Type FLV Axial Control Valve

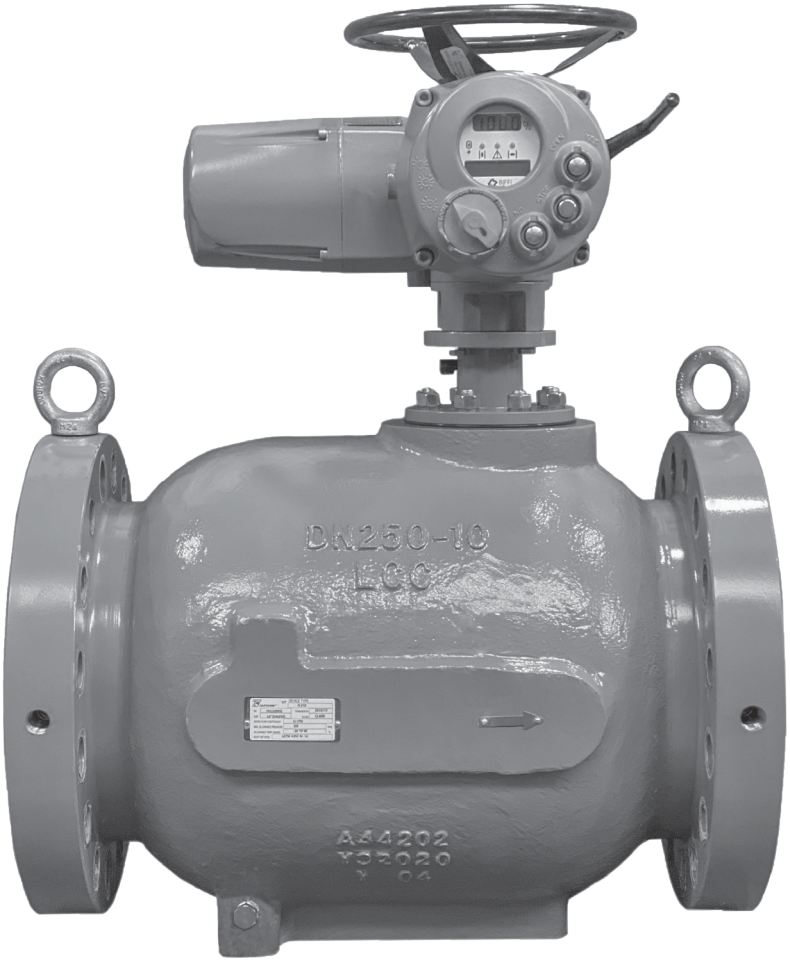


Figure 1. *Type FLV Axial Control Valve with Electric Actuator*

Features

- **Single-piece, integral flanged and ergonomic design of anti rolling feature in the body**
- **Greater flow rates than "top entry" control valve**
- **Linear and equal percentage flow characteristic**
- **Shorter bonnet for rotary actuator than that of linear actuator**
- **High accuracy and low drive torque**
- **Proven Whisper Trim™ technology for noise reduction**
- **In-line maintenance of seat ring**

Introduction

The Type FLV axial control valve is designed to meet a wide range of natural gas transmission, storage and distribution applications.

Main Reference Standards:

- IEC 60534
- GB/T 17213
- JB/T 7387

Specifications

The Specifications section gives some general specifications for the Type FLV axial control valve. The nameplates give detailed information for a specific control valve as built in the factory.

Main Valve

Body Sizes
DN 50 to 300 / NPS 2 to 12

End Connection Styles
CL300 RF and CL600 RF

Maximum Inlet Pressure(1)
CL300 RF: 51.7 barg / 750 psig
CL600 RF: 103 barg / 1500 psig

Maximum Differential Pressure(1)
CL300 RF: 51.7 barg / 750 psig
CL600 RF: 103 barg / 1500 psig

Flow Coefficient
See Table 1

Inherent Flow Characteristics
Linear
Equal Percentage

Flow Direction
Flow to Open
Flow to Close(3)

Shut Off Leakage Class
VI per IEC 60534-4

Accuracy
±1%

Cage Type
Window Cage(2)
Multi-path Cage
Silencer Cage for Noise Reduction

Main Valve (continued)

Temperature Capabilities(1)
Nitrile (NBR): -20 to 60°C / -4 to 140°F
Fluorocarbon (FKM): -10 to 60°C / 14 to 140°F

Construction Materials
Body: LCC Steel
Sleeve: Stainless steel
Trim: Stainless steel, Steel and Aluminum-Bronze
O-ring and Seal Assembly:
Nitrile (NBR) (standard) or Fluorocarbon (FKM) (optional)
Disk/Seat Ring and Y-ring:
Polytetrafluoroethylene (PTFE)

Electric Actuator

Input Signal
4 to 20 mA

Power
380V AC / 50 Hz

Electric Actuator Explosion Proof
ExdIIBT4

Electric Actuator IP Code
IP66 or IP68 (7 m, 72 hours)

Failure Position
Lock-in-Last Position

Options
Body Drainage Hole and Plug

Approximate Weights
See Tables 3 and 4

1. The pressure/temperature limits in this Bulletin or any applicable standard limitation should not be exceeded.
2. Do not exceed dP/P1 ratio of 0.60.
3. The flow to close option applies to DN 50 to 250 / NPS 2 to 10 Type FLV Equal Percentage Multi-path cages.

Product Description

The Type FLV axial control valve is designed according to IEC60534 standard. It is used as pressure or flow control valve on natural gas transmission, storage and distribution. The Type FLV axial control valve is designed to be used with non-corrosive fuel gases of 1st and 2nd family per EN 437. For any other gases, other than natural gas, please contact your local sales office.

A multi-path or silencer cage is recommended for high differential pressure applications where high noise is expected to occur with standard window cages. Silencer cage provides effective attenuation of aerodynamic noise (See Figure 3). It is recommended that a suitable filter/strainer be installed upstream of the regulator with silencer cage to prevent dirt particles from entering the silencer cage and clogging its flow passage holes.

The Type FLV is designed with an easy to access seat ring that can be removed from the valve body without removing the control valve from the pipeline. For this, a special spacer is installed upstream of the control valve. This spacer can be removed easily by loosening the inlet line bolting.

Once the spacer is removed from its position, the disk holder assembly that contains the PTFE disk can be easily unscrewed from the valve body. See Figure 4.

Principle of Operation

The Type FLV axial control valve regulates the gas flow in accordance to the desired set system pressure and/or flow rate. Changes in set pressure and/or flow rate are sensed by respective sensors and fed to a controller (PLC). The controller in-turn sends the command signal to the electric actuator which rotates and moves the control valve shaft and plug assembly to regulate the gas flow.

When the downstream demand increases, the downstream pressure will decrease momentarily. The controller will send a command signal to the electric actuator to rotate anti-clockwise to open the valve more to allow more gas to flow and maintain the downstream pressure.

Conversely, when the downstream demand decreases, the downstream pressure will increase momentarily. The controller will send a command signal to the electric actuator to rotate clockwise to close the valve to reduce the gas to flow and maintain the downstream pressure.

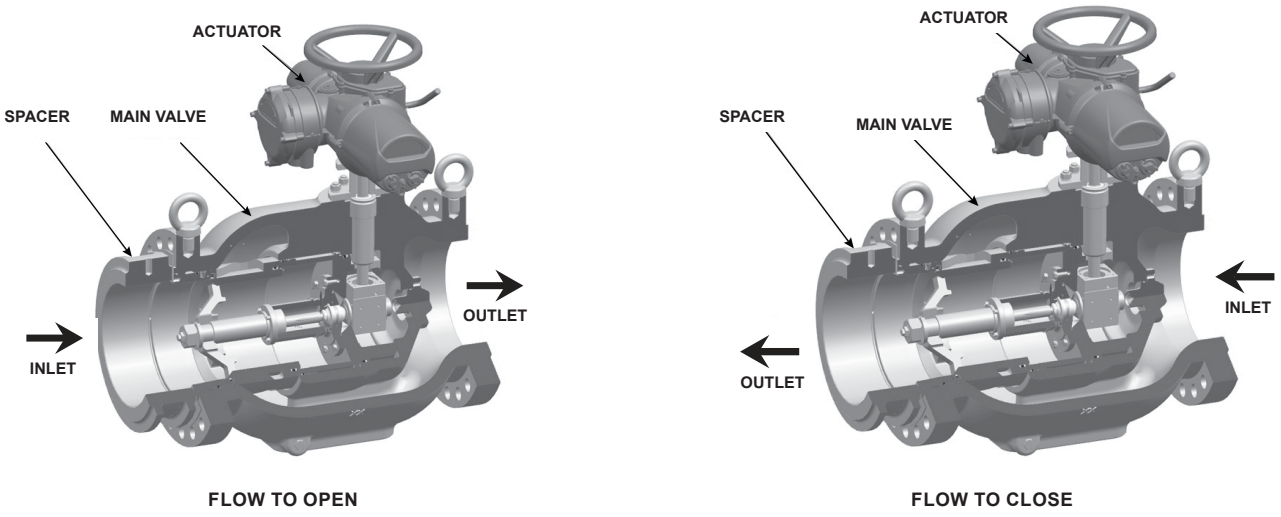


Figure 2. *Type FLV Flow Orientation*

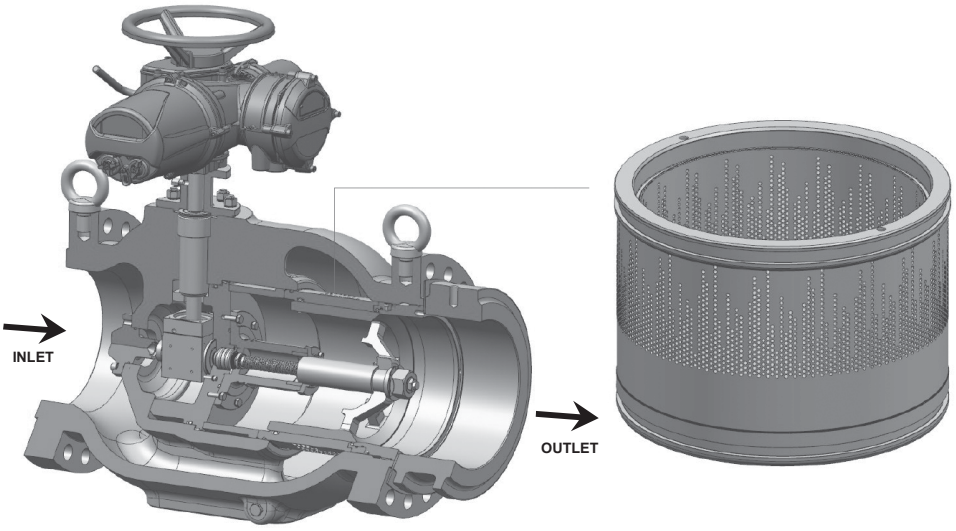


Figure 3. *Type FLV with Whisper Trim™ Cage*

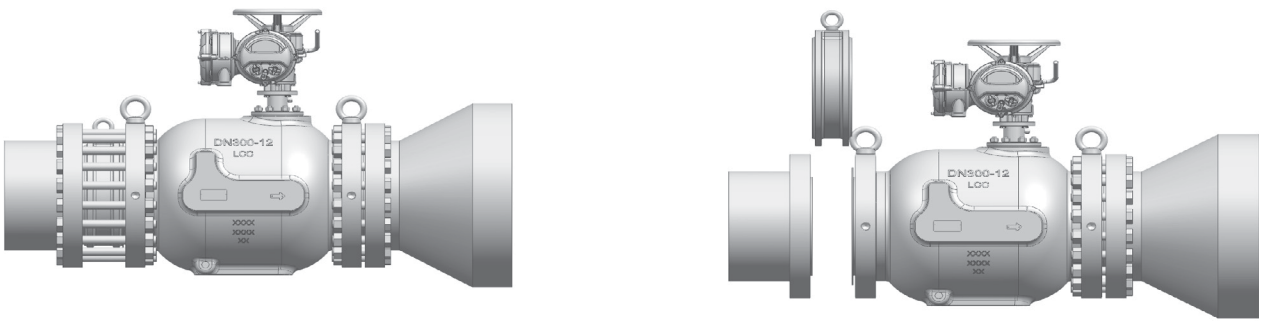


Figure 4. *Type FLV Installation*

Table 1. *Flow Coefficients at Maximum Valve Travel*

CAGE TYPE		VALVE SIZE, DN / NPS					
		50 / 2		80 / 3		100 / 4	
LINEAR WINDOW CAGE (DP/P1<0.6)	% Opening	20(1)	100	18(1)	100	16.5(1)	100
	C_g	42.9	2798	60	5925	76.5	9450
	C_v	1.37	91	2.01	210	2.2	286
	C_1	31.3	30.7	29.8	28.2	34.7	33
	X_T	0.62	0.6	0.56	0.47	0.76	0.71
	F_d	0.1	0.142	0.074	0.169	0.066	0.186
EQUAL PERCENTAGE MULTIPATH CAGE	% Opening	22(1)	100	19.2(1)	100	17(1)	100
	C_g	26	1984	51	4351	83	7002
	C_v	0.84	61	1.75	147.8	2.8	232
	C_1	31	32.5	29.1	29.4	29.6	30.1
	X_T	0.61	0.69	0.54	0.55	0.56	0.58
	F_d	0.447	0.069	0.333	0.065	0.302	0.052

1. Do not operate below this minimum value as seat erosion may result.

Table 1. *Flow Coefficients at Maximum Valve Travel (continued)*

CAGE TYPE		VALVE SIZE, DN / NPS							
		150 / 6		200 / 8		250 / 10		300 / 12	
LINEAR WINDOW CAGE (DP/P1<0.6)	% Opening	15.6(1)	100	15.0(1)	100	11.9(1)	100	18.3(1)	100
	C_g	98	20,456	205	37,000	247	58,000	430	82,000
	C_v	2.8	604	6.0	1150	7	1750	14	2650
	C_1	35.0	33.9	34.2	32.2	35.3	33.1	31.9	30.9
	X_T	0.774	0.730	0.738	0.654	0.787	0.694	0.641	0.605
	F_d	0.053	0.143	0.064	0.126	0.060	0.125	0.584	0.112
LINEAR MULTIPATH CAGE	% Opening	16.3(1)	100	15.7(1)	100	12.5(1)	100	14.8(1)	100
	C_g	145	18,900	200	35,000	296	53,000	260	63,800
	C_v	4.0	535	6	1100	8	1600	8	2100
	C_1	36.3	35.3	36.4	31.8	37.0	33.1	32.5	30.4
	X_T	0.831	0.789	0.836	0.640	0.865	0.694	0.668	0.583
	F_d	0.101	0.033	0.094	0.022	0.081	0.018	0.094	0.034
EQUAL PERCENTAGE WINDOW CAGE (DP/P1<0.6)	% Opening	16.8(1)	100	18.1(1)	100	13.7(1)	100	17.3(1)	100
	C_g	135	17,888	165	30,476	235	46,963	340	64,500
	C_v	3.6	507	5.0	912	7	1622	10	2136
	C_1	37.5	35.3	33.0	33.4	36.2	29.0	32.7	30.2
	X_T	0.889	0.790	0.688	0.710	0.826	0.530	0.676	0.576
	F_d	0.194	0.399	0.404	0.373	0.289	0.398	0.420	0.371
EQUAL PERCENTAGE MULTIPATH CAGE	% Opening	17.9(1)	100	16.6(1)	100	13.8(1)	100	15.9(1)	100
	C_g	102	12,818	200	24,464	288	38,598	330	55,436
	C_v	3.5	403	7.5	897	8	1409	11	1875
	C_1	29.1	31.8	26.7	27.3	34.3	27.4	30.8	29.6
	X_T	0.537	0.640	0.450	0.470	0.743	0.470	0.601	0.550
	F_d	0.230	0.039	0.191	0.028	0.202	0.022	0.213	0.037
EQUAL PERCENTAGE SILENCER (DP/P1<0.6)	% Opening	18.3(1)	100	15(1)	100	15(1)	100	17.3(1)	100
	C_g	93	12,414	67	23,369	417	28,685	340	42,345
	C_v	3	402.5	2.6	836	12.2	970	10	1420
	C_1	31.4	30.8	26.8	28	34.2	29.6	34	29.8
	X_T	0.62	0.6	0.45	0.49	0.74	0.55	0.57	0.56
	F_d	0.27	0.03	0.236	0.022	0.091	0.0124	0.0755	0.0103

1. Do not operate below this minimum value as seat erosion may result.

Table 2. *Gas Conversion*

GAS	RELATIVE DENSITY (d)	FACTOR (F)
Air	1	0.78
Butane	2.01	0.55
Propane	1.53	0.63
Nitrogen	0.97	0.79

Installation

The Type FLV axial control valve must be installed in horizontal pipes with the actuator on top and per the flow arrow mark shown on the body. See Figure 4.

Install the control valve where service conditions are within unit capabilities specified in specifications on page 2 and are within applicable codes, regulations or standard.

For safety during shutdown, block valve will be required immediately upstream and downstream of the control valve.

Capacity Information

To find approximate flow capacity and valve diameter, perform the following procedures:

Calculation Procedures

Symbols

Q = Natural gas flow rate in (Stm^3/h)
P_1 = Absolute inlet pressure in bar
P_2 = Absolute outlet pressure in bar
C_g = Flow coefficient
C_1 = Body shape factor
d = Relative density of the gas

Flow Rate Q

Calculate the required C_g with the following formula:

Sub-critical state with $P_2 > \frac{P_1}{2}$

$$Q = 0.525 \times C_g P_1 SIN \left(\frac{3417}{C_1} \sqrt{\frac{\Delta P}{P_1}} \right) DEG$$

Critical state with $P_2 \leq \frac{P_1}{2}$

$$Q = 0.525 \times C_g P_1$$

For other gases with different densities, the flow rate calculated with the above formulas must be multiplied with the correction factor:

$$F = \sqrt{\frac{0.6}{d}}$$

DN Sizes

Calculate the required C_g with the following formula:

Sub-critical state with $P_2 > \frac{P_1}{2}$

$$C_g = \frac{Q}{0.525 \times P_1 SIN \left(\frac{3417}{C_1} \sqrt{\frac{\Delta P}{P_1}} \right) DEG}$$

Critical state with $P_2 \leq \frac{P_1}{2}$

$$C_g = \frac{Q}{0.525 \times P_1}$$

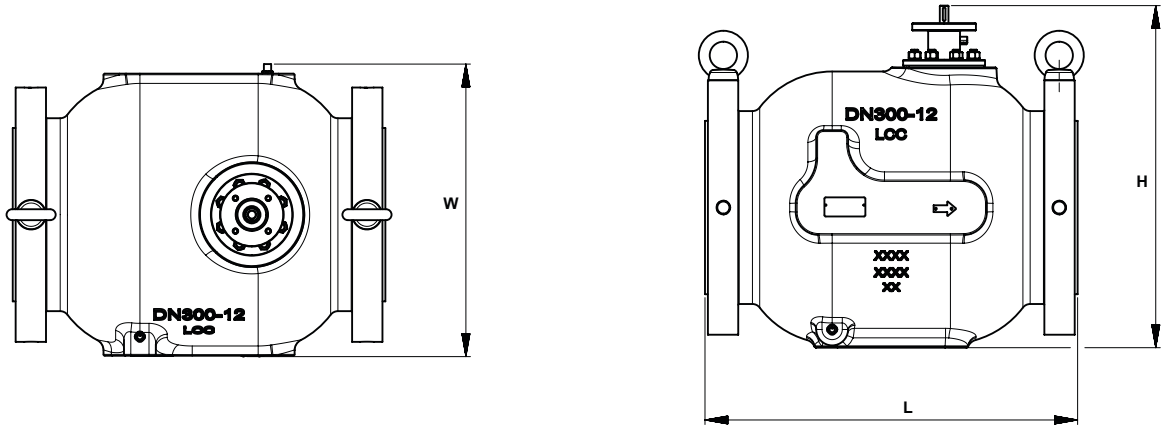
The above formulas apply to natural gas flow rate only. If the flow rate value (Q) refers to other gasses, divide it by the correction factor F (see Table 2).

After finding the DN of the valve, check that gas speed at the outlet flange does not exceed 150 m/sec, using the following formula:

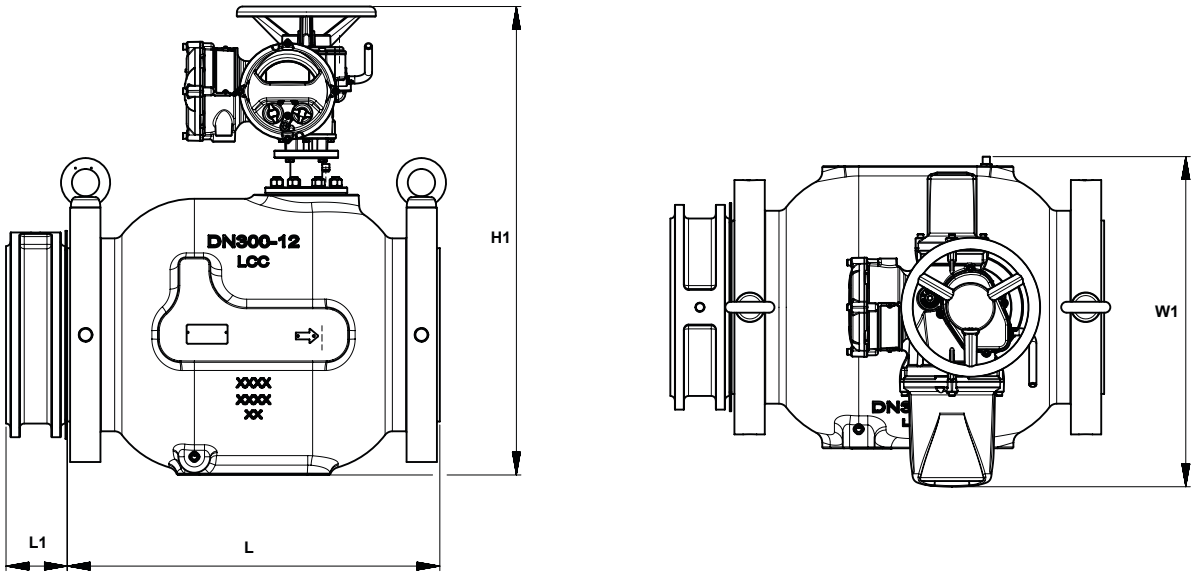
$$V = 345.92 \times \frac{Q}{DN^2} \times \frac{1 - 0.002 \times P_U}{1 + P_U}$$

V = velocity (m/s)
Q = Natural gas flow rate in (Stm^3/h)
DN = Valve nominal diameter (mm)
P_U = Inlet pressure in relative value (bar)

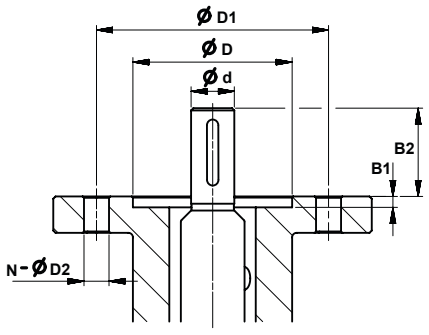
Dimensions and Weights



TYPE FLV MAIN VALVE



TYPE FLV WITH SPACER AND ELECTRIC ACTUATOR



TYPE FLV BONNET

Figure 5. *Dimensions and Weights*

Table 3. *Type FLV Main Valve Dimensions and Weights*

VALVE SIZE, DN / NPS	PRESSURE CLASS	L		W		H		WEIGHT	
		mm	In.	mm	In.	mm	In.	kg	lbs
50 / 2	CL300 RF	330	12.99	180	7.09	309.1	12.17	39	86
	CL600 RF	330	12.99	180	7.09	309.1	12.17	40	88
80 / 3	CL300 RF	380	14.96	226	8.90	360.8	14.20	71	157
	CL600 RF	380	14.96	226	8.90	360.8	14.20	72	159
100 / 4	CL300 RF	430	16.93	277	10.91	412.8	16.25	115.7	255
	CL600 RF	430	16.93	277	10.91	412.8	16.25	123	271
150 / 6	CL300 RF	473	18.62	380	14.96	500	19.69	185	408
	CL600 RF	508	20.00	380	14.96	500	19.69	208	459
200 / 8	CL300 RF	568	22.36	450	17.72	577	22.72	325	716
	CL600 RF	610	24.02	450	17.72	577	22.72	345	761
250 / 10	CL300 RF	708	27.87	532	20.94	666	26.22	510	1124
	CL600 RF	752	29.61	532	20.94	666	26.22	586	1292
300 / 12	CL300 RF	775	30.51	630	24.80	751.8	29.60	752	1658
	CL600 RF	819	32.24	630	24.80	751.8	29.60	832	1834

Table 4. *Type FLV with Spacer and Electric Actuator Dimensions and Weights*

VALVE SIZE, DN / NPS	PRESSURE CLASS	L1		W1(1)		H1(1)		WEIGHT	
		mm	In.	mm	In.	mm	In.	kg	lbs
50 / 2	CL300 RF	85	3.35	561	22.09	606.5	23.88	71	157
	CL600 RF	85	3.35	561	22.09	606.5	23.88	72	159
80 / 3	CL300 RF	105	4.13	561	22.09	654	25.75	103	227
	CL600 RF	105	4.13	561	22.09	654	25.75	104	230
100 / 4	CL300 RF	105	4.13	561	22.09	706	27.79	148	327
	CL600 RF	105	4.13	561	22.09	706	27.79	155	342
150 / 6	CL300 RF	125	4.92	561	22.09	791	31.14	227	500
	CL600 RF	125	4.92	561	22.09	791	31.14	263	580
200 / 8	CL300 RF	125	4.92	561	22.09	869	34.21	366	807
	CL600 RF	125	4.92	561	22.09	869	34.21	409	902
250 / 10	CL300 RF	130	5.12	564	22.20	959	37.76	575	1268
	CL600 RF	130	5.12	564	22.20	959	37.76	664	1464
300 / 12	CL300 RF	135	5.31	619	24.37	1045	41.14	832	1834
	CL600 RF	135	5.31	619	24.37	1045	41.14	922	2033

1. This dimension is based on actuator model “BIFFI:ICON-010R/30”. This dimension may be variable for other actuators.

Table 5. *Type FLV Bonnet Dimensions*

VALVE SIZE, DN / NPS	PRESSURE CLASS	d		D		D1		D2		B1		B2		NUMBER OF HOLES
		mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	mm	In.	
50 / 2	CL300 RF and CL600 RF	19	0.75	70	2.76	102	4.02	11	0.43	4.8	0.19	39	1.54	4
80 / 3														
100 / 4														
150 / 6														
200 / 8														
250 / 10														
300 / 12														

Ordering Information

Prior to ordering, complete the ordering guide to cross check your valve selections. Refer to Specifications section in page 2 for details. Review the description against each specification and the information in each referenced table or figure. Specify your choice wherever you find multiple choices.

Ordering Guide

Body Size
- □ DN 50 / NPS 2***
- □ DN 80 / NPS 3***
- □ DN 100 / NPS 4***
- □ DN 150 / NPS 6***
- □ DN 200 / NPS 8***
- □ DN 250 / NPS 10***
- □ DN 300 / NPS 12***

End Connection
- □ CL300 RF Flanged***
- □ CL600 RF Flanged***

O-ring Material
- □ Fluorocarbon (FKM), -10 to 60°C / 14 to 140°F***
- □ Nitrile (NBR), -20 to 60°C / -4 to 140°F***

Flow Characteristic
- □ Linear***
- □ Equal Percentage***

Cage Options
- □ Window Cage, dP/P1≤0.6***
- □ Multi-path Cage**
- □ Silencer Cage for Noise Reduction**

Control Valve Quick Order Guide	
* * *	Readily Available for Shipment
* *	Allow Additional Time for Shipment
*	Special Order, Constructed from Non-Stocked Parts. Consult Your local Sales Office for Availability.
Availability of the product being ordered is determined by the component with the longest shipping time for the requested construction.	

Flow Direction
- □ Flow to Open
- □ Flow to Close

Actuator
- □ Electric Actuator, 380V AC / 50 HZ***
- □ Electric Actuator, other voltages**
  Please specify: _____
- □ Electric Actuator: Input signal, 4 to 20 mA***
- □ Electric Actuator: Input signal, others**
  Please specify: _____

Specification Worksheet

Application:
Specific Use _____
Line Size _____
Gas Type and Specific Gravity _____
Gas Temperature _____
Does the Application Require Overpressure Protection?
☐ Yes ☐ No If yes, which is preferred:
☐ Relief Valve ☐ Monitor Regulator ☐ Shutoff Device
Is overpressure protection equipment selection assistance desired? _____

Pressure:
Maximum Inlet Pressure (P_{1max}) _____
Minimum Inlet Pressure (P_{1min}) _____
Downstream Pressure Setting(s) (P_2) _____

Flow:
Maximum Flow (Q_{max}) _____
Minimum Flow (Q_{min}) _____

Performance Required:
Accuracy Requirements? _____
Need for Extremely Fast Response? _____

Other Requirements: _____
_____

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