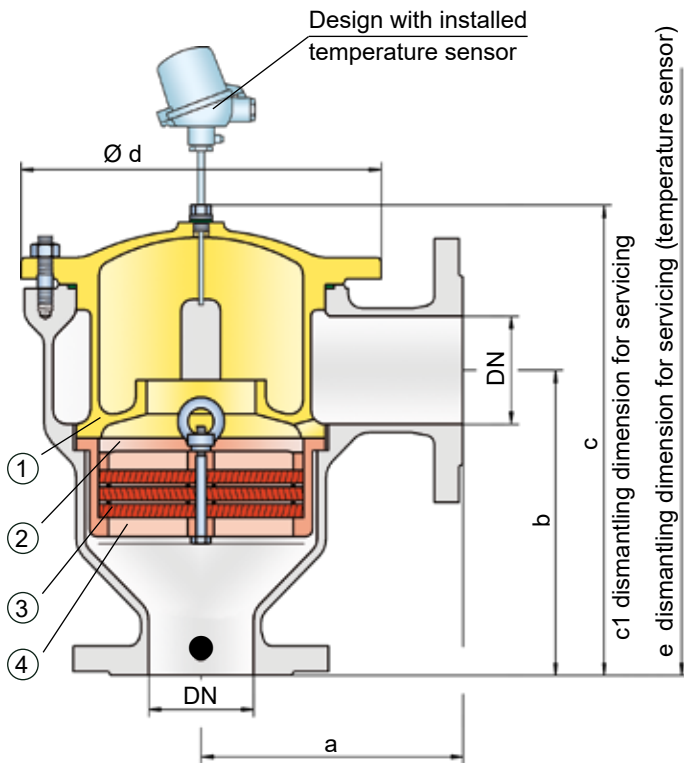


In-Line Detonation Flame Arrester

for unstable and stable detonations, and deflagrations in right angle design with a shock absorber, uni-directional

PROTEGO® DR/EU



● Connection to the protected side

Function and Description

The PROTEGO® DR/EU series of in-line detonation flame arresters represents further development of PROTEGO® flame arrester series DR/ES, which has been successfully used in industry for decades.

The device protects against deflagrations and stable and unstable detonations. The classic right-angle design offers considerable costs and maintenance advantages over the straight-through design.

Once a detonation enters the flame arrester, energy is absorbed from the detonation shock wave by the integrated shock absorber (1) before the flame is extinguished in the narrow gaps of the FLAMEFILTER® (3).

The PROTEGO® flame arrester unit (2) consists of several FLAMEFILTER® discs and spacers firmly held in the FLAMEFILTER® casing (4). The gap size and number of FLAMEFILTER® discs are by the operating conditions of the flowing mixture (explosion group, pressure, temperature). This device is can be used for explosion groups from IIA to IIB3 (NEC group D to C MESG ≥ 0.65 mm).

The standard design can be used with an operating temperature of up to +60°C / 140°F and an absolute operating pressure acc. to table 3. **Devices with special approval for higher pressures and temperatures are available upon request.**

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- low number of FLAMEFILTER® discs due to shock absorber technology
- quick removal and installation of the complete PROTEGO® flame arrester and the individual FLAMEFILTER® in the casing
- modular design enables replacement of the individual FLAMEFILTER® discs
- provides protection against deflagrations and stable and unstable detonations
- right-angle design eliminates need for pipe elbows
- advanced design for higher operating temperatures and pressures
- low pressure loss results in low operating and lifecycle costs
- cost-effective spare part

Design Types and Specifications

There are four different designs available:

Basic in-line detonation flame arrester	DR/EU-	-	-
In-line detonation flame arrester with integrated temperature sensor* as additional protection against short-time burning	DR/EU-	T	-
In-line detonation flame arrester with heating jacket	DR/EU-	H	-
in-line detonation flame arrester with integrated temperature sensor* and heating jacket	DR/EU-	H	- T

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)



Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity charts on the following pages.

DN	25 / 1"	32 / 1 ¼"	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"
a	125/4.92	125/4.92	153/6.02	155/6.10	198/7.80	200/7.87	250/9.84	332/13.07	335/13.19
b	140/5.51	140/5.51	183/7.20	185/7.28	223/8.78	225/8.86	290/11.42	357/14.06	360/14.17
c	210/8.27	210/8.27	290/11.42	290/11.42	365/14.37	365/14.37	440/17.32	535/21.06	535/21.06
c1	285/11.22	285/11.22	395/15.55	395/15.55	500/19.69	500/19.69	595/23.43	750/29.53	750/29.53
d	150/5.91	150/5.91	210/8.27	210/8.27	275/10.83	275/10.83	325/12.80	460/18.11	460/18.11
e	495/19.49	495/19.49	600/23.62	600/23.62	705/27.76	705/27.76	795/31.30	950/37.40	950/37.40

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,75 mm	IIB2	C	
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

DN		25 / 1"	32 / 1 ¼"	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"
Expl. Gr.	IIA P _{max}	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.5 / 21.7	1.2 / 17.4	1.2 / 17.4
	IIB2 P _{max}								1.4 / 20.3	1.4 / 20.3
	IIB3 P _{max}	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.4 / 20.3	1.2 / 17.4*

P_{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.

* special flame arrester unit

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	B	C	D	*For devices exposed to elevated temperatures above 150°C / 302°F, gaskets are made of PTFE. The housing and cover with the shock absorber can also be delivered in steel with an ECTFE coating.
Housing	Carbon Steel	Stainless Steel	Hastelloy	
Heating jacket (DR/EU-H-(T)-...)	Steel	Stainless Steel	Stainless Steel	
Cover with shock absorber	Steel	Stainless Steel	Hastelloy	
O-Ring	FPM *	PTFE	PTFE	
Flame arrester unit	A	C, D	E	

Special materials upon request.

Table 6: Material combinations of the flame arrester unit

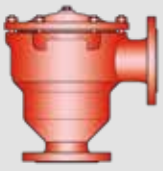
Design	A	C	D	E	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® casing	Steel	Stainless Steel	Stainless Steel	Hastelloy	
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

Special materials upon request.

Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

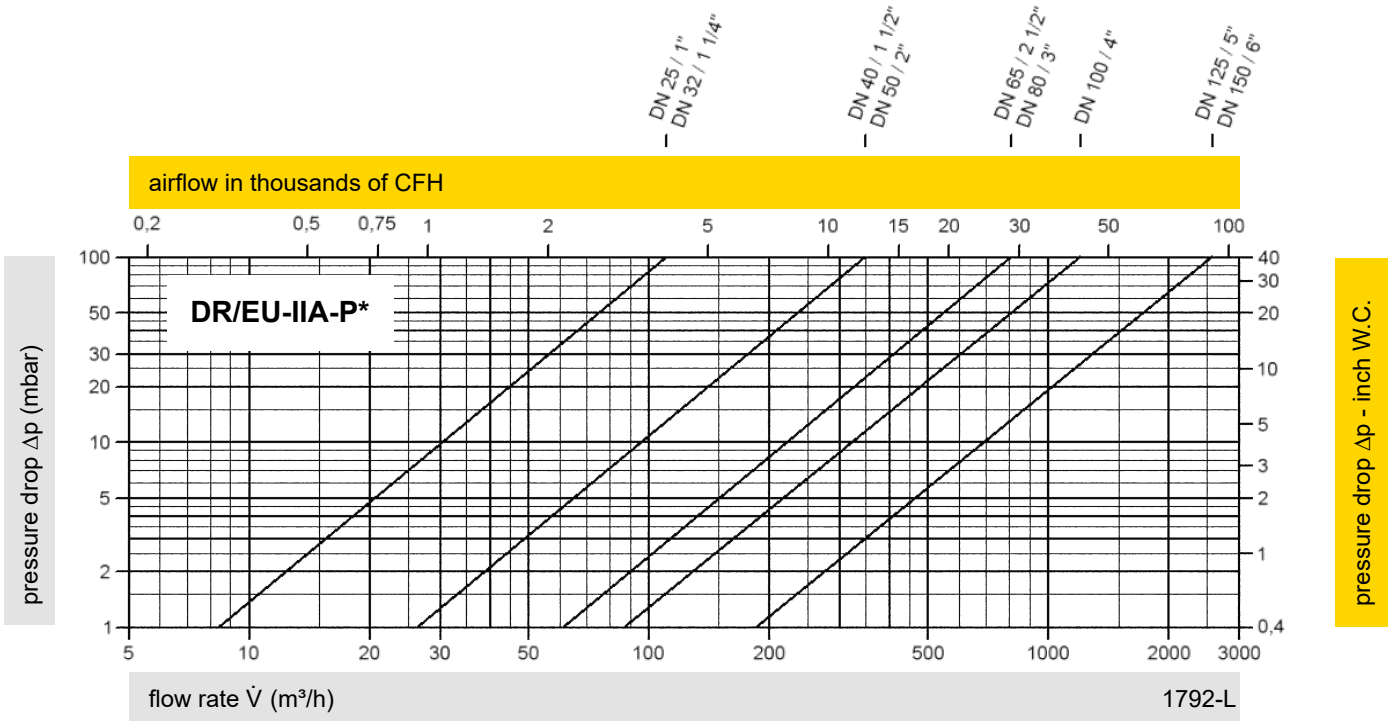




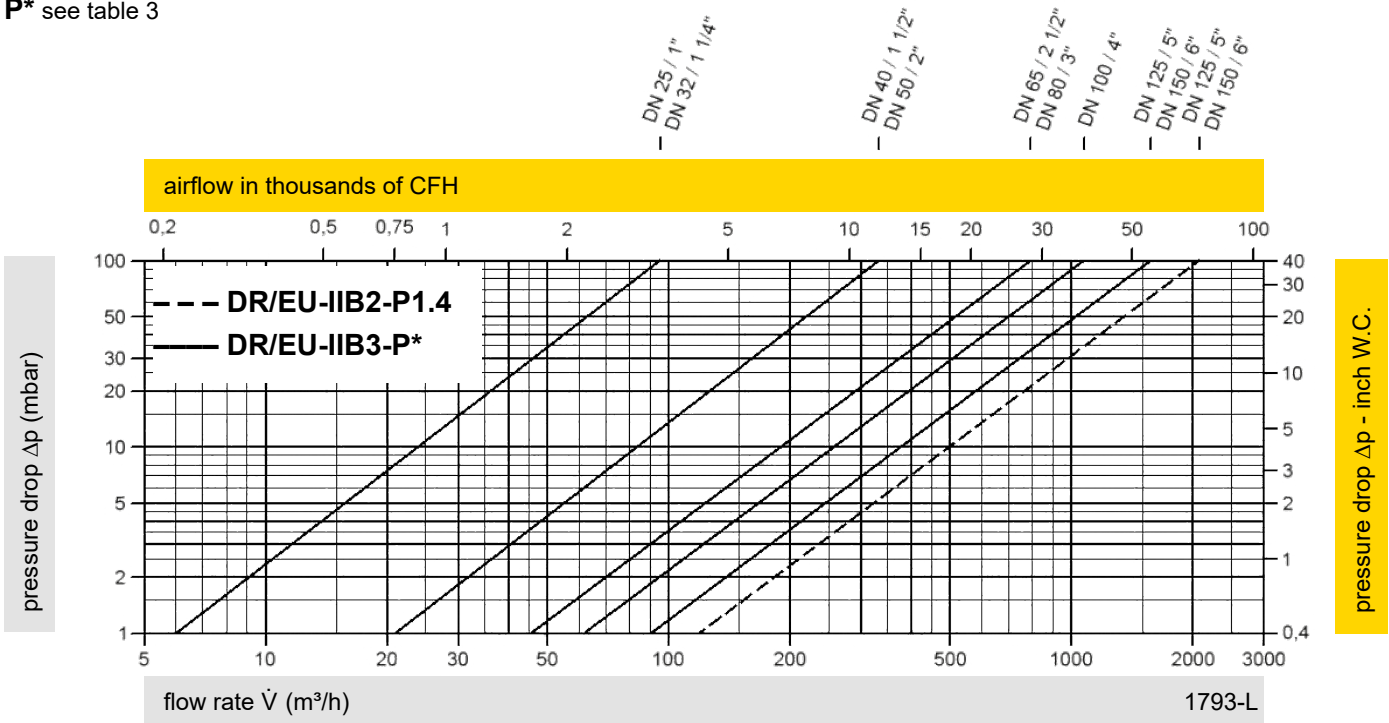
In-Line Detonation Flame Arrester

Flow Capacity Charts

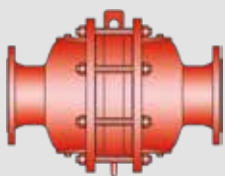
PROTEGO® DR/EU



P* see table 3



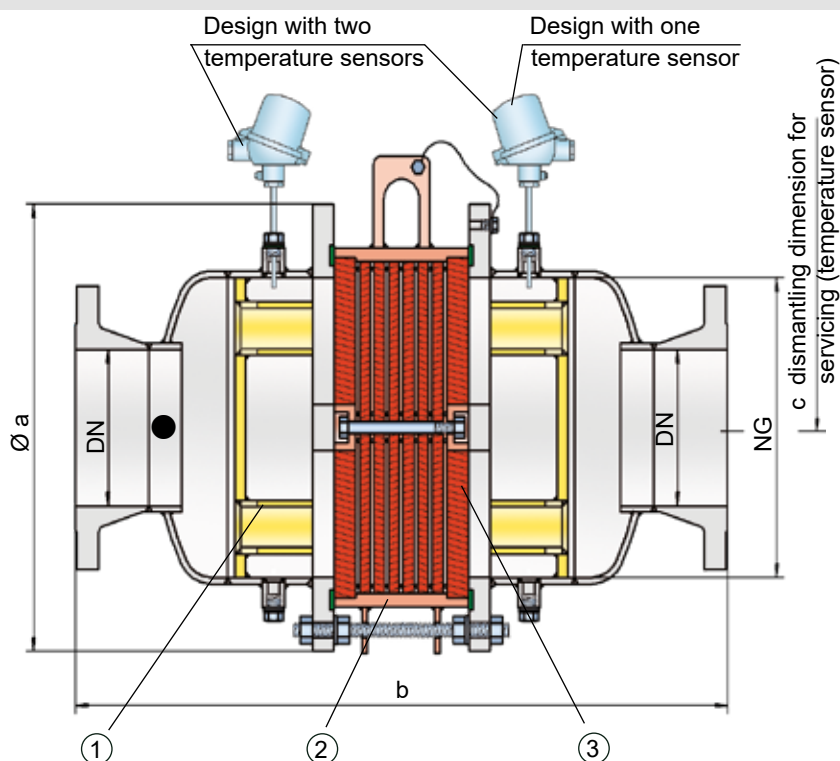
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."



In-Line Detonation Flame Arrester

for unstable and stable detonations, and deflagrations in a straight-through design with shock absorber, bi-directional

PROTEGO® DA-CG



● Connection to the protected side (only for type DA-CG-T-....)

Function and Description

The PROTEGO® DA-CG series of detonation arresters was mainly developed for the North American market and optimized to meet the demands of the US Coast Guard. The devices are symmetrical and offer bi-directional flame arresting for deflagrations and stable and unstable detonations.

The effective shock absorber (1) greatly reduces the speed of incoming detonations. This leads to improved flame extinguishing in the narrow gaps of the FLAMEFILTER® (3).

The flame arrester essentially consists of two housing parts with an integrated shock absorber and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit is modular and consists of several FLAMEFILTER® discs and spacers firmly held in a FLAMEFILTER® casing. The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use.

By specifying the operating conditions, such as the temperature, pressure, explosion group, and the composition of the fluid, the optimum in-line detonation flame arrester can be selected. Type PROTEGO® DA-CG flame arresters are available for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

The standard design can be used at an operating temperature of up to +60°C / 140°F and an absolute operating pressure acc. to table 3. **Devices with special approvals for higher pressures and higher temperatures are available upon request.**

The flame arresters have been approved in accordance with the American Standard 33 CFR part 154 and are accepted by the US Coast Guard.

Special Features and Advantages

- provides protection against deflagrations and stable and unstable detonations
- low number of FLAMEFILTER® discs due to shock absorber technology
- modular design enables individual cleaning and replacement of the FLAMEFILTER® discs
- different design allow scalable pressure loss over the area of the FLAMEFILTER®
- maintenance-friendly design
- available in large nominal widths
- advanced design for higher operating temperatures and pressures
- bi-directional operation, as well as any flow direction and installation position
- installation of temperature sensors possible
- minimal pressure loss resulting in low operating and lifecycle costs
- cost-effective spare parts

Design Types and Specifications

There are three different designs available:

Basic in-line detonation flame arrester **DA-CG-**

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short-time burning from one side **DA-CG-**

Detonation arrester with two integrated temperature sensors* as additional protection against short-time burning from both sides **DA-CG-**

Additional special flame arresters upon request.

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)



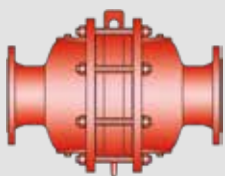
Table 1: Dimensions												Dimensions in mm / inches	
To select nominal width/nominal size (NG/DN) - combination, please use the flow capacity charts on the following pages.						Additional nominal width/nominal size (NG/DN) - combinations for improved flow capacity upon request.							
standard													
NG	150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1000 40"	1200 48"		
DN	≤ 50 2"	80 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 500 20"	≤ 600 24"		
a	285 / 11.22	285 / 11.22	340 / 13.39	460 / 18.11	580 / 22.83	715 / 28.15	840 / 33.07		1025 / 40.35	1255 / 49.41	1485 / 58.46		
b (D)	594 / 23.39	570 / 22.44	620 / 24.41	720 / 28.35	852 / 33.54	1052 / 41.42	1202 / 47.32		1500 / 59.06	1700 / 66.93	2000 / 78.74		
b (C)	650 / 25.59	650 / 25.59	700 / 27.56	800 / 31.50	900 / 35.43	1100 / 43.31	1250 / 49.21		1548 / 60.94	-	-		
c	300 / 11.81	300 / 11.81	330 / 12.99	380 / 14.96	490 / 19.29	540 / 21.26	590 / 23.23		690 / 27.17	790 / 31.10	880 / 34.65		

Table 2: Selection of the explosion group			
MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure												
Expl. Gr.	NG	150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1000 40"	1200 48"
	DN	≤ 50 2"	80 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 500 20"	≤ 600 24"
	IIA	P _{max}	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4
	IIB3	P _{max}	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.2	1.6 / 23.26	1.6 / 23.2

P_{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.





In-Line Detonation Flame Arrester

for unstable and stable detonations and deflagrations in a straight through design with shock absorber, bi-directional

PROTEGO® DA-CG

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	A	B	Special materials upon request.
Housing	Steel	Stainless Steel	
Gasket	PTFE	PTFE	
Flame arrester unit	A	B	

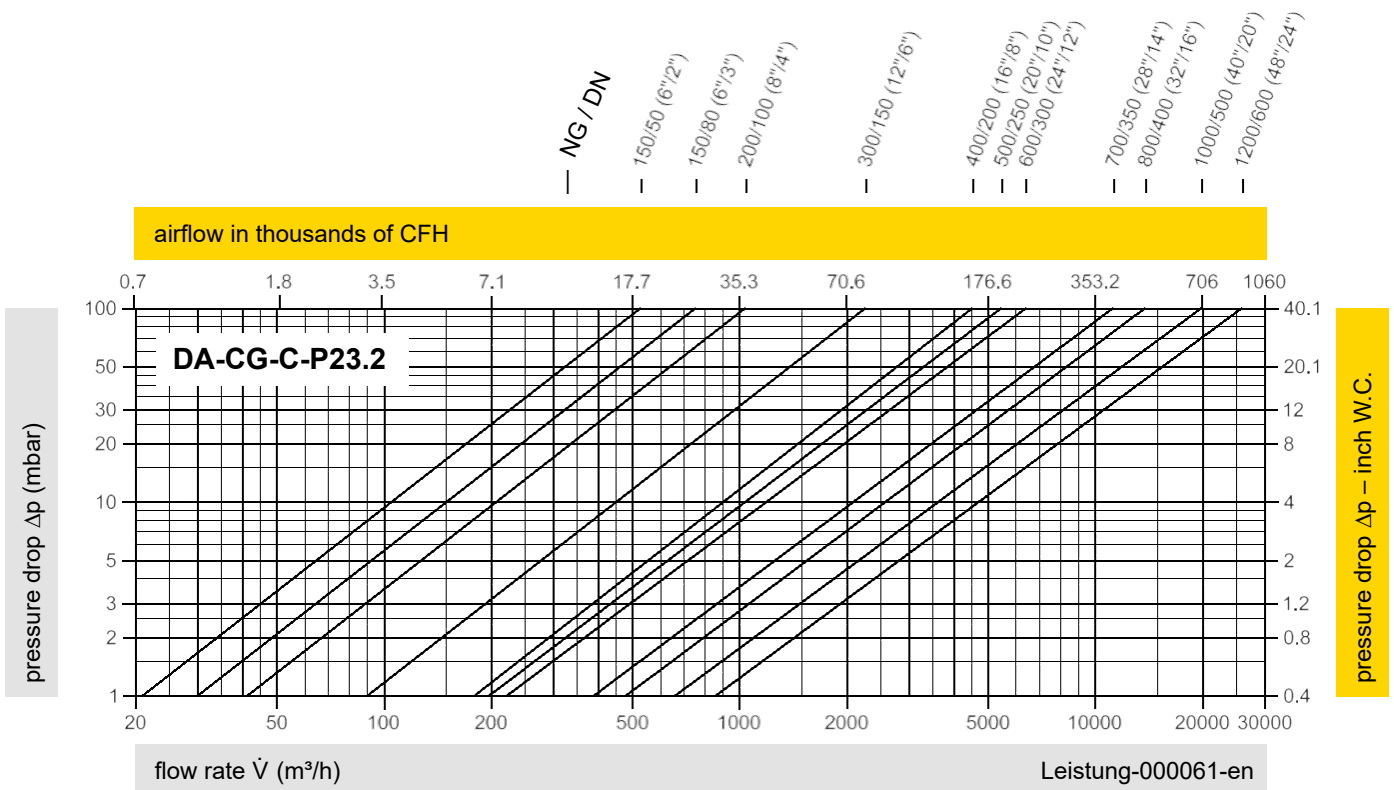
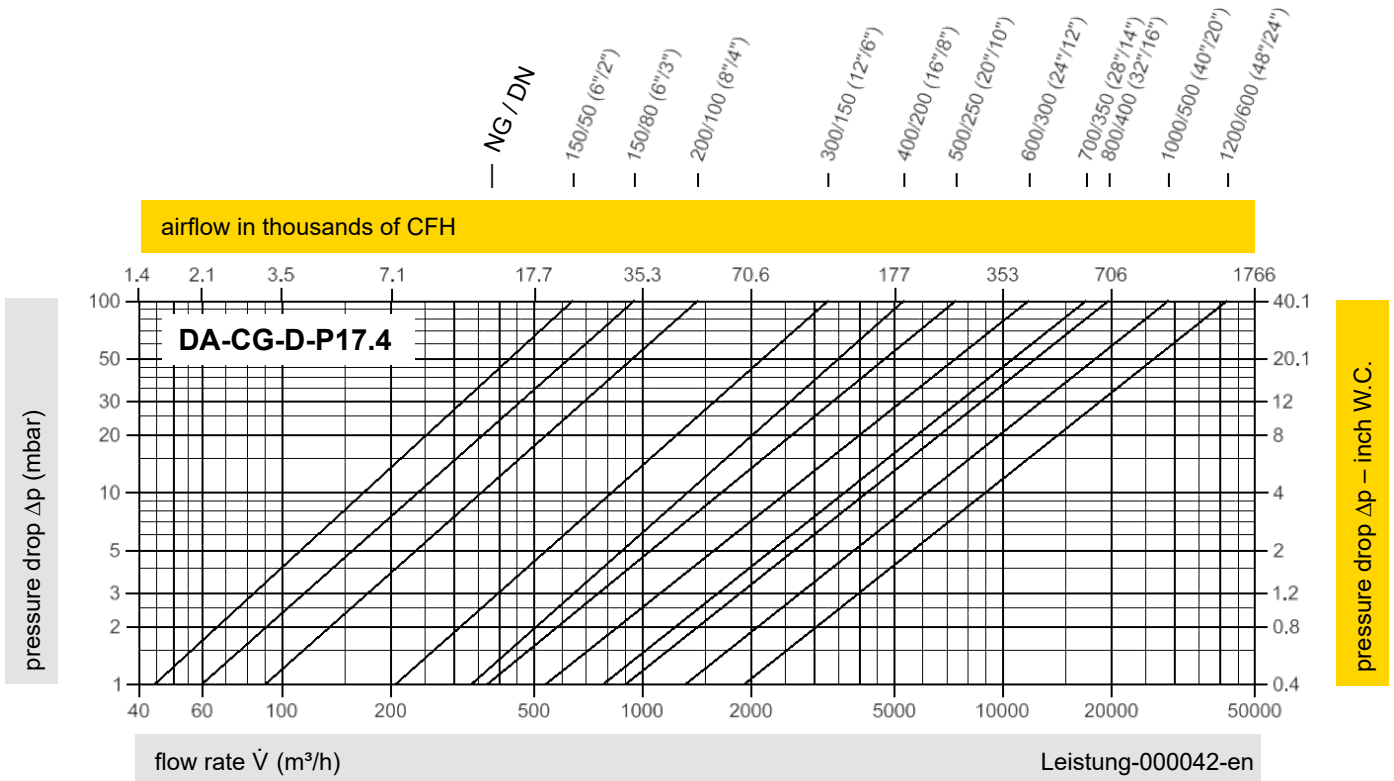
Table 6: Material combinations of the flame arrester unit

Design	A	B	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® casing	Steel	Stainless Steel	
FLAMEFILTER® *	Stainless Steel	Stainless Steel	
Spacer	Stainless Steel	Stainless Steel	

Special materials upon request.

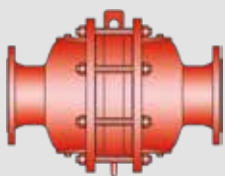
Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

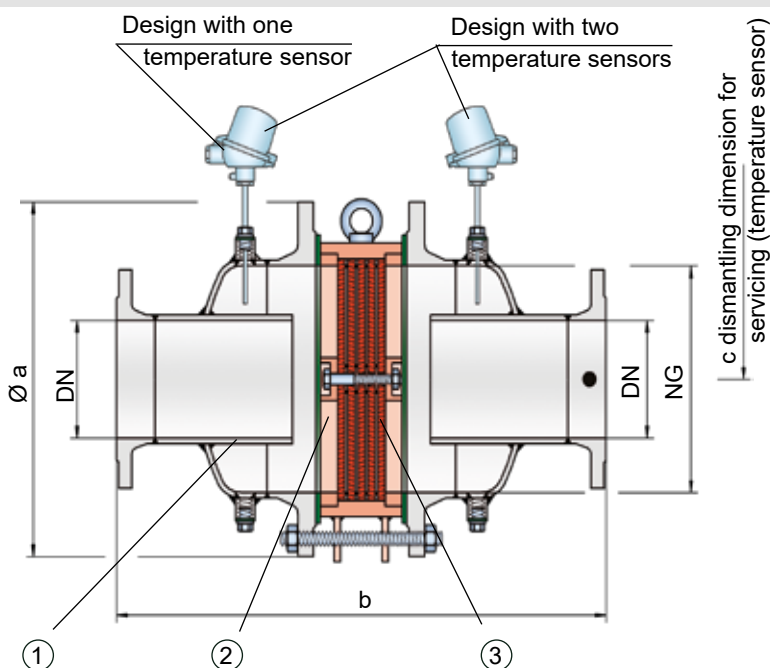




In-Line Detonation Flame Arrester

for unstable and stable detonations, and deflagrations in a straight-through design with a shock tube, bi-directional

PROTEGO® DA-UB



● Connection to the protected side
(only for type DA-UB-T-....)

Function and Description

The type PROTEGO® DA-UB in-line detonation flame arresters are the newest generation of flame arresters. Based on fluid dynamic and explosion-dynamic calculations, as well as decades of field tests, a line was developed that offers minimum pressure loss and maximum safety. The device uses the Shock Wave Guide Tube Effect (SWGTE) to separate the flame front and shock wave. The result is an in-line detonation flame arrester without a classic shock absorber, and the use of flame-extinguishing elements is minimized.

The devices are symmetrical and offer bi-directional flame arresting for deflagrations and stable and unstable detonations. The arrester essentially consists of two housing parts with an integrated shock tube (1) and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit is modular and consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® casing. The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use.

By specifying the operating conditions, such as the temperature, pressure, explosion group, and the composition of the fluid, the optimum detonation arrester can be selected from a series of approved devices. PROTEGO® DA-UB flame arresters are available for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

The standard design can be used at an operating temperature of up to +60°C / 140°F and an absolute operating pressure up to 1.1 bar / 15.9 psi. **Devices with special approval for higher temperatures and pressures (see table 3) are available upon request.** Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- optimized performance due to the patented *Shock Wave Guide Tube Effect (SWGTE)*
- low number of FLAMEFILTER® discs due to the patented shock tube (SWGTE)
- modular design enables replacement of the individual FLAMEFILTER® discs
- different designs allow scalable pressure loss over the area of the FLAMEFILTER®
- maintenance-friendly design
- advanced design for higher operating temperatures and pressures
- bi-directional operation, as well as any flow direction and installation position
- installation of temperature sensors possible
- minimal pressure loss resulting in low operating and lifecycle costs
- cost-effective spare parts

Design Types and Specifications

There are four different designs available:

Basic in-line detonation flame arrester **DA-UB - [] - []**

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short-time burning **DA-UB - [T] - []**

In-line detonation flame arrester with two integrated temperature sensors* for additional protection against short-time burning from both sides **DA-UB - [TB] - []**

In-line detonation flame arrester with heating jacket **DA-UB - [H] - []**

Additional special flame arresters upon request.

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)



Stabilized FLAMEFILTER®
Discs (Flyer pdf)



New PROTEGO® Flame Arrester Unit unique
maintenance friendly design (Flyer pdf)

Table 1: Dimensions

Dimensions in mm / inches

To select nominal width/nominal size (NG/DN) - combination, please use the flow capacity charts on the following pages.				Additional nominal width/nominal size (NG/DN) - combinations for improved flow capacity upon request.						
standard										
NG	150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1400 56"
DN	≤ 50 2"	80 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 600 24"
a	285 / 11.22	285 / 11.22	340 / 13.39	445 / 17.52	565 / 22.24	670 / 26.38	780 / 30.71	895 / 35.24	1015 / 39.96	1675 / 65.94
IIA -P1.1					700 / 27.56	800 / 31.50	1000 / 39.37	1200 / 47.24	1400 / 55.12	2200 / 86.61
IIA-P1.2	388 / 15.28	388 / 15.28	488 / 19.21	626 / 24.65						
b			500 / 19.69	638 / 25.12	724 / 28.50	824 / 32.44	1000 / 39.37	1200 / 47.24	1400 / 55.12	
IIB3-P1.1										
IIB3-P1.2	388 / 15.28	388 / 15.28								
c	500 / 19.69	500 / 19.69	520 / 20.47	570 / 22.44	620 / 24.41	670 / 26.38	720 / 28.35	770 / 30.31	820 / 32.28	1060 / 41.73

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

		150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1400 56"
NG											
DN		≤ 50 2"	80 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 600 24"
Expl. Gr.	IIA P _{max}	1.8 / 26.1	1.8 / 26.1	1.6 / 23.2	1.6 / 23.2	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.6 / 23.2
	IIB3 P _{max}	1.5 / 21.7	1.5 / 21.7	1.5 / 21.7	1.5 / 21.7	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	

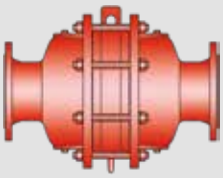
P_{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.

In-between size up to P_{max} upon request.

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request
-	Classification	





In-Line Detonation Flame Arrester

for unstable and stable detonations, and deflagrations in a straight-through design with a shock tube, bi-directional

PROTEGO® DA-UB

Table 5: Material selection for housing

Design	A	B	C
Housing	Steel	Stainless Steel	Hastelloy
Heating jacket (DA-UB-(T)-H-...)	Steel	Stainless Steel	Stainless Steel
Gasket	PTFE	PTFE	PTFE
Flame arrester unit	A	B, C	D

The housing is also available in Steel with an ECTFE coating.

Special materials upon request.

Table 6: Material combinations of the flame arrester unit

Design	A	B	C	D
FLAMEFILTER® casing	Steel	Stainless Steel	Stainless Steel	Hastelloy
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy

*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.

Special materials upon request.

Table 7: Flange connection type

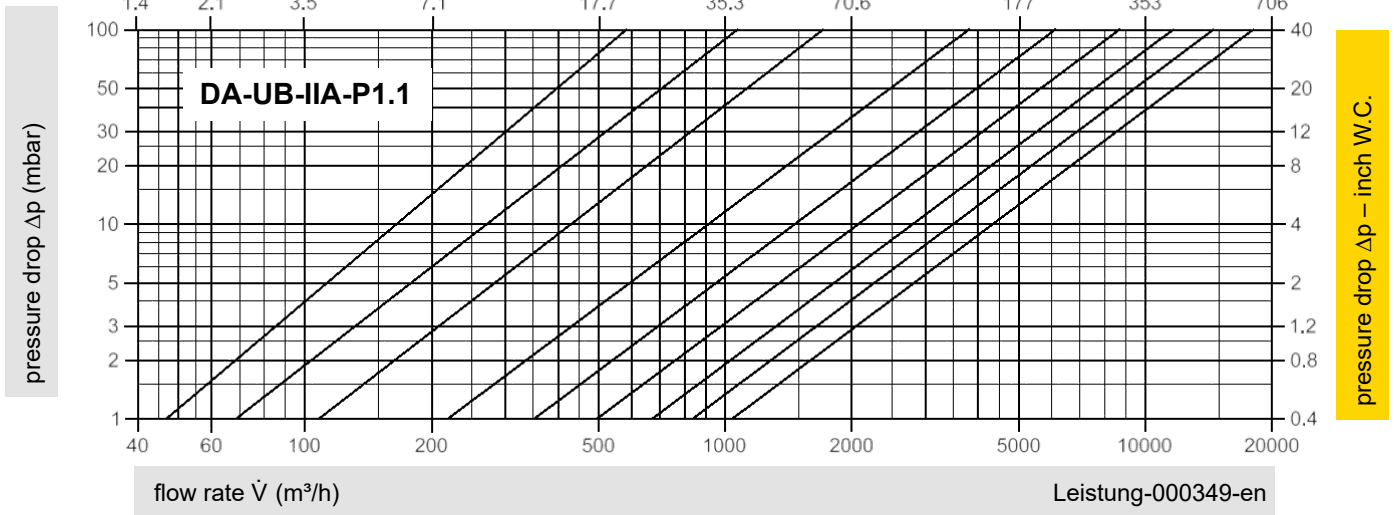
EN 1092-1; Form B1
ASME B16.5 CL 150 R.F.

Other types upon request.

* P1.2

— NG / DN
 — 150/50 (6" / 2") *
 — 150/80 (6" / 3") *
 — 200/100 (8" / 4") *
 — 300/150 (12" / 6") *
 — 400/200 (16" / 8")
 — 500/250 (20" / 10")
 — 600/300 (24" / 12")
 — 700/350 (28" / 14")
 — 800/400 (32" / 16")

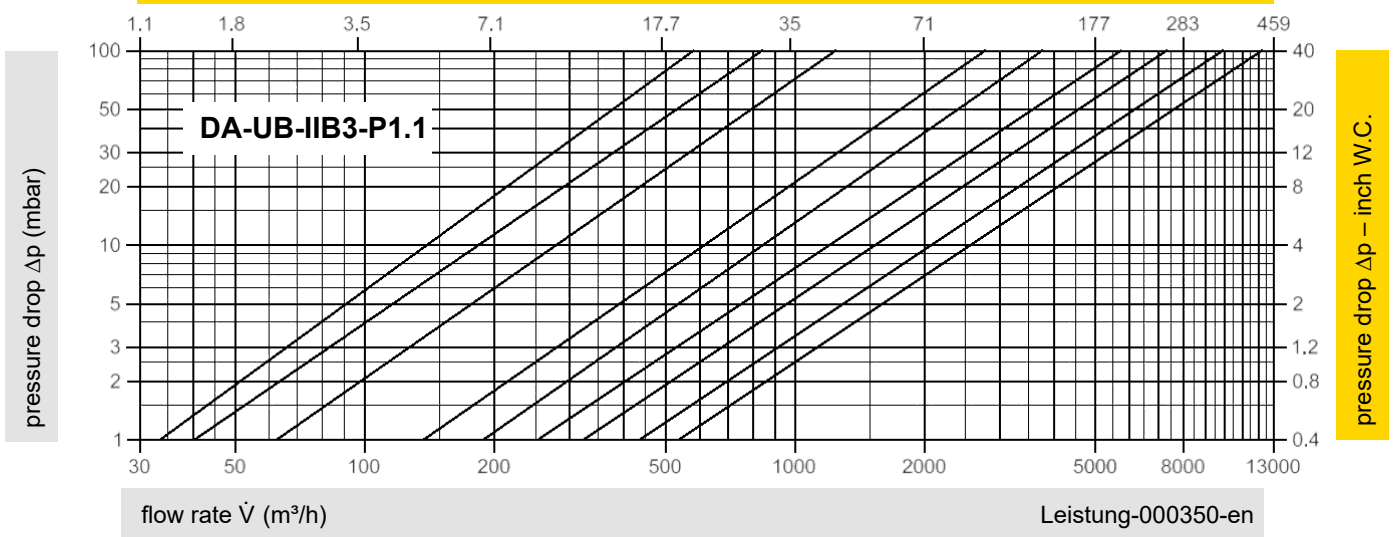
airflow in thousands of CFH



* P1.2

— NG / DN
 — 150/50 (6" / 2") *
 — 150/80 (6" / 3") *
 — 200/100 (8" / 4") *
 — 300/150 (12" / 6")
 — 400/200 (16" / 8")
 — 500/250 (20" / 10")
 — 600/300 (24" / 12")
 — 700/350 (28" / 14")
 — 800/400 (32" / 16")

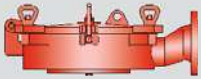
airflow in thousands of CFH



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

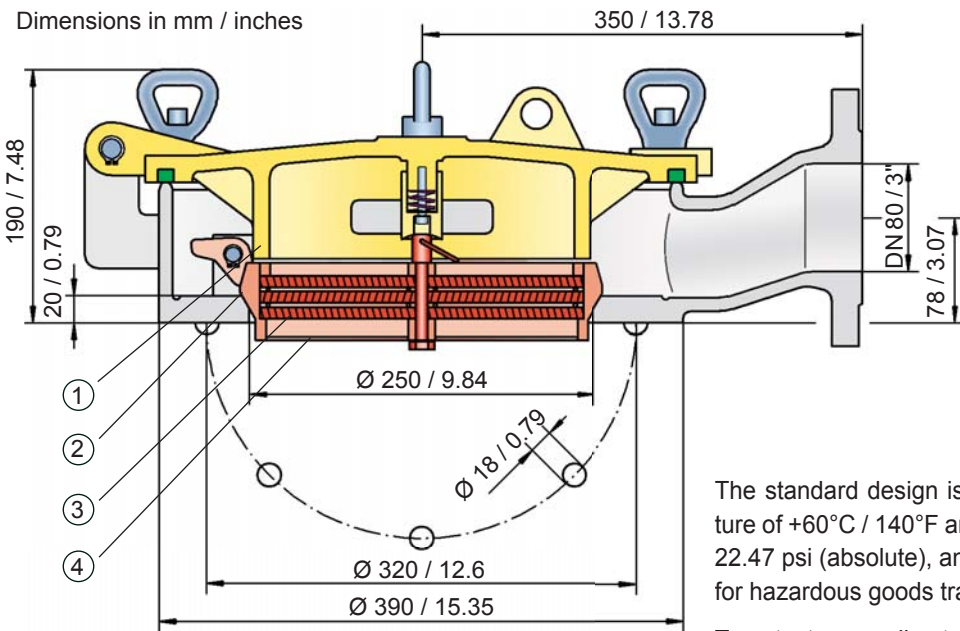


for safety and environment



Detonation Flame Arrester for tank ships and containers

PROTEGO® BR/TS-80-IIB3



The standard design is approved up to an operating temperature of +60°C / 140°F and an operating pressure up to 1.55 bar / 22.47 psi (absolute), and it meets all the conditions of the ADN* for hazardous goods transport on European Inland Waterways.

Type-tests according to EN ISO 16852 and classification societies are available.

Function and Description

The PROTEGO® BR/TS-80-IIB3 detonation flame arrester was developed for protecting tankships but can also be used for containers. These devices are especially used on tank ships operating on inland waterways or coastal shipping. The device is installed on the tank or a pipe section connected to the tank with a nominal size of 250 mm / 10" and connected to the vapour balancing line (DN 80 / 3"). The individual tanks connected via the vapour balancing line are technically decoupled by the detonation arresters and protected.

The device protects against unidirectional detonation. In particular, the arrester consists of a shock absorber (1) and the PROTEGO® flame arrester unit (2). The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® cage (4). It is movable and can be folded to the side for maintenance. The primary goal of this design is to enable the tank to be vented or supplied with air in an emergency when ice or crystallizing products clog the FLAMEFILTER®. The PROTEGO® BR/TS flame arrester is available for explosion groups IIA to IIB3 (NEC group D and C MESG ≥ 0.65 mm).

Special Features and Advantages

- meets all ADN* requirements
- flat design
- the emergency venting with the flexibly mounted flame arrester enables use even in bad weather conditions as well as with contaminated products
- extraordinarily easy to service
- the design of the PROTEGO® flame arrester unit enables individual FLAMEFILTER® discs to be replaced
- we offer support in calculating loading and unloading rates
- applicable for nearly all flammable liquids
- may be used as maintenance and cleaning hatch
- cost efficient spare parts

* European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways

Table 1: Material selection for housing

Design	A	B
Housing	Steel	Stainless Steel
Cover	Steel	Stainless Steel
Gasket	Tankatite	Tankatite
Flame arrester unit	A	A

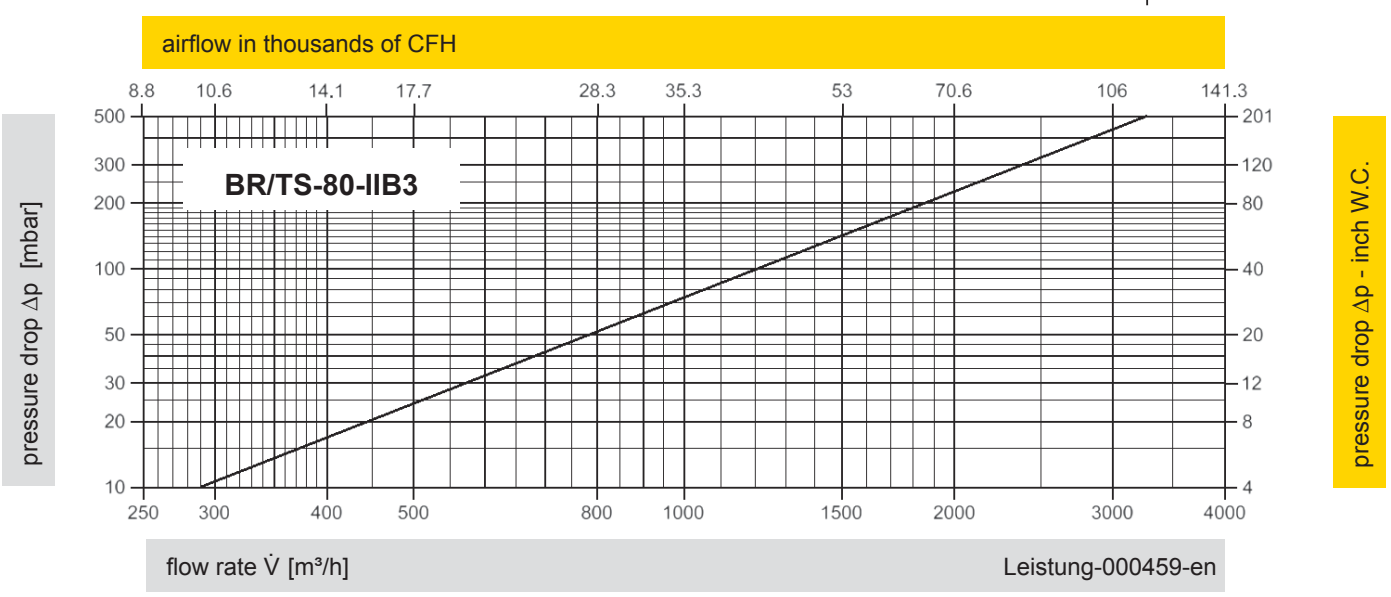
Table 2: Material for flame arrester unit

Design	A
FLAMEFILTER® cage	Stainless Steel
FLAMEFILTER®	Stainless Steel
Spacer	Stainless Steel

Table 3: Flange connection type

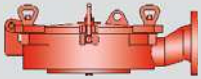
EN 1092-1; Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	

DN 80 / 3"



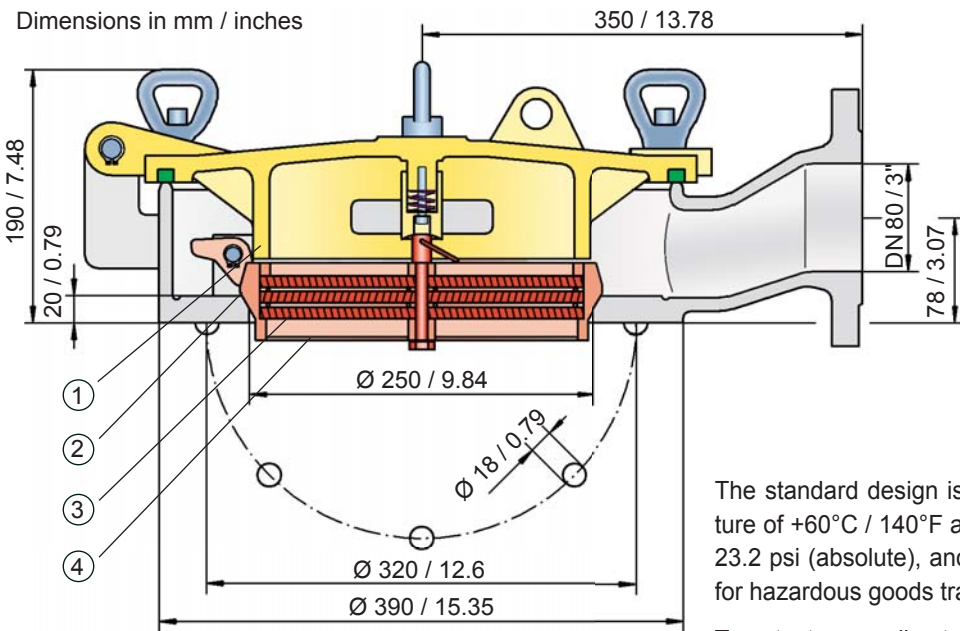
The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and CFH refer to the standard reference conditions of air ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".





Detonation Flame Arrester for tank ships and containers

PROTEGO® BR/TS-80-IIB-P1.6



The standard design is approved up to an operating temperature of +60°C / 140°F and an operating pressure up to 1.6 bar / 23.2 psi (absolute), and it meets all the conditions of the ADN* for hazardous goods transport on European Inland Waterways.

Type-tests according to EN ISO 16852 and classification societies are available.

Function and Description

The PROTEGO® BR/TS-80-IIB-P1.6 detonation flame arrester was developed for protecting tankships but can also be used for containers. These devices are especially used on tank ships operating on inland waterways or coastal shipping. The device is installed on the tank or a pipe section connected to the tank with a nominal size of 250 mm / 10" and connected to the vapour balancing line (DN 80 / 3"). The individual tanks connected via the vapour balancing line are technically decoupled by the detonation arresters and protected.

The device protects against unidirectional detonation. In particular, the arrester consists of a shock absorber (1) and the PROTEGO® flame arrester unit (2). The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® cage (4). It is movable and can be folded to the side for maintenance. The primary goal of this design is to enable the tank to be vented or supplied with air in an emergency when ice or crystallizing products clog the FLAMEFILTER®. The PROTEGO® BR/TS flame arrester is available for explosion groups IIA to IIB (NEC group D to B MESG ≥ 0.5 mm).

Special Features and Advantages

- meets all ADN* requirements
- flat design
- the emergency venting with the flexibly mounted flame arrester enables use even in bad weather conditions as well as with contaminated products
- extraordinarily easy to service
- the design of the PROTEGO® flame arrester unit enables individual FLAMEFILTER® discs to be replaced
- we offer support in calculating loading and unloading rates
- applicable for nearly all flammable liquids
- may be used as maintenance and cleaning hatch
- cost efficient spare parts

* European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways

Table 1: Material selection for housing

Design	A	B
Housing	Steel	Stainless Steel
Cover	Steel	Stainless Steel
Gasket	Tankatite	Tankatite
Flame arrester unit	A	A

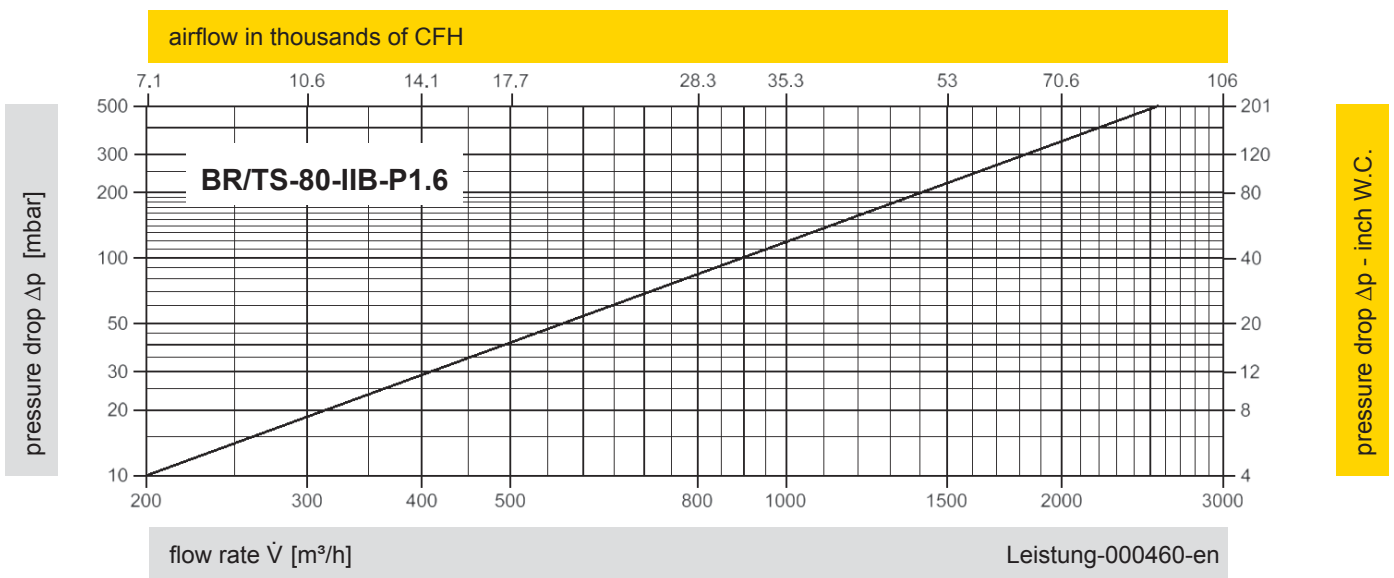
Table 2: Material for flame arrester unit

Design	A
FLAMEFILTER® cage	Stainless Steel
FLAMEFILTER®	Stainless Steel
Spacer	Stainless Steel

Table 3: Flange connection type

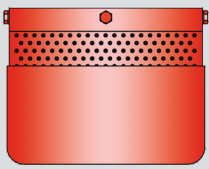
EN 1092-1; Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	

DN 80 / 3"



The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig.
Volume flow \dot{V} in [m³/h] and CFH refer to the standard reference conditions of air ISO 6358 (20°C, 1bar).
Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".





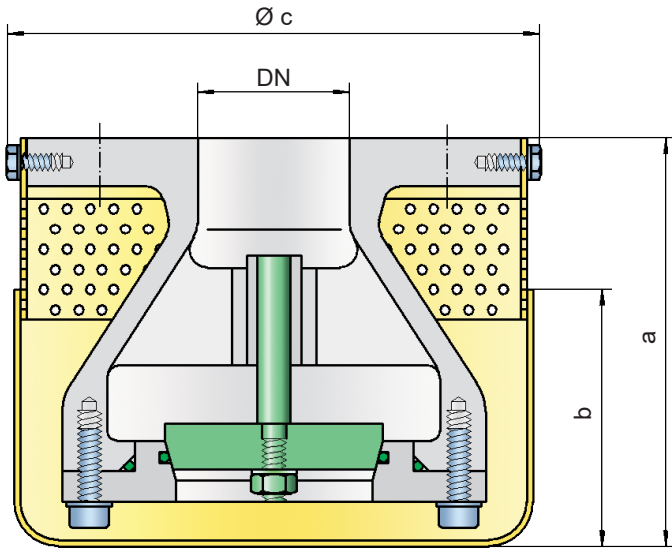
Detonation Flame Arrester

Detonation-proof foot valve for suction lines

PROTEGO® EF/V-IIB3



EFV-IIB3



Combustible mixtures can form in filling and drain lines of storage containers that are not always filled with product. Ignition of explosive atmospheres can lead to highly accelerated pipe deflagration or detonations. The detonation-proof foot valve prevents the combustion from being transmitted into the tank and destroying it. The design of the foot valve ensures that the strainer is always filled with residual product. Together with the special valve design, this combination prevents flame flash back from the inside out.

The application limits for the device are a product vapor/air mixture temperature of up to +60°C / 140°F and an absolute pressure up to 1.1 bar / 15.9 psi. This covers all the possible operating conditions of empty lines for flammable liquids.

The device protects against nearly all flammable liquids and is permitted for explosion group IIB3 (C MESG ≥ 0.65 mm).

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Function and Description

The PROTEGO® EF/V-IIB3 detonation-safe foot valve protects the suction line in a storage tank. The virtually maintenance-free device is installed at the end of the emptying line within the tank. During suction, the valve opens at an approximate under-pressure of 30 mbar / 12 inch W.C. When the pump is turned off, the device functions as a check valve and prevents the line from emptying. This is very helpful when the pump is restarted.

Special Features and Advantages

- virtually maintenance-free
 - check valve makes starting the pump easier
 - provides protection against deflagrations and stable detonations
 - useable for nearly all flammable liquids
 - meets TRGS* requirements
 - special strainer prevents solid particles from entering
- * TRGS = technical regulations for hazardous substances

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following page.

DN	25 1"	32 1 ¼"	40 1 ½"	50 2"	65 2 ½"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"
a	125 / 4.92	125 / 4.92	135 / 5.31	135 / 5.31	160 / 6.29	160 / 6.29	200 / 7.87	235 / 9.25	260 / 10.24	400 / 15.75	450 / 17.72
b	85 / 3.35	85 / 3.35	85 / 3.35	85 / 3.35	95 / 3.74	95 / 3.74	125 / 4.92	130 / 5.12	135 / 5.31	175 / 6.89	200 / 7.81
c	155 / 6.10	155 / 6.10	180 / 7.09	180 / 7.09	210 / 8.27	210 / 8.27	250 / 9.84	310 / 12.20	365 / 14.37	480 / 18.90	565 / 22.24

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
≥ 0,65 mm	IIB3	C	

Table 3: Specification of max. operating temperature

≤ 60°C / 140°F	T maximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

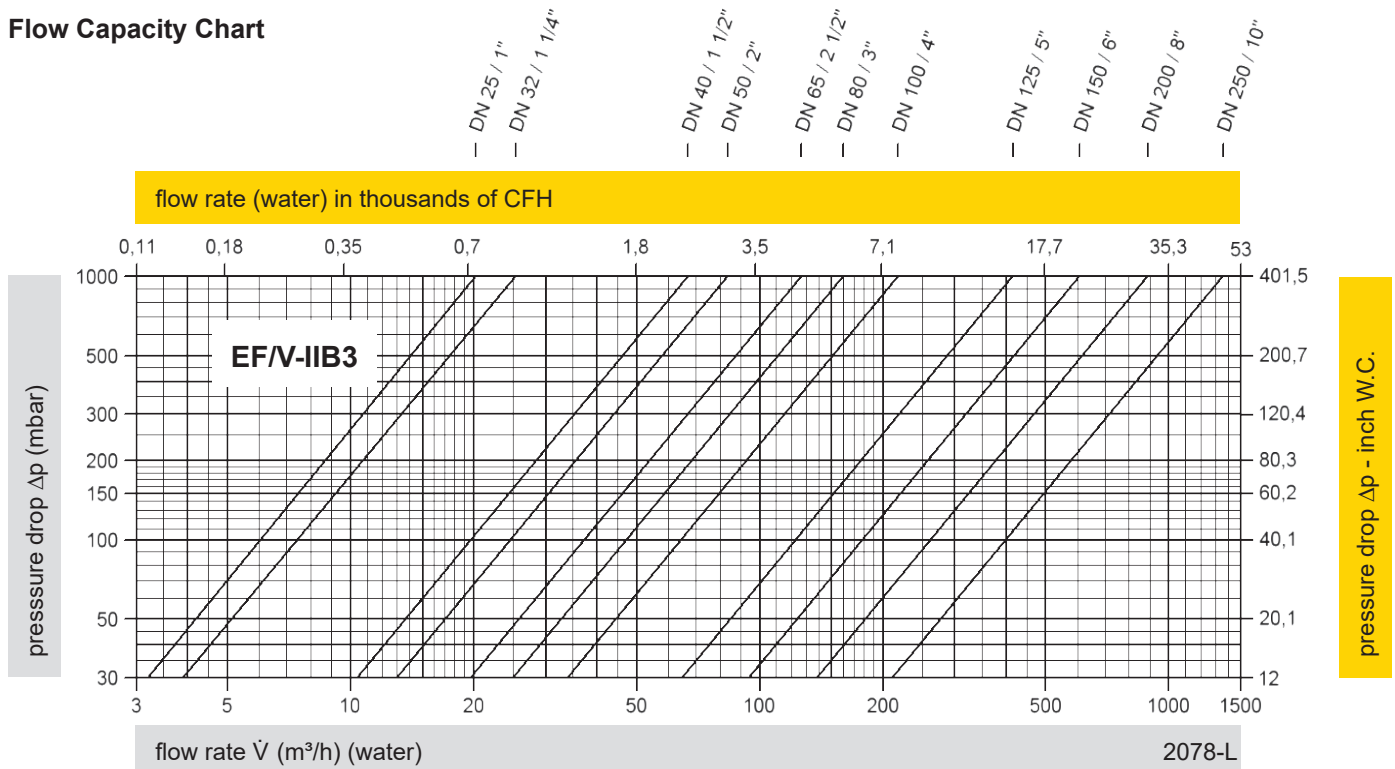
Table 4: Material selection for housing

Design	A	B	C	D	Special materials upon request.
Housing	Steel	Stainless Steel	Steel	Stainless Steel	
Valve	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	
Gasket (Valve)	PTFE	PTFE	PTFE	PTFE	
Gasket (Housing)	FPM	FPM	PTFE	PTFE	
Strainer	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	

Table 5: Flange connection type

EN 1092-1; Form A	Other types upon request.
ASME B16.5 CL 150 F.F.	

Flow Capacity Chart



Conversion: $\dot{V}_{water} = \dot{V}_{liquid} * \sqrt{\frac{\rho_{liquid}}{\rho_{water}}}$ $\dot{V}_{liquid} = \dot{V}_{water} * \sqrt{\frac{\rho_{water}}{\rho_{liquid}}}$

The volume flow \dot{V} in m³/h was determined with water, in accordance with DIN EN 60534, at a temperature $T_n = 20^\circ\text{C}$ and an atmospheric pressure $p_n = 1,013$ bar, kinematic viscosity $\nu = 10^{-6}$ m²/s.

To avoid electrostatic charge of flammable liquids, the maximum flow is limited (refer to TRGS 727, CENELEC-Report CLC/TR 60079-32-1).





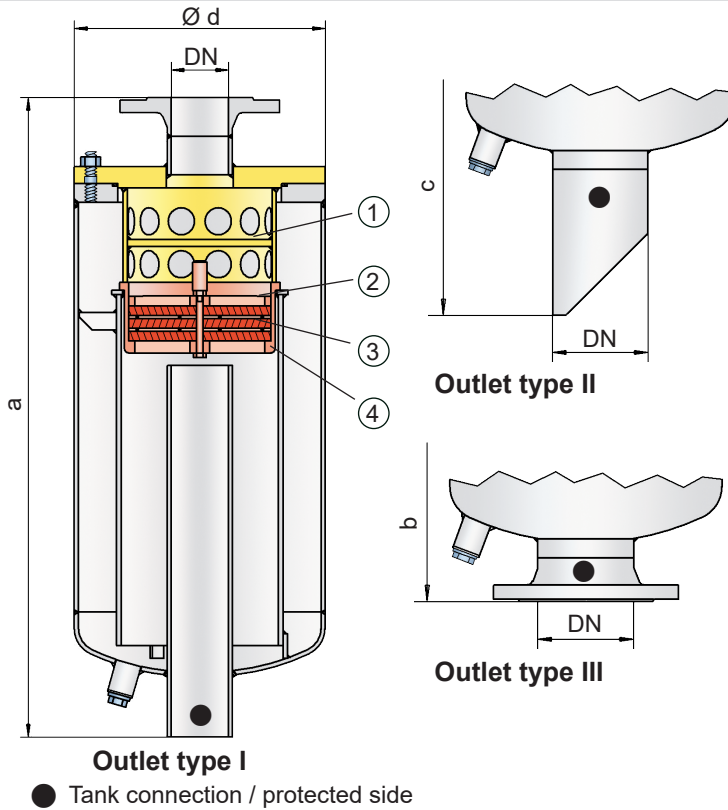
Liquid Detonation Flame Arrester

for filling and drain lines - internal installation



LDA-F

PROTEGO® LDA-F



The device is installed inside the container at the end of the line and prevents the combustion from being transferred into the tank if the explosive atmosphere ignites. The PROTEGO® LDA-F series of liquid detonation arresters combine the classic PROTEGO® flame arrester design with the siphon principle in which the liquid product serves as a barrier to flame propagation.

When a highly accelerated pipe deflagration or detonation occurs, the combustion pressure and flame propagation speed are substantially reduced by the design, converted into a low-energy deflagration, and then stopped by the remaining immersion liquid and the PROTEGO® flame arrester.

The application limits for the device is product vapor/air mixture temperatures up to +60°C / 140°F and an absolute pressure up to 1.1 bar / 15.9 psi. This covers all possible operating conditions of empty lines for flammable liquids. The liquid detonation arrester in standard design is pressure-resistant up to 10 bar / 145 psi. The device protects against nearly all flammable liquids and is approved for explosion groups IIA to IIB3 (NEC group D and C MESG ≥ 0.65 mm). Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Function and Description

The PROTEGO® LDA-F series of liquid detonation arresters was developed for storage tanks filling and drain lines that are not continuously filled with product and sometimes contain a combustible mixture. The integrated siphon protection (1) with PROTEGO® flame arrester unit (2) additionally prevents the liquid, in which the lines are immersed, from being siphoned off while the container is being drained. The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® cage (4). The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use.

Special Features and Advantages

- siphon protection offers increased safety
- low risk of contamination
- low pressure loss
- provides protection against deflagrations and stable detonations
- useable for nearly all flammable liquids
- meets TRGS* requirements
- available with different connections

* TRGS = technical regulations for hazardous substances

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following pages.

DN	25 1"	32 1 ¼"	40 1 ½"	50 2"	65 2 ½"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"
a	550 / 21.65	550 / 21.65	650 / 25.59	650 / 25.59	850 / 33.46	875 / 34.45	1050 / 41.34	1250 / 49.21	1450 / 57.09	1600 / 62.99	1975 / 77.76
b	588 / 23.15	590 / 23.23	692 / 27.24	695 / 27.36	895 / 35.24	925 / 36.42	1102 / 43.39	1305 / 51.38	1505 / 59.25	1662 / 65.43	2043 / 80.43
c	775 / 30.51	775 / 30.51	875 / 34.45	875 / 34.45	1075 / 42.32	1095 / 43.11	1270 / 50.00	1480 / 58.27	1680 / 66.14	1830 / 72.05	2275 / 89.57
d	140 / 5.51	140 / 5.51	220 / 8.66	220 / 8.66	275 / 10.83	275 / 10.83	356 / 14.07	457 / 17.99	508 / 20.00	600 / 23.62	711 / 27.99

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
≥ 0,65 mm	IIB3	C	



Stabilized FLAMEFILTER®
Discs (Flyer pdf)

Table 3: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 4: Material selection for housing

Design	A	B	Special materials upon request.
Housing	Steel	Stainless Steel	
Shock absorber	Steel	Stainless Steel	
Gasket	FPM	PTFE	
Flame arrester unit	A	A	

Table 5: Material for flame arrester unit

Design	A	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and cage materials are used. Special materials upon request.
FLAMEFILTER® cage	Stainless Steel	
FLAMEFILTER® *	Stainless Steel	
Spacer	Stainless Steel	

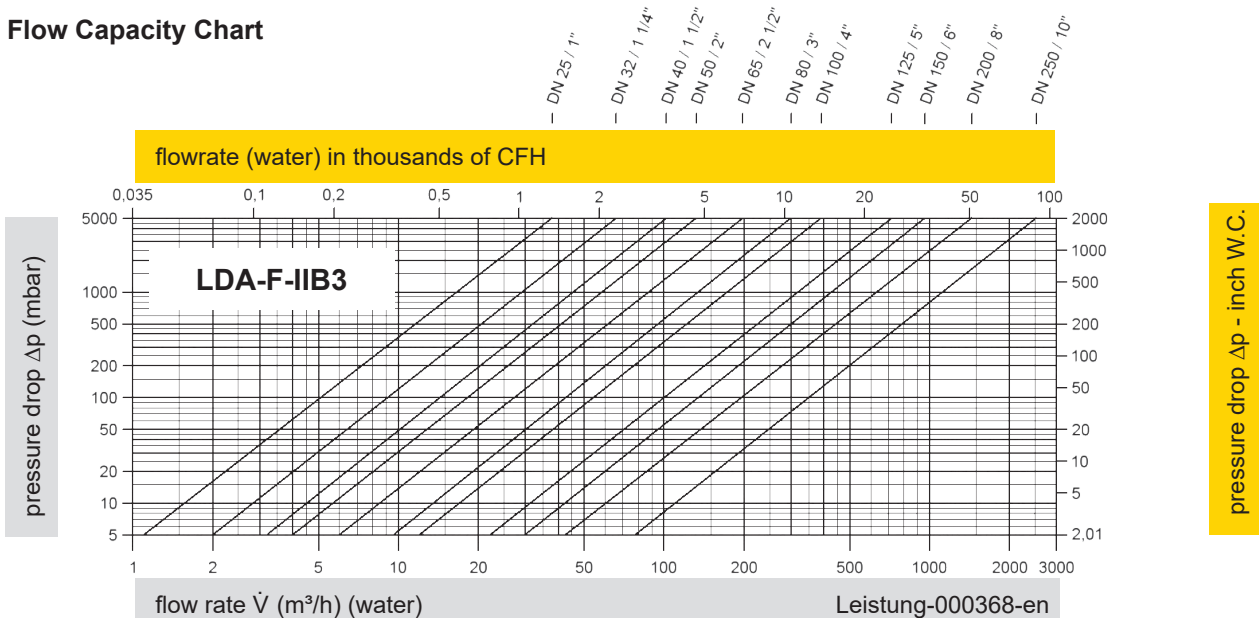
Table 6: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

Table 7: Outlet type

Outlet type	Classification	Other types upon request.
Straight pipe	I	
Beveled pipe	II	
EN 1092-1; Form B1	III	
ASME B16.5 CL 150 R.F.	III	

Flow Capacity Chart



Conversion: $\dot{V}_{water} = \dot{V}_{liquid} * \sqrt{\frac{\rho_{liquid}}{\rho_{water}}}$ $\dot{V}_{liquid} = \dot{V}_{water} * \sqrt{\frac{\rho_{water}}{\rho_{liquid}}}$

The volume flow \dot{V} in m³/h was determined with water, in accordance with DIN EN 60534, at a temperature $T_n = 20^\circ\text{C}$ and an atmospheric pressure $p_n = 1,013 \text{ bar}$, kinematic viscosity $\nu = 10^{-6} \text{ m}^2/\text{s}$.

To avoid electrostatic charge of flammable liquids, the maximum flow is limited (refer to TRGS 727, CENELEC-Report CLC/TR 60079-32-1).





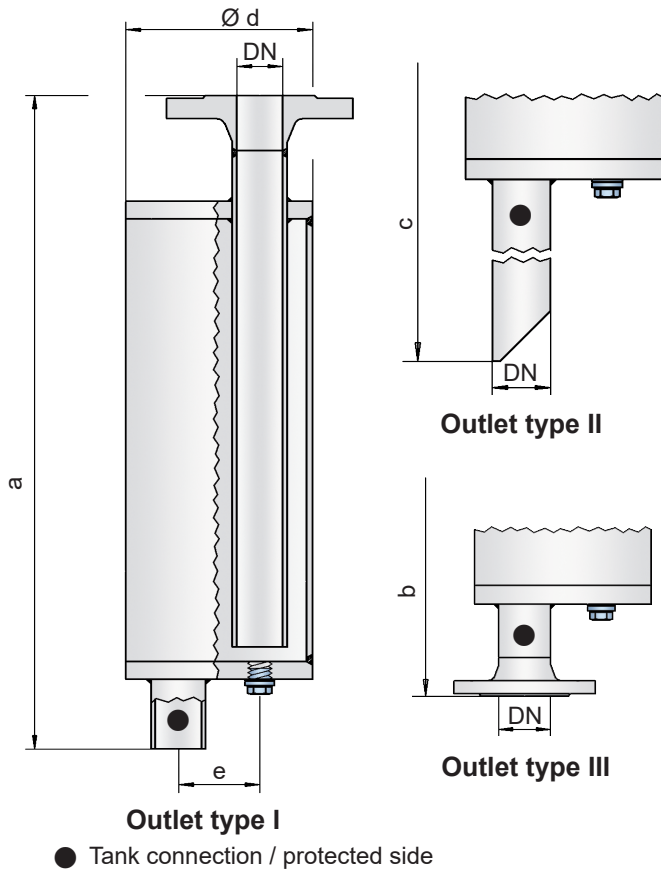
Liquid Detonation Flame Arrester

for filling lines - internal installation

PROTEGO® LDA



LDA



The device is installed inside the tank at the end of the line and prevents the combustion from being transferred into the tank if the explosive atmosphere ignites. The liquid detonation arresters function according to the siphon principle in which the liquid product serves as a liquid barrier to flame propagation.

When a highly accelerated pipe deflagration or detonation occurs, the combustion pressure and flame propagation speed is substantially reduced by the design, converted into a low-energy deflagration, and then stopped by the remaining immersion liquid.

The application range for the device is a product vapor/air mixture temperature of up to + 60°C / 140°F and an absolute pressure up to 1.1 bar / 15.9 psi. This covers all possible operating conditions of empty lines for flammable liquids. The liquid detonation arrester is pressure-resistant up to 10 bar / 145 psi. The device protects against nearly all flammable liquids and is approved for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- simple construction provides low risk of contamination
- low pressure loss
- provides protection against deflagrations and stable detonations
- useable for nearly all flammable liquids
- meets TRGS* requirements
- available with different connections

* TRGS = technical regulations for hazardous substances

Function and Description

The PROTEGO® LDA series of liquid detonation arresters was developed for storage tank filling lines that are not continuously filled with product and sometimes contain a combustible mixture.

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following pages.

DN	25 1"	32 1 1/4"	40 1 1/2"	50 2"	65 2 1/2"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"
a	500 / 19.69	580 / 22.83	700 / 27.56	700 / 27.56	825 / 32.48	925 / 36.42	1050 / 41.34	1150 / 45.28	1350 / 53.15	1650 / 64.96	2000 / 78.74
b	538 / 21.18	620 / 24.41	745 / 29.33	745 / 29.33	870 / 34.25	975 / 38.39	1102 / 43.39	1205 / 47.44	1405 / 55.31	1712 / 67.40	2068 / 81.42
c	725 / 28.54	805 / 31.69	925 / 36.42	925 / 36.42	1050 / 41.34	1145 / 45.08	1270 / 50.00	1380 / 54.33	1580 / 62.20	1880 / 74.02	2300 / 90.55
d	115 / 4.53	140 / 5.51	168 / 6.61	168 / 6.61	220 / 8.66	245 / 9.65	325 / 12.80	356 / 14.02	500 / 19.69	600 / 23.62	700 / 27.56
e	50 / 1.97	58 / 2.28	65 / 2.56	65 / 2.56	95 / 3.74	105 / 4.13	135 / 5.31	155 / 6.10	200 / 7.87	250 / 9.84	300 / 11.81

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
≥ 0,65 mm	IIB3	C	

Table 3: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 4: Material selection for housing

Design	A	B	Special materials upon request.
Housing	Steel	Stainless Steel	
Gasket	PTFE	PTFE	

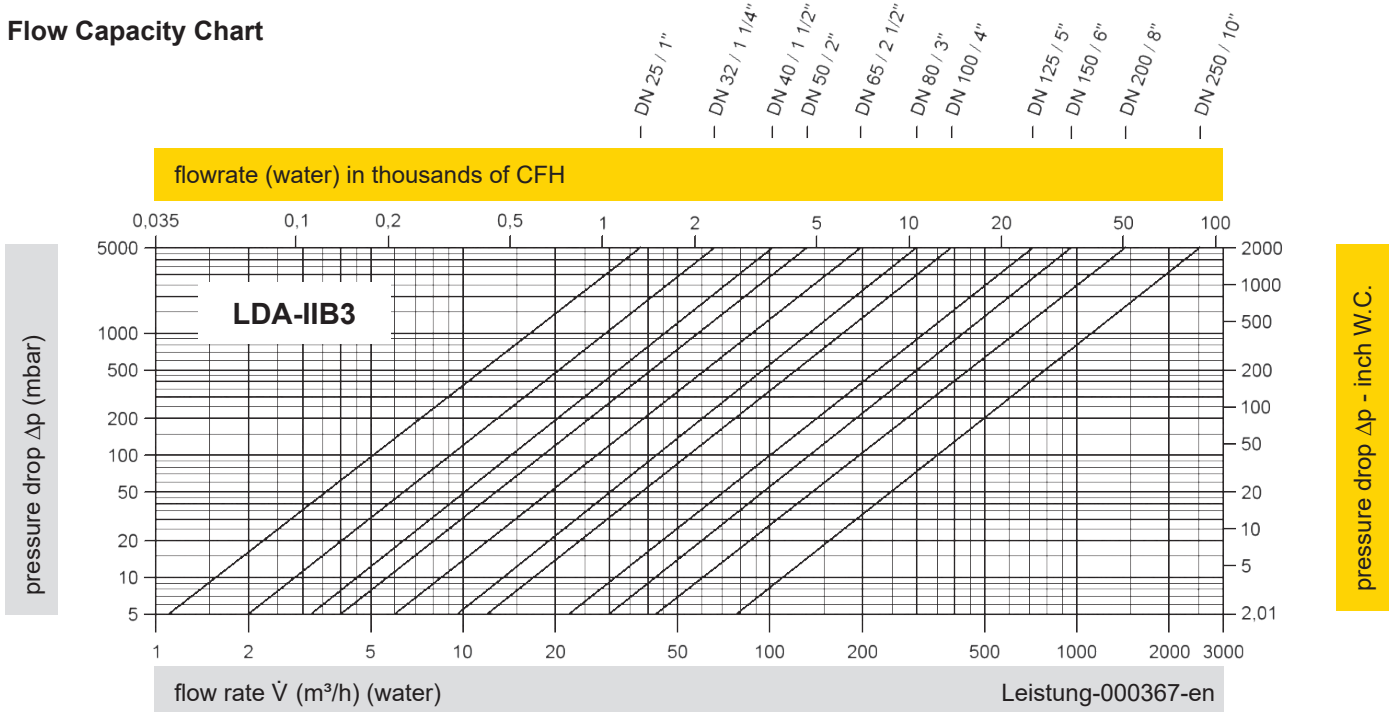
Table 5: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

Table 6: Outlet type

Straight pipe	I	Other types upon request.
Beveled pipe	II	
EN 1092-1; Form B1	III	
ASME B16.5 CL 150 R.F.	III	

Flow Capacity Chart

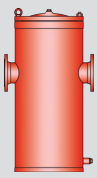


Conversion: $\dot{V}_{water} = \dot{V}_{liquid} * \sqrt{\frac{\rho_{liquid}}{\rho_{water}}}$ $\dot{V}_{liquid} = \dot{V}_{water} * \sqrt{\frac{\rho_{water}}{\rho_{liquid}}}$

The volume flow \dot{V} in m³/h was determined with water, in accordance with DIN EN 60534, at a temperature $T_n = 20^\circ\text{C}$ and an atmospheric pressure $p_n = 1,013 \text{ bar}$, kinematic viscosity $\nu = 10^{-6} \text{ m}^2/\text{s}$.

To avoid electrostatic charge of flammable liquids, the maximum flow is limited (refer to TRGS 727, CENELEC-Report CLC/TR 60079-32-1).





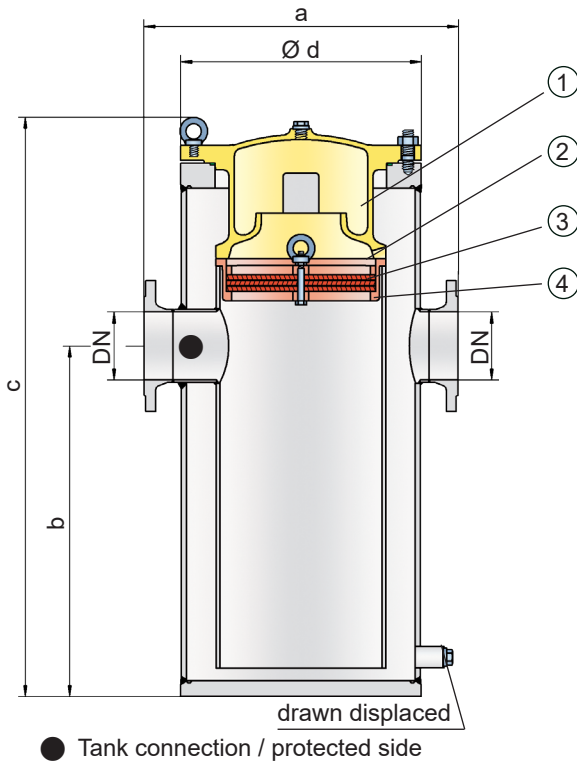
In-Line Liquid Detonation Flame Arrester

for filling and drain lines - external installation



[LDA-WF\(W\)](#)

PROTEGO® LDA-WF(W)



is ignited, the device prevents the combustion from traveling into the tank. The PROTEGO® LDA-WF(W) series of liquid detonation flame arresters combines the classic PROTEGO® flame arrester design with the siphon principle in which the liquid product serves as a barrier to flame propagation.

When a highly accelerated pipe deflagration or detonation occurs, the combustion pressure and flame propagation speed are substantially reduced, converted into a low-energy deflagration, and then stopped by the remaining immersion liquid and the PROTEGO® flame arrester.

The application range for the device is a product vapor/air mixture temperature of up to +60°C / 140°F and an absolute pressure up to 1.1 bar / 15.9 psi. **Devices with special approval for higher temperatures are available upon request.** This covers all possible operating conditions of empty lines for flammable liquids. The liquid detonation arrester is designed for pressures of up to 10 bar / 145 psi, resists explosion pressure, and provides protection for almost all flammable liquids. The device is approved for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm). **Special designs with a cleaning cover for highly viscous liquids can be provided.**

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards

Function and Description

The PROTEGO® LDA-WF(W) series of liquid detonation flame arresters was developed for storage container filling lines that are not continuously filled with product and sometimes contain a combustible mixture. The integrated siphon protection (1) with PROTEGO® flame arrester unit (2) additionally prevents the liquid, in which the lines are immersed, from being siphoned off while the container is being drained. The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® cage (4). The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use. The device is installed outside the container in the filling and drain lines. If the explosive atmosphere

Special Features and Advantages

- easily accessible due to external installation
- siphon protection offers increased safety
- low risk of contamination
- low pressure loss
- provides protection against deflagrations and stable detonations
- useable for nearly all flammable liquids
- meets TRGS* requirements

* TRGS = technical regulations for hazardous substances

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following pages.

DN	25 1"	32 1 1/4"	40 1 1/2"	50 2"	65 2 1/2"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"
a	250 / 9.84	250 / 9.84	346 / 13.62	350 / 13.78	446 / 17.56	450 / 17.72	500 / 19.69	600 / 23.62	600 / 23.62	700 / 27.56	900 / 35.43
b	325 / 12.80	325 / 12.80	415 / 16.34	415 / 16.34	535 / 21.06	535 / 21.06	600 / 23.62	915 / 36.02	915 / 36.02	1090 / 42.91	1300 / 51.18
c	475 / 18.70	475 / 18.70	605 / 23.82	605 / 23.82	831 / 32.72	831 / 32.72	936 / 36.58	1340 / 52.76	1340 / 52.76	1520 / 59.84	1750 / 68.90
d	150 / 5.91	150 / 5.91	210 / 8.27	210 / 8.27	275 / 10.83	275 / 10.83	325 / 12.80	460 / 18.11	460 / 18.11	510 / 20.08	610 / 24.02

Table 2: Selection of the explosion group

MESH	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
≥ 0,65 mm	IIB3	C	



Stabilized FLAMEFILTER®
Discs (Flyer pdf)

Table 3: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 4: Material selection for housing

Design	A	B	Special materials upon request.
Housing	Steel	Stainless Steel	
Shock absorber	Steel	Stainless Steel	
Gasket (shock absorber)	FPM	PTFE	
Gasket (locking screw)	PTFE	PTFE	
Flame arrester unit	A	A	

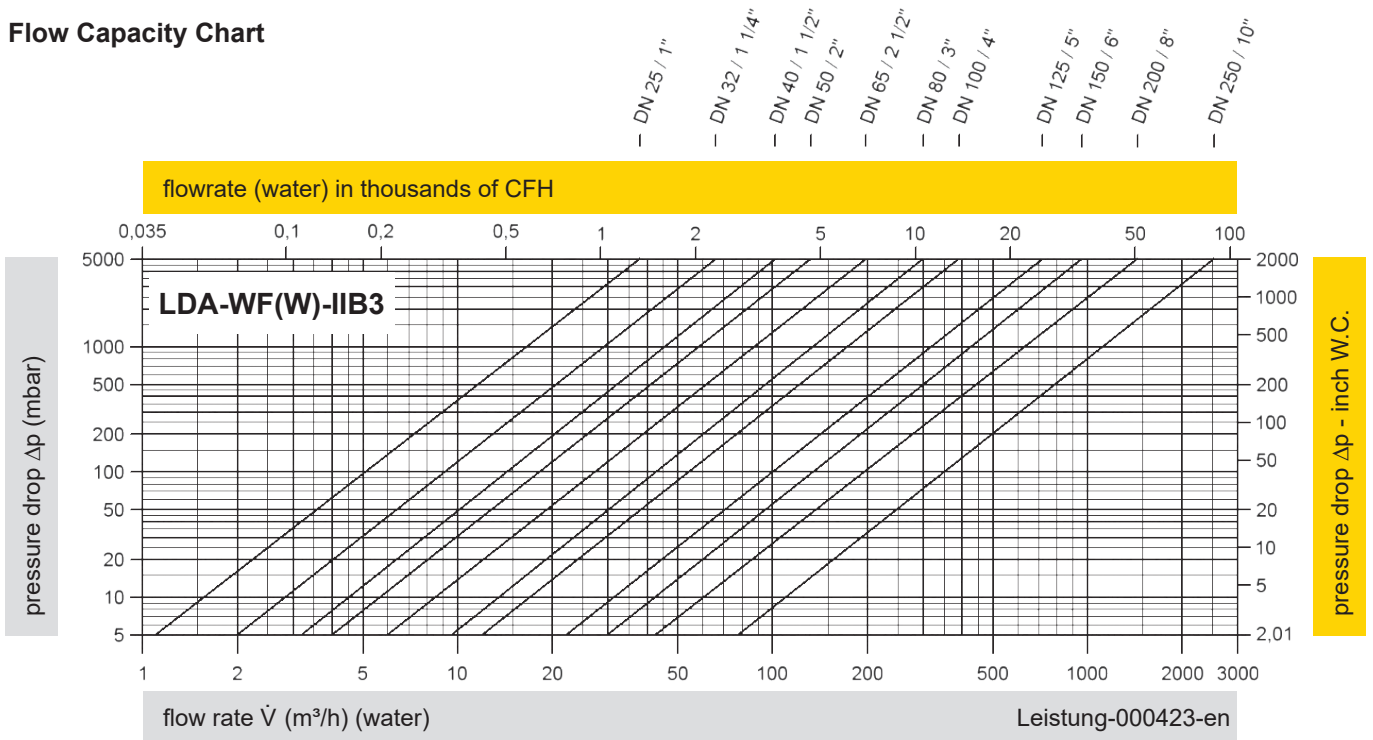
Table 5: Material for flame arrester unit

Design	A	* The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and cage materials are used. Special materials upon request.
FLAMEFILTER® cage	Stainless Steel	
FLAMEFILTER® *	Stainless Steel	
Spacer	Stainless Steel	

Table 6: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

Flow Capacity Chart

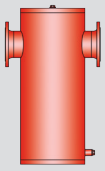


Conversion: $\dot{V}_{water} = \dot{V}_{liquid} * \sqrt{\frac{\rho_{liquid}}{\rho_{water}}}$ $\dot{V}_{liquid} = \dot{V}_{water} * \sqrt{\frac{\rho_{water}}{\rho_{liquid}}}$

The volume flow \dot{V} in m³/h was determined with water, in accordance with DIN EN 60534, at a temperature $T_n = 20^\circ\text{C}$ and an atmospheric pressure $p_n = 1,013 \text{ bar}$, kinematic viscosity $\nu = 10^{-6} \text{ m}^2/\text{s}$.

To avoid electrostatic charge of flammable liquids, the maximum flow is limited (refer to TRGS 727, CENELEC-Report CLC/TR 60079-32-1).





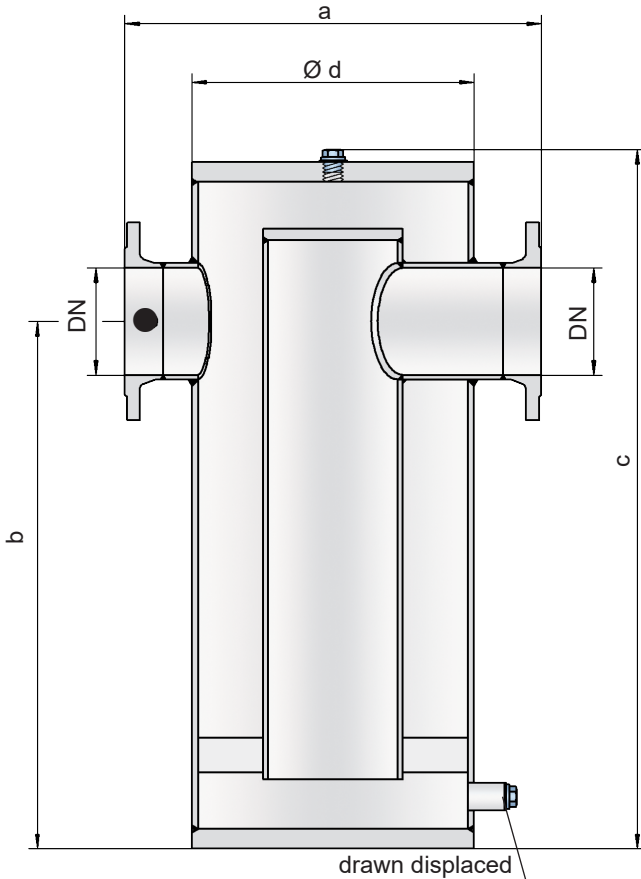
In-Line Liquid Detonation Flame Arrester

for filling lines - external installation

PROTEGO® LDA-W



LDA-W



● Tank connection / protected side

Function and Description

The PROTEGO® LDA-W liquid detonation flame arrester was developed for storage container filling lines that are not continuously filled with product and sometimes contain a combustible mixture. The device is installed outside the container in the filling line. If the explosive atmosphere is ignited, the device prevents the combustion from transferring into the tank. The PROTEGO® LDA-W series of liquid detonation flame arresters function according to the siphon principle in which the liquid product serves as a barrier against flame propagation.

When a highly accelerated pipe deflagration or detonation occurs, the combustion pressure and flame propagation speed are substantially reduced by the design and converted into a low-energy deflagration that is then stopped by the remaining immersion liquid.

The application range for the device is a product vapor / air mixture temperature of up to +60°C / 140°F and an absolute pressure of up to 1.1 bar / 15.9 psi. This covers all possible operating conditions of empty lines for flammable liquids. The liquid detonation arrester is designed for pressures of up to 10 bar / 145 psi, resists explosion pressure, and provides protection for almost all flammable liquids. The device is approved for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm). **Special designs with a cleaning cover for highly viscous and contaminated liquids are available.**

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- easily accessible due to external installation
- low risk of contamination
- low pressure loss
- provides protection against deflagrations and stable detonations
- useable for nearly all flammable liquids
- meets TRGS* requirements
- can also be used as a dirt catcher in a maintenance friendly design

* TRGS = technical regulations for hazardous substances

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following pages.

DN	25 1"	32 1 ¼"	40 1 ½"	50 2"	65 2 ½"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"	300 12"
a	250 / 9.84	275 / 10.83	350 / 13.78	350 / 13.78	450 / 17.72	450 / 17.72	500 / 19.69	600 / 23.62	600 / 23.62	700 / 27.56	850 / 33.46	1000 / 39.37
b	325 / 12.80	360 / 14.17	420 / 16.54	420 / 16.54	540 / 21.26	540 / 21.26	595 / 23.43	915 / 36.02	915 / 36.02	1100 / 43.31	1325 / 52.17	1480 / 58.27
c	445 / 17.52	480 / 18.90	565 / 22.24	565 / 22.24	720 / 28.35	720 / 28.35	800 / 31.50	1265 / 49.80	1265 / 49.80	1520 / 59.84	1830 / 72.05	2050 / 80.71
d	140 / 5.51	140 / 5.51	195 / 7.68	195 / 7.68	275 / 10.83	275 / 10.83	325 / 12.80	460 / 18.11	460 / 18.11	510 / 20.08	610 / 24.02	700 / 27.56

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
≥ 0,65 mm	IIB3	C	

Table 3: Specification of max. operating temperature

≤ 60°C / 140°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	Classification	

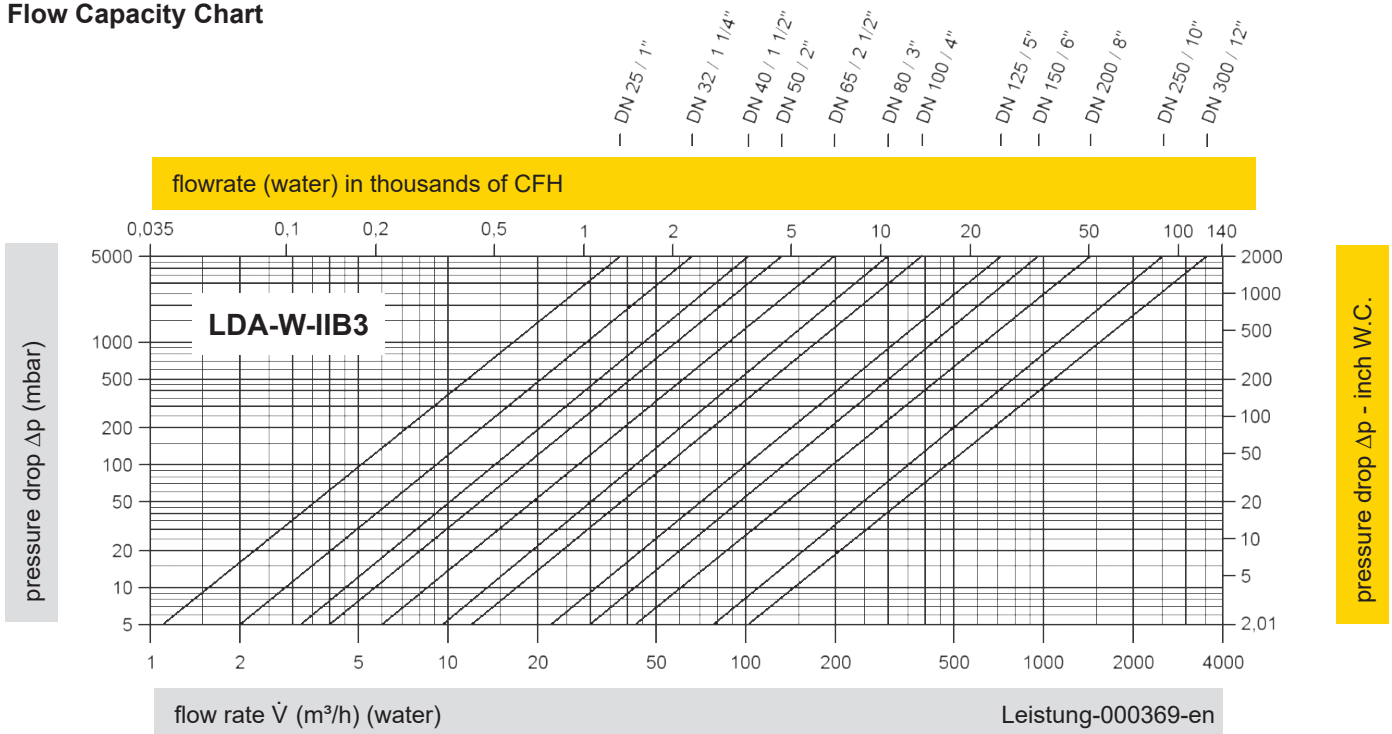
Table 4: Material selection for housing

Design	A	B	C	Special materials upon request.
Housing	Steel	Stainless Steel	Hastelloy	
Gasket	PTFE	PTFE	PTFE	

Table 5: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

Flow Capacity Chart

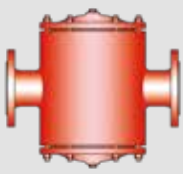


Conversion: $\dot{V}_{water} = \dot{V}_{liquid} * \sqrt{\frac{\rho_{liquid}}{\rho_{water}}}$ $\dot{V}_{liquid} = \dot{V}_{water} * \sqrt{\frac{\rho_{water}}{\rho_{liquid}}}$

The volume flow \dot{V} in m³/h was determined with water, in accordance with DIN EN 60534, at a temperature T_n = 20°C and an atmospheric pressure p_n = 1,013 bar, kinematic viscosity $\nu = 10^{-6}$ m²/s.

To avoid electrostatic charge of flammable liquids, the maximum flow is limited (refer to TRGS 727, CENELEC-Report CLC/TR 60079-32-1).





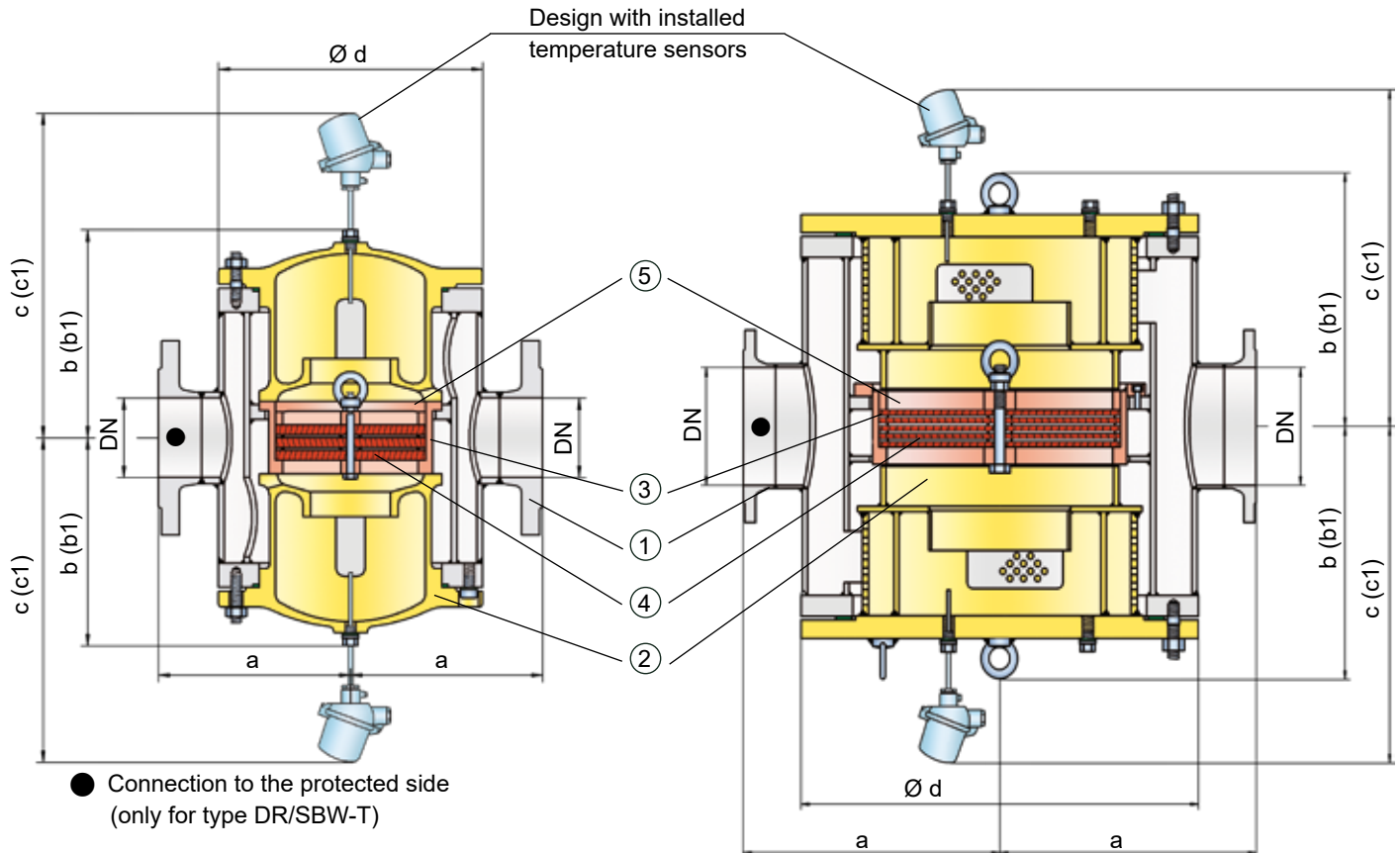
In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock absorber, bi-directional

PROTEGO® DR/SBW

DN 50/2" – DN 150/6"

DN 200/8" – DN 400/16"



Function and Description

In the development of the PROTEGO® DR/SBW in-line detonation flame arrester, special effort was made to ease future maintenance of the flame arresters. The PROTEGO® flame arrester unit (5) can be removed and cleaned within moments without having to disassemble the piping. The effective shock absorber of the device and elaborate housing geometry reduces the number of FLAMEFILTER® discs to a minimum.

The device is symmetrical and offers bidirectional flame arresting protecting from stable detonations and deflagrations. The flame arrester consists of a double-jacket housing (1) with two integrated shock absorbers (2) with the PROTEGO® flame arrester unit in the center. The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (4) and spacers firmly held in a FLAMEFILTER® cage (3). The number of FLAMEFILTER® discs and their gap size depends on the arrester's conditions of use. By indicating the operating parameters such as the temperature, pressure and explosion group and the composition of the fluid, the optimum in-line detonation flame arrester can be selected. The PROTEGO® DR/SBW series of flame arresters is available for explosion groups IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

The standard design is approved at an operating temperature up to +60°C / 140°F and an absolute operating pressure acc. to table 3. Devices with special approvals can be obtained for higher pressures and higher temperatures upon request.

Type-approved according to ATEX Directive as well as other international standards.

Special Features and Advantages

- particularly service-friendly design
- minimum number of FLAMEFILTER® discs due to use of effective shock absorber
- the modular design enables each individual FLAMEFILTER® discs to be exchanged
- bidirectional operation as well as any flow direction and installation position
- expanded application range for higher operating temperatures and pressures
- installation of temperature sensors possible
- minimum pressure loss and hence low operating and lifecycle cost
- cost efficient spare parts

Design Types and Specifications

There are four different designs available:

Basic in-line detonation flame arrester

DR/SBW- -

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short time burning from one side

DR/SBW- T -

In-line detonation flame arrester with two integrated temperature sensors* as additional protection against short time burning from both sides

DR/SBW- TB -

In-line detonation flame arrester with heating jacket

DR/SBW- H -

Additional special flame arresters upon request

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2).

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN) and nominal width (NG), please use the flow capacity charts on the following pages.

DN	50 / 2"	80 / 3"	100 / 4"	150 / 6"	200 / 8"	250 / 10"	300 / 12"	350 / 14"	400 / 16"
NG	150 / 6"	150 / 6"	200 / 8"	300 / 12"	500 / 20"	500 / 20"	600 / 24"	700 / 28"	800 / 32"
a	225/8.86	225/8.86	275/10.83	350/13.78	550/21.65	550/21.65	725/28.54	800/31.50	825/32.48
b	210/8.27	210/8.27	220/8.66	290/11.42	525/20.67	525/20.67	590/23.23	655/25.78	725/28.54
b1 *	325/12.80	325/12.80	360/14.17	475/18.70	835/32.87	835/32.87	960/37.80	1075/42.32	1215/47.83
c	395/15.55	395/15.55	410/16.14	475/18.70	630/24.80	630/24.80	700/27.56	765/30.12	835/32.87
c1 *	450/17.72	450/17.72	465/18.31	530/20.87	730/28.74	730/28.74	800/31.50	865/34.06	935/36.81
d	275/10.83	275/10.83	325/12.80	460/18.11	840/33.07	840/33.07	1000/39.37	1150/45.28	1250/49.21

* b1 dismantling dimension for servicing

c1 dismantling dimension for servicing (temperature sensor)

Table 2: Selection of the explosion group

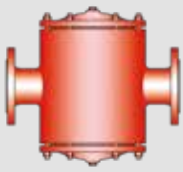
MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

Expl. Gr.	DN	50 / 2"	80 / 3"	100 / 4"	150 / 6"	200 / 8"	250 / 10"	300 / 12"	350 / 14"	400 / 16"
		NG	150 / 6"	150 / 6"	200 / 8"	300 / 12"	500 / 20"	500 / 20"	600 / 24"	700 / 28"
IIA	P _{max}	4 / 58	4 / 58	3 / 43.5	3 / 43.5	1.6 / 23.2	1.6 / 23.2	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9
IIB3	P _{max}	1.7 / 24.6	1.7 / 24.6	1.7 / 24.6	1.7 / 24.6	1.2 / 17.4	1.2 / 17.4	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9

P_{max} = maximum allowable operating pressure in bar / psi (absolute), higher operating pressure upon request.





In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock absorber, bi-directional

PROTEGO® DR/SBW

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	A	B	C
Housing	Steel	Stainless Steel	Hastelloy
Heating jacket (DR/SBW-H-(T)-...)	Steel	Stainless Steel	Stainless Steel
Cover with shock absorber	Steel	Stainless Steel	Hastelloy
Gasket	PTFE	PTFE	PTFE
Flame arrester unit	A	C, D	E

Special materials upon request.

Special device with unidirectional shock absorber DR/SW-... from DN 50 resp. NG 150 available.

Table 6: Material combinations of the flame arrester unit

Design	A	C	D	E
FLAMEFILTER® cage	Steel	Stainless Steel	Stainless Steel	Hastelloy
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy

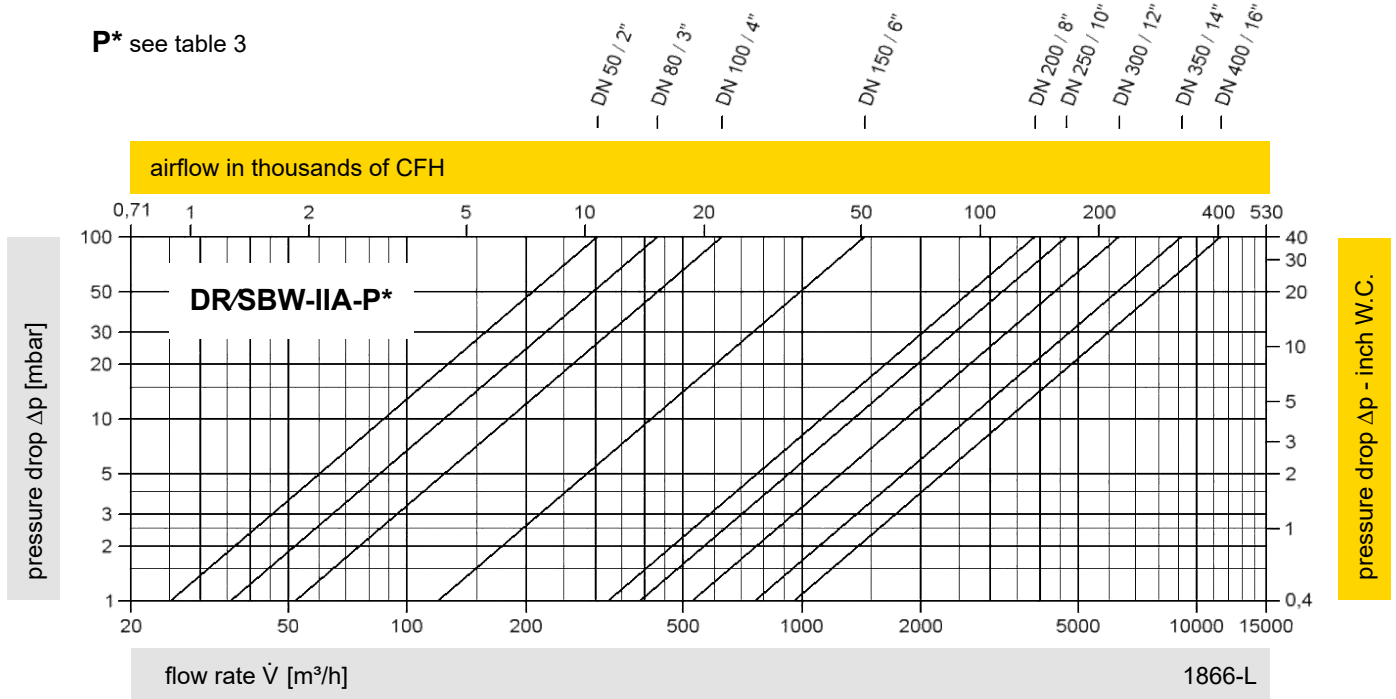
*The FLAMEFILTER® are also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.

Special materials upon request.

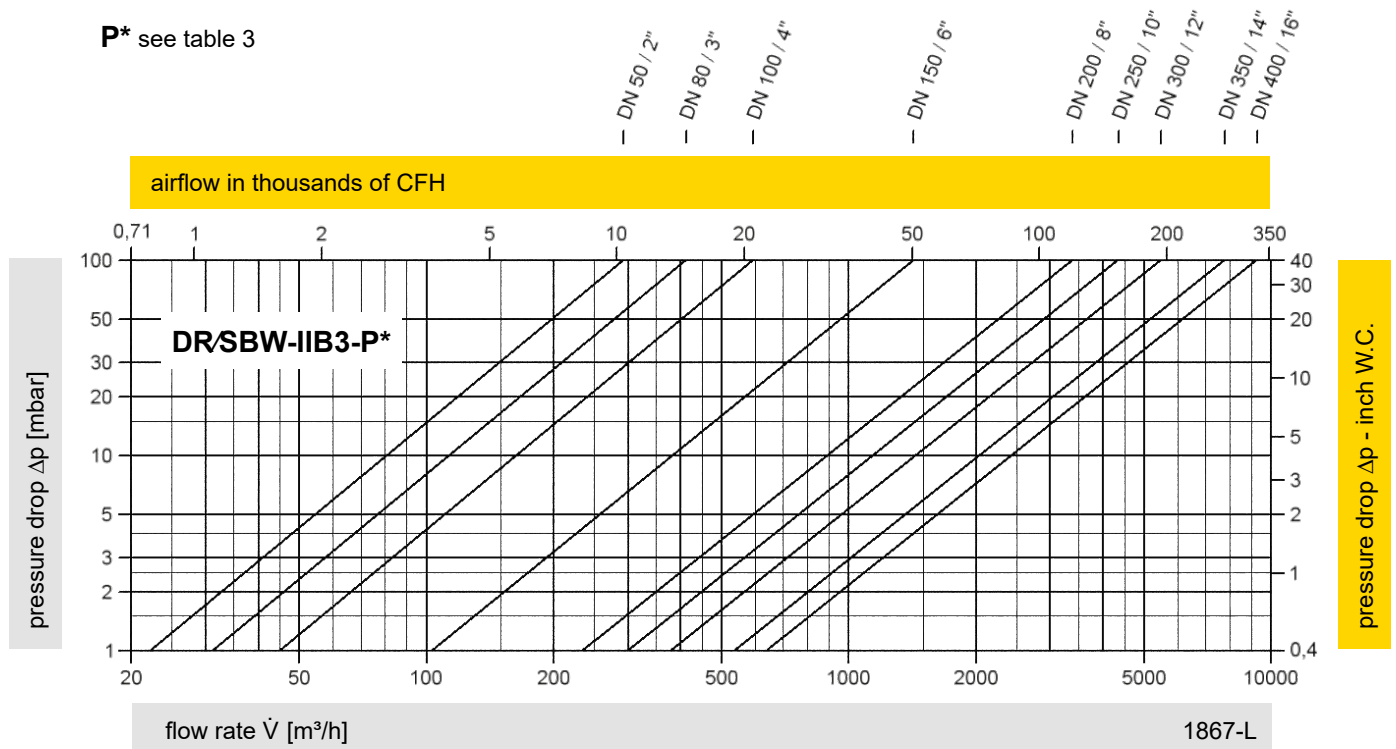
Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

P* see table 3

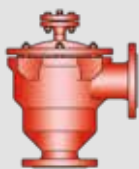


P* see table 3



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

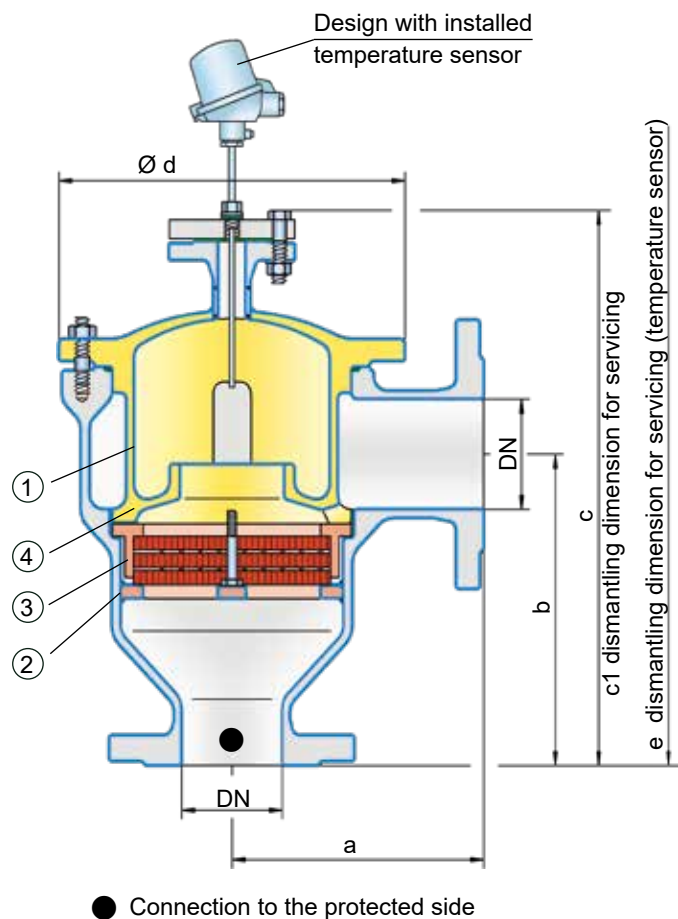




In-Line Detonation Flame Arrester

for stable detonations and deflagrations in right angle design with shock absorber, uni-directional

PROTEGO® DR/ES-PTFE



● Connection to the protected side

Function and Description

The PROTEGO® DR/ES-PTFE series in-line detonation flame arrester is distinguished by its unique resistance to adhesive and corrosive media. The use of fluoroplastics as a high-tech housing coating and as safety flame arrester element is unique throughout the world. The device represents a further development of PROTEGO® flame arresters DR/ES in a right angle design that have been used and proven for decades in industry. The device protects against deflagrations and stable detonations.

Once a detonation enters the flame arrester, energy is absorbed from the detonation shock wave by the integrated shock absorber (1) before the flame is extinguished in the narrow channel of the PTFE FLAMEFILTER® (3).

The PROTEGO® flame arrester unit (2) consists of several FLAMEFILTER® discs and spacers firmly held in the FLAMEFILTER® cage (4). The gap size and number of FLAMEFILTER® discs are determined by the operating data parameters of the mixture flowing in the line (pressure, temperature). The detonation arrester can be used for explosion group IIA (NEC group D). The standard design is approved at an operating temperature up to +60°C / 140°F and an absolute operating pressure acc. to table 3.

Type-approved according to ATEX Directive and EN 12874 as well as other international standards.

Special Features and Advantages

- build up of adhesive materials is prevented by the smooth surfaces
- minimum number of FLAMEFILTER® discs due to the effective shock absorber
- quick removal and installation of the complete PROTEGO® flame arrester unit and the individual FLAMEFILTER® discs in the cage
- the modular design enables each individual FLAMEFILTER® discs to be replaced
- offers protection against deflagrations and stable detonations
- the right angle design saves pipe elbows
- ideal for corrosive media
- less soiling of the device lowers service, operating and life-cycle cost

Design Types and Specifications

There are two different designs available:

Basic in-line detonation flame arrester **DR/ES - PTFE**

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short time burning **DR/ES - PTFE - T**

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2).

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity charts on the following pages

DN	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"
a	153 / 6.02	155 / 6.10	198 / 7.80	200 / 7.87	250 / 9.84	332 / 13.07	335 / 13.19
b	183 / 7.20	185 / 7.28	223 / 8.78	225 / 8.86	290 / 11.42	357 / 14.06	360 / 14.17
c	335 / 13.19	335 / 13.19	420 / 16.53	420 / 16.53	490 / 19.29	590 / 23.23	590 / 23.23
c1	455 / 17.91	455 / 17.91	585 / 23.03	585 / 23.03	680 / 26.77	835 / 32.87	835 / 32.87
d	210 / 8.27	210 / 8.27	275 / 10.83	275 / 10.83	325 / 12.80	460 / 18.11	460 / 18.11
e	685 / 26.97	685 / 26.97	770 / 30.31	770 / 30.31	840 / 33.07	940 / 37.01	940 / 37.01

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	

Table 3: Selection of max. operating pressure

$\frac{P_{op}}{P_{max}}$ $\frac{L}{L_0}$	DN	40 / 1 1/2"	50 / 2"	65 / 2 1/2"	80 / 3"	100 / 4"	125 / 5"	150 / 6"
	IIA P _{max}	1.1 / 15.9	1.1 / 15.9	1.2 / 17.4	1.2 / 17.4	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9

P_{max} = maximum allowable operating pressure in bar / psi (absolute), higher operating pressure upon request.

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	A	Special materials upon request.
Housing	Steel with an ECTFE coating	
Cover with shock absorber	Steel with an ECTFE coating	
Gasket	PTFE	
Flame arrester unit	A, B, C	

Table 6: Material combinations of the flame arrester unit

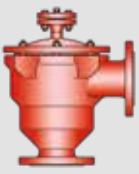
Design	A	B	C
FLAMEFILTER® cage	PTFE *	Hastelloy	Stainless Steel
FLAMEFILTER® *	PTFE *	PTFE *	PTFE *
Spacer	PEEK / ETFE / FEP	PEEK / ETFE / FEP	PEEK / ETFE / FEP

* electrically conductive

Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



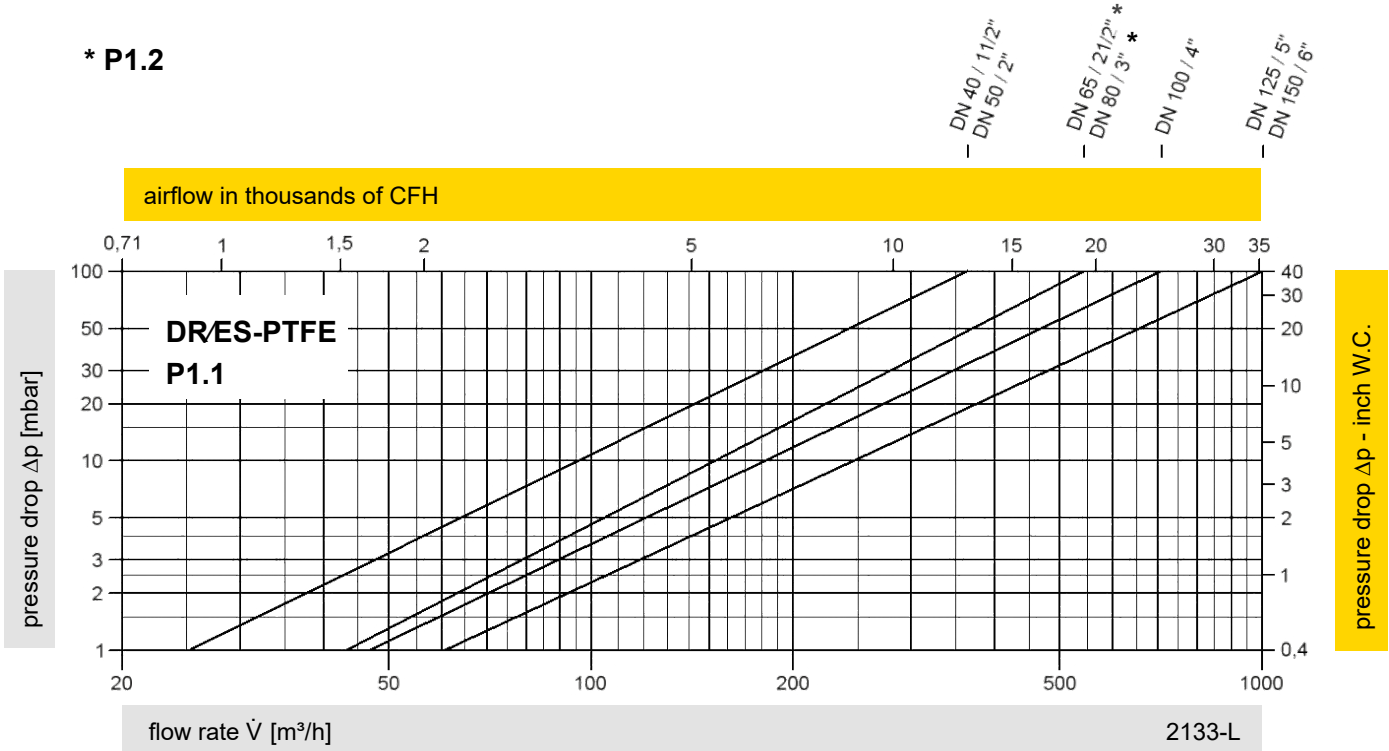


In-Line Detonation Flame Arrester

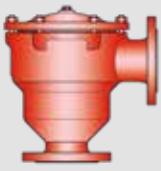
Flow Capacity Chart

PROTEGO® DR/ES-PTFE

* P1.2



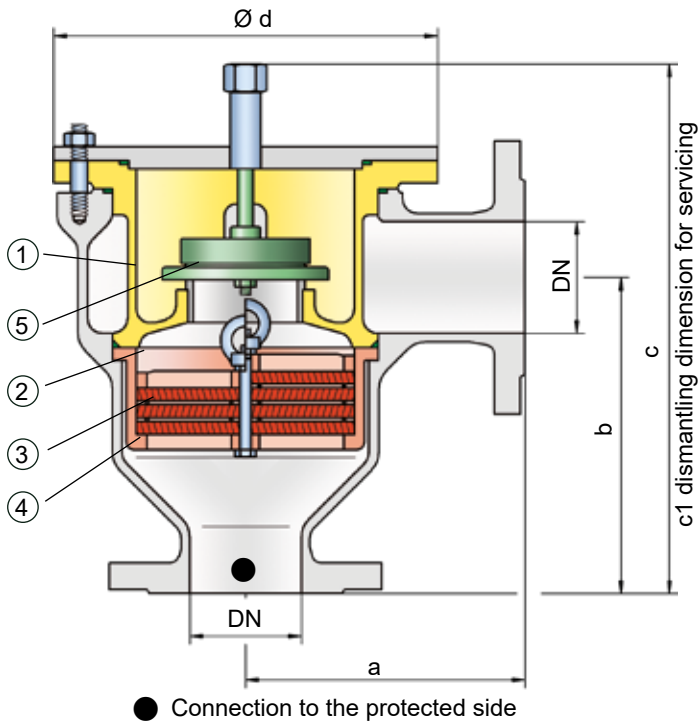
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."



In-Line Detonation Flame Arrester

with integrated pressure relief valve for stable detonations and deflagrations in right-angle design with shock absorber, uni-directional

PROTEGO® DR/ES-V



● Connection to the protected side

absorber, before the flame is extinguished in the narrow gaps of the FLAMEFILTER® (3). The flame suppression is guaranteed, regardless of the valve pallet position.

The PROTEGO® flame arrester unit (2) consists of several FLAMEFILTER® discs and spacers firmly held in the FLAMEFILTER® casing (4). The gap size and number of FLAMEFILTER® discs depend on the operating conditions of the flowing mixture (explosion group, pressure, temperature). This device is available for explosion groups from IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

The standard design is approved for an operating temperature of up to +60°C / 140°F and absolute operating pressure up to 1.2 bar / 17.4 psi. **Devices with special approval for higher pressures and temperatures are available upon request.** Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- integration of in-line detonation flame arrester and pressure relief valve in one device
- excellent tightness of the valve
- can be used as a detonation-proof valve in suction lines of storage tanks
- optimal use as an overflow valve in venting and gas supply lines
- low number of FLAMEFILTER® discs due to shock absorber technology
- quick removal and installation of the complete PROTEGO® flame arrester unit and the individual FLAMEFILTER® in the casing
- provides protection against deflagration and stable detonation
- advanced design for higher operating temperatures and pressures
- cost-effective spare parts

Design Types and Specifications

There are two different designs available:

Basic version of the detonation arrester with check valve **DR/ES-V-**

Detonation arrester with check valve and **DR/ES-V-H**

Set pressure: from +2.0 mbar up to +35 mbar
from +0.8 inch W.C. up to +14 inch W.C.

Higher or lower settings upon request.

Function and Description

PROTEGO® DR/ES-V series uniquely combines the function of an in-line detonation flame arrester with the function of a pressure relief valve in one device. The device protects against deflagration and stable detonation. The weight-loaded pallet type valve (5) integrated in the shock absorber (1) of the in-line detonation flame arrester is designed as a pressure relief valve. The set pressure of the valve is adjusted in the factory and can range from 2 to 35 mbar (0.8 to 14 inch W.C.). After the pressure increases 40% from its set pressure, the valve completely opens to yield the maximum volumetric flow. If installed in vent headers connected to storage tanks, the valve pallet works as a check valve. This means that the product cannot flow back from the suction line into the tank. Although several functions are integrated in a single housing, the device is extremely easy to service, which is primarily due to the right-angle design.

Once a detonation enters the flame arrester, energy is absorbed from the detonation shock wave by the integrated shock

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity charts on the following pages.

DN	25 / 1 / 32 / 1 1/4"	40 / 1 1/2"	50 / 2"	65 / 2 1/2"	80 / 3"	100 / 4"	125 / 5"	150 / 6"	200 / 8"
a	125 / 4.92	153 / 6.02	155 / 6.10	198 / 7.80	200 / 7.87	250 / 9.84	332 / 13.07	335 / 13.19	425 / 16.73
b	140 / 5.51	183 / 7.20	185 / 7.28	223 / 8.78	225 / 8.86	290 / 11.42	357 / 14.06	360 / 14.17	505 / 19.88
c	237 / 9.33	305 / 12.01	305 / 12.01	395 / 15.55	395 / 15.55	460 / 18.11	575 / 22.64	575 / 22.64	863 / 33.98
c1	345 / 13.58	410 / 16.14	410 / 16.14	530 / 20.87	530 / 20.87	615 / 24.21	790 / 31.10	790 / 31.10	1295 / 50.98
d	149 / 5.87	210 / 8.27	210 / 8.27	275 / 10.83	275 / 10.83	325 / 12.80	460 / 18.11	460 / 18.11	620 / 24.41



Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

Expl. Gr.	DN	25 / 1	32 / 1 ¼"	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"	200 / 8"
IIA	P _{max}	4.0/58.0	4.0/58.0	4.0/58.0	4.0/58.0	2.9/42.1	2.9/42.1	2.0/29.0	2.0/29.0	2.0/29.0	1.2/17.4
IIB3	P _{max}	3.0/43.5	3.0/43.5	2.0/29.0	2.0/29.0	2.0/29.0	2.0/29.0	1.5/21.7	1.4/20.3	1.4/20.3	1.1/15.9

P_{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	T _{maximum} allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	B	C	D	The housing and the cover with shock absorber can also be delivered in steel with an ECTFE coating.
Design	Steel	Stainless Steel	Hastelloy	
Heating jacket (DR/ES-V-H-...)	Steel	Stainless Steel	Stainless Steel	
Cover with shock absorber	Steel	Stainless Steel	Hastelloy	
Gaskets	PTFE	PTFE	PTFE	
Valve seat	Stainless Steel	Stainless Steel	Stainless Steel	
Flame arrester unit	A	C, D	E	

Special materials upon request.

Table 6: Material combinations of the flame arrester unit

Design	A	C	D	E	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® casing	Steel	Stainless Steel	Stainless Steel	Hastelloy	
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

Special materials upon request.

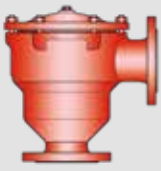
Table 7: Material selection for valve pallet

Design	A	B	C
Pressure range	I	II	III
Set pressure (mbar) [inch W.C.]	+2.0 up to +3.5 +0.8 up to +1.4	>+3.5 up to +14 >+1.4 up to +5.6	>+14 up to 35 >+5.6 up to 14
Valve pallet	Aluminum	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal

Table 8: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

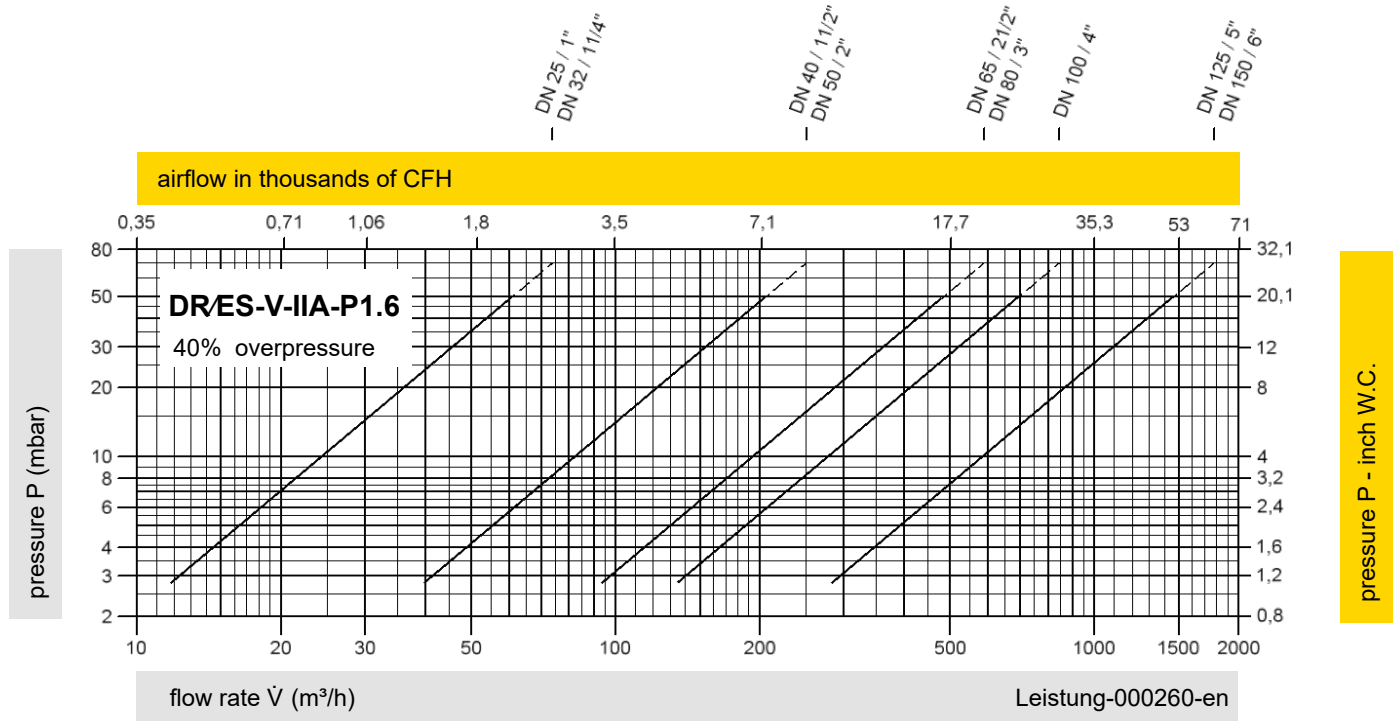
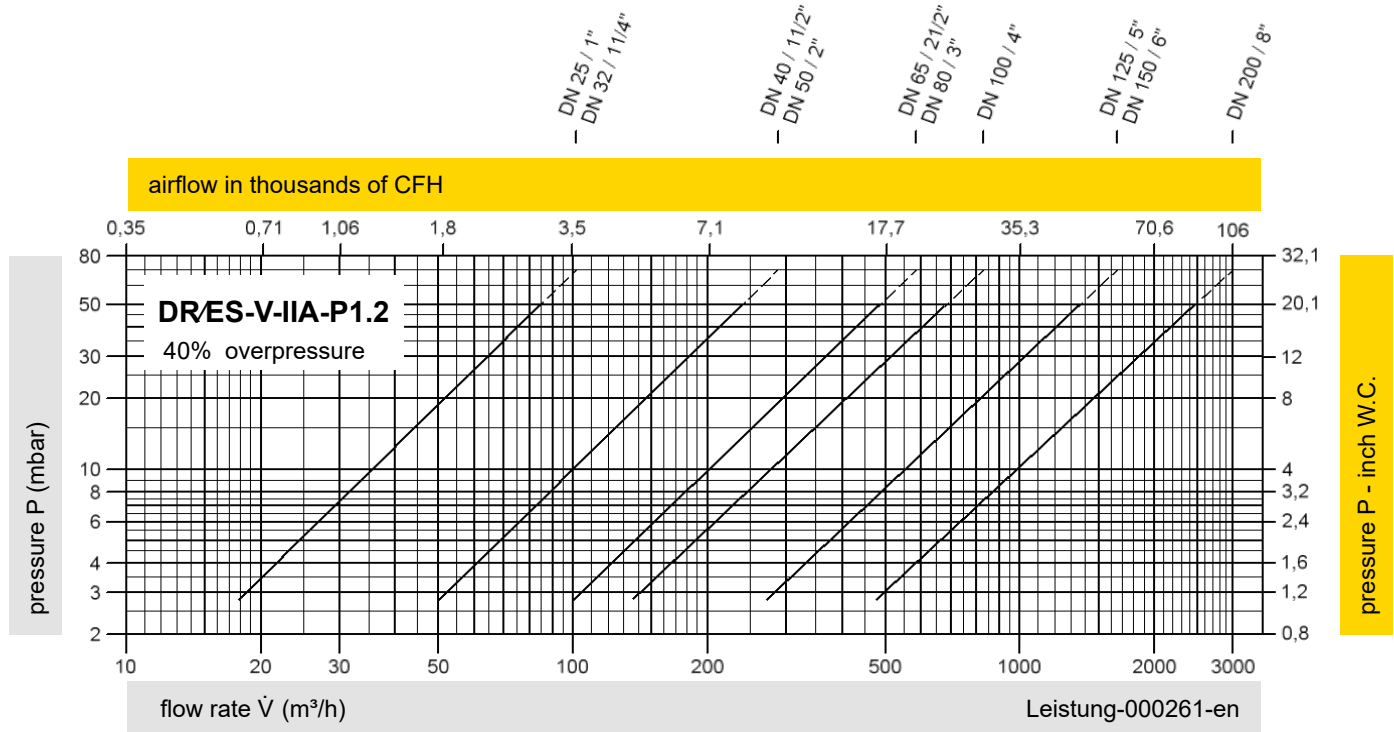




In-Line Detonation Flame Arrester

Flow Capacity Charts

PROTEGO® DR/ES-V



Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1,4}$$

Set pressure = the valve starts to open

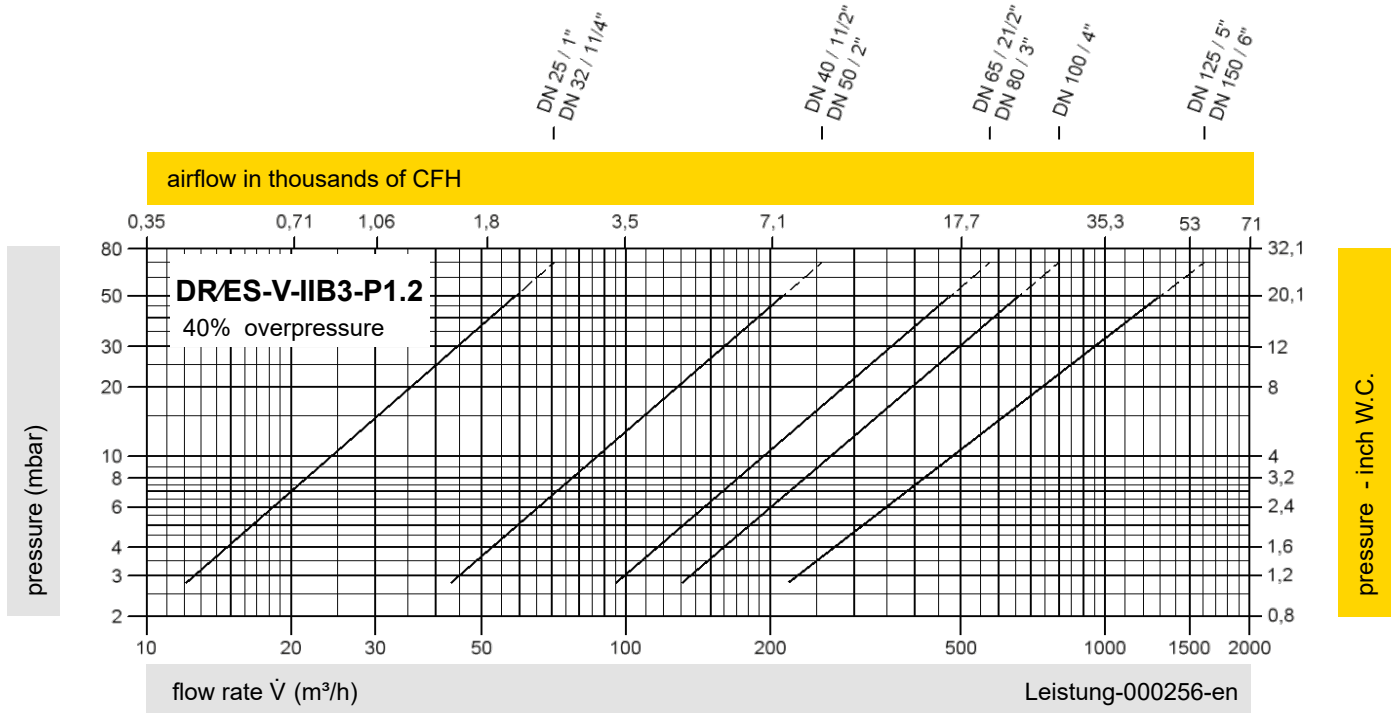
Opening pressure = set pressure plus overpressure

Overpressure = pressure increase over the set pressure

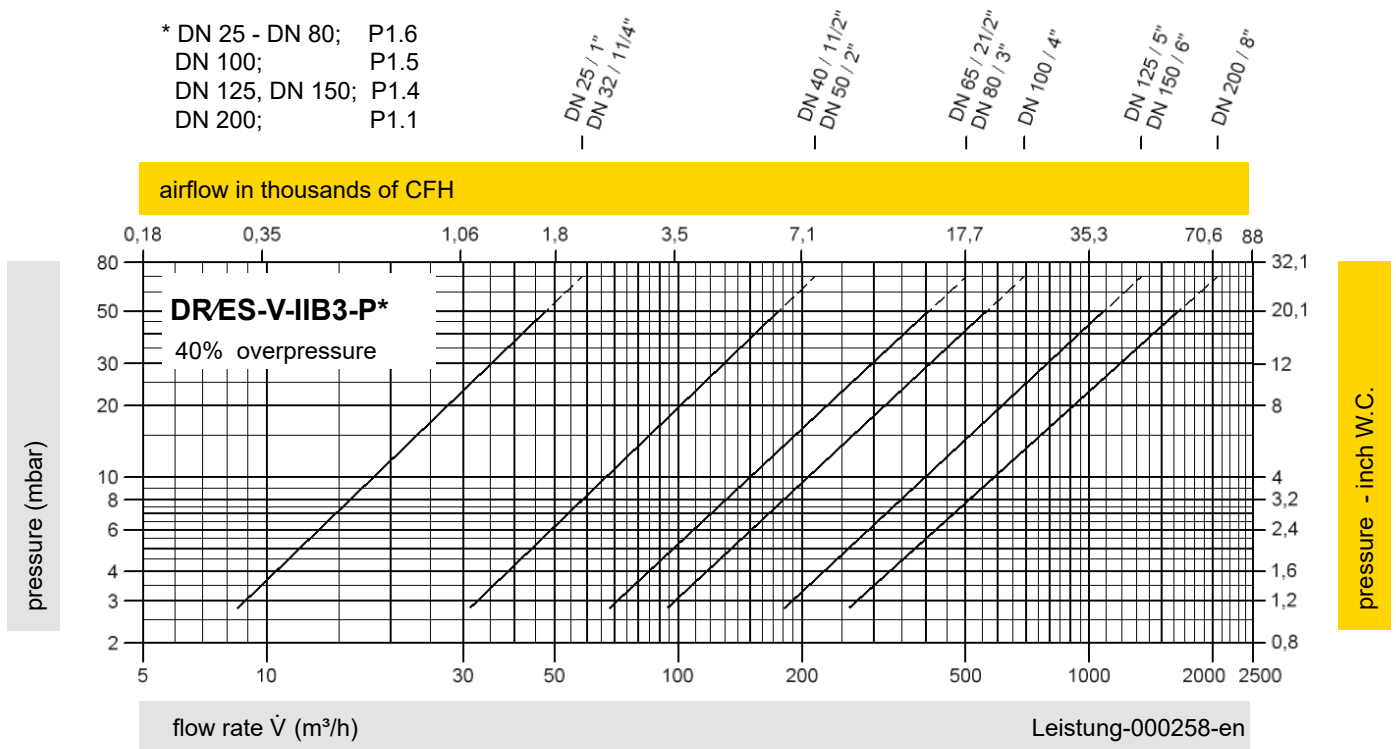
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

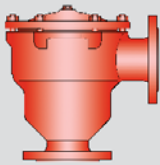
Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar).

For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."



* DN 25 - DN 80; P1.6
 DN 100; P1.5
 DN 125, DN 150; P1.4
 DN 200; P1.1

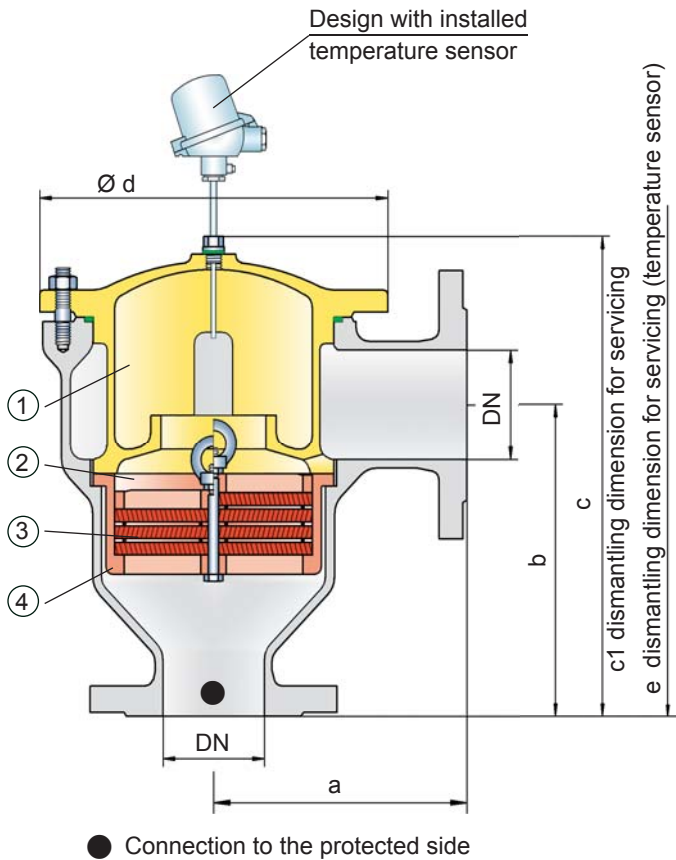




In-Line Detonation Flame Arrester

for stable detonations and deflagrations in right angle design with shock absorber, unidirectional

PROTEGO® DR/ES



The standard design is approved at an operating temperature up to +60°C / 140°F and an absolute operating pressure up to 1.2 bar / 17.4 psi. Devices with special approvals can be obtained for higher pressures and higher temperatures upon request.

Type-approved in accordance with the current ATEX Directive and EN ISO 16852 as well as other international standards.

Special Features and Advantages

- minimum number of FLAMEFILTER® discs due to the effective shock absorber
- quick removal and installation of the complete PROTEGO® flame arrester unit and FLAMEFILTER® discs in the cage
- due to modular design the FLAMEFILTER® discs can be individually replaced
- the right angle design saves pipe elbows
- extended application range for higher operating temperatures and pressures
- minimum pressure loss and hence low operating and life-cycle cost
- cost efficient spare parts

Design Types and Specifications

There are four different designs available:

- | | |
|---|---|
| Basic in-line detonation flame arrester | DR/ES- <input type="checkbox"/> - <input type="checkbox"/> |
| In-line detonation flame arrester with integrated temperature sensor* as additional protection against short time burning | DR/ES- <input type="checkbox"/> - <input type="checkbox"/> |
| In-line detonation flame arrester with heating jacket | DR/ES- <input type="checkbox"/> - <input type="checkbox"/> |
| In-line detonation flame arrester with integrated temperature sensor* against short time burning and heating jacket | DR/ES- <input type="checkbox"/> - <input type="checkbox"/> |

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)

Function and Description

The PROTEGO® DR/ES in-line detonation flame arrester has been used for decades in industrial plant construction because its right angle design offers advantages towards maintenance and costs in comparison to most straight designs.

Once a detonation enters the device, energy is absorbed from the detonation shock wave by the integrated shock absorber (1) before the flame is extinguished in the narrow gaps of the FLAMEFILTER® (3).

The PROTEGO® flame arrester unit (2) consists of several FLAMEFILTER® discs and spacers firmly held in the FLAMEFILTER® cage (4). The gap size and number of FLAMEFILTER® discs are determined by the operating data of the mixture flowing in the line (explosion group, pressure, temperature). This device is approved for explosion groups from IIA to IIB3 (NEC group D to C MESH ≥ 0.65 mm).

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity charts on the following pages

DN	25 / 1"	32 / 1 ¼"	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"	200 / 8"
a	125/4.92	125/4.92	153/6.02	155/6.10	198/7.80	200/7.87	250/9.84	332/13.07	335/13.19	425/16.73
b	140/5.51	140/5.51	183/7.20	185/7.28	223/8.78	225/8.86	290/11.42	357/14.06	360/14.07	505/19.88
c	210/8.27	210/8.27	290/11.42	290/11.42	365/14.37	365/14.37	440/17.32	535/21.06	535/21.06	810/31.89
c1	285/11.22	285/11.22	395/15.55	395/15.55	500/19.69	500/19.69	595/23.43	750/29.53	750/29.53	1230/48.43
d	150/5.91	150/5.91	210/8.27	210/8.27	275/10.83	275/10.83	325/12.80	460/18.11	460/18.11	620/24.41
e	495/19.49	495/19.49	600/23.62	600/23.62	705/27.76	705/27.76	795/31.30	950/37.40	950/37.40	1435/56.50

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	
> 0,90 mm	IIA	D	Special approvals upon request
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

DN		25 / 1"	32 / 1 ¼"	40 / 1 ½"	50 / 2"	65 / 2 ½"	80 / 3"	100 / 4"	125 / 5"	150 / 6"	200 / 8"
Expl. Gr.	IIA P _{max}	4.0/58.0	4.0/58.0	4.0/58.0	4.0/58.0	2.9/42.1	2.9/42.1	2.0/29.0	2.0/29.0	2.0/29.0	1.2/17.4
	IIB3 P _{max}	3.0/43.5	3.0/43.5	2.0/29.0	2.0/29.0	2.0/29.0	2.0/29.0	1.5/21.7	1.4/20.3	1.4/20.3	1.1/15.9

 P_{max} = maximum allowable operating pressure in bar / psi (absolute), higher operating pressure upon request

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	
-	Designation	higher operating temperatures upon request

Table 5: Material selection for housing

Design	B	C	D	
Housing	Steel	Stainless Steel	Hastelloy	* for devices exposed to elevated temperatures above 150°C / 302°F, gaskets made of PTFE. The housing and cover with the shock absorber can also be delivered in steel with an ECTFE coating.
Heating jacket (DR/ES-H-(T)-...)	Steel	Stainless Steel	Stainless Steel	
Cover with shock absorber	Steel	Stainless Steel	Hastelloy	
O-Ring	FPM*	PTFE	PTFE	
Flame arrester unit	A	C, D	E	Special materials upon request

Table 6: Material combinations of the flame arrester unit

Design	A	C	D	E	
FLAMEFILTER® cage	Steel	Stainless Steel	Stainless Steel	Hastelloy	* the FLAMEFILTER® are also available in the materials Tantalum, Inconel, Copper, etc. when the listed housing and cage materials are used.
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

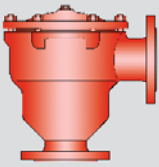
Special materials upon request

Table 7: Flange connection type

EN 1092-1; Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	



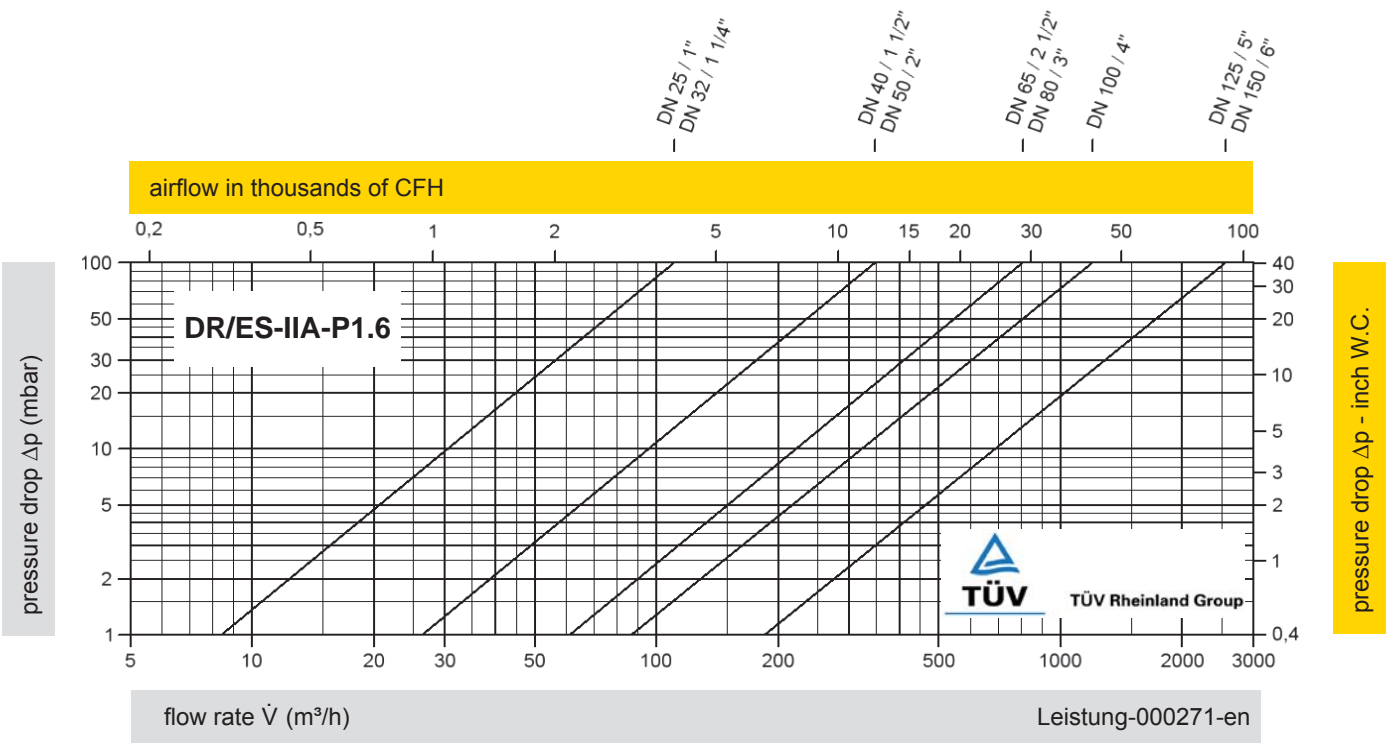
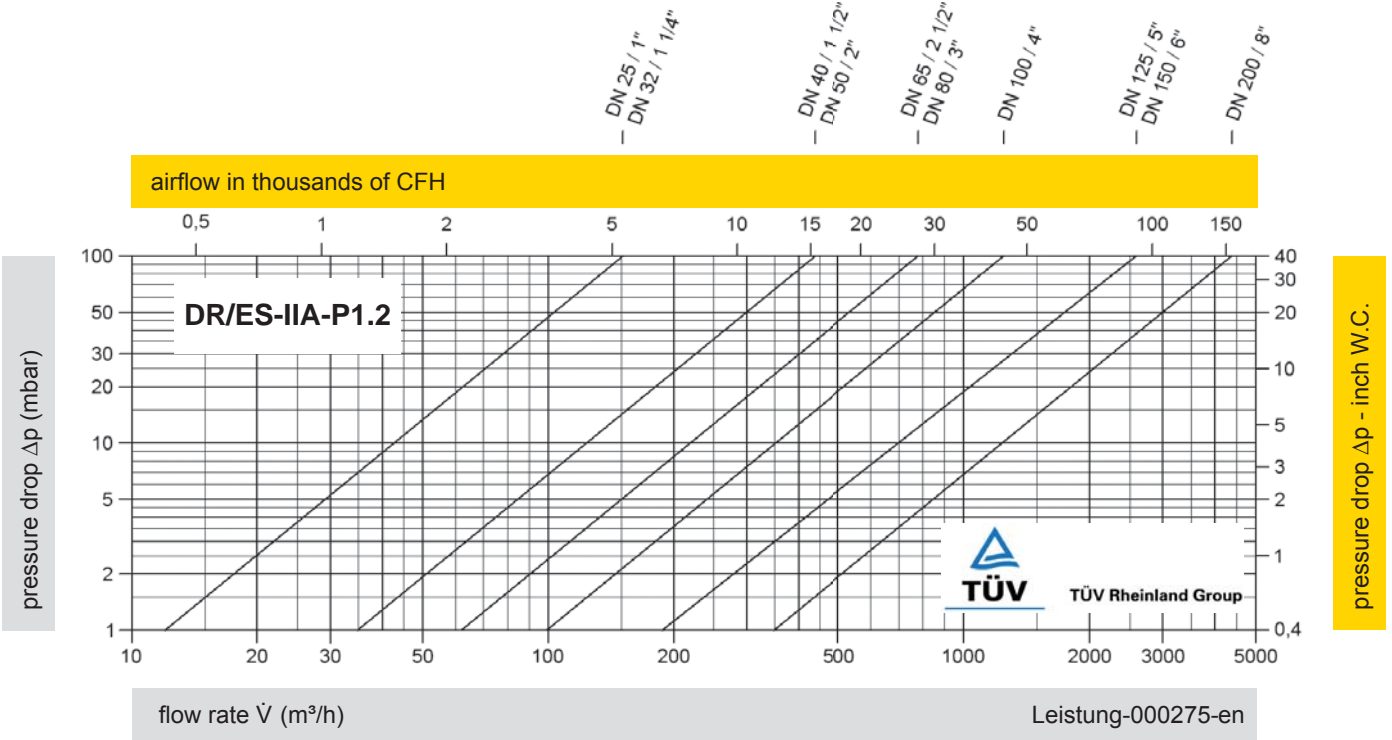
for safety and environment



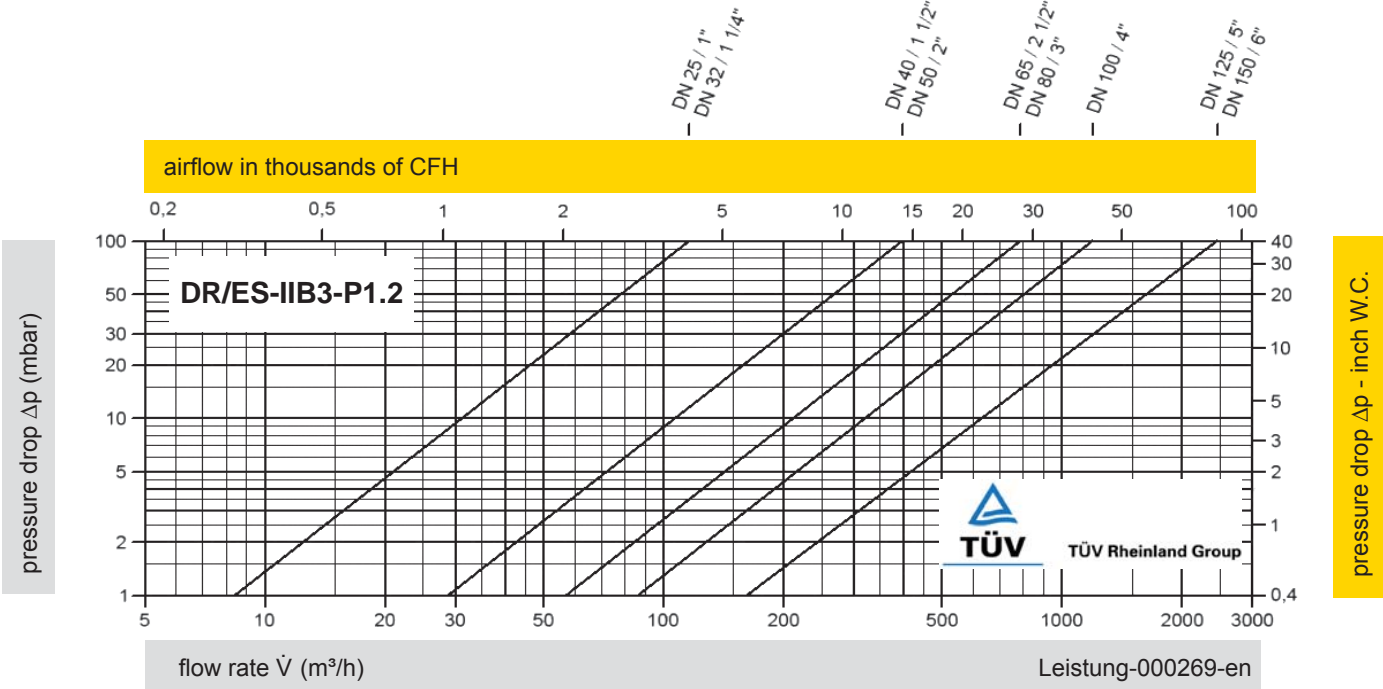
In-Line Detonation Flame Arrester

Flow Capacity Charts

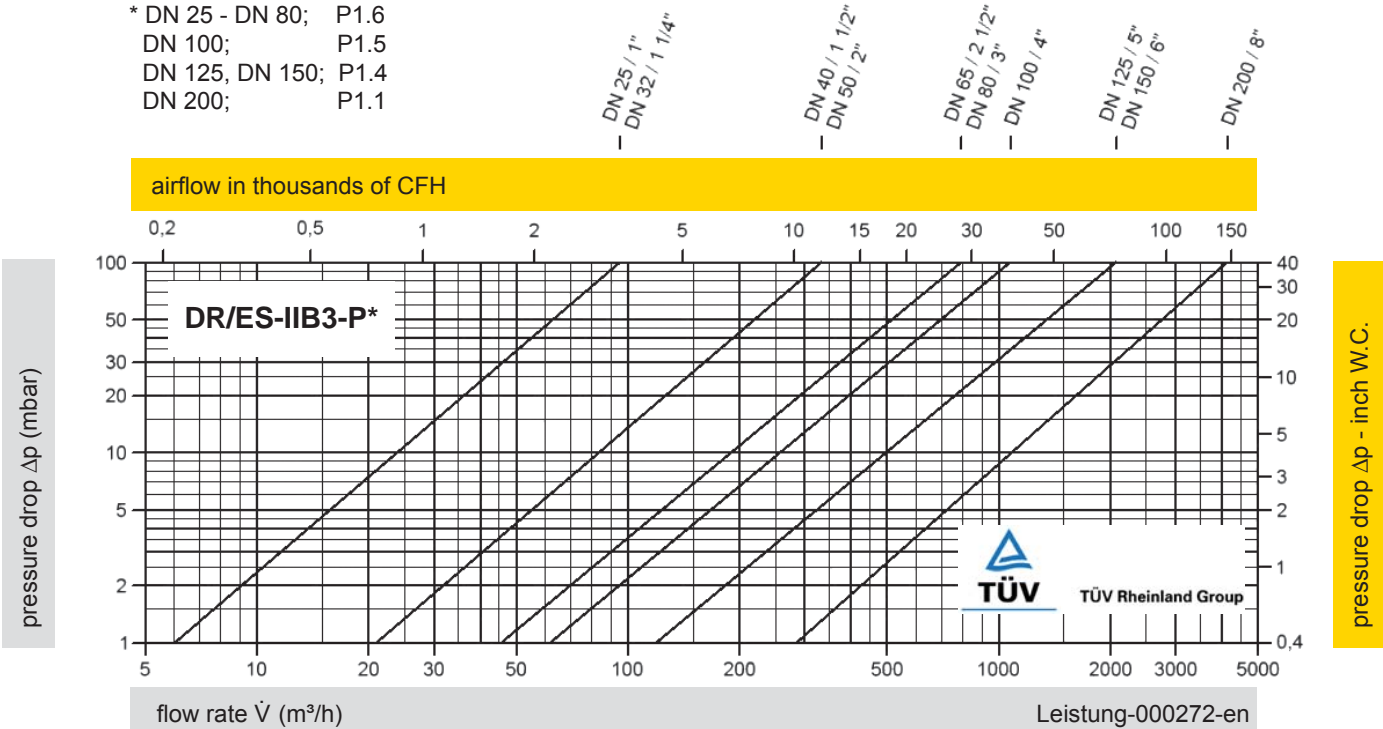
PROTEGO® DR/ES

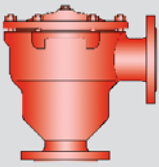


The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Vol. 1: "Technical Fundamentals".



* DN 25 - DN 80; P1.6
 DN 100; P1.5
 DN 125, DN 150; P1.4
 DN 200; P1.1

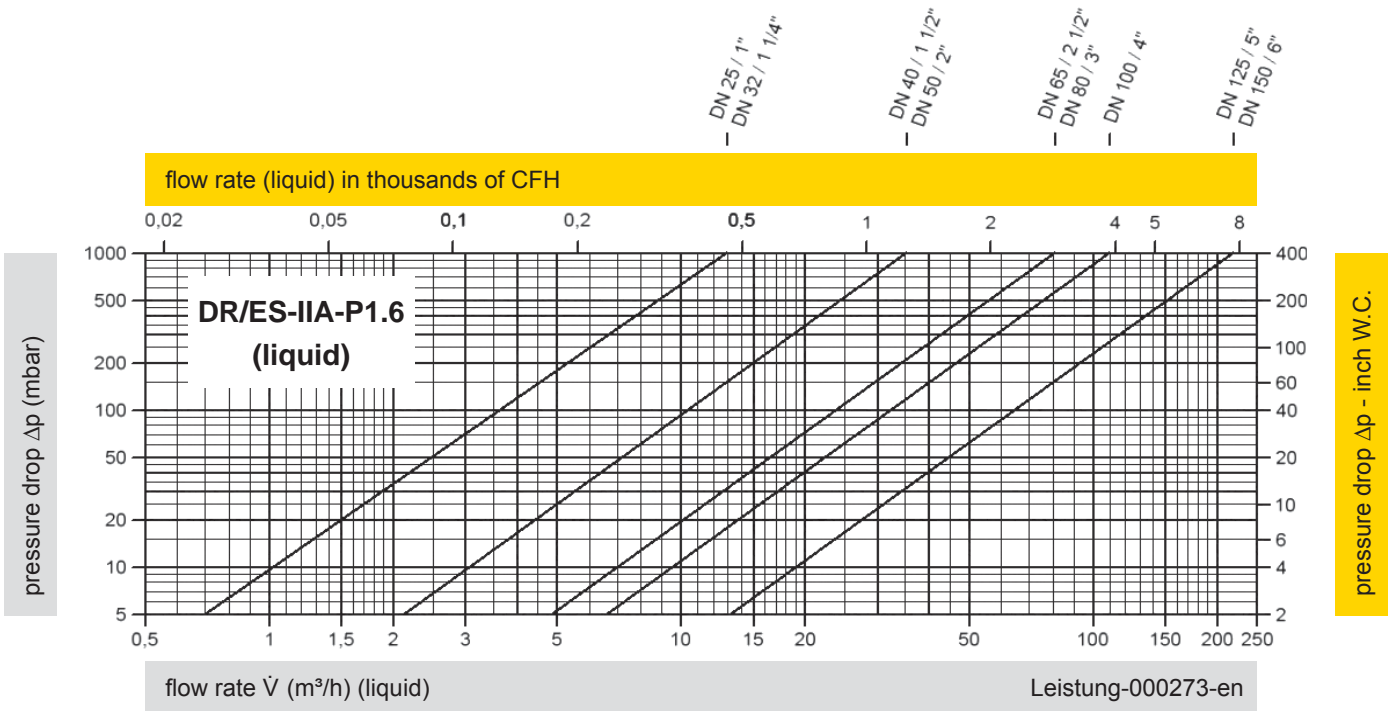




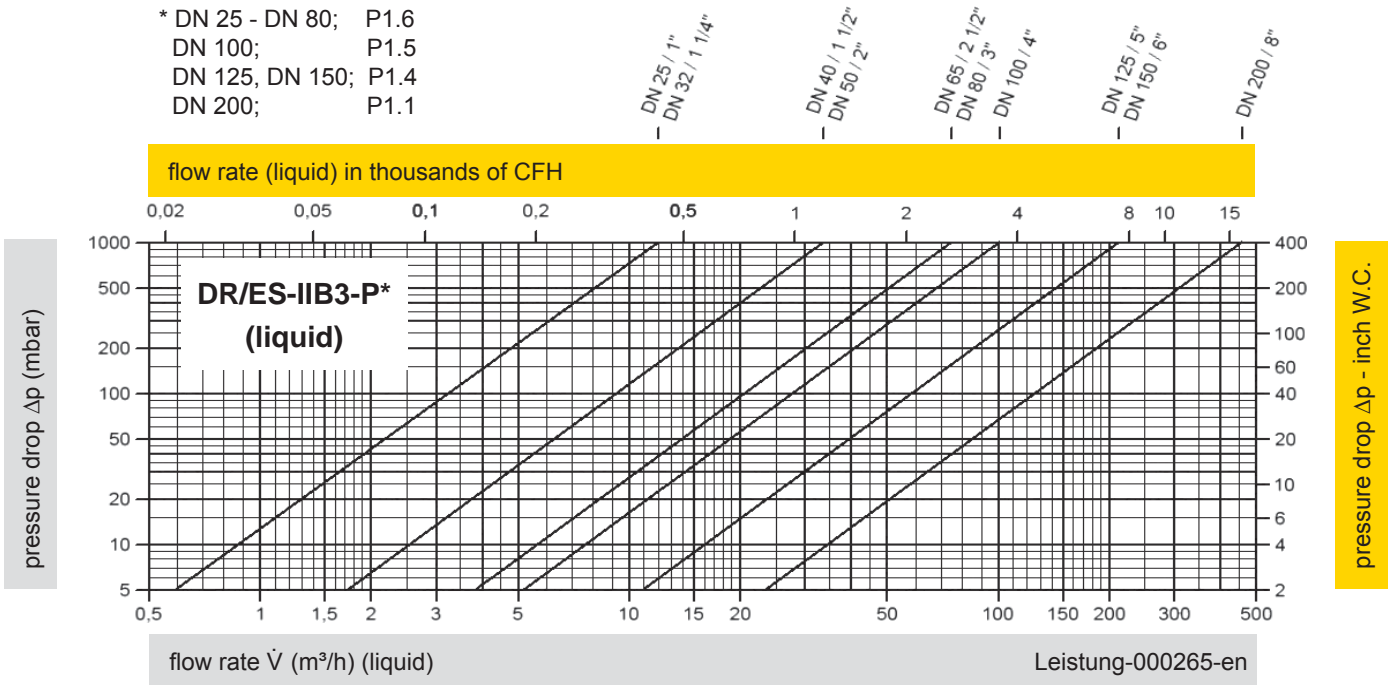
In-Line Detonation Flame Arrester

Flow Capacity Charts (liquid)

PROTEGO® DR/ES

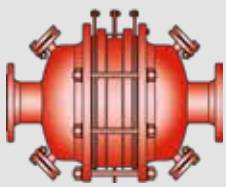


- * DN 25 - DN 80; P1.6
- DN 100; P1.5
- DN 125, DN 150; P1.4
- DN 200; P1.1



$$\text{Conversion: } \dot{V}_{\text{liquid}} = \dot{V}_{\text{water}} * \sqrt{\frac{\rho_{\text{water}}}{\rho_{\text{liquid}}}}$$

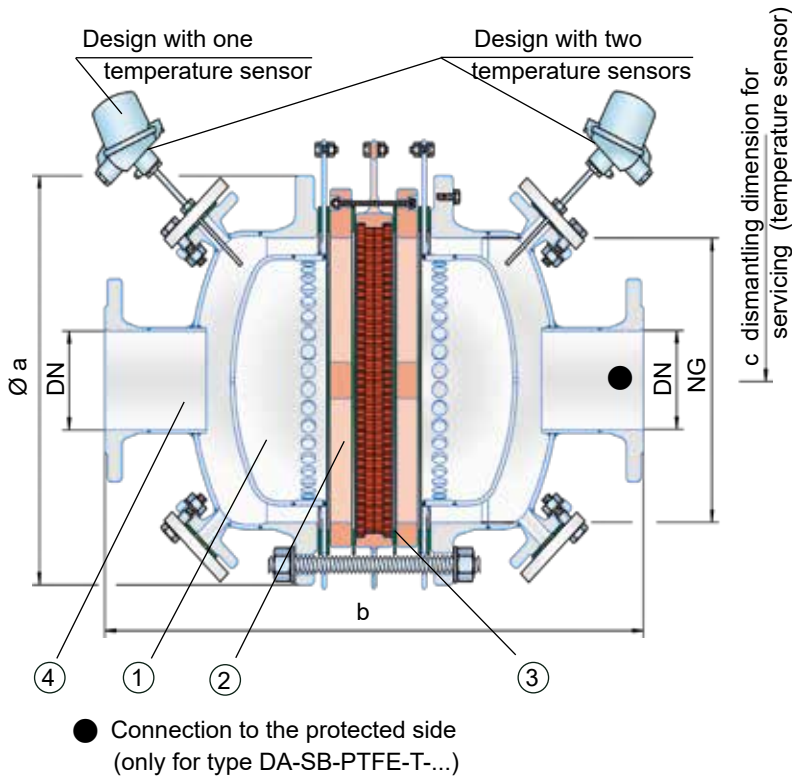
The volume flow \dot{V} in m³/h was determined with water according to DIN EN 60534 at a temperature $T_n = 15^\circ\text{C}$ and an atmospheric pressure $p_n = 1,013 \text{ bar}$, kinematic viscosity $\nu = 10^{-6} \text{ m}^2/\text{s}$



In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design
with shock absorber, bidirectional

PROTEGO® DA-SB-PTFE



Special Features and Advantages

- build up of adhesive materials is prevented by the smooth surfaces
- application especially for corrosive and polymerising media
- minimum number of FLAMEFILTER® discs due to the effective shock absorber
- different series allow increase of FLAMEFILTER® size for given flange connection resulting in lower pressure drop across the device
- service-friendly design
- the modular design enables each individual FLAMEFILTER® to be replaced
- bidirectional operation as well as any direction of flow and installation position
- Installation of temperature sensors is possible
- less soiling of the device lowers service, operating and life-cycle cost
- minimum pressure loss and associated low operating and life-cycle cost

Function and Description

The in-line detonation flame arresters type PROTEGO® DA-SB-PTFE are the latest generation of flame arresters and are distinguished by its unique resistance to adhesive and corrosive media. The use of fluoroplastics as a high-tech housing coating and as solid material for the flame arrester element is unique throughout the world.

The speed of incoming detonations is highly reduced by the effective shock absorber (1) and result in an equal pressure distribution across the FLAMEFILTER® surface. This improves the flame extinction in the narrow gaps of the original PTFE-FLAMEFILTER® (3).

The devices are symmetrical and offer bidirectional flame arresting for deflagrations and stable detonations. The arrester essentially consists of two coated housing parts (4), two coated shock absorbers and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit is modular and consists of several FLAMEFILTER® discs and spacers firmly held in a FLAMEFILTER® cage. The number of FLAMEFILTER® discs and their gap size depends on the arrester's conditions of use.

The detonation arrester PROTEGO® DA-SB-PTFE can be used for explosion group IIA (NFA group D). The standard design is approved at an operating temperature up to +60°C / 140°F. The maximum allowable operating pressure depends on nominal diameter (DN) and nominal size (NG) and amounts to a maximum of 2.4 bar / 34.8 psi absolute (for DN50 / 2" see table 3). Type-approved according to ATEX Directive and EN ISO 16852 as well as other international standards.

Design Types and Specifications

There are three different designs available:

- | | |
|---|--|
| Basic in-line detonation flame arrester | DA-SB-PTFE - <input type="checkbox"/> |
| In-line detonation flame arrester with integrated temperature sensor* as additional protection against short time burning from one side | DA-SB-PTFE - <input type="checkbox"/> |
| In-line detonation flame arrester with two integrated temperature sensors* for additional protection against short time burning from both sides | DA-SB-PTFE - <input type="checkbox"/> |

Additional special flame arresters upon request.

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)

Table 1: Dimensions

Dimensions in mm / inches

To select nominal width/nominal size (NG/DN) - combination, please use the flow capacity chart on the following pages.

NG	150 / 6"	150 / 6"	200 / 8"	300 / 12"
DN	50 / 2"	80 / 3"	80 / 3"	100 / 4"
a	287 / 11.30	287 / 11.30	342 / 13.46	447 / 17.60
b	407 / 15.75	407 / 15.75	497 / 19.57	645 / 25.39
c	400 / 15.75	400 / 15.75	530 / 20.87	530 / 20.87

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	

Table 3: Selection of max. operating pressure

NG	150 / 6"	150 / 6"	200 / 8"	300 / 12"
DN	50 / 2"	80 / 3"	80 / 3"	100 / 4"
P _{max}	2.4 / 34.8	1.1 / 15.9	1.2 / 17.4	1.2 / 17.4

P_{max} = allowable operating pressure in bar / psi absolut, higher operating pressure upon request.**Table 4: Specification of max. operating temperature**

≤ 60°C / 140°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	Classification	

Table 5: Material for housing

Design	A	Special materials upon request.
Housing	Steel with an ECTFE coating	
Shock absorber	Steel with an ECTFE coating	
Gasket	PTFE	
Flame arrester unit	A, B, C	

Table 6: Material combinations of the flame arrester unit

Design	A	B	C
FLAMEFILTER® cage	Steel with an ECTFE coating	Hastelloy	Stainless Steel
Spider rings	Steel with an ECTFE coating	Hastelloy	Stainless Steel
FLAMEFILTER® *	PTFE*	PTFE*	PTFE*
Spacer	PEEK / ETFE / FEP	PEEK / ETFE / FEP	PEEK / ETFE / FEP

Special materials upon request.

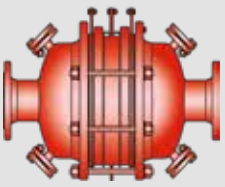
* electrically conductive

Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



for safety and environment



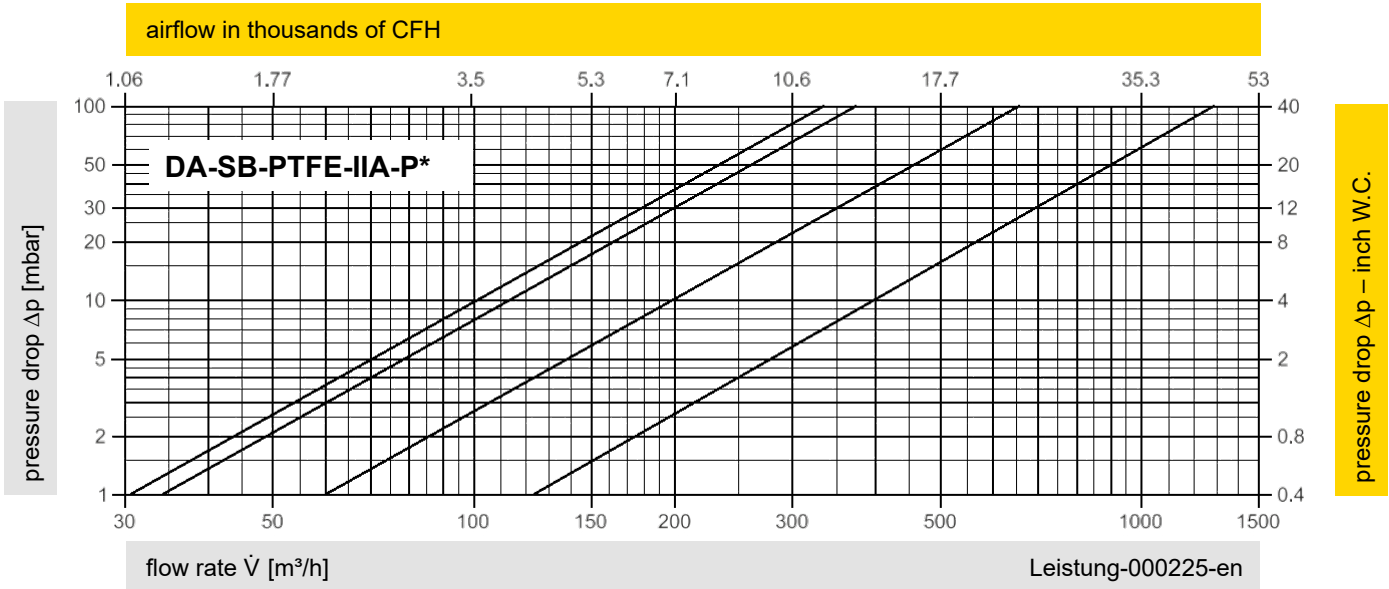
In-Line Detonation Flame Arrester

Flow Capacity Chart

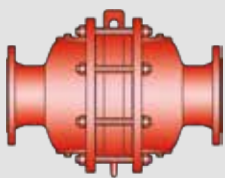
PROTEGO® DA-SB-PTFE

P* see table 3

NG / DN
 150,50 (6" / 2")
 150,80 (6" / 3")
 200,80 (8" / 3")
 300,100 (12" / 4")



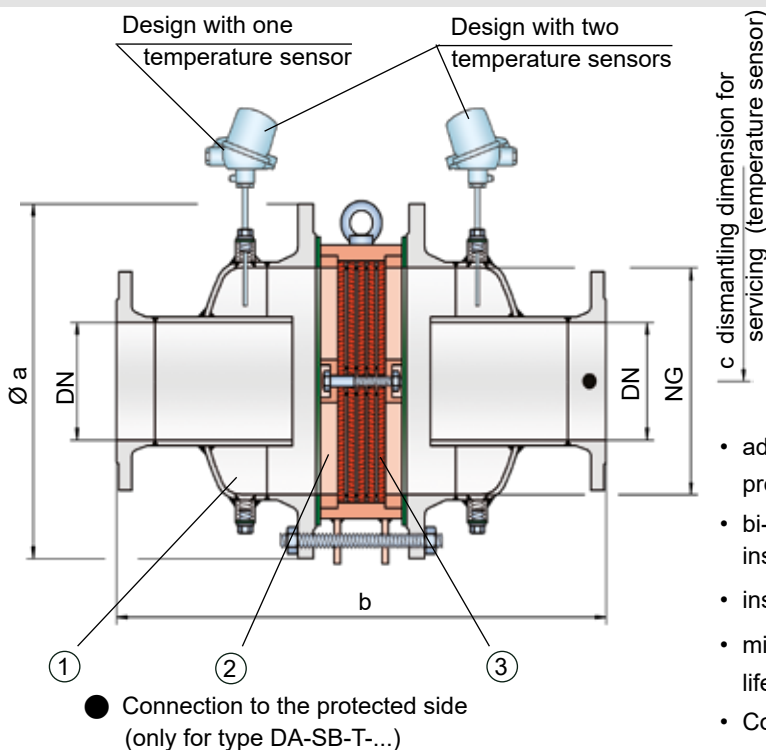
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."



In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock tube, bi-directional

PROTEGO® DA-SB



Function and Description

The in-line detonation flame arresters type PROTEGO® DA-SB are the newest generation of flame arresters. Based on flow and explosion dynamic calculations as well as decades of field tests, a product line was developed that offers minimum pressure losses with maximum safety. The flame arrester uses the Shock Wave Guide Tube Effect (SWGTE) to separate the flame front and shock wave. The result is an in-line detonation arrester without a classic shock absorber, which minimizes the use of FLAMEFILTER® discs.

The devices are symmetrical and offer bi-directional flame arresting for deflagrations and stable detonations. The arrester essentially consists of two housing parts with an integrated shock tube (1) and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit is modular and consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® casing. The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use.

By specifying the operating conditions, such as the temperature, pressure, explosion group, and the composition of the fluid, the optimum detonation arrester can be selected from a series of approved devices. The PROTEGO® DA-SB flame arresters are available for all explosion groups.

The standard design can be used with an operating temperature of up to +60°C / 140°F and an absolute operating pressure up to bar / 15.9 psi. Numerous devices with special approval for higher pressures (see table 3) and higher temperatures are available upon request. Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- optimized performance due to the patented Shock Wave Guide Tube Effect (SWGTE)
- low number of FLAMEFILTER® discs due to the patented Shock Wave Guide Tube Effect (SWGTE)
- modular design enables replacement of the individual FLAMEFILTER® discs
- different designs allow scalable pressure loss over the area of the FLAMEFILTER®
- maintenance-friendly design
- advanced design for higher operating temperatures and pressures
- bi-directional operation, as well as any flow direction and installation position
- installation of temperature sensors possible
- minimal pressure loss resulting in low operating and lifecycle costs
- Cost-effective spare parts
- installation of stabilized FLAMEFILTER® possible
- use of maintenance-friendly PROTEGO® flame arrester unit possible

Design Types and Specifications

There are four different designs available:

Basic in-line detonation flame arrester **DA-SB - [] - []**

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short-time burning from one side **DA-SB - [T] - []**

In-line detonation flame arrester with two integrated temperature sensors* for additional protection against short-time burning from both sides **DA-SB - [TB] - []**

In-line detonation flame arrester with heating jacket **DA-SB - [H] - []**

Additional special flame arresters upon request.

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)



Stabilized FLAMEFILTER®
Discs (Flyer pdf)



New PROTEGO® Flame Arrester Unit unique
maintenance friendly design (Flyer pdf)

Table 1: Dimensions

Dimensions in mm / inches

To select nominal width/nominal size (NG/DN) combination, please use the flow capacity charts on the following pages.		Additional nominal width/nominal size (NG/DN) combinations for improved flow capacity upon request.										
standard (special sizes up to NG 2000/80", DN 1000/40" available)												
NG	150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1000 40"	1200 48"	1600 64"
DN	≤ 50 2"	65, 80 2 1/2", 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 500 20"	≤ 600 24"	800 32"
a	285 / 11.22	285 / 11.22	340 / 13.39	445 / 17.52	565 / 22.24	670 / 26.38	780 / 30.71	895 / 35.24	1015 / 39.96	1230 / 48.43	1455 / 57.28	1915 / 75.39
IIA-P1,1	388 / 15.28	388 / 15.28	476 / 18.74	626 / 24.65	700 / 27.56	800 / 31.50*	1000 / 39.37*	1200 / 47.24	1400 / 55.12	1600 / 62.99	1800 / 70.87	2200/ 86.61**
IIA-P1,4-X3	400 / 15.75	400 / 15.75	488 / 19.21	626 / 24.65	724 / 28.50	800 / 31.50	1000 / 39.37	1200 / 47.24	1400 / 55.12			
b												
IIB3-P1,1	400 / 15.75	412 / 16.22	500 / 19.69	650 / 25.59	724 / 28.50	824 / 32.44	1000 / 39.37	1200 / 47.24	1400 / 55.12	1600 / 62.99	1800 / 70.87	
IIB3-P1,4-X3	412 / 16.22	412 / 16.22	512 / 20.16	650 / 25.59	724 / 28.50	824 / 32.44	1000 / 39.37	1200 / 47.24	1400 / 55.12			
IIC-P1,1	400 / 15.75	400 / 15.75	500 / 19.69	638 / 25.12	700 / 27.56	788 / 31.02	1000 / 39.37***	1200 / 47.24***	1400 / 55.12***			
c												
	500 / 19.69	500 / 19.69	520 / 20.47	570 / 22.44	620 / 24.41	670 / 26.38	720 / 28.35	770 / 30.31	820 / 32.28	950 / 37.40	1050 / 41.34	1250 / 49.21

* dimension b only for P1.4 / 20.3

** dimension b only for P1.2 / 17.4

*** EN 12874

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	
< 0,50 mm	IIC	B	

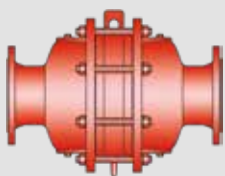
Table 3: Selection of max. operating pressure

NG		150 6"	150 6"	200 8"	300 12"	400 16"	500 20"	600 24"	700 28"	800 32"	1000 40"	1200 48"	1600 64"	
DN		≤ 50 2"	65, 80 2 1/2", 3"	≤ 100 4"	≤ 150 6"	≤ 200 8"	≤ 250 10"	≤ 300 12"	≤ 350 14"	≤ 400 16"	≤ 500 20"	≤ 600 24"	800 32"	
Expl. Gr.	IIA	P _{max}	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	2.1 / 30.5	1.4 / 20.3	1.4 / 20.3	1.4 / 20.3	1.1 / 15.9	1.1 / 15.9	1.2 / 17.4
	IIB3	P _{max}	1.4 / 20.3	1.4 / 20.3	1.4 / 20.3	1.8 / 26.1	1.8 / 26.1	1.8 / 26.1	1.8 / 26.1	1.4 / 20.3	1.4 / 20.3	1.1 / 15.9	1.1 / 15.9	
	IIC	P _{max}	2.2 / 31.9	2.2 / 31.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / 15.9	1.1 / * 15.9	1.1 / * 15.9	1.1 / * 15.9			

P_{max} = maximum allowable operating pressure in bar / psi absolut; higher operating pressure upon request.

In-between size up to P_{max} upon request.

* Capacity charts upon request.



In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design with shock tube, bi-directional

PROTEGO® DA-SB

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	≤ 200°C / 392°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	X3	Classification	

Table 5: Material selection for housing

Design	A	B	C	The housing is also available in Steel with ECTFE coating.
Housing	Steel	Stainless Steel	Hastelloy	
Heating jacket (DA-SB-(T)-H-...)	Steel	Stainless Steel	Stainless Steel	
Gasket	PTFE	PTFE	PTFE	
Flame arrester unit	A, B	B, C, D	D	

Special materials upon request.

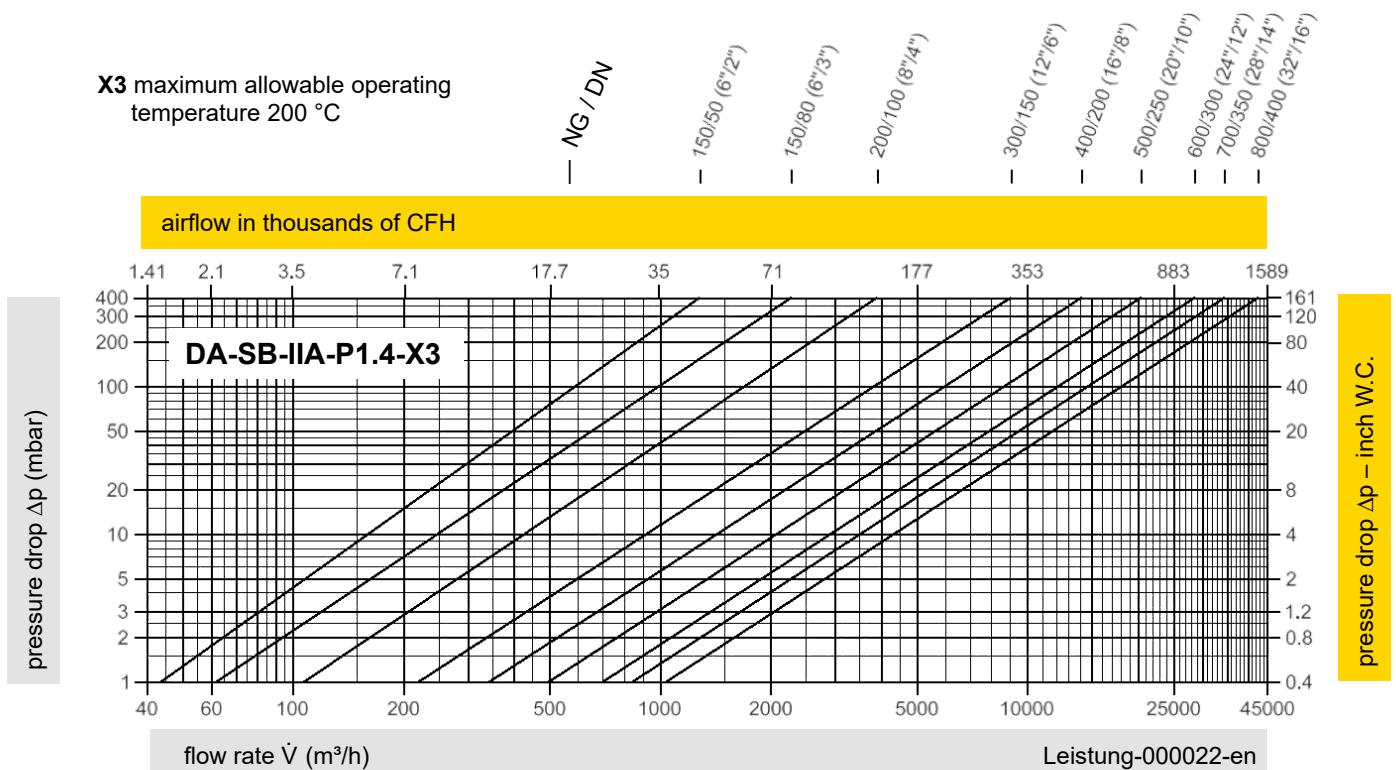
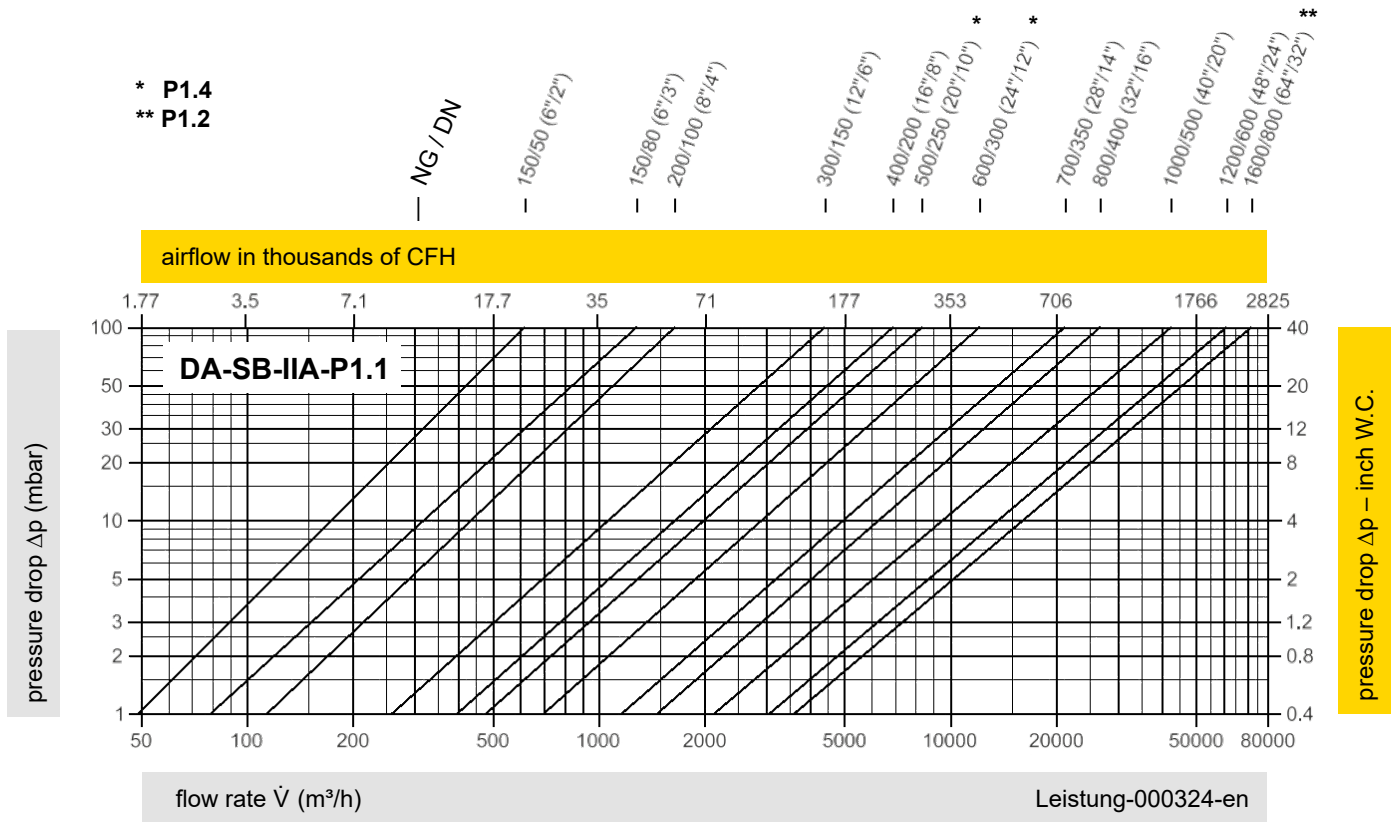
Table 6: Material combinations of the flame arrester unit

Design	A	B	C	D	*The FLAMEFILTER® are also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® casing	Steel	Stainless Steel	Stainless Steel	Hastelloy	
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	Hastelloy	

Special materials upon request.

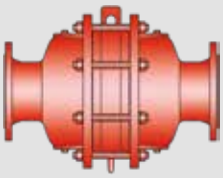
Table 7: Flange connection type

EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

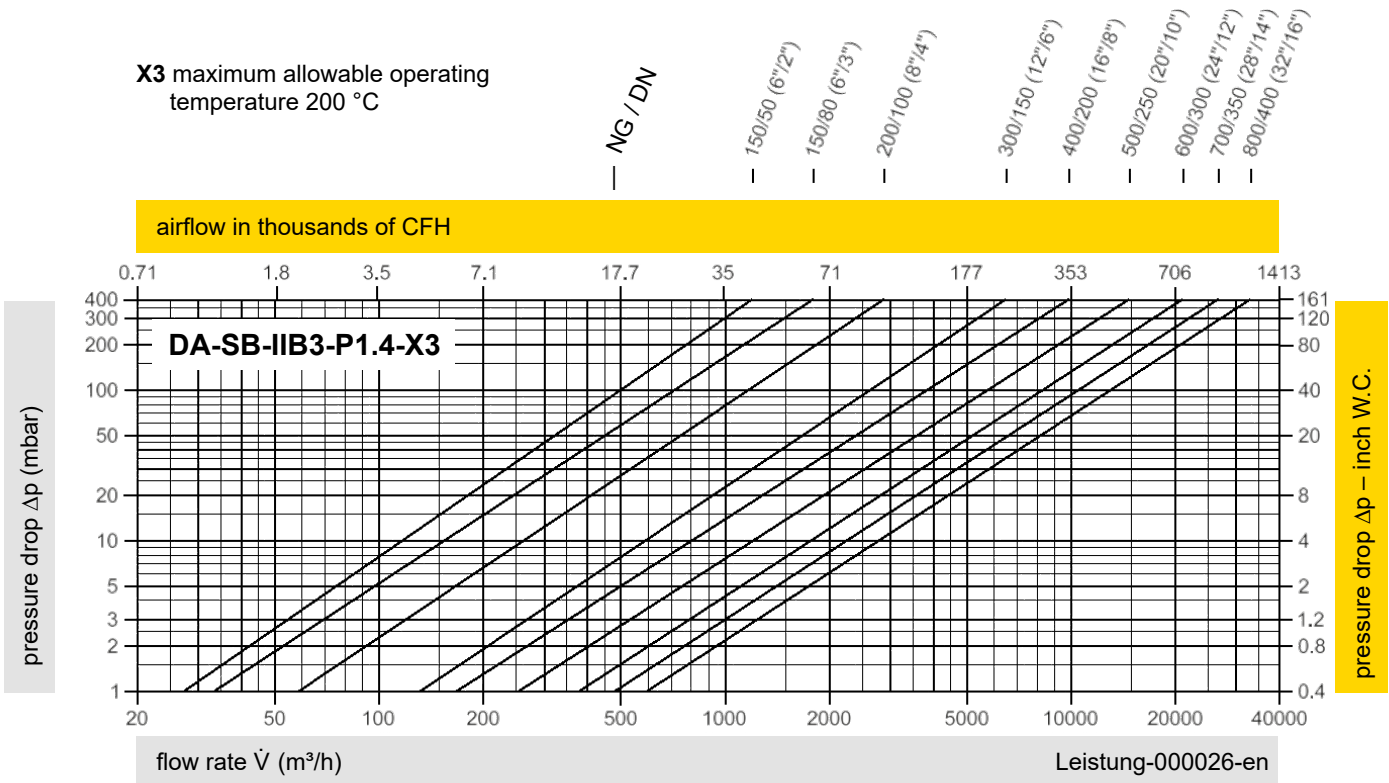
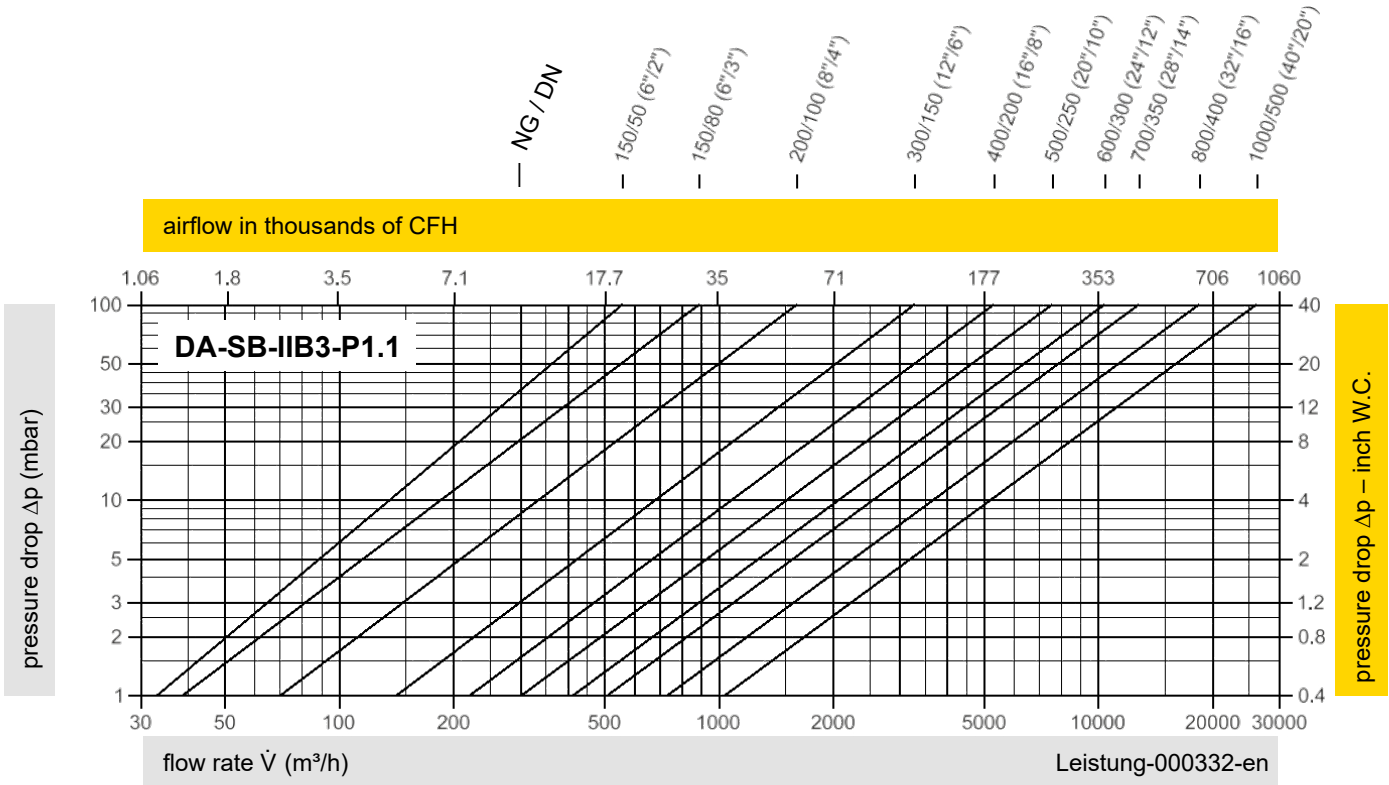




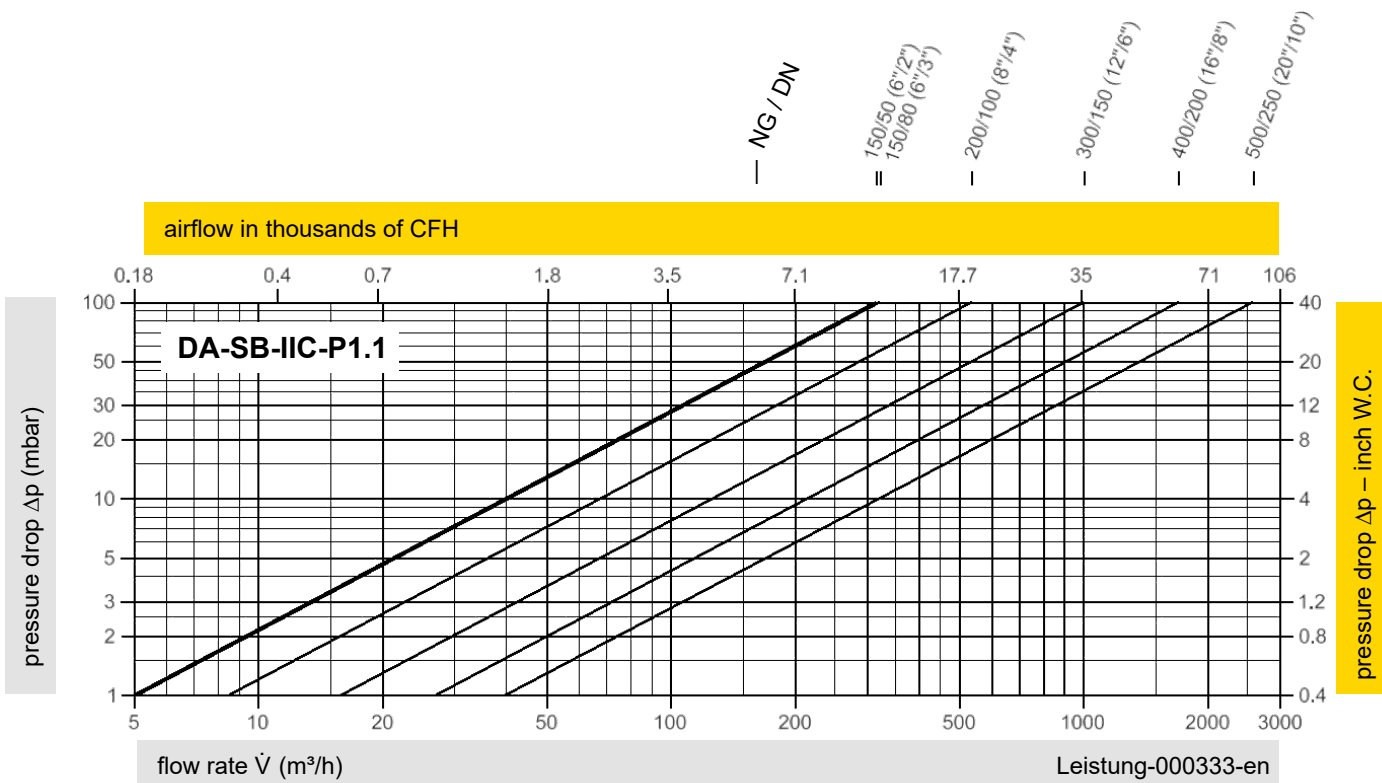
In-Line Detonation Flame Arrester

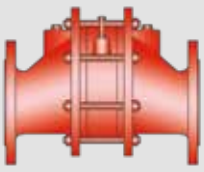
Flow Capacity Charts

PROTEGO® DA-SB



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.
 Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar).
 For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

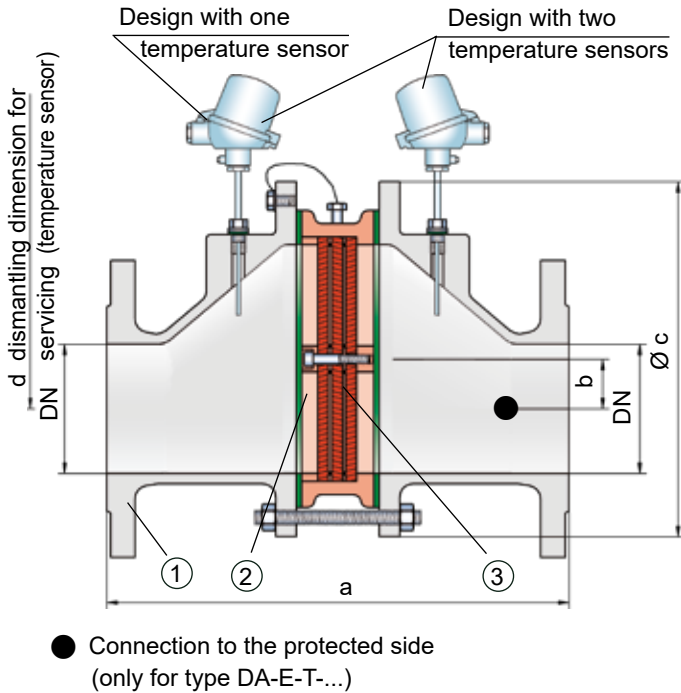




Eccentric In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design,
bi-directional

PROTEGO® DA-E



The standard design can be used with an operating temperature of up to +60°C / 140°F and an absolute operating pressure acc. to table 3. Devices with special approval for higher pressures and higher temperatures are available upon request.

The standard design can be used with an operating temperature of up to +60°C / 140°F and an absolute operating pressure acc. to table 3. **Devices with special approval for higher pressures and higher temperatures are available upon request.**

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- eccentric design prevents condensate build-up
- modular design enables replacement of the individual FLAMEFILTER® discs
- easy maintenance with fast assembly and disassembly of the FLAMEFILTER®
- advanced design allows for installation close to ground level
- bi-directional operation, as well as any flow direction and installation position
- provides protection against deflagration and stable detonation
- installation of temperature sensors possible
- cost-effective spare parts

Function and Description

The PROTEGO® DA-E series of detonation arresters are distinguished by its eccentric housing shape. When condensate accumulates within the PROTEGO® flame arrester unit, the design allows the liquid to drain without collecting large amounts in the housing. The eccentric design of the device has distinctive advantages over the classic flame arresters when installed at lower depths.

The detonation arrester is symmetrical and offers bi-directional flame arresting. The arrester essentially consists of two housing parts (1) and the PROTEGO® flame arrester unit (2) in the center. The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs (3) and spacers firmly held in a FLAMEFILTER® casing. The number of FLAMEFILTER® discs and their gap size depends on the arrester's intended use. By specifying the operating conditions, such as the temperature, pressure, explosion group, and the composition of the fluid, the optimum detonation arrester can be selected. The PROTEGO® DA-E series of flame arresters are available for explosion groups IIA to IIB3 (NEC Group D to C MESH ≥ 0.65 mm).

Design Types and Specifications

There are three different designs available:

Basic design of the detonation arrester **DA-E-**

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short-time burning of one side **DA-E-**

Detonation arrester with two integrated temperature sensors* as additional protection against short-time burning from both sides **DA-E-**

Additional special arresters upon request.

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)



Stabilized FLAMEFILTER®
Discs (Flyer pdf)

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity charts on the following pages.

DN		25 1"	32 1 ¼"	40 1 ½"	50 2"	65 2 ½"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"	300 12"	
Expl. Gr.	IIA	a	304/315* / 11.97/12.4*	304/315* / 11.97/12.4*	320/ 12.60	325/ 12.80	370/ 14.57	375/ 14.76	380/ 14.96	481/ 18.94	487/ 19.17	510/ 20.08	540/ 21.26	560/ 22.05
	IIB3	a	304/ 11.97	304/ 11.97	357/ 14.06	361/ 14.21	408/ 16.06	412/ 16.22	428/ 16.85	493/ 19.41	499/ 19.65	522/ 20.55	552/ 21.73	572/ 22.52
		b	29/ 1.14	29/ 1.14	29/ 1.14	29/ 1.14	38/ 1.50	38/ 1.50	39/ 1.53	65/ 2.56	65/ 2.56	55/ 2.17	58/ 2.28	60/ 2.36
		c	185/ 7.28	185/ 7.28	210/ 8.27	210/ 8.27	250/ 9.84	250/ 9.84	275/ 10.83	385/ 15.16	385/ 15.16	450/ 17.72	500/ 19.69	575/ 22.64
		d	400/ 15.75	400/ 15.75	410/ 16.14	410/ 16.14	440/ 17.32	440/ 17.32	460/ 18.11	520/ 20.47	520/ 20.47	540/ 21.26	570/ 22.44	600/ 23.62

* for IIA-P2.0

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	
> 0,90 mm	IIA	D	Special approvals upon request.
≥ 0,65 mm	IIB3	C	

Table 3: Selection of max. operating pressure

DN		25 1"	32 1 ¼"	40 1 ½"	50 2"	65 2 ½"	80 3"	100 4"	125 5"	150 6"	200 8"	250 10"	300 12"
Expl. Gr.	IIA	P _{max}	2.0 / 29.0	2.0 / 29.0	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4
	IIB3	P _{max}	1.1 / 15.9	1.1 / 15.9	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4	1.2 / 17.4

P_{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	
-	Classification	Higher operating temperatures upon request.

Table 5: Material selection for housing

Design	B	C	D	
Housing	Steel	Stainless Steel	Hastelloy	The housing is also available in carbon steel with an ECTFE coating.
Gasket	PTFE	PTFE	PTFE	
Flame arrester unit	A, C	C	D	

Special materials upon request.

Table 6: Material combinations of the flame arrester unit

Design	A	C	D	
FLAMEFILTER® casing	Steel	Stainless Steel	Hastelloy	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® *	Stainless Steel	Stainless Steel	Hastelloy	
Spacer	Stainless Steel	Stainless Steel	Hastelloy	

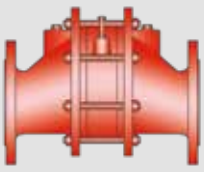
Special materials upon request.

Table 7: Flange connection type

EN 1092-1; Form B1	
ASME B16.5 CL 150 R.F.	Other types upon request.



for safety and environment



Eccentric In-Line Detonation Flame Arrester

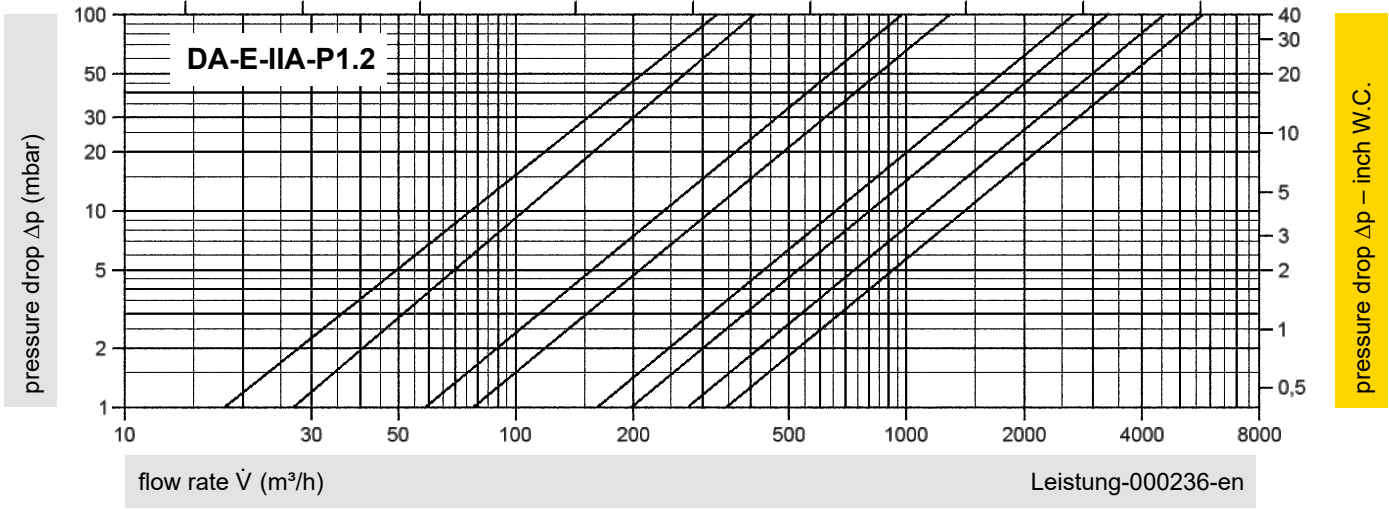
Flow Capacity Charts

PROTEGO® DA-E

* P1.3

DN 25 / 1" *
DN 32 / 1 1/4" *
DN 40 / 1 1/2" *
DN 50 / 2" *
DN 65 / 2 1/2"
DN 80 / 3"
DN 100 / 4"
DN 125 / 5"
DN 150 / 6"
DN 200 / 8"
DN 250 / 10"
DN 300 / 12"

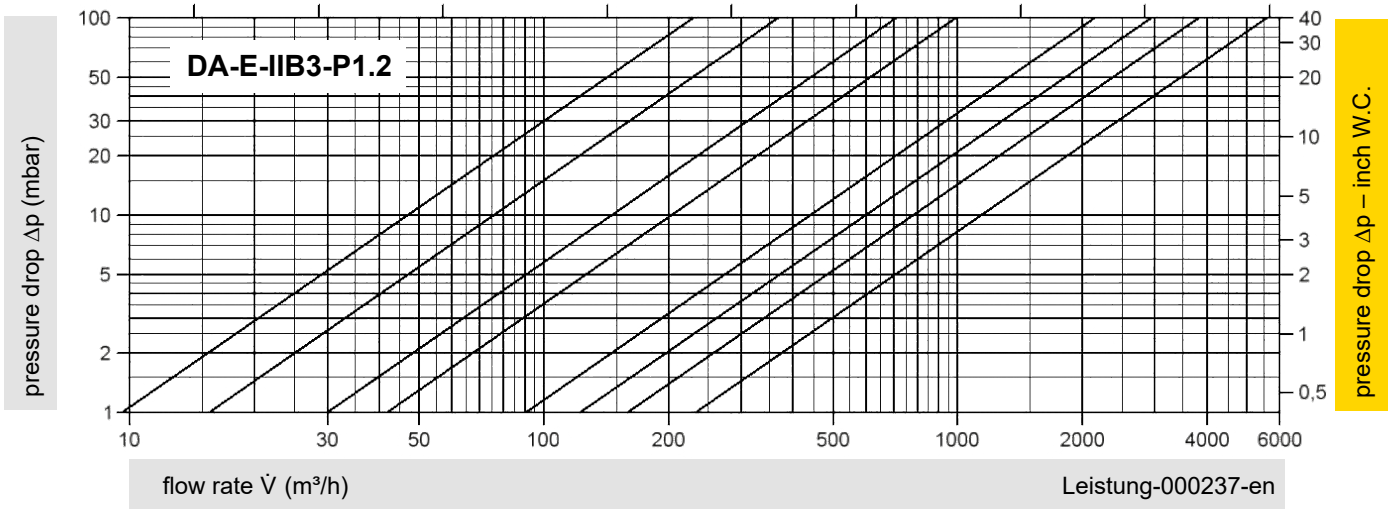
airflow in thousands of CFH



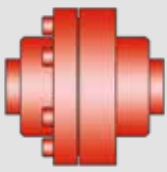
* P1.1

DN 25 / 1" *
DN 32 / 1 1/4" *
DN 40 / 1 1/2" *
DN 50 / 2" *
DN 65 / 2 1/2"
DN 80 / 3"
DN 100 / 4"
DN 125 / 5"
DN 150 / 6"
DN 200 / 8"
DN 250 / 10"
DN 300 / 12"

airflow in thousands of CFH



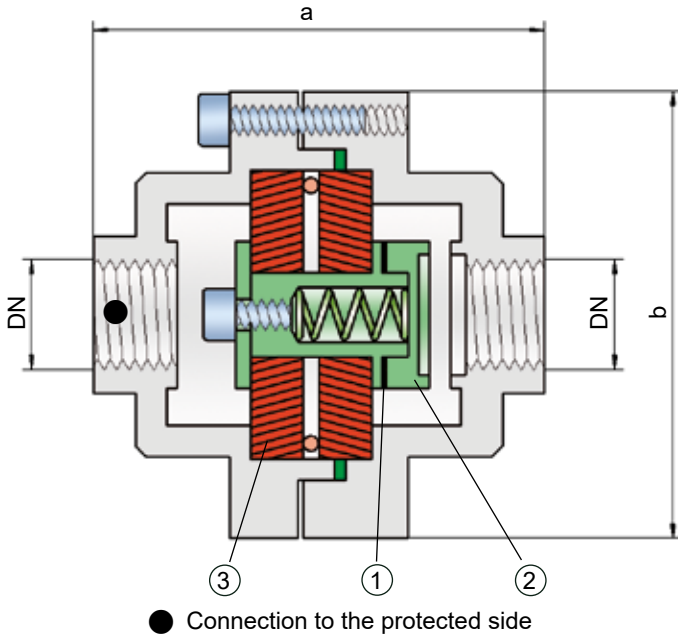
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."



In-Line Detonation Flame Arrester

with shut-off valve,
for stable detonations and deflagrations in a straight through design, uni-directional

PROTEGO® DR/SV



Once a detonation enters the flame arrester, energy is absorbed from the detonation shock wave by the central plate disc (2) before the flame is extinguished in the narrow gaps of the two FLAMEFILTER® discs (3). This device can be used for fluids of explosion group IIA (NEC group D).

The in-line detonation flame arresters are unidirectional and equipped with a threaded connection. The thread can be executed to international standards. The standard design can be used up to an operating temperature of +60°C / 140°F and an (absolute) operating pressure up to 1.1 bar / 15,9 psi.

Type-approved according to ATEX Directive and EN 12874 as well as other international standards.

Special Features and Advantages

- protects against stabilized burning
- no expensive emergency switch-offs are required
- temperature monitoring is not necessary
- minimum number of FLAMEFILTER® discs
- easy to maintain
- the individual FLAMEFILTER® discs can be quickly removed and installed
- the FLAMEFILTER® discs can be individually replaced
- provides protection from deflagrations and stable detonations
- ideal protective system for vacuum pumps
- cost efficient spare parts

Function and Description

The PROTEGO® DR/SV flame arrester series ideally combines the function of a detonation arrester with the advantages of a shut-off valve. In case of ignition, the fire can be stabilized within the flame arrester when the flammable gas continues to flow. Inside the detonation arrester, is a valve (1) that closes in case of fire, stops the additional supply of fuel and extinguishes the flames. Temperature sensors in combination with an emergency switch off do not have to be installed if the type PROTEGO® DR/SV device is used. This device is particularly useful for the suction-side protection of compressors and pumps.

The flame arrester protects against deflagrations and stable detonations. It can be installed anywhere in the pipe independently from the distance of the potential ignition source.

Table 1: Dimensions

Dimensions in mm / inches

To select the nominal size (DN), please use the flow capacity chart on the following page

DN	G 1/2"	G 3/4"
a	115 / 4.53	115 / 4.53
b	100 / 3.94	100 / 3.94

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	

Table 3: Selection of max. operating pressure

DN	G 1/2"	G 3/4"	P _{max} = maximum allowable operating pressure in bar / psi (absolute), higher operating pressure upon request.
P _{max}	1.1 / 15.9	1.1 / 15.9	

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	Tmaximum allowable operating temperature in °C	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection for housing

Design	A	B	Special materials upon request.
Housing	Brass	Stainless Steel	
Gasket	PTFE	PTFE	
Flame arrester unit	A	A, B	

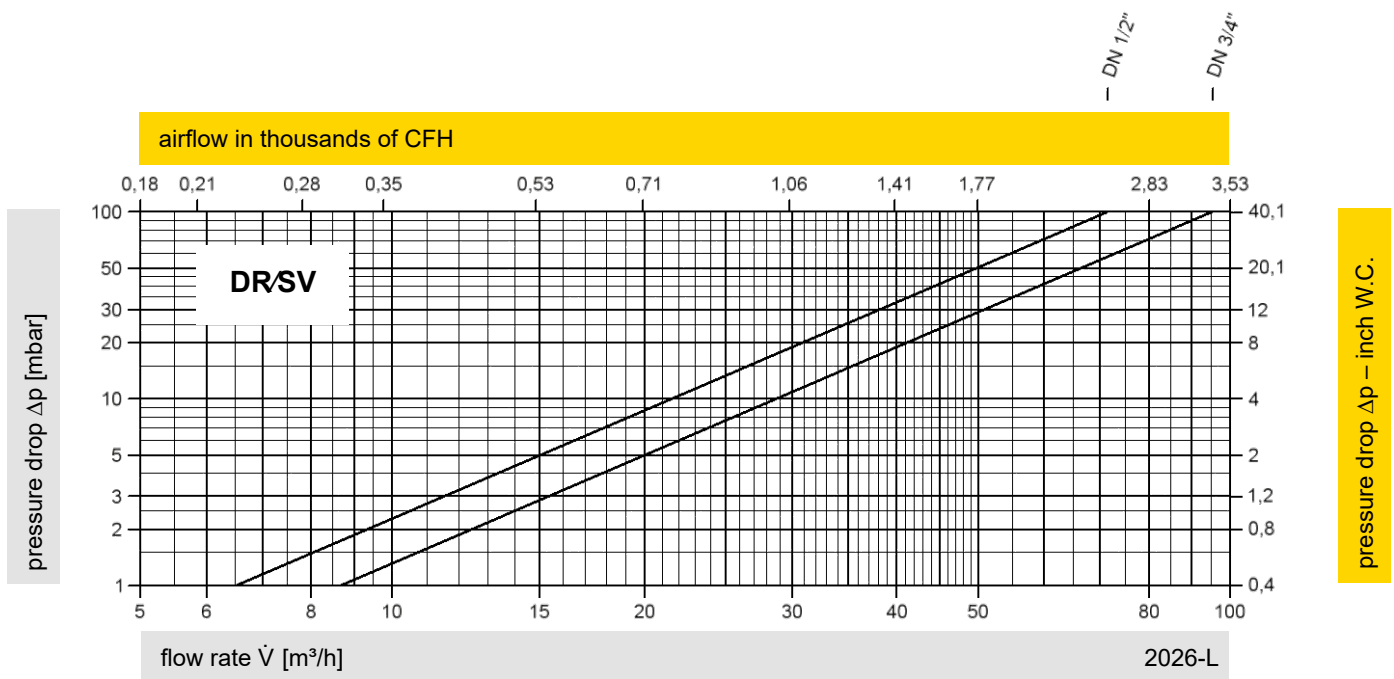
Table 6: Material combinations of the flame arrester unit

Design	A	B	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing and casing materials are used.
FLAMEFILTER® *	Stainless Steel	Stainless Steel	
Spacer	Stainless Steel	Stainless Steel	
Support for FLAMEFILTER®	Brass	Stainless Steel	
Washer	Brass	Stainless Steel	

Table 7: Type of connection

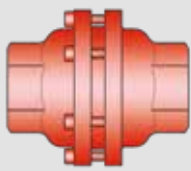
Pipe thread DIN ISO 228-1	DIN	Other types of thread upon request.
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Flow Capacity Chart



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in (m^3/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar). For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

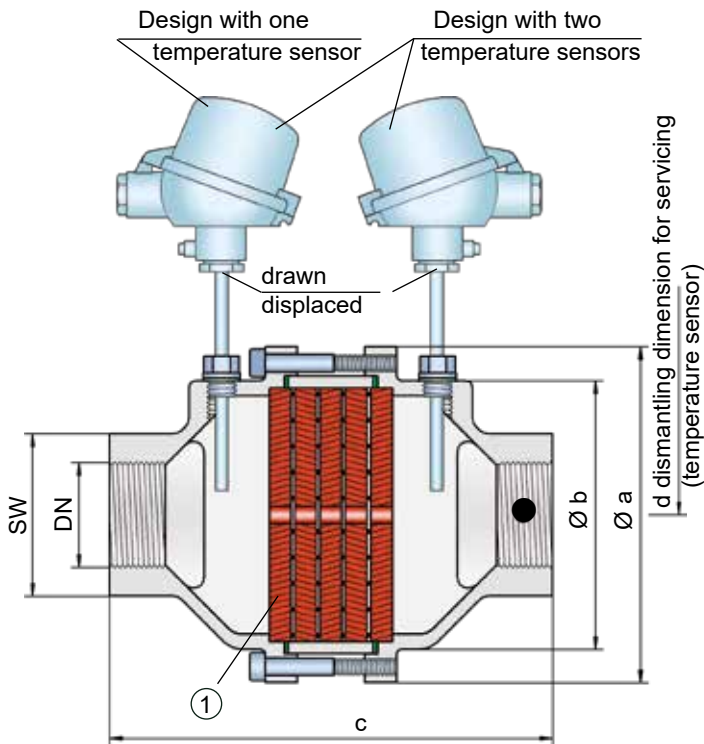




In-Line Detonation Flame Arrester

for stable detonations and deflagrations in a straight through design,
bi-directional

PROTEGO® DA-G



- Connection to the protected side (only for type DA-G-T-...)

The device is bi-directional and equipped with a threaded connection. This can be adapted to international standards. The detonation arrester can be used at any location in the pipe, regardless of the location of the ignition source.

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards.

Special Features and Advantages

- bi-directional
- modular design
- quick removal and installation of the individual FLAMEFILTER®
- easy maintenance and replacement of the individual FLAMEFILTER®
- Various uses possible
- Installation of temperature sensors for G 1½ and G 2 possible
- cost-effective spare parts

Design Types and Specifications

There are three different designs available:

Basic design of the DA-G in-line detonation flame arrester, size ½" to 2"

DA-G-

In-line detonation flame arrester with integrated temperature sensor* as additional protection against short burning from one side, size 1½" to 2"

DA-G- **T**

In-line detonation flame arrester with two integrated temperature sensors* as additional protection against short-time burning from both sides, size 1½" to 2"

DA-G- **TB**

*Resistance thermometer for device group II, category (1) 2 (GII cat. (1) 2)

Flange connection available upon request.

Function and Description

The PROTEGO® DA-G series is a compact in-line detonation flame arrester for installation in pipes with diameters up to 2" and is used, for example, in industrial applications such as gas analysis lines.

Once a detonation enters the flame arrester, energy is absorbed from the shock wave, and the flame is extinguished in the narrow gaps of the FLAMEFILTER® (1).

The PROTEGO® flame arrester unit consists of several FLAMEFILTER® discs firmly held in a housing. The gap size and number of FLAMEFILTER® discs are determined by the operating data and parameters of the mixture flowing in the line (explosion group, pressure, temperature).

To provide an optimum result between the housing size, number of FLAMEFILTER® discs and their gap size, a device was developed that can be used for all explosion groups - IIA, IIB3 and IIC (NEC Group D, C MESG ≥ 0.65 mm and B). The standard design can be used with an operating temperature of up to +60°C / 140°F and an absolute operating pressure up to 1.1 bar / 15.9 psi. **Devices with special approvals for higher pressures (see table 4) and higher temperatures are available upon request.**

Table 1: Dimensions

Dimensions in mm / inches, SW = width across flats

To select the nominal size (DN), please use the flow capacity charts on the following pages.

DN	G ½	G ¾	G 1	G 1 ¼	G 1 ½	G 2
a	80 / 3.15	80 / 3.15	100 / 3.94	100 / 3.94	155 / 6.10	155 / 6.10
b	55 / 2.17	55 / 2.17	76 / 2.99	76 / 2.99	124 / 4.88	124 / 4.88
c (IIA)	112 / 4.41	112 / 4.41	122 / 4.80	122 / 4.80	205 / 8.07	205 / 8.07
c (IIB3 and IIC)	135 / 5.31	135 / 5.31	145 / 5.71	145 / 5.71	205 / 8.07	205 / 8.07
d	—	—	—	—	400 / 15.75	400 / 15.75
SW	32 / 1.26	32 / 1.26	50 / 1.97	50 / 1.97	75 / 2.95	75 / 2.95

Table 2: Selection of the explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)	Special approvals upon request.
> 0,90 mm	IIA	D	
≥ 0,65 mm	IIB3	C	
< 0,50 mm	IIC	B	

Table 3: Selection of max. operating pressure

DN		G ½	G ¾	G 1	G 1 ¼	G 1 ½	G 2	P _{max} = maximum allowable operating pressure in bar / psi (absolute); higher operating pressure upon request.	
Expl. Gr.	IIA	P _{max}	1.2/17.4	1.2/17.4	1.1/15.9	1.1/15.9	1.1/15.9		1.1/15.9
	IIB3	P _{max}	1.1/15.9	1.1/15.9	1.1/15.9	1.1/15.9	1.4/20.3		1.4/20.3
	IIC	P _{max}	1.1/15.9	1.1/15.9	1.1/15.9	1.1/15.9	1.6/23.2		1.6/23.2

Table 4: Specification of max. operating temperature

≤ 60°C / 140°F	T _{maximum allowable operating temperature in °C}	Higher operating temperatures upon request.
-	Classification	

Table 5: Material selection

Design	B	C	*The FLAMEFILTER® is also available in Tantalum, Inconel, Copper, etc., when the listed housing materials are used.
Housing	Stainless Steel	Hastelloy	
Gasket	PTFE	PTFE	
FLAMEFILTER®*	Stainless Steel	Hastelloy	

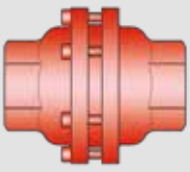
Special materials upon request.

Table 6: Type of connection

Pipe thread DIN ISO 228-1	DIN	Other types of thread upon request.
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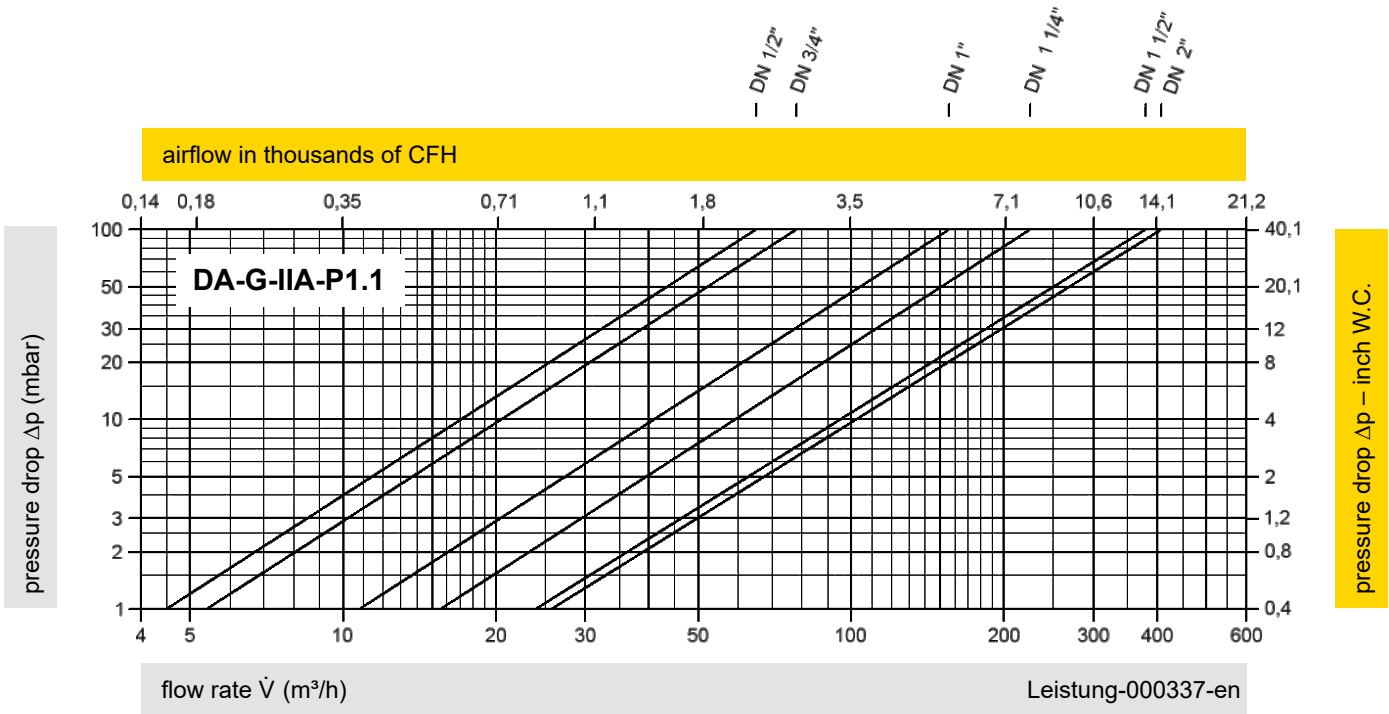
for safety and environment



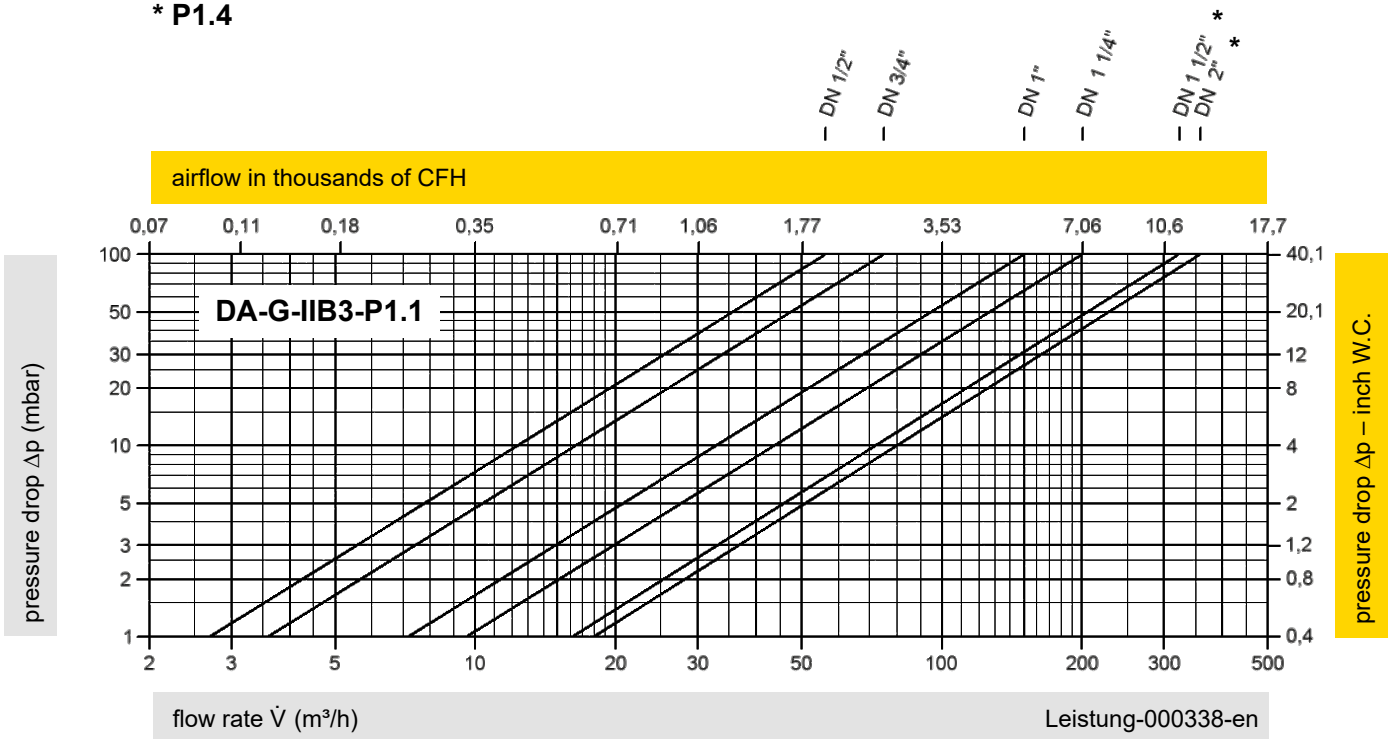
In-Line Detonation Flame Arrester

Flow Capacity Charts

PROTEGO® DA-G



* P1.4



The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.
 Volume flow \dot{V} in (m³/h) and CFH refer to the standard reference conditions of air in ISO 6358 (20°C, 1bar).
 For conversion to other densities and temperatures, refer to Sec. 1: "Technical Fundamentals."

* P1.6

