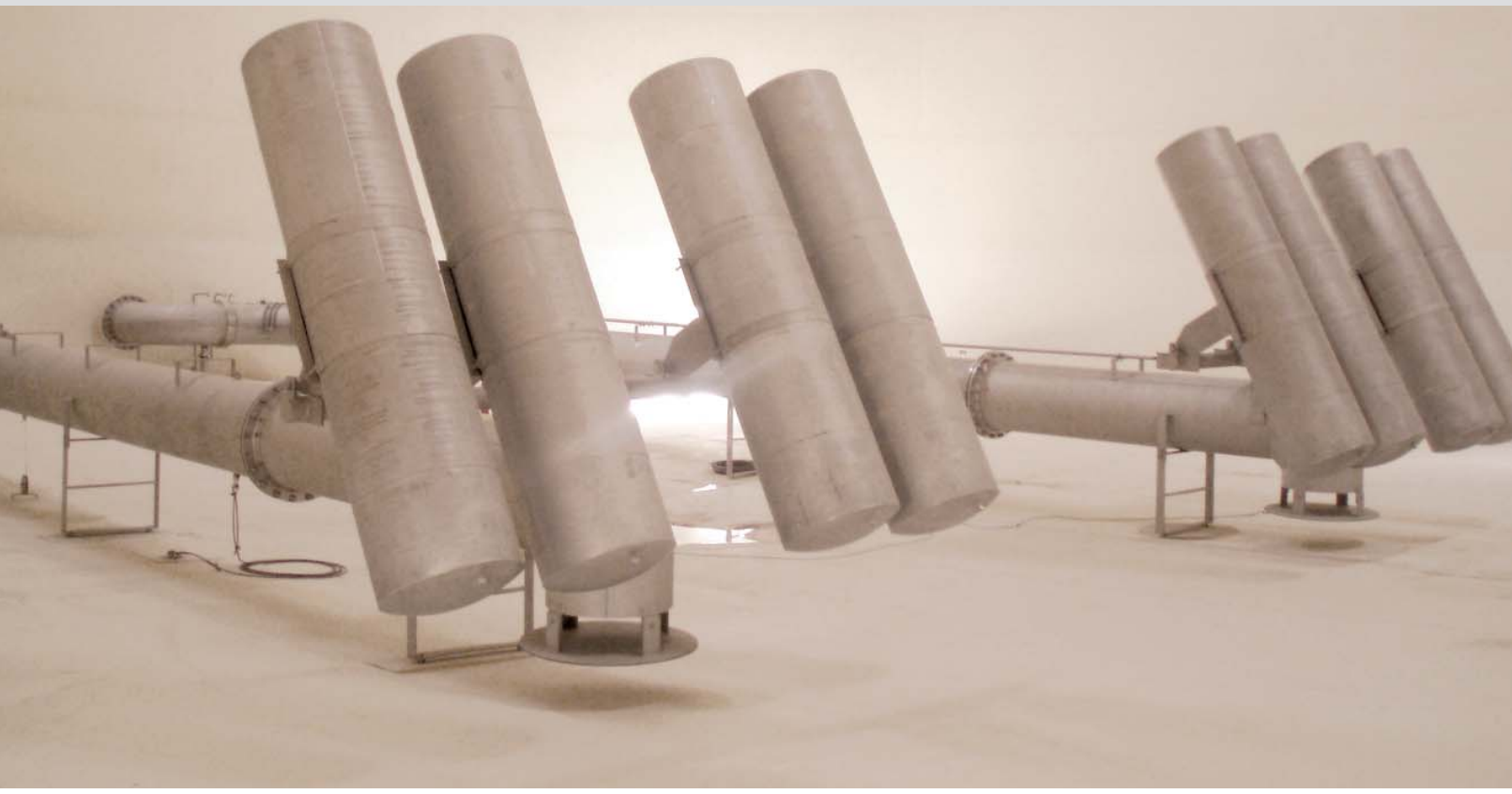
PROTEGO® Tank Accessories and Special Equipment



Volume 8

PROTEGO
for safety and environment

Tanks in tank farms and large vessels not only need to be equipped with flame arresters or pressure and vacuum valves but; in addition they need special equipment, which similar meets high requirements to operate safely.

Special Valves with Safety Functions

For emergency shut-off or for extraordinary operating conditions it is necessary to provide **internal safety valves** so that product leakage can be prevented quickly after a pipe burst. **Change-over valves** facilitate trouble-free valve maintenance.

Gauging and Sampling Equipment

Gauge and sampling hatches allow the use of **gauging and sampling devices** in the tank. For horizontal tanks deflagration proof gauging pipes are available.

For sampling and local venting in tanks that store flammable liquids PROTEGO® has designed special sampling and air bleed valves with flame arrester elements.

Explosion-proof floor drains for heliports pass flammable liquids (such as Kerosene) into catch tanks and prevent ignition inside. If an outside ignition source ignites the explosive atmosphere there is no flame transmission.

Floating Suction Units and Skimming Systems

Floating Suction Units PROTEGO® SA/S are designed to ensure that product in a storage tank is drawn off just below the surface of the liquid where it is cleanest.

Fixed roof tanks that store liquids with different density, so-called slop tanks, are fitted with the Float-Operated Skimming System PROTEGO® SA/DA for separating the phases.

Together with the tank operator or tank contractor we develop the best way to ensure both economical and safe operation.

Floating Roof Tank Equipment

For floating roof tanks the **drainage system for the floating roof** must be designed very precisely. Every movement of the floating roof must be taken into account and the load on the joints must not affect the free moving space. In case of restricted movement the system will crack, the pipes will bend and the joints will be stuck. In order to prevent the water in the system from standing and freezing, ensure sufficient drain to the lateral tank nozzle. Many years of experience are incorporated in the supplied systems that work without disruptions – starting from the **roof drain valves** to the systems with ball bearing joints or metal hose joints. With lowered floating roofs in maintenance positions the completely drained space below the floating roof must be vented through a **lift-actuated vent valve**. When storing flammable liquids in the tank venting is to be done through flame arresters.

Special Equipment

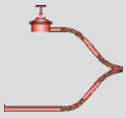
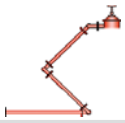
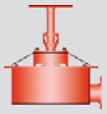
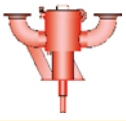
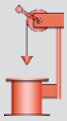
Hygroscopic products must be vented with dry air when stored. **Air-drying devices** with drying pearls prevent the air from saturating with humidity.

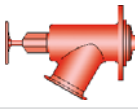
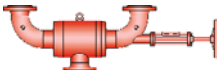
A special safety device is the **hydraulic flame arrester**. It is a collection device for large volume flows in pipelines collecting exhaust air from various plant areas, and it also functions as a backflow prevention device as it prevents the exchange of vapours. With extremely low pressure losses thanks to its relatively large drill holes in the sparge pipes the hydraulic flame arrester is insusceptible to clogging and therefore provides high plant availability. It can be used as flame arrester with substances of all explosion groups and provides protection against all types of combustion. The hydraulic flame arrester has to be monitored and controlled by instrumentation. Early involvement of our engineers in plant design is necessary to make the right selection.

Selection

The special valves, systems and devices are designed together with the operator, engineering company and tank contractor. PROTEGO® prepares a quotation based on the detailed system specifications.

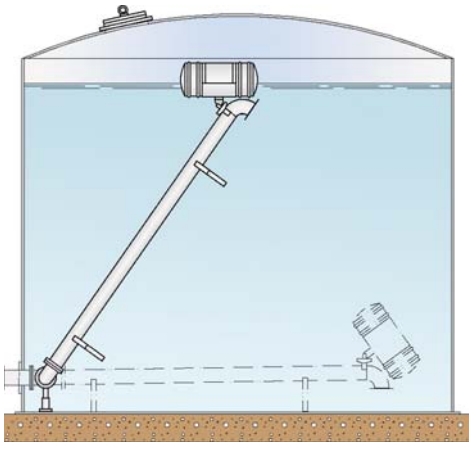
PROTEGO® Tank Accessories and Special Equipment

	Type	Size	Description	Page
Floating Suction Unit				
	SA/S		Floating Suction Unit	476 - 477
	SA/DA		Floating Skimmer System	478 - 479
Floating Roof Tank Equipment				
	SE/K	80 - 100 3" - 4"	Floating Roof Drainage System with Metal Hose Joint	480 - 481
	SE/CK	80 - 150 3" - 6"	Floating Roof Drainage System with Swivel Joints	482 - 483
	D/SR D/SR-W	80 - 150 3" - 6"	Roof Drain Valves	484 - 485
	AL/DK AL 200	200 8"	Vent Valve, Lift-actuated	486 - 488
Gauging and Sampling Equipment				
	PF/K PF/TK PS/KF	100 - 200 4" - 8"	Gauge Hatch with flange	490 - 491
	PS/K PS/TK	100 - 200 4" - 8"	Gauge Hatch with welded nozzle	492 - 493
	PU-IIA	25 - 50 1" - 2"	Gauging Pipe, deflagration proof	494 - 495
	PR/0	25 - 150 1" - 6"	Gauging and Sampling Pipe, verifiable	496 - 497
	VP/HK with PS/E und PG/H	100 - 150 4" - 6"	Gauging and Sampling Device with accessories	498 - 499
	VP/G-II-100 PG/H	100 4“	Sampling Device with accessories	500 - 501
	GS/F-IIB3	50 2“	Level Indicator, deflagration proof	502 - 503

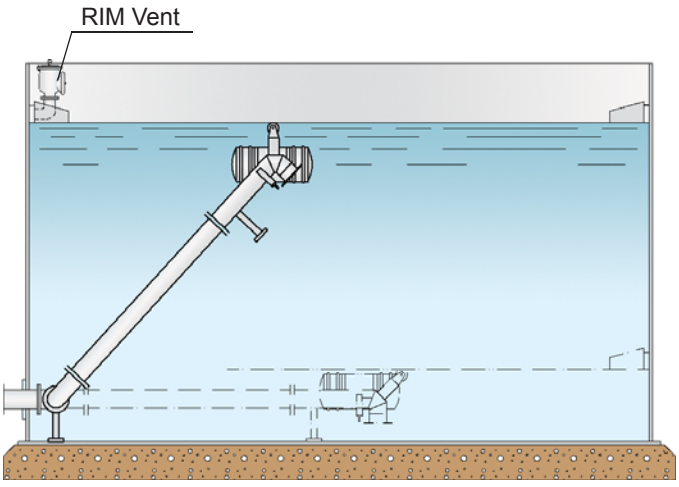
	Type	Size	Description	Page
Deflagration proof Special Valves				
	ZE/WU	15 - 25 G½" - G1"	Sampling and Air Bleed Valve, deflagration proof	504 - 505
	ZE/TK	15 - 25 G½" - G1"	Condensate Drain Valve, deflagration proof	506 - 507
Air-Drying Devices				
	LA	50 - 150 2" - 6"	Air-Drying Device	508 - 513
	LA/V	50 - 150 2" - 6"	Air-Drying Device with Check Valve	508 - 513
Special Safety Valves				
	NB/AP	150 - 200 6" - 8"	Fast Action Bottom Drain Valve with pneumatic actuator	514 - 515
	SI/F	50 - 200 2" - 8"	Internal Safety Valve	516 - 517
	SI/DP	150 - 300 6" - 12"	Internal Safety Valve	518 - 519
	WV/T	80 - 250 3" - 10"	Change-Over Valve	520 - 521

Floating Suction Unit

PROTEGO® SA/S



PROTEGO® SA/S for fixed roof tanks



PROTEGO® SA/S for floating roof tanks

Function and Description

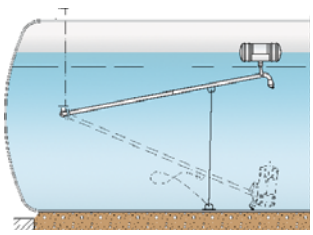
PROTEGO® Floating Suction Units - FSU - are designed to ensure that product in a storage tank is drawn off just below the surface of the liquid where it is cleanest, preventing the suction point being at the bottom of the tank where water and residuals will settle down.

Design Types and Specifications

PROTEGO® Floating Suction Units are designed and sized to suit the individual tank specifications and customer requirements.

PROTEGO® Floating Suction Units are designed for a long life in service. We use carbon steel or stainless steel for highly loaded components or aggressive media.

Solutions are available from 1” to 36” for horizontal or vertical tanks with fixed or floating roofs. Custom designs for unusual stored products are available.



PROTEGO® SA/S for horizontal tanks

Selection and Design

PROTEGO® Floating Suction Units offer experienced technology for a complete solution for the end-user. This includes easy installation and assembly and full documentation with an arrangement drawing showing the FSU placed in the tank with regards to all internals.

Essential for the design of the PROTEGO® Floating Suction Unit is the Heavy Duty Swivel Joint which fulfils the requirement for an in-service installation to avoid high costs of repairs and to extend the tank maintenance to the planned interval.

The Swivel Joint comes with/in

- a sturdy design made of carbon or stainless steel
- maintenance-free greased for a life-time with aviation approved grease
- large sized ball bearings with two races to cover all side-flow forces during operation.

PROTEGO® Floating Suction Units have an intake designed to avoid any forming of vortex. The intake is able to release trapped air.

Floats are all made of stainless steel and are 100 % pressure tested.

Options upon request:

- Sampling pipes
- Function indicator
- Stress calculation due to liquid movement
- On-site support

PROTEGO® Floating Suction Units are „Made in Germany“ and will provide many years of trouble free tank operation.

*Project:
Location:
Client:
*Enduser:
*Engineering:

Tank Main Details

*Fixed roof tank ☐		*Fixed roof tank with internal floating roof ☐	
*Floating roof tank ☐			
*Horizontal tank ☐			
Tank-No.:		*Tank height: mm	*Tank diameter: mm
*Maximum filling height: mm			
*Material request of floating suction unit:			

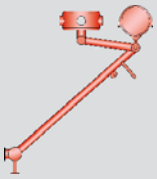
Product details

*Stored product:	
*Product specific gravity:	
Maximum product temperature: °C	

Tank details

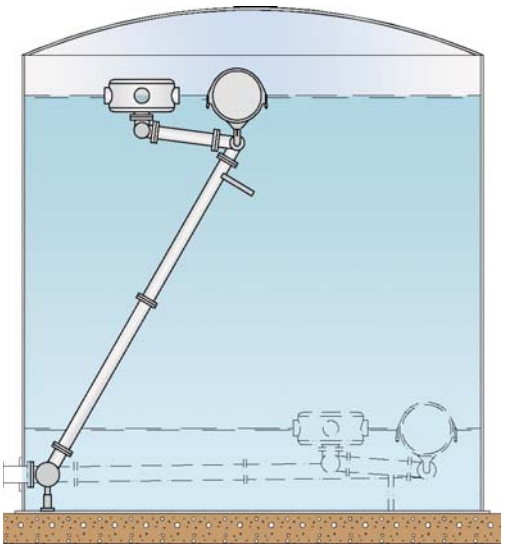
*Suction line size: DN		
*Shell nozzle centreline height / inwards projection: mm		
*Manhole size: DN		
Bottom slope: ☐	Slope direction:	
*Are there any obstructions? (columns, heating coils,...) ☐		if ☒ - please specify
*Tank drawing / sketch? ☐		if ☒ - specify request

* This information must be indicated on request!
Fill in and ☐ tick off, if applicable.

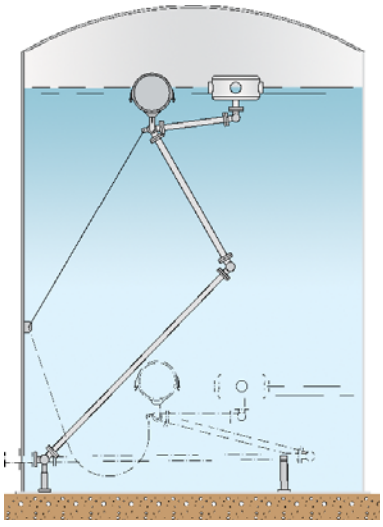


Floating Skimmer System

PROTEGO® SA/DA



PROTEGO® SA/DA for fixed roof tanks



PROTEGO® SA/DA with double-bend for fixed roof tanks

Function and Description

Fixed roof tanks that store liquids with different density these so-called slop tanks are fitted with the Floating Skimmer System PROTEGO® SA/DA for separating the phases. The design of the skimmer results from different densities. They are developed to draw off the product with lower specific weight from the surface of the stored medium.

Design Types and Specifications

PROTEGO® SA/DA Floating Skimmer Systems are designed and sized to suit the individual tank specifications and the stored medium as well as customer requirements.

PROTEGO® SA/DA Floating Skimmer Systems are designed for a long life in service in complete medium contact.

We use carbon steel or stainless steel for highly loaded components or aggressive media.

Solutions are available from 2” to 6” for tanks with fixed roofs.

Selection and Design

PROTEGO® Floating Skimmer Systems offer experienced technology for a complete solution for the end-user. This includes easy installation and assembly of the system in the tank and full documentation with an arrangement drawing showing the Floating Skimmer System placed in the tank with regards to all internals.

Essential for the design of the PROTEGO® Floating Skimmer Systems is the Heavy Duty Swivel Joint which fulfils the requirement for an in-service installation to avoid high costs of repairs and to extend the tank maintenance to the planned interval.

The Swivel Joint comes with/in

- a sturdy design made of carbon or stainless steel
- maintenance-free greased for a life-time with aviation approved grease
- large sized ball bearings with two races to cover all side-flow forces during operation.

PROTEGO® Floating Skimmer Systems SA/DA are fitted with a separate skimming float that is just responsible for separating the different phases. The weight of the complete system is floated by one or more floats.

Floats are always made of stainless steel and are 100 % pressure tested.

PROTEGO® Floating Skimmer Systems are „Made in Germany“ and will provide many years of trouble free tank operation.

*Project:
Location:
Client:
*Enduser:
*Engineering:

Tank Main Details

*Fixed roof tank ☐		
Tank No.:	*Tank height: : mm	*Tank diameter: mm
*Maximum filling height: mm		
*Material request of Skimming Systems:		

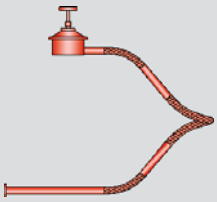
Product Details

*Stored liquid:	Specific gravity:
*Sucked in liquid:	Specific gravity:
Maximum product temperature: °C	

Tank Details

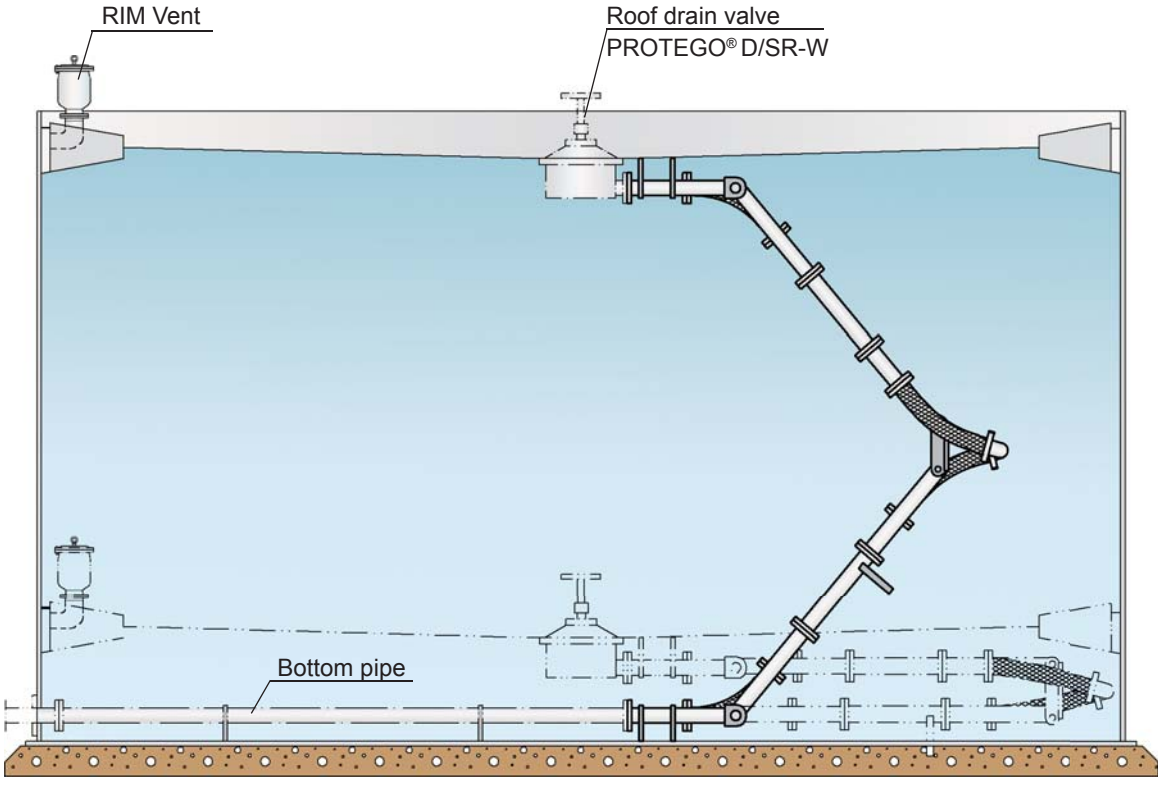
*Skimming System size: DN	
*Shell nozzle centreline height / inwards projection mm	
*Manhole size: DN	
Bottom slope: ☐	Slope direction:
*Are there any obstructions? (columns, heating coils,...) ☐	if ☒ - please specify
*Tank drawing / sketch ☐	if ☒ - specify request

* This information must be indicated on request!
Fill in and ☐ tick off, if applicable.



Floating Roof Drainage System with Metal Hose Joints

PROTEGO® SE/K



Function and Description

Floating roof tanks require a drainage system that automatically drains the accumulating rainwater off the floating roof. PROTEGO® SE/K is a single scissor-pipe-system that works with robust shackle joints. The water is drained by unstressed mounted and pressure resistant metal hoses.

The upper scissor pipe is connected to the roof drain valve and the lower scissor pipe is connected to the bottom pipe. Via the operational opened roof drain valve the water is transfered by the drainage system out of the tank.

Design Types and Specifications

PROTEGO® floating roof drainage systems are designed and sized to suit the individual tank specifications and customer requirements.

PROTEGO® floating roof drainage systems are designed for a long life in service. We use only carbon steel or stainless steel as the material of construction. For the carbon steel version the joint bearings are made of stainless steel.

Solutions are available from 3” to 8” for floating roof tanks with external floating roof.

Selection and Design

PROTEGO® Floating Roof Drainage Systems offer experienced technology for a complete solution for the end-user. This includes easy installation and assembly and full documentation with an arrangement drawing showing the Floating Roof Drainage System placed in the tank with regards to all internals.

The flexibility of the metal hose is realized by the shakle-bolted joint. Forces that may occur due to torsion or uneven movements of the floating roof are absorbed through design and arrangement of the joints and thus have no negative effects on the system or metal hoses. The water is drained by metal hoses that are directly connected to the scissor pipes. The drain water does not pass through the actual joints and therefore sealing elements as used for common swivel joint systems are not required.

For stability reasons metal hose joints are made of steel or stainless steel.

Options upon request:

- Roof drain valve
- Bottom pipe
- On-site support

PROTEGO® Floating Roof Drainage Systems are „Made in Germany“ and will provide many years of trouble free tank operation.

Project Data Sheet

for Floating Roof Drainage System with Metal Hose Joints

PROTEGO® SE/K

*Project:
Location:
Client:
*Enduser:
*Engineering:

Tank Main Details

*Floating roof tank ☐			
Tank No.:	*Tank height: : mm	*Tank diameter: mm	
*Maximum filling height: mm			
* Material request of Floating Roof Drainage System:			

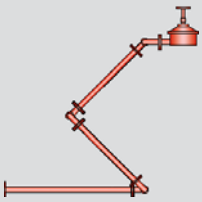
Product Details

*Product stored:	
*Specific gravity:	
Maximum product temperature: °C	

Tank Details

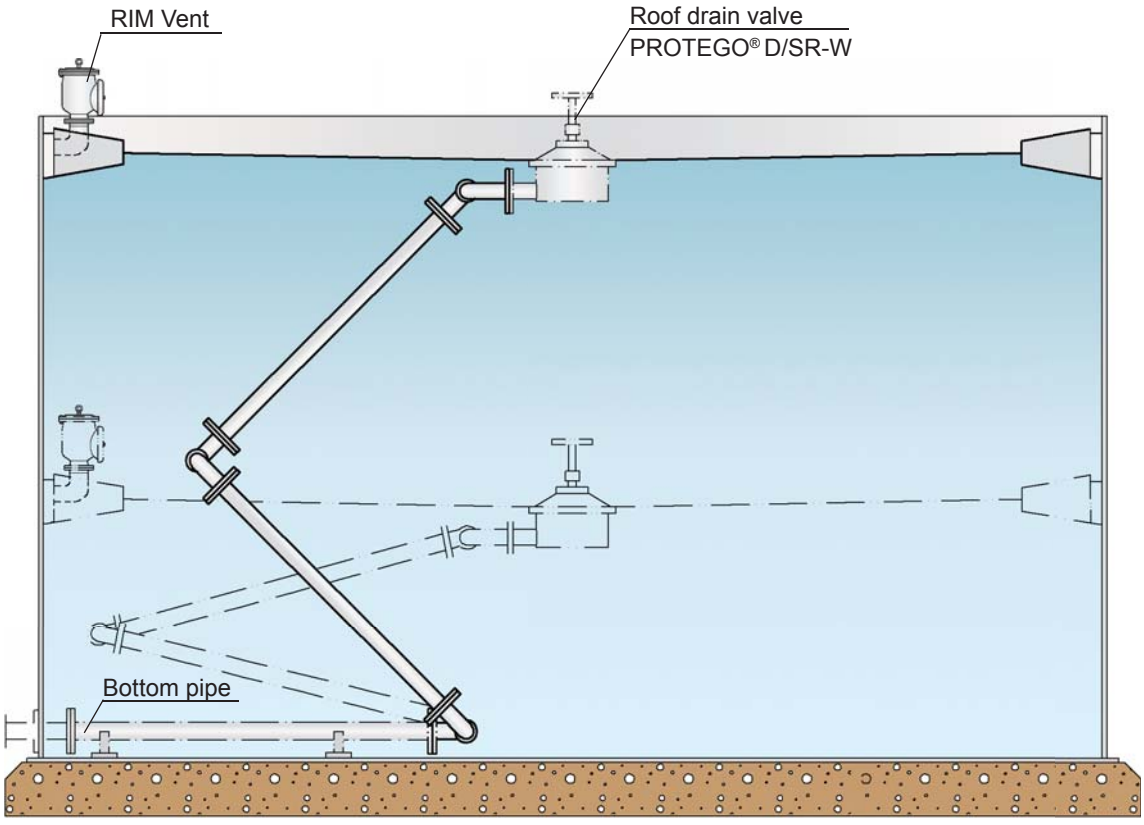
*Nominal diameter of drain line: DN		
*Shell nozzle centreline height / inwards projection mm		
*Manhole size: DN		
Bottom slope: ☐	Slope direction:	
*Are there any obstructions? (columns, heating coils,...) ☐		if ☒ - please specify
*Tank drawing / sketch ☐		if ☒ - please specify

* This information must be indicated on request!
Fill in and ☐ tick off, if applicable.



Floating Roof Drainage System with Swivel Joints

PROTEGO® SE/CK



Function and Description

Floating roof tanks require a drainage system that automatically drains the accumulating rainwater off the floating roof. PROTEGO® SE/CK is a single scissor-pipe-system that works with swivel joints.

The upper scissor pipe is connected to the roof drain valve, the lower scissor pipe is connected to the bottom pipe. Via the operational opened roof drain valve the water is transfered by the drainage system out of the tank.

Design Types and Specifications

PROTEGO® floating roof drainage systems are designed and sized to suit the individual tank specifications and customer requirements.

PROTEGO® floating roof drainage systems are designed for a long life in service. We use carbon steel or stainless steel for highly loaded components or aggressive media.

Solutions are available from DN 80/3” to DN 200/8” for floating roof tanks with external floating roof.

Selection and Design

PROTEGO® Floating Roof Drainage Systems offer experienced technology for a complete solution for the end-user. This includes easy installation and assembly and full documentation with an arrangement drawing showing the Floating Roof Drainage System placed in the tank with regards to all internals.

Essential for the design of the PROTEGO® Floating Roof Drainage System is the Heavy Duty Swivel Joint which fulfils the requirement for an in-service installation to avoid high costs of repairs and to extend the tank maintenance to the planned interval.

The Swivel Joint comes with/in

- a sturdy design made of carbon or stainless steel
- maintenance-free greased for a life-time with aviation approved grease
- large sized ball bearing with two races to cover all side-flow forces during operation.

Options upon request:

- Roof drain valve
- Bottom pipes
- On-site support

PROTEGO® Floating Roof Drainage Systems are „Made in Germany“ and will provide many years of trouble free tank operation.

Project Data Sheet

for Floating Roof Drainage System with Swivel Joints

PROTEGO® SE/CK

*Project:
Location:
Client:
*Enduser:
*Engineering:

Tank Main Details

*Floating roof tank ☐			
Tank No.:	*Tank height: : mm	*Tank diameter: mm	
*Maximum filling height: mm			
* Material request of Floating Roof Drainage System:			

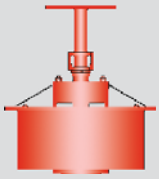
Product Details

*Product stored:	
*Specific gravity:	
Maximum product temperature: °C	

Tank Details

*Nominal diameter of drain line: DN		
*Shell nozzle centreline height / inwards projection mm		
*Manhole size: DN		
Bottom slope: ☐	Slope direction:	
*Are there any obstructions? (columns, heating coils,...) ☐		if ☒ - please specify
*Tank drawing / sketch ☐		if ☒ - please specify

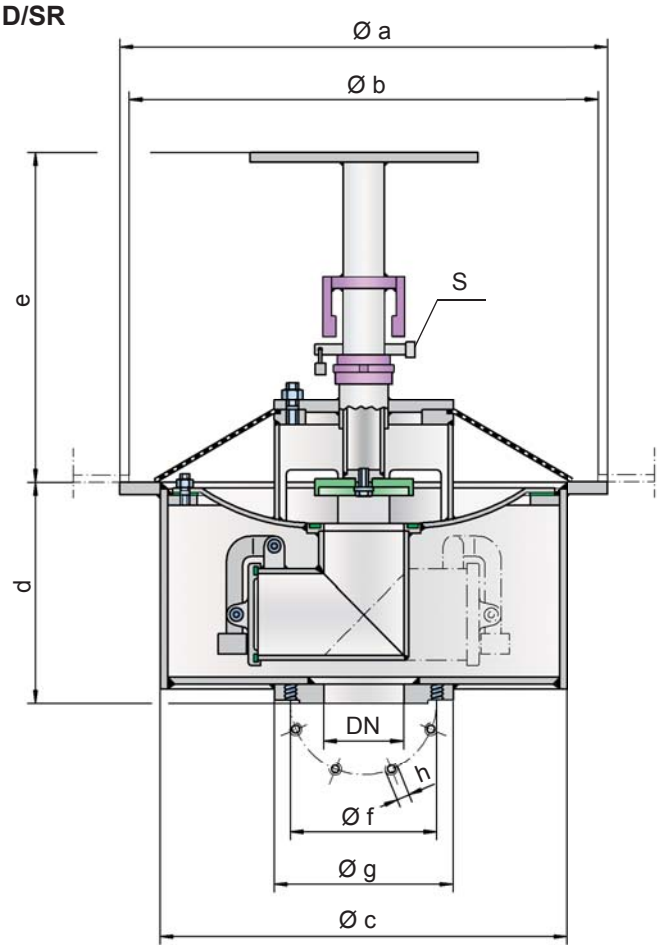
* This information must be indicated on request!
Fill in and ☐ tick off, if applicable.



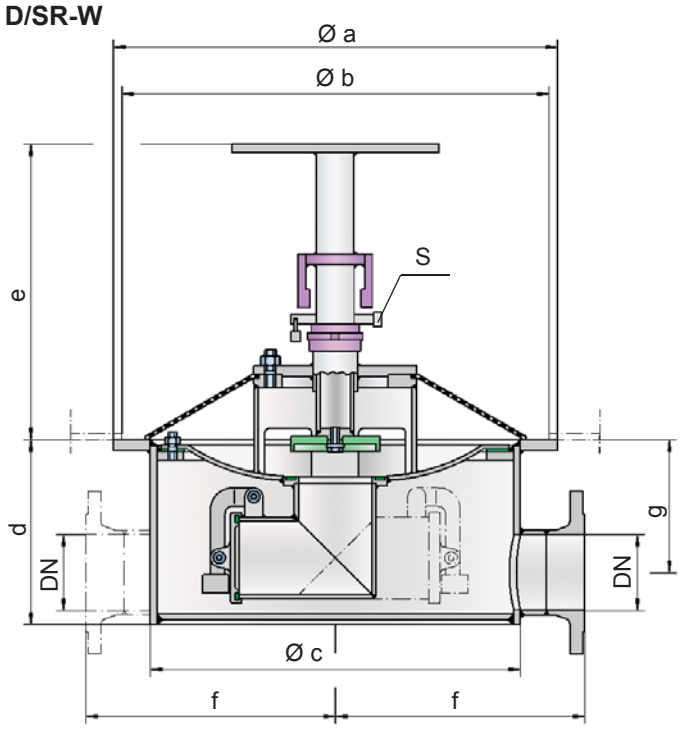
Roof Drain Valves

PROTEGO® D/SR and D/SR-W

D/SR



D/SR-W



Function and Description

The PROTEGO® roof drain valves D/SR or D/SR-W function like collection bowls and pass the collected rain water from the floating roof through the scissor pipes of a PROTEGO® floating roof drainage system, such as SE/K or SE/CK, into the sewage water system.

Under normal operating conditions the roof drain valve is open. In case of any leakage the non-return valve prevents the stored medium from escaping to the floating roof. The inlet screen protects the roof drain valve from any dirt, leaves or nesting birds.

Design Types and Specifications

Two designs are available:

Roof drain valve with vertical connection	**D/SR**
Roof drain valve with horizontal connection	**D/SR-W**

As an option a special design of the roof drain valve is available with protection against unauthorized closing of the quick-action shut-off (S).

Table 1: Dimensions D/SR Dimensions in mm / inches

DN	80 / 2"	100 / 4"	150 / 6"
a	550 / 21.65	600 / 23.62	650 / 25.59
b	490 / 19.29	540 / 21.26	590 / 23.23
c	450 / 17.72	500 / 19.69	550 / 21.65
d	240 / 9.45	280 / 11.02	330 / 12.99
e	490 / 19.29	490 / 19.29	490 / 19.29
f	160 / 6.3	180 / 7.09	240 / 9.45
g	200 / 7.87	220 / 8.66	285 / 11.22
h	M 16	M 16	M 20

Table 2: Dimensions D/SR-W Dimensions in mm / inches

DN	80 / 2"	100 / 4"	150 / 6"
a	550 / 21.65	600 / 23.62	650 / 25.59
b	490 / 19.29	540 / 21.26	590 / 23.23
c	450 / 17.72	500 / 19.69	550 / 21.65
d	205 / 8.07	250 / 9.84	320 / 12.6
e	490 / 19.29	490 / 19.29	490 / 19.29
f	285 / 11.22	320 / 12.6	350 / 13.78
g	150 / 5.91	180 / 7.09	225 / 8.86

Table 3: Material selection		
Design	A	B
Housing	Steel	Stainless Steel
Non-return valve	Red Brass	Red Brass
Valve disc	Steel	Stainless Steel
Quick-action shut-off	Steel	Stainless Steel
Gasket	PUR	PUR

The device must have sufficient corrosion resistance with regards to the stored media. If necessary, designs in special stainless steel quality should be selected.

Flange Connection Type

In type PROTEGO® D/SR the housing bottom is equipped with a loose flange with threaded holes according to EN 1092-1 or DIN DIN 2501, PN 16, or optionally according to any other international standard.

In the standard model of PROTEGO® D/SR-W the housing is equipped with a lateral flange connection to EN 1092-1 or DIN 2501, PN 16. Optionally, the connecting flanges can be made according to any other international standard. An additional flange connection is available.

Selection and Design

The specified maximum rainfall is required to determine the required nominal size. Alternatively, the connection size of the roof drain valve corresponds with the existing nominal dimension of the floating roof drainage system. Roof drain valves with 2 or 3 non-return valves are available as an option.

Necessary Data for Specification

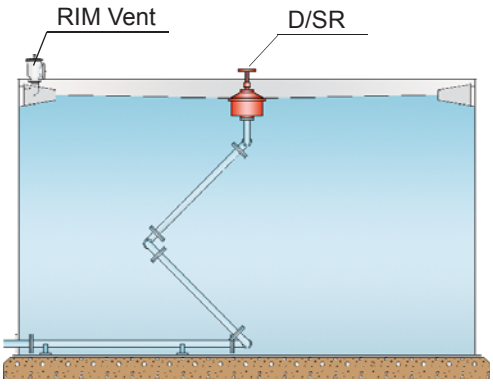
Maximum rainfall to be drained off (m³/h or CFH)

Material of floating roof

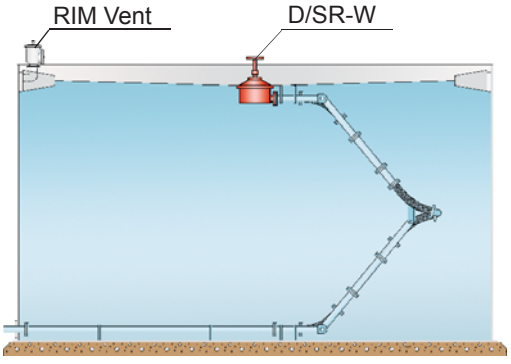
Connection size of the floating roof drainage system DN (mm or inches)

Design of floating roof drainage system

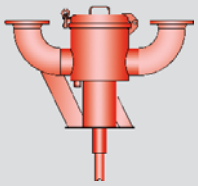
Application Examples



PROTEGO® roof drain valve type D/SR in combination with Floating roof drainage system PROTEGO® SE/CK



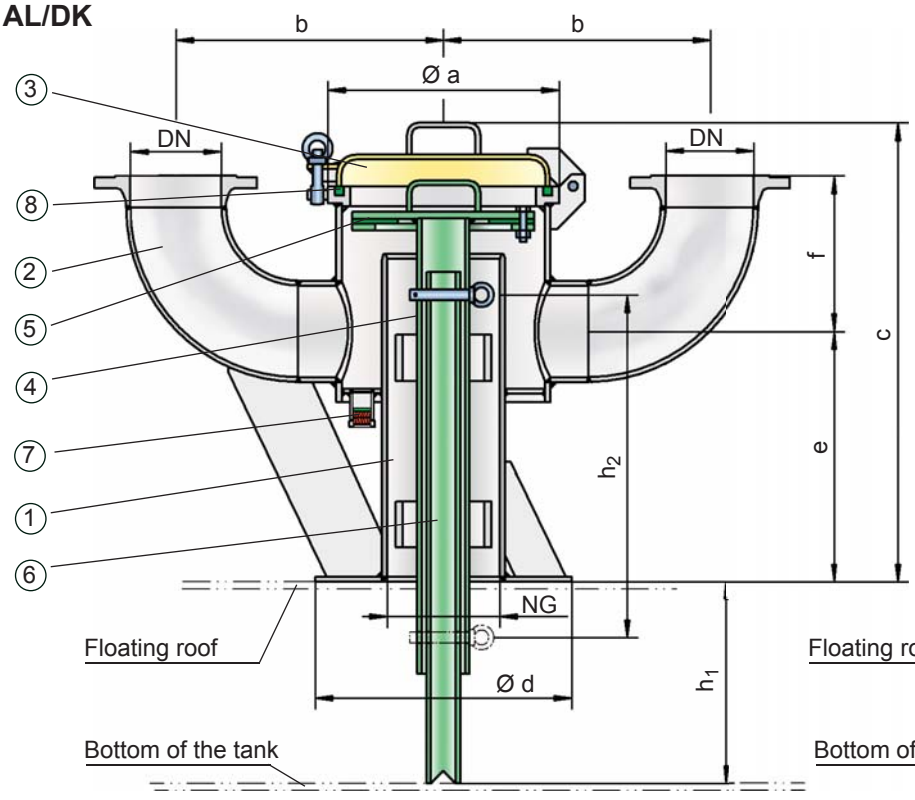
PROTEGO® roof drain valve type D/SR-W in combination with Floating roof drainage system PROTEGO® SE/K.



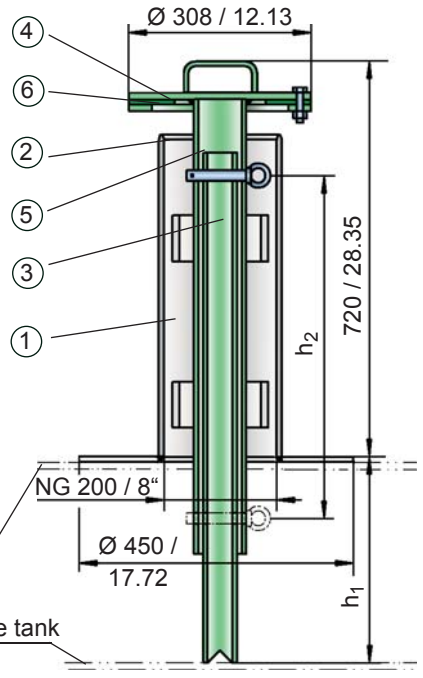
Vent Valve, Lift-actuated

PROTEGO® AL/DK and PROTEGO® AL 200

AL/DK



AL 200



Dimensions in mm / inches

Function and Description

PROTEGO® lift-actuated vent valves type AL/DK provide automatic venting of floating roof tanks when the floating roof is lowered on its supports and the tank is either finally drained or refilled. When the floating roof is in its lowest position the valve is forced to open through lift actuation and this prevents unacceptable vacuum during final draining or unacceptable pressure during refilling.

In general the device consists of a housing (1) with sheet-metal panel to be welded on the floating roof, two or four connection nozzles (2) for installation of vent caps, cover (3), lift (4) including valve pallet (5), lift pipe (6) and the condensate drain valve (7) which can be flame transmission proof if required. A flat gasket is attached to the valve pallet (5) to provide sealing. The cover (3) is sealed by a sealing cord (8).

In general the device PROTEGO® AL 200 consists of a housing (1) with sheet-metal panel to be welded on the floating roof as well as the valve seat (2), lift (3) including valve pallet (4) and lift pipe (5). A flat gasket (6) which provides sealing.

As the lowest position of the floating roof varies for operation and assembly specify the dimensions h_1 and h_2:

h_1: Distance between lower edge of sheet-metal panel (or mounting flange) and tank bottom in lowest position of floating roof (operating position with an empty tank).

h_2: Distance between floating roof in lifted maintenance position and height of floating roof in fully lowered operating position, if the tank is empty.

If the floating roof supports are changed from operating position to maintenance position the lift has to be lengthened as well. This is done with an adjustable locking pin that is secured with a bolt.

The valve is not flame transmission proof.

A hazard analysis (which considers the material selection and function of the device) shows that the device doesn't have any potential sources of ignition. Therefore they are not subject to the European Explosion Protection Directive 94/9/EC when used in explosive atmosphere.

Designs and Specifications

Table 1: Dimensions for AL/DK

NG	200 / 8"	200 / 8"	200 / 8"
DN	100 / 4"	150 / 6"	200 / 8"
a	350 / 13.78	350 / 13.78	350 / 13.78
b	465 /18.31	465 / 18.31	515 / 20.28
c	870 / 34.25	870 / 34.25	870 / 34.25
d	450 / 17.72	450 / 17.72	450 / 17.72
e	385 / 15.16	385 / 15.16	415 / 16.34
f	420 / 16.54	285 / 11.22	370 / 14.57

Dimensions in mm / inches

Table 2: Material

Housing	Steel
Valve guide	Stainless Steel
Gasket	FPM

special materials upon request

Table 3: Flange connection type DN2

EN 1092-1, Form B1 or DIN 2501, Form C, PN 16; from DN 200 PN 10	EN or DIN
ANSI 150 lbs RFSF	ANSI

other types upon request.

Selection and Design

The required quantity and nominal size DN will be defined based on the calculated flow rate from the thermal venting and pump rate in lowest floating roof position (Nm³/h or CFH) and based on the maximum acceptable tank pressure pT (mbar / inch W.C.) according to the flow capacity charts. Special models are available on request.
Flow rates and pressure losses of vent caps PROTEGO® BE/HR or PROTEGO® LH/AD have additionally to be taken into account according to the appropriate charts in the relevant data sheets or operating instructions.
Lift-actuated vent valves PROTEGO® AL 200 can be applied in case just venting is required.

Necessary Data for Specification

Stored product

Tank diameter (m or ft)

Tank height (m or ft)

Support height h_1 (operating position with empty tank)

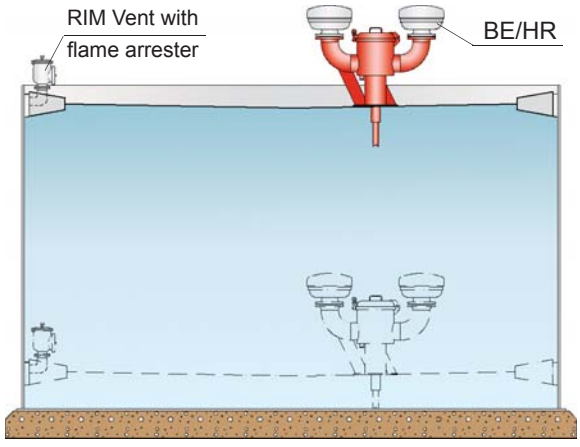
Support height h_2 (lifted assembly position)

Maximum allowable tank pressure p_T (mbar or inch W.C.)

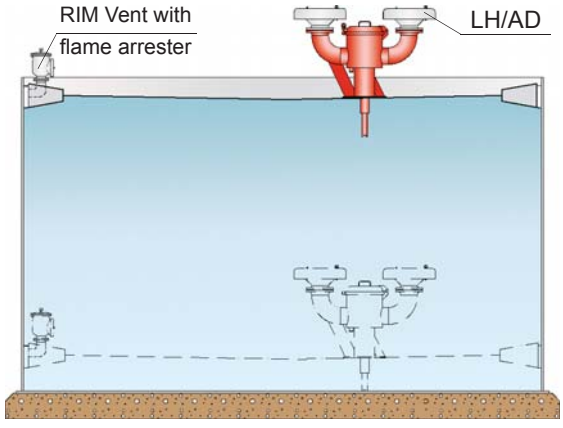
Pump rate (m³/h or CFH)

Application Examples for PROTEGO® AL/DK

Lift-actuated vent valves of type PROTEGO® AL/DK can be combined with vent caps type BE/HR which are deflagration proof and resistant against endurance burning. This ensures flame transmission proof ventilation.

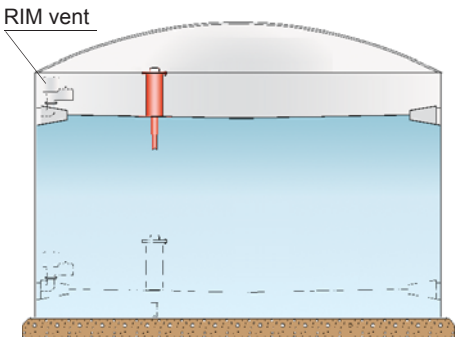


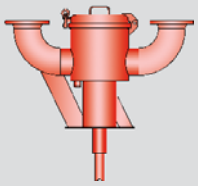
If resistance against endurance burning is not required the valves can alternatively be combined with PROTEGO® deflagration proof devices type PROTEGO® LH/AD. The applicable data sheets are available in volume 2 “Deflagration Flame Arresters, end-of-line and Vent Caps”.



Application Examples for PROTEGO® AL 200

PROTEGO® AL 200 for fixed roof storage tanks with internal floating roof.

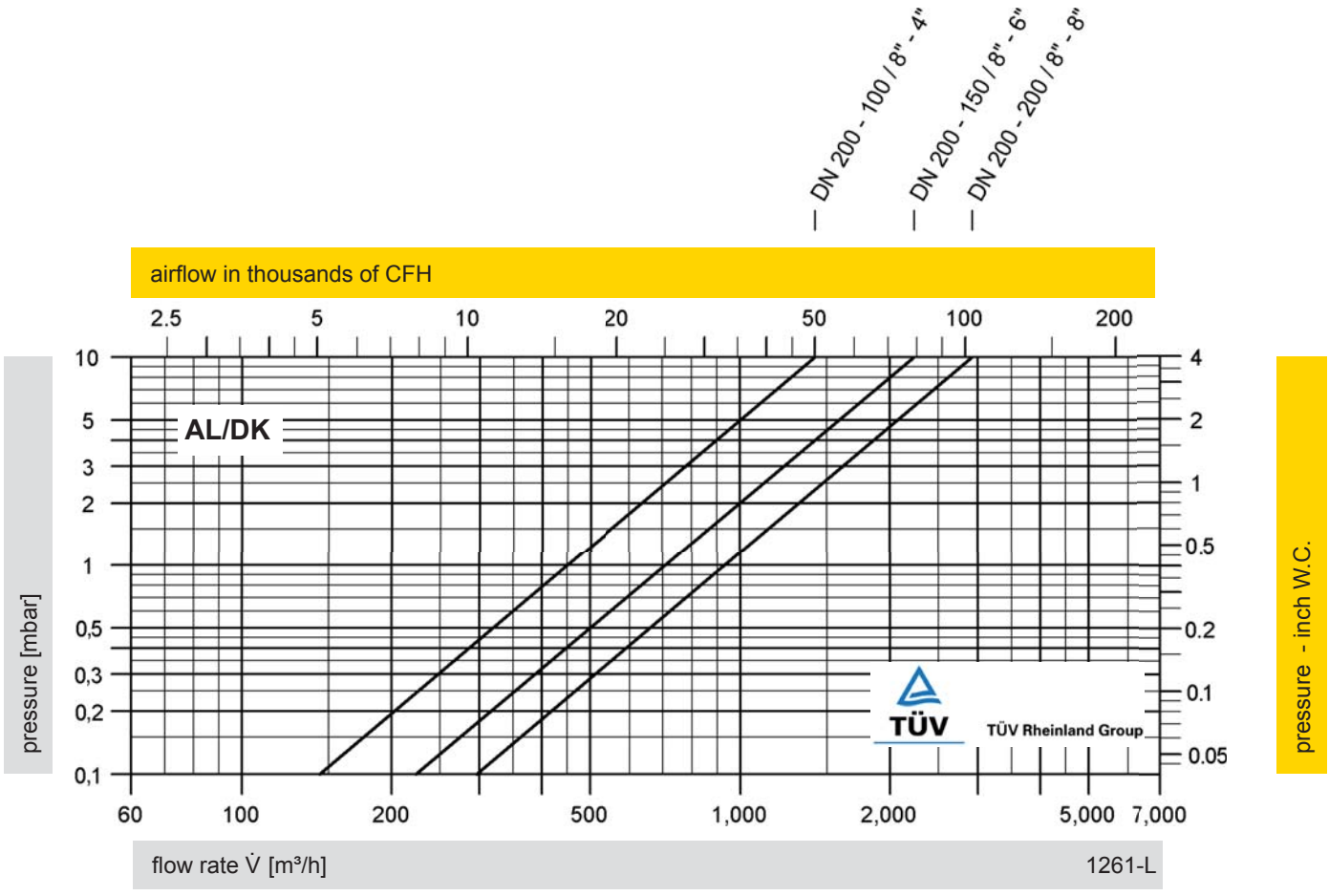


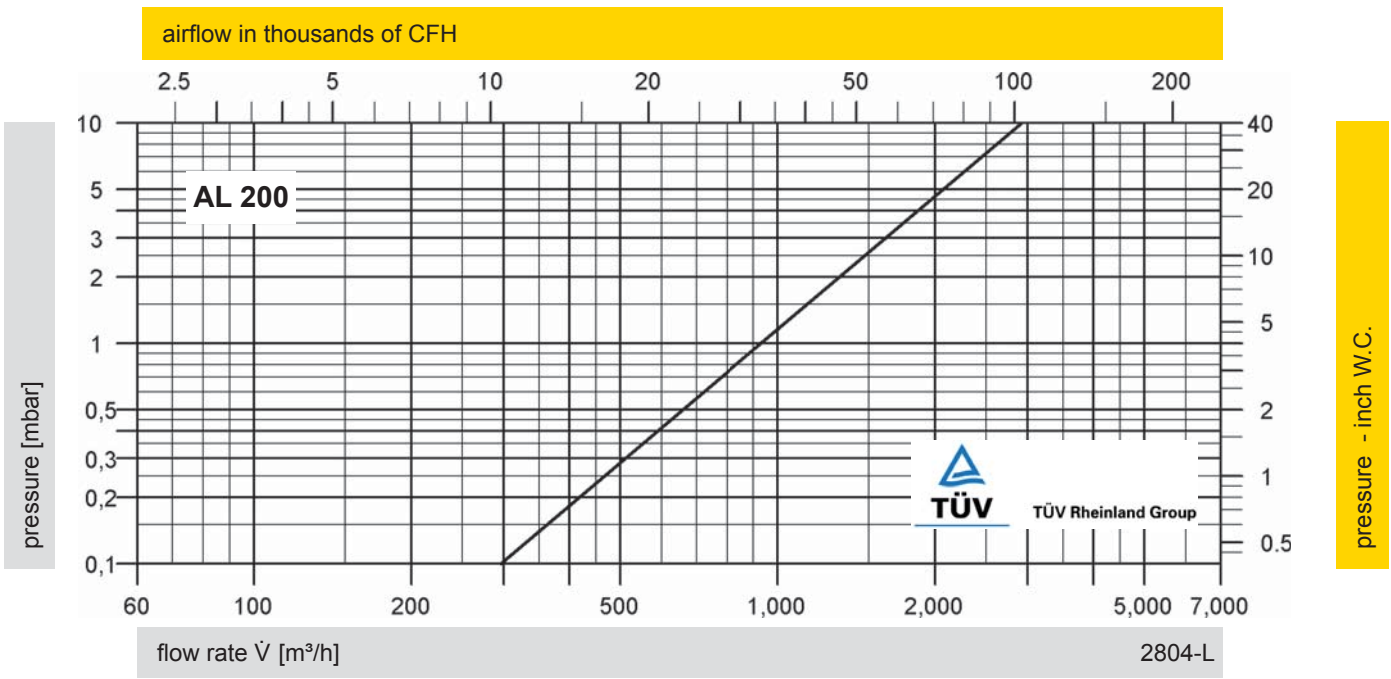


Vent Valve, Lift-actuated

Flow Capacity Charts

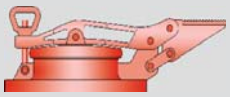
PROTEGO® AL/DK and PROTEGO® AL 200





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 ISO 6358 (20°C, 1bar).
Conversion to other densities and temperatures refer to Vol. 1: “Technical Fundamentals”.

Notes:

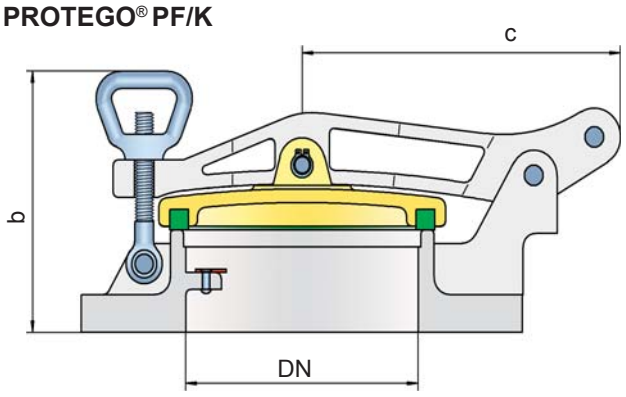


Gauge Hatch

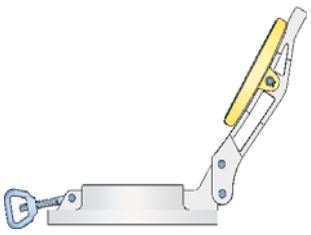
with flange

PROTEGO® PF/K, PF/TK and PS/KF

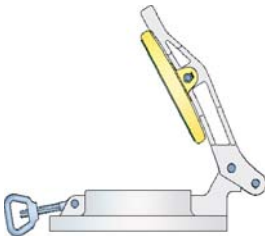
PROTEGO® PF/K



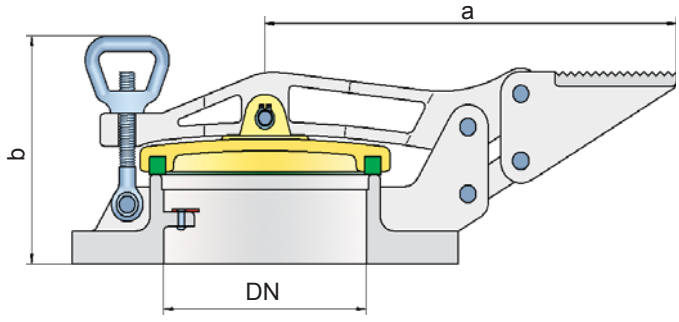
Design “I”
remaining open



Design “II”
automatic cover closing

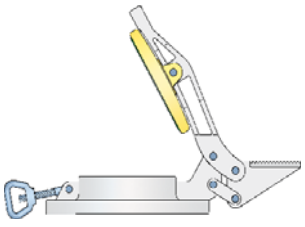


PROTEGO® PF/TK

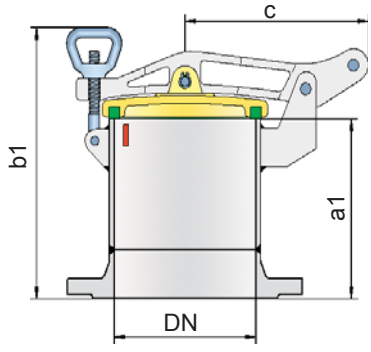


Pedal-operated version

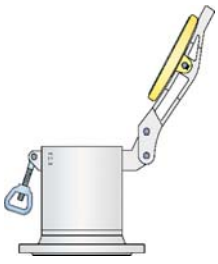
automatic cover closing



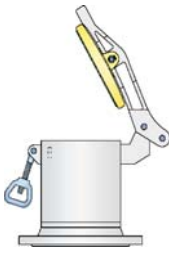
PROTEGO® PS/KF



Design “I”
remaining open



Design “II”
automatic cover closing



Function and Description

PROTEGO® gauge hatches types PF/K, PF/TK and PS/KF are used as lockable gauge nozzles which are only opened for gauging or sampling. Otherwise they are tightly closed.

The gauge hatches PROTEGO® PF/K, PF/TK and PS/KF mainly consist of housing, cover and bracket. As a standard the housing has stainless steel gauge marks.

In the pedal-operated version PROTEGO® PF/TK the gauging nozzle pedal is connected to both the housing and the bracket.

Design Types and Specifications

Depending on the intended use the following designs are available:

Gauge hatch with flange	**PF/K** design I and II „I“ : remaining open „II“ : automatic cover closing
Gauge hatch with flange and pedal	**PF/TK** automatic cover closing
Gauge hatch with flange nozzle	**PS/KF** design I and II „I“ : remaining open „II“ : automatic cover closing

Gauge hatches for welding to the tank are available as types PROTEGO® PS/K and PS/TK. A separate data sheet is available.

Table 1: Dimensions Dimensions in mm / inches

DN	100 / 4"	150 / 6"	200 / 8"
a	260 / 10.24	305 / 12.01	335 / 13.19
b	150 / 5.91	155 / 6.10	175 / 6.89
c	160 / 6.30	205 / 8.07	235 / 9.25
a1	225 / 8.86	265 / 10.43	300 / 11.81
b1	315 / 12.40	360 / 14.17	405 / 15.94

The nominal size depends on the dimensions of the gauging and sampling device.

Table 2: Material selection

Design	A	B	C	D
Housing	Ductile Iron*	Stainless Steel	Aluminium	Steel
Cover	Ductile Iron*	Stainless Steel	Aluminium Stainless Steel**	Steel

The combination of steel and aluminium in explosive environments is prohibited due to ignition danger.
* only for PF/K and PF/TK
** only for PF/TK-100

Flange Connection Type

The flange connection is to EN 1092-1, Form A or DIN 2501, Form B, PN 16; DN 200 PN10. Optionally, the connecting flange can be made according to any international standard.

Necessary Data for Specification

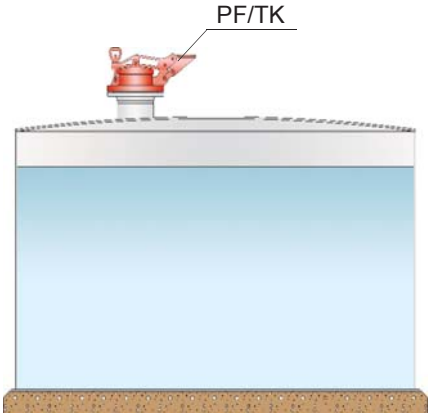
Stored product

Tank material

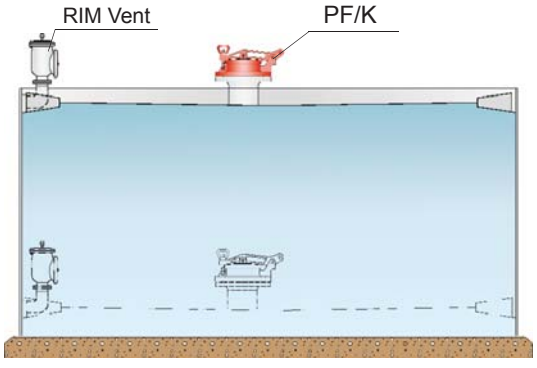
Tank nozzle DN (mm or inches)

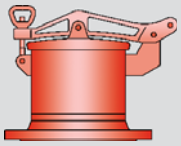
Application Examples

Gauge Hatches can for instance be used in combination with the manual gauge devices type PROTEGO® H/P or with the gauging and sampling device PROTEGO® VP/HK.



Gauge Hatches can be applied on tanks with floating roof.



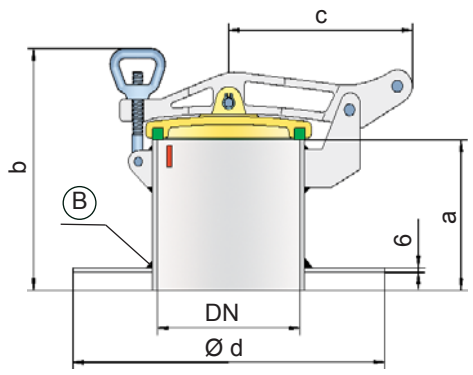


Gauge Hatch

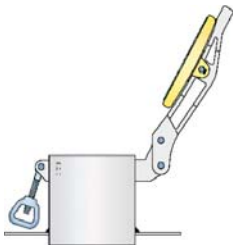
with welded nozzle

PROTEGO® PS/K, PS/TK

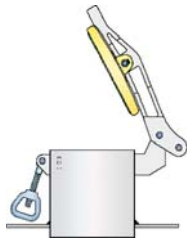
PROTEGO® PS/K



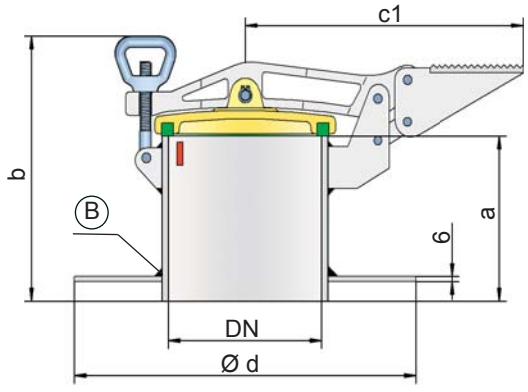
Design “I”
remaining open



Design “II”
automatic cover closing

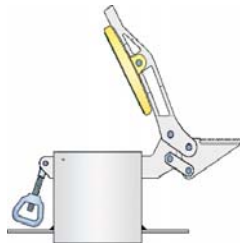


PROTEGO® PS/TK



Pedal-operated version

automatic cover closing



Ⓑ Welding on-site

Function and Description

PROTEGO® gauge hatches types PS/K and PS/TK are used as lockable gauge nozzles which are only opened for gauging

or sampling.

The gauge hatches PROTEGO® PS/K and PS/TK mainly consist of housing, cover and bracket. As a standard the housing has stainless steel gauge marks.

In the pedal-operated version PROTEGO® PS/TK the gauging nozzle pedal is connected to both the housing and the bracket.

Design Types and Specifications

Depending on the intended use the following designs are available:

Gauge hatch with welding nozzle	**PS/K** design I and II „I“ : remaining open „II“ : automatic cover closing
Gauge hatch with welding nozzle and pedal	**PS/TK** automatic cover closing

Gauge hatches with flange are available as type PROTEGO® PF/K, PF/TK and PS/KF. A separate data sheet is available.

Table 1: Dimensions			Dimensions in mm / inches
DN	100 / 4"	150 / 6"	200 / 8"
a	175 / 6.89	225 / 8.86	250 / 9.84
b	265 / 10.43	320 / 12.60	355 / 13.98
c	160 / 6.30	205 / 8.07	235 / 9.25
c1	260 / 10.24	305 / 12.01	335 / 13.19
d	275 / 10.83	350 / 13.78	450 / 17.72

The nominal size depends on the dimensions of the gauging and sampling device.

Table 2: Material selection		
Design	A	B
Housing	Steel	Stainless Steel*
Cover	Ductile Iron	Stainless Steel*

* only for PS/K

Flange Connection Type

The flange connection is to EN 1092-1, Form A or DIN 2501, Form B, PN 16; DN 200 PN10. Optionally, the connecting flange can be made according to any international standard.

Necessary Data for Specification

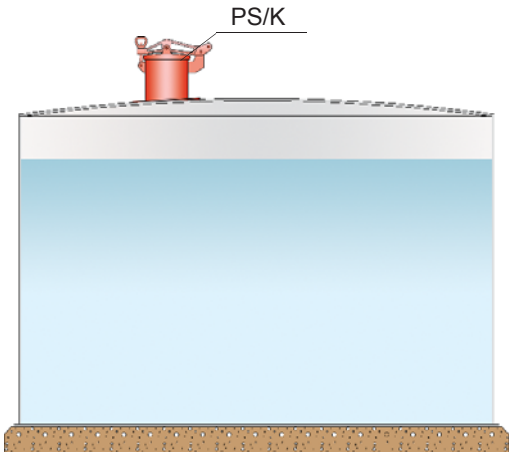
Stored product

Tank material

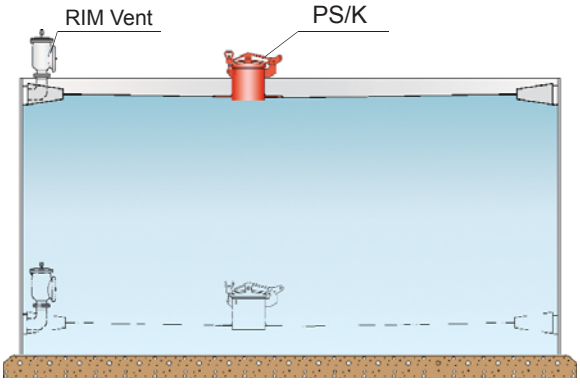
Tank nozzle DN (mm or inches)

Application Examples

Gauge Hatches can for instance be used in combination with the manual gauge devices type PROTEGO® H/P or with the gauging and sampling device PROTEGO® VP/HK.



Gauge Hatches can be welded on tanks with floating roof.

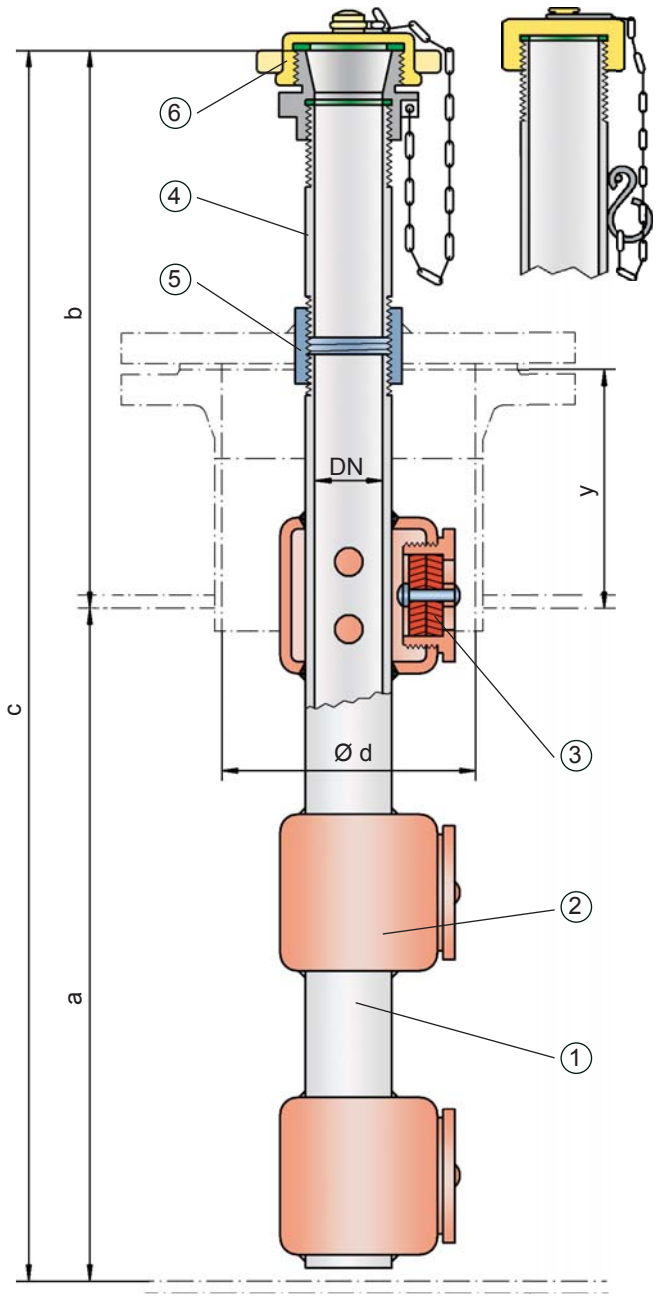


Gauging Pipe

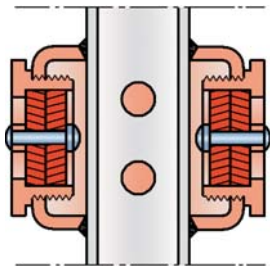
deflagration proof

PROTEGO® PU-IIA

Design A **Design B**



DN 40 / 1½" and 50 / 2"



Function and Description

The deflagration proof gauging pipes with integrated flame arresters type PROTEGO® PU are used for explosion-proof gauging of tank contents.

The gauging pipes of type PROTEGO® PU consist of insert pipe (1) with flame arresters (2) – equipped with FLAMEFILTER® (3) – connecting pipe (4), bushing (5) to be welded in the nozzle cover and cap (6). The number of flame arresters depends on the length of the gauging pipe. Please note the maximum dimension of 1.2 m / 3.94 ft for measure b and 4.1 m / 13.45 ft for measure c.

In normal operation the gauging pipe is closed with the cap. It is opened only for tank content gauging.

Type PROTEGO® PU ensures flame transmission protection against atmospheric deflagrations or in-line deflagrations of gas/air mixtures or product vapour/air mixtures of substances from explosion group IIA (MESG > 0.9 mm, NEC group D) in all ranges of flammable concentrations up to a service temperature of +60°C / 140°F.

This device is type approved and tested according to the European Standard EN 12874 – Flame Arresters – as a protective system according to European Directive 94/9/EC – equipment intended for use in potentially explosiv atmospheres. EC-Type Examination Certificates issued by a European notified body are available. Examination certificates from other approval authorities are available on request.

Design Types and Specifications

Table 1: Dimensions Dimensions in mm / inches

The measures a, b, y must be given with the order

DN	minimum size d
25 / 1"	150 / 5.91
32 / 1¼"	150 / 5.91
40 / 1½"	200 / 7.87
50 / 2"	200 / 7.87

Table 2: Material selection		
Design	A	B
Gauging pipe	Steel	Stainless Steel
Weld-in bushing	Steel	Stainless Steel
Cap	Brass	Stainless Steel
FLAMEFILTER® cage	Steel	Stainless Steel
FLAMEFILTER®	Stainless Steel	Stainless Steel

In design A the connecting pipe is equipped with reducing piece and blind cap – each with integrated sealing and chain. In design B the connecting pipe is closed with a hexagon cap connected to the retainer ring via chain and wire hoop.

Table 3: Explosion group		
MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)
> 0,90 mm	IIA	D

Special approvals upon request

Selection and Design

Select the required nominal sizes based on the gauging equipment size or nominal sizes of the connecting nozzle. Specify measures a, b and y for the definition of the quantity of integrated flame arresters.

Necessary Data for Specification

Storage product

Tank diameter (m or ft)

Tank nozzle height y (m or ft)

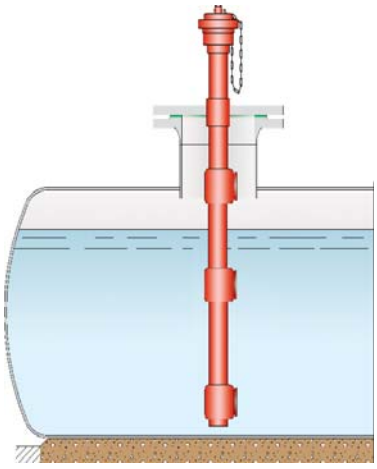
Length a (m or ft)

Length b (m or ft), max. 1.2 m / 3.94 ft

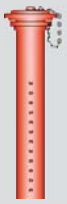
Please note the maximum length of 4.1 m / 13.45 ft for measure c

Gauging pipe diameter DN (mm or inches)

Application Example



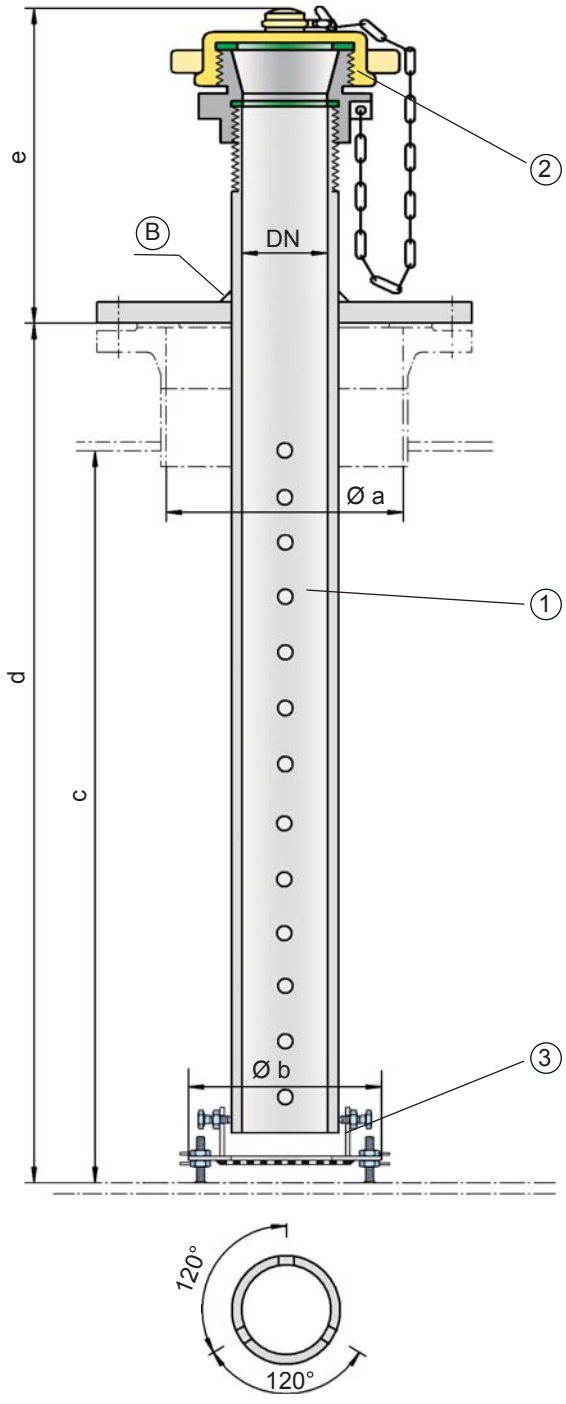
The gauging pipes of type PROTEGO® PU mainly serve for tank gauging in horizontal tanks using fuel dip stick or manual gauging device e.g. of type PROTEGO® HP.

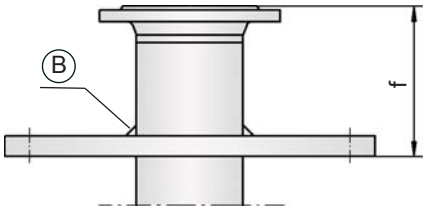


Gauging and Sampling Pipe

verifiable

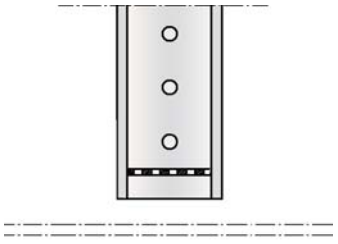
PROTEGO® PR/0





Version 1
Design with flange for combination with a gauging and sampling device (from DN 100 /4")

(B) job site welding



Version 2
Alternatively to gauging table (from DN 80 / 3") design with perforated bottom (DN 25 / 1" to DN 150 / 6")

Function and Description

The gauging and sampling pipes type PROTEGO® PR/0 are used for gauging of tank contents in horizontal or vertical tanks. They can be used in combination with other devices as for instance PROTEGO® VP/HK, PROTEGO® PS/E as well as PROTEGO® PG/H.
The gauging and sampling pipes PROTEGO® PR/0 consist of the gauging and sampling pipe (1), the cap (2) with gasket and the gauging table (3).

In normal operation the gauging pipe is closed with the cap. It is opened only for tank content gauging.
PROTEGO® PR/0 is not flame transmission proof and therefore special safety measures have to be implemented in order to avoid flame transmission into the tank caused by external ignition sources.

Design Types and Specifications

Table 1: Dimensions Dimensions in mm / inches

The measures c, d, e, f must be given with the order

DN	a	b	number of hole lines
25 / 1"	32	-	1
32 / 1¼"	40	-	1
50 / 2"	80	-	2
80 / 3"	100	305	3
100 / 4"	150 / 5.91	305	3
150 / 6"	200 / 7.87	375	3

Table 2: Material selection

Design	A	B
Gauging pipe	Steel	Stainless Steel
Gauge plate	Steel	Stainless Steel
Cap	Brass	Stainless Steel

For combination with other gauging device design 1 with welding neck flange is available (from DN 100 / 4").

Instead of the Gauging Table PROTEGO® PT/S a perforated bottom can be chosen alternatively (design 2).

Selection and Design

Select the required nominal sizes based on the gauging equipment size or nominal sizes of the connecting nozzle. Specify measures c, d e, and f must be specified with the order and necessary for the interpretation.

The device must be sufficiently resistant to corrosion through product vapour/air mixtures. If necessary, designs in special stainless steel quality should be selected.

Necessary Data for Specification

Storage product

Tank nozzle diameter DN

Tank inner diameter c (m or ft) for horizontal tanks

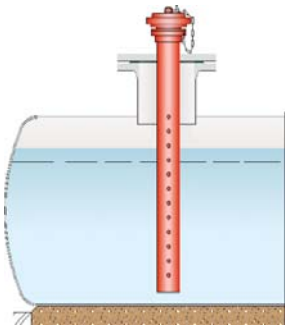
Tank height c (mm or inches) for standing tanks

Length d (mm or inches)

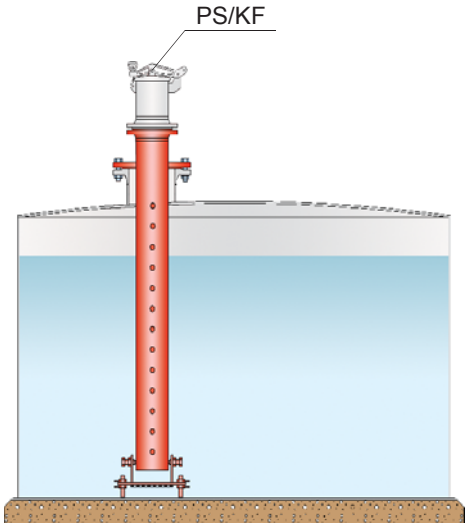
Length e (mm or inches)

stud length f (mm or inches)

Application Examples



Gauging and Sampling Pipe PROTEGO® PR/0 with perforated bottom for the horizontal tank.



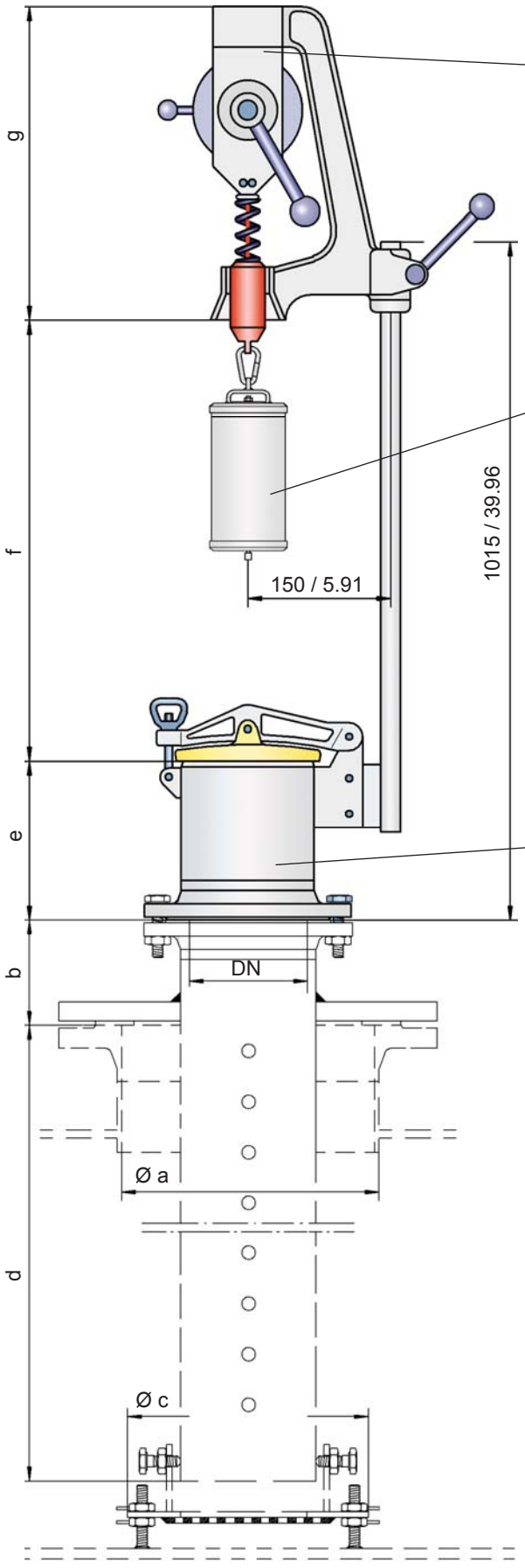
Gauging and Sampling Pipe PROTEGO® PR/0 with gauging table PROTEGO® PT/S as well as Gauging Nozzle PROTEGO® PS/KF for a vertical tank.

Also sampling with a suitable Sampling Pot PROTEGO® PG/H is possible. Information about gauging and sampling device are available in a separate catalogue sheet.

Gauging and Sampling Device

with accessories

PROTEGO® VP/HK with PS/E and PG/H

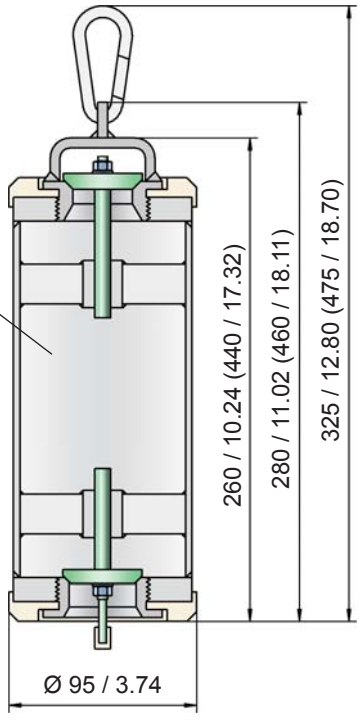


① Portable manual gauging and sampling device PROTEGO® VP/HK

③ Sampling pot PROTEGO® PG/H capacity:
1 liter /0.22 gal (UK)

(2 liters / 0.44 gal (UK) capacity = measures in brackets)

② Gauging nozzle PROTEGO® PS/E



Dimensions in mm / inches

Function and Description

The PROTEGO® gauging and sampling assembly consists of the manual gauging and sampling device PROTEGO® VP/HK (1), the gauging nozzle PROTEGO® PS/E (2), the gauging pipe PROTEGO® PR/0, the gauge plate PROTEGO® PT/S and the sampling pot PG/H (3). This assembly serves for gauging (determination of the liquid level) and sampling in horizontal or vertical aboveground tanks which store non-flammable or – if equipped appropriately – flammable liquids, this device may also be used for storage tanks approved by customs.

The portable gauging and sampling device PROTEGO® VP/HK is attached by a clamp to the fixing rod of the gauging nozzle. The millimeter-scale measuring tape – black anodized – is calibrated by customs.

The gauging pipe PROTEGO® PR/ 0 is made of an insert- pipe with holes. The slip-on flange is included in the shipment and has to be welded on during on-site assembly.

The gauging nozzle with hinged cover and clip-lock PROTEGO® PS/E is attached to the counter-flange of the gauging and sampling pipe. The locking nozzle has the fixing rod attached for connecting the gauging and sampling device PROTEGO® VP/HK.

The sampling constructed from stainless steel with conductive plastic caps pot PROTEGO® PG/H consists of housing with metallic sealing valve discs and snap-hook. Specify the required capacity (1 l or 2 l / 0.22 gal (UK) or 0.44 gal (UK)).

Design Types and Specifications

The assembly can be ordered either as complete unit or in individual devices. Please specify the nominal diameters DN for gauging nozzle and gauging pipe.

1) Manual gauging and sampling device VP/HK including

2) Gauging nozzle PS/E, DN (mm or inches)

3) Gauging pipe PR/0, DN (mm or inches)

Gauge plate PT/S

Sampling pot PG/H

Table 1: Dimensions Dimensions in mm / inches

DN	a	b	c	e	f	g
100 / 4"	150 / 5.91	150 / 5.91	305 / 12.01	300 / 11.81	640 / 25.20	280 / 11.02
150 / 6"	200 / 7.87	150 / 5.91	375 / 14.76	300 / 11.81	640 / 25.20	280 / 11.02

Measure d must be given with the order

Table 2: Material selection for VP/HK

Measuring tape	Stainless Steel
Lowering weight	Stainless Steel
Crank handle	Aluminium
Frame	Aluminium
Gauging nozzle PS/E	Steel or Stainless Steel
Gauging pipe PR/0	Steel or Stainless Steel
Gauging plate PT/S	Steel or Stainless Steel
Sampling pot PG/H	Stainless Steel

Selection and Design

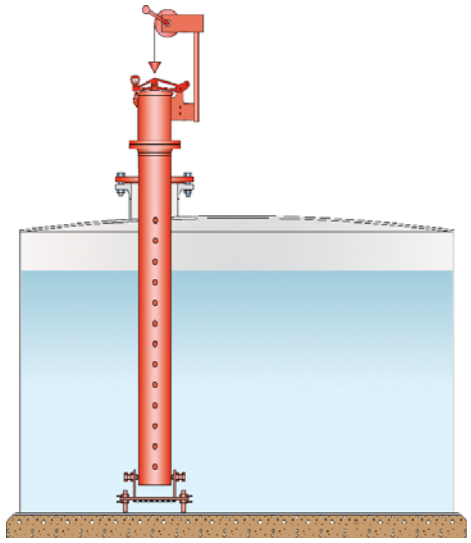
The materials of the tank and storage medium determine the basic materials to be selected.

Necessary Data for Specification

Specify the **tank dimensions** for the lengths of tape and gauging pipe PROTEGO® PR/0.

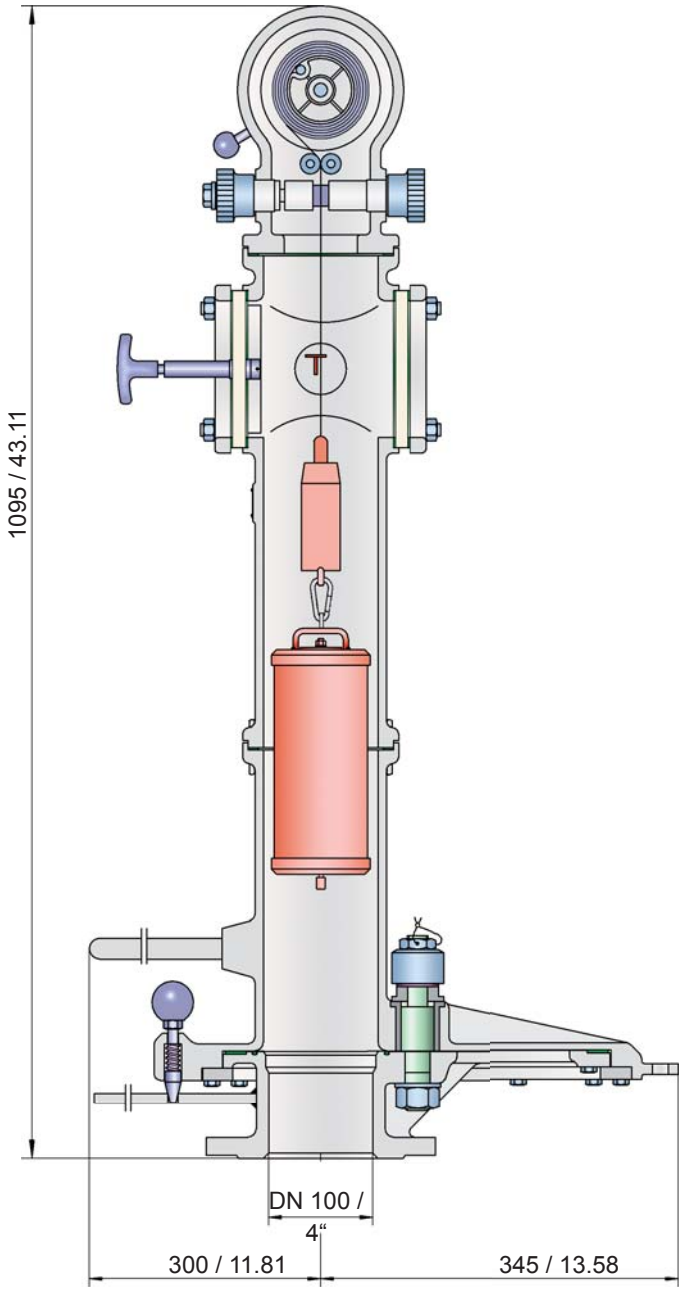
Specify the required capacity for the sampling pot PROTEGO® PG/H(1 l or 2 l / 0.22 gal (UK) or 0.44 gal (UK)).

Application Example



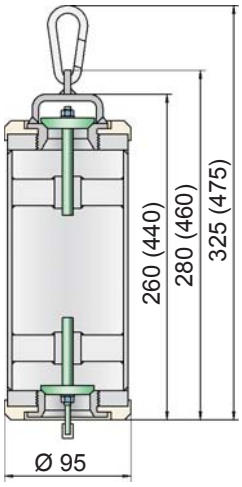
Sampling Device, gastight with accessories

PROTEGO® VP/G-II-100 and PG/H



Sampling pot
PROTEGO® PG/H
capacity:
1 liter /0.22 gal (UK)

(2 liters / 0.44 gal (UK)
capacity =
measures in brackets)



Dimensions in mm / inches

Function and Description

The gastight Gauging and Sampling Device PROTEGO® VP/G-II-100 in combination with a Sampling Pot PROTEGO® PG/H allows for sampling of the stored product without opening the tank to the atmosphere.

This device consists of the rotary table with connecting nozzle DN 100 or ANSI 4“, the operating button with crank for the measuring tape as well as the inspection glass top for monitoring the sampling level.

The rotary table has to be turned through 180° by a rotary table axis from resting position into operating position or the other way round. In resting position (figure 1) – measuring tape is wound up – the sampling pot can be mounted or removed.

Sampling takes place in operating position (figure 2). Where the measuring tape is manually lowered to the required position and rewound with the crank.

The devices are designed and tested according to the European Standards EN 1127-1, EN 13463-1 and EN 13463-5 as device according to European Directive 94/9/EG. EC-Type Examination Certificates issued by a European notified body are available. The scope applies to atmospheric conditions. That is a max. acceptable operating pressure of 1.1 bar absolute and a max. acceptable operating temperature of 60 °C.

Parts of this device being located in zone 0 comply with the requirements of non-electrical devices in ignition protection type c (protection by sage construction) of device group II, category 1G. They comply to the requirements for application in explosion group IIA and IIB and temperature category T1 to T6. Parts being located in zone 1 comply to device group II, category 2G.

Figure 1
Removal of the pot
in resting position

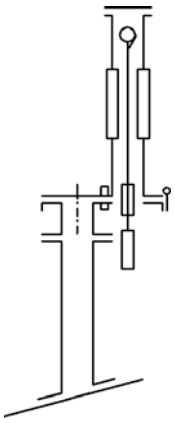
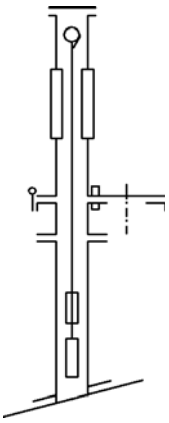


Figure 2
Sampling in
operating position



Flange Connection Type

Table 3: Flange connection type DN2	
EN 1092-1, Form B1 or DIN 2501, Form C, PN 16	EN or DIN
ANSI 150 lbs RFSF	ANSI

Necessary Data for Specification

Stored medium

Service temperature (°C or °F)

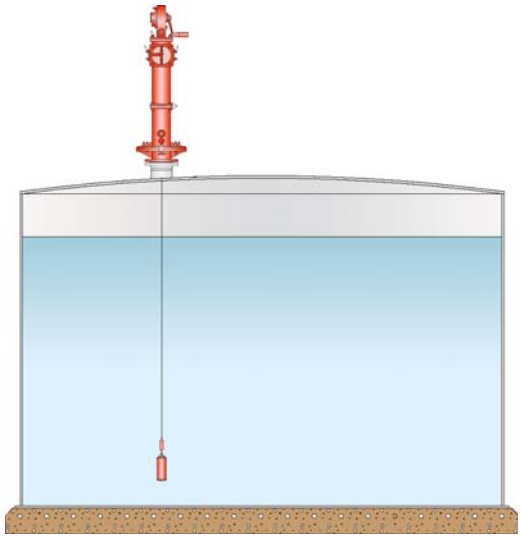
Operating pressure (bar or psi)

Tank material

Tank nozzle DN1 (mm or inches)

Application Example

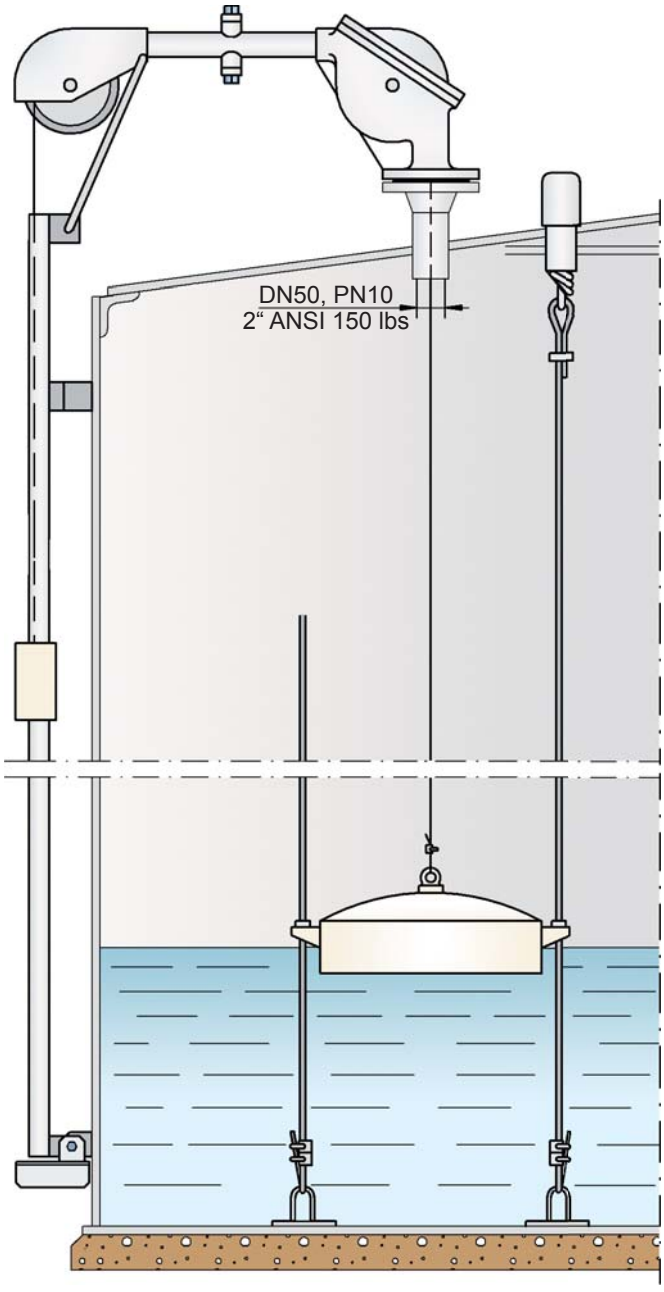
Gastight sampling on a tank meaning sampling without direct contact between gas zone and atmosphere.

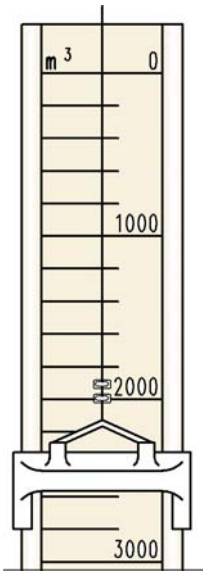


Level Indicator

deflagration proof

PROTEGO® GS/F-IIB3





Detailed scale available upon request

Function and Description

The Level Indicators PROTEGO® GS/F indicate the liquid level inside the tank on a graduated level indicator that is placed outside at the tank.

During filling and emptying the tank the float moves depending on the liquid level and via the operating rope activates the indicator weight. Depending on the changing liquid level the level indication is displayed outside on the graduated level indicator.

As standard the level is indicated reverse to the liquid level. Therefore the filling level “0” is placed on the upper end of the scale.

In case of atmospheric deflagration (outside explosions) flame transmission into the tank is prevented due to flame transmission proof gap bushings. Therefore, the PROTEGO® GS/F-IIB3 is explosion (deflagration) proof zone 0.

According to the type examination certificates, the liquid indicators PROTEGO® GS/F guarantee for flame transmission protection against atmospheric deflagration of gas or product / air mixtures of explosion group IIB3. The scope applies to atmospheric conditions. That is a max. acceptable operating pressure of 1.1 bar and a max. acceptable operating temperature of 60 °C.

Test certificates and EC-Type Examination Certificates issued by a European notified body are available

Design Types and Specifications

Following designs are available:

Level Indicator, standard design	**GS/F - IIB3**
Level Indicator, indication equal level	**GS/F - IIB3 (N)**
Level Indicator, half indication	**GS/F - IIB3 (H)**

Table 1: Material selection for housing group

Design	A	B
Roller box	Cast Iron	Stainless Steel
Deflection pulleys	Stainless Steel	Stainless Steel
Operating rope	Stainless Steel	Stainless Steel
Brackets	Steel	Stainless Steel
Indicator scale	Polystyrene	Polystyrene

The material of the connection flange has to be compatible to the material of the plant component.

Table 2: Material selection for float

Design	A	B
float	Steel	Stainless Steel
guide rope	Steel, galvanized	Stainless Steel

Table 3: Flange connection type

EN 1092-1, Form B1 or DIN 2501, Form C, PN 16	EN or DIN
ANSI 150 lbs RFSF	ANSI

Table 4: Selection of the explosion group

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

Selection and Design

Sufficient corrosion resistance with regard to the stored media must be considered. The design of the level indicators depends on the construction of the tank design

Necessary Data for Specification

Stored product

Tank material

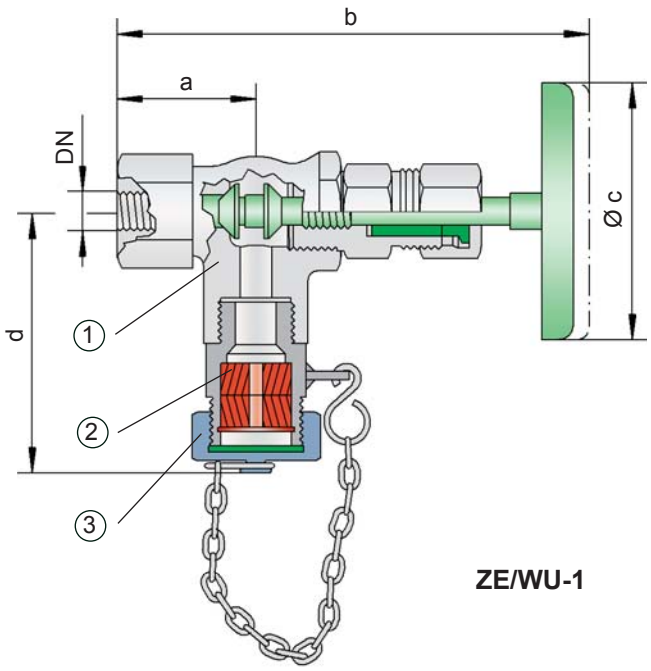
Tank diameter (m)

Tank height (m)

Sampling and Air Bleed Valve

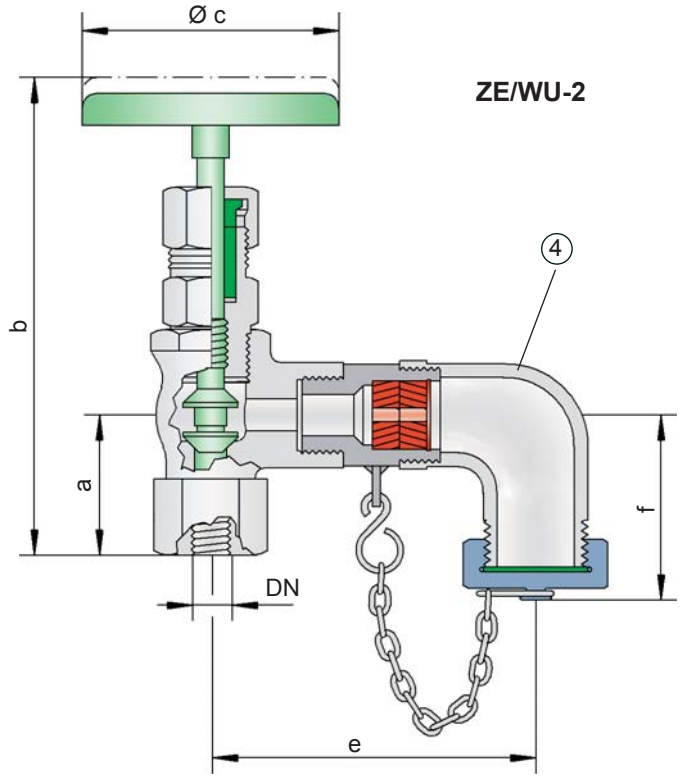
deflagration proof

PROTEGO® ZE/WU



ZE/WU-1

Standard design up to PN 25



ZE/WU-2

Function and Description

The PROTEGO® ZE/WU sampling and air bleed valve is used for flame transmission proof venting of pipelines and equipment that transports or processes flammable liquids, and for taking liquid samples.The valve incorporates an end-of-line deflagration flame arrester. Should the gas/air mixtures or product vapour/air mixtures ignite during venting, the valve prevents flash back into the system to be protected.

The sampling and air bleed valve PROTEGO® ZE/WU consists of the threaded angle valve in pressure stage PN25 (1) with hand wheel as standard design and female threaded connection (pipe thread G½“up to G1“) and the flame arrester (2) with cover (3).

As an optional elbow fitting (4) is available as outlet for sampling. The flame arrester (2) consists of the flame arrester cage with FLAMEFILTER®.

The valve opens manually with the hand wheel. For sampling, a suitable container is required.

The simple and sturdy design makes it suitable for nearly all flammable liquids. This device can be installed in any position.

Flame transmission protection is guaranteed against atmospheric deflagrations of gas/air mixtures or product vapour/air mixtures of explosion groups up to IIB (NEC group D to C) up to a service temperature of +60°C / 140°F and an absolute operating pressure up to 1.1 bar / 15.9 psi.

Type-approved according to ATEX Directive 94/9/EC and EN ISO 16852 as well as other international standards.

Designs and Specifications

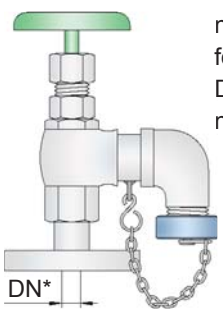
There are two designs available:

Sampling and air bleed valve, standard design **ZE/WU - 1**

Sampling and air bleed valve with elbow **ZE/WU - 2**

Special designs for higher pressures are available

Optionally available with flange connection (see figure)



* Position of drilling holes on flange connection as well as thickness upon request for size DN15 / ½“, DN20 / ¾“, DN25 / 1“, DN32 / 1¼“, DN40 / 1½“ and pressure nominal PN25/40 resp. PN100 available.

Table 1: Dimensions Dimensions in mm / inches

DN	a	b	Ø c	d	e	f
15 / G½"	40 / 1.57	140 / 5.51	70 / 2.76	80 / 3.15	96 / 3.78	67 / 2.64
20 / G¾"	50 / 1.97	165 / 6.50	85 / 3.35	80 / 3.15	89 / 3.50	67 / 2.64
25 / G1"	65 / 2.56	200 / 7.87	100 / 3.94	95 / 3.74	104 / 4.09	67 / 2.64

Table 2: Explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)
≥ 0,50 mm	IIB	C

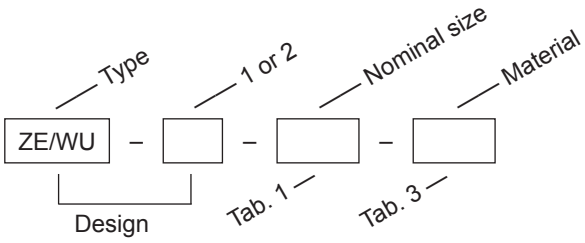
Table 3: Material

Design	A
Threaded angle valve	Stainless Steel
Elbow	Stainless Steel
Cover	Stainless Steel
FLAMEFILTER®	Stainless Steel

The valve must be sufficiently resistant to corrosion through the gas/air mixtures or product vapor/air mixtures. This applies mainly to the FLAMEFILTER®.

Table 4: Type of connection

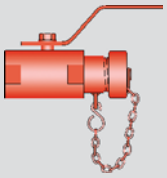
Pipe thread DIN ISO 228 T1	DIN



Order example

ZE/WU	–	1	–	¾"	–	A

Materials and chemical resistance:
Technical information upon request

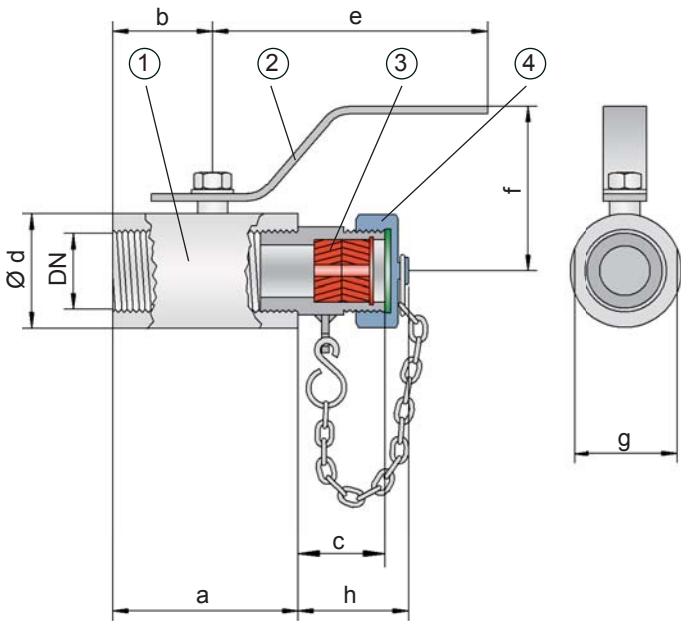


Condensate Drain Valve

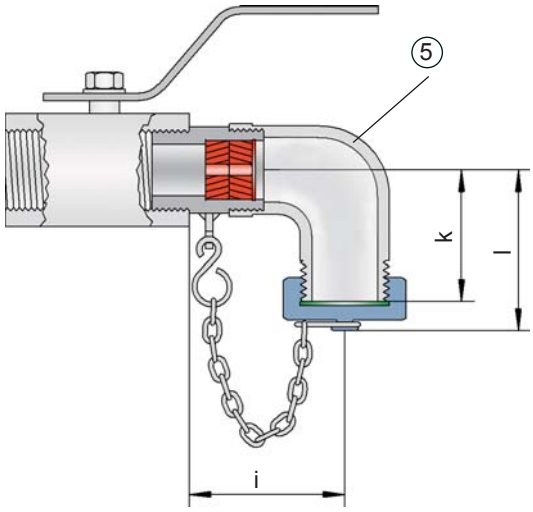
deflagration proof

PROTEGO® ZE/TK

ZE/TK-1



ZE/TK-2



Function and Description

The PROTEGO® ZE/TK condensate drain valve is used for flame transmission proof condensate drainage of devices or plant equipment (e.g. tanks, pipelines, etc.) where flammable liquids may condense and therefore flammable product vapour/air mixtures could develop. Furthermore the drain valves can be used for the venting of tanks, parts of plants and lines that transport or process flammable liquids. The drain valve incorporates an end-of-line deflagration flame arrester.

The condensate drain valve PROTEGO® ZE/TK consists of the ball valve (1) with hand lever (2) and female threaded connection (e.g. pipe thread G½" up to G1") and the flame arrester (3) with cover (4).

As an option a elbow fitting (5) is available as outlet.

The flame arrester (3) consists of flame arrester cage and FLAMEFILTER®.

The ball valve is opened with the hand lever. When draining condensate use a suitable container. When draining flammable and/or toxic products observe the appropriate safety provisions.

The simple and sturdy design it is suitable for nearly all flammable liquids, and can be installed in any position.

Flame transmission protection is guaranteed against atmospheric deflagrations of product vapour/air mixtures of explosion groups up to IIB (NEC groups D to C) up to a service temperature of +60°C / 140°F and an absolute operating pressure up to 1.1 bar / 15.9 psi.

Type-approved according to ATEX Directive 94/9/EC and EN ISO 16852 as well as other international standards.

Designs and Specifications

There are two designs available:

Condensate drain valve, standard design	**ZE/TK - 1**
Condensate drain valve with elbow	**ZE/TK - 2**

Special designs are available on request.

Table 1: Dimensions Dimensions in mm / inches

DN	a	b	c	Ø d	e	f	g	h	i	k	l
15 / G½"	60 / 2.36	30 / 1.18	33 / 1.30	32 / 1.26	110 / 4.33	55 / 2.17	27 / 1.06	45 / 1.77	54 / 2.13	38 / 1.50	67 / 2.64
20 / G¾"	65 / 2.56	35 / 1.38	33 / 1.30	38 / 1.50	110 / 4.33	60 / 2.36	34 / 1.34	45 / 1.77	54 / 2.13	38 / 1.50	67 / 2.64
25 / G1"	73 / 2.87	40 / 1.57	33 / 1.30	45 / 1.77	110 / 4.33	65 / 2.56	41 / 1.61	45 / 1.77	54 / 2.13	38 / 1.50	67 / 2.64

Table 2: Explosion group

MESG	Expl. Gr. (IEC/CEN)	Gas Group (NEC)
≥ 0,50 mm	IIB	C

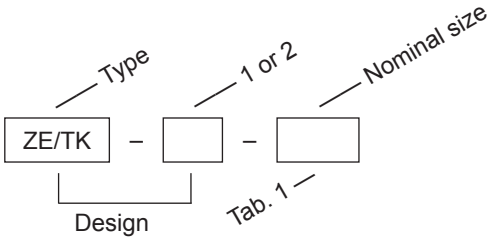
Table 3: Material

Ball valve	Stainless Steel
Elbow	Stainless Steel
Cover	Stainless Steel
FLAMEFILTER®	Stainless Steel

The valves must be sufficiently resistant to corrosion through the gas/air mixtures or product vapour/air mixtures. This applies mainly to the FLAMEFILTER®. If necessary, designs in special stainless steel quality should be selected.

Table 4: Type of connection

Pipe thread DIN ISO 228 T1	DIN



Order example

ZE/TK	–	1	–	¾"

Materials and chemical resistance:
Technical information upon request

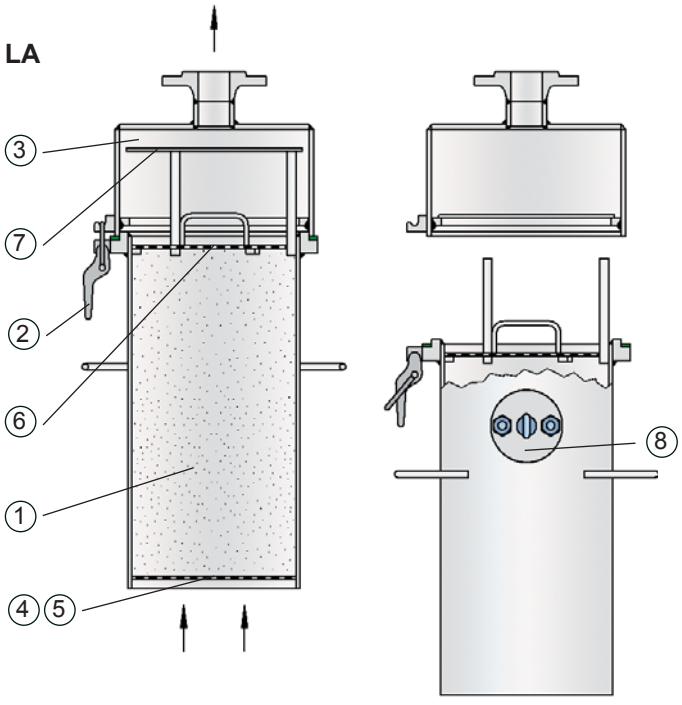
Air-Drying Device

PROTEGO® LA and LA/V

Function and Description

PROTEGO® Air-drying device of types LA or LA/V is used when suction air must be dried for atmospheric venting of storage tanks where only little or no humidity is allowed to get into the tank or the stored product due to the process engineering. They are usually used in vertical or horizontal aboveground tanks which store non-flammable or flammable liquids, and which must not be vented with humid air for safe operation.

LA



The single device LA mainly consists of the drying agent container (1). Its snap closing elements (2) connect it to the connection head (3) with flange connection according to DIN 2501 or to any other international standard.

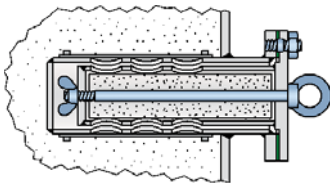
The bottom screen (4) and the protective strainer (5) are firmly welded into the drying agent container (1). The upper strainer cover (6) is loose. It can be removed easily to add or remove the drying agent. The connection head (3) contains the sealing plate (7) that closes the connection head opening when taking the drying agent container off. No humid air can be sucked in when changing the drying agent container.

The upper part of the drying agent container (1) holds the integrated control cartridge (8). The control cartridge can be removed during operation. It shows if the drying agent contains humidity and has to be replaced for regeneration.

Depending on the required flow rates or prescribed pressure losses the drying agent containers are delivered in two sizes – type I or type II. As parts of a modular system they are assembled into larger performance units.

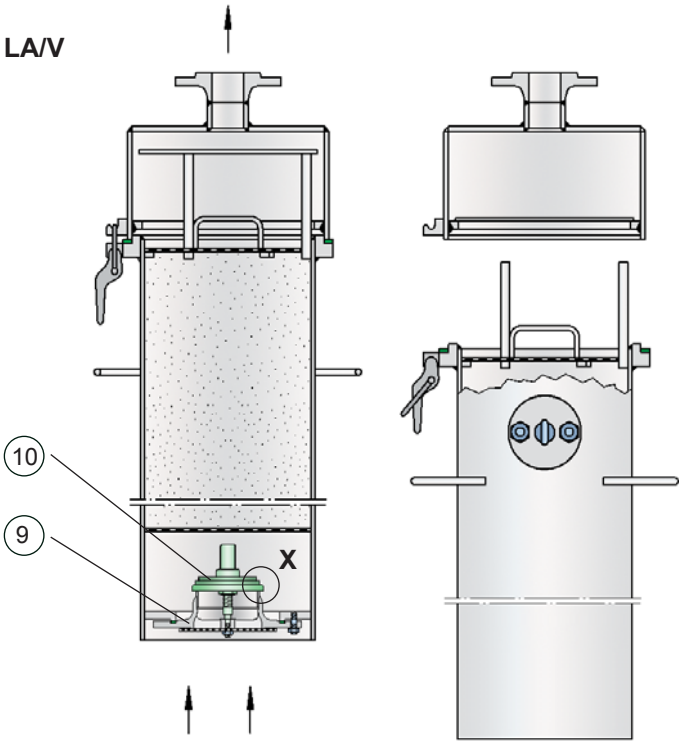
KC® drying pearls are used as the drying agent. The control cartridge (figure 1) is filled with special KC® indicator drying pearls. The required filling levels are specified in the relevant operating instructions.

Figure 1



The air-drying device type LA/V is essentially similar to type LA. Additionally, it has a replaceable check valve (9) with protective strainer and valve pallet (10) integrated in the inlet connection. When no air is sucked in through the air-drying device the device is sealed and tight towards the atmosphere. So at high air humidity the drying agent in the lower area of the drying agent container cannot absorb moisture.

LA/V



Detail **X**

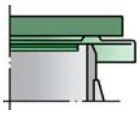


Figure 2

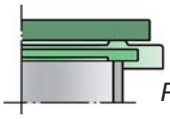


Figure 3

The design of the full lift valve pallet (10) depends on the set pressure:

- Vacuum range I -3,5 up to -5,0 mbar / -1.4 up to -2 inch W.C.
- Vacuum range II -5,0 up to -14,0 mbar / -2 up to -5.6 inch W.C.
- Vacuum range III -14,0 up to -35,0 mbar /-5.6 up to -14 inch W.C.

The FEP diaphragm with air cushion sealing (figure 2) is used as valve pallet sealing up to pressure range II. From pressure range III, a lapped metallic sealing is used (figure 3).

Designs and Specifications

There are two designs available:

Air-drying device, basic design	**LA**
Air-drying device with check valve	**LA/V**

Table 1: Material selection Type LA

Design	A	B
Housing	Steel	Stainless Steel
Bottom screen	Stainless Steel	Stainless Steel
Protective strainer	Stainless Steel	Stainless Steel
Cover	Steel	Stainless Steel

Table 2: Material selection Type LA/V

Design	A	B
Housing	Steel	Stainless Steel
Bottom screen	Steel	Stainless Steel
Protective strainer	Stainless Steel	Stainless Steel
Cover	Steel	Stainless Steel
Valve insert	Stainless Steel	Stainless Steel

Table 3: Material selection for valve pallet

Design	A	B	C
Vacuum range [mbar] [inch W.C.]	 -3.5 up to -5.0 -1.4 up to -2.0	 ≥-5.0 up to -14 ≥-1.4 up to -5.6	 ≥-14 up to -35 ≥-5.6 up to -14
Valve pallet	Aluminium	Stainless Steel	Stainless Steel
Sealing	FEP	FEP	Metal to Metal

Flange Connection Type

The connection flange is to EN 1092-1 or DIN 2501, PN 16. Optionally, the connecting flange can be made according to any international flange standard.

Selection and Design

In a system shown in figure 4 (see page 510) the maximum vacuum in the tank is calculated depending on the volume flow of the pressure loss Δp_{LA} of the air-drying device LA and the opening pressure p_O of the vent valve DZ/T or DV/ZU (see volume 6) or the tank pressure p_T given in the relevant capacity chart.

In a system according to figure 5 (see page 510) the maximum vacuum in the tank is calculated depending on the volume flow of the pressure loss Δp_{LA} of the air-drying device LA – plus check valve set pressure p_{VR} – and opening pressure p_O of the vent valve DZ/T or DV/ZU (see volume 6) or the tank pressure p_T given in the relevant capacity chart.

Additionally, the pressure loss in the pipeline between air-drying device and vent valve has to be taken into account; however, usually it is negligible.

Necessary Data for Specification

Maximum allowable tank vacuum p_T (mbar or inch W.C.)

Maximum possible volume flow $\dot{V}$ (m³/h or CFH)
(when emptying the tank)

Pressure loss or pipeline length

Tank material

Dimensions and Weights

See systems for arrangements page 512

Figure 4

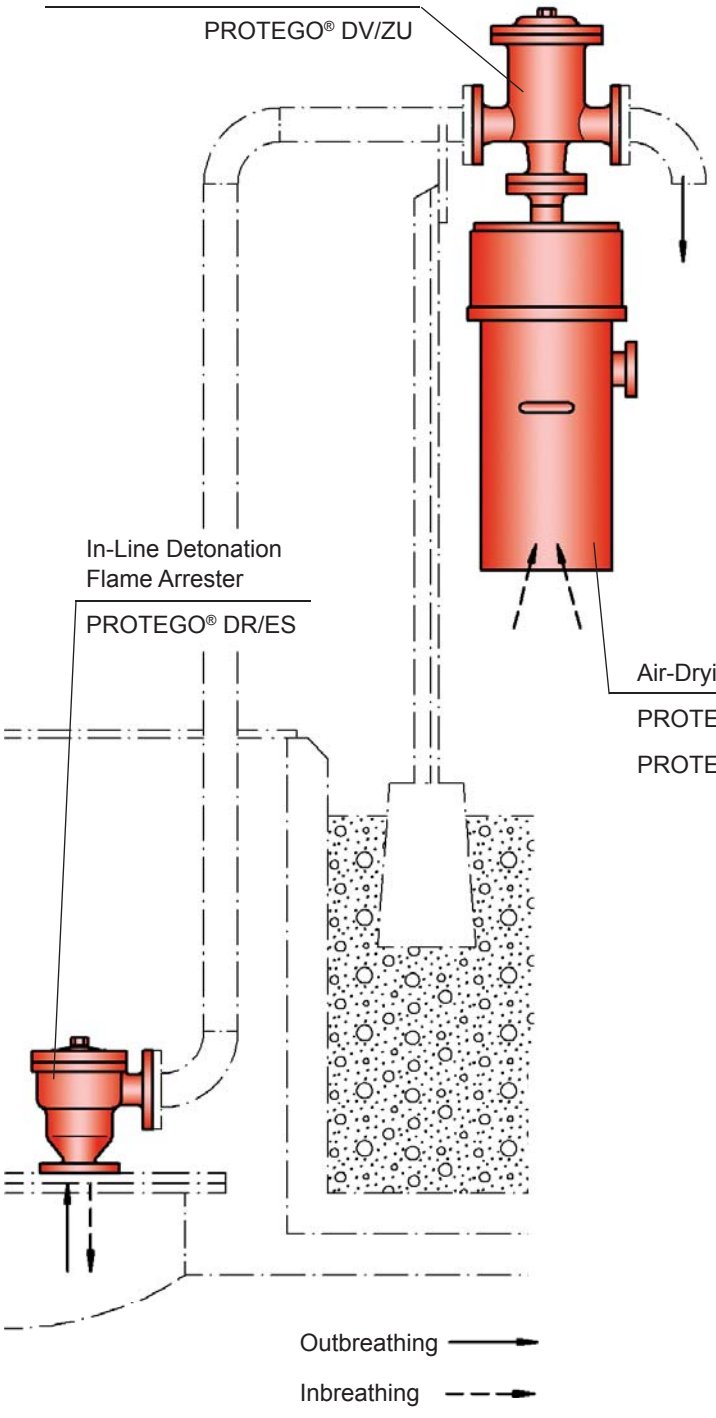
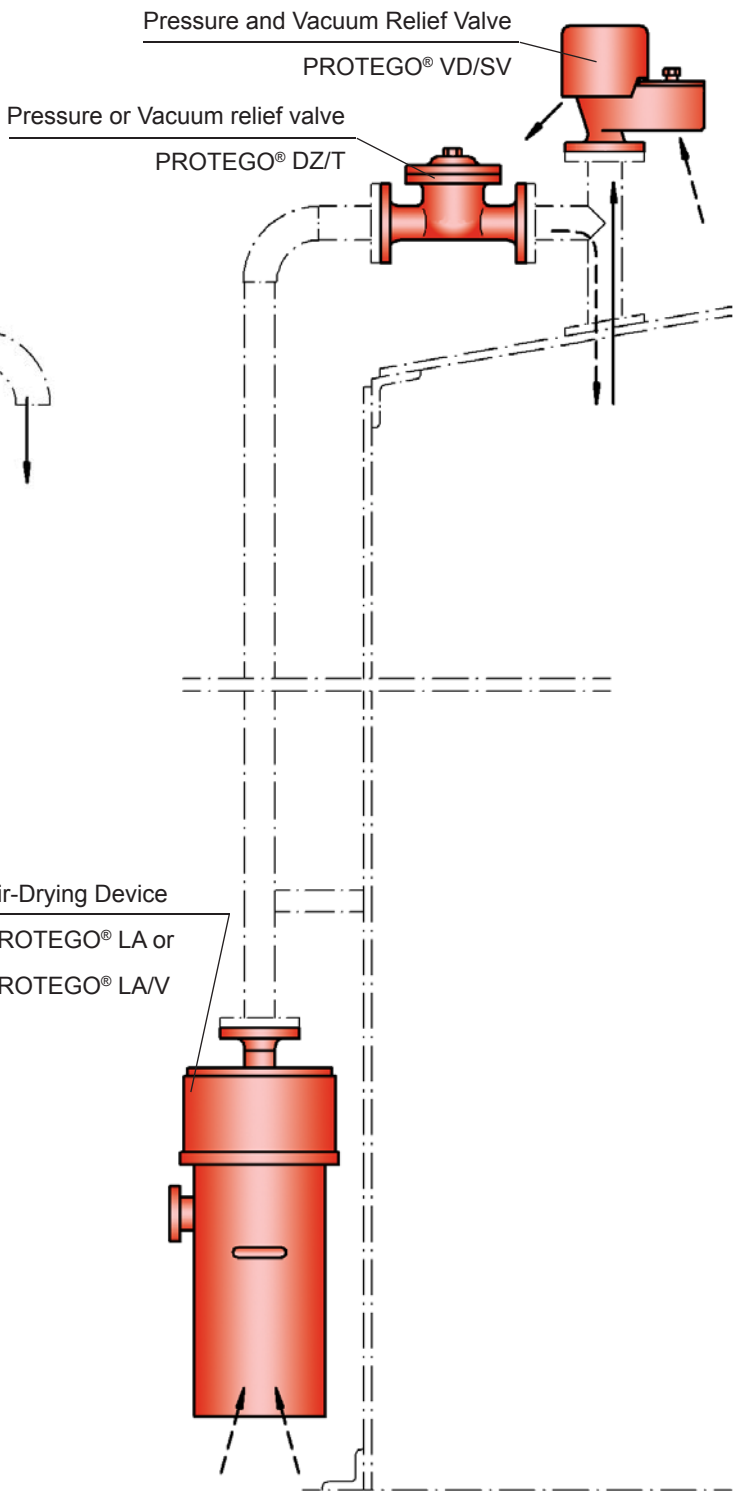


Figure 5



Air-drying devices of types LA or LA/V may be integrated into complete tank venting systems (see figures 4 and 5).

If flammable liquids are stored in the tank, then flame arresters have to be installed in addition to the air-drying device and the pressure and vacuum relief valves. Depending on the operating conditions it is also possible to combine other vent valves with the integrated air-drying device.

When the set vacuum is reached in the tank, the vacuum relief valve – for instance PROTEGO® type DZ/T or DV/ZU on figures 4 and 5 – connected to the air-drying device opens and the drying device LA sucks in atmospheric air while the drying agent (KC® drying pearls) absorbs the atmospheric humidity.

The drying agent must be replaced and regenerated when depleted. Using a control cartridge, it is easily possible to determine whether the drying agent is saturated with humidity.

If the specified pressure is reached in the examples shown in figures 4 or 5 the pressure side of the combined pressure and vacuum relief valve opens and the product vapour/air mixture escapes into the atmosphere. The valve could be for instance PROTEGO® type VD/SV or DV/ZU. Alternatively it is possible to pass the product vapour/air mixture through a suitable valve – e.g. PROTEGO® type DV/ZU into an exhaust line or exhaust system. Under pressure the vacuum side of the above valves remains closed and the product vapours cannot pass into the drying agent.

In larger tanks it is recommended to also use combined pressure and vacuum relief valves e.g. PROTEGO® type VD/SV. This ensures that in an emergency (failure of air-drying device) atmospheric air can be sucked in directly through the vacuum side. Often direct atmospheric emergency venting is required yet it is neither possible nor necessary to size the air-drying device for the maximum volume flow calculated (pump flow-rate and thermal flow according to EN 14015 or API 2000). Maximum thermal flow occurs only rarely and it is therefore usually sufficient to size the air-drying device according to the pump flow-rate for emptying and a thermal flow portion of approximately 25%.

Essentially, the air-drying device type PROTEGO® LA/V functions like type PROTEGO® LA. However, a check valve allows inbreathing only when the entire venting system – the tank and the drying container – is under vacuum at the set pressure of the check valve.

The devices are designed for venting rates sufficient for the breathing of storage tanks. However, they do not replace any valves designed for emergency venting.

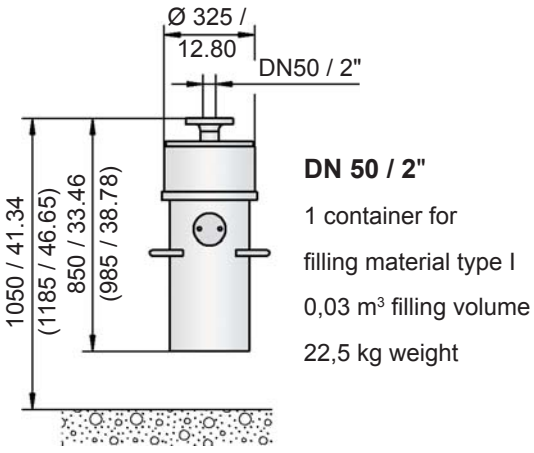
The drying agent saturation can be easily monitored using a control cartridge. The drying agent can be regenerated. Drying agent and control drying pearls are not included in the PROTEGO® LA or LA/V and can optionally be ordered together with the device.

Figure 6 (page 512) shows the combination options of PROTEGO® LA/V air-drying device in complete units. The overall dimensions, filling volumes and filling weights are also given in this figure.

Example arrangements of air-drying devices to complete systems for larger volume flows and nominal sizes

Note:
Overall dimensions differ in LA and LA/V (values in brackets refer to LA/V)

Figure 6



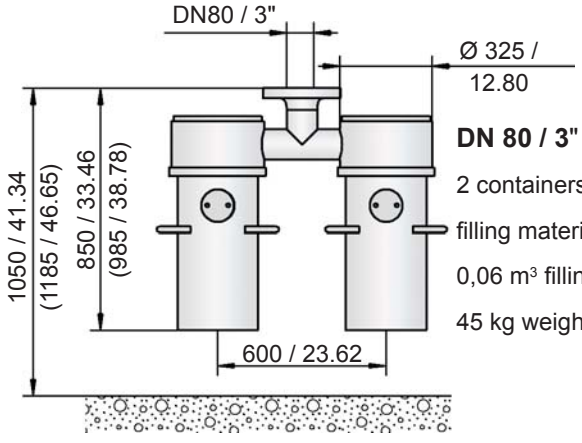
DN 50 / 2"

1 container for

filling material type I

0,03 m³ filling volume

22,5 kg weight



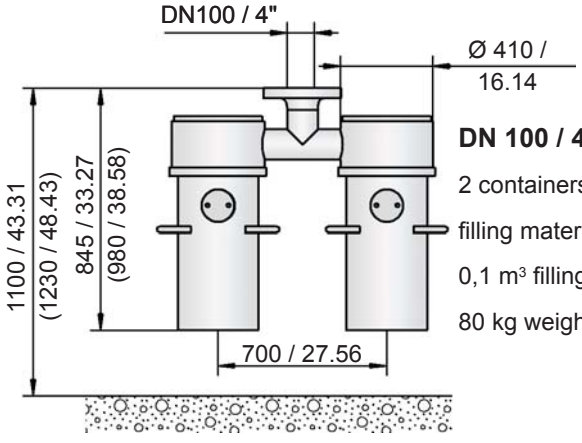
DN 80 / 3"

2 containers for

filling material type I

0,06 m³ filling volume

45 kg weight



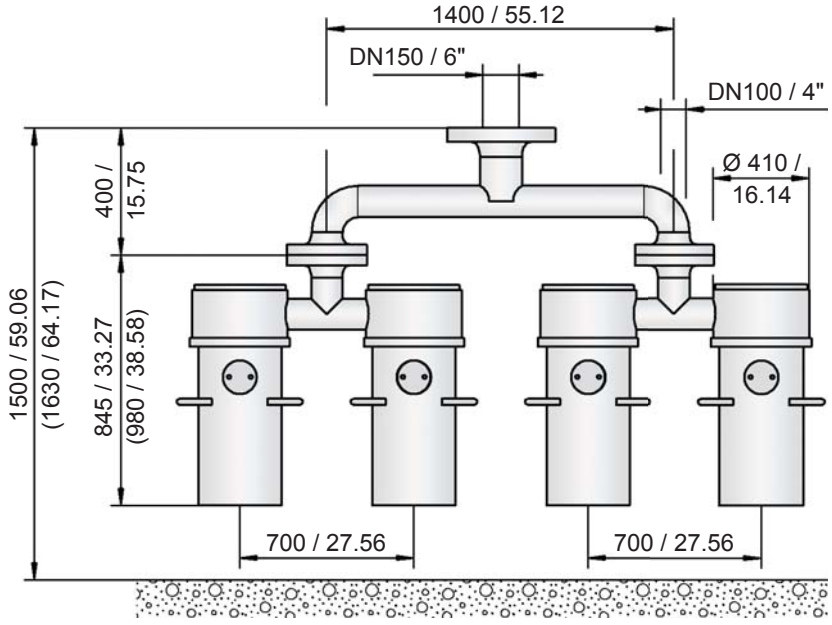
DN 100 / 4"

2 containers for

filling material type II

0,1 m³ filling volume

80 kg weight



DN 150 / 6"

4 containers for

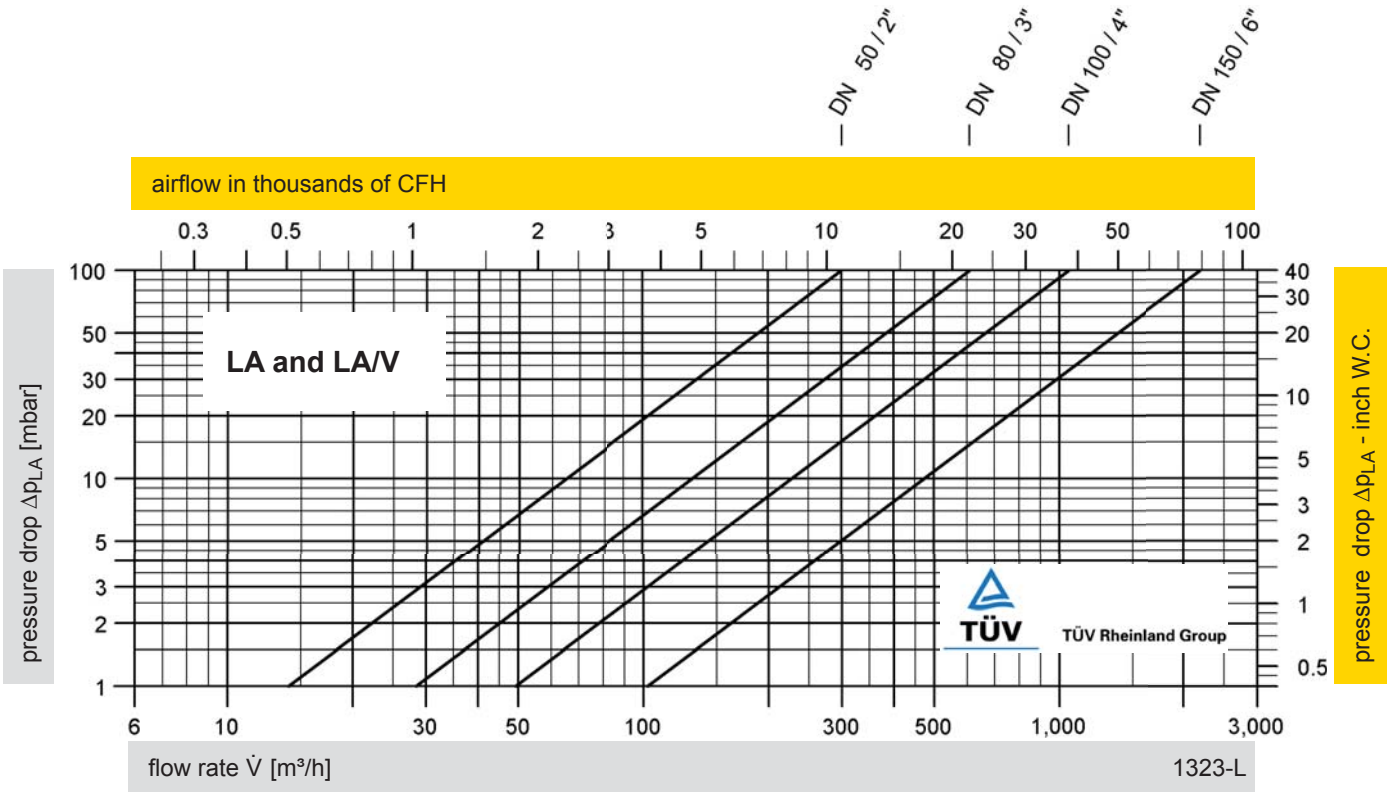
filling material type II

0,2 m³ filling volume

160 kg weight

Dimensions in mm / inches

PROTEGO® LA and LA/V



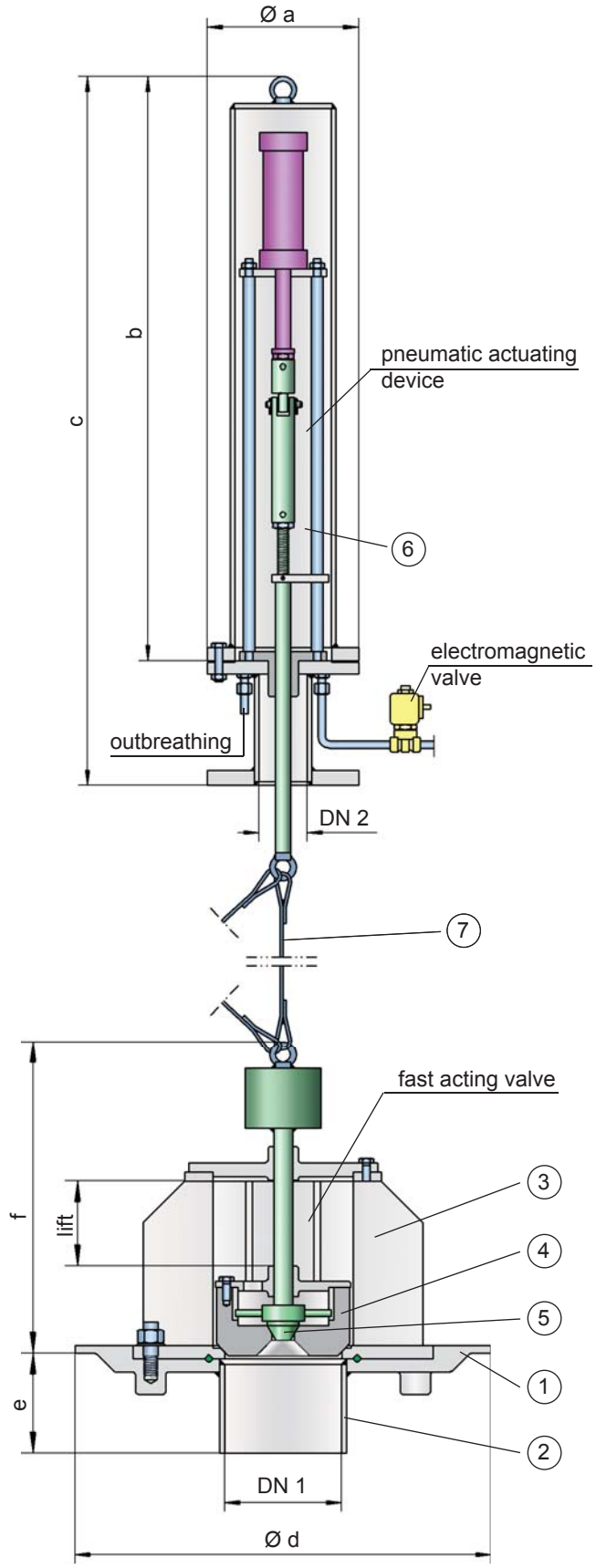
The flow capacity chart has been determined with a calibrated and TÜV certified flow capacity test rig.
Volume flow V̇ in [m³/h] and CFH refer to the standard reference conditions of air ISO 6358 (20°C, 1bar).
Conversion to other densities and temperatures refer to Vol. 1: “Technical Fundamentals”.

PROTEGO
for safety and environment

Fast Acting Bottom Drain Valve

with pneumatic actuator

PROTEGO® NB/AP



If fast acting valve is open, drag coefficient amounts to 1,5

Function and Description

Fast acting bottom drain valves type NB/AP from PROTEGO® are applied to tank seal draining nozzles to avoid leakage during hazardous situations (pipe bursting). For this reason the devices are also called “Quick Shut off Bottom Drain Valves”. They are mainly used for low temperature liquefied medium (down to -196°C / -321°F) storage tanks.

The device essentially consists of the bottom plate (1), which has to be welded onto the vessel bottom, a nozzle (2), which is to be welded to the emptying line and the flanged fast acting valve (3) with valve piston (4) and release valve cone (5) and the complete pneumatic actuating device (6), which is mounted to the roof of the vessel. Through lapped metallic valve pallet and release vent cone the required leak tightness is achieved.

The fast acting valve (3) and the actuator system (6) are connected by an actuator rope (7). An additional emergency rope allows the opening of the fast acting valve if the main actuator rope is damaged.

During normal operation a pneumatic cylinder holds the device in the open position. The piston in the pneumatic cylinder is actuated by a control line. The piston rod is retracted with the actuation spindle to lift the valve piston and keeps the valve open during normal operation. In the emergency case a remote release through a control valve closes the bottom drain valve. To close the bottom drain valve the control valve is actuated to vent the pneumatic cylinder. The dead weight of the valve piston lets it fall down and closing the valve. The control function has to be designed in such a way that the valve closes by itself even during loss of energy (Fail-Safe-Concept).

The design of the device is independent of the nominal diameter. The nominal diameter DN 1 is preset by the emptying line – standard is DN 150mm / 6”.

Under normal operation the valves are working unpressurized. To re-open the valve after a quick-shut-off a pressure is considered which is resulting of the liquid column above and the pressure in the gas head space.

Material selection is in accordance to the product and the operating temperature.

The bottom plate is welded in the tank bottom. Size and weld seam must consider the engineering requisition.

Design Types and Specifications

Table 1: Dimensions — Dimensions in mm / inches

DN 1	DN 2	a	b	c	d	e	f	Hub
150 / 6"	80 / 3"	200 / 7.87	1130 / 44.49	1430 / 56.30	550 / 21.65	175 / 6.89	465 / 18.31	160 / 6.30
200 / 8"	80 / 3"	200 / 7.87	1130 / 44.49	1430 / 56.30	600 / 23.62	175 / 6.89	470 / 18.50	160 / 6.30

Table 2: Material of fast action bottom drain valve

Bottom plate with nozzle	*
Valve housing with valve cone	Stainless Steel
Gasket	*
Actuator rope	Stainless Steel

* upon request

Table 3: Material of actuating device

Housing	Stainless Steel
Actuator spindle	Stainless Steel
Guide bushing	Copper
Gasket	PTFE
Protective cap	Stainless Steel
Pneumatic cylinder	Aluminium

Table 4: Flange connection type DN 2

EN 1092-1, Form B, PN 40 or upon request

Selection and Design

The main process data and product properties of the stored medium as well as the temperature of the stored product determine the material for the specific valve. Subsequently the **nominal diameter** and the **type of connection** are checked and selected.

The valve is available in nominal diameters of DN 150 mm / 6" and DN 200 mm / 8", whereas the connection for the pneumatic actuating device has a nominal diameter of DN 80 mm / 3".

The length of the actuator rope and of the emergency rope is determined by the height of the tank. The final adjustment is completed during installation. The material for the gasket is determined based on the operating conditions and/or other special requirements.

The material of the valve bottom plate needs to be compatible to the material of the tank bottom plate. If the material of the bottom plate is provided by the tank manufacturer, then close coordination between manufacturing planning and installation planning is necessary.

For special requirements the valve and the actuation system (e.g. with inductive position indicator) can be supplied with a special design.

Deviations from our standard design will be sized and specified with the support of our engineers for the specific application.

Necessary Data for Specification

Stored medium

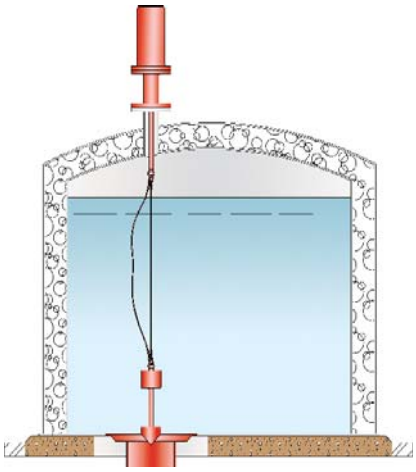
Operating temperature T (°C or °F)

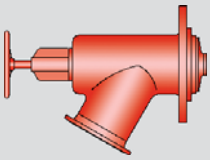
Operating pressure p (bar or psi)

Connection size DN 1

Tank height (m or ft)

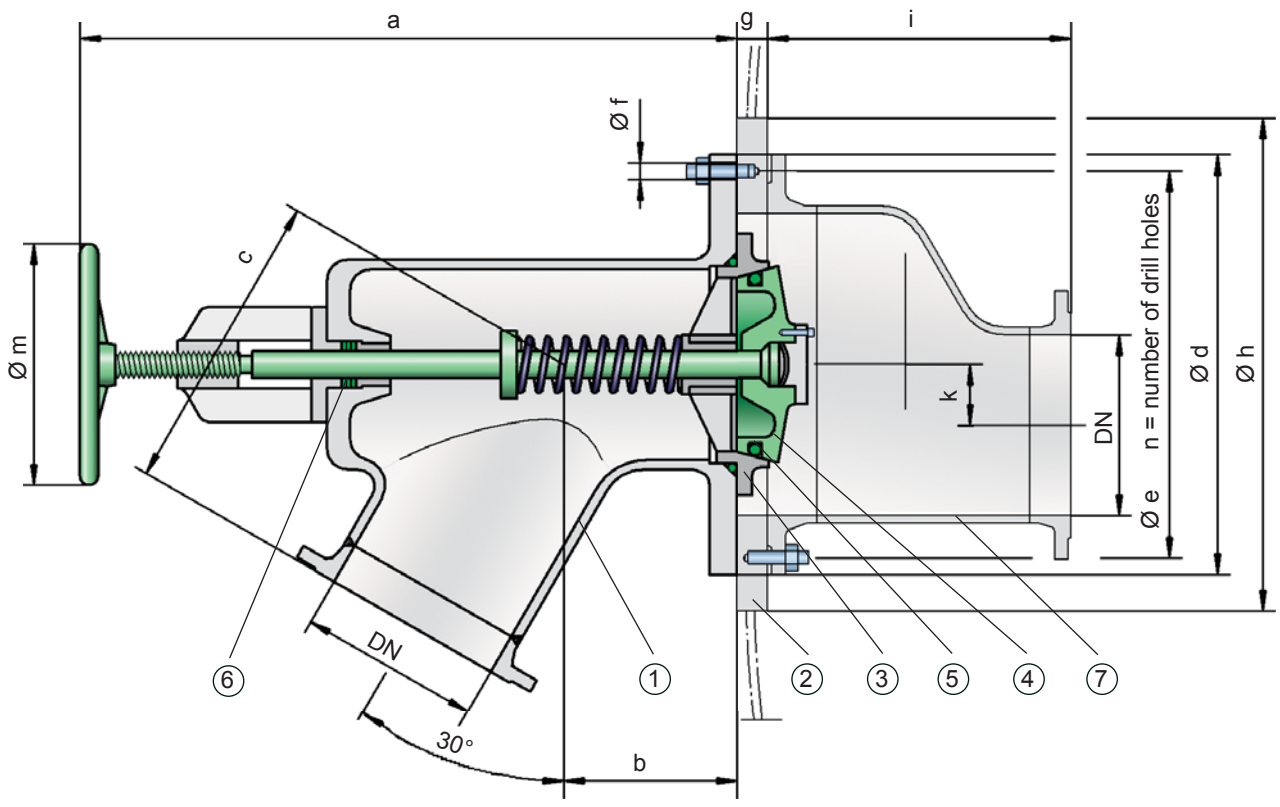
Application Example





Internal Safety Valve

PROTEGO® SI/F



Function and Description

The PROTEGO® internal safety valve type SI/F is a shut-off valve and protects the downstream liquid lines of storage tanks and tanks in process plants of the chemical, petrochemical and pharmaceutical industries, thus increasing both safety and availability of the plants.

The internal safety valve SI/F (figure 1) consists of housing (1), mounting flange (2), valve seat (3), valve disc (4) and sealing (5). The mounting flange is welded into the tank shell. The valve seat is replaceable. The valve seat and valve disc are lapped metallic surfaces and an additional O-ring is installed to ensure the required tightness. The spindle sealing (6) can be adjusted or replaced and is designed for a test pressure of 25 bar / 363 psi.

A gate valve that is supplied by the user and serves for normal operation is connected to the external nozzle of the housing. The internal safety valve is kept open under normal operating conditions. It is only closed for longer shut-downs, in case of emergency or for necessary repairs to the gate valve.

It is closed by an “internal sealing“, e.g. the valve is closed inside of the tank. This ensures that the tank cannot leak in case of damage to external components or leakages in any connected pipelines.

The special design of PROTEGO® tank shut-off valves of type SI/F is such that only the mounting flange (2) is welded to the tank shell, and so most other parts can be replaced. Replacement of important external parts does not require the draining of the tank. This fact provides significant operation advantages.

Type SI/F by PROTEGO® is available in a range of nominal sizes and materials. Optionally, the internal safety valve can be equipped with an internal nozzle (7) to connect to a suction and filling pipe or a swing pipe system (SI/FA).

Tank shut-off valves of this type are usually operated manually. Versions with an explosion proof electric actuator for direct or remote control are also available.

Alternatively it is possible to use special versions with pneumatic control (PROTEGO® SI/DP) under specific tank design (e.g. double-shell tank).

Design Types and Specifications

Two designs are available:

Internal safety valve, standard design	**SI/F**
Internal safety valve with internal connection nozzle (7)	**SI/FA**

Table 1: Dimensions Dimensions in mm / inches

DN	a	b	c	d	e	f	g	h	i	k	m	n
50 / 2"	371/14.61	75/2.95	170/6.69	240/9.45	205/8.07	14/0.55	30/1.18	305/12.01	250/9.84	54/2.13	200/7.87	8
65 / 2 ½"	400/15.75	85/3.35	190/7.48	305/12.01	205/8.07	14/0.55	30/1.18	305/12.01	240/9.45	45/1.77	200/7.87	8
80 / 3"	416/16.38	90/3.54	200/7.87	330/12.99	230/9.06	14/0.55	30/1.18	330/12.99	290/11.42	53/2.09	200/7.87	8
100 / 4"	434/17.09	100/3.94	225/8.86	270/10.63	230/9.06	14/0.55	30/1.18	330/12.99	270/10.63	40/1.57	200/7.87	8
150 / 6"	658/25.91	130/5.12	320/2.60	410/16.14	370/14.57	18/0.71	40/1.57	505/19.88	440/17.32	78/3.07	400/15.75	12
200 / 8"	725/28.54	145/5.71	365/14.37	540/21.26	405/15.94	18/0.71	45/1.77	540/21.26	450/17.72	68/2.68	400/15.75	12

Table 2: Material selection

Design	A	B
Housing	Steel	Stainless Steel
Valve seat	Stainless Steel	Stainless Steel
Valve disc	Stainless Steel	Stainless Steel
Spring	Stainless Steel	Stainless Steel
Bushing	PTFE	PTFE
Hand wheel	Steel	Steel
Spindle sealing	PTFE	PTFE
Mounting flange	Steel	Stainless Steel

Table 3: Flange connection type

EN 1092-1, Form B1 or DIN 2501, Form C, PN 16	EN or DIN
ANSI 150 lbs RFSF	ANSI

other types upon request

Selection and Design

Together with the customer our engineers design and specify the valve for each specific application. The relevant plant specifications are taken into account when defining the required nominal sizes and connection types. Also the operating temperature and resulting special operating conditions may require special materials. The mounting flange material must be compatible with the tank material. If there are special requirements for the valve or operating parameters please contact us: If necessary we will arrange for special designs.

Necessary Data for Specification

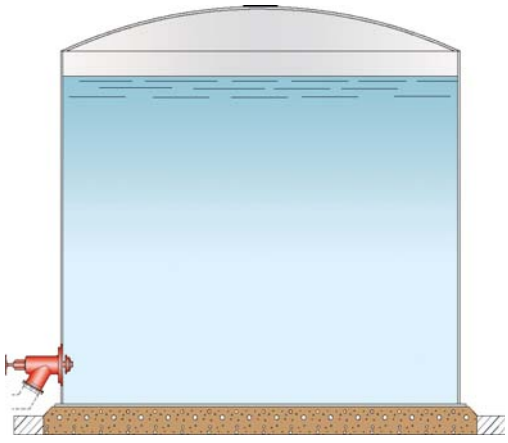
Stored medium

Tank height (m or ft)

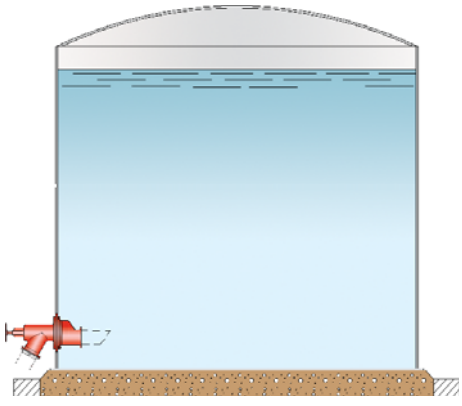
Tank material

Connection diameter of drain pipe, DN (mm or inch)

Application Examples



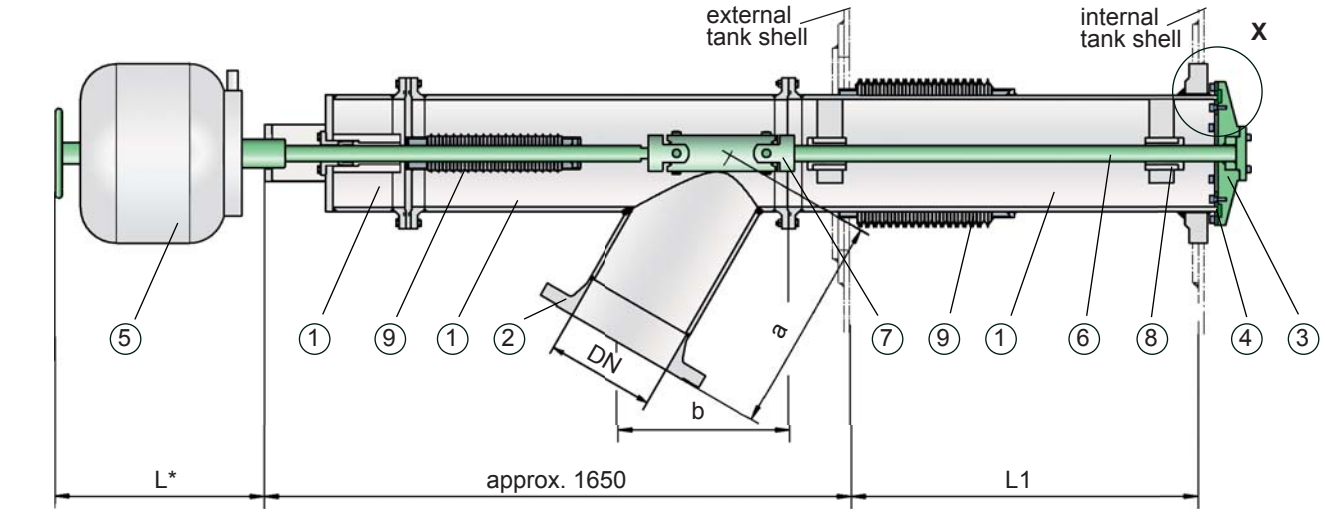
PROTEGO® SI/F



PROTEGO® SI/FA with internal connection nozzle

Internal Safety Valve

PROTEGO® SI/DP



*depends on actuator

Function and Description

PROTEGO® SI/DP internal safety valves are used as additional shut-off valves for double-shell tanks, e.g. for storing liquefied gasas, cryogenic gases, other low temperature products or chemicals.

Generally a gate valve that is supplied by the user and serves for normal operation is connected to the external nozzle of the housing. The internal safety valve is kept open under normal operating conditions. It is only closed for longer shut-downs, in case of emergency or for necessary repairs to the gate valve.

The key feature of these valve devices is the actual shut-off element that is located inside the tank. The advantage of this valve design is that it prevents any leakage from the tank in the event of any external parts of the assembly getting damaged. It also means that maintenance work can be carried out on the actuator without any need to dismantle the pipeline or empty the tank. We recommend to use bottom drain valve PROTEGO® NB/AP for emptying the tank completely.

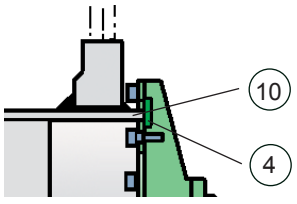
The internal safety valve mainly consists of three housing parts (1) with lateral connecting nozzle (2) for installation of pipeline, valve cone (3) with sealing (4) and pneumatic actuator (5). Required tightness (refer to detail X) is guaranteed by grounded valve seat (10) and gasket. Bushings (8) guide the split valve spindle (6), which is equipped with double Cardan joint (7). Two compensators (9) are provided to support the length modification resulting from temperature variations.

The internal safety valve is operated / opened by a simple pneumatic actuator. The necessary force for closing the valve is generated by compression springs of adequate size built into the actuator. This closing force is assisted further by the column of liquid in the tank, which presses onto the valve cone. The controls are designed in such a way that in the event of any fault, e.g. loss of control media (compressed air for the actuator and/or electrical power for the 3-way solenoid valve), the internal safety valve automatically closes tight.

By attaching an additional component the internal safety valve can also be operated, e.g. opened and closed, via a hand wheel. This attachment needs to be removed for the valve to operate automatically.

Type SI/DP by PROTEGO® is available in a range of nominal sizes. Optionally, the internal safety valve can be equipped with an internal nozzle to connect to a suction and filling pipe or a swing pipe system.

Detail **X**



Designs and Specifications

Table 1: Dimensions		Dimensions in mm / inches
DN	a	b
150 / 6"	300 / 11.81	350 / 13.78
200 / 8"	400 / 15.75	400 / 15.75
250 / 10"	500 / 19.68	450 / 17.72
300 / 12"	600 / 23.62	500 / 19.68

Table 2: Materialselection	
Design	A
Housing	Stainless Steel
Valve disc	Stainless Steel
Valve spindle	Stainless Steel
Spindle sealing	PTFE
Bushing	PTFE
O-rings	PTFE

Table 3: Flange connection type	
EN 1092-1, Form B1 or DIN 2501, Form C, PN 16; from DN 200 PN 10	EN or DIN
ANSI 150 lbs RFSF	ANSI

other types upon request

Selection and Design

Together with the customer our engineers design and specify the valve for each specific application. The relevant plant specifications are taken into account when defining the required nominal sizes and connection types. Also the operating temperature and resulting special operating conditions may require special materials. The mounting flange material must be compatible with the tank material. If there are special requirements for the valve or operating parameters please contact us: If necessary we will arrange for special designs.

Necessary Data for Specification

Stored medium

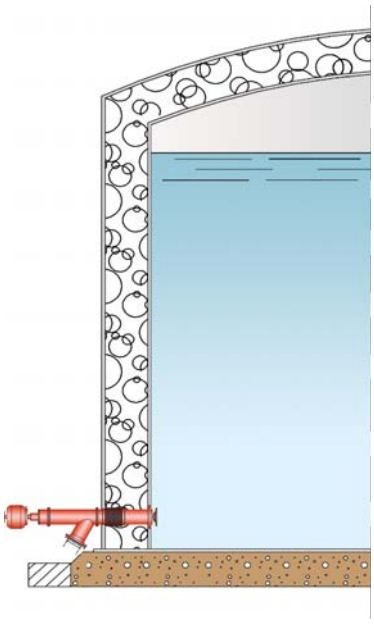
Tank height/Tank diameter (m or ft)

Jacket space L1

Tank material

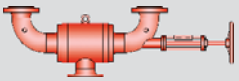
Connection diameter of drain pipe, DN (mm or inch)

Application Example

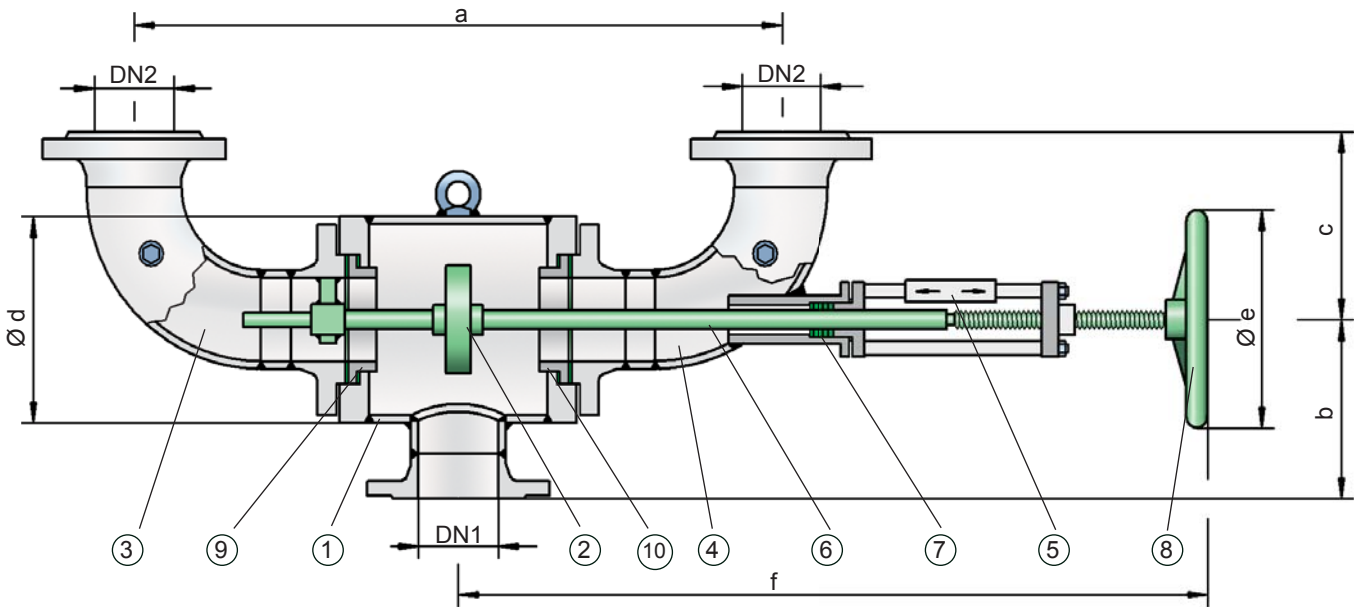


Internal safety valve PROTEGO® SI/DP for a double-shell tank.

Change-Over Valve



PROTEGO® WV/T



Function and Description

PROTEGO® change-over valves type WV/T are mainly used together with other valves or safety devices (e.g. PROTEGO® flame arresters) on cryogenic storage tanks and on tanks in process plants of chemical, petrochemical and pharmaceutical industries. They increase the operating safety of the technical equipment to be protected because each valve or safety device can be checked, maintained or repaired without any service break-down.

The valves mainly consist of housing (1) with flange connections DN 1 and two lateral connection elbows (3, 4) with flange connections DN 2 and the valve disc (2). If necessary it is possible to displace and turn the connection elbows. The valve seats (9, 10) are replaceable. The valve disc with metallic sealing surface is movable on the valve spindle (6). This ensures good adjustment to the valve seats even with high temperature differences. The sealing between valve disc and valve spindle is provided by an O-ring. The valve spindle is guided by bearing bushings; to the outside it is sealed by an adjustable packing (7).

The change-over valve allows the operator to block one valve or safety device at a time by operating the hand wheel (8). In normal operation the valve disc is in central position and the gas/liquid flows through the two connection elbows. By turning the hand wheel to the stop, one of the connection elbows (3 or 4) is blocked while the other one remains open. The actual position of the valve disc can be identified from the position indicator (5) displayed on the valve spindle.

Due to their design and appropriately selected materials the valves are distinguished by their high functional safety and very good flow rates. All elements that affect the function are made out of stainless steel.

Because of the variable nozzle positions the design of the PROTEGO® change-over valves WV/T facilitates connection of valves or other safety devices both with angle or straight through connection without additional adaptors.

Positions of nozzles

I. 

II. 

III. 

drag coefficient ζ = 1,2 for valve in center position
ζ = 2,6 if one side of valve closed

Change-over valves of type WV/T stand out by their simple design, easy handling, the option of quick replacement of components that effect the function and consequently by their excellent availability and operational reliability. The lapped metallic sealing surfaces ensure a high degree of tightness even in low temperature ranges.

These valves are not flame transmission proof and do not refer to the European Explosion Protection Directive 94/9/EC, even if installed in explosive atmospheres.

A hazard analysis (which considers the material selection and function of the device) shows that the device doesn't have any potential sources of ignition.

Design Types and Specifications

Special devices in heatable design can be used under specific operating conditions:

- with crystallizing products or products which tend to form deposits that affect the function
- in use under extreme weather conditions in winter (frost), when product vapour might condensate in the undercooled valve, so ice bridges could develop, which could probly block the valve disc

Table 1: Dimensions — Dimensions in mm / inches

DN1	80 / 3"	100 / 4"	150 / 6"	200 / 8"	200 / 8"	250 / 10"
DN2	80 / 3"	100 / 4"	150 / 6"	150 / 6"	200 / 8"	250 / 10"
a	780 / 30.71	780 / 30.71	960 / 37.80	960 / 37.80	1130 / 46.12	1450 / 57.09
b	250 / 9.84	250 / 9.84	310 / 12.20	310 / 12.20	330 / 13.47	360 / 14.17
c *	303 / 11.93	205 / 8.07	285 / 11.22	285 / 11.22	367 / 14.98	450 / 17.72
d	273 / 10.75	273 / 10.75	324 / 12.76	324 / 12.76	355 / 14.49	457 / 17.99
e	250 / 9.84	250 / 9.84	250 / 9.84	250 / 9.84	400 / 16.33	400 / 15.75
f	905 / 35.63	905 / 35.63	1070 / 42.13	1070 / 42.13	1195 / 48.78	1515 / 59.65
f_{min}	810 / 31.89	810 / 31.89	950 / 37.40	950 / 37.40	1170 / 47.76	1360 / 53.54
f_{max}	995 / 39.17	995 / 39.17	1190 / 46.85	1190 / 46.85	1310 / 53.47	1695 / 66.73

* for connection flange DIN PN16 resp. from DN 200 DIN PN 10

Table 2: Material selection

Design	A	B
Housing and connection elbows	Steel	Stainless Steel
Valve disc	Hastelloy	Hastelloy
Packing	PTFE	PTFE
Spindle sealing	FPM	FPM
Handwheel	Steel	Steel

The connection flange material must be compatible to the material of the plant component. Special models of change-over valves are available for specific requirements.

Table 3: Flange connection type

EN 1092-1, Form B1 or DIN 2501, Form C, PN 16; from DN 200 PN 10	EN or DIN	other types upon request
ANSI 150 lbs RFSF	ANSI	

Selection and Design

Together with the customer our engineers design and specify the valve for the specific case. The relevant plant specification is taken into account when defining the required nominal sizes and connection types. In standard versions the maximum allowable service temperature is +200°C / 392°F under a maximum allowable operating pressure of 6 bar / 87 psi. The device must have sufficient corrosion resistance with regard to the media to be stored or transported. If necessary, designs in special stainless steel quality should be selected.

Necessary Data for Specification

Stored medium

Service temperature (°C or °F)

Operating pressure (bar or psi)

Tank material

Tank nozzle DN1 (mm or inches)

Tank nozzle DN2 (mm or inches)

Position of nozzle I, II or III

PROTEGO
for safety and environment