

Engineering
GREAT Solutions



Safety Valves for Process Industries

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Safety Valves Introduction

IMI Bopp & Reuther spring loaded safety valves can be found wherever pressure systems for steam, gases and liquids need to be reliably protected. Customers from every area of the process industry benefit from our experience and process expertise:

We develop both individual solutions and standard products for

- > Chemical industry
- > Petrochemicals
- > Power generation and supply
- > Process steam systems
- > Water supply systems
- > Refineries
- > Polymer applications

Our solutions for critical fluids and operating conditions help to optimise processes and protect people and plants. Our company has been a highly specialized partner of the process industry for decades; almost all the global players in this branch are among our customers.

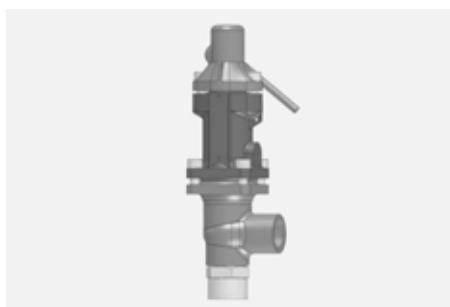
*Safety valves for
all sectors of the
process industry*



Safety valves overview

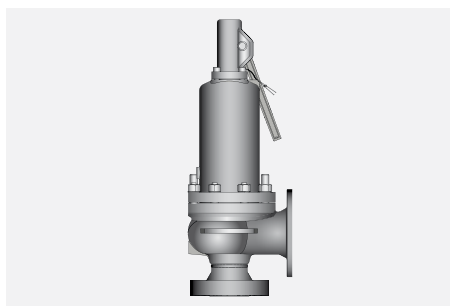
Safety valves have the function of preventing inadmissible overpressure in pipe systems, pressure vessels and boilers, in order to avoid danger to people, plant and the environment. They are set to a higher pressure than the operating pressure of the protected system. Safety valves ...

- ... open once the set pressure is reached.
- ... discharge the required mass flow in a controlled manner.
- ... close after the pressure has dropped.



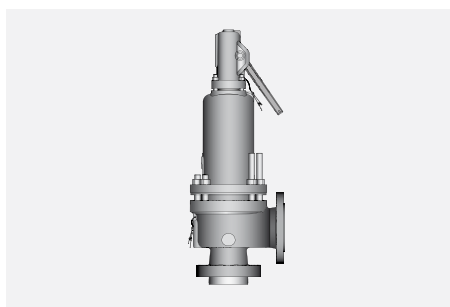
Regular flow safety valves for pressure relief in accordance to PED, DIN/EN and ASME

Safety valves for pressure systems with low mass flow or where the mass flow is of marginal importance, e.g. with thermal expansion, are grouped in the application category **Regular Flow**.



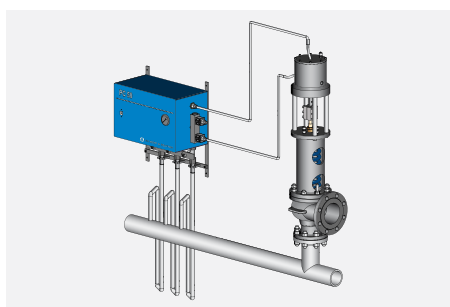
High flow process and steam safety valves to PED and DIN/EN standards

In the application category **High Flow**, the required capacity is usually the most important criteria for selecting a size. The size of the outlet is always larger than the inlet, in order to provide the space for supercritical relief of the fluid in the discharge area.



High flow safety relief valves according to API Standard 526, ASME Sec. I, Sec. III, Sec. VIII and PED

This category includes high performance process and steam safety valves certified to ASME Sec. I, Sec. III and Sec. VIII.



Special valves

This category includes **Controlled Safety Valves, Control Unit, Pressure Reducing Valves** and **Change Over Valves**.

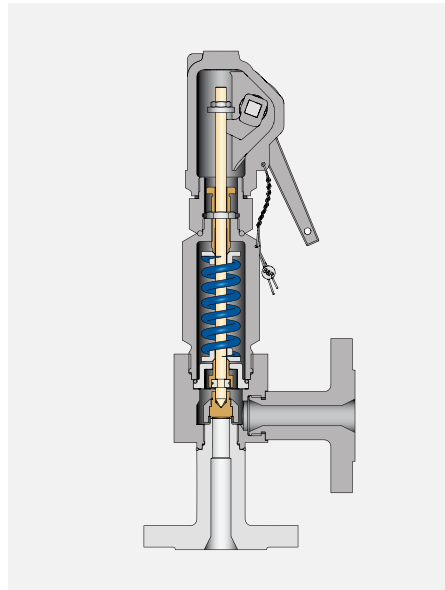
IMI Bopp & Reuther develops, designs, labels, manufactures and supplies safety valves in accordance with common approvals and standards, which can be found in the detailed product description.

Regular Flow

Flexible selection of optimal and cost-effective safety valves

The Regular Flow programme offers a great number of types and sizes, material designs and an extensive range of connections. Flange, weld-end, threaded and clamp-type connections can be selected to suit the pressure system. Special connections are easy to provide, if requested by the customer.

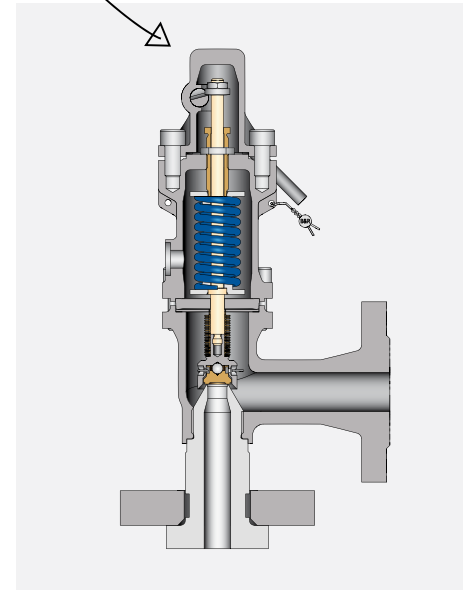
ASME VIII certified



Si 0

The main applications for this Compact Safety Valve is **high pressure** in the chemical industry.

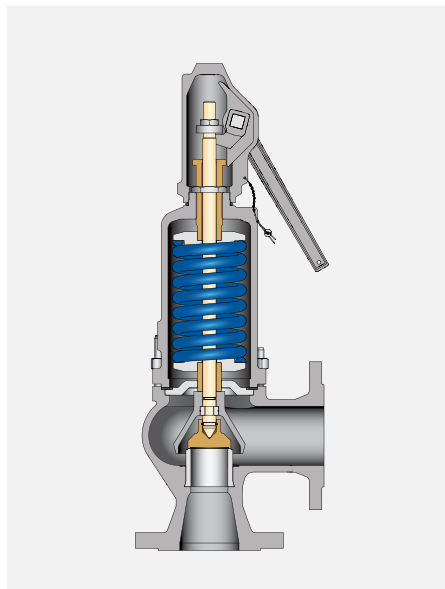
The **block body design in 1.4571** stainless steel provides an excellent chemical resistance.



Si C1

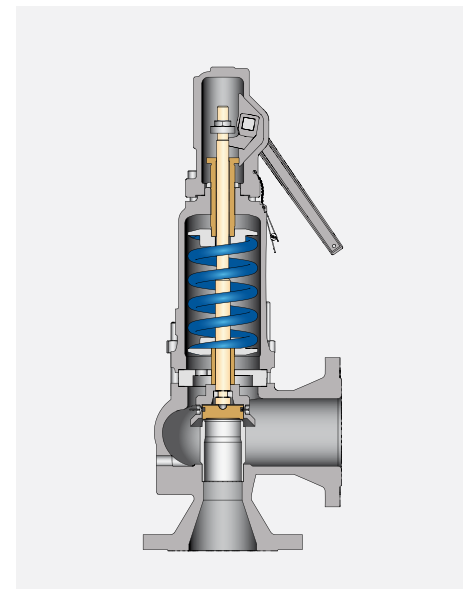
The Compact Safety Valve is installed in compressors and wherever medium must be relieved as effect of thermal exposure.

The valve is available with **EN and ASME flanges**.



Si 2x21 with seat bushing Si 2x23/24/25 with full nozzle

The **Low & High Pressure Valve** finds its operating conditions prevalently in water supply and for protection of system components at high pressure and feed water supply. Smooth and stable behaviour thanks to comparatively low lift.



Si 4x22

The state-of-the-art **Safety Valve for Liquids** has a cost-effective body design with seat bushing.

Stable function at low lift and built up back pressure up to 20% for conventional design enables use in many applications.

Si 0

The basic version of the Si 0 High Pressure Compact Safety Valve is delivered with male screwed inlet and female screwed outlet, gastight bonnet and cap.

Sizes	DN 15 to 25	NPS ½" to 1"
Set pressures	0.40 bar g up to 400 bar g	6.6 psig to 5800 psig
Materials	1.4571	stainless steel

Benefits and features

The compact spring-loaded safety valve is made of stainless steel (1.4571) for high chemical resistance. It is also available with bellows to balance back pressure and for high tightness to the outside, even at higher back pressures.

The safety valve has a variety of connections and is wear resistant with hard-faced seat.

The valve Si 0329 for pressure protection (vapours, gases and liquids) is used in the chemical and petrochemical industry, for industrial gases, cooling and oxygen applications, equipment engineering and chemical reactors, also suitable for mobile pressure vessels and for back pressures above 60 bar g.

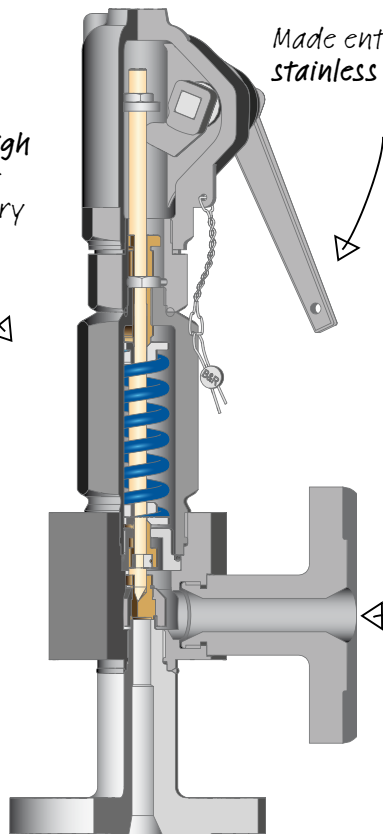
Si 0321 compact safety valve with flange connection



One of our smallest compact safety valves Si 0



Ideal for very high pressures in the chemical industry

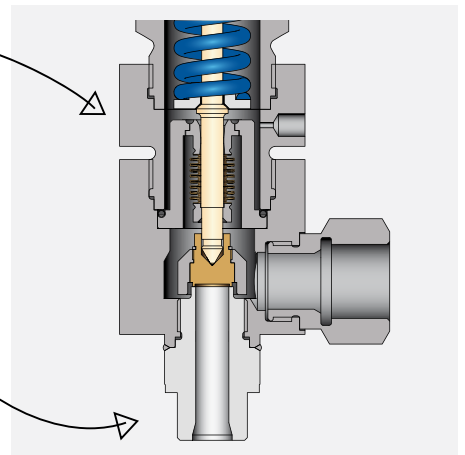


Made entirely of stainless steel

Bellows upon request

Also available with threaded connection

Suitable for high back pressures



Si 042, the designation "4" in the type code specifies bellows design.

Si C1 *ASME VIII certified*

The compact safety valve series is the ideal solution for protection against excess pressure in all industrial applications in the low-to-medium capacity range involving steam, gases and liquids. This universal compact safety valve is certified **according to PED and ASME VIII.**

Sizes	DN 15 to 25	NPS ½" to 1"
Set pressures	0.55 bar g up to 200 bar g	8 psig to 2900 psig
Materials	1.0619	WCB
	1.4408	CF8M

Benefits and features

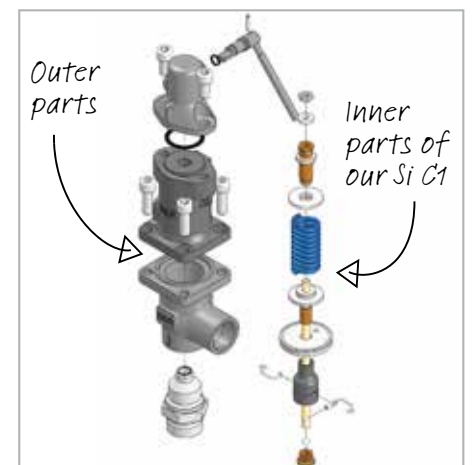
Si C1 valve is available with multiple options, which includes balanced bellows for body seat sizes 12.2 mm and 17 mm.

This series has an excellent return on investment and due to the simple design, it is available at very short notice, providing various types of connection. Thanks to a ball-bearing disc there is increased sealing performance.

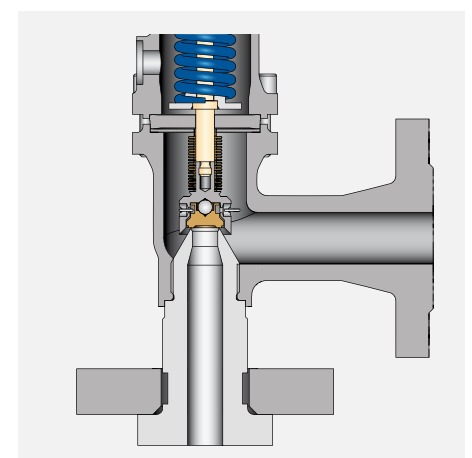
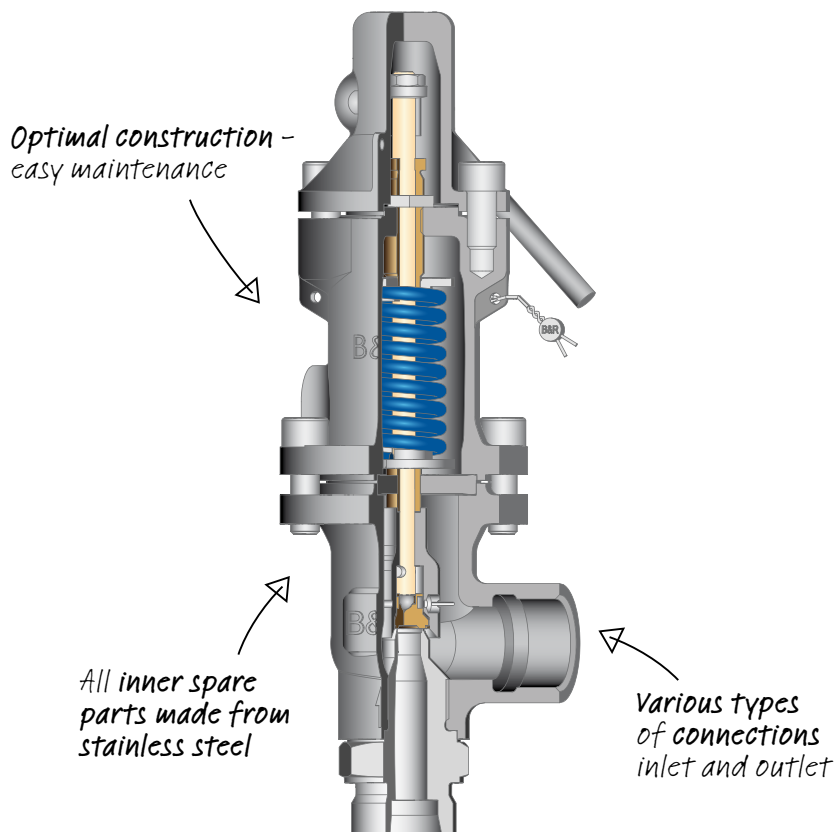
The compact design covers a broad range of applications: the major purpose is thermal expansion, protection of pipelines, chemical and petrochemical industry, technical gases, cooling and oxygen applications, OEM applications (e.g. pumps and compressors) and also for steam, gases or liquids.



Si C1329, the standard compact safety valve with threaded connection



Straight forward design for easy assembly



Sizes DN 20 and DN 25 (¾" and 1") with balanced bellows possible

Si 2x21 / Si 2x23/24/25

Si 2x21 is a low cost regular Safety Valve especially built for low pressure. Built for high pressure the Si 2x23/24/25 is full nozzle design with a solid inlet nozzle.

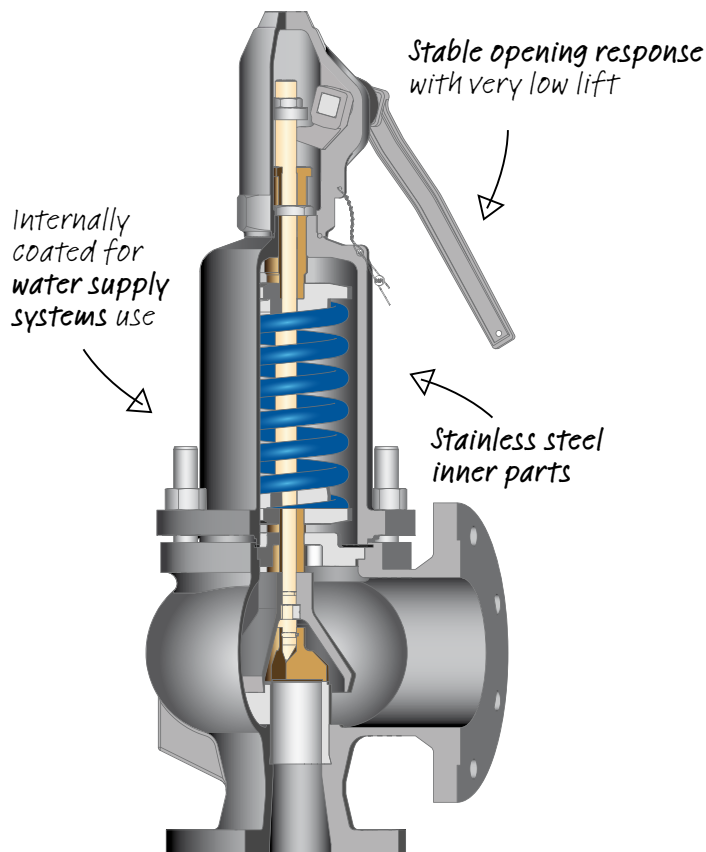
	Si 2x21	Si 2x23/24/25
Sizes	DN 20 to 150	DN 15 to 50
Set pressures	0.45 bar g to 16 bar g	0.45 bar g to 400 bar g
Materials	0.6025 / GG 25	1.0619
		1.4408

Benefits and features

There functional behaviour smooth and stable.

Easy maintenance because of special design features, e.g. one part spindle. Dismantling of the valve for lapping of seat and disc without change of set-pressure is possible.

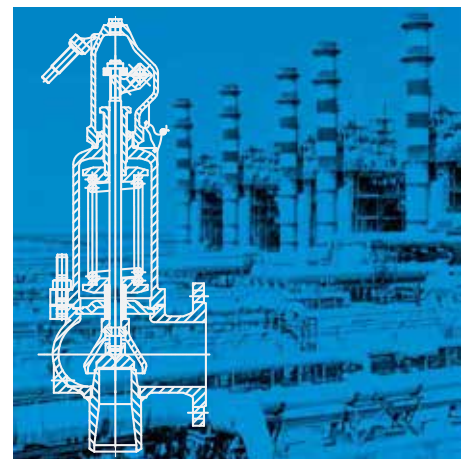
This product is used for the following applications: vapours, gases or liquids; protection of systems downstream of control valves, water supply up to PN 16 and Si 2x23/24/25 up to PN 400. Internally luberpox coated the Si 2x21 is suitable for drinking water service.



Si 2321, our cast iron safety valve for basic applications



Spare parts for all safety valves upon request and supported for many years.



High pressure safety valve Si 2323 for cooling water circle in power plant.

Si 4x22

The modern Safety Valve for all regular capacity applications in all process industries sectors

Sizes	DN 25 to 100	NPS 1" to 4"
Set pressures	0.1 bar g up to 40 bar g	1.5 psig to 600 psig
Materials	1.0619	WCB
	1.4408	CF8M

Benefits and features

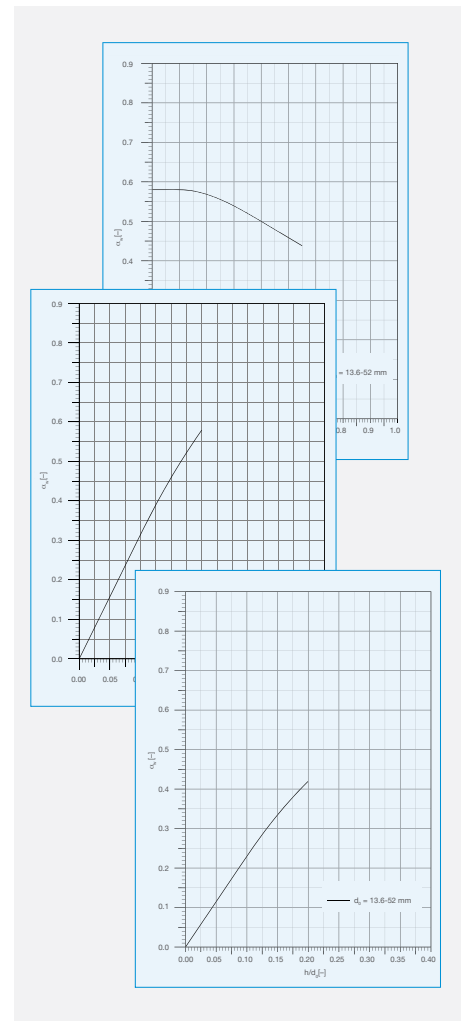
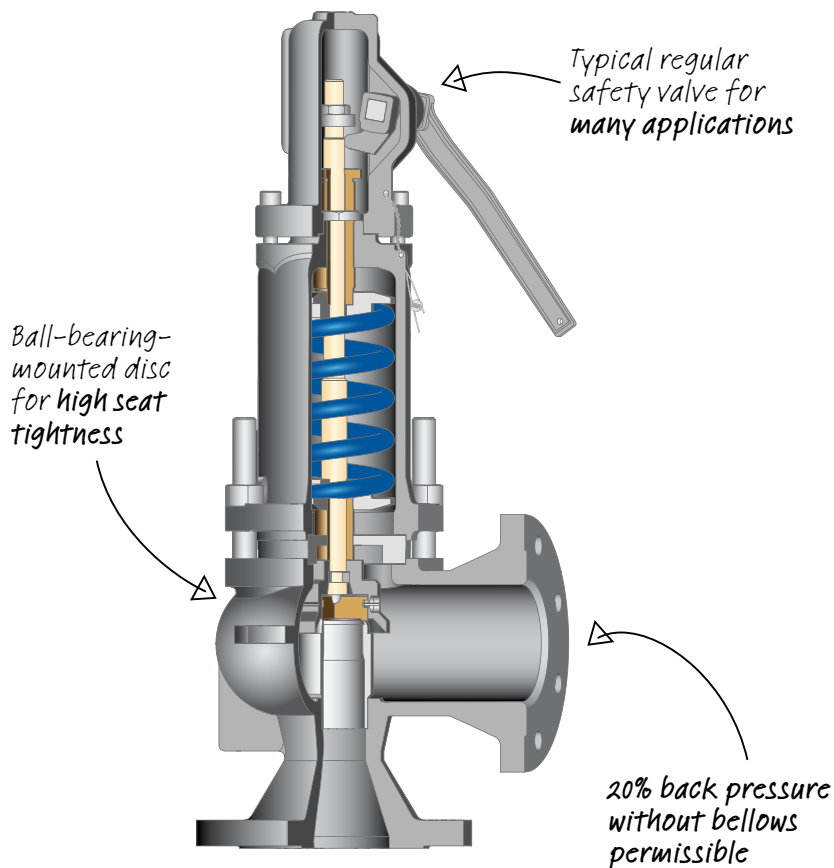
This valve series has a cost-effective body design with seat bushing developed with the modular principle with other series and a smooth and stable behavior thanks to comparatively low lift.

The inner parts are made of stainless steel.

For applications in thermal expansion, protection of pipelines, protection of heat exchangers, chemical industry, petrochemicals, industrial gases, cooling and oxygen applications and for other process applications up to PN 40.



Si 4322, our standard process safety valve for regular capacities



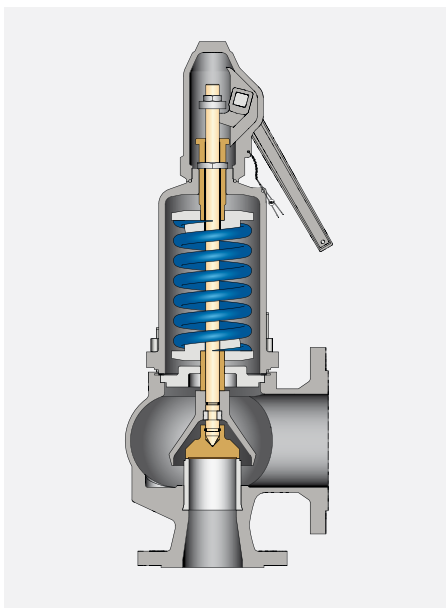
Si 4322 certified by EC type examination.

High Flow Safety Valves according to PED, DIN/EN

The required capacity is usually the most important criteria for selecting a size in this category. With reference to the inlet size, high flow valves can discharge the highest capacity and in particular on gas/vapour service open rapidly for instant pressure relief.

The size of the outlet is always larger than that of the inlet, in order to provide the fluid room for supercritical relief in the discharge.

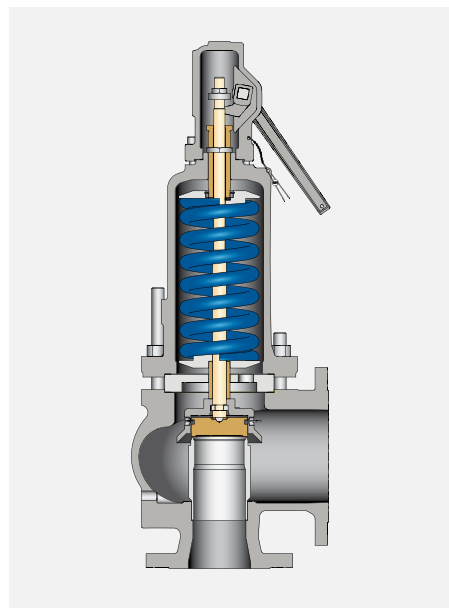
The variety of pressure ratings, temperature classes and sizes provides a flexible choice for all industrial requirements.



Si 6x01

The **Low Pressure Safety Valve for Steam Applications** has a cast iron body with stainless steel inner parts (except for spring and spring washer).

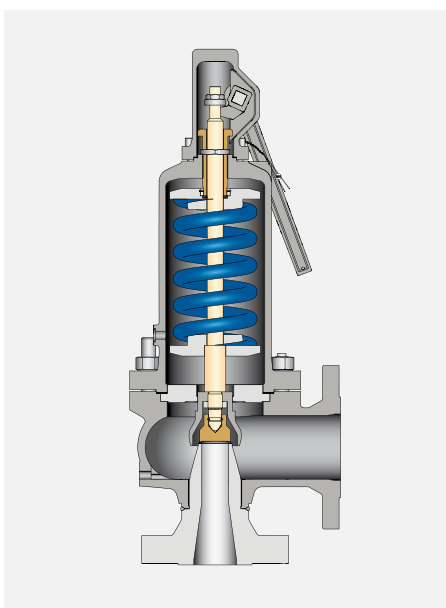
It is cost-efficient due to its semi-nozzle design.



Si 4x02

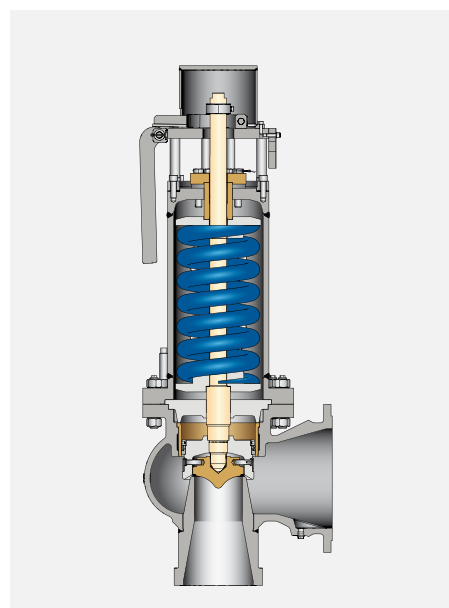
The state-of-the-art **High Capacity Process Safety Valve for medium pressure** has a cost-effective semi nozzle body design with seat bushing.

It is developed in modular design with other series and offers a reliable function with ideal capacity.



Si 6x03-05

The proven quality **high-pressure safety valve** has a reliable design with solid inlet nozzle, screwed in and welded. It offers various sizes and options and is available in material designs for high as well as low temperatures.



Si 6106

The **High Pressure Steam Safety valve** with materials suitable for high temperature application.

The product is ideal for combination with the pneumatic actuator AK and PC 50/53 control unit for "controlling" the discharge process.

Si 6x01

This low pressure safety valve is often used in steam applications and protection of heat generation units. It has a cast iron body with stainless steel inner parts (except for spring and spring washer).

Sizes	DN 20 to 150
Set pressures	up to 16 bar g
Materials	0.6025 / GG 25

Benefits and features

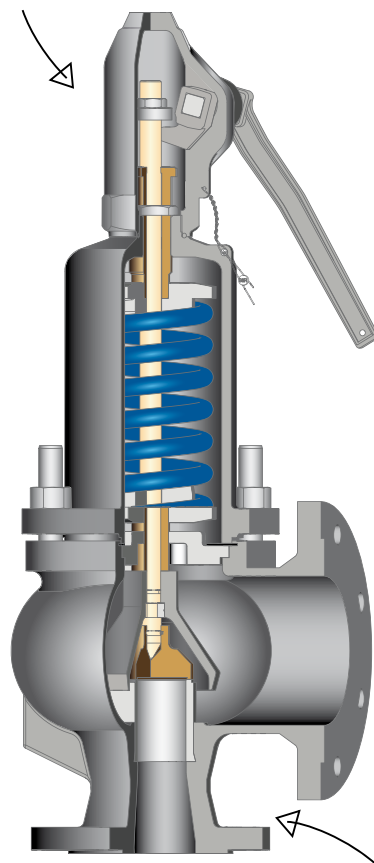
The semi nozzle body design makes the valve cost-effective. It is suitable for vapours, gases and liquids.

With limited options and variations the Si 6x01 is standardized for ease of use also for non-industrial sectors.



Si 6301, standard version of our cost-efficient low pressure valve

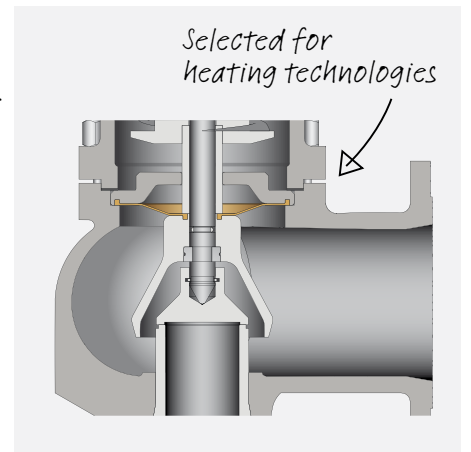
Basic valve for low pressure



Economic for heating systems and water use

Options upon request

Selected for heating technologies



The special design with diaphragm seal (option .58) serves to tightly seal the spring chamber and guides

Spare parts: spring, discs, disc holders



Spare parts for all safety valves upon request and always on call

Si 4x02

The state-of-the-art High Capacity Process Safety Valve for medium pressure has a cost-effective semi nozzle body design with seat bushing.

Sizes	DN 20 to 200	NPS 1" to 8"
Set pressures	0.1 bar g up to 40 bar g	1.5 psig to 600 psig
Materials	1.0619	WCB
	1.4408	CF8M

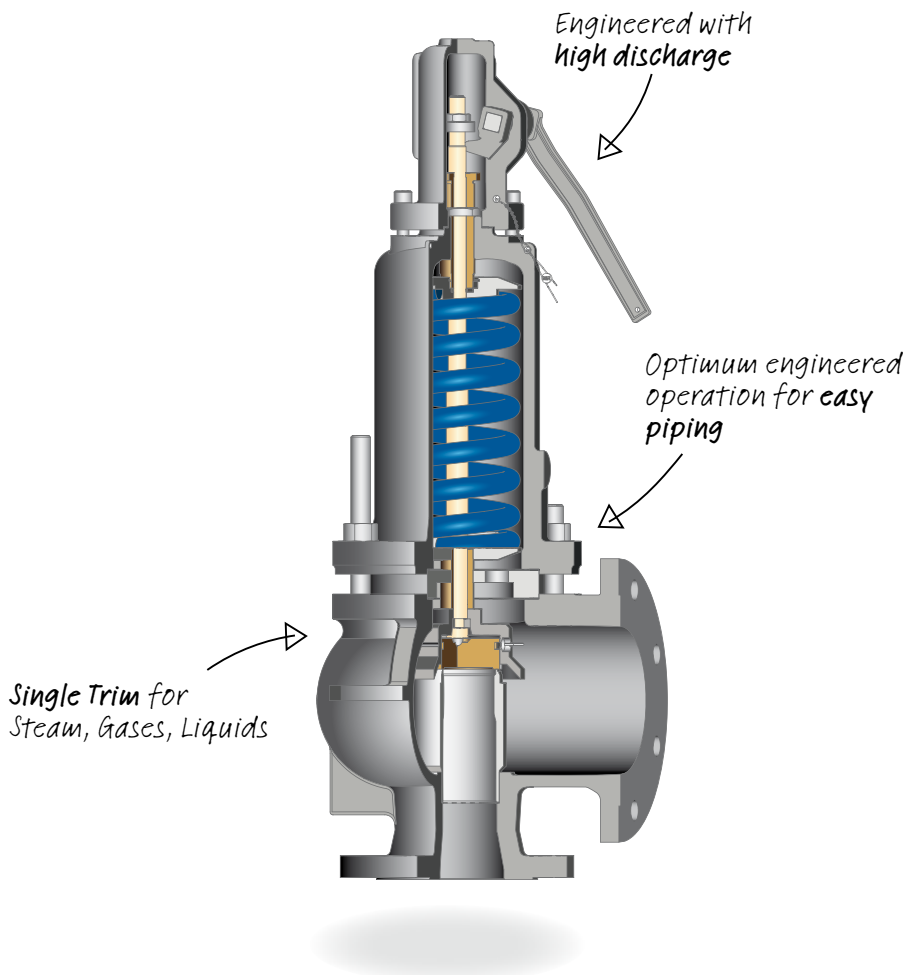
Benefits and features

Developed as a modular design with other series, it provides a reliable function with ideal capacity.

The inner parts are made of stainless steel (except for spring and spring washer).

Easy maintenance because of dismantling of the valve for lapping of seat and disc without change of set-pressure is possible and the bellows is in a safe location because it is outside the flowpath for ensuring extended lifetime.

For vapours, gases and liquids, typical applications are protection of pressure vessels, heat exchangers, system components. Suitable for all industrial applications such as chemical and petrochemical industry, technical gases, cooling and oxygen applications, power generation and power supply and steam boilers up to PN 40.



Si 4302, state-of-the-art high capacity process safety valve for medium pressure



Si 4302 as cutaway model



IMI Bopp & Reuther new sizing software Si-Tech 4.0 - A worldclass tool for sizing and selection of safety valves.

Si 6x03 / Si 6x04 / Si 6x05

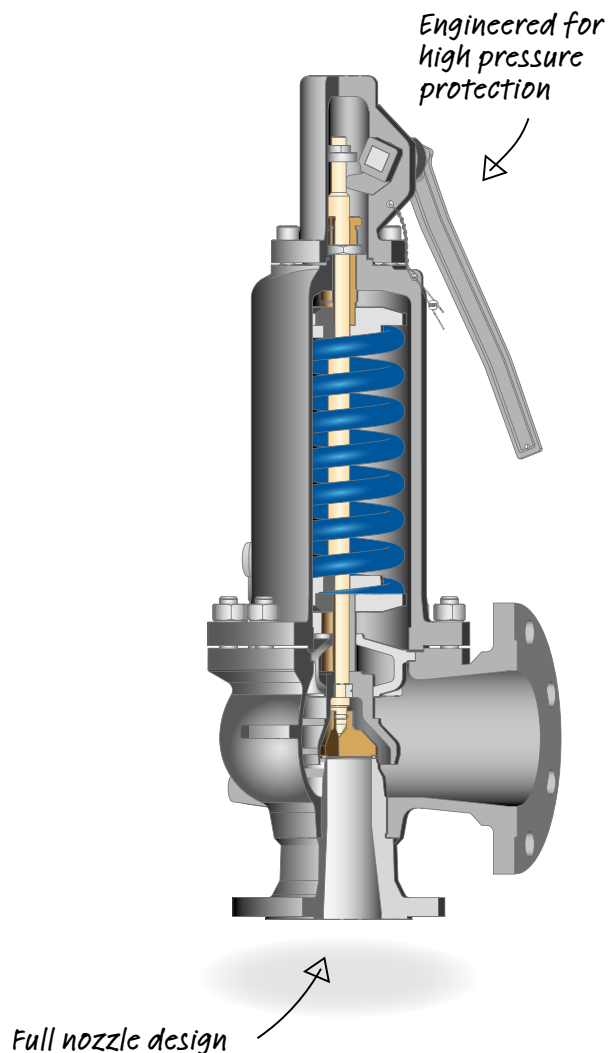
The proven IMI Bopp & Reuther high-pressure safety valve has a reliable high quality design with solid inlet nozzle, screwed in and welded, available with various sizes and options.

Si 6303/6304/6305	
Sizes	DN 25 to 400
Set pressures	up to 250 bar g
	1.0619
Materials	1.7357
	1.4408

Benefits and features

Different material designs are available for high as well as low temperatures.

For vapours, gases and liquids. Typical applications are the protection of system components, steam boiler, air separator, power plants and industrial steam generation. It is also used in high-pressure chemical processes and paper factories.



Si 6303 high-pressure safety valve also for low temperatures



Seal welds with the highest accuracy between nozzle and body



IMI Bopp & Reuther high-pressure safety valves type Si 63 installed

Si 6106

The High Pressure Steam Safety valve is designed to manage high forces.

Sizes	DN 80 to 300
Set pressures	15 bar g up to 200 bar g
Materials	1.0619 GS
	1.7357CrMo
	1.7359CrMo 9-10

Benefits and features

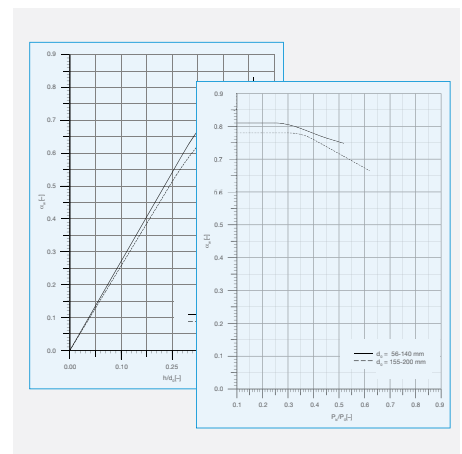
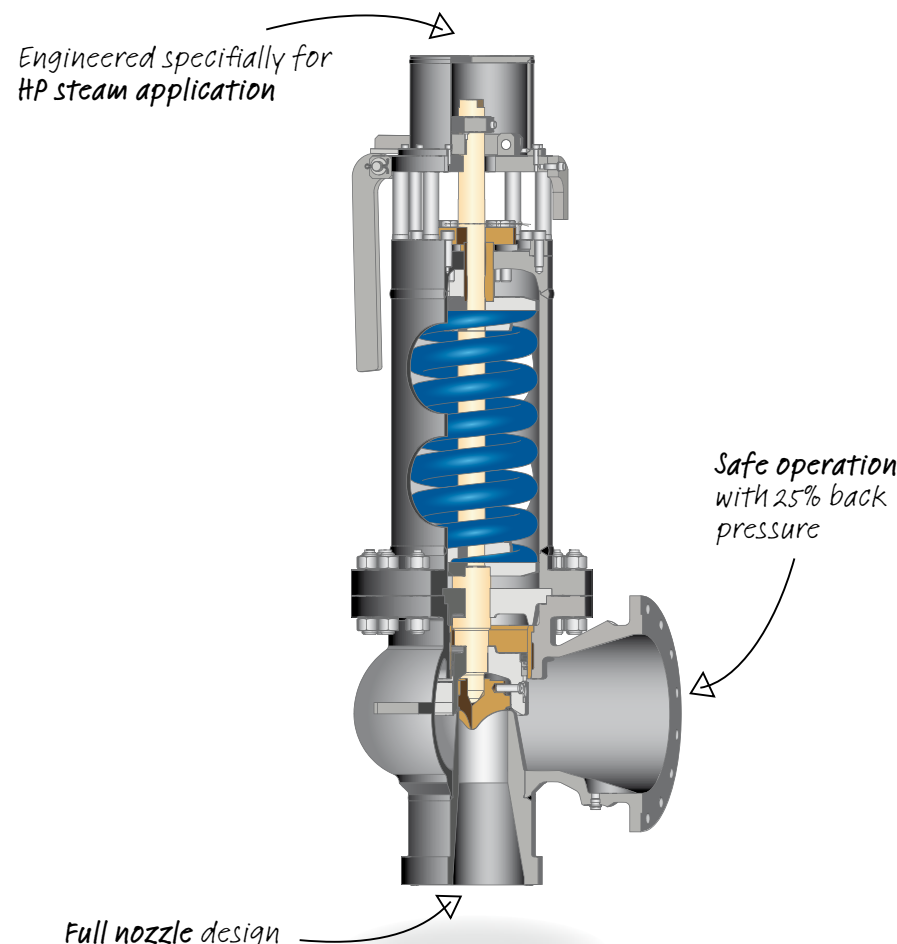
The benefits of this High Pressure Safety Valve is a solid inlet nozzle, screwed in and welded. The material design is for high temperatures with the option to select the material at the inlet in accordance with customer specifications.

It is ideal for combination with the pneumatic actuator AK and to be operated with the PC 50/53 control unit. This installation provides for “controlling” the discharge process. Open bonnet design with the resulting ventilation of the bonnet chamber permits a standard steel spring to be used in fluid temperatures up to 400°C.

Suitable for applications such as steam boilers, superheaters, power plants and industrial steam generators, for steam temperatures above 500 °C and large flow diameter with high pressures.



Si 6106, high pressure steam safety valve with piston AK.



Si 6106, coefficient of discharge α_w depending on h/d_0 and p_v/p_0 for gases and vapours



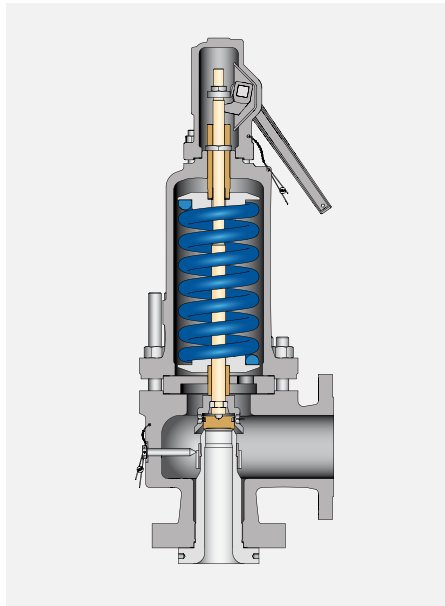
IMI Bopp & Reuther does possess the technology to perform high quality body seat repair.

Safety Valves according to ASME, API

This application category includes safety valves, which belong to global industry standards, e.g. API 526. The valves are manufactured in accordance with ASME Sec. I or VIII.

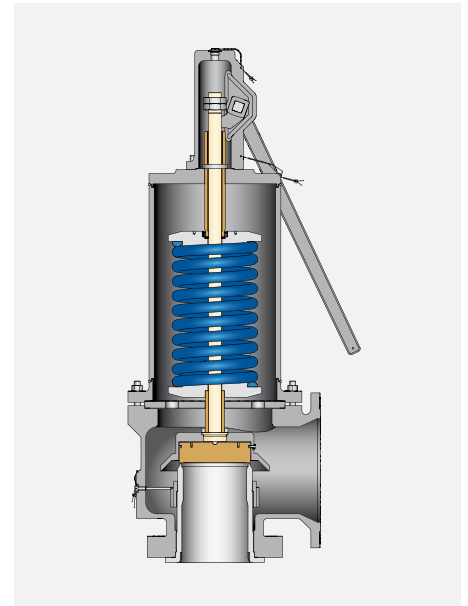
The applications for Si 8 type valves can be found in the chemical industry, petrochemicals, oil/gas – onshore and offshore, refineries, tank farms and closed systems.

Series Si 9 is built for high performance applications on fired vessels as per ASME Sec. I.



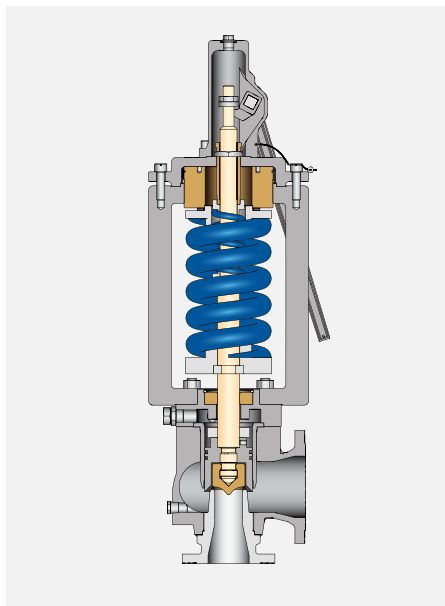
Si 8 D-T

The **API Safety Valve** is manufactured in accordance with API 526, ASME Code Sec. VIII. The National Board of Boiler (NB) and Pressure Vessel Inspectors certified capacities for air, steam and water.



Si 8 V, W

Exceeding the API 526 standard the additional orifices V and W meet very large capacity requirements.



Si 9

The **High Performance Steam Safety Valve Si 9** is designed according to ASME Sec. I requirements. A large scale of orifice sizes ensure optimum selection.

Si 8 Size D-T according to API 526

The Si 8 Safety Valve type fully meets the specification of API 526 and is manufactured in accordance with ASME Code Sec.VIII.

Sizes	NPS 1" to 8"	
Set pressures	up to 414 bar g	up to 6000 psig
Materials	1.0619	WCB
	1.7357	WC6
	1.4408	CF8M

Benefits and features

The Si 8 series is also approved by EC type examination and can be CE marked.

The one-trim design makes the valve suitable for gas, vapour and liquids.

The valve has a positive lift stop at full capacity. The disc bearing has been optimized for high seat tightness.

The nozzle ring is always set to lowest position because the valve is designed to operate at optimum without ring adjustment.

Maintenance is easy due to a one-part spindle, a simplified disc retention clip and the rugged guide design.

Suitable for applications in the chemical and petrochemical industries, closed systems, oil/gas – onshore and offshore, refineries and tank farms as well as nuclear facilities according to ASME Sec. III.

Upon request the fulfillment of NACE MR 0175 and NACE MR 0103 requirement is available.

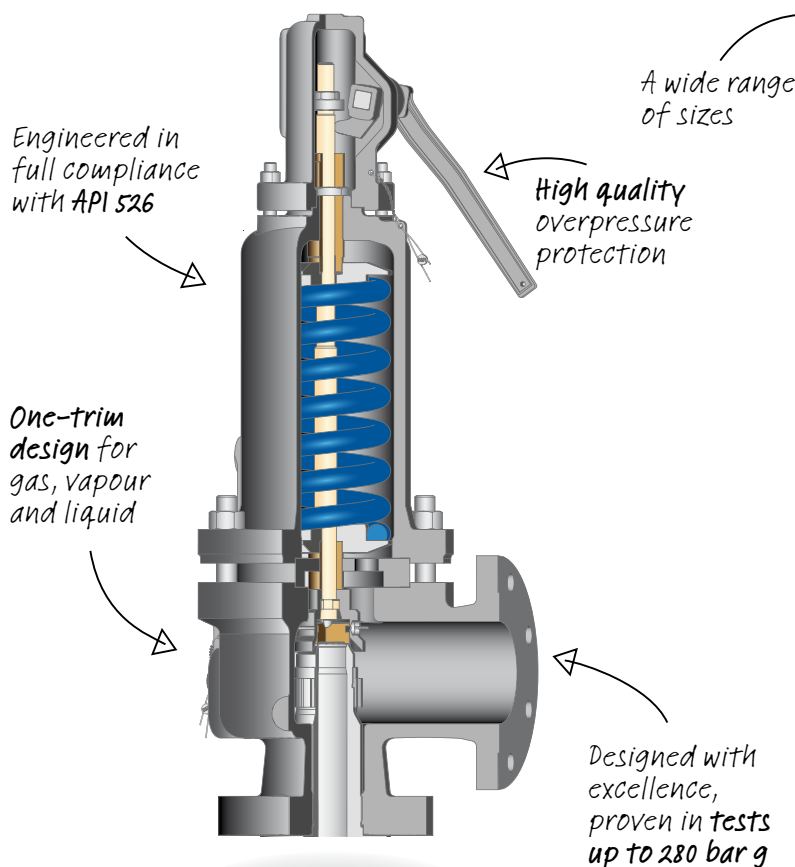
Ideal für die chemische und petrochemische Industrie



Si 8401, API safety valve with bellows



API valve group with different sizes individually adjusted to specification.



Explosion view of API valve shows inner and outer parts.

Si 8 Large Sizes V, W

The additional orifice sizes V and W allow for selection of one or smaller quantity of valves where the API 526 standard would require a multiple installation for large capacity. Based on the general API range **V, W orifices** are designed for high capacities.

Sizes	NPS 10" to 12"	
Set pressures	up to 20.7 bar g	up to 300 psig
Materials	1.0619	WCB
	1.7357	WC6
	1.4408	CF8M

Benefits and features

The additional orifice sizes V and W are made for very large flow applications.

These capacities are also certified by the National Board of Boiler and Pressure Vessel Inspectors.

Using similar design the orifice D-T - valve benefits also apply to sizes V and W.

Suitable for applications in the chemical and petrochemical industries, closed systems, oil/gas – onshore and offshore, refineries and tank farms as well as nuclear facilities according to ASME Sec. III.

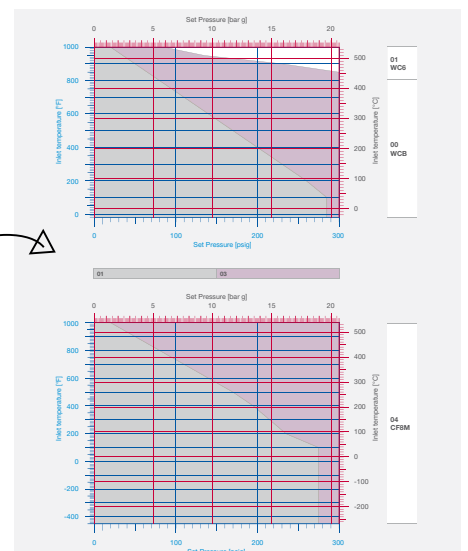
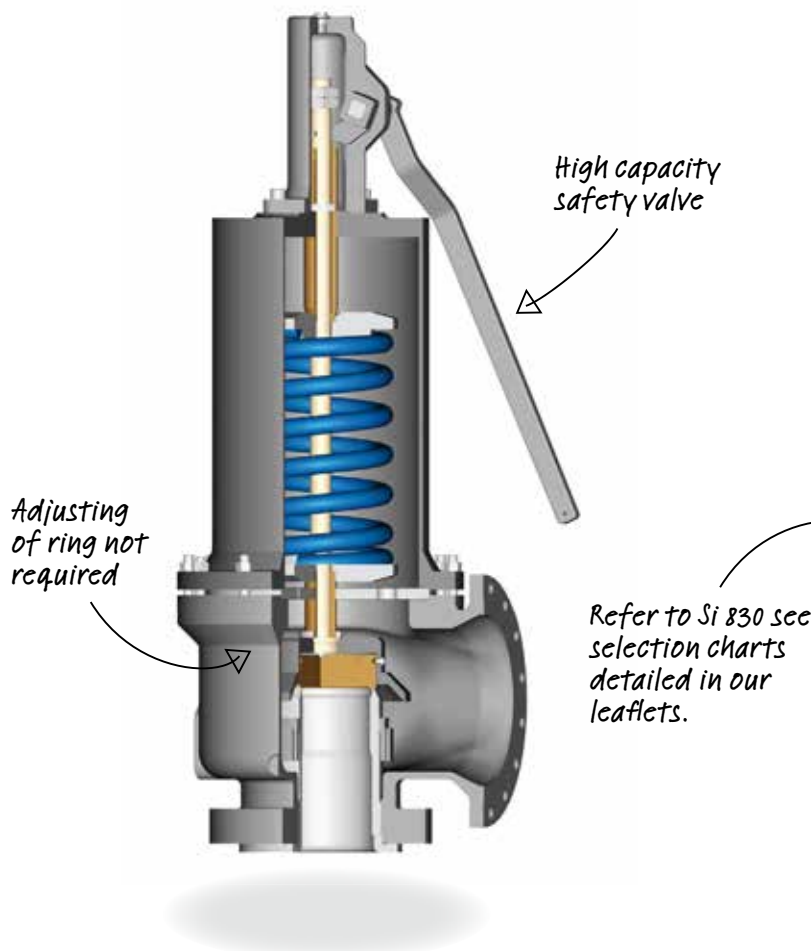
Bellows in safe location, outside the flowpath



Orifice W-safety valve for high capacity applications



Si 84 with balanced bellows



Selection chart for Orifice W, that shows the used material depending on temperature and set pressure.

Si 9

The high performance Steam Safety Valve Si 9 is designed according to ASME Sec.I in requirements. A large scale of orifice sizes ensures optimum selection.

Sizes	NPS 1½" to 12"	
Set pressures	3 bar g to 330 bar g	44 psig to 4.786 psig
Materials	WCB	
	WC9	
	C12A	

Benefits and features

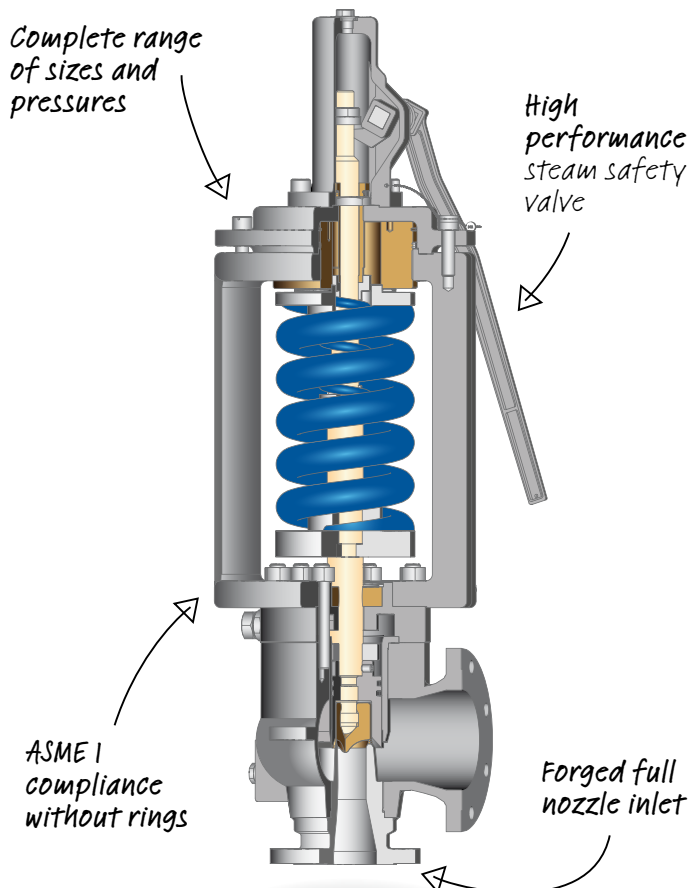
Fixed overpressure and blowdown according ASME Sec. I with no rings hence no requirement for adjustment.

It guarantees a stable position of the disc by mechanical lift stop at full lift. The optimized disc spindle connection offers high seat tightness.

The forged inlet nozzle is available with welding connection or flanged connection. Special disk spring design for high pressures and large orifice diameters is proven.

The Si 9 is full nozzle design and the inlet pressure contained by a forged solid part. The cast outlet body is charged by the relieved pressure only. The valve function is stable up to 25% built up to backpressure.

This product is used for the following applications: power plants and industrial steam generation; steam applications in the petrochemical industry; steam boilers; superheaters and process steam systems.



ASME safety valve Si 910x.83b with disc spring for high pressure steam application

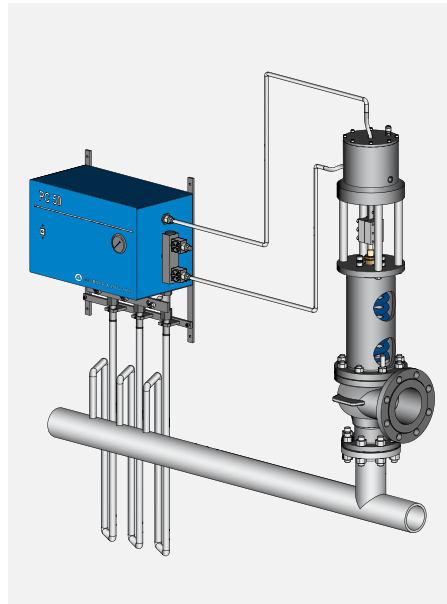


IMI Bopp & Reuther operates 2 steam test benches for hot setting of steam safety valves



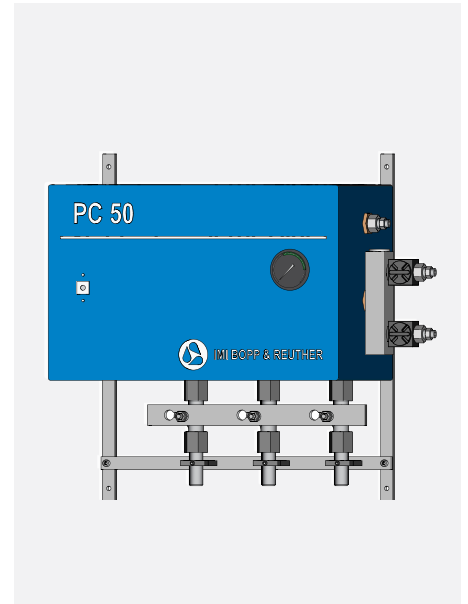
Special Valves

The category includes Controlled safety valves, Control Unit, Pressure Reducing valves and Change Over valves.



Controlled Safety Pressure Relief System (CSPRS)

The operation limits of spring loaded safety valves can be improved by use of pneumatic control.



Control Unit PC 50

The “Control Unit” PC 50 is designed for operation of pneumatic assisted safety valves.



Re 34

The “Pressure Reducing Valve” regulates automatically the downstream pressure in water supply installations. It is suitable for variable downstream consumption and large pressure differences.



Change Over Valves

“Change Over Valves” allows switching from one Safety Valve to another during continuous system operation in order to avoid process interruption or shutdown.

Controlled Safety Pressure Relief System (CSPRS)

This Controlled Safety Pressure Relief System is used primarily where standard spring-loaded safety valves cannot meet stringent operating conditions. In addition to the safety valve spring the controlled safety valve is equipped with an air pressure cylinder piston.

The control unit PC 50 operates in accordance with the closed circuit principle, i.e. the loading air discharges by reaching the engage pressure (usually set pressure).

5 piston sizes are available and combinable with all safety valves from **DN 25 to DN 400**.

Benefits and features

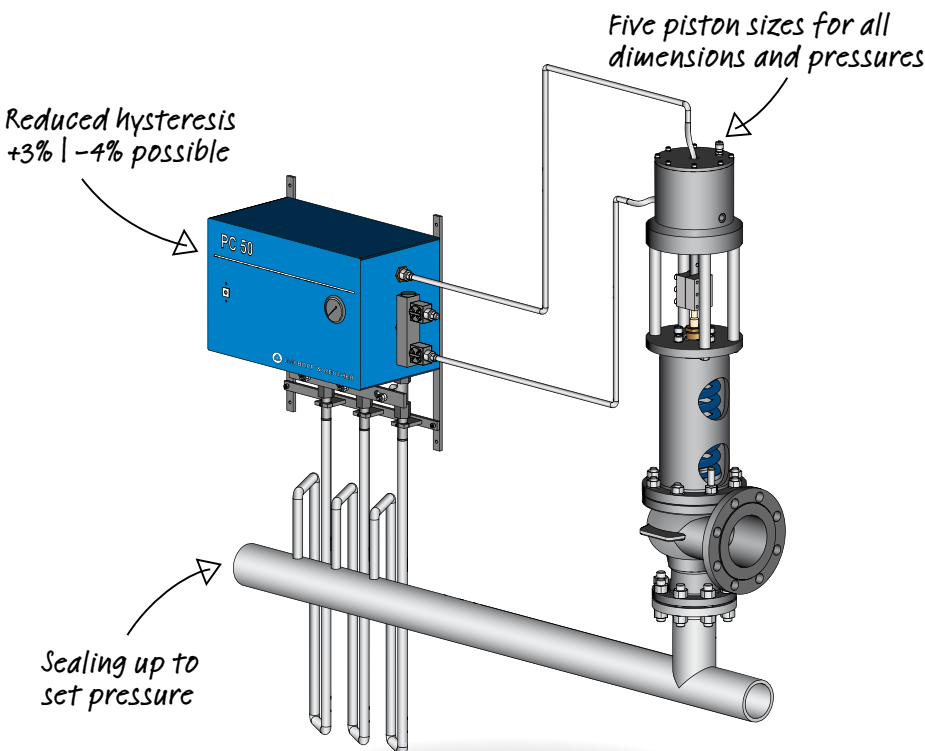
The load air increases the closing force up to the set pressure and the lifting air supports the blow-off process.

The fail-safe function of the safety valve is guaranteed by installed spring loading even in case of air failure. More than one safety valve can be operated with one control unit.

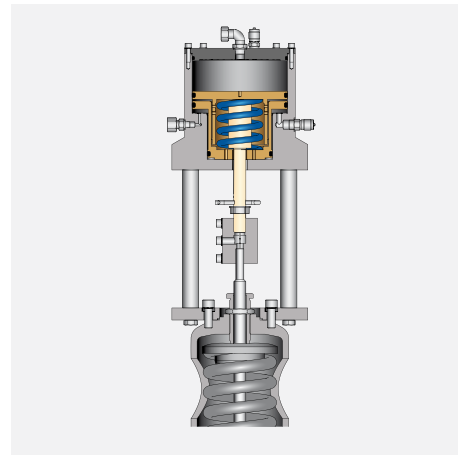
There is a static performance, e.g. increased tightness up to valve opening, high setting accuracy, and precise repetition of the set pressure thus improving operating efficiency.

Typical applications are systems with high operating pressures, increased tightness requirements, limited opening and reseating parameters, critical applications.

For nuclear application the Control Unit PC 50 is available in stainless steel body housing with reinforced superstructure. This design is dynamically qualified for 3g including fundamental frequency test.



PC 50 control unit with connected pneumatic assisted springloaded safety relief valve



Pneumatic piston AK based on differential area piston principle.



API valves prepared for pneumatic assistance, equipped with supplementary loaded piston.

PC 50

The use of the Pneumatic Control Unit PC 50 with set pressure of **0.1 bar g up to 250 bar g** is to control safety valves with modular differential surface double acting piston AK or safety valve with integrated differential surface piston.

Benefits and features

The standard device offers pneumatic triple redundancy.

The pressure switches can be checked during operation.

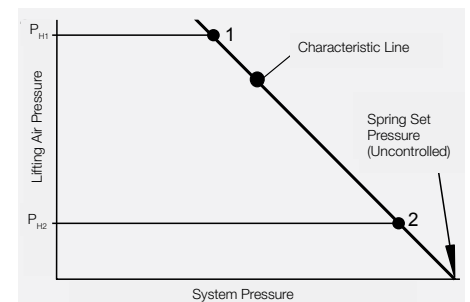
Only one auxiliary power (pneumatic air) required for operation.

The pressure switch design is a frictionless force-balance measuring system and with high setting accuracy (<1%).

This product is suitable for gases, steam or liquids, for applications in chemical and petrochemical industries, in process industries, power generation, in conjunction with assisted safety valves as well as for nuclear applications.



Control Unit PC 50 controls safety valves with piston and lifting device.



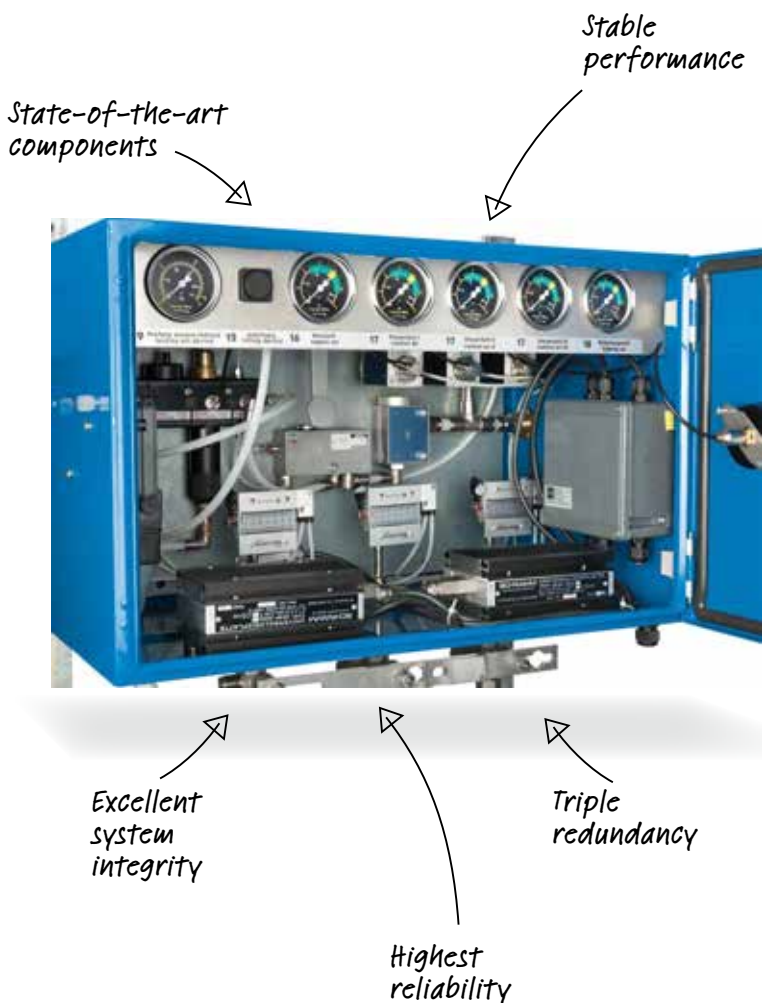
The test procedure is carried out at first (zero point method) with two system pressures at least—in the diagram the points 1 and 2.

The registered lifting air pressure PH1 and PH2 at the pressure gauge and the pressure of the system are entered into diagram.

The connecting straight line through the measured points meets the x-axis of the diagram at the set pressure.

If, during a repeated test, the measured values are on the characteristic line of the zero point measurement, this is considered as a proof of the set pressure.

Mobile Testing: Test of set pressure of safety valve during operation



Re 34

This pressure reducing valve with sizes **DN 65 to DN 400** for water is suitable for variable downstream consumption and large pressure differences. This valve balances the inlet pressure by a proven and tested piston system, in which the seals can be replaced quickly and easily.

Benefits and features

The valve works independently from external energy. Also it provides constant, but adjustable low downstream pressure, even at variable upstream pressure and fluctuating volume flow. At no flow conditions the valve is completely tight.

A well proven piston-venturi nozzle system provides high endurance and long service life. The stainless steel insert is easy to disassemble and requires only little space for maintenance.

Another benefit is the low mounting height which allows changing the sealing elements without removing the body from the line.

Applications are cold water, potable water, fluctuating flow and largest volume mass flow.

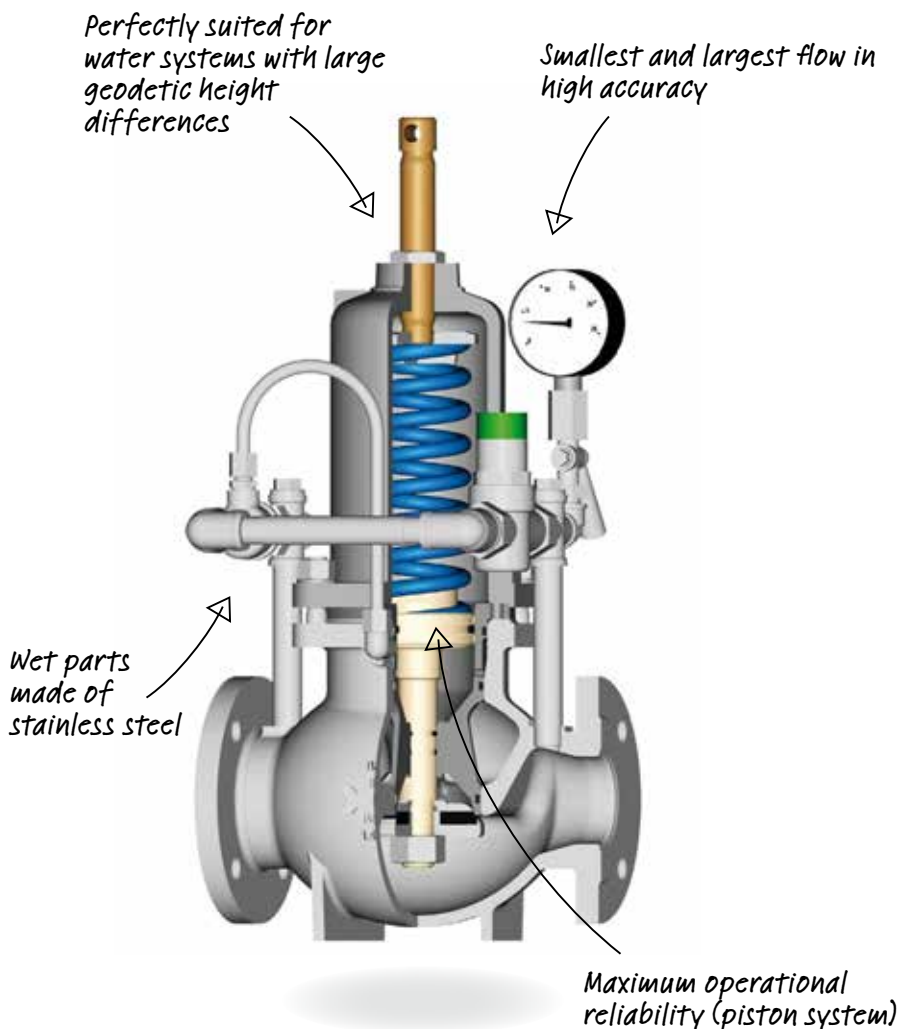


Re 3431, pressure reducing valve usually used for water applications

Re 34 piston as spare part upon request



Re 34 produced for usage in sewage plants



Change Over Valve

Change Over Valves with the sizes **DN 20 to DN 300** for all industrial facilities that require 100 % plant availability – even during maintenance and testing of safety valves.

Benefits and features

IMI Bopp & Reuther Change Over Valves Assemblies increase process performance and plant availability by providing the opportunity to switch from one safety valve to another without process interruption or shutdown, whenever maintenance of the safety valve in operation is needed.

Our Change Over Valves are designed and selected for best flow efficiency with superior zeta-value in order to fulfill the maximum inlet pressure loss requirements of 3% according to AD 2000 and API 520.

Their high efficiency design often allows smaller nominal diameters, which saves pipe network operation costs.

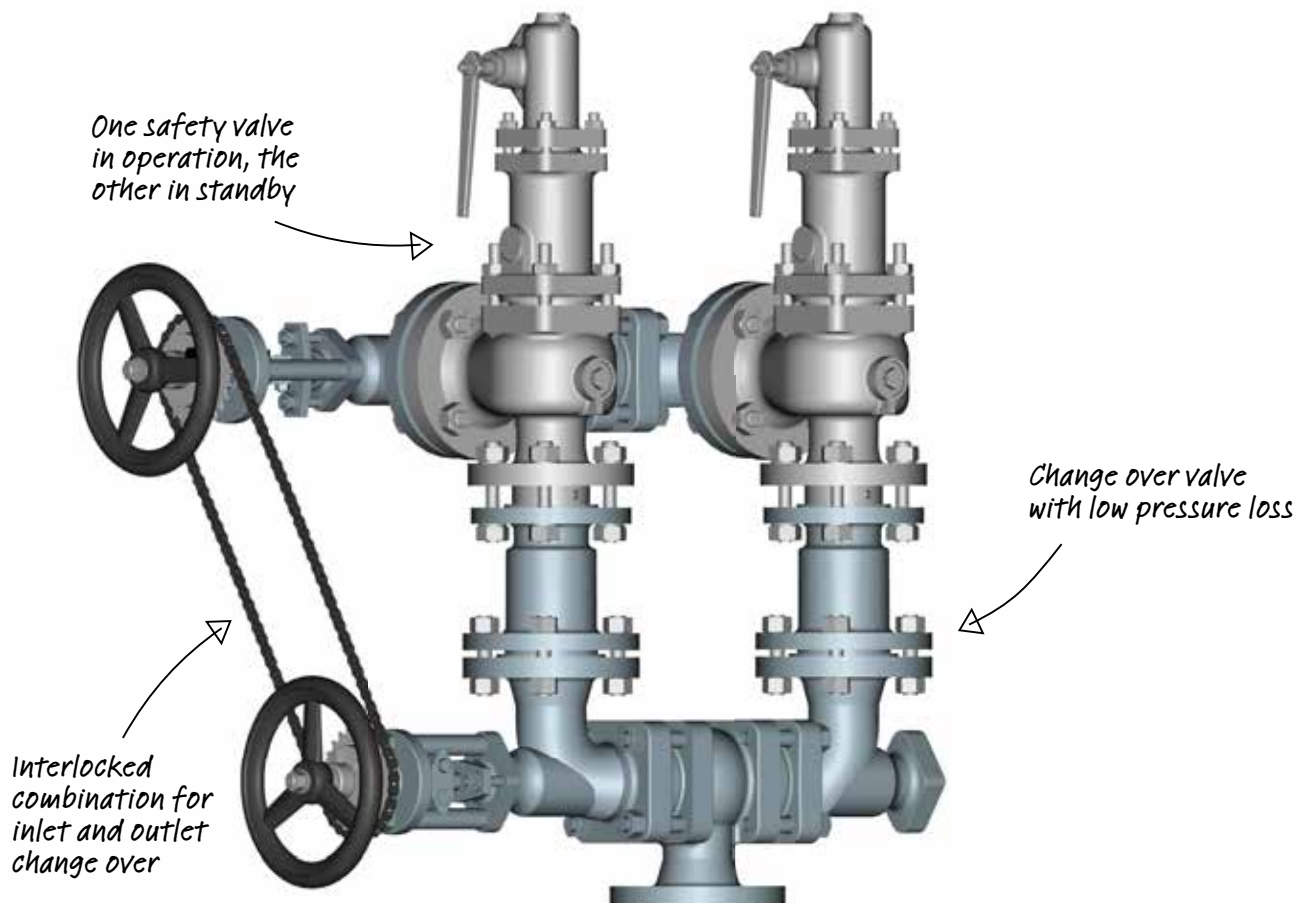
Change Over Valves can be used in two ways:

- 1) As stand alone valve at the inlet inside of two safety valves, in case of blowdown to atmosphere.
- 2) As interlockable Change Over Valve combination on the inlet and outlet side of two safety valves in case of blowdown to discharge piping.

Change Over Valves are used for steam, gases or liquids in these applications: chemical and petrochemical industries, process industries and plant construction.



Change over valve with two low cost regular safety valves Si 2323



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