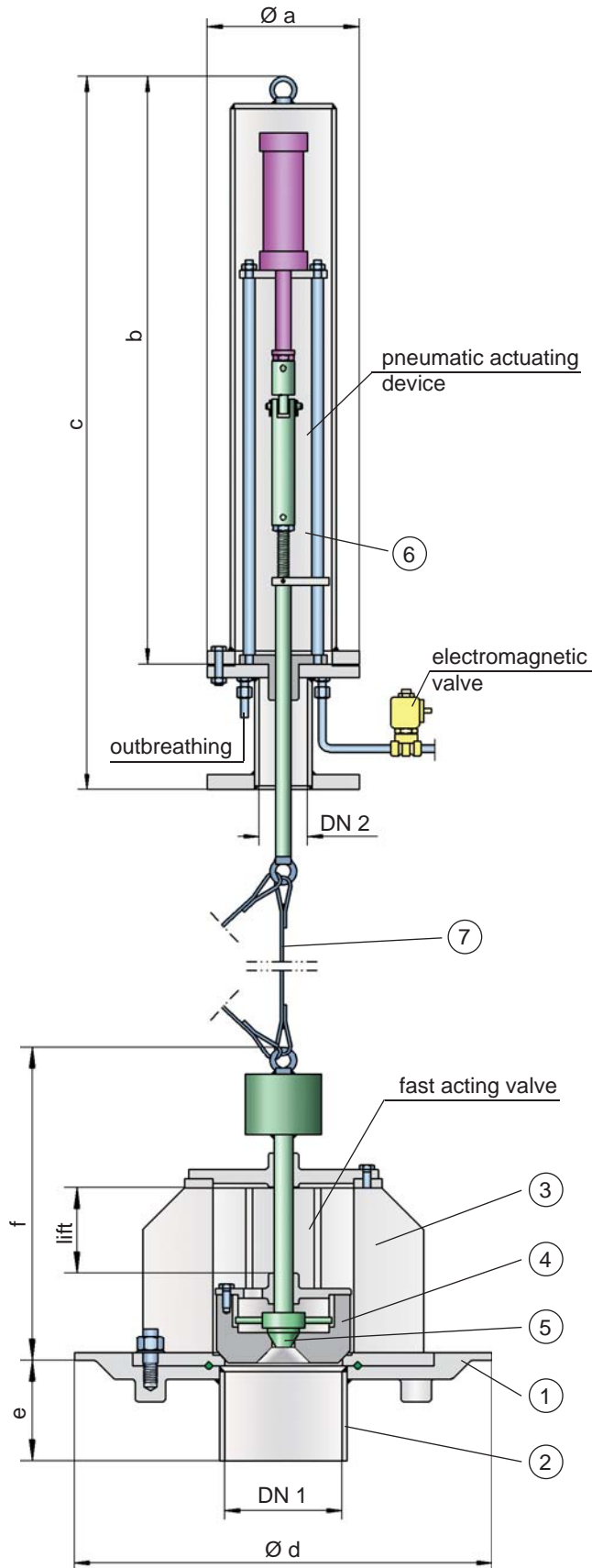




In-tank Valve with pneumatic actuator

PROTEGO® NB/AP



Function and Description

In-tank 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.

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

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
250 / 10"	80 / 3"	200 / 7.87	1130 / 44.49	1430 / 56.30	740 / 29.13	175 / 6.89	485 / 19.09	160 / 6.30

Table 2: Material of fast action bottom drain valve

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

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 in-tank 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.

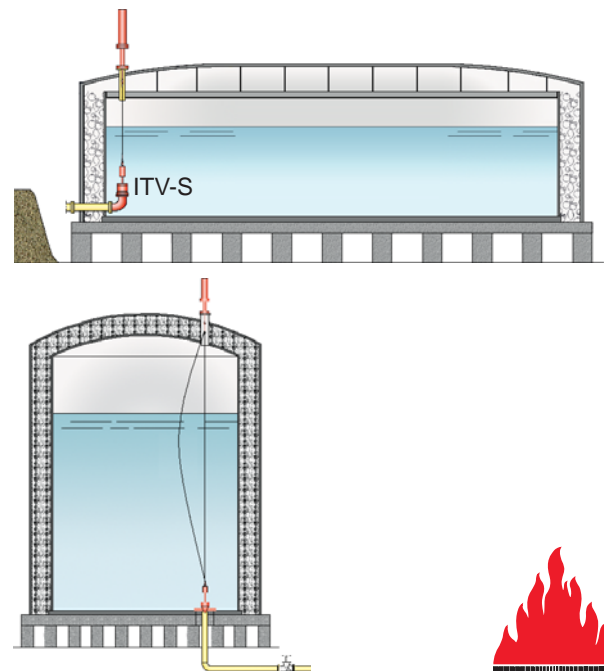
For special requirements the valve and the actuation system (e.g. with inductive position indicator) can be supplied with a special design.

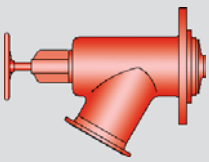
Deviations from our standard design will be sized and specified with the support of our engineers for the specific application.

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)

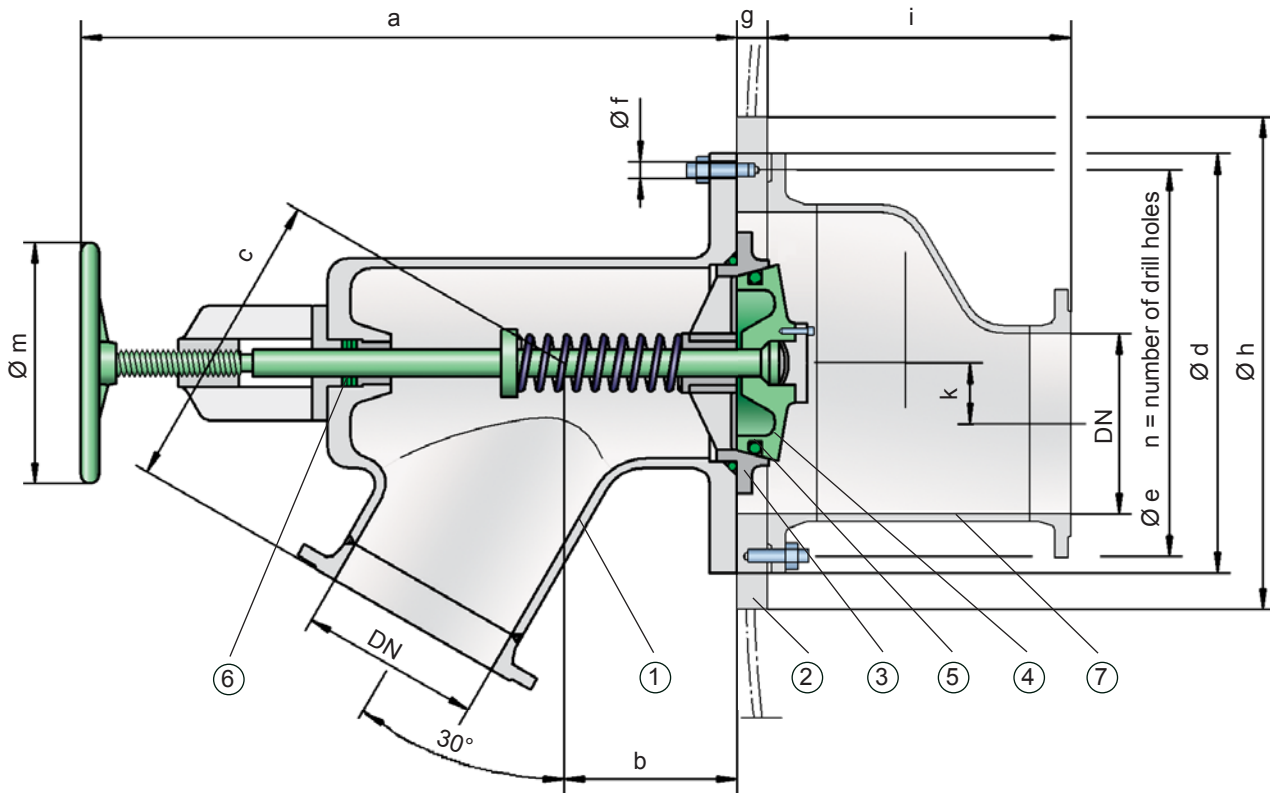
Application Example





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	Aluminium	Aluminium
Spindle sealing	PTFE	PTFE
Mounting flange	Steel	Stainless Steel

Table 3: Flange connection type DN

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

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

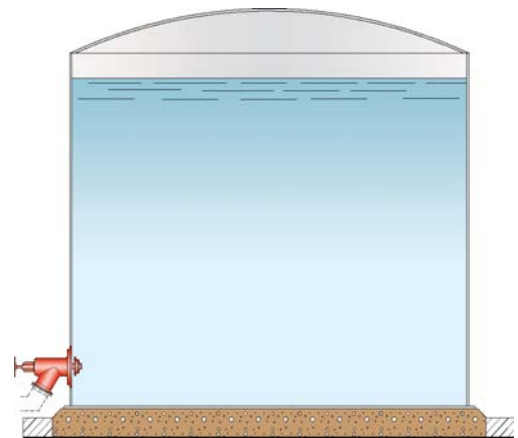
Stored medium

Tank height (m or ft)

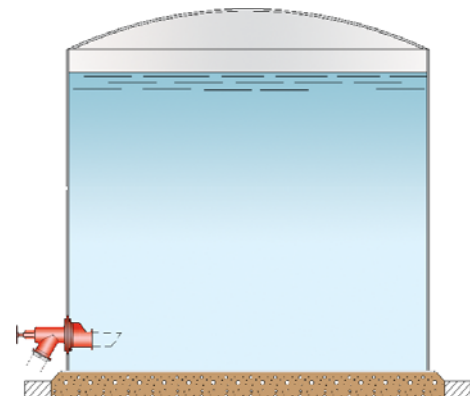
Tank material

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

Application Examples



PROTEGO® SI/F



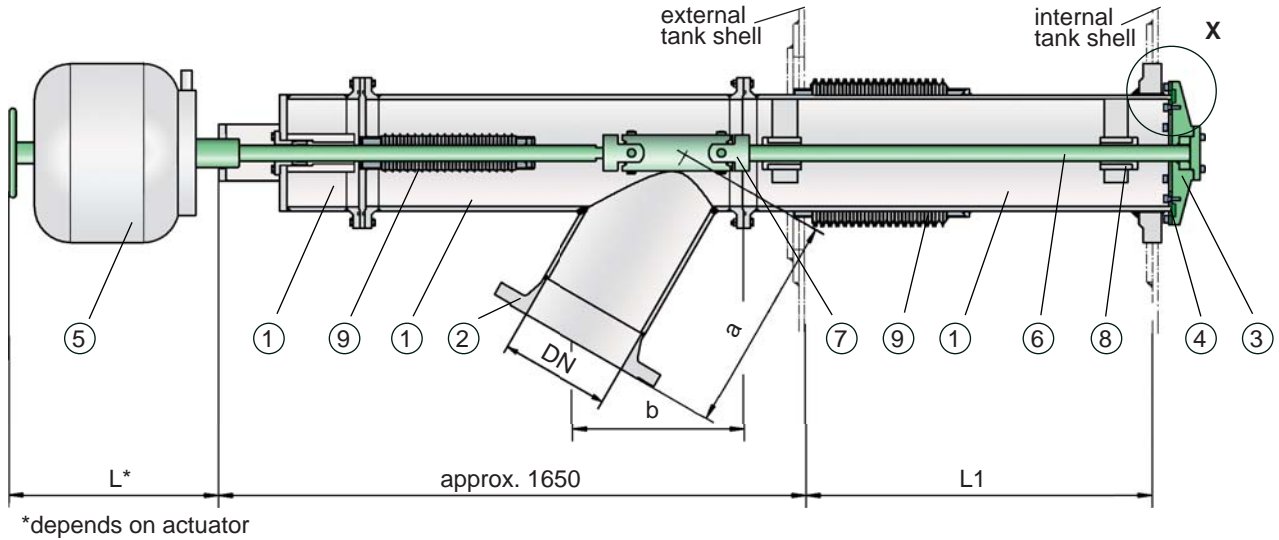
PROTEGO® SI/FA with internal connection nozzle



In-tank Valve

Internal Safety Valve

PROTEGO® SI/DP



*depends on actuator

Function and Description

PROTEGO® SI/DP in-tank valves are used as additional shut-off valves for full containment tank systems, e.g. for storing liquefied gases, 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 in-tank 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.

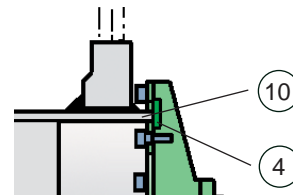
The internal safety valve mainly consists of three housing parts (1) with lateral connecting nozzle (2) for installation of pipeline, valve cone (3) with sealing (4) and pneumatic actuator (5). Required tightness (refer to detail X) is guaranteed by grounded valve seat (10) and gasket. Bushings (8) guide 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 in-tank 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 in-tank 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 DN	
EN 1092-1, Form B1	other types upon request
ASME B16.5; 150 lbs RFSF	

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

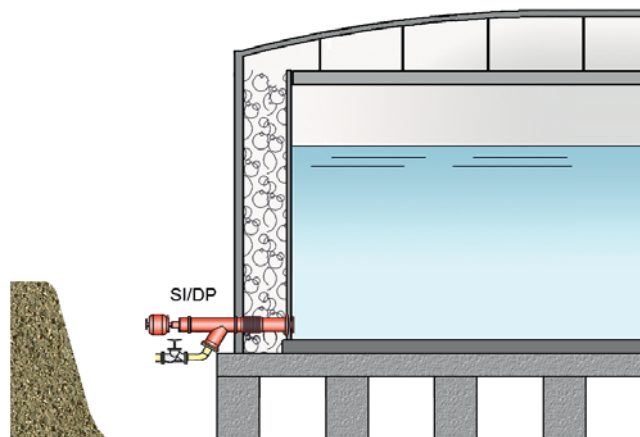
Tank height/Tank diameter (m or ft)

Jacket space L1

Tank material

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

Application Example

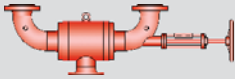


In-tank valve PROTEGO® SI/DP for a full containment tank system as per API 625.

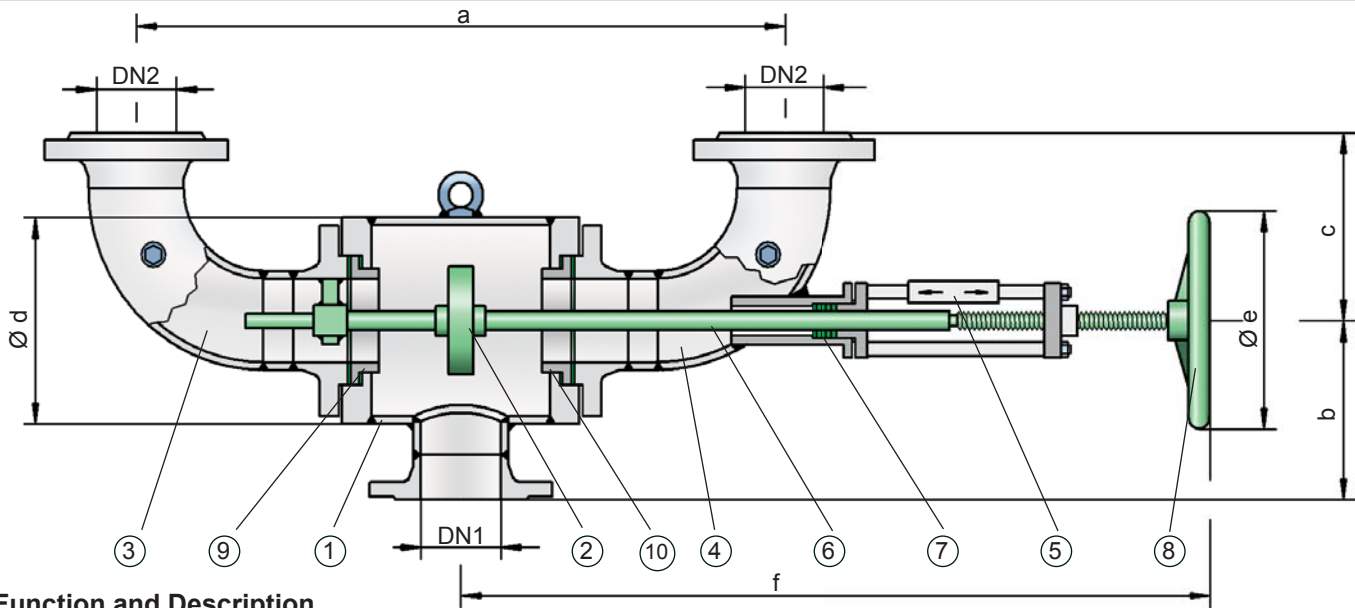


for safety and environment

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).

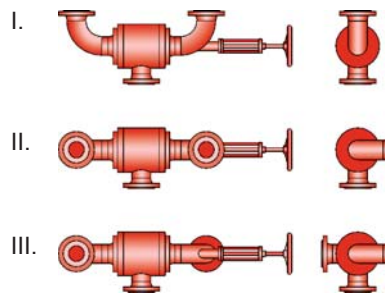
The change-over valve allows the operator to block one valve or safety device at a time by operating the hand wheel (8). In normal operation the valve disc is in central position and the gas/liquid flows through the two connection elbows. By turning the hand wheel to the stop, one of the connection elbows (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.

Depending on the requirements, the change-over valve in normal operation can be in mid-position or in end position: Mid-position, e.g. when a high capacity of relief is required through emergency relief valves controlled in parallel, or end position, e.g. in case of flame arresters which, controlled in parallel, can be used or cleaned alternately as necessary.

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



drag coefficient $\zeta = 1,2$ for valve in center position
 $\zeta = 2,6$ 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 probably block the valve disc

Table 1: Dimensions					Dimensions in mm / inches		
DN1	80 / 3"	100 / 4"	150 / 6"	200 / 8"	200 / 8"	250 / 10"	300 / 12"
DN2	80 / 3"	100 / 4"	150 / 6"	150 / 6"	200 / 8"	250 / 10"	300 / 12"
a	780 / 30.71	780 / 30.71	960 / 37.80	960 / 37.80	1130 / 46.12	1450 / 57.09	1650 / 64.96
b	250 / 9.84	250 / 9.84	310 / 12.20	310 / 12.20	330 / 13.47	360 / 14.17	415 / 16.34
c *	303 / 11.93	205 / 8.07	285 / 11.22	285 / 11.22	367 / 14.98	450 / 17.72	525 / 20.67
c**	323 / 12.72	230 / 9.06	317 / 12.48	317 / 12.48	407 / 16.02	483 / 19.01	571 / 22.48
d	273 / 10.75	273 / 10.75	324 / 12.76	324 / 12.76	355 / 14.49	457 / 17.99	500 / 19.68
e	250 / 9.84	250 / 9.84	250 / 9.84	250 / 9.84	400 / 16.33	400 / 15.75	500 / 19.68
f	905 / 35.63	905 / 35.63	1070 / 42.13	1070 / 42.13	1080 / 42.52	1515 / 59.65	1655 / 59.65
f _{min}	810 / 31.89	810 / 31.89	950 / 37.40	950 / 37.40	1170 / 47.76	1360 / 53.54	1470 / 57.87
f _{max}	995 / 39.17	995 / 39.17	1190 / 46.85	1190 / 46.85	1310 / 53.47	1695 / 66.73	2015 / 79.33

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

** for connection flange ANSI 150 lbs

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

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

