



Valves and Solutions for the Process Industries



Overview Process Industries

1. Business Unit **Process Industries** **“Safety Relief Valves”**

- 1.1 This is our business
- 1.2 Organisation
- 1.3 Offices and Locations
- 1.4 Facts & Figures
- 1.5 Products
- 1.6 Experience
- 1.7 Philosophy and Mission
- 1.8 Certifications and Authorisations
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1. Business Unit **Process Industries** **„Safety Relief Valves“**

1.1 This is our business

- Bopp & Reuther has been a highly specialized partner of the process industry for more than 135 years.
- our 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:
Chemical industry, Petrochemicals, Power generation and supply, Process steam systems, Water supply systems, Refineries, Polymer applications
- we develop both individual solutions and standard products for all of these areas.



1958: Si 61 Full lift safety valves, supplied to protect a plant for utilizing geothermal steam



2009: Si 84 High-performance safety valves, used for protection in an ethylene cracker

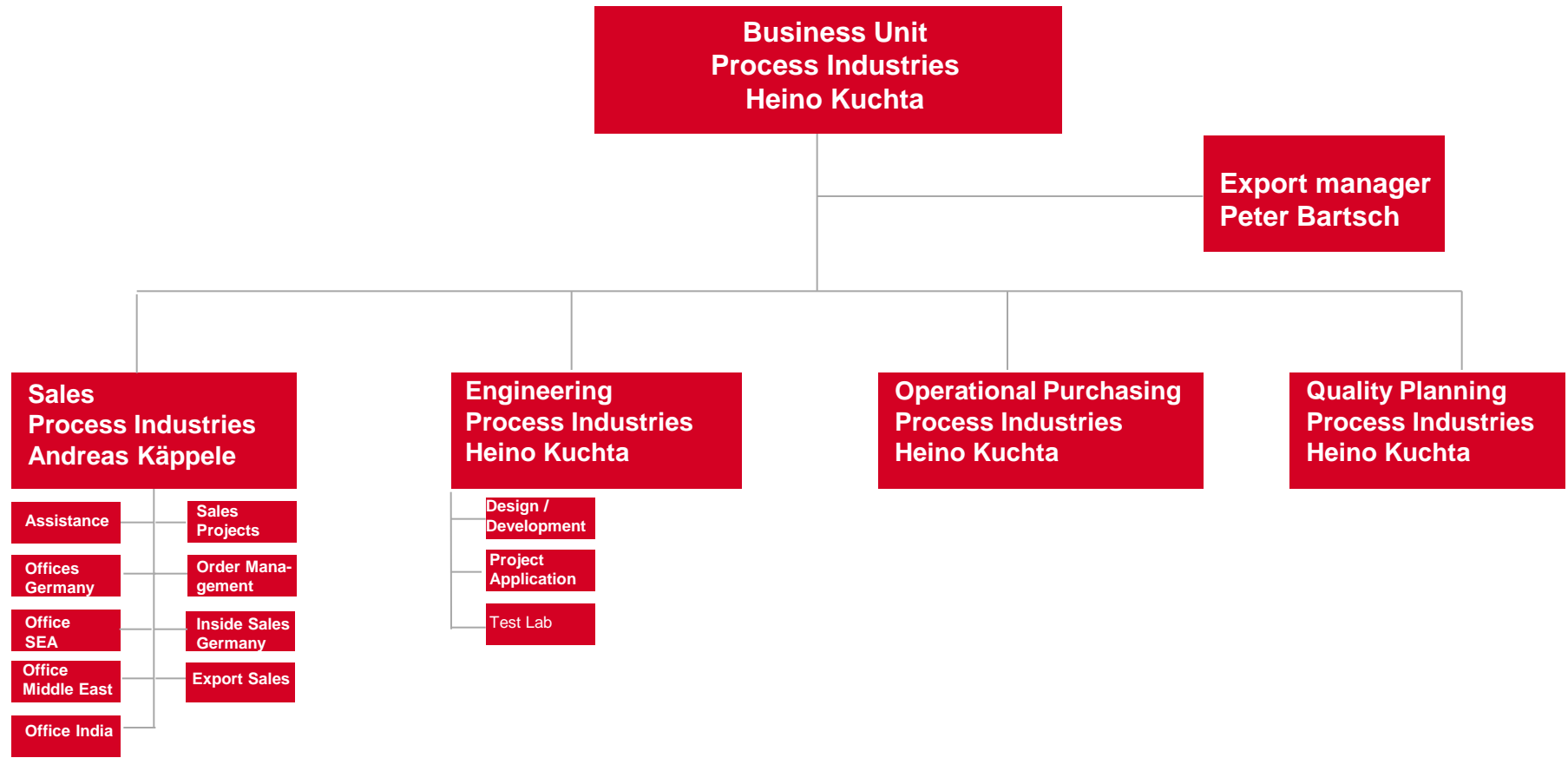


There are many reasons to choose Bopp & Reuther:

- We use the latest technologies throughout – from construction through production to quality control.
- We operate one of the most modern and efficient valve testing stations in the world.
- We are leaders in the heat treatment of critical materials. Standards committees and technical bodies acknowledge our expertise.
- We provide service for every valve all over the world – since 2010 pulling on resources from not only Bopp & Reuther but also from our partner companies.



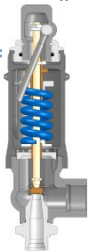
1.2 Organisation



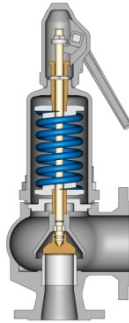


1.5 Products - Safety Valves for the Process Industry Contents

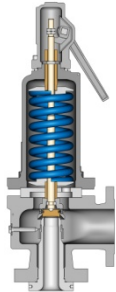
01- Thermal Safety Valves
 Si 13
 Si 06 / Si 25 / Si 43



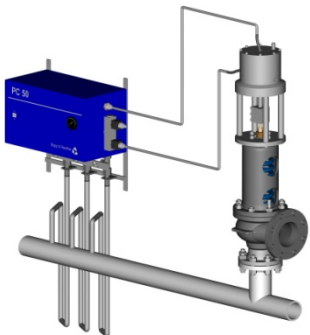
02 - Process & Steam Safety Valves in acc. with PED and DIN/EN
 Si 63 / Si 43 / SiF



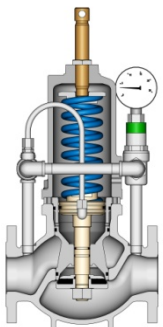
03 - Process & Steam Safety Valves in acc. with ASME VIII
 Si 83
 Si 43



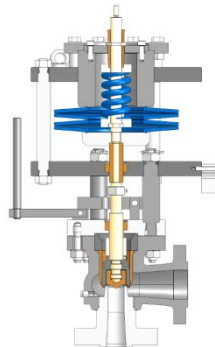
04 - Controlled Safety Valves (CSPRS)



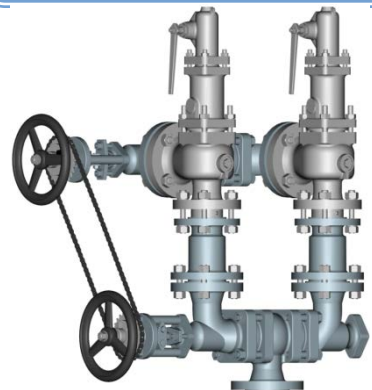
05 - Pressure Reducing Valve for Water



06 - Steam Safety Valves, ASME I
 Si 61 / Si 91 / Si 95



07 - Options & Changeover valves





01

Thermal Safety Valves

| | |
|------------------------------------|--------------|
| Compact Safety Valve | Si 11/13/14 |
| High-Pressure Compact Safety Valve | Si 0614 |
| Low-Pressure Valve for Liquids | Si 2501 |
| Process Safety Valve for Liquids | Si 4322 |
| High-Pressure Valve for Liquids | Si 2503 - 04 |



Thermal Safety Valves

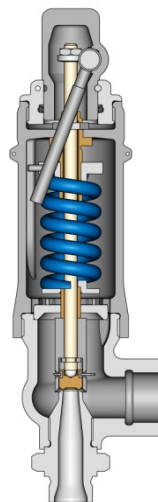
Design

| | |
|-------------------|---|
| Sizes | DN 10 to DN 150 |
| Pressure ratings | PN 10 to PN 400 150# to 2500# |
| Flow diameters | 7 mm to 93 mm |
| Orifice letters | B to F |
| Set pressures | 0,1 bar to 400 bar 5 psi to 5800 psi |
| Temperature range | -270 C to 450 C -454 F to 842 F |
| Materials | 1.0619 / WCB 1.4408 / CF8M 0.6025 / GG25 1.408 / CF8 1.4571; Nickel-based materials available on request |

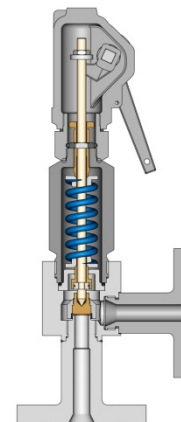
Applications e.g. - Steam, gases or liquids; Thermal expansion; Protection of pipelines; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; OEM applications; Low capacity and high pressure; Various connection options

Approvals

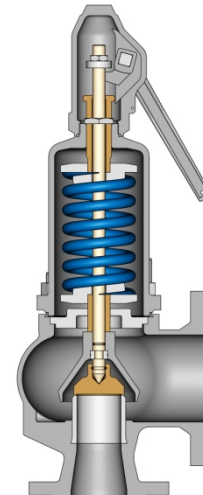
VdTÜV; PED 97/23/EC (CE); ASME:III (NV), VIII (UV)



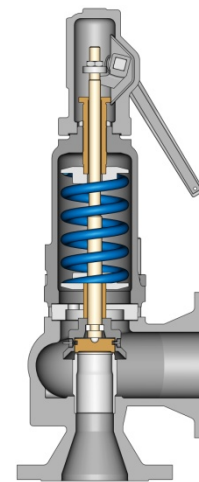
Si 13



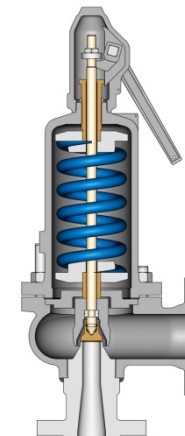
Si 0614



Si 2501



Si 4322



Si 2503-04



Compact Safety Valve Si 11/13/14

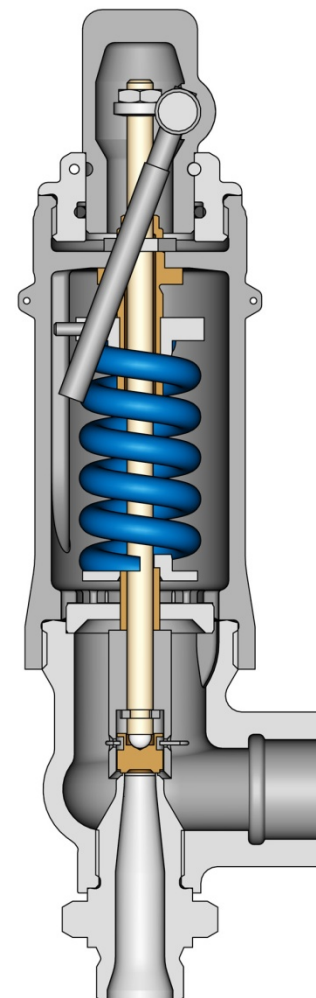
Design

| | |
|-------------------|--|
| Sizes | DN 10 to DN 50 |
| Pressure ratings | PN 40 to PN 400 150# to 2500# |
| Flow diameters | 7,2 mm to 19,5 mm |
| Orifice letters | B to F |
| Set pressures | 0,3 bar to 400 bar 5 psi to 5800 psi |
| Temperature range | -270 C to 427 C -454 F to 800 F |
| Materials | 1.0619 / WCB 1.4408 / CF8M Nickel-based materials available on request |

Applications - Steam, gases or liquids; Thermal expansion; Protection of pipelines; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; OEM applications; Low capacity and high pressure; Various connection options

Approvals

VdTÜV; PED 97/23/EC (CE); ASME:III (NV), VIII (UV)





High-Pressure Compact Safety Valve Si 0614

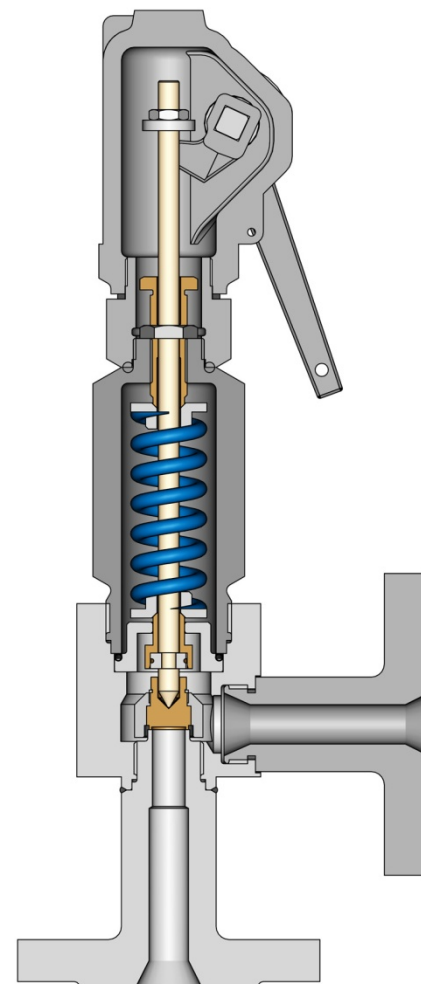
Design

| | |
|-------------------|----------------------------------|
| Sizes | DN 15, DN 25 NPT 3/4" |
| Pressure ratings | PN 40 to PN 400 150# to 2500# |
| Flow diameters | 7 mm, 12,5 mm |
| Set pressures | 0,3 bar to 400 bar |
| Temperature range | -270 C to 400 C |
| Materials | 1.4571 |

Applications - Steam, gases or liquids; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; Equipment engineering and chemical reactors; Low capacity and high pressure up to 400 bar; Suitable for back pressures greater than 60 bar, Various connection options

Approvals

VdTÜV; PED 97/23/EC (CE)





Low-Pressure Valve for liquids Si 2501

Design

Sizes DN 15 to DN 150

Pressure ratings PN 16

Flow diameters 12 mm to 93 mm

Set pressures 0,1 bar to 16 bar

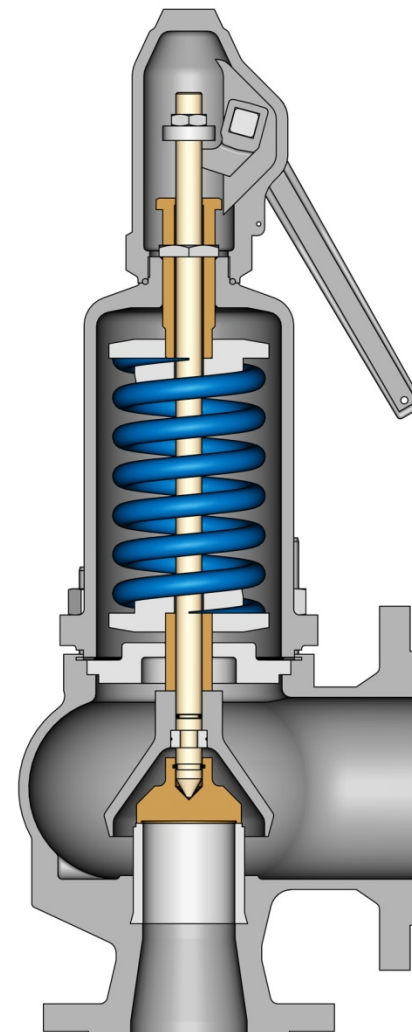
Temperature range -10 C to 300 C

Materials 0.6025 / GG25

Applications - Steam, gases or liquids; Protection of systems downstream of control valves; Water supply up to PN 16; Approved for drinking water

Approvals

VdTÜV; PED 97/23/EC (CE)





Process Safety Valve for Liquids Si 4322

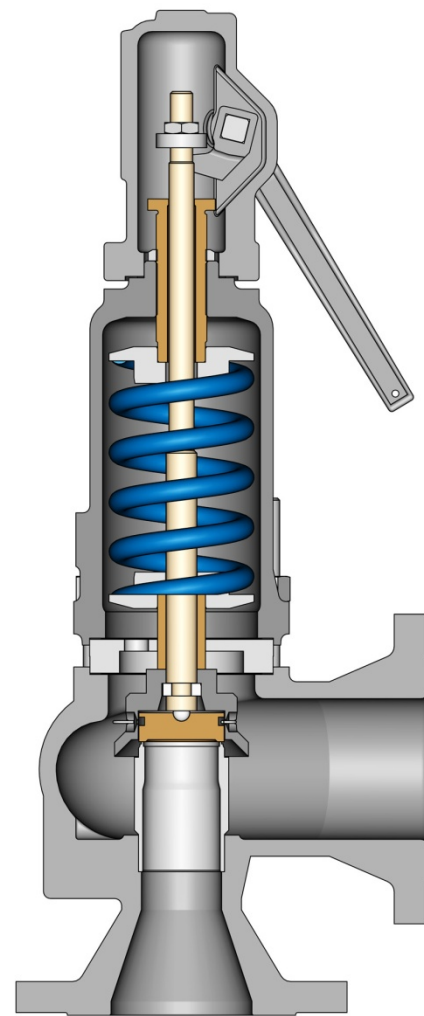
Design

| | |
|-------------------|---|
| Sizes | DN 15 to DN 100 |
| Pressure ratings | PN 10 to PN 40 150# to 300# |
| Flow diameters | 8 mm to 52 mm |
| Set pressures | 0,1 bar to 40 bar 1,5 psi to 600 psi |
| Temperature range | -270 C to 450 C -454 F to 842 F |
| Materials | 1.0619 / WCB 1.4408 / CF8M Other materials available on request |

Applications - Steam, gases or liquids; Thermal expansion; Protection of pipelines; Protection of heat exchanges; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; Other process applications

Approvals

VdTÜV; PED 97/23/EC (CE)





High-Pressure Valve for Liquids Si 2503-04

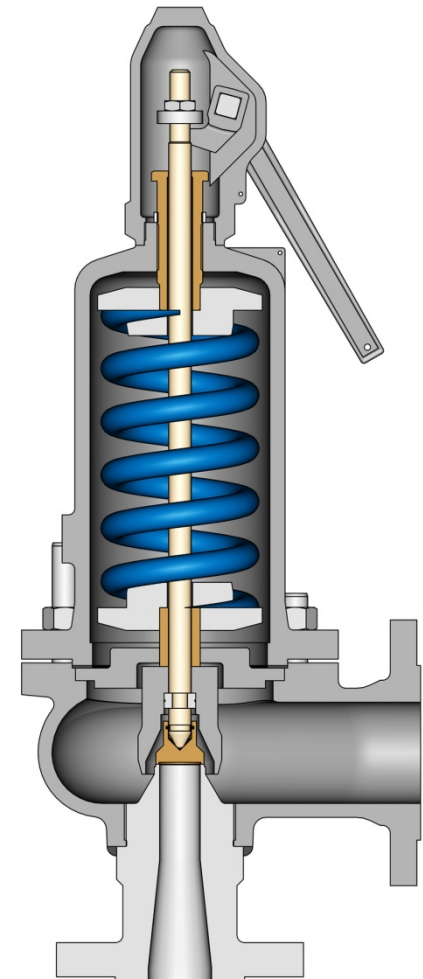
Design

| | |
|-------------------|---|
| Sizes | DN 15 to DN 65 NPS ½" to NPS 2 ½" |
| Pressure ratings | PN 160 to PN 400 1500# to 2500# |
| Flow diameters | 12 mm to 93 mm |
| Set pressures | 0,5 bar to 400 bar 7 psi to 5800 psi |
| Temperature range | -196 C to 400 C -320 F to 752 F |
| Materials | 1.0619 / WCB 1.4308 / CF8 1.4408 / CF8M |

Applications - Steam, gases or liquids; Power generation; Feed water supply up to PN 100

Approvals

VdTÜV; PED 97/23/EC (CE)





02

Process & Steam Safety Valves in Acc. with PED and DIN/EN

| | |
|---|--------------|
| Low-Pressure Valve for Steam Applications | Si 6301 |
| High-Capacity Process Safety Valve | Si 4302 |
| High-Pressure Safety Valve | Si 6303 - 05 |
| Foil Safety Valve | SiF 150 |



Process & Steam Safety Valves in Acc. with PED and DIN/EN

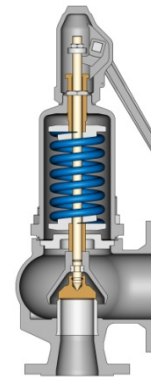
Design

| | |
|-------------------|---|
| Sizes | DN 20 to DN 400 NPS ¾" to NPS 16" |
| Pressure rating | PN 10 to PN 400 |
| Flow diameters | 16 mm to 280 mm |
| Set pressures | 0,1 bar to 250 bar |
| Temperature range | -270 C to 550 C |
| Materials | 1.0619 / WCB 1.4408 / CF8M 0.6025 / GG25 1.408 / CF8 1.7357 / WC6 1.4571; Nickel-based materials available on request |

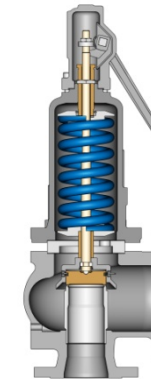
Applications eg. - Steam, gases or liquids / hot water; Heating systems; Steam applications up to PN 16; Acc.to TRD 421 and 721
Securing plat components; Steam boilers; Air separation plants;

Approvals

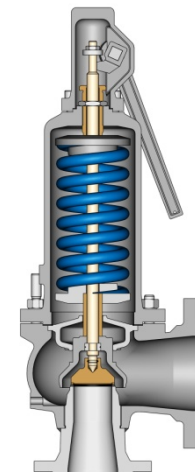
VdTÜV; PED 97/23/EC (CE)



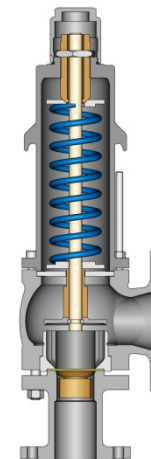
Si 6301



Si 4302



Si 6303-05



SiF 150



Low-Pressure Valve for Steam Application Si 6301

Design

Sizes DN 20 to DN 200

Pressure rating PN 16

Flow diameters 16 mm to 155 mm

Set pressures Up to 16 bar

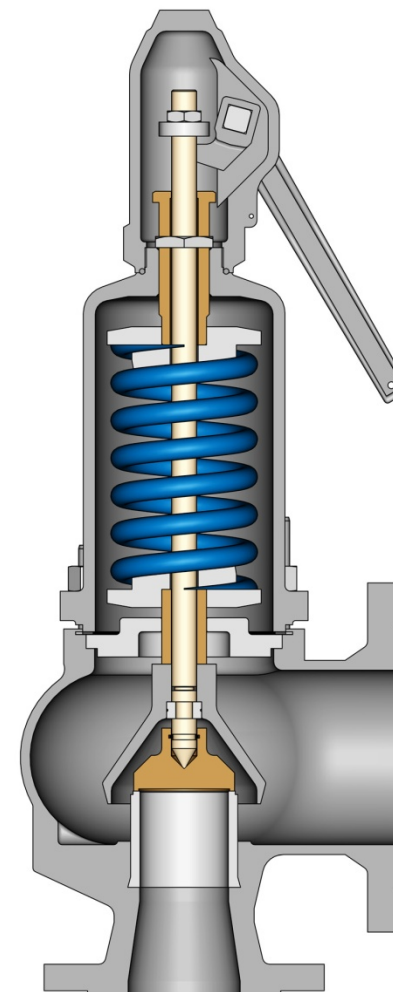
Temperature range -10 °C to 300 °C

Materials 0.6025 / GG25

Applications - Steam, gases or liquids / hot water; Heating systems; Steam applications up to PN 16; Acc.to TRD 421 and 721

Approvals

VdTÜV; PED 97/23/EC (CE)





High-Pressure Safety Valve

Si 6303 - 05

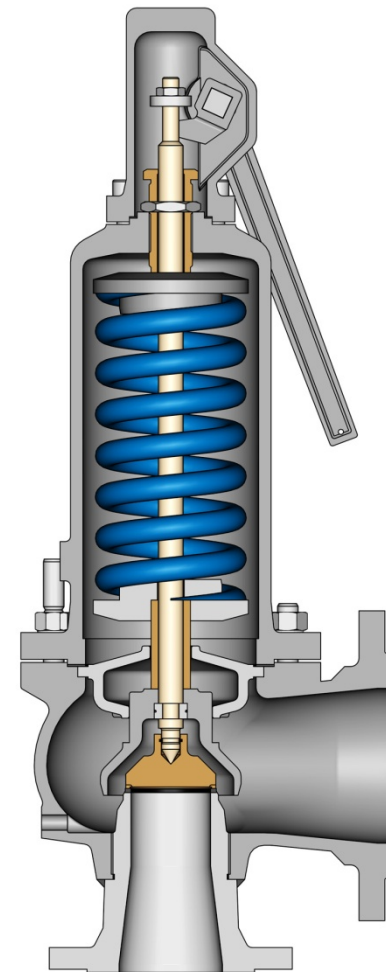
Design

| | |
|-------------------|---|
| Sizes | DN 25 to DN 200 NPS 3/4" to NPS 16" |
| Pressure rating | PN 160 to PN 400 1500# to 2500# |
| Flow diameters | 16 mm to 280 mm |
| Set pressures | Up to 250 bar Up to 3625 psi |
| Temperature range | -196 C to 550 C -320 F to 1020 F |
| Materials | 1.0619 / WCB 1.4308 / CF8 1.4408 / CF8M 1.7357 / WC6 |

Applications - Steam, gases or liquids; Securing plat components; Steam boilers; Air separation plants; Power plants and industrial steam generation; Paper mills; Chemical high-pressure processes

Approvals

VdTÜV; PED 97/23/EC (CE)





High-Capacity Process Safety Valve Si 4302

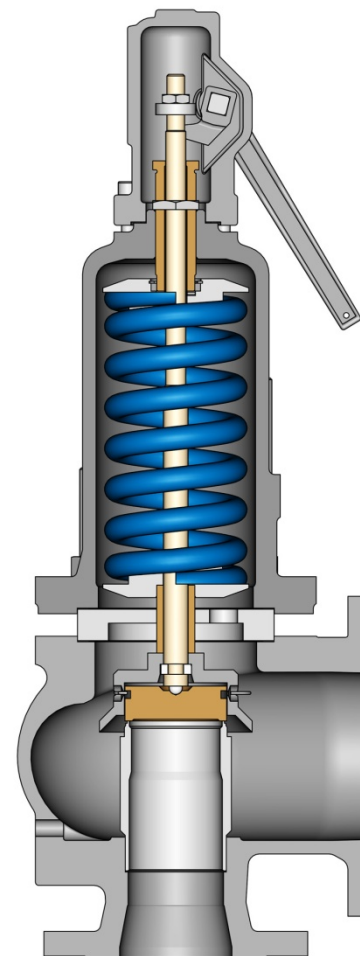
Design

| | |
|-------------------|---|
| Sizes | DN 25 to DN 200 NPS 1" to NPS 8" |
| Pressure rating | PN 10 to PN 40 150# to 300# |
| Flow diameters | 17 mm to 156 mm |
| Set pressures | 0,1 bar to 40 bar 1,5 psi to 600 psi |
| Temperature range | -270 C to 450 C -454 F to 842 F |
| Materials | 1.0619 / WCB 1.4408 / CF8M Other materials available on request |

Applications - Steam, gases or liquids; Protection of pressure vessels; Protection of heat exchangers; Protection of plant components; Suitable for all industrial applications; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; Power generation and supply; Steam boilers up to PN 40

Approvals

VdTÜV; PED 97/23/EC (CE)





Foil Safety Valve SiF 150

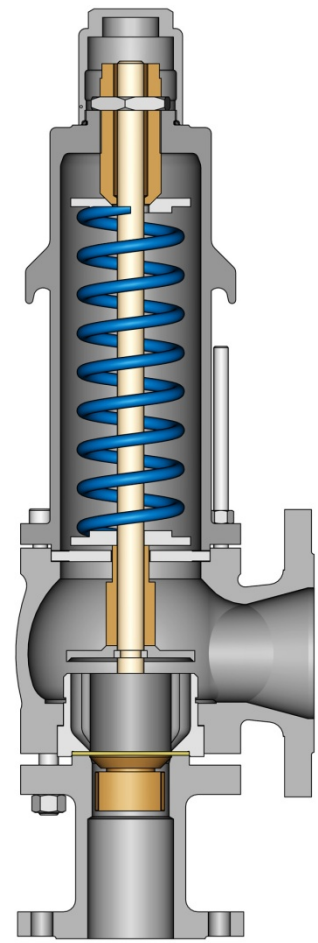
Design

| | |
|-------------------|--|
| Sizes | DN 25 to DN 300 NPS 3/4" to NPS 16" |
| Pressure rating | PN 10 to PN 400 |
| Flow diameters | 27 mm to 275 mm |
| Set pressures | 0,5 bar to 40 bar |
| Temperature range | -196 C to 550 C |
| Materials | 1.0619 1.4408 |

Applications – Steam or gases; Chemical industry; Polymer applications; Polymer applications; Solar industry; Extreme tightness requirements; Agressive, toxic substances;
A sheet of foil in the valve seat, optionally made from lead, aluminum, PTFE, silver or gold, ensures tightness

Approvals

PED 97/23/EC (CE)





03

Process & Steam Safety Valves in Acc. with ASME VIII

| | |
|---|-------------------|
| API Safety Valve | Si 8301 - 07 |
| API High-Capacity Safety Valve | Si 8301 – 03 V, W |
| ASME Safety Valve for High Capacity up to 300# | Si 4302 |



Process & Steam Safety Valves in Acc. with ASME VIII

Design

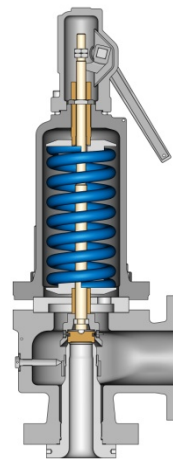
| | |
|-------------------|---|
| Sizes | NPS 1" to NPS 12" |
| Pressure rating | 150# to 2500# |
| Orifice letters | D to W |
| Flow diameters | 17 mm to 156 mm 0,67 inch to 6,14 inch |
| Set pressures | 0,1 bar to 40 bar |
| Temperature range | -270 C to 538 C -454 F to 1000 F |
| Materials | 1.0619 / WCB 1.7357 / WC6 1.4408 / CF8M |

Applications - Steam, gases or liquids; Thermal expansion; Chemical industry; Petrochemicals; Oil/gas – onshore and offshore; Refineries and tank farms

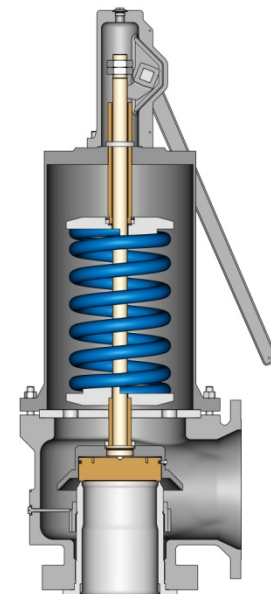
Applications in acc. with API 526 standard
Closed systems

Approvals

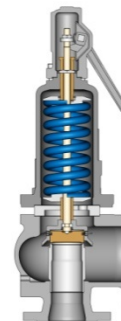
VdTÜV; PED 97/23/EC (CE); ASME III (NV), VIII (UV)



Si 8301-07



Si 8301-03 V,W



Si 4302



API Safety Valve Si 8301 - 07

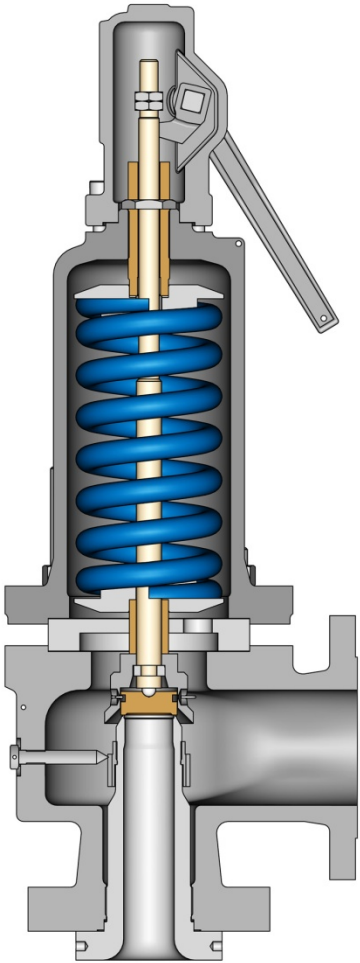
Design

| | |
|-------------------|---|
| Sizes | NPS 1" to NPS 8" |
| Pressure rating | 150# to 2500# (EN flange connection as option) |
| Orifice letters | D to T |
| Set pressures | Up to 414 bar Up to 6000 psi |
| Temperature range | -268 C to 538 C -450 F to 1000 F |
| Materials | 1.0619 / WCB 1.7357 / WC6 1.4408 / CF8M |

Applications - Steam, gases or liquids; Thermal expansion;
Chemical industry; Petrochemicals; Oil/gas – onshore and offshore;
Refineries and tank farms
Applications in acc. with API 526 standard
Closed systems

Approvals

VdTÜV; PED 97/23/EC (CE); ASME III (NV), VIII (UV)

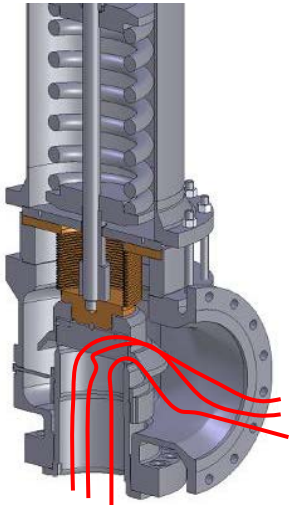




Examples of Difference of Bopp & Reuther API Safety Valve to others

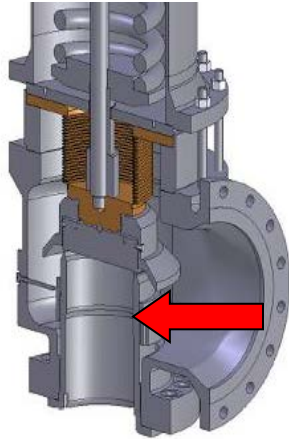
Proven Bellow design

- Bellow not in flow path
- less vibration impact
- longer life time of bellows



Setting without nozzle ring

- Ring built-in as per API/ASME
- but No Ring adjustment necessary
- Easy maintenance
- Avoids mistakes during setting
- Stable function with no trim changes in turbulent flow areas





API High-Capacity Safety Valve Si 8301 – 03 V, W

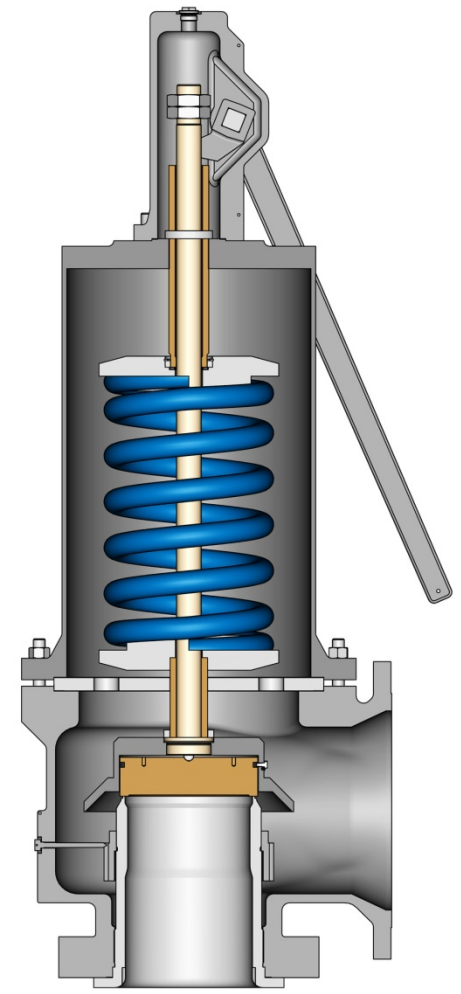
Design

| | |
|-------------------|---|
| Sizes | NPS 10" to NPS 12" |
| Pressure rating | 150# to 300# |
| Orifice letters | V to W |
| Set pressures | Up to 20,7 bar Up to 300 psi |
| Temperature range | -268 C to 538 C -450 F to 1000 F |
| Materials | 1.0619 / WCB 1.7357 / WC6 1.4408 / CF8M |

Applications - Steam, gases or liquids; Chemical industry; Petrochemicals; Oil/gas – onshore and offshore; Refineries and tank farms,
 Technical design in acc. with API 526 standard
 Applications in acc. with API 526 standard and API RP 520
 Closed systems

Approvals

PED 97/23/EC (CE); ASME: VIII (UV)





ASME Safety Valve for high Capacity up to 300# Si 4302

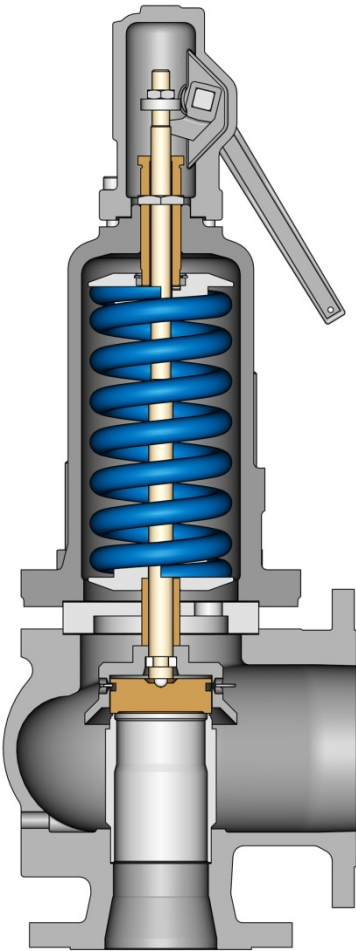
Design

| | |
|-------------------|---|
| Sizes | NPS 1" to NPS 8" |
| Pressure rating | 150# to 300# |
| Flow diameters | 17 mm to 156 mm 0,67 inch to 6,14 inch |
| Set pressures | 0,1 bar to 40 bar 1,5 psi to 600 psi |
| Temperature range | -270 C to 450 C -454 F to 842 F |
| Materials | 1.0619 / WCB 1.4408 / CF8M Other materials available on request |

Applications - Steam, gases or liquids; Protection of pressure vessels; Protection of heat exchanges; Protection of plant components; Suitable for all industrial applications acc. to ASME; Chemical industry; Petrochemicals; Industrial gases; Cooling and oxygen applications; Power generation and oxygen applications; Power generation and supply; Steam boilers up to 300#

Approvals

ASME: VIII (UV)





04

Controlled Safety Valves and Control Unit

Controlled Safety Valves
Control Unit PC 50



Controlled Safety Valves

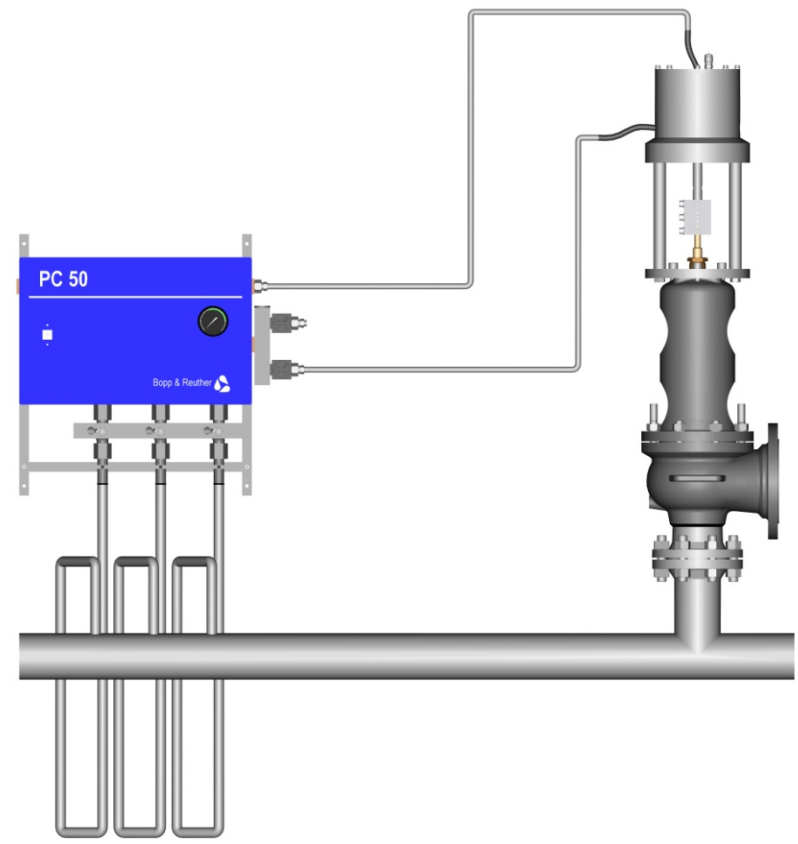
Design

| | |
|------------|---|
| Sizes | 5 piston sizes available, combinable with all safety valves from DN 25 to DN 400 |
| Function | <p>The load air increases the closing force up to the set pressure and the lifting air supports the blow-off process.</p> <p>The fail-safe function of the safety valve is guaranteed even in case of air failure.</p> <p>More than one safety valve can be operated with a control unit.</p> |
| Advantages | <p>Stable performance</p> <p>Sealing up to set pressure</p> <p>Reduced hysteresis (+3% / -4% possible)</p> <p>High degree of accuracy</p> |

Applications - Steam, gases or liquids; Chemical industry; Petrochemicals; Process industry; Plant construction; Power generation; Working pressure close to set pressure; Stabilizing the function of critical applications; Systematic control of several safety valves; Process-specific lifting before the set pressure is reached

Approvals

VdTÜV; PED 97/23/EC (CE)





Control Unit PC 50

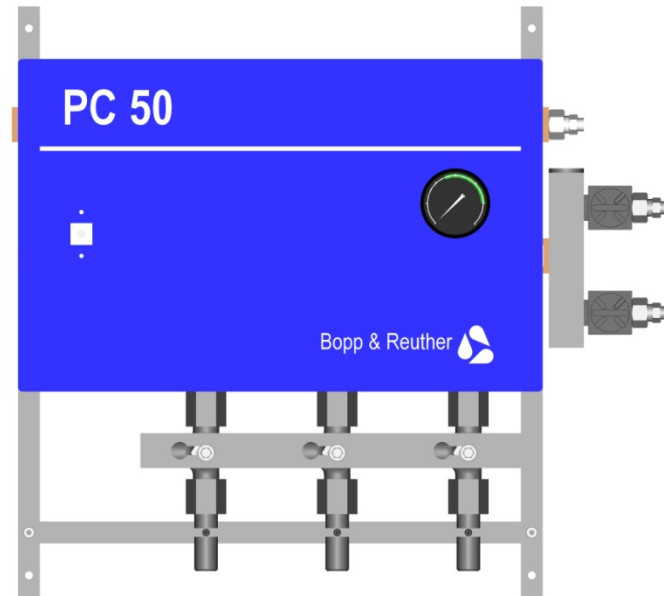
Design

| | |
|-------------------|---|
| Modular design | Standard device is purely pneumatic Triple redundancy Pressure switches can be checked during operation No air consumption in operating condition Only auxiliary power (pneumatic) required for operation |
| Pressure switches | Frictionless force-balance measuring system High setting accuracy (<1%) |
| Set pressures | 0,1 bar to 250 bar |
| Extension options | Safety valve testing option; Magnetic remote release; Heating; Ex-design; Free of non-ferrous metals; Pressure transmitter for critical substances |

Applications – In conjunction with assisted safety valves; For steam, gases or liquids; Power generation; Power generation; Chemical industry; Petrochemicals; Process Industry; Plant construction; Optimizing the function of safety valves with supplementary loading; Stable performance; High set pressure repeatability; Control of several safety valves

Approvals

VdTÜV; PED 97/23/EC (CE)





05

Pressure Reducing Valve for Water

Pressure Reducing Valve for Water Re 3431 - 33



Pressure Reducing Valve for Water Re 3431 - 33

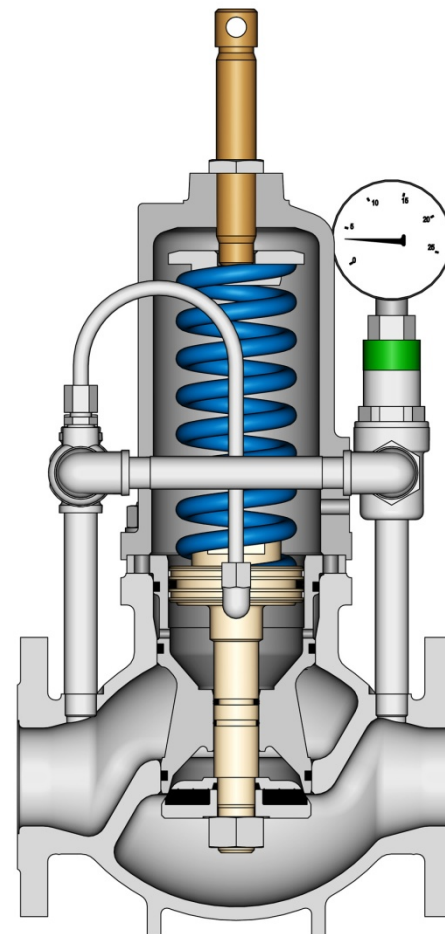
Design

| | |
|-------------------|--|
| Sizes | DN 65 to DN 400 |
| Pressure ratings | Up to PN 40 |
| Upstream Pressure | Up to 40 bar |
| Materials | Body 1.4408 / CrNiMo All medium wetted parts stainless steel |
| Advantages | Piston control via Venturi nozzle and nozzle with spring loading Easy maintenance Stainless steel insert |

Applications – Water supply systems; Suitable for variable downstream consumption and large power differences; Approved for

Approvals

VdTÜV; PED 97/23/EC (CE)





06

Steam Safety Valves

| | |
|---|--------------|
| High-Pressure Steam Safety Valve | Si 6106 |
| Steam Safety Valve in Acc. with ASME | Si 9101 – 05 |
| High-Pressure Steam Safety Valve in Acc. with ASME | Si 9106 |
| High-Pressure Steam Safety Valve in Acc. with ASME | Si 9504 – 07 |



Steam Safety Valves

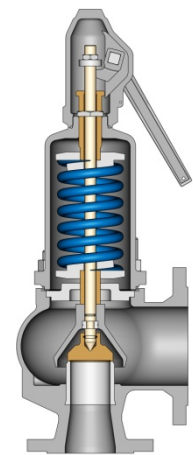
Design

| | |
|-------------------|--|
| Sizes | DN 80 to DN 300 NPS 1 1/2 " to NPS 10" |
| Pressure ratings | PN 40 to PN 160 |
| Flow diameters | 65 mm to 200 mm |
| Set pressures | 1 bar to 330 bar 0,787 inch to 9,252 inch |
| Temperature range | -46 C to 620 C -50 F to 1150 F |
| Materials | 1.0619 / GS 1.7357 / CrMo 1.7379 / CrMo 9-10 WCB; WC9; C12A |

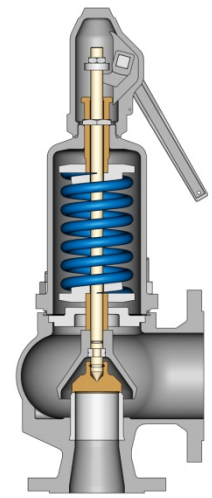
Applications – Steam boilers; Superheaters; Power plants and industrial steam generation; Steam temperatures greater than 500 C; Large flow diameters at high pressures; Process steam systems

Approvals

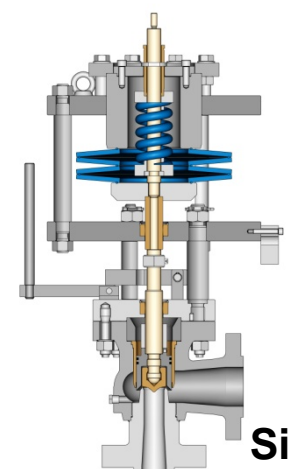
VdTÜV; PED 97/23/EC (CE)



Si 6106



Si 9101-06



Si 9504-07



High-Pressure Steam Safety Valve Si 6106

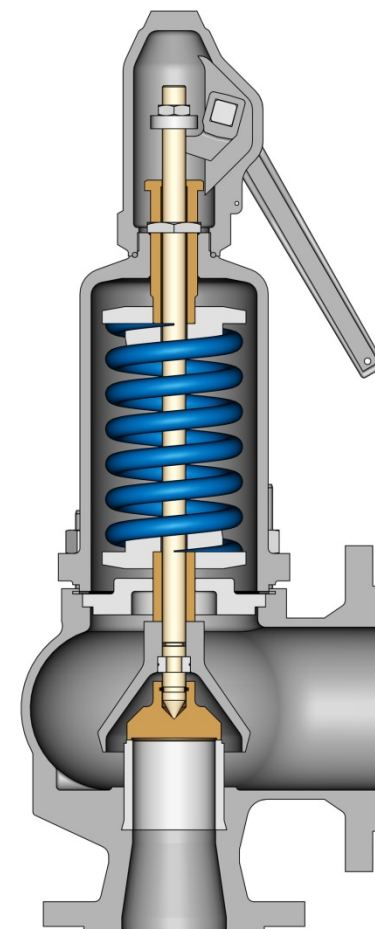
Design

| | |
|-------------------|--|
| Sizes | DN 80 to DN 300 |
| Pressure ratings | PN 40 to PN 160 |
| Flow diameters | 65 mm to 200 mm |
| Set pressures | Up to 180 bar |
| Temperature range | Up to 550 °C |
| Materials | 1.0619 / GS 1.7357 / CrMo 1.7379 / CrMo 9-10 |

Applications – Steam boilers; Superheaters; Power plants and industrial steam generation; Steam temperatures greater than 500 °C; Large flow diameters at high pressures

Approvals

VdTÜV; PED 97/23/EC (CE)





Steam Safety Valve in Acc. with ASME Si 9101 - 05

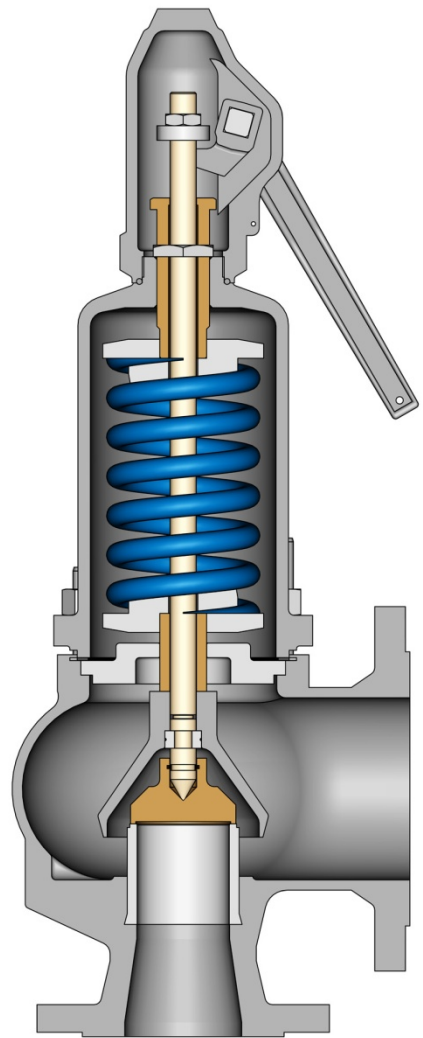
Design

| | |
|-------------------|--|
| Sizes | NPS 1 ½" to NPS 10" |
| Pressure ratings | 150# to 1500# |
| Flow diameters | 20 mm to 120 mm 0,787 inch to 4,724 inch |
| Set pressures | 1 bar to 150 bar 14,5 psi to 2175 psi |
| Temperature range | -46 C to 620 C -50 F to 1150 F |
| Materials | WCB WC9 C12A Other materials available on request |

Applications – Power plants and industrial steam generation; Steam applications in the petrochemical industry; Steam boilers; Superheaters, Process steam systems

Approvals

PED 97/23/EC (CE); ASME: I (V), III (NV), VIII (UV)





High-Pressure Steam Safety Valve in Acc. with ASME Si 9504 - 07

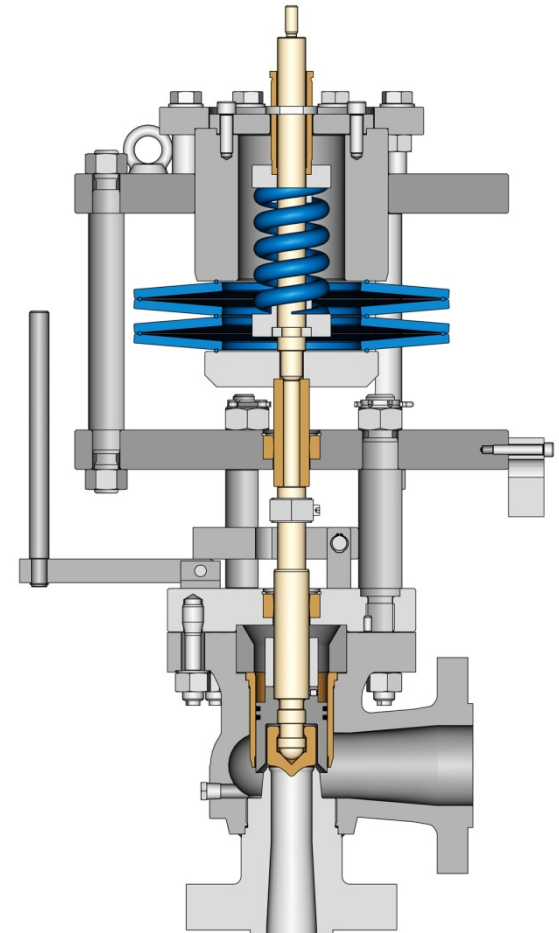
Design

| | |
|-------------------|--|
| Sizes | NPS 1 ½" to NPS 20" |
| Pressure ratings | 900# to 2500# |
| Flow diameters | 20 mm to 235 mm 0,787 inch to 9,252 inch |
| Set pressures | 1 bar to 330 bar 14,5 psi to 4786 psi |
| Temperature range | -46 C to 620 C -50 F to 1150 F |
| Materials | WCB WC9 C12A Other materials available on request |

Applications – Power plants and industrial steam generation; Steam applications in the petrochemical industry; Steam boilers; Superheaters, Process steam systems

Approvals

PED 97/23/EC (CE); ASME: I (V), III (NV), VIII (UV)





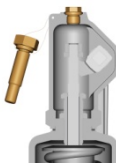
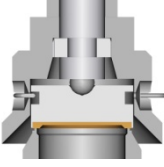
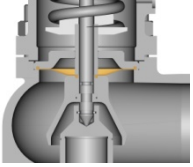
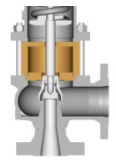
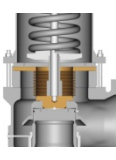
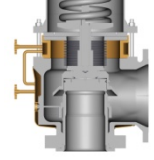
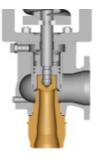
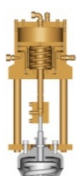
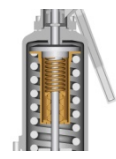
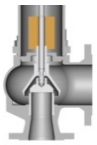

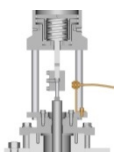
07

Options & Changeover Valves

Options available for Spring Loaded Safety Valves
Changeover Valves



Options available for Spring Loaded Safety Valves

| | | |
|---|---|---|
|  |  |  |
| .B Test gag | .11 Disc with soft seal | .58 Diaphragm seal |
|  |  |  |
| .15 Cooling spacer | .16 Bellows | .18 Heating jacket |
|  |  |  |
| .22 Weld end inlet | .26ak Pneumatic piston | .38 Vibration damper |
|  |  |  |
| .57 Weight loading | .14 Lift indication with inductive proximity switch | .14 Lift indication for design .26ak |



Changeover Valve

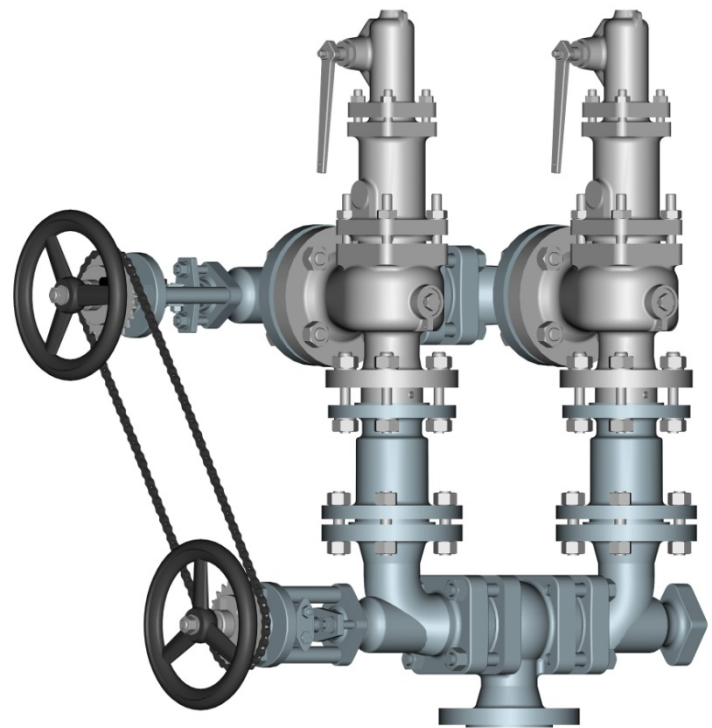
Design

| | |
|-------------------|---|
| Sizes | DN 20 to DN 300 |
| Max. set pressure | 160 bar |
| | Spindle seal with stuffing box or additionally with bellows |
| | Inlet blocking: One changeover valve at the inlet of two safety valves |
| | Inlet and outlet blocking: Two changeover valves connected by a chain, one changeover valve each at the inlet and outlet of two safety valves |

**Applications – Steam, gases or liquids; All industrial facilities where 100 % plant availability is required (even during maintenance and checking of safety valves).
Chemical industry; Petrochemicals industry; Process industry; Plant construction**

Approvals

PED 97/23/EC (CE)





1.6 Bopp & Reuther Experience with other Enterprise Agreements

| Customer | Products | Status | Comment |
|-------------------------------------|---|--------------------------|--|
| BASF | Safety Valves DIN/EN | Major Supplier | Valves and Casting Suppliers approved by BASF |
| Linde | Safety Valves | Major supplier for ASU | Valves comply to LINDE Specification, Casting suppliers approved |
| HDW | Safety Valves and Special Valves | Single supplier | R&D of valves to application |
| MIRO | Safety Valves API and TRV | Major Supplier | |
| Hitachi, CIIC China, OMV, RWE Power | Control Valves, Nuclear Valves, Service | Major or Single Supplier | |