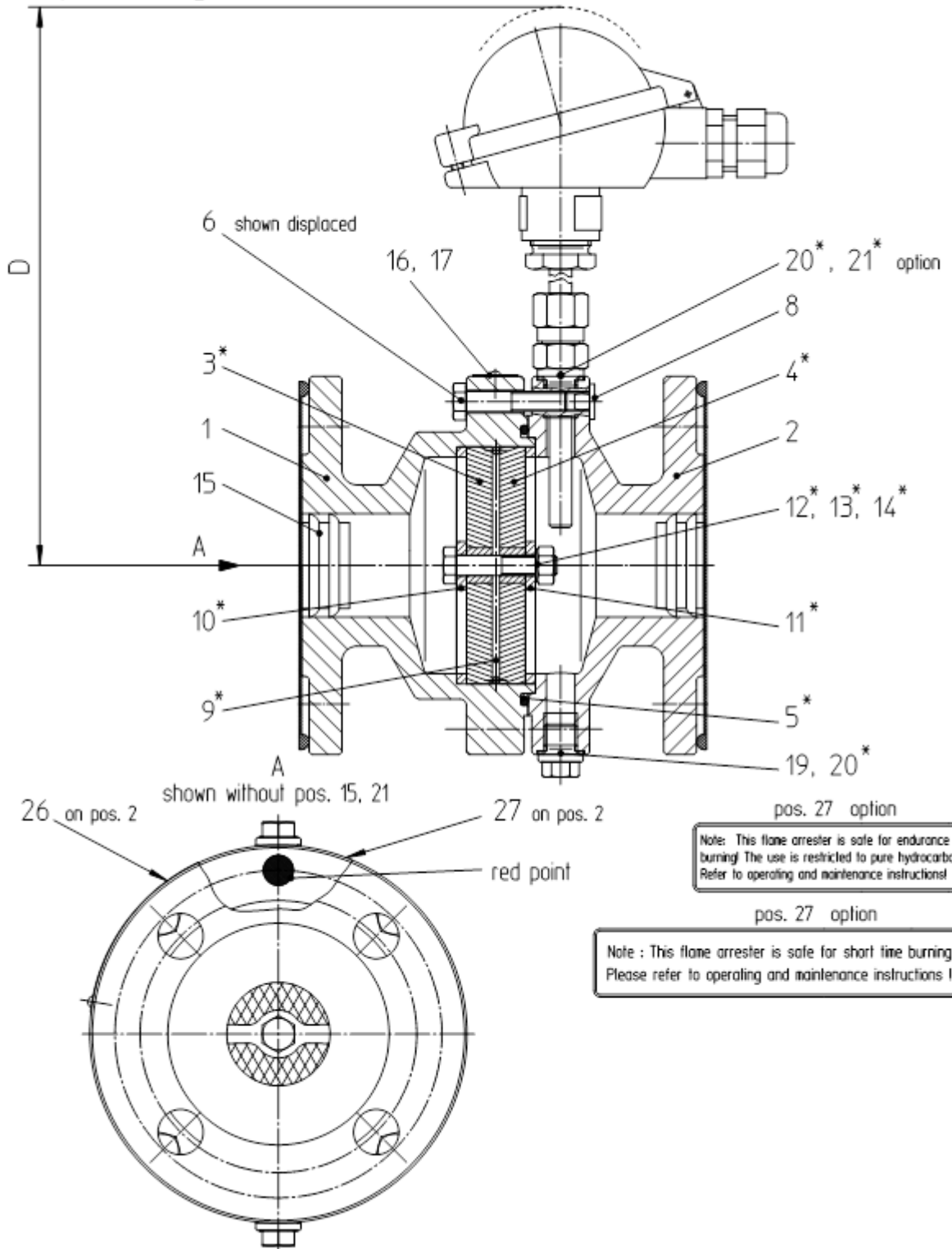


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Spare part drawing 931-A-T



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