

**Control steam with greater efficiency and accuracy.**

## **Sempell Steam Conditioning Valves.**

Take control and optimize performance with our advanced range of steam conditioning solutions.



# You need greater control of your critical steam applications.

Producing steam at specific temperatures and pressures is one of your biggest challenges. Controlling steam temperatures with any degree of precision and reliability can be extremely problematic. If the temperature is too high, you risk damaging the installation; if it is too low, efficiency drops and if there is excessive fluctuation, your boiler and turbine components will have a much shorter lifespan. Variations in load demand brought by renewables, make it even more difficult to ensure accurate high pressure control.

If you don't supply steam at controlled temperatures and pressures, you could either impact the reliability and efficiency of your industrial process or face stiff penalties as a utility provider.

“The stability of the steam temperature is very important for the safe and economical operation of the unit.”

- **Thermal Science and Engineering**



“Control of superheated steam temperature is becoming more and more challenging, because of unknown disturbances caused by the frequent and extensive load changes, and strict control requirements for the efficiency and safety.”

- **Control Engineering Practice - International Federation of Automatic Control**



“In times of an increasing share of volatile renewable generation, the issue of flexibility of conventional power plants is of growing importance. The fundamental challenge for the operation of the power plants is competition, with its market-driven rules.”

- **VGB PowerTech - International technical association for generation and storage of power and heat.**

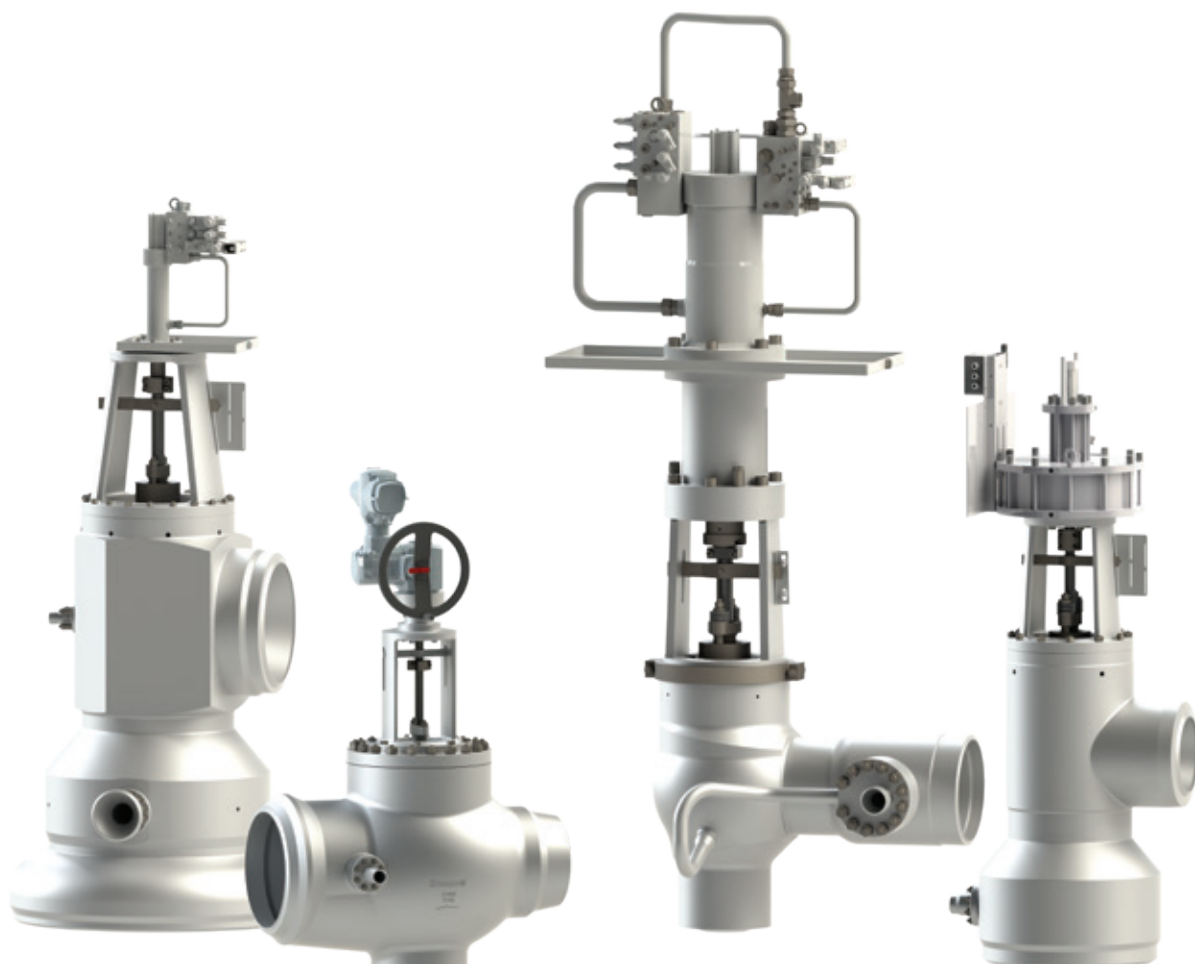






What if you could improve your operational efficiency and prevent unnecessary stress in boiler and turbine thick-walled components by accurately controlling steam temperature?

## Sempell steam conditioning valves help precise steam temperature and pressure control.



By choosing a Sempell steam conditioning valve you receive an optimally sized and selected solution to fit your application needs and to properly control the steam pressure and temperature of your system.

Purpose-designed for the latest generation of high-efficiency supercritical and ultra-supercritical power plants, our valves are also suitable for the power generation units serving industrial and processing plants.

The steam conditioning portfolio includes: turbine bypass systems for HP/IP and LP (with or without safety functions), HP and LP control and isolation water valves, and steam reducing valves.

With advanced features like the unique Sempell atomizing steam desuperheating nozzle and a tailor-made trim, they help to generate steam at the specific temperatures and pressures you require, while also limiting the effects of thermal stress and erosion.

**SEMPELL™**





Your cyclical operation might continue to evolve, along with daily start-stops and faster ramp rates, but with Sempell valves you will always be in total control.

### **Control steam temperature and pressure better to improve your reliability**

Discover the ways that Sempell valves maintain steam at precisely controlled temperatures and learn how our valves accurately and reliably control pressure through the full flow range.

[Learn more ▶ P 5](#)

### **Design new plants more cost effectively**

Find out how new plants can be designed in a more compact way, with shorter pipes and see how fitting Sempell valves can extend the life of your installation.

[Learn more ▶ P 7](#)

### **The steam conditioning portfolio**

See and understand the Sempell solutions available to you.

[Learn more ▶ P 9](#)





## Take control of the most difficult steam environments.

We recognize just how critical steam temperature control is to the safe and economical operation of your plant - and how difficult it can be to manage accurately.

You don't want the temperature too high because it could seriously damage the installation, but if it's too low, the efficiency of the turbine will be poor. Which is why our Sempell valves feature a unique atomizing steam desuperheating nozzle, providing tighter control and a more precise steam temperature.

Steam pressures can also vary enormously, principally due to the changes in load demand caused by renewables. By tailoring the design of each valve trim, Emerson can help make sure any pressure is reliably controlled throughout the full control range, not just around the operational point.

### What's your challenge?

You need to find a better way of producing steam at precisely controlled temperatures and pressures.



### What's your opportunity?

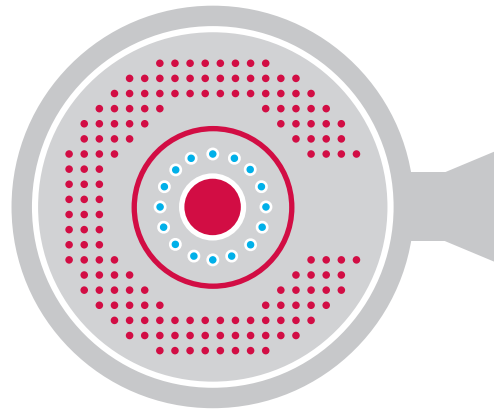
By controlling steam with greater accuracy, you can improve the performance and efficiency of your plant.



## Central Steam Nozzle

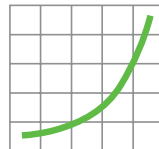
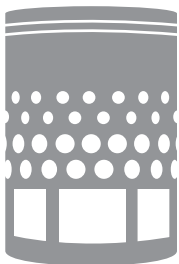
The desuperheating takes place at the outlet of the valve by means steam-assisted atomization of cooling water. The special nozzle design ensures the cooling water is embedded between an inner and outer atomizing steam jet to provide a complete break-up of cooling water into very fine droplets.

This nozzle is characterized by the central position in the steam flow. This means the temperature is more homogeneous over the pipe diameter providing more accurate temperature measurement and allows tighter and better temperature control.

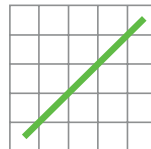


## Customized Valve Trim Design

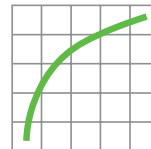
The trim for each valve is individually designed to meet the exact characterization required for the application. Our experienced engineering teams can use advanced Computational Fluid Dynamics (CFD) and Finite Element Analysis (FEA) models, to analyse complex geometries in valve design. This confirms pressure is accurately and reliably controlled through the full control range and not just around the operation point.



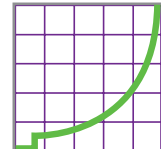
Equal Percentage



Linear



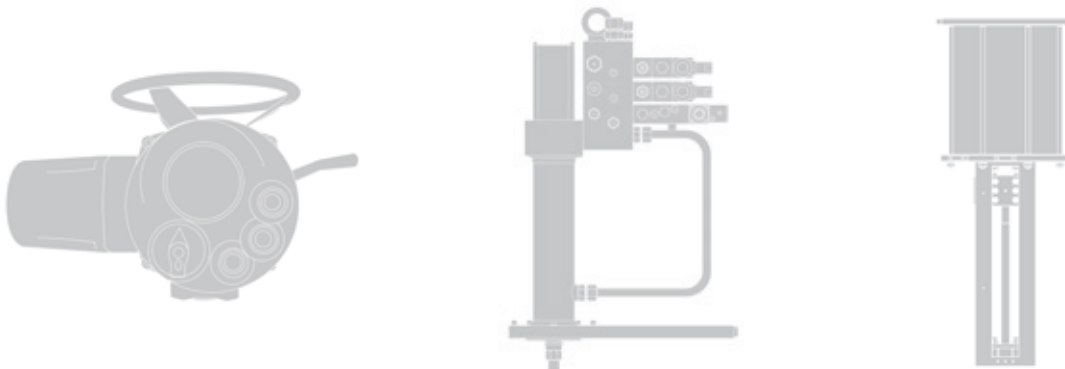
Quick Opening



Modified equal percentage (with pre-lift plug)

## Actuators for Fast, Precise Control

Sempell steam conditioning valves are available with a range of actuators – electric, hydraulic and pneumatic - sized to meet the specific operating conditions and to provide fast and precise control.







## Benefit from longer lifecycles and more efficient plant design.

Steam conditioning valves operate in severe service conditions which can cause thermal stress resulting in erosion and potential damage, particularly with heavy plant cycling. The innovative design of our atomizing steam desuperheating nozzle and exchangeable inner parts help extend the lifetime of the installation and allows design engineers to use more compact pipelines, reducing material and cost.

### What's your challenge?

You want to design more efficient plants and also extend the lifetime of your installation.



### What's your opportunity?

Design more compact and cost-effective plants, and reduce the threat of thermal stress and erosion in your steam turbine.



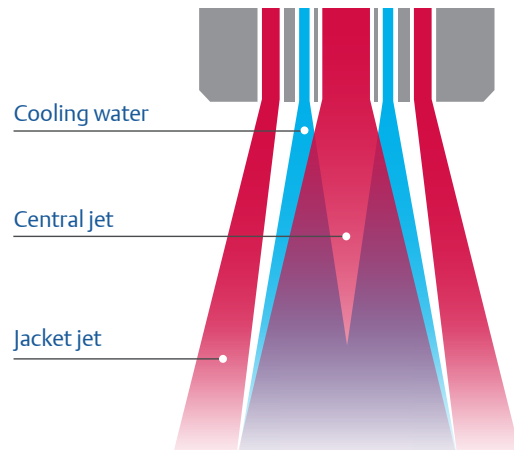


## Atomizing Steam Jet

In the last reduction stage, a diffuser plate is used which creates an even outlet flow and eliminates steam vortex forming. The atomizing steam is delivered from the cage plug and does not require a separate assist steam control valve.

The atomizing steam jet passes the central nozzle with sonic velocity, hits the injection water and breaks it up to a very fine spray. This fine spray water jet is covered by a second outer cone of assist steam. This cone works like a protection layer and prevents the water droplets from contacting the inner pipe wall.

As a result, thermal shocks or premature material fatigue in the outlet pipe are avoided.

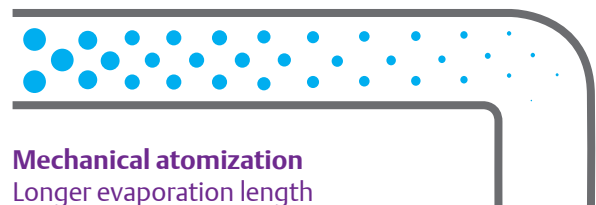
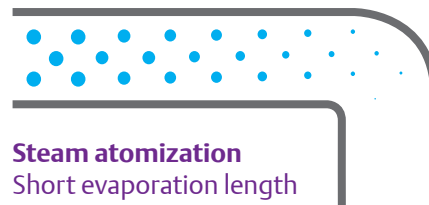


## Short Evaporation Length

The atomizing steam flow has a much higher velocity than the injection water droplets.

This high-kinetic energy results in a break-up of the water into droplets of much smaller diameter than those achievable with mechanical atomization. This yields an excellent heat transfer which leads to a rapid evaporation of the injection water droplets. Delay in evaporation of water droplets by a saturated steam streaks, typical of mechanical atomization, is prevented because the water drops are continuously in direct contact with the superheated steam.

The shorter required evaporation length allows pipe lengths to be reduced optimizing plant design and reducing costs.



## Flexible Design

### Pressure balancing for a compact and flexible design

In applications with high differential pressures and large valve seat diameters the forces required to open the valve can be very high. The conventional solution is to use a separate volume above the cage, with outlet pressure conditions to help balance the pressure. Less force is then required and a smaller actuator can be specified, while still maintaining a tight seal.

Sempell valves have a pilot plug with spring option to help to balance pressure on the trim. These features allow a much more compact solution with the flexibility of vertical or horizontal installation and is proven in service since 2001. Sempell bypass valves can also serve flow directions under or above the plug, and so easily adapt to any plant design.

## Reduced Maintenance

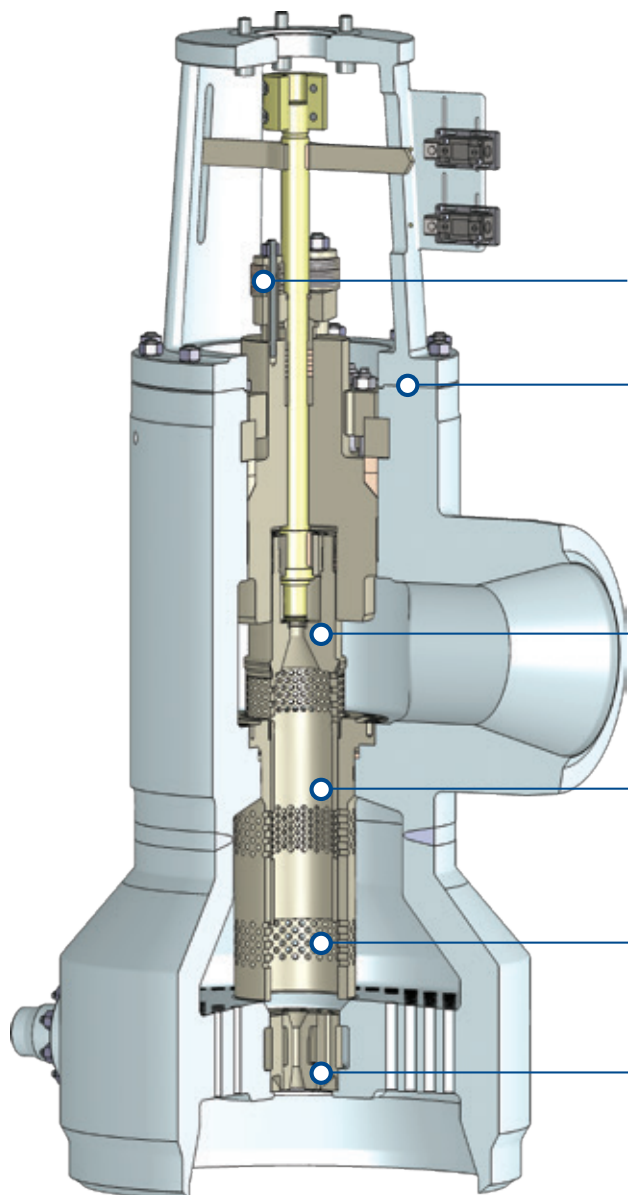
### Pressure seal bonnet to limit maintenance

When a valve is first commissioned the line pressure can cause leaks at the bonnet to body seal requiring attention and the bolts to be tightened. The Sempell valve design uses specially designed bushes securing the bonnet and cover in a single element. This removes the need for additional maintenance once the valve is installed.

# The Sempell 115 turbine bypass valve for greater reliability and flexibility under extreme conditions.

The Sempell type 115 steam conditioning valve is designed for superheated steam applications in the turbine bypass system. The type 115 is available as a HP-version for supercritical steam conditions and a LP-version for superheated steam in the low-pressure system. The 115 precisely controls steam flow, reduces pressure and cools down steam in case of a turbine trip event. The conditioned steam bypasses the turbine and is fed to either the reheater or the condenser, meeting their specified design conditions and ensuring a steady flow of low pressure and low temperature steam.

The turbine bypass valves also control steam flow and temperature during turbine and steam generator start-up or shut down. In the turbine bypass station, steam temperature must be reduced to protect downstream components from high temperatures and pressures. This is achieved by multiple pressure reduction stages and by injecting the finest droplets of cool feedwater into the steam flow. These steam conditioning valves provide greater reliability and flexibility under extreme conditions.



## Sempell 115 turbine bypass valve

### 1. Spring loaded packing for long term leak tightness

### 2. Pressure seal bonnet

- Leak tight under high fluid pressures
- Specially designed bonnet and cover to avoid any bonnet floating
- No additional requirement to tighten bolts

### 3. Pressure balanced trim with pilot plug

- Class V tightness
- Compact solution allows smaller actuators, while maintaining a tight seal
- Flexibility of vertical or horizontal installations

### 4. Quickly and easily exchangeable seat

- Easy adaptation to new operational conditions
- Easy maintenance

### 5. Multi-staged perforated plug/cage

- Low noise and anti-vibration
- Customized trim ensures ideal fitted Cv-Value and optimal range of flow control

### 6. Atomizing steam desuperheating nozzle

- Short evaporation length
- Thermal shock protection of downstream piping
- Precise temperature control through homogeneous temperature distribution of cooled steam



## Turbine Bypass Valves

### High pressure turbine bypass valves Sempell 115 HP/IP



High-pressure turbine bypass valves are available with different flow characteristics to fit the exact needs of the application. The desuperheater is integrated into the outlet providing a compact design.

- Pressure balanced trim with pilot plug, to allow shut-off class V
- Pressure reduction multi-stage cage
- Size: NPS 6 to 30 / DN 150 to 750
- Pressure: up to Class 4500 / 320 bar
- Temperature: up to 630°C

### Low pressure turbine bypass valves Sempell 115 LP



Low-pressure turbine bypass valves provide reliable steam conditioning to protect the condenser. The multi-stage surface perforated plug maximizes capacity for low pressure load cases. With the optional bumped boiler head, we can enlarge the valve's outlet while keeping a compact design.

- Pressure balanced trim with pilot plug, to reduce actuator size
- Size: NPS 20 to 60 / DN 500 to 1500
- Pressure: up to Class 1250 / 100 bar
- Temperature: up to 630°C

## Turbine Bypass Valves

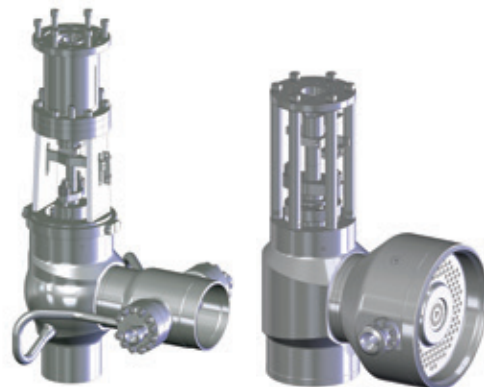
### Low pressure globe valve Sempell 111



Steam control valve with integrated atomizing steam nozzle to cool superheated steam at low pressures and protect the condenser in case of a turbine trip event. Control of steam flow and temperature during turbine start-up or shut down.

- No mechanical wear parts in water injection nozzle providing long lifetime and low maintenance
- Generous straight through globe body for low pressure losses
- Order-specific optimization of trim flow areas and desuperheater
- Leakage class FCI 70-2: up to V
- Optional safety function: in close direction

### High pressure turbine bypass valves with safety functions Sempell 315 /315 CHP



Steam conditioning valves with safety function to control steam flow and temperature during turbine and steam generator start-up or shut down. Downstream piping is protected from thermal shock.

- Safety function to DIN EN ISO 4126-5 (TRD 421)
- Excellent low load behaviour
- Multiple stage trim
- Low noise and vibration
- Size: NPS 6 to 60 / DN 150 to DN 1500
- Pressure: up to Class 4500 / 320 bar

## Turbine Bypass Valves

### High pressure turbine bypass valves Sempell 302



Steam conditioning valves for protection of the cold reheat system, in particular the reheater and condenser in case of a turbine trip event. Control of steam flow and temperature during turbine start-up or shut down.

- Zero meter evaporation length
- No thermal pipe shock and erosion optimized seat injection
- Optional pre-warming and condensate drain studs
- Body optimized against stress
- Size: NPS 6 to 60 / DN 150 to DN 1500
- Pressure: up to Class 4500 / 320 bar

### Tailor made turbine bypass valves Sempell 231 / 215

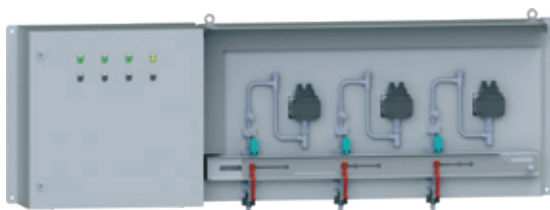


Tailor made steam conditioning valves for unconventional desuperheating applications on steam turbine bypass systems.

- Optional safety function in closing direction, for overpressure protection of the downstream system, according to DIN EN ISO 4126-5 (TRD 421)
- Safety and spring-loaded packing for long-term leak tightness
- Leakage class FCI 70-2: up to V
- Size: NPS 6 to 60 / DN 150 to DN 1500
- Pressure: up to Class 4500 / 320 bar

## Steam Testing

### Steam test device Sempell STE6



The STE6 is a safety control device to monitor the pressure in steam lines and to operate hydraulic actuated valves in accordance with TRD 421/DIN EN ISO 4126-5. The safety function is initiated by a 1oo3 (one out of three) logic.

The STE6 is connected to the steam lines via three pressure lines, in which steam condenses to water. The water fills hydraulic seals to ensure reliable pressure monitoring by three individually pressure switches. If the pre-adjusted pressure is exceeded, the hydraulic actuated valve moves into its safe position.

## Steam Control Valves

### High pressure steam reducing valves Sempell 155



Low noise steam reducing valves controlled by multistage trims used for boiler start-up, shut down and process steam generation.

- Pressure reduction by multi-stage expansion
- Specific trim flow areas for optimal control range
- Exchangeable trim and seat allow adjustment to changed operational conditions
- Optional pre-warming and condensate drain studs
- Size: NPS 6 to 20 / DN 150 to DN 500
- Pressure: up to Class 4500 / 320 bar



## Water Control & Isolation Valves

### High pressure straight through valves Sempell 141 HP



Straight through type water control valves for high pressure applications including: water injection at HP/IP bypass systems.

- Multi-stage trim offers a high control range to fit specific needs
- Safety and spring-loaded packing for long-term leak tightness
- Exchangeable seat and jacket
- Body protected against flashing
- Size: NPS 1 to 16 / DN 25 to DN 400
- Pressure: up to Class 2600 / 375 bar

### Low pressure straight through valves Sempell 141 LP



Intermediate and low pressure control valves for water pressure and flow rate applications.

- Exchangeable seat
- Valve can be easily disassembled
- Spring-loaded packing with long term leak tightness
- Multistage trim
- Size: NPS 2 1/2 to 26 / DN 65 to DN 650
- Pressure: up to Class 1300 / 250 bar

## Water Control & Isolation Valves

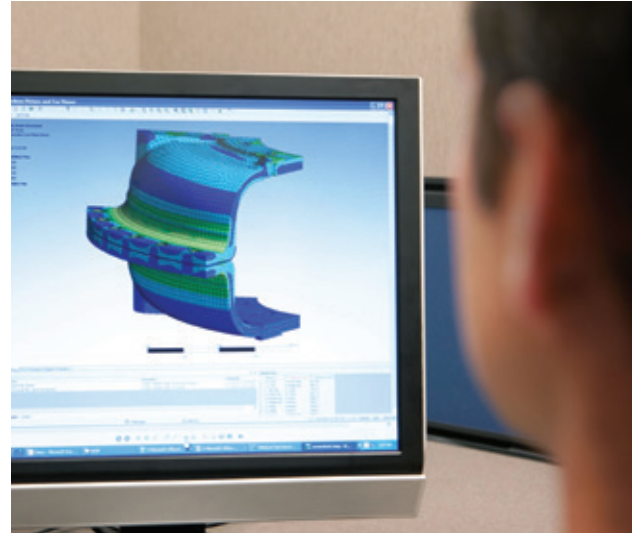
### High pressure angle valves Sempell 142



Low maintenance angle type water control valves for high pressure applications including: water injection at HP/IP bypass systems; feedwater start-up control; minimum flow valve at feedwater pumps and blow-down valve at drum boilers.

- Easily changeable trim and seat
- Body protected against flashing
- Suitable for continuous operation
- Thermal stress resistant
- Size: NPS 1 to 16 / DN 25 to DN 400
- Pressure: up to Class 2800 / 480 bar





## Long term support with a partner you can trust.

Our experience in delivering control, safety relief and isolation valves for critical environments goes back more than a hundred years when the business was founded by Albert Sempell in Mönchengladbach, Germany. The business is now based at a 70,000 m<sup>2</sup> state-of-the-art plant in Korschenbroich, Germany, dedicated to the production of valves used in conventional and nuclear power generation, as well as power applications in all process industries.

### Project management expertise

When it comes to managing the complexity of projects involving steam conditioning, you need a reliable partner that can achieve your key project milestones - especially on the turbine bypass station, which is often a critical element in the overall project requirement. A partner like Emerson.

#### Delivering expert project management

- Emerson has the experienced skill base capable of providing expert project management and product knowledge dedicated to power generation applications for commercial generation and industrial or process applications.
- Our project managers are involved from the early phases of a project to ensure successful execution and delivery.
- Their role is to develop individual project plans, including schedules, milestone alignment, procurement strategy, execution strategy, resources and communication.
- Responsible for leadership of the project team from project administration and order administration to engineering and plant project personnel, they use standardized global processes and tools to allocate resources where they are available, preventing delays and bottlenecks.

### Experienced engineering teams use digital modelling and analysis tools

Based at our main engineering center in Germany, our Computational Fluid Dynamics (CFD) experts optimize the flow path through our steam conditioning valves for maximal capacity combined with minimal pressure loss. We also use numerical models to enhance the design of our atomizing steam nozzles to provide the shortest evaporation length for cooling water combined with homogeneous temperature distribution.

Transient Finite Element Analysis (FEA) is used to assess fatigue and durability of our valves for high cycling rates under severe service.

### Using additive manufacturing to accelerate new product development

At Emerson we are committed to addressing our customers' engineering design challenges, while accelerating the speed to market of new and rigorously-tested products. Additive technologies allow us to broaden our design potential in order to solve more complex problems, in new ways. Design limits are pushed back; pilot production and testing are accelerated.





## Products which deliver reliability and performance.

As the sector has undergone significant change, we have continued to pioneer, produce and deliver specialized valve solutions with a high focus on reliability and performance.

### Where quality comes as standard

- Our factory in Germany is regularly inspected and audited by major quality authorities including Lloyd Register, BSI, Bureau Veritas, TÜV and complies with ISO 9001:2015
- Our manufacturing capabilities include welding, hardfacing, machining and grinding to ensure extremely high-quality production

### Advanced manufacturing capabilities

#### World class machining

- CNC machining centers, including 5-axis centers
- Lifting capabilities of up to 20 tons
- Advanced lapping machines from FLP Microfinishing

#### State-of-the-art connection welding and surface cladding technologies

- Gas Metal-Arc welding (GMAW)
- Gas Tungsten-Arc welding (GTAW)
- Plasma Transfer-Arc welding (PTA) for the hard facing of valve seats with cobalt based and cobalt free alloys
- Submerged-Arc welding (SAW) for components up to 10 tons
- Orbital-welding equipment
- Welding robot system for hard facing
- Associated electrical and gas fired furnaces for pre- and post-weld heat treatment

### Setting new testing standards

- Depending on application and customer requirement, we can perform functional testing, with or without actuation.
- Non-destructive testing (NDT) including X-ray/US/MP/DP
- Steam test facility capable of 200 bar / 350°C for FAT testing



## Lifecycle services.

### The pathway to improved operational performance starts with choosing our lifecycle support

The performance of a steam conditioning valve is dependent on the physical environment, the service conditions, and the desired control objectives and strategies. To maintain performance, appropriate precautions are required through its full life time, from installation and commissioning to maintenance and repair. Emerson has the experience, knowledge and proven capability that are critical in delivering expert services for steam conditioning applications.

Our certified technicians partner with you across the globe to help you maintain safe operation, improve reliability and optimize plant performance.



### Maintenance

Keep your plant operating safely, consistently and economically

### Reliability

Improve your asset reliability and preserve your investments

### Performance

Optimize your plant performance goals





## Maintenance

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### QuickShip program

QuickShip is a world-class fulfillment program that allows for fast shipment of parts and products to maximize speed and responsiveness.

It leverages our global infrastructure, local presence and commitment to service to help you avoid downtime, stay on schedule respond to the unexpected, and control cost in today's challenging environments.

### Installed base and spares planning

When critical parts fail, you need replacement hardware components quickly to minimize costly disruption to plant operations. Let us help you achieve the right level of spares needed to support your plant, whether they're shipped to you or managed onsite.

### Local support

No matter where you are located, we make ourselves available to help you implement changes during normal operations or prepare for planned outages without diverting your manpower from other important duties.



## Reliability

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### Start-up, cold and hot commissioning

Prior to start-up and commissioning, our certified technicians can also assist with the preparation of pickling or flushing - disassembling the valves to protect them, fixing your pickling trims, then re-assembling the valves

We can carry out any pressure tests, delivering all the appropriate pressure test devices that need to be applied to our valves. We will verify valves for you during the cold and hot commissioning. Should safety functions need to be implemented, we will make sure all your valves are tested in accordance with the relevant code requirements.

### Shutdowns, turnarounds & outages

Properly planned shutdowns, turnarounds, and outages can be ideal opportunities to align maintenance with your business goals and implement long-term reliability strategies.

Our technicians have a unique ability to carry out on-site repairs on critical assets - using mobile tools to perform grinding and lapping for sealing or functional surfaces.



## Performance

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### Adapt to new operating conditions

Steam conditioning valves that have been designed for base load production, sometimes have to be adapted to changing economic environments - whether it's to allow more cycling or produce steam for district heating. In cases like these, we can optimize the installation by:

- Installing pre-warming systems
- Redesigning the installed valves, replacing the cage to fit new flow conditions
- Replacing existing valves to improve results
- Offering advice for changing the unit design, in order to increase steam availability for process applications

## Supporting steam generation facilities across the globe.

The Korschenbroich plant has built a reputation as experts in control, safety relief and isolation valves for conventional and nuclear power plants. Sempell steam conditioning valves are installed in turbine bypass applications worldwide.

Asia (ex China) **45**

China **61**

Europe & Russia (ex Germany) **130**

Germany **216**

Middle East & Africa **45**

Rest of World **3**





## International certification and standards.

Emerson's Korschebroich factory and Q.A. procedures are not only inspected and audited regularly by major quality authorities but are in full compliance with the following international rules and standards.

DIN EN ISO 3834-2

DCSEI

DIN EN ISO 9001:2015

AD-2000 HP0

ISO 14001:2015

ASME Section I

PED 2014/68/EU

ASME Section VIII

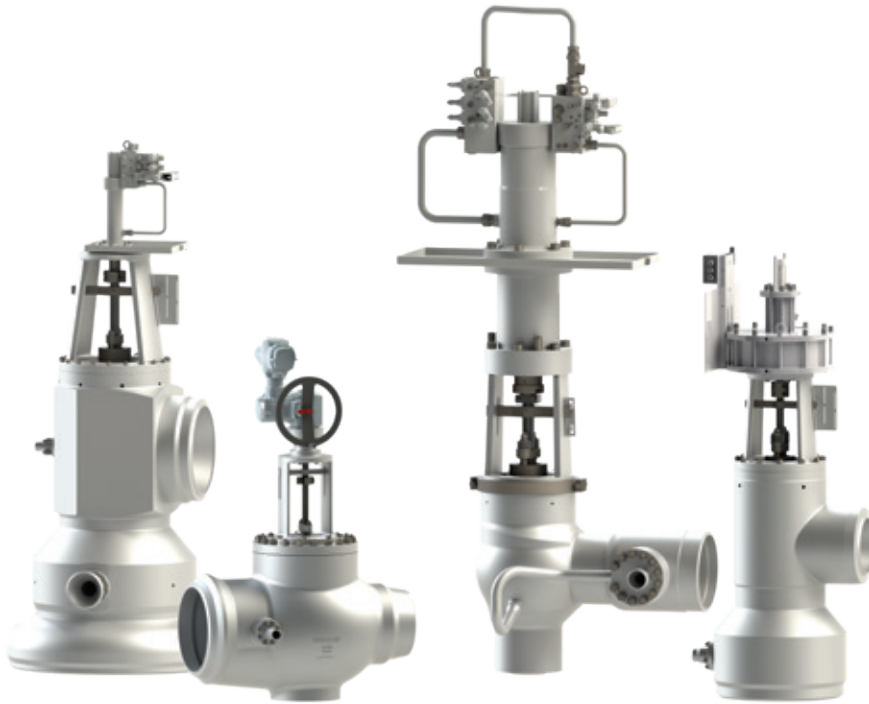
OHSAS 18001:2007

SCCP:2011

And other national and international technical regulations and standards for valves according to customer specification.







**Produce steam at precisely  
controlled temperature  
and pressure.**



**SEMPELL™**

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