

PROTEGO® Deflagration Flame Arresters

end-of line
and Vent Caps



Volume 2



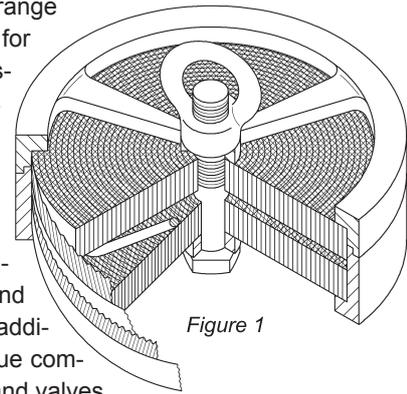
for safety and environment

More than 50 years ago, PROTEGO® started developing special devices for protecting systems against explosions as well as pressure and vacuum relief valves that meet the highest standards for performance, pressure conservation, and tight seals. This yielded the original Braunschweiger FLAMEFILTER® (Fig. 1) as well as a series of additional innovations that led to numerous patents and imitators. In close cooperation with scientific institutions, continued technical challenges were overcome to meet the increasing requirements for safety and environmental protection.

Today, these products are used throughout the world under the brand names PROTEGO® and FLAMEFILTER® mainly for the following applications:

- ① In tank farms for refineries and chemical plants
- ② In processing plants for chemical and pharmaceutical industries
- ③ In vapour combustion plants
- ④ In ship building, offshore platforms, in loading facilities
- ⑤ In vapour recovery systems
- ⑥ As component for machineries and devices
- ⑦ In biogas and landfill applications
- ⑧ In flare systems

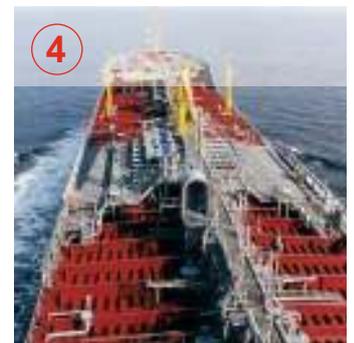
Our comprehensive product range reliably protects systems for generating, storing, and transporting gases and liquids of every hazard category against dangers such as endurance burning, deflagration and detonation. Our complete line of valves enables tank farms to be safely and economically ventilated. In addition, PROTEGO® offers unique combinations of flame arresters and valves.



All of our devices are tested by independent national and international third parties in the world's largest test facility and have got at least one of the many certifications. The actual performance of the devices is determined in a modern flow measuring test rig to obtain reliable data for their practical use.



PROTEGO®, FLAMEFILTER®, and FLAMMENFILTER® are international trademarks owned by Braunschweiger Flammenfilter GmbH.



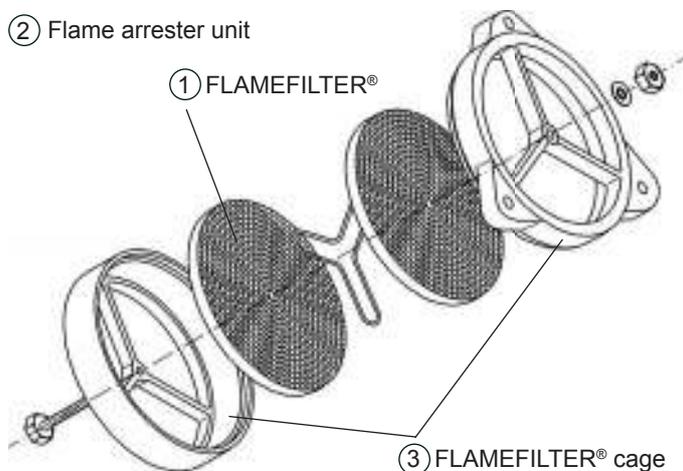
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Function and description

The different combustion processes and installation locations of flame arresters are discussed in „Technical Fundamentals“ (Vol. 1). In this volume we present the PROTEGO® product range for end-of-line deflagration flame arresters and vent caps. These devices protect against atmospheric deflagration, atmospheric deflagration and short time burning or atmospheric deflagration and endurance burning, which also includes short time burning. Vent caps without flame arrester elements complete our range of end-of-line devices.

PROTEGO® end-of-line deflagration flame arresters are “state-of-the-art” safety devices which are installed on storage tanks, vessels or in process plants. They provide safe protection against atmospheric deflagration, short time burning or endurance burning if potentially explosive vapours are discharged. They mitigate the impact of atmospheric deflagration and prevent flame transmission to protect equipment which is not designed to be explosion pressure proof.

The main component is the FLAMEFILTER® (1), which stops the propagation of flames. The flame arrester unit (2) consists of one or two flame arrester elements which are secured in a FLAMEFILTER® cage (3). The gap size and number of FLAMEFILTER® depend on the relevant data of the process media (i.e. explosion group, pressure, temperature).



Deflagration and short time burning proof end-of-line flame arresters are equipped with a temperature sensor, which detects a stabilized flame on the flame arrester element. If a flame is detected, measures shall be taken to extinguish the flame and prevent endurance burning.

Should venting of an explosive mixture over a long period of time be unavoidable and no secondary measure is implemented to extinguish a flame, devices which provide endurance burning protection shall be installed. **Deflagration and endurance burning proof end-of-line flame arresters** from PROTEGO®,

are equipped with a fusible link, which melts if a flame stabilizes on the flame arrester element and then allows the weather hood to move into the open position. This allows the flame to transfer most of its heat directly to the environment, preventing flashback through the FLAMEFILTER®.

Vent caps without flame arrester elements, protecting against environmental impact (harsh weather conditions, bird nests, etc.) complete our product range.

In close cooperation with scientific institutions, PROTEGO® has developed safety devices which can be applied to all explosion hazardous locations and provide protection against atmospheric deflagration, short time burning and endurance burning. Our devices are subjected to type examination and certificates according to ATEX and other international standards are issued (CE, FM, Gost-R, GL, etc.).

A broad variety of types, designs, sizes and materials can be provided. Most importantly we have the capability to custom design and develop solutions in our test facility, which is the technologically most advanced in the world.

Special features and advantages

The following factors should be considered for selecting a device: **Deflagration protection, deflagration and short time burning protection** including temperature control or **deflagration and endurance burning protection**, which includes deflagration protection. **Vent caps** don't have a flame arrester element.

With regard to operating conditions **higher temperatures** have to be considered if standard values for atmospheric operation are exceeded.

For selecting an appropriate device, the **explosion group** according to the MESG value must be considered.

The correct **approval** has to be chosen or may be requested.

The plant specification needs to be considered to select the appropriate connection and **size**.

Depending on the application, it may be important to select a device with a **heating jacket** or heating coil, but please note that not all devices are available with this feature. Electrical trace heating may be an alternative.

We provide special designs for **critical media** and product properties (i.e. viscosity, density, crystallization and polymerization).

Preferred applications

PROTEGO® end-of-line deflagration flame arresters and vent caps are mainly installed on storage tanks and vessels of the chemical, petrochemical and pharmaceutical industry in order to protect them.

Installation and maintenance

PROTEGO® end-of-line deflagration flame arresters and vent caps are installed as close as possible to the protected equipment. They can be installed in any position. Only short-time burning proof end-of-line deflagration flame arresters, which are equipped with a temperature sensor and endurance burning proof deflagration flame arresters must be installed with the FLAMEFILTER® in the horizontal position according to the installation instructions.

The modular design of the end-of-line deflagration flame arresters assures the easiest possible maintenance. For onsite maintenance purposes, the device has to be installed in a location where it can be easily accessed. For larger sizes it may be necessary to provide lifting equipment. With trained personal maintenance is most efficient.

PROTEGO® end-of-line deflagration flame arresters are installed in explosion hazardous areas. It is important to select the correct device for the specific application. The manufacturer's statement of conformity confirms the tasks for which the deflagration flame arrester is suitable. The user documents proper use in accordance with the applicable safety regulations.

Selection

Based on main process data, the different types of devices can be selected from our product range:

- **Atmospheric deflagration proof, short time burning proof, endurance burning proof or vent caps**
- **Explosion group** of the processed mixture
- Standard or special operating conditions with **higher temperatures**

After that the following criteria have to be verified or selected:

- **Size** and type of connection
- **Approvals** according to ATEX, FM etc.
- **Heating jacket** or heating coil

After this pre-selection other details, such as material, coating etc. can be selected or defined in the data sheet.

Should it not be possible to determine a device fitting your requirements, please do not hesitate to contact us: in many cases we can provide special designs or approvals.

Sizing

The size of the device is selected or double checked with our volume flow / pressure drop diagrams. Should clogging of the flame arrester element be likely a safety factor should be considered for sizing.

Given: Flow rate \dot{V} m³/h or CFH
max. all. pressure drop Δp in mbar or In W.C.

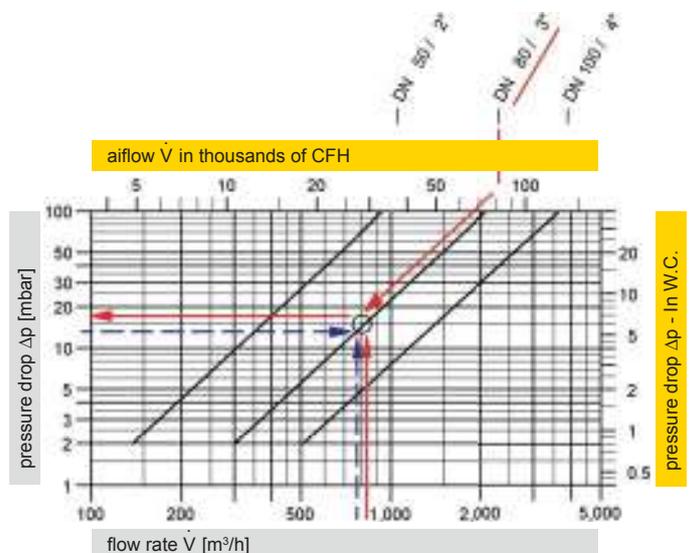
Desired: Size of the device DN

Procedure: Intersection point of straight line through the flow rate and maximum allowable pressure drop is below or on the size curve

Given: Flow rate \dot{V} m³/h or CFH
size of nozzle connection DN

Desired: Pressure drop (flow resistance)
 Δp in mbar or In W.C.

Procedure: Intersection point of the straight line through the flow rate and size curve, horizontal straight line provides the pressure drop



Guidance for calculating the volume flow or influence of density is covered in the "Technical Fundamentals" (see Vol. 1).

The device can be specified or ordered if all above steps are completed.

For special applications, please complete the process data sheet from Volume 1 to provide the necessary information for a quotation.



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PROTEGO® Deflagration Flame Arresters, end-of-line, and Vent Caps

	Type	Size	Explosion group		Approvals	X = Special design for higher temperatures	X = Heating jacket /heating coil	Page
			ATEX	NEC				
Deflagration flame arrester, end-of-line								
	BE/AD	15 - 50 ½" - 2"	IIB3, IIC	C B	ATEX			8 - 10
	LH/AD	50 - 800 2" - 32"	IIB3, IIC	C B	ATEX	X		12 - 15
Deflagration flame arrester, short time burning proof, end-of-line								
	LH/AD-T	50 - 800 2" - 32"	IIB3, IIC	C B	ATEX	X		16 - 19
Deflagration flame arrester, endurance burning proof, end-of-line								
	BE/HZ	15 - 32 ½" - 1¼"	IIA	D	ATEX			20 - 21
	BE/HK	20 - 80 ¾" - 3"	IIA, IIB3	D C	ATEX FM		X	22 - 24
	BE/HK-E	20 - 80 ¾" - 3"	IIB1	–	ATEX		X	26 - 28
	BE/HR	80 - 100 3" - 4"	IIA, IIB3		ATEX FM		X	30-32

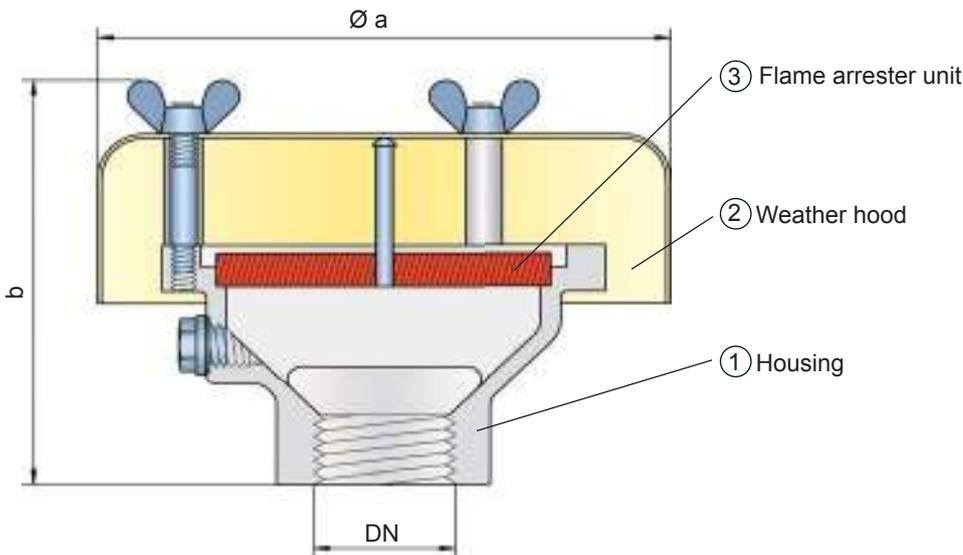
	Type	Size	Explosion group		Approvals	X = Special design for higher temperatures	X = Heating jacket / heating coil	Page
			ATEX	NEC				
Deflagration flame arrester, endurance burning proof, end-of-line (Continuation)								
	BE/HR-E	80 - 100 3" - 4"	IIB1	-	ATEX		X	34 - 36
	BE/HR 400	150 - 200 6" - 8"	IIA	D	ATEX		X	38 - 40
	LH/EB 400	150 - 400 6" - 16"	I	E	ATEX			42 - 44
Vent caps, end-of-line, without flame arrester unit								
	EH/0	20 - 80 ¾" - 3"						46 - 47
	EH/OS	100 - 600 4" - 24"						48 - 49
	E/KS	50 - 200 2" - 8"						50 - 51





Deflagration Flame Arrester, End-of-Line

PROTEGO® BE/AD



Function and Description

The BE/AD end-of-line deflagration flame arrester provides protection against atmospheric deflagrations. The device is typically installed on vent lines of small vessels and plants which are not pressurized. For safe application it is important that an endurance burning situation can be excluded, so typically it is installed on vents lines which discharge vapour for a short time period only. The device prevents flame transmission from atmospheric deflagration into the vessel or plant.

The BE/AD consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). The device is equipped with a metal weather hood. The FLAMEFILTER® gap size will depend on the devices intended use. Detailing the operating conditions such as the temperature, pressure, explosion group and the composition of the fluid, enables PROTEGO® to select the best end-of-line deflagration flame arrester for your application. The BE/AD series end-of-line deflagration flame arrester is available for substances from explosion groups IIA to IIC (NEC groups B to D). The standard design can be used with operating temperature of up to +60°C / 140°F.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- Weather hood provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- almost maintenance free
- quick removal of FLAMEFILTER®
- available with threaded connection
- provides protection against atmospheric deflagration
- low operating and lifecycle cost

Design Type and Specification

Deflagration flame arrester, end-of-line, basic design **BE/AD**

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	G ½" / 15	G ¾" / 20	G 1" / 25	G 1¼" / 32	G 1½" / 40	G 2" / 50
a	116 / 4.57	116 / 4.57	116 / 4.57	116 / 4.57	200 / 7.87	200 / 7.87
b	80 / 3.15	80 / 3.15	85 / 3.35	85 / 3.35	150 / 5.91	150 / 5.91

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
≥ 0,65 mm	IIB3	C	
< 0,5 mm	IIC	B	

Table 3: Selection of max. operating temperature (°C / °F)

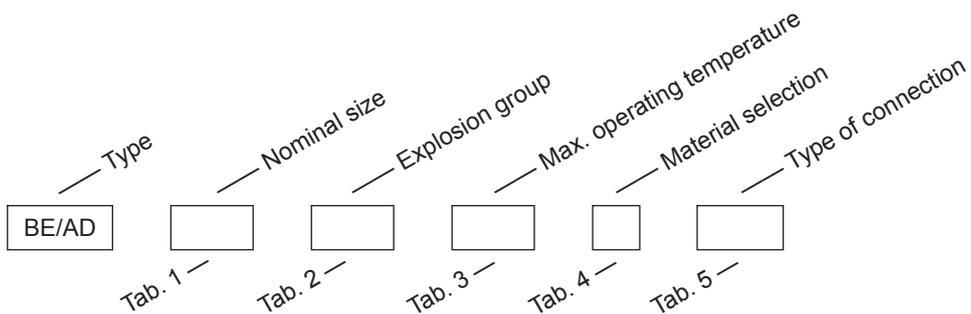
≤ 60°C / 140°F	≤ 100°C / 212°F	≤ 150°C / 302°F	≤ 180°C / 356°F	≤ 200°C / 392°F	≤ 250°C / 482°F	* upon request
(Standard)	X0*	X1*	X2*	X3*	X4*	

Table 4: Material selection

Design	A	B	C	Special materials upon request
Housing	Steel	Stainless steel	Hastelloy	
Weather hood	Stainless steel	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Stainless steel	Hastelloy	

Table 5: Type of connection

Pipe thread DIN ISO 228-1	DIN	other types of thread upon request
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**Order example**

BE/AD - 2" - IIB3 - (std) - A - DIN

Materials and chemical resistance: Technical information upon request



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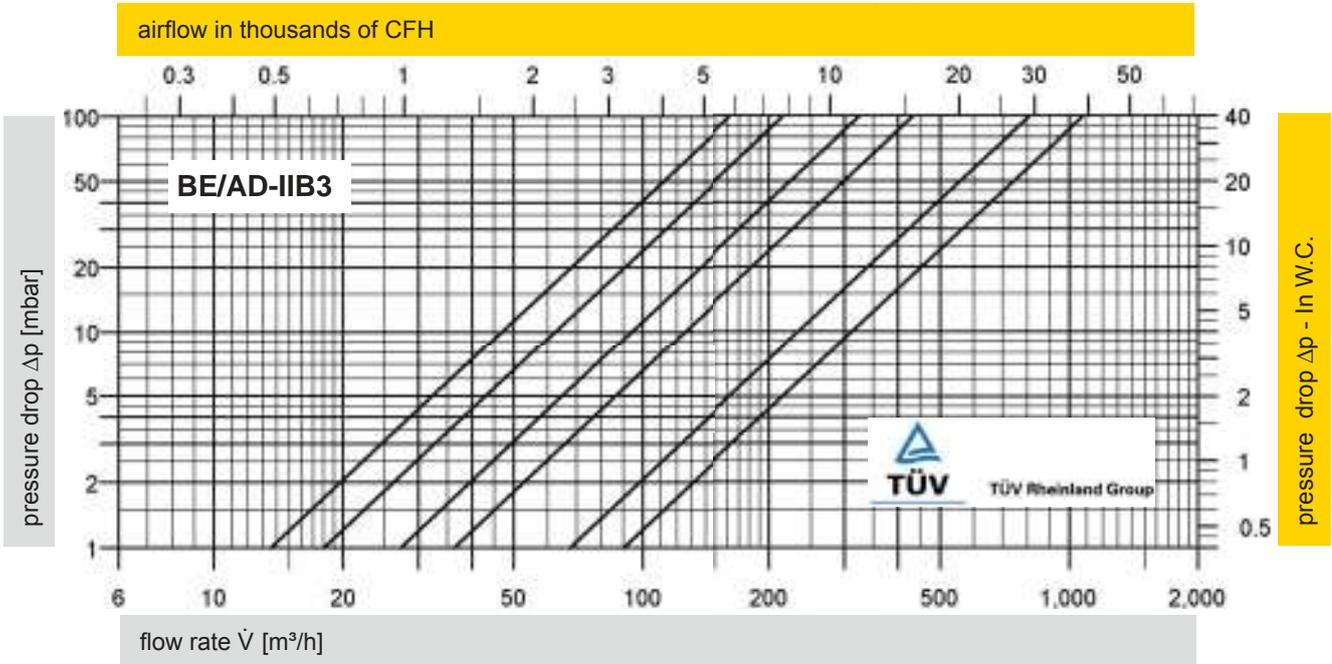


Deflagration Flame Arrester, End-of-Line

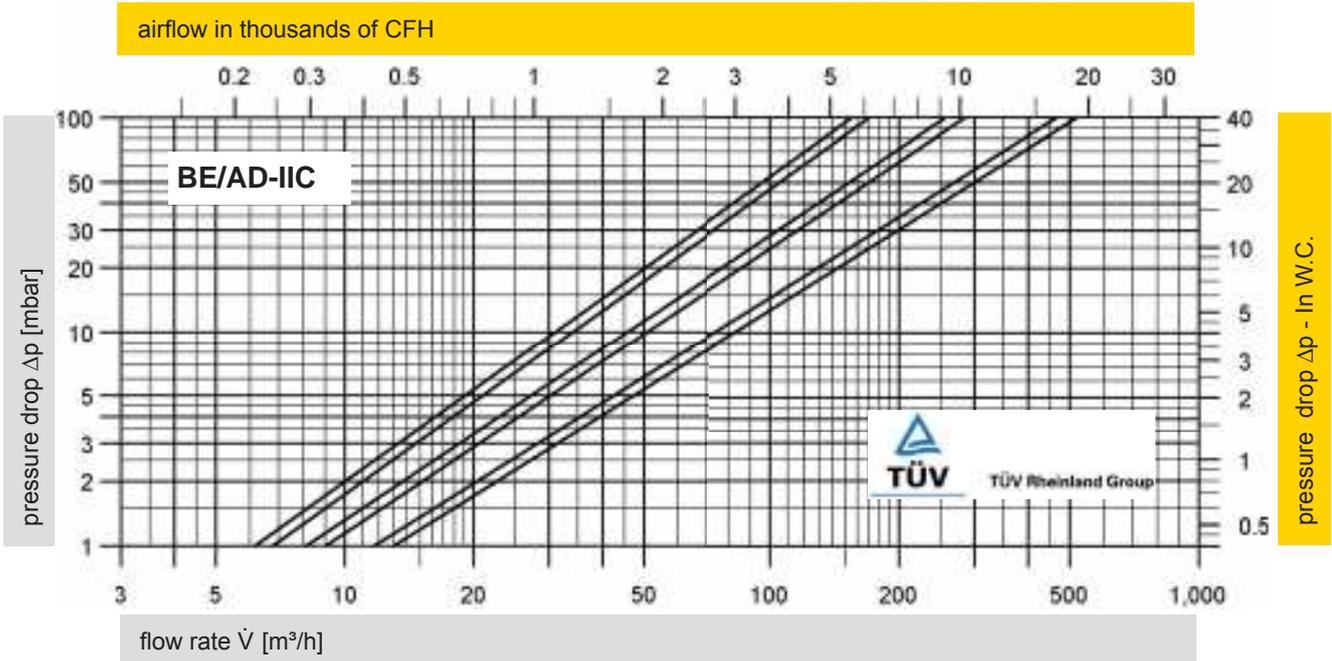
Flow Capacity Charts

PROTEGO® BE/AD

DN 15 / 1/2"
 DN 20 / 3/4"
 DN 25 / 1"
 DN 32 / 1 1/4"
 DN 40 / 1 1/2"
 DN 50 / 2"



DN 15 / 1/2"
 DN 20 / 3/4"
 DN 25 / 1"
 DN 32 / 1 1/4"
 DN 40 / 1 1/2"
 DN 50 / 2"

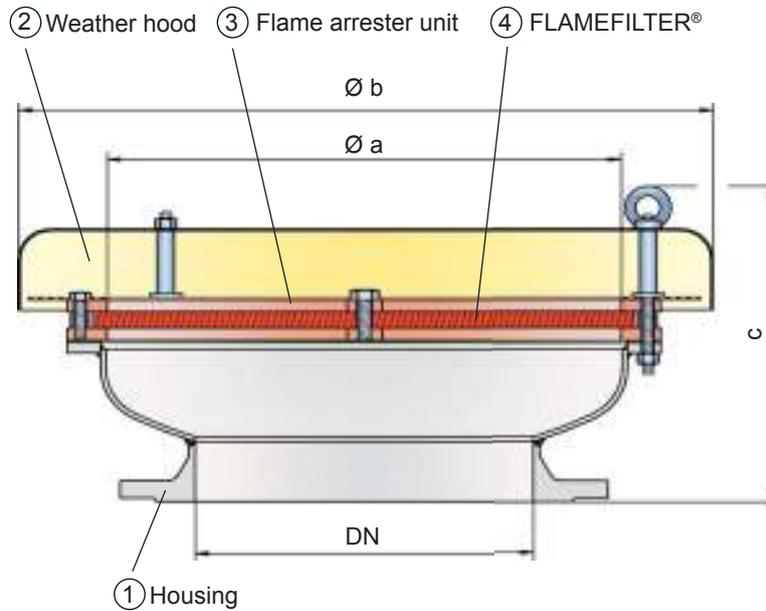


The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Deflagration Flame Arrester, End-of-Line

PROTEGO® LH/AD



Function and Description

The LH/AD end-of-line deflagration flame arrester provides protection against atmospheric deflagration. The device is typically installed on vent lines of vessels and plants which are not pressurized. For safe application it is important that an endurance burning situation can be excluded, so typically it is installed on vent lines which discharge vapour for a short time period only. The device prevents flame transmission from atmospheric deflagration into the vessel or plant.

The LH/AD consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). The device is equipped with a metal weather hood. A protection screen is installed between the weather hood and the housing to keep animals out. The FLAMEFILTER® (4) gap size will depend on the devices intended use. Detailing the operating conditions such as the temperature, pressure, explosion group and the composition of the fluid, enables PROTEGO® to select the best end-of-line deflagration flame arrester for your application. The LH/AD series end-of-line deflagration flame arrester is available for substances from explosion groups IIA to IIC (NEC groups B to D). The standard design can be used with operating temperature of up to +60°C / 140°F. Several devices of this design are tested and approved for higher temperatures.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- weather hood provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- available in sizes DN 50 (2") – up to DN 800 (32")
- easy maintenance
- cost effective spare parts
- available for elevated operating temperatures
- protection against atmospheric deflagration

Design Type and Specification

End-of-line deflagration flame arrester, basic design **LH/AD**

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	a	b	IIB3	IIC
			c	c
50 / 2"	100 / 3.94	200 / 7.87	170 / 6.69	185 / 7.28
80 / 3"	150 / 5.91	240 / 9.45	180 / 7.09	195 / 7.68
100 / 4"	200 / 7.87	295 / 11.61	220 / 8.66	235 / 9.25
150 / 6"	300 / 11.81	550 / 21.65	260 / 10.24	270 / 10.63
200 / 8"	300 / 11.81	550 / 21.65	260 / 10.24	270 / 10.63
250 / 10"	400 / 15.75	600 / 23.62	355 / 13.98	370 / 14.57
300 / 12"	400 / 15.75	600 / 23.62	350 / 13.78	365 / 14.37
350 / 14"	600 / 23.62	800 / 31.50	405 / 15.94	415 / 16.34
400 / 16"	600 / 23.62	800 / 31.50	400 / 15.75	410 / 16.14
500 / 20"	700 / 27.56	1000 / 39.37	415 / 16.34	430 / 16.93
600 / 24"	800 / 31.50	1200 / 47.24	485 / 19.09	505 / 19.88
700 / 28"	1000 / 39.37	1400 / 55.12	520 / 20.47	545 / 21.46
800 / 32"	1200 / 47.24	1600 / 62.99	560 / 22.05	585 / 23.03

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
≥ 0,65 mm	IIB3	C	
< 0,5 mm	IIC	B	

Table 3: Selection of max. operating temperature (°C / °F)

≤ 60°C / 140°F	≤ 100°C / 212°F	≤ 150°C / 302°F	≤ 180°C / 356°F	≤ 200°C / 392°F	≤ 250°C / 482°F	* upon request
(Standard)	X0*	X1*	X2*	X3*	X4*	

Table 4: Material selection

Design	A	B	Special materials upon request
Housing	Steel	Stainless steel	
Weather hood	Stainless steel	Stainless steel	
Protection screen	Stainless steel	Stainless steel	
Flame arrester unit	A	A,B	



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Deflagration Flame Arrester, End-of-Line

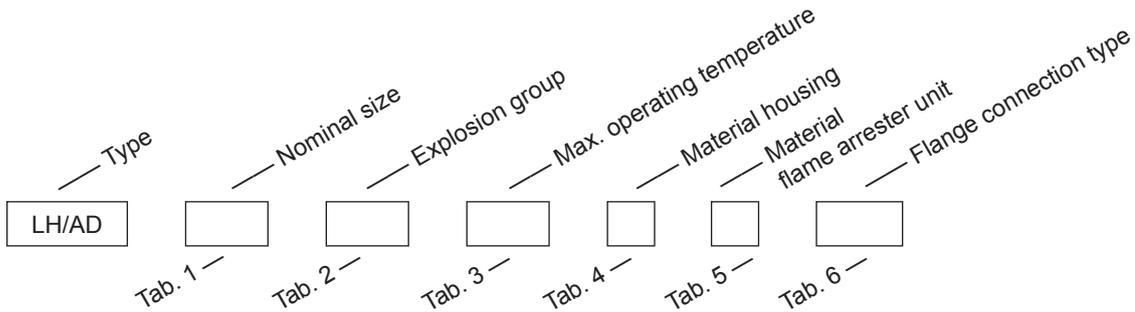
PROTEGO® LH/AD

Table 5: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Stainless steel	

Table 6: Flange connection type

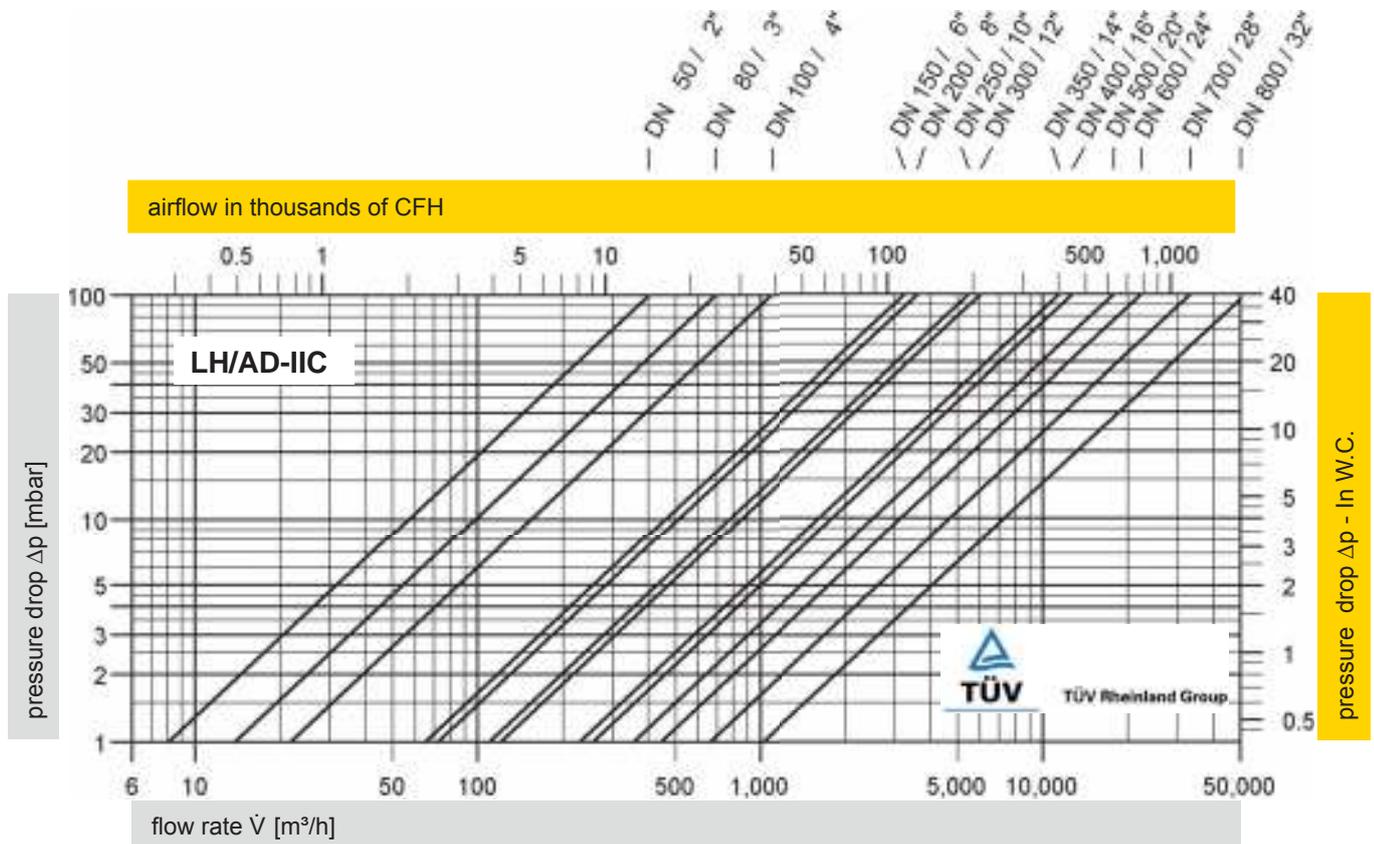
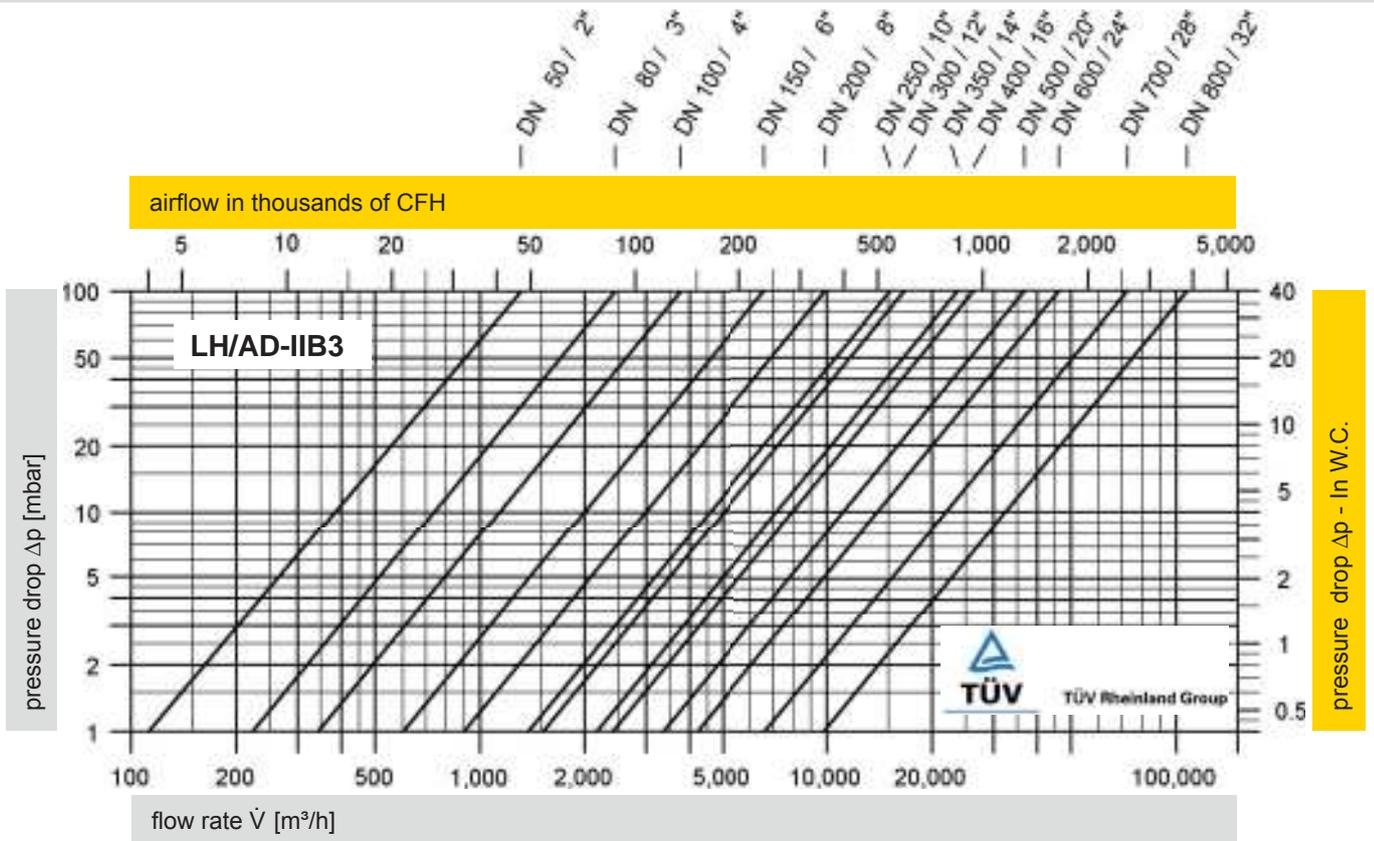
DIN 2501, Form C, PN 16, from DN 200 PN10	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example



Materials and chemical resistance: Technical information upon request



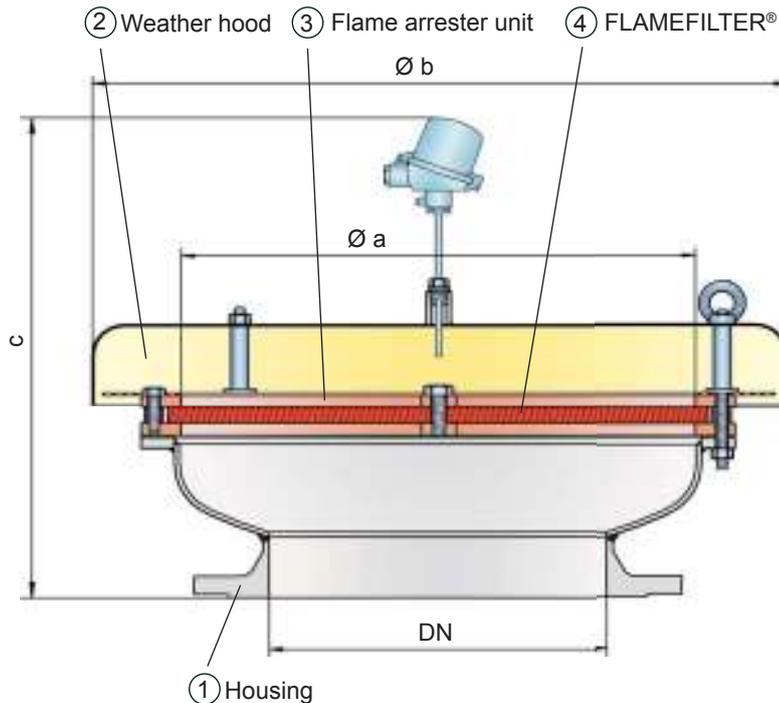
The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.





Deflagration Flame Arrester, short time burning-proof, End-of-Line

PROTEGO® LH/AD-T



Function and Description

The LH/AD-T end-of-line deflagration flame arrester provides protection against atmospheric deflagration and short time burning on the flame arrester element. The device is typically installed on vent lines of vessels and plants which are not pressurized. The device is equipped with a temperature sensor which immediately detects a flame on the FLAMEFILTER® surface. After the flame is detected, a secondary measure, such as inerting or closing of a shut-off valve to block the vapour flow to the device, should activate within 60 seconds and extinguish the flame, so that the plant can operate safely. The device prevents flame transmission from short time burning and atmospheric deflagration into the vessel or plant.

The LH/AD-T consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). The device is equipped with a metal weather hood. The FLAMEFILTER® (4) gap size depends on the devices intended use. Detailing the operating conditions such as the temperature, pressure, explosion group and the composition of the fluid, enables PROTEGO® to select the best end-of-line deflagration flame arrester for your application. The LH/AD series end-of-line deflagration flame arrester is available for substances from explosion groups IIA to IIC (NEC groups B to D). The standard design can be used with operating temperature of up to +60°C / 140°F. Several devices of this design are tested and approved for higher temperatures.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- weather hood provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- available in sizes DN 50 (2") – up to DN 800 (32")
- easy maintenance
- cost effective spare parts
- available for elevated operating temperatures
- protection against short time burning and atmospheric deflagration

Design Type and Specification

End-of-line deflagration flame arrester, basic design **LH/AD-T**

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	a	b	IIB3	IIC
			c	c
50 / 2"	100 / 3.94	240 / 9.45	530 / 20.87	550 / 21.65
80 / 3"	150 / 5.91	295 / 11.61	560 / 22.05	580 / 22.83
100 / 4"	200 / 7.87	350 / 13.78	585 / 23.03	605 / 23.82
150 / 6"	300 / 11.81	600 / 23.62	630 / 24.80	655 / 25.79
200 / 8"	300 / 11.81	600 / 23.62	630 / 24.80	655 / 25.79
250 / 10"	400 / 15.75	800 / 31.50	750 / 29.53	770 / 30.31
300 / 12"	400 / 15.75	800 / 31.50	740 / 29.13	760 / 29.92
350 / 14"	600 / 23.62	1000 / 39.37	800 / 31.50	820 / 32.28
400 / 16"	600 / 23.62	1000 / 39.37	790 / 31.10	815 / 32.09
500 / 20"	700 / 27.56	1200 / 47.24	810 / 31.89	835 / 32.87
600 / 24"	800 / 31.50	1200 / 47.24	935 / 36.81	960 / 37.80
700 / 28"	1000 / 39.37	1500 / 59.06	975 / 38.39	995 / 39.17
800 / 32"	1200 / 47.24	1700 / 66.93	1015 / 39.96	1035 / 40.75

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
≥ 0,65 mm	IIB3	C	
< 0,5 mm	IIC	B	

Table 3: Selection of max. operating temperature (°C / °F)

≤ 60°C / 140°F	≤ 100°C / 212°F	≤ 150°C / 302°F	≤ 180°C / 356°F	≤ 200°C / 392°F	≤ 250°C / 482°F	* upon request
(Standard)	X0*	X1*	X2*	X3*	X4*	

Table 4: Material selection

Design	A	B	Special materials upon request
Housing	Steel	Stainless steel	
Weather hood	Stainless steel	Stainless steel	
Protection screen	Stainless steel	Stainless steel	
Flame arrester unit	A	A,B	





Deflagration Flame Arrester, short time burning-proof, End-of-Line

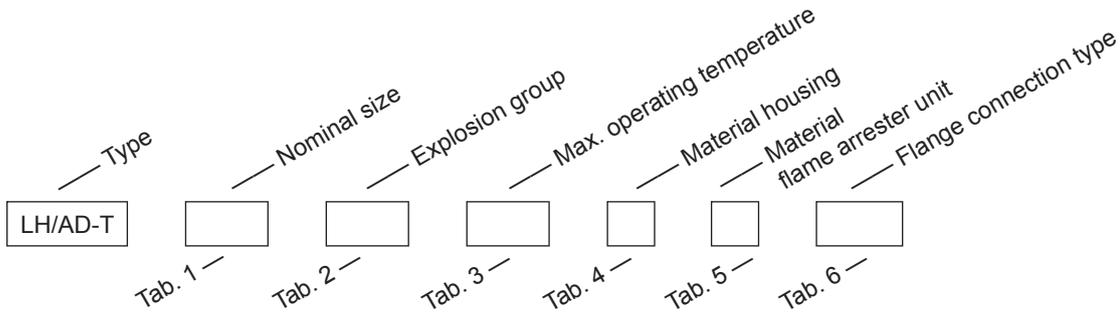
PROTEGO® LH/AD-T

Table 5: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Stainless steel	

Table 6: Flange connection type

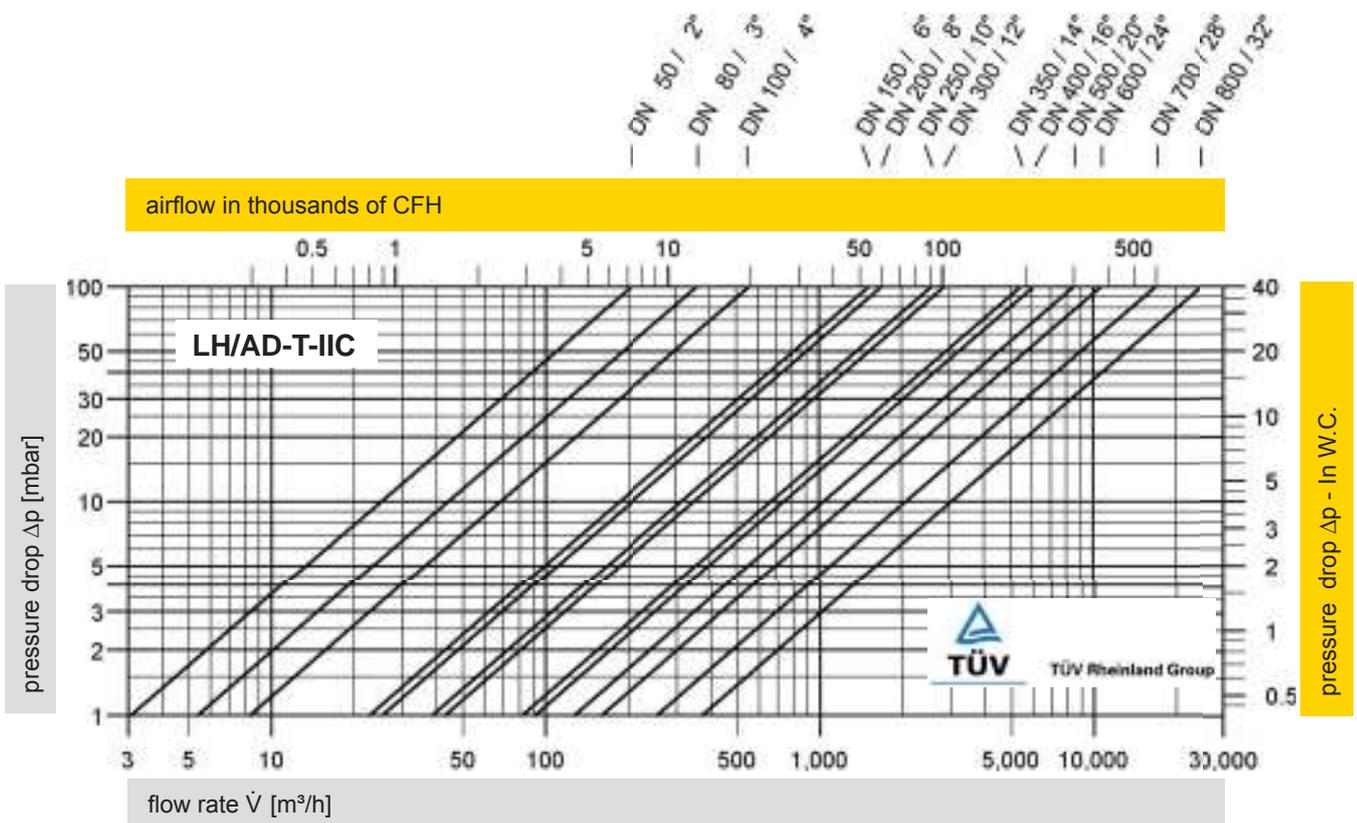
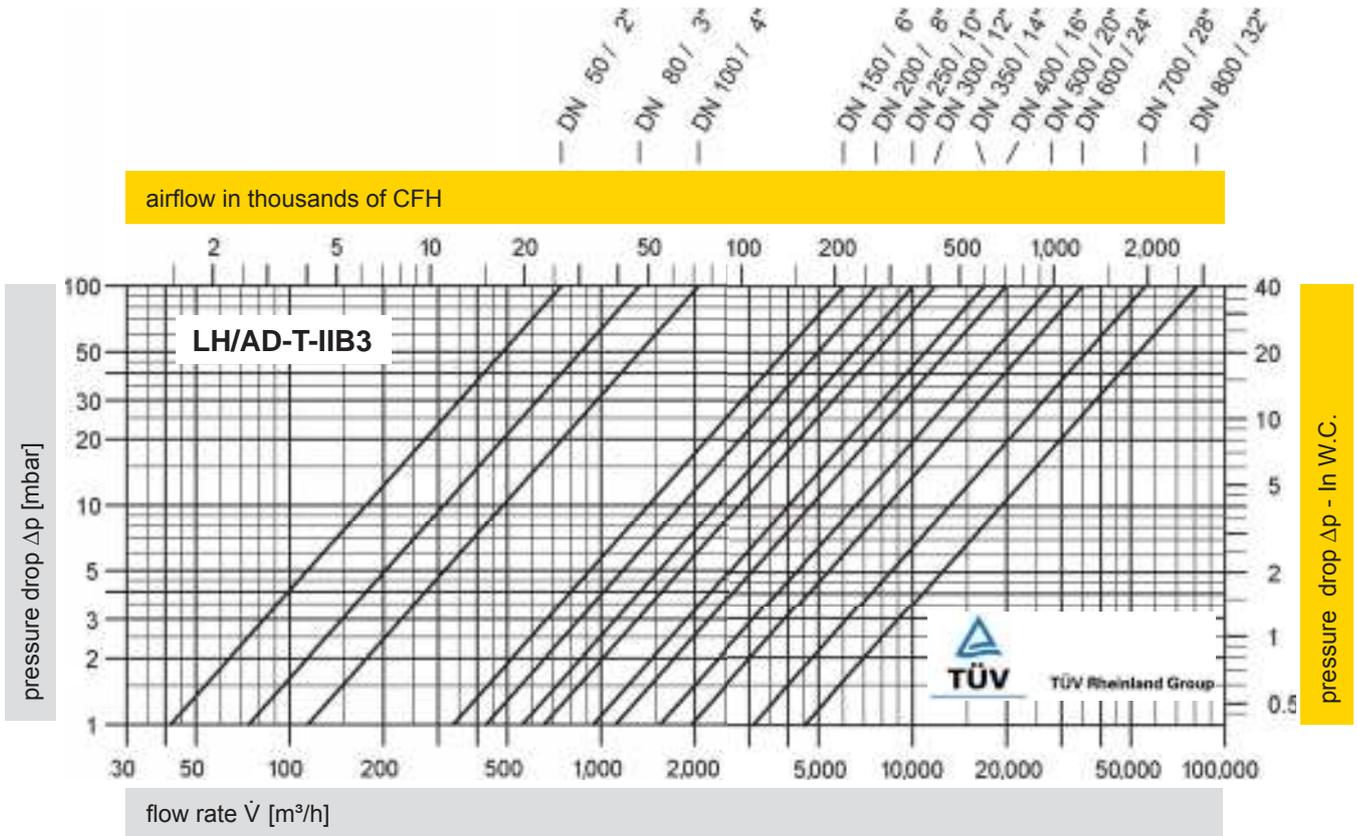
DIN 2501, Form C, PN 16, from DN 200 PN10	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example

LH/AD-T - 800 - IIC - (std) - A - A - DIN

Materials and chemical resistance: Technical information upon request



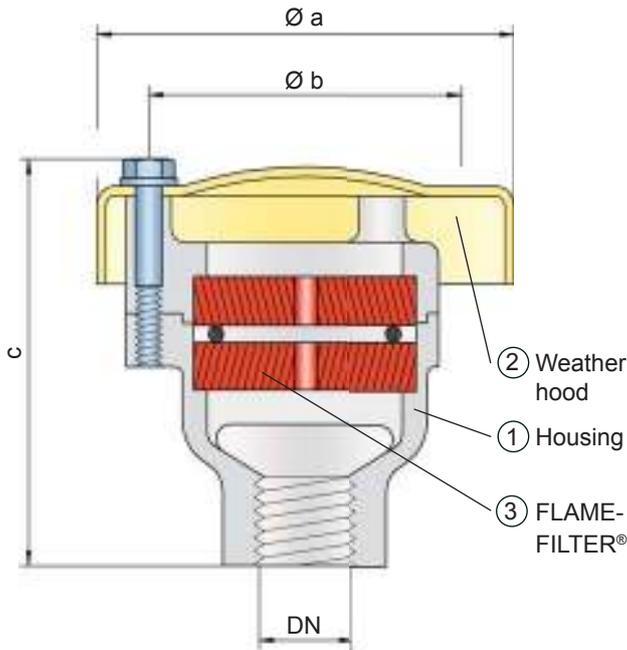
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Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HZ



The BE/HZ consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit. The weather hood is made out of acrylic glass, which will melt when impacted by flames and allow heat to dissipate to the environment. The flame arrester unit consists of two FLAMEFILTER® (3), which are installed in the housing.

The standard design can be used for operating temperatures up to +60°C / 140°F.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other internationally accepted standards.

Special Features and Advantages

- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- cost effective protection for small vessels and plants
- modular design allows replacement of single FLAMEFILTER®
- modular design results in low spare part costs
- protection against atmospheric deflagration and endurance burning

Design Type and Specification

End-of-line deflagration flame arrester, basic design **BE/HZ**

Function and Description

For many years the PROTEGO® BE/HZ end-of-line deflagration flame arrester has been successfully used to protect small vessels and plants which are not pressurized. The device provides protection against atmospheric deflagration and stabilized flames which can burn for very long time on the flame arrester element surface, so called endurance burning. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propagating into the vessel or plant.

Table 1: Dimensions

Dimensions in mm / inches

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

DN	15 / ½"	20 / ¾"	25 / 1"	32 / 1¼"
a	87 / 3.43	87 / 3.43	114 / 4.49	114 / 4.49
b	80 / 3.15	80 / 3.15	100 / 3.94	100 / 3.94
c	85 / 3.35	85 / 3.35	90 / 3.54	90 / 3.54

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	A	B
Housing	Steel	Stainless steel
Weather hood	Acrylic glass	Acrylic glass
Flame arrester unit	A	A,B

Special materials upon request

Table 4: Material combinations of flame arrester unit

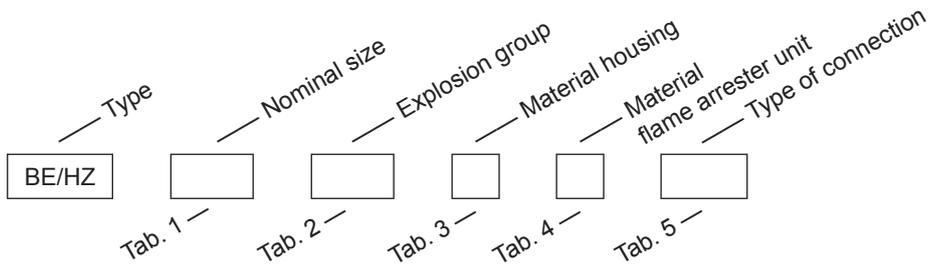
Design	A	B
FLAMEFILTER®	Stainless steel	Hastelloy
Spacer	Stainless steel	Hastelloy

Table 5: Type of connection

Pipe thread DIN ISO 228T1

DIN

other types of thread upon request

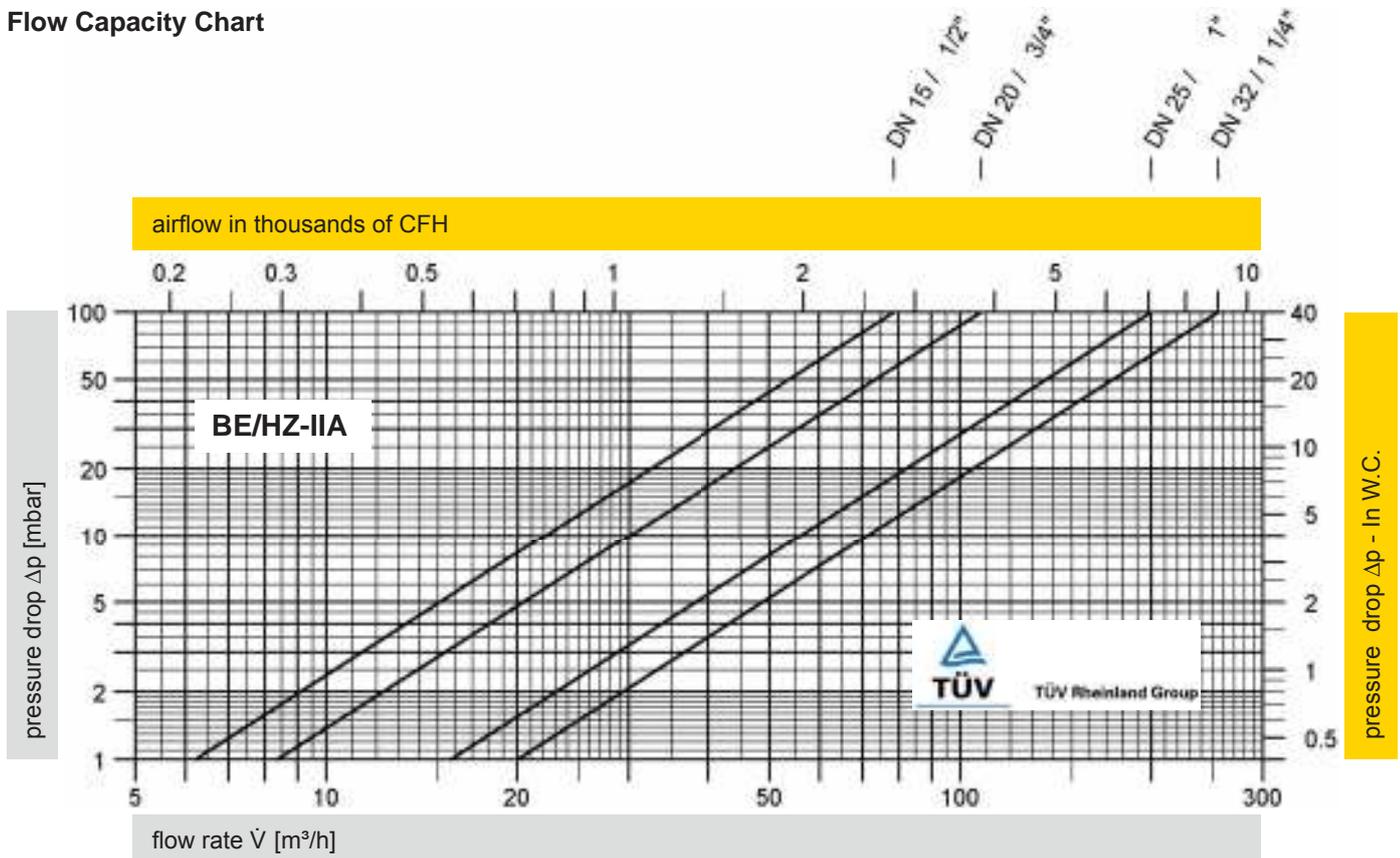


Order example



Materials and chemical resistance: Technical information upon request

Flow Capacity Chart



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 SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



for safety and environment

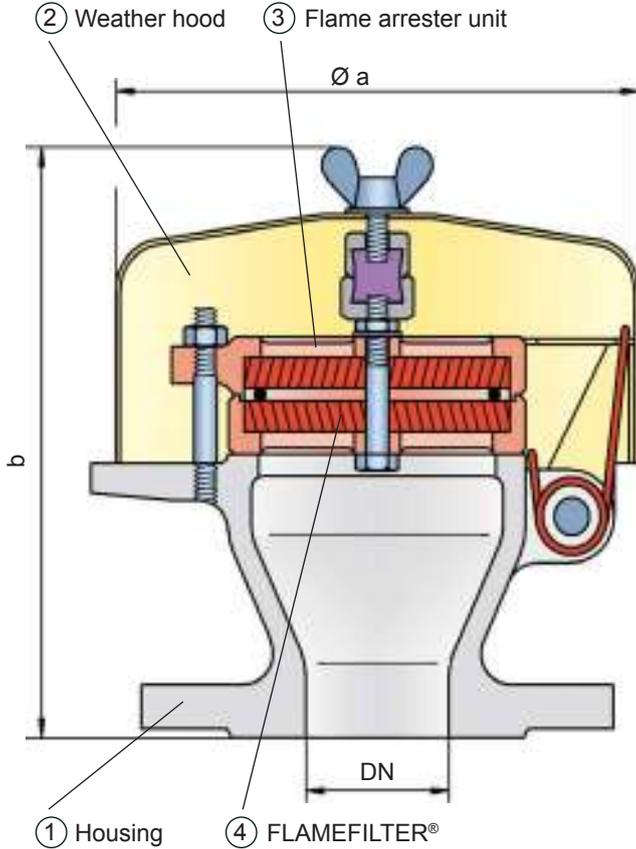


Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HK



FM Approvals
Specification Tested



located in a center position, will melt and let the spring loaded weather hood move into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage. The FLAMEFILTER® gap size depends on the devices intended use. Detailing the operating conditions such as the temperature, pressure, explosion group and the composition of the fluid, enables PROTEGO® to select the best end-of-line deflagration flame arrester for your application. The BE/HK series end-of-line deflagration flame arrester is available for substances from explosion groups IIA to IIB3 (NEC groups C to D). In a modified design, this device is also available for Ethanol applications.

The standard design can be used with operating temperature of up to +60°C / 140°F.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood will open and signal the impact of a flame
- weather hood out of metal don't produce secondary combustion, as created from plexiglass hoods residues
- endurance burning protection for IIB3 and IIA vapour (NEC group C and D)
- fusible link is resistant against chemicals
- modular design allows replacement of single FLAMEFILTER®
- modular design results in low spare part costs
- protection against atmospheric deflagration and endurance burning

Design Types and Specifications

There are two different designs:

End-of-line deflagration flame arrester, basic design **BE/HK - []**

End-of-line deflagration flame arrester with heating jacket **BE/HK - [H]**

Special designs available on request

Function and Description

For many years the PROTEGO® BE/HK end-of-line deflagration flame arrester has been successfully used to protect vessels and plants which are not pressurized. The device provides protection against atmospheric deflagration and stabilized flames which can burn for very long time on the flame arrester element surface, so called endurance burning. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propagating into the vessel or plant.

The BE/HK consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation the metal weather hood is in a closed position. If a stabilized flame burns on the flame arrester element surface, the fusible link,

Table 1: Dimensions

Dimensions in mm / inches

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

Exp. Gr.	DN	20 / ¾"	25 / 1"	32 / 1¼"	40 / 1½"	50 / 2"	65 / 2½"	80 / 3"
	a		163 / 6.42	163 / 6.42	163 / 6.42	183 / 7.20	183 / 7.20	218 / 8.58
IIA	b	175 / 6.89	175 / 6.89	175 / 6.89	190 / 7.48	190 / 7.48	200 / 7.87	200 / 7.87
IIB3	b	180 / 7.09	180 / 7.09	180 / 7.09	190 / 7.48	190 / 7.48	200 / 7.87	200 / 7.87

Dimensions for deflagration flame arrester with heating jacket upon request

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

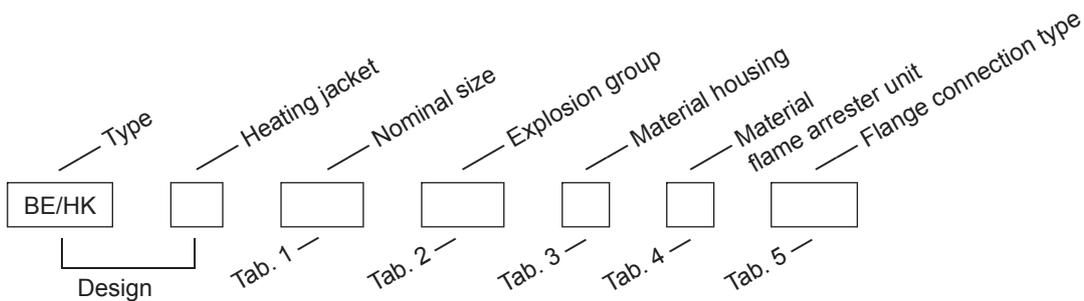
Design	A	B	C	Special materials upon request
Housing	Ductile Iron	Steel	Stainless steel	
Weather hood	Steel	Steel	Stainless steel	
Flame arrester unit	A	A	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Hastelloy	
Spacer	Stainless steel	Hastelloy	

Table 5: Flange connection type

DIN 2501, Form C, PN 16	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example

BE/HK - H - 80 - IIA - B - B - DIN

Materials and chemical resistance: Technical information upon request



for safety and environment



Deflagration Flame Arrester, endurance burning proof, End-of-Line Flow Capacity Charts

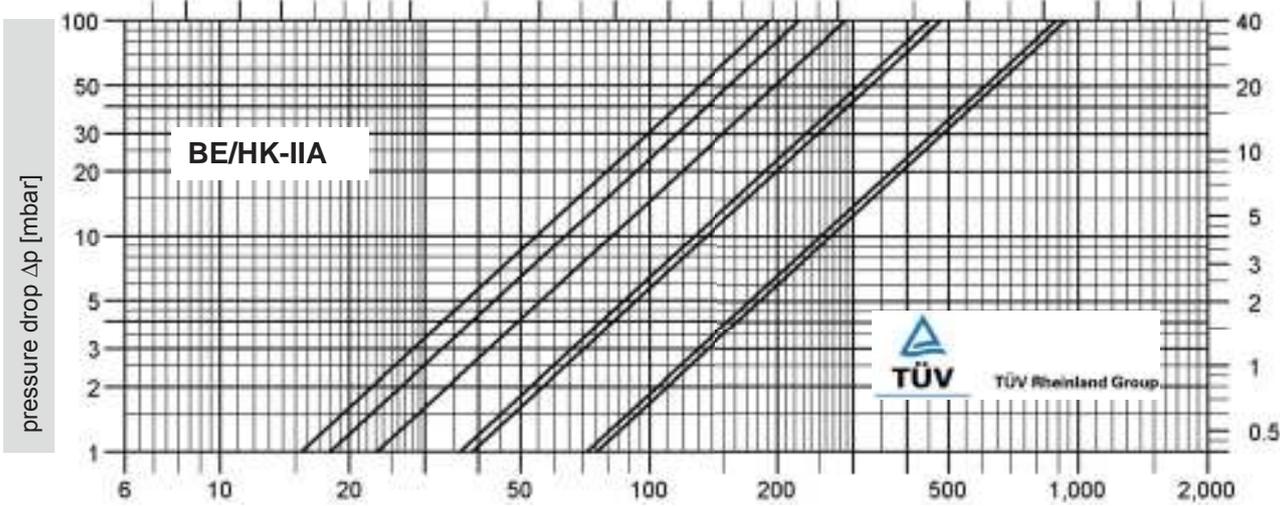
PROTEGO® BE/HK



FM Approvals
Specification Tested

DN 20 / 3/4"
DN 25 / 1"
DN 32 / 1 1/4"
DN 40 / 1 1/2"
DN 50 / 2"
DN 65 / 2 1/2"
DN 80 / 3"

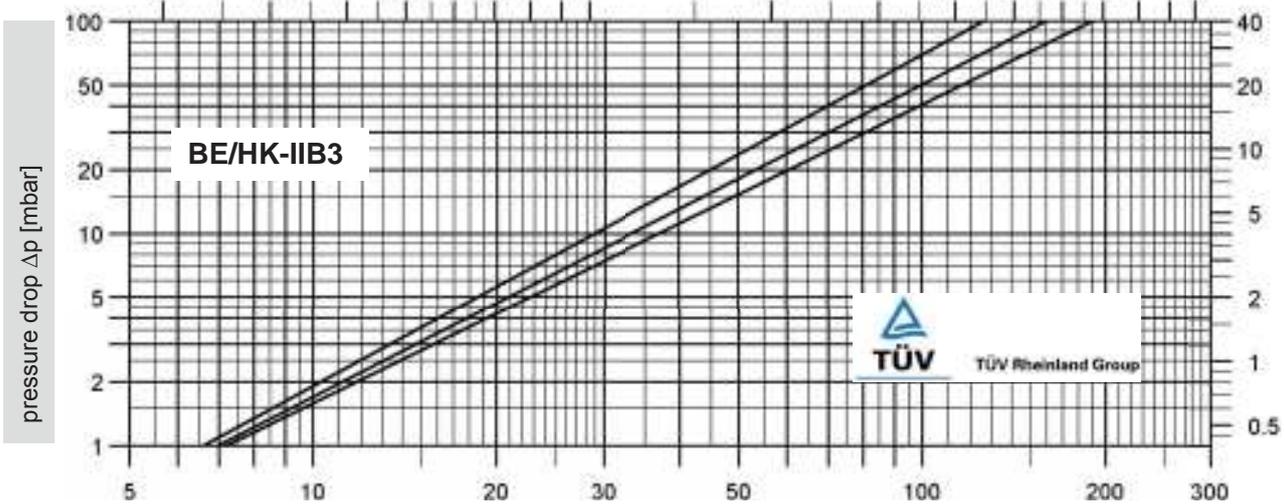
airflow in thousands of CFH



flow rate \dot{V} [m³/h]

DN 20 / 3/4"
DN 25 / 1"
DN 32 / 1 1/4"

airflow in thousands of CFH



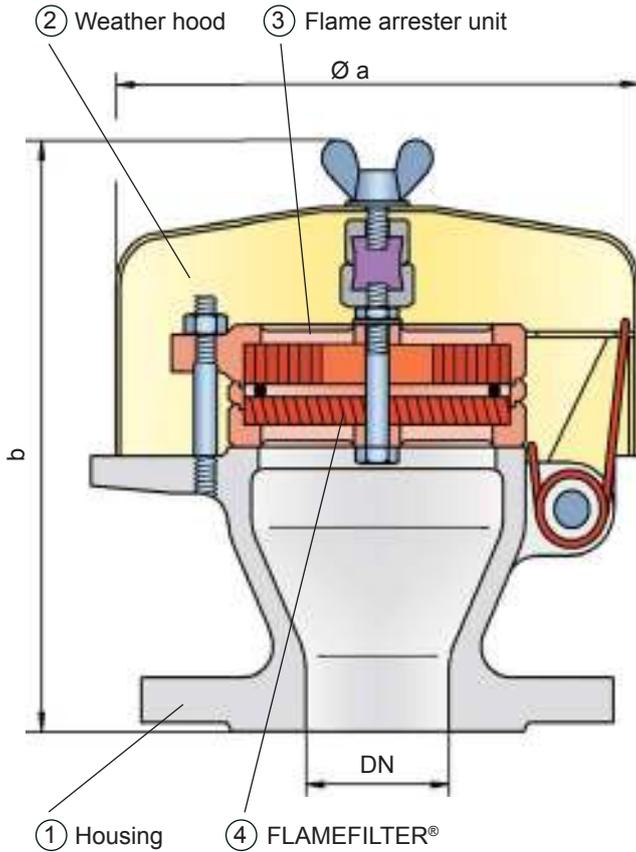
flow rate \dot{V} [m³/h]

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 SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HK-E



flame burns on the flame arrester element surface, the fusible link, located in a center position, will melt and let the spring loaded weather hood move into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage.

The BE/HK-E end-of-line deflagration flame arrester is available for alcohols and other substances with MESG $\geq 0,85\text{mm}$.

The standard design can be used for operating temperatures up to $+60^\circ\text{C} / 140^\circ\text{F}$.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other internationally accepted standards.

Special Features and Advantages

- endurance burning protection for alcohols and hydrocarbons with MESG $\geq 0,85\text{mm}$.
- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood will open and signal the impact of a flame
- weather hood out of from metal don't produce secondary combustion, as created from plexiglass hoods residues
- fusible link is resistant against chemicals
- modular design allows replacement of single FLAMEFILTER®
- modular design results in low spare part costs
- protection against atmospheric deflagration and endurance burning

Design Types and Specifications

There are two different designs:

End-of-line deflagration flame arrester, basic design

BE/HK-E -

End-of-line deflagration flame arrester with heating jacket

BE/HK-E -

Special designs available on request

Function and Description

The PROTEGO® BE/HK-E end-of-line deflagration flame arrester was specifically developed for vessels which are not pressurized and store Ethanol or other alcohols. The combustion of alcohol requires a modified flame arrester element design to provide protection against endurance burning. In addition, the device provides protection against atmospheric deflagration. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propogating into the vessel or plant.

The BE/HK-E consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation the metal weather hood is in a closed position. If a stabilized

Table 1: Dimensions

Dimensions in mm / inches

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

DN	20 / ¾"	25 / 1"	32 / 1¼"	40 / 1½"	50 / 2"	65 / 2½"	80 / 3"
a	163 / 6.42	163 / 6.42	163 / 6.42	183 / 7.20	183 / 7.20	218 / 8.58	218 / 8.58
b	180 / 7.09	180 / 7.09	180 / 7.09	190 / 7.48	190 / 7.48	200 / 7.87	200 / 7.87

Dimensions for deflagration flame arrester with heating jacket upon request

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
≥ 0,85 mm	IIB1	-	

Table 3: Material selection for housing

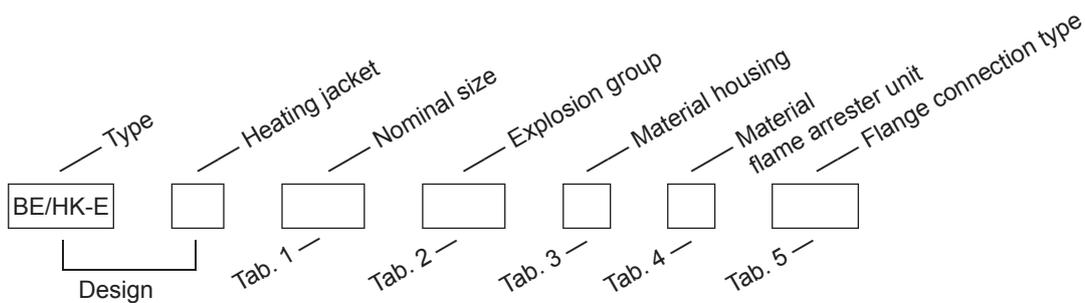
Design	A	B	C	Special materials upon request
Housing	Ductile Iron	Steel	Stainless steel	
Weather hood	Steel	Steel	Stainless steel	
Flame arrester unit	A	A	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Hastelloy	
Spacer	Stainless steel	Hastelloy	

Table 5: Flange connection type

DIN 2501, Form C, PN 16	DIN	other types DIN upon request
ANSI 150 lbs RF5F	ANSI	



Order example

BE/HK-E - H - 80 - IIB1 - B - B - DIN

Materials and chemical resistance: Technical information upon request

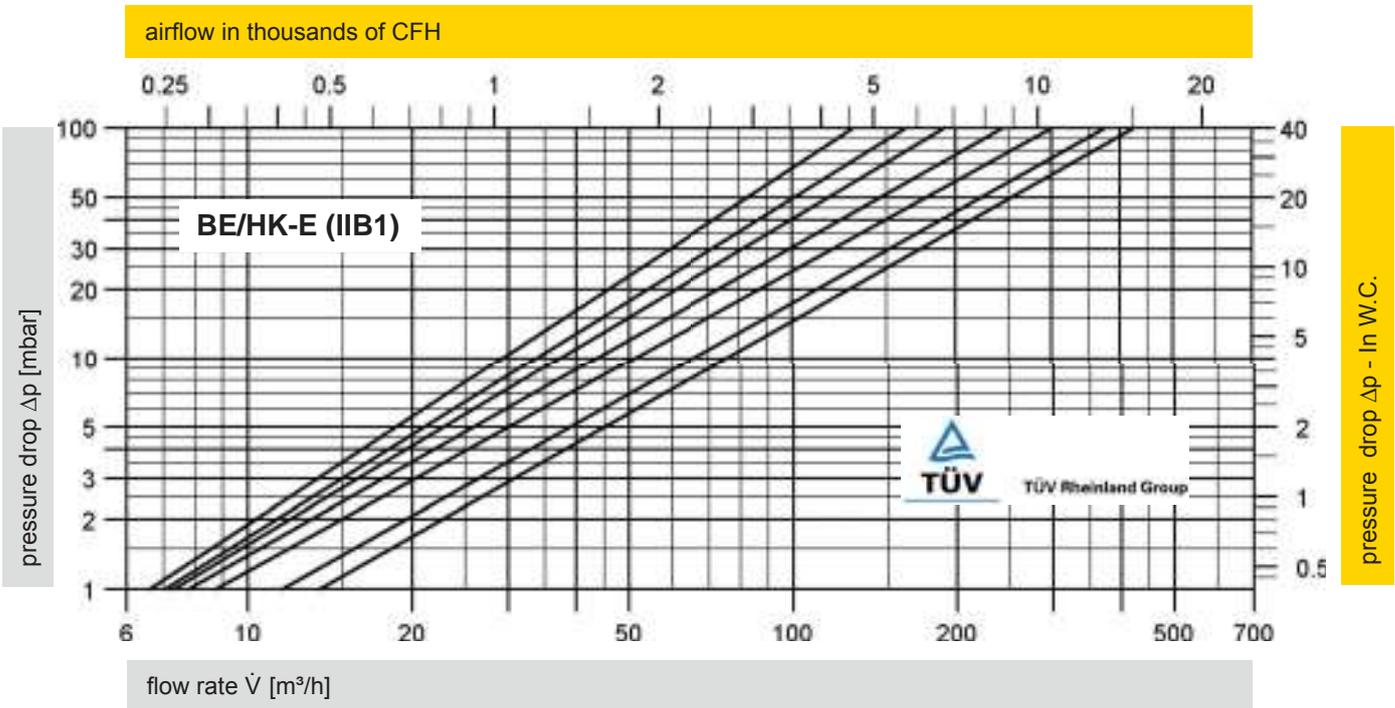




Deflagration Flame Arrester, endurance burning proof, End-of-Line Flow Capacity Charts

PROTEGO® BE/HK-E

DN 20 / 3/4"
DN 25 / 1"
DN 32 / 1 1/4"
DN 40 / 1 1/2"
DN 50 / 2"
DN 65 / 2 1/2"
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 [m^3/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.

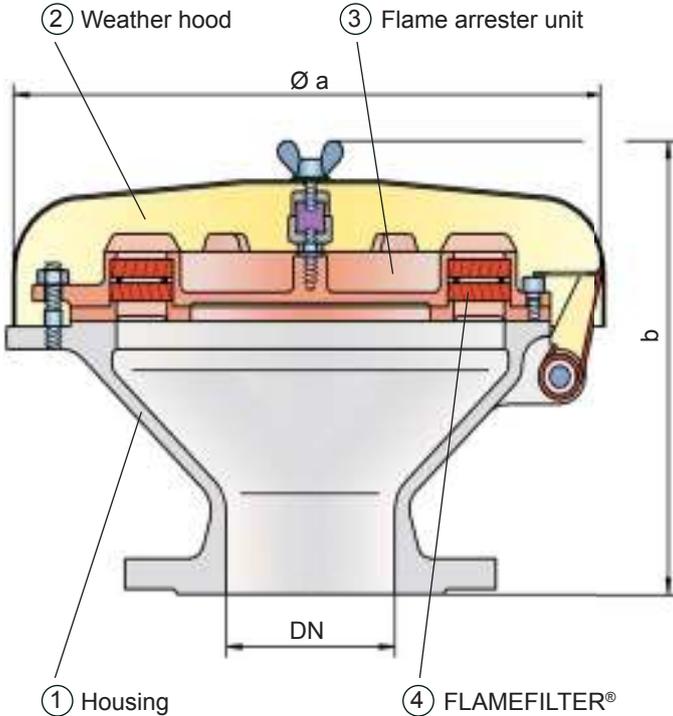


Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HR



FM Approvals
Specification Tested



Function and Description

For many years the PROTEGO® BE/HR end-of-line deflagration flame arrester has been successfully used to protect vessels and plants which are not pressurized. The device provides protection against atmospheric deflagration and stabilized flames which can burn for very long time on the flame arrester element surface, so called endurance burning. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propagating into the vessel or plant.

The BE/HR consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation the metal weather hood is in a closed position. If a flame burns on the flame arrester element surface, the fusible link, located in a center position, will melt and let the spring loaded weather hood move into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage. The FLAMEFILTER® gap size will

depend on the devices intended use. Detailing the operating conditions such as the temperature, pressure, explosion group and the composition of the fluid, enables PROTEGO® to select the best end-of-line deflagration flame arrester for your application. The BE/HR series end-of-line deflagration flame arrester is available for substances from explosion groups IIA to IIB3 (NEC groups C to D). In a modified design, this device is also available for Ethanol applications.

The standard design can be used with operating temperature of up to +60°C / 140°F. Several devices of this design are tested and approved for elevated temperatures.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- protection against atmospheric deflagration and endurance burning
- endurance burning protection for IIB3 and IIA vapour (NEC groups C and D)
- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood opens and signal the impact of a flame
- fusible link is resistant against chemicals
- weather hood out of metal don't produce secondary combustion, as created from plexiglass hoods residues
- modular design allows replacement of single FLAMEFILTER®
- modular design results in low spare part costs

Design Types and Specifications

There are two different designs:

End-of-line deflagration flame arrester, basic design

BE/HR -

End-of-line deflagration flame arrester with heating jacket

BE/HR -

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	80 / 3"	100 / 4"	Dimensions for deflagration flame arrester with heating jacket upon request
a	353 / 13.90	353 / 13.90	
b	250 / 9.84	250 / 9.84	

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

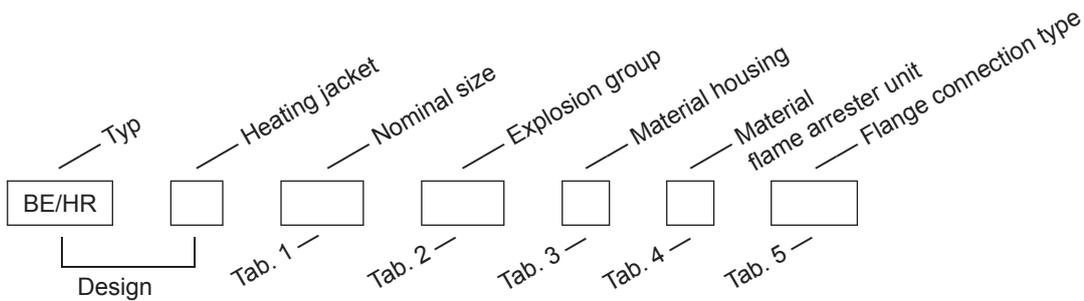
Design	A	B	C	Special materials upon request
Housing	Ductile Iron	Steel	Stainless steel	
Weather hood	Steel	Steel	Stainless steel	
Flame arrester unit	A	A	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Hastelloy	
Spacer	Stainless steel	Hastelloy	

Table 5: Flange connection type

DIN 2501, Form C, PN 16	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example

BE/HR - H - 100 - IIB3 - B - B - DIN

Materials and chemical resistance: Technical information upon request





Deflagration Flame Arrester, endurance burning proof, End-of-Line

Flow Capacity Charts

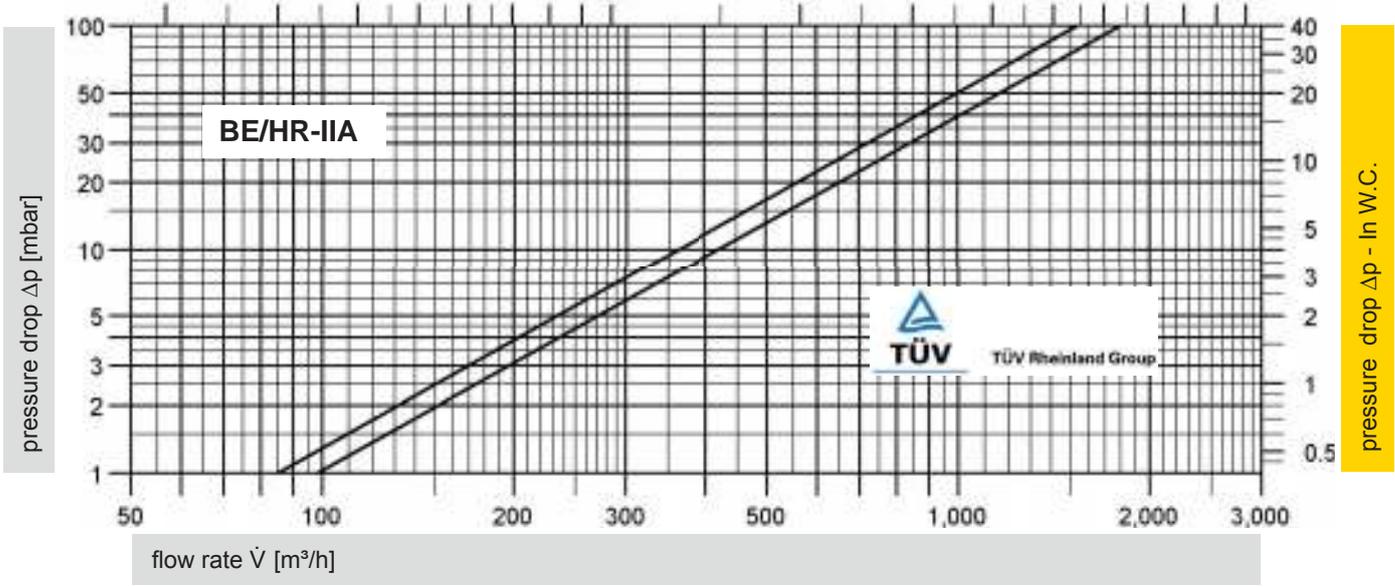
PROTEGO® BE/HR



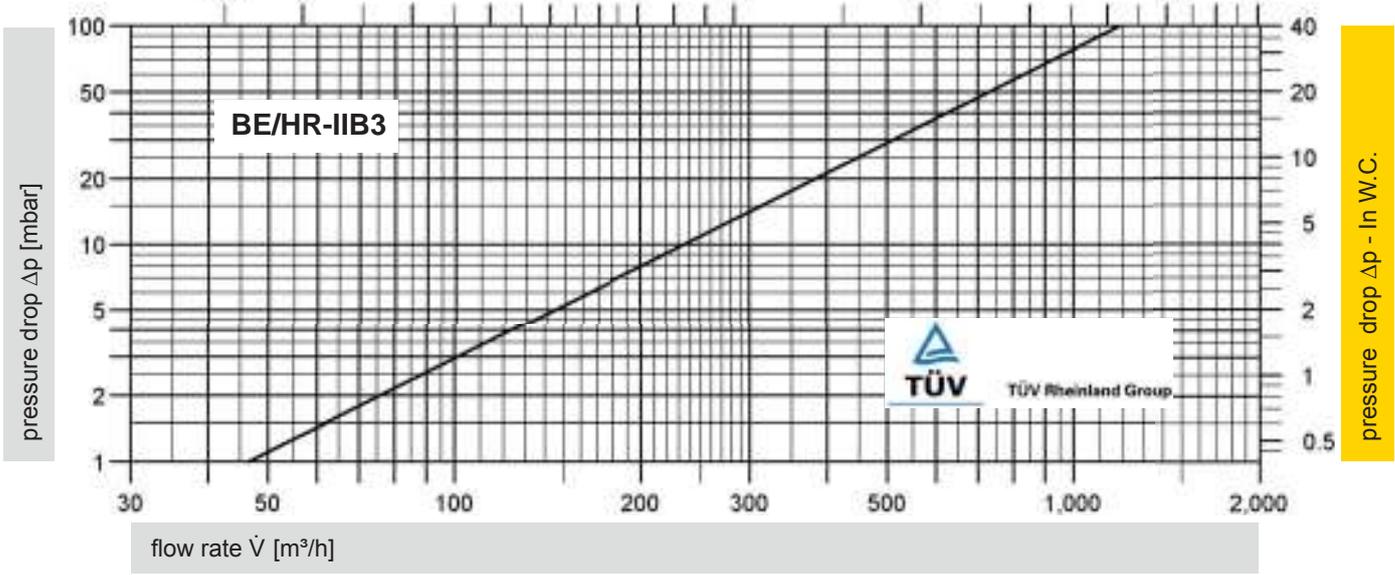
FM Approvals
Specification Tested

DN 80 / 3"
DN 100 / 4"

airflow in thousands of CFH



airflow in thousands of CFH

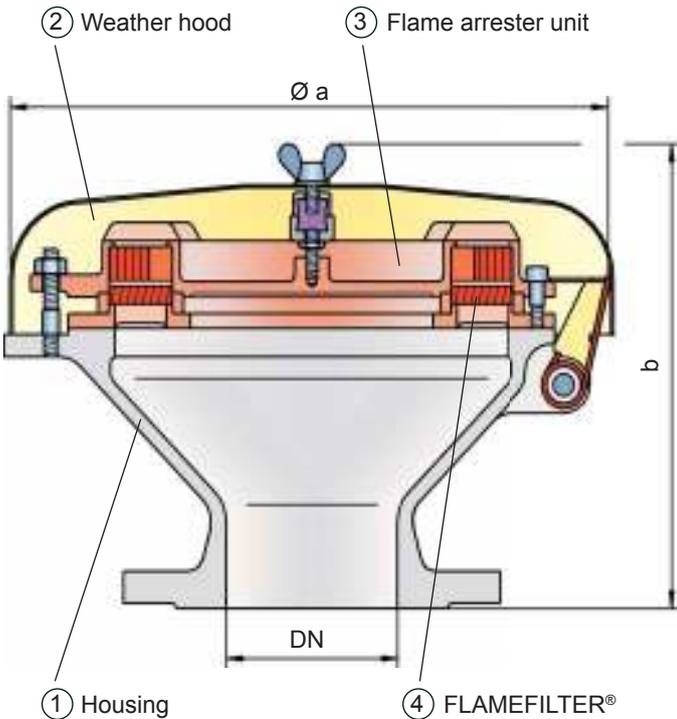


The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HR-E



The BE/HR-E end-of-line deflagration flame arrester is available for alcohols and other substances with a MESG $\geq 0,85$ mm.

The standard design can be used for operating temperatures up to $+60^{\circ}\text{C} / 140^{\circ}\text{F}$.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other internationally accepted standards.

Special Features and Advantages

- endurance burning protection for alcohols and hydrocarbons with a MESG $\geq 0,85$ mm
- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood opens and signal the impact of a flame
- weather hood out of metal don't produce secondary combustion, as created from plexiglass hoods residues
- fusible link is resistant against chemicals
- modular design allows replacement of single FLAMEFILTER®
- modular design results in low spare part costs
- protection against atmospheric deflagration and endurance burning

Design Types and Specifications

There are two different designs:

End-of-line deflagration flame arrester, basic design **BE/HR - E -**

End-of-line deflagration flame arrester with heating jacket **BE/HR - E -**

Special designs available on request

Function and Description

The PROTEGO® BE/HR-E end-of-line deflagration flame arrester was specifically developed for vessels which are not pressurized and store Ethanol or other alcohols with a MESG $\geq 0,85$ mm. The combustion of alcohol requires a modified flame arrester element design to provide protection against endurance burning. In addition, the device provides protection against atmospheric deflagration. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propagating into the vessel or plant.

The BE/HR-E consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation, the metal weather hood is in a closed position. If a flame burns on the flame arrester element surface, the fusible link, located in a center position, will melt and let the spring loaded weather hood move into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage.

Table 1: Dimensions

Dimensions in mm / inches

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

DN	80 / 3"	100 / 4"	Dimensions for deflagration flame arrester with heating jacket upon request
a	353 / 13.90	353 / 13.90	
b	250 / 9.84	250 / 9.84	

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
≥ 0,85 mm	IIB1	-	

Table 3: Material selection for housing

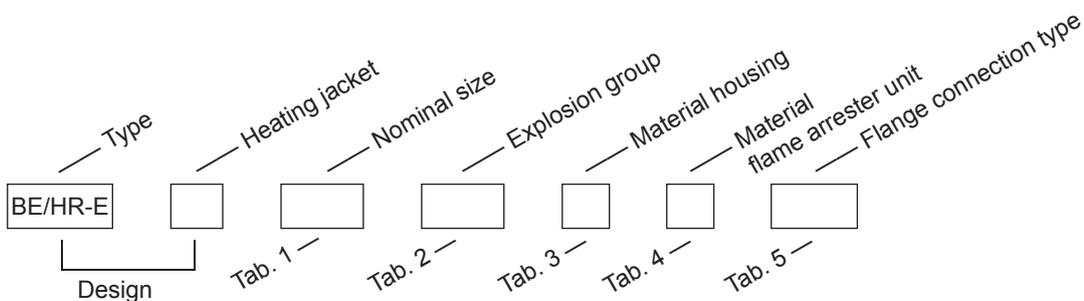
Design	A	B	C	Special materials upon request
Housing	Ductile Iron	Steel	Stainless steel	
Weather hood	Steel	Steel	Stainless steel	
Flame arrester unit	A	A	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Hastelloy	
Spacer	Stainless steel	Hastelloy	

Table 5: Flange connection type

DIN 2501, Form C, PN 16	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example

BE/HR-E - H - 80 - IIB1 - B - B - DIN

Materials and chemical resistance: Technical information upon request

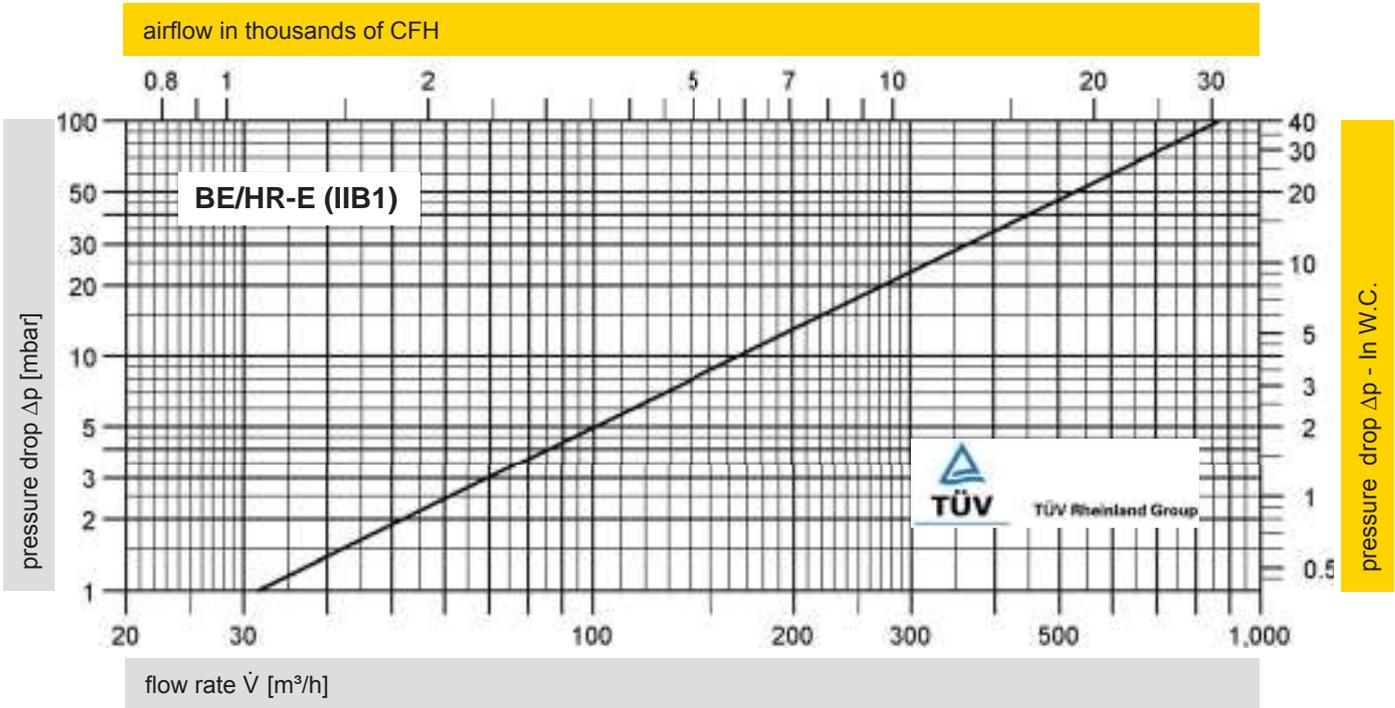




Deflagration Flame Arrester, endurance burning proof, End-of-Line
Flow Capacity Chart

PROTEGO® BE/HR-E

DN 80 / 3"
 DN 100 / 4"

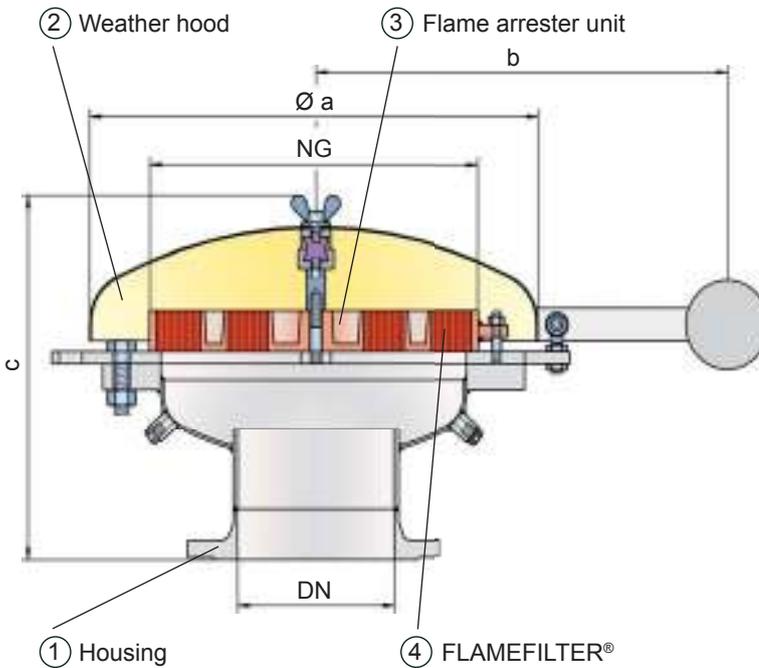


The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® BE/HR-400



Function and Description

The PROTEGO® BE/HR-400 end-of-line deflagration flame arrester is designed to protect large vessels and plants which are not pressurized. The device provides protection against atmospheric deflagration and stabilized flames which can burn for very long time on the flame arrester element surface, so called endurance burning. Main application area is on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration from propagating into the vessel or plant.

The BE/HR-400 consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation, the metal weather hood is in a closed position. If a stabilized flame burns on the flame arrester element surface, the fusible link, located in a center position, will melt and an external counterweight will move the weather hood into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage. The FLAMEFILTER® are arranged concentrically and are manufactured in a

patented process. The FLAMEFILTER® cage has integrated cooling channels to allow heat to be transferred away from the center of the device.

The BE/HR-400 end-of-line deflagration flame arrester is available for substances from explosion group IIA (NEC group D). The standard design can be used for operating temperatures up to +60°C / 140°F.

Type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other internationally accepted standards.

Special Features and Advantages

- protection against atmospheric deflagration and endurance burning
- endurance burning protection hydrocarbons of explosion group IIA (NEC group D)
- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood opens and signal the impact of a flame
- fusible link is resistant against chemicals
- weather hood out of metal don't produce secondary combustion, as created from plexiglass hoods residues
- maintenance friendly design

Design Types and Specifications

There are two different designs:

End-of-line deflagration flame arrester, basic design **BE/HR - □**

End-of-line deflagration flame arrester with heating coil **BE/HR - R**

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	150 / 6"	200 / 8"
NG	400 / 16"	400 / 16"
a	600 / 23.62	600 / 23.62
b	545 / 21.46	545 / 21.46
c	485 / 19.09	485 / 19.09

Dimensions for deflagration flame arrester with integrated heating coil upon

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

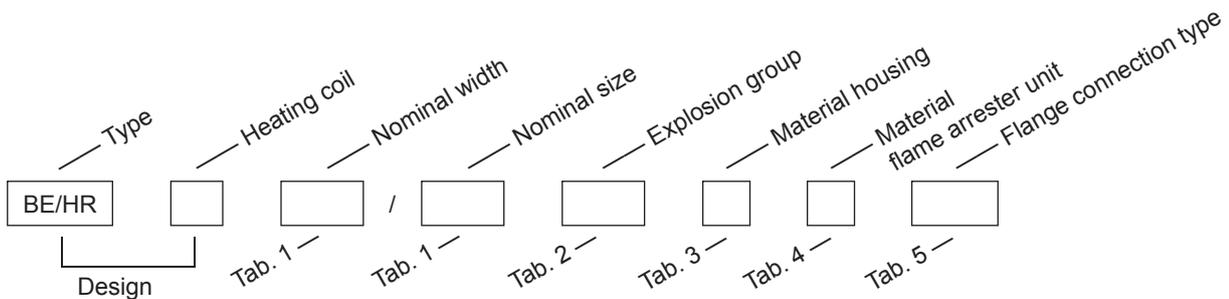
Design	A	B	Special materials upon request
Housing	Steel	Stainless steel	
Weather hood	Steel	Stainless steel	
Flame arrester unit	A, B	B	

Table 4: Material combination of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Stainless steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Stainless steel	

Table 5: Flange connection type

DIN 2501, Form C, PN 16, from DN 200 PN10	DIN	other types upon request
ANSI 150 lbs RF5F	ANSI	



Order example

BE/HR - R - 400 / 150 - IIA - B - B - DIN

Materials and chemical resistance: Technical information upon request

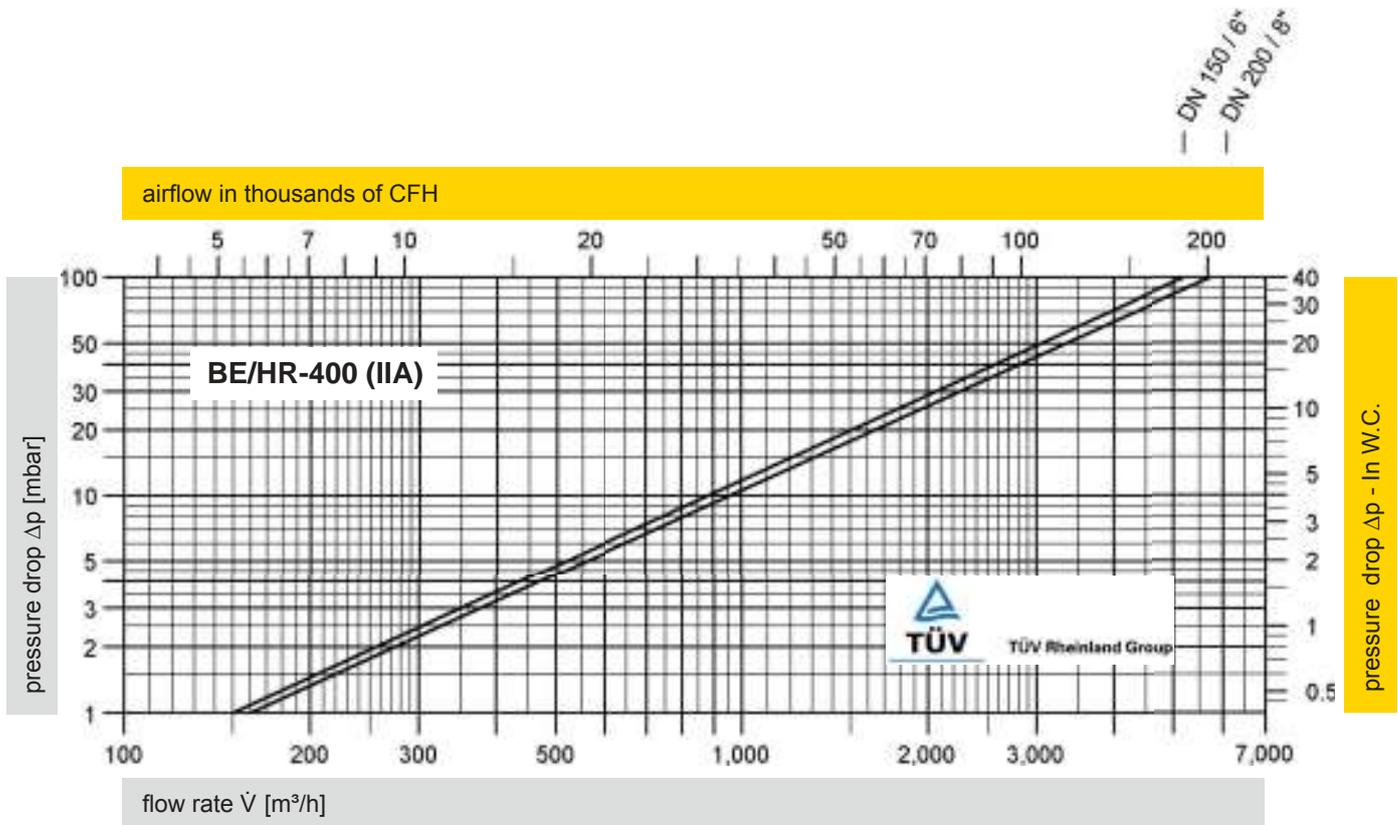




Deflagration Flame Arrester, endurance burning proof, End-of-Line

Flow Capacity Chart

PROTEGO® BE/HR-400

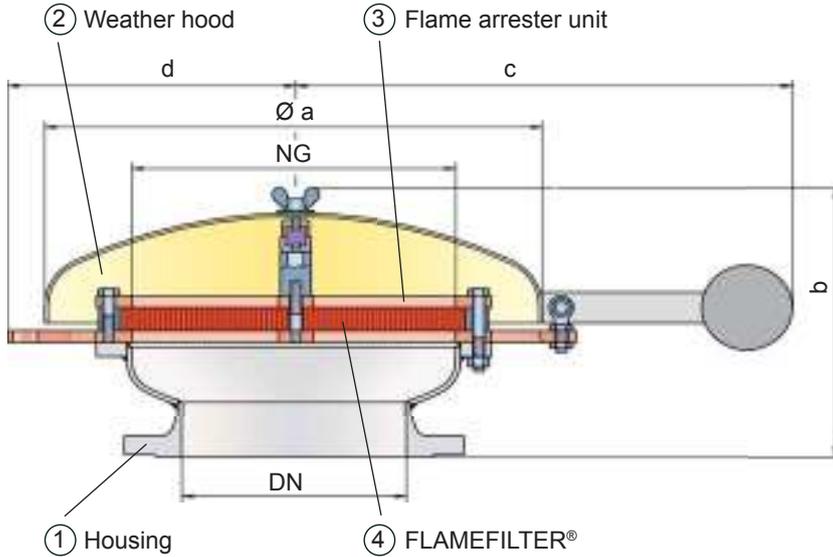


The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Deflagration Flame Arrester, endurance burning proof, End-of-Line

PROTEGO® LH/EB 400



The LH/EB series end-of-line deflagration flame arrester is available for substances from explosion group I (NEC group E). The standard design can be used with operating temperature of up to +60°C / 140°F.

Special certificates for mining are available and the device is type-approved according to ATEX Directive 94/9/EC and EN 12874 as well as other international standards.

Special Features and Advantages

- most efficient deflagration flame arrester for methane/air mixtures
- certificates for mining are available
- protection against atmospheric deflagration and endurance burning
- weather hood protects against environmental impact (i.e. weather, bird nests, etc.)
- weather hood will open and signal the impact of a flame
- fusible link is resistant against chemicals
- weather hood out of metal don't produce secondary combustion, as created from plexiglass hoods residues
- maintenance friendly design

Function and Description

The PROTEGO® LH/EB 400 end-of-line deflagration flame arrester is used to protect plants and vessels which are not pressurized and process Methane/Air mixtures. The device provides protection against atmospheric deflagration and stabilized flames which can burn for a very long time. This device is specifically applied to vent lines of decommissioned underground mines. Other areas of application are biogas, land-fill gas and sewage gas. The device is installed on suction and vent lines, with the goal to prevent flame transmission caused by endurance burning or atmospheric deflagration propagating into the vessel or plant.

The LH/EB 400 consists of a housing (1), a weather hood (2) and the PROTEGO® flame arrester unit (3). During normal operation, the metal weather hood is in a closed position. If a flame burns on the flame arrester element surface, the fusible link, located in a center position, will melt and an externally located weight will move the weather hood into the open position. The flame arrester unit consists of two FLAMEFILTER® (4), which are installed in a FLAMEFILTER® cage.

Design Type and Specification

End-of-line deflagration flame arrester, **LH/EB 400**
basic design

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

DN	150 / 6"	200 / 8"	250 / 10"	300 / 12"	350 / 14"	400 / 16"
NG	400 / 16"	400 / 16"	400 / 16"	400 / 16"	400 / 16"	400 / 16"
a	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62
b	340 / 13.39	340 / 13.39	340 / 13.39	340 / 13.39	340 / 13.39	340 / 13.39
c	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62	600 / 23.62

Table 2: Selection of explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC/NFPA)	Special approvals upon request
> 1,14 mm	I	E	

Table 3: Material selection for housing

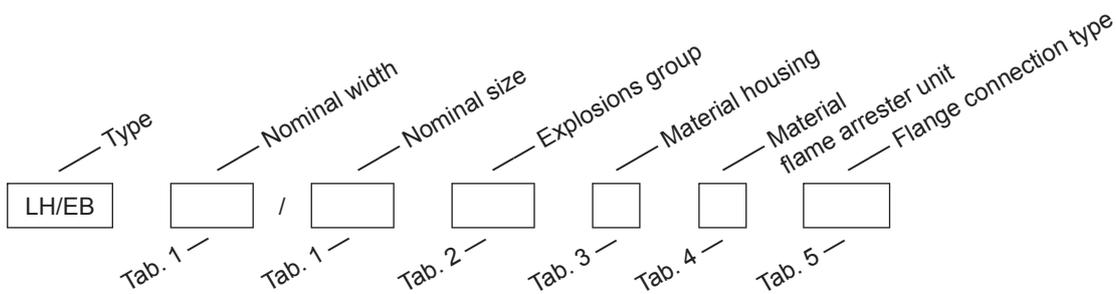
Design	A	B	Special materials upon request
Housing	Steel	Stainless steel	
Weather hood	Steel	Stainless steel	
Flame arrester unit	A, B	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	Special materials upon request
FLAMEFILTER® cage	Steel	Stainless steel	
FLAMEFILTER®	Stainless steel	Stainless steel	

Table 5: Flange connection type

DIN 2501, Form C, PN 16, from DN 200 PN10	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	



Order example

LH/EB - 400 / 150 - I - B - B - DIN

Materials and chemical resistance: Technical information upon request



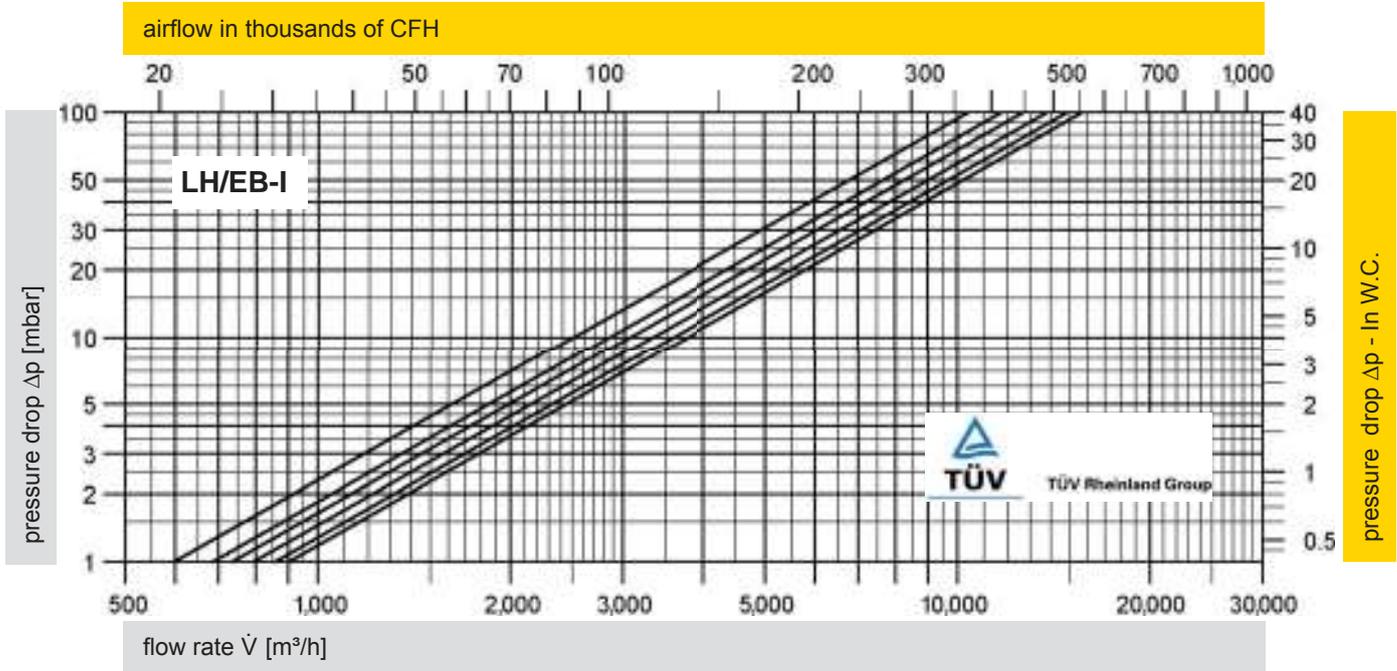


Deflagration Flame Arrester, endurance burning proof, End-of-Line

Flow Capacity Chart

PROTEGO® LH/EB

DN 150 / 6"
DN 200 / 8"
DN 250 / 10"
DN 300 / 12"
DN 350 / 14"
DN 400 / 16"

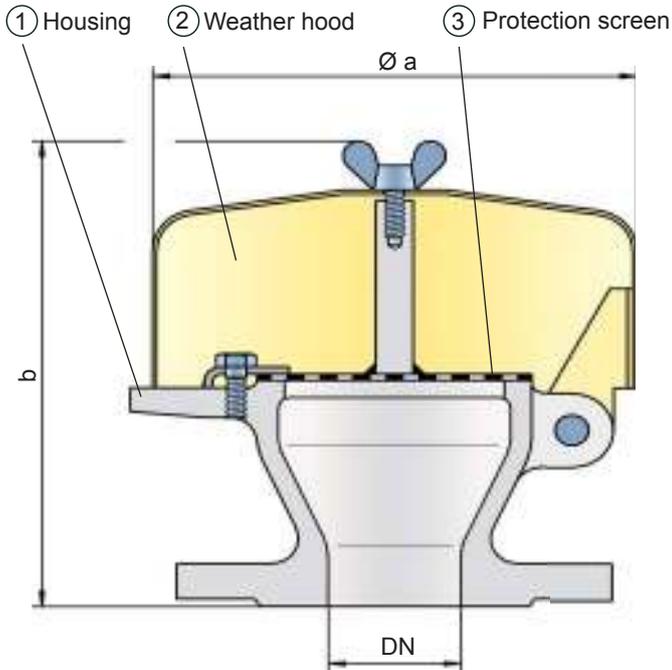


The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.



Vent Cap, End-of-Line

PROTEGO® EH/0



The vent cap EH/0 main components are a housing (1), a weather hood (2) and a protection screen (3). The device is equipped with a fixed weather hood out of metal. The protection screen prevents particles or rain from entering the line.

Special Features and Advantages

- vent cap provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- almost maintenance free
- certified flow performance curves

Design Type and Specification

Vent cap, basic design

EH/0

Special designs available on request

Function and Description

The E/H0 vent cap allows vessels which are not pressurized to vent. This device prevents rain and dirt from entering the vent line. The EH/0 vent cap is not flame transmission proof. It is often used in combination with detonation flame arresters, when those are used in vent lines, installed at a position which creates a long run up distance from the end of the vent line to prevent endurance burning. The EH/0 vent cap will then be installed at the end of that vent line to prevent particles or rain from entering the line.

Table 1: Dimensions

Dimensions in mm / inches

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

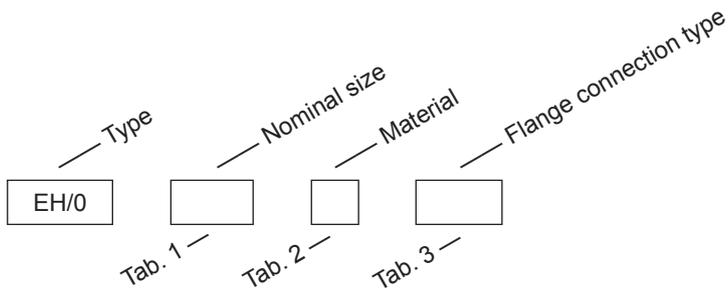
DN	20 / ¾"	25 / 1"	32 / 1¼"	40 / 1½"	50 / 2"	65 / 2½"	80 / 3"
a	163 / 6.42	163 / 6.42	163 / 6.42	183 / 7.20	183 / 7.20	218 / 8.58	218 / 8.58
b	175 / 6.89	175 / 6.89	175 / 6.89	190 / 7.48	190 / 7.48	200 / 7.87	200 / 7.87

Table 2: Material selection

Design	A	B	C	
Housing	Ductile Iron	Steel	Stainless steel	Special materials upon request
Weather hood	Steel	Steel	Stainless steel	

Table 3: Flange connection type

DIN 2501, Form C, PN 16	DIN	other types upon request
ANSI 150 lbs RFSS	ANSI	

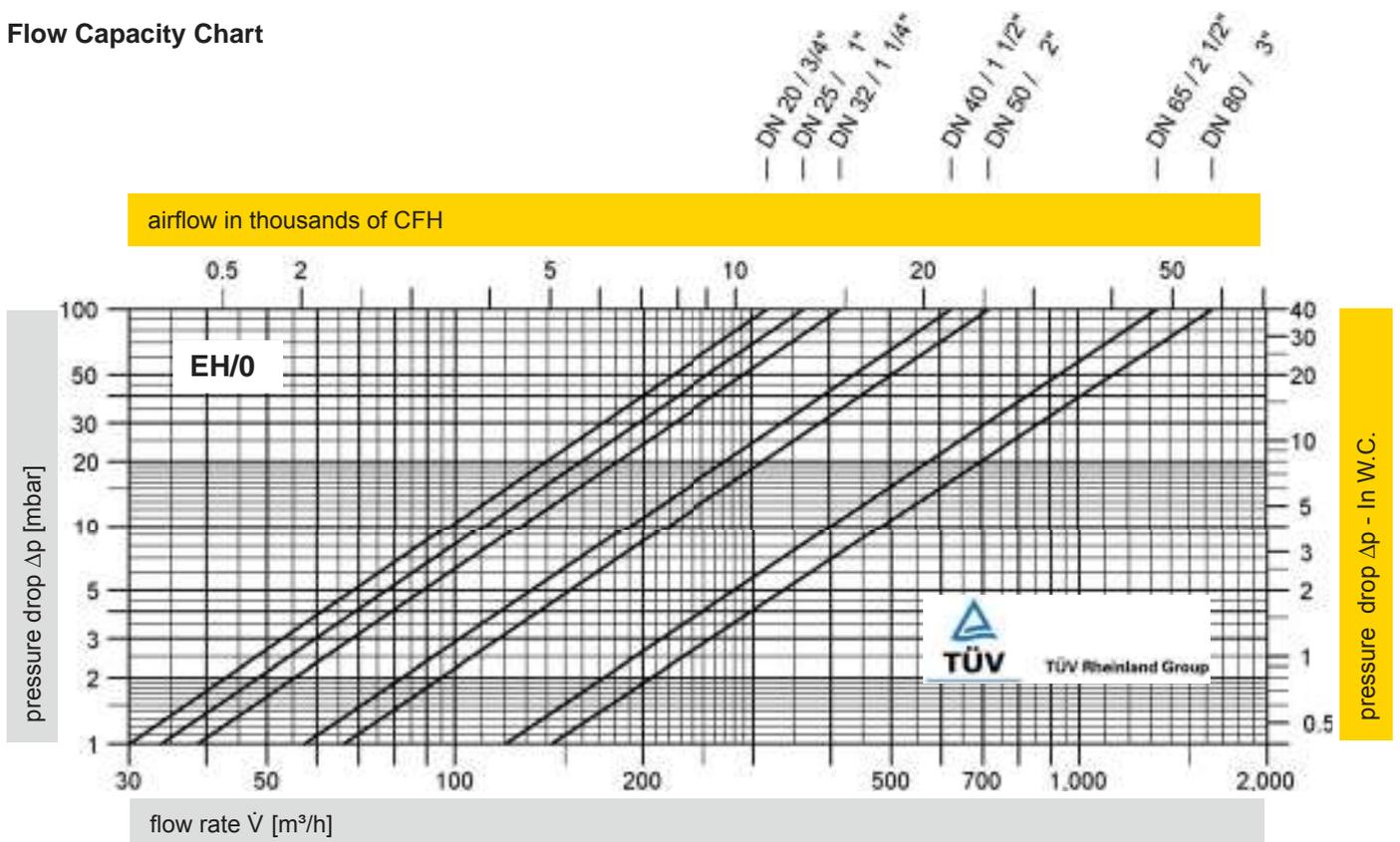


Order example

EH/0 - 80 - B - DIN

Materials and chemical resistance: Technical information upon request

Flow Capacity Chart



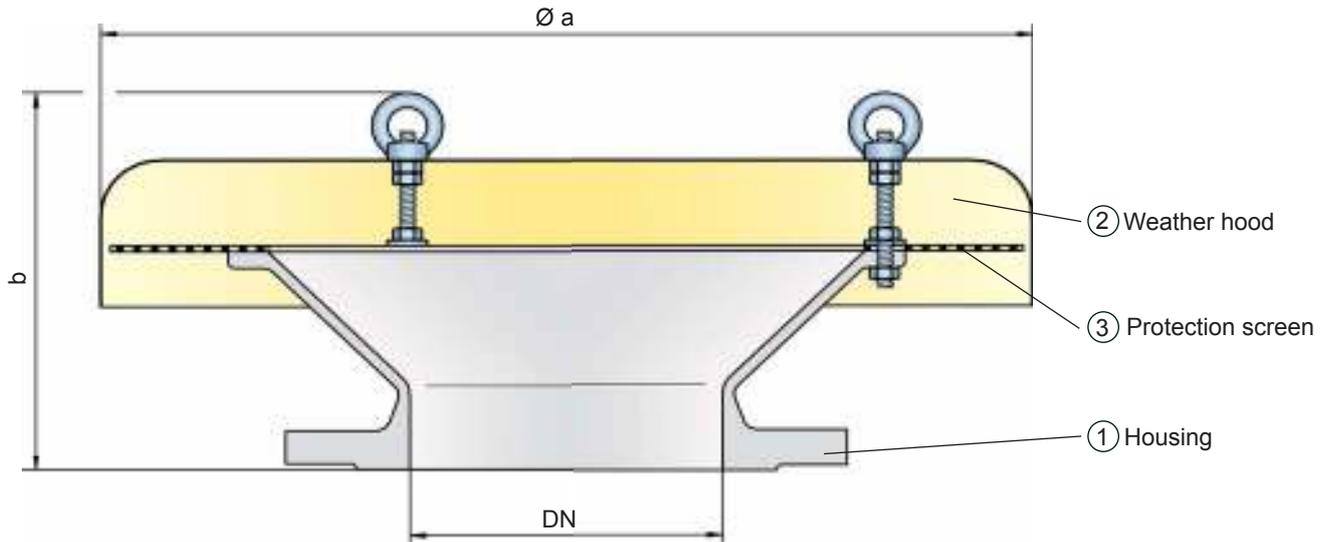
The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in [m³/h] and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.





Vent Cap, End-of-Line

PROTEGO® EH/OS



Function and Description

The EH/OS vent cap allows vessels which are not pressurized to vent. This device prevents rain and dirt entering the vent line. The EH/OS vent cap is not flame transmission proof. It is often used in combination with detonation flame arresters, when those are used in vent lines, installed at a position which creates a long run up distance from the end of the vent line to prevent endurance burning. The EH/OS will then be installed at the end of that vent line to prevent particles or rain from entering the line.

The vent cap EH/OS main components are a housing (1), a weather hood (2) and a protection screen (3). The device is equipped with a fixed weather hood out of metal. The protection screen prevents particles or rain from entering the line.

Special Features and Advantages

- vent cap provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- almost maintenance free
- certified flow performance curves

Design Types and Specification

Vent cap, basic design

EH/OS

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

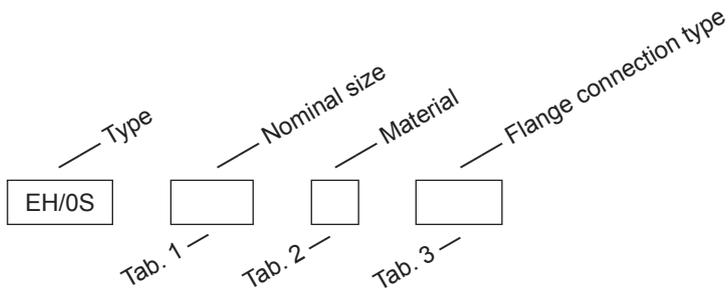
DN	100 / 4"	150 / 6"	200 / 8"	250 / 10"	300 / 12"	350 / 14"	400 / 16"	500 / 20"	600 / 24"
a	295 / 11.61	550 / 21.65	550 / 21.65	600 / 23.62	600 / 23.62	600 / 23.62	650 / 25.59	800 / 31.50	1000 / 39.37
b	230 / 9.06	240 / 9.45	240 / 9.45	325 / 12.80	320 / 12.60	335 / 13.19	370 / 14.57	385 / 15.16	520 / 20.47

Table 2: Material selection

Design	A	B	Special materials upon request
Housing	Steel	Stainless steel	
Weather hood	Stainless steel	Stainless steel	

Table 3: Flange connection type

DIN 2501, Form C, PN 16, from DN 200 PN 10	DIN	other types upon request
ANSI 150 lbs RFSS	ANSI	

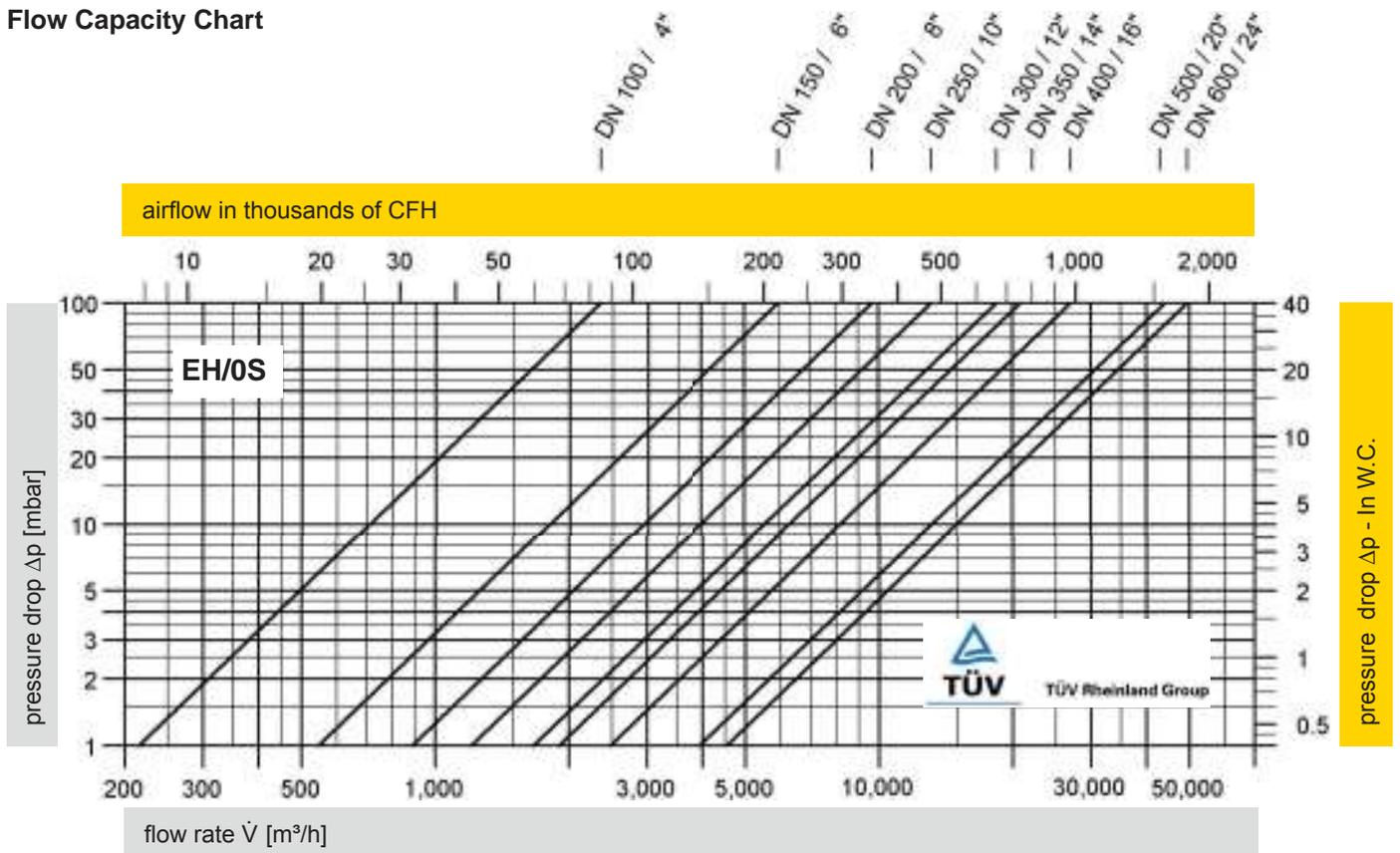


Order example

EH/OS - 100 - B - DIN

Materials and chemical resistance: Technical information upon request

Flow Capacity Chart



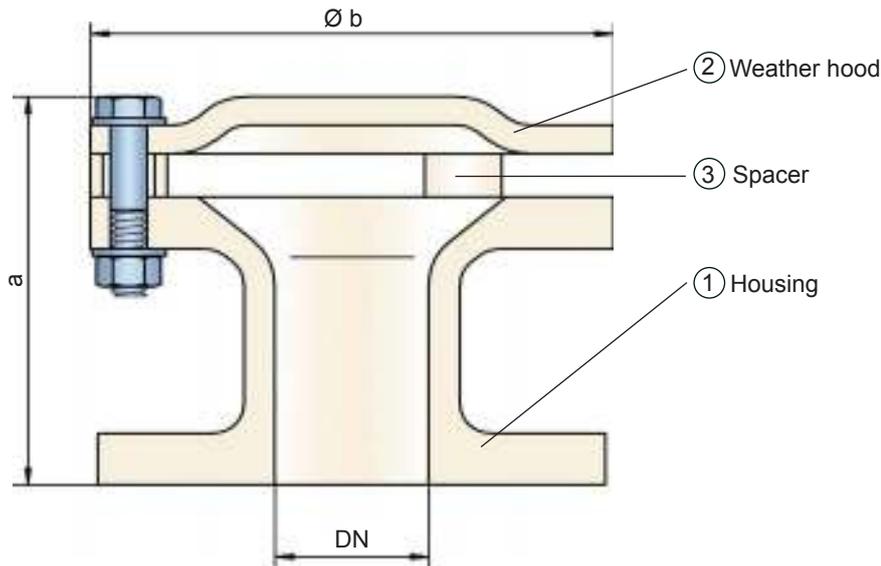
The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig. Volume flow \dot{V} in m^3/h and SCFH refer to the Technical Standard ISO 6358 (20°C, 1bar). Conversion to other densities and temperatures refer to Technical Fundamentals.





Vent Cap, End-of-Line

PROTEGO® E/KS



Function and Description

The E/KS vent cap allows vessels which are not pressurize to vent. The vent cap is made out of plastic and is the best solution in applications with aggressive media. This E/KS vent cap prevents rain and dirt from entering the vent line. The device is not flame transmission proof. It is often used in combination with detonation flame arresters, when those are used in vent lines, installed at a position which creates a long run up distance from the end of the vent line to prevent endurance burning. The E/KS vent cap will then be installed at the end of that vent line to prevent particles or rain from entering the line.

The vent caps main components are a housing (1), a weather hood (2) and spacers (3).

Special Features and Advantages

- vent cap provides protection against environmental impact (harsh weather conditions, bird nests, etc.)
- cost effective device
- almost maintenance free
- certified flow performance curves

Design Types and Specification

Vent cap, basic design

E/KS

Special designs available on request

Table 1: Dimensions

Dimensions in mm / inches

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

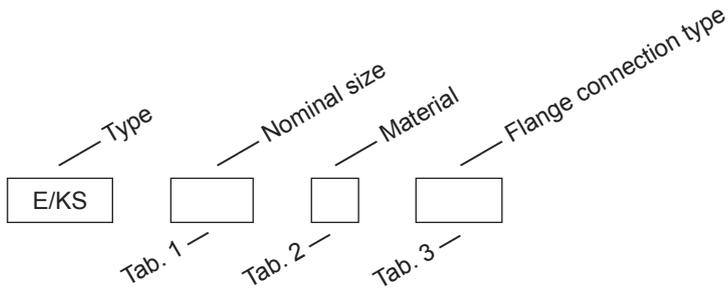
DN	50 / 2"	80 / 3"	100 / 4"	150 / 6"	200 / 8"
a	135 / 5.31	140 / 5.51	145 / 5.71	195 / 7.68	200 / 7.87
b	170 / 6.69	230 / 9.06	300 / 11.81	375 / 14.76	450 / 17.72

Table 2: Material selection

Design	A	B	C	
Housing	PE	PP	PVDF	Special materials upon request
Weather hood	PE	PP	PVDF	

Table 3: Flange connection type

DIN 2501, Form C, PN 16, from DN 200 PN 10	DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	

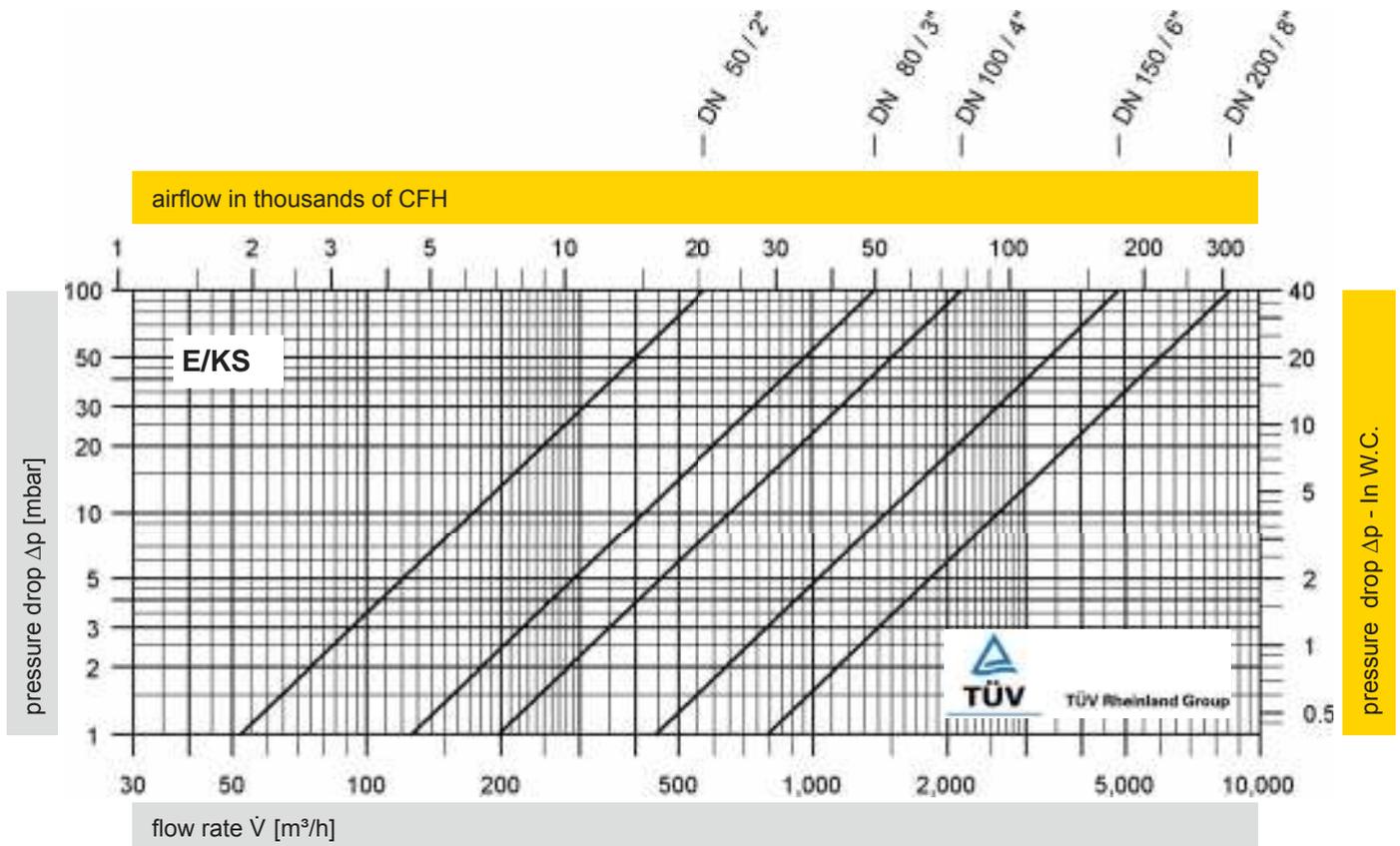


Order example

E/KS - 200 - B - DIN

Materials and chemical resistance: Technical information upon request

Flow Capacity Chart



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Materials, Terms and Conversion Tables

Pressure

1 bar	= 14.504 psi	1 lb/ft ²	= 47,88 N/m ²
	= 29.530 inch Hg		= 0,4788 mbar
	= 0.987 atm		= 0,0470 mm WC
	= 401.47 inch H ₂ O		
1 mbar	= 0.0145 psi	1 inch WC	= 249,08 N/m ²
	= 0.0295 inch Hg		= 2,4908 mbar
	= 0.4019 inch H ₂ O		= 25,4 mm WC
	= 2.089 lb/ft ²	1 inch Hg	= 33,864 mbar
1 kPa	= 10 mbar	1 psi	= 68,94757 mbar
1 inch H ₂ O	= 2,49089 mbar	1 inch Hg	= 33,8639 mbar
1 Pa	= 1 N/m ²	1 psi	= 1 lb/ft ²

Temperature

To convert °C in °F use	$T_F = 32 + 1,8 T_C$
	0°C = 32°F
	100°C = 212°F
To convert °F in °C use	$T_C = \frac{5}{9} (T_F - 32)$
	0°F = -17,8°C
	100°F = 37,8°C

Material

DIN Material Number	DIN-Material	ASTM-Material	
0.6020	GG 20	A 278-30	C.I.
0.7040	GGG 40	A 536-77	C.I.
1.0619	GS-C 25	A 216 Gr. WCB	C.S.
1.4301	X5 CrNi 18 10	A 240 Gr. 304	S.S.
1.4408	G-X6 CrNiMo 18 10	A 351 Gr. CF 8 M	S.S.
1.0425	P 265 GH	A 515 Gr. 60	C.S.
1.4541	X6 CrNiTi 18 10	A 240 Gr. 321	S.S.
1.4571	X10 CrNiMoTi 18 10	A 240 Gr. 316 Ti	S.S.
3.2581	G-Al-Si 12	A 413	Alu
Ta	Tantal	UNS R05200	
2.4610	NiMo 16 Cr 16 Ti	UNS N06455	C-4
2.4686	G-NiMo 17 Cr	UNS N30107	Casting
2.4602	NiCr 21 Mo 14 W	UNS N06022	C-22
2.4819	NiMo 16 Cr 15 W	UNS N10276	C-276

The applicable materials are specified in the quotation or the order acknowledgement:

In general the following means
 CC (Carbon steel) = 1.0619 or 1.0425
 SS (Stainless steel) = 1.4408 or 1.4571
 Hastelloy = 2.4686 or 2.4602

Important differences: US decimals in accordance to SI-System

e.g. 1 m	= 100 cm	= 100,00 cm	(UK/US: 100.00 cm)
1 km	= 1.000 m	= 1.000,00 m	(UK/US: 1,000.00 m)

Sealings and Coatings

PTFE	= polytetrafluoroethylene
PVDF	= polyvinylidene fluoride
PFA	= perfluoroalkoxy polyme
FPM 70	= fluor carbon rubber
WS 3822	= aramide and anorganic fibers as well as mineral reinforcement materials bonded with NBR rubber
ECTFE	= ethylene chlorotrifluoro etylene
FEP	= perfluoroethylene propylene

DN	10	15	20	25	32	40	50	65	80	100
Size	1/4	1/2	3/4	1	1 1/4	1 1/2	2	2 1/2	3	4

DN	125	150	200	250	300	350	400	450	500	600
Size	5	6	8	10	12	14	16	18	20	24

DN	700	800	900	1000	1200	1400	1600	1800	2000
Size	28	32	36	40	48	56	64	72	80

Length

1 cm	= 0.3937 inch	1 inch	= 25,4 mm
1 m	= 3.2808 ft	1 ft	= 12 inch = 0,3058 m
	= 1.0936 yards	1 yard	= 3 ft = 0,9144 m
1 km	= 0.621 miles	1 mile	= 1,609 km

Area

1 cm ²	= 0.1550 sq inch	1 sq inch	= 6,4516 cm ²
1 m ²	= 10.7639 sq ft	1 sq ft	= 0,0929 m ²
	= 1.196 sq yards	1 sq yard	= 0,836 m ²
1 km ²	= 100 hectares		
	= 0.3861 sq miles		
	= 247 acres		

Volume

1 cm ³	= 0.06102 cu inch	1 cu inch	= 16,3870 cm ³
1 liter	= 0.03531 cu ft	1 cu ft	= 28,317 liter
	= 0.21998 gal (UK)	1 gal (UK)	= 4,5461 liter
	= 0.26428 gal (US)	1 gal (US)	= 3,785 liter
1 m ³	= 35.315 cu ft	1 cu ft	= 0,028317 m ³
	= 6.299 petr. barrels	1 petr. barrel	= 0,15876 m ³

Mass

1 g	= 0.03527 oz	1 oz	= 28,35 g
1 kg	= 2.2046 lb	1 lb	= 16 oz
			= 0,4536 kg

Velocity and Volume Flow

1 m/s	= 196.85 ft/min	1 ft/min	= 0,508 cm/s
1 km/h	= 0.6214 mph	1 mph	= 1,60934 km/h
1 m ³ /h	= 4.403 gal/min (US)	1 gal/min (US)	= 0,227 m ³ /h
	= 3.666 gal/min (UK)	1 gal/min (UK)	= 0,273 m ³ /h
	= 0.5886 cu ft/min	1 cu ft/min	= 28,317 liter/min
1 kg/h	= 0.0367 lb/min	1 lb/min	= 27,216 kg/h
		1 cu ft/h	= 0,028317 m ³ /h

Torsion

1 Nm	= 0.723 lbf ft	1 lbf ft	= 1,38 Nm
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Density

1 kg/dm ³	= 62.43 lb/cu ft	1 lb/cu ft	= 0,016 kg/dm ³
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Safety devices are installed to prevent damage. The requirements need to be defined as early as the engineering stage so that a suitable device can be specified. After delivery and startup, function must be ensured at all times. The comprehensive PROTEGO® program range requires preventive services, assistance during start-up, and qualified maintenance for long term trouble-free operation.



Technical Advice

Experienced PROTEGO® professionals are available to answer the many and complex questions regarding application. They are trained to consider issues relating to process engineering from a safety perspective. Standard and tailored solutions are generated based on current regulations and state-of-the-art information.

Training

By offering continuing education and regular training for the employees of our domestic and foreign customers, we make sure that state-of-the-art knowledge is incorporated into system engineering. We regularly conduct training seminars that cover the theory of technical fundamentals, examples of applications and practice in installing and servicing PROTEGO® devices. The seminars can be offered either at our place of business or at the customers.

Research and Development

Our R&D center continuously reviews and develops our devices and incorporates product features relevant to safety engineering. In addition, we develop devices jointly with the customer for customer-specific requirements. The result: Continuous improvement of the performance and quality of flame arresters and valves as well as superior knowledge from basic research, which is incorporated into the design of process engineering systems.

Installation and Servicing

We value service and maintenance just as highly as product quality. Qualified operating and service instructions are sufficient for trained professional technicians to perform maintenance tasks. We can provide our trained field service technicians for installation and servicing, or you can use our authorized workshops. The key is trained personnel who are sufficiently prepared for their tasks in our manufacturing plant. Trained qualified professional shops are given a certificate and are authorized to perform maintenance on PROTEGO® devices. We will provide you with contacts in your region.

Spare Parts Service

We have original spare parts for you in our headquarter as well as in support centers worldwide. Original spare parts and regular servicing tailored to the respective operating conditions guarantee trouble-free operation.



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