BERMAD 700 SERIES HYDRAULIC CONTROL VALVES

Overview

The 700 Series is the BERMAD flagship product line, especially for Waterworks applications.

This Engineering Guide will assist in the selection of the most appropriate BERMAD valves by presenting and organizing the necessary technical data into easy-to-read formats.

Basic Design Features

The basic body design (globe or angle) results in lower pressure loss, reduced weight, and higher resistance to cavitation damage compared to that of a conventional globe control valve.

Valves are available in sizes 1½ to 32 inch (40-800 mm), threaded or flanged, with pressure ratings up to ISO PN 25; ANSI Class 300 psi. The valves are hydraulically operated by means of diaphragm actuators, (except for high-pressure application piston actuators). Principally, the valves are constructed of ductile cast iron or steel (other alloys are available) and are available with various protective coatings.

The double-chambered actuator provides a versatility not found in conventional control valves and achieves smooth drip-tight closing, accurate regulation and positive on/off control. The associated control trim provides all the necessary coordinated and complementary accessories for optimum valve operation. This actuator resists wear and tear from movement, prevents leakage due to dirt, is not sensitive to sediments, and has no need for lubrication. The life expectancy of its Nylon-reinforced diaphragm is virtually endless.

The standard flat sealing disk assembly includes a seal of NBR (Buna-N). Many special sealing materials are also available. The flat disc can be replaced by a throttling plug for applications with low flows and high pressure drops.

Optionally, the valve can be fitted with several accessories such as a valve position indicator, a mechanical closure and flow adjuster (for manual operation), limit switch assemblies (for position remote monitoring), and a lift spring assembly.

Standards

BERMAD is certified according to the ISO 9001 Quality Assurance Standard and each valve is certified as complying with NSF, WRAS, and other recognized international standards.

[1] - Double Chambered Actuator
The entire actuator assembly (seal disk to top cover) can be easily removed from the valve body as one complete unit, providing ease of inspection and maintenance.

[2] - Cover Plug
Enables on-site retrofit of:
Indicator: For visual valve opening indication
Limit-switch: For signaling valve position to control system
Valve Position Transmitter: For analog transmission of valve position to control system

[3] - Diaphragm Assembly
The unshaped, nylon reinforced, diaphragm is supported by the cover and separation partition on its circumference while the diaphragm washers provide full support over the majority of the surface. It is centrally guided. Diaphragm load is limited to only stretching forces applied to the active area.

[4] - Inherent Separation Partition
The built-in separation includes the bearing which provides complete central guiding for the valve moving assembly. In the double chambered configuration, it isolates the lower control chamber from the flow.
In the single chambered configuration, it separates the lower control chamber from the flow so that the diaphragm is protected and free from flow stresses.

[5] - Spring
Optional for single-chambered configurations or when the check feature is required.
Superfluous for double-chambered configurations.

[6] - Seal Disc Assembly
Self-aligning, seal disc assembly provides balanced, free movement and a resilient seal for perfect, drip-tight sealing. It enables using several variations of seals and plugs for a wide range of applications and working conditions.

[7] - Seat
Stainless steel, raised, replaceable in-line and on-site.

[8] - Wide Body ("Y" or Angle pattern)
Hydrodynamically designed for efficient flow with minimal pressure loss and excellent resistance to cavitation.
Full bore, valve port area clear of obstructions, no ribs or stem guides.
Increases capacity by 25% over ordinary globe valves. Also Angle pattern valve is available.

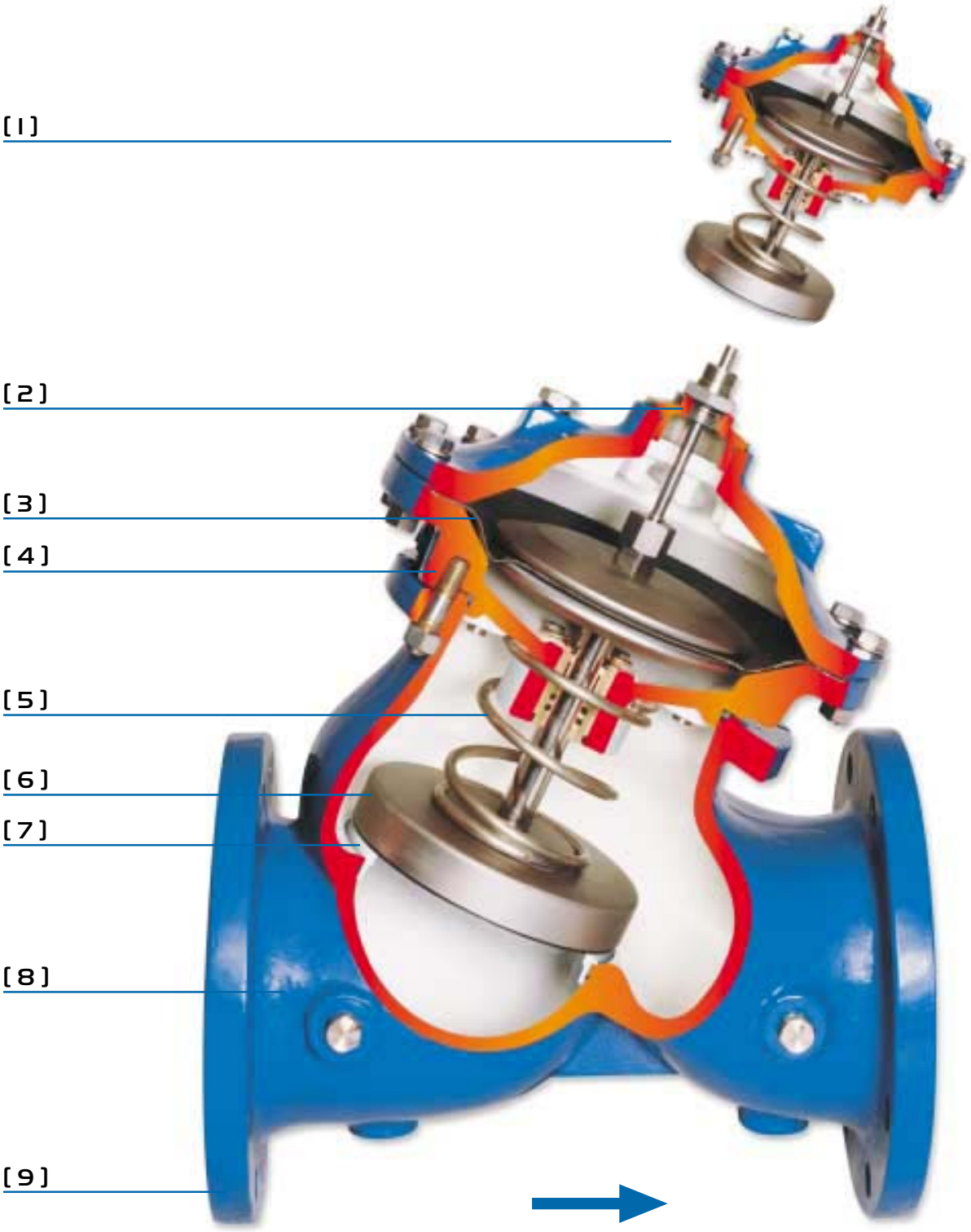
[9] - End Connections
Conforms to pressure ratings and standards of: ISO, ANSI, JIS, BS, and others.

Valve Plug Options

U-Port
Throttling Plug

Flat disc: "Quick opening plug": Standard plug provides high flow and quick response.

Throttling plugs: A throttling plug is used in order to provide more accurate, stable and smooth response for pressure and flow regulation while reducing noise and vibration.
Two types are available:
"U" contour (standard) and "V" contour.


[1]
[2]
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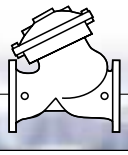
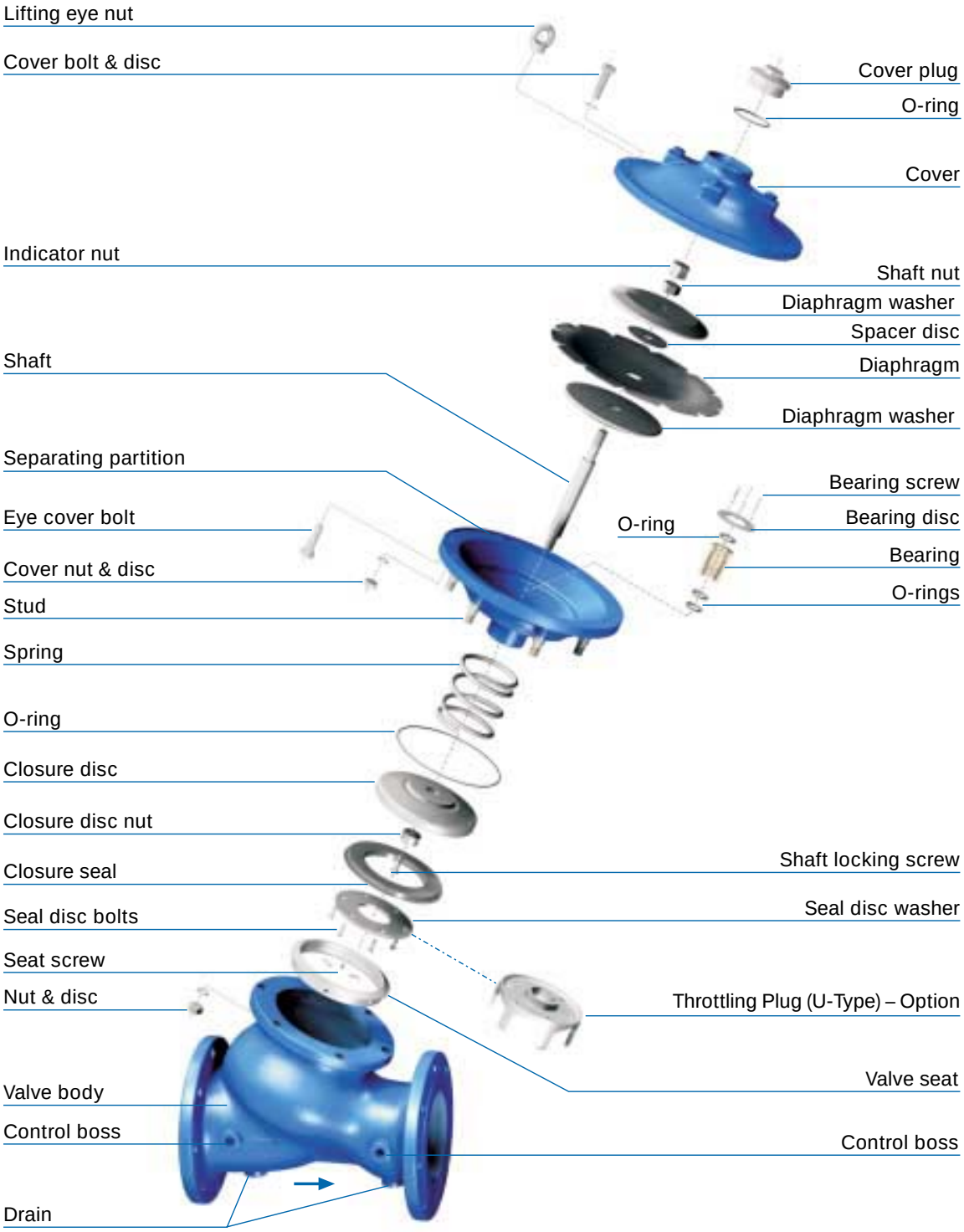


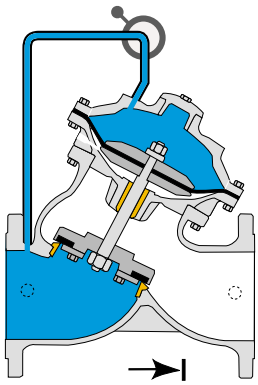
Valve - Exploded View

700 Series

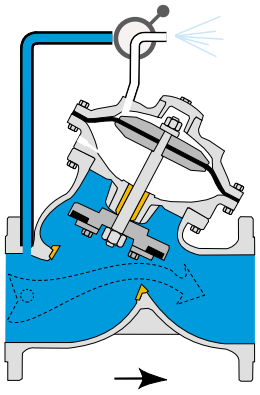


For spare parts ordering, Please use BERMAD "Spare Parts Ordering Guide"

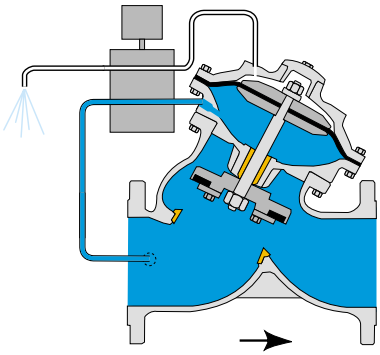
On-Off Modes



Closed Position
Line pressure applied to the upper control chamber of the valve creates a superior force that moves the valve to the closed position and provides drip tight sealing.



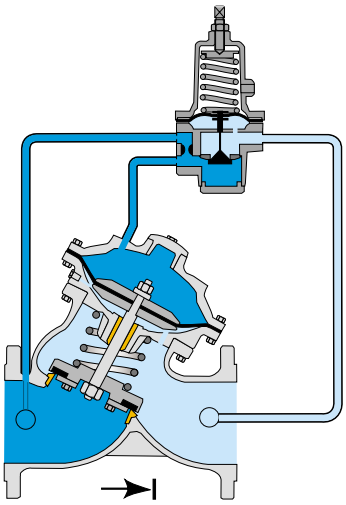
Open Position
Discharging the pressure in the upper control chamber to atmosphere or some other lower pressure zone causes the line pressure acting on the seal disc to move the valve to the open position.



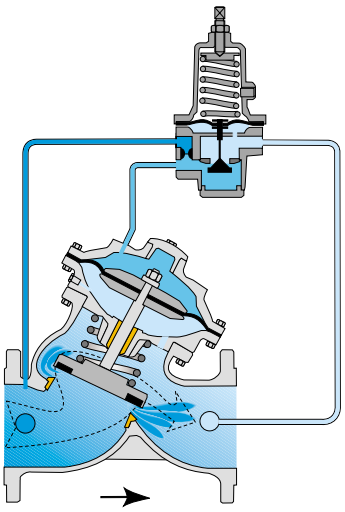
Powered Open Position
Pressure in the upper control chamber is discharged and line pressure is applied to both the lower control chamber and the seal disc. This creates a force that powers the valve to the open position.

Modulating Mode

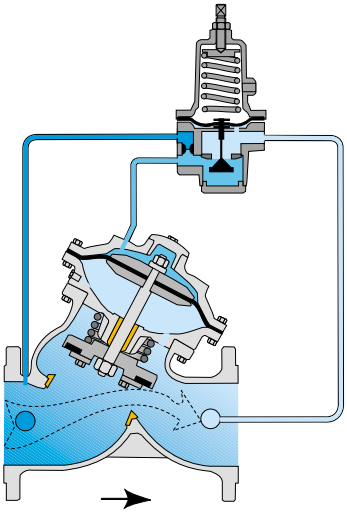
Pressure Reducing Models



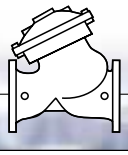
Closed Position
The closed adjustable pilot valve traps line pressure in the upper control chamber and the resulting force moves the valve to the fully closed position.



Modulating Position
The pilot valve senses and reacts to line pressure changes and opens or closes accordingly.
The pilot valve controls the pressure in the upper control chamber of the valve causing the valve to modulate to an intermediate position between fully open and closed.



Modulating Open Position
The open pilot valve releases line pressure from the upper control chamber and the line pressure acting on the seal disc moves the valve to the open position.



SI Metric

Connection Standard
- Flanged: ISO 700S-1 (Ductile iron),
- Threaded: NPT or BSP 40, 50, 65 & 80 mm

Water Temperature
- Up to 80ºC

Available Sizes ("Y" & Angle)
- 40, 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 750 and 800 mm

Working pressure
- ISO PN 16: 16 bar
- ISO PN 25: 25 bar

Standard Materials
- Main valve body and cover
  Ductile iron EN 1563
- Main valve internals
  Stainless steel, bronze and coated steel
- Control Trim
  Brass Components/Accessories
  Forged brass fittings & copper tubing
- Elastomers
  NBR (Buna-N)
  EPDM
  Viton
- Coating
  Fusion Bonded Epoxy, RAL 5005 (Blue)
  NSF 61 and WRAS approved
  or Electrostatic Polyester Powder, RAL 6017 (Green)

Optional Materials
- Main valve body/internals
  Cast Carbon steel ASTM A-216-WCB
  Cast Stainless steel 316 CF8M (316)
  Aluminum
  Ni.Al. bronze
  Titanium
  Alloy 20
  Duplex
  Hastalloy
  Marine Bronze
  SMO
- Control Trim
  Stainless steel 316
  Hastalloy C-276

US English

Connection Standard
- Flanged: ANSI B16.42 (Ductile iron),
- Threaded: NPT or BSP 1¹/₂, 2, 2¹/₂ & 3 inch

Water Temperature
- Up to 180ºF

Available Sizes ("Y" & Angle)
- 1¹/₂, 2, 2¹/₂, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 28, 30 and 32 inch

Working pressure
- Class #150: 250 psi
- Class #300: 400 psi

Manufacturers Standard Materials
- Main valve body and cover
  Ductile iron ASTM A-536
- Main valve internals
  Stainless steel, bronze and coated steel
- Control Trim
  Brass Components/Accessories
  Forged brass fittings & copper tubing
- Elastomers
  NBR (Buna-N)
  EPDM
  Viton
- Coating
  Fusion Bonded Epoxy, RAL 5005 (Blue)
  NSF 61 and WRAS approved
  or Electrostatic Polyester Powder, RAL 6017 (Green)

Optional Materials
- Main valve body/internals
  Cast Carbon steel ASTM A-216-WCB
  Cast Stainless steel CF8M (316)
  Aluminum
  Ni.Al. bronze
  Titanium
  Alloy 20
  Duplex
  Hastalloy
  Marine Bronze
  SMO
- Control Trim
  Stainless steel 316
  Hastalloy C-276

Standard Operation Pressure – Materials Data

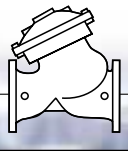
End Connections Standards / Pressure Ratings / Materials / Max. Operating Pressure

Bermad Code	End Connections Standard	Pressure Class	Cast Iron ASTM A-126 B	Bronze ASTM B 62	Ductile Iron ASTM A-536	Carbon Steel ASTM A-216 WCB	Stainless Steel ASTM A-531 CF 8M
10	I S O	PN 10	10 bar	+	+	+	+
16	I S O	PN 16	16 bar	16 bar	+	+	+
25	I S O	PN 25	–	25 bar	25 bar	25 bar	25 bar
A1	A N S I	# 125	175 psi	+	+	+	+
A2	A N S I	# 250	300 psi	+	+	+	+
A5	A N S I	# 150	–	225 psi	250 psi	285 psi	285 psi
A3	A N S I	# 300	–	400 psi	400 psi	400 psi	400 psi
BD	BS 10	Table D	100 psi	+	+	+	+
BS	BS 10	Table H	300 psi	400 psi	400 psi	400 psi	400 psi
J1	J I S	10 K	14 bar	+	+	+	+
J6	J I S	16 K	22 bar	27 bar	27 bar	27 bar	27 bar
J2	J I S	25 K	–	28 bar	28 bar	28 bar	28 bar
B1	A B N T	10	10 bar	+	+	+	+
B6	A B N T	16	16 bar	16 bar	+	+	+
B2	A B N T	25	–	25 bar	25 bar	25 bar	25 bar
	Threads						
BP	B S P		16 bar				
PH	B S P			25 bar	25 bar	25 bar	25 bar
NP	N P T		230 psi				
NH	N P T			400 psi	400 psi	400 psi	400 psi

+ Available, Not required by the standard pressure class
– Not available

Control Chamber Displacement Volume

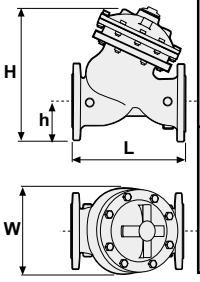
Sizes	mm	40	50	60	80	100	150	200	250	300	350	400	450	500	600-800
	inch	1 1/2"	2"	2 1/2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"-32"
Volume	Liter	0.125	0.125	0.125	0.3	0.45	2.15	4.5	8.5	12.4	12.4	29.8	29.8	29.9	98
	Gallon	0.03	0.03	0.03	0.03	0.12	0.57	1.19	2.25	3.28	3.28	7.88	7.88	7.88	25.9



SI Metric

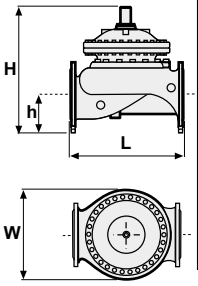
Flanged

Y Pattern



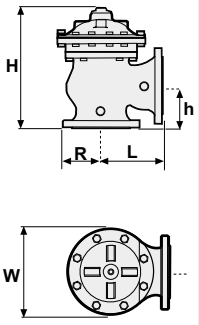
	mm	40	50	65	80	100	150	200	250	300	350	400	450	500
ISO PN 10; 16	L	205	210	222	250	320	415	500	605	725	733	990	1000	1100
	W	155	165	178	200	223	320	390	480	550	550	740	740	740
	h	78	83	95	100	115	143	172	204	242	268	300	319	358
	H	239	244	257	305	366	492	584	724	840	866	1108	1127	1167
	Weight (Kg)	9.1	10.6	13	22	37	75	125	217	370	381	846	945	962
ISO PN 20; 25	L	205	210	222	264	335	433	524	637	762	767	1024	1030	1136
	W	155	165	185	207	250	320	390	480	550	570	740	740	750
	h	78	83	95	105	127	159	191	223	261	295	325	357	389
	H	239	244	257	314	378	508	602	742	859	893	1133	1165	1197
	Weight (Kg)	10	12.2	15	25	43	85	146	245	410	434	900	967	986

G Pattern



	mm	600	700	750	800
ISO PN 10 ; 16	L	1450	1650	1750	1850
	W	1250	1250	1250	1250
	h	470	490	520	553
	H	1965	1985	2015	2048
	Weight (Kg)	3250	3700	3900	4100
ISO PN 20 ; 25	L	1500	1650	1750	1850
	W	1250	1250	1250	1250
	h	470	490	520	553
	H	1965	1985	2015	2048
	Weight (Kg)	3500	3700	3900	4100

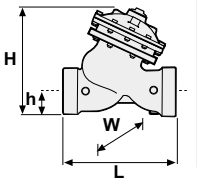
Angle Pattern



	mm	40	50	65	80	100	150	200	250	300	350	400	450
ISO PN 10 ; 16	L	124	124	149	152	190	225	265	320	396	400	450	450
	W	155	155	178	200	222	320	390	480	550	550	740	740
	R	78	83	95	100	115	143	172	204	248	264	299	320
	h	85	85	109	102	127	152	203	219	273	279	369	370
	H	227	227	251	281	342	441	545	633	777	781	1082	1082
	Weight (Kg)	9.5	10	20	21.5	35	71	118	205	350	370	800	820
ISO PN 20 ; 25	L	124	124	149	159	200	234	277	336	415	419	467	467
	W	165	165	185	207	250	320	390	480	550	550	740	740
	R	78	85	95	105	127	159	191	223	261	293	325	358
	h	85	85	109	109	135	165	216	236	294	299	386	386
	H	227	227	251	287	350	454	558	649	796	801	1099	1099
	Weight (Kg)	11	11.5	13.5	23	41	81	138	233	390	245	855	870

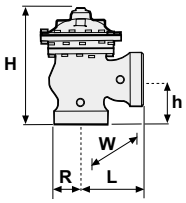
Threaded

Y Pattern

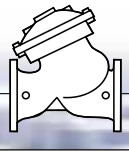


	mm	40	50	65	80
BSP ; NPT	L	155	155	212	250
	W	122	122	122	163
	h	40	40	48	56
	H	201	202	209	264
	Weight (Kg)	5.5	5.5	8	17

Angle Pattern



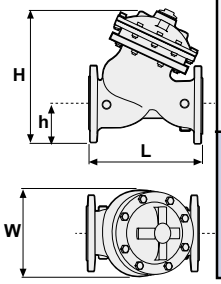
	mm	50	65	80
BSP ; NPT	L	121	140	159
	W	122	122	163
	R	40	48	55
	h	83	102	115
	H	225	242	294
	Weight (Kg)	5.5	7	15



US English

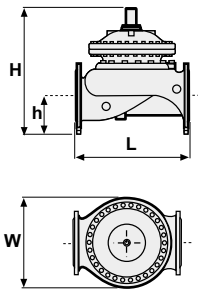
Flanged

Y Pattern



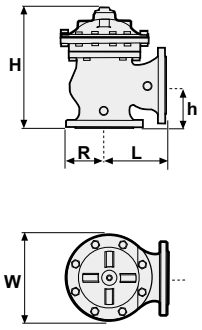
	inch	1½"	2"	2½"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"
ANSI 125 ; 150	L	8.1	8.1	8.3	9.8	12.6	16.3	19.7	23.8	28.5	28.9	39.0	39.4	43.3
	W	6.1	6.1	7.0	7.9	8.8	12.6	15.4	18.9	21.7	21.7	29.1	29.1	29.1
	h	3.1	3.3	3.7	3.9	4.5	5.6	6.8	8.0	9.5	10.6	11.8	12.6	14.1
	H	9.4	9.6	10.1	12.0	14.4	19.4	23.0	28.5	33.1	34.1	43.6	44.4	45.9
	Weight (lb)	20	23	29	49	82	165	276	478	816	840	1865	2083	2121
ANSI 250 ; 300	L	8.1	8.3	8.7	10.4	13.2	17.0	20.6	25.1	30.0	30.2	40.3	227.1	44.7
	W	6.1	6.5	7.3	8.1	9.8	12.6	15.4	18.9	21.7	22.4	29.1	29.1	29.5
	h	3.1	3.3	3.7	4.1	5.0	6.3	7.5	8.8	10.3	11.6	12.8	14.1	15.3
	H	9.4	9.6	10.1	12.4	14.9	20.0	23.7	29.2	33.8	35.2	44.6	45.9	47.1
	Weight (lb)	22	27	33	55	95	187	322	540	904	957	1984	2132	2174

G Pattern



	inch	24"	28"	30"	32"
ANSI 125 ; 150	L	57	65	70	73
	W	49	49	49	49
	h	18.5	19	20.5	21.8
	H	77	78	79.3	80.6
	Weight (lb)	7150	8140	8580	9020
ANSI 250 ; 300	L	59	65	70	73
	W	49	49	49	49
	h	18.5	19	20.5	21.8
	H	77	78	79.3	80.6
	Weight (lb)	7700	8140	8580	9020

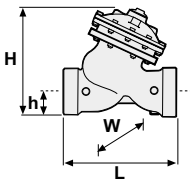
Angle Pattern



	inch	1½"	2"	2½"	3"	4"	6"	8"	10"	12"	14"	16"	18"
ANSI 125 ; 150	L	4.9	4.9	5.9	6.0	7.5	8.9	10.4	12.6	15.6	15.7	17.7	17.7
	W	6.1	6.1	7.0	7.9	8.7	12.6	15.4	18.9	21.7	21.7	29.1	29.1
	R	3.1	3.3	3.7	3.9	4.5	5.6	6.8	8.0	9.8	10.4	11.8	12.6
	h	3.3	3.3	4.3	4.0	5.0	6.0	8.0	8.6	10.7	11.0	14.5	14.5
	H	8.9	8.9	9.9	11.1	13.5	17.4	21.5	24.9	30.6	30.7	42.6	42.6
	Weight (lb)	21	22	44	47	77	157	260	452	772	816	1764	1808
ANSI 250 ; 300	L	4.9	4.9	5.9	6.3	7.9	9.2	10.9	13.2	16.3	16.5	18.4	18.4
	W	6.5	6.5	7.3	8.1	9.8	12.6	15.4	18.9	21.7	21.7	29.1	29.1
	R	3.1	3.3	3.7	4.1	5.0	6.3	7.5	8.8	10.3	11.5	12.8	14
	h	3.3	3.3	4.3	4.3	5.3	6.5	8.5	9.3	11.6	11.8	15.2	15.2
	H	8.9	8.9	9.9	11.3	13.8	17.9	22.0	25.6	31.3	31.5	43.3	43.3
	Weight (lb)	24	25	30	51	90	179	304	514	860	540	1885	1918

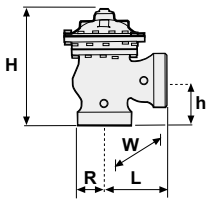
Threaded

Y Pattern



	inch	1½"	2"	2½"	3"
BSP ; NPT	L	6.1	6.1	8.3	9.8
	W	4.8	4.8	4.8	6.4
	h	1.6	1.6	8.2	2.2
	H	7.9	8.0	8.2	10.4
	Weight (lb)	12	12	18	37

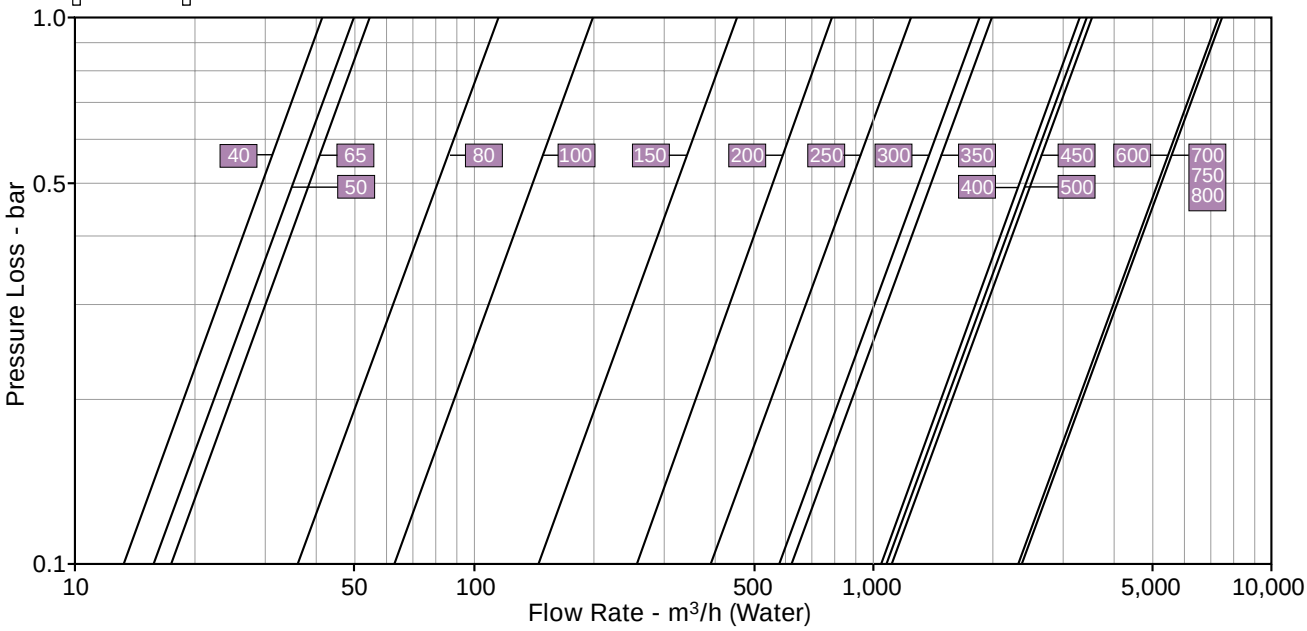
Angle Pattern



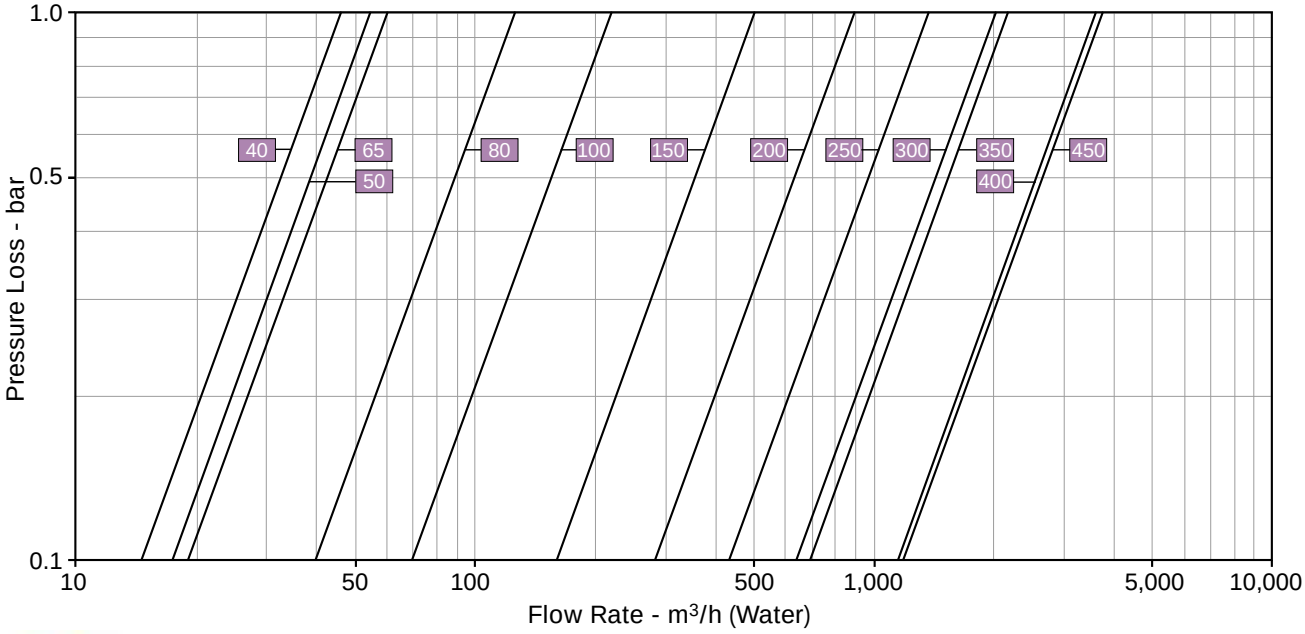
	inch	2"	2½"	3"
BSP ; NPT	L	4.8	5.5	6.3
	W	4.8	4.8	6.4
	R	1.6	1.9	2.2
	h	3.3	4.0	4.5
	H	8.9	9.5	11.6
	Weight (lb)	12	15	33

SI Metric

Y Pattern, Flat Disc

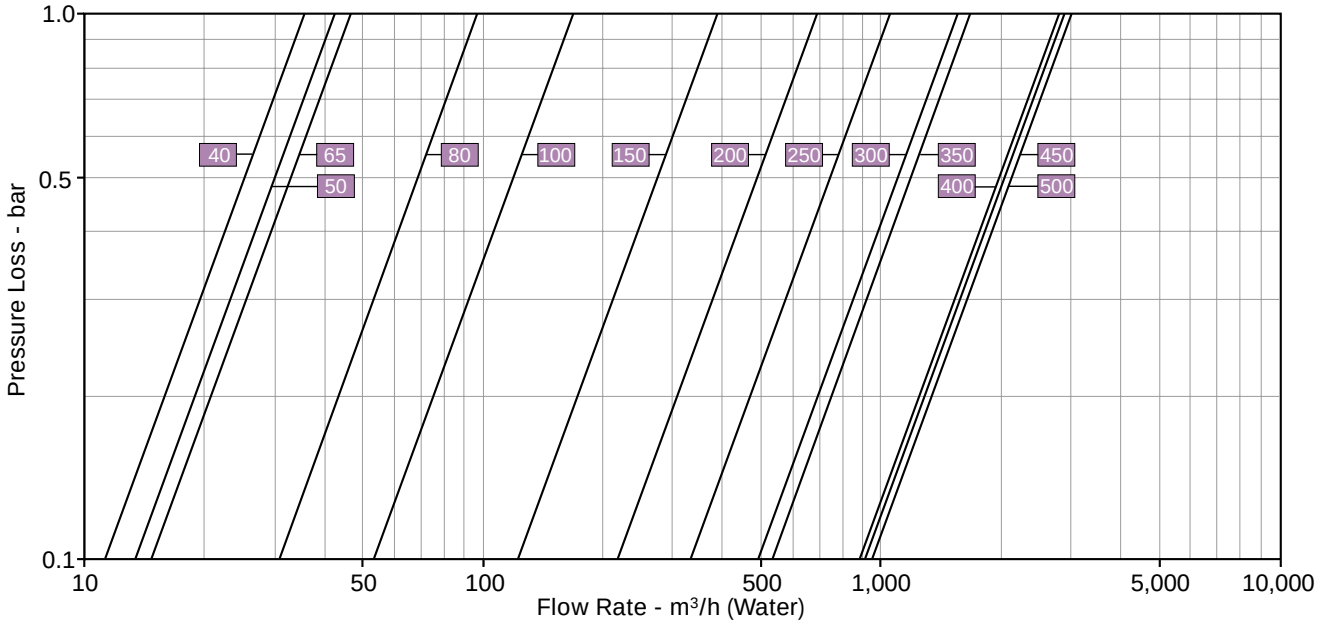


Angle Pattern, Flat Disc

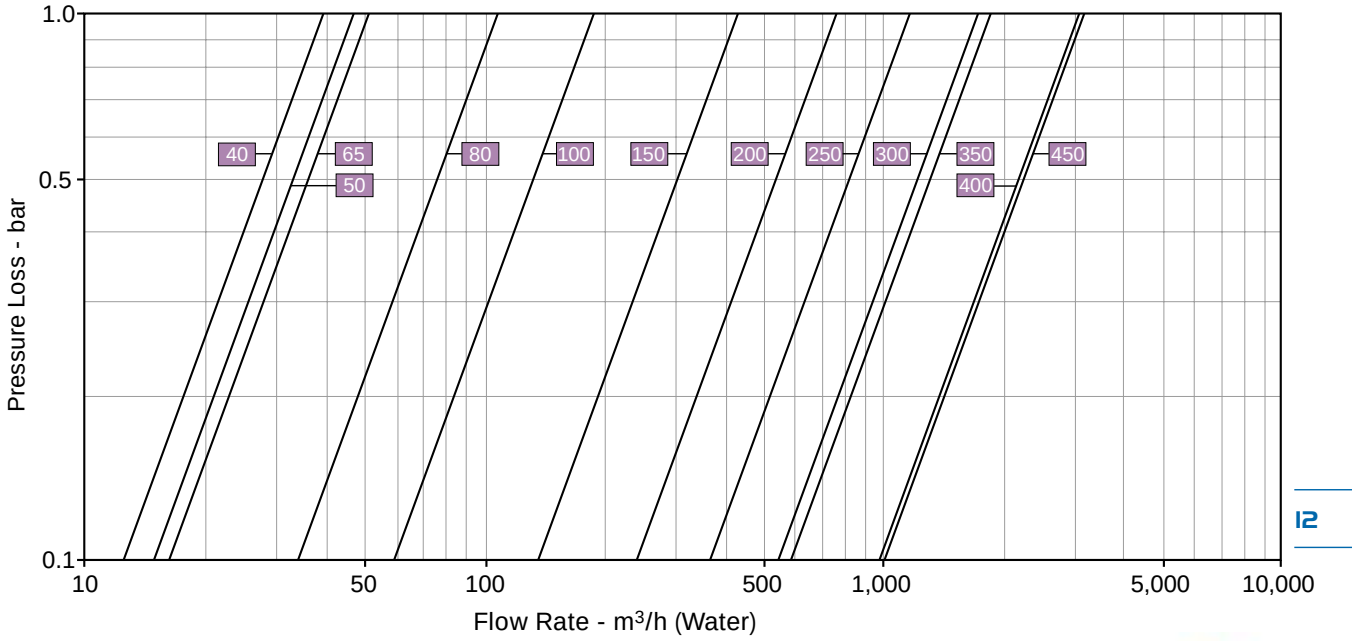


SI Metric

Y Pattern, Throttling Plug (U-Type)

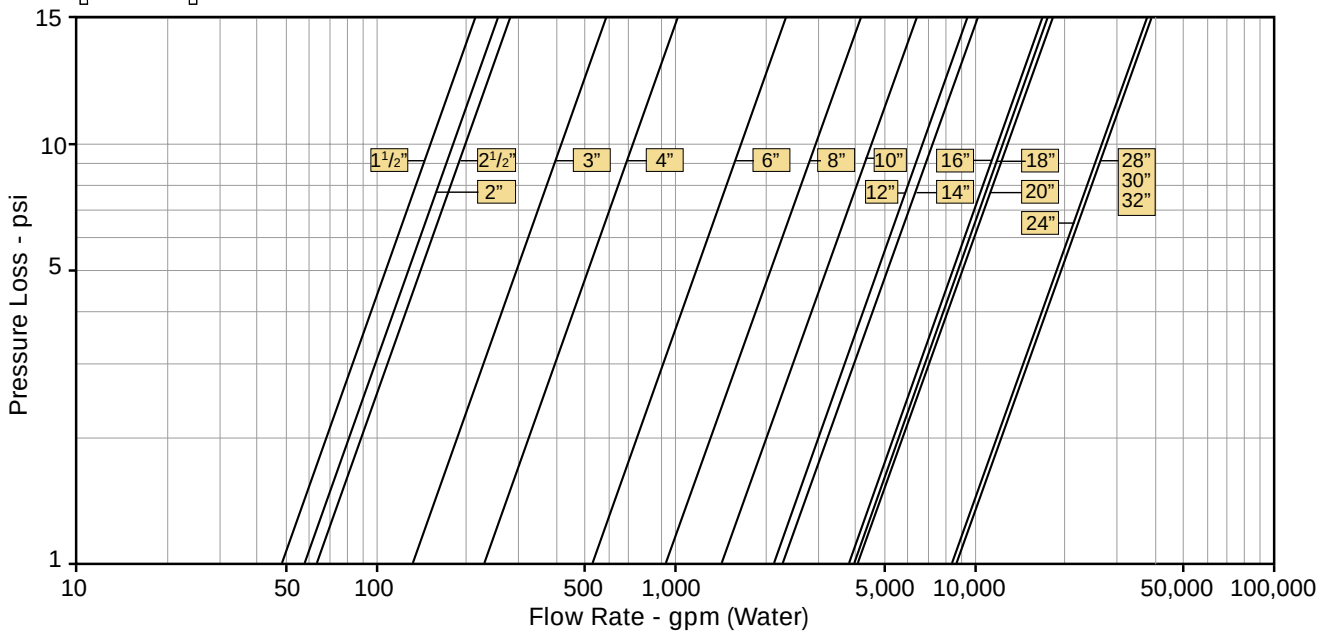


Angle Pattern, Throttling Plug (U-Type)

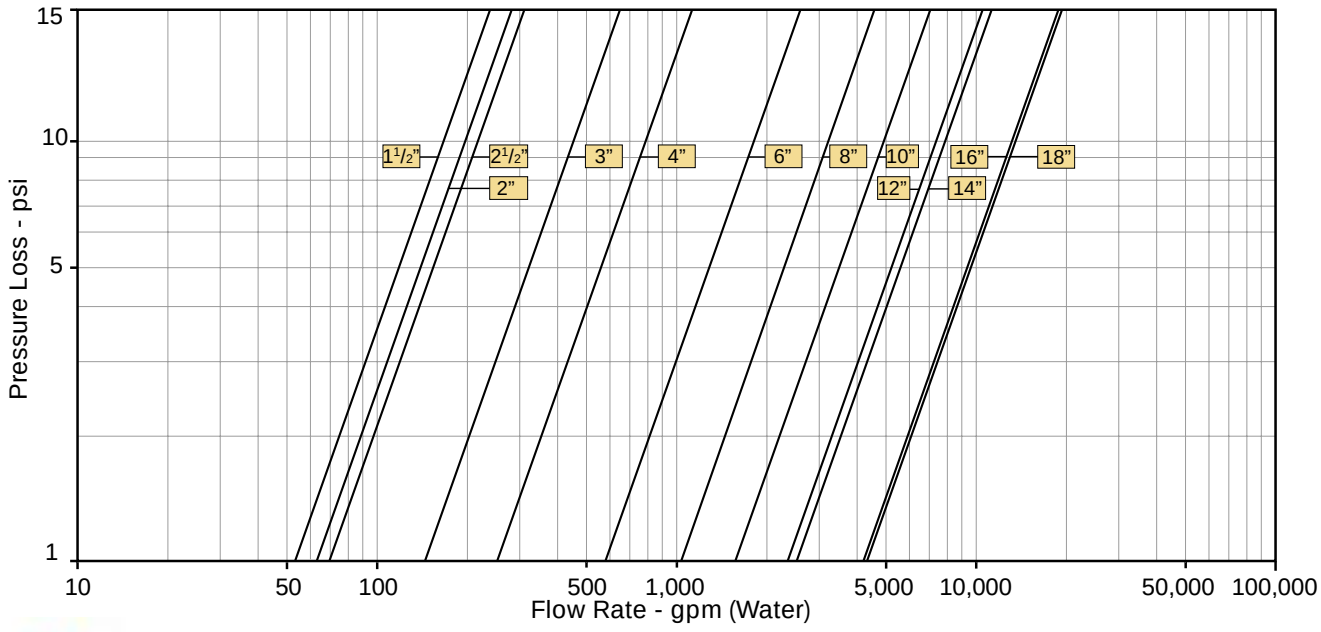


US English

Y Pattern, Flat Disc

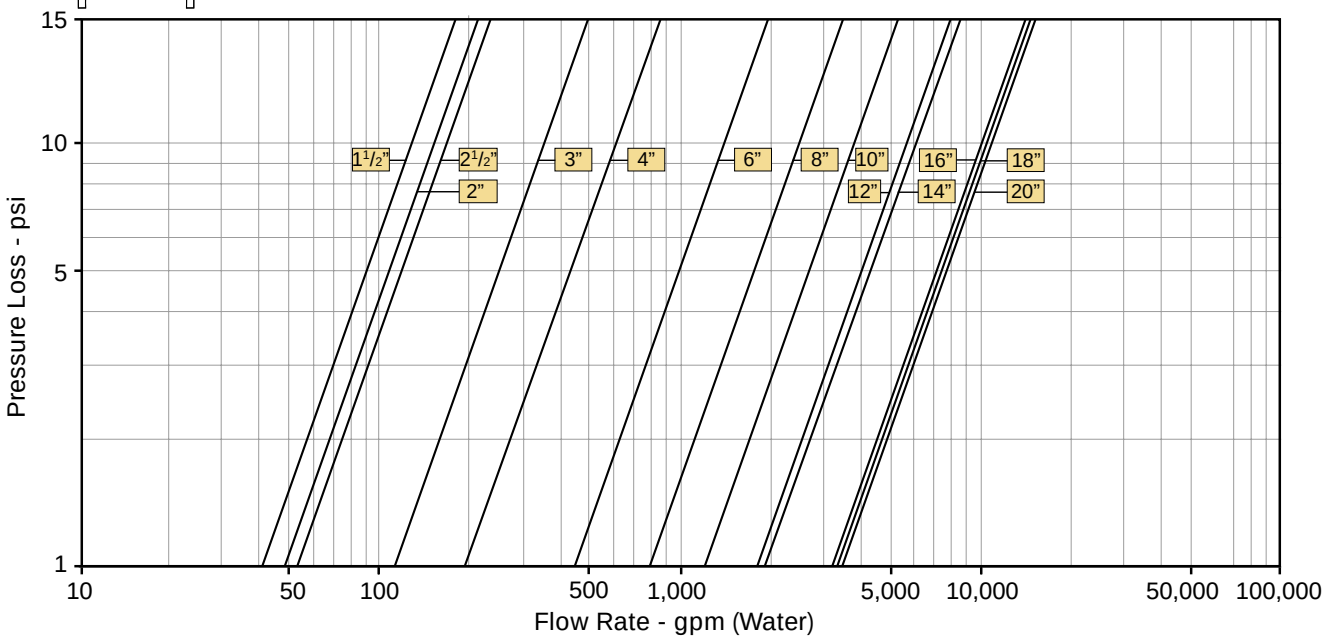


Angle Pattern, Flat Disc

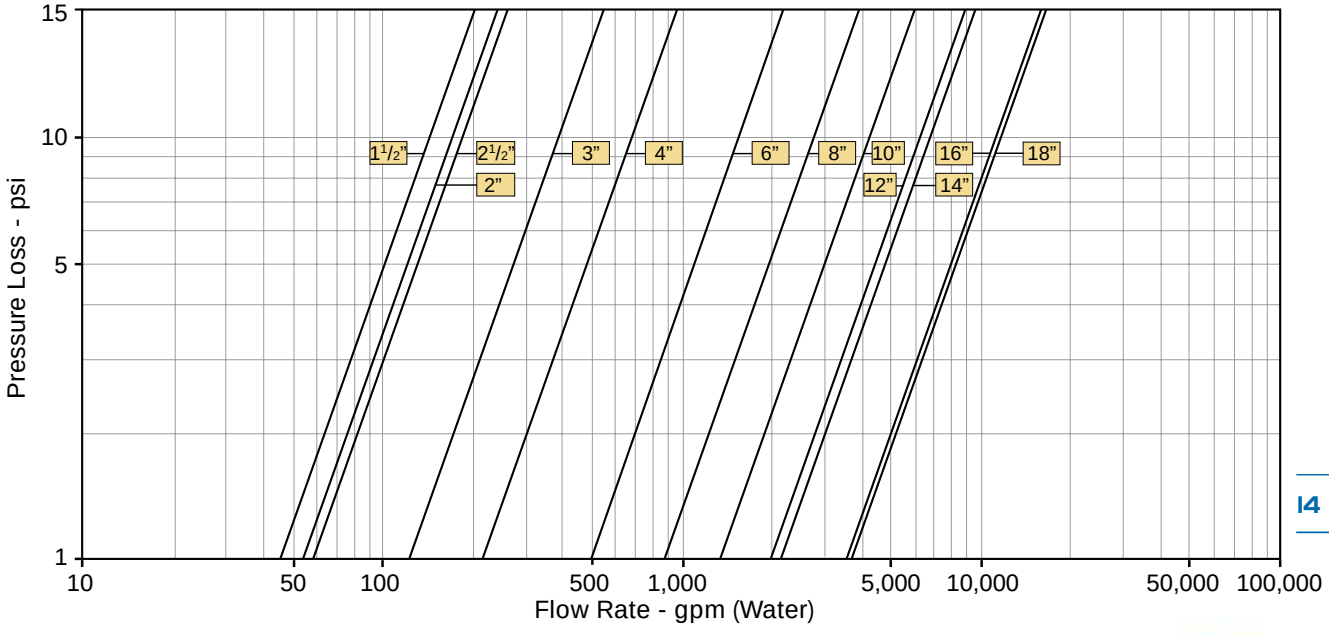


US English

Y Pattern, Throttling Plug (U-Type)

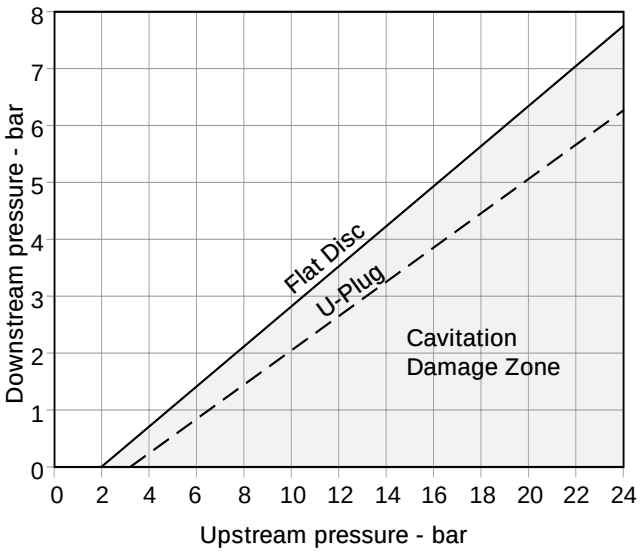


Angle Pattern, Throttling Plug (U-Type)



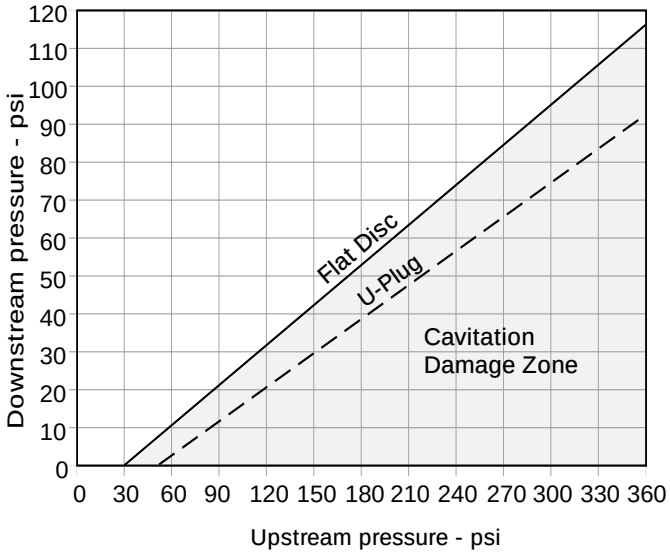
Cavitation Guide

SI Metric



Cavitation Guide

US English



Cavitation

The cavitation phenomenon has a significant affect on control valve and system performance.
Cavitation may damage the valve and piping by the affects of erosion and vibration. Cavitation also generates noise and may limit and ultimately choke the flow.
As the pressure differential across the valve increases, the static pressure of the flow passing through the throttling area of the valve (Vena Contracta) drops sharply.
When the fluid's static pressure reaches liquid vapor pressure, vapor cavities (bubbles) form and grow until they violently implode by the recovered pressure downstream to the valve seat.
The implosion of these cavities generates high-pressure surges, micro jets and intensive heat, which erode valve components and downstream piping. In its final stage, cavitation flashes and chokes the flow.
The above Cavitation Guides for Bermad 700 Series valves are based on the formula commonly used in the valve industry:

$\sigma = (P2-Pv) / (P1-P2)$

Where:

σ = Sigma, cavitation index, dimensionless
P1 = Upstream pressure, absolute
P2 = Downstream pressure, absolute
Pv = Liquid vapor pressure, absolute
(Water, $18^{o}C$ = 0.02 bar-a ; $65^{o}F$ = 0.3 psi-a)

Use these guides and your applications upstream and downstream pressures to determine whether their intersection lies in or out of the cavitation damage zone.
Considerations to avoid cavitation damage:

A) Reduce system pressure in stages designing each pressure stage to be above cavitation conditions.
B) Consider using other valve selection criteria
   a. Valve body and plug type
   b. Valve size
   c. Valve material

Notes:

1. An alternate cavitation index formula introduced by ISA is:
   $\sigma_{ISA} = (P1-Pv) / (P1-P2)$ which equals $\sigma+1$
2. The above charts should be considered only as a general guide.
3. For optimum system and control valve application please consult Bermad.

SI Metric

	mm	40	50	65	80	100	150	200	250	300	350	400	450	500
Y-Pattern Flat Disc 	Kv	42	50	55	115	200	460	815	1,250	1,850	1,990	3,310	3,430	3,550
	K	2.3	3.9	9.2	4.9	3.9	3.7	3.8	3.9	3.7	5.9	3.7	5.5	7.8
	Leq - m	4.3	10.3	33.4	21.6	23.0	37.5	53.9	70.0	85.6	159.9	112.7	204.8	323.8
Y-Pattern U-Plug 	Kv	36	43	47	98	170	391	693	1,063	1,573	1,692	2,814	2,916	3,018
	K	3.1	5.4	12.8	6.7	5.4	5.2	5.2	5.4	5.1	8.2	5.1	7.6	10.8
	Leq - m	6.0	14.3	46.2	29.9	31.9	51.9	74.6	96.8	118.4	221.3	155.9	283.5	448.1
Angle Pattern Flat Disc 	Kv	46	55	61	127	220	506	897	1,375	2,035	2,189	3,641	3,773	NA
	K	1.9	3.2	7.6	4.0	3.2	3.1	3.1	3.2	3.1	4.9	3.0	4.5	NA
	Leq - m	3.6	8.5	27.6	17.8	19.0	31.0	44.6	57.8	70.7	132.1	93.1	169.3	NA
Angle Pattern U-Plug 	Kv	39	47	51	108	187	430	762	1,169	1,730	1,861	3,095	3,207	NA
	K	2.6	4.5	10.6	5.6	4.5	4.3	4.3	4.5	4.2	6.8	4.2	6.2	NA
	Leq - m	5.0	11.8	38.2	24.7	26.4	42.9	61.7	80.0	97.9	182.9	128.9	234.3	NA

US English

	inch	1.5"	2"	2.5"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"
Y-Pattern Flat Disc 	Cv	49	58	64	133	230	530	940	1,440	2,140	2,300	3,820	3,960	4,100
	K	2.3	3.9	9.2	4.9	3.9	3.7	3.8	3.9	3.7	5.9	3.7	5.5	7.8
	Leq-feet	14.2	33.8	109.5	70.8	75.6	123.0	176.9	229.5	280.8	524.5	369.6	671.9	1,062.3
Y-Pattern U-Plug 	Cv	41	49	54	113	200	450	800	1,230	1,820	1,950	3,250	3,370	3,490
	K	3.1	5.4	12.8	6.7	5.4	5.2	5.2	5.4	5.1	8.2	5.1	7.6	10.8
	Leq-feet	19.7	46.8	151.6	97.9	104.6	170.2	244.8	317.6	388.6	725.9	511.6	930.0	1,470.3
Angle Pattern Flat Disc 	Cv	53	64	70	146	250	580	1,040	1,590	2,350	2,530	4,210	4,360	NA
	K	1.9	3.2	7.6	4.0	3.2	3.1	3.1	3.2	3.1	4.9	3.0	4.5	NA
	Leq-feet	11.7	28.0	90.5	58.5	62.5	101.6	146.2	189.7	232.0	433.4	305.5	555.3	NA
Angle Pattern U-Plug 	Cv	45	54	59	124	220	500	880	1,350	2,000	2,150	3,580	3,710	NA
	K	2.6	4.5	10.6	5.6	4.5	4.3	4.3	4.5	4.2	6.8	4.2	6.2	NA
	Leq-feet	16.3	38.7	125.3	80.9	86.5	140.7	202.4	262.5	321.2	599.9	422.8	768.6	NA

SI Metric

	mm	600	700	750	800
G-Pattern Flat Disc 	Kv	7,350	7,500	7,500	7,500
	K	3.8	6.7	8.8	11.4
	Leq - m	188.0	390.1	550.9	760.7

US English

	inch	24"	28"	30"	32"
G-Pattern Flat Disc 	Cv	8,490	8,670	8,670	8,670
	K	3.8	6.7	8.8	11.4
	Leq-feet	616.6	1,280.0	1,807.3	2,495.6

Valve flow coefficient, Kv or Cv $Kv(Cv)=Q\sqrt{\frac{G_f}{\Delta P}}$

Where:
Kv = Valve flow coefficient (flow in m^3/h at 1bar Diff. Press.)
Cv = Valve flow coefficient (flow in gpm at Diff. Press. 1psi)
Q = Flow rate (m^3/h ; gpm)
ΔP = Differential pressure (bar ; psi)
G_f = Liquid specific gravity (Water = 1.0)

$Cv = 1.155\ Kv$

Flow resistance or Head loss coefficient, $K = \Delta H \frac{2g}{V^2}$

Where:
K = Flow resistance or Head loss coefficient (dimensionless)
ΔH = Head loss (m ; feet)
V = Nominal size flow velocity (m/sec ; feet/sec.)
g = Acceleration of gravity (9.81 m/sec^2 ; 32.18 $feet/sec^2$)

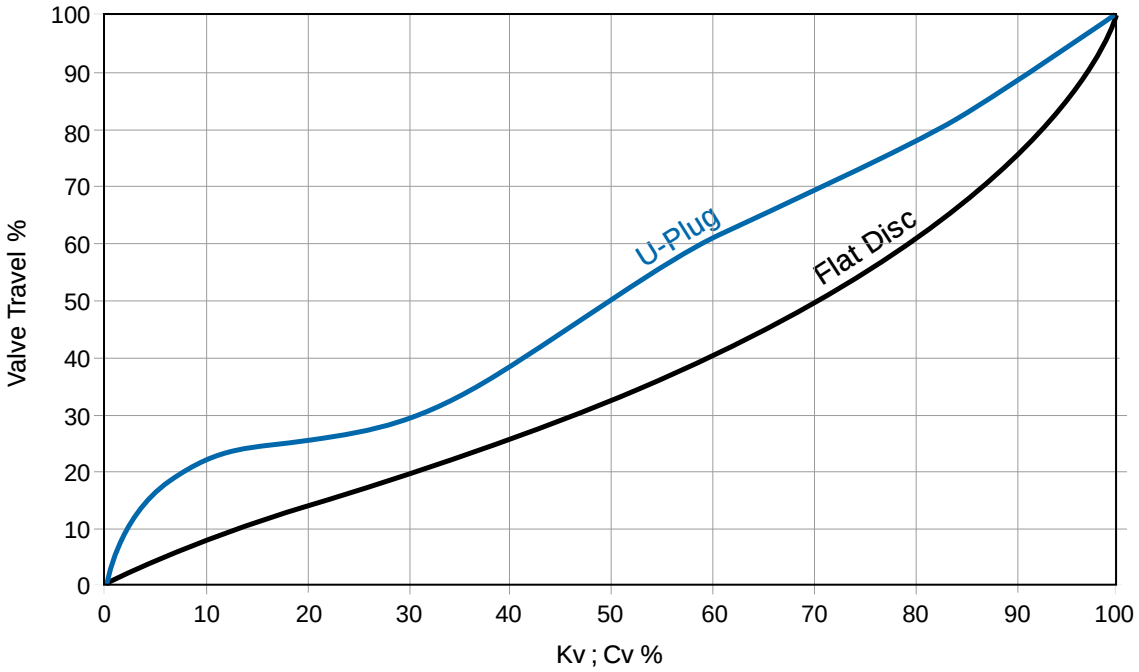
Equivalent Pipe Length, Leq $Leq = Lk \cdot D$

Where:
Leq = Equivalent nominal pipe length (m ; feet)
Lk = Equivalent length coefficient for turbulent flow in clean commercial steel pipe (SCH 40)
D = Nominal pipe diameter (m ; feet)

Note:
The Leq values given are for general consideration only.
Actual Leq may vary somewhat with each of the valve sizes.

Valve Plugs Characteristics

Kv ; Cv to Valve Opening Chart



Typical Pressure Reducing Performance Chart

Actual Hydraulic Laboratory Results