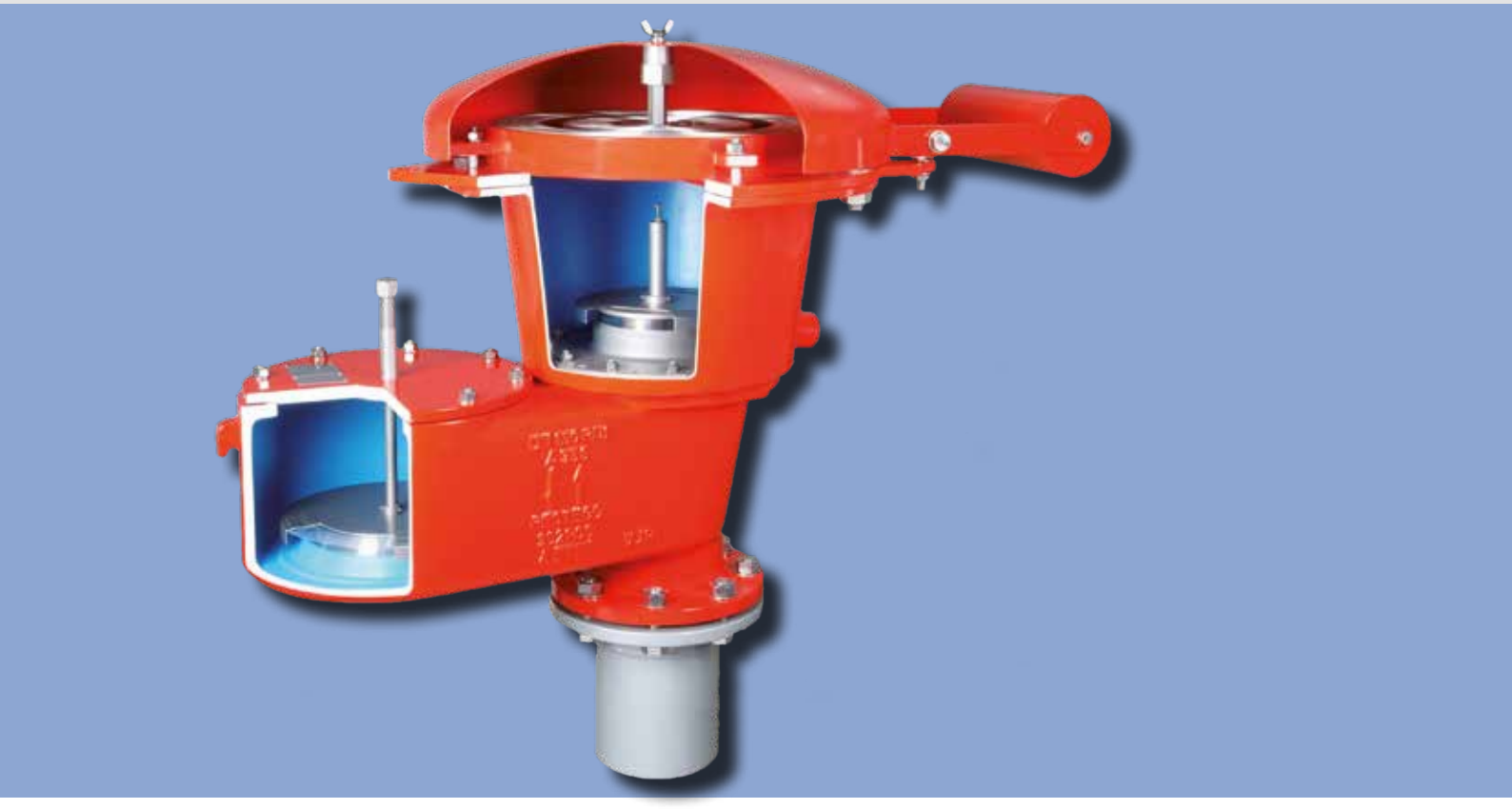
PROTEGO® Pressure/Vacuum Relief Valves

with Flame Arrester - End-of-Line



Section 7

PROTEGO

for safety and environment

Pressure/Vacuum Relief Valves with Flame Arrester – End-of-Line

The working principle and installation location of valves on tanks and equipment is discussed in “Technical Fundamentals“ (Sec. 1). This section discusses end-of-line pressure/vacuum relief valves with integrated flame arrester units.

Function and Description

These valves are used to protect plant components (e.g., tanks, pipelines) from exceeding maximum allowable operating pressures and vacuum. They offer additional protection against atmospheric deflagration, and some valves also protect against endurance burning (Figure 1).

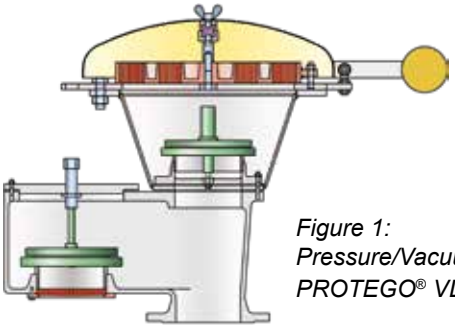


Figure 1:
Pressure/Vacuum Relief Valve PROTEGO® VD/SV-HRL

PROTEGO® Pressure relief valves with an integrated flame arrester unit provide protection against unallowable overpressure, atmospheric deflagration and endurance burning. Additionally, they reduce emissions almost up to the set pressure.

PROTEGO® Vacuum Relief Valves with an integrated flame arrester unit provide protection against unallowable vacuum and atmospheric deflagration. Additionally, they prevent air intake almost up to the set pressure.

PROTEGO® Pressure Vacuum Relief Valves with an integrated flame arrester unit perform all of the above-mentioned functions for pressure and vacuum relief, and they protect against atmospheric deflagration or against atmospheric deflagration and endurance burning.

The special design of the PROTEGO® valves achieves full lift after 10% overpressure above the set pressure. This “full-lift-type-technology” allows for the use of set pressures at just 10% below the maximum allowable working pressure (MAWP or Design Pressure) of the tank. After just 10% overpressure above set pressure, the valve will reach its full capacity to safely relieve the required mass flow. Conventional relief valves for low pressure applications need 80%-100% overpressure (API 2000) for reaching full lift and full relieving capacity. They open later and shut off earlier, which results in unnecessary product losses.

Special features and advantages

Continuous investments in and a commitment to research and development have PROTEGO® to design a valve for low pressure applications, providing you with the following advantages:

- 10% full-lift technology results in product savings (possible reduction of product losses greater than 30%)
- PROTEGO® valves open later and re-seat earlier than conventional valves, resulting in optimized pressure management and conservation of inert gases
- high flow capacity reduces costs through the use of smaller valves
- seal above the normal standards
- flame arrester for almost all chemical mixture
- valve pallet is guided inside the housing to protect against harsh weather conditions
- flame arrester not in contact with product during operation with closed valve pallets, reducing maintenance intervals
- endurance burning protection against alcohols

In order to meet the highest demands of the industry and to reduce leakage rates, our valve pallets and seats are manufactured from high-quality stainless steel and are hand lapped using highly developed manufacturing processes. Valve pallets with air-cushioned diaphragms are used for low set pressures.

Valves with integrated flame arresters are approved for substances in explosion groups IIA and IIB3 and, with special approvals, for alcohols.

Main areas of application: as pressure and vacuum valves; as pressure relief valves; as pressure holding/conservation valves; as simple control valves for storage of flammable liquids

PROTEGO® Diaphragm Valves function as pressure vacuum relief valves. The flexible diaphragm allows them to work as a dynamic flame arrester which provides endurance burning protection. For additional safety, these devices are equipped with a static flame arrester unit. This “one-of-a-kind” diaphragm valve can be used under extreme cold weather conditions below freezing and for problem products which tend to polymerize (e.g., Styrene, Acrylate). A specially designed valve seat, combined with the flexible diaphragm, prevents the diaphragm from freezing on the valve seat due to, e.g., condensed and frozen product vapors at low temperatures. Any build-up ice is blown off by the deformation of the diaphragm when the pressure increases.

This valve does not have any guiding elements which are likely to stick and/or clog.

Main areas of application: same as above for storage of flammable liquids, especially when storing monomers.

PROTEGO® High Velocity Pressure Relief Valves (Jet Valves) open and close almost immediately due to an integrated magnet. As a result, the required pressure increase from set pressure to full lift is almost 0%, which significantly contributes to the reduction of emissions. All PROTEGO® high velocity relief valves are tested and designed to resist oscillating flow and are equipped with a specially designed valve cone and seat so that a free jet is created vertically during pressure relief. As a result, the product vapors are quickly and effective released, and the gas concentration in the immediate vicinity (e.g., ship deck) is reduced. This valve, which works on the principal of a dynamic flame arrester, is approved for substances in explosion groups IIA, IIB3 and IIC (NEC D, C and B).

Main areas of application: transportation of flammable liquids on tankers and special onshore tasks.

Installation and servicing

All PROTEGO® valves are delivered with detailed installation and maintenance instructions. Please pay special attention to the separate instructions for removing transportation protection if they have been installed to protect the PROTEGO® valves. We have devised special checklists to ensure correct installation and operation of PROTEGO® valves.

Selection and sizing

Selection and sizing of the correct PROTEGO® valve is critical for the safe operation of the system. Consider the following to select the appropriate valve:

Function: Pressure relief, vacuum relief, or combined pressure/vacuum relief; protection against atmospheric deflagration or atmospheric deflagration and endurance burning.

Type of Valve: Weight-loaded valve, diaphragm valve, high velocity pressure relief valve, or high velocity pressure relief valve with combined vacuum valve.

Design: with horizontal or vertical connection to the protected vessel. These valves are weight-loaded, so the pallet has to be installed in a vertical direction. The maximum possible pressure setting depends on the design of the valve. Metallic or soft sealing are important criteria for low leak rates and have to be chosen based on the intended use.

Explosion group: IIA, IIB3, IIC (NEC D, C, B).

Process of combustion: endurance burning or atmospheric deflagration.

Operating conditions: Polymerization; condensation; problems that can cause the FLAMEFILTER® to clog; operating temperatures; operating pressures oxygen content; volume flows.

The **valve size** has to be determined so that the volume flow to be released does not exceed the allowable pressure of the protected vessel. Certified opening pressure/volume flow rate diagrams are available for the design of the valves. The operating conditions have to be known for correct sizing. Sometimes, vessels may already be equipped with pre-existing nozzles (e.g., older vessels). In such cases, it might be necessary to adjust the volume flow rate to be released over several valves. For correct sizing, each possible system back-pressure or additional pressure losses have to be considered.

Valve sizing:

The valve size is dimensioned for the calculated required flow rate (→ Section 1) or given.

Given: Volume flow (e.g., in-breathing or outbreathing of a storage tank as the sum of the pump rates and thermal breathing) $\dot{V}_{max}$ in m3/h (CFH) and maximum allowable (tank) pressure p in mbar (inch W.C.).

Desired: Nominal valve size DN

Procedure: The required. size of the valve can be taken from the intersection point of $\dot{V}_{max}$ and p valve operating pressure = max. allowable tank pressure. The pressure diagram shows the valves performance as the opening pressure in function of the flow rate with the valve fully open.

The set pressure of the valve has to be selected so that the calculated volume flow can be safely released. A valve with a 10% overpressure characteristic has to be set at 10% below the maximum allowable tank pressure.

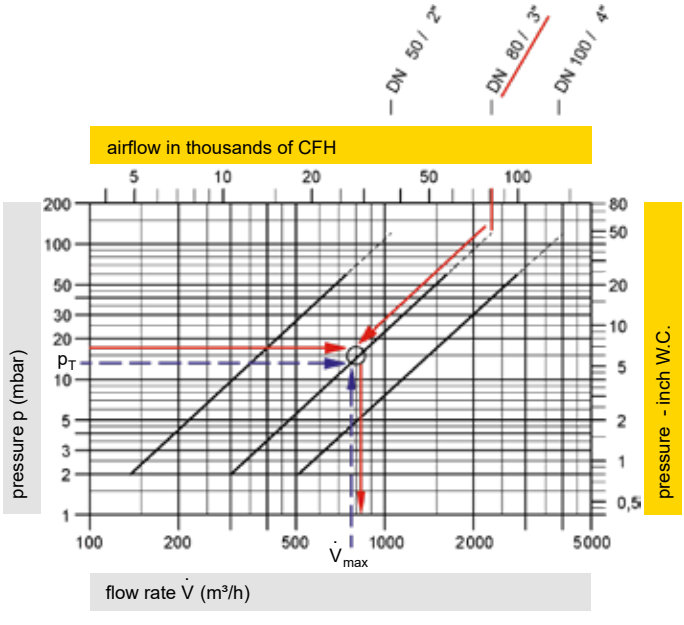
Many conventional valves require 100% overpressure to reach full lift, i.e., the set pressure must be set to half the maximum allowable tank pressure. These conventional valves open earlier and cause unnecessary product losses.

Alternatively the valve performance may have to be checked if the required size and maximum allowable tank pressure are provided.

Given: (tank) nozzle size DN and maximum allowable (tank) pressure p in mbar (inch W.C.)

Desired: flow rate of valve in m³/h (CFH) and set pressure p_{set}

Procedure: The intersection of the straight lines through p and the valve performance curve of the (nozzle) size DN shows the design volume flow rate $\dot{V}_{max}$. The set pressure p_{set} is 10% (PROTEGO® Technology), 40% or 100% below the maximum allowable (tank) pressure p_T.



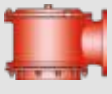
The set pressure of the valve (= valve starts to open) is the maximum allowable pressure of the equipment minus the valves characteristic overpressure which is required for the valve to reach full lift.

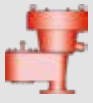
The overpressure percentage of PROTEGO® valves is 10% unless otherwise specified. Within 10% overpressure, the valve will reach its performance at full lift. A further performance increase will follow the curve according to the pressure volume flow diagram.

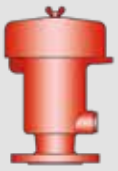
When selecting materials, the plant and engineering specifications have to be considered.

PROTEGO® Pressure/Vacuum Relief Valves with Flame Arrester – End-of-Line

Catalog

	Type	Size	Pressure setting: positive setting range mbar / inch W.C.	Pressure setting: negative setting range mbar / inch W.C.	O = endurance burning-proof X = prevent flashback in case of atmospheric deflagrations	Explosion group: ATEX	Explosion group: NEC	Approvals		Design O = horizontal connection X = vertical connection	O = soft sealing X = metallic sealing	O = for critical substances (polymerization, corrosion, crystallization)	O = Heating jacket, heating coil	Page
Pressure Relief Valves, Pallet Type														
	P/EB	50 - 80 2" - 3"	+3.5 up to +210/ +1.4 up to +84		O / X	IIA	D	ATEX		X	O / X		O	290 - 292
	P/EB-E	50 - 80 2" - 3"	+3.5 up to +210/ +1.4 up to +84		O / X	IIB1	–	ATEX		X	O / X		O	294 - 296
	P/EBR	80 - 100 3" - 4"	+3.5 up to +210/ +1.4 up to +84		O / X	IIA, IIB3	D, C	ATEX		X	O / X		O	298 - 300
	P/EBR-E	80 - 100 3" - 4"	+3.5 up to +210/ +1.4 up to +84		O / X	IIB1	–	ATEX		X	O / X		O	302 - 304
	D-SVL-EB	150 -200 6" - 8"	+2.0 up to +60/ +0.8 up to +24		O / X	IIA	D	ATEX		X	O / X		O	306 - 308
	BE/HR-D	150 -200 6" - 8"	+2.0 up to +35/ +0.8 up to +14		O / X	IIA	D	ATEX		X	O / X			310 - 312
Vacuum Relief Valves, Pallet Type														
	SV/E	50 - 300 2" - 12"		-2.0 up to -60/ -0.8 up to -24	X	IIB3, IIB IIC	C, B, B	ATEX IMO		O	O / X		O	314 - 317
Pressure/Vacuum Relief Valves, Pallet Type														
	PV/EB	50 - 80 2" - 3"	+2.0 up to +210/ +0.8 up to +84	-3.5 up to -35/ -1.4 up to -14	O / X	IIA	D	ATEX		O	O / X		O	318 - 320
	PV/EB-E	50 - 80 2" - 3"	+2.0 up to +210/ +0.8 up to +84	-3.5 up to -35/ -1.4 up to -14	O / X	IIB1	–	ATEX		O	O / X		O	322 - 324
	PV/EBR	80 - 100 3" - 4"	+2.0 up to +210/ +0.8 up to +84	-3.5 up to -50/ -1.4 up to -20	O / X	IIA, IIB3	D	ATEX		O	O / X		O	326 - 329
	PV/EBR-E	80 - 100 3" - 4"	+2.0 up to +210/ +0.8 up to +84	-3.5 up to -50/ -1.4 up to -20	O / X	IIB1	–	ATEX		O	O / X		O	330 - 332

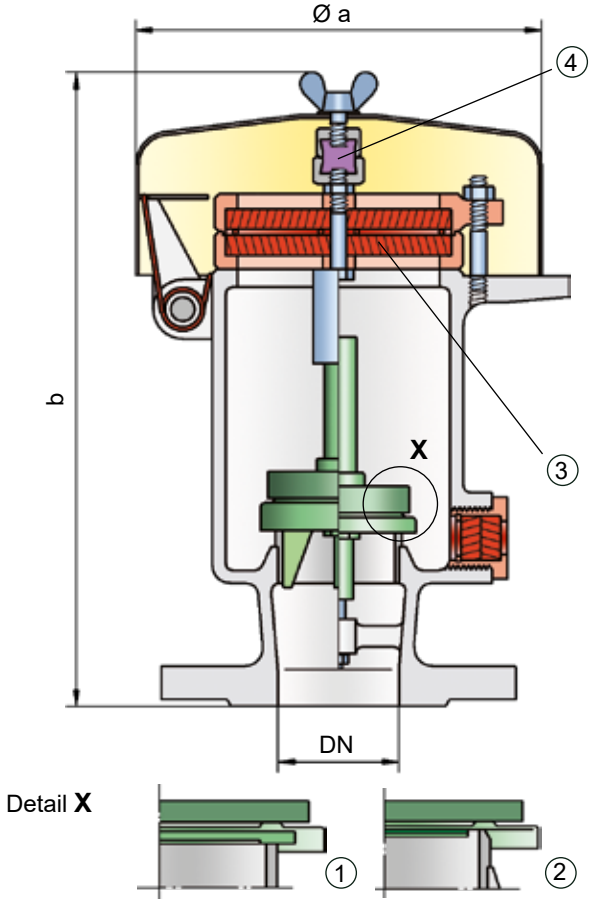
	Type	Size	Pressure setting positive setting range mbar / inch W.C.	Pressure setting negative setting range mbar / inch W.C	O = endurance burning proof X = prevent flashback in case of atmospheric deflagrations	Explosion group ATEX	Explosion group NEC	Approvals		Design O = horizontal connection X = vertical connection	O = soft sealing X = metallic sealing	O = for critical substances (polymerization, corrosion, crystallization)	O = Heating jacket, heating coil	Page
Pressure/Vacuum Relief Valves, Pallet Type (Continuation)														
	VD/SV-AD and VD/SV-ADL	80 - 150 3" - 6"	+3.5 up to +35/ +1.4 up to +14	-2.0 up to -35/ -0.8 up to -14	X	IIB3	C	ATEX		X	O / X			334 - 336
	VD/SV-HR	80 - 100 3" - 4"	+3.5 up to +35/ +1.4 up to +14	-2.0 up to -35/ -0.8 up to -14	O / X	IIA, IIB3	D, C	ATEX		X	O / X			338 - 341
	VD/SV-HRL	100-150 4" - 6"	+3.5 up to +35/ +1.4 up to +14	-2.0 up to -35/ -0.8 up to -14	O / X	IIA	D	ATEX		X	O / X			342 - 344
	VD-SV-EB	200 10“	+2.0 up to +60/ +0.8 up to +24	-2.0 up to -60/ -0.8 up to -24	O / X	IIA	D	ATEX		X	O / X		O	346 - 348
	VD/TS	50 - 300 2" - 12"	+3.5 up to +50/ +1.4 up to +20	-2.0 up to -25/ -0.8 up to -10	X	IIB3	C	ATEX		X	O / X			350 - 353
Pressure/Vacuum Relief Valves, Diaphragm Valves														
	UB/SF	80 - 150 3" - 6"	+3.5 up to +140/ +1.4 up to +56	-3.5 up to -35/ -1.4 up to -16	O / X	IIB3	C	ATEX		X	O	O	O	354 - 361
	UB/DF	80 - 150 3" - 6"	+3.5 up to +140/ +1.4 up to +56		O / X	IIB3	C	ATEX		X	O	O	O	362 - 367
	UB/VF	80 - 150 3" - 6"		-3.5 up to -35/ -1.4 up to -16	X	IIB3	C	ATEX		X	O	O	O	368 - 371
Pressure Relief Valves, High Velocity Valve														
	DE/S	80 - 150 3" - 6"	+100 up to +500/ +40 up to +200		O / X	IIB3, IIB	C, B	ATEX		X	X			-IIB -IIB3
	DE/S-MK VI	80 - 150 3" - 6"	+60 up to +350/ +24 up to +140		O / X	IIB3, IIC	C, B	ATEX IMO		X	X			-IIB3 -IIC



Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® P/EB



Pressure settings:

+3.5 mbar up to +210 mbar
+1.4 inch W.C. up to +84 inch W.C.
Higher pressure settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof P/EB type PROTEGO® valve is a highly developed pressure relief valve with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and prevents product losses almost up to the set pressure, while at the same time protecting against atmospheric deflagration as well as endurance burning. The PROTEGO® flame arrester unit is designed to achieve minimum pressure losses with maximum safety. The PROTEGO® P/EB valve is available for substances in explosion group IIA (NEC group D MESG > 0.90 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is far above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with a high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use in corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow in and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

Type-approved in accordance with the current ATEX Directive and EN 12874, as well as other international standards.

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmosphere in accordance with ATEX
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Demonstration of endurance burning Video

Design Types and Specifications

The valve pallet is weight-loaded. At set pressure >80 mbar (32.1 inch W.C.), an extended design is used.

There are two different designs:

Pressure relief valve, basic design **P/EB - –**

Pressure relief valve with heating jacket **P/EB - H**
(max. heating fluid temperature +85°C / 185°F)

Additional special devices available upon 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"	50 / 2"	80 / 3"	80 / 3"
Set pressure	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.
a	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58
b	287 / 11.30	452 / 17.80	289 / 11.38	454 / 17.87

Dimensions for pressure relief valve with heating jacket upon request.

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (P/EB-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

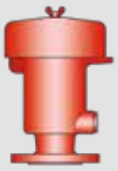
Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +210 >+5.6 up to +84	>+14 up to +210 >+5.6 up to +84	Special materials and higher pressure settings upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Flange connection type

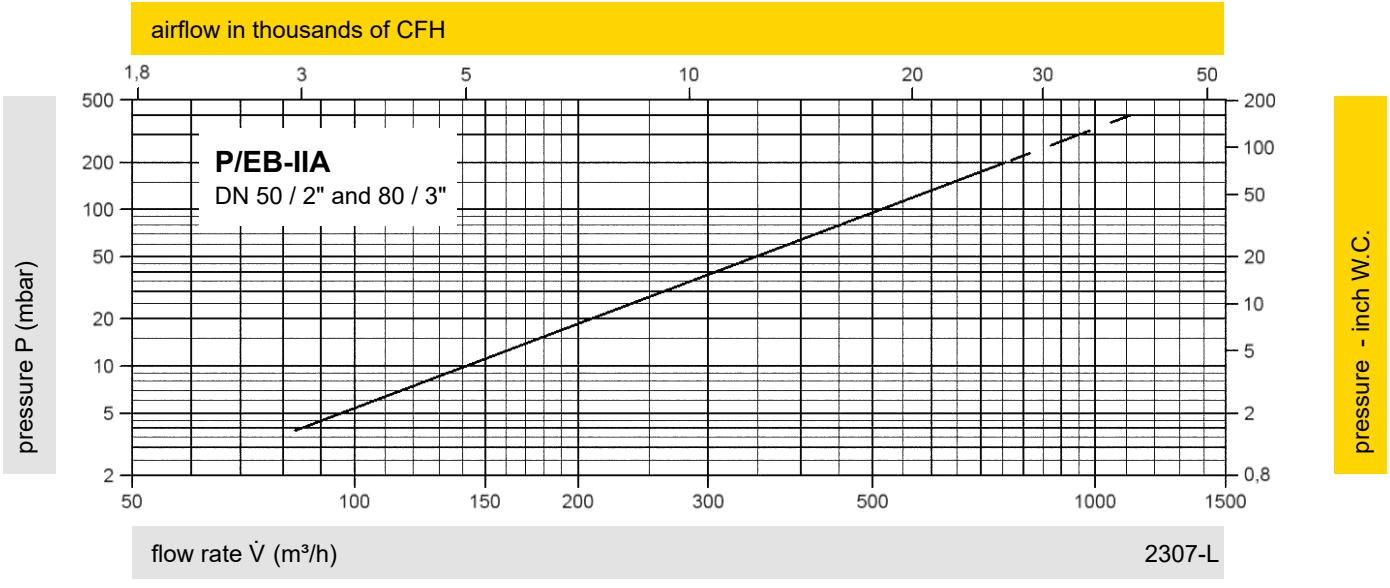
EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



Pressure Relief Valve

Flow Capacity Chart

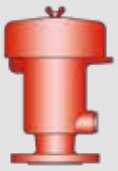
PROTEGO® P/EB



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

Volume flow V̇ 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.”

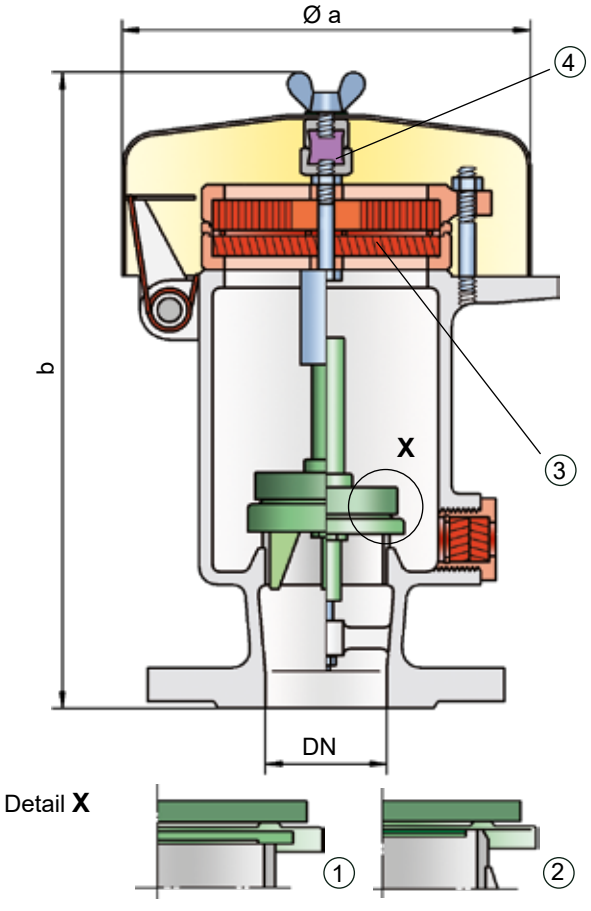
Notes:



Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® P/EB-E



Pressure settings:

+3.5 mbar up to +210 mbar
+1.4 inch W.C. up to +84 inch W.C.
Higher pressure settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof P/EB-E type PROTEGO® valve is a highly developed pressure relief valve for large flows with an integrated flame arrester unit that is specifically designed for use in ethanol production, processing, and storage. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and prevents product losses almost up to the set pressure, while at the same time protecting against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The P/EB-E valve is available for substances of explosion group IIB1 (MESG ≥ 0.85 mm) and provides specific protection against deflagration and endurance burning of alcohol/air mixtures (such as ethanol/air).

The valve functions proportional, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached). The tank pressure is maintained up to the set pressure with a tightness that is far above the usual standards due to our state-of-the-art manufacturing. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used up to an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as protective system according in areas with potentially explosive atmospheres in accordance with ATEX
- protected against deflagration and endurance burning of alcohol/air mixtures from explosion group IIB1
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Demonstration of endurance burning
Video

Design Types and Specifications

The valve pallet is weight-loaded. At set pressures >80 mbar (32.1 inch W.C.), an extended design is used.

There are two different designs:

Pressure relief valve, basic design **P/EB - E - [–]**

Pressure relief valve with heating jacket **P/EB - E - [H]**
(max. heating fluid temperature +85°C / 185°F)

Additional special devices available upon request.

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

DN	50 / 2"	50 / 2"	80 / 3"	80 / 3"
Set pressure	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.
a	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58
b	288 / 11.34	453 / 17.83	290 / 11.42	455 / 17.91

Dimensions for pressure relief valve with heating jacket upon request.

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (P/EB-E-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +210 >+5.6 up to +84	>+14 up to +210 >+5.6 up to +84	Special materials and higher pressure settings upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Flange connection type

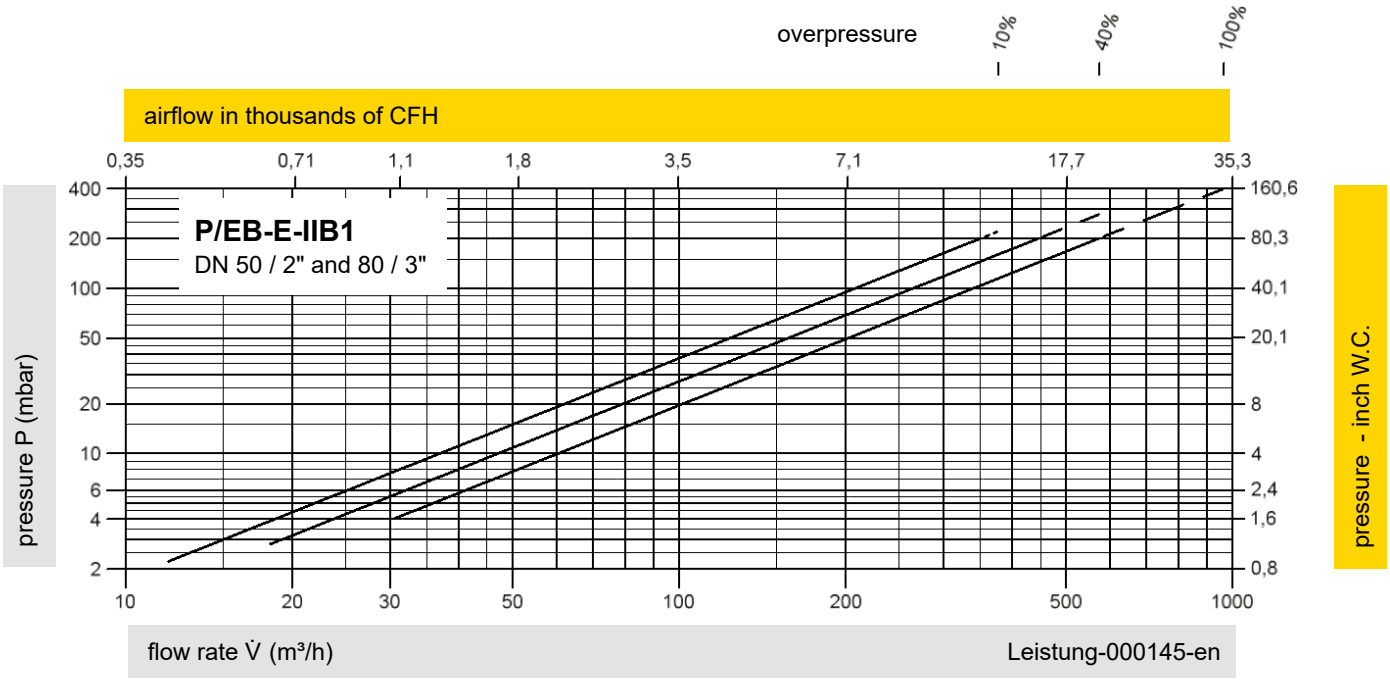
EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

PROTEGO
for safety and environment

Pressure Relief Valve

Flow Capacity Chart

PROTEGO® P/EB-E



Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

Set pressure = the valve starts to open

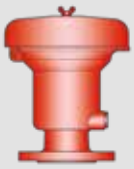
Opening pressure = set pressure plus overpressure

Overpressure % = percentage 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 V̇ 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.”

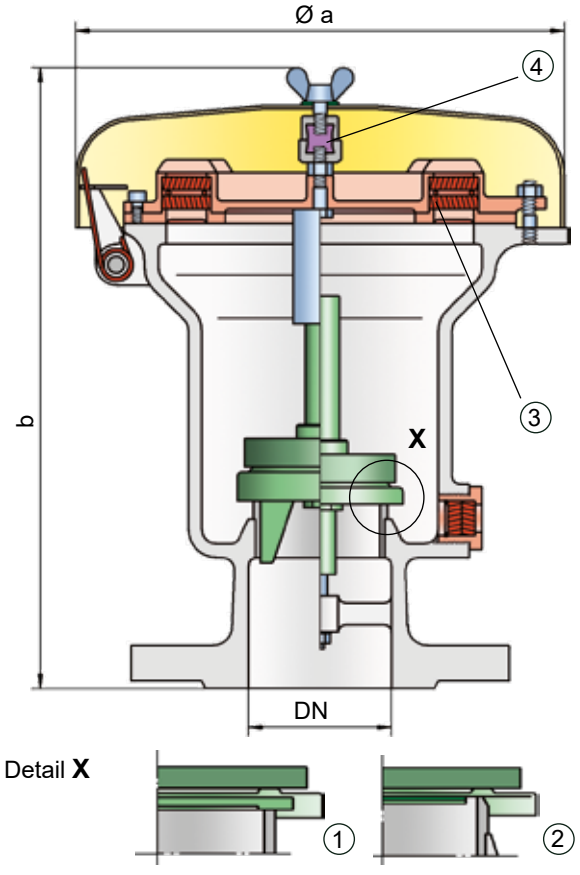
Notes:



Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® P/EBR



Pressure settings:

+3.5 mbar	up to	+210 mbar
+1.4 inch W.C.	up to	+84 inch W.C.

Higher pressure settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof P/EBR type PROTEGO® valve is a highly developed pressure relief valve for large flows with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and prevents product losses almost up to the set pressure, while at the same time protecting against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. P/EBR valves are available for substances from explosion groups IIA and IIB3 (NEC group D and C MESG ≥ 0.65 mm).

If the set pressure is reached for a valve approved for explosion Group IIA (NEC group D), the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range. Valves approved for explosion group IIB3 (NEC group C) function proportionally, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to the set pressure with a tightness that is far above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2) in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift (applies to explosion group IIA)
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Demonstration of endurance burning Video

Design Types and Specifications

The valve pallet is weight-loaded. At set pressures >80 mbar (32.1 inch W.C.), an extended design is used.

There are two different designs:

Pressure relief valve, basic design **P/EBR -** **–**

Pressure relief valve with heating jacket **P/EBR -** **H**
(max. heating fluid temperature +85°C / 185°F)

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	80 / 3"	80 / 3"	100 / 4"	100 / 4"
Set pressure	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.
a	353 / 13.90	353 / 13.90	353 / 13.90	353 / 13.90
b	345 / 13.58	505 / 19.88	345 / 13.58	505 / 19.88

Dimensions for pressure relief valve with heating jacket upon request.

Table 2: Selection of 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: Material selection for housing

Design	B	C	
Housing Heating jacket (P/EBR-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +210 >+5.6 up to +84	>+14 up to +210 >+5.6 up to +84	Special materials and higher pressure settings upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Flange connection type

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

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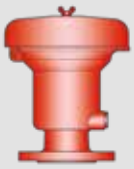
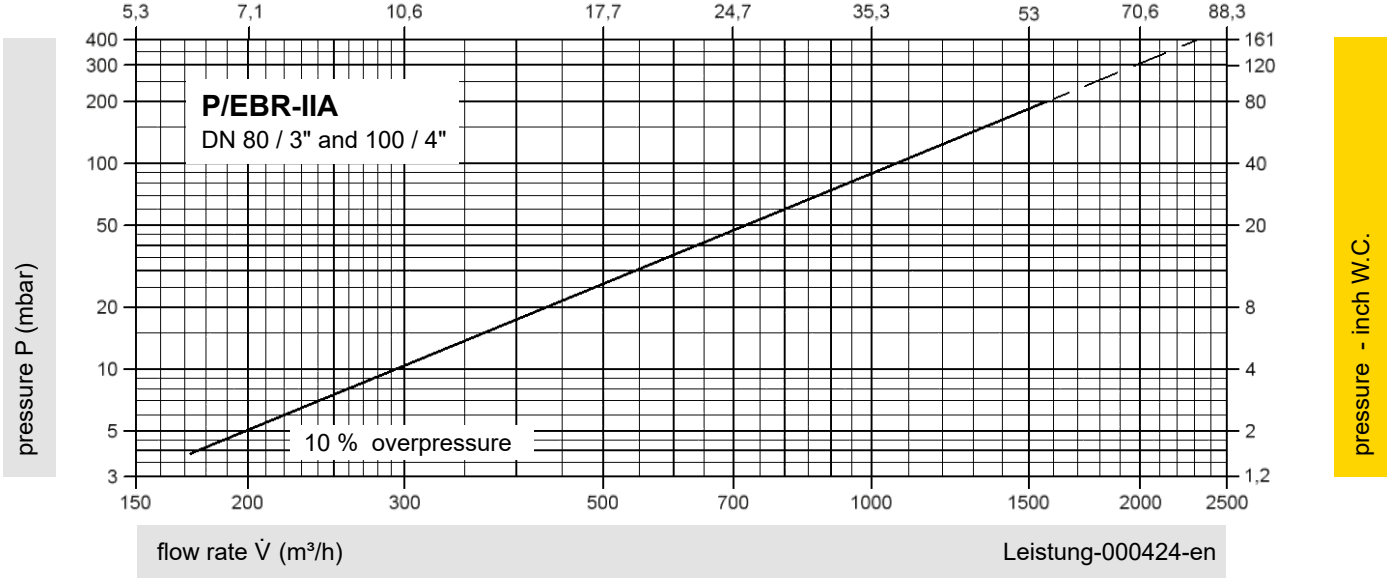


Pressure Relief Valve

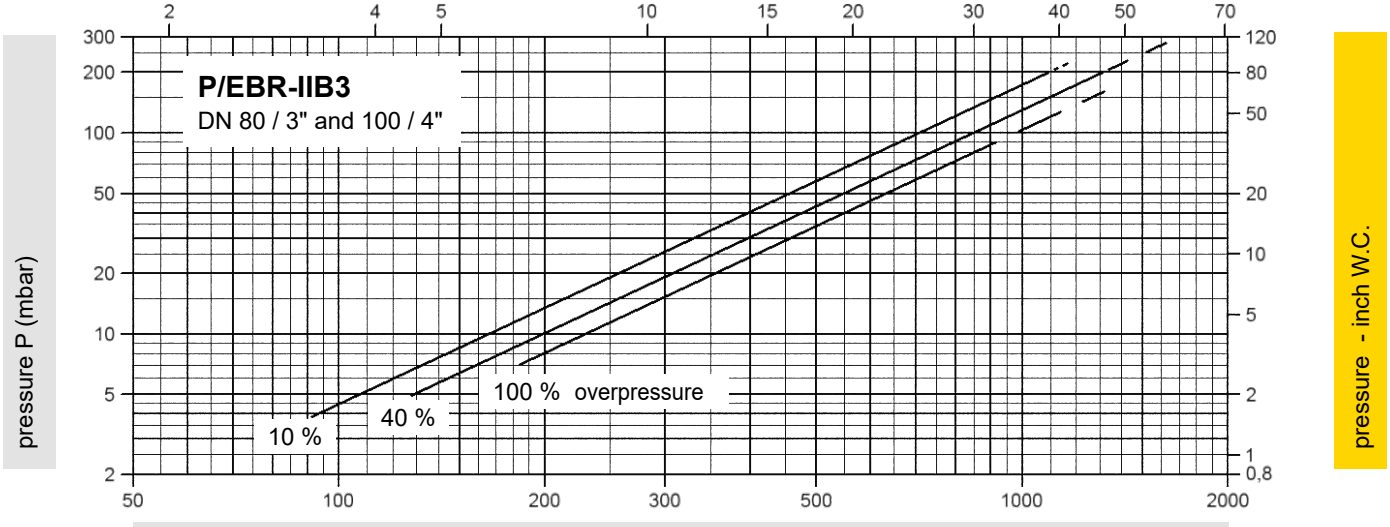
Flow Capacity Charts

PROTEGO® P/EBR

airflow in thousands of CFH



airflow in thousands of CFH



Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

Set pressure = the valve starts to open

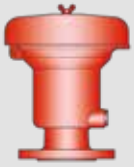
Opening pressure = set pressure plus overpressure

Overpressure % = percentage 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 V̇ 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.”

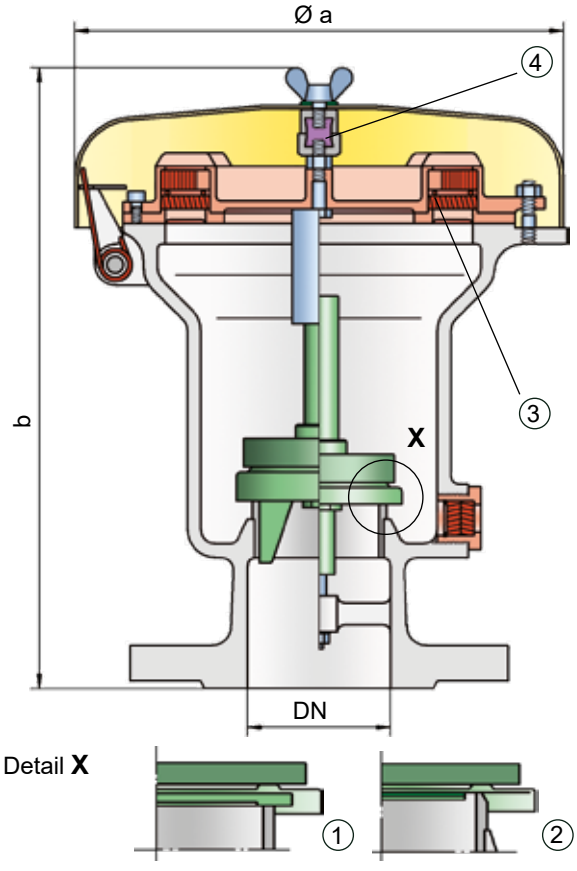
Notes:



Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® P/EBR-E



Pressure settings:

+3.5 mbar up to +210 mbar
+1.4 inch W.C. up to +84 inchW.C.
Higher pressure settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof P/EBR-E type PROTEGO® valve is a highly developed pressure relief valve for large flows with an integrated flame arrester unit that is specifically designed for use in ethanol production, processing, and storage. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and prevents product losses almost up to the set pressure, while at the same time protecting against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The P/EBR-E valve is available for substances of explosion group IIB1 (MESG ≥ 0.85 mm) and provides specific protection against deflagration and endurance burning of alcohol/air mixtures (such as ethanol/air).

The valve functions proportional, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use corrosive fluids. After the over pressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- protected against deflagration and endurance burning of alcohol/air mixtures from explosion group IIB1
- high flow capacity due to larger FLAMEFILTER® cross section
- PROTEGO® flame arrester unit provides protection against atmospheric deflagration and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Demonstration of endurance burning
Video

Design Types and Specifications

The valve pallet is weight-loaded. At set pressures >80 mbar (32.1 inch W.C.), an extended design is used.

There are two different designs:

Pressure relief valve, basic design **P/EBR - E - –**

Pressure relief valve with heating jacket **P/EBR - E - H**
(max. heating fluid temperature +85°C / 185°F)

Additional special devices available upon 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	80 / 3"	80 / 3"	100 / 4"	100 / 4"
Set pressure	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.	≤ +80 mbar ≤ +32.1 inch W.C.	> +80 mbar > +32.1 inch W.C.
a	353 / 13.90	353 / 13.90	353 / 13.90	353 / 13.90
b	345 / 13.58	505 / 19.88	345 / 13.58	505 / 19.88

Dimensions for pressure relief valve with heating jacket upon request.

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (P/EBR-E-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +210 >+5.6 up to +84	>+14 up to +210 >+5.6 up to +84	Special materials and higher pressure settings upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Flange connection type

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

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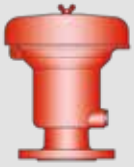
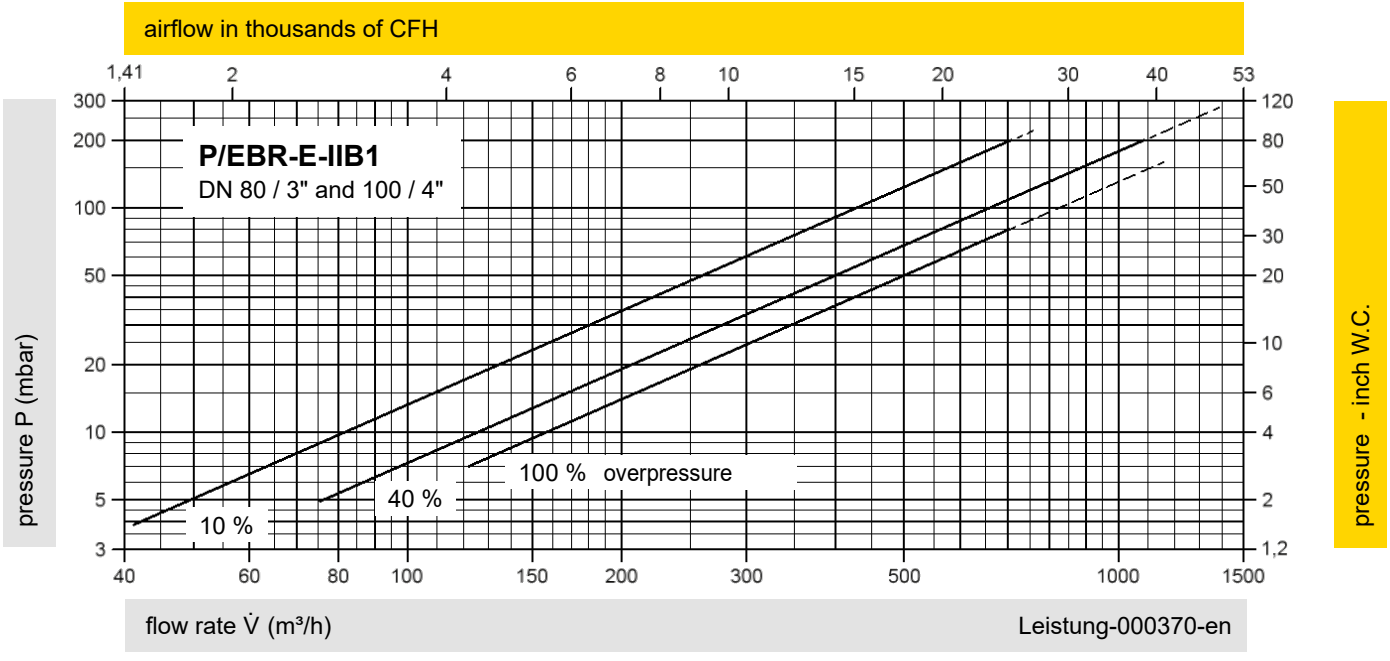


Pressure Relief Valve

Flow Capacity Chart

PROTEGO® P/EBR-E



Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

Set pressure = the valve starts to open

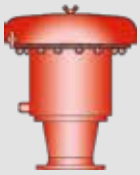
Opening pressure = set pressure plus overpressure

Overpressure % = percentage 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 V̇ 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.”

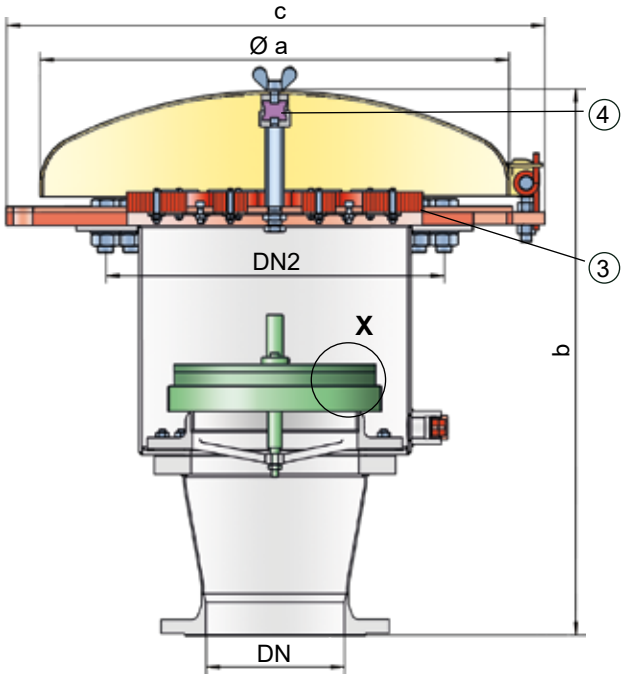
Notes:

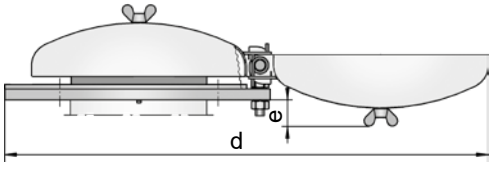


Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® D-SVL-EB-IIA





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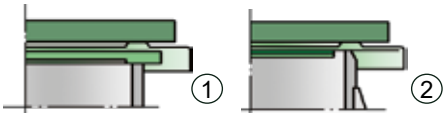


Pressure settings:

+2.0 mbar up to +60 mbar
+0.8 inch W.C. up to +24 inch W.C.
Higher pressure settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof D-SVL-EB type PROTEGO® valve is a highly developed pressure relief valve for large flows with an integrated flame arrester PROTEGO® EB. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against excess pressure and prevents product losses almost up to the set pressure; while at the same time protecting against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. PROTEGO® D-SVL-EB valves are available for substances for substances of explosion group IIA (NEC group D MESG > 0.9 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.
The tank pressure is maintained up to the set pressure with a tightness that is above the conventional standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with a high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use in corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.
If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated flame arrester PROTEGO® EB (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used up to an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 – Appendix L and ISO 28300 (API 2000).

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- set pressure close to opening pressure for optimum pressure maintenance in the system
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Demonstration of endurance burning Video

Design Types and Specifications

The valve pallet is weight-loaded.

There are two different designs:

Pressure relief valve, basic design **D-SVL-EB -** **–**

Pressure relief valve with heating jacket **D-SVL-EB -** **H**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

DN	DN2	a	b	c	d	e
150 / 6“	400 / 16“	705 / 27.76	754 / 29.68	802 / 31.57	1500 / 59.06	109 / 4.29
200 / 8“	400 / 16“	705 / 27.76	846 / 33.31	802 / 31.57	1500 / 59.06	109 / 4.29

Dimensions for pressure relief valve with heating jacket upon request.

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	A	B	
Housing Heating jacket (D-SVL-EB-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Spacer	PTFE	PTFE	
Flange ring	Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	
Flame arrester unit	A	A, B	

Table 4: Material combination of flame arrester unit

Design	A	B	
FLAMEFILTER® casing	Steel	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	Stainless Steel	
Safety bar	Stainless Steel	Stainless Steel	

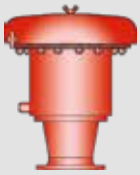
Table 5: Material selection for valve pallet

Design	A	B	C	D	E	F
Pressure range (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	>+35 up to +60 >+14 up to +24	>+14 up to +35 >+5.6 up to +14	>+35 up to +60 >+14 up to +24
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	Metal to Metal	PTFE	PTFE

Special materials and higher pressure settings upon request.

Table 6: Flange connection type

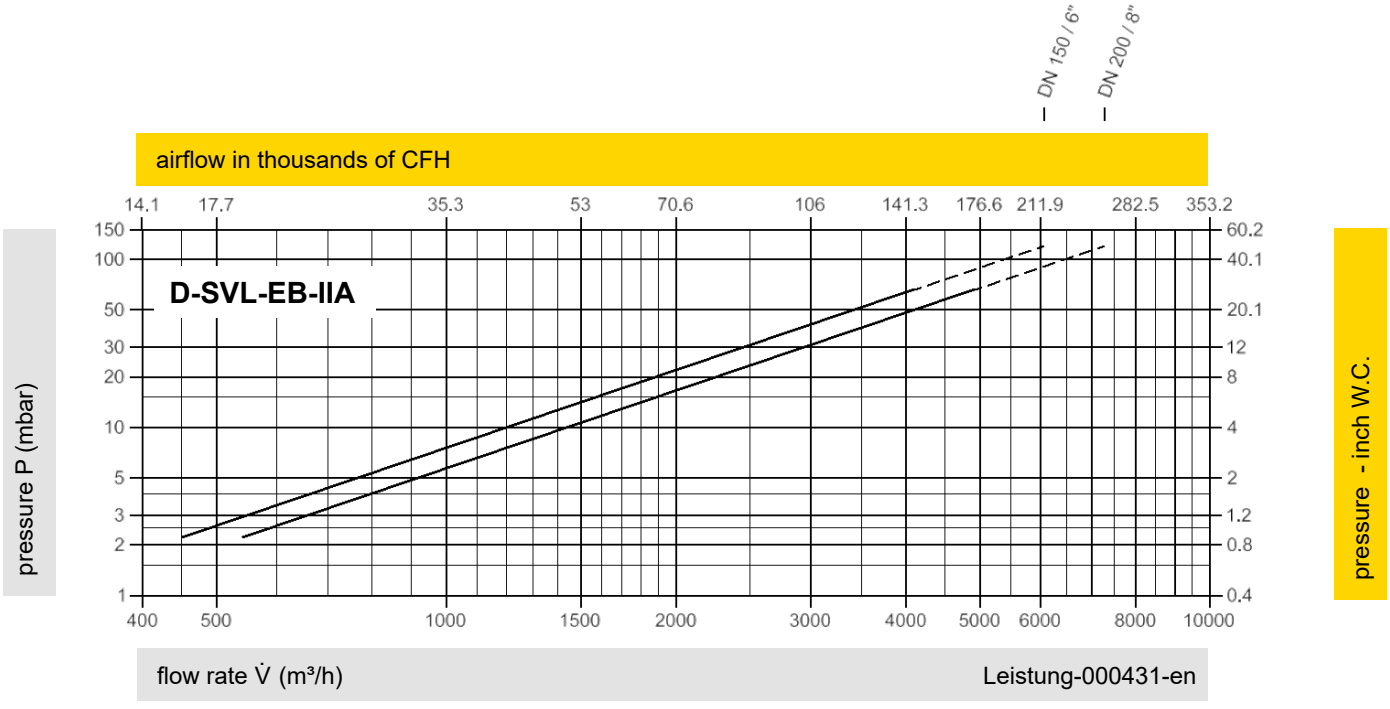
EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	



Pressure Relief Valve

Flow Capacity Chart

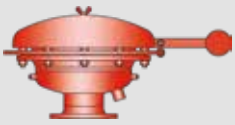
PROTEGO® D-SVL-EB-IIA



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

Volume flow V̇ 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.”

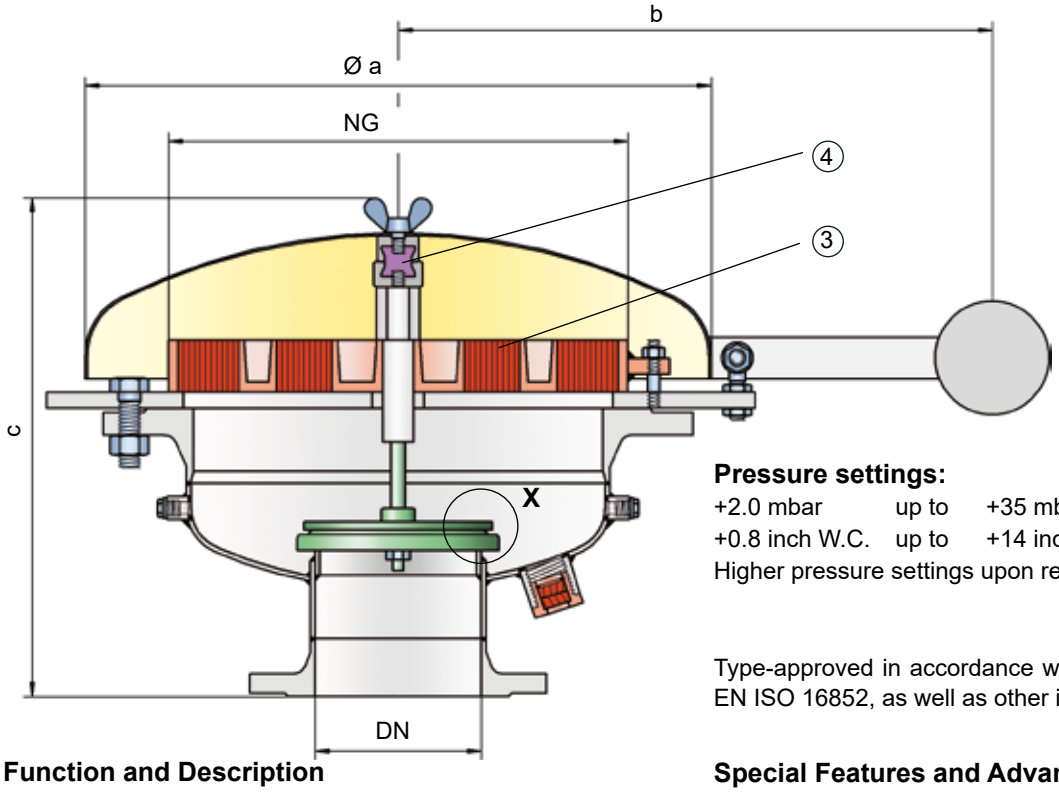
Notes:

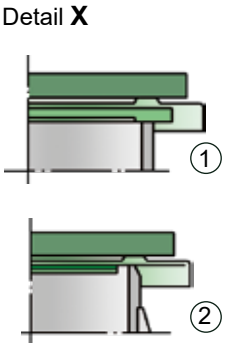


Pressure Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® BE/HR-D





Pressure settings:

+2.0 mbar up to +35 mbar
+0.8 inch W.C. up to +14 inch W.C.
Higher pressure settings upon request.

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

Function and Description

The deflagration-proof and endurance burning-proof BE/HR-D type PROTEGO® valve is a highly developed pressure relief valve with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers. and process equipment. The valve offers reliable protection against overpressure and prevents product losses almost up to the set pressure, while at the same time protecting against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The BE/HR-D valve is available for substances from explosion group IIA (NEC group D MESG > 0.9 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 40% overpressure. The tank pressure is maintained up to the set pressure with a tightness that is far above conventional standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/ air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

Special Features and Advantages

- requires only 40% overpressure to reach full lift
- due to 40% technology, higher set pressures can be used, resulting in reduced product loss, as compared to conventional 100% technology (compare API 2000)
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- high flow capacity due to large FLAMEFILTER® cross section
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design

Design and Specifications

The valve pallet is weight-loaded.

Pressure relief valve, basic design **BE/HR-D-400/...**

Additional special devices available upon request.

Demonstration of endurance burning
Video

Table 1: Dimensions — Dimensions in mm / inches

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

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

NG = Nominal size.

Table 2: Selection of explosion group

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

Special approvals upon request.

Table 3: Material selection for housing

Design	A	B
Housing	Steel	Stainless Steel
Valve seat	Stainless Steel	Stainless Steel
Weather hood	Steel	Stainless Steel
Flame arrester unit	A	B

Special materials upon request.

Table 4: Material combinations of flame arrester unit

Design	A	B
FLAMEFILTER® casing	Steel	Stainless Steel
FLAMEFILTER®	Stainless Steel	Stainless Steel

Special materials upon request.

Table 5: Material selection for valve pallet

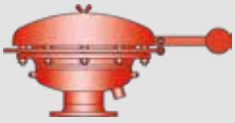
Design	A	B	C
Pressure range (mbar) (inch W.C.)	+2.0 up to +3.5 +0.8 up to +1.4	>+3.5 up to +14 >+1.4 up to +5.6	>+14 up to +35 >+5.6 up to +14
Valve pallet	Aluminum	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal

Special materials and higher pressure settings upon request.

Table 6: Flange connection type

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

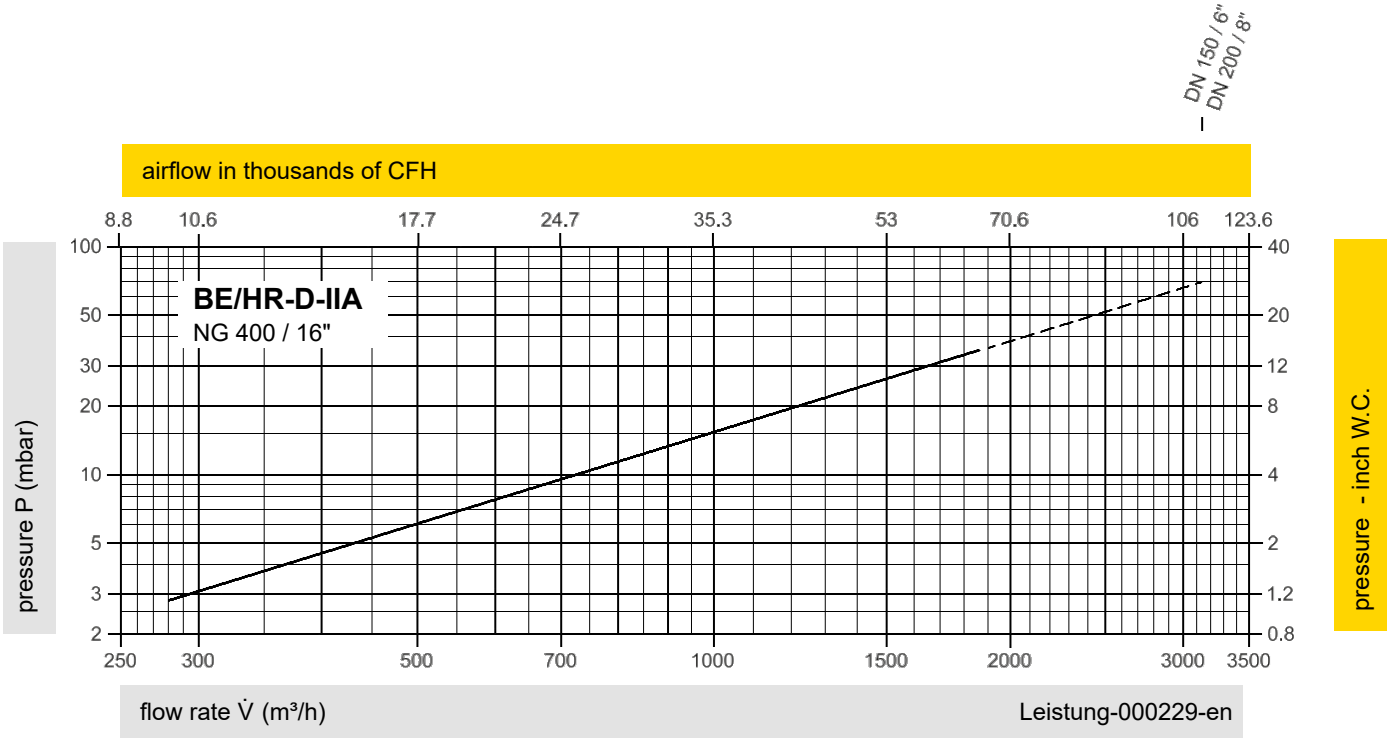
Other types upon request.



Pressure Relief Valve

Flow Capacity Chart

PROTEGO® BE/HR-D



Remark

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

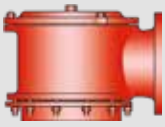
Set pressure = the valve starts to open

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 V̇ 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.”

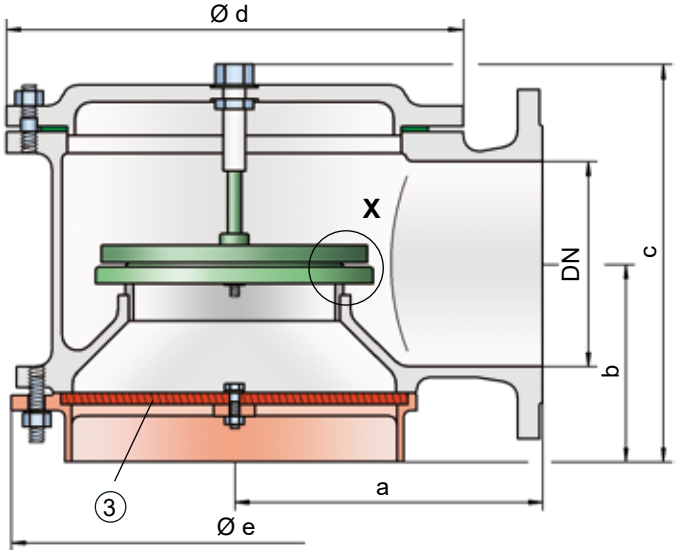
Notes:



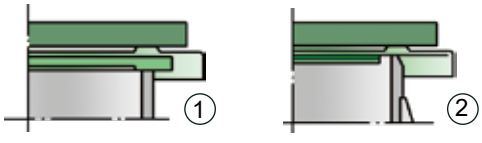
Vacuum Relief Valve

Deflagration-proof

PROTEGO® SV/E



Detail **X**



Vacuum settings:

-2.0 mbar up to -60 mbar (-0.2 kPa up to -6 kPa)

-0.8 inch W.C. up to -24 inch W.C.

Higher vacuum settings upon request.

Function and Description

The deflagration-proof SV/E type PROTEGO® valve is a state-of-the-art vacuum relief valve with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission-proof in-breathing on tanks, containers, and process equipment. The valve offers reliable protection against vacuum and prevents in-breathing of air almost up to the set pressure; while at the same time protecting against atmospheric deflagration. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® SV/E valve is available for substances from explosion groups IIA to IIC.

When the set vacuum is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set vacuum that is only 10% above the maximum allowable working vacuum (MAWV) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set vacuum with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal, (2) in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use corrosive fluids. After the vacuum is balanced, the valve re-seats and provides a tight seal.

If the valve is used in atmospheres forming an explosive mixture with air and the mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank.

The standard design is tested at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000). In addition, numerous versions for higher operating temperature are available.

Type-approved in accordance with the current ATEX Directive and EN ISO 16852, as well as other international standards. Additional certificates from classification organizations for use on ships are also available.

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- excellent tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- high flow capacity
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations
- integrated FLAMEFILTER® saves space and weight and reduces costs
- FLAMEFILTER® is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- available in a special design with lifting device (for ships)

Design Types and Specifications

The valve pallet is weight-loaded. **Higher vacuum can be achieved upon request. with a special spring loaded design.**

There are four different designs:

Vacuum relief valve, basic design	**SV/E-** [–] **-** [–]
Vacuum relief valve with heating jacket (max. heating fluid temperature +85°C / 185°F)	**SV/E-** [–] **-** [**H**]
Vacuum relief valve with lifting gear (ship design)	**SV/E-** [**S**] **-** [–]
Vacuum relief valve with lifting gear (ship design) and heating jacket (max. heating fluid temperature +85°C / 185°F)	**SV/E-** [**S**] **-** [**H**]

Additional special devices available upon request.

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

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"	250 / 10"	300 / 12"
a	140 / 5.51	170 / 6.69	190 / 7.48	230 / 9.06	300 / 11.81	325 / 12.80	425 / 16.73
b	105 / 4.13	115 / 4.53	125 / 4.92	165 / 6.50	195 / 7.68	230 / 9.06	280 / 11.02
c	225 / 8.86	240 / 9.45	320 / 12.60	410 / 16.14	460 / 18.11	525 / 20.67	575 / 22.64
d	170 / 6.69	235 / 9.25	280 / 11.02	335 / 13.19	445 / 17.52	505 / 19.88	505 / 19.88
e	215 / 8.46	215 / 8.46	255 / 10.04	345 / 13.58	435 / 17.13	470 / 18.50	635 / 25.00

Table 2: Selection of explosion group

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

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	B	C	
Housing Heating jacket (SV/E-(S)-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seat	Stainless Steel	Stainless Steel	
Gasket	PTFE	PTFE	
Flame arrester unit	B	B	

Table 5: Material combinations of flame arrester unit

Design	B	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	

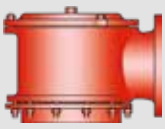
Table 6: Material selection for valve pallet

Design	A	B	C	D	E	F
Vacuum range (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	<-35 up to -60 <-14 up to -24	<-14 up to -35 <-5.6 up to -14	<-35 up to -60 <-14 up to -24
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	Metal to Metal	PTFE	PTFE

Special materials and higher pressure settings upon request.

Table 7: Flange connection type

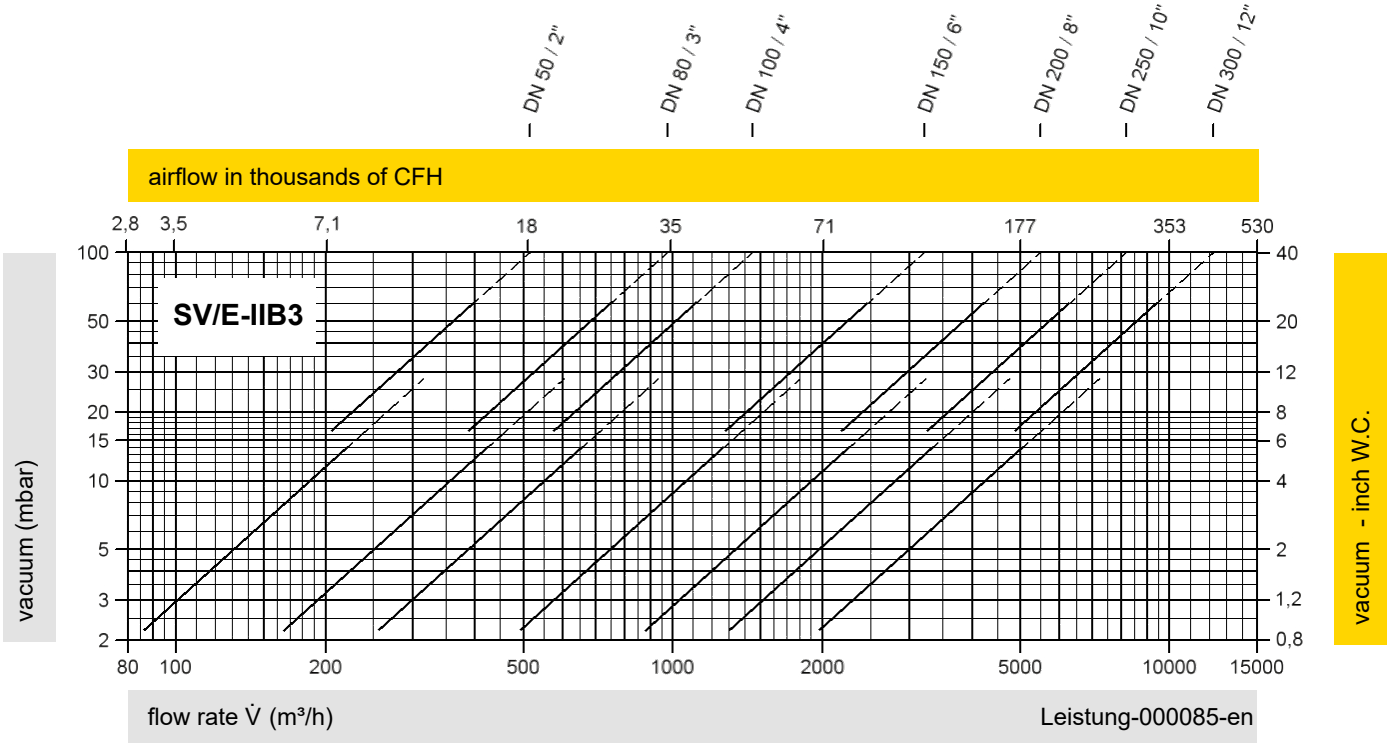
EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

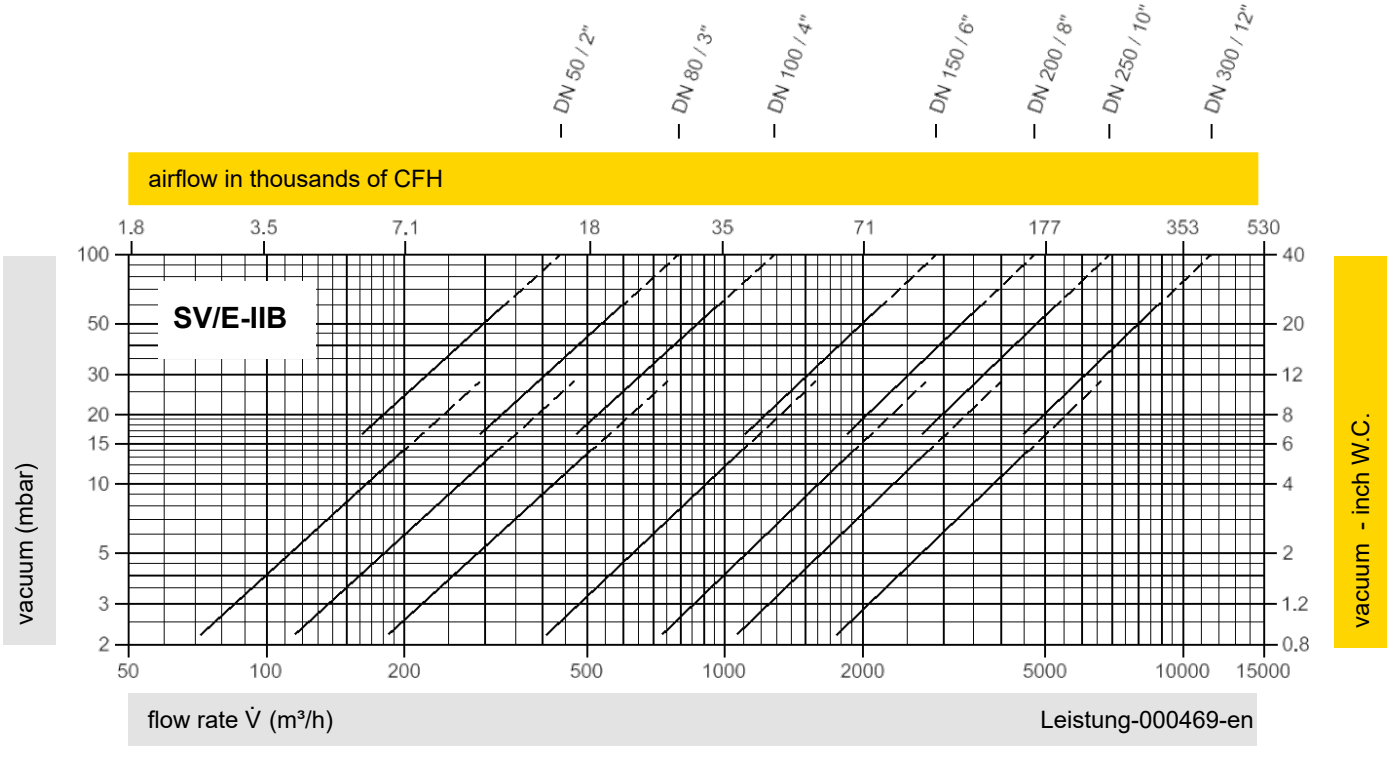


Vacuum Relief Valve

Flow Capacity Chart

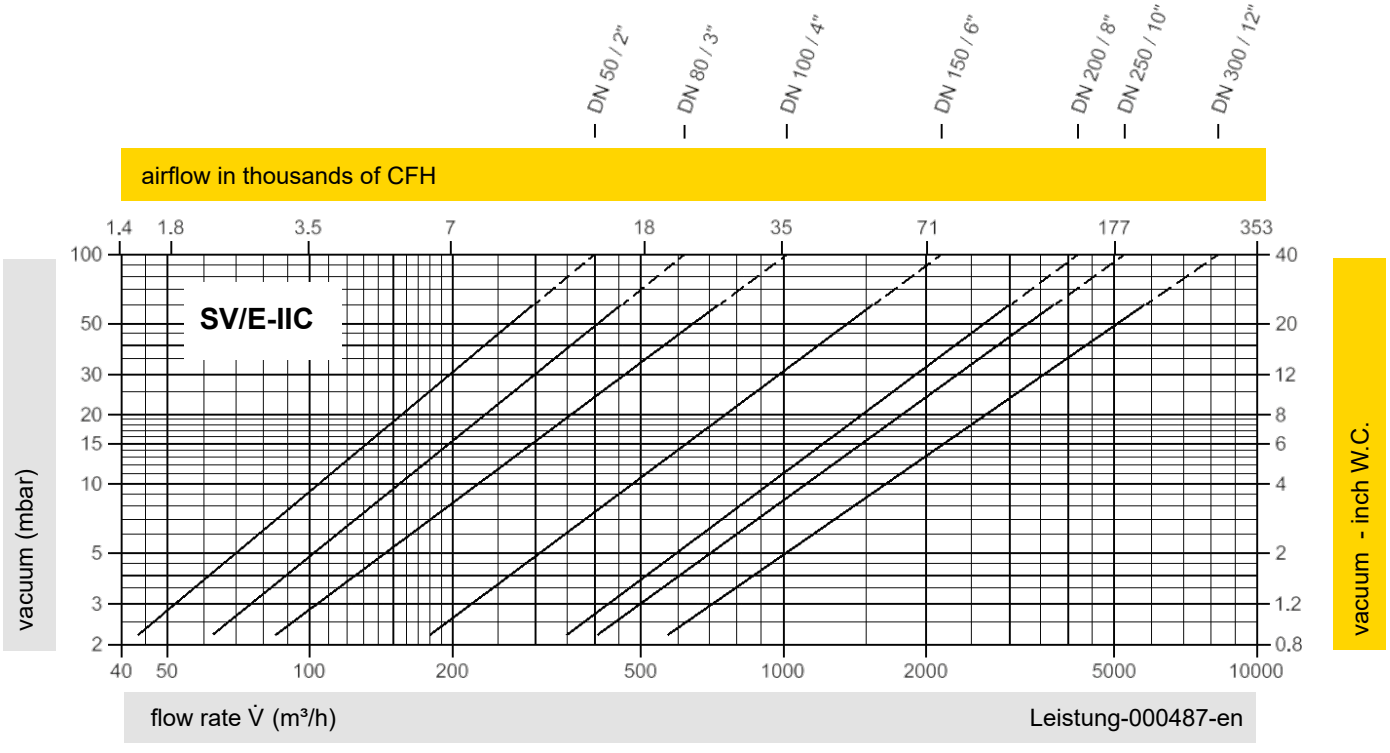
PROTEGO® SV/E

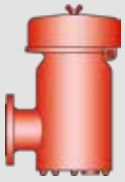




The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”

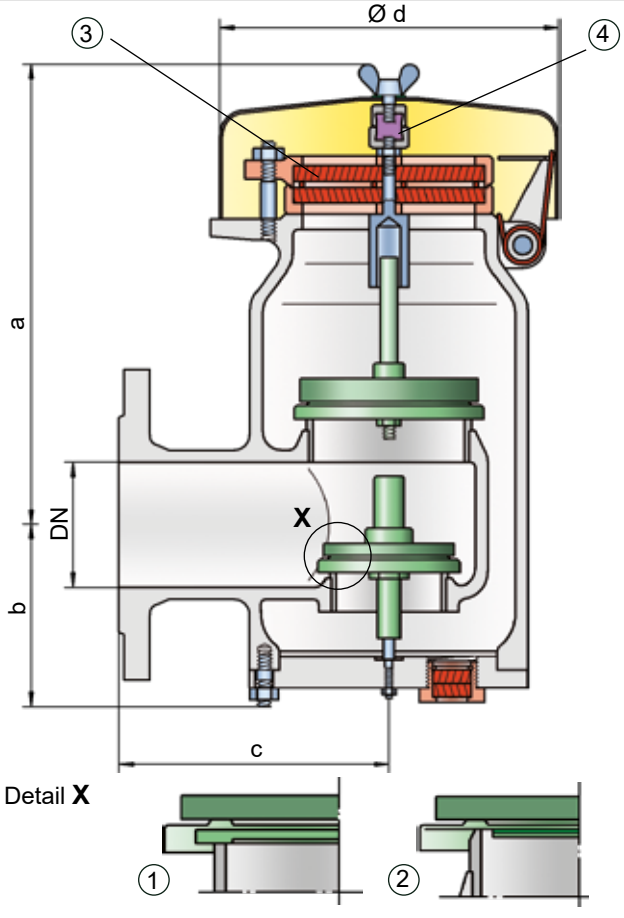

DN 50 / 2"
DN 80 / 3"
DN 100 / 4"
DN 150 / 6"
DN 200 / 8"
DN 250 / 10"
DN 300 / 12"
airflow in thousands of CFH
1.4
1.8
3.5
7
18
35
71
177
353
SV/E-IIC
100
50
30
20
15
10
5
3
2
40
20
12
8
6
4
2
1.2
0.8
vacuum (mbar)
vacuum - inch W.C.
40
50
100
200
500
1000
2000
5000
10000
flow rate V̇ (m³/h)
Leistung-000487-en



Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® PV/EB



Settings:

pressure:	+2.0 mbar	up to	+210 mbar
	+0.8 inch W.C.	up to	+84 inch W.C.
vacuum:	-14 mbar	up to	-35 mbar
	-5.6 inch W.C.	up to	-14 inch W.C.
vacuum:	-3.5 mbar	up to	-14 mbar
	-1.4 inch W.C.	up to	-5.6 inch W.C.

For presssure up to max. + 150 mbar / 60.2 inch W.C.
Higher and lower settings upon request.

Function and Description

The atmospheric deflagration-proof and endurance burning-proof PV/EB type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® PV/EB valve is available for substances from explosion group IIA (NEC group D MESG > 0.9 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) or maximum allowable working vacuum (MAWV) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated PROTEGO® flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

Type-approved in accordance with the current ATEX Directive and EN 12874, as well as other international standards.

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% and 100% technology
- valve opens later and closes earlier than conventional valves
- excellent tightness, resulting in lowest possible product losses and environmental pollution
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- PROTEGO® flame arrester unit provides protection against atmospheric deflagration and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapor
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- available in a special design with lifting device

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Demonstration of endurance burning Video

Design Types and Specifications

Almost any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded. When the difference between the pressure and vacuum exceeds 150 mbar / 60.2 inch W.C., special valve pallets are used.

There are two different designs:

Pressure/vacuum relief valve, basic design **PV/EB-–**

Pressure/vacuum relief valve with heating jacket **PV/EB-H**
(max. heating fluid temperature +85°C / 185°F)
Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	50 / 2"	50 / 2"	80 / 3"	80 / 3"	
Set pressure	≤ +60 mbar ≤ +24.1 inch W.C.	> +60 mbar > +24.1 inch W.C.	≤ +60 mbar ≤ +24.1 inch W.C.	> +60 mbar > +24.1 inch W.C.	Dimensions for pressure/ vacuum relief valve with heating jacket upon request.
a	308 / 12.13	443 / 17.44	308 / 12.13	443 / 17.44	
b	108 / 4.25	108 / 4.25	108 / 4.25	108 / 4.25	
c	165 / 6.50	165 / 6.50	167 / 6.57	167 / 6.57	
d	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58	

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (PV/EB-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seats	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	
Pressure range (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 +210 >+5.6 up to +84	>+35 up to +210 >+14 up to +84	Special materials and higher set pressures upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

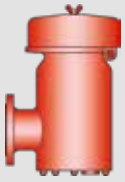
Table 6: Material selection for vacuum pallet

Design	A	B	C	D	
Vacuum range (mbar) (inch W.C.)	-3.5 up to -5.0 -1.4 up to -2.0	<-5.0 up to -14 <-2.0 up to -5.6	<-14 up to -35 <-5.6 up to -14	<-14 up to -35 <-5.6 up to -14	Special materials and higher set vacuum upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 7: Flange connection type

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

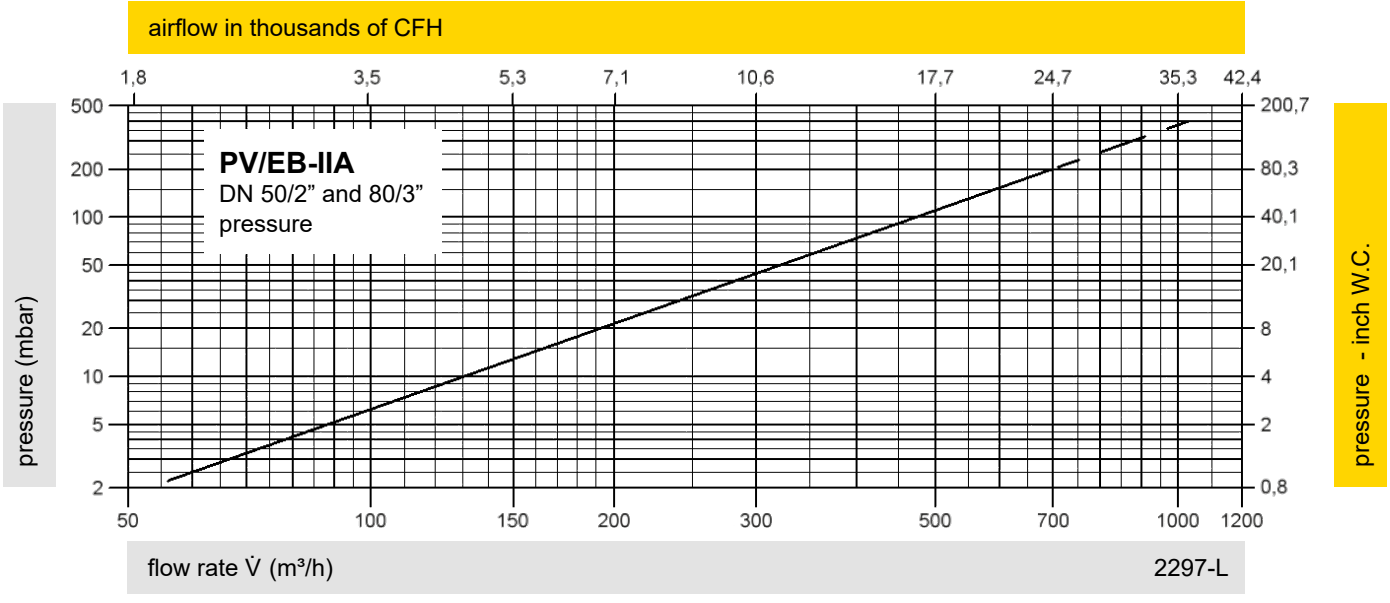
PROTEGO
for safety and environment

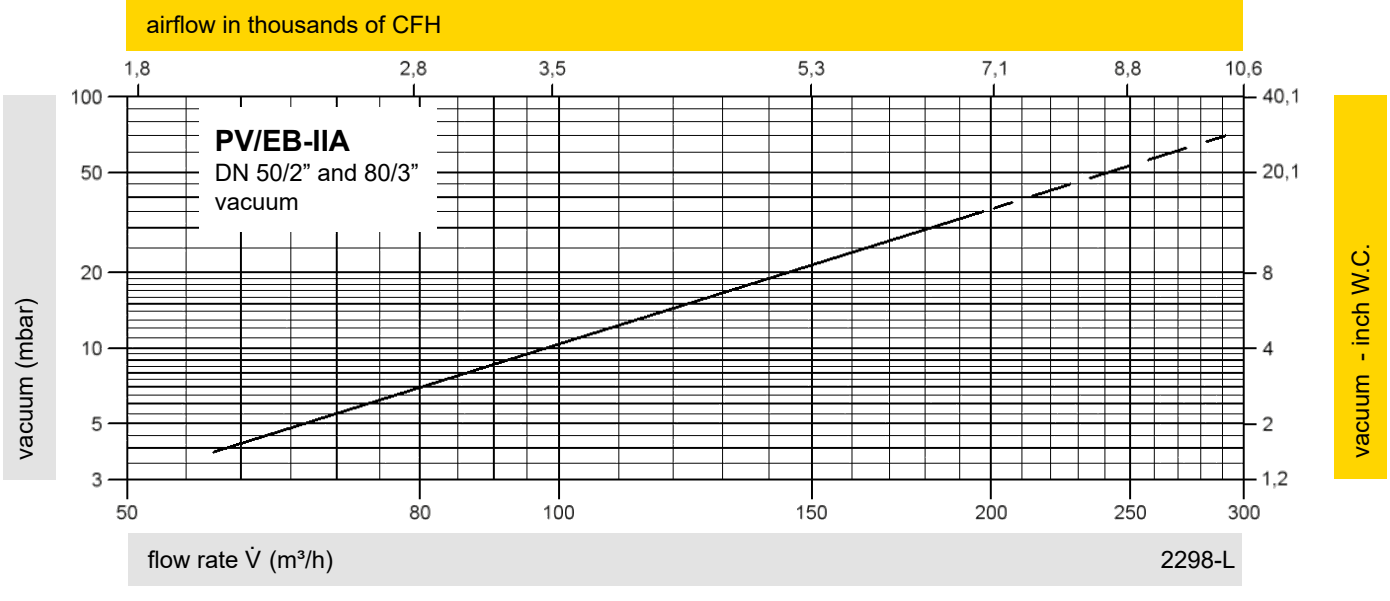


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® PV/EB

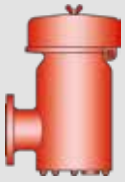




The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”

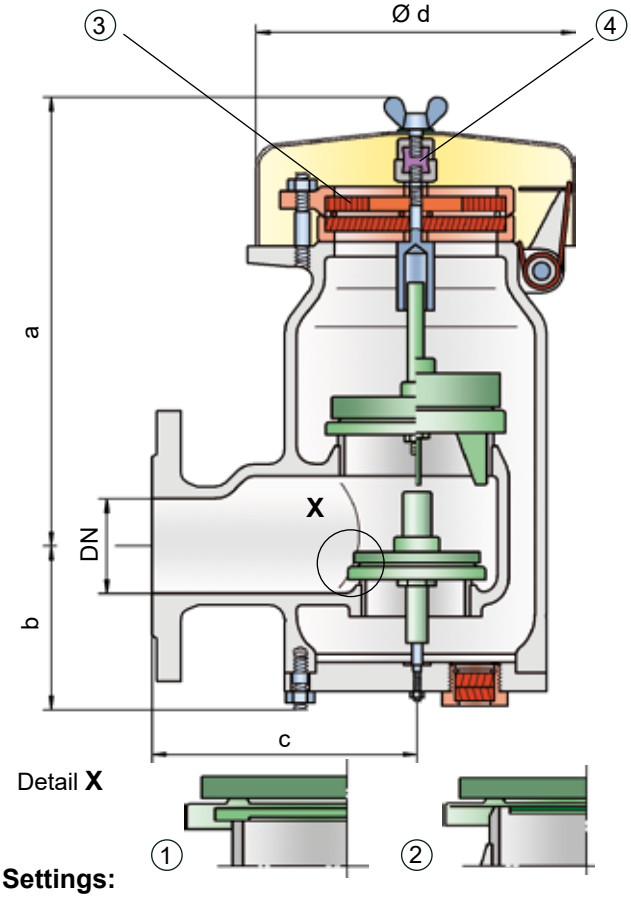
Notes:



Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® PV/EB-E



Settings:

pressure:	+2.0 mbar	up to	+210 mbar
	+0.8 inch W.C.	up to	+84 inch W.C.
vacuum:	-14 mbar	up to	-35 mbar
	-5.6 inch W.C.	up to	-14 inch W.C.
vacuum:	-3.5 mbar	up to	-14 mbar
	-1.4 inch W.C.	up to	-5.6 inch W.C.

For presssure up to max. + 150 mbar / 60.2 inch W.C.
Higher and lower settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof PV/EB-E type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester unit that is specifically designed for use in ethanol production, processing, and storage. It is primarily used as a safety device for flame transmission-proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and as endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® PV/EB-E valve is available for substances from explosion group IIB1 (MESG ≥ 0.85 mm) and provides specific protection against deflagration and endurance burning of alcohol/air mixtures (such as ethanol/air).

The valve functions proportionally, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and reduced environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- protected against deflagration and endurance burning of alcohol/air mixtures from explosion group IIB1
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit is saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallets
- available in a special design with lifting device

Demonstration of endurance burning
Video

Design Types and Specifications

Almost any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded. When the difference between the pressure and vacuum exceeds 150 mbar / 60.2 inch W.C., special valve pallets are used.

There are two different designs:

Pressure/vacuum relief valve, basic design **PV/EB-E-** **–**

Pressure/vacuum relief valve with heating jacket **PV/EB-E-** **H**
(max. heating fluid temperature +85°C / 185°F)

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	50 / 2"	50 / 2"	80 / 3"	80 / 3"	
Set pressure	≤ +60 mbar ≤ +24.1 inch W.C.	> +60 mbar ≤ +24.1 inch W.C	≤ +60 mbar ≤ +24.1 inch W.C	> +60 mbar ≤ +24.1 inch W.C	Dimensions for pressure/ vacuum relief valve with heating jacket upon request.
a	308 / 12.13	443 / 17.44	308 / 12.13	443 / 17.44	
b	108 / 4.25	108 / 4.25	108 / 4.25	108 / 4.25	
c	165 / 6.50	165 / 6.50	167 / 6.57	167 / 6.57	
d	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58	

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (PV/EB-E-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seats	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	
Pressure range (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 +210 >+5.6 up to +84	>+35 up to +210 >+14 up to +84	Special materials and higher set pressures upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Material selection for vacuum pallet

Design	A	B	C	D	
Vacuum range (mbar) (inch W.C.)	-3.5 up to -5.0 -1.4 up to -2.0	<-5.0 up to -14 <-2.0 up to -5.6	<-14 up to -35 <-5.6 up to -14	<-14 up to -35 <-5.6 up to -14	Special materials and higher set vacuum upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 7: Flange connection type

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

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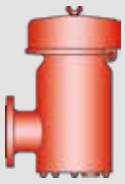
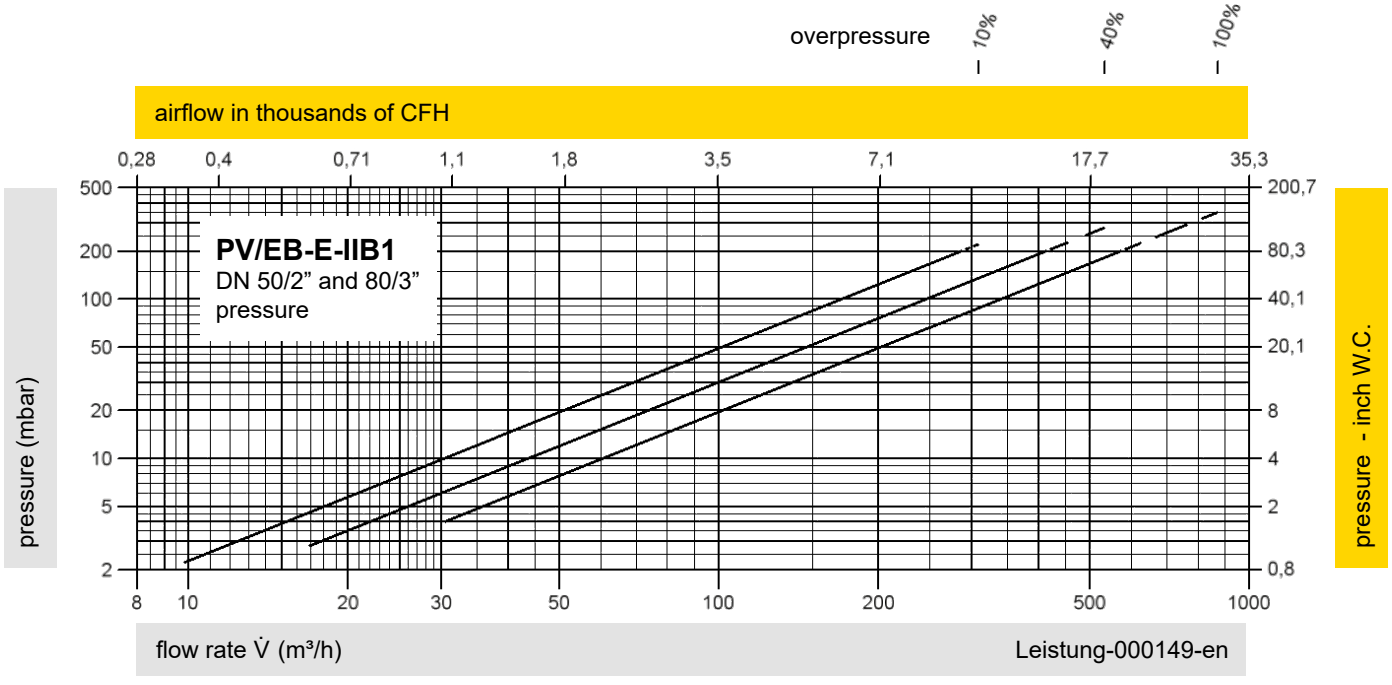
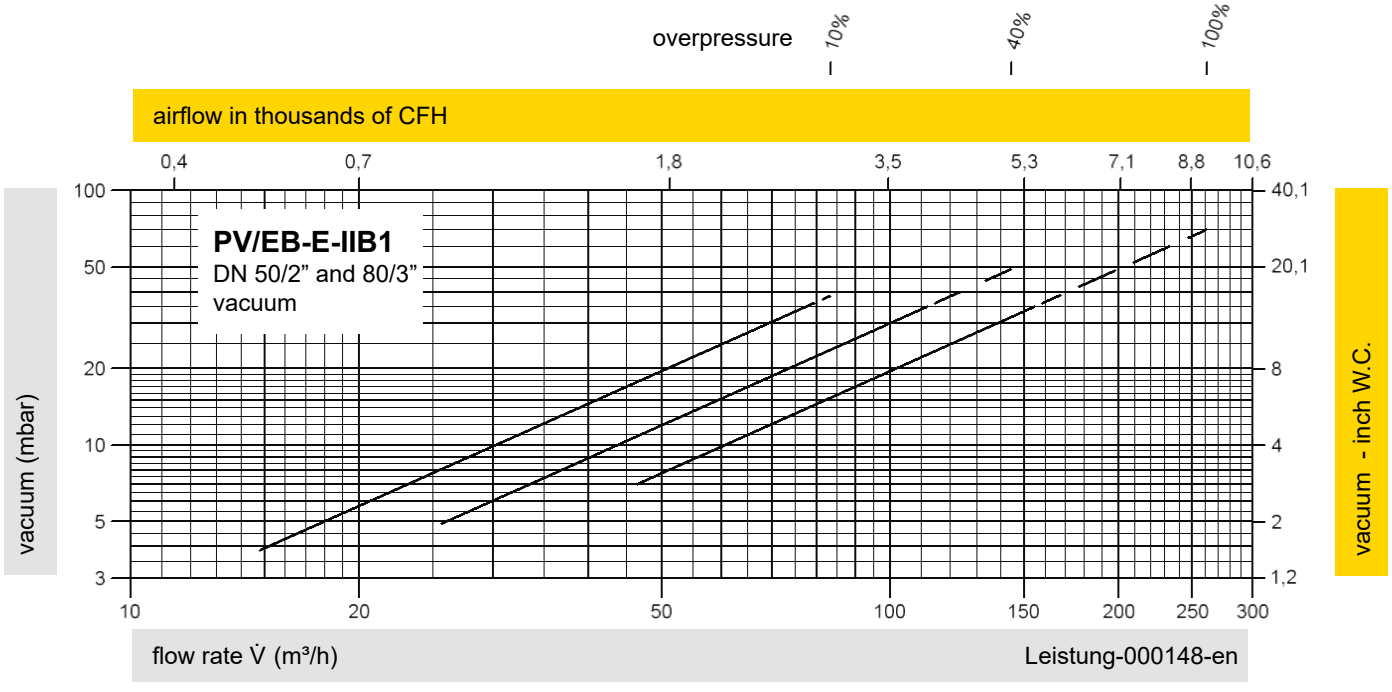


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® PV/EB-E





Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

Set pressure = the valve starts to open

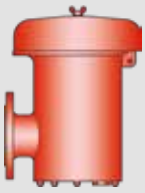
Opening pressure = set pressure plus overpressure

Overpressure % = percentage 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 V̇ 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.”

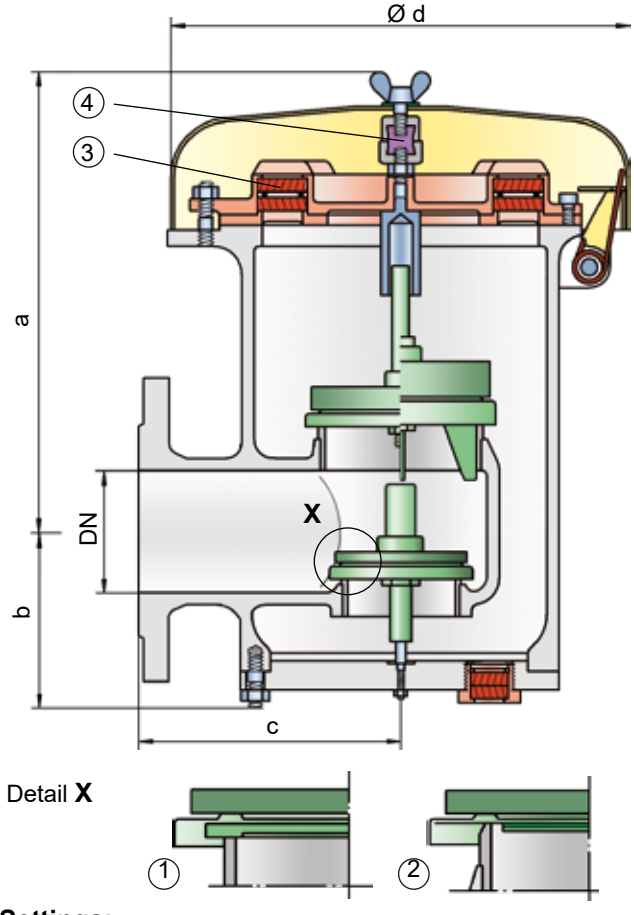
Notes:



Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® PV/EBR



Detail **X**

Settings:

pressure:	+2.0 mbar	up to	+210 mbar
	+0.8 inch W.C.	up to	+84 inch W.C.
vacuum:	-14 mbar	up to	-50 mbar
	-5.6 inch W.C.	up to	-20 inch W.C.
vacuum:	-3.5 mbar	up to	-14 mbar
	-1.4 inch W.C.	up to	-5.6 inch W.C.

For presssure up to max. + 150 mbar / 60.2 inch W.C.
Higher and lower settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof PV/EBR type PROTEGO® valve is a highly developed combined pressure/ vacuum relief valve for high flow capacities with an integrated flame arrester. It is primarily used as a safety device for flame transmission-proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. PROTEGO® PV/EBR valves are available for substances from explosion groups IIA to IIB3 (NEC group D to C MESG ≥ 0.65 mm).

The valve functions proportional, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- high flow capacity due to larger FLAMEFILTER® cross section
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- available in a special design with lifting device

Demonstration of endurance burning
Video

Design Types and Specifications

Almost any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded. When the difference between the pressure and vacuum exceeds 150 mbar / 60.2 inch W.C., special valve pallets are used.

There are two different designs:

Pressure/vacuum relief valve, basic design **PV/EBR-–**

Pressure /vacuum relief valve with heating jacket (max. heating fluid temperature +85°C / 185°F) **PV/EBR-H**

Additional special devices available upon request.

Table 1: Dimensions — Dimensions in mm / inches

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

DN	80 / 3"	80 / 3"	100 / 4"	100 / 4"
Set pressure	≤ +35 mbar ≤ +14 inch W.C.	> +35 mbar > +14 inch W.C.	≤ +35 mbar ≤ +14 inch W.C.	> +35 mbar > +14 inch W.C.
a	345 / 13.58	475 /18.70	345 / 13.58	475 /18.70
b	141 / 5.55	141 / 5.55	141 / 5.55	141 / 5.55
c	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58
d	353 / 13.90	353 / 13.90	353 / 13.90	353 / 13.90

Dimensions for pressure/ vacuum relief valve with heating jacket upon request.

Table 2: Selection of explosion group

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

Special approvals upon request.

Table 3: Material selection for housing

Design	B	C
Housing Heating jacket (PV/EBR-H-...)	Steel Steel	Stainless Steel Stainless Steel
Valve seats	Stainless Steel	Stainless Steel
Weather hood	Steel	Stainless Steel

Special materials upon request.

Table 4: Material combination of flame arrester unit

Design	A
FLAMEFILTER® casing	Stainless Steel
FLAMEFILTER®	Stainless Steel
Spacer	Stainless Steel

Special materials upon request.

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D
Pressure range (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 +210 >+5.6 up to +84	>+35 up to +210 >+14 up to +84
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	PTFE

Special materials and higher set pressures upon request.

Table 6: Material selection for vacuum pallet

Design	A	B	C	D
Vacuum range (mbar) (inch W.C.)	-3.5 up to -5.0 -1.4 up to -2.0	<-5.0 up to -14 <-2.0 up to -5.6	<-14 up to -50 <-5.6 up to -20	<-14 up to -50 <-5.6 up to -20
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	PTFE

Special materials and higher set vacuum upon request.

Table 7: Flange connection type

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

Other types upon request.

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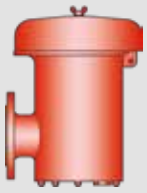
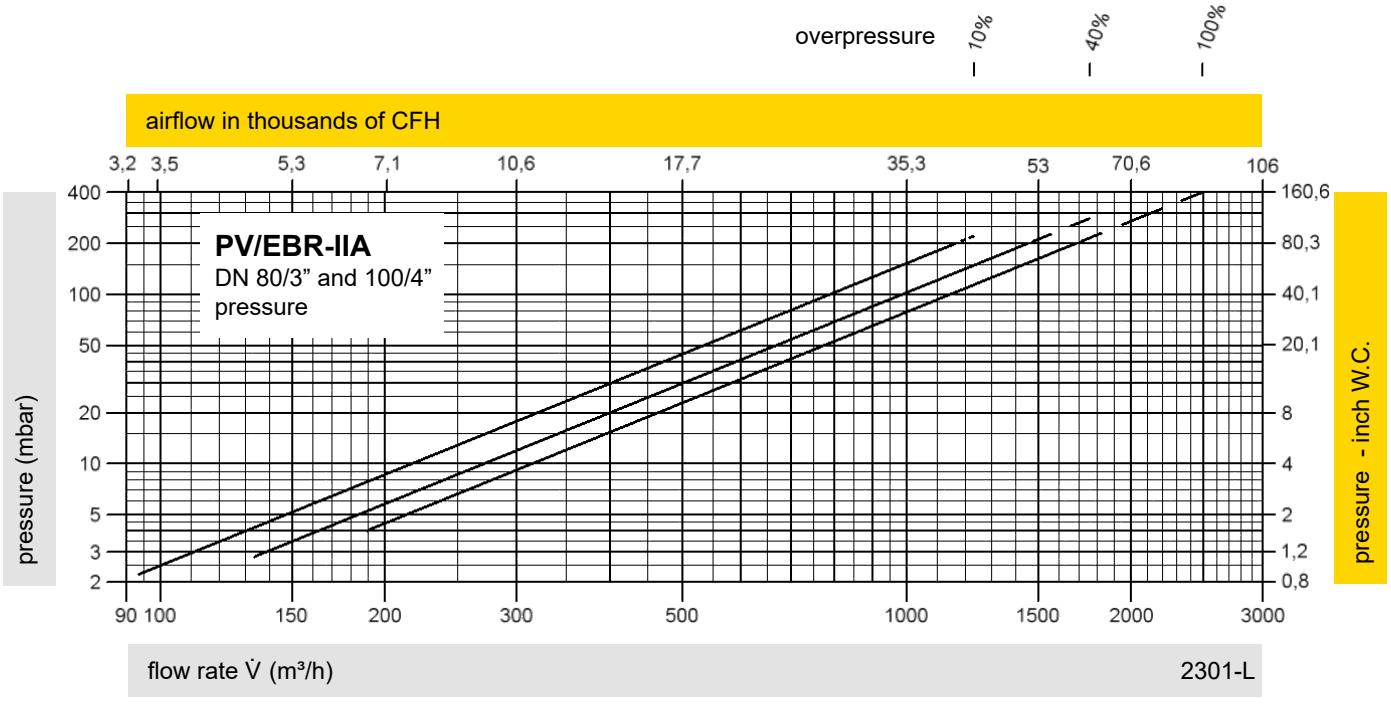
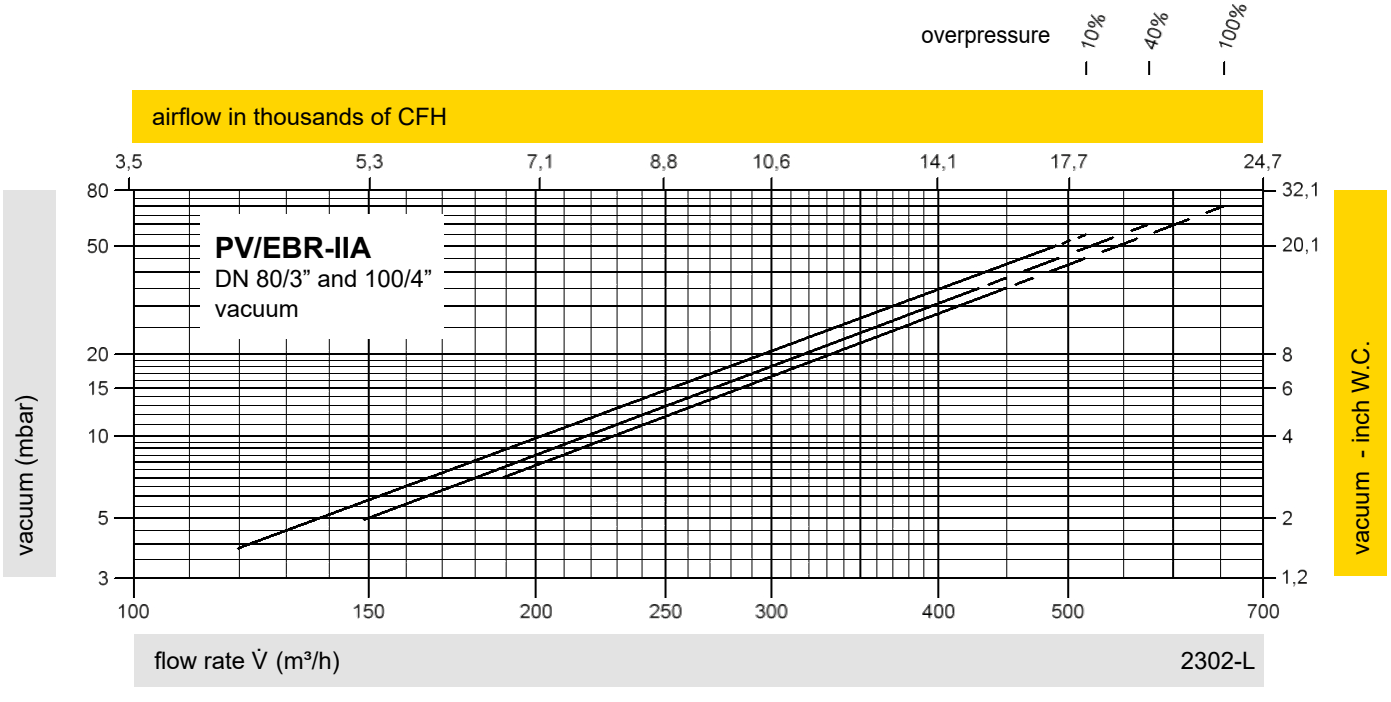


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® PV/EBR





Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

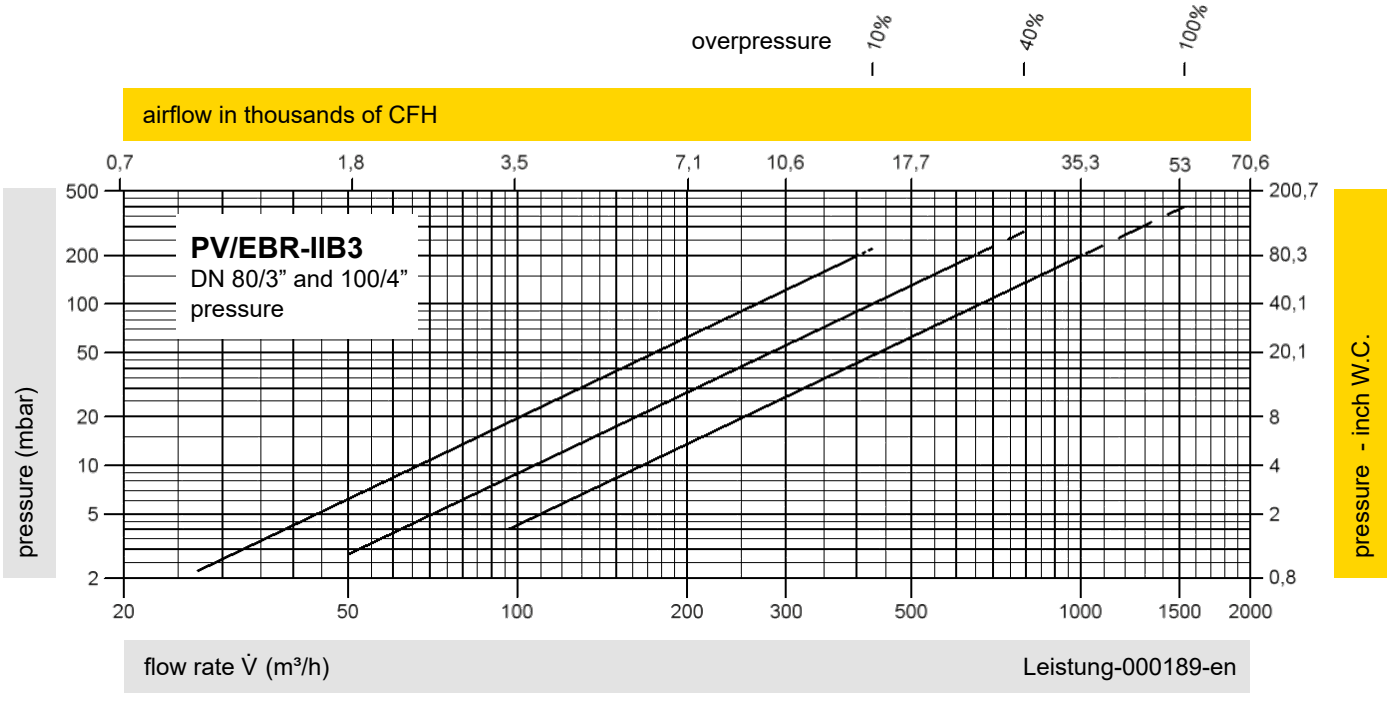
Set pressure = the valve starts to open

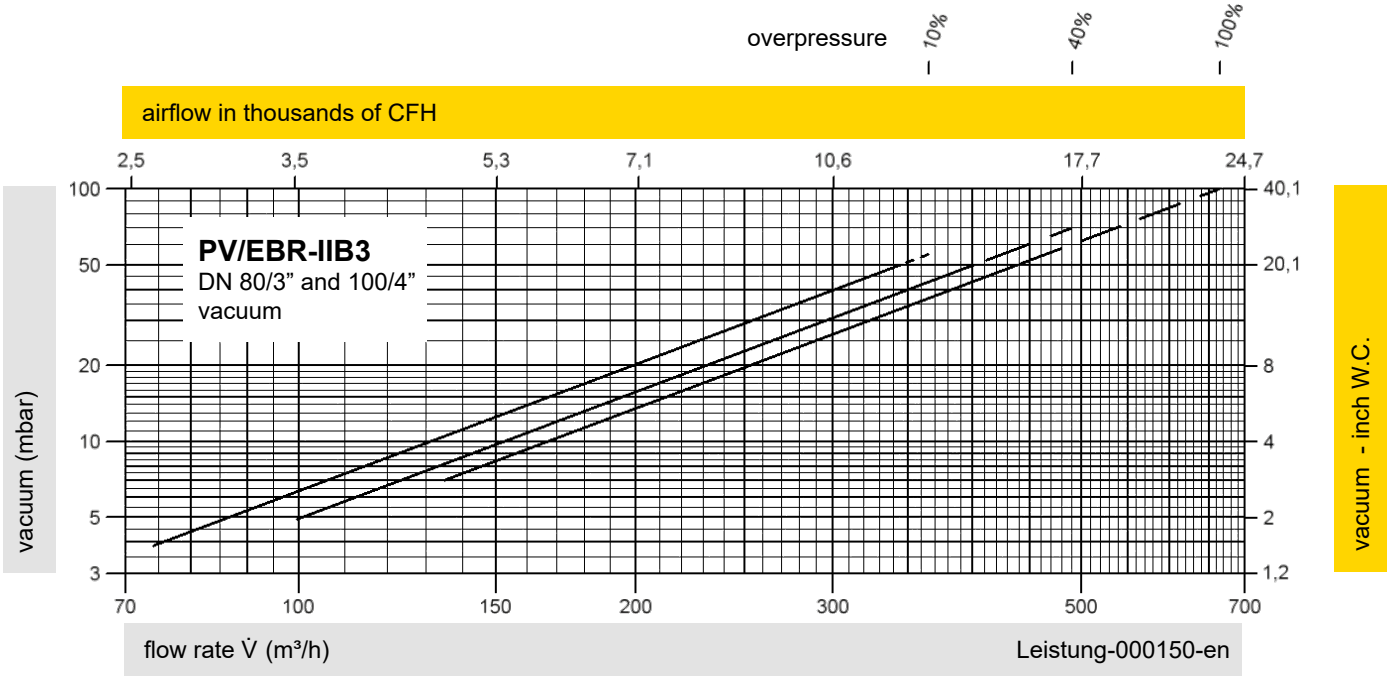
Opening pressure = set pressure plus overpressure

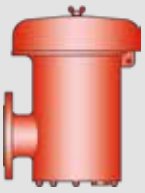
Overpressure % = percentage pressure increase over the set pressure

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

Volume flow V̇ 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."


overpressure
10%
40%
100%
airflow in thousands of CFH
0,7
1,8
3,5
7,1
10,6
17,7
35,3
53
70,6
500
200
100
50
20
10
5
2
200,7
80,3
40,1
20,1
8
4
2
0,8
PV/EBR-IIB3
DN 80/3" and 100/4"
pressure
pressure (mbar)
pressure - inch W.C.
20
50
100
200
300
500
1000
1500
2000
flow rate V̇ (m³/h)
Leistung-000189-en

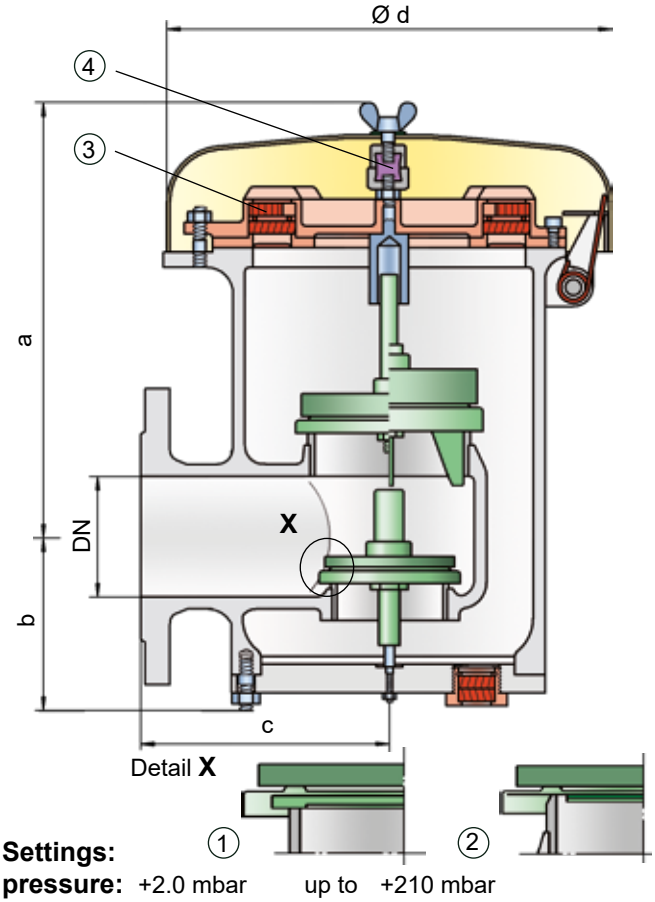

overpressure
10%
40%
100%
airflow in thousands of CFH
2,5
3,5
5,3
7,1
10,6
17,7
24,7
100
50
20
10
5
3
40,1
20,1
8
4
2
1,2
PV/EBR-IIB3
DN 80/3" and 100/4"
vacuum
vacuum (mbar)
vacuum - inch W.C.
70
100
150
200
300
500
700
flow rate V̇ (m³/h)
Leistung-000150-en



Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® PV/EBR-E



Settings:

pressure:	+2.0 mbar	up to	+210 mbar
	+0.8 inch W.C.	up to	+84 inch W.C.
vacuum:	-14 mbar	up to	-50 mbar
	-5.6 inch W.C.	up to	-20 inch W.C.
vacuum:	-3.5 mbar	up to	-14 mbar
	-1.4 inch W.C.	up to	-5.6 inch W.C.

For presssure up to max. + 150 mbar / 60.2 inch W.C.
Higher and lower settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof PV/EBR-E type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester that is specifically designed for use in ethanol production, processing, and storage. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® PV/EBR-E valve is available for substances from explosion group IIB1 (MESG ≥ 0.85 mm) and provides specific protection against deflagration and endurance burning of alcohol/air mixtures (such as ethanol/air).
The valve functions proportional, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is e nsured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent the valve pallets from sticking when sticky substances are used and to enable the use corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and reduced environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX in areas
- protected against deflagration and endurance burning of alcohol/air mixtures and substances from explosion group IIB1
- high flow capacity due to larger FLAMEFILTER® cross section
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- available in a special design with lifting device

Demonstration of endurance burning
Video

Design Types and Specifications

Almost any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded. When the difference between the pressure and vacuum exceeds 150 mbar / 60.2 inch W.C., special valve pallets are used.

There are two different designs:

Pressure/vacuum relief valve, basic design **PV/EBR-E-** **–**

Pressure/vacuum relief valve with heating jacket (max. heating fluid temperature +85°C / 185°F) **PV/EBR-E-** **H**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	80 / 3"	80 / 3"	100 / 4"	100 / 4"	
Set pressure	≤ +35 mbar ≤ +14 inch W.C.	> +35 mbar > +14 inch W.C.	≤ +35 mbar ≤ +14 inch W.C.	> +35 mbar > +14 inch W.C.	Dimensions for pressure/ vacuum relief valve with heating jacket upon request.
a	345 / 13.58	475 / 18.70	345 / 13.58	475 / 18.70	
b	141 / 5.55	141 / 5.55	141 / 5.55	141 / 5.55	
c	218 / 8.58	218 / 8.58	218 / 8.58	218 / 8.58	
d	353 / 13.90	353 / 13.90	353 / 13.90	353 / 13.90	

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	B	C	
Housing Heating jacket (PV/EBR-E-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seats	Stainless Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	

Table 4: Material combination of flame arrester unit

Design	A	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	
Spacer	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	
Pressure range (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 +210 >+5.6 up to +84	>+35 up to +210 >+14 up to +84	Special materials and higher set pressures upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Material selection for vacuum pallet

Design	A	B	C	D	
Vacuum range (mbar) (inch W.C.)	-3.5 up to -5.0 -1.4 up to -2.0	<-5.0 up to -14 <-2.0 up to -5.6	<-14 up to -50 <-5.6 up to -20	<-14 up to -50 <-5.6 up to -20	Special materials and higher set vacuum upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 7: Flange connection type

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

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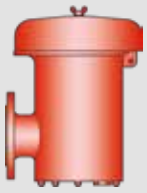
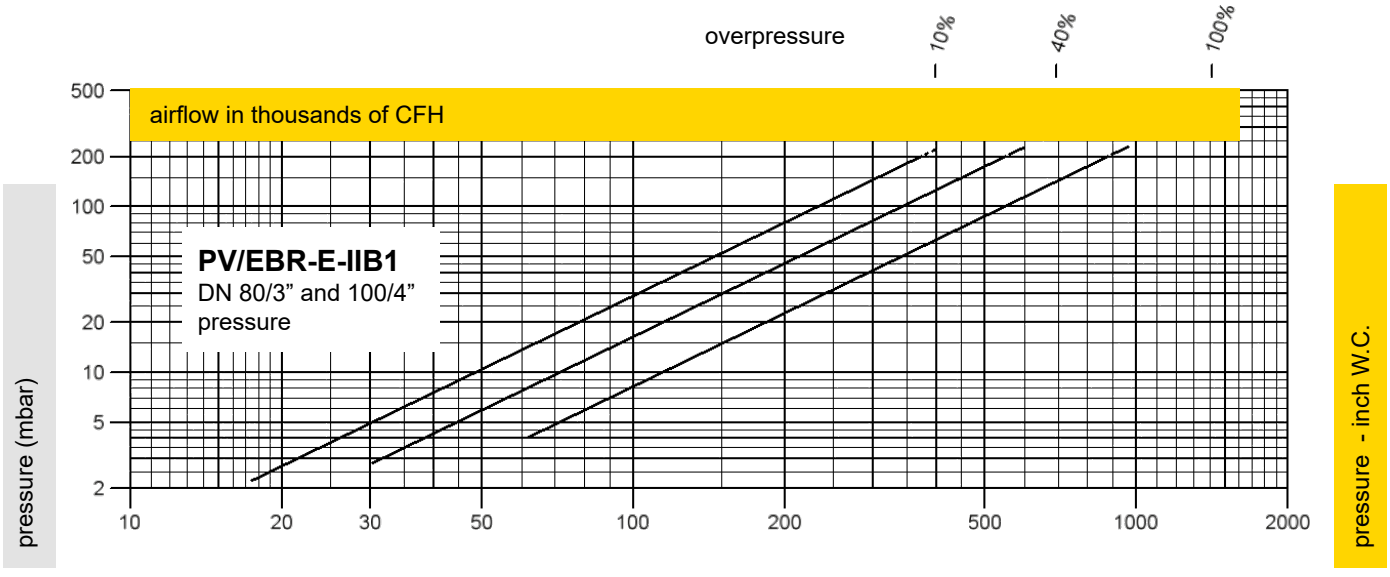
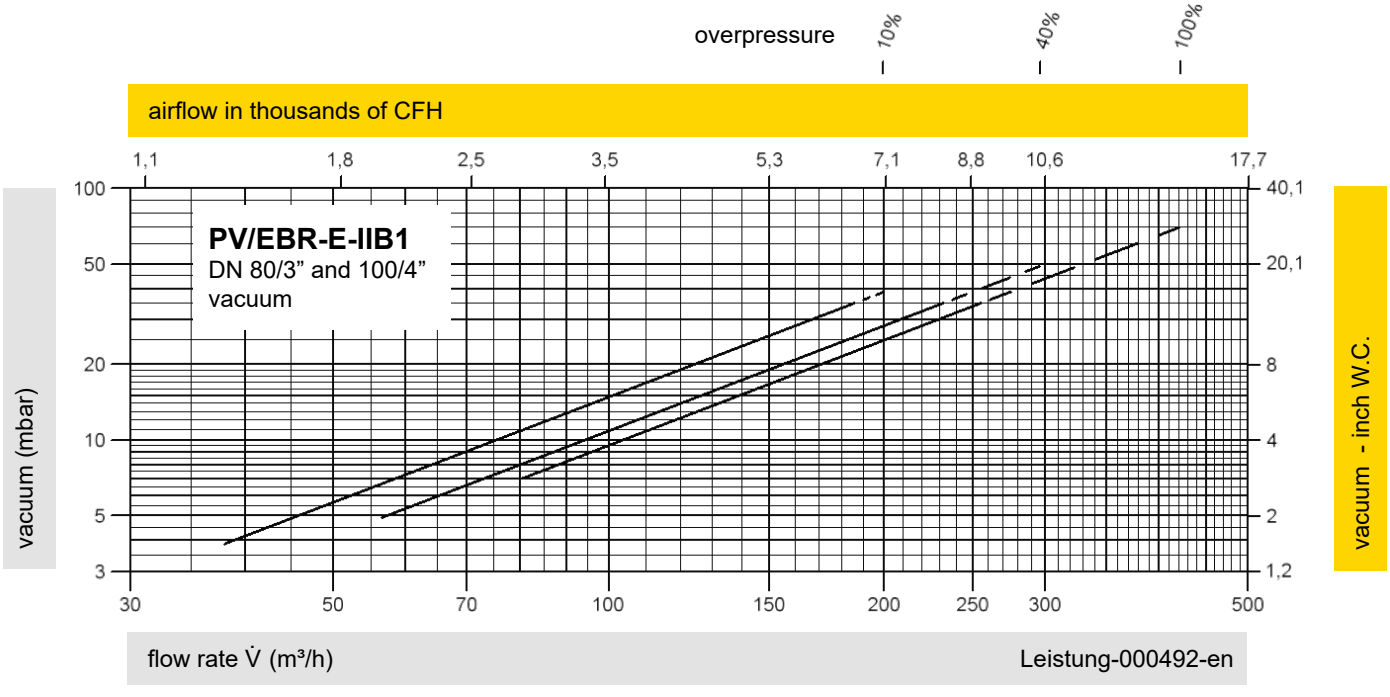


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® PV/EBR-E





Remark

$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

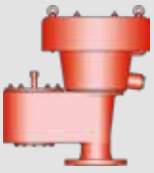
Set pressure = the valve starts to open

Opening pressure = set pressure plus overpressure

Overpressure % = percentage 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 V̇ 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."

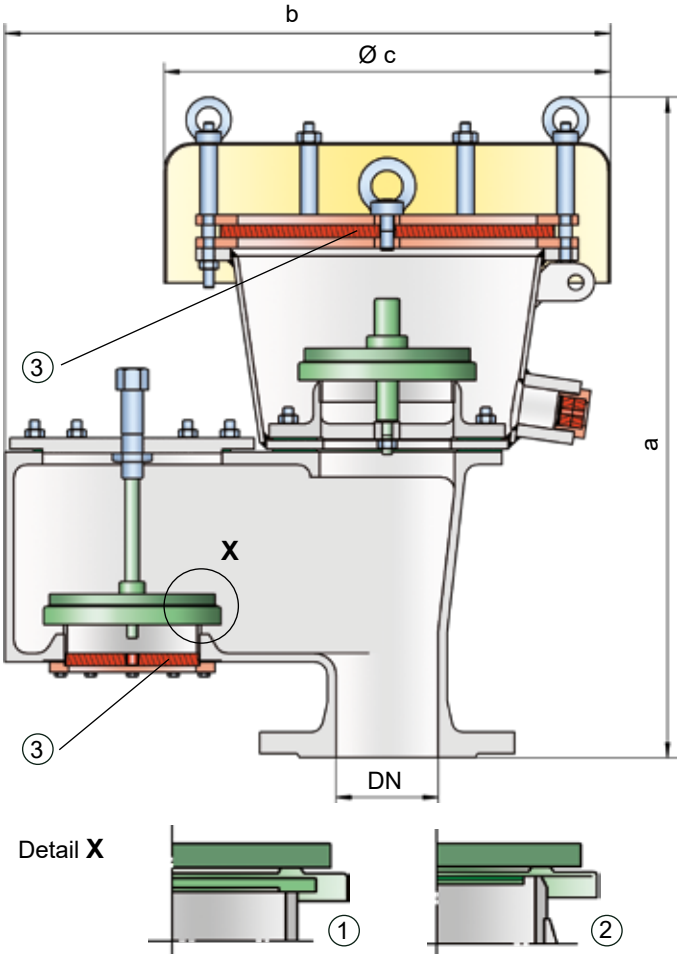
Notes:



Pressure/Vacuum Relief Valve

Atmospheric Deflagration-proof

PROTEGO® VD/SV-AD and VD/SV-ADL



Settings:

pressure:	+3.5 mbar	up to	+35 mbar
	+1.4 inch W.C.	up to	+14 inch W.C.
vacuum:	-2.0 mbar	up to	-35 mbar
	-0.8 inch W.C.	up to	-14 inch W.C.

Higher and lower settings upon request.

Function and Description

The deflagration proof VD/SV-AD(L) type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester unit. It is primarily used as a safety device for flame-transmission-proof in-breathing and out-breathing in tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents out-breathing of product vapor and in-breathing of air almost up to the set pressure, and protects against atmospheric deflagration. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The deflagration-proof PROTEGO® VD/SV-AD(L) valve is available for substances from explosion groups IIA to IIB3 (NEC group D to C MESG ≥ 0.65 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) or maximum allowable working vacuum (MAWV) of the tank. After years ofdevelopment, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is above to the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use of corrosive fluids. After the over-pressure is released or the vacuum is balanced, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission resulting from atmospheric deflagration into the tank. The vacuum side is also protected against atmospheric deflagration.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- higher flow capacity
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- best possible technology for API tanks

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Design Types and Specifications

Any combination of vacuum and pressure levels can be set for the valve.

The valve pallets are weight-loaded.

There are two different designs:

Pressure/vacuum relief valve with housing, standard design **VD/SV-AD**

Pressure/vacuum relief valve with expanded housing **VD/SV-ADL**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

	VD/SV-AD		VD/SV-ADL	
DN	80 / 3"	100 / 4"	100 / 4"	150 / 6"
a	540 / 21.26	565 / 22.24	650 / 25.59	760 / 29.92
b	475 / 18.70	575 / 22.64	700 / 27.56	855 / 33.66
c	350 / 13.78	350 / 13.78	600 / 23.62	600 / 23.62

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	A	B	
Housing	Steel	Stainless Steel	The housings are also available with an ECTFE coating.
Valve seats	Stainless Steel	Stainless Steel	
Gasket	PTFE	PTFE	Special materials upon request.
Weather hood	Stainless Steel	Stainless Steel	
Flame arrester unit	A, B	B	

Table 4: Material combinations of flame arrester units

Design	A	B	
FLAMEFILTER® casing	Steel	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +35 >+5.6 up to +14	>+14 up to +35 >+5.6 up to +14	Special materials and higher set pressures upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Material selection for vacuum valve pallet

Design	A	B	C	D	
Vacuum range (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	<-14 up to -35 <-5.6 up to -14	Special material and higher set vacuum upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 7: Flange connection type

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

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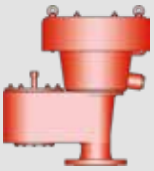
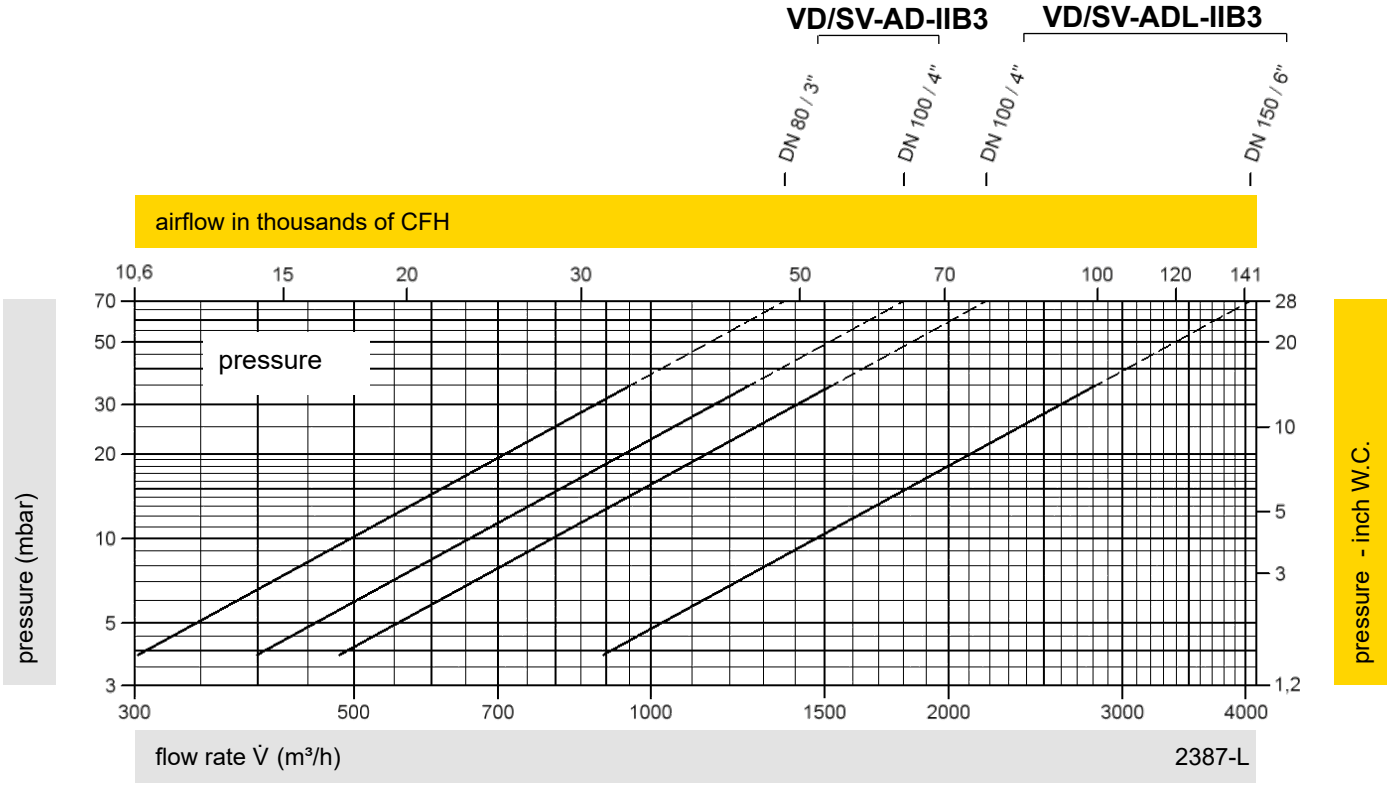
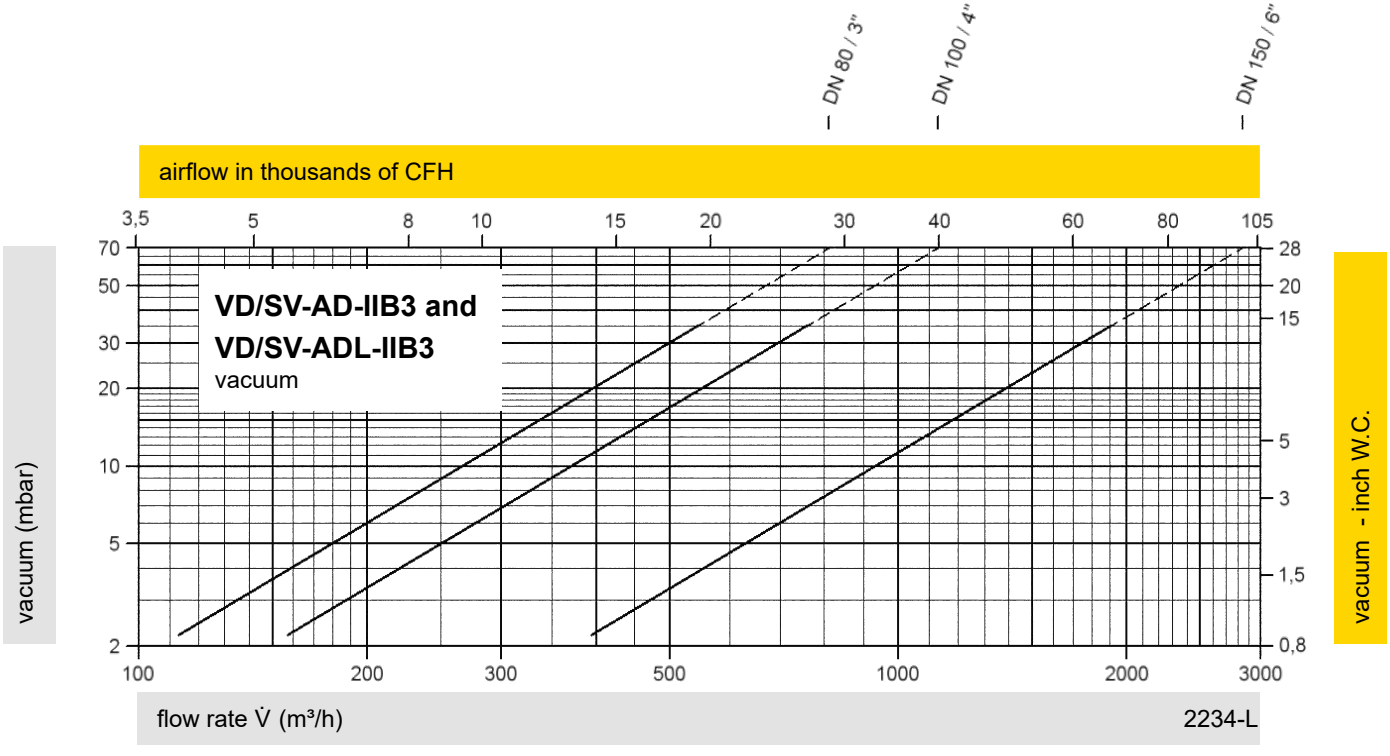


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® VD/SV-AD and VD/SV-ADL

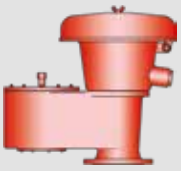




The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”

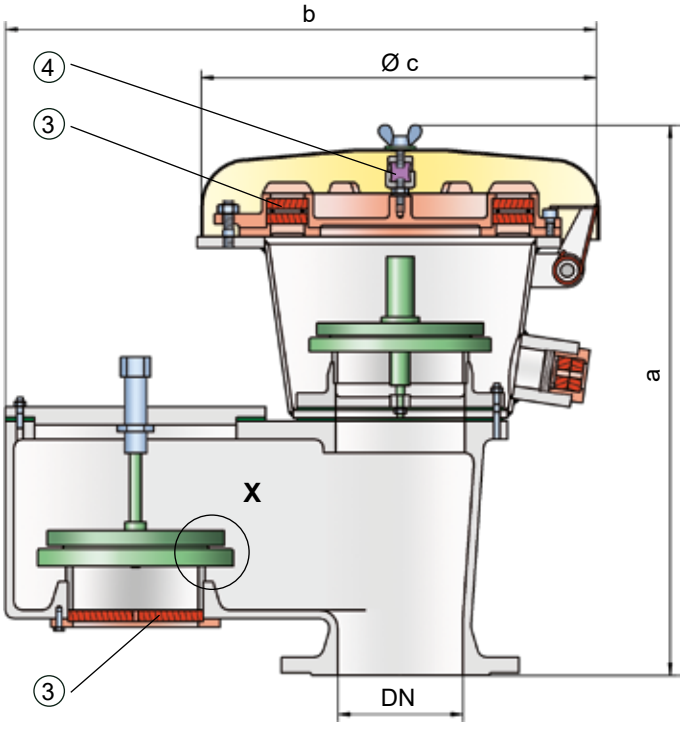
Notes:



Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® VD/SV-HR



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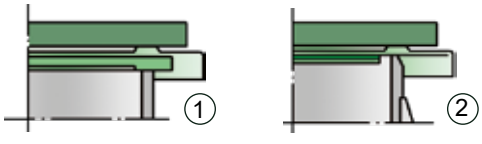


Settings:

pressure:	+3.5 mbar	up to	+35 mbar
	+1.4 inch W.C.	up to	+14 inch W.C.
vacuum:	-2.0 mbar	up to	-35 mbar
	-0.8 inch W.C.	up to	-14 inch W.C.

Higher and lower settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof VD/SV-HR type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester. It is primarily used as a safety device for flame transmission-proof in-breathing and out-breathing in tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents out-breathing of product vapor and in-breathing of air almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The deflagration and endurance burning-proof PROTEGO® VD/SV-HR device is available for substances from explosion groups IIA to IIB3 (NEC group D to C MESG ≥ 0.65 mm).

If the set pressure is reached for a valve approved for explosion Group IIA (NEC group D), the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range. Valves approved for explosion group IIB3 (NEC group C) function proportionally, so the set pressures should be selected in relation to the proportional behavior (such as a 10%, 40%, or 100% overpressure from the set pressure to the relieving pressure at which the required flow performance is reached).

The tank pressure is maintained up to set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by the valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- PROTEGO® flame arrester unit provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- high flow capacity due to larger FLAMEFILTER® cross section
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Design and Specifications

Any combination of vacuum and pressure levels can be set for the valve.

The valve pallets are weight-loaded.

Pressure/vacuum relief valve, basic design **VD/SV-HR**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	80 / 3"	100 / 4"
a	500 / 19.69	543 / 21.38
b	477 / 18.78	577 / 22.72
c	353 / 13.90	353 / 13.90

Table 2: Selection of explosion group

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

Special approvals upon request.

Table 3: Material selection for housing

Design	A	B
Housing	Steel	Stainless Steel
Valve seats	Stainless Steel	Stainless Steel
Gasket	PTFE	PTFE
Weather hood	Steel	Stainless Steel
Flame arrester unit	A	A

Special materials upon request.

Table 4: Material combination of flame arrester unit

Design	A
FLAMEFILTER® casing	Stainless Steel
FLAMEFILTER®	Stainless Steel

Special materials upon request.

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +35 >+5.6 up to +14	>+14 up to +35 >+5.6 up to +14
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	PTFE

Special materials and higher set pressures upon request.

Table 6: Material selection for vacuum valve pallet

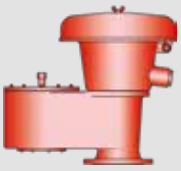
Design	A	B	C	D
Vacuum range (mbar) (inch W.C.)	-2.0 up to -3.5 -0.8 up to -1.4	<-3.5 up to -14 <-1.4 up to -5.6	<-14 up to -35 <-5.6 up to -14	<-14 up to -35 <-5.6 up to -14
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	PTFE

Special material and higher set vacuum upon request.

Table 7: Flange connection type

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

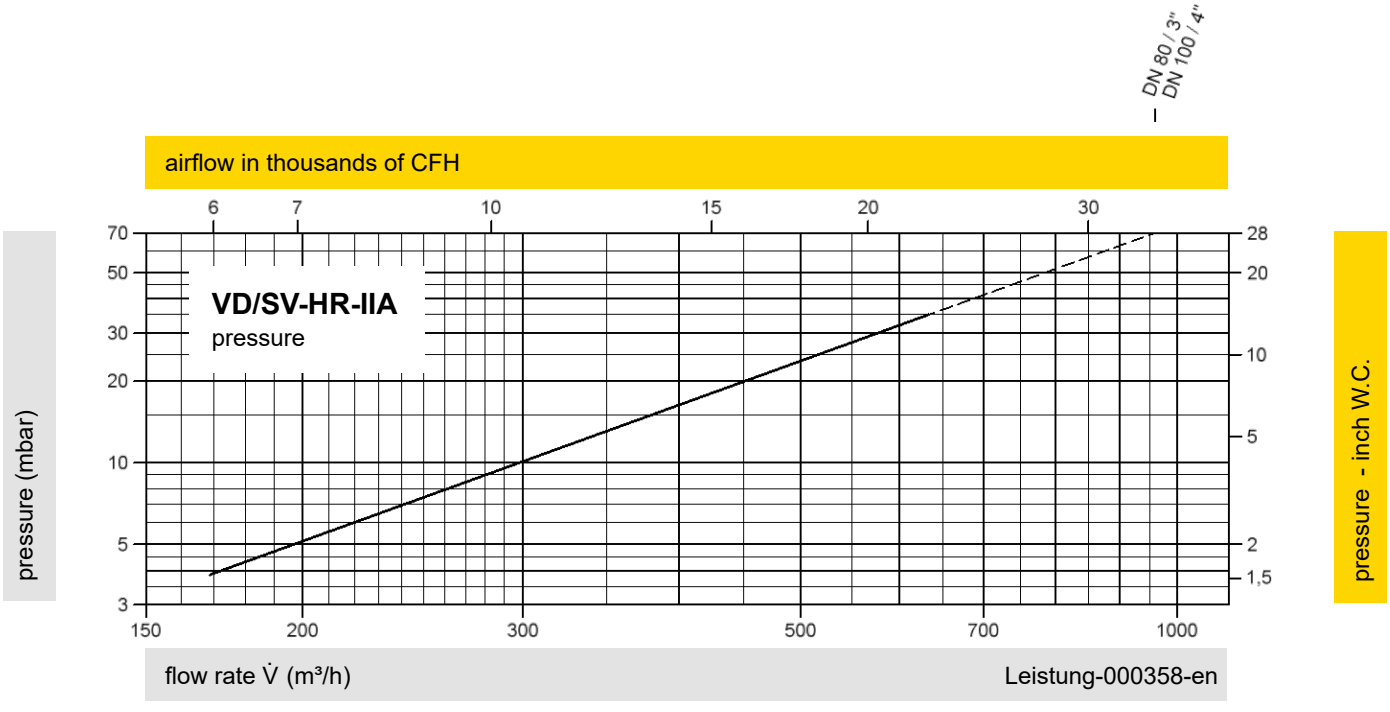
Other types upon request.

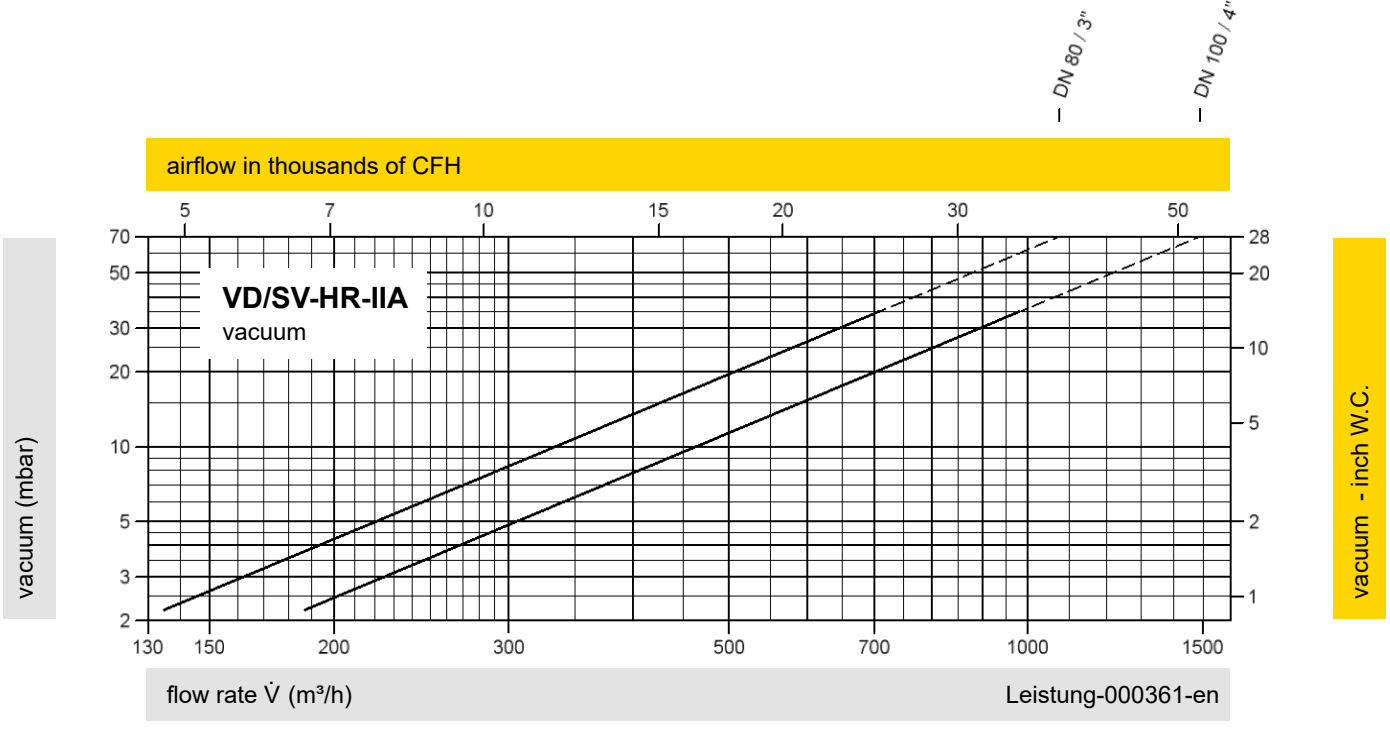


Pressure/Vacuum Relief Valve

Flow Capacity Charts

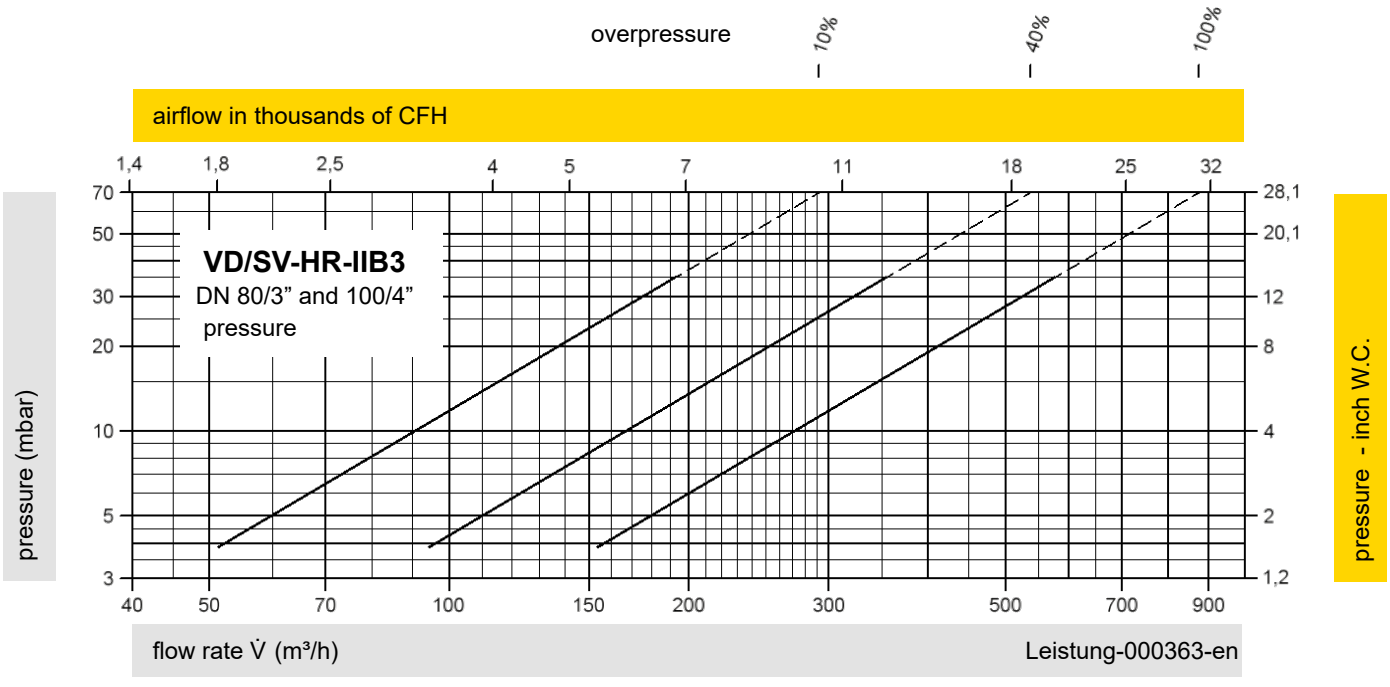
PROTEGO® VD/SV-HR





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

Volume flow V̇ 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.”



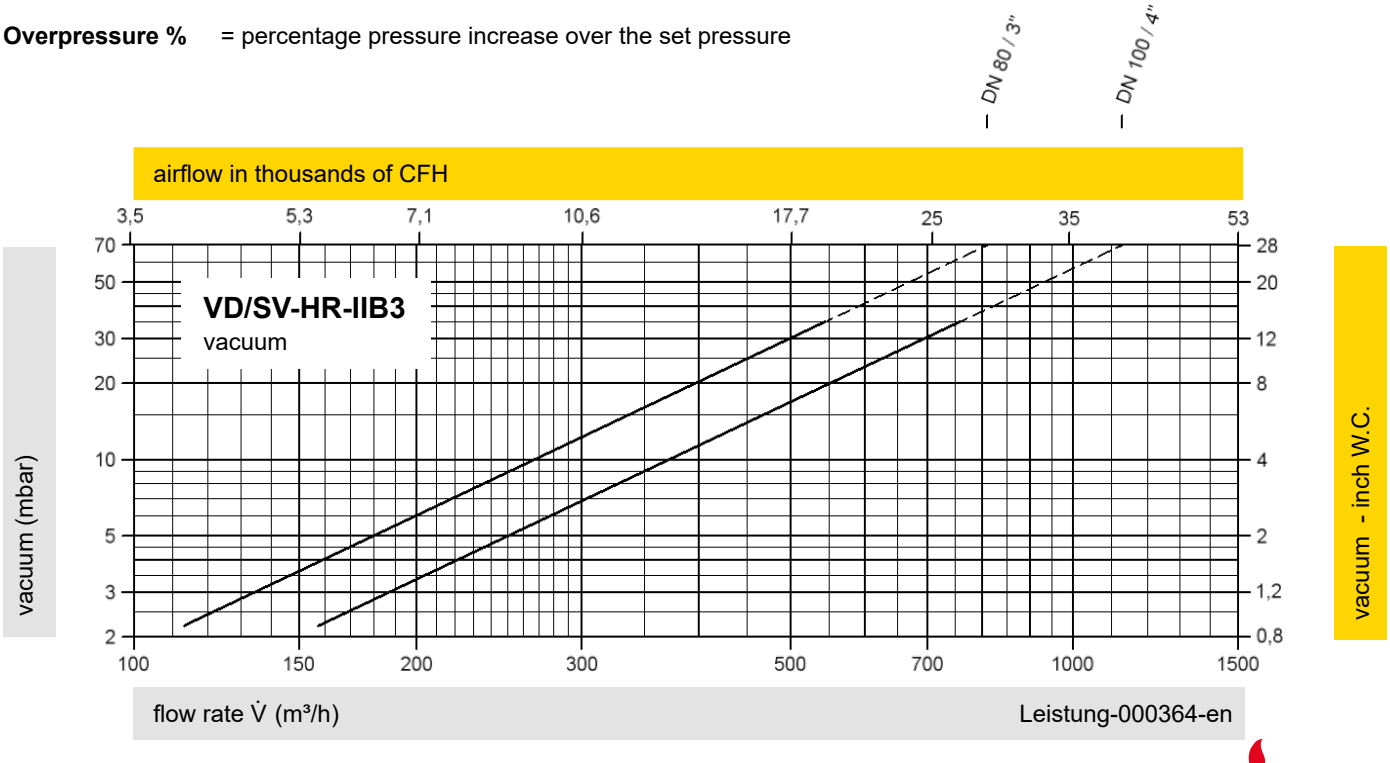
Remark

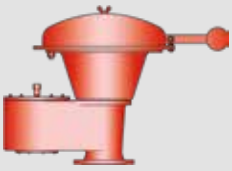
$$\text{set pressure} = \frac{\text{opening pressure resp. tank design pressure}}{1 + \frac{\text{overpressure \%}}{100\%}}$$

Set pressure = the valve starts to open

Opening pressure = set pressure plus overpressure

Overpressure % = percentage pressure increase over the set pressure

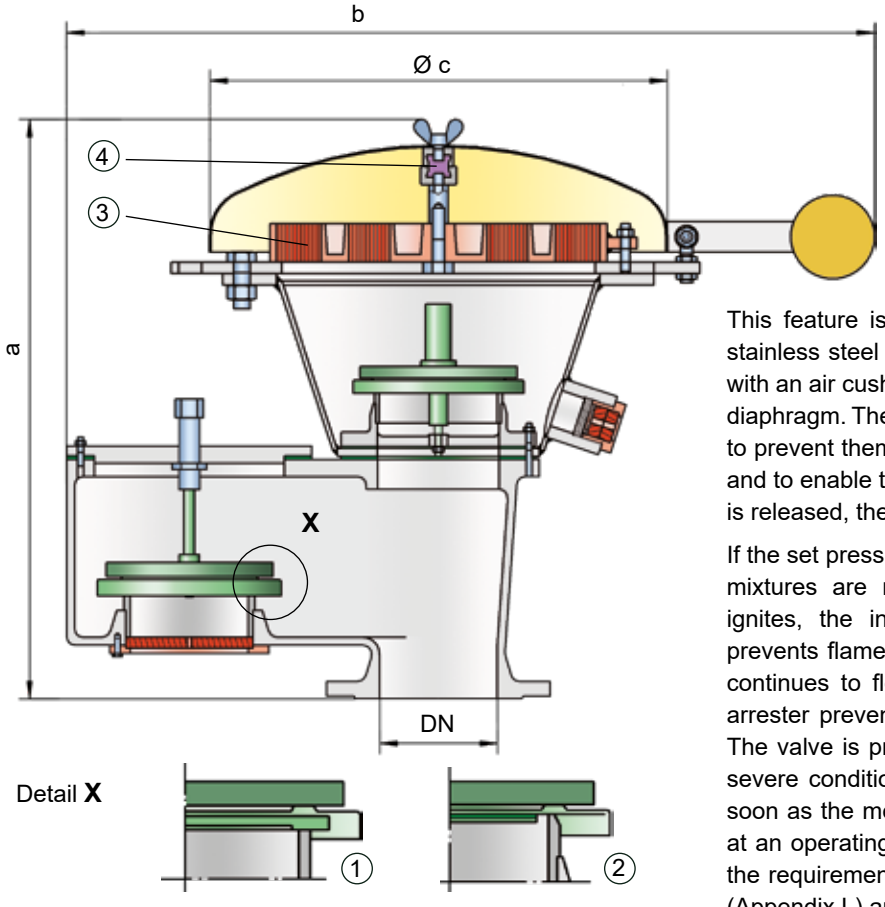




Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® VD/SV-HRL



Detail **X**

Settings:

pressure:	+3.5 mbar	up to	+35 mbar
	+1.4 inch W.C.	up to	+14 inch W.C.
vacuum:	-2.0 mbar	up to	-35 mbar
	-0.8 inch W.C.	up to	-14 inch W.C.

Higher and lower settings upon request.

Function and Description

The atmospheric deflagration and endurance burning-proof VD/SV-HRL type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester. It is primarily used as a safety device for flame transmission proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® VD/SV-HRL device is available for substances of explosion group IIA (NEC group D MESG > 0.9 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) or maximum allowable working vacuum (MAWV) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is above The normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized occurs, the integrated flame arrester prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts. The valve can be used at an operating temperature of up to +60°C /140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- high flow capacity due to large FLAMEFILTER® cross section

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet
- best technology for API tanks

Design and Specifications

Any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded.

Pressure/vacuum relief valve, basic design **VD/SV-HRL**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	100 / 4"	150 / 6"
a	650 / 25.59	760 / 29.92
b	1000 / 39.37	1155 / 45.47
c	600 / 23.62	600 / 23.62

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	A	B	
Housing	Steel	Stainless Steel	
Valve seats	Stainless Steel	Stainless Steel	
Gasket	PTFE	PTFE	Special materials upon request.
Weather hood	Steel	Stainless Steel	
Flame arrester unit	A, B	B	

Table 4: Material combinations of flame arrester unit

Design	A	B	
FLAMEFILTER® casing	Steel	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	
Pressure range (mbar) (inch W.C.)	+3.5 up to +5.0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +35 >+5.6 up to +14	>+14 up to +35 >+5.6 up to +14	Special materials and higher set pressures upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 6: Material selection for vacuum valve pallet

Design	A	B	C	D	
Vacuum range (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	<-14 up to -35 <-5.6 up to -14	Special material and higher set vacuum upon request.
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	
Sealing	FEP	FEP	Metal to Metal	PTFE	

Table 7: Flange connection type

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

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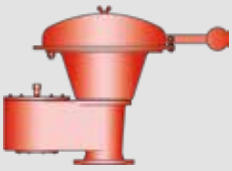
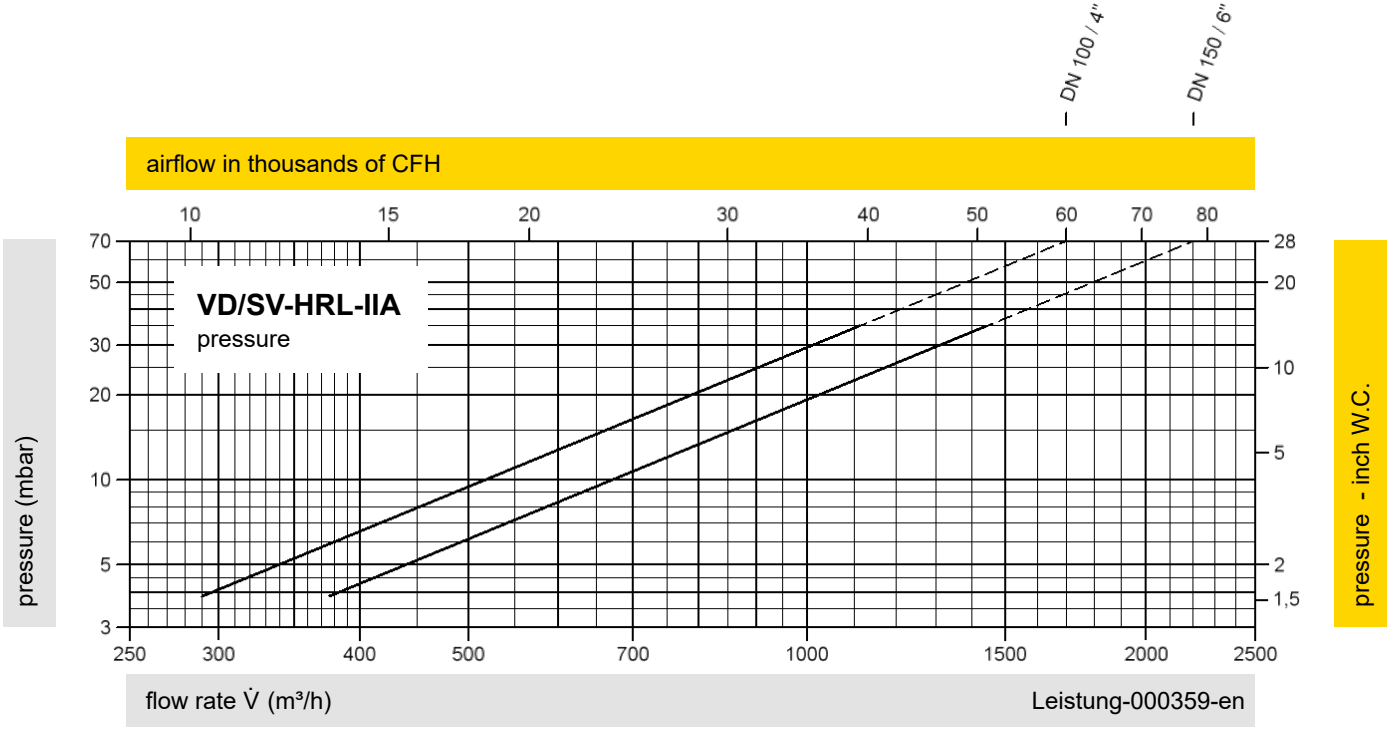
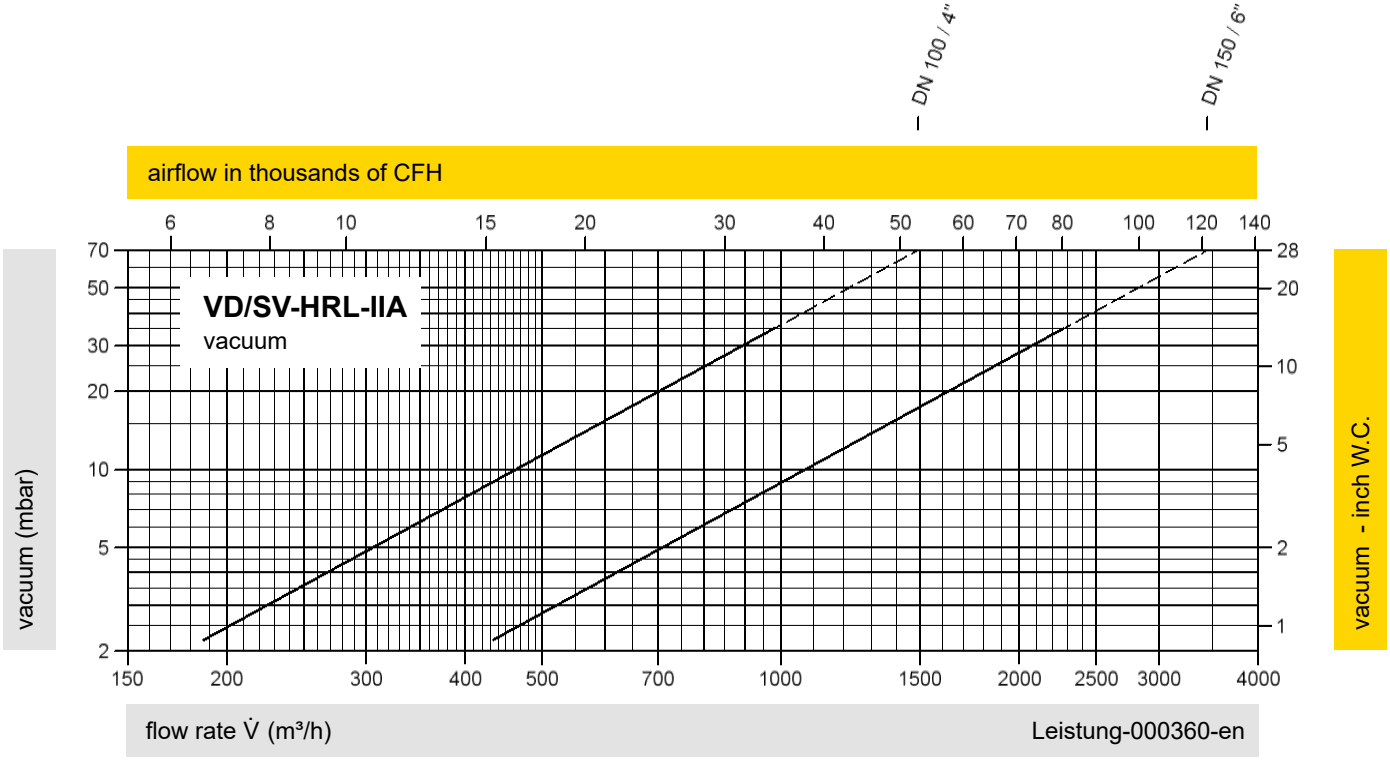


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® VD/SV-HRL

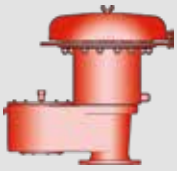




The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”

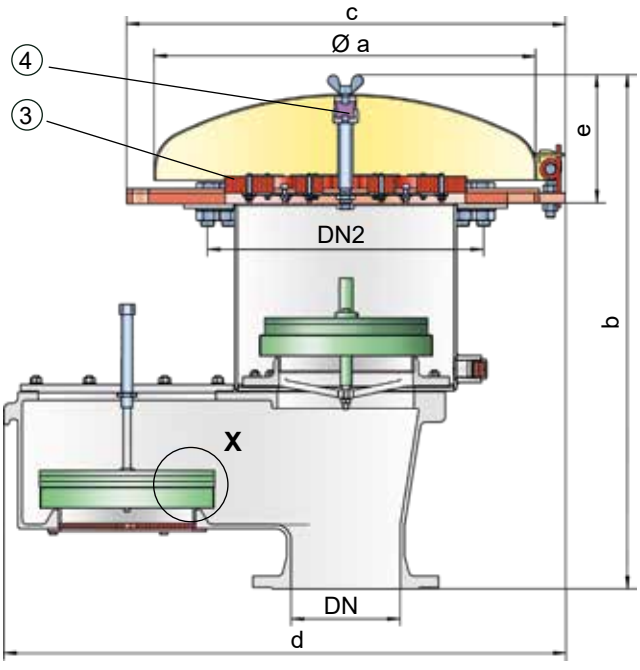
Notes:

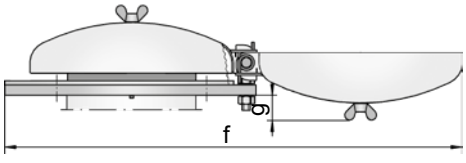


Pressure/Vacuum Relief Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® VD-SV-EB





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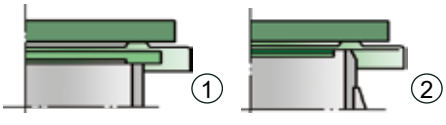


Settings:

pressure:	+2.0 mbar	up to	+60 mbar
	+0.8 inch W.C.	up to	+24 inch W.C.
vacuum:	-2.0 mbar	up to	-60 mbar
	-0.8 inch W.C.	up to	-24 inch W.C.

Higher and lower settings upon request.

Function and Description

The deflagration-proof and endurance burning-proof VD-SV-EB type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with the integrated flame arrester PROTEGO® EB. It is primarily used as a safety device for flame transmission-proof in-breathing and out-breathing in tanks, containers, and process equipment. The valve offers reliable protection against over pressure and vacuum, prevents out-breathing of product vapor and in-breathing of air almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The deflagration-proof and endurance burning-proof PROTEGO® VD-SV-EB device is available for substances from explosion group IIA (NEC group D MESG > 0.9 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with a high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use in corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated flame arrester PROTEGO® EB (3) prevents flame transmission into the tank. If additional mixture continues to flow and stabilized burning occurs, the integrated flame arrester unit prevents flashback as a result of endurance burning. The valve is protected and also fulfils its function under these severe conditions. The spring-loaded weather hood opens as soon as the melting element (4) melts.

The valve can be used at an operating temperature of up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift for explosion group IIA (NEC group D) vapours
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve opens later and closes earlier than conventional valves
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations and endurance burning
- integrated PROTEGO® flame arrester unit saves space and weight and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky substances caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- high flow capacity due to large FLAMEFILTER® cross section
- flameproof condensate drain
- maintenance-friendly design
- modular design enables replacement of individual FLAMEFILTER® discs and valve pallet

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Demonstration of endurance burning Video

Design and Specifications

Any combination of vacuum and pressure levels can be set for the valve.
The valve pallets are weight-loaded.

Pressure/vacuum relief valve, basic design **VD-SV-EB -** **–**

Pressure/vacuum relief valve, with heating jacket **VD-SV-EB -** **H**

Additional special devices available upon request.

Table 1: Dimensions Dimensions in mm / inches

DN	DN2	a	b	c	d	e	f	g
150 / 6“	400 / 16“	705 / 27.76	844 / 33.23	802 / 31.57	957 / 37.68	235 / 9.25	1500 / 59.06	109 / 4.29
200 / 8“	400 / 16“	705 / 27.76	939 / 36.97	802 / 31.57	1027 / 40.43	235 / 9.25	1500 / 59.06	109 / 4.29

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	A	B	
Housing Heating jacket (VD-SV-EB-H-...)	Steel Steel	Stainless Steel Stainless Steel	Special materials upon request.
Valve seats	Stainless Steel	Stainless Steel	
Gasket	PTFE	PTFE	
Flange ring	Steel	Stainless Steel	
Weather hood	Steel	Stainless Steel	
Flame arrester unit	A	A, B	

Table 4: Material combination of flame arrester unit

Design	A	B	
FLAMEFILTER® casing	Steel	Stainless Steel	Special materials upon request.
FLAMEFILTER®	Stainless Steel	Stainless Steel	
Safety bar	Stainless Steel	Stainless Steel	

Table 5: Material selection for pressure valve pallet

Design	A	B	C	D	E	F
Pressure range (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	>+35 up to +60 >+14 up to +24	>+14 up to +35 >+5.6 up to +14	>+35 up to +60 >+14 up to +24
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	Metal to Metal	PTFE	PTFE

Special material and higher set pressure upon request.

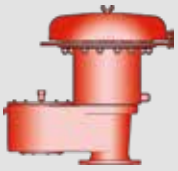
Table 6: Material selection for vacuum valve pallet

Design	A	B	C	D	E	F
Vacuum range (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	<-14 up to -35 <-5.6 up to -14	<-35 up to -60 <-14 up to -24	<-35 up to -60 <-14 up to -24
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	PTFE	Metal to Metal	PTFE

Special material and higher set vacuum upon request.

Table 7: Flange connection type

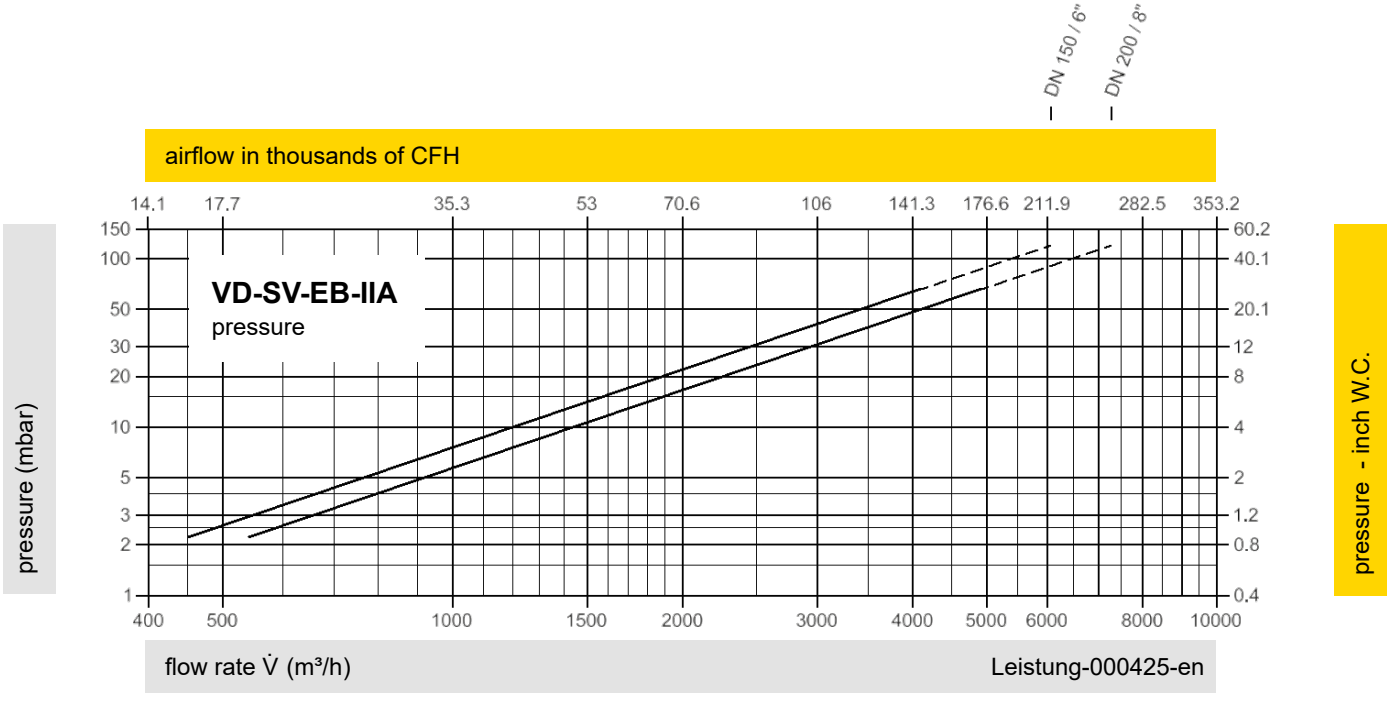
EN 1092-1; Form B1	Other types upon request.
ASME B16.5 CL 150 R.F.	

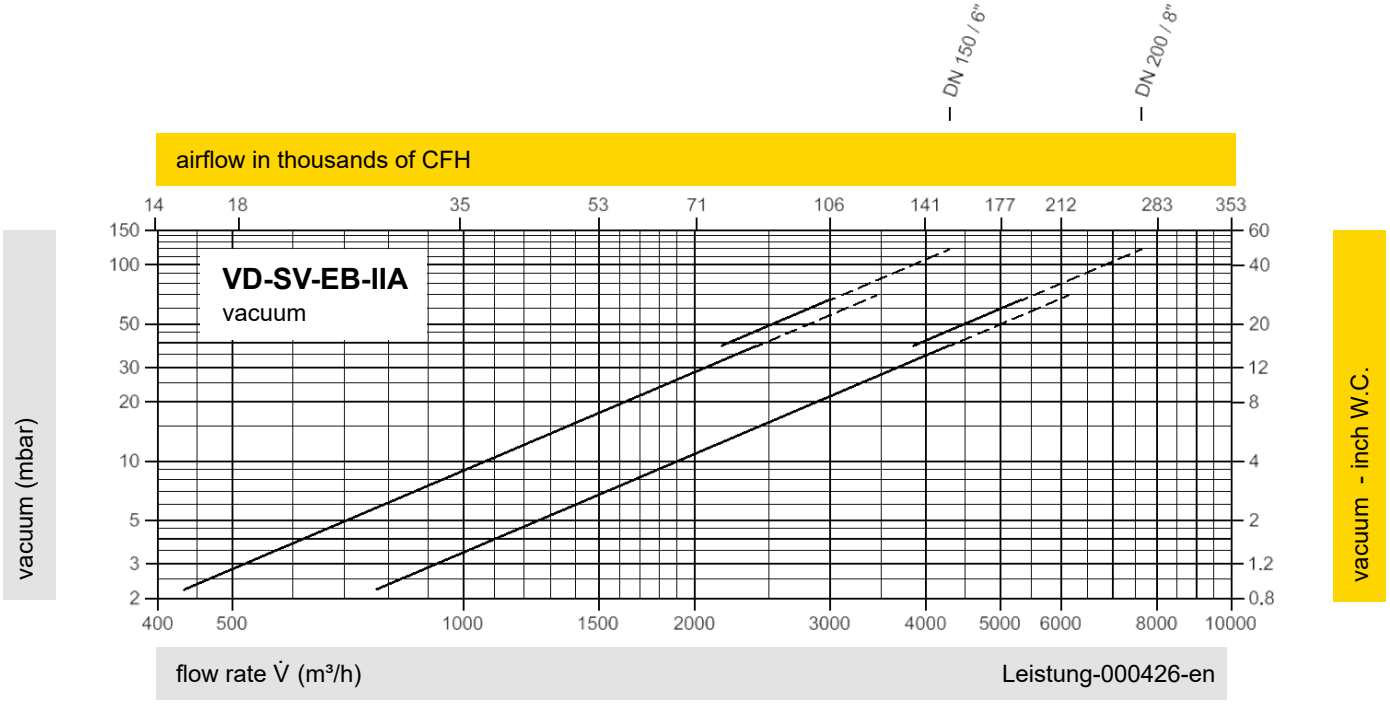


Pressure/Vacuum Relief Valve

Flow Capacity Charts

PROTEGO® VD-SV-EB-IIA

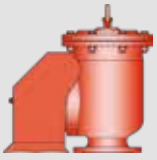




The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”

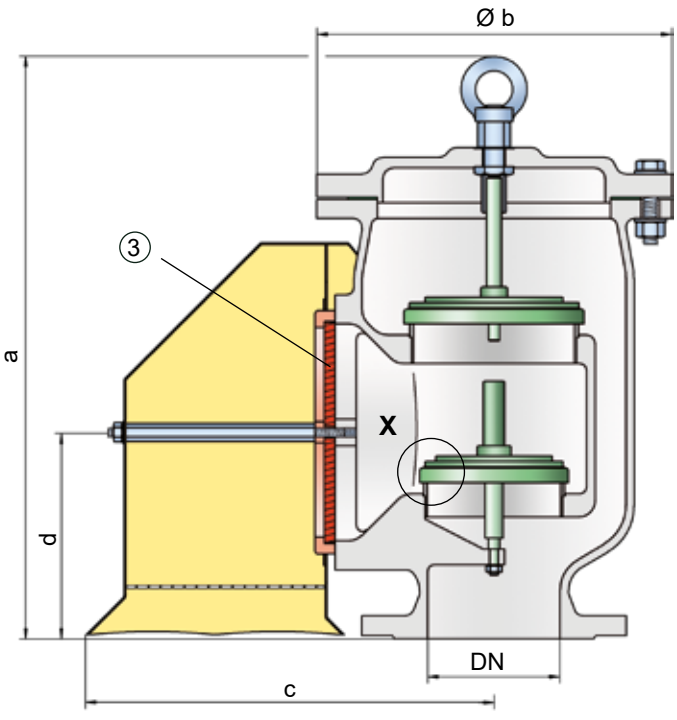
Notes:



Pressure/Vacuum Relief Valve

Atmospheric Deflagration-proof

PROTEGO® VD/TS



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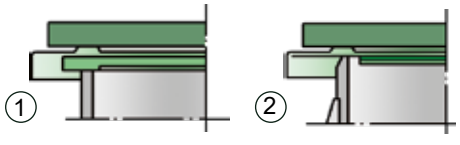

Settings:

pressure:	+3.5 mbar	up to	+50 mbar
	+1.4 inch W.C.	up to	+20 inch W.C.
vacuum:	-2.0 mbar	up to	-25 mbar
	-0.8 inch W.C.	up to	-10 inch W.C.

Higher and lower settings upon request.

Function and Description

The atmospheric deflagration-proof VD/TS type PROTEGO® valve is a highly developed combined pressure/vacuum relief valve for high flow capacities with an integrated flame arrester unit. It is primarily used as a safety device for flame transmission proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration. The PROTEGO® flame arrester unit is designed to achieve minimum pressure drop with maximum safety. The PROTEGO® VD/TS device is available for substances from explosion groups IIA to IIB3 (NEC group D to C MESG ≥ 0.65 mm).

When the set pressure is reached, the valve starts to open and reaches full lift within 10% overpressure. This unique 10% technology enables a set pressure that is only 10% below the maximum allowable working pressure (MAWP) or maximum allowable working vacuum (MAWV) of the tank. After years of development, this typical opening characteristic of a safety relief valve is now also available for the low pressure range.

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our state-of-the-art manufacturing technology. This feature is ensured by valve seats made of high quality stainless steel and with individually lapped valve pallets (1), or with an air cushion seal (2), in conjunction with high quality FEP diaphragm. The valve pallets are also available with a PTFE seal to prevent them from sticking when sticky substances are used and to enable the use of corrosive fluids. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. If this mixture ignites, the integrated PROTEGO® flame arrester unit (3) prevents flame transmission into the tank.

The standard design is tested at an operating temperature up to +60°C / 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000). In addition, numerous versions for higher operating temperature are available.

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

Special Features and Advantages

- 10% technology for minimum pressure increase up to full lift
- extreme tightness, resulting in lowest possible product losses and reduced environmental pollution
- due to 10% technology, set pressure is close to opening pressure for optimum pressure maintenance in the system as compared to conventional 40% or 100% technology
- valve pallet is guided inside the housing to protect against harsh weather conditions
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- FLAMEFILTER® provides protection against atmospheric deflagrations
- integrated flame arrester unit saves space and reduces costs
- PROTEGO® flame arrester unit is protected from clogging and sticky products caused by product vapors
- minimum pressure loss of the PROTEGO® flame arrester unit
- high flow capacity
- maintenance-friendly design
- sturdy housing design
- best possible technology for API tanks

Design and Specifications

Any combination of vacuum and pressure levels can be set for the valve. The valve pallets are weight-loaded.

Pressure/vacuum relief valve, basic design **VD/TS-**

Additional special devices available upon request.

P/V-Valve with integrated Flame Arrester Many traditional configurations are a safety risk. (Flyer pdf)

Safety Risk (Video)

P/V-Valve with integrated Flame Arrester (Video)

Vents - 10% Technology (Flyer pdf)

Leak Rate/10% Technology (Flyer pdf)

Table 1: Dimensions Dimensions in mm / inches

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

DN	50 / 2"	80 / 3"	100 / 4"	125 / 5"	150 / 6"	200 / 8"	250 / 10"	300 / 12"
a	340 / 13.39	430 / 16.93	490 / 19.29	610 / 24.02	610 / 24.02	705 / 27.76	765 / 30.12	930 / 36.61
b	210 / 8.27	280 / 11.02	310 / 12.20	390 / 15.35	390 / 15.35	445 / 17.52	505 / 19.88	560 / 22.05
c	206 / 8.11	277 / 10.91	347 / 13.66	427 / 16.81	427 / 16.81	534/ 21.02	604 / 23.78	823 / 32.40
d	125 / 4.92	150 / 5.91	180 / 7.09	230 / 9.06	230 / 9.06	270 / 10.63	310 / 12.20	445 / 17.52

Table 2: Selection of explosion group

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

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	C	D	E
Housing	Aluminum	Steel	Stainless Steel	Hastelloy
Valve seats	Stainless Steel	Stainless Steel	Stainless Steel	Hastelloy
Gasket	PTFE	PTFE	PTFE	PTFE
Weather hood	Aluminum	Aluminum	Stainless Steel	Hastelloy
Flame arrester unit	A	A	A	C
Pressure valve pallet	A-F	A-F	A-F	G-I
Vacuum valve pallet	A-E	A-E	A-E	F-H

Special materials upon request.

Table 5: Material combination of flame arrester unit

Design	A	C	
FLAMEFILTER® casing	Stainless Steel	Hastelloy	Special materials upon request.
FLAMEFILTER®	Stainless Steel	Hastelloy	

Table 6: Material selection for pressure pallet

Design	A	B	C	D	E
Pressure range (mbar) (inch W.C.)	+3.5 up to +5,0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +35 >+5.6 up to +14	>+35 up to +50 >+14 up to +20	>+14 up to +35 >+5.6 up to +14
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal	Metal to Metal	PTFE
Weight	Stainless Steel	Stainless Steel	Stainless Steel	Lead	Stainless Steel

Design	F	G	H	I
Pressure range (mbar) (inch W.C.)	>+35 up to +50 >+14 up to +20	+3.5 up to +5,0 +1.4 up to +2.0	>+5.0 up to +14 >+2.0 up to +5.6	>+14 up to +35 >+5.6 up to +14
Valve pallet	Stainless Steel	Titanium	Hastelloy	Hastelloy
Sealing	PTFE	FEP	FEP	Metal to Metal
Weight	Lead	Hastelloy	Hastelloy	Hastelloy

Special material and higher set pressure upon request.

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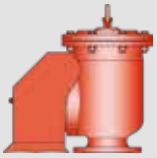


Pressure/Vacuum Relief Valve

Atmospheric Deflagration-proof

PROTEGO® VD/TS

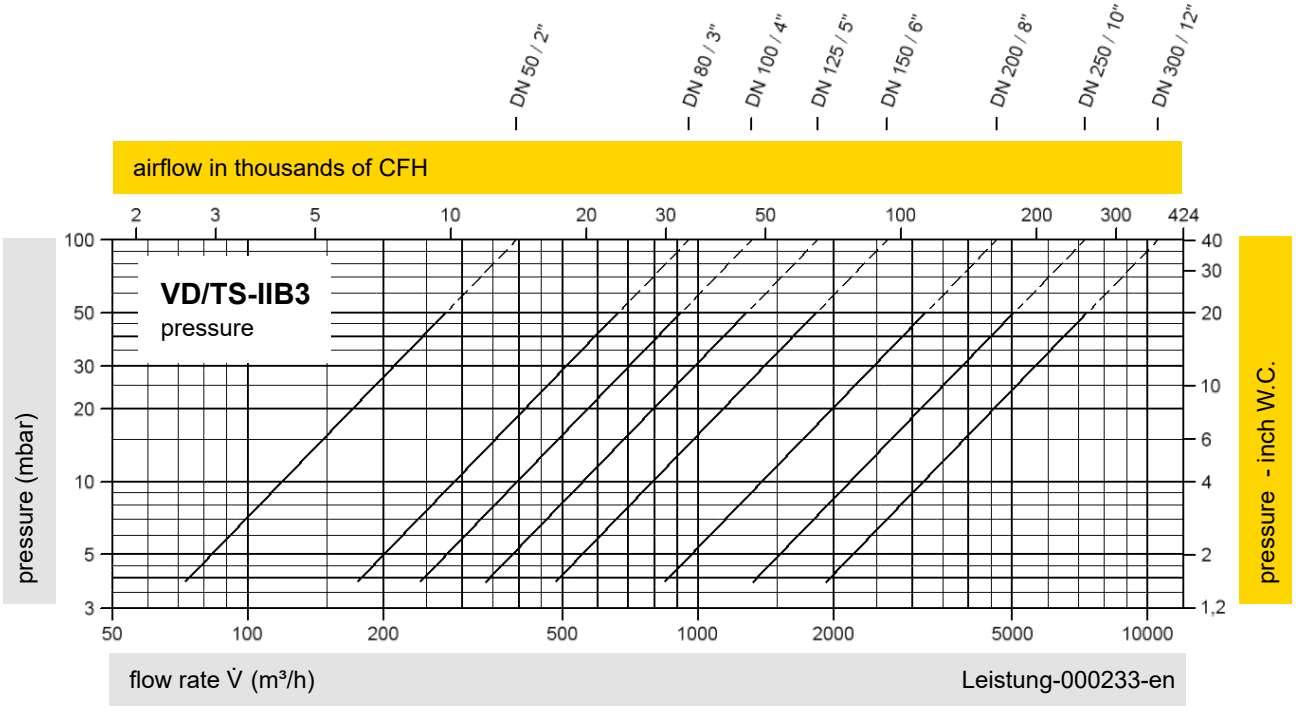
Table 7: Material selection for vacuum pallet

Design	A	B	C	E	F
Vacuum range (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 -25 <-5.6 up to -10	<-14 up to -25 <-5.6 up to -10	-2.0 up to -3.5 -0.8 up to -1.4
Valve pallet	Aluminum	Stainless Steel	Stainless Steel	Stainless Steel	Titanium
Sealing	FEP	FEP	Metal to Metal	PTFE	FEP
Weight	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel	Hastelloy

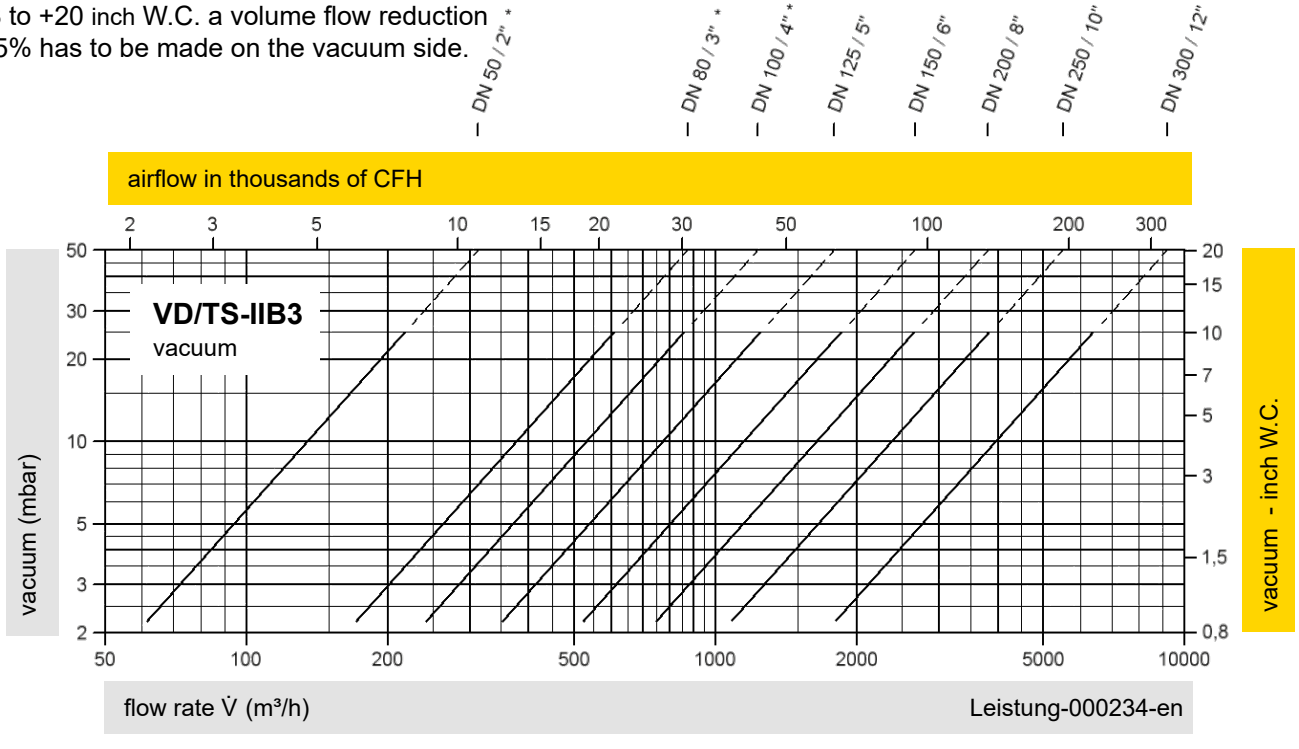
Design	G	H	
Vacuum range (mbar) (inch W.C.)	<-3.5 up to -14 <-1.4 up to -5.6	<-14 up to -25 <-5.6 up to -10	Special material and higher set vacuum upon request.
Valve pallet	Hastelloy	Hastelloy	
Sealing	FEP	Metal to Metal	
Weight	Hastelloy	Hastelloy	

Table 8: Flange connection type

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



***** at set pressure of +22 to +50 mbar / +8.8 to +20 inch W.C. a volume flow reduction of 15% has to be made on the vacuum side.



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

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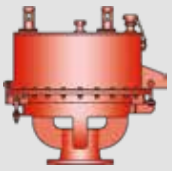
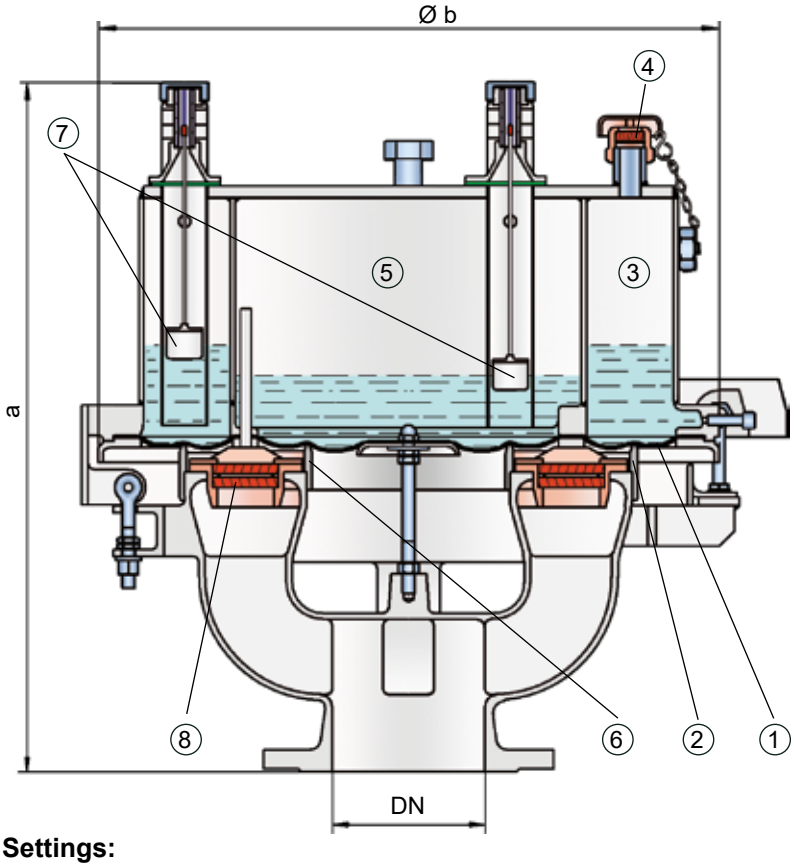


Pressure/Vacuum Diaphragm Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® UB/SF



Settings:

pressure:	DN 80	+3.5 mbar	up to	+50 mbar
		+1.4 inch W.C.	up to	+20 inch W.C.
	DN 100	+3.5 mbar	up to	+45 mbar
		+1.4 inch W.C.	up to	+18 inch W.C.
	DN 150	+3.5 mbar	up to	+46 mbar
		+1.4 inch W.C.	up to	+18.4 inch W.C.

Higher pressure settings up to +140 mbar (56.2 inch W.C.) in special design with additional liquid reservoir as well as lower pressure settings upon request.

vacuum:	-3.5 mbar	up to	-35 mbar
	-1.4 inch W.C.	up to	-14 inch W.C.

Higher vacuum settings upon request.

Function and Description

The PROTEGO® UB/SF diaphragm valve is the only deflagration-proof and endurance burning-proof valve of its kind in the world. It is a highly developed combined pressure and vacuum valve with dynamic and static flame arrester. It is primarily used as a safety device for flame transmission-proof in-breathing and out-breathing on tanks, containers, and process equipment. The valve provides reliable protection against overpressure and vacuum, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® UB/SF diaphragm valve has proven itself over many years under a wide variety of operating conditions in the mineral oil and chemical industries. Worldwide, it is the only vent which works reliably with problem products such as Styrene or Acrylates.

The set pressure is adjusted with a freeze resistant water-glycol mixture which ensures safe operation under extreme cold weather conditions. The PROTEGO® UB/SF valve is available for substances from explosion group IIB3. When the pressure in the tank reaches the set pressure, the diaphragm (1) on the outer valve seat ring (2) is lifted and vapors are released into environment. The set pressure is adjusted by weight of the liquid load (water-glycol mixture) in the outer ring chamber (3). The overpressure chamber is equipped with an opening (4) to keep the pressure in balance. The opening is equipped with a FLAMEFILTER® to prevent flame transmission into the overpressure chamber. If a vacuum builds up in the tank, it is transferred to the vacuum chamber (5) (inner chamber) through pressure balancing tubes. If the set vacuum is reached, the atmospheric pressure lifts the diaphragm of the inner valve seat ring (6), resulting in ventilation of the tank. Both the overpressure and underpressure are adjusted via the filling level of the load liquid in the various chambers and can be checked by floating level indicators (7).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our highly developed manufacturing technology. This is achieved by the liquid loaded diaphragm pressing tightly around the special designed valve seat surface area even when the operating pressure increases, which reduces surface pressure and unnecessary leakage. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. The speed at which these mixtures exit the annular gap between the diaphragm and the outer valve seat ring is considerably greater than the flame speed. If this mixture ignites, flashback into the tank is prevented. If the mixture flow continues, the dynamic flame arresting feature prevents a flashback, even in the case of endurance burning. Even at relatively low flow rates, e.g., during thermal out-breathing, the gap formed by the volumetric flow is so narrow, that flames in the gap are extinguished and a flashback is prevented. At very low pressure settings, the explosion pressures resulting from an atmospheric deflagration may be strong enough to lift the diaphragm off the valve seat rings. The ignition into the tank can be prevented by installing the PROTEGO® flame arrester unit (8). This PROTEGO® flame arrester unit provides additional protection against atmospheric deflagration when the valve is open for maintenance and inspection.

The valve can be used at an operating temperature of up to +60°C /140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000)

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

UB/SF-IIB3
(Flyer pdf)

Frost-Proof P/V Diaphragm
Valve (Video)

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- high flow capacity
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- protection against atmospheric deflagrations and endurance burning for products up to explosion group IIB3 (NEC group C MESG ≥ 0.65 mm)
- minimum pressure loss of the PROTEGO® flame arrester unit
- flame arrester venting and ventilation of the pressurized chamber
- optimal frost protection
- automatic condensate drain
- monitoring of the load liquid by level indicator
- easy operation monitoring and maintenance by simply opening the hinged valve cap
- modular design enables replacement of individual FLAMEFILTER® discs and diaphragm
- particularly suitable for problematic products such as styrene, acrylates, etc.

Design Types and Specifications

The valve can be combined with almost any combination of vacuum and pressure settings. The diaphragm is pressurized by liquid. Higher pressures are available upon request in a special version with an additional attachment. When there is a substantial difference between the pressure and vacuum, special designs with weight-loaded vacuum discs are used.

There are two different designs:

Pressure/vacuum diaphragm valve, basic design **UB/SF -** **–**

Pressure/vacuum diaphragm valve with heating coil **UB/SF -** **H**
(max. heating fluid temperature +85°C / 185°F)

In addition to the standard design, a series of specially developed designs (e.g., for acrylate or styrene storage tanks, etc.) can be provided upon request.

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

Table 1: Dimensions Dimensions in mm / inches

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

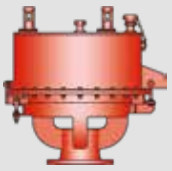
DN	pressure	80 / 3"	100 / 4"	150 / 6"
a	up to +28 mbar / +11.2 inch W.C.	615 / 24.21	645 / 25.39	680 / 26.77
a	> +28 mbar / +11.2 inch W.C.	765 / 30.12	795 / 31.30	830 / 32.68
b		410 / 16.14	485 / 19.09	590 / 23.23

Pressure settings > +50 mbar / +20 inch W.C. (DN 80/3”), > +45 mbar / +18 inch W.C. (DN 100/4”), > +46 mbar / +18.4 inch W.C. (DN150/6”) with additional liquid reservoir - dimensions upon request.

Dimensions for pressure/vacuum diaphragm valves with heating coil upon request.

Table 2: Selection of explosion group

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



Pressure/Vacuum Diaphragm Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® UB/SF

Table 3: Material selection for housing

Design	C	D
Housing	Steel	Stainless Steel
Valve top	Stainless Steel	Stainless Steel
Heating coil (UB/SF-H-...)	Stainless Steel	Stainless Steel
Valve seats	Stainless Steel	Stainless Steel
Gasket	FPM	PTFE
Diaphragm	A, B	A, B
Flame arrester unit	C	C

The housings are also available with an ECTFE coating.

Special materials upon request.

Coated Devices (Flyer pdf)

Table 4: Material selection for diaphragm

Design	A	B
Diaphragm	FPM	FEP

Special materials upon request.

Table 5: Material combinations of flame arrester unit

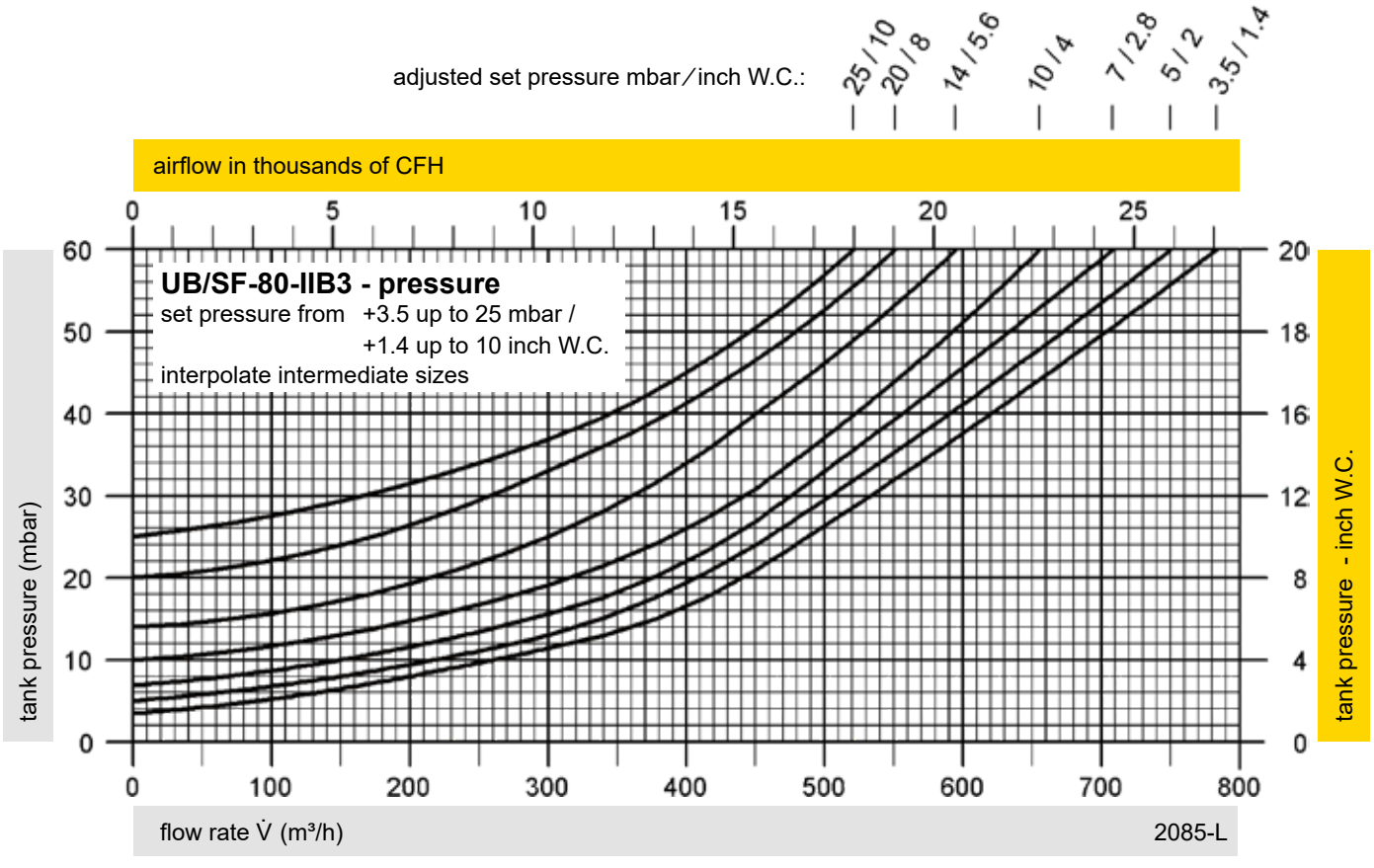
Design	C
FLAMEFILTER® casing	Stainless Steel
FLAMEFILTER®	Stainless Steel
Spacer	Stainless Steel

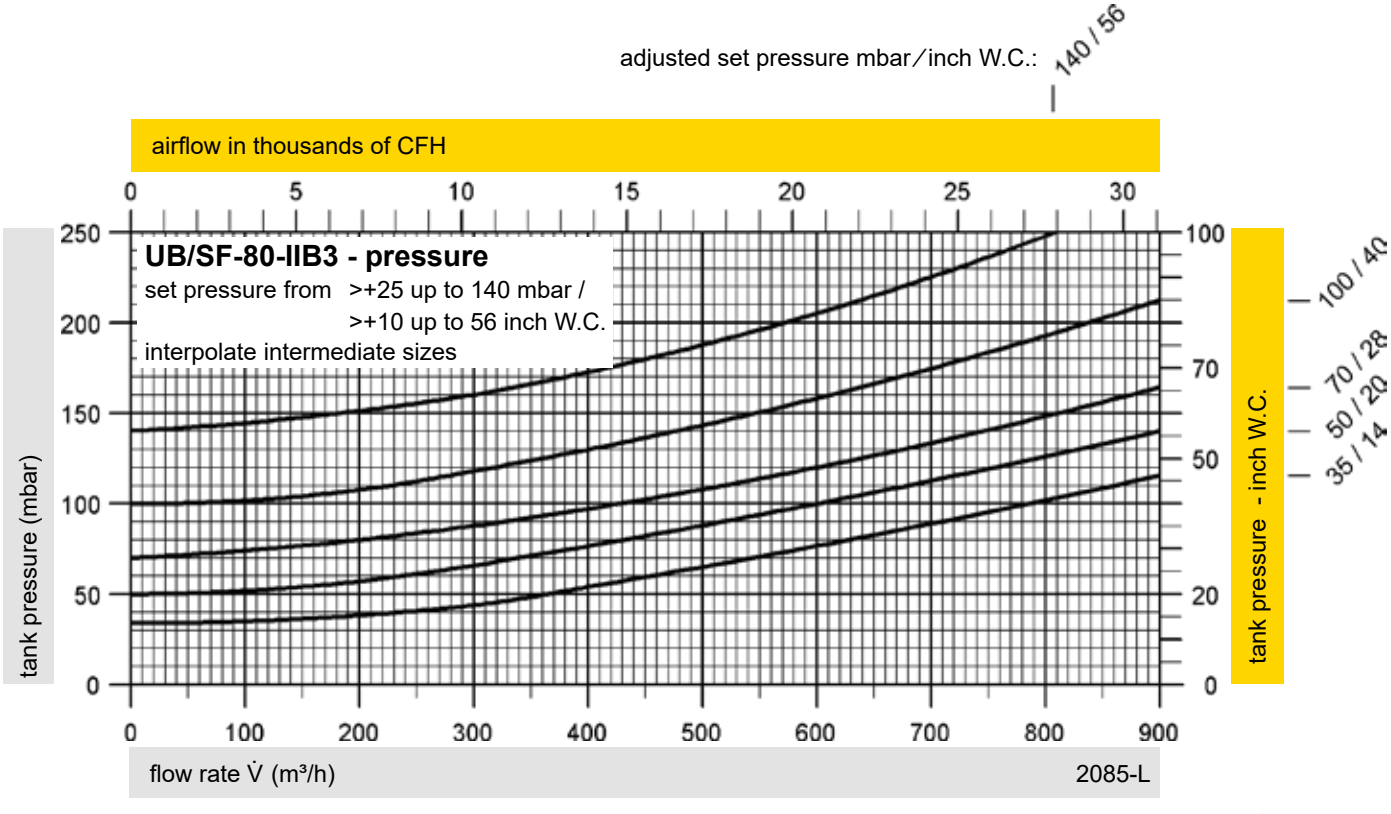
Special materials upon request.

Table 6: Flange connection type

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

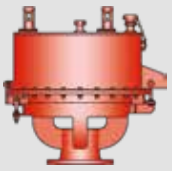
Other types upon request.





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

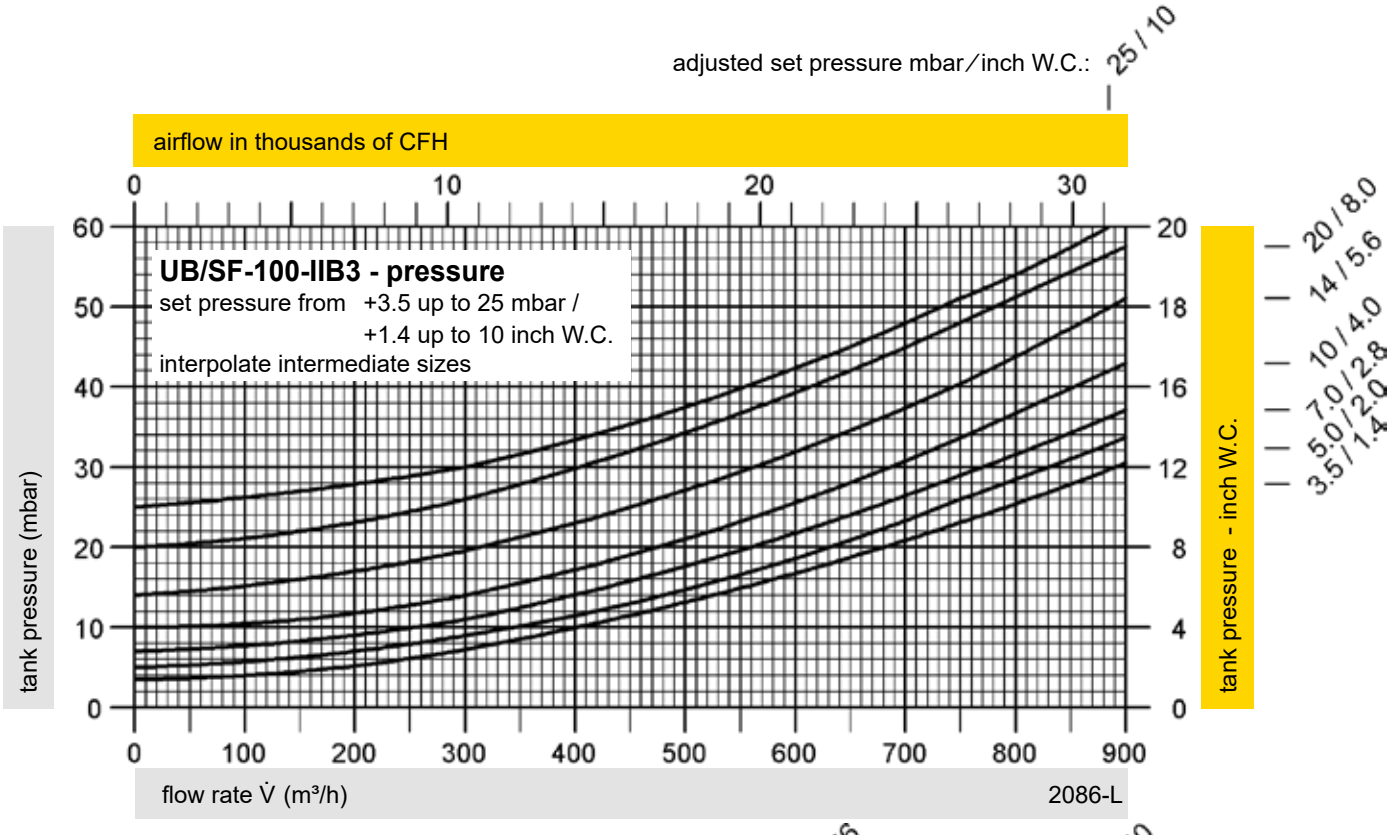
PROTEGO
for safety and environment

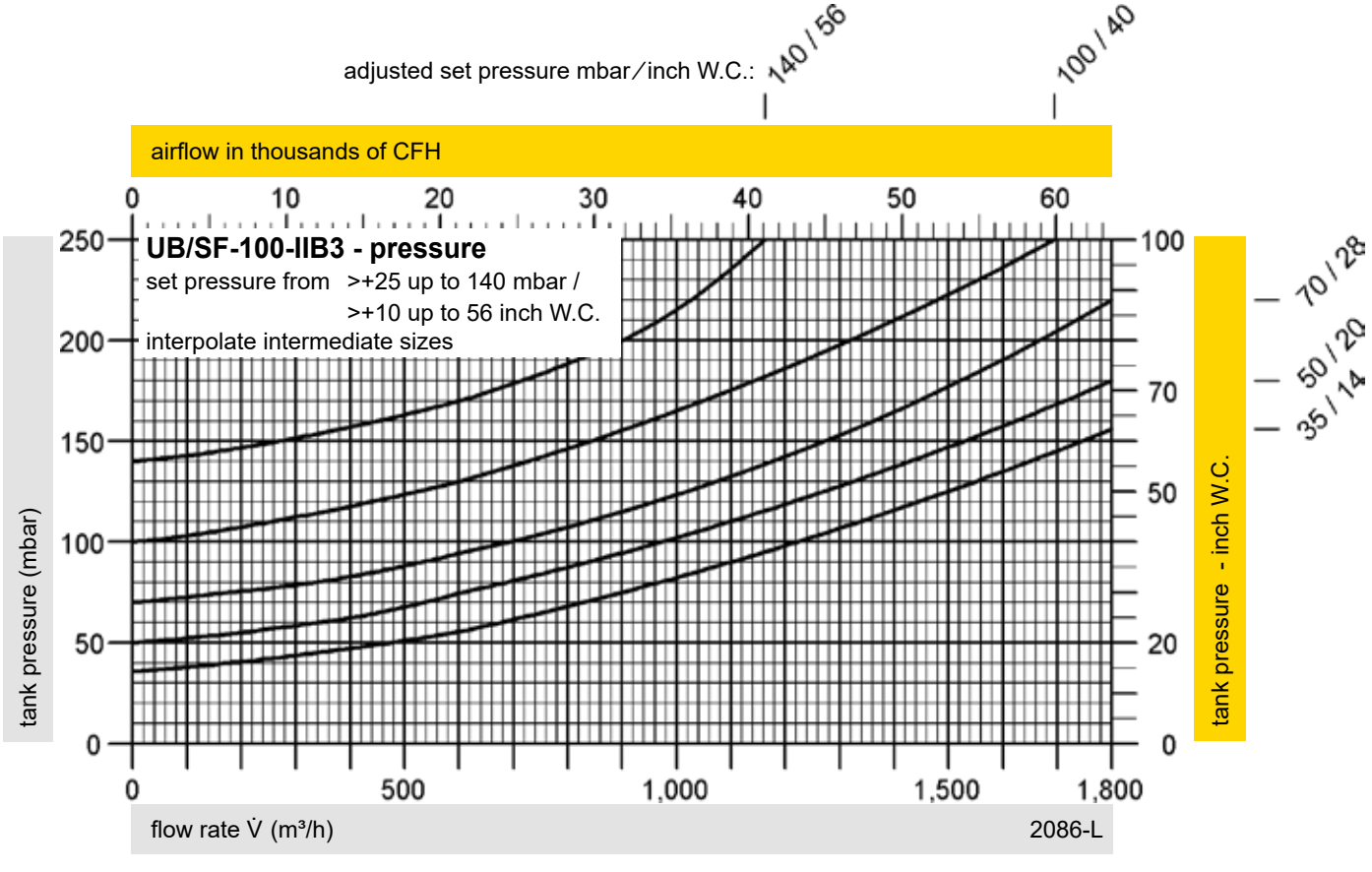


Pressure/Vacuum Diaphragm Valve

Flow Capacity Charts - Pressure

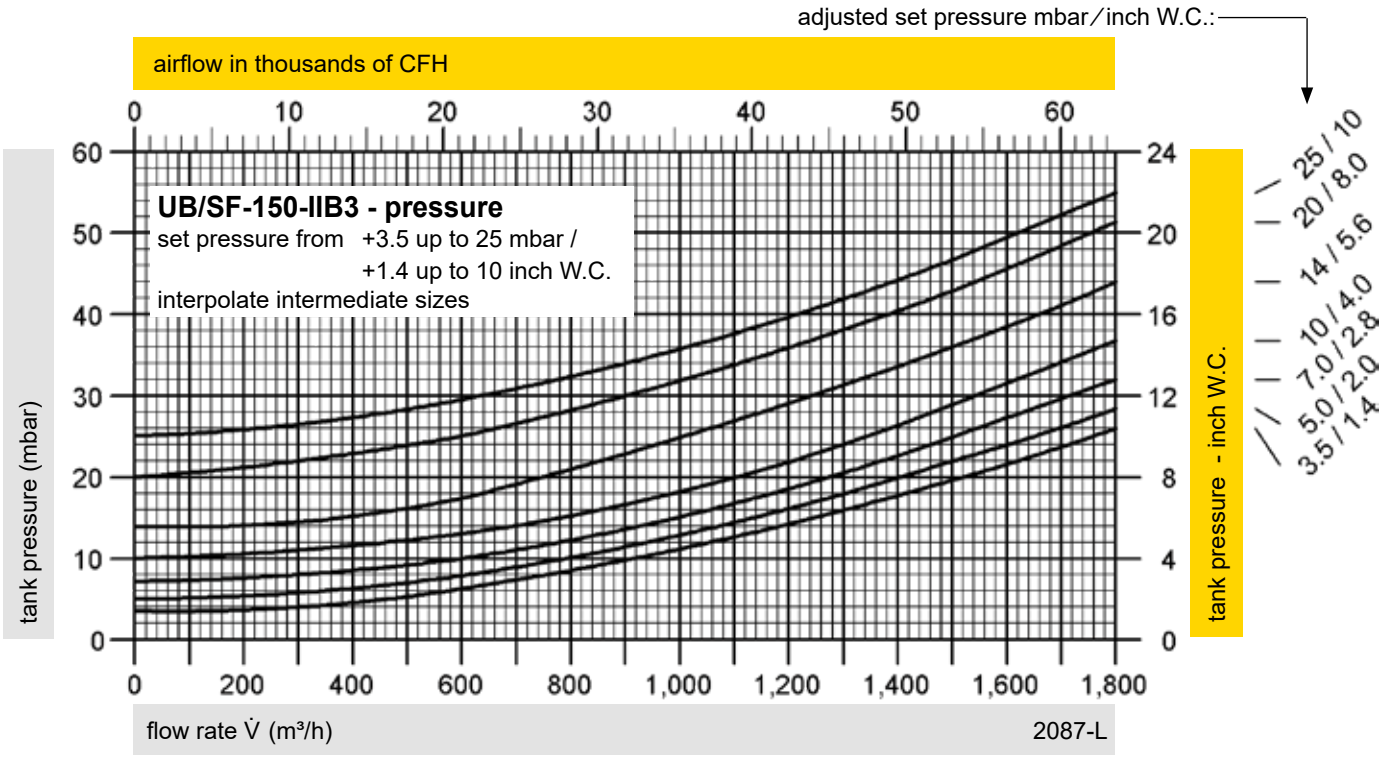
PROTEGO® UB/SF-100

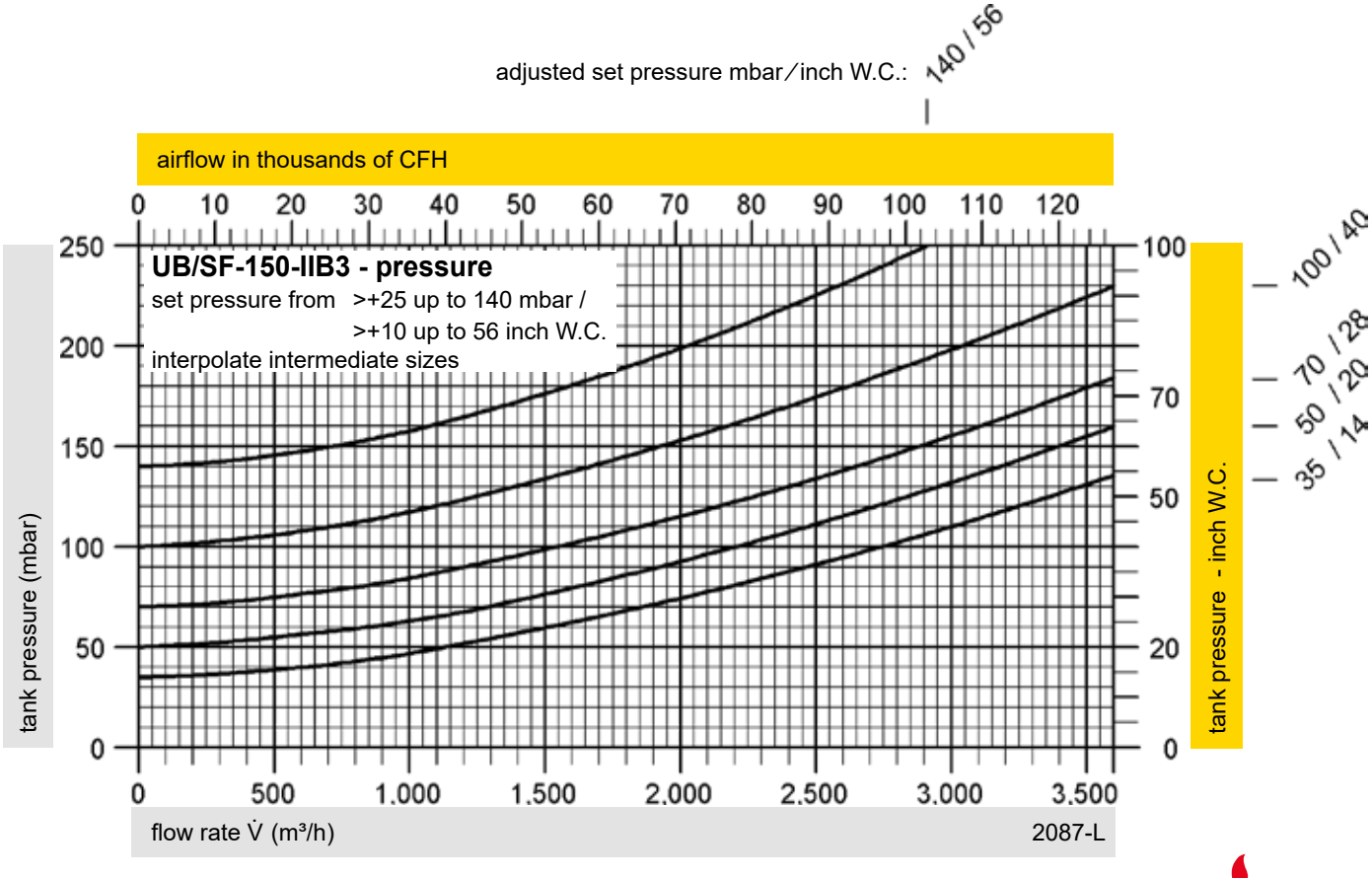


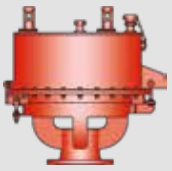


The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”


adjusted set pressure mbar/inch W.C.:
airflow in thousands of CFH
UB/SF-150-IIB3 - pressure
set pressure from +3.5 up to 25 mbar /
+1.4 up to 10 inch W.C.
interpolate intermediate sizes
tank pressure (mbar)
tank pressure - inch W.C.
25 / 10
20 / 8.0
14 / 5.6
10 / 4.0
7.0 / 2.8
5.0 / 2.0
3.5 / 1.4
0 10 20 30 40 50 60
0 200 400 600 800 1,000 1,200 1,400 1,600 1,800
flow rate V̇ (m³/h)
2087-L

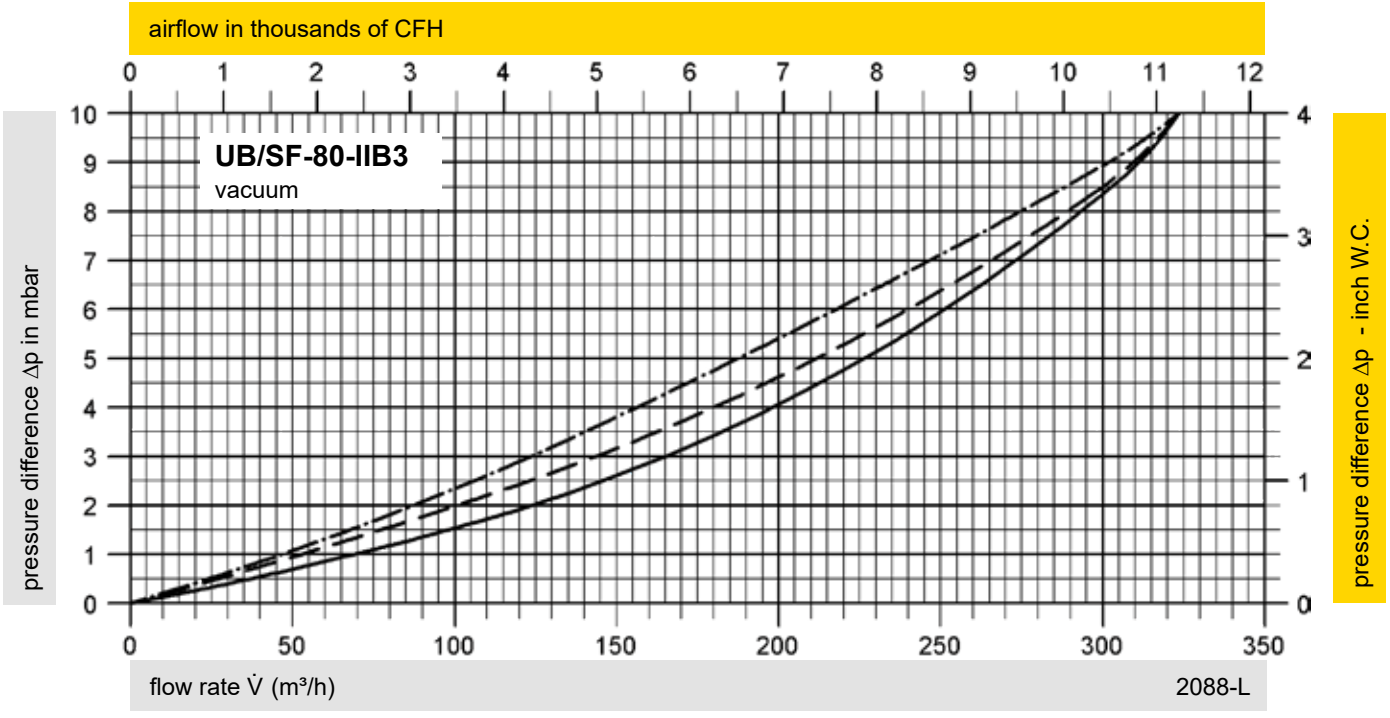

adjusted set pressure mbar/inch W.C.:
140 / 56
airflow in thousands of CFH
UB/SF-150-IIB3 - pressure
set pressure from >+25 up to 140 mbar /
>+10 up to 56 inch W.C.
interpolate intermediate sizes
tank pressure (mbar)
tank pressure - inch W.C.
100 / 40
70 / 28
50 / 20
35 / 14
0 10 20 30 40 50 60 70 80 90 100 110 120
0 500 1.000 1.500 2.000 2.500 3.000 3.500
flow rate V̇ (m³/h)
2087-L



Pressure/Vacuum Diaphragm Valve

Flow Capacity Charts - Vacuum

PROTEGO® UB/SF-80 and 100



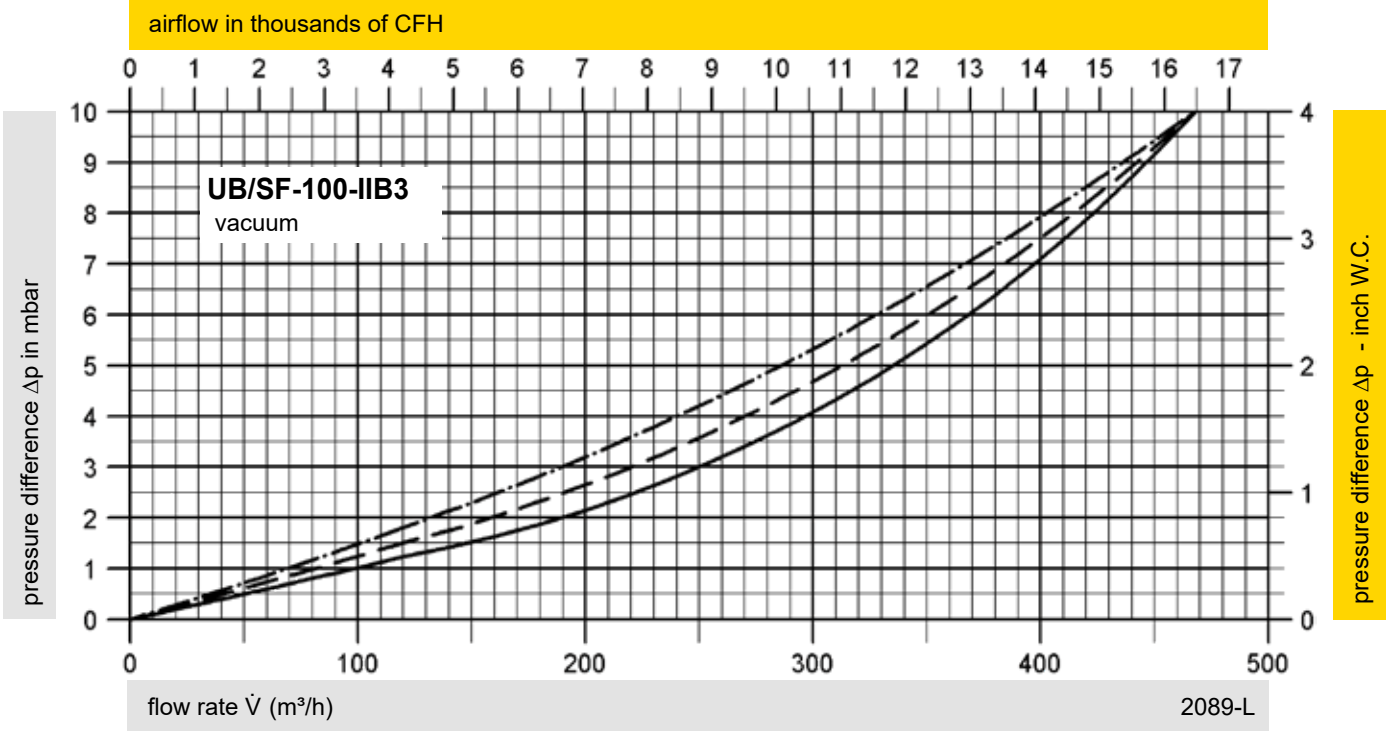
pressure difference = max. allowable tank design vacuum - valve set vacuum

adjusted set vacuum:

——— ≤ -5 mbar / ≤ -2 inch W.C.

– – – > -5 mbar up to ≤ -7 mbar / > -2 inch W.C. up to ≤ -2.8 inch W.C.

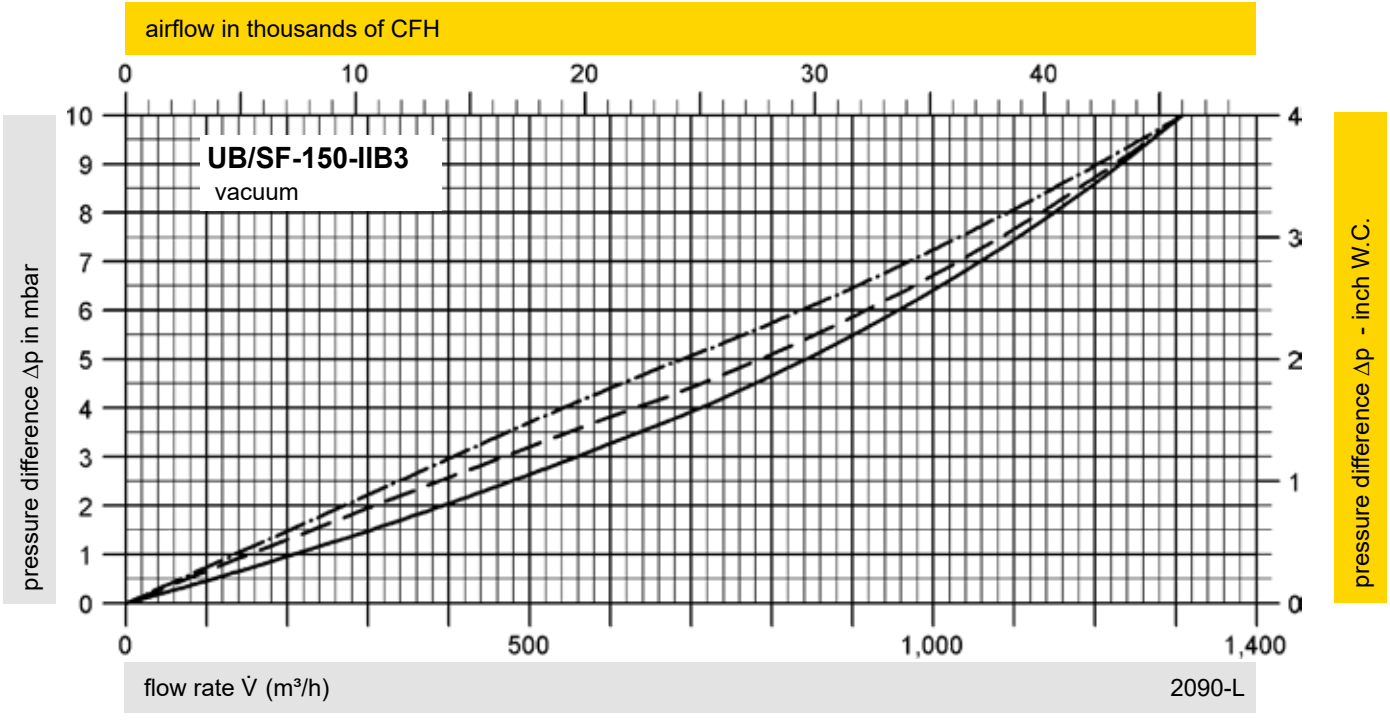
– · – · – > -7 mbar up to ≤ -35 mbar / > -2.8 inch W.C. up to ≤ -14 inch W.C.



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

Volume flow V̇ 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.”

PROTEGO® UB/SF-150



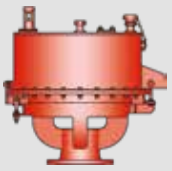
pressure difference = max. allowable tank design vacuum - valve set vacuum

adjusted set vacuum:

——— ≤ -5 mbar / ≤ -2 inch W.C.

– – – > -5 mbar up to ≤ -7 mbar / > -2 inch W.C. up to ≤ -2.8 inch W.C.

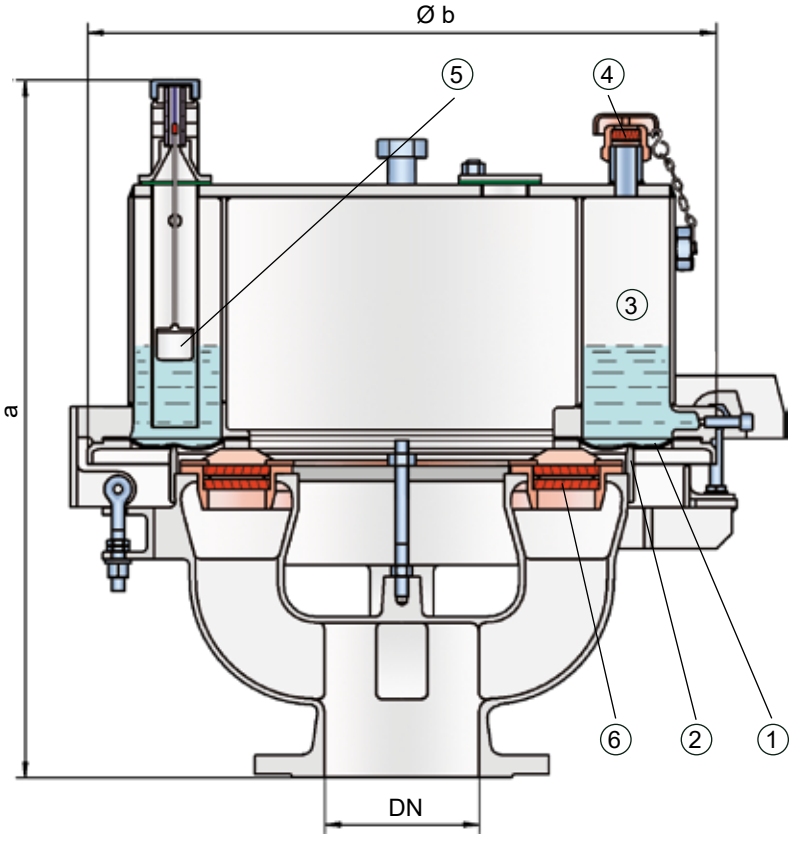
– · – · – > -7 mbar up to ≤ -35 mbar / > -2.8 inch W.C. up to ≤ -14 inch W.C.



Pressure Diaphragm Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® UB/DF



When the pressure in the tank reaches the set pressure, the diaphragm (1) on the outer valve seat ring (2) is lifted and vapors are released into the environment. The set pressure is adjusted by the weight of the liquid load (water-glycol mixture) in the outer ring chamber (3). The overpressure chamber is equipped with an opening (4) to keep the pressure in balance. The opening is equipped with a FLAMEFILTER® to prevent flame transmission into the overpressure chamber. The overpressure setting is determined by the filling level of the loading liquid and can be adjusted by a floating level indicator (5).

The tank pressure is maintained up to the set pressure with a tightness that is above the normal standards due to our highly developed manufacturing technology. This is achieved by the liquid loaded diaphragm pressing tightly around the special designed valve seat surface area even when the operating pressure increases, which reduces surface pressure and unnecessary leakage. After the overpressure is released, the valve re-seats and provides a tight seal.

If the set pressure is exceeded, explosive gas/product vapor/air mixtures are released into the atmosphere. The speed at which these mixtures exit the annular gap between the diaphragm and the outer valve seat ring is considerably greater than the flame speed. If this mixture ignites, flashback into the tank is prevented. If the mixture flow continues, the dynamic flame arresting feature prevents flashback, even in the case of endurance burning. Even at relatively low flow rates, e.g., during thermal out-breathing, the gap formed by the volumetric flow is so narrow, that flames in the gap are extinguished, and a flashback is prevented. At very low pressure settings, the explosion pressures resulting from an atmospheric deflagration may be strong enough to lift the diaphragm off the valve seat rings. The ignition into the tank can be prevented by installing the PROTEGO® flame arrester unit (8). This PROTEGO® flame arrester unit provides additional protection against atmospheric deflagration when the valve is open for maintenance and inspection.

The valve can be used at an operating temperature of up to +60°C/140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Pressure Settings:

DN 80	+3.5 mbar	up to	+50 mbar
	+1.4 inch W.C.	up to	+20 inch W.C.
DN 100	+3.5 mbar	up to	+45 mbar
	+1.4 inch W.C.	up to	+18 inch W.C.
DN 150	+3.5 mbar	up to	+46 mbar
	+1.4 inch W.C.	up to	+18.4 inch W.C.

Higher pressure settings up to +140 mbar (56.2 inch W.C.) in special design with additional attachment and lower pressure settings upon request.

Function and Description

The PROTEGO® UB/DF diaphragm valve is a worldwide unique deflagration-proof and endurance burning-proof pressure relief valve combining the function of a dynamic and static flame arrester. It is primarily used as a safety device for flame transmission-proof out-breathing on tanks, containers, and process equipment. The valve offers reliable protection against overpressure, prevents the in-breathing of air and product losses almost up to the set pressure, and protects against atmospheric deflagration and endurance burning if stabilized burning occurs. The PROTEGO® UB/DF diaphragm valve has proven itself over many years under a wide variety of operating conditions in the mineral oil and chemical industries. The set pressure is adjusted with a freeze resistant water-glycol mixture which ensures safe operation under extreme cold weather conditions. The PROTEGO® UB/DF valve is available for substances from explosion group IIB3 (NEC group C MESG ≥ 0.65 mm).

Frost-Proof P/V Diaphragm Valve (Video)

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- high flow capacity
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- protection against atmospheric deflagrations and endurance burning for products up to explosion group IIB3 (NEC group C MESG ≥ 0.65 mm)
- minimum pressure loss of the PROTEGO® flame arrester unit
- flame arrester venting and ventilation of the pressurized chamber
- optimal frost protection
- automatic condensate drain
- monitoring of the load liquid by level indicator
- easy operation monitoring and maintenance by simply opening the hinged valve cap
- modular design enables replacement of individual FLAMEFILTER® discs and diaphragm
- particularly suitable for problematic products such as styrene, acrylates, etc.

Design Types and Specifications

The diaphragm is pressurized by liquid. Higher pressures are available upon request in a special version with an additional attachment.

There are two different designs:

Pressure diaphragm valve, basic design **UB/DF - [–]**

Pressure diaphragm valve with heating coil **UB/DF - [H]**
(max. heating fluid temperature +85°C / 185°F)

In addition to the standard design, a series of specially developed designs (e.g., for acrylate or styrene storage tanks, etc.) can be provided upon request.

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

Table 1: Dimensions Dimensions in mm / inches

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

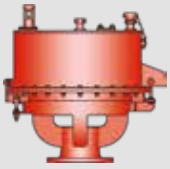
DN	pressure	80 / 3"	100 / 4"	150 / 6"
a	up to +28 mbar / +11.2 inch W.C.	615 / 24.21	645 / 25.39	680 / 26.77
a	> +28 mbar / +11.2 inch W.C.	765 / 30.12	795 / 31.30	830 / 32.68
b		410 / 16.14	485 / 19.09	590 / 23.23

Pressure settings > +50 mbar / +20 inch W.C. (DN 80/3”), > +45 mbar / +18 inch W.C. (DN 100/4”), > +46 mbar / +18.4 inch W.C. (DN150/6”) with additional liquid reservoir - dimensions upon request.

Dimensions for pressure diaphragm valves with heating coil upon request.

Table 2: Selection of explosion group

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



Pressure Diaphragm Valve

Deflagration-proof and Endurance Burning-proof

PROTEGO® UB/DF

Table 3: Material selection for housing

Design	C	D
Housing	Steel	Stainless Steel
Valve top	Stainless Steel	Stainless Steel
Heating coil (UB/DF-H-...)	Stainless Steel	Stainless Steel
Valve seat	Stainless Steel	Stainless Steel
Gasket	FPM	PTFE
Diaphragm	A, B	A, B
Flame arrester unit	C	C

The housings are also available with an ECTFE coating.
Special materials upon request.

Coated Devices
(Flyer pdf)

Table 4: Material selection for diaphragm

Design	A	B
Diaphragm	FPM	FEP

Special materials upon request.

Table 5: Material combinations of flame arrester unit

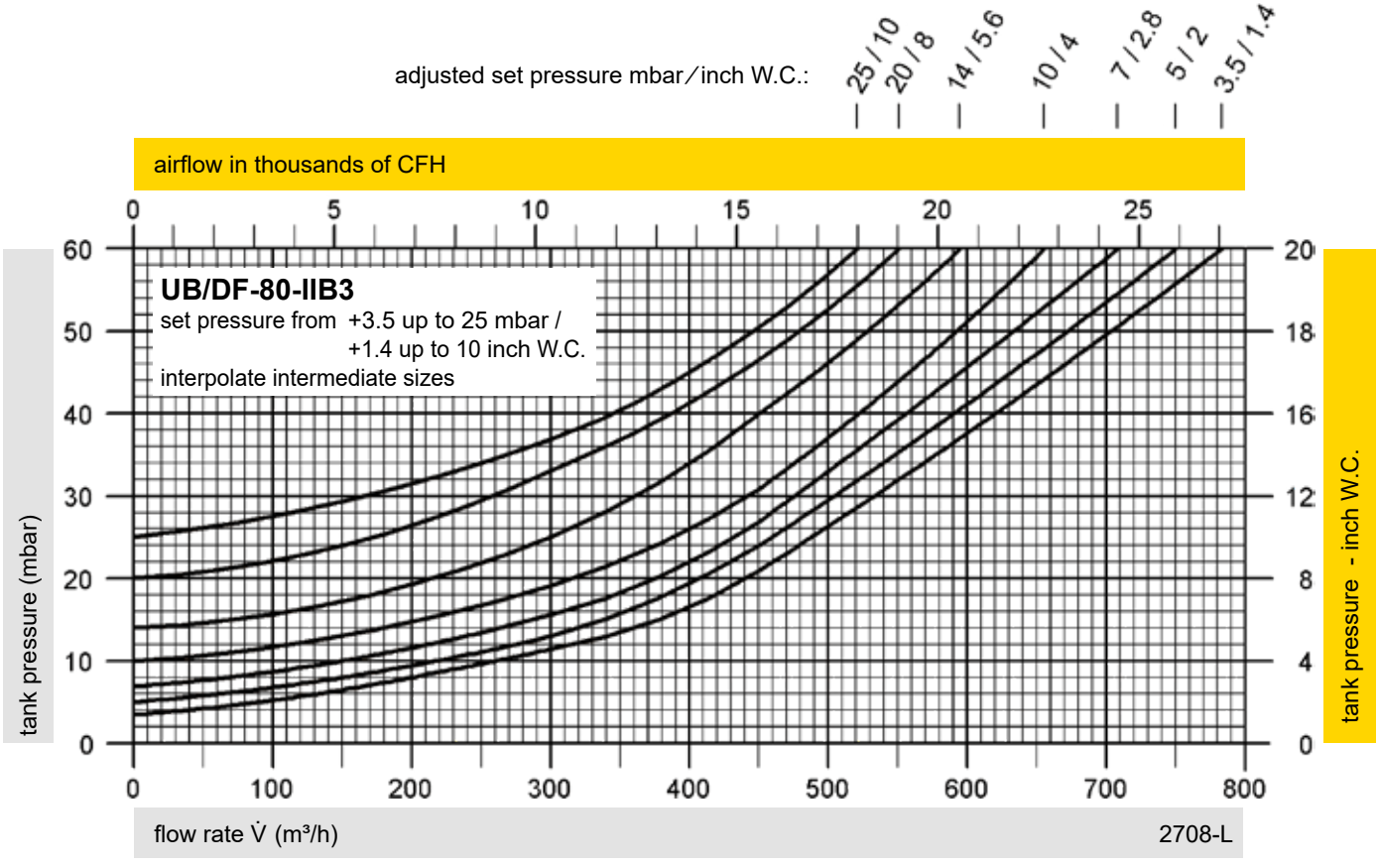
Design	C
FLAMEFILTER® casing	Stainless Steel
FLAMEFILTER®	Stainless Steel
Spacer	Stainless Steel

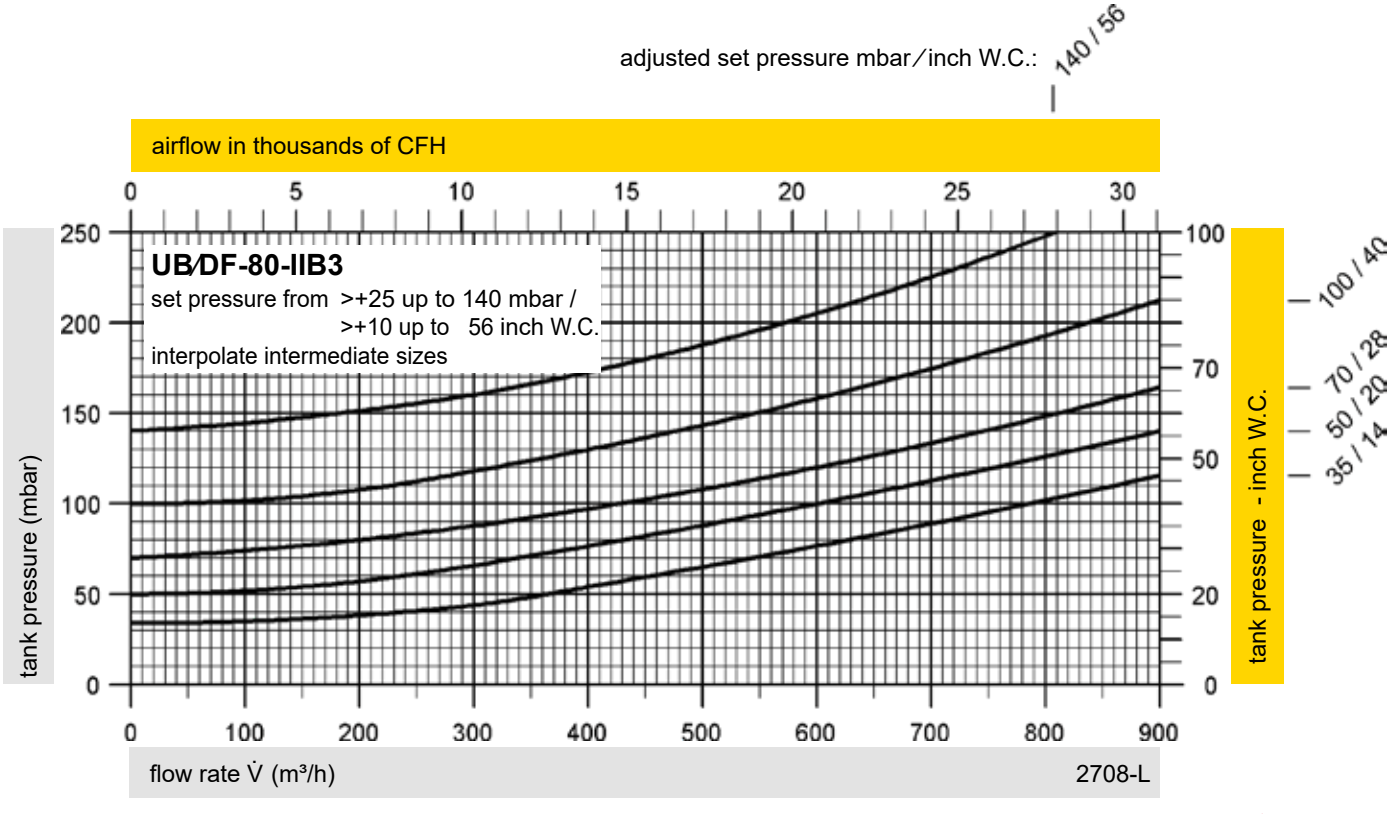
Special materials upon request.

Table 6: Flange connection type

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

Other types upon request.





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

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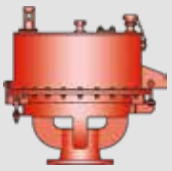
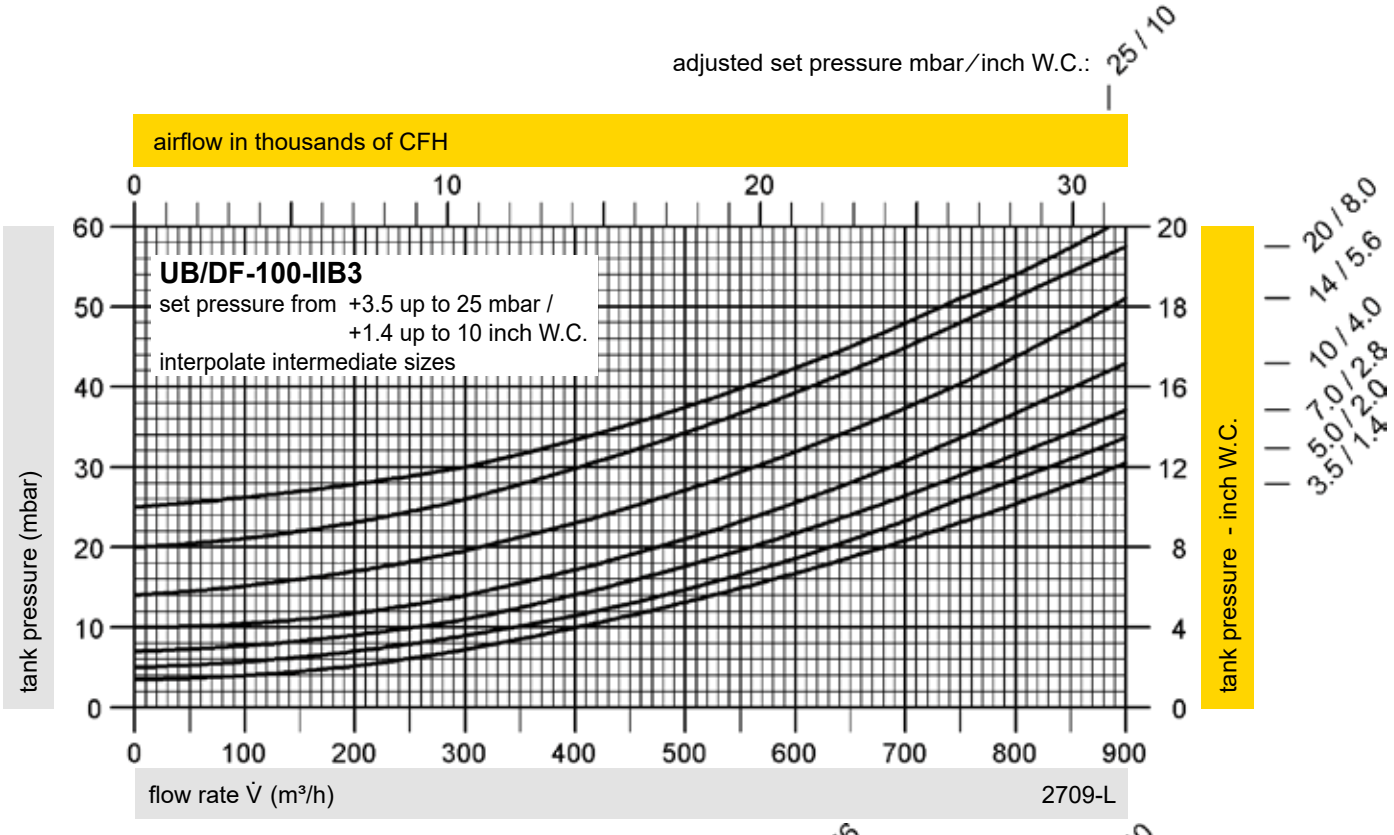
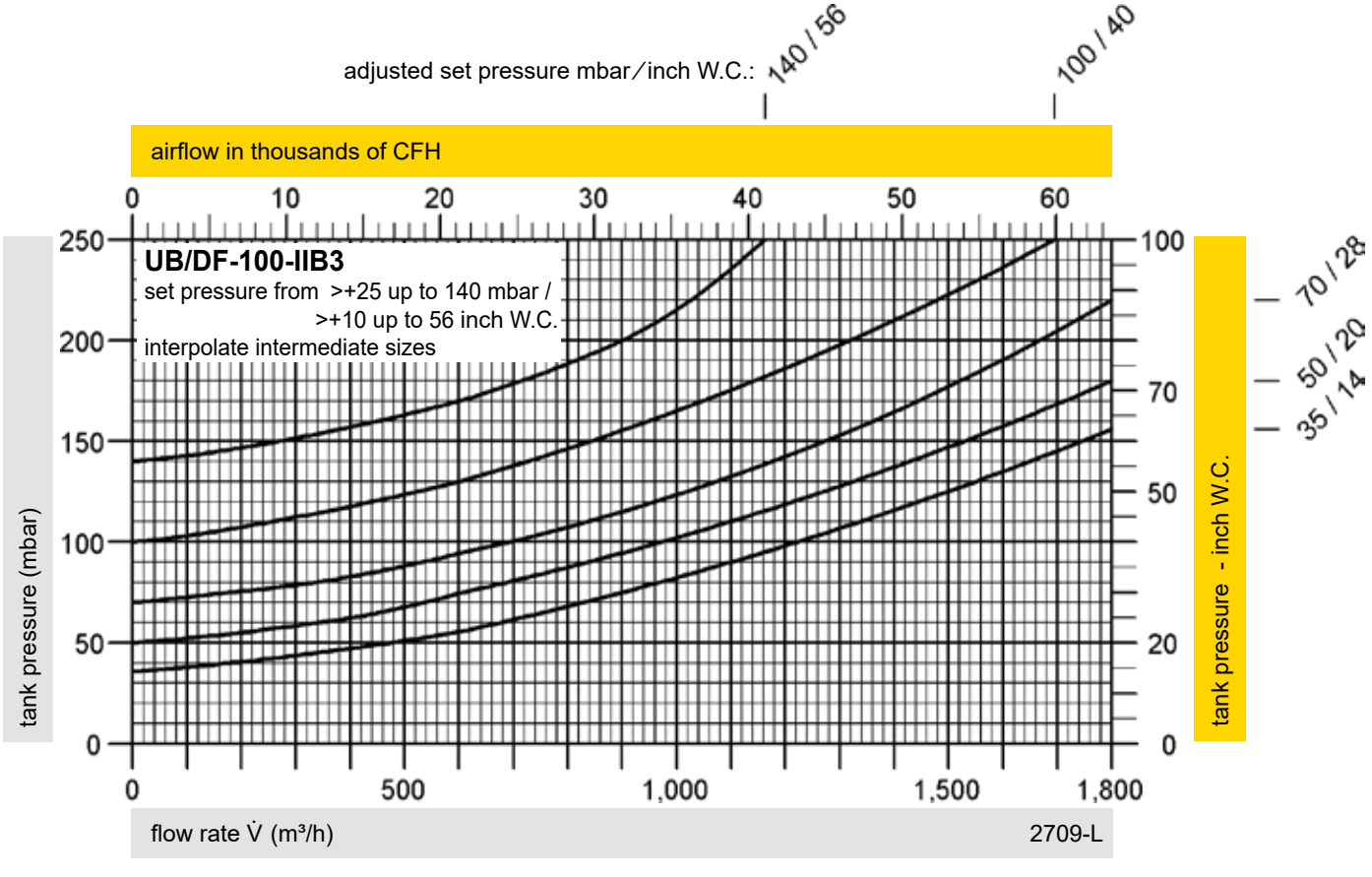


Pressure Diaphragm valve

Flow Capacity Charts

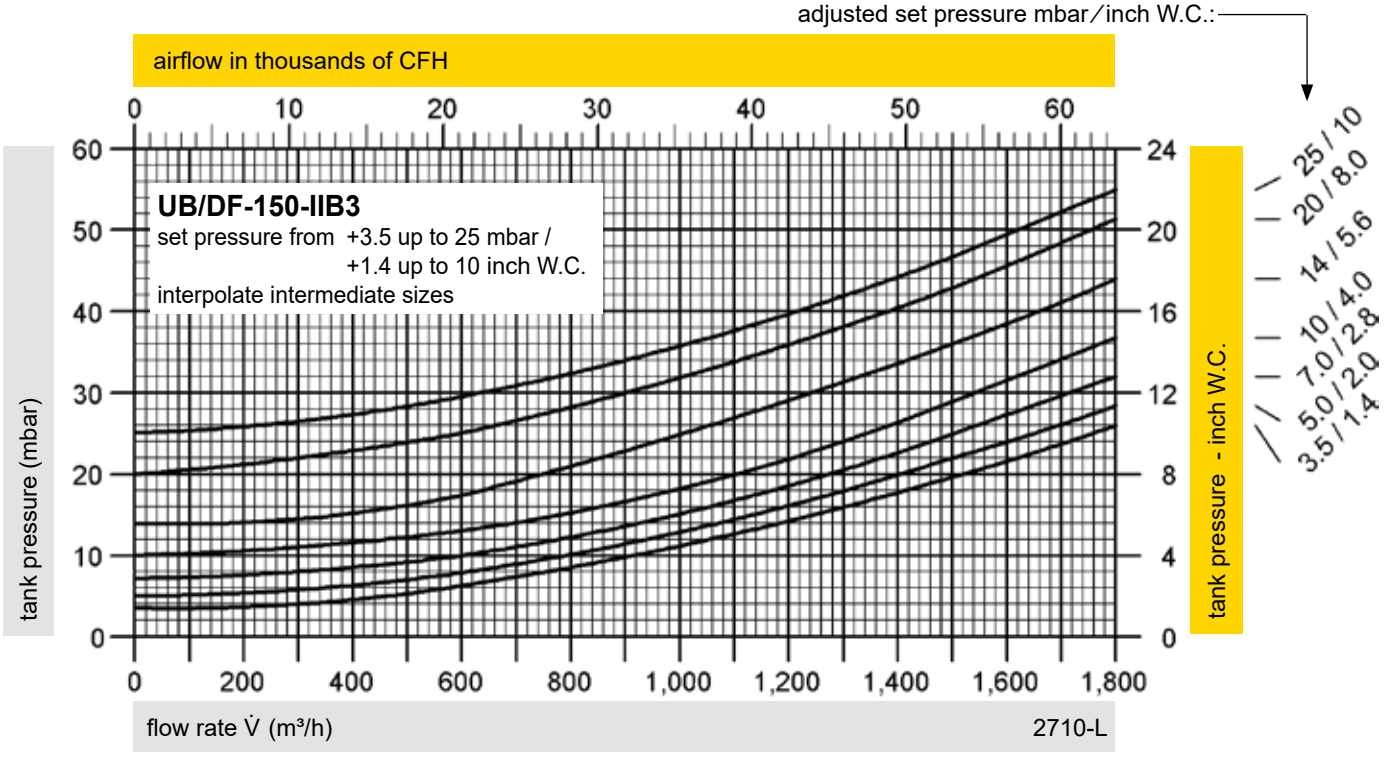
PROTEGO® UB/DF

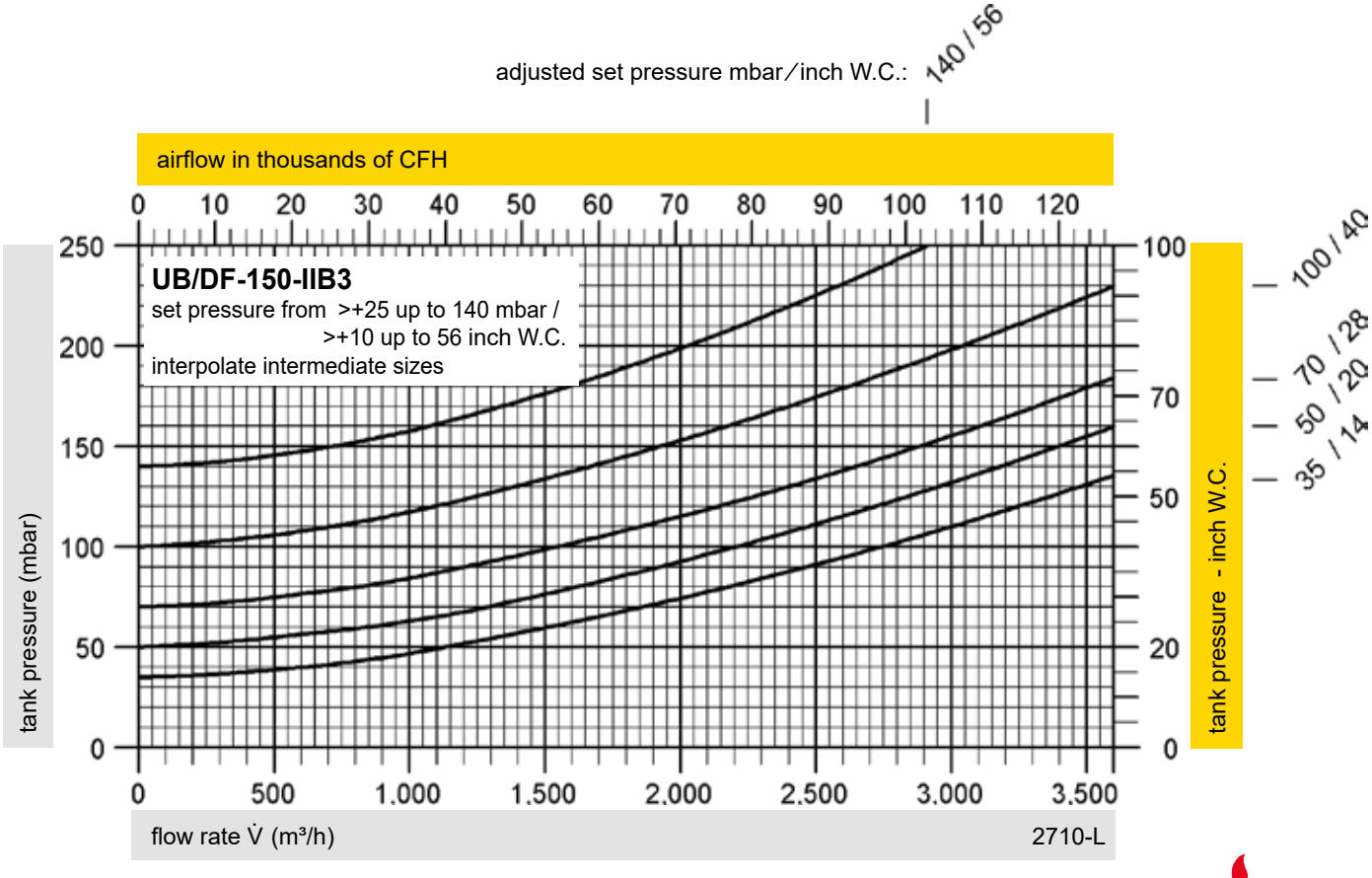


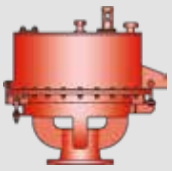


The flow capacity charts have been determined with a calibrated and TÜV certified flow capacity test rig.

Volume flow V̇ 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.”


adjusted set pressure mbar/inch W.C.:
airflow in thousands of CFH
UB/DF-150-IIB3
set pressure from +3.5 up to 25 mbar / +1.4 up to 10 inch W.C.
interpolate intermediate sizes
tank pressure (mbar)
tank pressure - inch W.C.
25 / 10
20 / 8.0
14 / 5.6
10 / 4.0
7.0 / 2.8
5.0 / 2.0
3.5 / 1.4
flow rate V̇ (m³/h)
2710-L

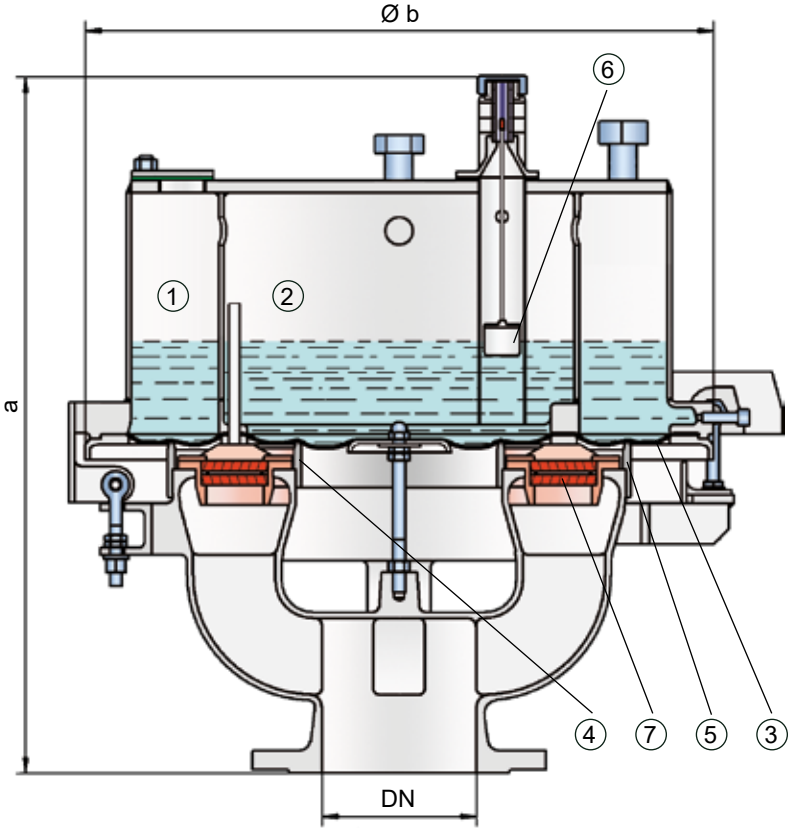

adjusted set pressure mbar/inch W.C.:
140 / 56
airflow in thousands of CFH
UB/DF-150-IIB3
set pressure from >+25 up to 140 mbar / >+10 up to 56 inch W.C.
interpolate intermediate sizes
tank pressure (mbar)
tank pressure - inch W.C.
100 / 40
70 / 28
50 / 20
35 / 14
flow rate V̇ (m³/h)
2710-L



Vacuum Diaphragm Valve

Deflagration-proof

PROTEGO® UB/VF



Vacuum Settings: -3.5 mbar up to -35 mbar
-1.4 inch W.C. up to -14 inch W.C.
Higher vacuum settings upon request.

Function and Description

The PROTEGO® UB/VF diaphragm valve is a worldwide unique vacuum relief valve combining the function of a dynamic and static flame arrester. It is primarily used as a safety device for flame transmission-proof in-breathing on tanks, containers, and process equipment. The valve offers reliable protection against vacuum build up, prevents the in-breathing of air and product losses almost up to the set vacuum, and protects against atmospheric deflagration. The PROTEGO® UB/VF diaphragm valve has proven itself over many years under a wide variety of operating conditions in the mineral oil and chemical industries. Worldwide, it is the only vent which works reliably with problem products such as styrene or acrylates. The set vacuum is adjusted with a freeze resistant water-glycol mixture which ensures safe operation under extreme cold weather conditions. The PROTEGO® UB/VF valve is available for substances from explosion group IIB3.

If a vacuum builds up in the tank, it is transmitted through pressure balancing tubes into the vacuum chambers (1), (2), which are connected to each other. This will remove the weight of the load liquid, and the atmospheric pressure will lift the diaphragm (3) off the inner and outer valve seat rings (4, 5), resulting in ventilation of the tank. The vacuum setting is adjusted via the filling level of the load liquid and can be checked by a floating level indicator (6).

The tank vacuum is maintained up to the set vacuum with a tightness that is above the normal standards due to our highly developed manufacturing technology. This is achieved by the liquid loaded diaphragm pressing tightly around the special designed valve seat surface area even when the operating vacuum increases, which reduces surface pressure and unnecessary leakage. After the vacuum is balanced, the valve re-seats and provides a tight seal.

At very low vacuum settings, the explosion pressures resulting from an atmospheric deflagration may be strong enough to lift the diaphragm off the valve seat rings. The ignition into the tank can be prevented by installing the PROTEGO® flame arrester unit (7). This PROTEGO® flame arrester unit provides additional protection against atmospheric deflagration when the valve is open for maintenance and inspection.

The valve can be used at an operating temperature of up to +60°C/ 140°F and meets the requirements of European tank design standard EN 14015 (Appendix L) and ISO 28300 (API 2000).

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

Special Features and Advantages

- excellent tightness, resulting in lowest possible product losses and environmental pollution
- set pressure close to opening pressure for optimum pressure maintenance in the system
- high flow capacity
- can be used as a protective system in areas with potentially explosive atmospheres in accordance with ATEX
- protection against atmospheric deflagrations for products up to explosion group IIB3 (NEC group C MESG ≥ 0.65 mm)
- minimum pressure loss of the PROTEGO® flame arrester unit
- optimal frost protection
- automatic condensate drain
- monitoring of the load liquid by level indicator
- easy operation monitoring and maintenance by simply opening the hinged valve cap

Frost-Proof P/V Diaphragm Valve (Video)

- modular design enables replacement of individual FLAMEFILTER® discs and diaphragm
- particularly suitable for problematic products such as styrene, acrylates, etc.

Design Types and Specifications

The diaphragm is pressurized by liquid.

There are two different designs:

Vacuum diaphragm valve, basic design **UB/VF - –**

Vacuum diaphragm valve with heating coil **UB/VF - H**
(max. heating fluid temperature +85°C / 185°F)

In addition to the standard design, a series of specially developed designs (e.g., for acrylate or styrene storage tanks, etc.) can be provided upon request.

Table 1: Dimensions Dimensions in mm / inches

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

DN	vacuum	80 / 3"	vacuum	100 / 4"	150 / 6"
a	up to -28 mbar / 11.2 inch W.C.	615 / 24.21	up to -22 mbar / 8.8 inch W.C.	645 / 25.39	680 / 26.77
a	< -28 mbar / 11.2 inch W.C.	765 / 31.12	< -22 mbar / 8.8 inch W.C.	795 / 31.30	830 / 32.68
b		410 / 16.14		485 / 19.09	590 / 23.23

Dimensions for vacuum diaphragm valve with heating coil upon request.

Table 2: Selection of explosion group

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

Table 3: Material selection for housing

Design	C	D	
Housing	Steel	Stainless Steel	The housings are also available with an ECTFE coating. Special materials upon request.
Valve top	Stainless Steel	Stainless Steel	
Heating coil (UB/VF-H-...)	Stainless Steel	Stainless Steel	
Valve seat	Stainless Steel	Stainless Steel	
Gasket	FPM	PTFE	
Diaphragm	A, B	A, B	
Flame arrester unit	C	C	

Coated Devices (Flyer pdf)

Table 4: Material selection for diaphragm

Design	A	B	
Diaphragm	FPM	FEP	Special materials upon request.

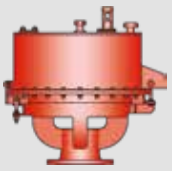
Table 5: Material combinations of flame arrester unit

Design	C	
FLAMEFILTER® casing	Stainless Steel	Special materials upon request.
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.	

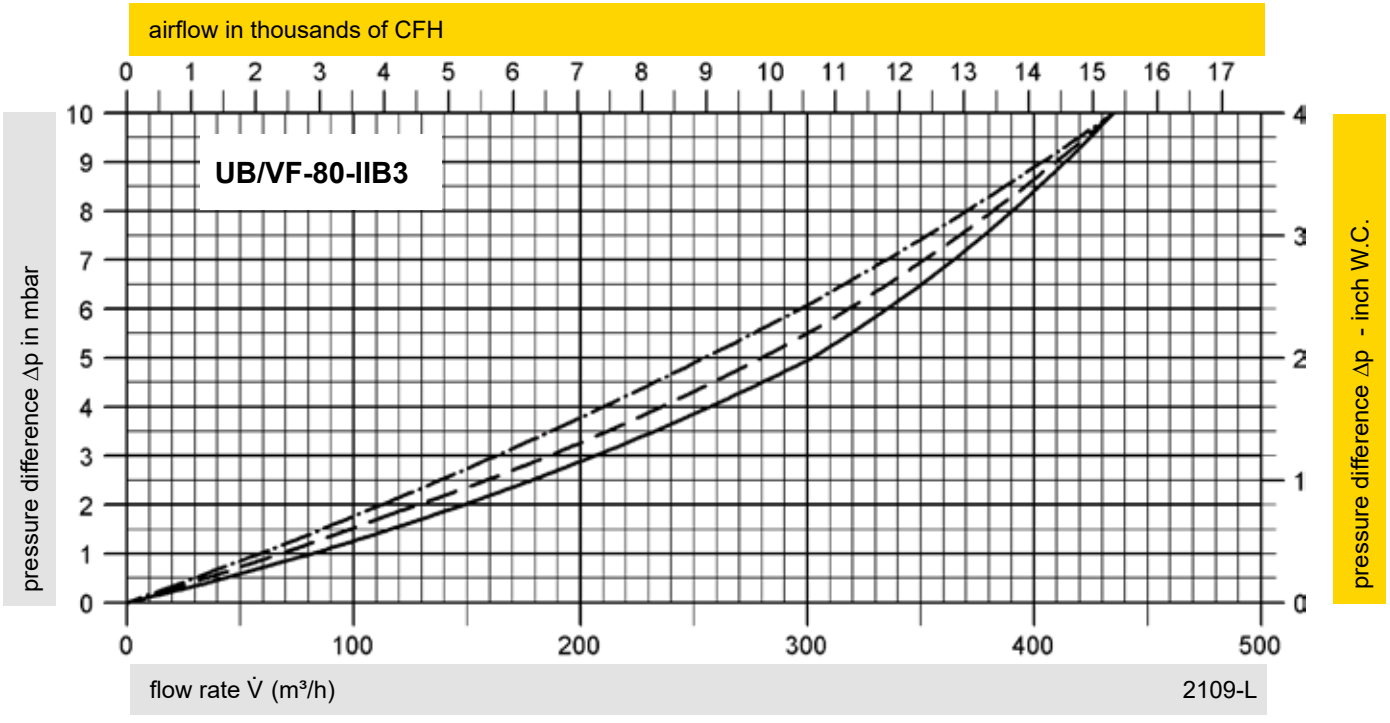
PROTEGO
for safety and environment



Vacuum Diaphragm Valve

Flow Capacity Charts

PROTEGO® UB/VF



pressure difference = max. allowable tank design vacuum - valve set vacuum

adjusted set vacuum:

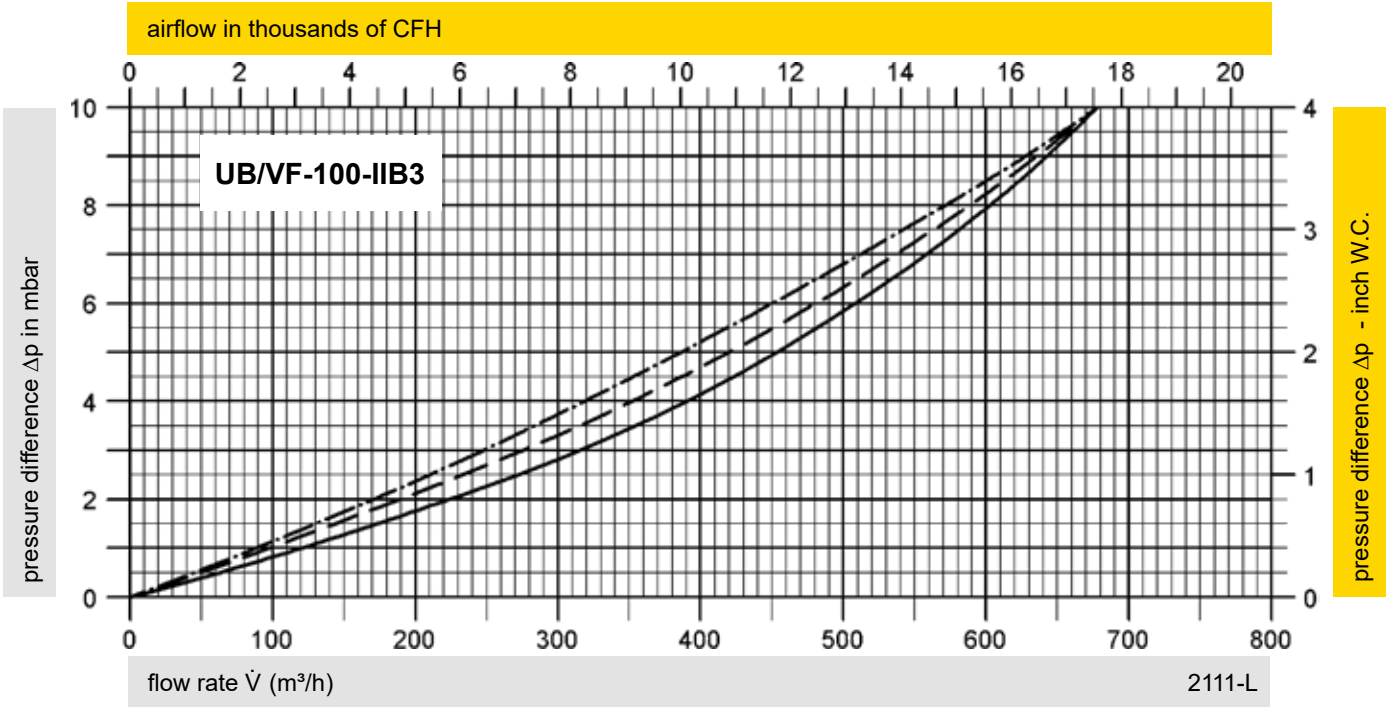
——— ≤ -5 mbar / ≤ -2 inch W.C.

— — — > -5 mbar up to ≤ -7 mbar / > -2 inch W.C. up to ≤ -2.8 inch W.C.

— · — · — > -7 mbar up to ≤ -35 mbar / > -2.8 inch W.C. up to ≤ -14 inch W.C.

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

Volume flow V̇ 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.”



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— · — · — > -7 mbar up to ≤ -35 mbar / > -2.8 inch W.C. up to ≤ -14 inch W.C.