

For your critical nuclear needs.



Sempell Nuclear Valves

Secure leak-tight performance and 100% reliability for high pressure, high temperature applications.



NO ONE KNOWS NUCLEAR BETTER

Emerson has been a mainstay of the nuclear industry since the first commercial nuclear power stations started operation in the 1950s.

As the sector has undergone significant change and the demands on nuclear plant operators have grown ever greater, we have remained the trusted flow control partner of choice.

That's because 24 hours a day, Emerson's experts are working with nuclear plants across the globe to help them increase safety and reliability, reduce downtime and protect the environment.



EMERSON

A GLOBAL NETWORK OF INTERNATIONAL BRANDS

EMERSON IS THE NAME BEHIND THE WORLD'S MOST COMPREHENSIVE RANGE OF VALVES, ACTUATORS AND ASSOCIATED FLOW CONTROL PRODUCTS.

Supplying a host of leading global brands, we work closely with the oil & gas, power generation, mining, chemical, food & beverage and marine industries, to anticipate their needs and exceed their expectations.

EXCELLENCE IN ENGINEERING

Emerson's position as the technology leader in flow control is solidified by the collective resources of our brands. Utilizing the latest systems and technology, our specialists produce the highest quality flow products at competitive market pricing.

QUALITY PHILOSOPHY

A strong commitment to maintaining and improving the quality of both product performance and customer service is inherent within our management policy.

Our factories and Q.A. procedures are inspected and audited regularly

by major quality authorities including Lloyd Register, BSI, Bureau Veritas, TÜV and comply with ISO 9000:2000.

APPLICATION SOLUTIONS

Working closely with industry contractors and users, combining advanced technology with outstanding engineering expertise, Emerson's engineers are able to develop specific proposals for individual process requirements.

PROJECT PACKAGES

The extensive product range enables the design and supply of integrated project packages to simplify supply chains.

ANYWHERE IN THE WORLD

Emerson's products can be found at work in every corner of the globe with over 30,000 people worldwide, working with clients and partners on six continents. Our flow management solutions are backed by unrivalled customer services, experience and support.





A TRADITION OF EXCELLENCE

WITH OVER 140 YEARS OF EXPERIENCE, WE PROVIDE OUR POWER CUSTOMERS WITH OPTIMAL SOLUTIONS FOR HIGH PRESSURES, EXTREME TEMPERATURES AND CRITICAL APPLICATIONS TO MEET THE MOST STRINGENT SAFETY REGULATIONS.

The Sempell range delivers control, safety relief and isolation valves to conventional and nuclear power plants.

The result of decades of expertise in thermodynamics, the range includes turbine bypass and startup control valves of unparalleled reliability for applications in supercritical, ultra-supercritical and nuclear power plants.

There are forged gate, globe and check valves that serve the EN and ASME power generation markets and nuclear applications to meet customer specifications and nuclear standards.

Applying cutting edge material science and valve designs has created isolation and non-return valves that are designed for all types of power plants.

Emerson pioneered new technology for pilot operated pressurizer safety valve systems on the new GEN III reactors, regardless of code and provides other critical solutions, including system medium operated main steam isolation valves and main steam safety valves.

The quality and experience of our service organization is unequalled; with a complete range of spare parts, maintenance, mobile machining, in-line testing, planning and engineering capabilities to keep plants running efficiently.

HISTORY

Sempell is now part of Emerson, one of the world's foremost manufacturers of valves for pressure protection and severe isolation applications. Although now part of a leading global organization Sempell has its own history in the design, development and manufacture of products for the nuclear power industry, here are a few highlights:

1874 Founded as the Rheinische Armaturen- und Maschinenfabrik by Albert Sempell.

1960 First valves delivered for NPP.

1970 First delivery of pilot operated safety valves based on conventional technology to German NPP.

1973 Delivery of the first system medium-operated main steam isolation valve (gate type) to German NPP.

1976 First Main Steam Valve Set (FSA) developed for German NPPs.

1980 Delivery of cobalt-free gate valves (Babcock type) for the emergency core cooling system of PWR (VVER1000)

1984 Blow-down testing of main steam isolation valve (Babcock gate type), at large valve testing facility GAP in Karlstein, Germany. Full scale testing of FSA-station (MSVS) under operating conditions

1985 Qualification of pressurizer pilot-operated safety valves for two-phase flow conditions (ATWS - Anticipated Transients Without Scram)

1989 First manufacturer of safety valves in Germany to receive the ASME 'UV stamp'

1990 Quality management system certified in accordance with ISO 9001

1991 Deutsche Babcock AG, Oberhausen acquired Sempell AG

1995 Blow-down testing of cobalt-free high pressure isolation gate valve at GAP in Karlstein, Germany

1997 Sempell sold to TYCO International Ltd. and integrated into the Flow Control division.

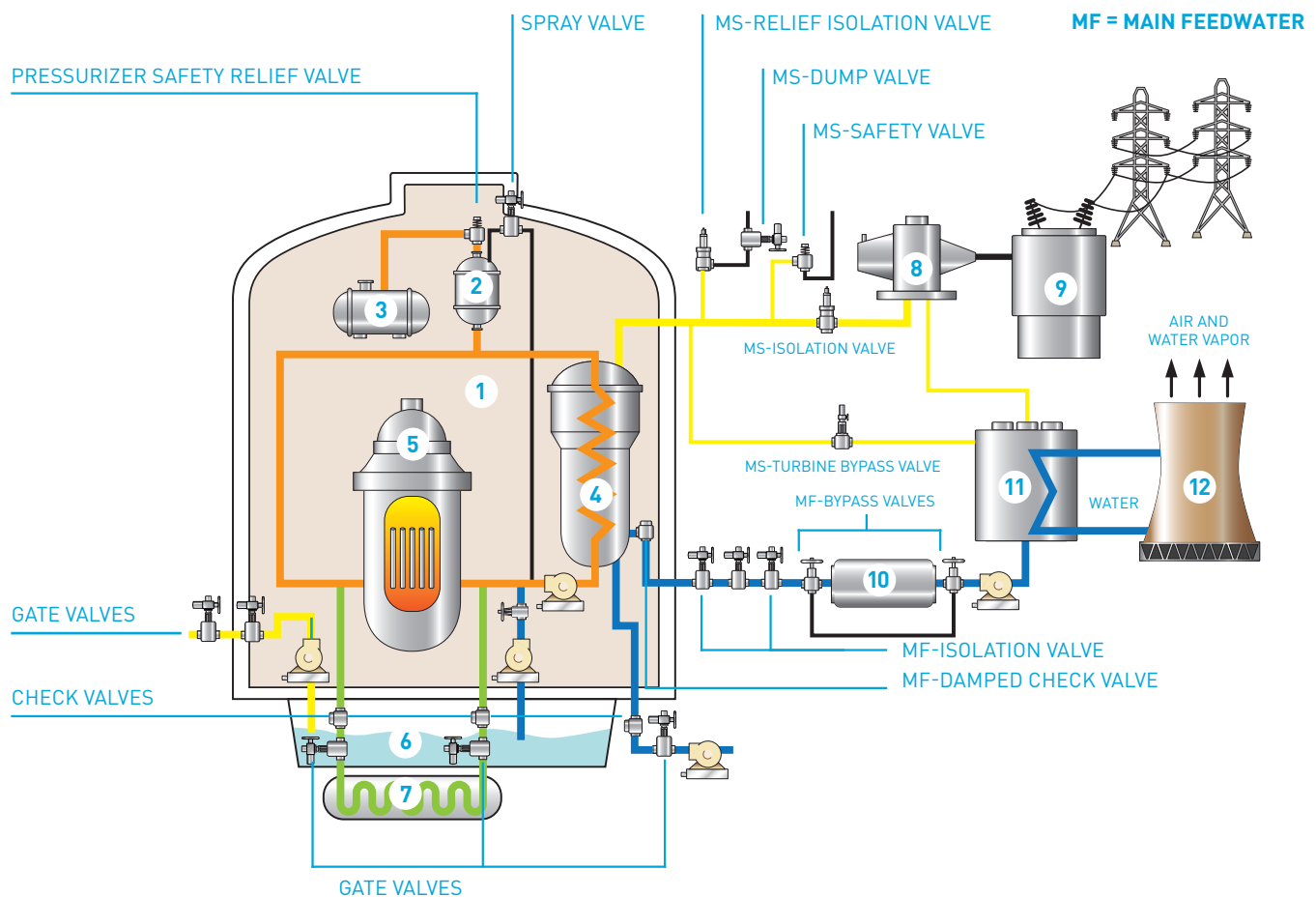
2003 Sempell received the ASME III 'N-stamp'

2011 Delivery of the first ASME III qualified PSRV in compact design for APR1400 reactor

2012 Sempell AG changed to Sempell GmbH. Merger of Tyco International's Flow Control business unit with Emerson.

2017 Integration of Sempell GmbH into Emerson - Flow Control Business Unit.

PRESSURIZED WATER REACTOR PWR



KEY TO PWR

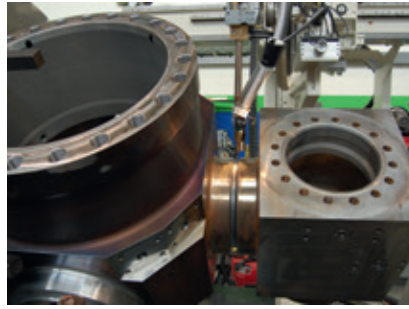
1. Containment building
2. Pressurizer
3. Blow down tank
4. Steam generator
5. Reactor pressure vessel
6. Reactor sump
7. Emergency cooling system
8. Turbine
9. Generator
10. Preheater
11. Condenser
12. Cooling tower

SEMPELL RANGE NUCLEAR VALVES

Application solutions

- Main steam system
 - Pilot operated main steam isolation valves (MSIV)
 - Pilot operated main steam safety valves (MSSV)
 - Pilot operated main steam relief isolation / blow-down isolation valves (MSRIV)
 - Main steam relief / dump control valves (MSRCV)
 - Main steam turbine bypass valves (MSTBV)
- Pressurizer
- Pilot operated pressurizer safety relief valves (PSRV)
- Emergency core cooling system
 - Austenitic gate, globe and check valves
- Main feedwater system
 - Main feedwater damped check valves (MFDCV)
 - Main feedwater bypass valves / preheater protection bypass valves
 - Main feedwater isolation valves (MFIV)
 - Main feedwater control valves (MFCV)
- Gate, globe check valves
- Control valves
- Spring loaded safety valves

Sempell also provides proven solutions for BWR, PHWR and FRB.



NUCLEAR VALVES

APPLICATIONS FOR NUCLEAR POWER PLANTS

To date, many thousands of standard and special valves have been delivered to all known reactor types.

Spare parts for all Sempell and the former Babcock valve types can still be delivered today, more than 30 years after the first delivery date.

Our design engineers, order processors and maintenance personnel have secured, documented and safeguarded the component knowledge, enabling the further development of special design solutions.

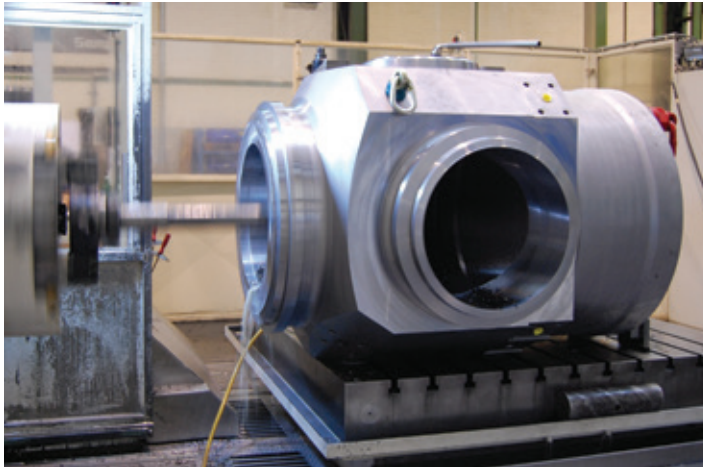
The Sempell valve manufacturing facility supplies nuclear components to RCC-M, KTA, PNAEG and ASME standards.

It holds all major industry certifications, including ASME Section III and VIII, ISO 9001:2000, PED and has established partnerships or global supply agreements with many major companies.

With 20,500m² of production space in a specialized manufacturing plant, this is a truly global manufacturing facility for customized nuclear products, using the latest automation technology and specialized machinery, including over 30 CNC machines.

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MSIV & MFIV

MAIN STEAM & MAIN FEEDWATER ISOLATION VALVES

Quick closing valves are installed in boiling and pressure water reactors for fast and safe isolation of the main steam pipeline, with stroke times between 1–5 sec.

Globe and gate valve designs are used, both of which have advantages and disadvantages.

Globe valves with flat seats guarantee a good seat tightness and easy maintenance. Angle type bodies, which give good access from the top, have acceptable pressure loss; straight designed bodies with inclined stems have lower pressure loss.

Gate valves always have low ξ -values and thus low pressure losses. In many cases the seats are reduced by one size compared to the inlet diameter. Compared with globe valves, their seat surface needs more maintenance.

The MSIV can influence the efficiency of a power plant by restricting flow and producing turbulences. We use ANSYS CFX state of the art fluid dynamic calculation software to provide optimized designs.

Our range concentrates on system medium-operated valves according to the relief principle with over 190 MSIV in gate or globe type designs installed.

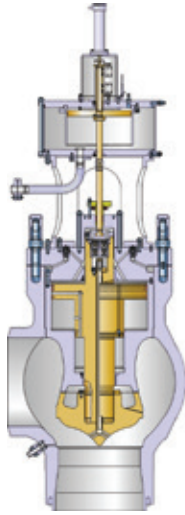
This actuation principle eliminates many of the inherent failure mechanisms found on fast-acting pneumatic (spring to close) or hydraulic (gas to close) actuators.

Full scale blow-down tests have been carried out for both the gate and globe valve designs at the Karlstein testing facility GAP (GroßArmaturenPrüfstand).

Medium-operated designs ensure low loads on the pipework in case of earthquakes. The pressure containing parts consist of the valve housing; there are no welds to be subjected to pressure and low overall heights mean reduced space requirements.

These valves have very few components and parts that are subjected to wear; the only moving parts being the disc assembly, piston and piston rod.

The MFIVs isolate the main feedwater flow to the secondary side of the steam generators following a high-energy line break (HELB). Closure of the MFIVs interrupts the flow to the steam generators, terminating the event of feedwater line breaks occurring upstream of the MFIVs or MFCVs. Closure of the MFIVs terminates effectively the further supply of feedwater to an affected steam generator, limiting the mass and energy release for steam line breaks or feedwater line breaks inside the containment, and reducing the cooldown effects.



TYPE EBS32

Application

PWR main steam isolation valve
Ensuring fast closing in emergency modes

Design

System medium-operated with a pneumatic drive to keep the valve open in absence of system pressure
Stroke time: 3-5s

Reference

PWR AREVA NP
(former Siemens KWU) PWR (WER)
Rosatom

Size

up to NPS 24/DN 600

Pressure

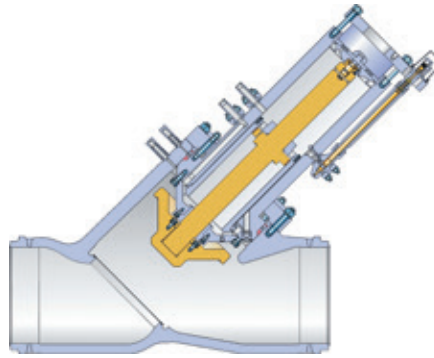
Class 900/PN 160

Body material

A105 (1.0460)

Qualification

1:1 scale tests with steam at GAP
Karlstein-Siemens



TYPE SSS9

Application

BWR main steam isolation valve
First barrier inside containment
Ensuring fast closing in emergency modes

Design

System medium-operated with a permanent magnet to keep the valve open in absence of system pressure
Stroke time: 1-2s

Reference

BWR Sweden, Westinghouse
(former ASEATOM)

Size

up to NPS 18/DN 450

Pressure

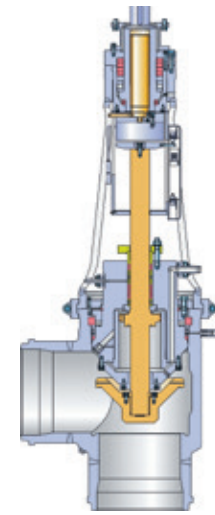
Class 900/PN 160

Body material

Cast steel WCB with stubs of forged steel A105 (1.0460)

Qualification

Sempell laboratory



TYPE ESS9

Application

Main steam isolation valve
Second barrier outside containment
Ensuring fast closing in emergency modes

Design

System medium-operated with an electric solenoid for opening and stem buoyancy to keep the valve open in absence of system pressure

Reference

BWR Sweden, Westinghouse
(former ASEATOM)

Size

up to NPS 18/DN 450

Pressure

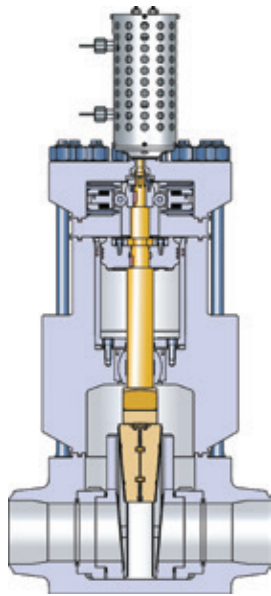
Class 900/PN 160

Body material

Cast steel WCB with stubs of forged steel A105 (1.0460)

Qualification

Sempell laboratory



TYPE GPS50

Application

Main feedwater isolation gate valve.
Ensuring fast closing in emergency modes

Design

System medium-operated with a mechanical coupling to keep the valve open in absence of system pressure.

References

HTR China

Size

NPS 24 / DN 600

Pressure

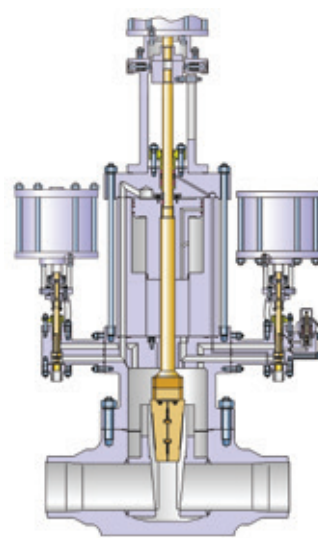
up to class 1500 / PN 250

Body material

Carbon steel

Qualification

Sempell laboratory and seismic qualification.



TYPE GPS50

Application

Pipe-break isolation gate valve
Ensuring fast closing in emergency modes

Design

System medium-operated with a mechanical coupling to keep the valve open in absence of system pressure and pneumatic coupling for operation

Reference

BWR Finland

Size

up to NPS 24/DN 600

Pressure

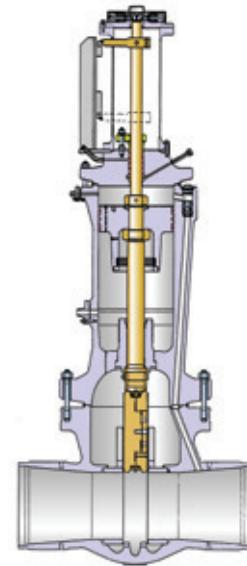
Class 150/PN 20

Body material

Carbon steel and stainless steel

Qualification

Sempell laboratory with saturated water



TYPES 614-322/614-324

Application

Main-steam isolation gate valve.
Ensuring fast closing in emergency modes

Design

System medium-operated with a mechanical coupling to keep the valve open in absence of system pressure
Stroke time: 3-5s

Reference

PWR Germany, PWR (VER) Russia, Ukraine, Czech Republic, Slovakia, Hungary

Size

up to NPS 24/DN 600

Pressure

Class 900/PN 160

Body material

Cast steel WCB with stubs of forged steel A105 (1.0460)

Qualification

1:1 scale tests with steam at GAP
Karlstein-Siemens

Upgrades are available to fulfil safety requirements and lower operating costs.

MSSV

MAIN STEAM SAFETY VALVES

Main steam safety valves are installed to avoid inadmissible pressure increases in a system.

Depending on the required specifications, either spring-loaded or pilot-operated safety valves are installed. Some international standards, such as the ASME code, only allow spring-loaded designs.

Pilot-operated safety valves have the advantage that they blow-off larger quantities at higher pressures through a reduced number of valves.

For a 4-loop plant with approx. 1200 MW, up to five spring-loaded safety valves per loop must be installed to meet the blow-off capacity.

With pilot-operated safety valves, the necessary capacity can be blown-off by only one valve per loop.

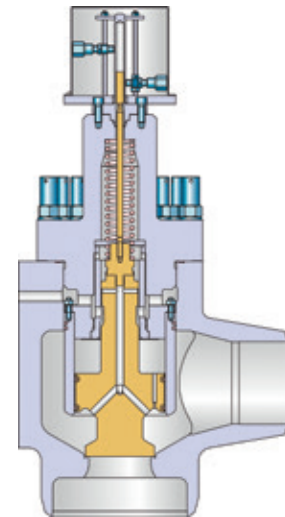
The safety valve, type VS99, provides a pilot-operated pressure release solution for the main steam system and pressurizer.

The design is suitable for all major reactor types. It is characterized by excellent operation irrespective of the type of medium: steam, gas, water or two-phase-flow. Operational stability is maintained even when capacities are below the maximum rate. High temperature applications up to 570°C are available.

The valve's main disc is held closed by the full working pressure right up to opening. High pressure seating ensures an absolutely hermetic seal far superior to spring-loaded valves. The high sealing load generated by the pressure of the working medium is almost impossible to achieve by any other method.

All working parts operate inside the obstruction-free pressure chamber and are exposed constantly to the working temperature, eliminating thermal expansion problems.

The seating surfaces of the disc and body are outside the flow path of the escaping medium; flow does not pass across or impinge on the seating surfaces.



TYPE VS99

Application

PWR and BWR main steam safety valve

Design

Block-design with direct mounted pilot valves, low and high pressure in-situ test during operation, accurate pilot set pressure opening value with > 1% repeatability

Reference

Damped closing: PWR AREVA NP (former Siemens KWU)

Undamped: BWR Westinghouse (former ASEA-ATOM)

Size

up to NPS 18/DN 450

Pressure

up to Class 2500/PN 420

Body material

Cast or forged carbon steel; special material on request

Qualification

1:1 scale tests with steam at GAP Karlstein-Siemens



MSVS Main steam valve set

MSVS MAIN STEAM VALVE SET

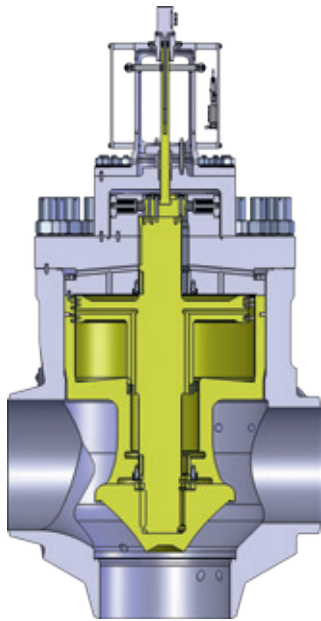
Quick-closing valves are installed in PWR and BWR for fast and safe isolation of the main steam pipe line in case of pipe rupture. For PWR the stroke time is between 3-5 sec.; BWR requires between 1-2 sec.

In many PWR, MSIVs and MSSVs are installed separately in the main steam line. In the FSA-Station (Frischdampf-Schnellschluss-Sicherheits-Armaturen-Station), four valves are welded and installed together. All valves are medium-operated by solenoid valves. In addition to the MSIV and MSSV, there is a blow-down isolation valve, which is installed upstream of the main steam control valve to vent the pipe to the atmosphere and a unique isolation valve to isolate the MSSV in case of malfunction of a pilot valve and guarantee safe isolation of the blow-off line. It is full-scale tested under operating conditions with nominal discharge of steam and discharge in emergency modes (steam, water-steam-mixture). These Main Steam Valve Sets have been delivered to a dozen NPPs.

A similar concept can be found in the latest Russian PWR-design (VER1000), to be supplied to China and the Rosatom new built PWR in Russia and abroad with 1200 MW (VER1200). The main difference is that in this reactor design, with four loops, two MSSVs are installed per loop with no isolation valve upstream of the MSSVs.

Each main steam valve unit consists of: a system medium-operated, angle-type main steam isolation valve; two main steam safety valves (or steam generator safety valves) which operate sequentially; a main steam dump valve to atmosphere and an isolating valve upstream of this.

Main Steam Valve Sets are totally integrated to provide main steam isolation and safety relief to the atmosphere in the event of failures upstream or downstream. The safety and isolation valve bodies are welded to the MSIV body to produce the most compact unit design.



TYPE EBS32

Application

Main steam isolation valve
Fast closing under emergency conditions

Design

System medium-operated

Reference

PWR Areva NP (former Siemens KWU)
PWR (VVER), China, Rosatom

Size

NPS 24/DN 600

Pressure

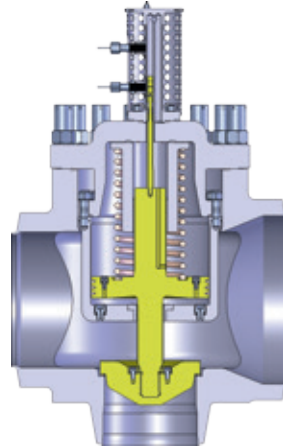
Class 900/PN 160

Body material

P355QH1 (1.0571) 1.6310

Qualification

1:1 tests based on the GAP-Karlstein qualification for FSA Station



TYPE TBS34

Application

Blow down isolation valve. Main steam relief isolation valve (as a separate valve in EPR reactor designs)

Design

System medium-operated

Reference

PWR Areva NP (former Siemens KWU)
PWR (VVER), China, Rosatom

Size

NPS 18/DN 450

Pressure

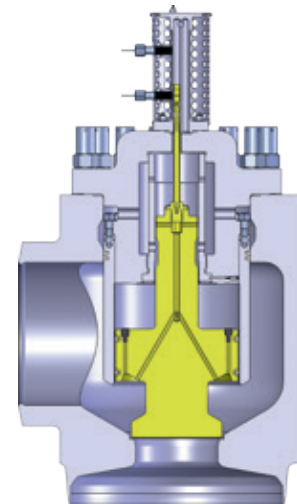
Class 900/PN 160

Body material

P355QH1 (1.0571) 1.6310

Qualification

1:1 tests based on the GAP-Karlstein qualification for FSA Station



TYPE VS99

Application

Main steam safety valve

Design

System medium-operated

Reference

PWR Areva NP (former Siemens KWU)
PWR (VVER), China, Rosatom

Size

NPS 18/DN 450

Pressure

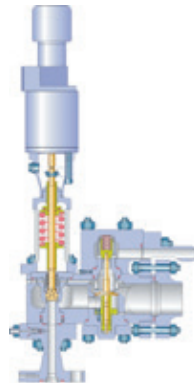
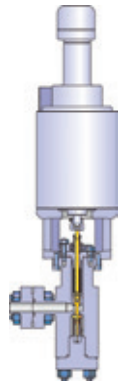
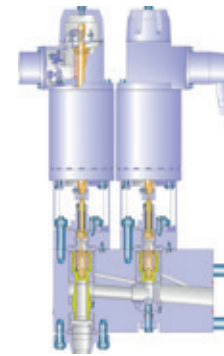
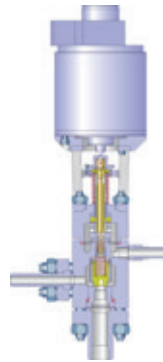
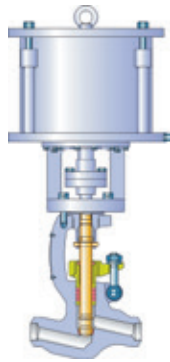
Class 900/PN 160

Body material

P355QH1 (1.0571) 1.6310

Qualification

1:1 tests based on the GAP-Karlstein qualification for FSA Station



TOP ROW left to right
Type NICO 4000 with pneumatic
Type EMS 3/4
Type DMS 5/6

BOTTOM ROW left to right
Type VCA
Type VS 66

PILOT VALVES

Medium-operated valves are controlled by pilot valves which are operated by system medium (self-acting) or external energy. After the pilot valve opens, the pressure in the pressure chamber of the main valve is released and the valve lifts either to open or close.

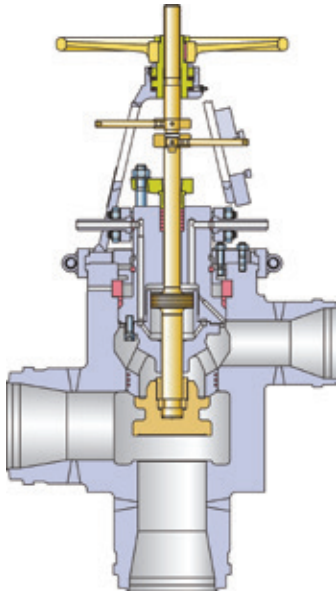
The NICO 4000 is available as a straight or angle type globe valve with electric or pneumatic actuator, fail-safe open or fail-safe close.

Solenoid pilot valves are designed to relieve the control chambers of valves controlled by their own medium quickly and reliably, meeting fail-safe requirements. Type EMS 3 is a pilot-operated valve that works to the de-energized open principle. The Type EMS 4 works to the energized open principle.

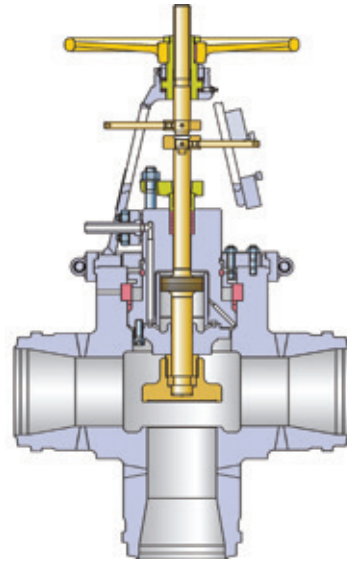
The Type DMS 6 double solenoid control valve comprises two series-connected pilot-operated valves in a common body. In the opened position, medium flows through the complete valve. The design permits an alternating functional test of the inner and outer valve without having to operate the main valve. Its solenoids are qualified to the IEEE standard.

The VCA solenoid pilot valve was developed for pressurizer applications and is used where pressure relief is necessary below the set pressure of spring-loaded pilot valves. Based on its application in the primary circuit, the solenoids are LOCA qualified to KTA 3504. For pressurizer safety valves, different actuation types of pilot valves are available that ensure advanced control for the feed and bleed load cases and cold-overpressure protection of the reactor vessel.

The steam-operated VS66 consists of a spring-loaded safety relief valve, acting as an impulse valve and a relay check valve, by which pressure in the control line and main valve chamber is released. It is self-acting and the solenoid on top of the impulse valve provides improved seat tightness.



AVS5 Inlet valve



AVS4 Outlet valve

TYPE AVS5 / AVS4

Application

Feedwater/preheater protection

Design

Low pressure in cast steel; high pressure in forged steel. Medium-operated according to releasing principle, with blocking stem

Reference

German, Swedish, Eastern European NPP

Size

NPS 3-18/DN 75-450

Pressure

LP: Class 150 - 600/PN 20 - 100

HP: Class 900 - 2500/PN 150 - 420

Body material

As specified; most common: A216 WCB (1.0619), A105 (1.0460), 1.6368

PROTECTION OF PREHEATERS

Preheater changeover valves protect against the consequences of a break in the high pressure feedwater pipes.

The Sempell principle of forced changeover using three-way and check valves was developed over 30 years ago, they are designed to be medium-operated and controlled via pilot valves. The lower side of the piston of the AVS5 changeover valve at the inlet and the AVS4 check valve at the outlet is reduced in pressure, due to the opening of the control valves. The high pressure medium is blown off into the atmosphere and the upper side of the piston continues to be supplied with high pressure system medium. The resulting forces close the inlet and outlet valves simultaneously.

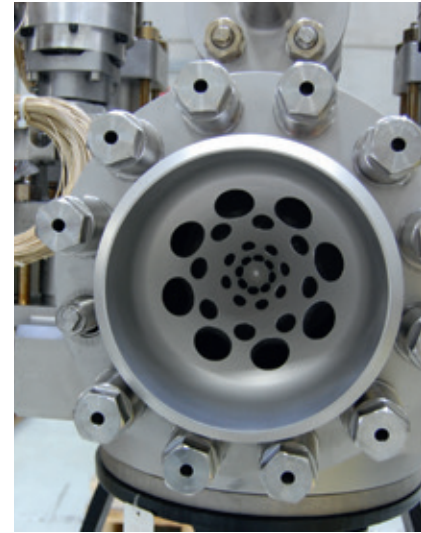
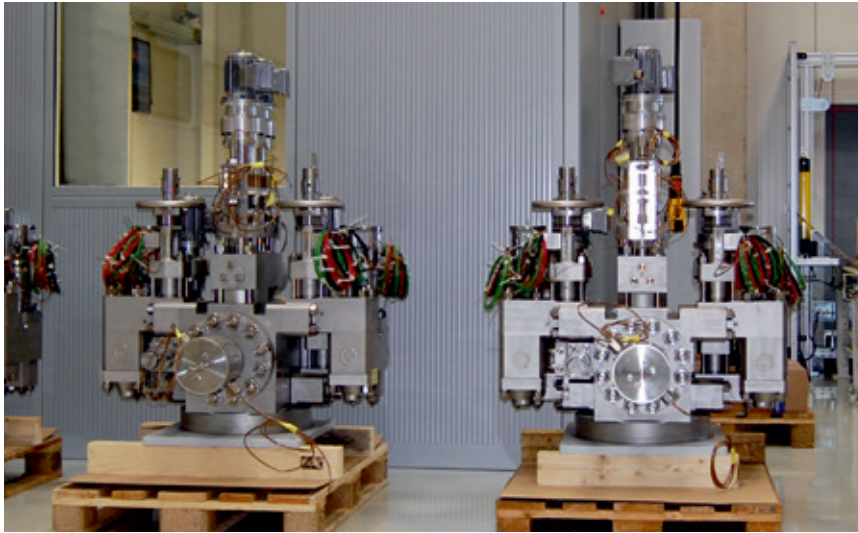
Their primary features and advantages are:

- Rapid closing (the lift is only ¼ that of comparable gate valves)
- High actuation forces due to highly different forces on the actuation piston

- Automatic locking between feedwater flow in preheater and bypass directions eliminates faulty actuations ensuring the boiler receives a constant water supply.
- Protection against unintentional opening at high differential pressures. The valve can only open after pressure balance.
- Alternatives available to moderate the closing speed; required if the water may hit and damage the separation wall of the preheater or if operating times are specified.

The bodies for high pressure designs are made from forged steel and can be adjusted to the pipeline easily. Cast steel materials are available for low-pressure applications.

Only one control valve is necessary for operating both main valves within one loop. Two types are available: Type EMS3 or 4 solenoid control valves or the NICO 4000 straight pattern globe valve.



PSRV

PSRV PRESSURIZER SAFETY RELIEF VALVES

Pilot operated safety relief valves are used to protect the pressurizer against overpressure.

In pressurized water reactors, the energy of the primary circuit is transferred to the secondary steam system by the steam generators. The pressurizer compensates for any expansion in the coolant volume occurring during operation and accidents. The design criterion for pressurizer safety valves is not the reactor power but the maximum possible volume expansion of the coolant in response to a temperature increase.

The valves' design takes into account the combination of failures which will produce the maximum possible pressure and temperature rise, leading to the maximum blow-off rates required. The VS99 is a pilot operated pressurizer safety valve which operates to the relief principle.

The working pressure is applied to the valve disc. When the pressure increases, the sealing force on the valve seat rises.

We have a large installed base of PSRVs in all German Siemens/KWU reactors and most Russian VVER-type PWR reactors, as well as in newly designed GEN III reactors such as the French EPR and the Korean APR1400. At German PWRs, three main safety valves were installed in the pressurizer system; two providing double redundancy plus one operational blow-down valve. For optimized availability, four self-acting spring-loaded pilot valves were mounted redundantly to each main valve: two are in service, two rest in standby. In an emergency, remote-controlled pilot valves with electrical actuators reduce the pressure in the primary circuit to levels below the set pressure of the spring-loaded pilot valves.

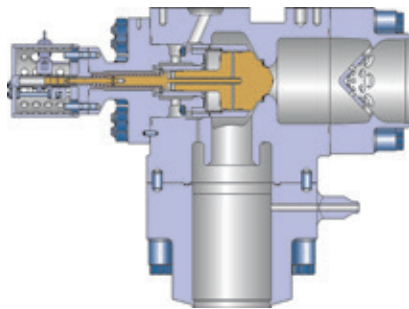
One operational mode is the activation of the injection of emergency coolant, called the bleed and feed procedure. The valves also provide cold overpressure protection of the reactor vessel.

Extensive qualification programs have been performed for the major reactor designs and we are qualified according to KTA and ASME III. This extensive experience and technological development enables special solutions to be offered for the new GEN III reactors. Valves for the European EPR are delivered to RCC-M, for the Russian PWR to NP-068-05 and for the Korean APR1400 to ASME III (NV-stamp).

THE KOREAN APR1400 SOLUTION

Four main valves type VS99, are welded directly on top of the pressurizer horizontally for optimized pipe conduction. Two self-acting pilot valves, type VS66, per main valve are used redundantly, enabling the impulse and control lines to be locked by integrated stop valves. They are connected to the system pressure by independent feeding lines within the main valve body, producing a compact design. A double motor valve, type PDE, is installed for opening below set pressure. The design received the NV stamp and the valve station is qualified for steam, two-phase-flow and subcooled water media operation.

PSRV FOR APR 1400



TYPE VS99

Application

Pressurizer safety relief valve - primary circuit

Design

Block-design with direct, horizontally-mounted pilot valves

Reference

Shin Kori 3&4, Shin Hanul 1&2, Barakah 1- 4

Size

NPS 8/DN 200

Pressure

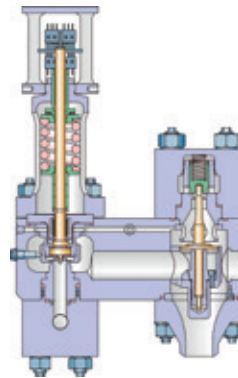
up to Class 2500/PN 400

Body material

A182 F316 LN (1.4406)

Qualification

Flow co-efficient by NB, USA
Function by Areva, Karlstein with steam, water and two-phase mixture, ASME QME-1



TYPE VS66

Application

Spring-loaded pilot valve

Design

Floating design

Reference

Shin Kori 3&4, Shin Hanul 1&2, Barakah 1- 4

Size

NPS 1/DN 25

Pressure

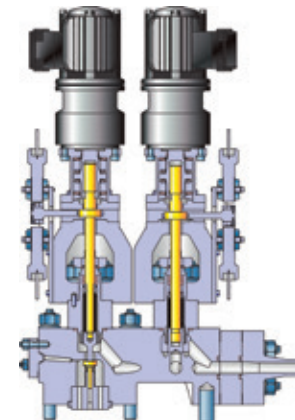
up to Class 2500/PN 400

Body material

A182 F316 LN (1.4406)

Qualification

ASME III NV (together with VS99)
Stable performance when subjected to two-phase flow or low flow transient; no costly loop seal required.



TYPE DPDE

Application

Bleed & feed valve

Design

Motor operated pilot valve with integrated isolation valve in one forged body

Reference

Shin Kori 3&4, Shin Hanul 1&2, Barakah 1- 4

Size

NPS 1/DN 25

Pressure

up to Class 2500/PN 400

Body material

A182 F316 LN (1.4406)

Qualification

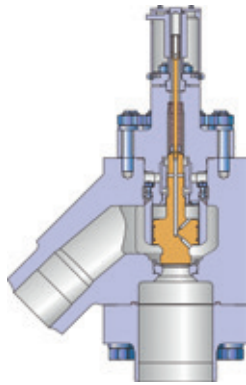
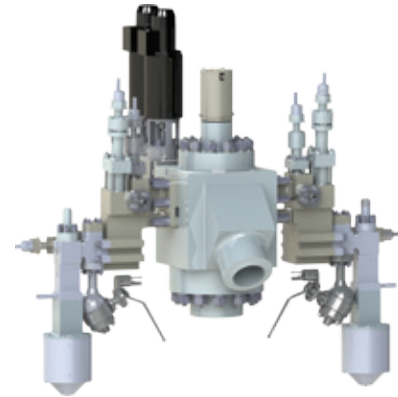
ASME III NV (together with VS99)

PSRV PRESSURIZER SAFETY RELIEF VALVES

THE EUROPEAN EPR SOLUTION

Three main valves, type VS99, are mounted directly to the side of the pressurizer with an inlet angled at 45°, enabling the valves to be vertical. A permanent water loop fills the main and pilot valves, so during blow down purely sub-cooled water will be relieved first. Two pilot valves, type Sierion, are on each main valve. This is a non-floating steam pilot valve which performs well with different media conditions including pure steam, water, 2-phase-mixture and subcooled water. Stop valves are located between the main and pilot valves for the impulse and control lines. Only one pilot valve is active at a time. Typically, a double solenoid valve, type DMS, is used as a bleed and feed valve.

PSRV FOR EPR



TYPE VS99

Application

Pressurizer safety relief valve
- primary circuit

Design

Block-design with direct mounted pilot valve

Reference

Olkiluoto 3, Flamanville 3, Taishan 1 + 2

Size

NPS 4 & 6/DN 100 & 150

Pressure

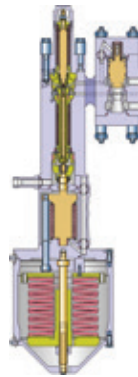
Class 1500/PN 250

Body material

Z2 CN 19-10 N2

Qualification

Areva laboratory Erlangen with steam, water and two-phase mixture and Karlstein



TYPE SIERION

Application

Pilot valve for pressurizer safety valve
- primary circuit

Design

Non-floating design

Reference

Olkiluoto 3, Flamanville 3, Taishan 1 + 2
PWE Goesgen

Size

NPS 1/DN 25

Pressure

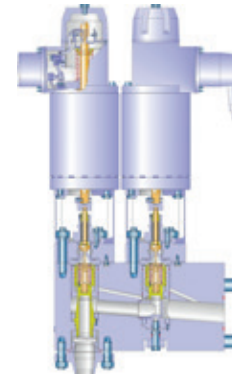
Class 1500/PN 250

Body material

Z2 CN 19-10 N2

Qualification

Areva laboratory Erlangen with steam, water and two-phase mixture and Karlstein



TYPE DMS 6

Application

Bleed & feed valve

Design

A double solenoid pilot valve with a forged one-piece body and 2 valves that alternate for testing during operation

Reference

First used for FSA-station; appr. 800 pilot valves in use

Size

NPS 1½/DN 32

Pressure

Class 1500/PN 250

Body material

Z2 CN 19-10 N2

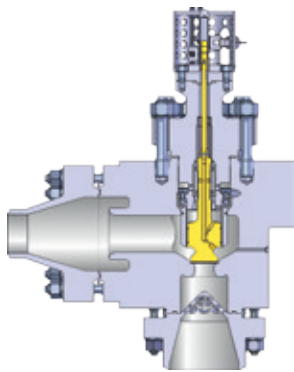
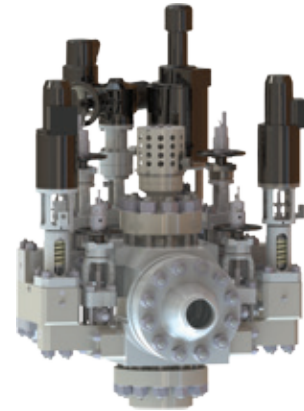
Qualification

Full scale tested together with MSIV and MSSV, IEEE qualified solenoid by Whyte Inspection Laboratories, California

THE RUSSIAN VVER SOLUTION

The pressurizer is equipped with three independent safety valves which are installed in parallel on a steam collector pipeline. The main valve VS99 body is angular with a lateral inlet nozzle and vertical downward outlet nozzle. Two spring-loaded pilot valves, Type VS66, are located on each main valve. They are equipped with a solenoid that provides supplementary seat tightness forces and assists opening and closing. Should the solenoids fail (switch-off failure), the pilot valves function as self-acting spring-loaded safety valves no external energy is needed. The VS66 pilot valves are connected to the system pressure by independent feeding lines within the main valve body. The VS99 is equipped with a separate impulse line actuated by a remote-controlled solenoid valve, type VCA. The valves are qualified for operation of steam, two-phase-flow and subcooled water.

PSRV FOR VVER



TYPE VS99

Application

Pressurizer safety valve - primary circuit

Design

Block-design with direct mounted pilot valve

Reference

PWR Germany and Brazil, PWR (VVER)

Size

up to NPS 8/DN 200

Pressure

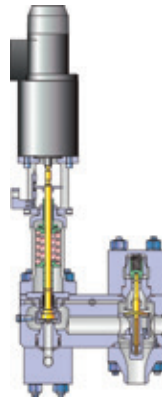
Class 1500/PN 250

Body material

1.4553/1.4541

Qualification

Areva laboratory Erlangen with steam, water and two-phase mixture and Karlstein, for compact design see APR1400 qualification



TYPE VS66

Application

Spring-loaded pilot valve

Design

Floating design

Reference

PWR Germany and Brazil, PWR (VVER)

Size

NPS 1/DN 25

Pressure

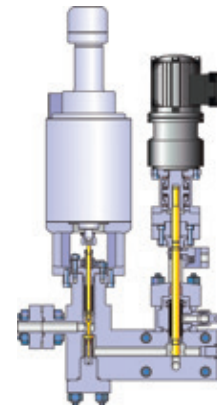
Class 1500/PN 250

Body material

1.4553/1.4541

Qualification

Together with VS99, stable valve performance when subjected to two-phase flow or low-flow transient; no costly loop seal required



TYPE VCA

Application

Bleed & feed valve

Design

Energized open solenoid valve with integrated isolation valve in one forged body

Reference

PWR Germany, PWR (VVER)

Size

NPS 1/DN 25

Pressure

Class 1500/PN 250

Body material

1.4553/1.4541

Qualification

Together with VS99

CHECK / SWING CHECK VALVES

Check valves are used in the steam and water cycles.

Normally undamped swing check valves are installed under steam conditions, offering the advantages of a compact design, low pressure loss and simple maintenance. They can be installed in straight pipes, while disc check valves can also be designed as angle type, with a bottom inlet.

Either swing check valves or damped check valves are suitable for feedwater systems. Rapid changes in mass flows in high-pressure lines can cause pressure surges and forces which exceed the permissible material strength limits. Consequently, particular importance is placed on the closing behavior of check valves after a break has occurred in high-pressure pipes.

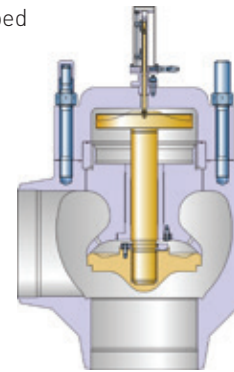
Our qualified damped valve design is similar to the undamped valves but with a piston, which slows the closing movement to eliminate the water-hammer-effect. These valves are specially engineered to customer specifications.

Compared to a standardized design, they slow down the valve closing by damping the fluid dynamic loads from pressure waves after check valves close as much as necessary to keep them within limits without endangering pipe integrity. They also enable closing as quickly as possible, to reduce the loss of feed water to a minimum and thus ensure reactor coolant pressure boundary integrity. To operate within a wide load range, a stable, full open position is adapted to the minimum load cases and the valves are optimized for pressure loss.

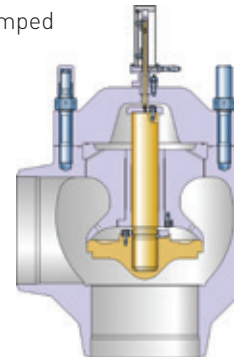
To demonstrate their suitability for pipe-break protection in feedwater lines, blowdown tests have been performed with a DN 350 valve in the HDR Kahl experimental power plant.

Check valves for emergency core cooling systems are designed as swing or piston check valves and are often designed to special requirements, with blocking or lifting stems.

Damped



Undamped



TYPE EBS30/EBS3

Application

Main feedwater damped check valves for pipe-break protection

Design

One-piece block-design, position indicators available on request

Reference

PWR AREVA NP (former Siemens KWU)
VVER Russia
Swedish NPP

Size

up to NPS 18/DN 450

Pressure

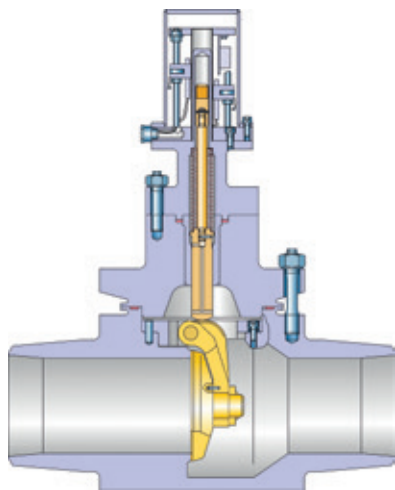
Class 1500/PN 250

Body material

A105 (1.0460), F 508 and SS

Qualification

Test-loop HDR Kahl



TYPE HKS 5

Application

Swing check valve for steam, water, feedwater

Design

One-piece block-design, position indicators available on request

Reference

PWR, BWR AREVA NP (former Siemens KWU)

BWR Westinghouse (former ASEATOM)

PWR (VVER), Russia, China, Ukraine, Czech Republic, Slovakia

Size

up to NPS 18/DN 450

Pressure

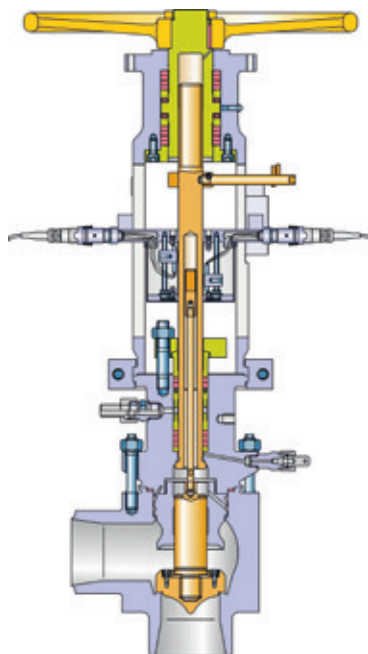
Class 1500/PN 250

Body material

A105 (1.0460) and SS

Qualification

Sempell laboratory



TYPE EBS51

Application

Screw down check valve for emergency cooling systems - SIS

Design

One piece block-design with centrally blocking stem

Reference

PWR AREVA NP (former Siemens KWU)

Size

up to NPS 12/DN 300

Pressure

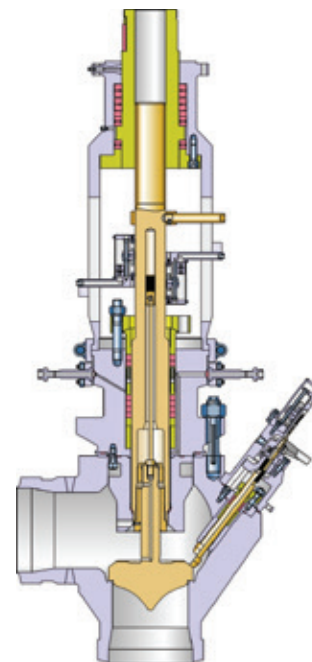
Class 1500/PN 250

Body material

Stainless steel

Qualification

Siemens laboratory in Erlangen (Germany)



TYPE EBS55

Application

Lift check valve for emergency cooling systems - SIS

Design

One-piece block-design with outside blocking stem

Reference

PWR AREVA NP (former Siemens KWU), PWR (VER) Slovakia

Size

up to NPS 12/DN 300

Pressure

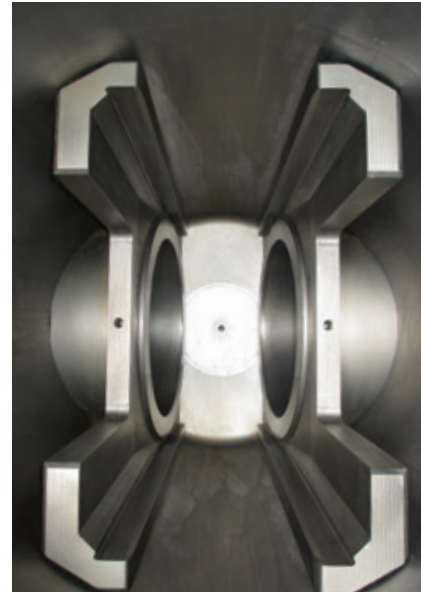
Class 1500/PN 250

Body material

Stainless steel

Qualification

Siemens laboratory in Erlangen (Germany)



GATE VALVES

Gate valves are often installed instead of globe valves, because of their low pressure loss.

For high-pressure applications, wedge gate and parallel slide valves are used in standard designs.

In wedge gate valve design, wedges are only in contact with the seats in the final closed position. This protects the seat surfaces, as guidances in the body avoid a permanent contact on the surfaces during stroking. The standard Sempell wedge gate valve is limit switch controlled. For seat tightness, the valves rely on fluid pressure force acting on the disc. With cup springs within a flexible split wedge design, excellent seat tightness in both directions can be ensured at very low pressures. As an option, torque switch control can be provided, where limit switch control guarantees operation without any thermal binding effects.

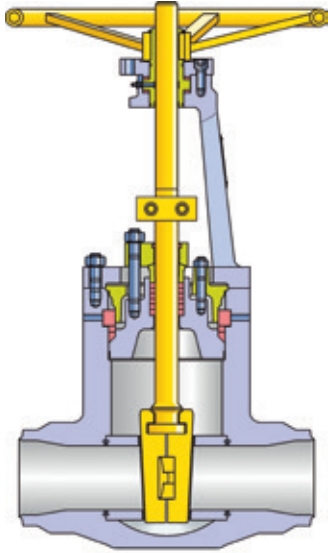
The parallel slide valve does not have lateral guidances, as a permanent contact on the seats controls this task. The friction this causes applies stresses on the seats during complete lifting but it does have the advantage that thermal binding is eliminated.

Special gate valve designs, mainly with electric actuators, fulfil extra tasks such as a 'malfunction and blow-down ability'. Blow-down and cycling tests and calculations have been undertaken to prove that the design fulfils its function and tightness after actuation at a complete pipe break or malfunction of the actuator.

Gate valves for quick closing functions are often equipped with pneumatic actuators, mainly fail-safe to close.

All gate valves in contact with the primary circuit media are in qualified cobalt-free hardfacing design and can be installed with vertical or horizontal stems.

Compared with castings, forged valve bodies offer the advantages of a more uniform structure, greater density, higher strength integrity characteristics and closer dimensional tolerances. Cast designs are available as an economical alternative.



TYPE GA251

Application

Balance of plant and turbine island

Design

Split wedge and parallel slide type pressure seal options for overpressure protection of the upper valve body cavity

Reference

Conventional application

Size

up to DN 24/DN 600

Pressure

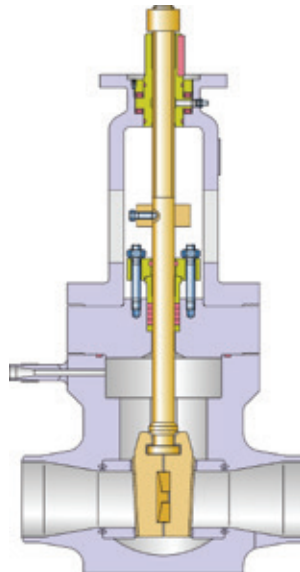
up to Class 4500/PN 720

Body material

Carbon steel, high-temperature steel

Qualification

Sempell laboratory



TYPE GPS4

Application

Standard wedge or parallel slide gate valve for steam and water circuits

Design

Split wedge, stellite hard-faced seats, non-rotating stem, backseat, limit switch control, superior leak-tightness.

Options

Cobalt-free hard-facings, live loading, leak-off or double packing, packing blow-out, wedge cup springs for leak tightness at low system pressure.

Reference

PWR, BWR AREVA NP (former Siemens KWU)

BWR Westinghouse (former ASEA-ATOM)

Size

up to NPS 24/DN 600

Pressure

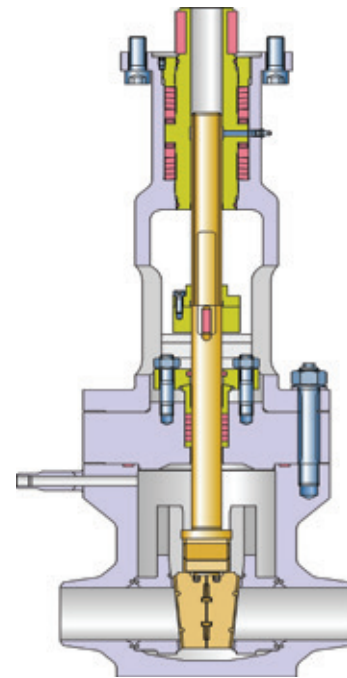
up to Class 2500/PN 400

Body material

Forged CS and SS

Qualification

Sempell laboratory



TYPE GPS5

Application

Blow-down isolation gate valve for steam and water circuits for complete guillotine pipe-break and electric actuator malfunction

Design

Split wedge, stellite hard-faced seats, non-rotating stem, backseat, limit switch control, superior leak-tightness, precise wedge guiding, D-shaped wedges avoid tilting effects, leak tightness at low system pressure by cup springs.

Options

Cobalt-free hard-facings, torque switch control, live loading, leak-off or double packing, and packing blow-out.

Reference

German, Swedish and Finnish NPP

Size

up to NPS 24/DN 600

Pressure

up to Class 2500/PN 400

Body material

Forged CS and SS

Qualification

Tests at GAP Karlstein-Siemens

STOP AND CHECK VALVES

NICO 4000

Globe valves are used in many isolation applications.

The Sempell NICO 4000 Series is a further development of the former Deutsche Babcock NICO 3000 Series, with high-pressure stop valves in a number of designs it also includes check valves (with supporting spring) and valves with bellows.

They are used in all steam and water systems with either electric or pneumatic actuators and with a broad range of accessories.

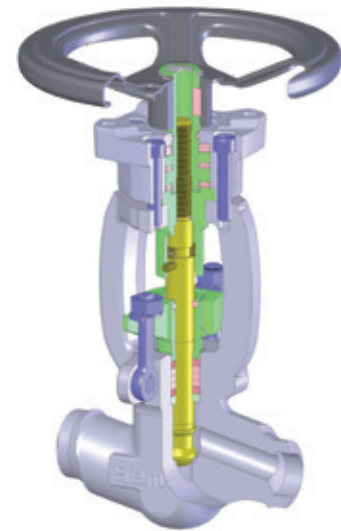
All standard bodies and yokes are die-forged and available in carbon or stainless steel. Parts are manufactured to customers' specification and nuclear requirements. The bodies are purchased with double-certified materials to meet DIN or ASME standards.

Standard Type 110-212 bodies are one piece die-forged, which means the bonnet is an integral part of the body, without an additional cover seal. The nozzles are sufficiently long for heat treatment and the cylindrical connection permits UT of the welding edge. The body seat can be chosen in Stellite 6 or Co-free. Special care is taken during insertion of the backseat into the body.

In comparison, the Type 111-212 two-piece body has an integrated backseat. The separate bonnet is attached to the body by large screw-necked-down bolts and the stem is assembled into the bonnet from below with packing.

Type 111-246 bellows valves are available for applications requiring extreme seat tightness. Designed for high pressures and temperatures, the bellows is braced by a cylindrical intermediate piece and is welded to the bottom of the non-rotating stem. The design is not welded, which guarantees easy maintenance and exchange of damaged bellows.

The series is completed by a Type 211-231 check valve, with the same body as Type 111-246. The disc is normally equipped with a spring, which allows easy vertical installation. A separate guide piece guarantees free movement.



TYPE 110-212

Application

Steam, water

Design

Die-forged, one-piece body in straight design, prepared for electric or pneumatic actuator mounting

Reference

German PWR,
Sweden & Finland BWR, Russia VVER

Size

NPS ½ - 2/DN 15 - 50

Pressure

Class 2500/PN 420

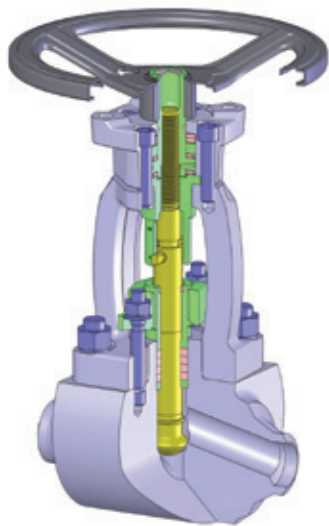
Body material

A105 (1.0460)

A182 F 347 (1.4550)

Qualification

TUV type-tested



TYPE 111-212

Application

Steam, water

Design

Two-piece body with bellows, prepared for electric or pneumatic actuator mounting

Reference

Only used as special solution

Size

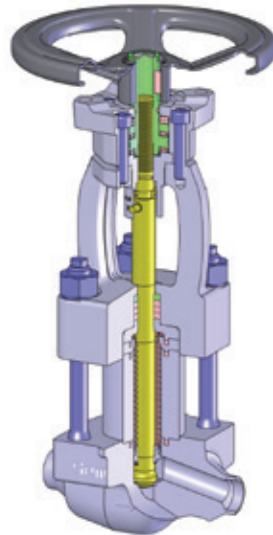
NPS 1/2 - 2/DN 15 - 50

Pressure

Class 2500/PN 420

Body material

Different special materials available on request



TYPE 111-246

Application

Steam, water

Design

Two-piece body with bellows, prepared for electric or pneumatic actuator mounting

Reference

German PWR, Sweden & Finland BWR, Russia WVER

Size

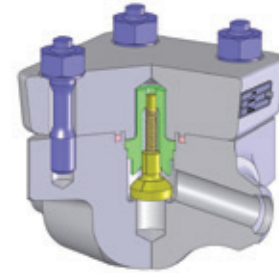
NPS 1/2 - 2/DN 15 - 50

Pressure

Class 2500/PN 420

Body material

A105 (1.0460), A182 F 347 (1.4550), A182 F 316L (1.4404), others on demand



TYPE 211-231

Application

Steam, water

Design

Lift check valve

Reference

German PWR, Sweden & Finland BWR, Russia WVER

Size

NPS 1/2 - 2/DN 15 - 50

Pressure

Class 2500/PN420

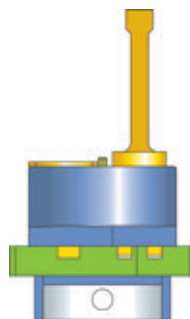
Body material

A105 (1.0460), A182 F 347 (1.4550)

LOCKING SYSTEMS

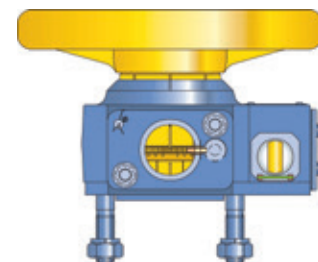
With a choice of interlocking types, combined with a sufficient number of non-interchangeable lock and key numbers, even complicated extensive interlocking problems are solved easily.

There are two series:



TYPES A1 - A5

Optional with one or two keys as sequence locks - not adjustable



TYPE A 301

Adjustable and also suitable for a subsequent change of the locking position. Combined to ISO 5210.

CONTROL VALVES

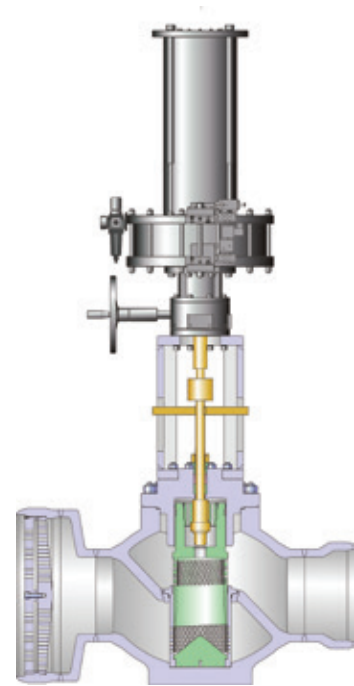
Control valves impose a certain pressure loss on the fluid, which can be modulated in order to pass exactly the desired mass flow rate through the valve. The ability to change the flow of water or steam through systems is especially important during startup and shutdown, load-follow operation and transients. The new built GENIII plants have to operate within a wide load range and high availability is also required as not every slight fault should result in plant shutdown.

Our valves are made specifically to nuclear design and quality assurance standards.

Applications for steam-reducing valves are found mainly in the conventional island, on the turbine bypass or tapplings from the main steam system. The main steam dump valve to atmosphere is a fast acting control valve which can react immediately to the isolation-relief valve's opening. It is installed in front of the control valve and controls the venting of excess system pressure to atmosphere, holding it to a preset level.

Two opposing functions are performed in the feedwater control valve. During full-load operation, the minimum possible pressure drop with maximum mass-flow is required. During startup of the boiler plant, high differential pressures with low mass-flow are to be reduced. In many cases, these requirements lead to the use of two valves. The 30%, normally multistage start-up valve (bypass) is combined with a single-stage full-load valve.

The task of the pressurizer spraying system is to reduce the coolant pressure when required. Pressurizer spray valves are available in control valve and solenoid controlled (open/closed) designs and are opened or closed in accordance with the coolant pressure. During normal operation they are closed. A spray valve has a small bore-hole in the valve disc to braid the spray lines and the volume compensation line at a given temperature with a continuous flow rate.



TYPE 151N

Application

Main steam turbine bypass valve

Design

Quick-acting design, balanced trim to reduce actuator size significantly, removable seat ring, wear resistant materials, separated seat surface and control geometry

Size

NPS 2 - 20/DN 50 - 500 (inlet)

NPS 4 - 50/DN 100 - 1250 (outlet)

Pressure

According to customer specification

Body material

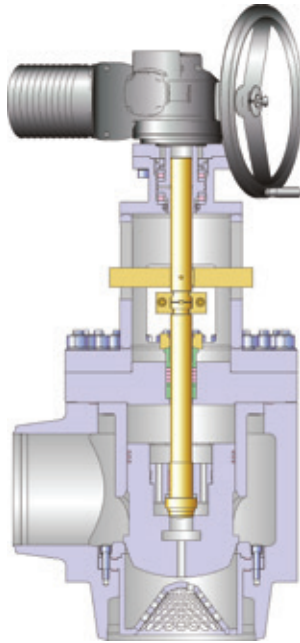
As specified; most common:

A216WCB/A105 (1.0619/1.0460)

A217WC6/A182F12 (1.7357/1.7335)

A217WC9/A182F22 (1.7379/1.7380)

A351CF3M/A182F316L (1.4409/1.4404)



TYPE 152

Application

Main steam dump valve to atmosphere

Design

Quick-acting design, balanced trim to reduce actuator size significantly, removable seat ring, wear-resistant materials, separated seat surface and control geometry

Size

NPS 2 - 20/DN 50 - 500 (inlet)

NPS 4 - 50/DN 100 - 1250 (outlet)

Pressure

According to customer specification

Body material

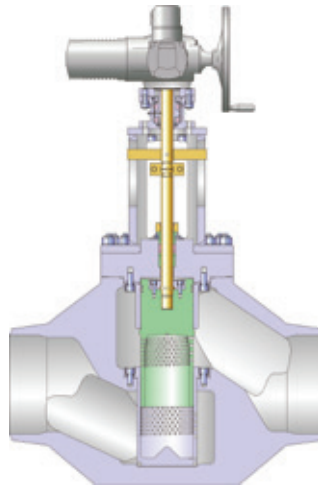
As specified; most common:

A216WCB/A105 (1.0619/1.0460)

A217WC6/A182F12 (1.7357/1.7335)

A217WC9/A182F22 (1.7379/1.7380)

A351CF3M/A182F316L (1.4409/1.4404)



TYPE 141H

Application

Main feedwater control valve

Design

Throttling stages designed to eliminate cavitation damage, wear resistant materials, balanced trim to reduce actuator size significantly and removable seat ring. Also available as angle-type (142) and Z-type (143)

Size

NPS 1 - 20/DN 25 - 500

Pressure

According to customer specification

Body material

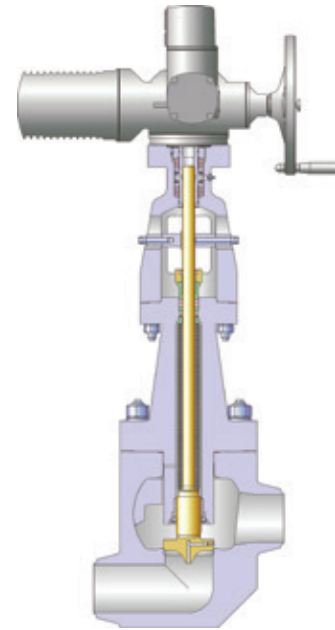
As specified; most common:

A216WCB/A105 (1.0619/1.0460)

A217WC6/A182F12 (1.7357/1.7335)

A217WC9/A182F22 (1.7379/1.7380)

A351CF3M/A182F316L (1.4409/1.4404)



TYPE ZBS 5

Application

Control valve for pressurizer system

Design

Bellows-sealed, Z-form forged body, high quality material, cobalt-free hardfacing at seat, disc and guiding surfaces. Different control characteristics available, permanent flow over throttle defined to customers' specification

Size

up to NPS 4/DN 100

Pressure

Class 1500/PN250

Body material

A182 F321/1.4541 (1.4553)

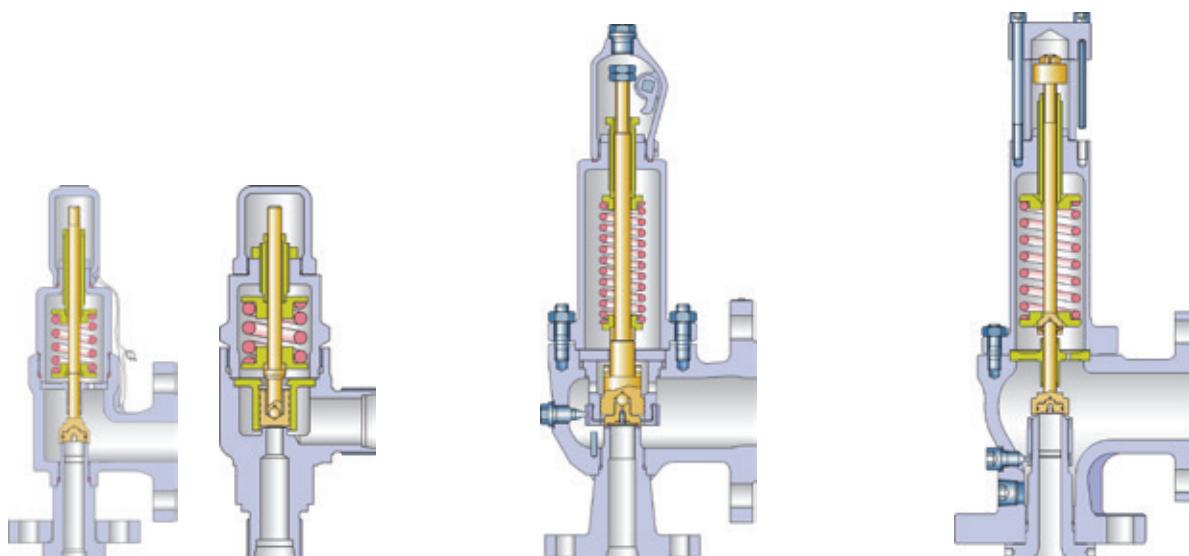
SPRING LOADED SAFETY VALVES

Our safety valves are currently being used in over 30 nuclear power stations.

As safety valves are the last device to protect equipment against overpressure they must work reliably and within limited pressure boundaries. For many years the company has supported the introduction of type testing for safety valves to establish binding standards for quality, performance and safe operation.

These Sempell safety valves are all TÜV-type tested with certified flow coefficients and operational characteristics. Series S and Mini S are also type-tested to ASME VIII. Valves certified for gas and steam are full-lift valves, which work with a pop-action opening within only 5% overpressure. They are certified with 10% overpressure for liquid.

Most valves are of conventional closed bonnet type. Open-bonnet valves are used for certain steam applications, allowing the spring to stay at lower temperature even in high temperature installations. Balanced bellows type valves can be supplied specifically for back pressure conditions.



TYPE MINI S/VSE0

Application

Thermal expansion or small steam loads

Design

Threaded or flanged forged blow-off bodies

Reference

German, Swedish and Finnish NPP

Size

NPS 1/2 - 1/DN 15 - 25

Pressure

Mini S: Class 150 - 300/PN 20 - 64
VSE0: Class 150 - 2500/PN 20 - 420

Body material

Mini S: A216 WCB, A312 TP 304, A351 CF8M VSE0: 304SS

Qualification

Mini S to ASME VIII and VdTUV type-tested VSE0: VdTUV type-tested

TYPE VSE/R

Application

Steam, gas, water

Design

Spring-loaded safety valves with a piston/guide bush trim path design. Balanced bellows available; block-body design on request

Reference

German, Swedish and Finnish NPP

Size

NPS 1 - 10/DN 25 - 250

Pressure

Class 150 - 2500/PN 20 - 420

Body material

WCB, stainless steel

Qualification

VdTUV type-tested

TYPE S-SERIES

DIN/ASME

Application

Steam, gas, water

Design

Spring-loaded safety valves with a bell type trim path design. Balanced bellows available; block-body design on request

Reference

German, Swedish and Finnish NPP

Size

NPS 1 - 8/DN 25 - 200

Pressure

Class 2500/PN 420

Body material

WCB, stainless steel

Qualification

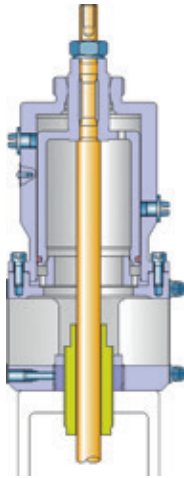
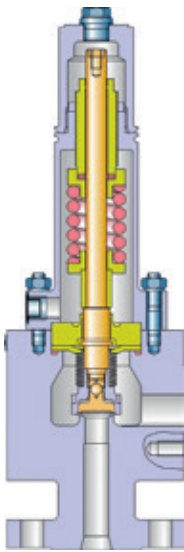
To ASME VIII and VdTUV type-tested

They allow increased accumulated back pressure values and the effect of superimposed back pressure on set pressure is fully compensated. Sometimes bellows are just used to prevent the relieved fluid from entering into the upper part of the valve. Small safety valves are installed for thermal expansion. The VSE0 is mainly used for high-pressure applications, while set pressure of the

Mini S, which is available in balanced bellows design, is limited to 50 bar.

The VSE/R and Series S are available in a wide range of sizes to cover all capacities. The PSE is used specifically in liquid applications where a proportional characteristic is required. Above set pressure, this valve opens steadily with increasing pressure ensuring only the actual necessary capacity is relieved during opening.

In some critical liquid installations safety valves are at risk of chatter and can be equipped with a viscosity dampening device, which ensures stable operation.



TYPE PSE

Application

Liquids

Design

Spring-loaded safety valve with a block-body design

Reference

German, Swedish and Finnish NPP

Size

NPS 1 - 6/DN 25 - 150

Pressure

Class 2500/PN 420

Body material

Stainless steel

Qualification

VdTUV type-tested

VISCO-DAMPER

Application

Special accessory for stabilization of safety valves, suitable for pop acting and proportional valves in liquid systems

Design

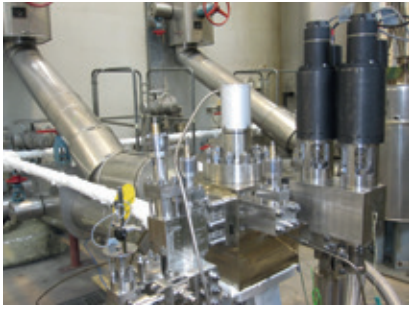
Viscosity damping device can be installed on existing valves between bonnet and cap

Reference

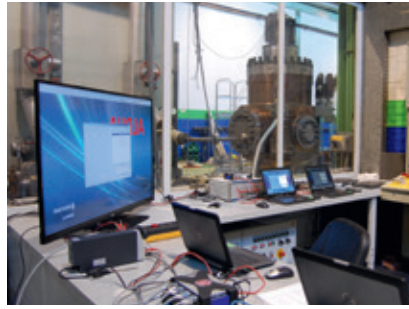
German, Swedish and Finnish NPP

Qualification

VdTUV type-tested



Steam test facility with pressurizer safety relief valve



Steam test facility with MSIV

DEDICATED RESEARCH & DEVELOPMENT

CRITICAL CUSTOMER AND ENVIRONMENTAL REQUIREMENTS, SPECIAL MATERIALS OR SPECIFICATIONS ARE OUR DAILY BUSINESS.

ENGINEERING & MANUFACTURING

With highly qualified design engineers, technicians and many years of experience, we research and develop optimized solutions for all appropriate applications. Close collaboration ensures that designs and manufacturing processes meet the most modern technical standards. The flow behavior of gas and liquid properties are analyzed experimentally and with the aid of numerical simulations.

SIMULATION

Powerful 3D CAD and dimensioning software enables accurate product design and optimization. The ANSYS CFX software tool is available for detailed flow analysis by means of Computational Fluid Dynamics and dynamic Finite Element Analyses.

TESTING

Valves are tested with air, water and steam at near operating conditions. Prototype tests for special valves are executed with steam or tests on spring-loaded safety valves with gas for type-testing.

PRIMARY CIRCUIT CONDITIONS

A specialty is an electrically-heated steam test facility, which can operate at primary circuit steam conditions of a pressurizer water reactor up to 200 bar and 350°C, producing 1t of steam/h. There's also a pressure vessel with 3 test rigs.

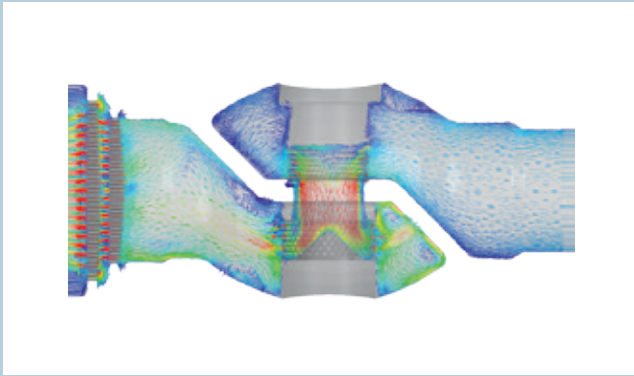
MOBILE TEST EQUIPMENT FOR SAFETY VALVES

SESITEST software has been specially designed to enable time and costs to be reduced significantly during plant startup. It enables the accurate assessment of set pressure and other safety valve functional characteristics in-situ under normal operating conditions with no need to raise the line pressure or remove the valve from the plant.

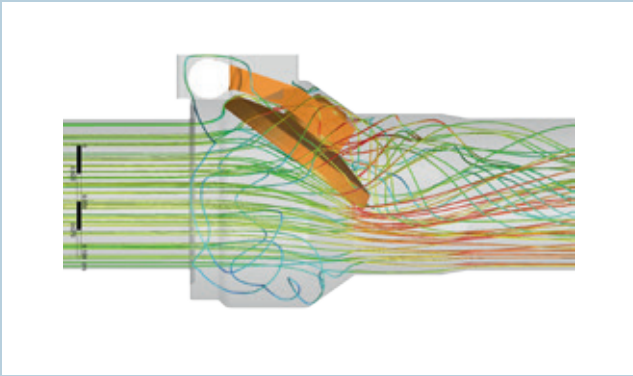
It also allows the selection of various test sequences and output documentation formats and includes a database in which valve identification and test data can be stored. Additional graphical analysis and calculations can also be carried out.

SPECIFIC ENGINEERING CAPABILITIES

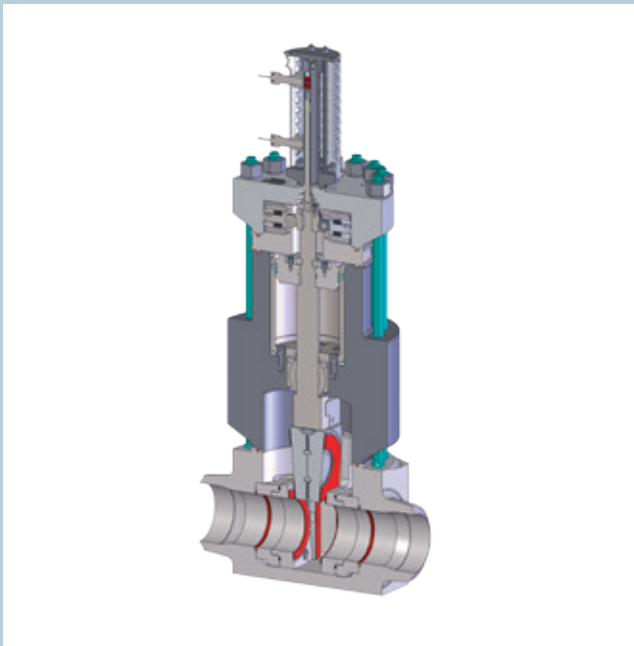
- Valve design
- Stress analysis and finite element analysis
- Application engineering
- Flow analysis
- Seismic qualification
- Thrust and torque calculation
- Actuator sizing
- Root - cause failure analysis
- System upgrades
- Validation of retrofit changes



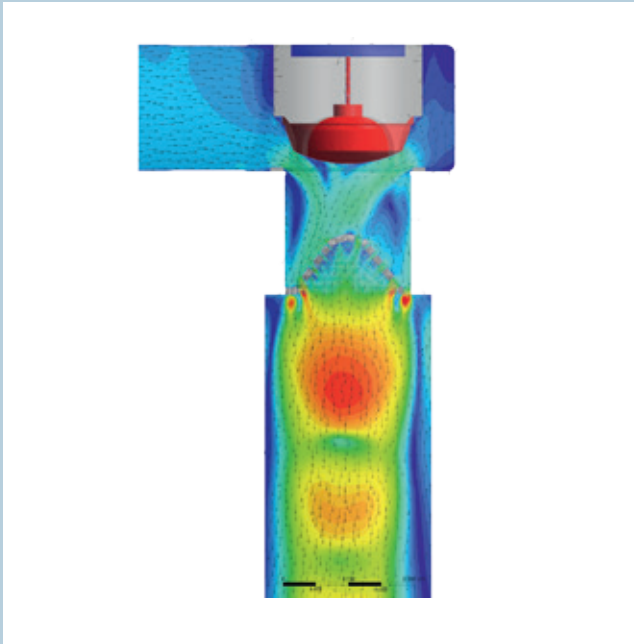
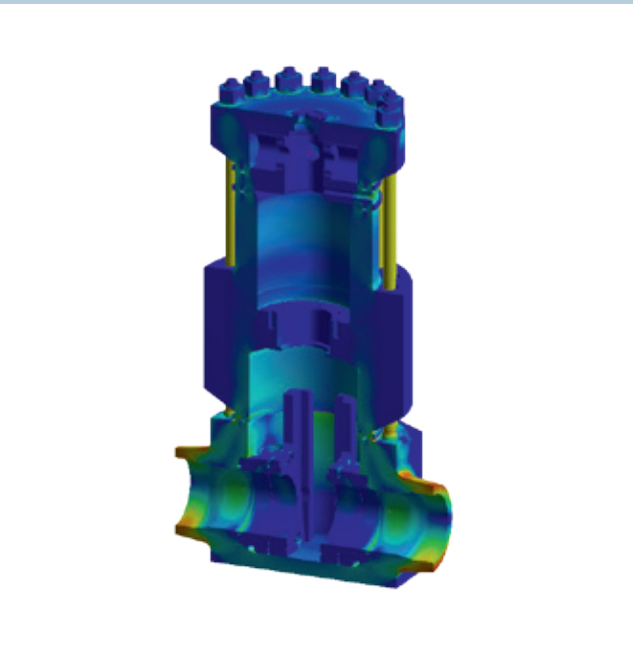
Flow capacity analysis of a turbine bypass control valve



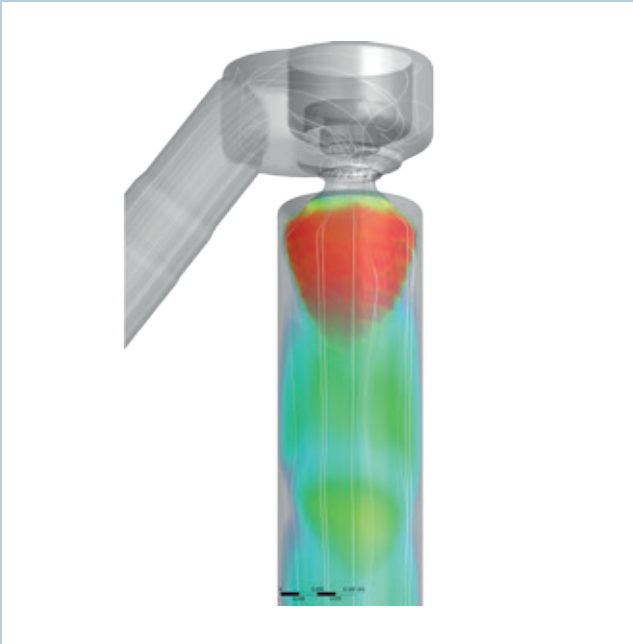
Opening behavior analysis of a swing check valve



Stress intensity analysis at a medium operated gate valve



Velocity distribution and direction in a main steam control valve





AFTER MARKET SERVICE

Emerson brings over 100 years of service expertise to you. Emerson's OEM-trained technicians in over 80 service centres worldwide offer unrivalled OEM and non-OEM product expertise coupled with a deep understanding of applications in nuclear power generation.

We offer a range of options to take advantage of Emerson Service; drawing on our experience of developing flow technology specifically for use in primary and secondary circuits and all reactor types we have the capabilities to fit your service needs.

EMERSON SERVICE PORTFOLIO INCLUDES:

- Installation & Commissioning support
- Valve Automation
- Service & Application Training
- Parts & Replacements Management
- Inspection, Testing & Certification
- Maintenance & Repair
- Turnarounds, Revisions & Shutdowns
- Product Upgrades & Modifications
- End of Life Support
- Asset Integrity Management

SERVICE CAPABILITIES

Emerson can support you either in the field, or from our own state-of-the-art production facilities. With strategically distributed service teams available 24 /7/365, and a fleet of fully stocked service vehicles.

All our workshops are available to complete repair work in addition to our mobile machining tools and special equipment adapted for on-site use including advanced measuring and testing equipment with requested documentation technology to enhance the service provided. The delivery of approved documentation based on customer specifications, as well as the monitoring of the entire construction, is an integral part of our service.

Our experts can be reached around the clock and have the experience and authority to make independent decisions with respect to the prevailing circumstances, eliminating

time consuming delays. We are able to carry out repair work inside a nuclear power plant, always governed by procedures prepared by us and approved by the customer and the authorized inspector. This also applies to the supervision of complete manufacturing, installation and all related documentation.

Our pickup and delivery services assist you with your service and repair needs with minimal downtime.

Emerson's facilities and technicians and products meet nuclear industry standards, both international and local, including: ASME, DIN, EN, ISO, HAF, IAEA, KTA, OHSAS, PED and RCC-M.

We are also certified through leading organizations including: ASME, Bureau Veritas, DNV, Inspecta, Lloyds Register and TÜV.

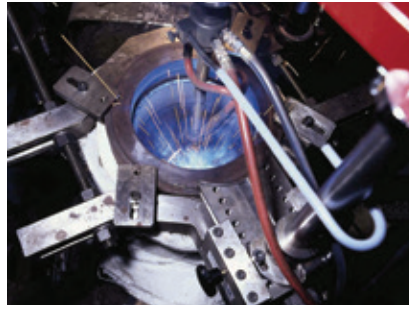


MOBILE TURNING EQUIPMENT

Our mobile machining equipment can be adjusted for all application conditions, enabling us to perform high quality and cost-effective repairs within plants. The special construction of our mobile turning lathes enables nearly all components to be machined on site.

Machining jobs:

- Longitudinal turning
- Surface machining
- Angle machining
- Turning of various profiles



MOBILE WELDING EQUIPMENT

Our transportable welding equipment was developed for in-situ operation. The special construction of the welding parameter control means our welding machines can meet all particular requirements in various welding positions. Therefore it is e.g. possible to perform automated V-MAG welding techniques with reproducible welding parameters on site at low costs. Plant components can remain in the plant while being processed. It is no longer necessary to cut them out and process them in a workshop on the site.



MOBILE MEASURING TECHNIQUES

- Measurement of active actuator current
- Torque measurement of:
 - actuators
 - valves
- Measurement of stroke times
- Measurement of actuating power reserves on valves with an auxiliary control device
- Solenoid force measurement
- Set up of spring-loaded safety valves
- Checking the control devices of valves
 - pneumatic control
 - hydraulic control
- Measurements with assessment of function and application
- Technical documentation

TURNAROUND MANAGEMENT

OUTSOURCING TURNAROUND MANAGEMENT

Turnaround management service by Emerson can help you optimize the turnaround cycle and duration through proper planning and execution; this helps you meet cost and schedule objectives, as well as increase your productivity and competitiveness.

Nuclear plant turnarounds require dedicated end-to-end project management. Emerson provides the people, resources, and equipment to support customers with comprehensive planning and preparation of work, on-site execution, and state-of-the-art reporting and documentation.

PROCESS

Our teams perform site surveys to assess the asset condition and scope and budget the activities accordingly.

We then plan and schedule the right people, equipment and parts needed well in advance.

We execute the planned activities and provide detailed progress updates. Our global OEM network allows us quickly address and solve emerging issues.

When the turnaround is completed, we provide a comprehensive report which includes insights and lessons learned from the recently completed job.

CUSTOMER BENEFITS

Increase budget accuracy by 50% through assessment of the asset population and its repair needs.

Improve scoping and planning accuracy, and reduce turnaround duration by up to one week, ensuring a 95% schedule adherence.

Achieve zero defects and zero harm through improved risk management and optimized use of resources.

Save 20% on emergency adders by using advanced parts procurement.

Rely on the expert network we can provide as OEMs.



INTERNATIONAL CERTIFICATION AND STANDARDS

Our Quality Management system ranges from raw materials purchasing through all other manufacturing stages. International quality standards apply throughout with strict controls ensuring they always are met. Regardless of location, our customers can be sure that the quality parameters valid in their national market are met without fail.

The efficiency of our Quality Management system follows international rules:

ASME SECTION III N, NV, NPT CERTIFICATION

For construction of nuclear valves for Class 1, 2, 3

ASME SECTION VIII UV CERTIFICATION

For construction of pressure relief valves

RCC-M

Design and construction for mechanical components of PWR nuclear islands

KTA 1401

Nuclear Safety Standards Commission (KTA): General requirements on quality assurance

KTA 3201.3

Nuclear Safety Standards Commission (KTA): Components of the reactor coolant pressure boundary of light water reactors

DIN EN ISO 3834-2

Quality requirements for fusion welding of metallic materials - Part 2: Comprehensive quality requirements (ISO 3834-2:2005).

DIN EN ISO 9001:2008

Quality management systems – Requirements (ISO 9001:2008)

ISO 14001:2004

Environmental management systems requirements with guidance for use (ISO 14001:2004)

PED 97/23/EC

Pressure Equipment Directive (Full Quality Assurance)

OHSAS 18001:1999

Certificate for an occupational health safety management system

CSEI

Manufacture License of Special Equipment People's Republic of China

SCCP

SGU-Management System in conformity with the standard SCCP petrochemistry

IAEA 50 CQ

Quality assurance for safety in nuclear power plants

HAF 604

NNSA approval for design and manufacturing of valves class 1, 2, 3



WORLDWIDE REFERENCES

ARGENTINA

Atucha 1 PWR 350 MW
Atucha 2 PWR 700 MW

BELGIUM

Doel 1+2 PWR 400 MW
Doel 3+4 PWR 1000 MW

BRAZIL

Angra 2+3 PWR 1300 MW

BULGARIA

Kozlodui 1-4 PWR 440 MW
Kozlodui 5+6 PWR 1000 MW

CZECH REPUBLIC

Dukovany 1-4 PWR 440 MW
Temelin 1+2 PWR 1000 MW

FEDERAL REPUBLIC OF GERMANY

Brokdorf PWR 1200 MW
Emsland PWR 1300 MW
Grafenrheinfeld PWR 1300 MW
Grohnde PWR 1400 MW
Gundremmingen 1+2 BWR 1300 MW
Isar 2 PWR 1400 MW
Neckarwestheim 2 PWR 1400 MW
Philippsburg 2 PWR 1400 MW

FINLAND

Olkiluoto 1+2 BWR 720 MW
Loviisa 1+2 PWR 440 MW
Olkiluoto 3 PWR 1600 MW

FRANCE

Flamanville 3 PWR 1600 MW

HUNGARY

Paks 1-4 PWR 440 MW

PEOPLE'S REPUBLIC OF CHINA

Fangjishan 1+2 PWR 1000 MW
Fuqing 1+2 PWR 1000 MW
Guangdong PWR 1000 MW
Hainan PWR 650 MW
Ling Ao BWR 1000 MW
Taishan 1+2 PWR 1600 MW
Tianwan 1-4 PWR 1000 MW

RUSSIA

Balakovo 1-3 PWR 1000 MW
Beloyarsk 3 FBR 600 MW
Beloyarsk 4 FBR 800 MW
Kalinin 1-3 PWR 1000 MW
Kola 4 PWR 440 MW
Leningrad II 1+2 PWR 1200 MW
Novovoronezh 5 PWR 1000 MW
Novovoronezh II 1+2 PWR 1200 MW

SLOVAKIA

Bohunice 1-4 PWR 440 MW
Mochovce 1-4 PWR 440 MW

SOUTH KOREA

Shin Kori 3+4 PWR 1400 MW
Shin Hanul 1+2 PWR 1400 MW

SPAIN

Trillo BWR 1066 MW

SWEDEN

Ringhals 1 BWR 875 MW
Ringhals 2 PWR 915 MW
Ringhals 3+4 PWR 960 MW
Oskarshamn 1 BWR 465 MW
Oskarshamn 2 BWR 630 MW
Oskarshamn 3 BWR 1200 MW
Forsmark 1+2 BWR 1000 MW
Forsmark 3 BWR 1200 MW

SWITZERLAND

Beznau 1 PWR 380 MW
Gösgen-Däniken PWR 1020 MW
Leibstadt BWR 1085 MW
Mühleberg BWR 370 MW

THE NETHERLANDS

Borssele PWR 480 MW

UKRAINE

Chmelnyzky 1+2 PWR 1000 MW
Juschno Ukrainsk 1-3 PWR 1000 MW
Rovno 1+2 PWR 440 MW
Rovno 3+4 PWR 1000 MW
Zaporozhye 1-6 BWR 1000 MW

UNITED ARAB EMIRATES

Barakah 1 - 4 PWR 1400 MW

Emerson Electric Co.
Global Headquarters
8000 West Florissant Avenue
St. Louis, Missouri, 63136
United States
T +1 314 679 8984
ContactUs@Emerson.com
Emerson.com/FinalControl

**Final Control
North America**

Marshalltown
301 South 1st Avenue
Marshalltown, Iowa, 50158
United States
T +1 641 754 3011

McKinney
3200 Emerson Way
McKinney, Texas, 75070
United States
T +1 800 558 5853

Houston
19200 Northwest Freeway
Houston, Texas, 77065
United States
T +1 281 477 4100

Stafford
3950 Greenbriar Drive
Stafford, Texas, 77477
United States
T +1 281 274 4400

**Emerson Automation Solutions
World Area Headquarters**

Asia Pacific
1 Pandan Crescent
Singapore 128461
T +65 6777 8211

Europe
Neuhofstrasse 19a P.O. Box
1046 CH 6340 Baar,
Switzerland
T +41 41 768 6111

Latin America
1300 Concord Terrace Suite 400
Sunrise, Florida 33323,
United States
T +1 954 846 5030


Middle East & Africa

Emerson FZE P.O. Box 17033,
Jebel Ali Free Zone - South 2,
Dubai, United Arab Emirates
T +971 4 8118100

 Emerson.com

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VCPBR-03316-EN 17/08



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