FLOWSERVE™

Valtek MegaStream

Control Valves

Valtek MegaStream

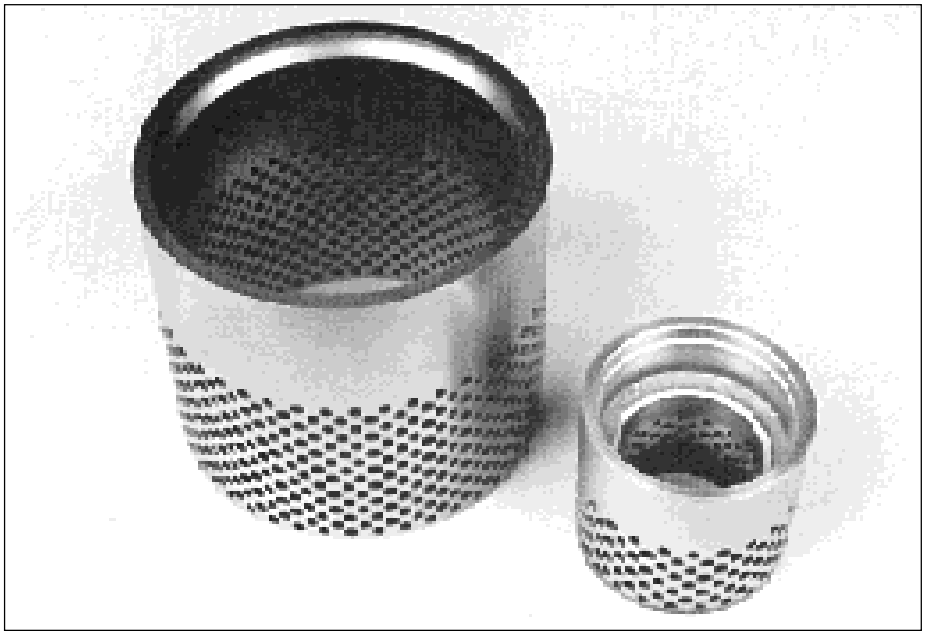


Figure 1: MegaStream Trim

The Valtek® MegaStream™ valve trim effectively reduces gaseous noise in automatic control valves. MegaStream trim is available in two styles: the economical, interchangeable one and the two-stage retainer for noise reduction up to 15 dBA, and the multistage retainer for noise reduction approaching 30 dBA.

The MegaStream concept and principle, explained in detail on the following pages, are the result of extensive research and engineering study. These principles have been incorporated into the trim design, allowing MegaStream to be used in a wide variety of applications: chemical/petroleum plants, refineries, power plants, process industries, nuclear industries, and wherever a highly successful noise reduction valve is required.

Some of the built-in design features of MegaStream noise control valves are:

1. Staged pressure reduction through a series of carefully designed drilled-hole cylinders called “stages.”
2. Velocity control.
3. Turbulence control.
4. Acoustic impedance.
5. Generous plug-to-inner-stage clearance which avoids galling and sticking.

MegaStream’s design simplicity has reduced the cost of noise reduction valves by using many standard parts and by avoiding unnecessary hardening of inner surfaces.

The concepts of noise generation have been explored in detail at the Valtek gaseous noise test facility. With advanced computer programs, the anticipated noise generated by any control valve can be easily determined.

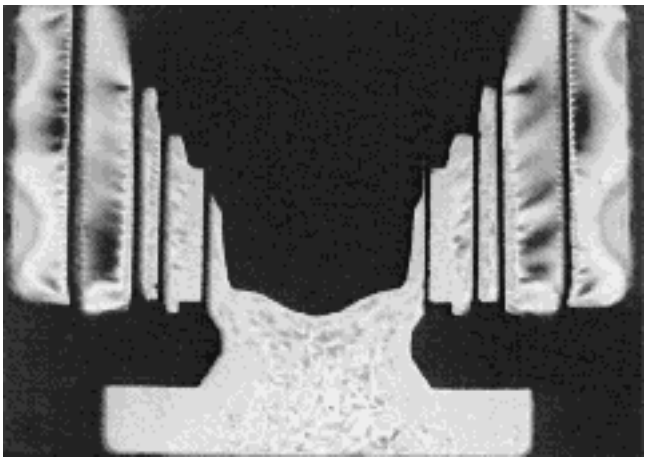


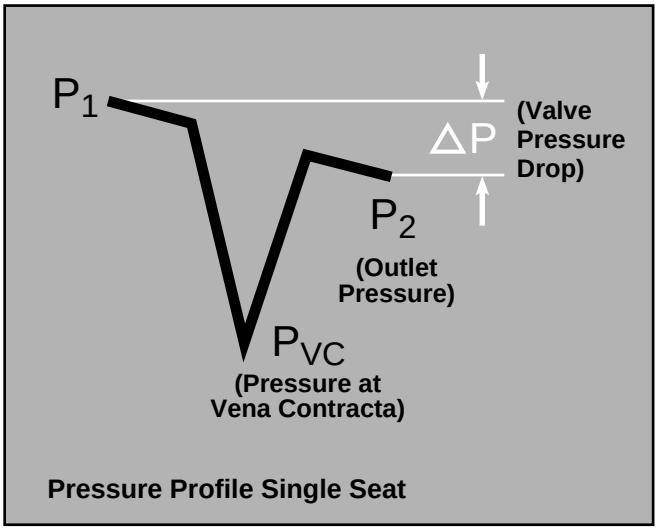
Figure 2: MegaStream Polariscope Display

A basic principle of MegaStream noise control valves is the restructuring of noise generating turbulence. This principle is clearly illustrated in this polariscope display (Figure 2) of MegaStream trim with birefringent fluid. Note the turbulence generated in the fluid as it passes through the seat and how this turbulence decreases as the flow continues through each successive stage.

Valtek MegaStream

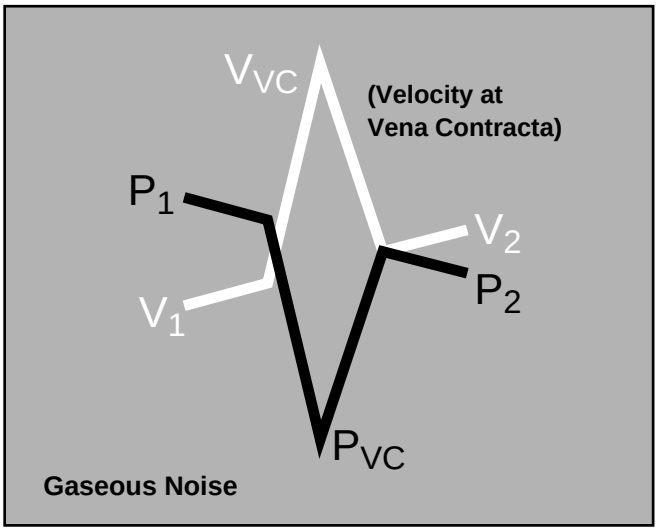
The Basic Principles

In conventional single-throttling-point globe control valves, a vena contracta (point of greatest flow constriction) occurs immediately downstream of the throttling point. A simplified pressure profile of the fluid as it passes through the valve shows slight pressure losses in the inlet and outlet passages, and a substantial reduction of pressure at the vena contracta. Note that the overall pressure drop between the inlet and the outlet does not reveal how far the pressure may have dropped within the valve itself.



The Problem with Gases

The problem becomes apparent by superimposing a velocity profile on the pressure profile, discussed above. For single-throttling-point control valves, with the sharp pressure reduction, the velocity will be greatly increased at the vena contracta. While considerable noise can be generated as velocities in the valve approach sonic levels, substantial noise can be generated even where inlet and outlet velocities are significantly less than sonic.



The Solution

The solution to the problem is to reduce the pressure from inlet to outlet gradually without allowing a sharp pressure drop at the vena contracta. Thus, gaseous velocities are maintained at reasonable values throughout the valve and high noise levels are simply not generated. Also, by breaking the flow into many small flow streams, turbulent energy is reduced and dissipated. In addition, noise generated upstream is substantially blocked by successive stages.

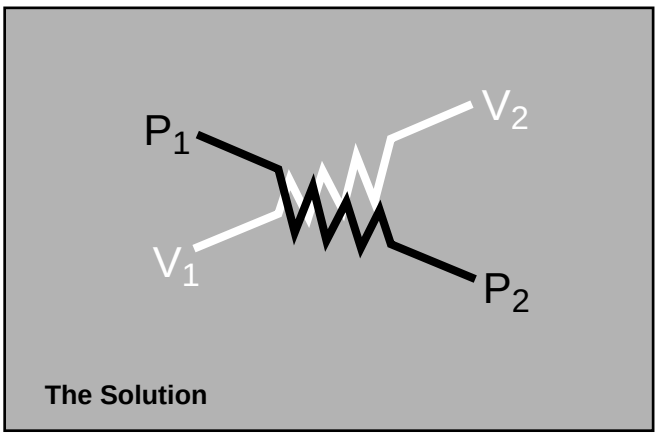


Figure 3: Pressure / Velocity Graphs

Valtek MegaStream

MegaStream – The Effective Solution

Valtek MegaStream trim eliminates the problem of control valve noise by dealing effectively with gaseous pressure reduction, and by controlling turbulence carried into the downstream piping.

Pressure Reduction

The pressure drop in MegaStream trim is distributed so that it occurs not only at the throttling point between the plug and seat, but also at each stage, from the inside of the retainer to the outside. This pressure drop occurs largely as a result of the sudden expansions and contractions that take place as the flow passes through the MegaStream trim. Each stage is designed to take a small pressure drop, avoiding the high velocities present in single-throttling-point trims. This gradual pressure reduction is achieved by designing sufficient stages to keep the velocity low.

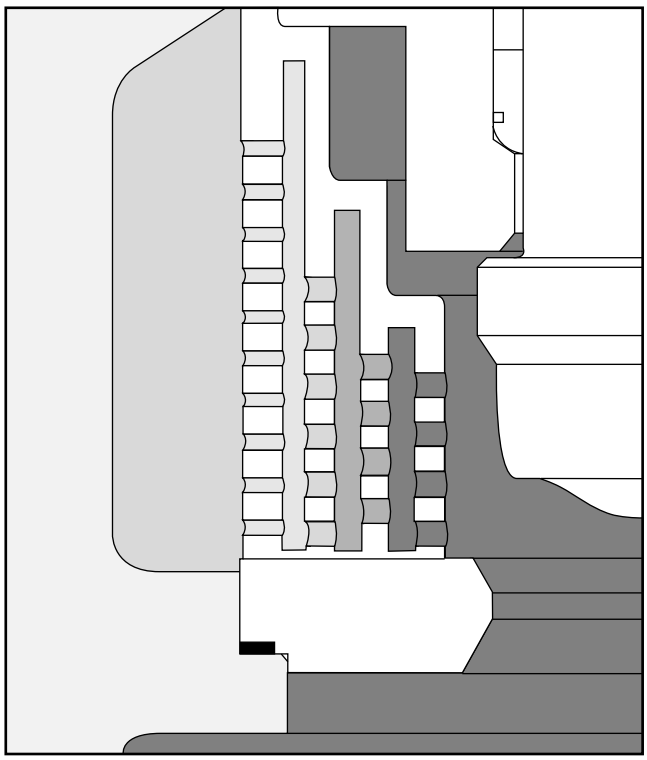


Figure 4: MegaStream Stages

Each retainer stage of MegaStream trim handles a portion of the pressure drop, significantly reducing the high velocity and the turbulence generated by the single throttling point.

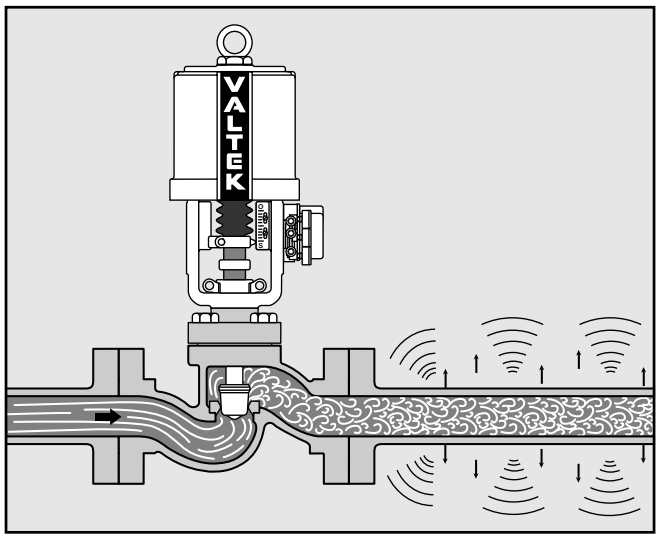


Figure 5: Downstream Piping Noise with Standard Valve

Turbulence Generation

Control valve noise is largely a result of turbulence generated within the valve. This turbulence is carried into the downstream piping where the localized pressure changes resulting from the turbulence vibrate the relatively thin pipe wall which radiates noise to the surroundings. Valtek MegaStream control valves are designed to control this turbulence. Each stage is designed with a large number of holes or orifices. Each successive stage has additional holes or orifices, permitting increased flow area to handle the increased gas volume resulting from the pressure drop.

The turbulence present in the fluid as it leaves the final stage of the MegaStream trim is limited by controlling the physical size of the individual fluid streams. The smaller fluid stream size exiting the final stage of the MegaStream trim limits the amount of turbulence energy present. Further, the smaller turbulent eddies are more easily dissipated. The result is a fluid stream leaving the valve that contains no large-scale turbulent eddies sufficient to cause substantial noise generation in the downstream piping. The stages also effectively limit much of the sound vibration generated at the throttling area. This attenuating effect is made possible by the acoustic impedance characteristics of the material and design, which provide resistance to further transmission of incident sound energy. The acoustic impedance described is a principal factor permitting the control of noise when the valve plug is throttled close to the seat.

Valtek MegaStream

Velocities

One of the fundamental design considerations with MegaStream control valves is maintaining reasonable and acceptable velocities at every point as the flow passes through the valve. This requires careful attention to flow areas and area ratios at the various stages in the retainer, as well as elsewhere in the valve.

With gases, it is commonly understood that as the velocity approaches the speed of sound the valve will be noisy. Control valve noise often becomes excessive for velocities much less than sonic. Valtek MegaStream valves are designed for an optimal maximum gas velocity of mach 0.33 at the valve outlet. The MegaStream design engineer carefully assesses velocities for the most critical flowing conditions at the following points (refer to Figure 6):

1. The inlet passageway to the valve.
2. The internal flow area of the MegaStream retainer at various plug positions.
3. The gallery flow area formed between the outside diameter of the retainer and the inside diameter of the valve body.
4. The valve outlet passage flow area. For proper noise control, the downstream piping must be equal to or larger than the valve outlet size.

Heavy-duty Top-stem Guiding

MegaStream valves utilize heavy-duty, top-stem guiding for several reasons:

1. Since the flow characteristics of the MegaStream valve are determined by the shape of the plug, it is a relatively simple matter of changing the plug to provide equal percentage, linear or quick-open trim. Changing the characteristic of a cage-guided valve requires replacement of the cage, which is very expensive.
2. Double, top-stem guiding eliminates the cost of hardened materials associated with cage-guiding. Even when the proper materials are used, cage-guided valves will often gall or bind.
3. Double, top-stem guiding eliminates tight clearances in the flow stream. Wider clearances allow small particles to pass through the valve without causing sticking or galling.

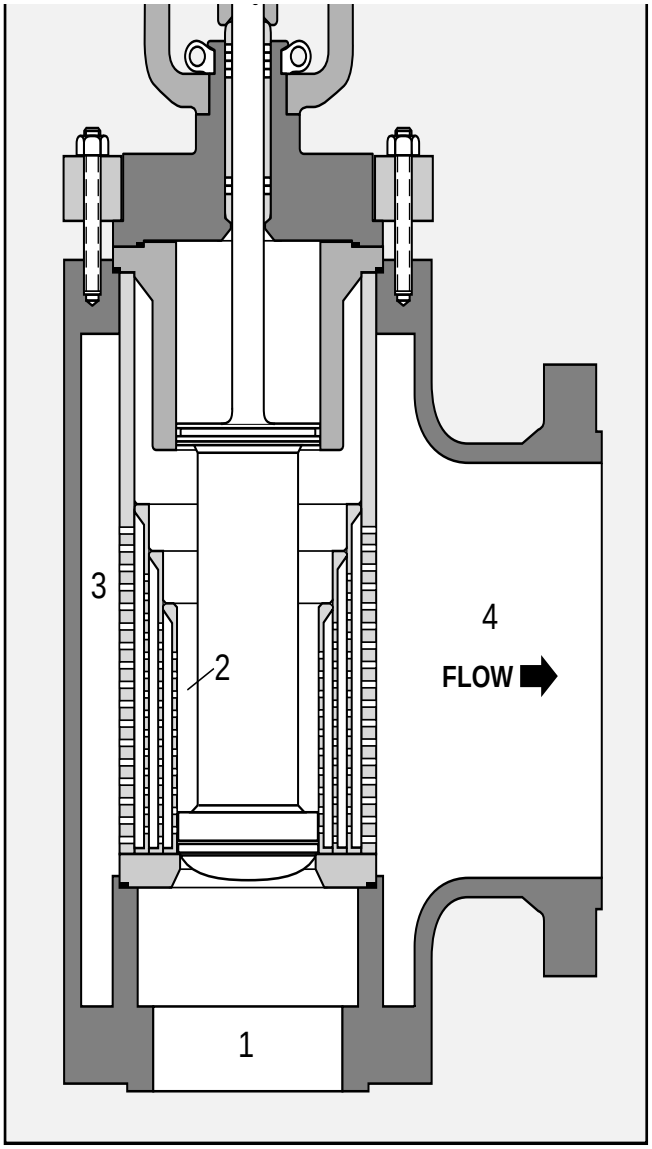


Figure 6: Velocity Checkpoints

WARNING: High acoustic noise levels are accompanied by high mechanical vibration levels. These vibration levels can cause failure of the valve, piping or associated equipment resulting in property damage and/or personal injury. Acoustic noise and mechanical vibration levels are greatly compounded (up to 50 times) when the frequency of the excitation matches acoustic and/or mechanical natural frequencies of the system. Noise control trim (source treatment) should always be considered in any high energy (high pressure and high flow) and/or resonant noise/vibration applications.

Valtek MegaStream

Flow Characteristics

Three flow characteristics are available in MegaStream control valves.

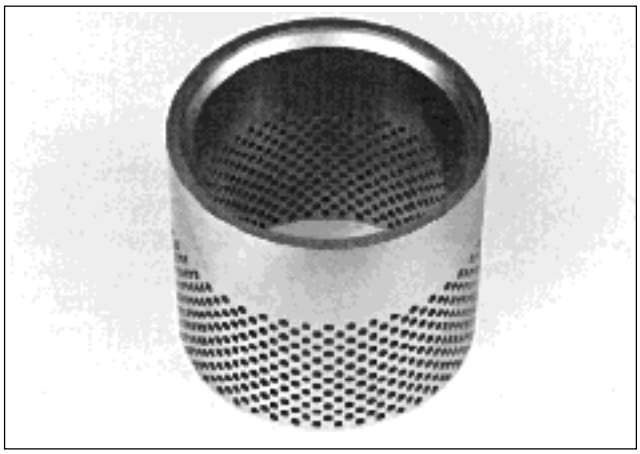
"Equal percentage" is the most common characteristic in process control. Here, the change in flow per unit of valve stroke is directly proportional to the flow occurring before the change is made.

"Linear" characteristic produces an equal change of flow per unit of valve stroke. This characteristic is generally used on those systems where pressure drop is relatively constant or the valve pressure drop is a major portion of the total system drop.

"Quick-open" characteristic is used for on-off service. This characteristic is designed to provide maximum flow quickly and, when used with the MegaStream retainer, effectively reduces noise.

Gaseous Noise Testing

Tests are continually underway at the Valtek gaseous noise test facility. The facility was developed jointly by Valtek engineers and Brigham Young University. This facility has up to 5000 psi blow down capability and direct computer data acquisition.



Valve Size Estimation

To estimate the required MegaStream valve size, use the following procedure:

1. Estimate required flow capacity. For one and two-stage retainer designs, use the sizing equations for conventional globe valves (see the Valtek Sizing & Selection Manual, Section 3). Since three through seven-stage retainers are designed not to choke, the sizing equations must be adjusted by setting $X_T = 1$.
2. Calculate the pressure drop ratio, P_1/P_2, for the maximum C_V condition.
3. Using the standard MegaStream data in Table I, locate the valve size that accommodates both the required C_V and the pressure ratio calculated in step 2. The pressure ratio must not exceed the maximum P_1/P_2 limit indicated for the size and C_V selected.
4. The discharge mach number should be 0.33 or less, except for valves venting to atmosphere which require a mach number of 0.1 or less.

NOTE: *These calculations indicate an* ***estimated*** *valve size and C_V which must be confirmed by Valtek design engineers. (Other design considerations may also influence the final size selection).*

Ordering Information

The following information must be provided when ordering a MegaStream valve:

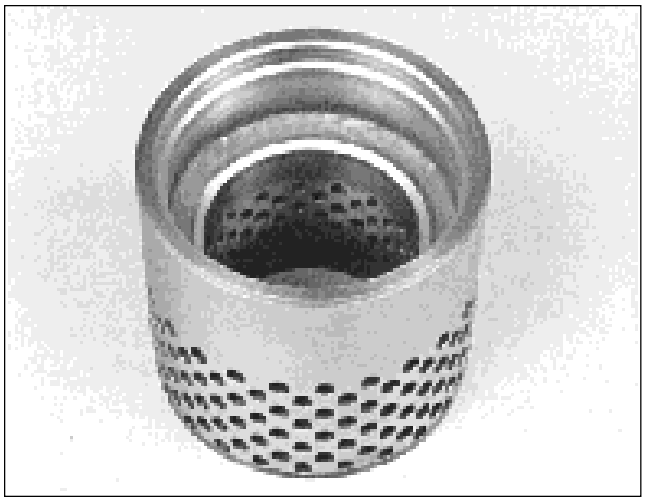
1. Size and type: globe or angle
2. Start-up and operating conditions: inlet and outlet pressures, temperature, flow rate, fluid's specific gravity or molecular weight, vapor pressure or gas compressibility
3. Maximum operating temperatures and pressures
4. Maximum allowable sound pressure levels
5. Body pressure rating and end connections
6. Materials required: trim, body and packing
7. Actuator requirements: type (pneumatic or manual), failure position, size and minimum air supply
8. Positioner signal requirements
9. Accessories required

Valtek MegaStream

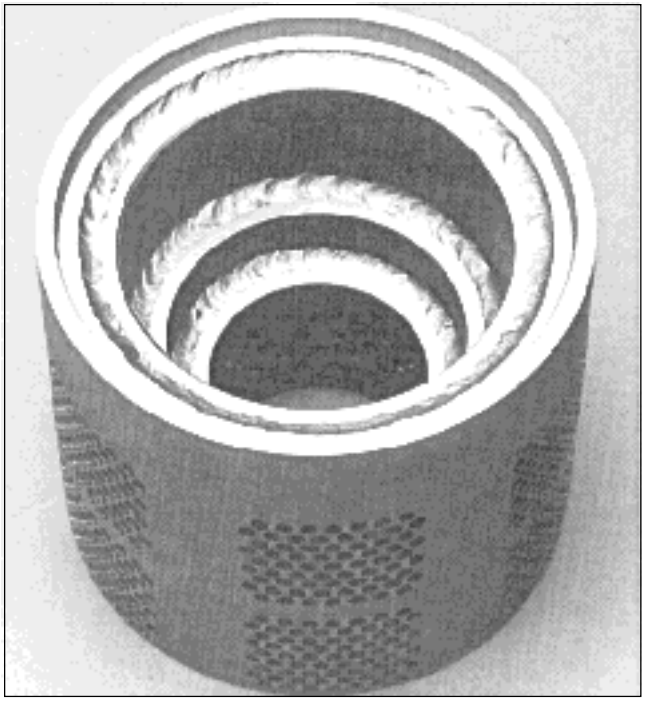
One and Two-stage Retainers

MegaStream valves equipped with one or two-stage retainers represent an economical and innovative approach to low noise applications by permitting up to 15 dBA noise reduction. A standard retainer is constructed from heavy-duty, 316 stainless steel, drilled-hole cylinders.

Since one standard design exists for each valve size, special engineering is not required. This results in lower prices and quicker deliveries. Because of parts interchangeability with standard seat retainers, one and two-stage retainers can be fitted into conventional Mark One valves without special or additional parts. The simplicity of design also permits easy removal and cleaning.



Two-stage, drilled hole retainer.

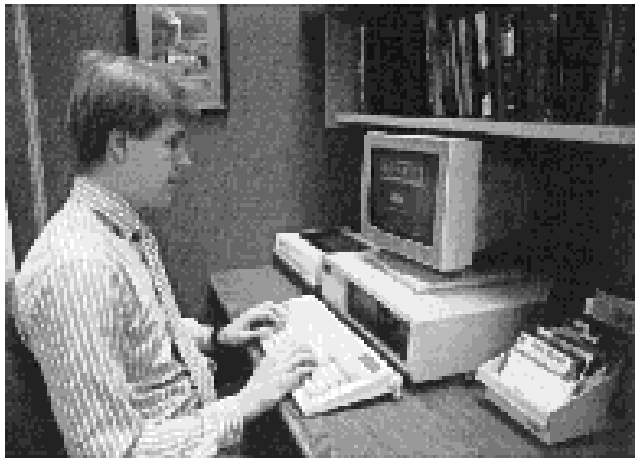


Multistage retainer.

Multistage Retainers

For larger noise reduction levels (up to 30 dBA), multistage retainers incorporate from three to seven stages. Each stage is welded in place. The outer stage allows proper gasket compression to be applied to the bonnet and seat gasket.

Refer to Figure 7 for standard attenuation data.



MegaStream Noise Reduction Possibilities

Flowserve has developed and made available the *Performance!* software program for use on IBM® and compatible personal computers running Windows® 95 or NT. This program can determine within minutes anticipated noise generation levels for conventional valves and, at the same time, verify the noise reduction capabilities of a MegaStream valve for the same application. Section 13 in the Valtek Sizing & Selection manual also contains information dealing with gaseous noise.

MegaStream quotations often include guaranteed maximum noise levels (±5 dBA) as required to meet your specifications and OSHA standards.

Valtek MegaStream
Trim Data

Table I: MegaStream Class 150-600 Standard Trim Data

Valve Size (in.)	Trim No.	Max. P_1/P_2	Stages	Max. C_v	Seat Area (sq.in.)	Stroke (in.)
1	.81	*	1	11	.52	.75
	.50	*	2	6	.20	.75
1 1/2	1.25	*	1	29	1.23	1.00
	1.00	*	2	22	.79	.75
2	1.62	*	1	46	2.07	1.50
	1.00	*	2	25	.79	.75
3	2.62	*	1	106	5.41	2.00
	2.00	*	2	78	3.14	1.50
	1.25	4.3	3	36	1.23	1.00
4	3.50	*	1	190	9.62	2.50
	2.62	*	2	130	5.41	2.00
	1.62	4.3	3	62	2.07	1.50
6	5.00	*	1	400	19.64	3.00
	3.50	*	2	260	9.62	2.50
	3.00	4.3	3	180	7.07	2.00
	2.25	6.4	4	95	3.98	2.00
8	6.25	*	1	620	30.68	4.00
	5.00	*	2	500	19.64	3.00
	4.00	4.3	3	320	12.57	2.50
	3.50	6.4	4	230	9.62	2.50
	2.62	9.6	5	140	5.41	2.00
	1.62	14.5	6	62	2.07	1.50
10	8.00	*	1	1000	50.26	4.00
	6.25	*	2	780	30.68	4.00
	4.50	4.3	3	450	15.90	3.00
	3.50	6.4	4	270	9.62	2.50
	3.00	9.6	5	190	7.07	2.00
	2.62	14.5	6	140	5.41	2.00
12	9.50	*	1	1340	70.88	4.00
	7.38	*	2	1050	42.78	4.00
	6.00	4.3	3	700	28.27	4.00
	5.00	6.4	4	480	19.63	3.00
	4.00	9.6	5	310	12.57	2.50
	3.50	14.5	6	220	9.62	2.50
	2.62	32.0	7	130	5.41	2.00
14	10.00	*	1	1620	95.03	4.00
	8.00	*	2	1300	50.26	4.00
	7.38	4.3	3	970	42.78	4.00
	6.00	6.4	4	640	28.27	4.00
	5.00	9.6	5	430	19.63	3.00
	4.00	14.5	6	280	12.57	2.50
	3.00	32.0	7	170	7.07	2.00
**16	9.50	*	1	1740	70.88	6.00
	8.00	*	2	1360	50.26	4.00
	7.38	4.3	3	1060	42.78	4.00
	6.25	6.4	4	750	28.27	4.00
	5.00	9.6	5	490	19.63	3.00
	4.00	14.5	6	320	12.57	2.50
	3.50	32.0	7	230	9.62	2.50
**18	11.00	*	1	2250	95.03	6.00
	10.00	*	2	1940	78.54	6.00
	8.50	4.3	3	1400	56.74	6.00
	7.38	6.4	4	1010	42.78	4.00
	6.00	96	5	670	28.27	4.00
	5.00	14.5	6	450	19.63	3.00
	4.00	32.0	7	300	12.57	2.50
**20	12.00	*	1	2730	113.10	8.00
	11.00	*	2	2360	95.03	6.00
	9.00	4.3	3	1640	63.62	6.00
	7.38	6.4	4	1130	42.72	4.00
	6.25	9.6	5	780	30.68	4.00
	5.00	14.5	6	500	19.63	3.00
	4.00	32.0	7	330	12.57	2.50
**24	13.00	*	1	3220	132.70	8.00
	12.00	*	2	2860	113.10	8.00
	11.00	4.3	3	2290	95.03	6.00
	9.00	6.4	4	1600	63.62	6.00
	7.38	9.6	5	1010	42.72	4.00
	6.00	14.5	6	720	28.27	4.00
	5.00	32.0	7	490	19.63	3.00

* See page 9 for attenuation vs. P_1/P_2
** Fabricated angle body

This standard MegaStream data table is intended to indicate available designs. Consult Valtek engineers to determine the suitable designs and options for particular applications.

Valtek MegaStream
Attenuation Curves

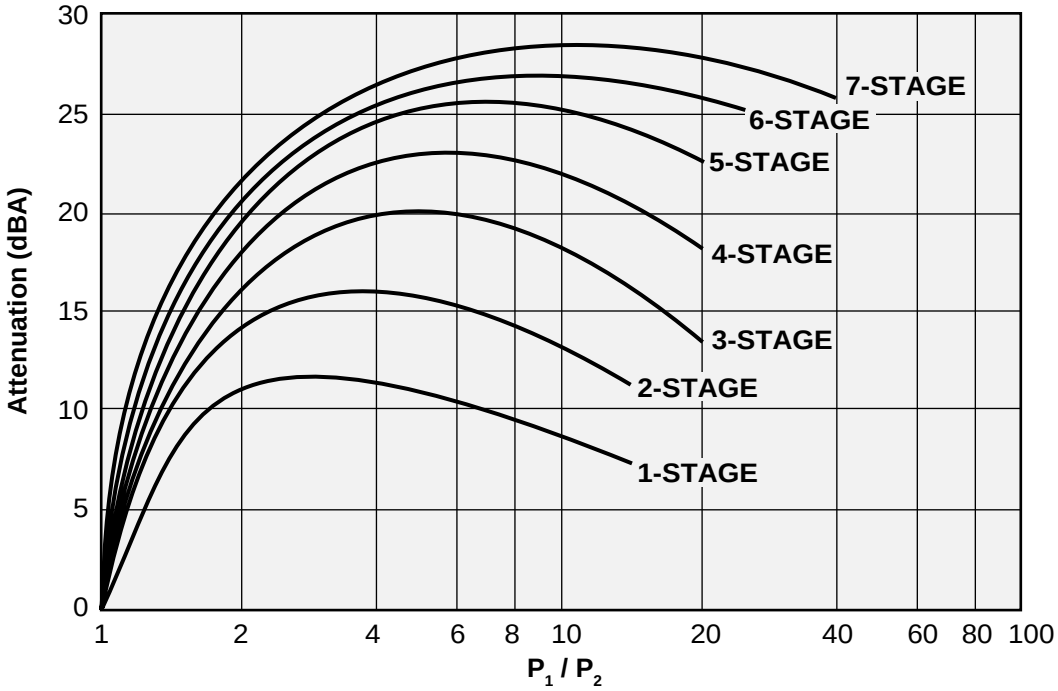


Figure 7: One and Multistage MegaStream Noise Attenuation Curves

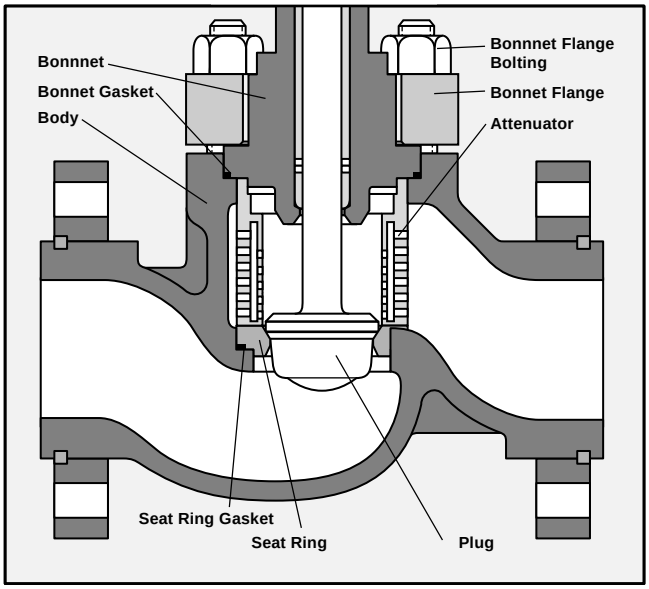


Figure 8: Standard, Two-stage MegaStream

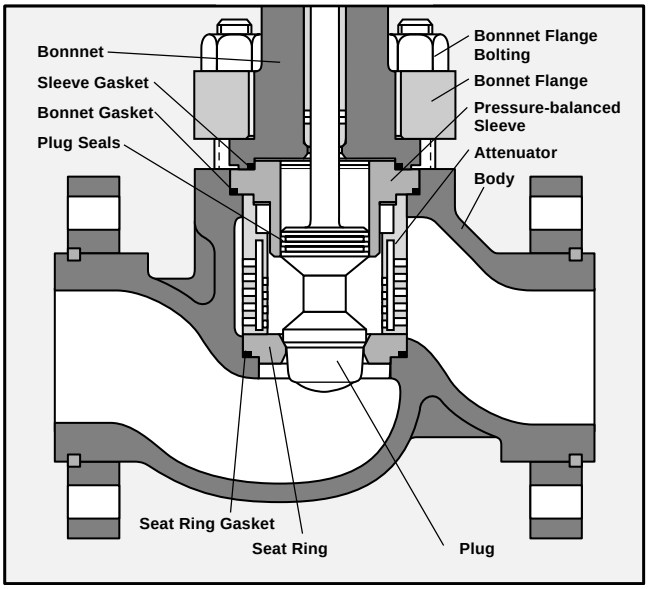


Figure 9: Pressure-balanced, Two-stage MegaStream

MegaStream valves equipped with one and two-stage retainers are interchangeable with standard Mark One seat retainers. Both one and two-stage MegaStream valves are available in either unbalanced or pressure-balanced designs. The pressure-balanced design uses a standard retainer along with a special pressure-balanced sleeve and plug.

Valtek MegaStream

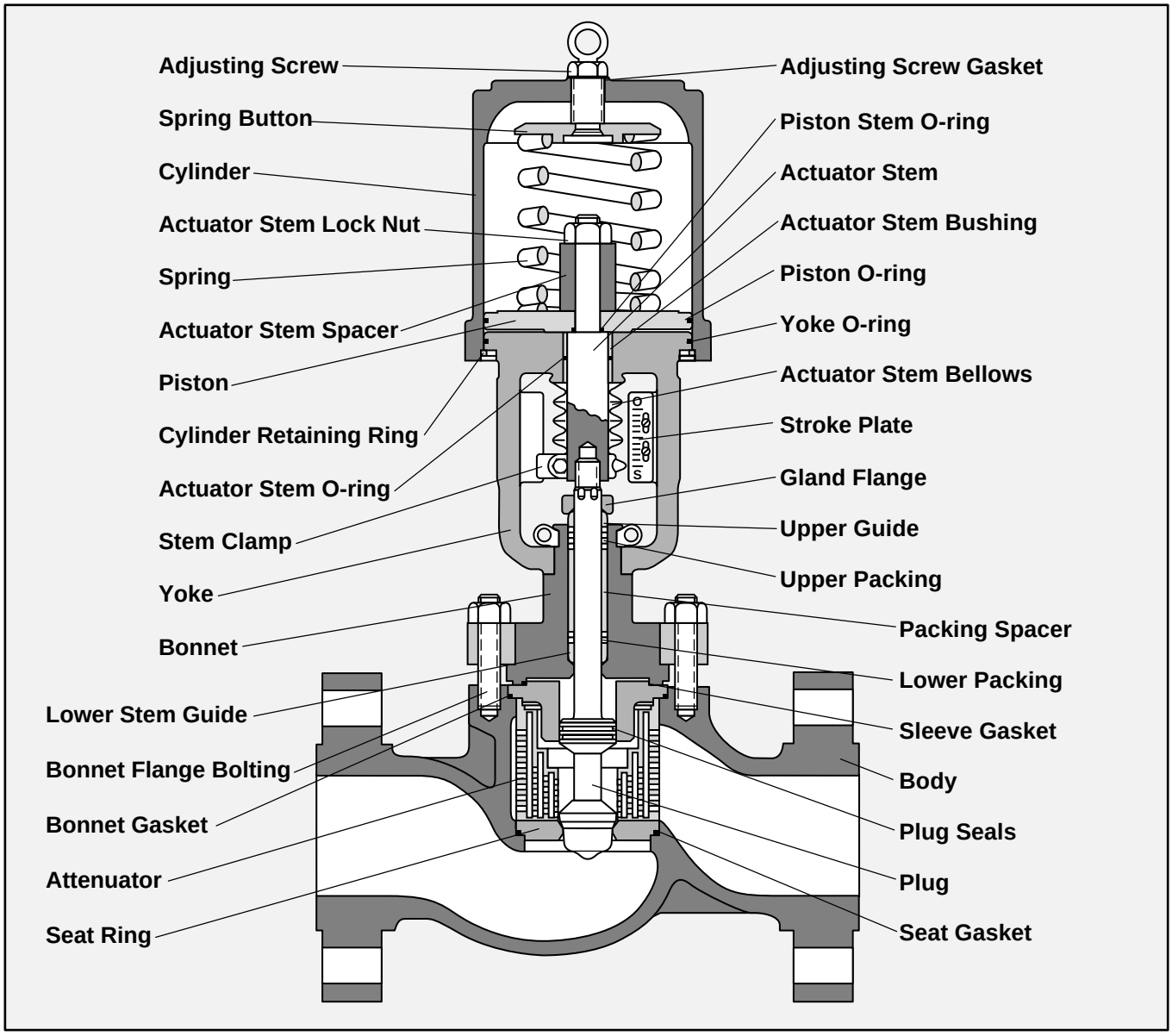


Figure 10: Cast Globe Body Construction with Pressure-balanced, Multistage MegaStream Retainer

Multistage MegaStream valves (three stages and above) are manufactured in sizes 1 through 14-inch utilizing conventional and interchangeable Mark One globe bodies. Except for the multistage MegaStream retainer, all other parts of these valves are interchangeable with the Mark One control valve. Therefore, for additional design features and accessories, refer to the Valtek Mark One Control Valves and Linear Actuator brochures.

MegaStream sizes 16 through 36-inch are customarily fabricated in an angle body configuration with the inlet on the bottom and the outlet on the side. Because these bodies are fabricated, it is possible to construct a small inlet with a large outlet – an arrangement ideal for velocity control. As a cost-saving measure, if the downstream side of the valve is protected by a safety valve or is discharged to atmosphere, the body and outlet can be constructed with a lower pressure rating than the inlet.

Valtek MegaStream
Dimensions

Refer to the Valtek Mark One Control Valve sales bulletin for dimensional information of MegaStream valve sizes 1 through 14-inch. Face-to-face and actuator dimensional information will be identical.

Typical fabricated angle body dimensions are shown below. This information is for estimation only. If required, contact Valtek Engineering for specific certified dimensional drawings.

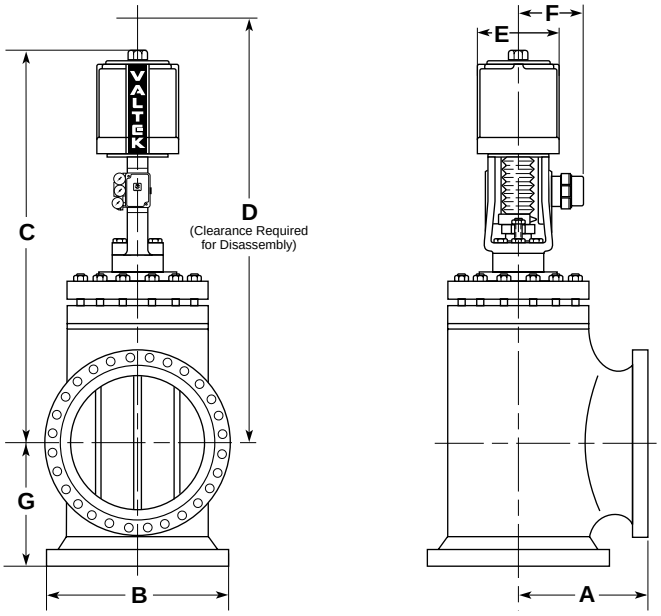


Table II: Fabricated Angle Body Dimensions (inches/mm)

Valve Size	Class	A		B		E*		F*		J*		K*	
16	150	17.0	432	17.0	432	24.0	610	55.0	1397	12.0	305	10.5	267
	300	17.8	451	17.8	451	24.0	610	55.5	1410	12.0	305	10.5	267
	600	19.3	489	19.3	489	24.0	610	57.0	1448	12.0	305	10.5	267
18	150	19.0	483	19.0	483	24.0	610	56.0	1422	12.0	305	10.5	267
	300	19.8	502	19.8	502	24.0	610	57.0	1448	12.0	305	10.5	267
	600	21.0	533	21.0	533	24.0	610	58.0	1473	12.0	305	10.5	267
20	150	20.7	526	20.7	526	24.0	610	58.5	1486	12.0	305	10.5	267
	300	21.4	543	21.4	543	24.0	610	59.5	1511	12.0	305	10.5	267
	600	22.8	578	22.8	578	24.0	610	60.5	1537	12.0	305	10.5	267
24	150	23.0	584	23.0	584	24.0	610	65.0	1651	12.0	305	10.5	267
	300	23.6	600	23.6	600	24.0	610	65.0	1651	12.0	305	10.5	267
	600	25.3	641	25.3	641	24.0	610	66.0	1676	12.0	305	10.5	267
30	150	27.1	689	27.1	689	24.0	610	75.0	1905	12.0	305	10.5	267
	300	30.3	768	30.3	768	24.0	610	75.0	1905	12.0	305	10.5	267
	600	32.0	813	32.0	813	24.0	610	76.0	1930	12.0	305	10.5	267
36	150	31.9	809	31.9	809	24.0	610	80.0	2032	12.0	305	10.5	267
	300	36.0	914	36.0	914	24.0	610	82.0	2083	12.0	305	10.5	267
	600	37.9	962	37.9	962	24.0	610	84.0	2134	12.0	305	10.5	267

NOTE: *Various inlet sizes are available for fabricated angle body valves. Contact factory for specific sizes required. *Size 100 Cylinder assumed.*

Valtek MegaStream
Standard Materials of Construction

Table III: Body Assembly

Body and Bonnet	Steel, stainless steel, alloys as required
Plug and Seat Ring	316 stainless steel or 316 stainless steel with Stellite, Inconel, alloys as required
MegaStream Retainer	Nickel-plated carbon steel, 316 stainless steel, Inconel
Guides	Bronze, Grafoil lined S.S., Stellite, Teflon-lined S.S
Packing	Teflon, Teflon AFP, Glass-filled Teflon, Graphite/AFP, Graphite/ AFP w/Inconel wire, Grafoil
Packing Spacer	316 stainless steel, other alloys
Gaskets	Spiral-wound stainless steel and Flexite Super, or non-asbestos, or Grafoil; Teflon, Metal O-ring, Inconel
Bonnet Flange Bolting	Stainless steel, other materials as requested
Gland Flange	Stainless steel, painted carbon
Gland Flange Bolting	Zinc-plated steel, stainless steel
Yoke Clamp	Stainless steel
Yoke Clamp Bolting	Zinc-plated steel, stainless steel

Table IV: Actuator Assembly

Cylinder and Piston	Anodized aluminum
Yoke	Ductile iron
O-rings	Buna-N, Viton
Stem Bushings	Oilite bronze
Stem Nut	Zinc-plated steel
Cylinder Retaining Ring	Zinc-plated steel, Dichromate dipped
Stem Clamp	Stainless steel, carbon steel
Actuator Stem	416 stainless steel
Spring	Carbon steel
Spring Button	Painted steel
Stroke Plates	Aluminum

NOTE: *Other materials are available. Contact factory for further information.*

For more information, contact:

For more information about Flowserve and its products,
contact www.flowserve.com or call USA 972 443 6500

Manufacturing Facilities

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Quick Response Centers

5114 Railroad Street
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104 Chelsea Parkway
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CERTIFIED ISO 9000 SELECT LOCATIONS