

**MOTOYAMA**

# General Specifications

# Gyroll

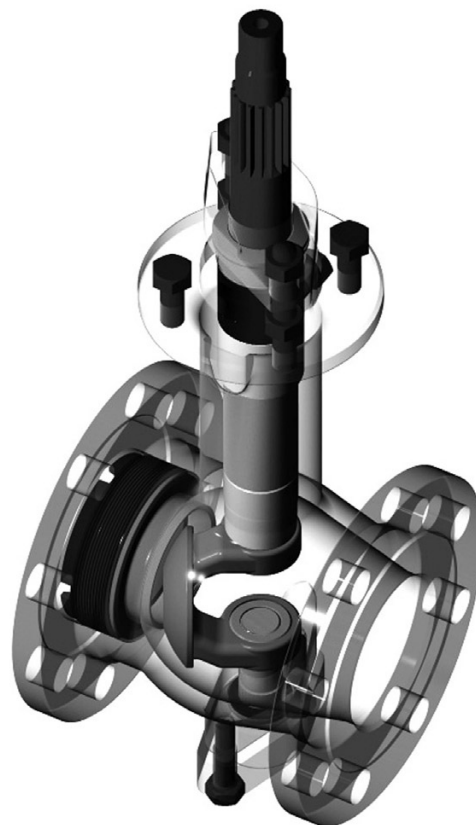
## Model 92 ECCENTRIC ROTARY PLUG VALVES

### FEATURES

- Eccentric Plug does not touch to the Seat-ring until at the fully closed position
- Port is reducible by changing retainer only, without changing Plug and Seat
- Downsizing actuators & good controllability with low driving torque
- Light weight & Compactness
- Valve action (DA or RA) is convertible without changing/adding parts
- Easy installation and maintenance
- Large Cv
- High rangeability (100 : 1)
- Wide operating temp.range (−100 °C ~ +500 °C)
- No pit on inner surface of the body, less adhesion, suitable to Slurry and/or Fibre containing fluid control service applications.
- Positive shut-off performance
- Superior controllability
- Wide service application (Ceramics trim type is available as option)

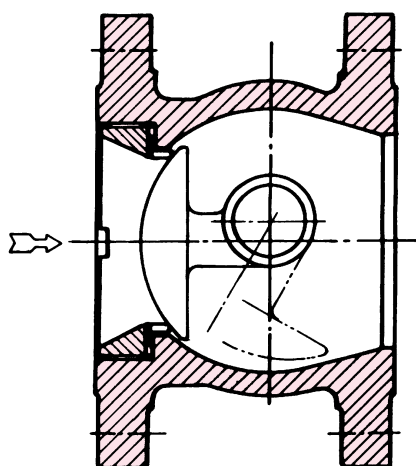
#### ■ Typical Applications

- Steel Industry (Cooling water, COG control)
- Smoke extraction desulphurization (For slurry contained liquid)
- Petroleum refinery
- Drainage



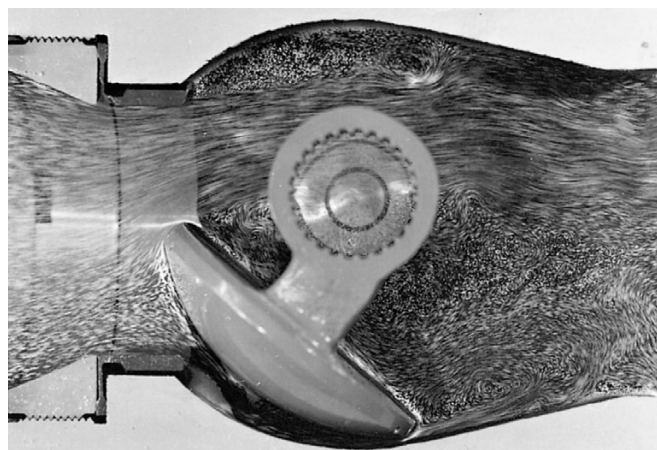
92

#### Construction of Full Port



#### Movement of the plug

#### Visible Experimental Photograph



#### Valve Style and Specifications

92 -	Style No.	
	↓	
	A ... Standard Gyroll	
	CT ... Ceramic Trim Gyroll	Options
	CS ... Body Ceramics Sprayed Gyroll	

# 1. SPECIFICATIONS

Valve Model		Spring return diaphragm actuator operated Eccentric plug valve										
Valve Model No		2992-A, PM92-A										
Body Type		92										
Valve size	mm	25	40	50	80	100	150	200	250	300	350	
	inch	1	1 1/2	2	3	4	6	8	10	12	14	
Pressure Rating		JIS10, 20K ASME/JPI Class 150, 300										
End Connection		RF, FF, (※ RJ)										
Body Material		WCB, CF8, CF8M, CF3M										
Plug Material		CF8M, CF3M See page 4										
Bonnet Type		Body Integrated type										
Gland Type		Bolted Grand										
Packing		Braided packing, Molded packing										
Gasket		Serrated gasket										
Guiding		Inner guide										
Plug Action		Plug Closed clockwise										
Seat		Metal seat, Resilient seat										
Valve Characteristics		Positioner cam characterized Equal Percentage characteristic is available										
Actuator		Model 2900 Spring return diaphragm actuator					Model 00 Spring type single acting cylinder operated					
Actuator size		240HP	330HP	400HP	500H	500HP	BS-2	BS-3	BS-4	BS-5	BS-6	
Spring Range kPa (kgf/cm <sup>2</sup> G)		80 to 200 (0.8 to 2.0)			60 to 220 (0.6 to 2.2)	40 to 200 ... Direct (0.4 to 2.0) Action 80 to 240 ... Reverse (0.8 to 2.4) Action	190 to 240 (1.9 to 2.4) ... 60° Direct Action 160 to 210 (1.6 to 2.1) ... 60° Reverse Action 100 to 240 (1.6 to 2.4) ... 90°					
Supply Air Pressure kPa (kgf/cm <sup>2</sup> G)		280 (2.8)					400 (4.0)					
Rotary Angle		60°					60°, 90°					
Air Piping Connection		Rc1/4					Rc1/4		Rc1/2			
Ambient temperature		-20 °C ~ +70 °C (※ -50 °C ~ -20 °C, +70 °C ~ +100 °C)					-20 °C ~ +60 °C (※ -40 °C ~ -20 °C, +60 °C ~ +100 °C)					
Painting Color		Silver										
Control Mode		Throttling control, On-off										
Valve Action		Direct action (Air-to close), Reverse action (Air-to open)										
Available Max. Pressure		Pressure limit shall conform to the standard of material & pressure temperature rating										
Available Temperature		(Metal seat) -100 °C ~ +500 °C, (Resin seat) -20 °C ~ +200 °C										
Allowable Differential Press.		See Page 5										
Rated Cv Value		See Page 5										
Flow Characteristics		See Page 6 ~ 7										
Range-ability (Cv Ratio)		100 : 1 (60° Opening)										
Allowable Seat Leakage Rate	Metal Seat	ANSI/FCI ≥ Class IV (≥ 0.01% of rated Cv) Tight Shut Off (T.S.O.) (≥ 0.001% of rated Cv) (*ANSI/FCI Class V applicable for body size 80mm or more)										
	Resin Seat	ANSI/FCI Class VI (25mm ... 1 bubble/min, 200mm ... 45 bubble/min)										
Action Accuracy (1)	Hysteresis Error (with Positioner)	■ Model PM00 : Max. 3%F.S. ■ Model 2900/2800 : Max. 2%F.S.										
	Linearity (with Positioner)	■ Model PM00 : Max. ± 3%F.S. ■ Model 2900/2800 : Max. ± 2%F.S.										
Options ※	Actuator	Air exposure bolt & nut S.S., Handwheel, Travel stop (one side).										
	Accessories	Pneumatic positioner (PA92A), Electro-pneumatic positioner (EA90AC, EA91AC, EA10S), Air filter regulator (MR2000). Limit switch, Solenoid valve, and Others.										
	Others	The high pressure gas safety law certification, Jacketed (full, semi), Oring-guide, Resin-guide, Water free, Oil free, Specified painting color.										

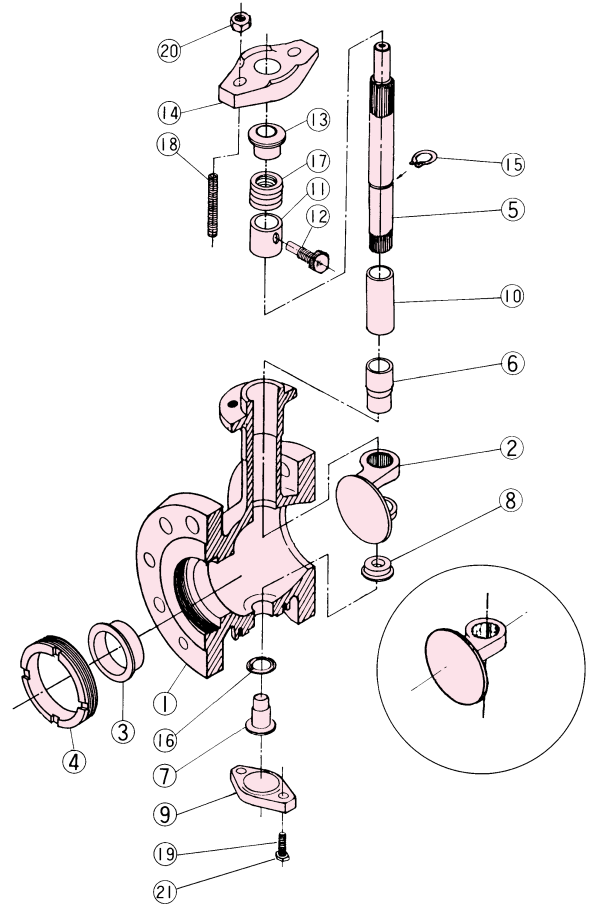
[Notes] (1) ※ Manufactured and mounted as options according to customer's request.  
 (2) Double acting cylinder actuator is applicable on request.

## 2. CONSTRUCTIONS

### 1 Valve Body

Model 92 is designed to control by expanding or reducing flow path area by rotating semi-spherical plug with seat-ring bore.

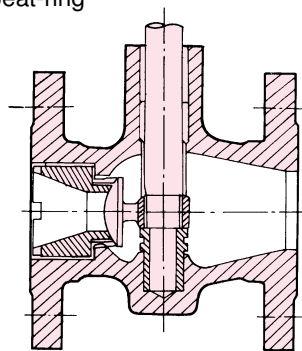
No.	Part Name
1	Body
2	Plug
3	Seat-ring
4	Retainer
5	Shaft
6	Guide bushing
7	Guide post
8	Guide collar
9	Bottom cover
10	Spacer-ring
11	Stopper-ring
12	Plug pin
13	Gland bushing
14	Gland flange
15	Split-ring
16	Gasket
17	Grand packing
18	Grand bolt
19	Bottom bolt
20	Gland nut
21	Bottom nut



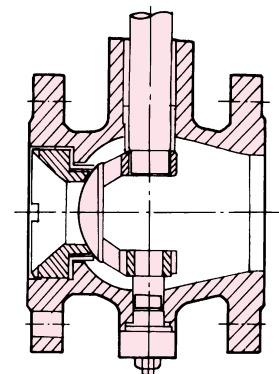
[Note] When valve size is 50 mm or smaller, no guide post (7), bottom cover (9), gasket (16) and bottom bolt (19), bottom nut (21) used.

### 2 Reduced Port

Port is reduced by retainer bore, Plug/Seat-ring change is not required to reduce port.

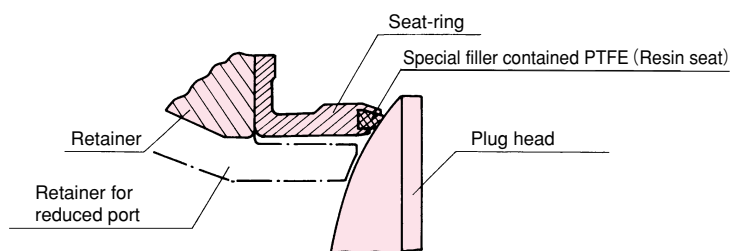


Size 25mm ~ 50mm  
(1in. ~ 2in.)



Size 80mm ~ 350mm  
(3in. ~ 14in.)

### 3 Resin Seat



# 3. MAIN PARTS MATERIALS

## 1 Typical Combination of Materials

### ■ Metal Seat

Body Material	Process Temp. Range	Plug	Seat-ring (Metal seat)	Guide Bushing Guide Collar	Shaft Guide Post
WCB	-20 to +250 °C	SCS14A CoCr Alloy Seat	SUS316	SUS316 CoCr Alloy	SUS316
	+251 to +350 °C		SUS316 CoCr Alloy Seat		
CF8 CF8M	-100 to +250 °C		SUS316		
	+251 to +500 °C		SUS316 CoCr Alloy Seat		
CM3M	-100 to +250 °C	SCS16A CoCr Alloy Seat	SUS316L	SUS316L CoCr Alloy	SUS316L
	+251 to +500 °C		SUS316L CoCr Alloy Seat		

### ■ Resin Seat

Body Material	Process Temp. Rang	Plug	Seat-ring (Metal seat)	Guide Bushing Guide Collar	Shaft Guide Post
WCB CF8 CF8M	-20 to +200 °C	SCS14A	T#9020-SCCF	SUS316 CoCr Alloy	SUS316
CF3M		SCS16A		SUS316L CoCr Alloy	SUS316L

## 2 Selection table of Metal seat (CoCr Alloy) & Resin seat

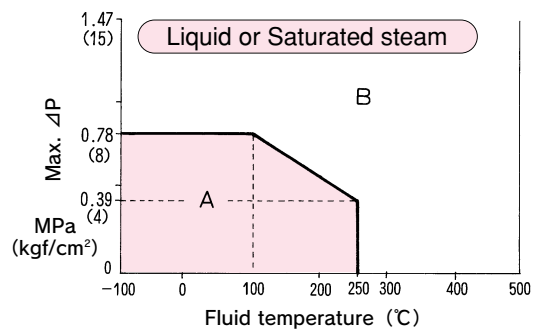
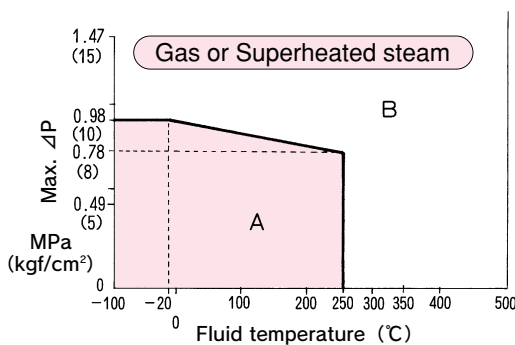
### ■ Selection of Metal seat

(Hardening treatment classification of plug & seat-ring to comply with fluid conditions.)

Class	Part Name	
	Plug	Seat-ring
A	CoCr Alloy Seat	N/A
B	CoCr Alloy Seat	CoCr Alloy Seat
C	CoCr Alloy face	CoCr Alloy Seat

[Notes]

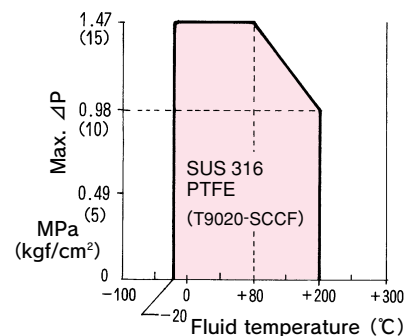
- (1) Class C is for Incipient Cavitations or Flashing Service.
- (2) Different type Seat will be applied to Cavitations or Slurry Service.
- (3) In case of On-off or Tight Shut Off service, class B should be selected even through applicable Pressure and Temperature Range is within class A.



### ■ Selection of Resin seat

[Notes]

- (1) When, corrosion resistant trim materials are selected, Resin seat is recommended.
- (2) For Oxygen service or Colouring free service, seat material T9020-G20 is recommended. Such case, allowable temperature range is -20°C to +200°C.



## 4. ALLOWABLE DIFFERENTIAL PRESSURE

### 1 Model 2992 –

Unit : MPa (kgf/cm<sup>2</sup>)

Actuator size		240HP	330HP	400HP	500H	500HP
Valve size						
(mm)	(inch)					
25	1	3.92 (40)				
40	1½	3.92 (40)				
50	2	2.25 (23)	3.92 (40)			
80	3	0.17 (1.8)	3.82 (39)			
100	4	0.094 (0.96)	1.96 (20)	3.72 (38)		
150	6		0.41 (4.2)	1.07 (11)	2.84 (29)	3.92 (40)
200	8			0.58 (6.0)	1.47 (15)	2.05 (21)
250	10			0.34 (3.5)	0.88 (9.0)	1.17 (12)
300	12			0.24 (2.5)	0.62 (6.4)	0.86 (8.8)
350	14					0.57 (5.9)

[Notes]

- Regardless of port size (full port or reduced port) and seat type (metal seat or resin seat), the left table is applicable but allowable max. pressure of resin seat is restricted as shown in page 4.
- Multiply 1/1.2 to the figures in the table to find allowable shut-off pressures for T.S.O. (Tight Shut-off) application with metal seat.
- Multiply 1/1.5 to the figures in the table to find allowable shut-off pressure for Model 92-CT and 92-CS type.
- Spring range for actuator size 500 HP is 40-200kPaG (4.0-2.0kgf/cm<sup>2</sup>G) for direct action and 80-240kPaG (0.8-2.4kgf/cm<sup>2</sup>G) for reverse action.
- Select Model PM92 in case of 90 degree of rotary angle.

### 2 Model PM92 –

Unit : MPa (kgf/cm<sup>2</sup>)

Shaft Material		SUS316					SUS630		
Actuator size		BS-2	BS-3	BS-4	BS-5	BS-6	BS-3	BS-4	BS-6
Valve size									
(mm)	(inch)								
25	1	3.92 (40)							
40	1½	3.62 (37)	3.92 (40)						
50	2	1.86 (19)	2.84 (29)				3.92 (40)		
80	3		2.54 (26)	3.92 (40)					
100	4		1.27 (13)	2.64 (27)				3.92 (40)	
150	6			1.37 (14)	3.92 (40)				
200	8			0.74 (7.6)	2.15 (22)	3.23 (33)			3.92 (40)
250	10			0.43 (4.4)	1.27 (13)	1.86 (19)			2.75 (28)
300	12			0.30 (3.1)	0.91 (9.3)	1.27 (13)			1.96 (20)
350	14				0.61 (6.3)	0.91 (9.3)			1.27 (13)

[Notes]

- Regardless of rotary angle (60° or 90°), port size (full port or reduced port) and seat type (metal seat or resin seat), the above table is applicable but allowable max. pressure of resin seat is restricted as shown in page 4.
- Multiply 1/1.2 to the figures in the table to find allowable shut-off pressure for T.S.O. (Tight Shut-off) application with metal seat.
- Multiply 1/1.5 to the figures in the table to find allowable shut-off pressure for Model 92-CT and 92-CS type.
- SUS630 will be applied in case required shut-off pressure is more than the capacity of standard shaft material.

## 5. FLOW CHARACTERISTICS

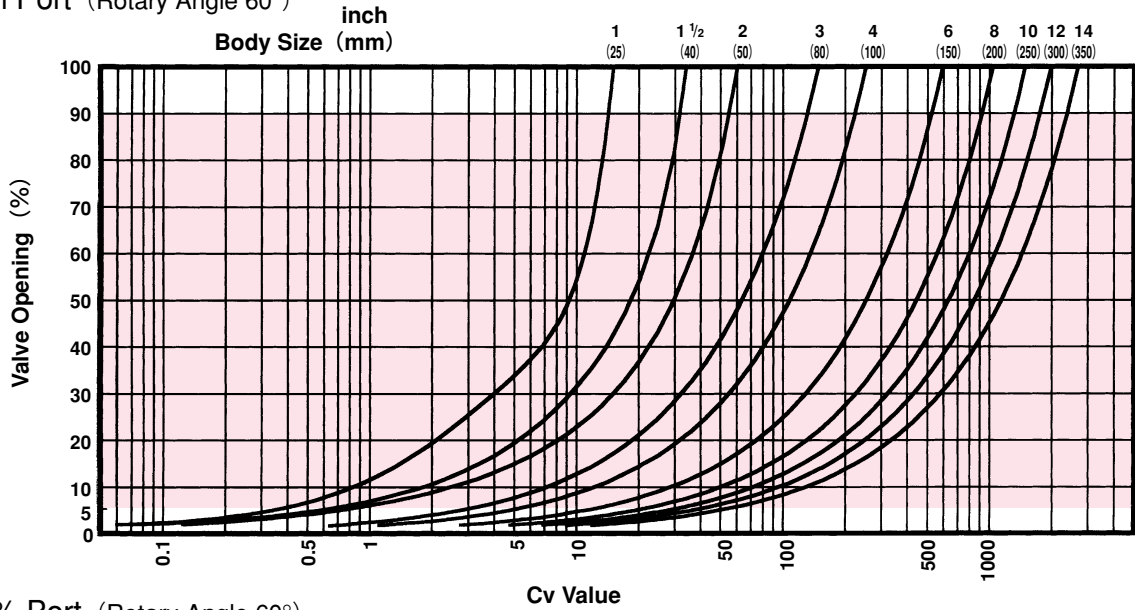
### 1 Rated Cv Value

Valve size		Full Port			Reduced Port					
(mm)	(inch)	Body × Port size	Cv		60 % Port			40 % Port		
			60°	90°	Body × Port size	Cv		Body × Port size	Cv	
						60°	90°		60°	90°
25	1	25 [mm] × 25 [mm]	15	/	25 [mm] × 0.6	9	/	25 [mm] × 0.4	6	/
40	1½	40 [mm] × 40 [mm]	34		40 [mm] × 0.6	20.4		40 [mm] × 0.4	13.6	
50	2	50 [mm] × 50 [mm]	60		50 [mm] × 0.6	36		50 [mm] × 0.4	24	
80	3	80 [mm] × 080 [mm]	150	220	80 [mm] × 0.6	90	130	80 [mm] × 0.4	60	85
100	4	100 [mm] × 100 [mm]	255	390	100 [mm] × 0.6	153	230	100 [mm] × 0.4	102	150
150	6	150 [mm] × 150 [mm]	600	950	150 [mm] × 0.6	360	560	150 [mm] × 0.4	240	370
200	8	200 [mm] × 200 [mm]	1050	1700	200 [mm] × 0.6	630	1010	200 [mm] × 0.4	420	660
250	10	250 [mm] × 250 [mm]	1500	2500	250 [mm] × 0.6	900	1480	250 [mm] × 0.4	600	980
300	12	300 [mm] × 300 [mm]	2000	3500	300 [mm] × 0.6	1200	2070	300 [mm] × 0.4	800	1360
350	14	350 [mm] × 350 [mm]	2700	4900	350 [mm] × 0.6	1620	2920	350 [mm] × 0.4	1080	1920

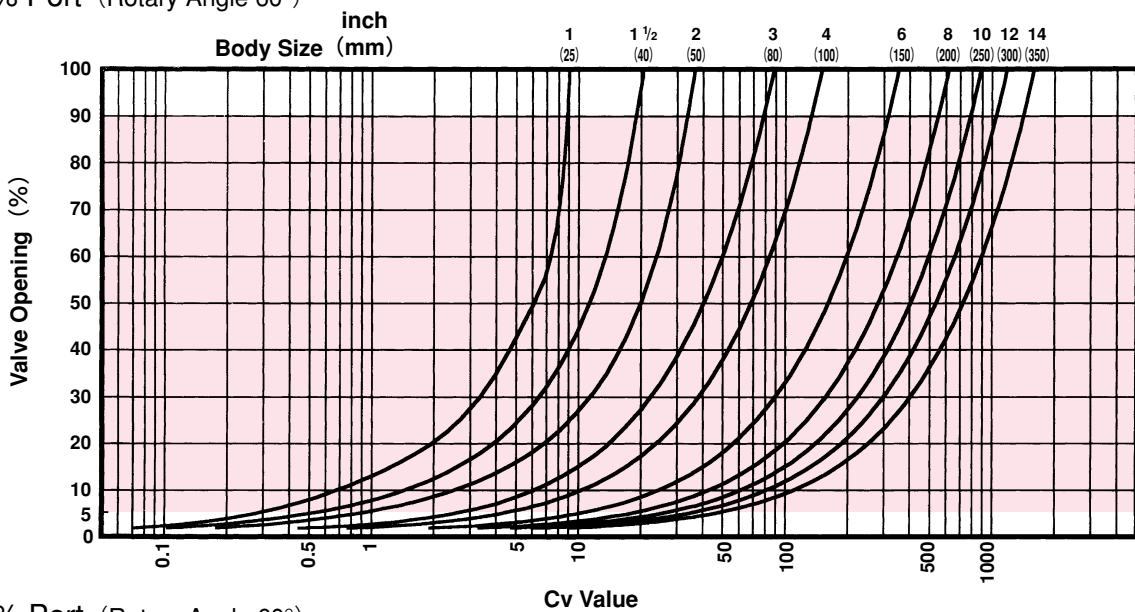
[Notes] : Reduced port is available only for range in above table.

## 2 Flow Characteristics

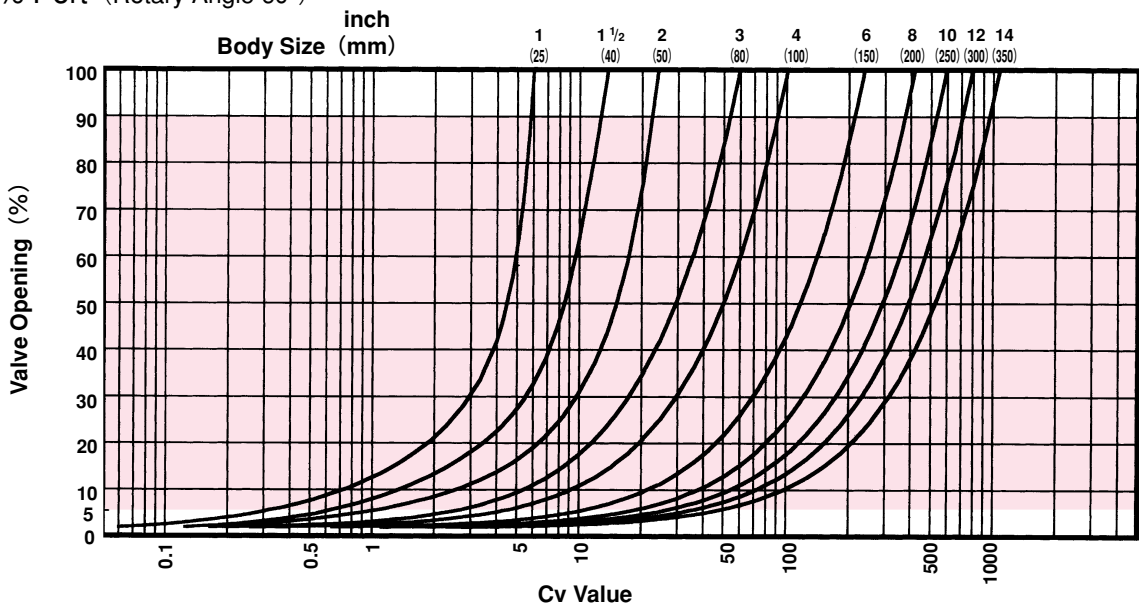
■ Full Port (Rotary Angle 60°)



■ 60% Port (Rotary Angle 60°)



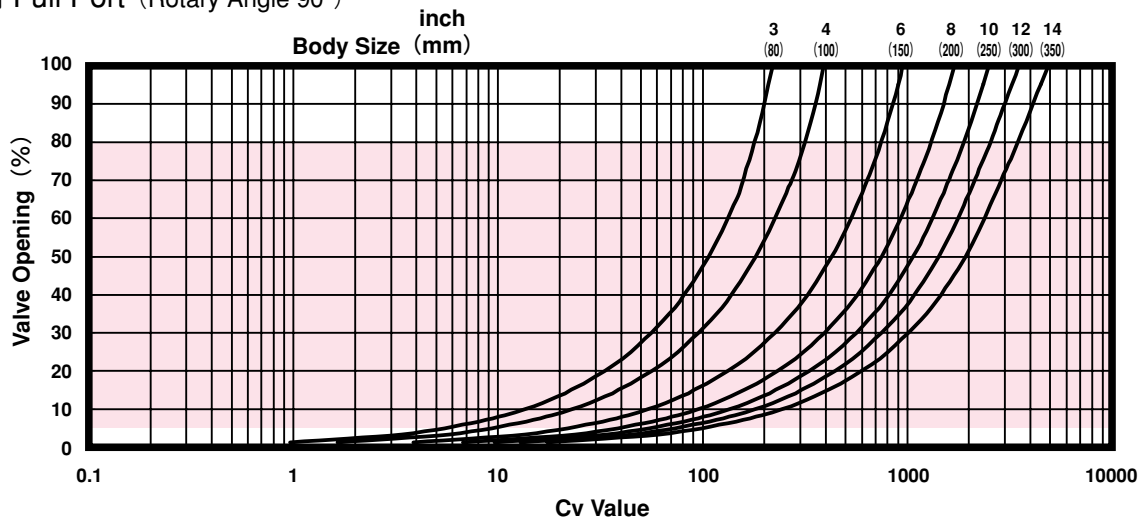
■ 40% Port (Rotary Angle 60°)



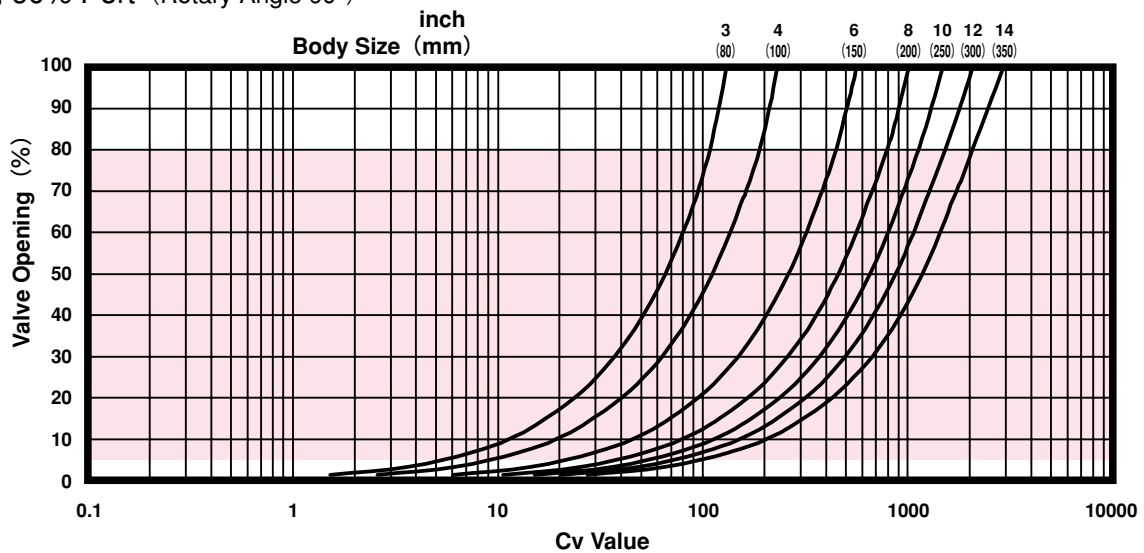
[Notes] : Colored zones are appropriate ranges for control (modulating) service.

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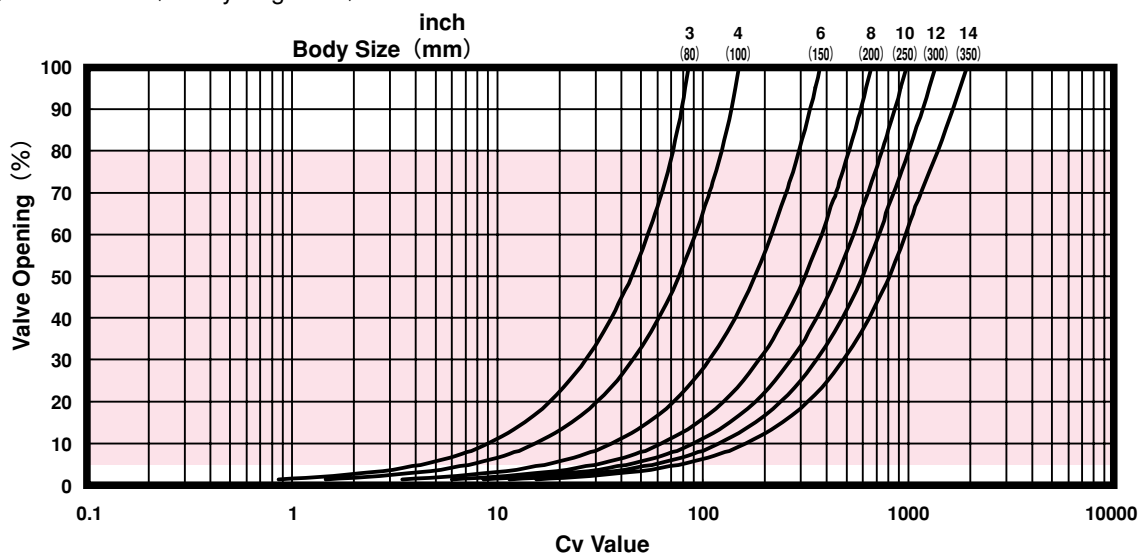
■ Full Port (Rotary Angle 90°)



■ 60% Port (Rotary Angle 90°)



■ 40% Port (Rotary Angle 90°)



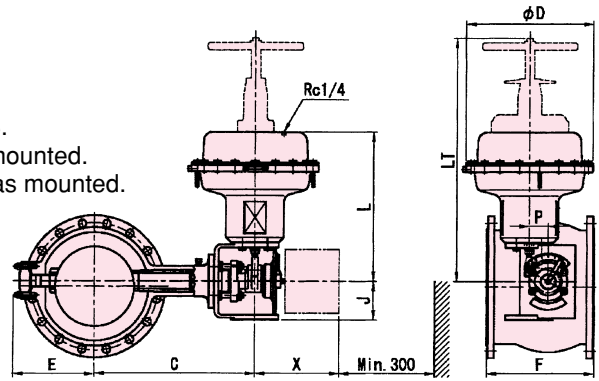
[Notes] : Colored zones are appropriate ranges for control (modulating) service.

# 6. DIMENSIONS & WEIGHTS

1 Model 2992 – □

■ Main dimensions and weights

- (1) Table below shows for mounting orientation R-3.
- (2) "X" shows the dimension when Positioner has mounted.
- (3) "LT" shows the dimension when Hand Wheel has mounted.



The space for maintenance

Valve size		F		E	Actuator size	D	L	LT	J	C	X	P	Approx Weights (kg)	
(mm)	(inch)	JIS10K, 20K	ASME 150, 300										10K	12K
25	1	120		40	240HP	240	270	475	70	225	250	30	21	22
40	1½	134		50	240HP	240	270	475	70	235	250	30	23	24
50	2	140		60	240HP	240	270	475	70	245	250	30	25	27
					330HP	330	430	685	95	260	250	52	44	46
80	3	165		130	240HP	240	270	475	70	305	250	30	34	37
					330HP	330	430	685	95	320	250	52	53	56
100	4	194		140	240HP	240	270	475	70	315	250	30	44	50
					330HP	330	430	685	95	330	250	52	63	69
					400HP	400	470	765	121	350	265	61	92	98
150	6	229		185	330HP	330	455	710	121	430	265	52	89	96
					400HP	400	470	765	121	430	265	61	118	125
					500H(P)	500	620	1075	140	435	295	104	189	196
200	8	243		210	400HP	400	470	765	121	455	265	61	158	173
					500H(P)	500	620	1075	140	460	295	104	229	244
250	10	297		235	400HP	400	470	765	121	485	265	61	203	233
					500H(P)	500	620	1075	140	490	295	104	274	304
300	12	338		255	400HP	400	470	765	121	505	265	61	253	293
					500H(P)	500	620	1075	140	510	295	104	324	364
350	14	428		310	500HP	500	620	1075	140	550	295	104	383	430

- [Notes] (1) "X" is the dimension to have mounted Motoyama EA-91AC Positioner. This dimension will be changed to have mounted other type of Positioners.  
 (2) Approx. Weights shows the weight of valve assembly without Hand Wheel.

■ Mounting orientations

Several combination of Valve Body and Actuator is available as follows. It is also available to mount Actuator horizontal. D-1 or R-1 is our standard shipping orientation unless otherwise specified.

Direct Action				Reverse Action					
D-1	Standard	D-2	D-3	D-4	R-1	Standard	R-2	R-3	R-4
D-1H	D-2H	D-3H	D-4H	R-1H	R-2H	R-3H	R-4H		

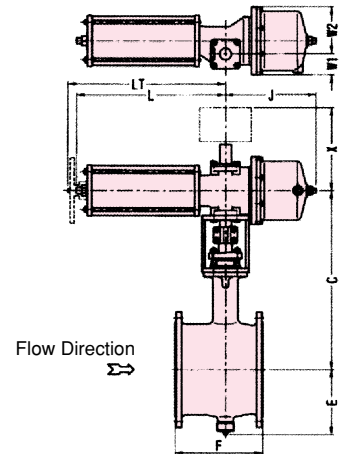
[Legend] → : Flow direction



## 2 Model PM92 – □

### ■ Main dimensions and weights

- (1) Table below shows for mounting orientation R-2.
- (2) "X" shows the dimension when Positioner has mounted.
- (3) "LT" shows the dimension when Hand Wheel has mounted.

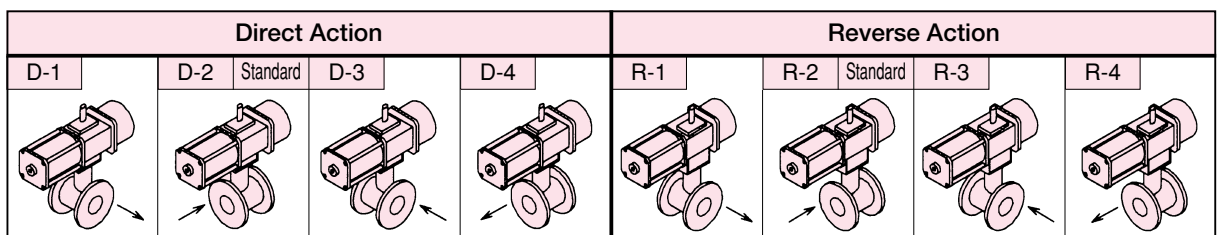


Valve size		F JIS10K, 20K ASME 150, 300	E	Actuator size	L	LT	J	C	X	W <sub>1</sub>	W <sub>2</sub>	Approx Weights (kg)	
												10K	20K
(mm)	(inch)												
25	1	120	40	BS-2	335	362	210	325	330	38	106	27	28
40	1½	134	50	BS-2	335	362	210	335	330	38	106	29	30
				BS-3	451	482	276	420	360	52	140	58	59
50	2	140	60	BS-2	335	362	210	345	330	38	106	31	33
				BS-3	451	482	276	430	360	52	140	60	62
80	3	165	130	BS-2	335	362	210	425	330	38	106	41	44
				BS-3	451	482	276	490	360	52	140	69	72
				BS-4	575	609	351	500	370	81	188	113	116
100	4	194	140	BS-3	451	482	276	500	360	52	140	79	85
				BS-4	575	609	351	510	370	81	188	123	129
150	6	229	185	BS-4	575	609	351	635	370	81	188	150	157
				BS-5	745	795	446	710	420	117	256	269	276
200	8	243	210	BS-4	575	609	351	660	370	81	188	190	205
				BS-5	745	795	446	735	420	117	256	309	324
				BS-6	931	1006	638	710	405	130	326	498	513
250	10	297	235	BS-4	575	609	351	690	370	81	188	235	265
				BS-5	745	795	446	765	420	117	256	354	384
				BS-6	931	1006	638	740	405	130	326	543	573
300	12	338	255	BS-4	575	609	351	710	370	81	188	285	325
				BS-5	745	795	446	785	420	117	256	404	444
				BS-6	931	1006	638	760	405	130	326	593	633
350	14	428	310	BS-5	745	795	446	825	420	117	256	463	510
				BS-6	931	1006	638	800	405	130	326	652	699

- [Notes] (1) "X" is the dimension to have mounted Motoyama EA-91AC Positioner.  
This dimension will be changed to have mounted other type of Positioners.  
(2) Approx. Weights shows the weight of valve assembly without Hand Wheel.

### ■ Mounting orientations

Various orientations of valve body and actuator are available, as shown below, in order for easy installation in limited piping space. Also available to mount actuator in horizontal position. D-2 and R-2 is the standard orientation to be delivered unless otherwise specified.



[Legend] → : Flow direction

## 7. Options

### Model 92-CT Ceramic Trim Gyroll

Model 92-CT has been improved its anti-wear ability, in addition to the original superior controllability, by applying ceramic parts on the plug and seat-ring.

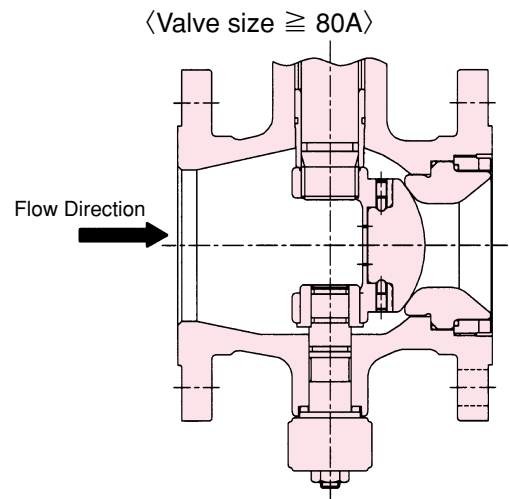
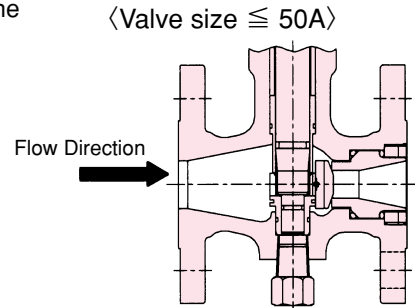
#### Typical Applications

- For anti-wear, slurry applications
- Desulphurization Plant (Slurry)
- Sewage Plant
- Fly ash conveying line

#### Specifications

Body Type		92-CT					
Valve size	(mm)	25	40	50	80	100	150
	(inch)	1	1½	2	3	4	6
Materials	Body	CF8, CF8M, CF3M					
	Plug	Plug Head: Ceramics (Zirconia for 25mm and 40mm, Alumina for 50mm to 150mm) Plug Base: SCS14A (SUS316), SCS16A (SUS316L)					
	Seat-Ring	Ceramics (Zirconia for 25mm and 40mm, Alumina for 50mm to 150mm)					
	Guide	SUS316 + CoCr Alloy + O ring, SUS316L + CoCr Alloy + O ring					
Flow Direction		Flow to close					
Pressure Range		2MPaG (20kgf/cm <sup>2</sup> G)					
Temperature Range		0°C ~ +200°C (Thermal Shock Temp. ≤ 80°C)					
Allowable Seat Leakage		ANSI/FCI Class IV (≥ 0.01% of rated Cv)					

[Note] Available port size is 60% and 40% port only.



### Model 92-CS Body Ceramics Sprayed Gyroll

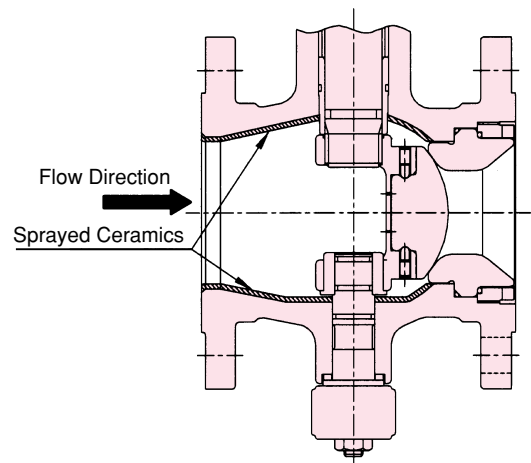
Model 92-CS has been improved its anti-erosion ability, in addition to the ceramics trim, by applying ceramic coating thermal spray on inner wall surface of the valve body.

#### Specifications

Body Type		92-CS					
Valve size	(mm)	25	40	50	80	100	150
	(inch)	1	1½	2	3	4	6
Materials	Body	CF8, CF8M, CF3M + Inner ceramics thermal sprayed (Alumina)					
	Plug	Plug Head: Ceramics (Zirconia for 25mm and 40mm, Alumina for 50mm to 150mm) Plug Base: SCS14A (SUS316), SCS16A (SUS316L)					
	Seat-Ring	Ceramics (Zirconia for 25mm and 40mm, Alumina for 50mm to 150mm)					
	Guide	SUS316 + CoCr Alloy + O ring, SUS316L + CoCr Alloy + O ring					
Flow Direction		Flow to close					
Pressure Range		2MPaG (20kgf/cm <sup>2</sup> G)					
Temperature Range		0°C ~ +200°C (Thermal Shock Temp. ≤ 80°C)					
Allowable Seat Leakage		ANSI/FCI Class IV (≥ 0.01% of rated Cv)					

[Notes] (1) Available port size is 60% and 40% port only.

(2) Body and bonnet split type for valve size 25mm to 50mm



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## 8. Jacketed Body

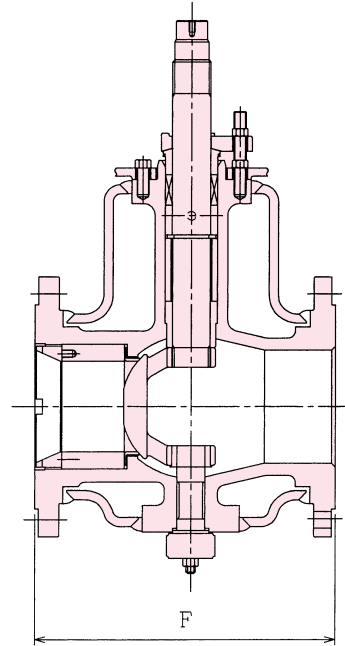
Jacketed Valve Body is most suitable for high viscous fluid service.  
 Jacketed Body is available for standard Valve Body Pressure Rating specified on page 2.

### 1 Full Jacketed Type ... B Type

Where duplex tube is piping, Connection Flange Size is coming larger than Valve standard connection Size.  
 In this design, Full Jacketed Type (B Type) is employed.

#### Standard Dimensions Unit : mm

Valve size		Flange Size		F
mm	inch	mm	inch	
25	1	50	2	220
40	1½	65	2½	240
50	2	80	3	250
80	3	125	5	285
100	4	150	6	315
150	6	200	8	380
200	8	250	10	400
250	10	300	12	470
300	12	350	14	550

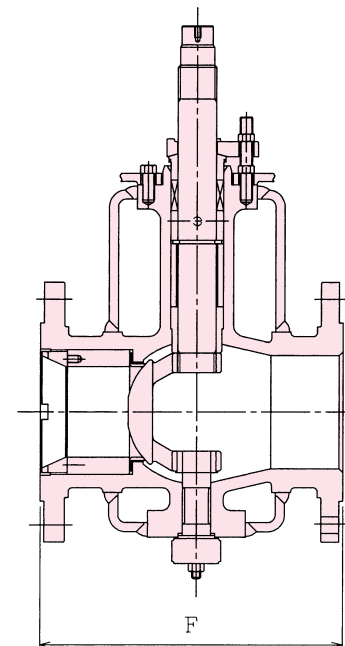


### 2 Semi Jacketed Type ... G Type

Semi Jacketed Type is employed if Connection Flange Size is equal to Valve standard connection Size.

#### Standard Dimensions Unit : mm

Valve size		Flange Size		F
mm	inch	mm	inch	
25	1	25	1	220
40	1½	40	1½	240
50	2	50	2	250
80	3	80	3	285
100	4	100	4	315
150	6	150	6	380
200	8	200	8	400
250	10	250	10	470
300	12	300	12	550





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