



# PYTHON

**SQUEEZING OUT PERFORMANCE**

Bulletin 740-A

## 1100 Series Control Valve

Providing precise control for all your application needs.



**Armstrong®**



# Armstrong Python™ - 1100 Series Control Valves



When accurate control is desired from your steam or water applications the Armstrong Python 1100 Series Control Valve will squeeze every bit of performance out of your system and deliver precise control. With a wide range of materials, sizes, trim, and other features, you are sure to find the Python can accurately control your system. The Python 1100 Series Control Valve is constructed and equipped with state of the art materials and is designed to meet the most stringent budget.

## Product Features

- Series 1100 valves are Globe two-way single seated body design valves, which satisfy the majority of control applications for HVAC, industrial and commercial markets.
- Body with top entry trim and bolted bonnet facilitates easy access to all internal parts for in-line inspection, maintenance and trim replacement.
- Stream line flow path provides large flow capacity.
- Variety of trim options are available to satisfy a vast application range including reduced port trims enabling nearest accurate selection for precise control requirements.
- Trims with top bush guided plugs are available with simple construction for stable operation, assuring high rangeability and turndown ratios.
- Micro trims available for control of minute flow rates.
- Trims with large guide plugs are available for full pressure balancing effect providing an economical choice for high pressure applications.
- All parts are renewable in-line.
- Pneumatic and electro-pneumatic positioners.
- Carbon steel body construction.
- Reverse and direct acting multi-spring actuators.
- Available in 1/2" - 2" NPT and 2-1/2" - 4" ANSI flange design.
- Rated for class IV shut-off.



Python Series 1100 Control Valve



Python Series 1100 Control Valve with Positioner

## Accessories

- Pneumatic Valve Positioner
- Electro-Pneumatic (E/P) Valve Positioner
- Digital Valve Positioners
- Pressure/Temperature Controllers
- Air Filter Regulator

# Python™ - 1100 Series Control Valve



## List of Materials

Part	Material
Valve Body*	Carbon Steel A216 Gr. WCB
Bonnet*	
Valve/Valve Seat	Stainless Steel AISI 410
Valve Stem	Stainless Steel 316
Gland Packing	V-Teflon - option 1 (366°F Max.) Grafoil - option 2
Yoke	S.G. Iron
Actuator Spring	Chrome Vanadium/Spring Steel
Actuator Diaphragm	Nitrile Reinforced with Nylon Fiber

\*Stainless steel available.

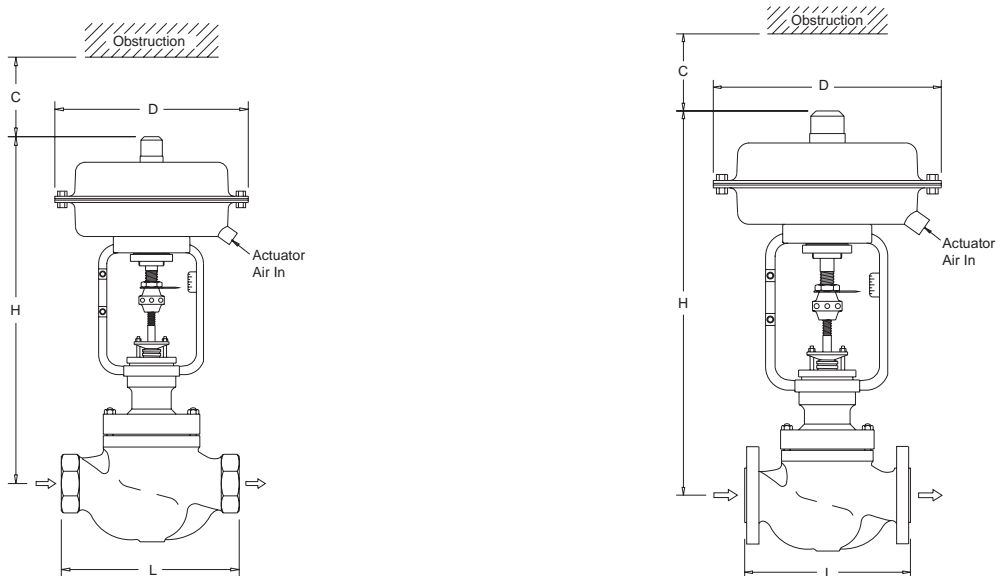
## Technical Data

Flow	Equal Percentage	
Leakage	ANSI Class IV	
Rangeability	50:1	
Travel	1/2" to 1"	11/16" (18 mm)
	1-1/2" to 2"	1-1/8" (28 mm)
	2-1/2" to 4"	1-1/2" (38 mm)
Maximum Temperature	450°F (232°C)	
Maximum Pressure	300 PSIG (20 bar)	

## Dimensions and Weights

Size, in		Face to Face "L"						"C"		"D"		"H"		Weight					
in	mm	NPT		150#		300#		in	mm	in	mm	in	mm	NPT		150#		300#	
		in	mm	in	mm	in	mm							lb	kg	lb	kg	lb	kg
1/2"	15	6-1/2"	165	—	—	—	—	4"	102	9-7/16"	240	18-1/2"	470	31	14	—	—	—	—
3/4"	20	6-1/2"	165	—	—	—	—	4"	102	9-7/16"	240	18-1/2"	470	31	14	—	—	—	—
1"	25	7-3/4"	197	7-1/4"	184	7-3/4"	197	4"	102	9-7/16"	240	18-1/2"	470	33	15	36	16	40	18
1-1/2"	40	9-1/4"	235	8-3/4"	222	9-1/4"	235	5"	127	11-7/16"	290	20-9/32"	515	51	23	55	25	60	27
2"	50	10-1/2"	267	10"	254	10-1/2"	267	5"	127	11-7/16"	290	20-9/32"	515	60	27	65	30	71	32
2-1/2"	65	—	—	10-7/8"	276	11-1/2"	292	6"	152	15"	380	25-3/16"	640	—	—	120	54	135	61
3"	80	—	—	11-3/4"	299	12-1/2"	318	6"	152	15"	380	25-3/16"	640	—	—	135	61	154	70
4"	100	—	—	13-7/8"	353	14-1/2"	368	6"	152	15"	380	26-3/8"	670	—	—	176	80	220	100

**Note:** Additional sizes up to 20" available upon request.

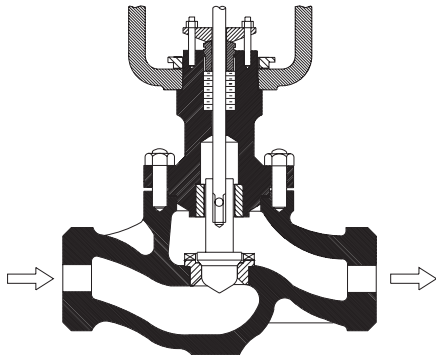


**All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.**

## Various Trim Options

### Contour Top Guided

The Contour Top Guided trims are the preferred choice for a variety of control applications due to their simple construction. Heavy top guided trim provides maximum support to impart complete stability. The plug shank is guided at the lowest portion of the bonnet minimizing the effect of side thrust on the valve plug and eliminating trim vibration.



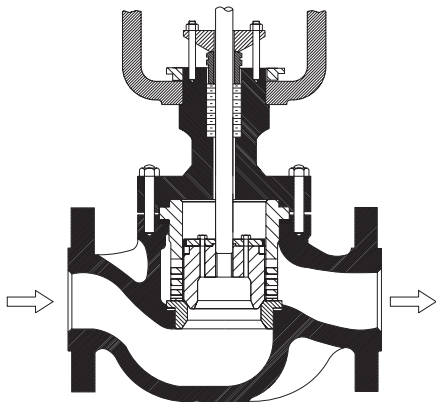
**Contoured Top Guided Trim (Unbalanced)**

### Multi-Hole Cage Guided - Pressure Balanced

The large guide trims with pressure balancing effect enable the valve to handle higher  $\Delta p$  shut off without employing high power actuators. The flow characteristic is achieved through plug contour. Equalizing holes are opened in the plug which effectively cancel out the unbalanced force impressed on the top and bottom of the valve plug.

Pressure balance sealing is attained; 1) At seating surface  
2) Through pressure balance seal rings which are fitted on the plug seal applying pressure along the inner wall of the large guide having a ground, honed and chrome plated surface.

This multi-hole trim also helps with noise attenuation.



**Multi-Hole Cage Guided Pressure Balanced Trims**

**Table 4-1. Contoured Top Guided Cv Values**

Valve Size		Trim Size		Cv
in	mm	in	mm	
1/2, *3/4, 1	15, *20, 25	1/8	3	1
		1/4	6	2
		5/16	8	3
		1/2	15	5
		3/4	20	9
1-1/2	40	1	25	13
		1-1/2	40	30
		1-1/4	32	20
2	50	1	25	13
		2	50	50
		1-1/2	40	30
2-1/2	65	1-1/4	32	20
		2-1/2	65	80
		2	50	50
3	80	1-1/2	40	30
		3	80	110
		2-1/2	65	80
4	100	2	50	50
		4	100	200
		3	80	110
		2-1/2	65	80

**Note:** Additional sizes up to 20" available upon request.

\* The trim size must be less than or equal to the valve size.

**Table 4-2. Multi-Hole Cage Guided Cv Values**

Valve Size		Trim Size		Cv
in	mm	in	mm	
1-1/2	40	1-1/2	40	24
		1-1/4	32	16
		1	25	10
2	50	2	50	40
		1-1/2	40	24
		1-1/4	32	16
2-1/2	65	2-1/2	65	64
		2	50	40
		1-1/2	40	24
3	80	3	80	90
		2-1/2	65	64
		2	50	40
4	100	4	100	160
		3	80	90
		2-1/2	65	64

**Note:** Additional sizes up to 20" available upon request.

*All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.*

## Multi-Spring Actuators: Series M

The "M" Series control valve actuators are diaphragm actuators with pre-compressed multi-spring construction. They are compact (fewer parts), easy to maintain and quickly reversible. The actuators are suitable for regulating and on/off applications. Various models are available covering small to larger thrust requirements.

The increasing air pressure supply moves the diaphragm and actuator stem opposing the spring force. With decreasing air pressure supply, the spring force moves the diaphragm in the opposite direction and back to the normal position. To get various loading capacities the number of springs are altered.

## Specifications

- **Maximum Diaphragm Pressure:**  
50 psi (3.5 bar) for Model M and Mp
- **Actuator travel:**  
11/16", 1-1/8", 1-1/2"  
(18, 28, 38 mm)
- **Diaphragm:**  
Nitrile reinforced with Nylon fiber
- **Operating Temperature Range:**  
-40° to 176°F (-40° to 80°C)
- **Connections:**  
1/4" NPT (F) for Models 00 and 11  
3/8" NPT (F) for Model 22
- **Permissible Linearity and Hysteresis:**  
±5% of Signal Pressure Range

## Features:

- **Utility** - Applicable for regulating and on-off applications
- **High Power** - Variety of models provide choice for low and high thrust requirements
- **Construction** - Due to multi-spring arrangement the actuators are lightweight and compact
- **Reversible** - The actuators are field reversible without demanding addition or deletion of parts
- **Long Service Life** - Rigid construction and durable components provide a long lasting service life
- **Minimum Maintenance** - The actuators are virtually maintenance free
- **Accuracy** - Rolling diaphragm construction provides constant effective area throughout the stroke

## Direct Acting Actuators (Fail Open)

The actuator stem moves downward with increasing diaphragm pressure. When this pressure is reduced the opposing spring force moves the actuator stem upward. On air failure, the actuator stem is pulled to the extreme upward position by spring force.

### This actuator is suitable for the following:

Fail Open - For valves with plugs that push down to close  
Fail Close - For valves with plugs that push down to open

## Reverse Acting Actuators (Fail Close)

The actuator stem moves upward with increasing diaphragm pressure. When this pressure is reduced the opposing spring force moves the actuator stem downward. On air failure, the actuator stem is pushed to extreme downward position by spring force.

### This actuator is suitable for the following:

Fail Close - For valves with plugs that push down to close  
Fail Open - For valves with plugs that push down to open

**Table 5-1. Air Volume Required Per Stroke.**

Model Number	Cubic Feet/Stroke
M-00, Mp-00	0.012
M-11, Mp11	0.035
M-22, Mp-22	0.082



# Armstrong® Python™ - 1100 Series Control Valve

**Table 6-1. Contoured Top Guided Shut Off Pressure**

Model No.	Air Supply Pres. to Diaphragm	Spring Setting Range		Diaphragm Area	Maximum Differential Pressure (PSI) Δ P / Shut Off Pressure										
		Direct Acting Actuator	Reverse Acting Actuator		Trim Size										
		PSI	PSI		1/8"	1/4" - 5/16"	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"
M-00	20	3 - 15	3 - 15	30	914	619	206	134	94	—	—	—	—	—	—
	23		6 - 18	30	1922	1317	457	309	222	—	—	—	—	—	—
	25		—	30	2930	2012	710	480	350	—	—	—	—	—	—
	34	6 - 30	6 - 30	30	1922	1317	457	309	222	—	—	—	—	—	—
	37		9 - 32	30	2930	2012	710	480	350	—	—	—	—	—	—
	40		12 - 35	30	3837	2711	961	654	478	—	—	—	—	—	—
M-11	20	3 - 15	3 - 15	55	—	—	—	—	—	121	78	43	—	—	—
	23		6 - 18	55	—	—	—	—	—	269	178	102	—	—	—
	25		—	55	—	—	—	—	—	415	279	162	—	—	—
	34	6 - 30	6 - 30	55	—	—	—	—	—	269	178	102	—	—	—
	37		9 - 32	55	—	—	—	—	—	415	279	162	—	—	—
	40		12 - 35	55	—	—	—	—	—	562	376	222	—	—	—
M-22	20	3 - 15	3 - 15	95	—	—	—	—	—	—	—	—	51	35	16
	23		6 - 18	95	—	—	—	—	—	—	—	—	114	80	38
	25		—	95	—	—	—	—	—	—	—	—	178	125	62
	34	6 - 30	6 - 30	95	—	—	—	—	—	—	—	—	114	80	38
	37		9 - 32	95	—	—	—	—	—	—	—	—	178	125	62
	40		12 - 35	95	—	—	—	—	—	—	—	—	240	172	85

Do not exceed 50 PSIG air pressure to the actuator

**Table 6-2. Multi-Hole Cage Guided Shut Off Pressure**

Model No.	Air Supply Pres. to Diaphragm	Spring Setting Range		Diaphragm Area	Maximum Differential Pressure (PSI) Δ P / Shut Off Pressure				
		Direct Acting Actuator	Reverse Acting Actuator		Trim Size				
		PSI	PSI		1-1/2"	2"	2-1/2"	3"	4"
M-11	20	3 - 15	3 - 15	55	257	150	—	—	—
	23		6 - 18	55	802	590	—	—	—
	25		—	55	1346	1028	—	—	—
	34	6 - 30	6 - 30	55	802	590	—	—	—
	37		9 - 32	55	1346	1028	—	—	—
	40		12 - 35	55	1891	1467	—	—	—
M-22	20	3 - 15	3 - 15	95	—	—	298	190	97
	23		6 - 18	95	—	—	881	669	482
	25		—	95	—	—	1473	1149	866
	34	6 - 30	6 - 30	95	—	—	881	669	482
	37		9 - 32	95	—	—	1473	1149	866
	40		12 - 35	95	—	—	2048	1628	1250

Do not exceed 50 PSIG air pressure to the actuator

All dimensions and weights are approximate. Use certified print for exact dimensions. Design and materials are subject to change without notice.



## Valve Sizing

To determine the size of valve you need, calculate the required Cv value for your application. Once you have calculated the required Cv, refer to the valve Cv charts on page 3 to determine the size and trim of valve. Globe style control valves have the best control in the midrange of the valve's capacity. It is best to pick a valve so the calculated Cv is between 15% and 85% of the valve's maximum Cv. See the formulas below for steam and water applications. Consult factory for other types of fluids.

### For Saturated Steam Service

#### Subcritical Flow

When  $\Delta P < 0.81(P_1/2)$

$$C_v = \frac{W}{2.1\sqrt{\Delta P(P_{1A}+P_{2A})}}$$

#### Critical Flow

When  $\Delta P \geq 0.81(P_1/2)$

$$C_v = \frac{W}{1.633 (P_{1A})}$$

### For Liquid Service

$$C_v = \frac{(GPM) \sqrt{G}}{\sqrt{\Delta P}}$$

- Cv = Valve flow coefficient
- W = Maximum flow capacity of steam, lbs/hr
- P<sub>1A</sub> = Inlet Pressure, psia (psig + 14.7)
- P<sub>2A</sub> = Outlet Pressure, psia (psig + 14.7)
- ΔP = Pressure drop (P<sub>1</sub> - P<sub>2</sub>) psi
- GPM = Maximum flow capacity of Liquid, GPM
- G = Specific Gravity

## Actuator Sizing

To determine the required actuator, you need to determine the differential pressure (shut off pressure). The shut off pressure for a pressure reduction application is the pressure difference between P<sub>1</sub> and P<sub>2</sub>. The shut off pressure for a temperature control application is the P<sub>1</sub> pressure.

Once you have calculated your shut off pressure, select the actuator model and spring setting range that exceeds your calculated shutoff pressure with the trim size previously selected. Select reverse acting for air to open (fail close) applications or direct acting for air to close (fail open) applications.

Make sure the required air pressure is available for the spring range selected.

### Sizing Example 1:

- Fluid: Saturated Steam
- P<sub>1</sub> = 140 psig
- P<sub>2</sub> = 20 psig
- Flow: 13,000 lbs/hr
- Actuator: Air to open (Fail Close)

#### Solution:

Valve Selection: Select the correct formula needed to calculate Cv. We need to use the critical flow formula since  $\Delta P > .81(P_1/2)$ .

$$C_v = \frac{13,000}{1.633(140 + 14.7)} = 52$$

Refer to the Cv charts on Page 4. Select a 2-1/2" Multi-hole cage guided with 2-1/2" Trim. Top bush guided would work as well, but multi-hole cage was chosen to help with noise attenuation.

*Actuator Selection:* Determine your shutoff pressure (ΔP).

$$\Delta P = 140 - 20 = 120 \text{ psi}$$

Refer to chart 6-2 (multi-hole cage guided) and go to the 2-1/2" trim size column. Follow the column until you get to a pressure greater than 120 psi, then follow the row horizontally to determine you need a Model M-22 with the 3-15 psi spring range.

Complete valve selection is 1100 series, 2-1/2" 150# Flange with 2-1/2" Multi-hole cage trim and M-22 actuator with 3-15 psi spring range.

### Sizing Example 2:

- Fluid: Saturated Steam
- Application: Temperature Control
- P<sub>1</sub>: 125 psig
- Flow: 1750 lbs/hr
- Actuator: Air to open (Fail Close)

#### Solution:

Since this is a temperature control application and we do not know the P<sub>2</sub> pressure, we will size the valve with a 30% pressure drop. We need to use the subcritical flow formula.

$$C_v = \frac{1750}{2.1\sqrt{(37)((125+14.7)+(88+14.7))}} = 8.8$$

Refer to the Cv charts on Page 4. Select a 1" Contoured top guided with full port trim. The 1" is chosen over the 3/4" because the valve will control best between 15% - 85% of maximum valve capacity. The 3/4" valve would be operating at 98% of valve capacity.

#### Actuator Selection:

For temperature control applications, the shut off pressure is the P<sub>1</sub> pressure. Refer to chart 6-1 (Contoured Top Guided) and go to the 1" trim size column. Follow the column until you get to a pressure greater than 125 psi, then follow the row horizontally to determine you need a Model M-00 with a 6 - 18 psi spring range.

Complete valve selection is 1100 series 1" NPT with 1" contoured top guided trim and M-00 actuator with 6 - 18 psi spring range.



**Washdown Equipment**

Steamix® hose stations from Armstrong offer a maximum temperature rise set point and cold water failure shutdown for ultimate user safety. Armstrong hot and cold water hose stations include a thermostatic mixing valve for optimum flexibility, control and safety for applications where there is a central hot water supply.



**TVS800**

Put the principle of the inverted bucket steam trap to work in a tough cast iron package and you have the best of both worlds-energy efficiency and long-lasting reliability. Add the advantages of valves integrated into one compact trap/valve casting, and you extend the benefits into installation, trap testing and maintenance.



**Drain Separators**

Armstrong's drain separators increase thermal efficiency, reduce water hammer and corrosion by separating condensate. The cyclone structure maximizes liquid separation while keeping the pressure loss extremely low and with no moving parts.



**Tank Heaters**

Armstrong tank heaters are built to withstand the rigorous demands encountered in industrial installations. The heavy-duty features of our units were developed in response to a need for tank heaters that could provide efficient heat transfer without sacrificing structural integrity.



**Steam-A-Ware™**

Steam-A-ware™ sizing and selection for steam, air and hot water systems. Includes steam traps, pressure reducing valves, temperature regulators, water heaters and condensate pumps of various types, sizes and configurations for any application. Easy-to-use Steam-A-ware allows you to store multiple product specifications in a schedule and access Armstrong's library of materials from the CD or the Web.

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