ACV SERIES

Automatic Hydraulic Control Valves

GENERAL INFORMATION

FEATURES BASIC VALVES

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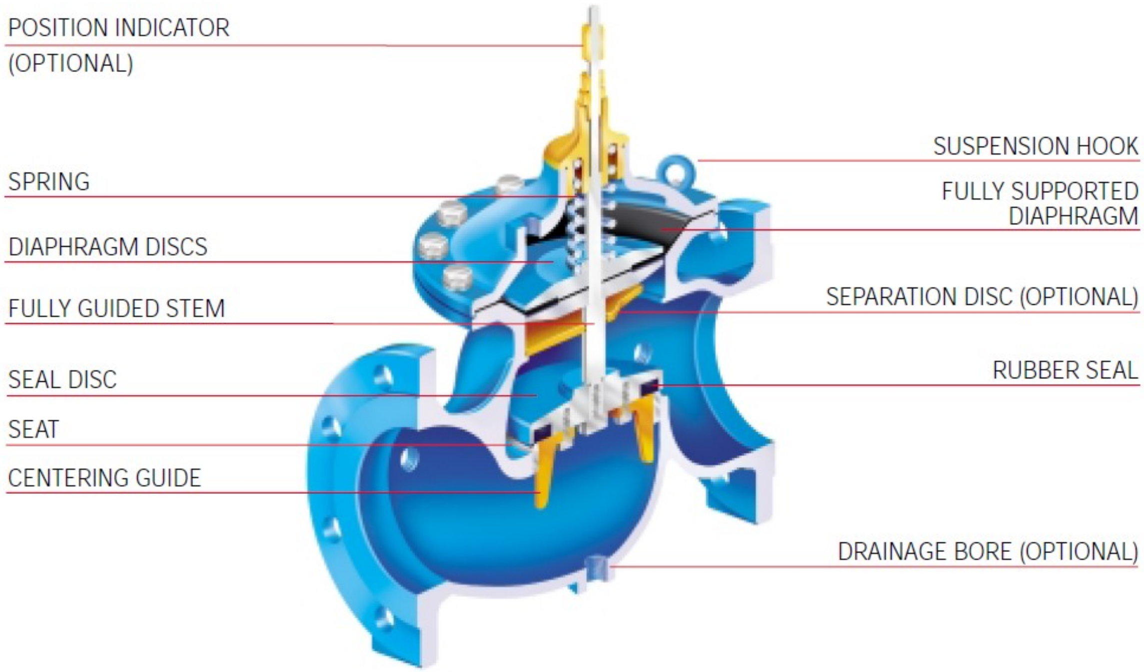

BEECO'S ACV Series, the latest line of state-of-the-art globe type automatic control valves, is designed to withstand even the most demanding water control systems requirements. The experts at BEECO developed this technically advanced line with capabilities far beyond any other valve on the market.

Features of the BEECO ACV Series

- The capability to regulate near zero flow, **as standard on all sizes,** completely eliminating the need for a special low flow device (throttling plug) or a low flow bypass valve, while ensuring very low head loss in "fully open" conditions.
- A standard valve model, fit for all control operations. A specific pilot(s) provides the required application.
- The flange (face to face) dimensions suit ISO Standards. This allows for quick and easy replacement of old equipment, without the need for additional pipeline modifications.
- The valve has an internal floating shaft, allowing for no friction or leakage, eliminating the need for shaft sealing. The unique design of the shaft provides for easy field maintenance.
- The valve has a resilient seal disc, guided by almost frictionless centering device.
- The valve's body is made of Ductile Iron, withstanding both high hydraulic, and mechanical stresses.
- A standard single chamber valve, enabling jam-free operation in sensitive regulating conditions. If desired, conversion to a double chamber valve can easily br done in line without removing the valve.
- The valve comes with an easily replaceable seat, made of Stainless Steel. It maintains excellent durability against erosion, ensuing a drip-tight seal.
- During the closing procedure, the pace slows down, preventing and damage that may occur due to water slam/surge.
- The series includes, as an optional feature, a valve position indicator, attached by a floating connection (ball and socket) resulting in smooth movement, with no wear or tear on the indicator seal.

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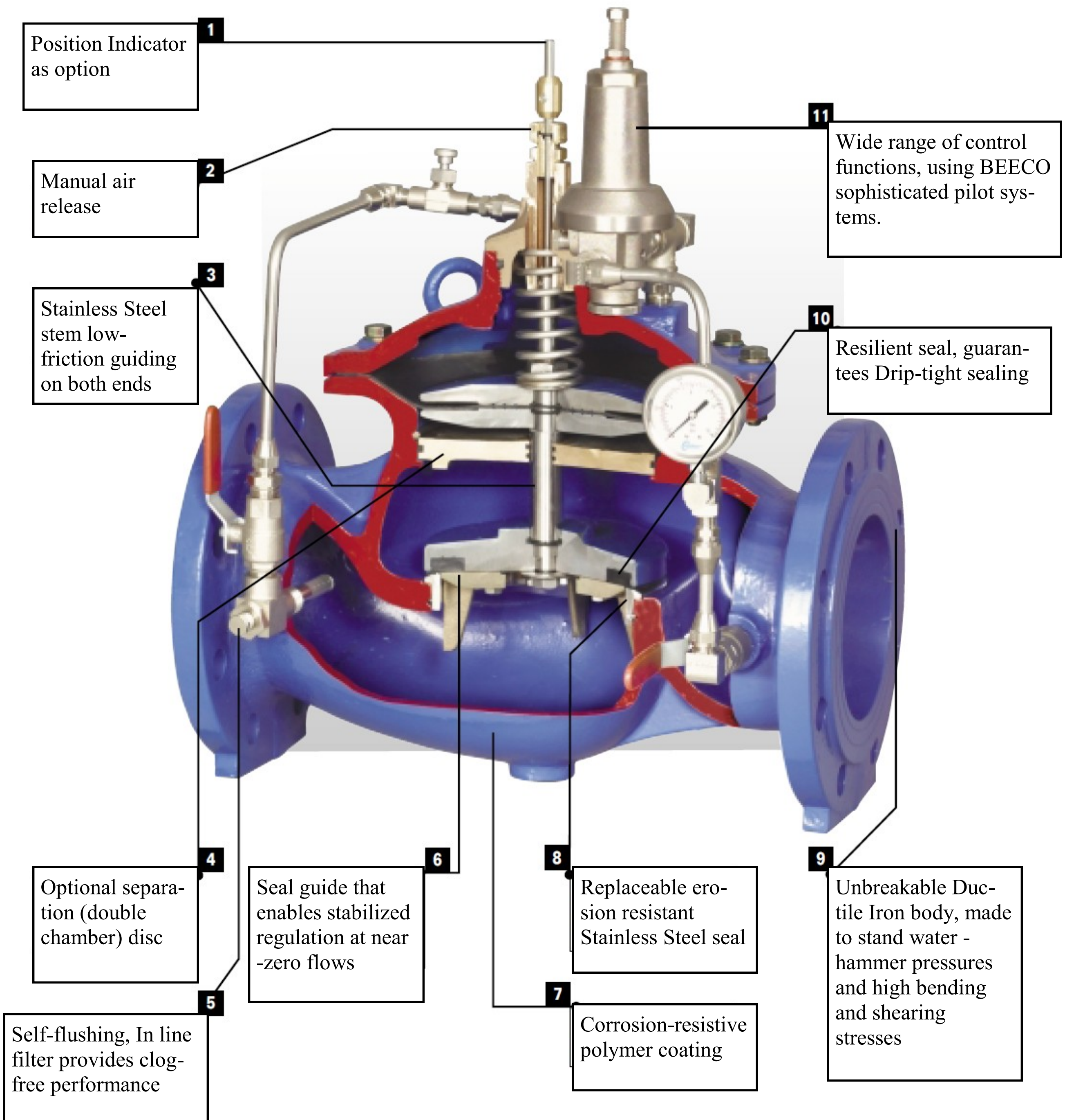

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U.S. OFFICE: 1321 WEST 119TH STREET, CHICAGO, IL, 60643-5109 ■ PHONE: 1.800.465.2736 ■ FAX: 773.341.3049

CANADA OFFICE: 150 NORFINCH DRIVE, UNIT #3, TORONTO, ON M3N 1X6 ■ PHONE: 1.800.387.3880 ■ FAX: 416.679.0350

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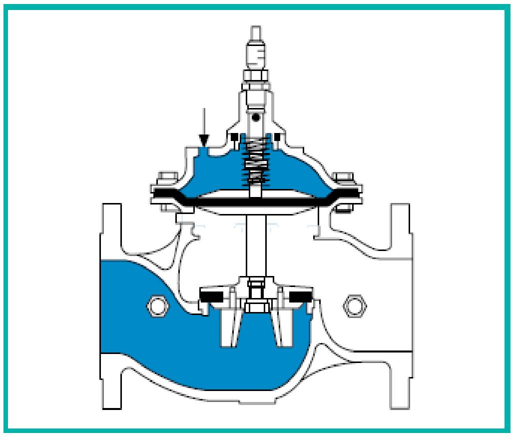
On-Off Mode

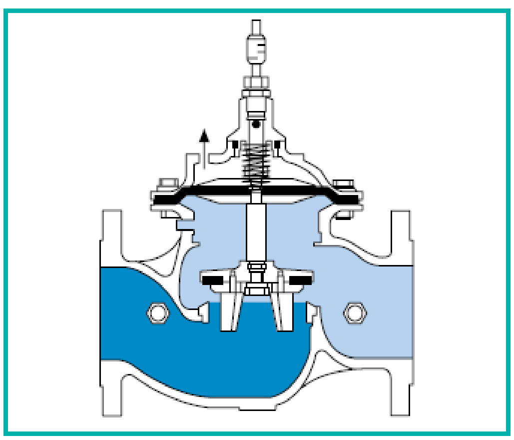
Standard (Single Chamber) Valve

Closed Mode: The control pressure (taken from the pipeline) is applied by the control device to the control chamber (top of the diaphragm).
The pipeline pressure pushes the seal to open, and the control chamber pressure forces the diaphragm to close. Since the diaphragm area is larger than the seal area, it has greater hydraulic force so the valve remains in the "closed" position.



Closed Mode

Open Mode: The control device relieves the pressure from the control chamber. The pipeline pressure forces the seal to the "open" position so that the fluid can pass through the valve.
While the valve is open, outlet pressure is applied to the lower side of the diaphragm.



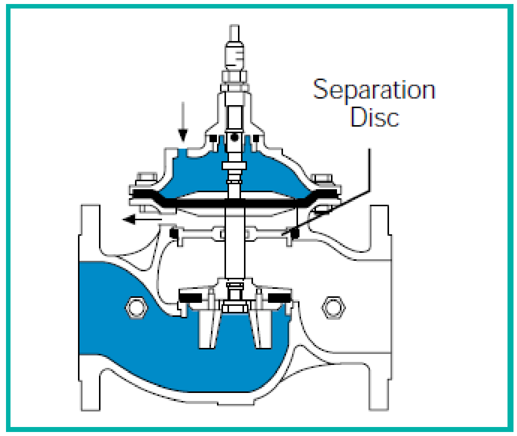
Open Mode

Double Chamber Valve (Version D)

The double chamber version is created by inserting a separation disc between the diaphragm and the seal. This assembly creates a second control chamber below the diaphragm, permitting for the activation of the valve in low-pressure systems and enabling faster valve response. The response to varying conditions is quick, since there is no restriction to diaphragm movement due to the fact that the relevant part of the control chamber has drained.

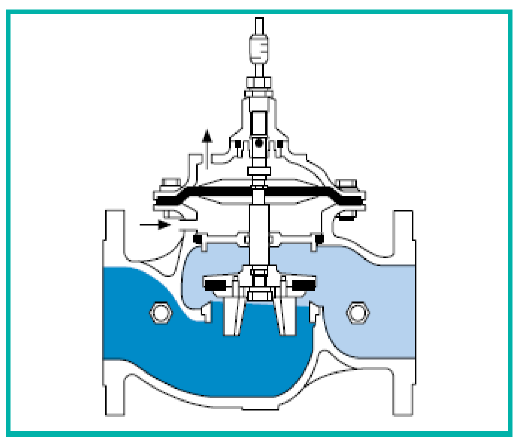
The closure pace of the double chambered valve tends to slow toward the end of the "closing" procedure. This feature reduce the danger of pressure surges in short pipelines.

Closed Mode: The control pressure (taken from the pipeline) is applied to the top of the diaphragm. The bottom control chamber drains.
The pipeline pressure pushes the seal to open, but since the diaphragm area is larger than the seal area it creates greater hydraulic force and thus the valve closes.



Closed Mode

Open Mode: The control device releases the pressure from the top control chamber.
The seal assembly is forced to the "open" position by the pipeline pressure, allowing flow through the valve.

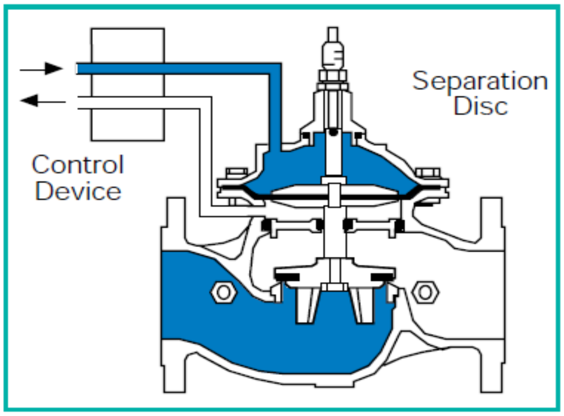


Open Mode

Power-Opening Mode Double Chamber Valve

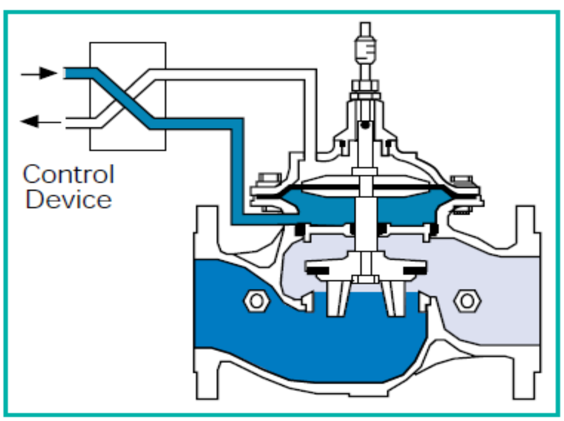
This operating mode is selected when the control pressure is taken from an external source (a water system with higher pressure, compressed air, etc...) rather than from the pipeline. This mode is usually selected when pipeline pressure is extremely low. The control system is able to pressurize one chamber while simultaneously draining the other one.

Closed Mode: The control device applies pressure to the top chamber while draining the bottom chamber. The diaphragm is forced down, causing the seal to close the water passage.



Closed Mode

Open Mode: The control device releases the pressure from the top control chamber and applies pressure to the bottom control chamber. The seal assembly is forced to the "open" position, allowing flow through the valve.



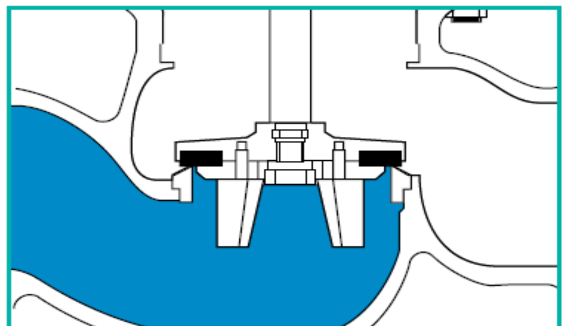
Open Mode

Modulating Mode

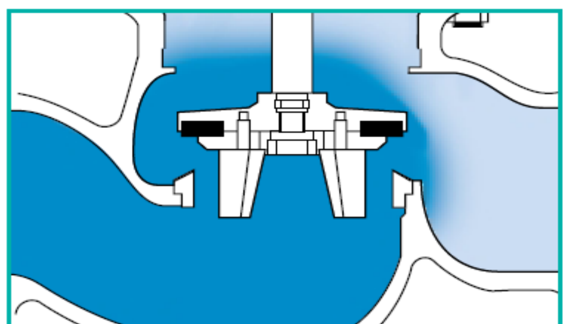
General

Positioning the seal a short distance (less than 1/4 of the seat diameter) from the seat, creates friction and turbulence, causing energy loss in the fluid passing through the valve.
The results are:
-Reduction of pressure and flow rate.
-Increase of inlet pressure.
The position of the seal assembly is dictated by the volume of control fluid in the top control chamber which is determined by the control device.
The control device is operated by hand (manual control), by electric current (solenoid valve), or by hydraulic pressure (pilot valves, hydraulic relays). All can be used in standard (single chamber) valves as well as in double chamber valves.

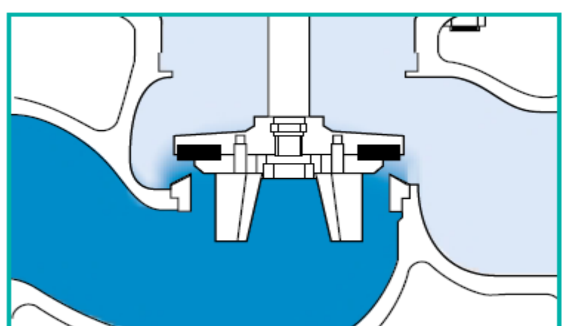
Modulating mode in standard (single chamber) valves.



Closed



Fully Open



Regulating

2-Way Control Device

The 2-way control device is assembled on a control circuit, connecting upstream to downstream through the control chamber.

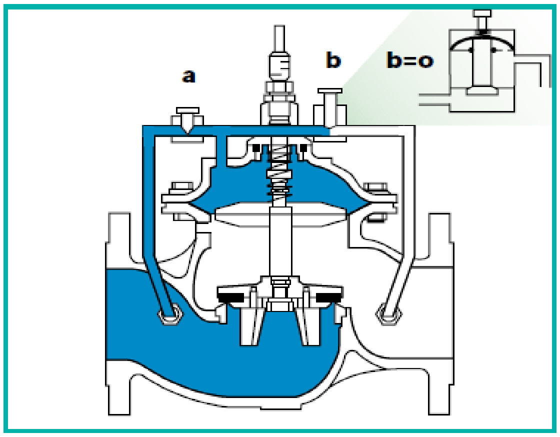
There are two restrictors assembled in this circuit:

(a) A nozzle or a needle valve at a fixed opening.

(b) A modulating device (pilot), whose passage may vary from complete closure (b=o) to a fully open size (when b>a).

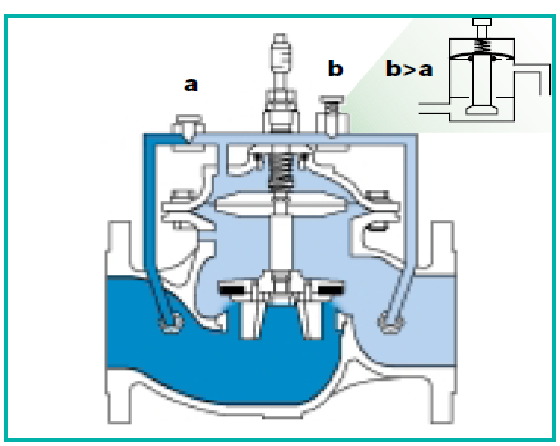
The volume of the control media in the chamber is determined by the relative passages (a) and (b), or in fact by the opening of (b), as (a) is fixed.

Closed Mode: Pilot (b) senses a downstream pressure higher than the set-point and closes passage (b). Through passage (a) the upstream water flows directly into the upper part of the control chamber, forcing the diaphragm to close the valve.



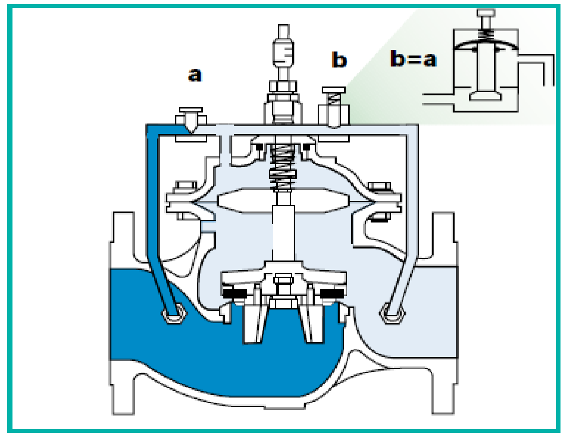
Closed Valve

Open Mode: Pilot (b) senses a downstream pressure lower than the set-point, and fully opens passage (b), larger than (a). All the water from the upstream flows through (a) and (b), directly to the downstream, allowing water from the upper part of the control chamber to partially drain until the pressure in the chamber equals the downstream pressure. Pressure in the upper part of the control chamber is decreased and the upstream water pressure forces the seal disc to rise (opening the valve).



Open Valve

Regulating Mode: The pilot is set to the required downstream pressure. The pilot senses when the downstream pressure reaches the required value causing passage (b) to equal passage (a) *b=a*. Now, water that flows through the control loop passes from (a) through (b) and into the downstream. The control media in the upper part of the control chamber is now steady, keeping the diaphragm and seal in a fixed position. Any change in the downstream pressure will change the b=a balance. This change adds or drains water from the control chamber, thus opening or closing the main valve until it reaches the balanced regulating position b=a once again.



Regulating Valve

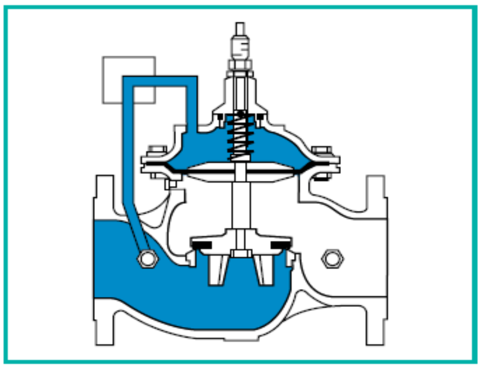
The 2-way control device provides sensitive, accurate, and constant modulating, control of the main valve. The main valve does not fully open, as the control device prevents total draining of the control chamber.

The 2-way control device is standard in most pressure regulating valves.

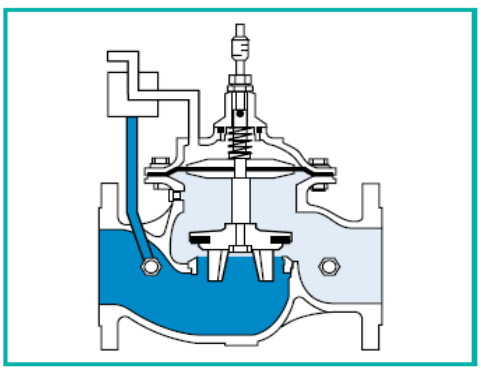
3-Way Control Device

The 3-way control device is a small selector valve which:
1.Permits passage of the control media into the main valve control chamber (initiating the "closing" procedure),
or
2. Permits drainage of the control media from the control chamber to the atmosphere (initiating the "opening" procedure).

Some of the 3-way control devices have a third mode as well, which prevents inflow or outflow from the control chamber, so that the main valve remains fixed when the device is in this mode.
This mode is used in on-off valves or when the regulating valve is fully open, in order to obtain specific operating conditions. Once in position, there is no water flow through the control chamber.
The 3-way control device may open the main valve entirely, creating minimum head loss.
The 3-way control device must be used when external media (not pipeline water) is used to control the valve, or when the control media is abrasive.



Closed Valve

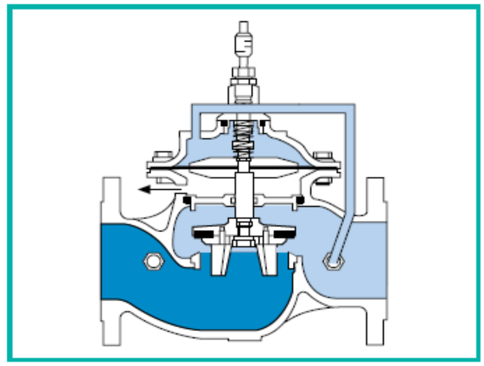


Open Valve

Proportional Pressure Reducer

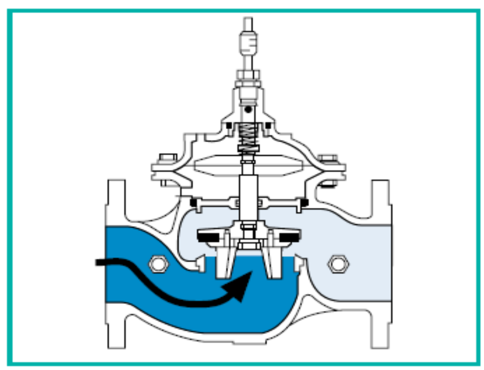
The proportional pressure reducer is a valve that has a control chamber permanently connected to the downstream.
This valve must be a double chamber [D] type.
The balance of hydraulic forces created between the high pressure on the small seal area, and the lower downstream pressure on the larger diaphragm area, causes a fixed ratio of inlet/outlet pressure of approximately 3:1.

No other control device is needed.

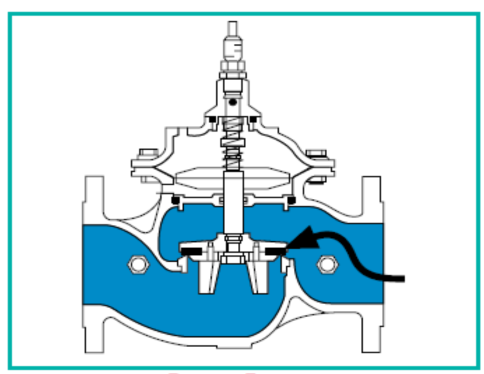


Non-Return (Check Valve) Mode Double Chamber Valve

Flow in the normal direction forces the seal to the "open" position, allowing for free flow. When downstream pressure exceeds upstream pressure, return flow may occur, causing the seal disc to instantly close as a result of both hydraulic force and the spring's force.



Regular Flow



Return Flow

ACV SERIES

Automatic Hydraulic Control Valves

ENGINEERING DATA

COMPONENTS

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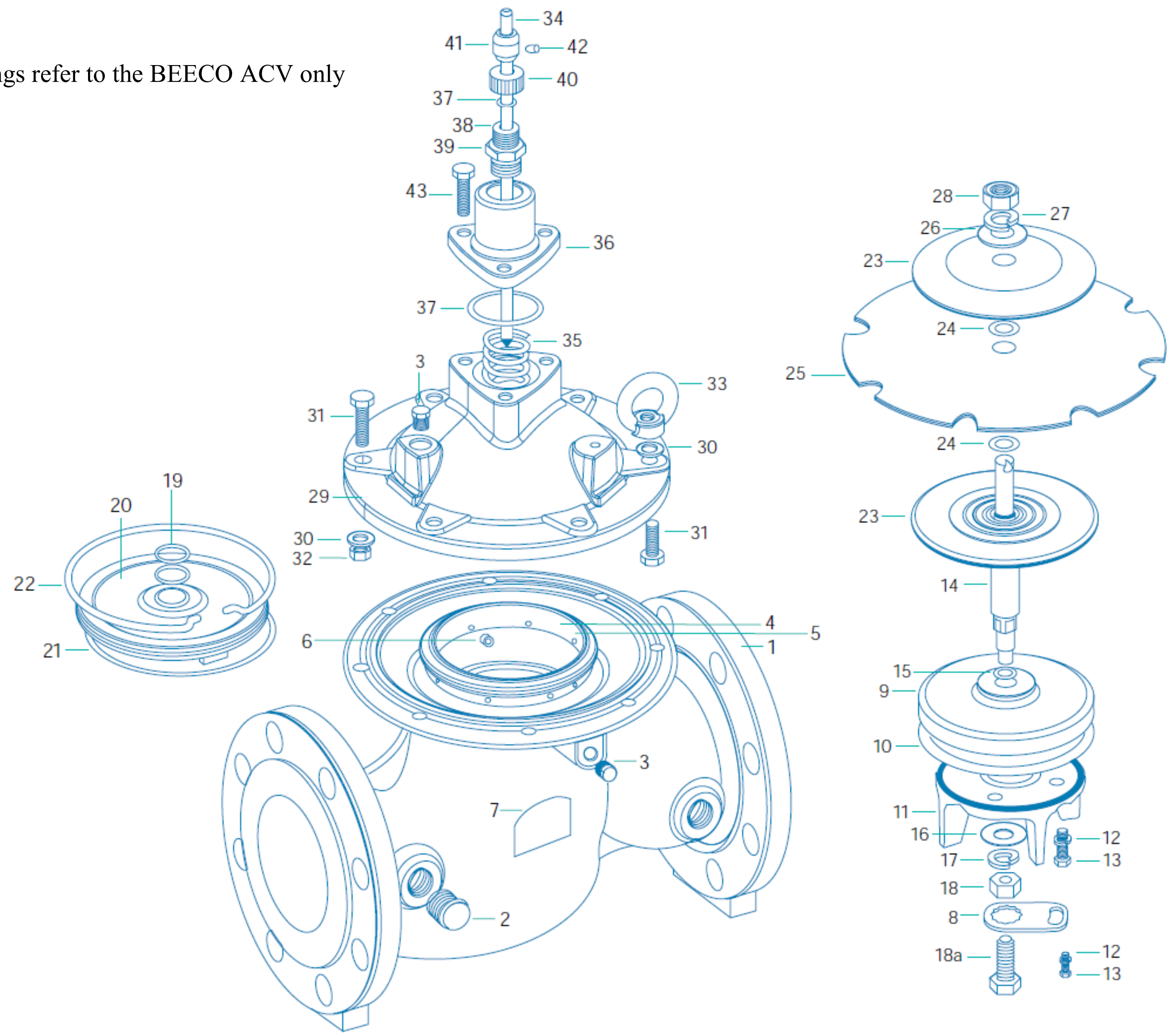
Drawings refer to the BEECO ACV only



Component No.	Description	Material
1	Body	Ductile Iron
2	Plug	Brass
3	Plug	Brass
4	Seat	SST
5	Seat Locking Bolt	SST304
6	Seat Locking Bolt (Long)	SST304
7	ID Tag	Aluminum
8***	Bolt Safety Disc	SST
9	Seal Disc	Ductile Iron
10	Seal	Rubber
11	Seal Guide	Bronze + SST
12	Spring Washer	SST316
13	Bolt	SST316
14	Shaft	SST303
15	O-Ring	Rubber

Component No.	Description	Material
16	Washer	SST316
17	Spring Washer	SST316
18 (3", 4")	Nut	SST316
18a***	Bolt	SST316
19*	O-Ring	Rubber
20*	Separating Disc	Bronze
21*	O-Ring	Rubber
22*	Lock Spring	SST302
23	Diaphragm Disc	Ductile Iron
24	O-Ring	Rubber
25	Diaphragm	Rubber
26	Washer	SST316
27	Spring Washer	SST316
28	Nut	SST316
29	Bonnet	Ductile Iron

Component No.	Description	Material
30 (1 1/2"-8")	Washer	Steel (SST)
31 (1 1/2"-8")	Bolt	Steel (SST)
32 (1 1/2"-8")	Nut	Steel (SST)
33	Lifting Ring	Steel
34**	Position Indicating Rod	SST304
35	Spring	SST302
36	Guiding Cover	Brass/Bronze
37	O-Ring	Rubber
38	O-Ring	Rubber
39	Adapter	Brass
40	Air release Nut	Brass
41**	L.S. Actuating Nut	Brass
42**	Locking Bolt	SST304
43	Cover Bolt	Steel

* In double chamber models only. ** Valves equiped with position indicator only. *** For 1 1/2", 2", 6"-20" Valves.

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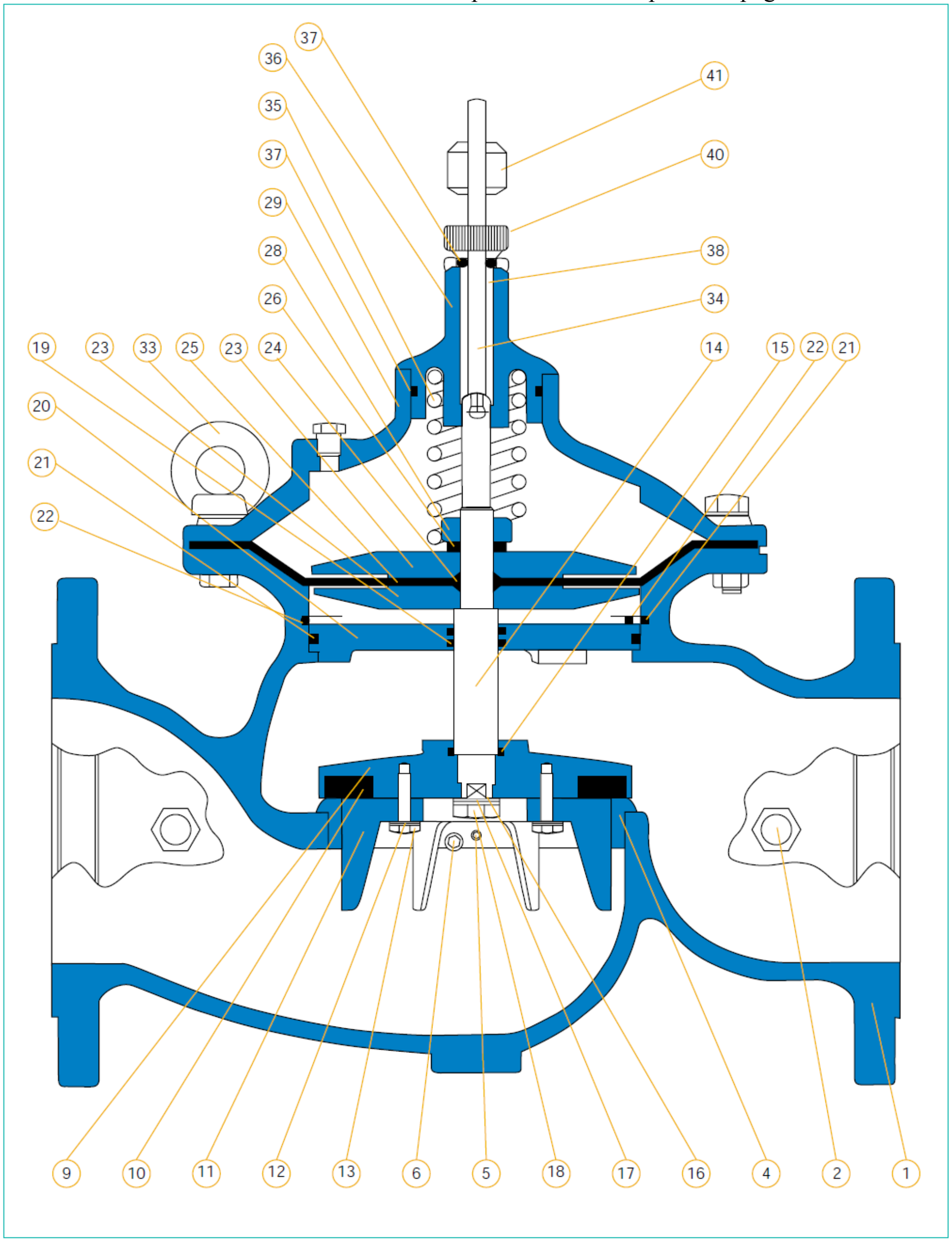
ACV SERIES

Automatic Hydraulic Control Valves

ENGINEERING DATA

COMPONENTS

The numbers match the component list on the previous page



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U.S. OFFICE: 1321 WEST 119TH STREET, CHICAGO, IL, 60643-5109 ■ PHONE: 1.800.465.2736 ■ FAX: 773.341.3049

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ACV SERIES

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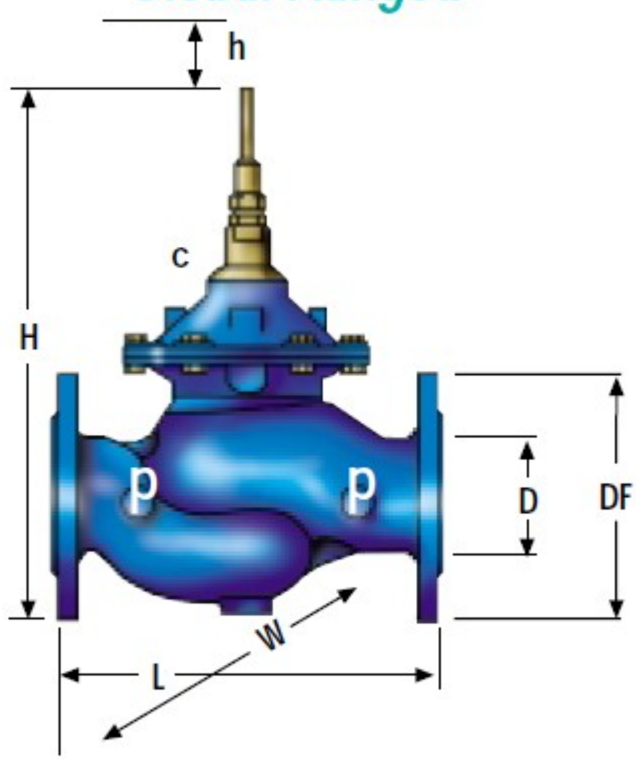
Automatic Hydraulic Control Valves
ENGINEERING DATA

Dimensions & Weights

Globe Flanged type

Valve - D (Nominal)	2"	2 1/2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"
L (inch.)	9 1/16	11 1/2	12 3/16	13 3/4	18 7/8	23 1/16	28 3/4	33 7/16	38 9/16	43 5/16	47 1/4	49 3/16
H (inch.)*	9 1/4	11 9/16	15 3/4	17 1/16	21 15/16	25 9/16	32 3/8	37 3/16	39	49 3/16	49 3/16	49 3/16
h (inch.)**	11/16	11/16	1 1/8	1 1/8	1 9/16	2 3/8	3 1/8	3 15/16	3 15/16	5 11/16	5 11/16	5 11/16
DF(mod.30) (inch.)	6 1/2	7 5/16	7 7/8	8 11/16	11 1/4	13 9/16	16 1/8	18 1/8	20 1/2	22 13/16	24 7/16	28 1/8
DF(mod.31) (inch.)	6 1/2	7 5/16	7 7/8	9 7/16	12	14 3/16	16 3/4	19 1/8	21 7/8	24 7/16	26 3/8	28 3/4
P (Control Port)	1/2" NPT									2" BSP		
C (Control Port)	1/4" NPT —				1/4" & 1/2" NPT	1/2" NPT				2" BSP		
W (inch.)	7	7	7	9	13	16	21	24	24	33	33	33
Weight*** (lbs.)	26	29	48	82	176	346	540	892	1123	1810	2082	2159
Vol. (gallons)	0.03	0.03	0.08	0.18	0.4	1.1	2.6	4.9	4.9	13.2	13.2	13.2

Global Flanged



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ACV SERIES

Automatic Hydraulic Control Valves

ENGINEERING DATA

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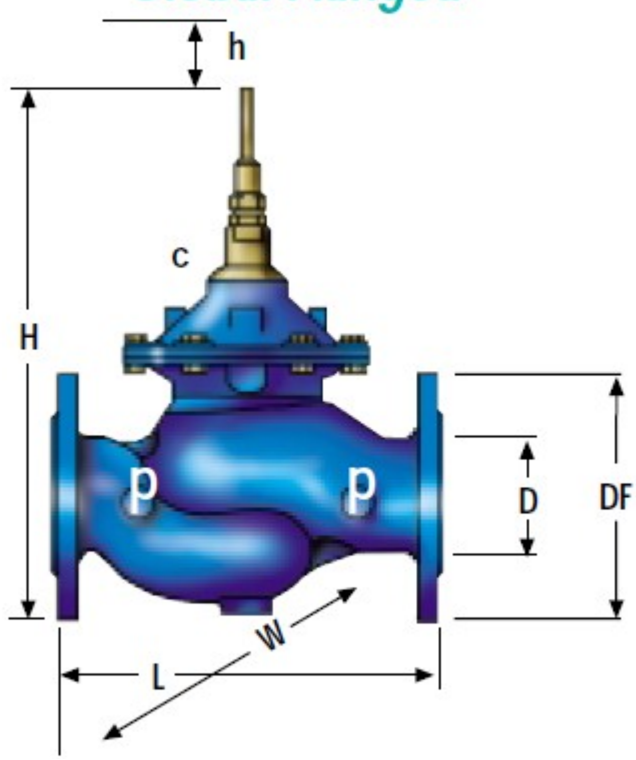
Dimensions & Weights

Globe Flanged type

Valve - D (Nominal)	50 (2″)	65 (2 $\frac{1}{2}$″)	80 (3″)	100 (4″)	150 (6″)	200 (8″)	250 (10″)	300 (12″)	350 (14″)	400 (16″)	450 (18″)	500 (20″)
L (mm)	230	292	310	350	480	600	730	850	980	1100	1200	1250
H (mm)*	235	294	400	433	558	650	823	944	990	1250	1250	1250
h (mm)**	18	18	28	28	40	60	80	100	100	145	145	145
DF(PN16) (mm)	165	185	200	220	285	345	410	460	520	580	620	715
DF(PN25) (mm)	165	185	200	240	305	360	425	485	555	620	670	730
P (CONTROL PORT)	$\frac{1}{2}$" NPT									2" BSP		
C (CONTROL PORT)	$\frac{1}{4}$" NPT				$\frac{1}{4}$" & $\frac{1}{2}$" NPT	$\frac{1}{2}$" NPT				2" BSP		
W (mm)	170	170	200	235	330	415	525	610	610	850	850	850
Weight*** (Kg)	12	13	22	37	80	157	245	405	510	822	945	980
Vol. Control Chamber (l)	0.1	0.1	0.3	0.7	1.5	4.3	9.7	18.6	18.6	50.0	50.0	50.0

Global Flanged



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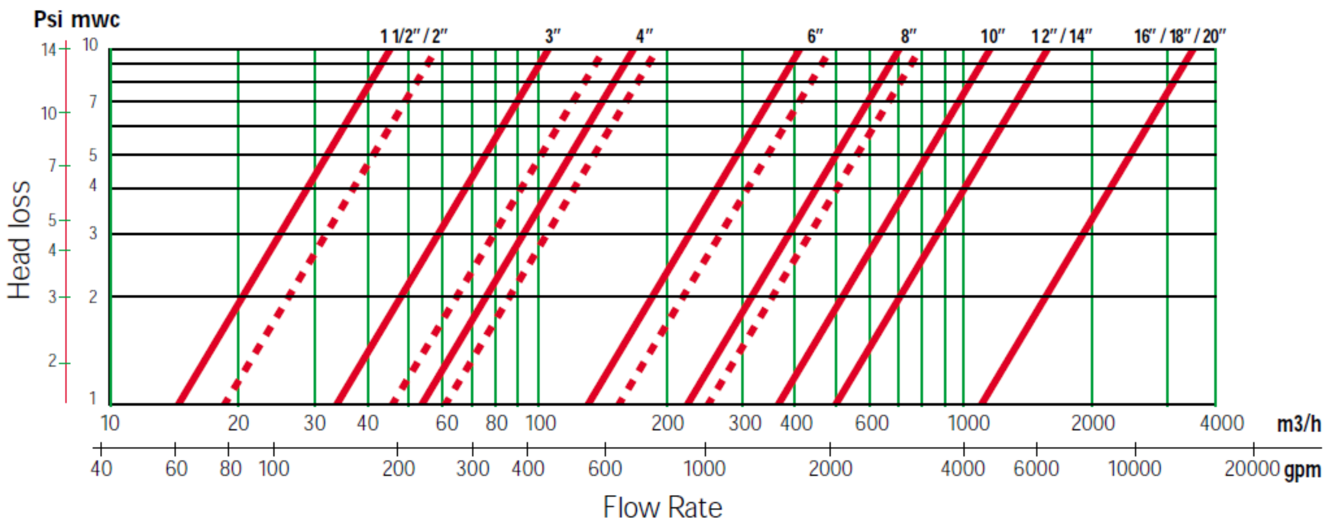
Headloss Charts

The graphs below indicate the hydraulic performance of the various control valves, affected by their control circuits:
Graph #1 - Matches On-Off, 3-Way Controlled Valves (fully open).
Graph #2 - Matches Modulating, 2-Way Controlled Valves.
Graph #3 - Matches Relief Valves (operating at high pressure differentials and high velocity flows)

Graph #1

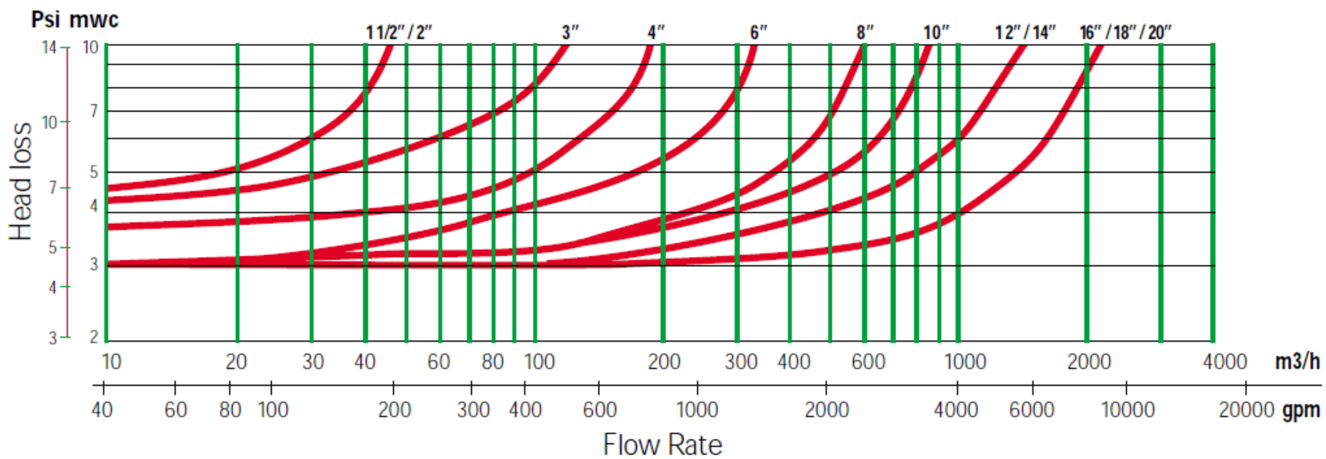
Relevant Control Valves: Solenoid Controlled (**EL**), Pressure Reducing (3-Way Control) **PR**(**3W**), Flow Rate Control (**FR**), Excessive Flow Shut-Off (**FE**), Differential Float Controlled (**FLDI1/FLDI2, FLDI/PS**), Altitude Control (**AL**), Electric Float Controlled (**FL/EL**), Pump Control (**BC**, **BC/PS**, **BC/TO**, **BC/FR**, **BC/CD**), Pressure Differential Sustaining (**DI**).



***Broken lines indicate data of Angle valves**

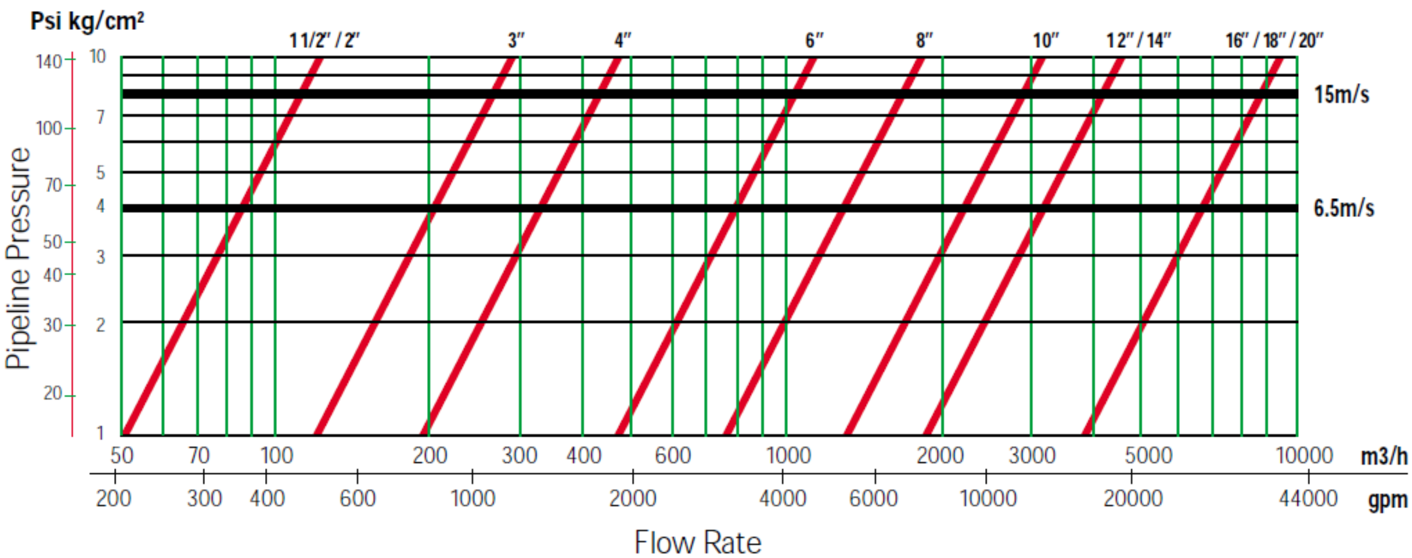
Graph #2

Relevant Control Valves: Hydraulic Check (**CV**), Pressure Reducing (**PR**), Proprtional Pressure Reducing **PR**(**D**), Pressure Reducing & Sustaining (**PR/PS**), Electrically Controlled Pressure Reducing (**PR/EL**), Pressure Sustaining (**PS**), Float Controlled (**FL**), Electronically Controlled (**EC**).



Graph #3

Relevant Control Valves: Pressure Relief **PS**(**R**), Quick Relief safety (**QR**), Surge Anticipating (**RE**), Surge Anticipating (Electric Activation) (**RE/EL**).



Size Selection Table

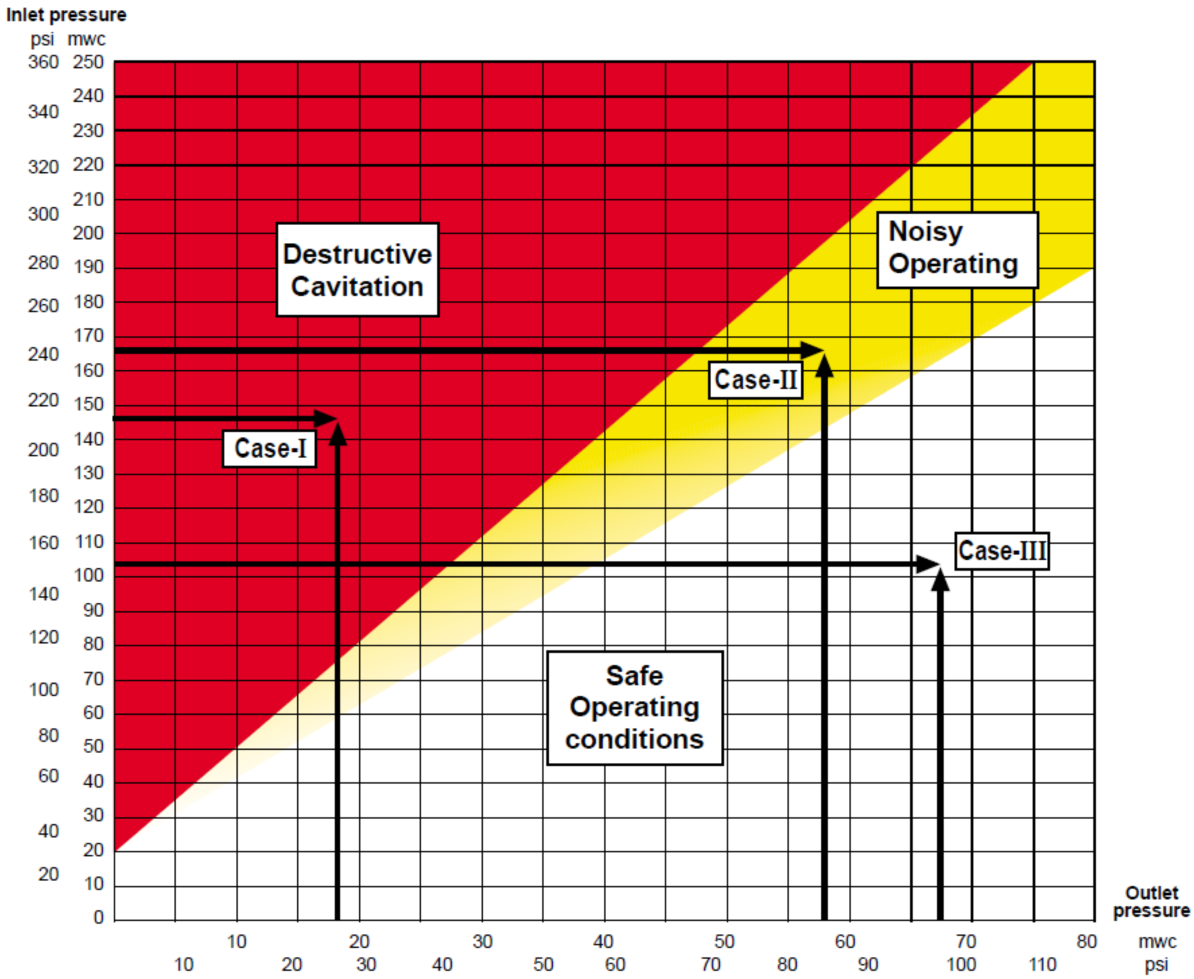
Valve Size (all types)		40 (1½")	50 (2")	65 (2½")	80 (3")	100 (4")	150 (6")	200 (8")	250 (10")	300 (12")	350 (14")	400 (16")	450 (18")	500 (20")
Max. Recommended Flow Rate For Continuos Operation (m^3/h - V=5.5m/s)		25	40	40	90	160	350	480	970	1400	1900	2500	3150	3900
Max. Recommended Flow Rate For Continuos Operation (Gpm - V=18f/s)		110	180	180	400	700	1600	2800	4300	6200	8400	11000	13900	17000
Min. Recommended Flow Rate		<1 m^3/h (<5 Gpm)												
Standard Type														
Flow Rate Factor:	Kv (Metric)	43	43	43	103	167	407	676	1160	1600	1600	3300	3300	3300
	Cv (US)	50	50	50	120	195	475	790	1360	1900	1900	3860	3860	3860
Head Loss Factor K (dimensionless)		2.2	5.4	15.4	6.7	5.6	4.8	5.5	4.5	5	9	3.8	5.9	9
Angle Type														
Flow Rate Factor:	Kv (Metric)	60	60		140	190	460	770						
	Cv (US)	70	70		164	222	537	900						
Head Loss Factor K (dimensionless)		1.3	2.8		3.3	4.3	4.3	4.2						

For head loss of fully open valves use the following equations:

$$H(Bar) = \left(\frac{Q(m^3/h)}{Kv}\right)^2 \qquad H(Psi) = \left(\frac{Q(Gpm)}{Cv}\right)^2$$

$$H = K\frac{V^2}{2g}$$

Cavitation Data



Cavitation Chart

Limits of operating conditions

The chart above sets the safe limits for valves that are supposed to operate at a considerable pressure differential. Such conditions generate noise and possible cavitation damages to the valve body.

How to use the chart:

i. Determine the maximal dynamic pressure that may be applied in the inlet of the valve.

ii. Draw an horizontal line from the pressure scale at the left side of the chart

iii. Find the requested outlet pressure in the pressure scale at the bottom of the chart.

iv. Draw an upward line at this point.

v. The intersection of the two lines defines the cavitation characteristics of the valve operation.

- In the case that it falls in the RED zone (case I)- the valve may be damaged in a fairly short time.
- In the case that it falls in the Yellow zone (case II)- the valve may generate a noise that exceeds 80db.
- In the case that the intersection is within the white zone (case III)- the valve will perform safely and quietly

General remark: The cavitation and noise data are based on tests done by the Utah State University, US, and Delft Hydraulic Laboratories, Holland.

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