BAKER HUGHES
a GE company

Masoneilan* Nuclear Service Control Valves

bhge.com

Our references

- European Pressurized Reactors: Globally the largest reference list covering 80 % of all applications for the EPR
  - Flamanville 3 (France) and Hinkley Point C (UK): roughly 80 valves each, including Turbine bypass to condenser, Turbine by pass to atm, Minflow FW valves, Moisture separators drains valves, feed tank supply and all BOP valves
  - Taishan 1 & 2 (China) : roughly 200 valves, including Turbine bypass to condenser, Minflow FW valves, sampling valves, Emergency feed water valves, reactor coolant system with chemical and volumetric control valves, safety injection valves, liquid and gaseous effluent treatment, Generator drain valves - 70% of the control valves reactor scope
- France: 900, 1300, 1500 MW plants : 15,000 valves working inside the 58 Edf units, including inside and outside containment applications
- Belgium: Doel 3 & 4, Tihange 2 & 3
- Spain: Asco Vandellos, Almaraz 1 & 2, Cofrentes
- UK: Sizewell B
- Sweden: Ringhals 1/2/3/4, Forsmark 1/2/3, Oskarshamn 3
- Romania: Cernavoda with Candu reactors
- China CPR 1000, AP 1000 and Candu reactors: roughly 2,000 valves installed in 38 units of nuclear power plants. Ling Ao phase 1 & 2, Daya Bay 1 & 2, Liaoning Hongyanhe 3 to 6, Fujian Ningde 1 to 4, Yangjiang 1 to 6, Hainan Changjiang 1 & 2, Fujian Fuqing 1 to 4, Guangxi Fangchenggang 1 & 2, Lufeng 1 & 2, Tianwan 5 & 6, Qinshan phase I, II, III (including Fangjiashan) : Turbine bypass to condenser, FW control valves, Effluent treatment, Moisture separator drains valves, Atmosphere Steam Dump control valve
- China Hualong N° 1 reactors: Fangchenggang 3 & 4, Fuqing 5 & 6 : FW and effluent treatment, bypass to condenser
- Korea: Ulchin 1 & 2, Shin Kori
- Japan: 9,000 control valves in most of the PWR and BWR reactors, including outside containment applications, heater drains, and other turbine island valves
- South Africa: Koeberg 1 & 2
- USA: 9,000 control valves and safety valves in most of the 99 PWR and BWR reactors in the USA, including inside and outside containment applications, FW control, heater drains, atmospheric dump and other turbine Island valves
- USA: 1,100 main steam safety valves and pressurizer safety valves
- Canada (Candu reactors): inside containment valves roughly 50 each in Bruce, Darlington, Pickering stations.

Masoneilan control valves, rotary and reciprocating valves, severe service control valves, pneumatic regulators and field instrumentation are high technology products recognized worldwide in the nuclear industry since the 60's. From the first French nuclear power plant up to most recent EPR reactors, thousands of Masoneilan control valves and instruments have been installed and maintained on primary and secondary circuits (manufacturing according to DESP, RCCM or ASME codes).

In January 2015, a **Nuclear Centre Of Excellence** (COE) has been inaugurated in Condé. More than 35 engineers are working to serve Best-In-Class our Customers and are fully dedicated to Nuclear segment.

- **Efficiency:** in one single place, experts are directly connected to nuclear processes. Nuclear activities are managed as a product line and Centre Of Excellence bears full responsibilities to give instructions and take decisions
- **Expertise:** Condé French plant has more than 50 years of experience in nuclear codes and technology and is tailored to customer's most demanding requirements.

Nuclear Certified Quality

BHGE maintains strict standards for Masoneilan nuclear control valves manufacturing and testing through **ESPN-Module H** and **ASME Stamp N&NPT** approved Quality Assurance programs. In addition, Condé facility in France holds ISO-9001 Quality System Certification, and is working to achieve further quality by setting internal standards that exceed those set by regulatory organizations. The Quality Management System and Design Control procedures outline design criteria and testing parameters.

Experts are providing Technical Support throughout the Product Life Cycle

Service organization stands behind each Masoneilan nuclear service control valve, with the expertise, technical skills and application knowledge that Customers expect from BHGE. We continually build upon a history of best practices, and our sales team is well qualified to help you select the right valve for your facility, application and specifications. Nuclear COE also provides guidance and technical solutions in solving difficult challenges and issues.

Our aftermarket support services team has the in-depth industry knowledge, product familiarity and implementation skills to help maintain continuous operations and cost-effective performance.

Culture of Nuclear Safety

Because Safety is the deed of every woman and man at her or his scale, BHGE Condé France invites all employees to share concerns about Nuclear Safety.

BHGE develops a genuine Culture of Nuclear Safety among them, encouraging communication, dialogue and interrogative attitude.

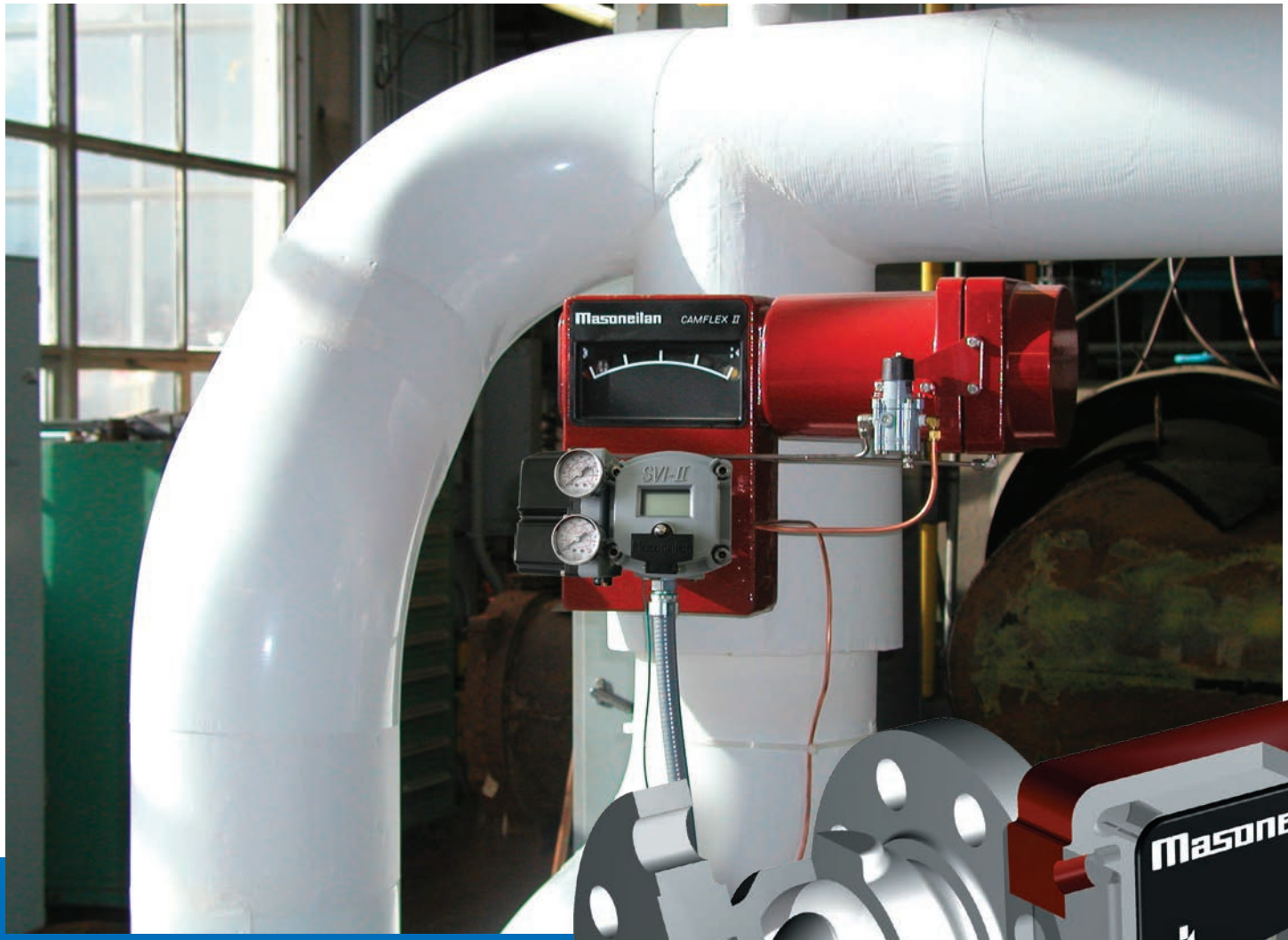
Condé Nuclear COE : Valve Solutions and Services Dedicated to the Nuclear Industry

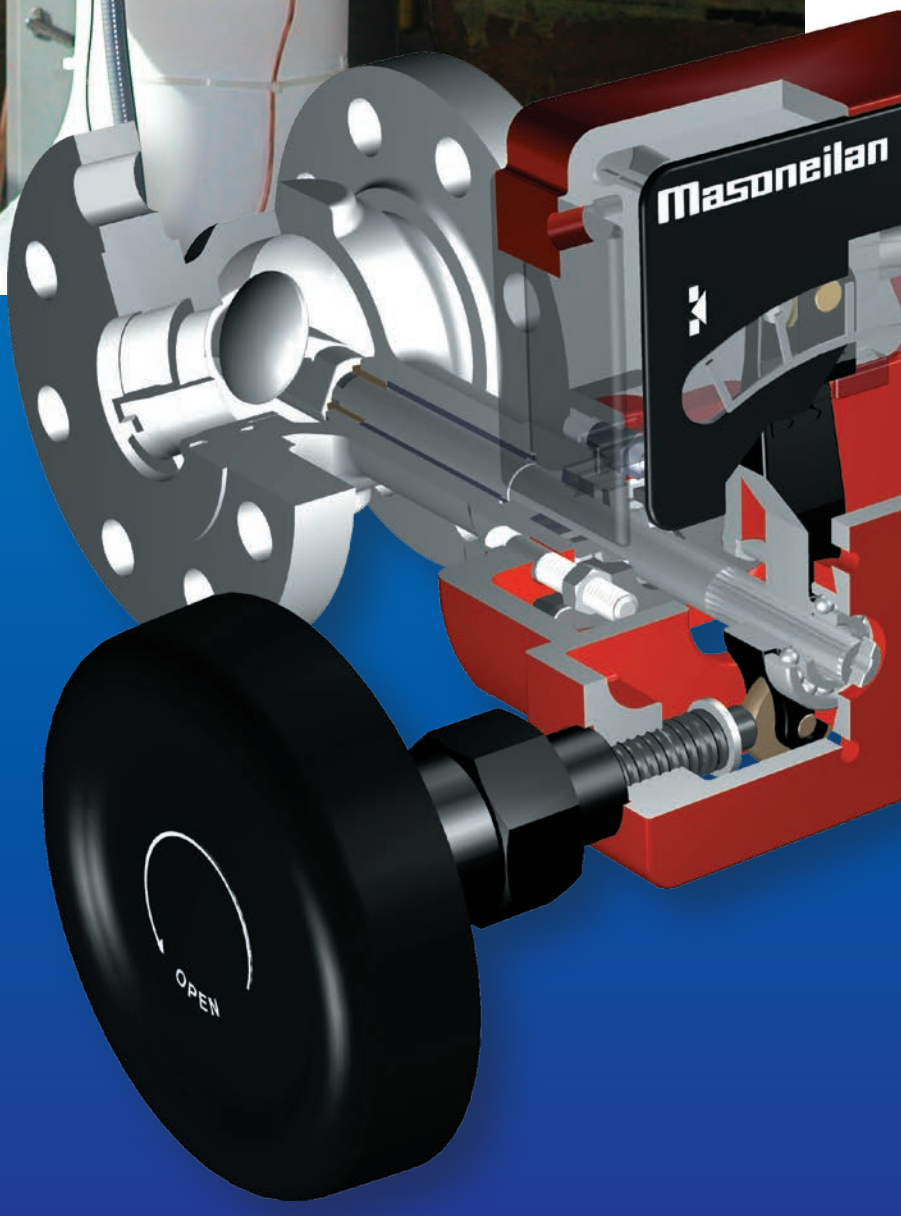
Nuclear Center Of Excellence – BHGE Condé Facility, Normandy, France

Nuclear Specifics	ESPN Module H	ASME III Stamp N&NPT	HAF 604 (China)	SSM FS Swedish Regulations
	EDF Qualification	Framatome (AREVA) QN 100	CEFRI E	UNE 73401 (Spanish Nuclear)

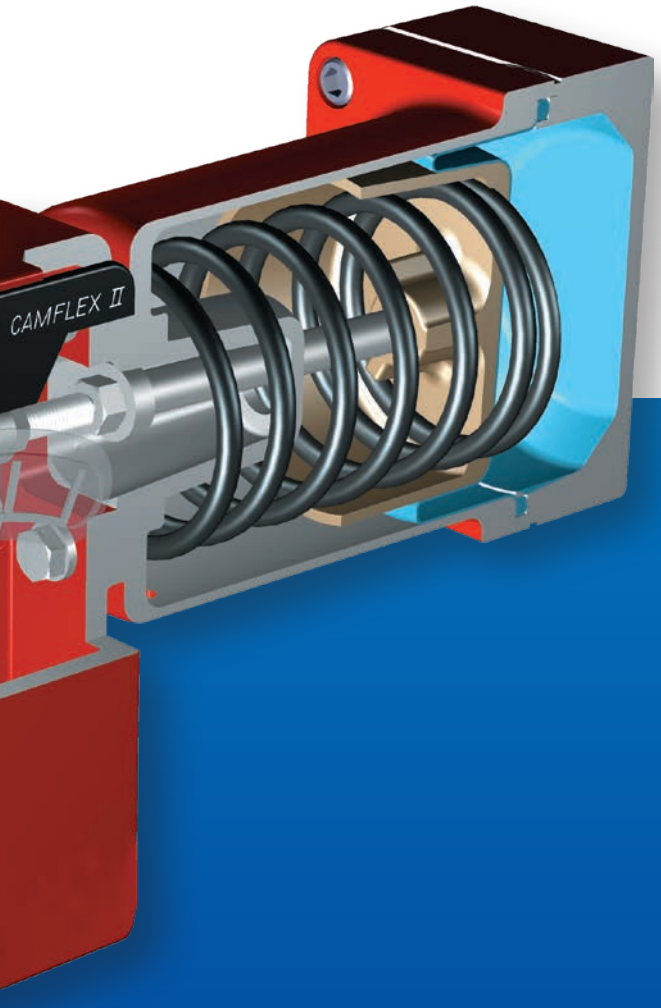
Condé COE Nuclear Certifications

I AM THE KEY TO NUCLEAR SAFETY


Masoneilan
CAMFLEX II
SVI-II


Masoneilan
OPEN

Rotary Control Valves



35002 Series Camflex* II Eccentric Plug

Sizes: 1" through 16"
(25 through 400 mm)

Ratings and Connections:
- flanged: ANSI 150 - 600
- flangeless: ANSI 150 - 600
  UNI-DIN 10 - 100
- screwed: NPT (1" through 2")

Body Materials:
- carbon steel
- stainless steel
- high nickel alloy

Actuators:
- model 35 spring diaphragm
- 70 Series cylinder

Trim:
- eccentric rotary plug

Inherent Characteristic:
- linear

As the original eccentric plug rotary valve, the 35002 Series Camflex valve combines quality performance and features with an economical design. The Camflex valve offers versatility and broad application. It is now supplied with the EF seal solution to reduce fugitive emissions.

Typical Applications:
- Low pressure heaters drain
- Ventilation system

Single-Seat Control Valves

21000 Series Globe & Angle Top-Guided Valve

Sizes: 3/4" through 8"
(20 through 200 mm)

Ratings and Connections:
- flanged: ANSI 150 - 2500
  UNI-DIN 10 - 400
- welded: BW or SW
- screwed: NPT 3/4" through 2"
  (20 through 50 mm)

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

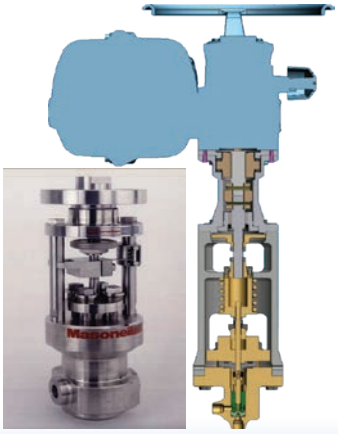
Actuators:
- model 87/88 multi-spring diaphragm
- cylinder
- electric

Trims:
- single seat plug top guided.
- Lo-dB* and anti-cavitation trims, single or double stage are available
- bellow seal

Inherent Characteristic:
- linear or equal percentage

The 21000 Series control valve is a heavy top-guided unbalanced design with noise attenuation and anti-cavitation trim options. It can handle a variety of process applications ranging from standard service conditions to more severe applications. It also includes standard bellows seal and soft seat configurations.

Typical Applications:
- Low pressure heater drain
- Effluent treatment
- Gland steam system turbine



28000 Series VariPak* Micro-Trim Globe Valve

Sizes: 1" (25 mm) standard
1/2" through 3/4"
(15 through 20 mm)
available on request

Ratings and Connections:
- flanged: ANSI 150 - 600
- flangeless for mounting between flanges: ANSI 150 - 2500
  UNI-DIN 10 - 400
- welded

Body Materials:
- stainless steel
- monel
- hastelloy C
- alloy 20

Actuator:
- integral spring diaphragm
- electric

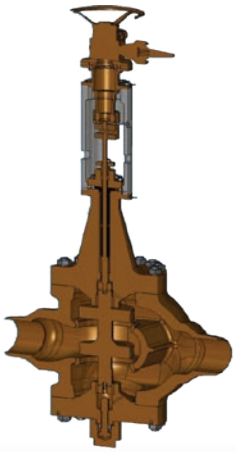
Trims:
- full stellite needle plug
- multistep trim available
- bellow seal

Inherent Characteristic:
- linear

The 28000 Series VariPak is a compact globe style valve specifically for microflow control. The VariPak includes an adjustable C_V feature between 100 percent and 40 percent that can meet applications requiring finer control. It is available with bellows seal and anti-cavitation trim options.

Typical Applications:
- Microflow applications
- Waste treatment plant
- Primary pump cleaning injection
- Effluent treatment system
- Sampling system

Double-Seat Control Valves



10000 Series Double-Seated Globe Valve

Sizes: 2” through 24”
(50 through 600 mm)

Ratings and Connections:
- flanged: ANSI 150 - 1500
  UNI-DIN 10 - 250
- welded: BW or SW

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

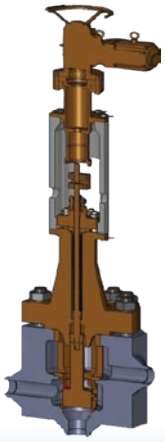
Actuators:
- model 87/88 multi-spring diaphragm
- cylinder
- electric

Trims:
- V-port or contoured plug
- top and bottom guided

Inherent Characteristic:
- linear, quick opening or equal percentage

The 10000 Series is a double-ported valve with top and bottom stem guiding. This design is suitable for high-pressure drop applications where dirty fluid conditions exist. The 10000 Series is widely used in hydrocarbon processing applications.

Typical Applications:
- Safety injection accumulator



80000 Series 3-Way Diverting or Combining Valve

Sizes: 1” through 10”
(25 through 250 mm)

Ratings and Connections:
- flanged: ANSI 150 - 600
  UNI-DIN 10 -100
- welded: BW or SW
  ANSI 900 - 2500 on request

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

Actuators:
- model 87/88 multi-spring diaphragm
- model 37/38 spring diaphragm
- cylinder

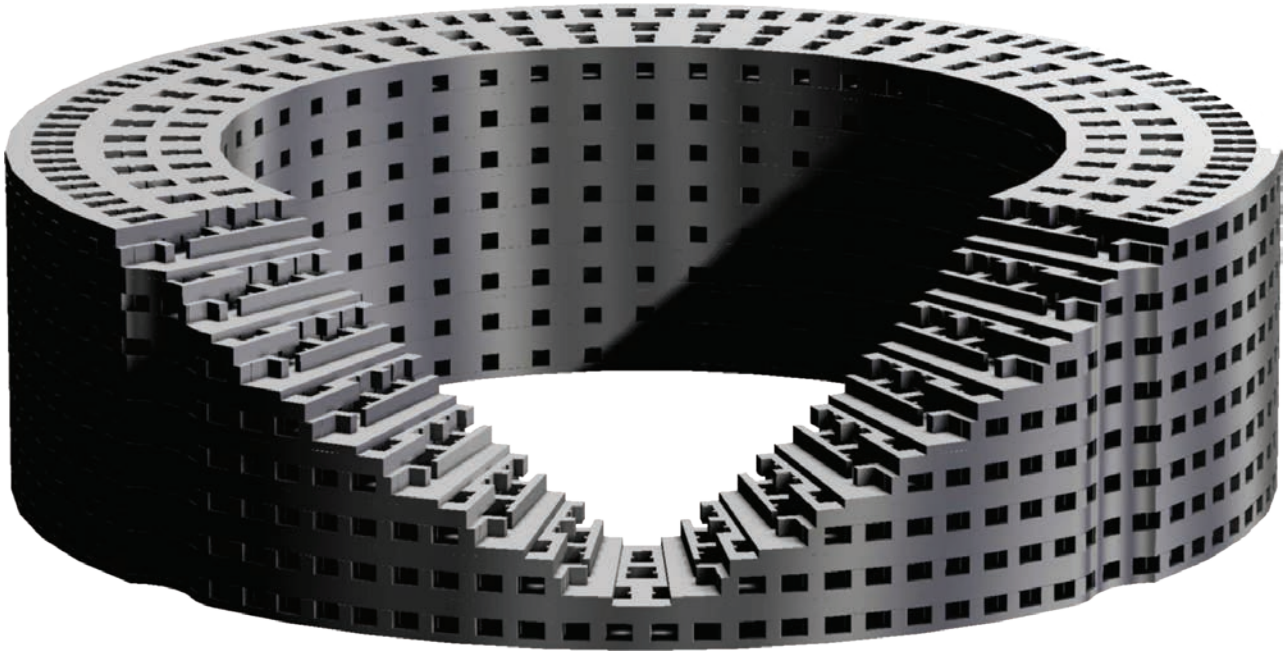
Trim:
- v-port plug

Inherent Characteristic:
- linear

The 80000 Series is a line of three-way control valves for either combining or diverting applications. Its key features include high flow capacities and low-pressure recoveries, resulting in efficient flow control performance.

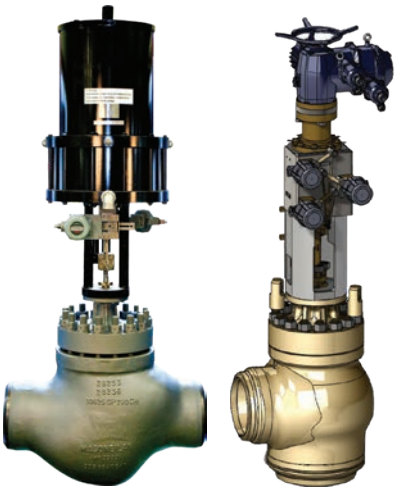
Typical Applications:
- Volumetric and chemical control system
- Turbine bearings lubrification system
- Reactor coolant storage

Stacked Plate Technology



V-Log* Energy Management Trim is manufactured from a brazed stack of laser-cut plates, each with a series of 90 degree turns used to redirect the flow of the process fluid through a high-resistant flow path. Each stage also includes an expansion and contraction in area for maximum pressure reduction efficiency. Further, each valve body is contoured to account for flow expansion and trim area velocity to manage the total system noise, offering customers a compact energy management control valve.

Cage-Guided Control Valves



41005 Series Globe & Angle Style Valve

Sizes: 2" through 24"
(50 through 600 mm)

Ratings and Connections:
- flanged: ANSI 150 - 2500
  UNI-DIN 10 - 400
- welded: BW or SW

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

Actuators:
- model 87/88 multi-spring diaphragm
- model 37/38 spring diaphragm
- cylinder
- electric

Trims:
- balanced with seal ring or pilot cage-guided trim
- Lo-dB*: low noise for steam anti-cavitation for liquid

Inherent Characteristic:
- linear or equal percentage

The 41005 Series is a heavy-duty valve design with balanced trim configurations. It offers cage guiding for added stability and the versatility to offer noise attenuation and anti-cavitation solutions. Available with various balancing seal options including auxiliary pilot design for unmatched high-temperature performance.

Typical Applications:
- HP heaters drains
- Moisture separator drains
- Feed tank supply
- Main feedwater valves

41005 Series Turbine Bypass to Condenser 41005 Series Steam Bybass to Atmosphere

Sizes: 4" through 36"
(100 through 900 mm)

Ratings and Connections:
- flanged: ANSI 150-2500
  UNI-DIN 10 - 400
- welded: BW

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

Actuators:
- model 37/38 spring-opposed diaphragm
- cylinder
- electric

Trims:
- balanced cage-guided trim.
- Lo-dB, anti-cavitation and VRT* (Variable Resistance Trim), single and multiple cages, V-Log are available

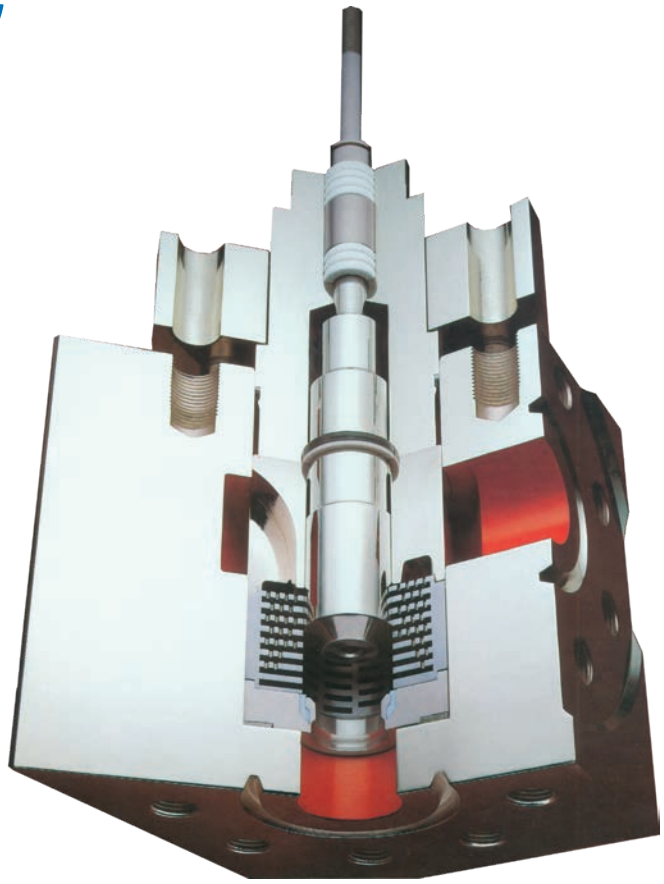
Inherent Characteristic:
- linear or equal percentage

The 41005 Series features an enlarged body. It offers cage guiding for added stability and the versatility to offer noise attenuation and anti-cavitation solutions. Available with various balancing seal options including auxiliary pilot design for unmatched high-temperature performance.

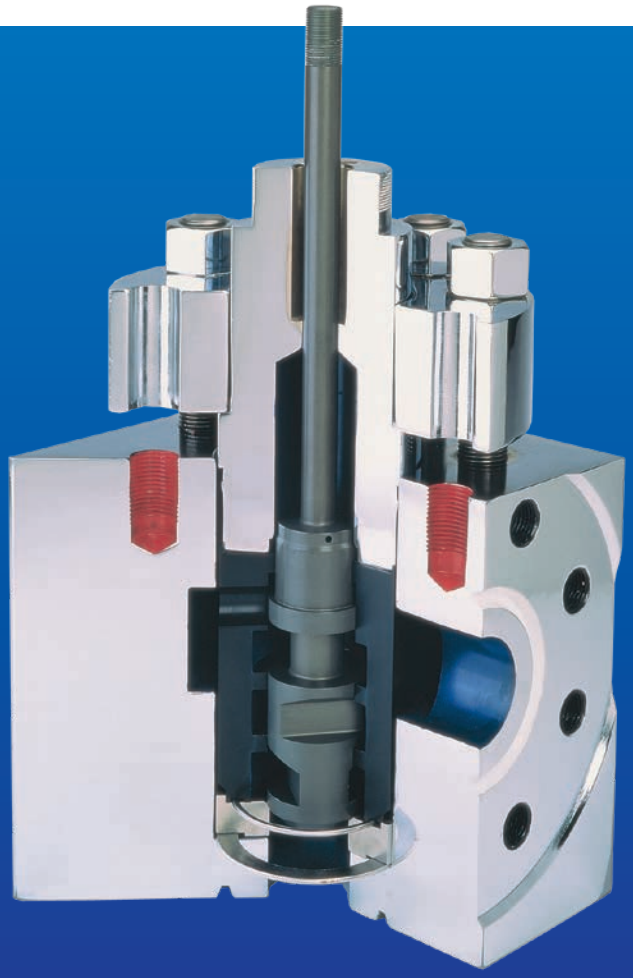
Typical Applications:
- Turbine bypass
- Bypass to atmosphere

Axial Flow Technology

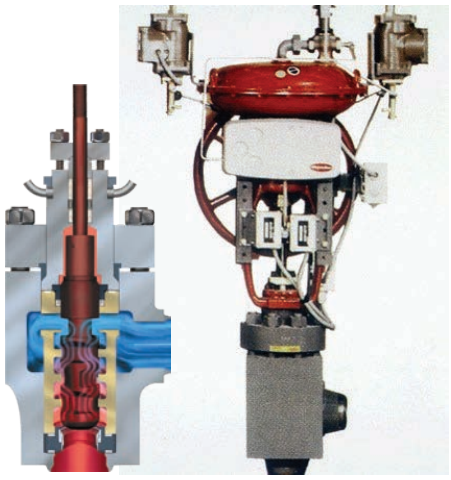
Variable Resistance Trim (VRT*), consists of a brazed stack of drilled plates which efficiently channel the flow through multiple turns in a tortuous path configuration. The design is primarily used in high-pressure drop liquid applications. VRT is typically packaged within standard Masoneilan globe and angle valve bodies.



Axial Flow trims offer multi-stage designs for the control of high-pressure liquids without the damaging effects of cavitation, erosion, and vibration. The unique flow design of the LincolnLog* develops the required resistance for throttling but also affords ample clearance for the passage of large particulate. The optional soft seat is specifically for boiler feedwater applications and offers long-term Class VI shut-off at demanding pressures.



Severe Service Control Valves



78400-18400 Series LincolnLog*

Sizes: 1" through 12"
(25 through 300 mm)

Ratings and Connections:
- flanged: ANSI 600 - 2500
  UNI-DIN 100 - 400
- welded: BW or SW

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

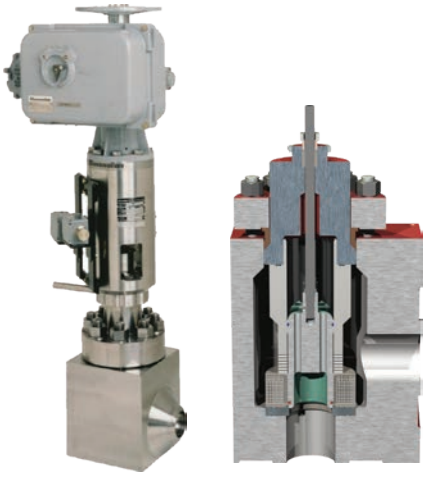
Actuators:
- model 37/38
  spring-opposed diaphragm
- model 87/88
  multi-spring-opposed diaphragm
- cylinder
- electric

Trims:
- axial flow technology
- multi-stage, cage-guided,
  anti-cavitation trim
- Class VI available on request

Inherent Characteristic:
- linear

The 18400 and 78400 Series valve is used in high-pressure liquid service applications to help eliminate cavitation.

Typical applications:
- Emergency feed water
- Steam generator drains
- Minimum flow feed water pump



41017 Series Globe Style 79000 Series Angle Style with VRT* Trim

Sizes: 1" through 6"
(25 through 150 mm)

Ratings and Connections:
- flanged: ANSI 600-2500
  UNI-DIN 100-400
- welded: BW

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

Actuators:
- model 87/88 multi-spring diaphragm
- model 37/38 spring diaphragm
- cylinder
- electric

Trim:
- multi-stage VRT trim design and VRT partial stack design for control over a wide range of applications

Inherent Characteristic:
- linear

The 79000 Series valves offer anti-cavitation service with control over a wide range of operating conditions, such as the ramp-up transition of a normal feedwater pump.

Typical Applications:
- Small flow feed water control
- Feedwater pump start-up valve
- Charging valve : volumetric & chemical control system

Advanced Smart Instruments

SVI* II AP Advanced Performance Digital Valve Positioner

Communication Platform:
- HART®

Signal - Supply - Features:
- 4-20 mA control signal
- loop powered (9Vdc @ 20 mA)
- supply pressure: 20 - 150 psi (1.4 - 10 bar)
- -40°C to 85°C (-40°F to +185°F)
- standard or advanced diagnostics
- single or double-acting
- local Exd LCD and pushbuttons
- local or remote-mount capable
- built-in position transmitter and switches
- non-contact travel sensor

Communication Software Interfaces:
- ValVue standalone
- integrated (PLUG-IN, SNAP-ON, FDM)
- eDDL or DTM

Hazardous Area Certifications:
- ATEX, FM, IEC, GOST, KOSHA, NEPSI, INMETRO and CSA approvals
- Explosion proof and intrinsically safe
- Nuclear qualified per IEEE 323 - 2003, 344 - 2004, 382 - 1996

Smart Valve Interface Advanced Performance (SVI II AP) is an intelligent digital valve positioner. SVI II AP offers advanced control technology for pneumatically actuated valves with a proven non-contact Hall Effect sensor for higher precision, reliability, greater flexibility, and ease of use. This solution delivers greater return on investment and provide maximum valve diagnostics capabilities.

ValVue is a communication software tool used to configure, calibrate, and perform valve diagnostics with the SVI II AP utilizing HART communications protocol.

12400 Series Digital Level Transmitter/Controller

Range: 14” through 120” (355 through 3048 mm)

Ratings and Connections:
- flanged: ANSI 150 - 2500 UNI-DIN 10 - 100
- screwed: NPT-F (1 1/2”, 2”)
- welded

Body Materials:
- carbon steel
- stainless steel
- chrome-moly

Displacer Materials:
- stainless steel
- other materials on request

Torque Tube Materials:
- Inconel
- stainless steel
- other materials on request

Electronic Instrument:
- HART protocol
- 4 - 20 mA signal
- ATEX, FM, FMc, JIS, CU TR, CRN, IEC, INMETRO, CCOE, IEC between main approvals
- SIL2 safety certified
- Optional 2 built-in level switches
- Optional second 4-20 mA output signal

The Masoneilan 12400 Series Instrument is a two-wire loop-powered, digital-displacement type level transmitter or controller with HART communication. This high performance instrument is easily set-up and calibrated with either ValVue communication software, EDDL, DTM a hand-held communicator, or local pushbuttons and digital display. This versatility allows the operator to configure, calibrate, and perform other functions either at the instrument or from the control room.

Typical Applications:
- LP & HP heaters
- Moisture separator tank levels

ValVue* Suite Standalone or Integrated Software

ValVue 3

Valvue 3 is a powerful, user friendly interface designed for set-up and diagnostics of control valves equipped with an SVI II AP, SVi1000, SVI FF, SVI II ESD, FVP or 12300 / 12400 Digital Level Transmitter/Controller. ValVue enhances the diagnostic capabilities of your control valves and improves asset efficiency when setting up a digital valve positioner or level transmitter. It offers electronic documentation of configuration and calibration results, as well as valve signature analysis. These solutions reduce the complexity in commissioning FOUNDATION® Fieldbus or HART® digital valve positioners and transmitters.

Valve Aware*

Valve Aware is a software based technology for monitoring and diagnosing the performance of any control valve during normal process operations. This solution for final control elements improves plant integrity, plant efficiencies and plant uptime resulting in reduced operational expenditures and increased plant profitability.

Pneumatic Instruments

Model 4700/4800P Pneumatic Positioner

Characteristics:
- linear or equal percentage obtained through the cam setting.

Options:
- bypass
- customized characteristic

Signals:
- 3 - 15 psig
- 6 - 30 psig
- 3 - 9 psig,
- 9 - 15 psig

Action:
- Direct and reverse action (reverse action available on pneumatic version only)

Model 4700/4800E Electro-Pneumatic Positioner

Characteristics:
- linear or equal percentage obtained through the relevant cam setting.

Options:
- bypass
- customized characteristic

Signals:
- 4 - 20 mA
- split range

Certification:
- explosion proof and intrinsically safe enclosure rating per IP 66 and NEMA X

Action:
- Direct and reverse action

Model 4411 Electro-Pheumatic Positioner

Output capacity:
- 12 scfm (20.4 Nm^3/h)

Signals:
- input: 4 - 20 mA (100 mA max)
- output: 3 - 15 psig, 6 - 30 psig

Certification:
- explosion proof and intrinsically safe enclosure rating per IP 66 and NEMA X

The 4411 I/P is manufactured with Reedex™ digital-micro valve technology for fast response. It is not sensitive to vibration.

- low air consumption
- adjustable tight shut-off feature

The Masoneilan Model 4700/4800P and 4700/4800E instruments are positioners that use a precision feedback cam for accurate positioning, faster response, and customized control characteristics for control valves. These positioners can be used with either rotary or reciprocating actuators. When mounting on reciprocating actuators, a simple, rugged turnbuckle and lever assembly couples stem motion to the cam. On rotary actuators, the cam is mounted directly to the shaft.

The main features of the 4700/4800 E/P Series are:

- multi-lobe cam
- simple zero and span adjustments
- corrosion resistant materials
- fully enclosed
- FM, CSA, ATEX approvals
- simple design
- easy to maintain
- optional bypass on pneumatic version
- dampening adjustment

Model 496 Rotary Limit Switch

Rating:
- 10 amps @ 300 Volts A.C.
- 0.6 amps @ 24/30 Volts D.C.

Position switches:
- one or two electromechanical switches
- one or two inductive proximity switches

Position transmitter:
- opto-electronic position transmitter
- **K3 qualified**

Hazardous Area Certifications:
- ATEX, FM and CSA approvals

The Masoneilan 496 Series switches and position transmitters can be configured as electromechanical switches, proximity switches, or opto-electronic position transmitters. These devices offer high resistance to vibration and electrical interference for reliable valve-mounted performance.

Mechanical and electrical components can operate in harsh environments and are approved for use with various hazardous area ratings including ATEX, FM, and CSA.

Model 78 Air Filter Regulator

Inlet Pressure Rating:
- 210 psi (15 bar) maximum

Filter Element:
- 5 µm sintered porous polyethylene

Pressure Set Range:
- 78-4 Model: 5-40 psi (0.35-2.8 bar)
- 78-40 Model: 5-100 psi (0.35-7 bar)

Ambient Temperature Range:
- -40°C to +83°C (-40°F to +182°F)

Connections:
- ¼" NPT or Rc

BHGE offers a variety of air filter regulating devices, including the Masoneilan Model 78 Air Filter Regulator for controlling the supply of process plant air to control valve accessories. These Masoneilan regulators are externally adjustable for fine tuning and include a locking feature for maintaining output pressure at the desired level. The compact design is easy to mount onto a range of equipment types using different methods and orientations to fit the specific application. BHGE also offers the Masoneilan Model 77 Three-Way Transfer Valve for added flexibility in applying and tying together various pneumatic devices within a control valve loop.

Model BR200 / BR400 High Capacity Volume Booster Relays

Maximum Supply Pressure:
- 150 psi (10.3 bar)

Maximum Signal Pressure:
- 150 psi (10.3 bar)

Ambient Temperature Range:
- -30°C to +100°C (-22°F to +212°F)
- optional: -55°C to +100°C (-43°F to +212°F)

Input / Output Ratio:
- 1:1

Maximum C_V:
- supply: 2.6
- exhaust: 2.4

Masoneilan Model BR200 and BR400 pneumatic booster relays offer high capacity air volume boost for faster, dynamic control valve system response. These devices feature a 1:1 input-to-output ratio with a maximum supply and signal pressure of 150 psi (10.3 bar). The BR200 and BR400 also include an integrated internal bypass valve for sensitivity adjustment and dynamic response optimization. These devices also have integrated filters in both the supply and signal ports and are configured using stainless steel components and corrosion resistant finishes for a robust and reliable assembly.

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