# IR-400 Basic Valve

The basic Model IR-400 diaphragm actuated hydraulically operated valve is at the leading edge of control valve design. It combines simple and reliable construction with superior performance, while at the same time being virtually free of the typical limitations associated with other single chambered valves. These automatic water control valves are designed for vertical or horizontal installation and are available in diameter sizes of 2-16"; DN50- DN400, in a wide range of materials and end connections.

The design of the IR-400 valve body includes a full bore seat with unobstructed flow path, free of any in-line ribs, supporting cage, or shafts.

The unique hydro-dynamic globe design provides high flow capabilities with minimum head loss. The cover is removable via four (4) fastening bolts (up to 10") for quick in-line inspection and service. The internal design of the IR-400 valve is based on innovative technology using advanced rubber-based materials to achieve a solid, one piece elastomeric assembly including a flexible fabric reinforced diaphragm, vulcanized with a rugged radial seal disk. The diaphragm is carefully balanced and peripherally supported to avoid distortion and to protect the elastomer, resulting in long-life and controlled actuation even under harsh conditions. One diaphragm and spring fully meet the valve's operating pressure range requirements. The diaphragm assembly can be easily removed from the valve body with no need for disassembling the valve from the line.

The Model IR-400 Basic Valve uses valve differential pressure to power the diaphragm assembly open or closed. The lower side of the diaphragm, which serves to cushion the closing of the valve, is exposed to downstream pressure through a dynamic peripheral passageway that its width responds to differential pressure and flow along the downstream side of the valve. The pressure in the control chamber varies, usually resulting from the combined action of a regulating pilot and a fixed orifice. This varying pressure modulates the valve to open or close.
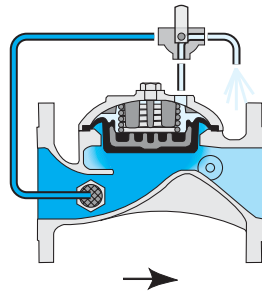
BERMAD Irrigation
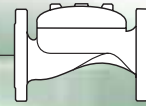
On-Off Modes
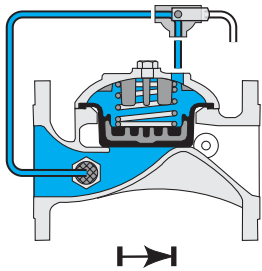
Closed Position

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

Open Position

Discharging the pressure from the control chamber to atmosphere or some other lower pressure zone, causes the line pressure acting on the plug to open the valve.

2-Way Modulating Modes
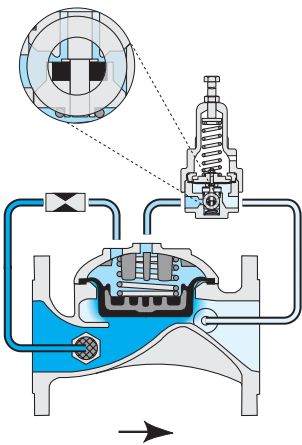
Modulating Closed

The restriction continuously allows line pressure into the control chamber. The pilot controls outflow from the control chamber.
Throttling when it senses a pressure rise, it causes pressure to accumulate in the control chamber, thereby forcing the valve to modulate closed.
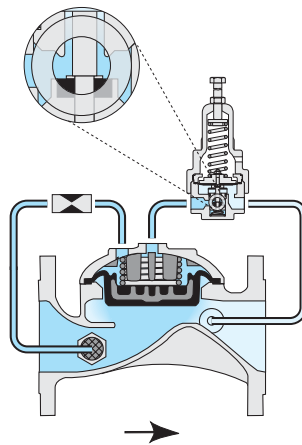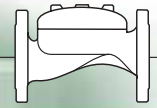
Modulating Open

The pilot modulates open when it senses a pressure drop releasing more flow from the control chamber than the restriction can allow in. This causes the accumulated pressure in the control chamber to drop and the valve modulates open.
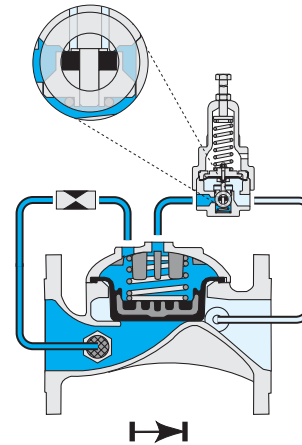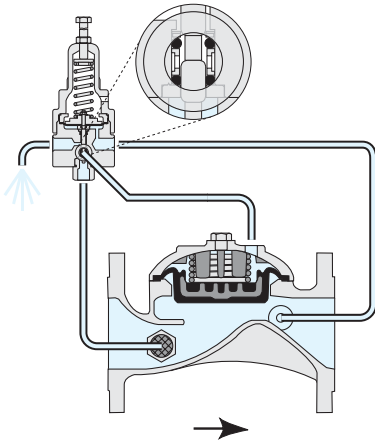
Zero Flow Position

When demand drops to zero, downstream pressure begins to rise as the flow enters a closed line. The pilot closes initiating a valve's irreversible closing process, eventually causing it to seal drip tight.
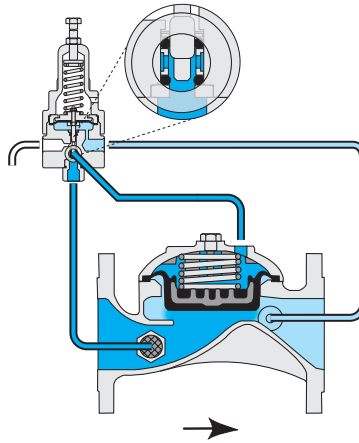
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3-Way Control Modes

Fully Open Position

When upstream pressure drops, the pilot blocks the pressure port and opens the drain port, venting the control chamber to the atmosphere. This fully opens the valve, minimizing head loss.

Modulating Closed

The pilot switches upon pressure rise, blocking the drain port and opening the pressure port.

This pressurizes the control chamber, forcing the valve to modulate closed.
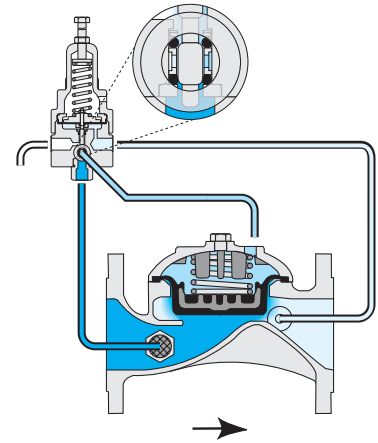
Locked Position

When sensed pressure is equal to setting, the pilot shaft moves and blocks both the drain port and the pressure port. This locks the pressure in the control chamber, freezing the valve in its last position until conditions change.
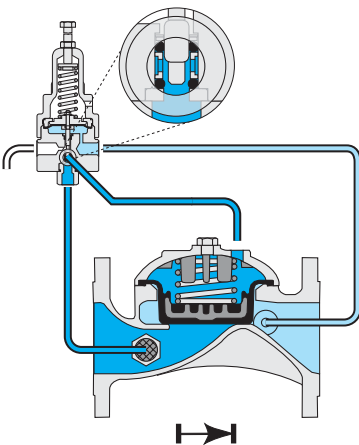
Zero Flow Position

When demand drops to zero, downstream pressure begins to rise as the flow enters a closed line. The pilot switches and pressurizes the control chamber initiating a valve's irreversible closing process, eventually causing it to seal drip tight.

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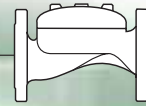
[1] Fastening Bolts

Only four bolts (up to 10"; DN250 valve) fasten valve cover to body, ensuring quick in-line inspection and service.

[2] Valve Cover

Locates, centralizes and fastens diaphragm and spring ensuring smooth and accurate performance. Simple construction enables quick in-line inspection and service.

[3] Auxiliary Closing Spring

One single spring fully meets valve requirements for operating pressure range, ensuring low opening pressure and secured closing.

[4] Diaphragm Assembly

One piece elastomeric assembly that includes a peripherally supported flexible diaphragm, vulcanized with a rugged radial seal disk.

- No need for special types of diaphragms to meet different operating conditions.
- Progressive dynamic guidance, resulting in exceptionally stable action and restrained closing.
- Valve opens and closes drip tight even with very low pressure supply.
- Perfectly balanced diaphragm with no distortion caused by uneven hydraulic forces on shut-off or during regulation.
- Exceptionally stable and chatter-free action during shut-off and pressure regulation.

[5] Body Threads

No need for nuts, simplifying valve disassembling and assembling for maintenance.
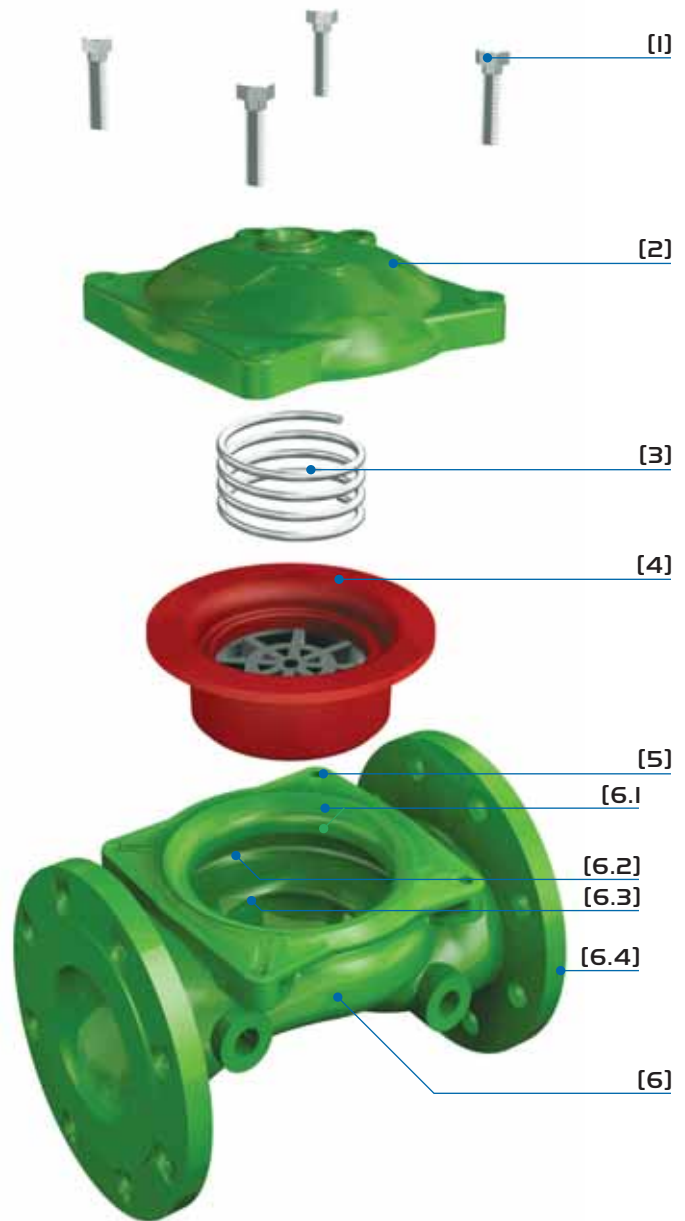
[6] Wide Body Valve

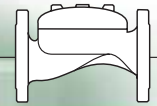Hydro-dynamically designed for efficient flow with minimal pressure loss and excellent resistance to cavitation.

[6.1] Diaphragm Supporting & Guiding
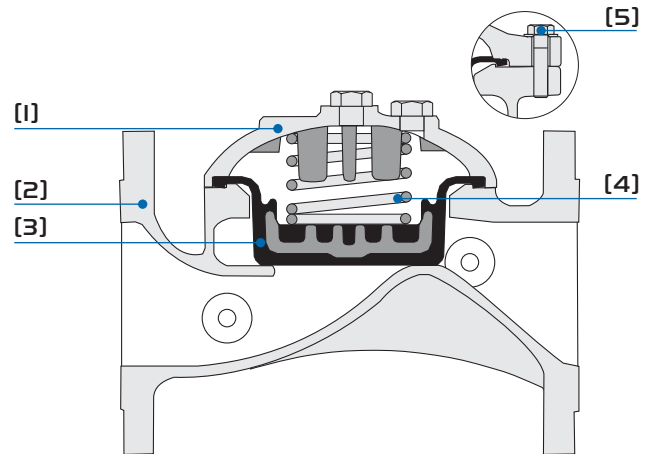
[6.2] Diaphragm Balancing Chamber

[6.3] Valve Seat: Full bore, valve port area clear of obstructions; no ribs or stem guides. Flow entrance is vertical to seal disk.

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

SI | Metric

Construction Materials

[1]
[2]
[3]
[4]
[5]

Description	GR-400	IR-400			
Size	DN20-50	DN40-150	DN200	DN250-400	DN50-100
Pattern	Globe	Globe	Globe	Globe	Angle
Cover [1]	Brass	Cast Iron	Cast Iron	Ductile Iron	Cast Iron
Valve Body [2]	Brass	Cast Iron[1]	Cast Iron[1]	Ductile Iron	Cast Iron
Diaphragm [3] Assembly	NR with Plastic VRSD[2]	NR with Plastic VRSD[2]	NR with Plastic VRSD[2]		NR with Plastic VRSD[2]
Spring [4]	St. St. 302	Stainless Steel 302 302			
External Bolts [5]	St. St. 304	Zinc-Cobalt Plated Steel			
Coating	Un-Coated	Polyester Green RAL 6017			
Pressure Rating	PN10	PN16			

(1) DN100 & 150 grooved valves are constructed of Ductile Iron
(2) Vulcanized Radial Seal Disk

Technical Specifications

Available Patterns, Size & End Connections

	GR-400				IR-400			
Connections	DN20	DN25	DN40	DN50	DN40	DN50	DN65	DN80R
Threaded	G	G	G	G	G	G & A	G & A	G & A
Flanged						G & A	G	G
Grooved						G		

	IR-400							
Connections	DN80	DN100	DN150	DN200	DN250	DN300	DN350	DN400
Threaded	G & A							
Flanged	G & A	G & A	G	G	G	G	G	G
Grooved	G & A	G & A	G					

G = Globe, A = Angle

Connections Standard:
Flanged: ISO 7005-2 (PN10 & 16)
Threaded: Rp ISO 7/1 (BSP.P) or NPT
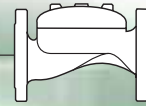Grooved: ANSI C606

Operating Pressure Ranges:
IR-400: 0.5-16 bar
For lower pressure requirements, consult factory
GR-400: 0.5-10 bar
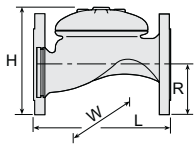
Temperature: Water up to 60°C

Standard Materials:
■ Castings & Forgings:
  ❑ Cast Iron to EN 1561
  ❑ Ductile Iron to EN 1563
  ❑ Brass
  ❑ Plasti: Polyamid 6+30% GF
■ Elastomers: NR to EN 681-1
■ Coatings: Electrostatic Powder Coating Polyester

SI Metric

Globe Pattern

Size		Flanged										
		DN50	DN65	DN80R	DN80	DN100	DN150	DN200	DN250	DN300	DN350	DN400
L	(mm)	205	205	210	250	320	415	500	605	725	742	742
H	(mm)	155	178	200	210	242	345	430	460	635	655	965
W	(mm)	155	178	200	200	223	306	365	405	580	587	600
R	(mm)	78	89	100	100	112	140	170	202	242	260	300
Weight (kg)		9	10.5	12.1	19	28	68	125	140	290	358	377

Size		Threaded					Grooved			
		DN40	DN50	DN65	DN80R	DN80	DN50	DN80	DN100	DN150
L	(mm)	153	180	210	210	255	205	250	320	415
H	(mm)	87	114	132	140	165	108	155	191	302
W	(mm)	98	119	129	129	170	119	170	204	306
R	(mm)	29	39	45	53	55	31	46	61	85
Weight (kg)		2	4	5.7	5.8	13	5	10.6	16.2	49

Angle Pattern
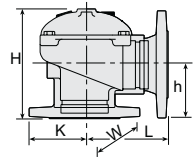
Size		Threaded				Grooved		Flanged		
		DN50	DN65	DN80R	DN80	DN80	DN100	DN50	DN80	DN100
L	(mm)	86	110	110	110	120	160	121	153	160
H	(mm)	136	180	178	184	194	223	160	205	223
W	(mm)	119	131	131	170	170	204	155	200	223
h	(mm)	61	93	91	80	90	112	83	101	112
K	(mm)	56	66	66	55	45	58	78	100	112
Weight (kg)		4.4	5.8	7	11	10	16	9	17	26

Globe Pattern GR-400
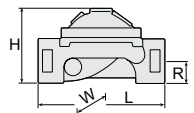
Size		DN20	DN25	DN40	DN50
L	(mm)	112	115	150	180
H	(mm)	68	70	89	103
W	(mm)	22	23	32	39
R	(mm)	72	72	94	118
Weight (kg)		0.95	0.95	1.5	4

Control Chamber Displacement Volume (liter)

DN50	DN65	DN80	DN100	DN150	DN200	DN250	DN300-400
0.113	0.179	0.291	0.668	1.973	3.858	3.858	13.75
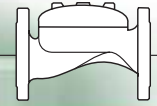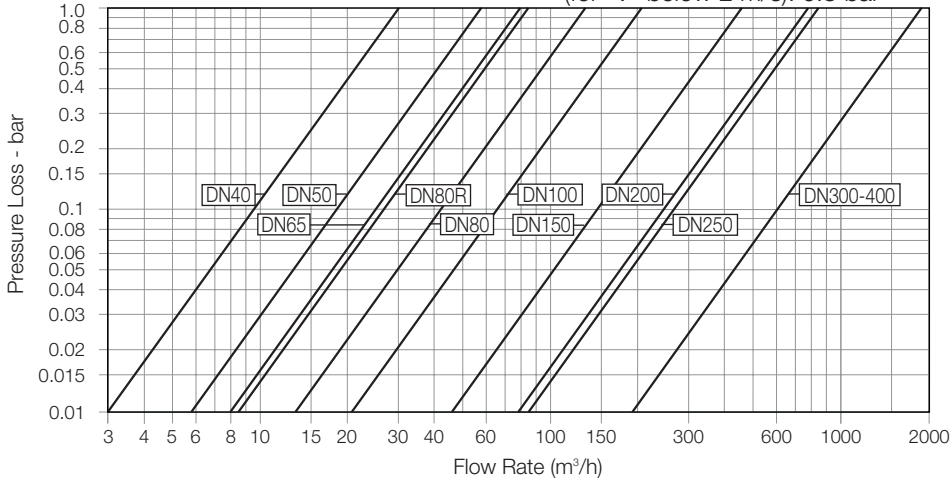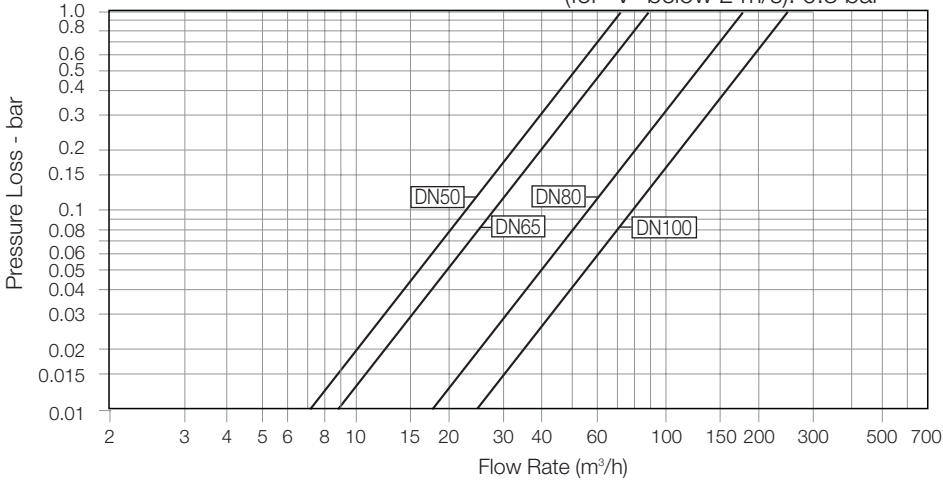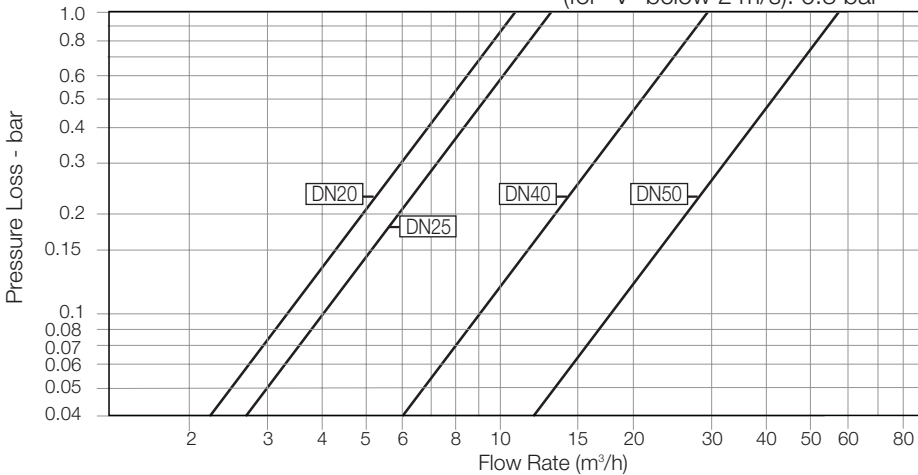
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Flow Charts

400 Series

SI Metric

Globe Pattern

2-Way circuit "Added Head Loss"
(for "V" below 2 m/s): 0.3 bar

DN40, DN65, DN50, DN80R, DN80, DN100, DN150, DN200, DN250, DN300-400

Angle Pattern

2-Way circuit "Added Head Loss"
(for "V" below 2 m/s): 0.3 bar

DN50, DN65, DN80, DN100

Globe Pattern GR-400

2-Way circuit "Added Head Loss"
(for "V" below 2 m/s): 0.3 bar

DN20, DN25, DN40, DN50
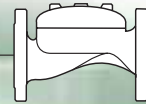
SI Metric

	Size	DN50	DN65	DN80	DN100	DN150	DN200	DN250	DN300-400
Globe Pattern	Kv	57	78	136	204	458	781	829	1,932
	K	3.2	4.2	2.9	4.0	4.0	4.4	3.9	3.6
	Leq - m	9.1	12.1	13.7	14	27.4	45.8	108	57

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)
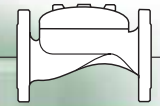V = Nominal size flow velocity (m/sec ; feet/sec.)
g = Acceleration of gravity (9.81 m/sec^2 ; 32.18 $feet/sec^2$)

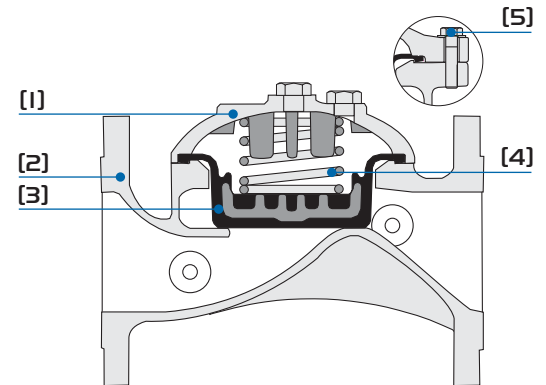Equivalent Pipe Length, Leq

$$Leq = Lk\cdot D$$

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.

Construction Materials

Description	GR-400	GR-400			
Size	³/₄-3"	1¹/₂-6"	8"	10-16"	2-4"
Pattern	Globe	Globe	Globe	Globe	Angle
Cover [1]	Brass	Cast Iron	Cast Iron	Ductile Iron	Cast Iron
Valve Body [2]	Brass	Cast Iron[1]	Cast Iron[1]	Ductile Iron	Cast Iron
Diaphragm [3] Assembly	NR with Plastic VRSD[2]	NR with Plastic VRSD[2]	NR with Cast Iron VRSD[2]		NR with Plastic VRSD[2]
Spring [4]	St. St. 302	Stainless Steel 302			
External Bolts [5]	St. St. 304	Zinc-Cobalt Plated Steel			
Coating	Un-Coated	Polyester Green RAL 6017			
Pressure Rating	150 psi	230 psi			

(1) 4 & 6" grooved valves are constructed of Ductile Iron
(2) Vulcanized Radial Seal Disk

Technical Specifications

Available Patterns, Size & End Connections

Connections	GR-400				IR-400			
	³/₄"	1"	1¹/₂"	2"	1¹/₂"	2"	2¹/₂"	3"R
Threaded	G	G	G	G	G	G & A	G & A	G & A
Flanged						G & A	G	G
Grooved						G		

Connections	IR-400							
	3"	4"	6"	8"	10"	12"	14"	16"
Threaded	G & A							
Flanged	G & A	G & A	G	G	G	G	G	G
Grooved	G & A	G & A	G					

G = Globe, A = Angle

Connections Standard:
Flanged:
- ANSI B16.42 (Cast Iron)
- ANSI B16.42 (Ductile Iron)

Threaded: NPT or Rp ISO 7/1 (BSP.P)
Grooved: ANSI C606

Operating Pressure Ranges:
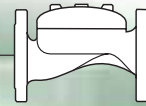IR-400: 7-232 psi
For lower pressure requirements, consult factory
GR-400: 7-150 psi
Temperature: Water up to 140°F

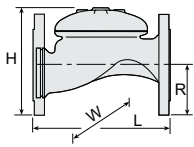### Standard Materials:
- Castings & Forgings:
  - Cast Iron to ASTM A-126 Class B
  - Ductile Iron to ASTM A-536
  - Brass
  - Plastic: Polyamid 6+30% GF
- Elastomers: NR to ASTM-D-2000
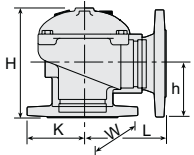- Coatings: Electrostatic Powder Coating Polyester

US English

Globe Pattern

Size		Flanged										
		2″	2¹/₂″	3″R	3″	4″	6″	8″	10″	12″	14″	16″
L	(inch)	8¹/₁₆	8¹/₁₆	8¹/₄	9¹³/₁₆	12⁵/₈	16⁵/₁₆	19¹¹/₁₆	23¹³/₁₆	28⁹/₁₆	29¹/₄	29¹/₄
H	(inch)	6¹/₈	7	7⁷/₈	8¹/₄	9¹/₂	13⁹/₁₆	16¹⁵/₁₆	18¹/₈	25	25¹³/₁₆	38
W	(inch)	6¹/₈	7	7⁷/₈	7⁷/₈	8³/₄	12	14³/₈	15¹⁵/₁₆	22⁷/₈	23¹/₈	23⁵/₈
R	(inch)	3¹/₁₆	3¹/₂	3¹⁵/₁₆	3¹⁵/₁₆	4¹/₂	5¹/₂	6¹¹/₁₆	7¹⁵/₁₆	9¹/₂	10¹/₄	11¹³/₁₆
Weight	(lb)	19.8	23.1	41.9	41.9	61.7	149.9	275.6	308.6	639.3	789.2	831.1

Size		Threaded					Grooved			
		1¹/₂″	2″	2¹/₂″	3″R	3″	2″	3″	4″	6″
L	(inch)	6	7¹/₁₆	8¹/₄	8¹/₄	10	8¹/₁₆	9¹³/₁₆	12⁵/₈	16⁵/₁₆
H	(inch)	3³/₈	4¹⁶/₁₆	5³/₁₆	5¹/₂	6¹/₂	4¹/₄	6¹/₁₆	7¹/₂	15⁷/₈
W	(inch)	3⁷/₈	4¹¹/₁₆	5¹/₁₆	5¹/₁₆	6¹¹/₁₆	4¹¹/₁₆	6¹¹/₁₆	8	12¹/₁₆
R	(inch)	1¹/₈	1¹/₂	1¹³/₁₆	2¹/₁₆	2³/₁₆	1³/₁₆	1⁶/₈	2³/₈	3³/₈
Weight	(lb)	4.4	8.8	12.6	12.8	28.7	11.0	23.4	35.7	108.0

Angle Pattern

Size		Threaded				Grooved		Flanged		
		2″	2¹/₂″	3″R	3″	3″	4″	2″	3″	4″
L	(inch)	3³/₈	4⁵/₁₆	4⁵/₁₆	4³/₈	4³/₄	6⁵/₁₆	4³/₄	6	6¹/₄
H	(inch)	5³/₈	7¹/₁₆	7	7¹/₄	7⁵/₈	8³/₄	6⁵/₁₆	8¹/₁₆	8³/₄
W	(inch)	4¹¹/₁₆	5³/₁₆	5³/₁₆	6¹¹/₁₆	6¹¹/₁₆	8	6¹/₈	7⁷/₈	8³/₄
h	(inch)	2³/₈	3¹¹/₁₆	3⁹/₁₆	3¹/₈	3⁹/₁₆	4¹/₂	3¹/₄	4	4⁷/₁₆
K	(inch)	2³/₁₆	2⁵/₈	2⁵/₈	2³/₁₆	1³/₄	2⁵/₁₆	3¹/₁₆	3¹⁵/₁₆	4⁷/₁₆
Weight	(lb)	9.7	12.8	15.4	24.3	22.0	35.3	19.8	37.5	57.3

Globe Pattern GR-400
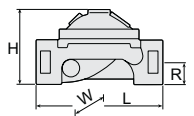
Size		³/₄″	1″	1¹/₂″	2″
L	(inch)	4⁷/₁₆	4¹/₂	5⁷/₈	7¹/₈
H	(inch)	2¹¹/₁₆	2³/₄	3¹/₂	4¹/₁₆
W	(inch)	⁷/₈	¹⁵/₁₆	1¹/₄	1⁹/₁₆
R	(inch)	2¹³/₁₆	2¹³/₁₆	3¹¹/₁₆	4⁵/₈
Weight	(lb)	2.1	2.1	3.3	8.8

Control Chamber Displacement Volume (gallons)

2″	2¹/₂″	3″	4″	6″	8	10″	12-16″
0.03	0.05	0.08	0.18	0.52	1.02	1.02	3.63
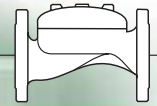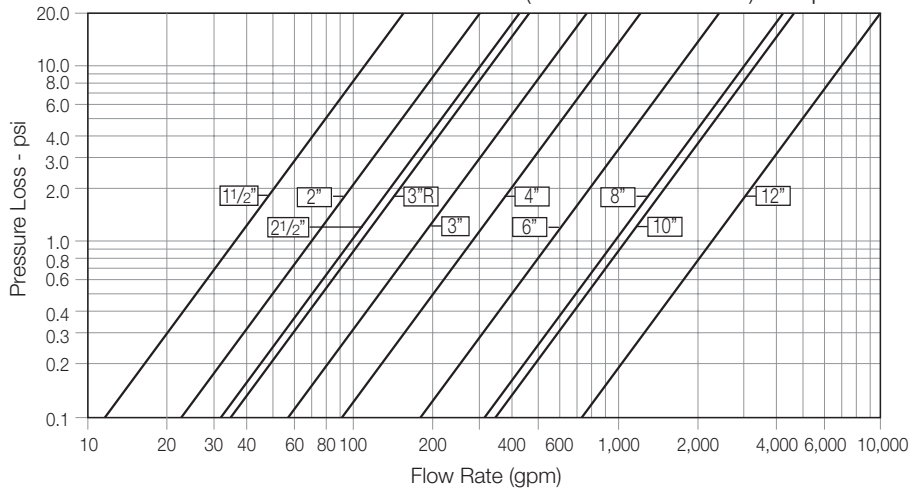
US English

Globe Pattern

2-Way circuit "Added Head Loss"
(for "V" below 6.5 f/s): 4.5 psi

Pressure Loss - psi vs Flow Rate (gpm)

Curves labeled: 1½", 2", 2½", 3"R, 3", 4", 6", 8", 10", 12"

Angle Pattern

2-Way circuit "Added Head Loss"
(for "V" below 6.5 f/s): 4.5 psi

Pressure Loss - psi vs Flow Rate (gpm)

Curves labeled: 2½", 2", 3", 4"

Globe Pattern GR-400

2-Way circuit "Added Head Loss"
(for "V" below 6.5 f/s): 4.5 psi

Pressure Loss - psi vs Flow Rate (gpm)

Curves labeled: 3/4", 1", 1½", 2"
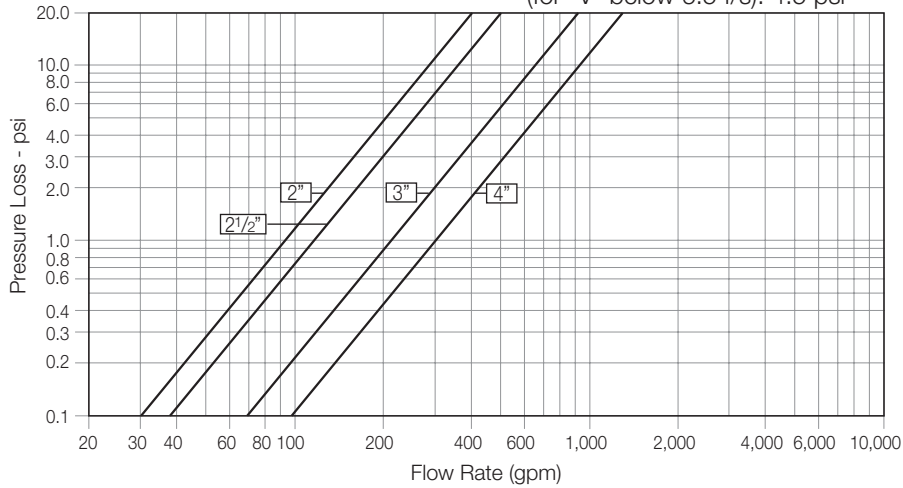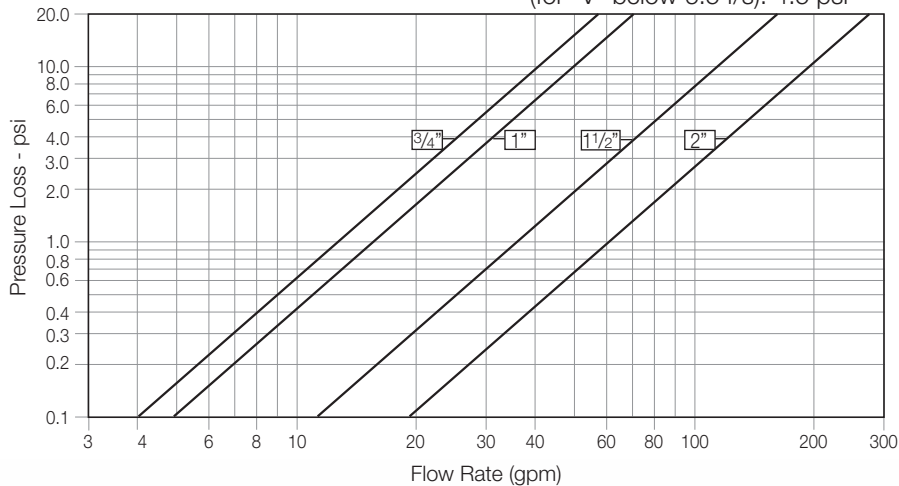
BERMAD
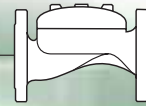
US English

		2"	2¹/₂"	3"	4"	6"	8"	10"	12-16"
Globe Pattern	Cv	66	90	157	236	529	902	957	2,231
	K	3.2	4.2	2.9	4.0	4.0	4.4	3.9	3.6
	Leq - ft	30	40	45	46	90	150	354	187

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.