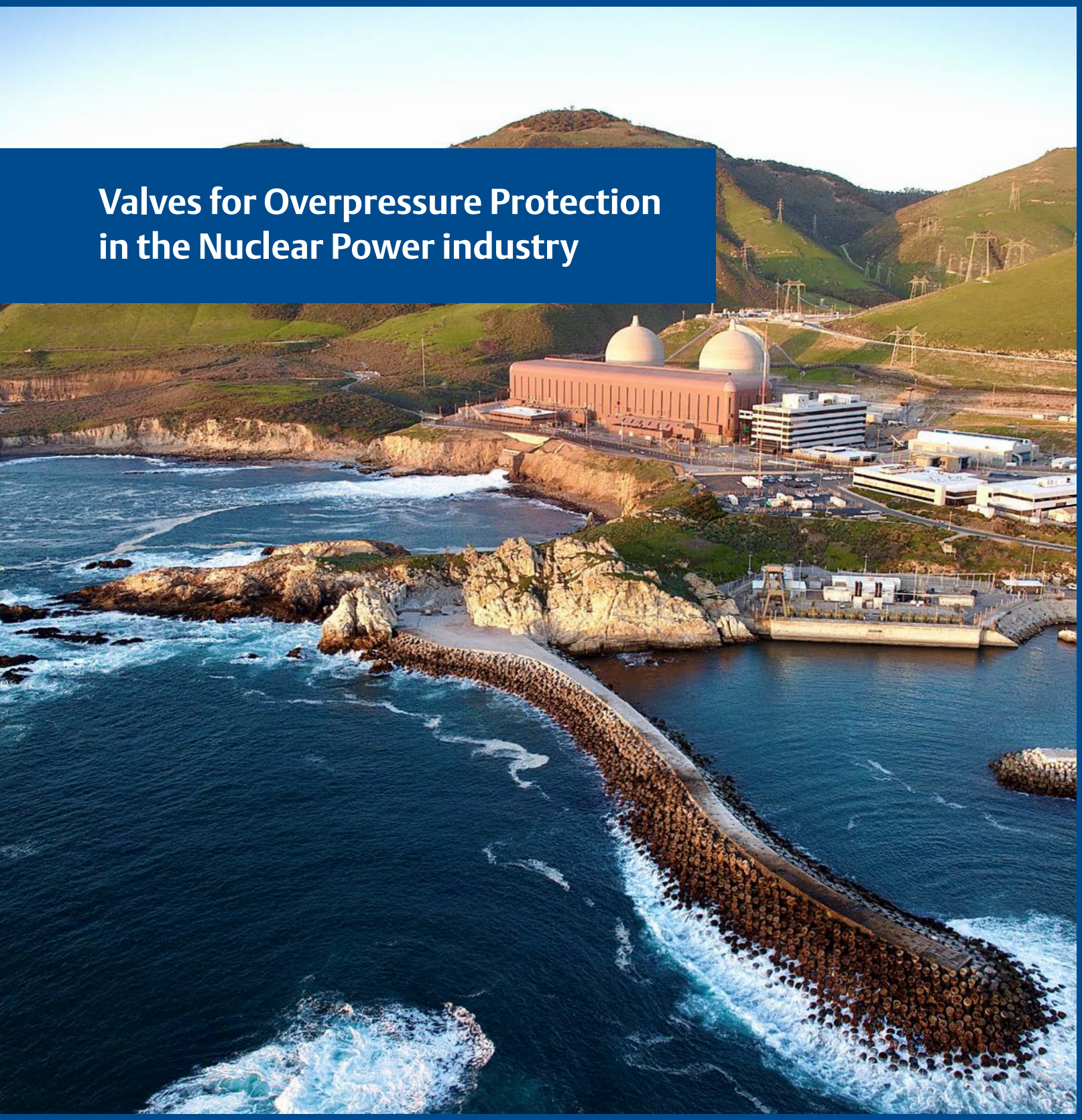
Valves for Overpressure Protection in the Nuclear Power industry



Crosby Valves for Nuclear Power

Pressure Relief Valves, Instrument Valves,
Check & Globe Valves, Auxiliary Equipment and Services

EMERSON™

Operate with confidence that your assets are safeguarded by an industry leader in overpressure protection

Emerson has been a mainstay of the nuclear industry since the first commercial nuclear power stations became operational more than 60 years ago. As such we have a unique understanding of the nuclear market's dynamics, technical complexities and on-going pressures to do more with less. We recognize how critical it is to keep a plant operating safely, effectively and economically. Which is why you can count on our long term support.

Our Crosby products have been manufactured since the 1870's and with a heritage in both pressure relief valves (PRVs) and the Nuclear industry our dedicated Nuclear team are devoted to providing support for new or modified products as operating plants are upgraded. New products continue to be developed to meet the enhanced performance requirements of advanced reactors now under construction.

Our track record and expertise in manufacturing pressure relief valves means our engineers can adapt and update products as required, helping you to improve the flexibility of your operation control and safety valves.

Extending your product life cycle and improving plant performance

- Emerson delivers expert product support for the full lifecycle of your plant
- This expertise can help to extend the operational life of your plant, from its original 40 year life cycle to 80 years
- Our obsolescence management solutions enable us to propose alternative solutions where existing products are no longer available

"Crosby Valves offer the most complete line of safety related valve products for critical pressure relief applications and serve a global customer base with diverse requirements and differing plan designs."

"The Nuclear Regulatory Commission (NRC) has granted 20-year license extensions to much of the existing US nuclear fleet, allowing them to operate for 60 years. A handful of reactors have already been approved to operate for a total of 80 years".
MIT Technology Review

Products which deliver reliability and performance

Emerson has continued to pioneer, produce and deliver specialized valve solutions for all types of reactors, ensuring compliance with all international certification requirements and nuclear standards, with a high focus on reliability and performance.

Where quality comes as standard

Nuclear Safety is embedded in every aspect of our business as a supplier of nuclear qualified material. Our manuals, procedures and processes must align with a range of nuclear codes and are monitored/ assessed through both internal and external audits and surveys by various nuclear regulatory organizations, customers and others.

Video inspection process

Inspections are an important part of our process, ensuring all quality standards are met. This process is now easier due to the option of video inspection. Inspectors can view a variety of tests remotely with live or recorded videos, photographs of some valve tests eliminating travel time and expense.

Qualification of nuclear safety related equipment

- No equipment leaves our factories unless we can demonstrate it has the capacity to fulfil its required function
- Emerson methods comply with qualification project requirements, codes and standards
- Test results and services engineers provide constant feedback enabling us to propose design improvements where required

World Class Manufacturing Capabilities

Our state-of-the-art technologies and facilities for machining, welding, assembly and testing ensure that the highest quality nuclear grade products are provided to meet your requirements and expectations.

Unique test capabilities confirm reliability and performance

The state-of-the-art testing capabilities at the Mansfield facility are unsurpassed by any other supplier of our kind. Mechanical and instrumentation expertise acquired through decades of experience in the nuclear power industry makes the Mansfield team uniquely qualified to assist customers with specialty testing and engineering analysis requirements.

Mansfield Engineering and Testing Capabilities include:

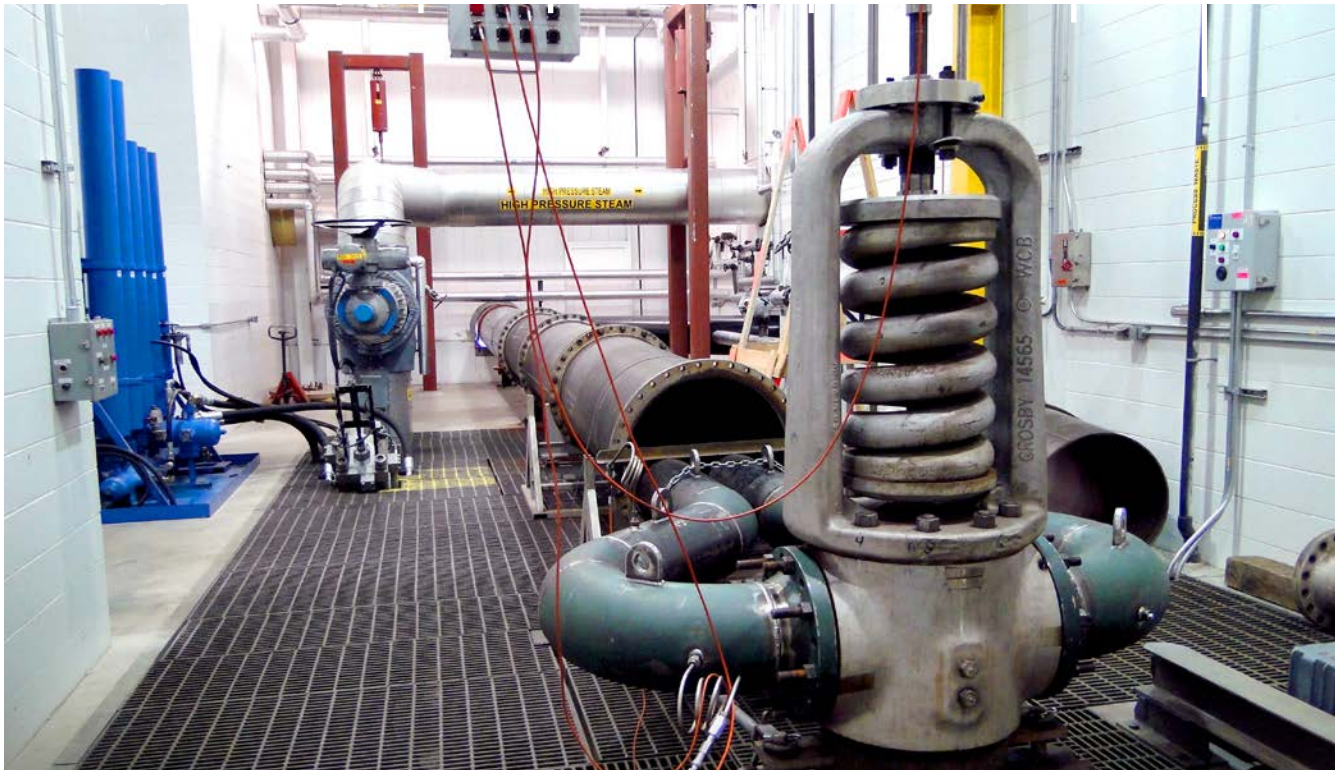
- Measured flow testing on air, steam and water
- Reaction force calculations
- Seismic calculations and testing
- Stress analysis
- Finite element analysis (FEA)
- Temperature correlation Testing
- Pressure testing in excess of 3,000 psig
- QME-1 qualification testing
- Full flow testing in excess of 2 million pounds per hour saturated steam at pressures exceeding 2,000 psig
- Operational testing with measurements of pressure, temperature, time and stroke among other parameters

High-Flow Steam Test Laboratory

The largest indoor and most sophisticated line in the world, the Emerson facility is designed to perform the stringent ASME Section III full-flow operational test requirements specific to ASME Class 2 Main Steam Safety Valve applications. This test facility is the only valve manufacturer-owned facility in the world.

Application Selection Matrix

Valve	Application			ASME section	Blowdown		Balanced	Orifice Size		Page
	Steam	Air/Gas	Liquid		Adjustable	Fixed	Y/N	<D	≥D	
HA	X			III	X		N		X	5
HB-BP-DF	X			III	X		Y		X	5
HB-BP	X			III	X		Y		X	6
JO/JB Over T	X	X		VIII	X		N/Y		X	6
81P			X	III & VIII		X	Y	X	X	7
83		X		III & VIII	X		N	X	X	7
JMB-WR			X	III & VIII	X		N	X		8
JMAK			X	III & VIII	X		N	X		8
JRAK			X	III & VIII	X		Y	X		8
JO/JB	X	X		III & VIII	X		N/Y		X	9
JLT/JOS/JBS	X	X	X	III & VIII	X		N/Y		X	9
900 Omni	X	X	X	III & VIII		X	N	X	X	11
800 Omni	X	X		III & VIII	X		N		X	11
VR		X		III		X	N	N/A	N/A	12



PRV for Critical Steam

Style HA
Class 2 - Main Steam Safety Valve for Pressurized Water Reactors

Designed for the challenging service and operating requirements of nuclear power plants. Style HA assures precise operation and continuing tightness plus ease of maintenance which characterizes Crosby safety valves. It is intended for service on pressurized water reactors as the main steam safety valve.

Inlet Sizes:	6” and 8” (DN 150 and 200)
Outlet Sizes:	6” to 12” (DN 150 to 300)
Connection:	Flanged, studded or welded
Orifice Sizes:	Q thru T
Set Pressure Range:	Up to 3000 psig (206.8 barg)
Materials:	Forged carbon steel body/stainless steel nozzle/ Inconel™ disc insert
Blowdown:	Two ring adjustable blowdown control
Service Media:	Saturated steam
ASME Code Capacity Cert:	Section III
Optional Features:	FLEXI-DISC® seat design, dual outlet design

Series HB-BP-DF
Class 1 -Main Steam Safety Valve for Boiling Water Reactors

Dual function safety valve fulfils the special overpressure safety requirements of boiling water reactor primary loops (where remotely controlled automatic steam blowdown valves are not used). The valve opens automatically or by means of an electrical solenoid valve, to actuate the valve by air cylinder. Bellows balances out the effects of high backpressure in the discharge system.

Inlet Sizes:	6” and 8” (DN 150 and 200)
Outlet Sizes:	6” to 10” (DN 150 to 250)
Connection:	Flanged or studded
Orifice Sizes:	R
Set Pressure Range:	Up to 3000 psig (206.8 barg)
Materials:	Forged carbon steel body/stainless steel nozzle/ Inconel™ disc insert
Blowdown:	Two ring adjustable blowdown controw
Service Media:	Saturated steam
ASME Code Capacity Cert:	Section III
Optional Features:	FLEXI-DISC® seat design

PRV for Critical Steam

Style HB-BP
Class 1 -Pressurizer Safety Valve for Pressurized Water Reactors BlockBody™ Design

Designed specifically to meet the exacting requirements of the Pressurizer Safety Valve application in PWRs worldwide. The bellows 'balances out' the effects of high backpressure in the discharge system, assuring constant popping pressure despite variable backpressure. Crosby's patented eductor design allows the valve to attain full lift at a pressure 3% above popping pressure. The valve provides full capacity, stable operation at backpressure up to 50% of the set pressure.

Inlet Sizes:	3" to 6" (DN 80 to 150)
Outlet Sizes:	3" to 8" (DN 80 to 200)
Connection:	Flanged or studded
Orifice Sizes:	K thru R
Set Pressure Range:	Up to 3000 psig (206.8 barg)
Materials:	Stainless steel body and nozzle / Inconel disc insert
Blowdown:	Two ring adjustable blowdown control
Service Media:	Saturated steam
ASME Code Capacity Cert:	Section III
Optional Features:	FLEXI-DISC® seat design; BlockBody design for applications with high discharge piping loads

JO and JB Over-T
High flow pressure relief valve for moisture separator and reheater applications

The JO and JB valve designs are also offered with orifice sizes greater than 'T' for applications with high flow rate requirements. The largest, with a capacity nearly seven times that of a 'T' orifice valve, can relieve over 3,000,000 lb/hr (1,360,800 kg/hr) steam at 300 psi (20.7 bar) pressure. Their dependability and performance has been proven by successful operation in nuclear power stations worldwide. A typical application in a nuclear power station is the moisture separator / reheater.

Inlet Sizes:	10" to 20" (DN 250 to 500)
Outlet Sizes:	14" to 24" (DN 350 to 600)
Orifice Sizes:	V thru BB2
Temperature Range:	-20°F to +450°F (-29 °C to +232°C)
Set Pressure:	25 psig to 300 psig (1.7 bar to 20.7 bar)
Media:	Air and Steam

Auxiliary Circuit & Turbine Island

Series 81P
Liquid applications

Soft seated, balanced, direct spring operated pressure relief valve designed for liquid applications. The spring chamber is isolated by the guide seal and the backpressure seal on the stem of the spindle and vented to atmosphere. Thus, the valve remains fully balanced and operational.

Inlet Sizes:	½" to 2" (DN 15 to 50)
Outlet Sizes:	½" to 2½" (DN 15 to 65)
Connection:	Flanged, threaded and welded
Orifice Sizes:	0.049 sq. in. and 0.196 sq. in. (31.6 sq. mm and 126.5 sq. mm)
Set Pressure Range:	50 psig to 2160 psig (3.5 barg to 149 barg)
Temp. Range:	-20°F to +500°F (-28.9°C to +260°C)
Materials:	Stainless steel with non-metallic seat; material options available
Blowdown:	Fixed blowdown: < 20%
Service Media:	Liquid
ASME Code Capacity Cert:	Section III & VIII

Series 83
Gas applications

Direct operated pressure relief valve, with an elastomer seat, is ideal for gas processes that operate close to the set pressure. It maintains tightness close to set pressure, opens fully at set pressure, and provides adjustment for short blowdown.

Inlet Sizes:	½" to 2" (DN 15 to 50)
Outlet Sizes:	½" to 2½" (DN 15 to 65)
Connection:	Flanged, threaded and welded
Orifice Sizes:	0.049 sq. in. and 0.196 sq. in. (31.6 sq. mm and 126.5 sq. mm)
Set Pressure Range:	20 psig to 3000 psig (1.4 bar to 206.8 bar)
Temp. Range:	-20°F to +500°F (-28.9°C to +260°C)
Materials:	Stainless steel with non-metalic seat; materials options available
Blowdown:	Adjustable blowdown control
Service Media:	Air and gas
ASME Code Capacity Cert:	Section III & VIII

Auxiliary Circuit & Turbine Island - J Series

JMB-WR
Liquid applications low flow

Conventional pressure relief valve designed for liquid service with small orifice for low flow. Its water ring design provides stable non-chattering valve performance on incompressible fluid applications with adjustable blowdown.

Inlet Sizes:	¾" and 1" (DN 20 and 25)
Outlet Sizes:	1" (DN 25)
Connection:	Flanged, threaded and welded
Orifice Sizes:	0.0120 sq. in. to 0.1098 sq. in (7.7 sq. mm to 70.8 sq. mm)
Set Pressure Range:	15 psig to 2750 psig(1.03 barg to 189.7 barg)
Temp. Range:	-75°F to +750°F (-59.4°C to +398.9°C)
Materials:	Stainless steel; material options available
Blowdown:	Adjustable blowdown control
Service Media:	Liquid
ASME Code Capacity Cert:	Section III & VIII

JMAK
Liquid applications low flow

Conventional pressure relief valve designed for use on liquid service. Its small orifice design makes it ideal for low flow applications at high or low pressures. The water ring allows for adjustable blowdown control.

Inlet Sizes:	½", ¾", 1" (DN 15, DN 20, DN 25)
Outlet Sizes:	1" (DN 25) and larger
Connection:	Flanged or studded
Orifice Sizes:	0.012 sq. in. to 0.1098 sq. in. (7.7 sq. mm to 70.8 sq. mm)
Set Pressure Range:	25 psig to 3600 psig (1.7 bar to 248.2 bar)
Temp. Range:	-75°F to +750°F (-59.4°C to +398.9°C)
Materials:	Stainless steel: material options available
Blowdown:	Adjustable blowdown control
Service Media:	Liquid
ASME Code Capacity Cert:	Section III & VIII

JRAK-BS
Liquid applications low flow

Balanced pressure relief valve designed for use on liquid service. The balancing bellows minimizes the effects of backpressure and prevents the process fluid from entering the spring chamber. Its small orifice design makes it ideal for low flow applications at high or low pressures. The water ring allows for adjustable blowdown control.

Inlet Sizes:	½", ¾", 1" (DN 15, DN 20, DN 25)
Outlet Sizes:	1" (DN 25) and larger
Connection:	Flanged or studded
Orifice Sizes:	0.012 sq. in. to 0.1098 sq. in. (7.7 sq. mm to 70.8 sq. mm)
Set Pressure Range:	25 psig to 3600 psig (1.7 bar to 248.2 bar)
Temp. Range:	-75°F to +750°F (-59.4°C to +398.9°C)
Materials:	Stainless steel: material options available
Blowdown:	Adjustable blowdown control
Service Media:	Liquid
ASME Code Capacity Cert:	Section III & VIII

JO / JB
Conventional / Balanced PRV for steam, air or gas

The JO/JB Pressure Relief Valve is designed for use on steam, air and gas service. Model JO conventional pressure relief valve provides two ring control for positive adjustment of both blowdown and pop action. Model JB balanced pressure relief valve provides single ring control for positive adjustment of blowdown. The balancing bellows minimizes the effects of backpressure and prevents the process fluid from entering the spring chamber.

Inlet Sizes:	1" to 8" (DN 25 to 200)
Outlet Sizes:	2" to 10" (DN 50 to 250)
Connection:	Flanged
Orifice Sizes:	D thru T
Set Pressure Range:	15 psig to 7500 psig (1.03 barg to 517.2 barg)
Temp. Range:	400°F to +1000°F (-240°C to +537.8°C)
Materials:	Cast carbon steel or stainless steel with stainless steel trim is standard; material options available
Blowdown:	Adjustable ring blowdown control
Service Media:	Steam, Air and Gas
ASME Code Capacity Cert:	Section III & VIII
Options:	Soft Seat Design

JLT / JOS / JBS
Conventional / Balanced PRV for steam, air, gas and liquid

Model JLT/JOS/JBS valves are designed with a single nozzle ring control to assure optimum performance. The JOS is a conventional safety relief valve designed for use on steam, air and gas service. The JBS balanced safety relief valve is designed for steam, air and gas service. The balancing bellows minimizes the effects of backpressure and prevents the process fluid from entering the spring chamber. The JLT has a liquid trim for incompressible fluid and can be supplied as conventional or balanced design.

Inlet Sizes:	1" to 8" (DN 25 to 200)
Outlet Sizes:	2" to 10" (DN 50 to 250)
Connection:	Flanged
Orifice Sizes:	D thru T2
Set Pressure Range:	15 psig thru 6000 psig (1 bar to 413.7 bar)
Temp. Range:	-450°F to +1000°F (-267.8°C to +537.8°C)
Materials:	Cast carbon steel or stainless steel with stainless steel trim is standard; material options available
Blowdown:	Adjustable ring blowdown control
Service Media:	Steam, Air and Gas, Liquid
ASME Code Capacity Cert:	Section III & VIII
Options:	Soft Seat Design

Auxiliary Circuit

900 OMNI-TRIM™
All services, small applications

Conventional safety relief valve designed for use on steam, air, gas and liquid service. Its single trim design provides stable operation on all service media. Precision flat metal to metal seats or elastomer O-ring soft seats provide exceptional seat tightness.

Inlet Sizes:	½" to 2" (DN 15 to 50)
Outlet Sizes:	1" to 2½" (DN 25 to 65)
Connection:	Flanged, threaded and welded
Orifice Sizes:	0.0551 sq. in. to 0.5674 sq. in (35.6 sq. mm to 366.1sq. mm)
Set Pressure Range:	15 psig to 5000 psig (1 bar to 344.7 bar)
Temp. Range:	-450°F to +750°F (-267.8°C to +398.9°C)
Materials:	Stainless steel; material options available
Blowdown:	Fixed blowdown: < 20%
Service Media:	Steam, air, gas and liquid
ASME Code Capacity Cert:	Section III & VIII
Options:	Soft Seat Design

800 OMNI-TRIM™
Steam, air, and gas applications

Conventional safety relief valve designed for use on steam, air and gas service. Its single trim design provides stable operation on compressible service media. Precise external blowdown control provides shorter blowdown than the Series 900

Inlet Sizes:	¾" to 2" (DN 20 to 50)
Outlet Sizes:	1" to 2½" (DN 25 to 65)
Connection:	Flanged, threaded and welded
Orifice Sizes:	0.1244 sq. in. to 0.5674 sq. in (80.3 sq. mm to 366.1 sq. mm)
Set Pressure Range:	15 psig to 5000 psig (1 bar to 344.7 bar)
Temp. Range:	-450°F to +750°F (-267.8°C to +398.9°C)
Materials:	Stainless steel; material options available
Blowdown:	Adjustable blowdown control
Service Media:	Steam, air, and gas
ASME Code Capacity Cert:	Section III & VIII
Options:	Soft seat design

Auxiliary Circuit

VR
Vacuum relief applications on vessels and tanks

Vacuum relief valve with metal or soft seats designed specifically to prevent systems from imploding and to protect piping and vessels when operating pressure is suddenly reduced because of system malfunction.

Inlet/Outlet Sizes:	1” to 10” (DN 25 -to 250)
Connection:	Flanged
Set Pressure Range:	-0.1 psig to -7 psig (0.007 barg to -0.48 barg)
Materials:	Stainless steel
Service Media:	Air and gas
ASME Code Capacity Cert:	Section III (for sizes 1”, 2”, and 3”)

Auxiliary Circuit & General Services

CV1B
Swing check valve to prevent flow in one direction

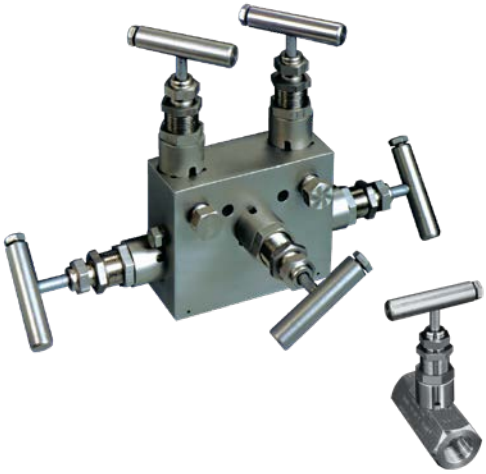
Wafer style body, swing check valve designed to prevent flow in one direction. When equipped with an extra lightweight disc and low force spring, the CV1B can be used for vacuum breaker applications. For applications where exceptional tightness is required, a replaceable elastomer seat is used. The CV1B meets the strict requirements of ASME Section III, Class 1, 2 or 3 to the year and applicable addenda determined by the customer. The CV1B can be supplied with or without the 'N' stamp.

Sizes:	2" to 36" (DN 50 to 900)
Connections:	Optional ANSI Class 150 to 1500
Certification:	Available with N stamp if required

Instrument Valves
Hand valves and manifolds for pressure, flow or level monitoring instruments

A full line of hand valves and instrument manifolds for isolation, equalization and drain functions used with instruments to measure process pressure, flow or level monitoring.

H7HS Hand Valve
PT7MHS Two-valve manifold
M1HS Three-valve manifold
DPMHS Five-valve manifold



Sizes:	¼" to ¾" (DN 8 to 20)
Connections:	Threaded, tube stud, pipe socket weld
Temperature:	800°F (430°C) maximum
Materials:	Stainless steel with graphite packing

Welbond
High pressure globe stop valve

The Welbond high pressure Y pattern globe valve is an established stop valve for general line service in nuclear applications. It offers the industry a value engineered product with minimum maintenance and maximum service life resulting from its unique in-line repairability feature.

Size Range:	½" to 2" (DN 15 to 50)
Connection:	Socket weld (standard)
Pressure/Temp Rating:	Class 1700
Material:	Carbon steel or stainless steel
Trim:	Stellite
ASME Code:	Section III

Diagnostic Tools

SPVD. Set Pressure Verification Device

A system for in situ testing, classified as a 'calibrated assist device' per ASME Section XIII Performance Test Code. Totally automatic - computer driven system for testing safety valves. Available in portable or permanently mounted models.

Stay informed with our diagnostic tools

- Emerson uses specialist diagnostic tools to check and analyze equipment quickly, safely and to determine when a valve needs reworking
- Ensure maintenance operations and relevant tests are undertaken quickly to limit exposure to radiation (ALARA compliance)
- Gain easy access to all your valve data with End Of Manufacturing Report (EOMR) software
- Data can be compiled from multiple sources and centralized in 3 to 5 days

A partner for the full lifecycle of your plant

With increased pressure for greater flexibility and the requirement to extend the operational life of plants our engineers will work with you to manage your assets getting more value and cost savings from your portfolio of products.

Obsolescence management

- Emerson will manage and maintain products for the full life cycle of your plant
- In addition, we can also provide alternative solutions for any products that are now obsolete
- Our obsolescence management enables continuous product updates/upgrades
- You will have ready access to commercial and classified parts

A highly skilled service organization

- Emerson understands that the nuclear industry is experiencing a serious skills shortage
- We can provide the dedicated and highly skilled service engineers the nuclear industry requires
- You can tap into our extensive experience and knowledge of global best practices
- Our service engineers are experts in the components being installed or commissioned, and can ensure correct, safe installation and on-time start-up

Valve solutions for your most demanding nuclear appplications

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Go Boldly™