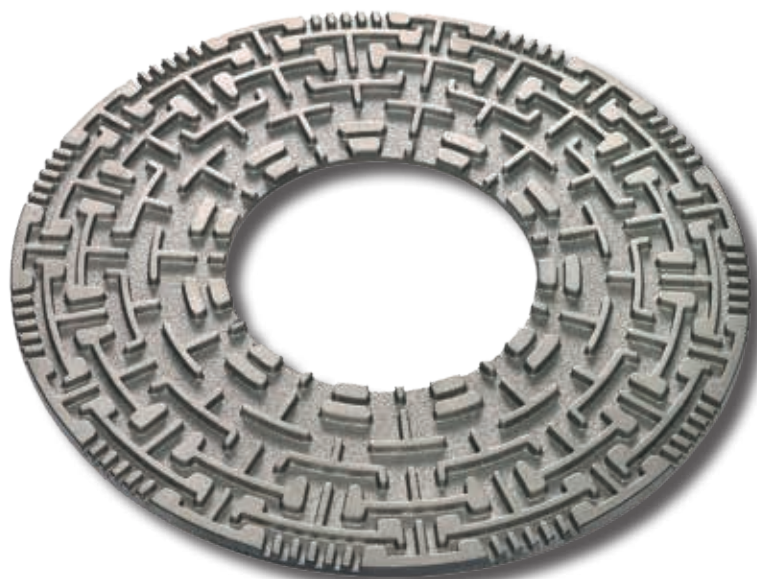


RAVEN™ TRIM

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With its Copes-Vulcan brand, Celeros Flow Technology has been providing control valves and desuperheaters for the power, process and nuclear industries since 1903. Copes-Vulcan provides a wide range of valves for the control of pressure, temperature and flow-induced noise in all types of power plants. Products include severe service and general service control valves, variable orifice desuperheaters, Raven™, trim and steam-conditioning valves and nuclear control valves, as well as custom designed specialty valves. The Copes-Vulcan brand is recognized worldwide as a leader in valves for severe and critical service applications. Our strength lies in our ability to provide innovative valve solutions for our customers' application needs.



RAVEN™ TRIM

Celeros FT's Copes-Vulcan brand has been providing valves to the Power, Pulp & Paper, Oil & Gas, and Petrochemical industries since 1903, and is recognized worldwide as a leader in valves for severe and critical service applications. Our strength truly lies in our ability to provide innovative valve solutions for our customers' application problems. The RAVEN™ Control Valve incorporates a unique advanced design that is superb at rapidly reducing flow velocities, resulting in valves that provide quiet, non-cavitating and non-erosive service. Ultimately, each RAVEN™ trim is specifically designed to provide the finest severe duty valve service by:

**Reducing and
Attenuating
Velocity,
Erosion and
Noise**

The RAVEN™ Control Valve was developed by highly experienced engineers who took the well-proven labyrinth disc stack type of trim and introduced two main patented innovations: resistance to the effects of blockage and reduction in noise. The innovative designs give this well-established technology for severe service applications even more technical advantages over other currently available trim designs

RESISTANCE TO THE EFFECTS OF BLOCKAGE

The expanding passage design, combined with multiple entry points to the individual flow passages, make blockage very unlikely. Unlike conventional labyrinth trim designs, RAVEN™ has relief points built into the labyrinth design. Under normal operation, these relief points have virtually no flow through them. In the event of blockage, the relief points are utilized. Extensive testing has shown that if a blockage occurs in RAVEN™ trim, all inlet ports and outlet ports are still utilized, minimizing any reduction in Cv and ensuring that the minimum designed number of pressure reducing stages are still used. In conventional labyrinth stack designs, a blockage in the stack eliminates the Cv of that path completely and in the case of a partial blockage, can actually generate noise.

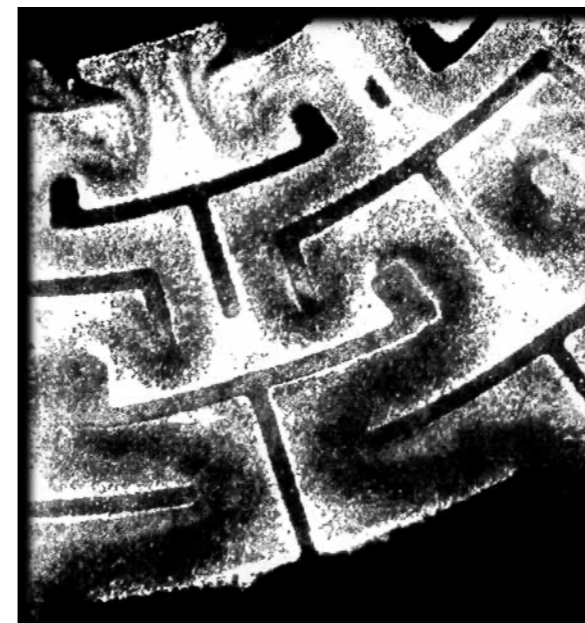


TEST CASE SHOWING SEVERE BLOCKAGE.
ALL INLETS AND OUTLETS STILL IN USE.
NEGLECTIBLE LOSS IN CV.



PROVEN SUPERIOR TECHNOLOGY

The actual gaseous flow through RAVEN™ trims shows the visible attachment phenomenon wherein the flow stream clings to each obstruction in its path, effectively taking the line of least resistance. Also, despite the multiple relief points in the flow path, it can clearly be seen that the fluid does not recombine within the RAVEN™ trim. The flow streams remain virtually separate from each other, ensuring the best velocity control.



TYPICAL PRODUCT APPLICATIONS

Power/Auxiliary Power Units

Boiler Feed Control
Boiler Feed Pump Minimum Flow (Bypass)
Inter Stage Attenuator Water Control
Boiler Drum Level Control
Soot Blower Header Control
Turbine Bypass
Start-Up Steam Vent
Spray Water Control
Deaerator Level Control
Condenser Steam Dump
Sampling Systems



Oil & Gas

Feed Gas Regulator
Overboard Water Dump Valves
Water Injection Systems
Pump Min Flow Valves
Fire Water Pump Discharge Valves & Min Flow Valves
Methanol Injection
Vapor Recovery Systems
Flue Gas Expander Bypass
First Stage Separator Level Control



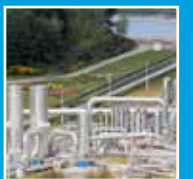
Gas Transportation/Storage

Gas Injection/Production
Active/Monitor Valve Systems
Compressor Antisurge
Gas to Flare
Fuel Gas Regulation
Surge Relief
Silencers



LNG

Compressor Antisurge
Acid Gas Separator
Pump Recirculation Valves
Hot Gas Bypass Valves
Joule Thompson Valves
Gas to Flare
Emergency Depressurising Valves



Petrochemical

Compressor Antisurge
Feed Gas Regulation
Expander Bypass
Process Gas Depressurising
Gas to Flare
Amine Pump Let Down and Recircs
Aux Power Unit Valves
Liquid Ammonia Let Downs

This is representative of the type of application where RAVEN trim can be used to ensure long trouble-free operation. This list is by no means exhaustive.

REDUCTION IN NOISE

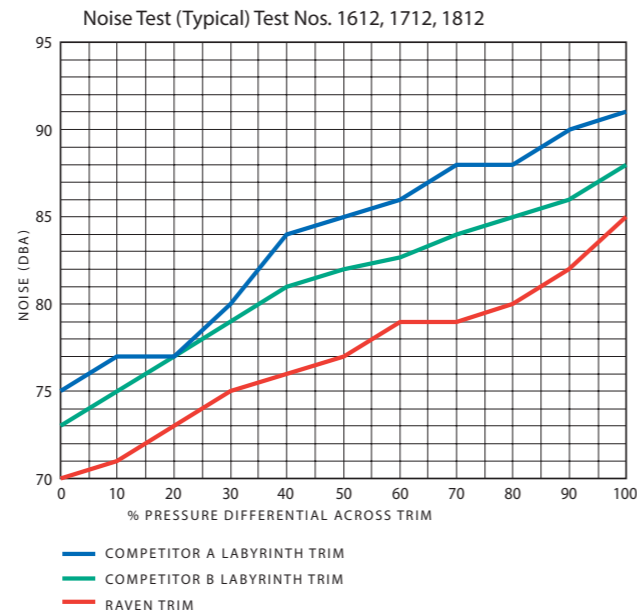
Labyrinth type trims have been widely accepted over the last 25 years as being the best solution in cases where high noise and vibration are likely. Their wide acceptance is based on the principles of reducing mass flow and strictly controlling the velocity of the medium within the trim. Copes-Vulcan valve engineers have taken this technology one step further. They found that by splitting the outlet flow of each labyrinth path into three or more small mass flows (rather than the one large flow) noise could be reduced by up to 3 dBA more than in a similar design labyrinth with the same number of pressure reducing stages. Size for size, RAVEN has been proven quieter than the leading competitor in extensive laboratory testing.

RAVEN PROVIDES TRUE VELOCITY CONTROL

Copes-Vulcan's RAVEN Control Valves offer a proven solution for severe service applications where a true velocity control trim is the best, or possibly the only, answer. The combined effect of numerous narrow flow channels, each with many sharp turns and a continually expanding flow path, is to remove kinetic energy from the fluid while gradually lowering its pressure. By limiting the fluid velocities inside the valve, RAVEN trim precludes problems typically associated with high velocity such as erosion, noise, vibration and poor control. The additional benefit for liquid flow is the elimination of cavitation and the damage it can do to a valve, its trim, and the downstream piping.

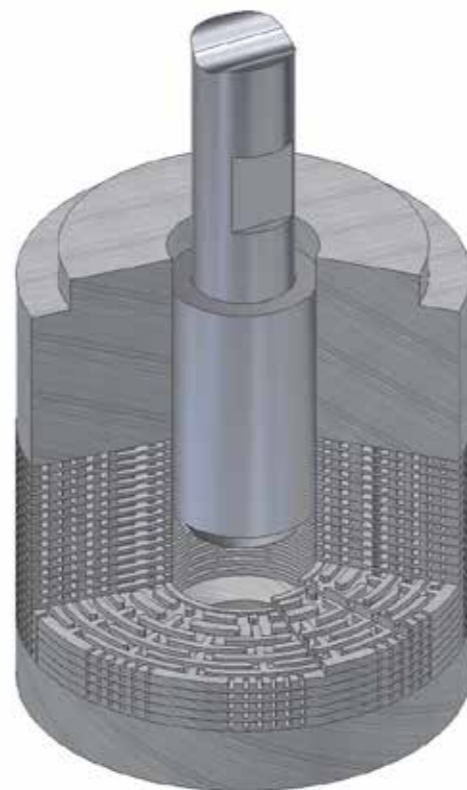
Trim Exit Velocity

SERVICE CONDITIONS	KINETIC ENERGY CRITERIA	EQUIVALENT WATER VELOCITY
	PSIA/KPA	FT/M PER SECOND
CONTINUOUS SERVICE, SINGLE PHASE FLUIDS	70 (450)	100 (30)
CAVITATING AND MULTI PHASE FLUID OUTLET (FLASHING)	40 (275)	75 (23)
VIBRATION SENSITIVE SYSTEM	11 (75)	40 (12)



STACKED DISC TECHNOLOGY

RAVEN's low velocities are achieved through the use of a trim cage made by bonding together a series of individual discs. Each disc has a pattern of carefully controlled orifices and channels with a multitude of sharp turns etched into its surface. As the trim's plug travels within the cage, the fluid is throttled and forced to travel an extremely tortuous path with each turn effecting a stage of pressure drop.

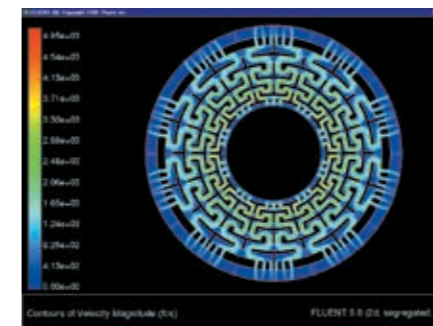


NARROW WALL DESIGN ALLOWS MORE STAGES OF DROP PER DISC

By its very design, RAVEN™ trim allows for many more stages of drop than conventional tortuous path trims. Superior to other velocity control trims, RAVEN™, through the use of a consistent narrow wall design, typically is more efficient at passing flow or allowing more turns or stages of drop in a given valve size.

MANUFACTURED TO EXACTING TOLERANCES

By manufacturing the flow channels to extremely close tolerances, RAVEN's calculated or predicted versus actual pressure drops are significantly more accurate than competitors. Hence, velocities are more uniform throughout the entire trim, further guarding against noise, erosion and cavitation. The unique methods employed to produce the individual discs and then bond them together provide the uniform flow passages and a high strength stack assembly.



MULTIPLE RELIEF POINTS PREVENT BLOCKAGE

Most RAVEN™ trims contain multiple relief points in the flow path as a standard feature. These relief points allow entrained debris to clear the main fluid flow, or in the case of significant path blockage, they provide an effective bypass route of the fluid. With the benefits of the relief points being obvious, the actual fluid flow streams still remain virtually separate or discrete from each other for best velocity control.

SEVERE DUTY CONSTRUCTION WITH ACTUATOR OPTIONS

A RAVEN™ Control Valve typically consists of an SD Severe Duty valve operated by either a powerful Series 700 or 1000 pneumatic diaphragm actuator or a Series 200 piston actuator. When required, electric, electro-hydraulic, hydraulic or gas-powered actuators can also be supplied.

LONG-LIFE AND RELIABILITY

Due to the velocity control techniques utilized in RAVEN™, vibration can be virtually eliminated. High velocity is a root cause of noise and vibration, which often can cause seal failure, instrumentation problems and cracking of valve components.

HIGH RANGEABILITY APPLICATIONS

Due to the characterization achievable within the disc stack, rangeabilities to 200:1 or as required by the application can be achieved. Wherever a split range, two valves in parallel installation is being considered using conventional valves, it is usually much more attractive, both commercially and technically, to combine both valves into a high rangeability RAVEN™ Control Valve. Typical applications include pipeline packing, boiler feed pumps, etc.

ANTISURGE VALVES

These valves require tight shutoff, fast-acting pneumatic control, low hysteresis, and since they can operate for extended periods, low noise. Operating speeds of one second can be reliably achieved using pneumatic actuation.

DEPRESSURIZING AND VENT VALVES

Since they operate normally in the closed position, a tight shutoff is critical to prevent valve degradation due to leakage. Copes-Vulcan has a well-proven zero leakage design seat that can be used together with RAVEN™ as required.

CUSTOM DESIGNED FOR EACH APPLICATION

Every RAVEN™ trim is custom designed to meet the needs of the toughest liquid, steam and gas services in the Oil and Gas, Petrochemical, Power and Process industries meeting NACE MR0175 where necessary. The number of pressure reducing stages is governed by two factors: velocity control and noise requirements. Either velocity or noise can be the factor determining the number of stages required. As per the latest ISA guidelines, RAVEN™ is designed to control velocity of the fluid within the trim to 100 ft./sec. (30m/s) (or the equivalent velocity head in case of gases). Dependent upon the differential pressure across the trim, the stages required to control the velocity are calculated. The lower the noise specification, the more stages required. The trim is also characterized to account for changes in flow and differential pressure at different valve openings.

ADAPTABLE FLOW DIRECTION

Flow can be either over or under the plug depending upon the fluid, the service and, in some instances, the piping configuration.

TIGHT SHUTOFF

Equipped with various plugs (eg. unbalanced, balanced, tandem, etc.), RAVEN™ can provide shutoff classes ranging from ANSI/FCI 70-2 Class IV to VI and MSS-SP-61. For particular applications Celeros can also supply our patented ZERO leakage design.

EASILY SERVICED

Quick-change design with no threaded or welded-in parts. Seat ring is a separate replaceable item.

RESISTS PLUGGING AND GALLING

A pressure-balancing groove inboard of the I.D. of each disc allows the plug to be completely balanced around its circumference, and provides a landing area for entrained debris, thus precluding plug galling. Additionally, bypasses in the flow path allow for entrained debris to clear the main fluid flow path.

RETROFITS/UPGRADES

RAVEN™ trim can be readily tailored to fit valves previously supplied with other trims styles, and valves manufactured by other suppliers. This has a cost benefit in that a new body is not required. This shortens delivery times considerably. Most refits can be carried out with the valve in position at site within one day.

TRIM RECOMMENDATIONS MATCHED TO THE APPLICATION

With the Copes-Vulcan brand, Celeros, unlike other manufacturers, offers a wide variety of performance-proven trim styles. This enables us to select the correct trim for every application without restriction. In applications requiring a high number of pressure reducing stages, RAVEN™ trim is the ideal solution. In less severe applications, a more economical trim style can be applied. It is our policy to quote the most economical trim that will satisfy a particular application.



RAVEN™ Specifications

TURNS/STAGES OF PRESSURE DROP

Application specific up to 60 or more

RANGEABILITY

100:1 or greater

TRIM CHARACTERISTICS

Equal percentage, linear or customized

VALVE SIZES

1.5–36" (38–914mm) and customized sizes

PRESSURE RATINGS

ANSI 150–4500

BODY STYLES

Straight-through globe, offset globe/Z pattern, angle style

BODY ENDS

Flanged, butt weld (to any standard or special requirement) or clamped

STANDARD TRIM MATERIALS

- Disc Stacks: 300 or 400 Series stainless steel, Inconel or other materials as required
- Plug & Seat: hardened 420 stainless steel, Stellite 316 stainless steel or other materials as required.

STANDARD BODY/BONNET MATERIALS

Carbon steel, chrome moly, stainless steel, and other castable or forged materials.

ACTUATORS:

- Series 1000 Pneumatic Diaphragm Actuators
- Series 200 Piston Actuators
- Electric
- Hydraulic Actuators
- Gas Powered Actuators
- Stepper Actuators

CODES & STANDARDS

Due to our specialist design capabilities, RAVEN™ Valves can be manufactured to meet virtually any standard in the world. Some of these standards are listed below:

ISO 9001

CE Accreditation

ASME Section 1 S Stamp

Section III N & NPT Stamps

Section III NCA 40C Stamp

CSA Z299.3 & Z299.4

MSSP61

NA V Ships 250–1500–1

ANSI B16.34, NQA 1, N45.2, B31.1

MIL I 45208A, Q9858, STD 2132

API 598



RAVEN™ TRIM

- | SPEED
- | EXCELLENCE
- | PARTNERSHIP

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Celeros Flow Technology reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction, and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing. Please contact your local sales representative for product availability in your region. For more information, visit www.celerosft.com.
CV_Raven-Trim_421_PB_A4_Version 01/2021 Issued 02/2021
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MULTIPLE NOZZLE SPRAY DESUPERHEATER

MNSD-V & MNSD-U

COPEL VULCAN®



Celeros Flow Technology is a full-lifecycle partner for sustainable flow technology solutions, from initial design and installation of equipment to after sales support, throughout an asset's full operational lifecycle.

Celeros FT's products and technologies support many different sources of power generation, including coal and natural gas, nuclear, solar and geothermal. The company's innovative product portfolio, containing many energy efficient products, includes valves, pumps and filters.

Celeros FT manufactures the Copes-Vulcan general service and severe duty control valves, desuperheaters and direct steam converting valves, as well as reciprocating, centrifugal, multi-stage and screw type pumps, filtration systems and strainers.



MULTIPLE NOZZLE SPRAY DESUPERHEATER (MNSD)

OFFERS HIGH TEMPERATURE CAPABILITIES AND LOW COOLANT CLASS V LEAKAGE RATING

The Multiple Nozzle Spray Desuperheater offers optimum performance and rangeability in a variable spray tube design. The Model MNSD-V fills the performance gap between the limited capability of a simple mechanical spray type desuperheater and the virtually unlimited capability of Copes-Vulcan's Variable Orifice Desuperheater (Model VO). And, the MNSD-V offers high temperature capabilities and low class V leakage rating.

FEATURES

- Temperature control to within 15°F (8°C) of saturation with the ability to hold set point within a tolerance of 10°F (6°C)
- Standard maximum available Cv of 10.5 (Kv of 8.9)
- Waterflow turndown of 150:1 or higher
- User friendly design — nozzles and trim assembly can be removed without disconnecting actuator
- No need for separate cooling water control valve
- Designed for applications with temperatures up to 1150°F (620°C)
- Available in standard classes 600, 900, 1500 and 2500 per ANSI B16.5
- Cooling water inlet pressures up to 3500 psig (24 MPag) allowable standard (higher pressures allowable per application)

- ANSI Class V FCI 70-2 tight shutoff capability
- Suitable for vertical or horizontal installation
- Standard ANSI connections: 3" (80mm) raised face flange (steam) 1.5" (40mm) raised face flange (water)
- Designed for high thermal fatigue life

Many applications require turndowns in excess of that offered by a simple mechanical spray desuperheater. Many applications require turndowns in excess of that offered by a simple mechanical spray desuperheater but do not necessarily warrant the expense or require the additional refinements offered by the Variable Orifice Desuperheater. Many of these intermediate duties can be met with a steam atomizing type desuperheater (SA-35), but atomizing steam is often not available, or the additional installation and operational expense is not economically justified. The Multiple Nozzle Spray Desuperheater has been designed for these applications.

The MNSD-V Desuperheater automatically controls the cooling water flow with the ability to modulate and shutoff. A separate cooling water control valve is not required as the unit itself controls variations in required coolant flow. Unlike competitive models that can only operate with relatively low water inlet pressures, the MNSD-V can be supplied to accept cooling water inlet pressures to 3500 psig (24 MPag).



DESIGN AND PRINCIPLE OF OPERATION

The MNSD-V consists essentially of a cage-guided plug situated within the nozzle tube just behind the discharge nozzles.

The nozzle tube assembly fits up into the bore of the mounting flange and is locked in place with a threaded ring. This junction enables the cooling water inlet connection to orient in any direction relative to the position of the discharge nozzle spray at time of assembly. * Field alteration of this orientation is also quite easy.

The MNSD-V Desuperheater head offers a means of mounting the unit to a companion flange on the main header. It also provides an inlet connection for the cooling water, a gland assembly for stem sealing and a mounting arrangement for the dependable Copes-Vulcan Model 700 Diaphragm Actuator.



*Standard orientation is cooling water inlet directly opposite spray outlet.

TYPICAL PRODUCT APPLICATIONS

Power



Chemical

Refineries



Pulp & Paper



DISCHARGE NOZZLES

The multiple nozzle arrangement located near the end of the nozzle tube is composed of up to 22 uniquely designed discharge nozzles arranged in an overlapping manner to offer an extremely smooth flow characteristic. The quantity, individual sizes, and placement of the discharge nozzles are selected for each application to optimize capacity, maximize controllability and rangeability.

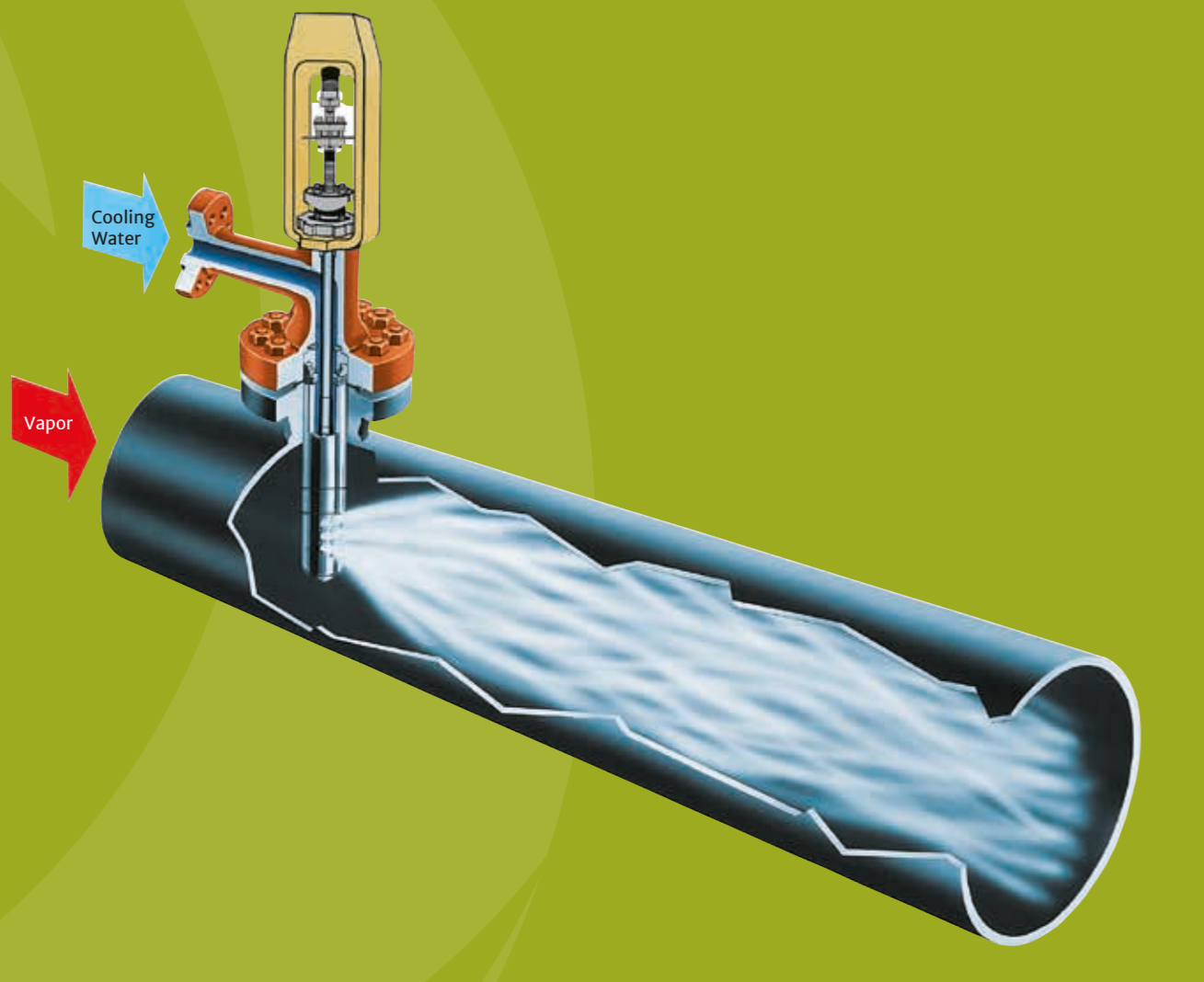


COOLING WATER

The cooling water is admitted to the nozzle tube assembly through the branch in the mounting head.

It reaches the lower portion of the nozzle tube assembly as the plug exposes the nozzles. With the plug seated, no cooling water can reach the discharge nozzles.

As the plug is extended by the actuator under the signals of the temperature control loop, cooling water is throttled at each exposed nozzle through flow characterization slots located just prior to the discharge nozzles.



OPTIMUM DESUPERHEATER EFFICIENCY

The cooling water then passes through specially designed swirl discharge nozzles. Most of the energy available from the differential pressure between the cooling medium and the main header is expended while expanded through the nozzles which intensifies mechanical atomization. The resulting soft, misty spray has a very low exit velocity. This promotes rapid absorption and optimum desuperheater efficiency, even at very low flow rates.

The spray from the first discharge nozzle, and typically the smallest, is quickly dispersed within an average of 3' (1m) from the point of discharge. As the plug continues to modulate open, a swirling interaction of the various discharge nozzle sprays maintains a narrow cone shaped pattern. This keeps the water droplets in the center of the header where the line turbulence is the greatest allowing for faster, more complete absorption of the cooling medium.

MATERIALS OF CONSTRUCTION

SIZING SELECTION

The MNSD-V/MNSD-U and all Copes-Vulcan desuperheaters can be sized by Copes-Vulcan or an authorized sales representative using SmartSize computer sizing program to assure correct application.

ITEM	MATERIAL
BODY CASTING	ASTM A217, Grade WC6
	ASTM A217, Grade WC9
	ASTM A217, Grade C12A
	ASTM A351, Grade CF8M
CAGE & TORQUE RING	ASTM A565, Grade 616, Type 422, Hardened
EXTENSION LEG	ASTM A182, Grade F22
	ASTM A565, Grade 616, Type 422, Hardened
RETAINING RING: (FOR SPRAY TUBE ASSEMBLY)	ASTM A479, Type 410, Hardened
PLUG	ASTM A565, Grade 616, Type 422, Hardened
ORIFICE DISC	ASTM A276, Type 420, Hardened
SWIRL DISC	300 Series Stainless Steel
SPACER	ASTM A479, Type 304
SEAL RINGS	Nitronic 60
ROLL PIN	400 Series Stainless Steel
SEAL (BODY/EXTENSION LEG) (CAGE/EXTENSION LEG)	Graphite with 316 SS
SEAT	UNS R3006 Stellite 6
STEM	ASTM A276, Type 316, Cond. B



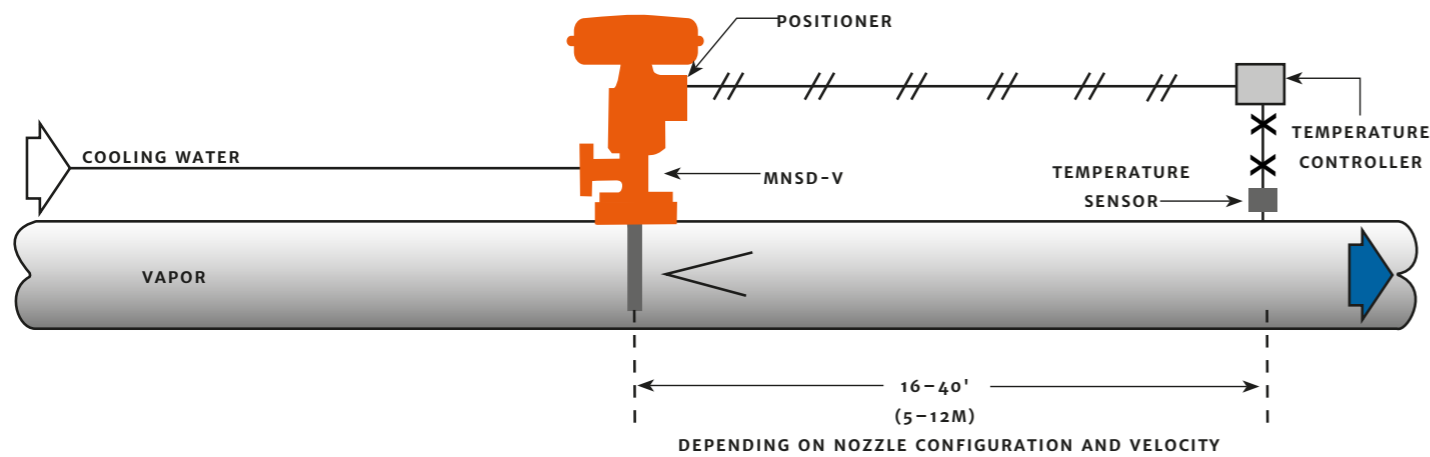
INSTALLATION RECOMMENDATIONS

For optimum control and performance, apply the following guidelines:

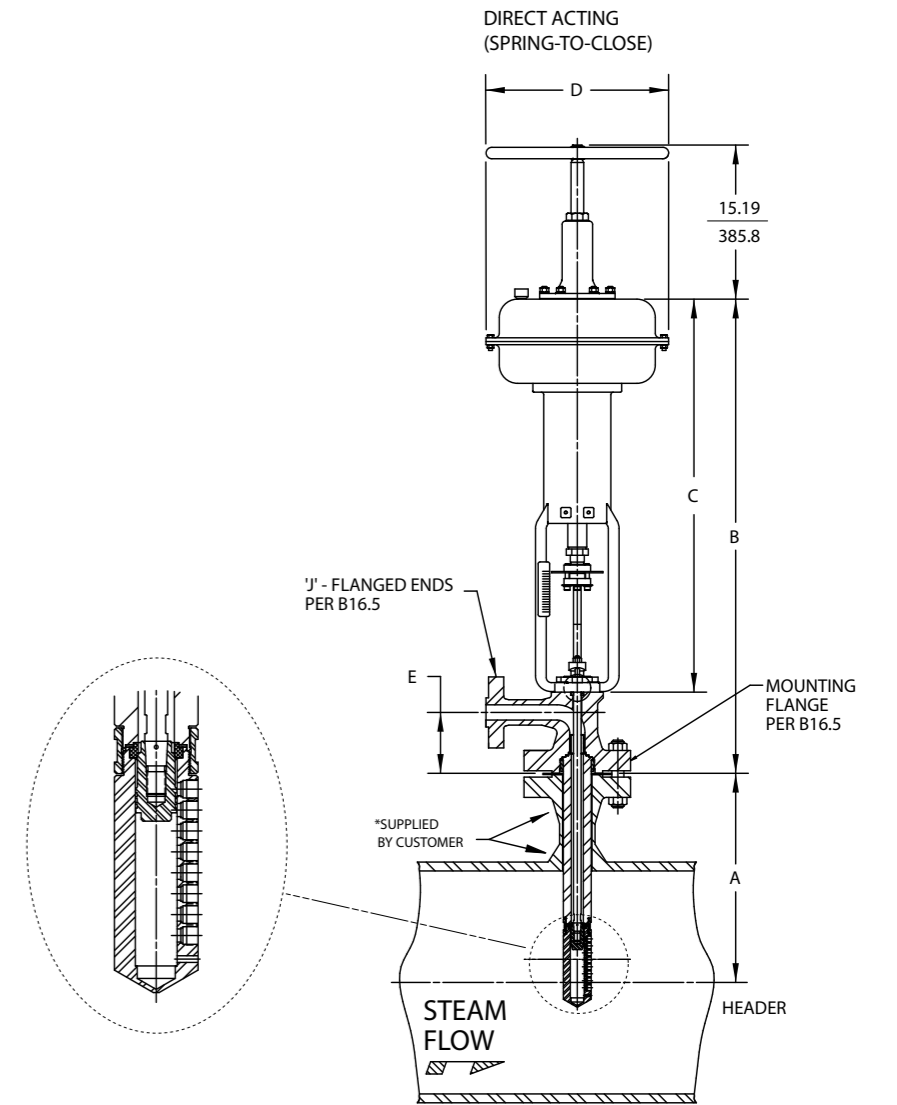
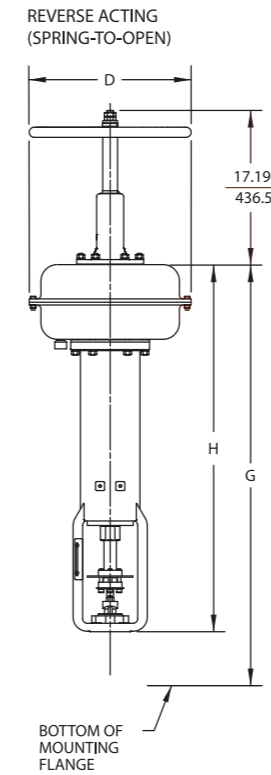
- If the difference between the cooling medium and the header vapor temperature is greater than 450°F (250°C), and if the main header wall thickness is greater than .5" (12mm), a thermal liner is recommended.
- For applications where unfiltered cooling medium is used, a 30 mesh strainer is recommended for installation upstream of the cooling medium inlet.

TYPICAL INFORMATION REQUIRED TO SIZE:

- Process steam flow rates
- Process steam pressure
- Process steam temperature (superheated)
- Desired process steam temperature (desuperheated)
- Available cooling water pressure
- Available cooling water temperature
- Process steam line size and schedule



DIMENSIONS



3" (80MM)

MOUNTING FLANGE SIZE

MAIN HEADER SIZE	A
6" (150mm)	12.06 306
8" (200mm)	13.06 332
10" (250mm)	14.12 358
12" (300mm)	15.12 384
14" (350mm)	15.75 400
16" (400mm)	16.75 425.4
18" (450mm)	17.5 451
20" (500mm)	18.75 477
22" (550mm)	19.75 502
24" (600mm)	20.75 527
30" (750mm)	23.63 600

3" (80MM) MODEL 700 CLASS 150 THROUGH 1500

ACTUATOR SIZE	DIMENSIONS							
	B	C	D	E	F	G	H	J FLANGE
160	39.91 998.5	31.31 795	18.00 457	6 152	9 229	39.31 998	32.38 822	1.5 40
160L	40.37 1025.4	39.75 1010	18.00 457	6 152	9 229	47.75 1213	40.81 1037	1.5 40

3" (80MM) MODEL 700 CLASS 2500

ACTUATOR SIZE	DIMENSIONS							
	B	C	D	E	F	G	H	J FLANGE
160	40.31 10245	31.31 795	18.00 457	7 178	9.5 241	41.37 1051	32.38 822	1.5 40
160L	41.37 1051	39.75 1010	18.00 457	7 178	9.5 241	49.81 1265	40.81 1037	1.5 40





| SPEED
| EXCELLENCE
| PARTNERSHIP

MNSD-V & MNSD-U

MULTIPLE NOZZLE SPRAY
DESUPERHEATER

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Celeros Flow Technology reserves the right to incorporate our latest design and material changes without notice or obligation. Design features, materials of construction, and dimensional data, as described in this bulletin, are provided for your information only and should not be relied upon unless confirmed in writing. Please contact your local sales representative for product availability in your region. For more information, visit www.celerosft.com.

CV_MNSD-Desuperheater_419_PB_A4_ Version 01/2021 Issued 02/2021
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SEVERE DUTY (SD) CONTROL VALVES

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Copes-Vulcan has been providing control valves and desuperheaters for the power, process and nuclear industries since 1903. Copes-Vulcan provides a wide range of valves for the control of pressure, temperature and flow-induced noise in all types of power plants. Products include severe service and general service control valves, variable orifice desuperheaters, Raven™, trim and steam-conditioning valves and nuclear control valves, as well as custom designed specialty valves. Copes-Vulcan is recognized worldwide as a leader in valves for severe and critical service applications. Our strength lies in our ability to provide innovative valve solutions for our customers' application needs.



SD SEVERE DUTY CONTROL VALVES

The SD-Severe Duty valve is Celeros's premium severe duty and critical service control valve design. The SD-Severe Duty line is the next generation of control valves designed specifically for severe duty applications. It is the preferred style of valve for applications such as pump recirculation, feedwater control and feedwater start-up, flashing or cavitating service, critical pressure drop gas and steam service, and any potentially noisy or vibration-prone service. It is also widely used for nuclear "N" stamp and seismic applications.

The SD-Severe Duty line incorporates a number of improvements such as:

Quick disconnect between valve stem and actuator yoke on most models that greatly simplifies service and inspection.

An extensive array of standard trims is available including many previously offered only as custom designs.

Shorter lead times/quicker delivery of both entire valve assemblies and replacement parts.

Improvements such as these, coupled with Celeros's innovative yet sound engineering practices, and a reputation for building the best control valves possible, assures that the SD-Severe Duty line is destined to become the new industry standard for severe duty and critical service applications.



For applications requiring pressure classes of 600 and below refer to Copes-Vulcan's GS Series valves.

CAN BE EQUALLY EMPLOYED AS A TURBINE BYPASS VALVE OR STEAM LETDOWN STATION.

- Repeatable class V tight shutoff
- High pressure balanced
- Full plug guiding with anti-rotation
- Steam atomisation of the cooling water
- Low coolant pressure required
- High water capacity for large cooling duties
- High turndown ratio for both steam and water
- Noise attenuating trim options
 - Single stage HUSH
 - Multi stage HUSH
 - RAVEN
- Extremely flexible
 - Flanged or butt weld connections
 - ANSI 150 - 4500, standard, intermediate and split classes
 - Minimum straight line lengths required
- Low maintenance
- 'Quick-Change' trim design no special tools

The DSCV-SA (Direct Steam Converting Valve - Steam Atomization) from Celeros is designed for unprecedented operational reliability and eliminates potential risks associated with substandard designs during plant start-up, shutdown and turbine trips.

As a result, the DSCV-SA is at the forefront of modern thermodynamic engineering in steam conditioning.

Key to the DSCV-SA's performance are a number of unique technical innovations developed by Celeros following extensive consultation with customers in the power generation sector.

SD Series valves can be fitted with an extensive array of standard and high performance trims to meet most severe duty/critical service requirements. Copes-Vulcan specialty trims such as Raven™, Hush™, Soft-Seated Hush, Tandem and GAD™ are readily available to meet the most severe applications. Additionally, custom engineered trims are supplied by Celeros as required. All trims are of quick change design to assure ease of maintenance. Most are fully interchangeable between like sizes to ensure maximum flexibility and reduced inventory requirements.

The SD-style design is in accordance with ASME B16.1, B16.5, B16.11, B16.25, B16.34 and, when required, will comply with standards such as CAN Z299.2, .3 and .4, ASME SEC.I, ASME SEC.III, B31.1, PED-"CE", 'N' & 'NPT', 97/23/EC-PED-CE and is also ISO-9001 certified.



TYPICAL PRODUCT APPLICATIONS

Feedwater Control



Condensate to Deaerator

Superheater Spray Control

Aux. Steam to Deaerator



Reheater Tank Drain to Condenser

Deaerator Water Level

Main Control



Boiler Water Tank to Condenser

Drum Level Control

Sootblower PRV



Continuous Blowdown

Boiler Feedpump

Min Flow Recirculation



HP Feedwater Start-Up Level Control Valve

RAVEN™ TRIM

Raven trim incorporates a unique advanced design that is superb at limiting flowing velocities to low levels resulting in valves providing service that is quiet, non-cavitating and non-erosive.

Raven's low velocities are achieved through the use of trim cage made by bonding together a series of individual discs. Each disc has a pattern of carefully controlled orifices and channels with a multitude of sharp turns etched into its surface. As the trim's plug travels within the cage the fluid is throttled and forced to travel an extremely torturous path with each turn effecting a stage of pressure drop.

The combined effect of numerous narrow flow channels, each with many sharp turns and a continually expanding flow path, removes kinetic energy from the fluid while gradually lowering its pressure. In doing so, abrupt velocity increases that are the source of noise are avoided. The additional benefit for liquid flow is the elimination of cavitation and the damage it can do to a valve, its trim and the downstream piping.

By its very design Raven trim allows for many more stages of drop than conventional torturous path trims.

Superior to other velocity control trims, Raven, through the use of a consistent narrow wall design, typically is more efficient at passing flow or allowing more turns or stages of drop in a given valve size.



ACTUAL GASEOUS FLOW THROUGH RAVEN TRIM.

Most Raven trims contain multiple relief points in the flow path as a standard feature. These relief points allow entrained debris to clear the main fluid flow, or in the case of significant path blockage, they provide an effective bypass route for the fluid.

With the benefits of the relief points, the actual fluid flow streams still remain virtually separate or discrete from each other for best velocity control.

By manufacturing the flow channels to extremely close tolerances, Raven's calculated or predicted versus actual pressure drops are significantly more accurate than competitors. Hence, velocities are more uniform throughout the entire trim, further guarding against noise, erosion and cavitation.

Ultimately, each Raven trim is specifically designed to provide the finest severe duty valve service by Reducing and Attenuating Velocity, Erosion and Noise.



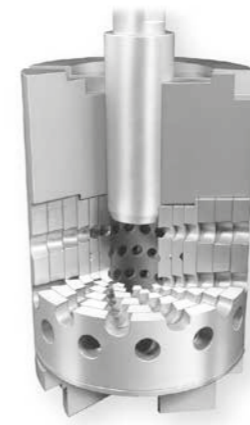
PROVEN SUPERIOR TECHNOLOGY

Note the highly visible attachment phenomenon wherein the flow stream hugs or clings to each obstruction in its path, effectively taking the path of least resistance. Also, despite multiple relief points in the flow path it can be clearly seen that the fluid does not recombine with the Raven trim, rather the flow streams remain virtually separate or discrete from each other for best velocity control.

HUSH® TRIM

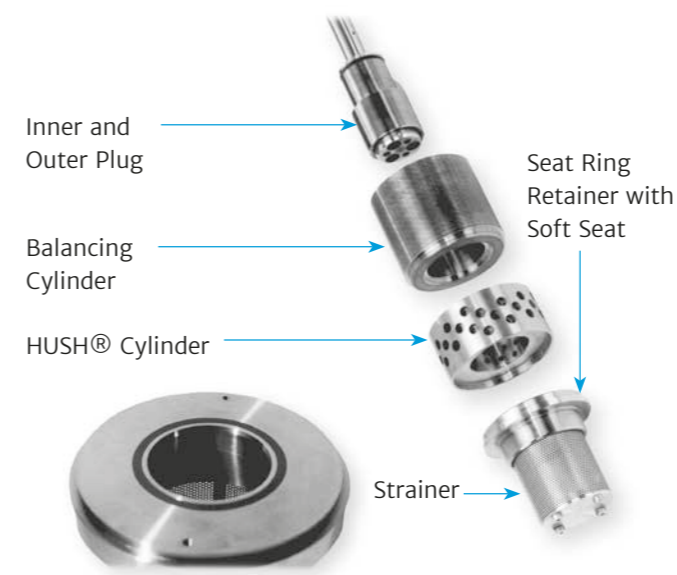
HUSH® Trim is an advanced concept in control valve trim for high pressure-drop liquid, gas and steam applications.

It is a cage guided type trim that provides excellent control for compressible and noncompressible fluid applications by directing the flow through a series of staged pressure drops. This unique trim eliminates cavitation in liquid flow and provides multiple pressure breakdown for noise attenuation in critical pressure drop compressible fluid applications.



EXCLUSIVE SOFT SEATED HUSH™ TRIM

Soft Seated HUSH Trim is designed for new or replacement trim in Copes-Vulcan valves as well as valves of other manufacturers. Any liquid control valve taking a pressure drop up to 5000 psi (34450 kPa) that spends more than 90% of the time in the closed position must use Soft Seated HUSH Trim to maintain zero leakage. Refer to Bulletin 142 for detailed information.



GAD™ TRIM

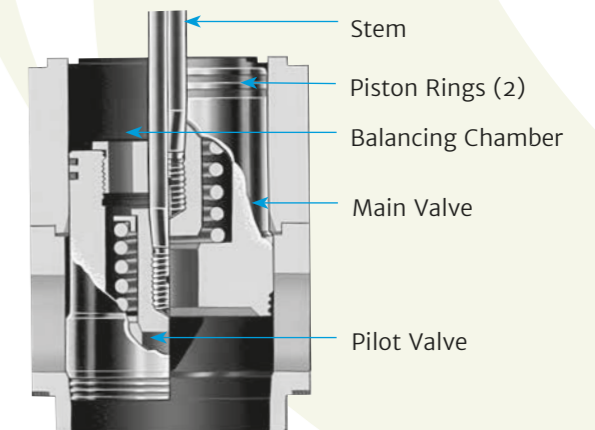
The Port Throttling GAD trim was developed to meet the rigorous requirements of feedwater startup control. Designed to give optimum flexibility in power operated control valves, the trim is available in double seat, balanced single seat, and tandem versions.

The GAD trim is equally suitable for use with steam and many other fluids. It has been successfully used on high pressure water applications involving pressure of up to 5075 psi (34970 kPa) and pressure differential of up to 3625 psi (24980 kPa).





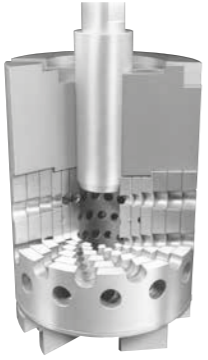

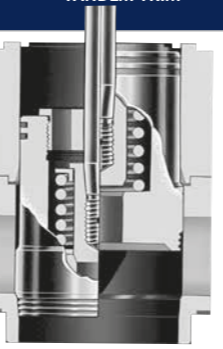
TANDEM TRIM

The Tandem Trim is designed primarily for high pressure differential applications where tight shutoff is essential. Such applications include steam and water pressure reduction, steam throttling to atmosphere or to a condenser, isolation, supercritical boiler startup and a variety of other uses in steam and water control systems. Refer to Bulletin 109 for detailed information.



TRIM TYPES

A wide variety of trims is available for SD-Severe Duty Control Valves. They are designed to match virtually any severe duty/critical service operational requirement. All SD trims feature a quick-change design to reduce downtime for inspection, maintenance or change out, and most are cage guided, further ensuring smooth, accurate operation. The majority of the trim line is interchangeable between like sizes, and many reduced trims are also available as standard.

TRIM TYPES	RAVEN	HUSH™ TRIM	SOFT SEATED HUSH™ TRIM	TANDEM TRIM
				
DESCRIPTION/ APPLICATION	Raven is Copes-Vulcan's top-of-the-line high performance specialty trim that offers a proven solution for those severe service applications where a true velocity control trim is the best or possibly the only answer. By limiting the fluid velocities inside the valve, Raven's stacked disc design precludes problems typically associated with high velocity such as erosion, noise, vibration and poor control. Every Raven trim is custom designed to meet the needs of the toughest liquid, steam and gas services in the power and process industries.	HUSH Trim (multiple stage) is a high performance specialty trim that is cage guided and provides excellent control for both compressible and noncompressible fluid applications. By directing the flow through a series of staged pressure drops, this unique trim eliminates cavitation in liquid flow and provides multiple pressure breakdown for noise attenuation in critical pressure drop compressible fluid application. It is designed for all valve sizes.	Soft seated Hush Trim (double plug) is a high performance specialty trim that is cage guided and designed to provide and maintain extremely tight shutoff for high pressure differential liquid applications. Typically applied to operating conditions that exhibit pressure drops in excess of 1800 psig (12400 kPag) that are to remain closed more than 25% of the time. It is the ideal trim for applications such as boiler feed pump recirculation, spray block valves and spray control valves.	Tandem Trim is a high performance specialty trim that is a cage guided, uniquely balanced port throttling trim designed to solve difficult high temperature, high pressure differential applications that would require oversized, expensive actuators if more standard trims were utilized. Due to the relatively small pilot plug designed into the tandem trim, tight shutoff of up to Class V can easily be achieved with a moderately sized, economically priced actuator. It is available for valves 4" (100mm) and larger.
STANDARD FCI 70-2/ANSI RATED SEAT LEAKAGE	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional *Class VI optional	Class VI standard	Class IV standard Class V optional
STANDARD TRIM CHARACTERISTIC	Linear standard, Specials optional	Linear standard, Specials optional	Linear standard, Specials optional	Special
TYPICAL FLOW DIRECTION	Under the seat Over the seat	Under the seat	Over the seat	Over the seat Under the seat
MAXIMUM RANGEABILITY	200:1 Or greater as required	35-50:1	Under the seat	25-50:1

* Class VI requires use of soft seat.


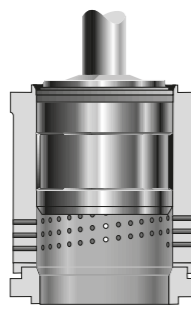
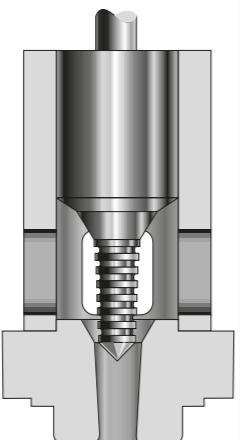

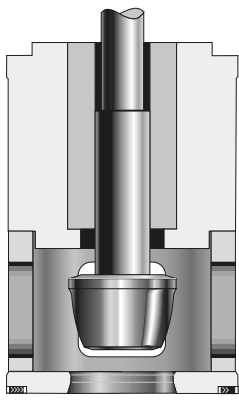
The trims shown in this bulletin represent the more common selections available. Additional standard, special and custom engineered trims can be supplied as required.

Standard stocked trim materials are 300 series and 400 series stainless steel. Other materials are available on special order.

GAD TRIM	UNBALANCED SINGLE SEAT PLUG THROTTLING	UNBALANCED SINGLE SEAT PORT THROTTLING	BALANCED SINGLE SEAT PORT THROTTLING	BALANCED SINGLE SEAT PORT THROTTLING (HI-TEMP)
				
GAD Trim is a high performance specialty trim that is cage guided and engineered to meet the rigorous requirements of feedwater control and feedwater startup control. Designed to give optimum flexibility in automated control valves, this trim is available in double seat, balanced single seat, tandem plug and one-stage Hush versions. GAD Trim is equally suitable for use with steam and many other fluids. It has been successfully used on high pressure water applications involving pressure of 5075 psi (34970 kPa) and pressure differential of up to 3625 psi (24980 kPa). It is available for valves 2" (50mm) and larger.	This trim style is a general purpose cage guided trim for on/off or modulating control. It is designed for low to moderate pressure drop applications. The solid plug has a contour on its lower end that provides varying flow area with lift, thus regulating the flow. It can be used with a wide variety of non-abrasive/non-adhesive compressible and noncompressible fluids. Standard trim for valve sizes 1.5" (40mm) and smaller.	This trim style is a general service cage guided trim for on/off or modulating control where moderate flow rates exist along with low differential pressures. The unbalanced single seat plug modulates flow by uncovering ports in the cage. The cage porting produces the pressure drop or flow control. This trim can be used in most non-abrasive/non-adhesive compressible and noncompressible fluids.	This trim style is a general purpose cage guided trim for on/off or modulating control suitable for use in most non-abrasive/non-adhesive compressible and noncompressible fluid services. The balanced plug design reduces actuator force requirements thus permitting the use of smaller, less expensive actuators while maintaining the tight shutoff capability. It is designed for valves 2" (50mm) and larger and is a standard offering when the service temperature does not exceed the 400°-500°F (204°-260°C) range, relative to pressure.	This general purpose cage guided trim is virtually identical in all respects to the balanced single seat port throttling trim except that piston rings are used in lieu of the elastomeric seal on the trim's plug. While the piston rings do limit the leakage rate to ANSI Class III, this trim is a viable option when a balanced plug is desirable and when temperatures of the fluid exceed 500°F (260°C). It is for valve sizes 2" (50mm) and larger.
Class III-IV Depending upon design selected	Class IV standard Class V optional	Class IV standard Class V optional	Class IV standard Class V optional *Class VI optional	Class IV standard
Modified parabolic, linear, equal percentage. All available as standard	Modified parabolic, linear, equal percentage.	Modified parabolic, linear, equal percentage	Modified parabolic, linear, equal percentage	Modified parabolic, linear, equal percentage
Over the seat	Under the seat	Under the seat	Over the seat	Over the seat
50:1	50:1	35-50:1	35-50:1	35-50:1

* Class VI requires use of soft seat.

TRIM TYPES (CONT.)

TRIM TYPES	ONE STAGE HUSH	CASCADE	CAV B9®	TOP GUIDED
				
DESCRIPTION/ APPLICATION	One Stage Hush trim is a specialty trim designed to reduce noise associated with compressible fluids as well as to reduce the undesirable effects of flashing and cavitation that would occur with most single pressure drop trims. The Hush cage consists of a single cylinder with a large number of radially drilled orifices. The fluid exits the orifices as low energy jets resulting in significant reductions in noise or erosion. Although numerous standard designs are available, One Stage Hush is often custom engineered to provide various flow characteristics or optimal performance under specific operating conditions.	This trim style is a cage guided plug throttling trim designed primarily for high pressure drop water applications where cavitation, vibration and excessive wear occur with conventional trims. The tapered plug fits into a cage and seat with a matching taper, thus small changes in flow area occur with respect to plug travel resulting in extremely high rangeability. The labyrinth grooves machined into the plug's taper create a series of orifices which reduces the total pressure drop in a series of stages. It is especially suited to applications where small flow rates must be controlled accurately.	CAV B9 trim can be applied in liquid service where low level cavitation is evident. By utilizing flow over the seat, the radially step-drilled cage design reduces the effects of cavitation along with the associated noise and erosion problems by forcing the cavitation to occur in the center of the cage, away from all metal surfaces. In instances where flashing conditions are experienced, flow under the seat is employed with the multitude of small ports reducing both noise and erosion. Although numerous standard designs are available, the trim can be custom designed to provide various flow characteristics or optimal performance under specific flow conditions. It is available for valves 2" (50mm) and larger.	This non-cage guided trim is designed for use with a wide variety of process applications involving corrosive, erosive and viscous line fluids and many steam and water applications. It is ideal for control applications where a maximum of free flow area is desired. The trim is unbalanced, single seat, plug throttling with the plug guided by a large diameter metal or teflon insert along the lower stem area. This guiding method ensures quiet, stable, vibration free operation with pressure drops limited to 600 psi (4130 kPa) under operating conditions. Pressure drop should also be limited to avoid cavitation or flashing. It is for valve sizes 4" (100mm) and smaller.
STANDARD FCI 70-2/ANSI RATED SEAT LEAKAGE	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional	Class IV standard Class V optional *Class VI optional	Class IV standard Class V optional *Class VI optional
STANDARD TRIM CHARACTERISTIC	Linear standard Specials optional	Special	Linear standard Specials optional	Equal percentage, linear
TYPICAL FLOW DIRECTION	Under the seat Over the seat	Under the seat	Under the seat (for flashing) Over the seat (for cavitation)	Under the seat
MAXIMUM RANGEABILITY	35-100:1	200:1	35-100:1	25:1

* Class VI requires use of soft seat.

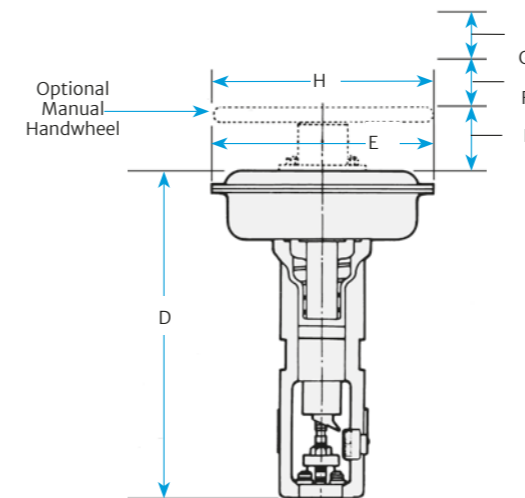
Actuators

MODEL 1000 ACTUATORS PNEUMATIC DIAPHRAGM — SPRING OPPOSED

Designed specifically for severe duty service, model 1000 actuators can be used in any application where shock and/or vibration are anticipated, or where seismic analysis is required. They are available with 60, 100, 160 260 and 400 in2 (390, 645, 1030, 1680 and 2580 cm2) of effective diaphragm area in both the direct and reverse acting mode. All models are available with manually operated override wheels.

To illustrate how the actuator transmits force, the shaded areas shown in the diagrams below will move during the direct and reverse acting modes. (Note the position of the diaphragm plate in each case.)

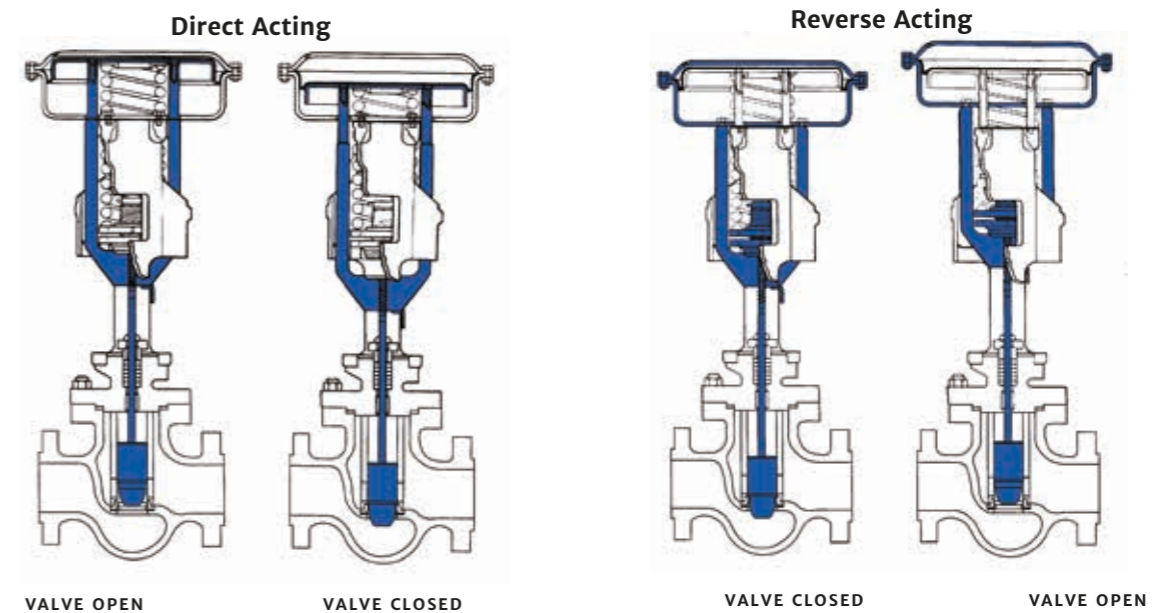
Conversion of the actuator from direct to reverse acting is accomplished simply by unfastening the diaphragm base from the frame and rotating it 90° until it is positioned above the threaded holes in the yoke. The actuator can be returned to the direct acting mode by reversing the procedure. Stem changes may be required.



Model 1000 Actuators Dimensions

ACTUATOR MODEL	D	E	F*	G**	H	I
1000-60	17.25 438	11.50 292	1.50 38	8.50 216	10.00 254	7.75 197
1000-100	25.56 649	15.12 383	3.50 89	11.25 286	18.00 457	7.75 197
1000-160	30.88 784	18.00 457	3.50 89	11.25 286	18.00 457	7.75 197
1000-400	47.25 1200	27.50 698	4.50 114	13.00 330	20.00 508	20.75 527

*Clearance required for reverse action
** Clearance required for actuator removal



VALVE OPEN VALVE CLOSED VALVE CLOSED VALVE OPEN

Actuators

THE SD-700 VALVE ASSEMBLY

The SD-700 valve assembly is comprised of an SD valve body, bonnet and trim with the 700 series actuator. In those instances where an SD valve (i.e. body, bonnet, trim, etc.) is necessary, but the use of the heavy duty, 1000 style actuator is not needed, the more economical 700 style operator can be utilized.

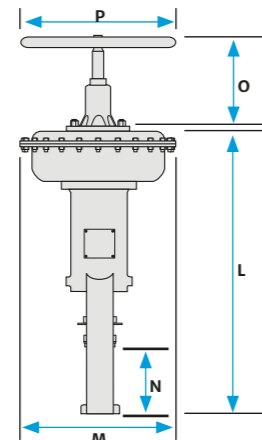
Series 700 actuators are pneumatic diaphragm operators that have spring return in both direct and reverse acting styles, offering fail-open and fail-closed modes respectively. The pressed steel diaphragm case construction along with the nylon reinforced Buna N rubber diaphragm permits a maximum allowable air supply pressure of 80 psig (550 kPag). This pre-formed diaphragm provides a constant effective area throughout the full extent of travel. With effective diaphragm areas ranging from 60-160 in2 (385-1030 cm2), Series 700 actuators can provide the necessary stem force to meet many operating requirements.

SERIES 700 ACTUATOR (SHOWN WITH OPTIONAL TOP-MOUNTED HANDWHEEL)

Reverse Acting (Spring-to-Close)

ACTUATOR SIZE	60	100	160	160L
L	21.09 536	28.06 713	32.38 822	40.81 1037
M	11.50 292	15.12 384	18.00 457	18.00 457
N*	6.50 165	6.50 165	6.25 159	6.38 162
O	6.72 171	11.38 289	11.56 294	17.19 437
P	10.00 254	18.00 457	18.00 457	18.00 457

Inches
millimeters *Distance to actuator stem connection



Direct Acting (Spring-to-Open)

ACTUATOR SIZE	60	100	160	160L
L	20.50 521	28.12 714	32.31 821	39.75 1010
M	11.50 292	15.12 384	18.00 457	18.00 457
N*	7.56 192	9.38 238	9.31 236	11.81 300
O	5.81 148	9.44 240	9.50 241	15.19 386
P	10.00 254	18.00 457	18.00 457	18.00 457

Inches
millimeters



MODEL 1000-260 ACTUATOR

This actuator provides 260 in2 (1680cm2) of effective diaphragm area and is offered with either direct or reverse action. As a variation of the 1000 style, the 1000-260 actuator has a number of features.

- Heavy duty, one-piece frame
- Large assortment of springs to cover a wide range of applications
- High thrust and long travel capability
- Optional handwheel activated hydraulic override units

MODEL 200 PISTON ACTUATORS

When necessitated by travel or thrust requirements, model 200 pneumatic actuators are supplied.

Contact Copes-Vulcan for details.

SERIES 300 MOTOR OPERATED

Motor operated actuators are available to meet specified operations. Contact Copes-Vulcan for details.

SIDE MOUNTED HANDWHEEL

Side mounted handwheels are available for the Series 700 actuator. Contact Copes-Vulcan for details and dimensions.



SERIES 800 MANUAL OPERATED ACTUATORS

Copes-Vulcan offers handwheel operated actuators for applications where an automated valve is not required or where compressed air service is unavailable. Series 800 actuators are suitable for both on/off and modulating service

ACCESSORIES

Typical valve-mounted accessories such as positioners, air filter regulators, solenoids, and limit switches are available as standard offerings.

Dimensions

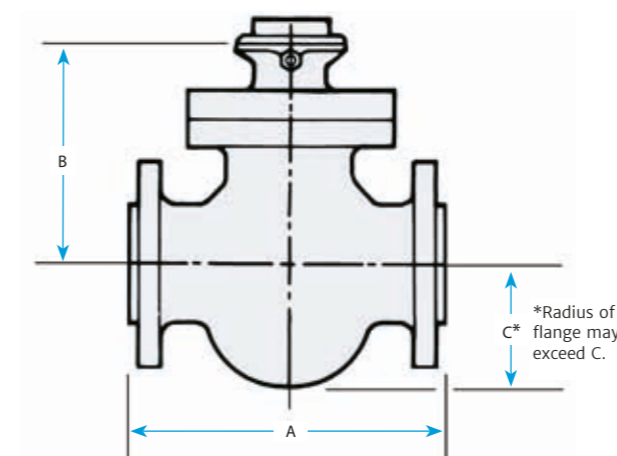
SD Valve Body/Bonnet Assembly

FLANGED ENDS

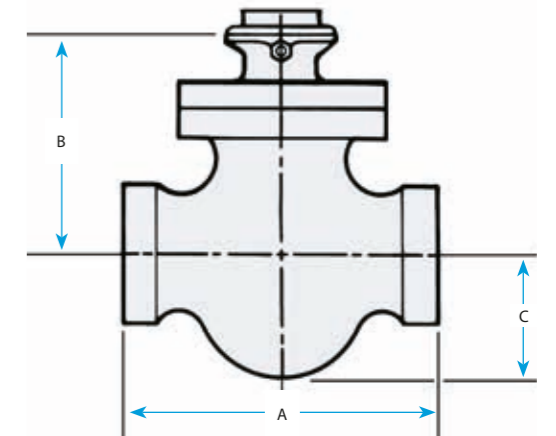
VALVE SIZE	CLASS 150			CLASS 300			CLASS 400			CLASS 600			CLASS 900			CLASS 1500			CLASS 2500		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
.75" 20mm	7.25 184	7.00 178	2.56 65	7.62 194	7.00 178	2.56 65	8.12 206	7.00 178	2.56 65	8.12 206	7.00 178	2.56 65	11.12 282	10.00 254	2.50 64	11.12 282	10.00 254	2.50 64	12.12 308	10.00 254	2.50 64
1" 25mm	7.25 184	7.00 182	2.56 65	7.75 197	7.00 178	2.56 65	8.25 210	7.00 178	2.56 65	8.25 210	7.00 178	2.56 65	11.50 292	10.00 254	2.75 70	11.50 292	10.00 254	2.75 70	12.50 318	10.00 254	2.75 70
1.5" 40mm	8.75 222	7.55 184	2.88 73	9.25 235	7.25 184	2.88 73	9.88 251	7.25 184	2.88 73	9.88 251	7.15 182	2.88 73	13.12 333	10.15 258	3.00 76	13.12 333	10.15 258	3.00 76	14.12 359	10.15 258	3.25 83
2" 50mm	10.00 254	7.34 186	3.50 89	10.50 267	7.34 186	3.50 89	11.25 286	7.34 186	3.50 89	11.25 286	7.34 186	3.50 89	14.75 375	10.15 258	3.75 95	14.75 375	10.15 258	3.75 95	15.75 400	10.15 258	3.88 99
2.5" 60mm	10.88 276	9.31 236	4.06 103	11.50 292	9.31 236	4.06 103	12.25 311	9.31 236	4.19 106	12.25 311	9.31 236	4.19 106	16.12 409	12.15 309	4.44 113	16.12 409	12.15 309	4.44 113	17.38 441	12.15 309	4.62 117
3" 75mm	11.75 298	9.72 247	4.44 113	12.50 318	9.72 247	4.44 113	13.25 337	9.72 247	4.50 114	13.25 337	9.72 247	4.50 114	17.38 441	12.47 317	4.56 116	17.38 441	12.47 317	4.56 116	18.12 460	12.47 317	4.81 122
4" 100mm	13.88 353	9.91 252	5.38 137	14.50 368	9.91 252	5.38 137	15.25 387	9.91 252	5.56 141	15.25 387	9.91 252	5.56 141	20.62 524	13.56 344	6.12 155	20.62 524	13.56 344	6.12 155	21.38 543	13.56 344	6.12 155
6" 150mm	17.75 451	12.16 309	7.69 195	18.62 473	12.16 309	7.69 195	19.50 495	12.16 309	7.88 200	19.50 495	12.16 309	7.88 200	23.62 600	14.81 376	8.12 206	23.62 600	14.81 376	8.12 206	27.25 692	14.81 376	8.94 227
8" 200mm	21.38 543	13.31 338	10.25 260	22.38 568	13.31 338	10.25 260	23.38 594	13.31 338	10.56 268	23.38 594	13.31 338	10.56 268	24.00 610	13.31 338	10.56 268	30.75 781	16.06 408	10.82 275	33.00 838	16.06 408	11.25 286
10" 250mm	29.38 746	19.00 482	13.00 330	30.75 781	19.00 482	13.00 330	31.75 806	19.00 482	13.00 330	31.75 806	19.00 482	13.00 330	32.50 826	19.00 482	13.00 330	34.00 864	22.06 560	13.00 330	42.00 1067	22.06 560	14.00 356
12" 300mm	35.25 895	23.06 586	15.00 381	36.75 933	23.06 586	15.00 381	37.75 959	23.06 586	15.19 386	37.75 959	23.06 586	15.19 386	38.50 978	23.06 586	15.10 386	40.00 1016	26.06 662	15.56 395	48.00 1219	26.06 662	15.31 389

Inches
millimeters

FLANGED ENDS



WELD ENDS AND THREADED ENDS



Note: The SD-style bonnet is easily adaptable to all sizes and types of pneumatic, electric and hydraulic actuators.

WELD ENDS AND THREADED ENDS (FOR 2" (50MM) AND SMALLER)

VALVE SIZE	CLASS 150			CLASS 300			CLASS 400			CLASS 600			CLASS 900			CLASS 1500			CLASS 2500		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
.75" 20mm	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	10.00 254	2.50 64	7.75 197	10.00 254	2.50 64	8.50 216	10.00 254	2.50 64
1" 25mm	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	7.00 178	2.56 65	7.75 197	10.00 254	2.75 70	7.75 197	10.00 254	2.75 70	8.50 216	10.00 254	2.75 70
1.5" 40mm	9.25 235	7.25 184	2.88 73	9.25 235	7.25 184	2.88 73	9.25 235	7.25 184	2.88 73	9.25 235	7.25 184	2.88 73	9.25 235	10.15 258	3.00 76	9.25 235	10.15 258	3.00 76	10.25 260	10.15 258	3.25 83
2" 50mm	10.50 267	7.34 186	3.50 89	10.50 267	7.34 186	3.50 89	10.50 267	7.34 186	3.56 90	10.50 267	7.34 186	3.56 90	11.50 292	10.15 258	3.75 95	11.50 292	10.15 258	3.75 95	12.50 318	10.15 258	3.88 99
2.5" 60mm	11.50 292	9.31 236	4.06 103	11.50 292	9.31 236	4.06 103	11.50 292	9.31 236	4.19 106	11.50 292	9.31 236	4.19 106	11.50 292	12.15 309	4.44 113	11.50 292	12.15 309	4.44 113	12.50 318	12.15 309	4.62 117
3" 75mm	12.50 318	9.72 247	4.44 113	12.50 318	9.72 247	4.44 113	12.50 318	9.72 247	4.50 114	12.50 318	9.72 247	4.50 114	12.50 318	12.47 317	4.56 116	12.50 318	12.47 317	4.56 116	15.00 381	12.47 317	5.56 141
4" 100mm	14.50 368	9.91 252	5.38 137	14.50 368	9.91 252	5.38 137	14.50 368	9.91 252	5.56 141	14.50 368	9.91 252	5.56 141	14.50 368	13.56 344	6.12 155	14.50 368	13.56 344	6.12 155	16.00 406	13.56 344	6.50 165
6" 150mm	20.00 508	12.16 309	7.69 195	20.00 508	12.16 309	7.69 195	20.00 508	12.16 309	7.88 200	20.00 508	12.16 309	7.88 200	20.00 508	14.81 376	8.12 206	22.00 559	14.81 376	8.12 206	24.00 610	14.81 376	9.44 240
8" 200mm	24.00 610	13.31 338	10.25 260	24.00 610	13.31 338	10.25 260	24.00 610	13.31 338	10.56 260	24.00 610	13.31 338	10.56 260	24.00 610	16.06 408	10.82 275	27.00 686	16.06 408	11.25 286	30.00 762	16.06 408	11.94 303
10" 250mm	30.00 762	19.00 482	13.00 330	30.00 762	19.00 482	13.00 330	30.00 762	19.00 482	13.00 330	30.00 762	19.00 482	13.00 330	30.00 762	22.06 560	13.00 330	40.00 1016	22.06 560	14.00 356	40.00 1016	22.06 560	14.88 378
12" 300mm	36.00 914	23.06 586	15.00 381	36.00 914	23.06 586	15.00 381	36.00 914	23.06 586	15.19 386	36.00 914	23.06 586	15.19 386	36.00 914	26.06 662	15.56 395	48.00 1219	26.06 662	15.31 389	44.00 1118	26.06 662	16.38 416

Inches
millimeters



SEVERE DUTY (SD) CONTROL VALVES

- | SPEED
- | EXCELLENCE
- | PARTNERSHIP

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