Valves and Systems for Nuclear Industries
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Valves and Systems Introduction

IMI Bopp & Reuther has been a partner for the nuclear power industry since the 1960s. Based on years of experience we design, manufacture and supply new and replacement valves for upgrades, new projects and special individual applications.

A strong partnership with the nuclear industry has developed as a result of this close and trusted relationship. The exchange of experience and information has also resulted in the continuous expansion of our product portfolio with the associated research and development that goes behind each customised solution, tried and tested in our own testing facilities and continuously updated to include the latest in technology and materials.

Today, IMI Bopp & Reuther is a highly respected supplier of standard and special valves for all types of nuclear power plants.

Thanks to extensive product and project documentation, IMI Bopp & Reuther is able to supply spare parts to valves that have been in service in nuclear power plants for decades.

Regular training, continuous consultation with planners and operators and the feedback from our own service personnel in nuclear power plants rounds off the IMI Bopp & Reuther profile.

IMI Bopp & Reuther has all the necessary international certifications and authorisations for the nuclear power plant industry (e.g. KTA, ASME Sec. III, N, NV, NPT- Stamp) and is additionally audited and approved by global players such as AREVA NP, EDF and KOPEC/KHNP. Regular internal and external audits from notified bodies such as the TÜV ensure that this extremely high quality is maintained.

Valves for the nuclear power plant industry are manufactured exclusively in our facilities in Mannheim, Germany. Modern production resources guarantee the “Made in Germany” quality and reputation.

Please contact us if you are looking for an individual solution that meets your requirements.
Valves and Systems for Nuclear Industries

Valves and Systems Overview

The main function of IMI Bopp & Reuther valves and systems is to protect investments, the environment and human life. We have great application experience in severe service. The continuous interaction with our customers ideally positions us to provide optimum products and solutions.

**Spring Loaded Safety Valves**

Safety valves have the function of preventing inadmissible overpressure in piping systems, pressure vessels and boilers, in order to avoid danger to people, the plant and the environment.

**Main Steam Safety Valves and DCRV**

This series includes the SiZ and Si 9 for use as main steam safety valves, also DCRV for special capabilities.

**Medium Operated Safety Valves**

The so-called pilot operated safety valves (POSV) uses the process medium to open or close the main valve. A special feature of this design is the loading principle.

**Gate Valves**

Gate valves are used to securely isolate water and steam lines. The main advantage over globe valves is the extremely low pressure drop across gate valves.

**Check Valves**

Swing check valves prevent backflow in any fluid system. Depending on the medium this product is available with or without a dampering device. The damper prevents “water hammer” in liquid processes.

**Control Valves**

Control Safety Valves are electrically actuated valves for continuous flow control.

**Control Units**

Control Units are designed to operate pneumatic assisted safety valves. The physical limits of a spring loaded safety valve can thus be improved. In case of air supply failure the valve still acts as a spring loaded safety valve.

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.
Spring Loaded Safety Valves

We have a wide range of types, sizes, materials and design as well as an extensive range of connections: flanges, weld-ends, threading and clamp-type connections can be selected to suit the pressure system.

Customising and special design solutions are our strengths. We are able to create products that have been designed precisely for your application.

**Si 0**
This **Compact Safety Valve** is used in **high pressure applications**. The **block body** provides a flexible design base that can be customised.

**Si C1**
This **Compact Safety Valve** is typically used in thermal expansion applications.

**Si 2**
This **Low & High Pressure Valve** is used in water supply, protection of system components at high pressures and feed water supply. Smooth and stable behaviour thanks to comparatively low lift.

**Si 4**
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 6**
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 8**
This series is manufactured in accordance with API 526, ASME Code Sec. III and VIII with National Board certified capacities for air, steam and water. Exceeding the API 526 standard the additional orifices V and W meet very large capacity requirements.
Si 0

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

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 15 to 25</th>
<th>NPS ½&quot; to 1&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>0.40 bar g up to 400 bar g</td>
<td>5.8 psig to 5800 psig</td>
</tr>
<tr>
<td>Materials</td>
<td>1.4571 stainless steel</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Germany (all NPP), Switzerland (Leibstadt, Gösgen)</td>
<td></td>
</tr>
</tbody>
</table>

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 0 for pressure protection (vapours, gases and liquids) is used for example in cooling and oxygen applications, and is suitable for mobile pressure vessels and for back pressures above 60 bar g.

Si 0321 compact safety valve with flange connection

Si 0321 compact safety valve with flange connection

One of our smallest compact safety valves Si 0

Made entirely of stainless steel

Bellows upon request

Also available with threadred connection

Si 042, the designation “4” in the type code specifies bellows design.
Si C1

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 Sec. III and VIII.

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 15 to 25</th>
<th>NPS ½” to 1”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>0.55 bar g up to 200 bar g</td>
<td>8 psig to 2900 psig</td>
</tr>
<tr>
<td>Materials</td>
<td>1.0619 WCB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.4408 CF8M</td>
<td></td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Bohunice, Gösgen, Ringhals, Taishan, et al.</td>
<td></td>
</tr>
</tbody>
</table>

Benefits and features

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

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

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

Optimal construction - easy maintenance

All inner parts made of stainless steel

Various types of connections inlet and outlet

Sizes DN 20 and DN 25 (¾” and 1”) optionally available with balanced bellows
The low cost regular safety valve is built especially for low pressure. The high pressure version of this valve series is equipped with a solid inlet nozzle.

<table>
<thead>
<tr>
<th></th>
<th>Si 2x21</th>
<th>Si 2x23/24/25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sizes</strong></td>
<td>DN 20 to 150</td>
<td>DN 15 to 50</td>
</tr>
<tr>
<td><strong>Set pressures</strong></td>
<td>0.45 bar g up to 16 bar g</td>
<td>0.45 bar g up to 400 bar g</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>0.6025 / GG 25</td>
<td>1.4308</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.4408</td>
</tr>
<tr>
<td><strong>Certifications</strong></td>
<td>TÜV and EC Type Test Approval, UV Stamp</td>
<td></td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>References Atucha, Beznau, Brokdorf, Jushno, Kola, Mochovce et al.</td>
<td></td>
</tr>
</tbody>
</table>

**Benefits and features**

Smooth and stable functional behaviour. 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.

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 others up to PN 400. Optionally available with Luberbox coating of wetted parts, suitable for drinking water service.

**Economic standard safety valve also available with proportional characteristic**

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

**High pressure safety valve Si 2 for cooling water circle in nuclear power plants.**
Si 4

The modern safety valve for all regular capacity applications.

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 25 to 100</th>
<th>NPS 1” to 4”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>0.1 bar g up to 40 bar g</td>
<td>1.5 psig to 600 psig</td>
</tr>
<tr>
<td>Materials</td>
<td>1.0619 WCB</td>
<td>1.4408 CF8M</td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval, ASME VIII</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Brokdorf, Isar, Mühleberg et al.</td>
<td></td>
</tr>
</tbody>
</table>

Benefits and features
This valve series has a cost-effective body and modular design with seat bushing. Smooth and stable behavior thanks to a comparatively low lift. The inner parts are made of stainless steel.

For applications in thermal expansion, protection of pipelines, protection of heat exchangers, for industrial gases, cooling and oxygen applications and other process applications up to PN40.

Ball-bearing-mounted disc for high seat tightness

20% back pressure without bellows permissible

Typical regular safety valve for many applications

Si 4322, our standard process safety valve for regular capacities

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

IMI Bopp & Reuther new sizing software Si-Tech 4.0 - A worldclass tool for sizing and selection of safety valves.
Si 6

This valve series ranges from low to high pressure with a reliable high quality design. Similar to the Si 2 series the low pressure version has a cost-efficient seat bushing, the high pressure version is instead equipped with a solid inlet nozzle, screwed in and welded leak tight. Available with various sizes and options.

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 20 to 400</th>
<th>NPS 3/4&quot; to 16&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>0.1 bar g up to 250 bar g</td>
<td>1.5 psig to 3600 psig</td>
</tr>
<tr>
<td>Materials</td>
<td>1.0619</td>
<td>WCB</td>
</tr>
<tr>
<td></td>
<td>1.4408</td>
<td>CF8M</td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval, ASME VIII</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td>Atucha, Balakovo, Brokdorf, Gösgen, Oskarshamn et al.</td>
<td></td>
</tr>
</tbody>
</table>

Benefits and features
Cost-effective design for low to high pressure range with multiple options suitable for vapours, gases and liquids in many different applications.

Materials are available for low to 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 control unit. This installation provides for “controlling” the discharge process. Open bonnet design available, ventilating the bonnet chamber permitting 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.

Engineered for high pressure protection
Full nozzle design
The Si 8 safety valve type fully meets the specification of API 526 and is manufactured in accordance with ASME Code Sec. III and VIII, for the orifice sizes D-T (orifices V-W outside API 526):

<table>
<thead>
<tr>
<th>Sizes</th>
<th>NPS 1” to 12”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>up to 414 bar g up to 6000 psig</td>
</tr>
<tr>
<td>Materials</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.0619 WCB</td>
</tr>
<tr>
<td></td>
<td>1.7357 WC6</td>
</tr>
<tr>
<td></td>
<td>1.4408 CF8M</td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval, ASME III + VIII</td>
</tr>
<tr>
<td>References</td>
<td>Oskarshamn, Ringhals et al.</td>
</tr>
</tbody>
</table>

**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 optimised for high seat tightness.

The nozzle ring is always set to the 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 robust 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 Section III.

Upon request NACE MR 0175 and NACE MR 0103 requirements can be implemented.
Main Steam Safety Valves and DCRV

Both valve series SiZ and Si 9 are being used as main steam safety valves in all reactor types worldwide in both primary and secondary circuits. They are designed for high performance applications and open/close very quickly to reduce steam loss to a minimum.

The DCRV is a demonstration of IMI B&R’s capabilities to find solutions to very specific problems. Based on the design of a standard spring loaded safety valve it was customised to withstand higher pressures (forged body), additionally equipped with a pneumatic piston (supplementary loading), a bellows (tightness) as well as a vibration damper (eliminating chattering).

Si 9
The Si 9507 was designed for the latest reactor types such as the EPR. Like the SiZ 2507 it is ASME Sec. III certified and TÜV as well as EC type test approved. In addition it’s QME-1 qualified.

SiZ
The SiZ 2507 is one of the two valve series specifically designed for the Main Steam Circuit. The integrated piston allows for pneumatic assistance if required. It is used in many of the nuclear power plants in Europe, Russia, Canada, Argentina, South Africa, South Korea and China.

DCRV
The Degasser Condenser Relief Valve was specifically designed and tested in cooperation with Canadian AECL for the CANDU reactor. It is in operation in many CANDU reactors worldwide.
**Si 9**

The high performance steam safety valve Si 9 is designed according to ASME Sec.I and Sec. III requirements. This valve can be customised as needed (orifice, materials, features).

<table>
<thead>
<tr>
<th>Sizes</th>
<th>NPS 1½&quot; to 12&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>3 bar g to 330 bar g</td>
</tr>
<tr>
<td>Materials</td>
<td>WCB</td>
</tr>
<tr>
<td></td>
<td>WC9</td>
</tr>
<tr>
<td></td>
<td>C12A</td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval, ASME III + VIII</td>
</tr>
<tr>
<td>References</td>
<td>Flamanville 3, Sae-Ul, Taishan, Yangjiang, Fangchenggang et al.</td>
</tr>
</tbody>
</table>

**Benefits and features**

Fixed overpressure and blowdown according ASME Sec. I and Sec. III with no rings hence no requirement for adjustment. For large flow, high pressure applications safeguarding main steam lines.

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

The forged inlet nozzle is available with weld-ends or flanges. The special belleville spring design for high pressures and large orifices is proven and allows for compact height.

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

This product is used for the following applications: conventional and nuclear power plants and industrial steam generation; steam applications in the petrochemical industry; steam boilers, superheaters and process steam systems.
SiZ 2507

**Sizes**
- DN 80 to 400

**Set pressures**
- PN 10 to PN 250

**Materials**
- Ferrite
- Austenite

**Certifications**
- TÜV and EC Type Test Approval, ASME III

**References**
- All Framatome 900 MW plants, Jushno, Koeberg, Paks et al.

**Benefits and features**
Similar in design and function to the Si 9 the SiZ series additionally offers an integrated air piston for pneumatic control (assisted opening and closing if required).

This product is used to safeguard the main steam lines in many nuclear power stations worldwide. Being in operation for decades without failure in dozens of pressure and heavy water reactors makes this valve type the most successful of the IMI B&R nuclear product range.

Over 1000 installations in main steam circuits of nuclear power stations worldwide

IMI Bopp & Reuther has the technology to perform high quality body seat repairs.

Upper valve can be blocked and removed avoiding re-setting the valve after inspection.
DCRV

Special proportional spring loaded safety valve for safeguarding primary and secondary liquid circuits

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 20 to 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set pressures</td>
<td>up to PN 160</td>
</tr>
<tr>
<td>Materials</td>
<td>Ferrite</td>
</tr>
<tr>
<td></td>
<td>Austenite</td>
</tr>
<tr>
<td>Certifications</td>
<td>TÜV and EC Type Test Approval, ASME VIII</td>
</tr>
<tr>
<td>References</td>
<td>Pickering, Wolsong, Qinshan, Embalse, Cernavoda et al.</td>
</tr>
</tbody>
</table>

Benefits and features
The 1994 incident at Pickering NPP which resulted in the loss of coolant was the trigger for the development of this special design valve to eliminate chattering on degasser/condenser piping.

IMI B&R designed, manufactured and tested this valve successfully in cooperation with AECL and Wyle Lab. Today this valve has replaced the original equipment in many of the worldwide CANDU plants ensuring continuous operation without failure.

Being a showcase this valve represents the flexible and innovative capabilities of IMI B&R. The experience gained with this project can also be transferred to other IMI B&R product lines. Our customers benefit from customised solutions that handle very specific application issues.

Vibration damper provides proportional characteristic eliminating valve chattering

Optional pneumatic piston for remote control (open/close)

Block body design for higher pressures and flexible choice of connection to piping

Spare parts: spring, discs, disc holders

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

Customised Si 4 valve design with vibration damper, bellows and pneumatic piston
Medium Operated Safety Valves

The medium operated safety valve model SiH 3112 works on the loading principle which offers increased tightness and a fail-close characteristic. The customer can choose the type and quantity of the pilot valves. The steam pressure acts in a closing direction on the cylinder plug. To open the main valve, the pilot valve directs the medium to the chamber in the cylinder plug.

Redundancy can be enforced by using two or more pilot valves. Common mode failure can be prevented by using pilot valves of different working principles. The supplementary magnetic closing force of the solenoid pilot valve increases the tightness. Optionally these pilot valves can be opened by magnetic force at pressures below set pressure.

Safety and Relief Valve
SiH 3112
Medium operated safety valve for safeguarding plant components in primary and secondary circuits.

LP Bypass Valve
SiH 3112-ND
Medium operated safety valve for safeguarding LP turbine during turbine trip in pressurised water reactors.

Pilot Valve
SiH 3115
For main valve SiH 3112
Options:
- Standard (spring loaded)
- With add. Air Piston
- With add. Solenoid

Control Unit
SiH 3115-ND
For main valve SiH 3112-ND
## SiH 3112 and SiH 3115

<table>
<thead>
<tr>
<th>Safety and Relief Valve SiH 3112</th>
<th>Pilot Valve SiH 3115</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sizes</strong></td>
<td></td>
</tr>
<tr>
<td>DN 100 to DN 400</td>
<td>ND 20 to DN 50</td>
</tr>
<tr>
<td><strong>Set pressures</strong></td>
<td></td>
</tr>
<tr>
<td>0 to PN 160</td>
<td>PN 40 to PN 250</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td></td>
</tr>
<tr>
<td>Ferrite</td>
<td>Ferrite</td>
</tr>
<tr>
<td>Austenite</td>
<td>Austenite</td>
</tr>
<tr>
<td><strong>Certifications</strong></td>
<td>TÜV and EC Type Test Approval, ASME III</td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Germany (Isar, Grundremmingen, Phillipsburg, Grafenrheinfeld, Biblis, Krümmel, Brunsbüttel), Switzerland (Gösgen), Finland (Olkiluoto), Russia (Kalinin, Kola, Novovoronezh), The Ukraine (Jushno, Rovno), Argentina (Atucha)</td>
</tr>
</tbody>
</table>

### Benefits and features

Medium operated safety valve (S+E) for safeguarding plant components used in primary and secondary circuits (steam, water, steam/water mixture) as:
- Pressuriser Safety Valve in Pressurised Water Reactor Plants
- Main Steam Safety Valve in Pressurised and Boiling Water Reactor Plants

The pilot valve is a direct acting angled valve with optional supplementary loading and/or opening by solenoid.

**Pilot operated pressuriser safety valve consisting of**
- Main Valve SiH 3112
- Two spring loaded pilot valves SiH 3115
- One solenoid operated pilot valve SiH 3115-M

**Pneumatic assisted pilot valve SiH 3115**

**Pressuriser safety valves in a heavy water reactor plant**

**Replaceable seat and with double magnet**
SiH 3112-ND and SiH 3115-ND

<table>
<thead>
<tr>
<th></th>
<th>LP Bypass Valve SiH 3112-ND</th>
<th>Control Unit SiH 3115-ND</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sizes</strong></td>
<td>DN 700</td>
<td>DN 25</td>
</tr>
<tr>
<td><strong>Set pressures</strong></td>
<td>PN 16</td>
<td>up to PN 400</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>Ferrite</td>
<td>Ferrite</td>
</tr>
<tr>
<td><strong>Certifications</strong></td>
<td>Individual Certification</td>
<td></td>
</tr>
<tr>
<td><strong>References</strong></td>
<td>Germany (Isar, Grohnde, Brokdorf, Unterweser, Biblis, Philippsburg, Neckarwestheim, Krümmel, Brunsbüttel), India (Tarapur)</td>
<td></td>
</tr>
</tbody>
</table>

**Benefits and features**
Medium operated safety valve for safeguarding LP turbine during turbine trip in pressurised water reactors.

The pilot valve is a hydraulically operated angled valve which acts as impulse control of the main valve.

In order to operate the valve at very low pressures this “pilot valve” is hydraulically supported.

**Loading principle:**
In order for the main valve to open, the piston chamber is loaded with system pressure. The difference in area of seat vs. piston allows the disc to lift at approx. 60% of the system pressure.

Main valve and control unit for low pressure turbine bypass

Pilot valve test setup

Easy design – longer lifetime
Gate Valves

Gate valves are generally used in the nuclear power industry to securely isolate water and steam lines. The main advantage over globe valves is the extremely low pressure drop across gate valves.

Of the two main types (wedge and parallel slide) IMI Bopp & Reuther favours the wedge gate valves. The tapered configuration of the seat allows high additional sealing forces, thus ensuring increased safety during operation.

Another advantage over parallel slide gate valves is that the sealing surfaces will be in contact only in the final closed position.

The guiding rail prevents the disc and seat from being in permanent contact during opening and closing thus reducing wear and extending trouble-free service life.

Low and Medium Pressure Wedge Gate Valves
NKS, MKS
Shut off valves for low and medium pressure applications for isolating liquids, vapors and steam

High Pressure Wedge Gate Valves
HKS
Shut off valve for high pressure in water and steam circuits
Wedge Gate Valves

Low and Medium Pressure Wedge Gate Valves NKS, MKS

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 50 to DN 300 (Dye forged shell body)</th>
<th>DN 350 to DN 600 (Welded body)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Pressure</td>
<td>up to PN 64 (Low Pressure)</td>
<td>PN 64 to PN 160 (Medium Pressure)</td>
</tr>
<tr>
<td>Materials</td>
<td>Ferrite</td>
<td>Seat hardfacing: e.g. Stellite 21 or cobalt free</td>
</tr>
<tr>
<td></td>
<td>Austenite</td>
<td></td>
</tr>
</tbody>
</table>

High Pressure Wedge Gate Valve HKS

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 50 to DN 600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Pressure</td>
<td>up to PN 350</td>
</tr>
<tr>
<td>Materials</td>
<td>Ferrite</td>
</tr>
<tr>
<td></td>
<td>Seat hardfacing: e.g. Stellite 21 or cobalt free</td>
</tr>
<tr>
<td></td>
<td>Austenite</td>
</tr>
</tbody>
</table>

Certifications
AREVA-Test results PTCTM-G/2010/de/066, hot functional tests including Integrity and Operability after Malfunction of electric actuator (swicht-failure)

References
Germany (Biblis, Philippsburg), Switzerland (Beznau), Bulgaria (Kozloduy)

Benefits and features
Shut off valves for low, medium and high pressure applications for isolating liquids, vapors and steam.

These wedge type gate valves come with hard faced sealing surfaces (cobalt free if required) and either weld-ends or flanges. They are equipped with hand wheels for manual operation and/or electric actuators. More options available upon request.

For low and medium pressures sizes up to DN 300 the body consists of two welded dye forged half shells. Larger sizes can only be offered in fully welded design. The high pressure bodies are machined of a single block of forged steel without any welding.
Check Valves

Swing check valves are used in the water and steam circuits in nuclear power plants.

When used in steam circuits, the swing check valves are undamped to allow a compact form and easy maintenance.

A damped version of the swing check valves is used in water circuits to absorb pressure surges. The dampening effect is achieved by adding a piston or spring mechanism to the valve thus preventing water hammering.

Low & Medium Pressure Swing Check Valves
NRK, MRK
Prevention of back flow in low and medium pressure water and steam lines

High Pressure Swing Check Valves
HRK
Prevention of back flow in high pressure water and steam lines
## Swing Check Valves

### Low and Medium Pressure Swing Check Valves NRK, MRK

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 50 to DN 300 (Dye forged shell body)</th>
<th>DN 350 to DN 600 (Welded body)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure</td>
<td>up to PN 64 Low Pressure</td>
<td>PN 64 to PN 160 Medium Pressure</td>
</tr>
<tr>
<td>Materials</td>
<td>Ferrite</td>
<td>Materials Seat hard facing:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>e.g. Stellite 21 or cobalt free</td>
</tr>
<tr>
<td></td>
<td>Austenite</td>
<td></td>
</tr>
</tbody>
</table>

### High Pressure Swing Check Valves - HRK

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 50 to DN 600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure</td>
<td>up to PN 400</td>
</tr>
<tr>
<td>Materials</td>
<td>Ferrite</td>
</tr>
<tr>
<td></td>
<td>Austenite</td>
</tr>
</tbody>
</table>

### Certifications

- [ ]

### References

- Germany (Biblis)

### Benefits and features

This Swing Check Valve series prevents back flow in low, medium and high pressure water and steam lines. The basic design of the body is identical to the gate valve series:

- forged half shells merged by electron beam welding for sizes up to DN300
- welded body for sizes starting from DN350
- block body design for pressures up to PN400

Available connections:

- Weld end
- Flanges

![Modular design for gate and check valves](image)

![Hardfaced seat cobalt free available](image)

![Undamped swing check valve for compressible fluids](image)

![High pressure check valve in block body design](image)
Control Valves

IMI Bopp & Reuther control valves are used to provide modulating control in emergency cooling systems of nuclear power plants. The valves control both pressure and flow based on a set pressure differential across the valve. It is equipped with an electric actuator that opens, closes and modulates the valve trim as required. Offering optimum pressure control the valve is designed specifically for all load cases.

The safety requirements for seismic specifications are calculated and verified by dynamic seismic tests.

WRD
Control valve with conical seat
WRD

WRD Control Valve with conical seat

<table>
<thead>
<tr>
<th>Sizes</th>
<th>up to DN 300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure</td>
<td>up to PN 100</td>
</tr>
<tr>
<td>Materials</td>
<td>Austentite</td>
</tr>
<tr>
<td>Certifications</td>
<td>Seismic certification by calculation and shake-table test kv-qualification by massflow test</td>
</tr>
<tr>
<td>References</td>
<td>Ukraine (Jushno), Sweden (Ringhals)</td>
</tr>
</tbody>
</table>

Benefits and features

Installed typically in the LP lines of the primary circuit this valve offers continuous flow and pressure control and prevents flashing and cavitation.

The body form suits individual piping arrangement requirements.

Seismic certification by calculation and shake-table test. Optimum kV – properties verified by mass-flow tests.

Hardfaced seat Cobalt free available

Find solutions for different sizes and materials

A bright range of spare parts with common material for the nuclear industries upon request
Control Units

Pneumatic control units are used to control the flow and direction of air to the various sections of the safety valve piston to keep the valve shut tight before the set pressure is reached, and when the set pressure is reached, the air is directed to assist opening the valve.

To keep the valve closed, the additional pneumatic forces on the closing piston add on the force of the spring and achieve an excellent tightness. As soon as the set pressure is reached, the “closing air” is bled off and air is directed under the lifting piston to assist the opening action.

Controlled Safety Pressure Relief System (CSPRS)

For high leak tightness, late or remote opening and stable behavior

Control Unit PC 50

The “Control Unit” PC 50 is designed to operate pneumatic assisted safety valves.
**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 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).

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

<table>
<thead>
<tr>
<th>Sizes</th>
<th>DN 25 to DN 400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certifications</td>
<td>TÜV type test approval, CE stamp, Optional version with TÜV seismic qualification in acc. with KTA 2201.4</td>
</tr>
<tr>
<td>References</td>
<td>Germany (Biblis), Switzerland (Benzau, Gösgen), South Africa (Koeberg)</td>
</tr>
</tbody>
</table>

**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 and PC 51 (Feed and Bleed)

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 valves with integrated differential surface 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).

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

<table>
<thead>
<tr>
<th>Set pressures</th>
<th>0.1 bar g to 250 bar g</th>
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</thead>
<tbody>
<tr>
<td>Certifications</td>
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</table>

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 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.

State-of-the-art components
Stable performance
Excellent system integrity
Triple redundancy
Highest reliability

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

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