ENGINEERED VALVES FOR NUCLEAR POWER GENERATION

TRILLIUM FLOW TECHNOLOGIES™

TRILLIUMFLOW.COM

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NUCLEAR LANDSCAPE - OPPORTUNITY AND CHALLENGE

"Without the support of nuclear power, we have no chance to reach our climate targets on time."
- Fatih Birol, Executive Director, International Energy Agency (IEA)

Opportunity

The International Energy Agency (IEA) recently published an updated version of its landmark 2021 report, "Net Zero Emissions by 2050: A Roadmap for the Global Energy Sector." The report indicates that for the global energy sector to help limit the rise in global temperatures to 1.5 °C above pre-industrial levels, global nuclear capacity would need to increase to 916 GWe by 2050. This is more than double the capacity of the existing fleet of commercial nuclear reactors as of 2024, most of which will be retired by the time we reach 2050. Consequently, the majority of the required 916 GWe will need to come from entirely new reactors. Currently, approximately 66 GWe of new nuclear reactors are under construction, and 84 GWe are planned, and although 365 GWe of projects have been proposed, very few are at a mature stage of design and/or financing.

Building new nuclear capacity on this scale and at this pace presents a significant challenge. This challenge becomes even greater when we consider the additional and potentially massive energy demands associated with data centers and Artificial Intelligence, as well as the proposed use of nuclear energy as a source of high-temperature heat for energy-intensive industrial processes, low-carbon hydrogen production, district heating, and desalination. None of these scenarios have been fully accounted for in the IEA projections, which means that the target for nuclear capacity could be raised to levels that few could have anticipated.

It is clear the nuclear industry has been presented with a tremendous opportunity, but significant challenges will need to be overcome to realize it fully. Some of these challenges will be new, as a substantial portion of global capacity will likely come from Generation III and Generation IV small modular reactors (SMRs), which are designed, constructed, operated, and applied very differently from current generation reactors. Achieving the necessary growth will require a globally coordinated effort to increase manufacturing capacity and capability, accelerate skill development, and manage and balance the demand for the same resources and talents needed to extend the lifetimes of the current operating fleet in a safe and sustainable manner.

Supply chain organizations within the nuclear sector will need to proactively support this effort by critically assessing their business models, reviewing key partnerships, and adopting a globally integrated approach to their operations. This strategy will ensure they can meet demand from multiple points in multiple regions across the globe. In parallel, nuclear reactor developers, owner/operators, and Engineering, Procurement, and Construction (EPC) companies will have to establish strong partnerships with these supply chain organizations.

Without this coordination and a proactive approach, the nuclear industry could fail to deliver on expectations. Such a failure could lead to significant revenue losses for organizations operating within the industry and jeopardize the achievement of the 1.5°C climate goal.

Design Challenge

Designing nuclear reactor systems presents multiple challenges, and with the emergence of new SMR technologies, many of these challenges are new or yet to be uncovered. Therefore, it is essential for nuclear technology developers, EPC firms, owners, and operators to have a strong and reliable supply chain that can provide guidance, support, and critical decision-making assistance at all stages of the design process. The design teams and customer-facing teams of these supply chain organizations need to demonstrate their capacity to collaborate to create product specifications tailored to specific requirements and optimized for availability, longevity, performance, reliability, and cost. Importantly, 'suppliers-partners' must adopt a mindset focused on providing full lifecycle support.

Funding Challenge

The nuclear industry often links funding for major projects to the achievement of key developmental milestones. This is especially true for new reactor technologies, such as SMRs, where the construction methods, operating models, regulatory processes, and applications are still largely undefined and untested. Funding often heavily relies on government support and cautious private investors, making it vulnerable to market sentiment, geopolitical factors, and other forces such as nuclear regulators' feedback, the wider energy landscape, and environmental aspects.

It is essential that supply chain partners support developers in meeting these key program milestones. Suppliers should align their strategies and goals with those of the programs they serve, positively impacting support and approvals from governments, funding bodies, potential customers, and regulators.

Operation & Maintenance challenge

In addition to the initial challenges of construction and capital expenditures (CAPEX), nuclear plant operators and owners must also contend with issues concerning operation and maintenance (O&M) as well as operating expenditures (OPEX) as they strive to ensure maximum safe and sustainable output from their reactors throughout their entire lifespan.

Widespread adoption within the supply chain of a full lifecycle mindset related to the provision of products and services is key to helping operators and owners achieve their O&M and OPEX objectives.

This approach requires the immediate supply chain to address customer requirements not only during construction but also at every stage of the operational lifetime. It involves proactive management of obsolescence, costs, and lead times within their own supply chains.

Exceptional supply chain partners think outside the box and explore ways to adapt to change. This includes exploring and adopting modern thinking, novel approaches, radical methodologies, and game-changing disruptive technologies.

Sustainability challenge

"If you want to reconcile jobs creation, strategic autonomy and sovereignty, and low carbon emissions, there is nothing more sustainable and reliable than nuclear energy." - Emmanuel Macron

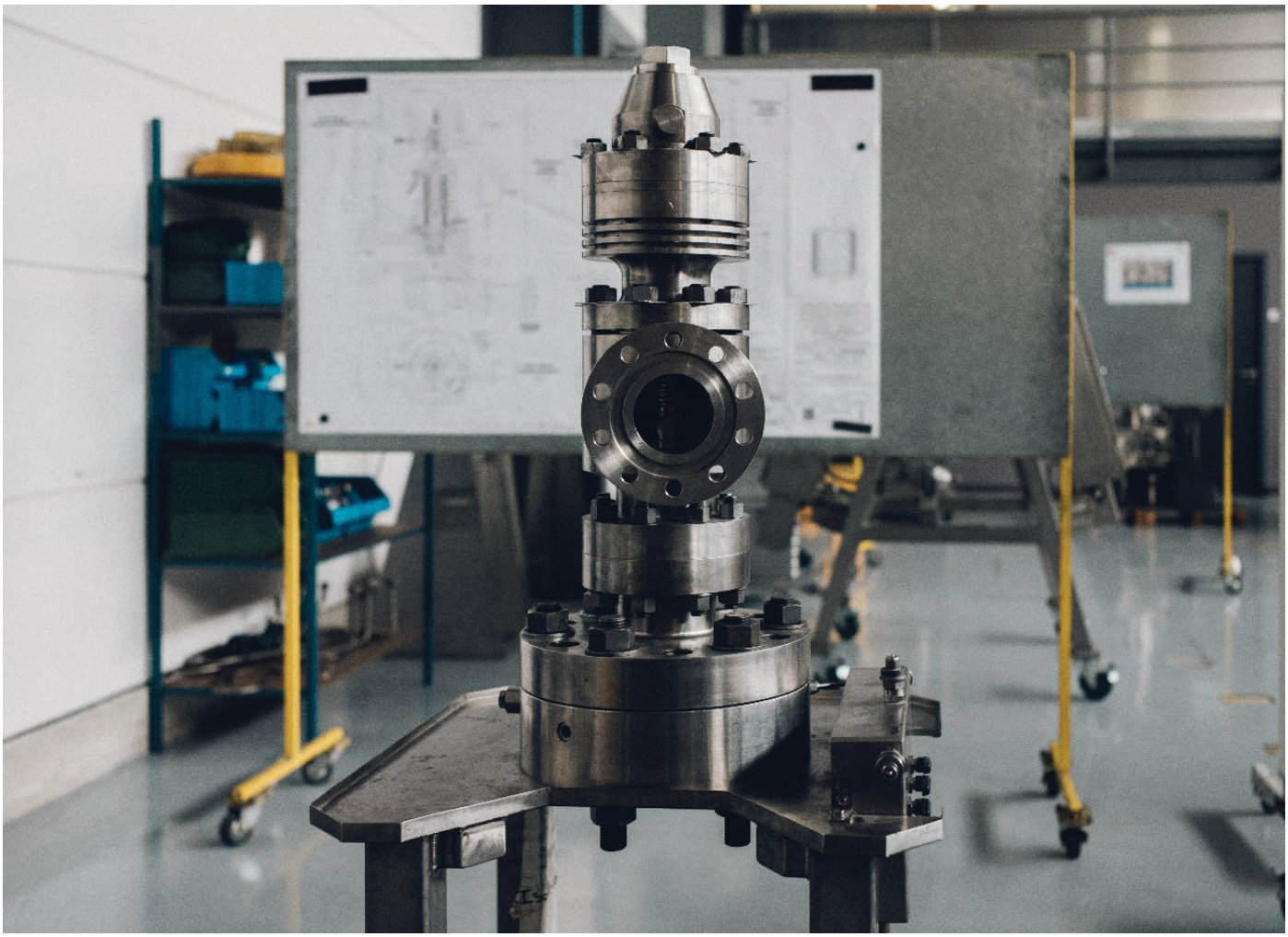
Sustainability is increasingly central to all major nuclear projects. A sustainable and ethical manufacturing approach is now a key expectation for all the actors involved in the nuclear industry, including vendors, EPCs, owners/operators, and the supply chain. It is essential at all levels of this modern nuclear ecosystem to strike a balance between costs and performance, as well as environmental and social impacts. The widespread adoption of sustainable and ethical practices is a vitally important towards a future with abundant and clean energy.

TRILLIUM OVERVIEW

"Our collective mission is clear: nuclear energy is clean energy, and if we are to ensure a liveable planet, build secure, sustainable supply chains for clean energy and bolster prosperity around the world, we need to make sure that nuclear energy does its part. I know we can make it happen, as long as we work together." - John Podesta

As a flow control original equipment manufacturer (OEM) and service provider, Trillium Flow Technologies™ (Trillium) understands the scale and breadth of the challenges faced by the nuclear industry and the impact they have on reactor developers, EPCs, owners, and operators. With our full lifecycle mindset, we support the industry across all stages of a plant project, from design & construction, operation & maintenance, to life extension, and defueling and decommissioning. We consider our work is not complete until the reactor we helped design and construct has been safely decommissioned at the end of a long and productive life. At Trillium, we work in partnership with you, our customer, to address your specific requirements and challenges. We ensure that your unique needs are integrated into our operating model and service offerings from the outset and that they are maintained and monitored throughout the reactor's lifespan.

We have been operating this way ever since our products were installed in the Calder Hall reactor in 1956, the world's first on-grid nuclear reactor. Over the past 70 years, Trillium's legacy brands, including Atwood & Morrill®, Batley®, Blakeborough®, Hiller®, Hopkinsons®, Sarasin-RSBD®, SEBIM®, Termomeccanica Pompe, and Tricentric® have built a reputation for reliability, performance, and quality in the nuclear sector. Today, we remain committed to delivering our expertise and support across an array of reactor types across the globe, with our valves, actuators, and pumps currently installed and operating in approximately 75% of the existing fleet, covering conventional islands, turbine islands, and balance of plant applications.



OUR VALVE & ACTUATOR LEGACY BRANDS

Engineered Isolation & Check Valves

Since 1900, Atwood & Morrill® has been synonymous with an uncompromising commitment to design excellence and product quality. The brand offers check, wye globe, three-way, and slide gate valves for a range of applications in the power generation, oil and gas, and petrochemical industries, including nuclear MSIV and MFIV applications.

High Performance Butterfly Valves

Since 1964, the Batley® range of precision-engineered butterfly valves has been widely used on a variety of isolation and control applications, including those within nuclear reactors.

Control & Severe Service Valves

For nearly 200 years, the Blakeborough® brand has provided a diverse range of control, choke, and steam control valves across an array of industries, covering applications such as severe service, three-way, and turbine bypass in nuclear reactors.

Valve Actuators

Hiller® has provided support to the commercial nuclear power generation industry with world-renowned, high-quality actuation systems for more than 60 years. These include pneumatic, hydraulic, electro-hydraulic, and electric solutions for both safety and non-safety applications, such as main steam isolation and main feedwater isolation.

Parallel Slide Gate & Globe Valves

Since 1843, Hopkinsons® parallel slide valves have supported a wide range of industrial applications, including steam isolation in nuclear reactors, feedwater isolation, safety applications, and decompression processes.

Non-Commodity Valves

Red Point provides a diverse range of non-commodity valves such as ball, globe, gate, check, and double block & bleed, all tailored to meet specific customer requirements. The brand caters to a wide array of applications and industries, including oil and gas, chemical and petrochemical, and power generation.

Pressure Relief Valves

With more than 120 years, the Sarasin-RSBD® valves have served a variety of industrial markets, including nuclear, where protective measures against overpressure are critical. The brand's portfolio includes direct spring-operated and pilot-operated pressure relief valves and changeover valves recognized globally for their high quality, innovative design, and durability.

High Performance Nuclear Pilot Safety Valves

SEBIM®'s high-performance pilot-operated safety valves have accumulated over 32,000 reactor years of international experience in the nuclear field. Designed with unparalleled engineering expertise, SEBIM® valves are recognized for their performance in accordance with precise and rigorous specifications. The brand provides innovative solutions for both safety and non-safety areas of a nuclear power plant, including steam and feed water isolation, as well as safety and decompression systems.

Triple Offset Butterfly Valves

For the past 50 years, the Tricentric® brand of metal-seated triple offset butterfly valves has provided highly engineered solutions across various industries and applications. These include nuclear containment venting systems (HCVS), containment isolation systems, residual heat removal systems, emergency core cooling, condensate systems, service water systems, heat exchanger isolation and controls, closed cooling water systems, core spray systems, and extraction steam isolation.

TRILLIUM CAPABILITIES

Supporting Structure

Trillium's dedicated nuclear function is specifically designed to provide exceptional service to our customers throughout all stages of their nuclear program's lifecycle. This includes initial concept design, detailed design, testing, construction, operation, defueling, and decommissioning. Our customer-facing teams are fully trained to ensure that needs and requirements are accurately captured, understood, and communicated to the technical teams. These technical teams are staffed with Suitably Qualified and Experienced Personnel (SQEP) to effectively support our customers. Our design teams benefit from the support of a global project management function, which ensures a seamless transition from design to delivery. In many cases, particularly with nextgeneration nuclear technologies like SMR, our customer-facing, engineering, and project management teams are sourced from multiple geographical regions to accommodate the various deployment locations of these programs.

Innovation

Nuclear is ideal for dealing with climate change because it is the only carbon-free, scalable energy source that's available 24 hours a day. The problems with today's reactors, such as the risk of accidents, can be solved through innovation."
– Bill Gates

Innovation is the golden thread that runs through all the activities we undertake at Trillium, from product design to advancements in production and the development of new and exciting through-life service packages. As we look ahead to the coming decades in the nuclear sector, we see several emerging trends that have the potential to enhance reactor performance and longevity while reducing design, construction, and O&M costs.

TRILLIUM CAPABILITIES

Commonization and Standardization

A significant trend in the nuclear industry is going to be the standardization or commonization of reactor designs, manufacturing and construction methods and plant operations procedures to enhance nuclear programs. Our approach at Trillium is to embrace these developments and integrate them into our product and service offerings. A key factor driving the push towards standardization and rationalization of requirements could be the adoption of advanced manufacturing technologies, including Additive Manufacturing (AM). These advanced manufacturing techniques offer substantial benefits, such as improved manufacturability of complex parts, flexibility in production locations, reduced obsolescence, lower costs, and shorter lead times. Therefore, controlled strategic implementation of advanced manufacturing in Trillium's operations and supply chain will remain a major focus over the next five years.

Supply Chain

Trillium foresees the necessity for a streamlined and globally coordinated approach to shared supply chains. All this with a view to improving lead times and capacity while ensuring that needs are met across multiple critical programs happening simultaneously. Artificial Intelligence could play a significant role in this process, and at Trillium, we are already exploring this as a possibility.

Condition Monitoring

Strong and appropriately skilled on-site support for customers is vital to ensure a proactive approach to Operations & Maintenance. The future implementation of live condition monitoring in specific plant applications also holds significant potential. Trillium offers live condition monitoring technology for control valves and is currently exploring the possibility of applying the same technology to isolation valves. Our technology involves using embedded sensors in tandem with advanced manufacturing methods to monitor the condition of critical surfaces.

TRILLIUM CAPABILITIES

Small Modular Reactors (SMRs)

Trillium is actively supporting and engaging with several current and potential customers in the SMR space at the global level, including both Gen III+ and Gen IV types. This effort is managed and coordinated through a central function whose task is to monitor trends and drive innovation activities tailored to customer needs. Gen III+ SMRs share significant commonality with existing GW-scale water-cooled nuclear programs; however, they also present unique aspects that differentiate them, including considerations related to funding, regulatory processes, design, manufacturing, localization, colocation, siting, operating models, operations and maintenance (O&M), and decommissioning. Generation IV reactors face similar challenges as Generation III+, but they must also address issues related to materials, manufacturability, and a broader range of cogeneration applications due to their higher operating temperatures.

Next-generation nuclear technology is prompting a reevaluation of typical practices within the nuclear sector, and to support this shift, we have cultivated a culture of innovative thinking at Trillium.

On-site Support

Once a reactor is in active service, Trillium can offer on-site support and an outage management program through our extensive team of trained service personnel located around the globe. We can proactively survey our Trillium installed base and provide recommendations for potential interventions, including upgrades, repairs, and replacements, and then carry out the necessary work with our personnel. This is often done in coordination with scheduled outages to minimize any disruption to operations.

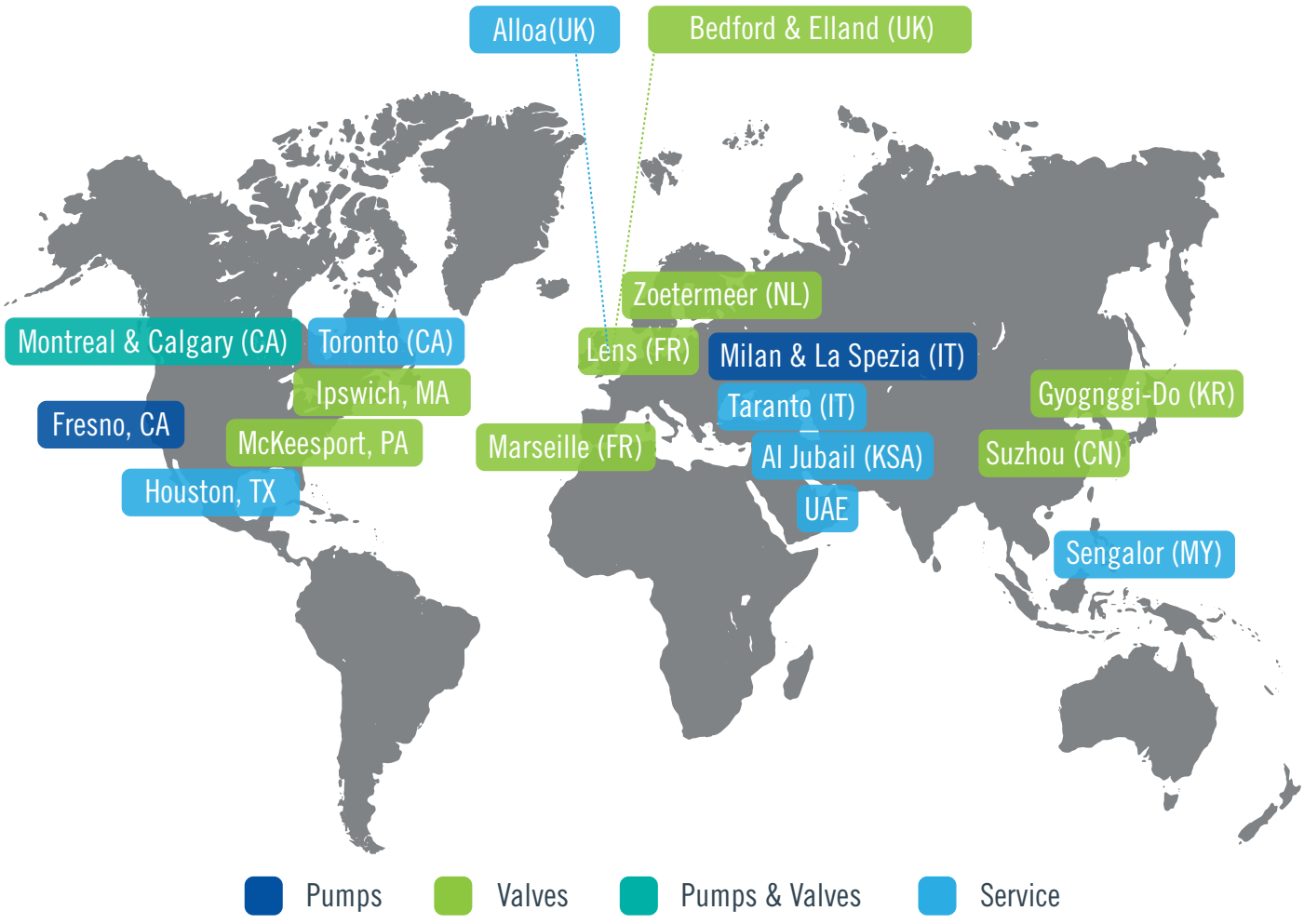
Globally Integrated Flexible Manufacturing

Trillium manufacturing operates on a truly global scale, with production sites located in the UK, France, the Netherlands, Italy, the USA, South Korea, and China. Among these, we have two sites that hold ASME Nuclear Component (N-type) Certification.

Furthermore, we understand the importance of positioning our production facilities close to our customers' target markets to effectively meet the demands of the next generation of nuclear reactors.

To achieve this, we have adopted a flexible manufacturing approach that allows multiple sites to produce the same product under the direction of a single design authority (DCO).

To maximize the benefits of this flexible manufacturing strategy, we have implemented a globally coordinated approach to supply chain management. This enables us to establish long-term partnerships, optimize costs, manage lead times, secure capacity, and adopt sustainable practices in our procurement activities.



Quality

Trillium operates quality programs to cover the full scope of our activities and deploys quality systems that have been developed specifically to serve the nuclear market.
Trillium is qualified to industry standards and working practices, including:

- ASME BPVC Section III (N and NPT Stamp)
- ASME BPVC Section VIII (UV Stamp)
- NQA-1 Quality system
- 10CFR50 App. B
- 10CFR 21
- RCC-E
- RCC-M
- CSA Z299
- OTT 87
- Performance testing and qualification to:
  ASME QME-1
  ASME B16.41
  IEEE 323
  IEEE 344
  IEEE 382
- ISO 9001
- ISO 14001
- ISO 17025
- PED 97/23/CE
- API Q1 TO API LICENCES:
  API 6D (6D-0182)
  API 6A (64-0445)
- TUV - AD MERKBLATT WRD HP 0
- ATEX 94/9/CE
- Lean manufacturing practices

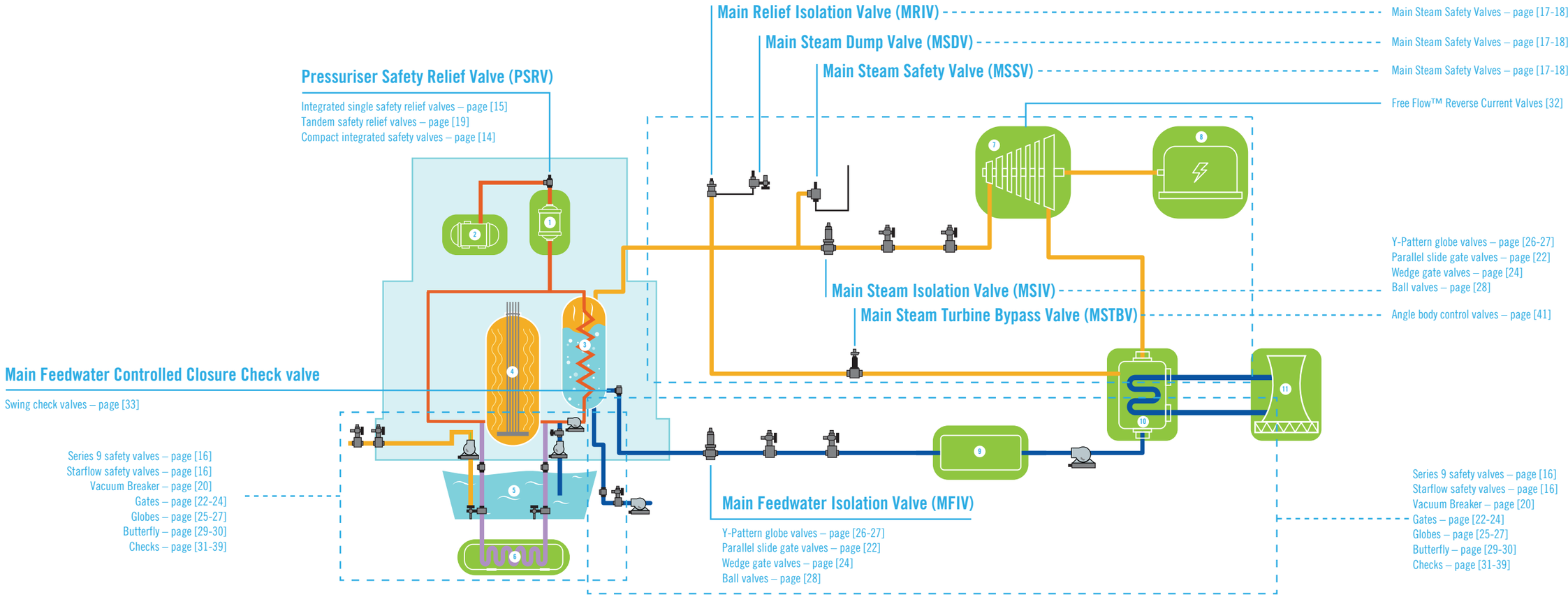
Sustainability - Environmental, Social, and Governance (ESG)

Trillium is fully committed to ensuring that our activities are not only protective of the environment but also contribute positively to its improvement. Additionally, we are dedicated to fostering social value and developing skills and opportunities in often underprivileged areas. We are passionate about Equality, Diversity, and Inclusion (ED&I) and actively encourage and support underrepresented groups in the nuclear sector. Each year, Trillium publishes an ESG report that outlines our key priorities and initiatives in these areas, as well as reports on our progress against the targets set in the previous year.

Click here to consult our Sustainability Report

TRILLIUM'S NUCLEAR PRODUCT RANGE - OVERVIEW

The majority of Trillium nuclear products currently in service are installed in Pressurized Water Reactors (PWR), Boiling Water Reactors (BWR), Advanced Gas-cooled Reactors (AGR), and PHWRs (Pressurized Heavy Water Reactors). As mentioned in our capabilities section, Trillium is also making significant progress in new technologies beyond these conventional reactor types and into Small Modular Reactors (SMRs), Gen III+ and Gen IV such as High-temperature Gas-cooled Reactor (HTGR). For the purposes of illustration, we herewith outline the different products we offer within the nuclear range using the example of a PWR-type reactor.



PWR SYSTEMS

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

SAFETY RELIEF VALVES

COMPACT INTEGRATED SAFETY VALVES

High safety protection level on smaller scale for Generation III and IV reactor designs

DSM 3000

DSM 3000

Applications:

- High and low pressure for liquid, steam, gas, and steam/water or gas/water mix
- Small capacity, high speed pressure transient
- Primary coolant safety for PWR SMR
- Primary coolant safety valves for research reactors
- Primary coolant safety valves for submarine

Sizes: ½-1½ inch (DN 15-40)
Pressure: From 70 to 2900 Psi (0.5 to 20 MPa)
Temperature: High temperature applications to 576°C (1069°F)
Class: ASME Class 150# – 2500# or customized
Features:

- Excellent operation irrespective of the type of fluid: steam, gas, liquid or two-phase
- Leak tightness up to the set-pressure maximizes the operating pressure and output power
- Non-flowing pilot valve minimizes ageing of the mechanism
- Accuracy of pilot set pressure opening value with repeatability better than 1%
- Soft opening/closing decreases the loads to the installation
- Low or high pressure in-situ test during operation for preventive maintenance
- Maintained stability even when flow capacities are well below the maximum rate, no chattering
- Reduced maintenance
- Proven and accurate repeatability and reliability
- Available remote control – power supply 48, 110, 220 V DC/AC – IP 65 – 100% operating factor
- K1 - 1 E qualified for applications within the containment area of nuclear plants
- Compact design
- Customized interfaces (upstream and downstream pipes)
- Forged stainless steel body – special material on request

References: France, Belgium, China

INTEGRATED SINGLE SAFETY RELIEF VALVES

Innovative compact design for over-pressure protection in cooling circuit

PRG 3000

Applications:

- Suitable for all nuclear reactor designs (PWR, BWR, CANDU PHWR, RBMK LWGR, HTGR)
- High and low pressure overpressure protection on steam, water, gas or steam/water mix
- Qualified for inside and outside reactor containment
- Safety functions during accidental conditions (feed & bleed)
- Pressuriser safety valves
- Steam generator safety valves
- Main steam safety valves
- Bleed condenser relief valves
- Reactor heat removal safety valves
- Reactor volumetric and chemical control circuit overpressure protection

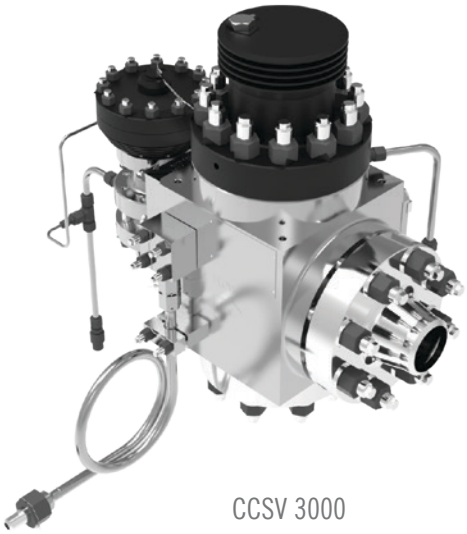
Sizes: 1-16 inch (DN 25-400)
Pressure: From 7 to 4300 PSI (0.05 to 30 Mpa)
Temperature: High temperature applications to 576°C (1069°F)
Class: ASME class 150# – 2500# or customized

PRG 3000 & CSV 3000

Features:

- Excellent operation irrespective of the type of fluid: steam, gas, liquid or two-phase
- Leak tightness up to the set-pressure maximizes the operating pressure and output power
- Non-flowing pilot valve minimizes ageing of the mechanism
- Accuracy of pilot set pressure opening value with repeatability better than 1%
- Soft opening/closing decreases the loads to the installation
- Low or high pressure in-situ test during operation for preventive maintenance
- Maintained stability even when flow capacities are well below the maximum rate
- No erosion of sealing faces, no chattering
- Reduced maintenance
- Proven and accurate repeatability and reliability
- Available remote control - power supply 48, 110, 220 V DC/AC – IP 65 – 100% operating factor
- K1 - 1 E qualified for applications within the ontainment area of nuclear plants
- Protection against cold overpressure (nuclear vessel protection within the NDTT curve)
- Compact design reduces size and weight
- Customized interfaces (upstream and downstream pipes)
- Prevention of LOCA (Loss of Coolant Accident): the unique feature guarantees reliable closing (Emergency Shut-Off (ESO))

References: China



CCSV 3000

SAFETY VALVES

Protection from Overpressure

9 Series

Starflow™ Series

- Spring loaded safety relief valves (Starflow™, 9 Series)
- Damped spring loaded relief valves
- Atmospheric relief valves
- Pilot operated safety relief valves
- Changeover valves

Applications:

- Suitable for all types of nuclear reactors (PWR, BWR, CANDU PHWR, RBMK LWGR, HTGR)
- High and low pressure overpressure protection on steam, water and gas lines
- Nuclear steam supply system (NSSS) and balance of nuclear island
  - Steam generator blowdown system
  - Electrical building chilled water system
  - Spent fuel pit cooling and treatment system
  - Reactor coolant system
  - Chemical and volumetric control system
  - Reactor boron and water make up system
  - Nuclear sampling system
  - Safety injection system
  - Nuclear island vent and drain system
  - Reactor heat removal system
  - Component cooling system
  - Instrument compressed air distribution system
  - Nuclear island demineralised water distribution
  - Gaseous waste treatment system
  - Boron recycling system
  - Waste auxiliary components cooling system

Size: ½ - 12 inch (DN 15-305)
Pressure: From 7 to 14500 PSI (0.05 to 100 Mpa)
Class: ASME Class 150# – 2500# or customized

Features:

- Full lift
- Semi or full nozzle design
- Metal or soft seat
- Cast or forged body
- Carbon, alloy or stainless steel
- Flange, threaded, welded
- Available with a damping system (GRAB) to prevent acoustic vibration phenomena

References: France, Belgium, Spain, Finland, UK, Bulgaria, Slovakia, China, South Korea, India, South Africa

MAIN STEAM SAFETY VALVES

High performance and repeatability

Starsteam Series

Starsteam Series (Spring Loaded)

Applications:

- Overpressure protection of Main Steam Line
- Suitable for all reactor technologies (PWR, CANDU PHWR, BWR, HTGR, SMRs)

Size: 1 - 16 inch (DN 25-400)
Pressure: From 70 to 2900 PSI (0.5 – 20 Mpa)
Temperature: Up to 1157 °F (625°C)
Class: ASME Class 150# - 4500#
Features:

- Cast or forged body
- Carbon, Stainless steel
- Overpressure +3%
- Adjustable Blowdown from 2% to 4%
- Semi-nozzle screwed/welded to the valve body
- Anti-seize design which consists in 2 thermoglide™ rings on the piston avoiding any metallic contact and preventing the valve from seizing, jamming and wearing.
- Increased tightness performances at high pressures (96 to 98% of Set Pressure) and high temperatures thanks to the Stardisc™ design
- Blowdown chamber allows fast blowdown adjustment and a rapid closing speed to protect the seat from the high steam velocity when reseating .
- In-situ testing ready (Pre-drilled yoke)

References: Finland, India, Ukraine, Russia, Bulgaria, Lithuania

MAIN STEAM SAFETY VALVES

Reliable protection in all steam/fluid conditions

GVG 3000

RVG 3000

- Main Steam Safety Valves (Pilot Operated)
- GVG 3000 Series (Bellows Sealed)
- RVG 3000 Series (Bellow Free)

Applications:

- Suitable for all types of nuclear reactors (PWR, BWR, CANDU PHWR, RBMK LWGR, HTGR)
- High and low pressure overpressure protection on steam, and steam/water mixtures
- Qualified for Nuclear Steam Supply
- System (NSSS)
- Safety functions during accidental conditions (feed & bleed)
- Steam generator safety valves

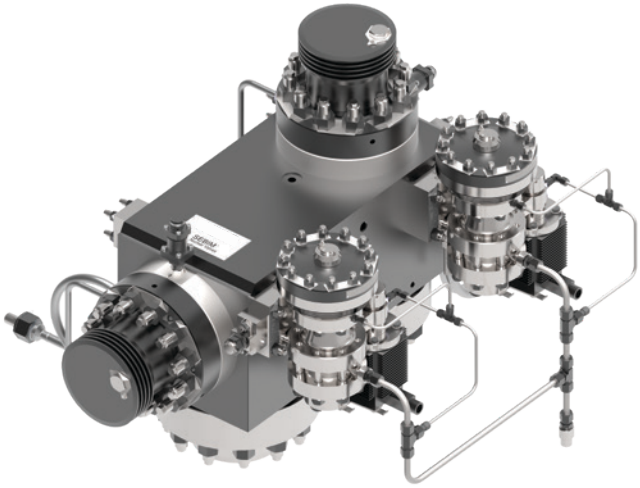
Sizes: 1-16 inch (DN 25-400)
Pressure: From 70 to 2900 Psi (0.5 to 20 MPa)
Temperature: High temperature applications to 576°C (1069°F)
Class: ASME Class 150# – 2500# or customized
Features:

- Excellent operation irrespective of the type of fluid: steam, gas, liquid or two-phase
- Leak tightness up to the set-pressure maximizes the operating pressure and output power
- Non-flowing pilot valve minimizes ageing of the mechanism
- Accuracy of pilot set pressure opening value with repeatability better than 1%
- Soft opening/closing decreases the loads to the installation
- Low or high pressure in-situ test during operation for preventive maintenance
- Maintained stability even when flow capacities are well below the maximum rate
- No erosion of sealing faces, no chattering
- Reduced maintenance
- Proven and accurate repeatability and reliability
- Available remote control - power supply 48, 110, 220 V DC/AC – IP 65 – 100% operating factor
- K1 - 1 E qualified for applications within the containment area of nuclear plants
- Protection against cold overpressure (nuclear vessel protection within the NDTT curve)
- Compact design reduces size and weight
- Customized interfaces (upstream and downstream pipes)
- Cast or forged carbon steel body – special material on request
- The unique design guarantees reliable closing

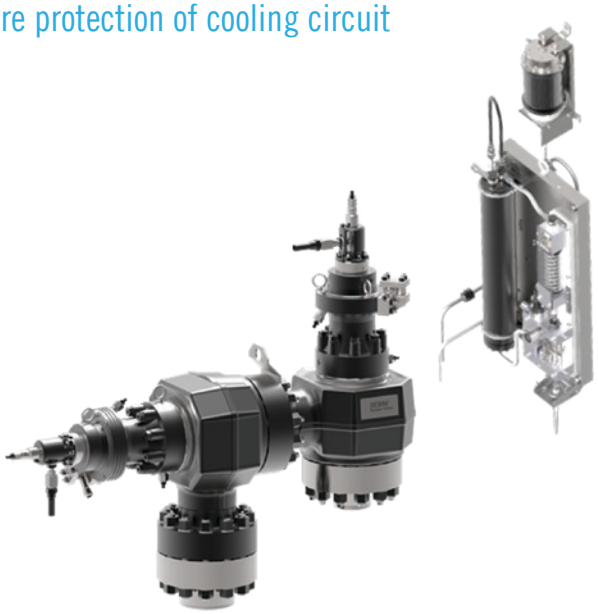
References: Finland, India, Ukraine, Russia, Bulgaria, Lithuania

TANDEM SAFETY RELIEF VALVES

Unique design for redundant safe closure in over-pressure protection of cooling circuit



CTSV 3000 tandem



PRG 2000 tandem

Tandem safety valves, compact tandem safety valves, super compact tandem safety valves

Applications:

- Suitable for all nuclear reactor designs (PWR, BWR, CANDU PHWR, RBMK LWGR, HTGR)
- High and low pressure overpressure protection on steam, water, gas or steam/water mix
- Qualified for inside and outside reactor containment
- Safety functions during accidental conditions (feed & bleed)
- Pressuriser safety valves
- Steam generator safety valves
- Main steam safety valves
- Bleed condenser relief valves
- Reactor heat removal safety valves
- Reactor volumetric and chemical control circuit overpressure protection

Sizes: 2-16 inch (DN 50-400)

Pressure: From 7 to 4300 PSI (0.05 to 30 Mpa)

Temperature: High temperature applications to 576°C (1069°F)

Class: ASME class 150# – 2500# or customized

Features:

- Excellent operation irrespective of the type of fluid: steam, gas, liquid or two-phase
- Leak tightness up to the set-pressure maximizes the operating pressure and output power
- Non-flowing pilot valve minimizes ageing of the mechanism
- Accuracy of pilot set pressure opening value with repeatability better than 1%
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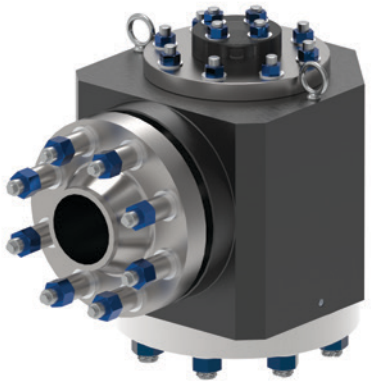
- No erosion of sealing faces, no chattering
- Reduced maintenance
- Proven and accurate repeatability and reliability
- Low power consumption of the actuator - power supply 48, 110, 220 V DC/AC – IP 65 – 100% operating factor
- K1 - 1 E qualified for applications within the containment area of nuclear plants
- Protection against cold overpressure (nuclear vessel protection within the NDTT curve) Compact design reduces size and weight
- Customized interfaces (upstream and downstream pipes)
- Prevention of LOCA (Loss of Coolant Accident): the unique TANDEM design guarantees reliable closing

References: France, Belgium, Switzerland, England, Russia, Ukraine, Armenia, Bulgaria, China, South Korea, Canada

VACUUM BREAKER VALVES

Designed to protect piping systems against vacuum



VB 2000 - forged

VB 2000 - cast

VB 2000

Applications:

- Vacuum breakers are used to prevent the collapse of a vessel or piping system due to a vacuum or negative pressure. They are essential components in piping systems to protect against potential damage or hazards caused by vacuum conditions
- When the system is at pressure, the differential between the system and the outside atmosphere keeps the vacuum breaker's port closed. When the system is in vacuum, the differential between the outside atmosphere and the system opens the vacuum breaker's port.

Size: 1 - 6 inch (DN 25-150)
Pressure: From -3 to - 0.7 PSI (0.002 - 0.005 Mpa)
Class : ASME Class 150# - 2500#
Features:

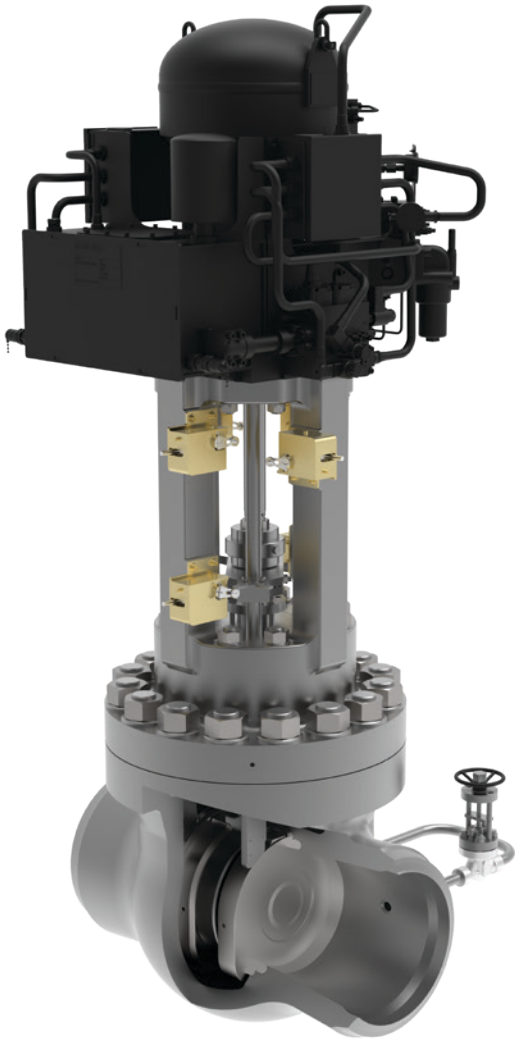
- Cast or forged body
- Carbon, Stainless steel, Duplex

References: France, Finland, China, South Korea

ISOLATION VALVES

GATE VALVES - PARALLEL SLIDE DESIGN

Sealed by line pressure



A219

Applications:
- Main Steam Isolation (MSIV)
- Main Feedwater Isolation (MFIV)
- Medium to High pressure system isolation

Design standards:
- ASME section III
- ASME B16.34
- RCC-M

Sizes: ½ - 36 inch (DN 15-900)

Pressure class: 150-2500

Features:
- Position seated - stops on limit not torque
- Wide, flat seating surface
- No thermal binding issues
- Bi-directional operation
- Non-galling
- Consistent thrust
- Addresses GL 89-10 issues

Materials of construction:
- **Body:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seat and wedge:**
  - Hardfaced with stellite or cobalt free materials

Seal design:
- Bolted bonnet (seal weld provision available)
- Pressure seal

End connections:
- Butt weld
- Flanged

Actuator options:
- Pneumatic
- Electric motor
- Gas-hydraulic
- Manual gear
- Bare stem

Other options:
- Position indication
- Instrumented stem
- Bonnet overpressure protection
- Seal weld
- Canopy weld
- Integral bypass arrangements/optional

References: AGR (UK), PWR (China, South Korea), PHWR (Canada, India, South Korea)

GATE VALVES - VENTURI PARALLEL SLIDE DESIGN

Reduced size and weight without compromise

A239

Applications:
- Main Steam Isolation (MSIV)
- Main Feedwater Isolation (MFIV)
- Medium to High pressure system isolation

Design standards:
- ASME Section III
- RCC-M

Sizes: 3 – 32 inch (DN80 – DN800)

Pressure class: 600 – 4500

Features:
- Position seated – stops on limit not torque
- Wide, flat seating surface – self-cleaning during stroke
- No risk of thermal binding
- Bi-directional operation
- Self-aligning discs
- Consistent thrust
- Reduced travel, topworks size and actuator size compared to full bore equivalent
- Low pressure drop – uninterrupted flow path
- Seat faces protected from flow when fully open
- Anti-blowout stem
- Ease of maintenance

Additional features depending on application:
- Disc guides
- Guide pillars
- D-shaped discs – prevent jamming in high flows
- Bypass/intergate relief arrangement
- Intergate drain
- Live-loading
- Double packing & leak-off
- Bonnet seal weld provision
- Cobalt free hard facing

Materials of construction:
- Carbon
- Alloy
- Stainless steel

Bonnet Design:
- Bolted
- Pressure seal

End connections:
- Butt weld
- Flanged

Actuator options:
- Manual
- Electric
- Pneumatic
- Gas-charged Hydraulic

References: AGR (UK), PHWR (Canada), PWR (Sweden)

GATE VALVES - SPLIT AND FLEXI WEDGE DESIGN

Providing isolation at both high and low pressures

A209

Applications:
- Main Steam Isolation (MSIV)
- Main Feedwater Isolation (MFIV)
- Medium to High pressure system isolation

Design standards:
- ASME section III
- ASME B16.34
- RCC-M

Sizes: 3-24 inch (DN 80-600)

Pressure class: 150-2500

Features:
- Flexible wedge design
- Bi-directional operation
- Precision body guides
- Tight shut-off
- Addresses GL 89-10 concerns

Materials of construction:
- **Body:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seat and wedge:**
  - Hardfaced with stellite or cobalt free materials

Seal design:
- Bolted bonnet (seal weld provision available)
- Pressure seal

End connections:
- Butt weld
- Flanged

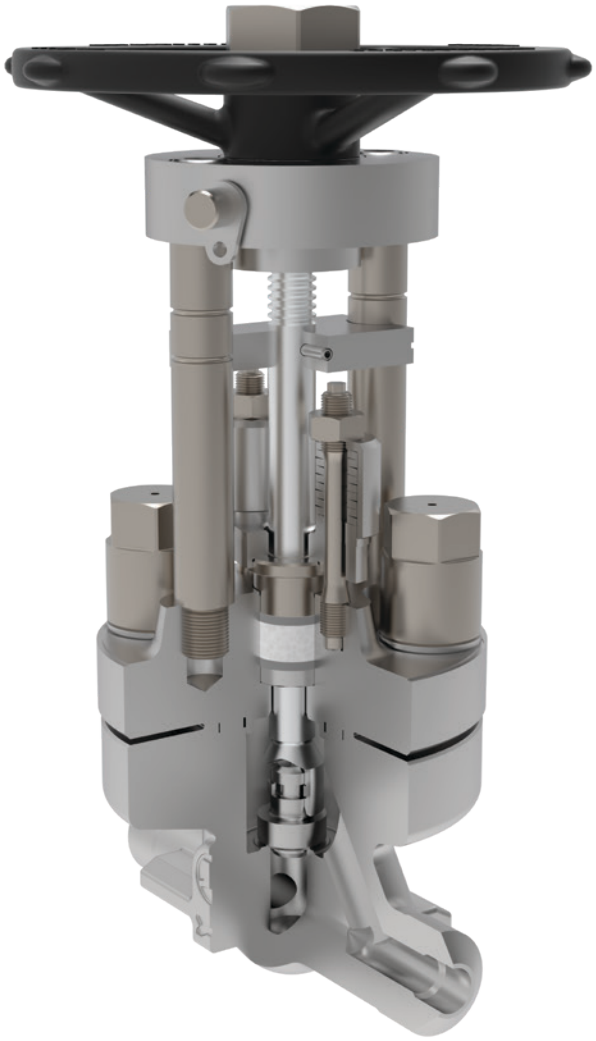
Actuator options:
- Pneumatic
- Electric motor
- Gas-hydraulic
- Manual gear
- Bare stem

Other options:
- Position indication
- Bonnet overpressure protection
- Seal weld (bolted bonnet)
- Canopy seal (pressure seal)
- Integral bypass arrangements/option
- Instrumented stem

References: AGR (UK), PHWR (Canada), PWR (Sweden)

GLOBE VALVES - T-PATTERN

A compact valve for system isolation on small diameter piping



A865

Applications:
- High & low pressure system isolation
- Containment isolation
- Intergate relief for gate valves

Figure Number: A865

Design standards:
- ASME Section III
- RCC-M

Sizes: 5/16 – 3 inch (DN8 – DN80)

Pressure class: 150 – 4500

Features:
- Extension on valve head to throttle flow at cracked open position to protect the seating faces against the scoring or cutting action of steam
- Isolates at high and low pressures
- Non-rotating rising stem
- Needle bearings in bridge for smooth operation
- Anti-blowout stem
- Ease of maintenance

Additional features depending on application:
- Combined stop & check valve variant available – This adds non-return flow duty with the ability to partially or fully restrict the lift of the valve head
- Bellows sealing
- Angle pattern body
- Live loading
- Double packing & leak-off
- Bonnet seal weld provision
- Metal or soft seated
- Cobalt free hard facing

Materials of construction:
- Carbon
- Alloy
- Stainless steel

Bonnet Design:
- Bolted
- Pressure seal
- Bonnetless and hermetically sealed

End connections:
- Butt weld
- Flanged

Actuator options:
- Manual
- Electric
- Pneumatic

References: AGR (UK), PWR (China, South Korea), PHWR (Canada, India, South Korea)

GLOBE VALVES - Y-PATTERN

Designed for tight shut-off with low pressure drop

Applications:
- Containment isolation
- Water Isolation
- Steam Isolation
- Equipment isolation requiring tight shut-off

Design standards:
- ASME section III
- ASME B16.34

Sizes: 3-30 inch (DN 77-610)

Pressure class: 150-2500

Features:
- Y-pattern for lower pressure loss
- Bevelled seats for tight sealing
- Large seat bore for reduced pressure drop

Materials of construction:
- **Body and poppet:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seat:**
  - Stainless steel overlays
  - Hardfacing alloys

Seal design:
- Bolted bonnet (seal weld provision available)
- Pressure seal

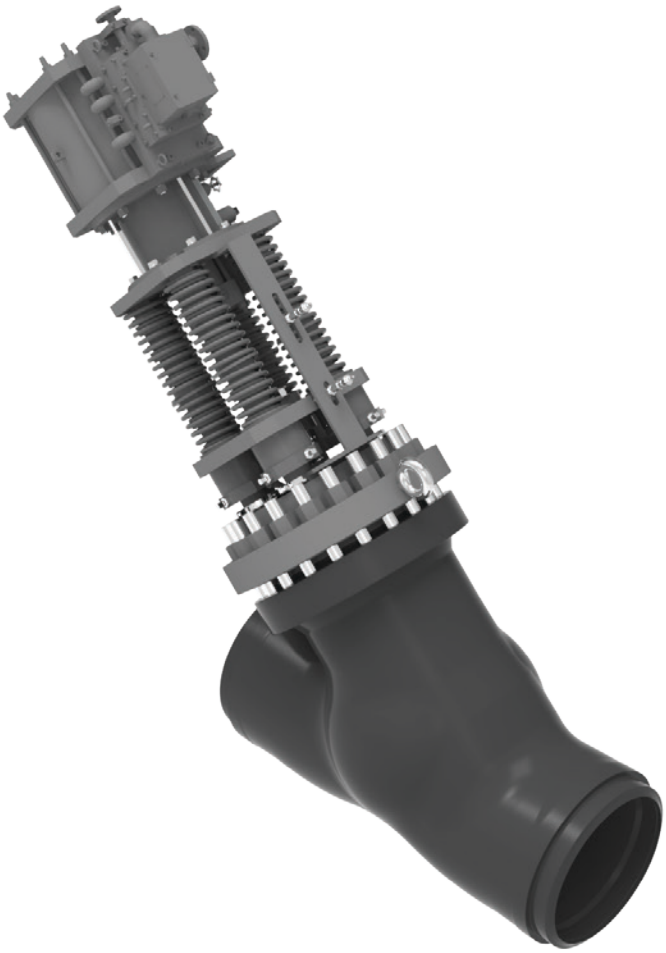
End connections:
- Butt weld
- Flanged

Actuator options:
- Pneumatic
- Electric motor
- Gas-hydraulic
- Manual gear
- Bare stem

Other options:
- Position indication
- Instrumented stem
- Non-cobalt hardfacing materials available

GLOBE VALVES - Y-PATTERN

Fast closing for critical protection



Applications:
- Main Steam Isolation (MSIV)

Design standards:
- ASME section III

Sizes: 4-38 inch (DN 100-950)

Pressure class: 600-1500

Features:
- Globe design ensures tight shut-off
- Quick closure design (typically 3-5 seconds)
- Simple and effective design - process and springs assist closure
- Compact valve and actuator design - low centre of gravity
- Advanced flow path design for minimal pressure loss
- Nose guide for tight seating
- Back seated for stability and resistance to vibration

Materials of construction:
- **Body and poppet:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seats and precision guides:**
  - Alloy hardfacing #21 overlay

Seal design:
- Bolted bonnet (seal weld provision available)

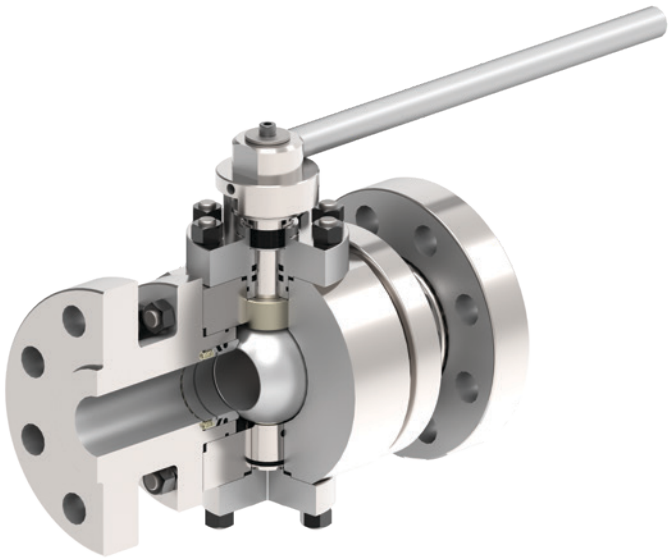
End connections: Butt weld

Actuator options:
- Pneumatic with spring assist
- Electric motor

Other options:
- Position indication
- Stem instrumentation

BALL VALVES

Covering a wide range of isolation applications



Applications:
- Containment isolation
- Equipment isolation
- Steam isolation
- Service water
- Condensate
- Circulating water
- Drains

Design Standards:
- ASME B16.34
- ASME Section III

Sizes : 25”- 16”

Pressure (Class): 150 - 2500

Features:
- Uni-directional or Bi-directional
- Maintains tight contact between ball/seat regardless of valve installation orientation
- Low coefficient of friction
- Excellent sliding and running properties
- Optimal selection of flexibility and stiffness of both ball and seat rings

Materials of Construction:
- **Body:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seat and Ball:**
  - Several qualified surface treatment techniques

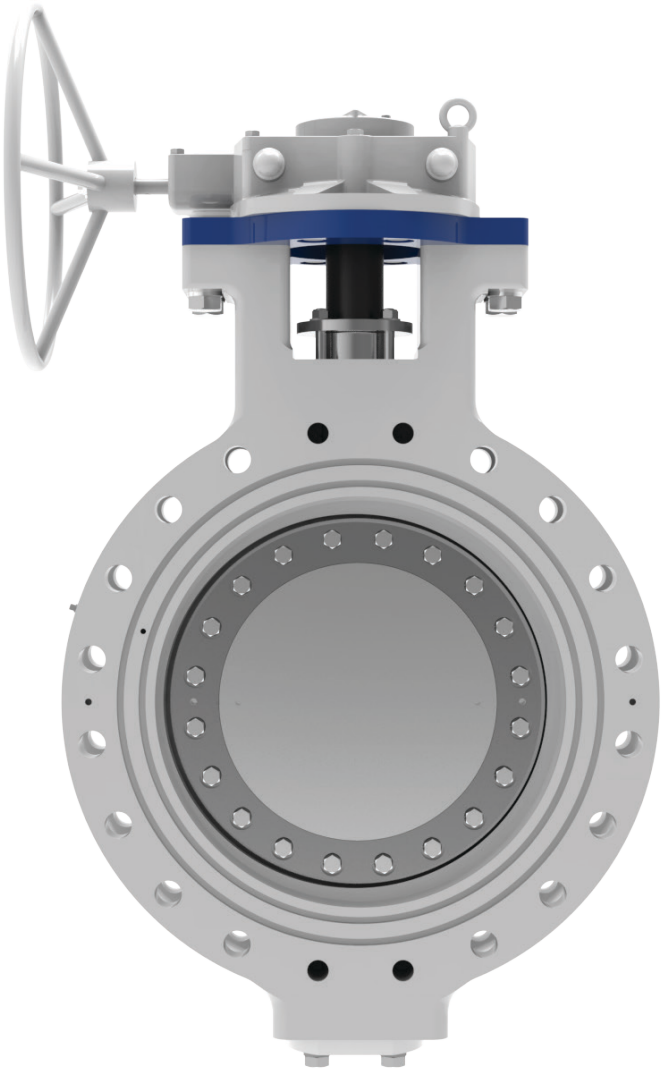
End connections:
- Butt weld
- Flanged
- Socket weld

Actuator options:
- Pneumatic
- Electric motor
- Manual gear

Options:
- Floating or Trunnion mounted
- Soft or metal seated
- Body style
- One piece body (top, side or end entry)
- Split body (two or three piece)
- Extended stem

BUTTERFLY VALVES - TRIPLE OFFSET

Exceptional seating for demanding applications



Applications:
- Containment isolation, vent and purge
- Equipment isolation
- Steam isolation
- Service water
- Condensate
- Circulating water

Design standards:
- ASME Section III
- ASME B16.34

Sizes: 3-72 inch (DN 73-1067)

Pressure class: Class 150-600

Features:
- Metal to metal seating uses no elastomers, allowing for high temperature service and resistance to radiation
- Triple offset design creates no rubbing, galling or wear, leading to long life and low maintenance
- Valve is torque seated in the closed direction, resulting in tight shut-off
- Bi-directional tight sealing

Materials of construction:
- Carbon steels
- Alloy steels
- Stainless steels
- AL6XN

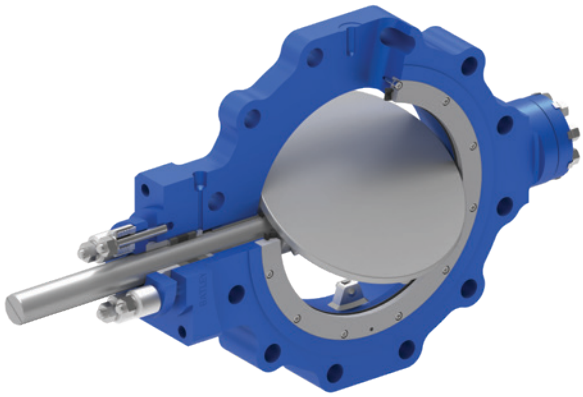
End connections:
- Double Flanged
- Lugged
- Wafer
- Special

Actuator options:
- Pneumatic
- Electric motor
- Gas-hydraulic
- Manual gear
- Bare stem

Options:
- Position indication
- Stem instrumentation
- Custom face to face dimensions available for replacing existing valves

BUTTERFLY VALVES – DOUBLE OFFSET

Resilient seated, high performance, and cost-effective solution for low pressure system isolation



BV21000 (Hyperseal)

BV20000 (Steadseal) and BV21000-BV22000 (Hyperseal)

Applications:

- Low pressure system isolation
- Containment isolation

Sizes: 3" – 100" (DN80 – DN2600)

Pressure Class: 150 – 300

Design Standards: ASME Section III or RCC-M

Key Features:

- Double offset – Moves the vane into and out of the seat
- with minimum wear and seating torque – extending life
- Resilient seated – Polymeric or Elastomeric
- Position seated – stops on limit not torque
- In the preferred direction the pressure energizes the seal,
- making it progressively tighter.
- Adjustable travel stop
- Bolted blank end flange
- One-piece shaft
- Suitable for horizontal or vertical shaft installation
- Streamlined vane to minimize pressure drop
- Tight shut-off and control functionality
- Stainless steel vane as standard

Additional features depending on application:

- Metallic, non-metallic and sealed journal bearings
- Vari-diff vane cowl to improve control performance.
- Live-loading
- Double packing and leak-off
- Packing blow-out

Materials of Construction: Carbon, alloy, or stainless steel

End Connections: Butt weld or flanged (wafer, lugged, tapped lugged, and full flange)

Actuation: Manual, Electric, Pneumatic

References: PHWR (Canada)

CHECK VALVES

FREE FLOW™ REVERSE CURRENT CHECK VALVES

Maximum flow reversal protection for steam turbines

Applications:
- Steam turbine protection
- Extraction steam non-return
- Turbine non-return
- Bleeder trip and bled steam non-return

Design standards: ASME B16.34

Sizes: 3-48 inch (DN 77-1118)

Pressure class: 150-600+
- Higher rating available upon request

Features:
- Side mounted air cylinder to provide rapid response to flow reversal
- Inclined seat design optimises performance with low pressure drop and fast closure
- Self-aligning disc and disc arm assures repeatable tight sealing

Materials of construction:
- **Body and disc:**
  - Carbon steels
  - Alloy steels
  - Stainless steels

Seat:
- Stainless steel overlays
- Hardfacing alloys

Cover seal design:
- Bolted bonnet

End connections:
- Butt weld
- Flanged

Options:
- Standard
- Limit switches
- Disc counterweight
- Manual test
- Live loaded packing
- Solenoid valve
- Position transmitter

SWING CHECK VALVES

Reliable protection against flow reversal

Applications:
- Feedwater
- Steam Isolation
- Emergency core cooling system
- Containment isolation
- Balance of plant

Design standards:
- ASME Section III
- ASME B16.34

Sizes: 3-36 inch (DN 80-915)

Pressure class: 150-2500

Features:
- Inclined seat that provides positive closing moment
- Wide flat seats to provide reliable tight shut off
- Streamlined design to minimize pressure loss

Materials of construction:
- Carbon steels
- Alloy steels
- Stainless steels

Cover seal designs:
- Bolted bonnet
- Pressure seal

End connections:
- Butt weld
- Flanged

Options:
- Seal weld (bolted bonnet)

LIFT CHECK VALVES - Y PATTERN

Exceptional protection from flow reversal

Applications:
- Feedwater
- Steam Isolation
- Emergency core cooling system
- Containment isolation
- Balance of plant

Design standards:
- ASME Section III
- ASME B16.34

Sizes: 3-36 inch (DN 80-915)

Pressure class: 150-2500

Features:
- Y-pattern for lower pressure loss
- Bevelled seats for tight sealing
- Fast response due to shorter stroke
- Stable at low flows

Materials of construction:
- Carbon steels
- Alloy steels
- Stainless steels

Cover seal designs:
- Bolted bonnet
- Pressure seal

End connections:
- Butt weld

LIFT CHECK VALVES - T-PATTERN

Simple compact design for flow reversal protection, reliability, and ease of maintenance

A365

Applications:
- Protection from flow reversal
- High pressure system isolation
- Containment isolation

Figure Number: A365

Design standards:
- ASME Section III
- RCC-M

Sizes: 5/16 – 3 inch (DN8 – DN80)

Pressure class: 150 – 4500

Features:
- Simple design – Valve head guided on bonnet
- Damped valve head to prevent slamming

Additional features & variants depending on application:
- Bonnet seal weld provision
- Angle pattern body
- Metal or soft seated
- Cobalt free hard facing
- Materials of Construction: Carbon,

Materials of construction:
- Carbon
- Alloy
- Stainless steel

Bonnet Design: Bolted or Pressure seal

End connections:
- Socket weld
- Butt weld
- Flanged

Actuator options: Not applicable

References: AGR (UK)

Extra information

The valve head is guided by the bonnet to ensure the valve lifts and re-seats reliably. A bleed hole in the bonnet guide damps the speed at which the valve can open and shut to prevent slamming.

The size and quantity of these holes can be tailored to suit specific application requirements. Soft seating is available which improves the sealing performance on gaseous media. The soft face is contained within the valve head.

CONTROLLED CLOSURE CHECK VALVES

Reducing water hammer effects and piping loads after feedwater line break

Applications: Feedwater lines in nuclear power stations

Design standards:

- ASME III
- 10CFR50 App. B
- ANSI B31.1

Sizes: 10 - 24 inch

Pressure class: ANSI Class 600, 900 and 1500

Features:

- Internal dashpot provides self-controlled closure
- Slow closure rate reduces pressure surge to acceptable levels
- Reverse flow is checked with throttling effect

Materials of construction:

- To customer specifications
- Usual materials include carbon steel with stainless steel trim and hardfacings for seats and guides

TESTABLE CHECK VALVES

Remote or manual testing for optimal reliability and continuous operation

Applications:

- High and low pressure core cooling systems and Feedwater Check Services in nuclear power stations

Design standards:

- ASME III
- 10CFR50 App. B
- ANSI B31.1

Sizes: 2 ½ - 24 inch

Pressure class: ANSI Class 600, 900 and 1500

Features:

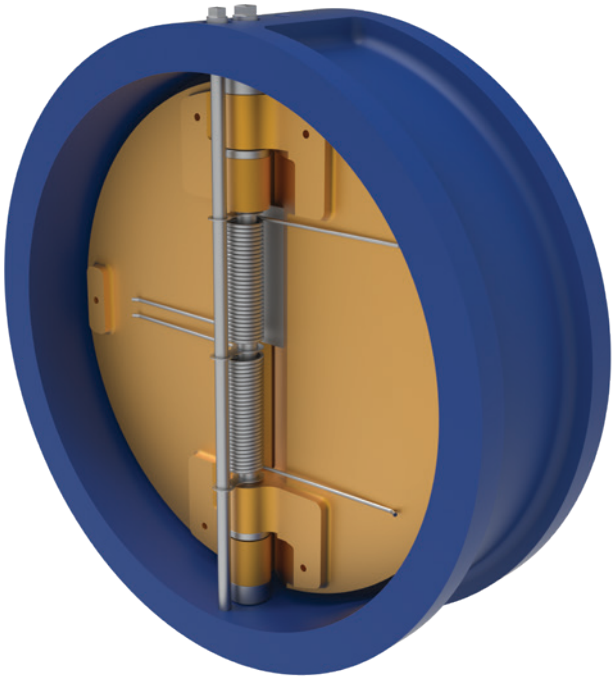
- Manual lever or air cylinder actuator permits local or remote testing
- Internal lost motion device allows free swing of disc independent of actuator and packing friction
- Magnetically tripped switches give positive (direct) indication of disc position

Materials of construction:

- Carbon steel or stainless steel as specified
- Trim materials: Stainless steel and hardfacings

DUAL PLATE CHECK VALVES

Rapid closure without reverse flow and reduced seal wear



Applications:

- Service water check

Design standards:

- ASME III
- 10CFR50 App. B
- ANSI B31.1

Sizes: 2 - 36 inch

Pressure class: ANSI Class 150 - 900

Temperature: From -450ºF through 1000ºF

Features:

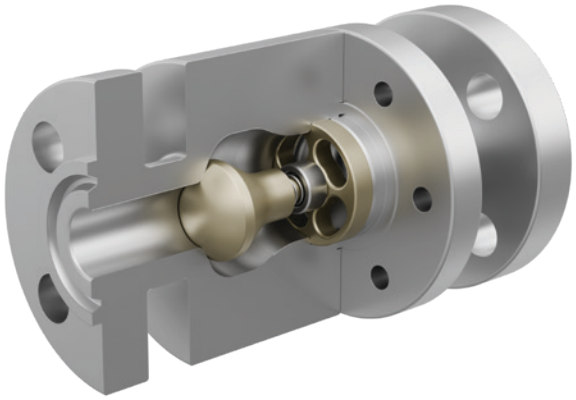
- Dual-plate design for light weight, small size, and strength
- Spring action closes each plate independently
- Stop pin
- One-piece body casting for maximum corrosion resistance
- Long-leg spring action eliminates seat scrubbing
- Hinge sleeve provides independent plate suspension
- Hinge pin
- Pin retainer

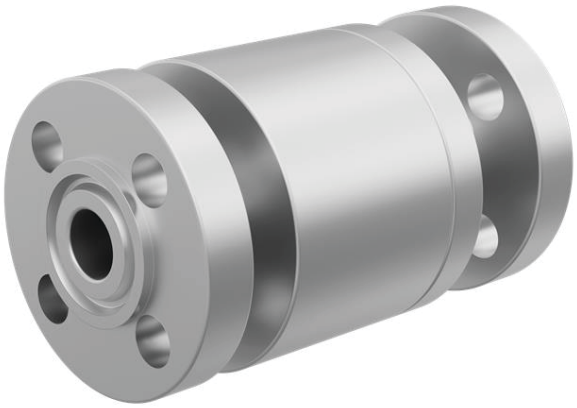
Materials of construction:

A wide variety of cast and fabricated materials for bodies, plates and trim for all types of service and temperature conditions.

NOZZLE CHECK VALVE

Engineered with low emission technology for reliability and longevity





Applications:

- Steam
- Feedwater
- Condensate
- Circulating water
- Balance of plant

Design Standards:

- ASME B16.34
- ASME Section III

Sizes : 2”- 16”

Pressure (Class): 150 - 2500

Features:

- Non-slam
- Design optimized for extended service life
- Low pressure cracking
- High flow capacity, minimizes flow velocity
- Horizontal or vertical installation

Materials of Construction:

- **Body:**
  - Carbon steels
  - Alloy steels
  - Stainless steels
- **Seat and Disc:**
  - Hardfaced seats

End connections:

- Butt weld
- Flanged

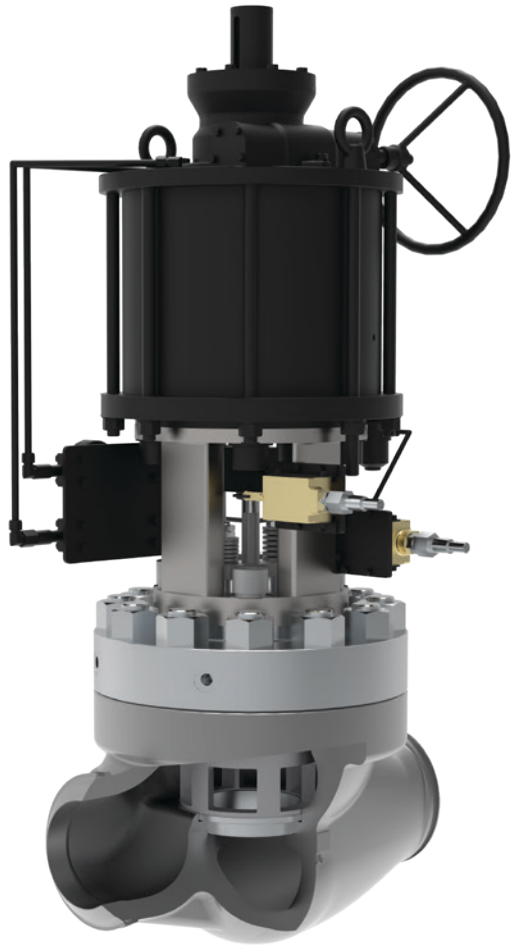
Options:

- Soft or metal seated

CONTROL VALVES

CONTROL VALVES - GLOBE & ANGLE PATTERN

High integrity coupled with high trim design flexibility



BV 500/1-BV502/3, and BV990 series

Applications:

- Process control
- Feedwater regulation & feed pump recirculation
- Main Steam Dump Valve (MSADV)
- Turbine Bypass

Design Standards: ASME Section III or RCC-M

Sizes: 3/8" – 36" (DN8 – DN900)

Pressure Class: 150 – 4500

Key Features:

- Cage guided for high stability
- Large range of tailored trim options – contour, spline, multi-flow, cascade, X-Tream™, vari-stage
- Single and multi-stage pressure drop
- Modular trim configuration
- Easy maintenance

Additional features depending on application:

- Solid or balanced plug
- Metal or soft seated
- Bellows bonnet
- Seat diffuser for body protection
- Live-loading
- Double packing & leak-off
- Bonnet seal weld provision
- Cobalt free hard facing

Materials of Construction: Carbon, alloy or stainless steel

Bonnet Design: Bolted

- End Connections: Butt weld or flanged

Actuation: Manual, Electric, Pneumatic, Gas-charged Hydraulic

References: AGR (UK), PWR (China, South Korea)

CONTROL VALVES - THREE-WAY GLOBE (MIXING / DIVERTING)

Precise control of two converging flow streams or appportioning of one flow into two flow streams

BV830

Applications:
- Temperature control
- Control of flow splitting

Design standards:
- ASME Section III
- RCC-M

Sizes: 1.5 – 16 inch (DN40 – DN400)

Pressure class: 150 – 1500

Features:
- Top and skirt guided plug to provide stability
- Modular trim configuration
- Easy maintenance from bonnet so can be serviced with body in situ (no separate bottom flange as with some designs)
- Balanced plug
- Clamped seats

Additional features depending on application:
- Metal or soft seated
- Bellows bonnet
- Live loading
- Double packing & leak-off
- Bonnet seal weld provision
- Cobalt free hard facing

Materials of construction:
- Carbon
- Alloy
- Stainless steel

Bonnet Design: Bolted

End connections:
- Butt weld
- Flanged

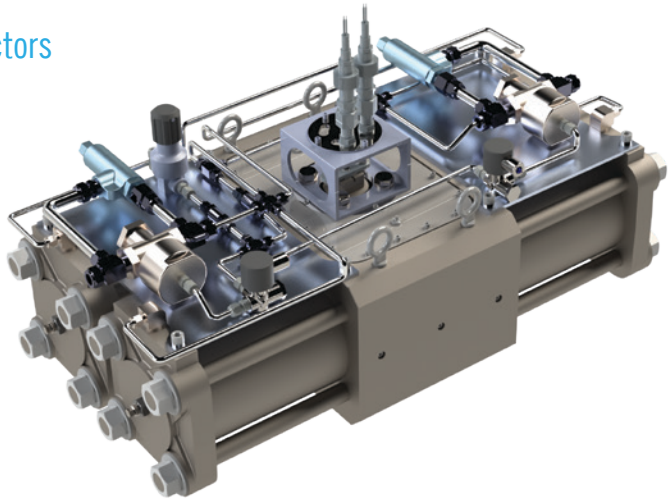
Actuator options:
- Manual
- Electric
- Pneumatic
- Gas-charged Hydraulic

References: PWR (South Korea)

VALVE ACTUATORS

QUARTER TURN RACK AND PINION VALVE ACTUATOR

Custom Designed for Large and Small Modular Reactors



Applications for quarter turn ball and butterfly valves:

- Safety and Non-Safety Service
- Primary Circuit
- Main Steam System
- Feedwater System
- Core Cooling Systems
- Auxiliary Systems
- Turbine Island

Torque output:

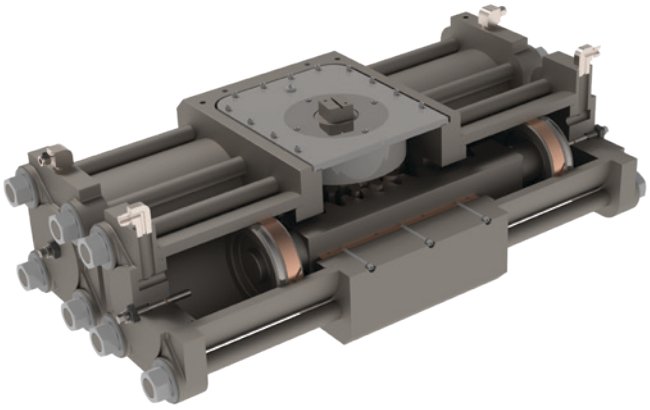
- Up to 150,000 ft-lbf [~108,000 N-m]
- Increased torque available upon request

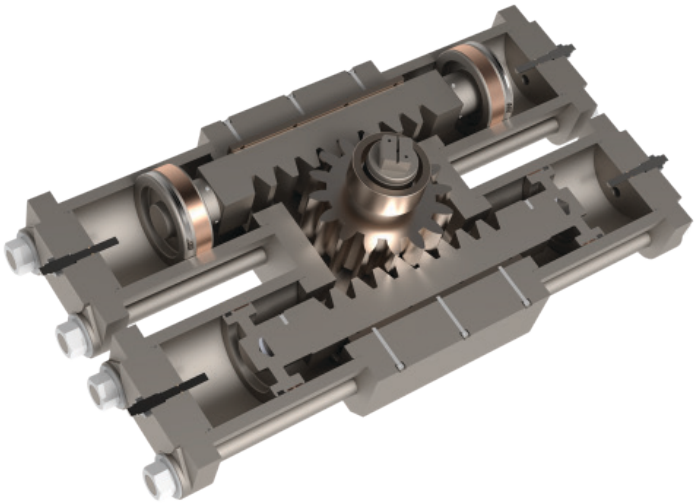
Control options:

- Spring Return – Fail mode powered by spring/non-safety related control powered by hydraulics
- Double Acting – Opening and Closing powered by hydraulics

Fail models:

- Spring Return – force valve into open or closed position upon loss of electrical power with gas or mechanical spring
- Double Acting – fail in-position upon loss of electrical power





Features:

- Custom design to meet specific needs
  - Controls
  - Torque output
  - Size and weight
- Valve Position Indication options
- No unintentional valve movement
- 60-year Life w/10+ year Service Schedule
- Compact design with symmetric Center of Gravity
- Lightweight compared to Actuators of equal torque
- Easily serviceable with online maintenance
- Qualified to IEEE 323 / IEEE 344 / IEEE 382

Quality Assurance Program:

Hiller products are certified to the following quality standards:

- ISO 9001
- ANSI N45.2
- 10 CFR50 Appendix B
- ASME NQA-1
- Accept 10CFR21
- Auditing services
- Inspection services
- Regularly audited by Nuclear

Procurement Issues Committee (NUPIC) and Nuclear Industry Assessment Committee (NIAC)

GAS CHARGED LINEAR HYDRAULIC ACTUATORS

Self-contained hydraulic actuators with integral nitrogen storage

Applications:

- Main steam isolation valves (MSIVs)
- Main feedwater isolation valves (MFIVs)
- Containment Isolation valves
- Any other isolation valve application requiring a fast closure time with a high output thrust

Design standards:

- Designed for 60 years service
- IEEE 323/344/382
- RCC-E applications (European standard)

Sizes:

- Actuator piston sizes available from 2" to 24" to meet all customer needs
- Additional sizes and configurations available upon request

Output Thrust:

- Final output thrust will vary depending on configuration but our qualified range envelopes up to 1,200,000 lbf (5,337 KN) end of stroke force

Closure Time:

- Specification dependent, but typically 1.5-4 seconds

Features:

- Plug and Play design - only requires power and signal to operate
- One time nitrogen gas precharge, lasts up to 60 years
- Minimal impact on plant systems and operators
- Ease of maintenance - no special tools required
- Variable speed controls

Materials of construction:

Customer specified or standard materials below:

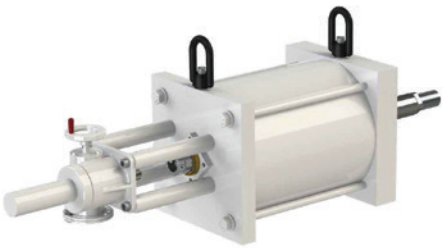
- Major Components: Carbon Steel
- Seals: Viton
- Bushings: Bronze

Options:

- Fully customizable design
- Dual motor design for reduced retract times and operability
- Position indication

Quality Assurance: Hiller products are certified to the following quality standards: 0CFR50 Appendix B, ASME NQA-1, CSA Z299.1, ISO 9001:2015, RCC-E A5000, QA 42.1, and ANSI N45.2

LINEAR PNEUMATIC ACTUATORS & LINEAR HYDRAULIC ACTUATORS



Linear Pneumatic or hydraulic powered actuators

Applications:
- Safety & Non-Safety
- Gate valves
- Globe valves
- Check valves
- Dampers

Design standards:
- Designed for 60 years service
- IEEE 323/344/382
- RCC-E applications (European standard)

Sizes:
- Custom design per client requirements.
- Typical ranges: 2" - 26" cylinder

Supply Pressures:
- Pneumatic – up to 652 psig (45 barg)
- Hydraulic – up to 5,000 psig (345 barg)

Output Thrust:
- Final output thrust will vary depending on configuration but our qualified range envelopes up to 600,000 lbf (2,669 KN)

Features:
- Repeatable speed control
- Simple mounting of controls via external tie rods
- Available dual piston design for smaller cylinder bore and increased thrust
- Variable fail-safe options

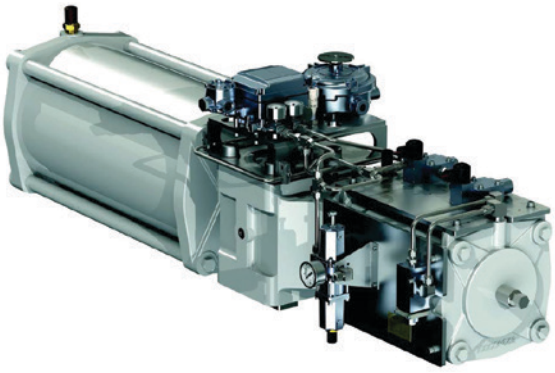
Materials of construction:
- Carbon Steel
- Steel
- Ductile Iron
- Bronze
- Viton

Manual Override Options:
- Jackscrew, Handwheel, and Hydraulic Override

Quality Assurance:

Hiller products are certified to the following quality standards:
- 10CFR50 Appendix B
- ASME NQA-1
- CSA Z299.1
- ISO 9001:2015
- RCC-E A5000
- QA 42.1
- ANSI N45.2

ROTARY PNEUMATIC OR HYDRAULIC ACTUATORS



Quarter Turn Actuator

Applications:
- Safety and Non-Safety
- Butterfly valves
- Ball Valves
- Plug valves
- Dampers

Design standards:
- Designed for 60 years service
- IEEE 323/344/382
- RCC-E applications (European standard)

Supply Pressures:
- Pneumatic – up to 250 psig (17 barg)
- Hydraulic – up to 5,000 psig (345 barg)

Output Torque:
- Final output torque will vary depending on configuration but our qualified range envelopes up to 27,000 lbf.ft (36,607 Nm)

Features:
- Single or dual acting design
- Simple mounting of controls via external tie rods
- Accurate bi-directional rotation adjustment via travel stops

Materials of construction:
- Carbon steel
- Stainless steel
- Ductile Iron
- Bronze
- Viton

Manual Override Options:
- Jackscrew, Handwheel, and Hydraulic Override

Quality Assurance:

Hiller products are certified to the following quality standards:
- 10CFR50 Appendix B
- ASME NQA-1
- CSA Z299.1
- ISO 9001:2015
- RCC-E A5000
- QA 42.1
- ANSI N45.2

TRILLIUM
FLOW TECHNOLOGIES™

TRILLIUM FLOW TECHNOLOGIES UK LTD

Britannia House, Huddersfield Rd,
Elland, HX5 9JR, United Kingdom
Tel. +44 1422 282000
Email: nuclear@trilliumflow.com

TRILLIUMFLOW.COM